

From: Mozafari, Brenda
Sent: Thursday, March 04, 2010 2:47 PM
To: Frehafer, Ken; Eric.Katzman@fpl.com; john.laffrey@fpl.com
Cc: Scott, Michael
Subject: DRAFT - REQUEST FOR ADDITIONAL INFORMATION ON GL-2004-02 (Unit 2)

Eric and Ken,

By letter to the U.S. Nuclear Regulatory Commission (NRC) dated April 16, 2009, you (Florida Power and Light Company) submitted responses to the NRC staff's January 16, 2009, request for additional information regarding Generic Letter 2004-02 for St. Lucie Unit 2.

The NRC staff has reviewed the information provided and determined that in order to complete its evaluation, additional information is needed. We would like to discuss the questions, in draft form below, with you in a conference call by the end of this month. The NRC staff would like to have a public phone conference to discuss your planned responses to each RAI by the end of April 2010. The call may be combined with a similar call for Unit 1 discussed in a separate email.

This e-mail aims solely to prepare you and others for the proposed conference calls. It does not convey a formal NRC staff position, and it is not a formal request for additional information.

To support resolution of the remaining sump performance issues identified below, we propose the following interactions:

Not later than 3/31/2010: We intend to hold a phone call to provide you an opportunity to ask clarifying questions about the attached RAIs or to show us where the information requested has already been provided, if applicable. After this call is held, we will issue the RAIs in a final docketed letter. (This call, at your option, may be done when Unit 1 is addressed.)

A public phone conference (or meeting, if you prefer) will be held by 4/30/2010, to discuss the your planned responses to each RAI. Due to the number, scope, and complexity of these RAIs, this will likely be an all-day phone conference with a lunch break. (Again, you have the option to accomplish this at the same time as Unit 1)

Contact me so we can work out the schedule for the next steps.

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St Lucie Unit 2
Request for Additional Information Regarding Licensee Responses to
Generic Letter 2004-02

Debris Characteristics

1. In its request for additional information (RAI) dated January 16, 2009, the NRC staff requested (RAI no. 2) that the licensee describe how the small fines debris size category was divided into small pieces and fines for Nukon, calcium silicate, and Foamglas debris. The NRC staff considers the licensee's response dated April 16, 2009, regarding Foamglas to be adequate. However, the NRC staff does not consider the portion of the response concerned with Nukon and calcium silicate to be sufficient. Specifically, as noted in the NRC staff's safety evaluation (SE) on the Nuclear Energy Institute (NEI) Guidance Report 04-07, a two-category debris size distribution is not considered appropriate for application with analytical refinements such as computational fluid dynamics. In addition, with respect to fibrous debris, no information was provided for the NRC staff to conclude that the percentages of fines and small pieces used for the strainer head loss testing were representative of the relative quantities of these types of debris that would be predicted to reach the plant strainers. Therefore, identify the quantity of fiberglass and calcium silicate fines that would be generated during a loss-of-coolant accident (LOCA). Further evaluate the consequent effects of explicitly modeling fine fibrous and calcium silicate debris with respect to transport, head loss, and other parts of the evaluation that would be affected if fine debris transport were explicitly considered, or alternately demonstrate that the existing evaluation would be bounding had a more refined debris size distribution consistent with the NRC staff's SE on NEI 04-07 been considered. Include a specific basis to demonstrate that the breakdown of fibrous small pieces and fines used for head loss testing is prototypical or conservative with respect to the analyzed plant condition.

Debris Transport

2. In RAI 6 in its January 16, 2009, letter, the NRC staff requested that the licensee provide contour plots of the velocity and turbulence in the containment pool, as well as for the corresponding conditions simulated in the strainer head loss test flume. The licensee provided information in response to the NRC staff's request, but the following points were not made sufficiently clear or are not considered resolved by the response. Provide additional information to address these points:
 - a. Describe the extent to which the high-flow and low-flow case results were used in the design basis transport analysis and in simulating the transport of debris in the strainer test flume. Although based on the licensee's response to RAIs 6 and 14, it is clear the low-pressure safety injection (LPSI) pump failure to trip case was examined by the licensee, it is not clear specifically for what purposes or at which times in the accident scenario the high- and low-flow cases were applied. This information is necessary because the licensee's response did not adequately demonstrate that proceduralized actions from the control room will lead to the prompt termination of flow from a LPSI pump that has failed to stop automatically.
 - b. The flow velocities in the vicinity of the strainer were unexpected, in that very low velocities appeared to be present along the approach to the strainer from which most of the debris and flow arrives, whereas very high velocities appeared to be present on the sheltered side of the strainers without an obvious physical reason. The NRC staff questioned whether this observed behavior was realistic or an artificial result of the computational fluid dynamics (CFD) boundary condition assumed at the strainer surface.
 - c. Clarify the basis for considering the turbulence in the test flume to be representative of the plant containment pool.
 - d. Provide the length of the pathway along the trench on the more stagnant side of the strainer that was used to determine a weighted average velocity along the approach to the strainers. The fluid velocities tend to be reduced along this pathway, and, as shown in Figure 8-1, very

little debris appears to transport to the strainers from this direction. It is not clear to the NRC staff that a representative length of the trench on the stagnant side was used for determining an averaged flume flow.

- e. Identify the elevation or depth that is represented by the contour plots provided.
3. In previous RAI 7, the NRC staff requested a description of the emergency core cooling system (ECCS) trench and how it was modeled in the CFD calculation, including the modeling of obstacles and equipment. The licensee provided a broad overview of the principles and methodology for modeling obstacles, but did not provide plant-specific details. From viewing the CFD contour plots provided by the licensee in response to RAI #6, it is not clear that any obstacles in the trench appear as either non-fluid regions or have an influence on the fluid flow in the trench. Based on discussion provided by the licensee concerning the equipment and objects located in the tank, as well as a photograph of one section of the trench, the NRC staff expects that obstacles would be present in the trench that would have a significant influence on the flow in the trench. Provide additional specific information concerning the major obstacles modeled in the trench, as well as the minimum clearances in the plant and in the CFD calculation.

Furthermore, based on the licensee's response to RAI 15, it is not clear that debris pieces would be incapable of transporting into and causing blockage or flow reductions in the ECCS trench as assumed by the licensee. Although alternate flowpaths would still be available to convey water to the strainers, it appears to the NRC staff that blockage in the trench would increase the velocity along the containment pool floor and potentially result in increased transport to the strainers. In light of this NRC staff conclusion, justify the assumption that this debris would be incapable of transporting into and causing blockage or flow reductions in the ECCS trench.

4. In previous RAI 9, the NRC staff requested that the licensee provide a basis for the assumptions made concerning debris erosion in the post-LOCA containment pool. The licensee's response to this question in its letter dated April 16, 2009, indicated that testing performed by Alion formed the basis for the assumed erosion value for small pieces of fiberglass of 10% over a 30-day period. The NRC staff did not consider the response adequate, but noted that Alion is currently in the process of conducting additional confirmatory testing to address NRC staff concerns with the 10% erosion value. Following the completion of the confirmatory testing, provide test results that demonstrate that 10% erosion over a 30-day period is justified for small pieces of fiberglass in the post-LOCA containment pool.

In addition, the strainer head loss testing performed at Alden Laboratory used a test protocol that appears to have permitted debris settlement. Identify the flow velocities applicable during the period for which the debris settlement was credited, and provide justification for neglect of erosion of any debris that settled during the performance of the head loss test. Specific justification should be provided for the assumed eroded percentage if the velocities in the test flume during the transport portion of the test were in excess of the incipient tumbling velocity at which erosion testing was performed.

5. In previous RAI 10, the NRC staff requested a description of the modeling of drainage from the containment sprays and a basis for assuming a uniform spray drainage model. The licensee's response did not provide a basis to conclude that the effect of non-uniform spray drainage (e.g., drainage from the refueling canal, floor drains, spillage from solid floors, etc.) can be neglected, either in the vicinity of the strainers (for the purpose of strainer testing that credits debris

settlement), or throughout the containment building (in the analytical debris transport analysis). In particular, it was not clear that streams of drainage water would realistically be broken up into dispersed droplets by obstacles prior to reaching the containment pool surface, or that the location of specific concentrated drainage sources is not significant. Provide additional basis to justify the assumed spray drainage model and identify any significant sources of non-uniform drainage that could affect either the analytical transport calculation or the flow modeling in the strainer test flume.

6. In previous RAI 12, the NRC staff requested a technical basis to support the assumption that 23% of the calcium silicate debris settles in the containment pool and a description of the sizes assumed for the settled debris. The NRC staff does not consider the licensee's response adequate for the following reasons: (1) the licensee's response appeared to credit inactive volumes with capturing washed-down debris, even though these inactive regions would typically fill prior to the majority of debris washing down from upper containment (which may be addressed by the licensee in general when responding to new RAI 7, below) and (2) the licensee did not respond concerning the size distribution of the calcium silicate assumed to settle in the containment pool. The second item is of concern to the NRC staff because it is not clear that the debris transport metrics used by the licensee to determine transport were applicable to the assumed debris size category and whether the potential for erosion has been considered. Provide additional justification to address the two remaining items identified herein.
7. In previous RAI 13, the NRC staff requested further information regarding the assumed locations of debris at the onset of the switchover to recirculation. The licensee provided discussions applicable to small fines and large pieces of debris. The NRC staff had two remaining issues regarding the licensee's response. The first is that the licensee's discussion of small fines debris assumed that a significant fraction of the small fines debris blown to upper containment would be washed down prior to the filling of inactive volumes in the containment pool and would be captured in these inactive volumes. This assumption is not consistent with the position stated in the SE on NEI 04-07 or the NRC staff's understanding regarding the sequence of post-LOCA events, since inactive pools typically fill quickly and time is necessary to wash debris from upper containment into the post-LOCA pool. The second issue is that the licensee assumed that 92% of small fines debris remaining in lower containment in active pools would remain inside the bioshield wall during pool fill. The licensee's approach of assuming that the percentage of small fines remaining inside the bioshield after pool fill is equal to the percentage of the total sump fluid volume that is located inside the bioshield appears to lack a physical basis. The NRC staff expects that, in reality, due to high pool velocities and directed flow toward the annulus, there would likely be an increased potential for debris to transport into the annulus than this volume ratio approach would predict. As such, there could be an increase in debris transport to the strainers, which are located in the annulus, compared to what the licensee has predicted. Provide additional justification to support this assumption or demonstrate that the transport results for small pieces remain conservative in spite of this issue.

Head Loss and Vortexing

8. Provide information that justifies that the debris added to the strainer performance testing was prepared to adequately or conservatively represent the debris predicted to arrive at the strainer by the plant transport evaluation. Address in your response the following points:
 - a. Clearly define the fibrous debris size categories considered in the transport evaluation.
 - b. Provide the amount of each fibrous debris size predicted to arrive at the strainer by the transport calculation.
 - c. Provide the amounts of each debris type and size added to the test. Provide justification for how the surrogate categories realistically or conservatively represented the debris predicted to reach the strainer by the transport evaluation. Provide information that quantifies the sizes of the fibrous debris surrogates.
 - d. Provide information that justifies that the fine fibrous debris added to the head loss testing was prepared such that it was easily suspendable.
 - e. State whether fine fibrous debris was removed from the small fibrous debris prior to addition to the test flume. If the fines were removed, provide information that justifies that this action resulted in prototypical or conservative head loss testing parameters.
 - f. Justify that significant agglomeration of debris did not occur during its addition to the test flume.
 - g. Justify that the flow rates and turbulence present in the test flume were representative or conservative with respect to those expected in the plant for the purposes of debris transport to the strainer.
9. The licensee's response stated that, following the addition of the full debris load to the test, there was open strainer area remaining on the strainer and that therefore a thin bed had not formed. Based on a review of the head loss test graph provided in response to previous RAI 24, it appeared that head loss was still increasing when chemical debris was added to the test. The licensee should justify that the test methodology, particularly the timing of the chemical debris addition, did not affect the test results non-conservatively by non-prototypically preventing the transport of debris to the strainer.
10. The response to previous RAI 27 stated that flow sweeps were conducted at the end of the head loss testing to ensure that the flow through the debris bed was laminar and a viscosity correction to the head loss results was appropriate. The application of a viscosity correction to the final head loss value is appropriate based on the results of the flow sweep. However, the licensee also performed a viscosity correction to the test results resulting from a non-chemical debris bed. Based on the post-test photographs that show strainer area that is covered only by chemical debris and no fibrous debris, it is not clear that a viscosity correction should be made to the non-chemical result. Justify the use of the viscosity correction to the non-chemical result or recalculate the non-chemical head loss at higher temperatures using an appropriate methodology.
11. Provide an evaluation of potential deaeration as the sump fluid passes through the debris bed. The results of the deaeration evaluation should be compared against the guidance contained in Appendix A of Regulatory Guide 1.82, Rev. 3 to ensure that the limits in the guidance are not exceeded. If deaeration is predicted to occur at limits within the guidance, adjust net positive suction head (NPSH) required as described in the Regulatory Guide and verify NPSH margin.

