UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
SAM NUNN ATLANTA FEDERAL CENTER
61 FORSYTH STREET SW SUITE 23T85
ATLANTA, GEORGIA 30303-8931

November 12, 2003

MEMORANDUM TO: Eric Leeds, Deputy Director
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

FROM: Victor M. McCree, Director ***/RA/***
Division of Reactor Projects

SUBJECT: TASK INTERFACE AGREEMENT (TIA 2003-05); NRC POLICY QUESTIONS ON TECHNICAL SPECIFICATION ADEQUACY AND RELATED TECHNICAL SPECIFICATION OPERABILITY AT BRUNSWICK NUCLEAR PLANT (INSPECTION REPORT 05000325,05000324/03-08)

Background: During a Region II Safety System Design and Performance Capability (SSDPC) inspection at the Brunswick Nuclear Plant [Docket Nos. 05000325 and 05000324], the inspection team identified a finding and unresolved item (URI) related to the adequacy of the Technical Specification (TS) Table 3.3.5.1-1 allowable value for the Condensate Storage Tank (CST) Level - Low function. This is the value at which the high pressure coolant injection (HPCI) pump suction will automatically transfer from its normal, non-safety related source (CST) to its safety related source (suppression pool). The licensee's calculation of record supporting this value did not adequately address the potential for air entrainment in the HPCI process flow due to vortexing in the CST. The calculation included both analysis and measurement errors.

Technical Specification Basis B 3.3.5.1 stated: "The CST Level - Low function allowable value is high enough to ensure adequate pump suction head while water is being taken from the CST." Section 9.2.6 of the UFSAR stated: "To allow time for the suction transfer to take place, this setpoint provides a margin of approximately 10,000 gallons in the tank after the setpoint is reached and before air will be entrained in the process flow." The licensee's calculation of record concluded that, if the HPCI pump was operating at its automatic flowrate of 4300 gpm during the CST Level - Low HPCI suction transfer, vortexing would cause some air to be entrained in the process flow and the entrained air would go through the HPCI pump. However, based on engineering judgement, the licensee engineers decided that the pump would not be damaged. The licensee's analysis was based on informal testing by a licensee engineer using a scale model made and operated by the engineer. Also, the licensee did not have a certification from the HPCI pump vendor that the pump could handle any amount of entrained air without being damaged.

The NRC inspectors performed an analysis based on information in NRC Regulatory Guide 1.82, "Water Sources for Long-Term Recirculation Cooling Following a Loss-of-Coolant Accident," and NUREG/CR-2772, "Hydraulic Performance of Pump Suction Inlets for Emergency Core Cooling Systems in Boiling Water Reactors." This analysis concluded that water with over 2% entrained air could pass through the HPCI pump for about five minutes. Further analysis by the inspectors, using information from a 2001 ASME paper by Alden

Laboratories titled JPGC2001/PWR-19010, “Air Entrainment in a Partially Filled Horizontal Pump Suction Line,” indicated that water with over 2% air could pass through the HPCI pump for about one minute.

The NRC inspection team identified deficiencies with the licensee’s calculation (not consistent with the UFSAR regarding air entrainment, reliance on informal/inappropriate tests and research papers, and measurement errors at the CST). These deficiencies were identified as a violation of 10 CFR 50, Appendix B, Criterion III, Design Control. The licensee entered the issue into their corrective action program in Action Request (AR) 102456 as a nonconforming condition and, in accordance with Generic Letter (GL) 91-18, performed an operability determination. The AR 102456 operability determination concluded that the CST Level - Low function was operable because no licensing/ design basis event would result in a sufficiently low level in the CST to challenge the CST Level - Low function. The AR also concluded that, since no licensing basis events would challenge the CST Level - Low function, the TS allowable value was adequate and did not need to be changed.

In response to NRC questions about that operability determination, the licensee obtained a letter from the pump vendor stating that the pump could withstand up to 5% of entrained air without damage. The licensee also initiated AR 106230-10 and performed another operability determination, which was more extensive than the first operability determination, but arrived at the same conclusions. The NRC inspectors received a copy of the AR 106230-10 operability determination on October 9, 2003.

Licensing Basis: The inspection team found that the licensing and design requirements for the CST Level - Low function were described as follows:

- Technical Specification Basis B 3.3.5.1 for the CST Level - Low function stated: [The CST Level - Low function] “...ensures that an adequate supply of makeup water is available to the HPCI pump. To prevent losing suction to the pump, the suction valves are interlocked so that the suppression pool suction valves must be open before the CST suction valve automatically closes. The function is implicitly assumed in the accident and transient analyses (which take credit for HPCI) since the analyses assume that the HPCI suction source is the suppression pool. The CST Level - Low function allowable value is high enough to ensure adequate pump suction head while water is being taken from the CST.”

- Section 9.2.6 of the UFSAR stated: “To allow time for the suction transfer to take place, this setpoint provides a margin of approximately 10,000 gallons in the tank after the setpoint is reached and before air will be entrained in the process flow.”

- The original Brunswick SER Section 9.2.6, dated November 1973, stated: “Initially, the HPCI pump takes suction from the condensate storage tank. Should this supply be at a low water level, suction is automatically transferred to the suppression pool.”

- A Brunswick Unit 2 license amendment application to raise the setpoint for the HPCI suction switchover due to suppression pool high level, dated October 22, 1975, stated: "During an accident situation, the normal suction for the HPCI system is from the condensate storage tank. When the level in the condensate storage tank reaches a preset low level, the suction is automatically switched to the suppression pool. Although

the suppression pool high level signal accomplishes the same function, changing the setpoint [of the suppression pool high level signal] upwards will not hinder the availability of water to the HPCI system because of the condensate storage tank low level switchover."

- The Standard Review Plan (SRP) included a review for provisions for automatically transferring from a normal water supply that is nonsafety related to an assured seismic Category 1 source if required. The SRP was silent on vortexing.

Licensee's Position: The licensee's position was that there were no licensing/design basis events that would result in a low CST level that would challenge the CST Level - Low function. They stated that the HPCI pump would not be running at its automatic flowrate of 4300 gpm with a low CST level because: 1) The TS-required Suppression Chamber Water Level - High function would activate first and would automatically transfer the HPCI pump suction from the CST to the suppression pool or 2) Operators could manually operate the HPCI pump with a low CST level, but would then manually stop the pump in response to a high reactor vessel water level and before any entrained air would reach the pump. Consequently, the licensee's operability determination stated: "The Low CST level setpoint does not need to provide any protection for LOCA events. It does provide protection when either an operator action in accordance with existing procedures, suppression pool level reduction is considered, or when early MSIV closure is not assumed." The licensee considered that the existing TS allowable value for the CST Level - Low function was adequate and did not need to be changed. The licensee planned to leave the TS allowable value unchanged.

The licensee stated that they based this position on NRC guidance in GL 91-18 and in IMC Part 9900, STS Section 1.0, Operability. They focused on the following words in IMC Part 9900:

> "Principal Criteria. The following are the principal criteria for TS operability requirements:
>
> a. The system operability requirements should be consistent with the safety analysis of specific design-bases events and regulatory requirements."
>
> "Because the technical specifications do not directly specify an LCO for many items that perform supporting functions, a knowledge of the plant design basis is essential to determine which support functions can affect plant operability."

The licensee also focused on these words from the TS Basis: "The function is implicitly assumed in the accident and transient analyses (which take credit for HPCI) since the analyses assume that the HPCI suction source is the suppression pool."

Based on their interpretation of these words, the licensee concluded that the CST Level - Low function must work only to the extent that it is challenged by licensing basis events.

Region II Position: The UFSAR, TS Basis, original Brunswick SER, and the Standard Review Plan all indicate that the CST Level - Low function is to ensure the availability of the safety-related suction source to the HPCI pump if the nonsafety-related source is depleted while the HPCI pump is operating. Implicit in this design function is the criteria that the HPCI pump will not be damaged during the suction transfer. Based upon this, the Region II position is that the

CST Level - Low suction transfer function needs to ensure that it's design basis requirements will be met regardless of the circumstances that call it into use. The design criteria does not appear to be dependent on any analysis of the sequence of licensing or design basis events.

The Region II staff did not attempt to review the sequence of all licensing/design basis events to check the licensee's contention that none would challenge the CST Level - Low function with the HPCI pump operating in automatic at 4300 gpm. However, an important point to note is that the CST is considered non-safety; and as such is not designed to withstand high winds, missiles, or seismic events. Additionally, the non-safety CST is not subject to the same quality of design, construction, and testing as safety-related equipment. The fact that the CST is considered non-safety may have been a significant factor related to the TS operability requirement for the CST Level - Low function for automatic transfer of the HPCI pump suction.

Region II Questions: RII requests that NRR review and provide a policy position on these questions:

1. Is it acceptable for the licensee to conclude that the CST Level - Low TS allowable value was adequate and did not need to be changed because only non-licensing/design basis events would challenge the CST Level - Low function while the HPCI pump was operating at 4300 gpm? Or must the TS allowable value be adequate to protect the HPCI pump from damage if the CST level becomes low while the pump is operating at 4300 gpm, independent of the event required to reach this condition?

2. Is it acceptable for the licensee to determine that the CST Level - Low function was operable because: 1) licensing/design basis events would not challenge the function while the HPCI pump was operating in automatic at 4300 gpm and 2) if operators were operating HPCI in manual with a low CST level, they would stop the pump before entrained air would reach the pump. Or should the operability determination have been based on the adequacy of the CST Level - Low function to protect the HPCI pump from damage if the CST level becomes low while the pump is operating at 4300 gpm, independent of the event required to reach this condition?

3. May the licensee use 10 CFR 50.59 to add an operator action (without NRC approval) to assist the CST Level - Low function in protecting the HPCI pump from air entrainment (e.g., an operator action to manually reduce the HPCI flowrate if the CST water level becomes low)?

The contents of this TIA were discussed and mutually agreed upon by C. Ogle and J. Moorman, of the Region II staff and C. Holden, B. Mozafari, K. Kavanagh, and R. Pulsifer of NRR on November 3, 2003. A due date for the TIA response of December 31, 2003, was mutually agreed upon. If you have any questions, please contact Robert Schin at (404) 562-4629 or Jim Moorman at (404) 562-4647.

Attachments: 1. NRC Inspection Report 05000325,05000324/03-08
2. Brunswick AR 106230-10 Operability Determination

cc w/attachments: (see Page 5)

cc w/attachments:
A. Blough, RI
S. Reynolds, RIII
D. Chamberlain, RIV
C. Casto, RII
P. Fredrickson, RII
C. Ogle, RII
J. Moorman, RII
R. Schin, RII
J. Barnes, RII
F. Congel, OE
T. Boyce, NRR
B. Mozafari, NRR
K. Kavanagh, NRR
S. Unikewicz, NRR

OFFICE	RII:DRS	RII:DRS	RII:DRS	RII:DRP			
SIGNATURE	RA	RA	RA	RA			
NAME	MOORMAN	OGLE	CASTO	FREDRICKSON			
DATE	11/04/2003	11/04/2003	11/05/2003	11/07/2003	11/ /2003	11/ /2003	11/ /2003
E-MAIL COPY?	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
PUBLIC DOCUMENT	YES NO						

OFFICIAL RECORD COPY DOCUMENT NAME: C:\ORPCheckout\FileNET\ML033240644.wpd