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

Subject: Brunswick Steam Electric Plant, Unit Nos. 1 and 2
Docket Nos. 50-325 and 50-324/License Nos. DPR-71 and DPR-62
Response to Request for Additional Information Regarding Request for License Amendment – Technical Specification 3.6.1.6, "Suppression Chamber-to-Drywell Vacuum Breakers"

References: Letter from Benjamin C. Waldrep to U.S. Nuclear Regulatory Commission, "Request for License Amendment – Technical Specification 3.6.1.6, Suppression Chamber-to-Drywell Vacuum Breakers," dated July 7, 2008 (ADAMS Accession Number ML081980056)

Letter from Farideh E. Saba (NRC) to Benjamin Waldrep (CP&L), "Request for Additional Information Regarding Proposed Change to Technical Specification 3.6.1.6, Suppression Chamber-to-Drywell Vacuum Breakers (TAC Nos. MD9184 and MD9185)," dated October 22, 2008 (ADAMS Accession Number ML082810616)

Ladies and Gentlemen:

By letter dated July 7, 2008, Carolina Power & Light Company (CP&L), now doing business as Progress Energy Carolinas, Inc., submitted a license amendment request to revise the Technical Specifications for the Brunswick Steam Electric Plant (BSEP), Unit Nos. 1 and 2. The proposed license amendment revises Surveillance Requirements 3.6.1.6.1 and 3.6.1.6.2, which specify testing requirements applicable to the suppression chamber-to-drywell vacuum breakers.

The NRC issued a letter on October 22, 2008, requesting, within 30 days following the date of the letter, additional information regarding the referenced amendment request. In a subsequent telephone discussion, the NRC Project Manager, Mrs. Farideh E. Saba, agreed to an extension of the deadline from 30 to 60 days for responding to this request. The enclosure to this letter provides the requested information.

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No regulatory commitments are contained in this letter. Please refer any questions regarding this submittal to Mr. Gene Atkinson, Supervisor - Licensing/Regulatory Programs, at (910) 457-2056.

I declare, under penalty of perjury, that the foregoing is true and correct. Executed on December 17, 2008.

Sincerely,

Benjamin C. Waldrep

WRM/wrm

Enclosure: Response to Request for Additional Information

cc (with enclosure):

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Response to Request for Additional Information

By letter dated July 7, 2008, Carolina Power & Light Company (CP&L), now doing business as Progress Energy Carolinas, Inc., submitted a license amendment request to revise the Technical Specifications (TS) for the Brunswick Steam Electric Plant (BSEP), Unit Nos. 1 and 2. The proposed license amendment revises Surveillance Requirements (SRs) 3.6.1.6.1 and 3.6.1.6.2, which specify testing requirements applicable to the suppression chamber-to-drywell vacuum breakers.

On October 22, 2008, the NRC issued a letter requesting additional information regarding the referenced amendment request. The following documents the responses to the NRC's information request.

NRC Question 1

Please explain why venting the suppression chamber for "extended periods" prior to venting the drywell has not been effective in limiting opening of the suppression chamber to drywell vacuum breakers (VBs). Are changes possible to this procedure that could eliminate vacuum breaker opening?

Response to NRC Question 1

The strategy for venting the suppression chamber prior to venting the drywell was only adopted after the last revision to SR 3.6.1.6.2 (i.e., by License Amendments 240 and 268 for Unit 1 and Unit 2, respectively), which added a requirement to perform a functional test of the suppression chamber-to-drywell vacuum breakers within 12 hours following an operation that causes any of the vacuum breakers to open. At the time of the previous revision to SR 3.6.1.6.2, it was not recognized that routine venting of the drywell atmosphere, which occurs approximately once per four or five days during normal operation, would result in one of the suppression chamber-to-drywell vacuum breakers opening. When the new TS surveillance was implemented, it became clear that the routine operation of drywell venting was resulting in the performance of the vacuum breaker functional test every four or five days, instead of the 92 day frequency specified for the routine surveillance.

To address this unintended consequence, a workaround was established within the containment venting procedure to vent the suppression chamber first, and then vent the drywell. The intent of this strategy was to ensure that the suppression chamber pressure remained less than the drywell pressure at all times, such that the vacuum breakers would not be challenged to open. The normal venting procedures use small (i.e., 2-inch) bypass lines to avoid opening the larger (i.e., 20-inch for suppression chamber, 18-inch for drywell) post-accident containment vent path for routine operation, because the small

valves have been shown by test or analysis to be capable of closing against the dynamic forces of a design basis loss-of-coolant-accident. The large diameter post-accident vent path valves have not been shown to be capable of closing against the dynamic forces of a design basis accident; therefore, a procedure change to use the large 20-inch vent valves is not a feasible alternative.

The vent path for the drywell goes through the large (i.e., 18-inch) inboard containment vent valve and uses a 2-inch globe (Unit 1) or gate (Unit 2) motor operated valve (MOV) to bypass the outboard vent valve for routine venting of the drywell. The 2-inch vent path for the suppression chamber bypasses both large (i.e., 20-inch) containment vent valves through a 2-inch globe (Unit 1) or gate (Unit 2) MOV and a 2-inch solenoid operated valve. The travel of the 2-inch solenoid valve has been verified using radiography, and the total stroke length for the solenoid valve disc is approximately 1/8 inch. This travel length was confirmed with the vendor (i.e., Valcor) to be the correct travel length for this valve. The flow resistance for the short-stroke solenoid valve is much greater than that for the 2-inch MOVs, so the flow rate through the suppression chamber vent path is much lower. The higher flow resistance would not be an issue for using the bypass line for controlled venting after an accident, with a high pressure in the suppression chamber. However, for routine operation the containment is typically vented at approximately 0.7 psig. Therefore, the large suppression chamber atmosphere volume combined with the restrictive vent path make this bypass line less effective for venting at normal operating pressures. The 2-inch suppression chamber vent bypass line has been verified to be free of obstruction, such as moisture buildup, by draining the line through local test connections, but no significant improvement in venting rate at low pressure was noted. This new venting strategy has increased the total time duration for venting the drywell from approximately 1.5 hours to approximately 8 hours, including the time to perform the vacuum breaker surveillance.

In summary, the current strategy for primary containment venting was only adopted as a workaround in an attempt to avoid an unintended consequence of the previous TS surveillance revision. The strategy uses a vent line that was not originally intended for use at normal containment operating pressures, and thus has not been as effective as desired. The equipment involved has been verified to be working properly per its design function. Use of the strategy has significantly increased (i.e., fivefold) the time that containment vent valves are in an off-normal (i.e., open) position.

NRC Question 2

Is it possible to limit the opening of the drywell vent valves so that the drywell is vented more slowly?

Response to NRC Question 2

The 2-inch drywell vent valves on both units are MOVs that fully open upon switch actuation (i.e., the valve logic features a seal-in contact in both the open and close circuit), and are not designed to be throttled. If the valves were modified to allow throttling, and hence a slower drywell venting process, the result would be a containment venting process that extended over several shifts with containment vent valves open, since the rate with the current venting strategy would still be controlled by the restrictive flow path for the suppression chamber which has the short-stroke solenoid valve. The goal of this TS change is to eliminate unnecessary vacuum breaker testing resulting from routine primary containment venting operations. As discussed in the response to Question 6 below, operating experience demonstrates that more frequent testing of the suppression chamber-to-drywell vacuum breakers negatively impacts the reliability of these vacuum breakers.

NRC Question 3

Is it possible to increase the differential pressure setting of the VB magnetic latches?

Response to NRC Question 3

SR 3.6.1.6.3 for the suppression chamber-to-drywell vacuum breakers requires that they open at less than 0.5 psid differential pressure. To ensure this requirement is met, the original design of the installed vacuum breakers is to fully open at 0.1 psid differential pressure. Maintenance and testing procedures for the vacuum breakers require the as-found lift setpoint be within a range of 0.072 to 0.11 psid. The lift setpoint of each vacuum breaker can be adjusted over a small range by changing the gap between the magnet and the magnet plate. However, significant increase in the opening differential pressure is not within the available range of adjustment for each vacuum breaker.

NRC Question 4

To your knowledge, is this a problem at other BWRs? If not, please explain why this is specific to Brunswick Steam Electric Plant (BSEP)?

Response to NRC Question 4

To the best of our knowledge, BSEP is unique in having adopted this particular surveillance requirement to functionally test all vacuum breakers after the opening of any one vacuum breaker (i.e., for reasons other than steam discharge to the suppression chamber). The vacuum breaker position is indicated in the main control room by position switch indication. Prior to implementation of the current Technical Specification

requirements, the brief cycling open of a vacuum breaker during drywell venting had no significance, so it was not raised as an issue. To ensure compliance with this Technical Specification requirement, Brunswick has installed a temporary modification that provides a sealed-in indication of any vacuum breaker that loses its full-closed indication, and has implemented routine operator checks of the temporary equipment. Without this temporary modification, a brief, transitory vacuum breaker opening event could occur and not be noticed by the operator.

In addition, many boiling water reactors (BWRs) of the same vintage as Brunswick have Technical Specification requirements and the associated plant equipment to maintain a minimum positive differential pressure between the drywell and suppression chamber, so opening of a vacuum breaker during venting should not be an issue.

NRC Question 5

Provide the operational history of the VBs at BSEP. For example, how long the VBs have been in service, and how many times the VB had been opened and tested.

Response to NRC Question 5

Each Brunswick unit features 10 suppression chamber-to-drywell vacuum breakers manufactured by Singer-GPE Controls. The vacuum breakers are designed to ensure that the negative pressure capability of the drywell is not exceeded in any design basis event. The suppression chamber-to-drywell vacuum breakers are of the swing-check type with soft seat arrangement. The vacuum breakers installed are all original plant equipment. Vacuum breakers frequently open for routine plant evolutions such as venting containment or any discharge of steam to the suppression chamber, such as testing of the High Pressure Coolant Injection or Reactor Core Isolation Cooling systems, so the exact number of times each vacuum breaker has opened in its history is not known. Vacuum breakers are routinely tested by verifying they are closed every 14 days (i.e., SR 3.6.1.6.1), by remote actuation to verify they will stroke open and closed every 92 days (i.e., SR 3.6.1.6.2), and by testing the full open differential pressure setpoint every 24 months (i.e., SR 3.6.1.6.3, which requires a plant shutdown to allow personnel entry into the suppression chamber). Note that because of the subject TS requirement to perform a functional test of all vacuum breakers if any one opens, the routine 92 day frequency surveillance is currently being performed much more frequently.

NRC Question 6

Provide the test history (including inservice testings and setpoint tests) of the VBs, and if any failures, discuss the causes of failures and failure mechanisms.

Response to NRC Question 6

The general test performance history of the suppression chamber-to-drywell vacuum breakers has been good. A review of the Brunswick corrective action program (CAP) entries for both Unit 1 and Unit 2 for the last eight years found a total of 28 condition reports associated with the vacuum breakers. The CAP entries related to test requirements are summarized as follows:

- There were several failures associated with a loss of control room closed position indication which affects SR 3.6.1.6.1. Alternate methods have been developed to verify that vacuum breakers are closed in case of a loss of position indication.
- There have been no examples of vacuum breakers which failed to open when functionally tested as required by SR 3.6.1.6.2. BSEP Unit 1 experienced a test failure in December 2004 that was later confirmed to be due to a failed open limit switch; however, the vacuum breaker was verified to not be stuck closed.
- There have been no failures of the vacuum breaker setpoint check required by SR 3.6.1.6.3 (i.e., performed only during outages). There was one adverse condition identified in November 2002 where vacuum breaker rebuild work was being performed before as-found testing was completed in accordance with SR 3.6.1.6.3 (i.e., a preconditioning issue).
- There was one notable test issue in July 2004 where, during a routine remote functional testing of vacuum breakers per SR 3.6.1.6.2, one vacuum breaker stuck in the open position and could not be closed. The inability to re-close the vacuum breaker meant that BSEP Unit 2 had to be shut down to meet the Limiting Condition for Operation requirements. The cause of the stuck open vacuum breaker was that the remote actuator, which is used for testing only, had bound in the open position. Some binding of the vacuum breaker pallet hinge was also found during the investigation. The investigation found that there had been at least three other industry events where an operating BWR had been required to shut down due to a vacuum breaker which stuck open during a surveillance; in all three events, issues with the test actuator was the cause for the stuck open vacuum breaker.

The last bullet is an area of concern for the plant when the 92-day functional test is being performed on an increased frequency basis. As a sample point, BSEP Unit 2 operator logs were reviewed for the month of October 2008 (i.e., Unit 2 operated at power the entire month); this review found that the Unit 2 drywell was vented six times in October 2008, and the vacuum breaker functional test was required to be performed after five out of the six venting evolutions. The TS Bases for SR 3.6.1.6.2 states that the 92 day frequency is based on Inservice Testing Program requirements to perform valve testing at least once every 92 days. Based on the test history for this surveillance, more frequent testing does not increase the reliability of the vacuum breakers.

Summary

The proposed license amendment revises Surveillance Requirements 3.6.1.6.1 and 3.6.1.6.2 to remove the requirement to perform a functional test of each suppression chamber-to-drywell vacuum breaker following an operation that causes any one vacuum breaker to open. Testing history has shown that there has never been a failure of a vacuum breaker to open, which is what the surveillance is intended to detect. Performance of this test on a highly frequent basis is undesirable because cycling of each vacuum breaker after any one has opened does not accomplish any safety goal, and exposes the plant to a risk that failure of a non-safety component (i.e., the actuator) can induce a failure of a safety-related component (i.e., the vacuum breaker). Efforts to avoid excessive performances of the functional test by venting the suppression chamber for an extended period have resulted in a fivefold increase in the time duration for a routine venting operation, and these efforts have met with limited success due to the design features of the installed equipment. Finally, the requirements of this TS has forced the installation of a temporary modification on each unit for the identification of a vacuum breaker opening during containment venting operations, in order to ensure compliance with the Surveillance Requirement 3.6.1.6.2.