FPL Energy Point Beach, LLC, 6610 Nuclear Road, Two Rivers, WI 54241

FPL Energy
Point Beach Nuclear Plant

November 16, 2007

NRC 2007-0085
GL 2004-02

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

Point Beach Nuclear Plant, Unit 1 and 2
Dockets 50-266 and 50-301
Renewed License Nos. DPR-24 and DPR-27

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

References: (1) NMC Letter to NRC dated August 8, 2003, "Nuclear Regulatory Commission Bulletin 2003-01: Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized-Water Reactors - 60-day Response." (ML032310423)

(2) Nuclear Regulatory Commission (NRC) Generic Letter (GL) 2004-02 dated September 13, 2004, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors." (ML042360586)

(3) NMC Letter to NRC dated September 1, 2005, "Nuclear Management Company Response to Generic Letter 2004-02, Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors, for Point Beach Nuclear Plant." (ML052500302)

(4) NRC Letter to NMC dated February 9, 2006, "Point Beach Nuclear Plant, Units 1 and 2: Request For Additional Information Re: Response to Generic Letter 2004-02, Potential Impact of Debris Blockage on Emergency Recirculation During Design-Basis Accidents at Pressurized Water Reactors." (ML060370491)

(5) NMC Letter to NRC dated October 3, 2006, "Supplemental Response to Generic Letter 2004-02, Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors." (ML062850105)

NRC Generic Letter (GL) 2004-02 (Reference 2) requested that licensees provide information regarding the potential impact of debris blockage on emergency recirculation during design basis events. Point Beach Nuclear Plant (PBNP) provided the requested information to the NRC on September 1, 2005 (Reference 3) and October 3, 2006 (Reference 5).

Item 2(b) of GL 2004-02 (Reference 2) states that all actions should be completed by December 31, 2007, and to provide justification for not implementing the identified actions during the first refueling outage starting after April 1, 2006.

During the fall 2006 (Unit 2) and spring 2007 (Unit 1) refueling outages for PBNP, corrective actions associated with GL 2004-02 were implemented by installing new sump strainers with substantially increased surface areas. Prior to installation, a prototype replacement strainer module had been flume tested with both a design basis and low fiber (thin bed) debris mix. The tests included powdered chemical additive to simulate potential chemical effects.

Subsequent developments in the understanding of potential chemical effects determined that use of powdered chemical surrogates did not result in as severe head loss as chemical precipitants formed in situ. Published studies on the subject suggest that in the operating regime of concern, chemical precipitants formed in situ and might create a disproportionate increase in strainer head losses. However, those studies were performed with substantially higher chemical concentrations (minimum of 100 ppm dissolved aluminum) and at much higher velocities (0.1 fps or higher) than would exist in the PBNP installation (maximum of 16 ppm dissolved aluminum and 0.0033 fps). The magnitude of the disparities between the published test conditions and the expected conditions in the PBNP sumps are such that a comparison cannot be made. To conclusively demonstrate the acceptability of the installed screens will require additional formal testing. This testing cannot be completed prior to the end of 2007.

A telephone conference was held on September 25, 2007, between NRC representatives and Nuclear Management Company, LLC (NMC) to discuss the need to extend the completion date of December 31, 2007, for GL 2004-02 closeout.

As discussed during the conference call, the actions to develop, perform and document the results of additional chemical effects testing, will extend into the second quarter of 2008. Preparation of the final response will follow completion of testing. This date is based on the longest duration testing contingency (large scale flume testing), and is constrained, in part, by the availability of suitable test facilities.

Additionally, the recently issued industry guidance on downstream effects, both in-vessel and ex-vessel, will require the previously completed analyses to be revised. These two testing activities cannot be accomplished by PBNP in parallel with the other GSI-191 efforts required by the end of 2007.

The enclosure provides the basis supporting the FPL Energy Point Beach, LLC (FPLE-PB) request to extend the final submittal date for PBNP compliance with the requirements of GL 2004-02 to June 30, 2008.

Summary of Commitments

This letter revises the following Regulatory Commitment stated in Reference 5.

> The final submittal of the testing and analyses demonstrating acceptable long-term ECCS performance in the areas of downstream and chemical effects will be made by June 30, 2008.

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

Executed on November 16, 2007.

Very truly yours,

FPL ENERGY POINT BEACH, LLC

James H. McCarthy
Site Vice President

Enclosure

cc: Administrator, Region III, USNRC
Project Manager, Point Beach Nuclear Plant, USNRC
Resident Inspector, Point Beach Nuclear Plant, USNRC
PSCW

ENCLOSURE

FPL ENERGY POINT BEACH, LLC

POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2

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

Background

In Generic Letter (GL) 2004-02, dated September 13, 2004 (Reference 2), NRC summarized the bases for concluding that existing pressurized-water reactors (PWRs) could continue to operate through December 31, 2007, while implementing the required corrective actions for NRC Generic Safety Issue 191 (GSI-191), "Assessment of Debris Accumulation on PWR Sump Performance."

This evaluation addresses the "Criteria for Evaluating Delay of Hardware Changes," as described in SECY-06-0078, dated March 31, 2006.

This evaluation also supports the FPL Energy Point Beach, LLC (FPLE-PB) request for extension of the completion date for the corrective actions at Point Beach Nuclear Plant (PBNP) to June 30, 2008, for the completion of expanded chemical effects testing and downstream effects analyses. The proposed extension of the GSI-191 implementation schedule by nine months does not alter the original conclusions summarized in GL 2004-02, in which the NRC staff determined that it is acceptable for PWR licensees to operate until the corrective actions are completed.

SECY-06-0078 Criterion

The licensee has a plant-specific technical/experimental plan with milestones and schedule to address outstanding technical issues with enough margin to account for uncertainties.

The licensee identifies mitigative measures to be put in place prior to December 31, 2007, and adequately describes how these mitigative measures will minimize the risk of degraded ECCS (emergency core cooling system) and CSS (containment spray system) functions during the extension period.

Reason for Request

Previously completed head loss testing that was intended to account for potential chemical effects has subsequently been determined to be inadequate because the use of powdered surrogates rendered the efficacy of the completed head loss test questionable. However, the very low concentrations of precipitant precursors calculated to exist in the PBNP sumps still provided reasonable assurance that the impact of potential chemical effects could be shown to be acceptable.

WCAP-16785, "Evaluation of Additional Inputs to the WCAP-16530-NP Chemical Model," Revision 0, dated May 2007 (Reference 2), documented tests performed to establish the minimum solubility limits for the chemical precipitants of concern. The WCAP concluded that all sodium aluminum silicate ($NaAlSiO8$) should be assumed to precipitate, regardless of concentration. This recommendation precluded eliminating chemical effects concerns on the basis of low chemical concentrations.

WCAP-16785 also addressed aluminum oxy-hydroxide (Al-O-OH). The solubility of Al-O-OH was found to be higher than what may be expected in the PBNP sumps. However, that information was limited to tests performed at elevated temperatures at a minimum of 140°F. Cooler conditions can be expected in the sump during long-term recirculation. Therefore, reliance on these values of solubility for demonstrating acceptability would not be appropriate.

Based on the above considerations, FPLE-PB determined that additional testing was necessary to demonstrate acceptable chemical effects. FPLE-PB intends to perform informational loop testing that uses plant-specific chemical concentrations and screen velocities. The planned testing will be similar to those described in NUREG/CR-6917, "Experimental Measurements of Pressure Drop Across Sump Screen Debris Beds in Support of Generic Safety Issue 191," dated February 2007 (Reference 3). Based upon the results of the informational testing, additional testing will be done in accordance with the requirements of 10 CFR 50, Appendix B, will be pursued to substantiate the adequacy of the replacement screens.

FPLE-PB has determined that performance of the longest duration contingency (flume testing) would be completed during the second quarter of 2008. This schedule is limited by test facility availability, and by the supporting analytical work necessary to establish debris transport modeling in the flume. Preparation and review of the final documentation will follow completion of the testing.

Recently issued guidance on the evaluation of in-core chemical effects requires the performance of an analysis using the loss-of-coolant-accident (LOCA) Deposition Model (LOCADM) contained in WCAP-16793-NP, "Evaluation of Long-Term Cooling Considering Particulate, Fibrous and Chemical Debris in the Recirculating Fluid," Revision 0, dated May 2007 (Reference 4). The LOCADM software is not currently configured to model upper plenum injection (UPI) plants, and it is not clear whether the recommendation in the WCAP to use LOCADM to assess in-core chemical effects is applicable to UPI plants. The emergent nature of this discrepancy and its late discovery, will extend the completion of the analysis into early 2008, and has been considered in establishing the schedule and resources necessary for resolution of issues associated with GSI-191.

Lastly, recently issued industry guidance contained in WCAP-16406-P, "Evaluation of Downstream Sump Debris Effects In Support of GSI-191," dated June 2005 (Reference 5), will require a revision of the previously completed ex-vessel downstream effects analysis. The revision of the guidance will require the use of the Archard wear model to analyze wear in the high head safety injection pumps. Revision of this analysis will be completed in the first quarter of 2008. No further modifications to the facility are expected to result from the completed analysis.

Mitigative Measures

1. Replacement Screens

   During the fall of 2006 and spring of 2007 refueling outages, new containment sump strainers were installed in the Unit 2 and 1 reactor containments, respectively.

   The new strainers are an improvement over the original strainer design, and increase the available flow area from ~21 ft^2 to ~1500 ft^2 for each of two redundant strainers in each of the containments. In addition, the size of the round holes in the strainers has been reduced from 1/8-inch to 0.066-inch diameter. The design approach velocity of the new screens is 0.0033 fps.

Testing of a scaled prototype module of the replacement strainers has been performed. The testing used two different debris loadings; design basis and a low fiber test designed to develop a nominal "thin bed." The tests were performed under ambient conditions. At the scaled design flow rate for the installed strainer, the differential pressure across the debris bed for the full design basis debris load was 0.110 ft. At the scaled design flow rate for the installed strainer, the differential pressure across the low fiber debris bed was 0.546 ft. These head losses would be lower with the hot, less viscous sump conditions early in an accident sequence.

The calculated clean strainer head loss for the installed strainers, including connecting piping, elbows, flow control devices, etc., is 0.4773 ft at 212°F.

Adding the results of the prototype screen head losses tests performed at ambient conditions to the calculated clean strainer head losses at design temperature results in projected head losses of 0.59 ft and 1.0 ft for the design basis and thin bed tests respectively.

The allowable head loss for the strainer is 38-inches. Therefore, a margin of greater than 2 feet exists to accommodate potential chemical effects.

2. Coatings Inspections and Qualification

Inspections of the protective coatings in containment are performed on a refueling outage frequency. Inspections of the pressurizer and reactor coolant system (RCS) loop compartments are performed during alternate outages because of As Low As Reasonably Achievable (ALARA) considerations. The inspections are part of a protective coating program complying with Regulatory Guide 1.54, "Service Level I, II, and III Protective Coatings Applied to Nuclear Plants," dated June 1973 (Reference 6), and ANSI N101.4-1972, "Quality Assurance Requirements for Protective Coatings Applied to Water-Cooled Nuclear Power Plants," dated November 28, 1972 (Reference 7), to ensure that coatings do not adversely affect safety-related systems, structures or components.

Laboratory analysis and in situ adhesion testing of the coatings on the polar crane rail support beam and on the polar crane structure coatings determined that these coatings, previously considered unqualified, are acceptable and would remain intact following a design basis LOCA. This has led to a reduction in the expected coatings debris generation from that used in the design of the replacement screens.

3. Containment Cleanliness

FPLE-PB has established a formal program for positively controlling potential debris sources in the containments. The program includes periodic inspections and assessment of latent debris, control of insulation changes, control of metallic aluminum, and control of introduced non-metallic materials such as tags, labels, tie-wraps, etc. inside containment. In MODE 1 through MODE 4, the containment is a special foreign material exclusion zone requiring strict controls on the types and quantities of materials that may be taken into or left inside of the containment buildings.

4. Procedure Guidance

Emergency operating procedure (EOP)1.3, "Transfer to Containment Sump Recirculation-Low Head Injection," directs operators to monitor for sump performance. If blockage is indicated, use of emergency contingency procedure (ECA) 1.3, "Containment Sump Blockage," is directed to manage and mitigate the effects of the blockage and to restore core injection.

5. Risk Evaluation

Generic Letter 2004-02 provides the following observations regarding risk significance that remain valid through the proposed extended implementation period to the completion of the chemical effects testing and downstream effects analyses. The probability of a large break LOCA remains extremely low, as does the probability of a small break LOCA that may require recirculation. The PBNP containment is open, eliminating areas of flow restriction that could concentrate flow and promote debris transport. The minimum time to switchover to recirculation (at least 27 minutes after initiation of an event) allows for significant settling of debris suspended by the initial blast and the initial wash-down of containment by containment spray.

Several plant-specific parameters also indicate that the risk of sump screen blockage and/or damage to downstream components is low. The design approach velocity for the PBNP screens is 0.0033 fps. During published benchmark studies, it was found that sustained velocities higher that 0.1 fps were necessary to transport debris. Therefore, the velocity that would be present in the PBNP sumps, and close to the screens, would be below that needed to deliver debris to the screen faces.

Although FPLE-PB uses a sodium hydroxide (NaOH) buffer, the calculated concentration of dissolved aluminum in the PBNP sumps is a maximum of 16.3 ppm, compared with the minimum 100 ppm concentration used in NRC-sponsored studies. The potential impact of possible adverse chemical effects on sump screen differential pressure are expected to be lower than suggested by the NRC-sponsored studies.

The high head safety injection pumps (HHSI) are the only pumps potentially affected by change in recommended wear modeling due to the suspended solids. For a large break LOCA, these pumps are secured immediately after sump recirculation is established; and within the confines of analyzed accidents, are only credited for subsequent operation to prevent boron concentration and precipitation. A large-break LOCA would not result in boron concentration and/or precipitation because the RCS is immediately depressurized and injected water mixes with and flushes the core outlet plenum.

In the case of a small break LOCA that resulted in an RCS pressure high enough to prevent low head (core outlet plenum) injection, procedurally directed manual actions to cool down and depressurize the RCS and restore low head injection would be completed within several hours. This would be before boron precipitation or high head safety injection (HHSI) pump failure from accelerated wear is expected to occur.

FPLE-PB is an UPI plant where all low head injection is delivered directly to the top of the reactor vessel rather than to the RCS cold legs. As described in Section 2.7.2 of WCAP-16793-NP, long-term cooling for UPI plants will be maintained. Similarly, the continued flushing of concentrated chemical species out of the break by the excess injection flow to the upper plenum should minimize chemical concentrations and fouling in the fuel assemblies.

6. Safety Features and Margins in Current Configuration/Design

The PBNP containment sump incorporates design features that help to minimize the possibility of strainer blockage. The containment sump is the lowest full containment floor elevation. The screens are located outside the RCS loop compartments to minimize the potential for damage from a high energy pipe failure. There are two redundant trains to minimize the potential for a single failure resulting in loss of function. The lower containment is an open, one-level area. The sump screens rest on supports, that are slightly off the sump floor, and are not mounted in a depressed sump that could collect debris and obstruct active screen area.

Following a safeguards actuation, it will take a minimum of 27 minutes from event initiation until the containment sump has filled to the point of supporting recirculation operation. During this period, debris generated by the LOCA blast would be wetted out by the hot sump fluid and would sink to the containment floor. The low velocities in the open sump elevation would preclude the transport of the sunken debris to the screen surfaces. Similarly, debris that may have been deposited in the immediate vicinity of the screens by the initial blast or by pool fill wash-down/sheeting would not be subject to transport up onto the screen surfaces under the prevailing low velocities because the screen disks are arranged with vertical faces.

The replacement sump screens are designed to withstand at least a 38-inch differential pressure (the maximum allowable head loss). During the qualification testing of the prototype strainer, significant margin to NPSH and structural limits was demonstrated under cold conditions with both design basis loads and a nominal thin bed load of debris.

FPLE-PB uses sodium hydroxide as a sump pH buffer. The sodium hydroxide is added via the containment spray system while spray is drawing from the refueling water storage tank (RWST). The duration of this spray is limited by the available RWST inventory. In the case of large break LOCA, the minimum time of injection spray would be at least 69 minutes. Spray would then be secured, and the caustic corrosion attack of aluminum components above the sump level would cease.

Calculations of aluminum corrosion performed in accordance with the guidance of WCAP-16530-NP, "Evaluation of Post-Accident Chemical Effects in Containment Sump Fluids to Support GSI-191," Revision 0, dated February 2006 (Reference 8), assumed that spray would continue for an assumed 6-hour duration. Due to the limited mass of aluminum resident in the PBNP containments, the calculations revealed that a maximum concentration of 16.3 ppm aluminum would result, despite the prolonged spray system operation assumed.

Conclusion

Based on the above discussion, FPLE-PB has determined that overall plant safety will be maintained until the final analytical and testing results can be provided to the Commission by June 30, 2008.

References

1. GL 2004-02, “Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors,” dated September 13, 2004.

2. WCAP-16785-NP, “Evaluation of Additional Inputs to the WCAP-16530-NP Chemical Model,” Revision 0, dated May 2007.

3. NUREG/CR-6917, “Experimental Measurements of Pressure Drop Across Sump Screen Debris Beds in Support of Generic Safety Issue 191,” dated February 2007.

4. WCAP-16793-NP, “Evaluation of Long-Term Cooling Considering Particulate, Fibrous and Chemical Debris in the Recirculating Fluid,” Revision 0, dated May 2007.

5. WCAP-16406-P, “Evaluation of Downstream Sump Debris Effects In Support of GSI-191,” dated June 2005.

6. Regulatory Guide 1.54,“ Service Level I, II, and III Protective Coatings Applied to Nuclear Plants,” dated June 1973.

7. ANSI N101.4-1972, “Quality Assurance Requirements for Protective Coatings Applied to Water-Cooled Nuclear Power Plants,” dated November 28, 1972.

8. WCAP-16530-NP, “Evaluation of Post-Accident Chemical Effects in Containment Sump Fluids to Support GSI-191,” Revision 0, dated February 2006.