Progress Energy

Serial: RNP-RA/03-0104

AUG 0 8 2003

United States Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
DOCKET NO. 50-261/LICENSE NO. DPR-23

SUBMITTAL OF INFORMATION REQUESTED BY
NRC BULLETIN 2003-01, "POTENTIAL IMPACT OF DEBRIS BLOCKAGE ON
EMERGENCY SUMP RECIRCULATION AT PRESSURIZED-WATER REACTORS"

Ladies and Gentlemen:

On June 9, 2003, NRC Bulletin 2003-01, "Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized-Water Reactors," was issued requesting that licensees provide a response containing information requested in accordance with Option 1 or Option 2 of this Bulletin within 60 days. The purpose of this letter is to provide the H. B. Robinson Steam Electric Plant (HBRSEP), Unit No. 2, response to NRC Bulletin 2003-01.

Attachment I provides an Affirmation in accordance with the provisions of Section 182a of the Atomic Energy Act of 1954, as amended, and 10 CFR 50.54(f).

Attachment II provides the required response, in accordance with Option 2 of the Bulletin.

If you have any questions concerning this matter, please contact Mr. C. T. Baucom.

Sincerely,

Jan F. Lucas
Manager – Support Services – Nuclear

Progress Energy Carolinas, Inc.
Robinson Nuclear Plant
3581 West Entrance Road
Hartsville, SC 29550

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CAC/cac

Attachments:

I. Affirmation

II. Submittal of Information Requested by NRC Bulletin 2003-01, "Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized-Water Reactors"

c: Mr. L. A. Reyes, NRC, Region II
Mr. C. P. Patel, NRC, NRR
NRC Resident Inspector

AFFIRMATION

The information contained in letter RNP-RA/03-0104 is true and correct to the best of my information, knowledge and belief; and the sources of my information are officers, employees, contractors, and agents of Progress Energy Carolinas, Inc. I declare under penalty of perjury that the foregoing is true and correct.

Executed on: AUG 0 8 2003

C. L. Burton
Director – Site Operations
HBRSEP, Unit No. 2

H.B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2

SUBMITTAL OF INFORMATION REQUESTED BY NRC BULLETIN 2003-01, "POTENTIAL IMPACT OF DEBRIS BLOCKAGE ON EMERGENCY SUMP RECIRCULATION AT PRESSURIZED-WATER REACTORS"

Progress Energy Carolinas, Inc. (PEC) has evaluated the current status of H. B. Robinson Steam Electric Plant (HBRSEP), Unit No. 2, with regard to the information and criteria provided by NRC Bulletin 2003-01, "Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized-Water Reactors," dated June 9, 2003. It has been determined that detailed analyses have not been performed for HBRSEP, Unit No. 2, to demonstrate compliance exists with 10 CFR 50.46(b)(5), and other existing applicable regulatory requirements, relative to the potentially adverse post-accident debris blockage effects identified in Bulletin 2003-01. Therefore, response Option 2 is applicable, and recirculation sump compensatory measures will be implemented, as described in the following information, to reduce the risk associated with the potential for degraded emergency sump recirculation performance.

NRC Information Request

Option 2: Describe any interim compensatory measures that have been implemented or that will be implemented to reduce the risk which may be associated with potentially degraded or nonconforming Emergency Core Cooling System (ECCS) and Containment Spray System (CSS) recirculation functions until an evaluation to determine compliance is complete. If any of the interim compensatory measures listed in the Discussion section will not be implemented, provide a justification. Additionally, for any planned interim measures that will not be in place prior to your response to this bulletin, submit an implementation schedule and provide the basis for concluding that their implementation is not practical until a later date.

Response

HBRSEP, Unit No. 2, Containment Vessel (CV) ECCS Sump Description

The following information summarizes the salient aspects of the ECCS, CSS, and CV. Additional information is available in the Updated Final Safety Analysis Report for HBRSEP, Unit No. 2.

The CV ECCS sump (called "emergency sump" in NRCB 2003-01) is three feet wide, one foot deep, and follows the outside diameter of the reactor coolant loop shield wall for approximately twenty-five feet at Elevation 228 ft. (above sea-level); the bottom of the sump is at Elevation 227 ft. In the bottom of the sump are the inlets to two lines that deliver water from the sump to the suctions of the low-head safety injection (LHSI) pumps. Each of the two lines is located inside a larger diameter guard pipe. The inlets to the lines are approximately eighteen feet apart.

Fluid entering the sump must pass through screens that enclose the entire sump opening. The screens are mounted at approximately a 45 degree angle, have an approximate overall area of 116 square feet (sq. ft.), and an approximate free area of 82 sq. ft.

Immediately outside of the sump is a 4.5 ft. baffle wall, with 9 inch high openings at its base. Three of the 9 inch high openings are approximately 7.5 ft. wide and two openings are approximately 2.3 ft. wide. The baffle wall on three sides, combined with the reactor coolant loop shield wall on one side, completely surround the sump opening. A hood is located over the sump to prevent debris from falling directly into the area between the sump screens and the baffle wall. Approximately 2 ft. outside of the baffle wall is a 9 inch curb. The curb completely surrounds the baffle wall.

Staged debris removal of the water entering the LHSI pump suction piping during recirculation is accomplished as follows:

- Debris approximately one inch and above is held back by the coarse screens, located at the base of the shield wall inside the Reactor Coolant Pump Bays.
- Submerged debris approaching the CV ECCS sump along the floor is held back by the 9 inch curb.
- Floating debris approaching the CV ECCS sump is initially blocked by the 4.5 ft baffle wall. By the time the CV water level is high enough to carry floating debris over the wall, the level is above the sump screens.
- Neutral and near neutral buoyant debris that passes over the 9 inch outer curb and through the 9 inch high openings in the base of the baffle wall will reach the sump screens. Debris greater than approximately 7/32 inch diameter will be stopped by the screens. Debris smaller than approximately 7/32 inch diameter may pass through the screens and enter the suction of the LHSI pumps.

As Reactor Coolant System (RCS) pressure drops after a Large Break Loss-of-Coolant Accident (LBLOCA), the accumulators inject borated water. Subsequently, the high-head safety injection (HHSI) and LHSI systems will inject additional borated water from the refueling water storage tank (RWST). The injection phase of the LBLOCA will continue until the RWST level reaches 27%. At this point, operators will begin realigning the ECCS and CSS from the injection mode to the long term recirculation mode; the realignment is completed prior to the RWST level reaching 9%.

The current licensing and design bases of the HBRSEP, Unit No. 2, ECCS and CSS do not include any description of realignment of the system back to the injection mode after the sump recirculation is established.

RESPONSES TO NRC COMPENSATORY MEASURES 1 THROUGH 6

The NRC has recommended six interim measures and has requested a justification for not performing any of the six, if applicable. Additionally, the NRC has requested an implementation schedule and basis for delaying implementation of any compensatory measure until a later date.

The following information provides the HBRSEP, Unit No. 2, evaluation of these compensatory measures and the basis for the proposed implementation schedule, as applicable.

COMPENSATORY MEASURE 1: Operator training on indications of and responses to sump clogging.

During the recirculation phase of a LOCA, the LHSI pumps are either injecting directly into the RCS or are being used to provide a suction source for the HHSI or CSS pumps or both, depending upon CV and RCS pressure conditions. Blockage of the CV sump during the recirculation phase of a LOCA would likely cause a loss of net positive suction head (NPSH) to the LHSI pumps, which in turn would likely cause the LHSI pumps to cavitate. The cavitation will adversely affect the discharge pressure and flow rate of the pumps, and produce erratic readings on the LHSI pump discharge pressure and flow indicators.

HBRSEP, Unit No. 2, will accomplish this compensatory measure in two phases. In phase one, licensed operator overview training will be conducted. This training will provide the theory behind the issue, expected indications of sump blockage, and planned strategies for mitigation. In addition, the simulator model has been revised to provide indications of varying degrees of sump blockage. The simulator will be used to demonstrate the indications of CV ECCS sump blockage as part of the overview training.

Phase two will consist of procedure revisions that will provide the operator response, and formal operator training on those revisions prior to implementation. The target date of the procedure revisions and formal training will extend past the 60 day response date to accommodate training cycle schedules for five operating crews.

The proposed procedure revisions may be placed in two broad categories. The first category includes those actions that may be accomplished prior to indications of CV sump screen blockage. These actions should be consistent with the current licensing and design bases, and the associated procedure changes must be evaluated in accordance with 10 CFR 50.59 to determine if NRC approval is required prior to implementation of the changes. These actions include:

- Starting only one train of safeguards pumps when aligning for long term recirculation after sufficient time has elapsed.
- Diagnostic steps that direct the operators to monitor the applicable pressure and flow indicators for signs of ECCS sump blockage.
- Refilling the RWST from the normal make-up source, if available, when alignment to recirculation mode is complete.

The second category of actions includes those actions that take place after sump blockage has been diagnosed. Complete loss of ECCS flow due to sump blockage is not considered in the current accident analyses for HBRSEP, Unit No. 2. Therefore, compensatory actions or mitigation measures for this condition are considered to be "beyond design basis."

The appropriate emergency procedures will be revised to provide operators with procedural guidance relative to responding to a loss of the ECCS sump suction due to blockage. The procedure revisions are expected to include the following sump blocking mitigation measures:

- Stop CSS pumps under allowable conditions.
- Raise CV pressure using either Station or Instrument Air, to potentially improve NPSH.
- Realign to the injection mode if sufficient inventory has been restored to the RWST.
- Reduce ECCS flow requirements in the recirculation phase of a LOCA.
- Allow intermittent operation of the LHSI pumps.

Completed Actions to Address Compensatory Measure 1:

- The simulator model has been revised to provide indications of varying degrees of sump blockage.

Planned Actions to Address Compensatory Measure 1:

- Overview training for licensed operators on indications of ECCS sump blockage, including proposed procedural strategy, will be covered in Licensed Operator Continuing Training (LOCT) Cycle 4, starting July 28, and will be completed by August 28, 2003. This schedule is based on the current LOCT schedule.
- Formal training on approved procedures will be performed during LOCT Cycle 5, starting September 22, and will be completed by November 14, 2003.
- Emergency procedure revisions that contain guidance on identification and mitigation of sump clogging will be made effective by November 14, 2003. This schedule is based on the estimated time to complete the procedure revisions and to develop and perform training prior to issuance. If it is determined that any of these changes cannot be implemented without prior NRC approval in accordance with 10 CFR 50.59, then these changes will not be made until such time that NRC approval is received.

COMPENSATORY MEASURE 2: Procedural modifications, if appropriate, that would delay the switchover to containment sump recirculation (e.g., shutting down redundant pumps that are not necessary to provide required flows to cool the containment and reactor core, and operating the CSS intermittently).

HBRSEP, Unit No. 2, does not consider this compensatory measure achievable at the present time. The HBRSEP, Unit No. 2, licensing basis General Design Criteria (GDC) require that accident analysis acceptance criteria still be met with the assumption of a single active failure. Proposed actions to stop ECCS pumps or throttle flow, concurrent with a single failure, could create conditions that have not been considered in the current design basis safety analyses.

The Westinghouse Owners Group (WOG) has published "Transmittal of Response Template for NRC Bulletin 2003-01, 'Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized-Water Reactors'." This WOG publication contains the following specific comments relative to Compensatory Measure 2.

- These actions would be inconsistent with the overall WOG Emergency Response Guidelines (ERG) philosophy. The WOG ERGs are symptom-based procedures that provide for the monitoring of plant parameters and prescribe actions based on the response of those parameters. To avoid the risk of taking an incorrect action for an actual event, the WOG ERGs do not prescribe contingency actions until symptoms that warrant those contingency actions are identified.

- These actions would be inconsistent with the current operator response using the WOG ERGs that has been established through extensive operator training. The expected operator response is based on the optimal set of actions considering both design basis accidents and accidents outside the design basis. The WOG ERG operator response is not limited to a specific accident progression in order to provide optimal guidance for a wide range of possible accidents.

In the future, if changes to the WOG ERGs are received that provide guidance for the delay of switchover to recirculation, these changes will be reviewed for incorporation into the emergency operating procedures in accordance with the applicable process for such changes at HBRSEP, Unit No. 2.

HBRSEP, Unit No. 2, has also evaluated delaying switchover to the recirculation phase by providing additional fluid for the injection phase.

The RWST high level alarm reflects a level of 92.5%, which is approximately 2 inches below the overflow line. The margin between the high level alarm and the overflow line cannot be reduced because the high level alarm plus uncertainties is currently greater than the elevation of the overflow pipe.

During the injection phase of a LOCA, when the RWST level decreases to 27% (Elevation 238.91 ft) the emergency procedures provide guidance for switching from the injection phase to the recirculation phase prior to reaching an RWST level of 9% (Elevation 233.06 ft). The minimum RWST level which provides sufficient NPSH to the LHSI pumps is Elevation 234.41 ft. Due to this NPSH requirement, the switchover to long term recirculation is a time sensitive series of steps that cannot be delayed to allow the injection of additional water from the RWST.

In summary, the small operating band at the top of the RWST and the NPSH constraints at the bottom demonstrate that there is no additional volume available to prolong the injection phase.

Finally, the HBRSEP, Unit No. 2, compliance with 10 CFR 50, Appendix K, is such that a single active failure may occur at any time during the injection phase. Under this assumption, performing actions to shutdown a redundant train during the injection phase could result in a loss of both trains should the single failure occur after the redundant train is shutdown. This would necessitate a manual operator action to restart the standby train with a corresponding period in which no flow was being provided for core cooling. This is not supported by the current HBRSEP, Unit No. 2, safety analyses and licensing basis. This action would require an extensive evaluation, and possibly additional Appendix K accident analyses or a license

amendment request in accordance with 10 CFR 50.59. Therefore, it is concluded that this type of action cannot be implemented as an interim compensatory measure at this time.

COMPENSATORY MEASURE 3: Ensuring that alternative water sources are available to refill the RWST or to otherwise provide inventory to inject into the reactor core and spray into the containment atmosphere.

As part of the evaluation of NRCB 2003-01, methods of filling the RWST via normal makeup and transfer of water from the Spent Fuel Pool were considered for HBRSEP, Unit No. 2. Normal makeup to the RWST is accomplished via the Chemical and Volume Control System using blended makeup from the Boric Acid Storage Tanks and the Primary Water Storage Tank. This occurs at a rate of between 75 and 100 gpm, the rate being dependent on blender settings. Additional makeup via transfer of water from the Spent Fuel Pool to the RWST was examined and deemed to be undesirable. As an action for this compensatory measure, the emergency procedures will be revised to initiate makeup to the RWST, using the normal makeup system, provided it is available. This action is currently deemed to be within the current design basis of the plant. If it is subsequently determined that any of these changes cannot be implemented without prior NRC approval in accordance with 10 CFR 50.59, then these changes will not be made until such time that NRC approval is received.

Planned Actions to Address Compensatory Measure 3:

- The emergency procedures will be revised to initiate makeup to the RWST, using the normal makeup system, provided it is available. These procedure revisions will be included with the other changes described under Compensatory Measure 1, and will be made effective on the same date, November 14, 2003. This schedule is based on the estimated time to complete the procedure revisions and to develop and perform training prior to issuance.

COMPENSATORY MEASURE 4: More aggressive containment cleaning and increased foreign material controls.

HBRSEP, Unit No. 2, has performed CV insulation and cleanliness inspections, in accordance with NEI 02-01, "Condition Assessment Guidelines: Debris Sources Inside PWR Containments," as the first step toward addressing the phenomenon discussed in NRCB 2003-01.

An HBRSEP, Unit No. 2, program procedure, PLP-006, "Containment Vessel Inspection/ Closeout," provides instructions for complete and consistent closeout inspection of the CV. PLP-006 is normally completed at the last CV entry prior to RCS heatup after a major outage (e.g. refueling), or for any entry into the CV while the RCS temperature is above 200 degrees F.

A review of PLP-006 was conducted during the evaluation of the NRCB 2003-01. The following aspects of PLP-006 were found to be consistent with an effective CV cleanliness program:

- The Operations Manager, or his designee, performs a final tour of the CV to verify compliance with procedural requirements prior to closeout.

- A lead person is assigned responsibility for ensuring cleanliness for each maintenance activity.
- Items stored in the CV must meet one of the following criteria:
  - Have no protective coating (paint).
  - Have protective coatings that are resistant to design basis accident conditions.
  - Be encapsulated within mesh with openings not to exceed 7/32 inch.
- Items stored in the CV are verified to be stored as identified below:
  - Stored on the locations evaluated as acceptable to maintain recirculation.
  - Stored in the condition listed, e.g., as close to the floor as possible; at least two feet from safety related equipment; stored in a position to prevent rolling or overturning; and stored on a concrete floor.
- Floor drains are verified clear of obstructions, and drain socks are removed prior to the RCS reaching 200 degrees F.

During the review of the CV cleanliness program, it was determined that two aspects could be strengthened. Specifically, stressing CV cleanliness during pre-job briefings for maintenance activities performed when containment integrity is established (i.e., RCS temperature above 200 degrees F) and removal of temporary signs and postings prior to exceeding RCS temperature of 200 degrees F and for activities in the CV when RCS temperature is above 200 degrees F. Additionally, to increase awareness on the need for CV cleanliness, training will be provided to maintenance and radiological control personnel prior to the next refueling outage.

Completed Actions to Address Compensatory Measure 4:

- A procedural requirement has been added to PLP-006 to discuss CV cleanliness in a pre-job brief for maintenance activities performed when RCS temperature is above 200 degrees F.
- A procedural requirement has been added to PLP-006 to remove temporary signs and postings prior to RCS temperature exceeding 200 degrees, and for activities in the CV when RCS temperature is above 200 degrees F.

Planned Actions to Address Compensatory Measure 4:

- Provide outage-related training to maintenance and radiological control personnel on the importance of CV cleanliness. This training will be completed prior to the next refueling outage, which is currently scheduled for April 2004.

COMPENSATORY MEASURE 5: Ensuring containment drainage paths are unblocked.

A review was performed of CV design drawings to determine if locations exist, that were not previously considered, that could hold water during a design basis accident. Such locations could trap fluid and reduce water available for recirculation, which could cause a reduction in the CV fluid level at the ECCS sump. The fluid level present for long term recirculation is an input to the accident analysis and NPSH design calculations. No locations were identified that would hold a sufficient quantity of water to change the assumptions in the safety analysis and NPSH design calculations relative to the CV recirculation water level.

Engineered scaffolding frames and storage boxes are permitted inside the CV during power operations. Storage requirements for these items are documented in site procedure PLP-006 and are evaluated for post-accident conditions, including reviews for seismic stability, ECCS sump operation, zinc and aluminum limitations, and potential debris source term (free of tape, paint, rubber, wood, etc.).

The discussion section of NRCB 2003-01 identifies five licensee event reports that pertain to discovery of conditions that could have caused holdup or diversion of recirculation sump inventory at other plants. HBRSEP, Unit No. 2, has reviewed these licensee event reports. Additionally, based on the review of CV design drawings, as discussed above, there are currently no identified conditions at HBRSEP, Unit No. 2, that would be expected to cause holdup or diversion to the extent that ECCS sump performance would be impaired. As further evaluations and analyses of the HBRSEP, Unit No. 2, CV sump performance and ECCS recirculation are conducted, it is anticipated that operating experience, such as the licensee event reports identified in NRCB 2003-01, will be utilized.

During the review of CV drain paths, it was determined that the lower cavity is drained to the lower levels of CV through valve WD-1757. The normal position of WD-1757 is "locked open." The position of valve WD-1757 was verified as "locked open" during a CV entry on June 25, 2003.

No additional actions have been identified for this compensatory measure.

Completed Actions to Address Compensatory Measure 5:

- The position of valve WD-1757 was verified as "locked open" during a CV entry on June 25, 2003.

COMPENSATORY MEASURE 6: Ensuring sump screens are free of adverse gaps and breaches.

Prior to startup from each refueling outage, the ECCS sump is inspected in accordance with Engineering Surveillance Test procedure EST-139, "ECCS Containment Sump Inspection." The scope of EST-139 includes the following specific inspections:

- ECCS Coarse Filtration Screens

  The ECCS coarse filtration screens cover openings in the biological shield wall through which recirculated water will flow during the course of a LOCA. The screens consist of a single layer of wire fabric. The screens are inspected to ensure that screen openings do not exceed 1.25 inches; openings between the screen frames and adjacent wall and floor structures, and around penetrating items, do not exceed 1.25 inches; there is no evidence of structural distress or abnormal corrosion; and, the screens are not restricted by debris.

- ECCS Sump Inlet Structure and Hood

  The ECCS sump inlet structure consists of a 9 inch curb, to hold back non-buoyant debris that may be moving along the CV floor, followed by a 4.5 foot baffle wall with 9 inch high penetrations at its base, to hold back floating debris. A stainless steel hood is located above these structures to ensure debris falling from above the sump inlet does not bypass the curb and baffle wall. The ECCS Sump inlet structure, including the hood, is inspected to ensure it is clean and there is no evidence of structural distress.

- ECCS Sump Screens

  The ECCS sump screens are located downstream of the baffle wall and cover the ECCS sump opening. The sump screens consist of two layers of wire fabric. The screens are inspected to ensure that the outer screen openings do not exceed 0.50 inch square; the inner screen openings do not exceed 0.22 (7/32) inch square; openings between the screen frames and adjacent wall and floor structures do not exceed 0.19 (3/16) inch; there is no evidence of structural distress or abnormal corrosion; and, the screens are not restricted by debris.

The EST-139 inspection is performed in conjunction with Plant Program Procedure PLP-059, "Refueling Startup Readiness Assessment," and meets surveillance requirement SR 3.5.2.6 of Technical Specifications Section 3.5.2. The PLP-059 system readiness assessment specifically includes an affirmation of readiness by the Superintendent Systems Engineering that systems are ready to support MODE 4 and MODE 2 operations.

The EST-139 inspection of the ECCS sump was completed at the end of the most recent refueling outage, i.e., Refueling Outage 21, in November of 2002. During the inspection, special attention was focused on ensuring that there were no adverse gaps or breaches in the coarse screens in the biological shield wall, nor in the fine screens at the ECCS sump inlet. Action items identified in the inspection were resolved and the sump placed in satisfactory condition prior to startup from that outage.

No additional actions have been identified for this compensatory measure.

Conclusion

The proposed compensatory measures for ECCS sump blockage have been evaluated. Actions have been and will be taken to further reduce the possibility that ECCS sump blockage may cause the loss of ECCS or CSS function during a LOCA, as described in the preceding information. The bases for the implementation times have been provided, where applicable. No additional compensatory measures have been identified during the review of this issue.