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U7-C-NINA-NRC-140010

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
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South Texas Project Units 3 and 4
Docket Nos. 52-012 and 52-013
Response to Request for Additional Information

Reference: Letter: Tom Tai to Scott Head "Request for Additional Information Letter No. 443 Related to SRP Section 1.5 for Nuclear Innovation North America, LLC (NINA) Combined License Application"

Attached is the Nuclear Innovation North America, LLC (NINA) revised response to the NRC staff question 01.05-25 which was included in the Request for Additional Information (RAI) letter referenced above. The attachment provides the Revision 1 response to the following RAI question which supersedes the previous response in its entirety.

01.05-25

There are no COLA changes in this RAI response.

There are no commitments in this submittal.

If you have any questions, please contact me at (979) 316-3011 or Bill Mookhoek at (979) 316-3014.

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

Executed on 5/21/14

Scott Head
Manager, Regulatory Affairs
NINA STP Units 3&4

Attachment:

RAI 01.05-25, Revision 1

D091
NRO

Cc: w/o attachment except*

(paper copy)

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QUESTION:

The NRC staff requests that the STP COL applicant describe the provisions for design, manufacture, testing, installation, and surveillance to provide assurance of the seismic, environmental, and functional capability of existing and future safety-related pumps, valves, and dynamic restraints to perform their intended functions as part of the mitigation strategies for an extended loss of AC power event at STP Units 3 & 4. As part of this request, the STP COL applicant should indicate whether any safety-related pumps, valves, and dynamic restraints used as part of the mitigation strategies for an extended loss of AC power event will have performance requirements that differ from their original design and performance specification (such as differences in pump net positive suction head available).

RESPONSE

This response replaces the previous response to RAI 01.05-25 in its entirety. Changes from the previous response are shown by revision bars in the right margin.

All safety related pumps, valves, and dynamic restraints utilized as part of the mitigation strategies for an ELAP are permanently installed plant equipment. The design, manufacture, testing, installation, and surveillance to provide assurance of the seismic, environmental, and functional capability requirements for these components are discussed in DCD/FSAR Chapters 3, 5, 6 and Appendix 1E. There are no additional components in this category to be installed in the future. The operation of these components during normal and emergency conditions is described in the DCD/FSAR. After the initial automatic start and suction shift from the Condensate Storage Tank (CST) to the suppression pool, RCIC will be operated manually during this event. Manual operation will not change the performance requirements for the system. No performance requirements that differ from their original design and performance specification will be necessary since these requirements will not be exceeded during implementation of strategies discussed in FSAR Appendix 1E, Subsection 1E.2.4 and the STP 3 & 4 ABWR FLEX Integrated Plan. Some items that were specifically considered were:

1) Battery room ventilation and the battery chargers will be lost at the beginning of the event. A deep load shed of DC loads will be performed within the first hour of the event. Battery performance will remain acceptable since the battery discharge rate will be low and no charging causing hydrogen generation will be occurring.
2) RCIC will operate within the design and performance requirements listed, however while connected to the suppression pool, the suction temperature will be allowed to increase to 250°F, which is the qualification temperature for the limiting component (pump bearings). NINA has evaluated the NPSH for this condition and found it acceptable based on using containment overpressure generated during the event. A summary of this evaluation is provided below. With the elevated suction temperature RCIC will perform within the requirements. Once suction is shifted to the Condensate Storage Tank, NPSH ceases to be a concern.

3) Valves, piping, and instrumentation will operate within the design and performance requirements.

Testing of the safety related equipment is performed in accordance with the requirements of the Technical Specifications and the Maintenance Rule Program.

NPSH Evaluation

RCIC NPSH is evaluated during the time that the RCIC suction is aligned to the suppression pool. Once the suppression pool nears 250 degrees F, suction is switched to the Condensate Storage Tank (CST). This occurs at about 10 hours.

The formulation for NPSH is based on FSAR Table 5.4-1a:

$NPSH\ (available) = H_{ATM} + H_S - H_{VAP} - H_F$

H_{ATM} = Atmospheric Head (pressure on water surface)
H_S = Static Head (column of water above the RCIC pump centerline)
H_{VAP} = Vapor Pressure Head
H_F = Frictional head due to suction pipe friction and the suction strainer head

The MAAP analysis indicates that the minimum NPSH (available) occurs at 8 hours. At 8 hours, the containment pressure is 27.2 psia, the suppression pool level is 24.3 feet, and the suppression pool water temperature is 227 degrees F.

At these conditions, the terms in the NPSH equation are:

H_{ATM} = 65.9 feet (20.1 m)
H_S = 20 feet (6.1 m)
H_{VAP} = 47.6 feet (14.5 m)
H_F = 6.9 feet (2.1 m)

H_{ATM} is calculated based on the 27.2 psia containment pressure. H_S is calculated based on a 24.3 feet suppression pool level with the RCIC pump centerline at 3.3 feet elevation above the bottom of the suppression pool per Table 5.4-1a. The H_{VAP} is calculated based on 227 degrees F suppression pool water. H_F is from Table 5.4-1a of the FSAR.

$NPSH\ (available) = 65.9.0 + 20.0 - 47.6 - 6.9 = 31.4$ feet (9.6 m)

NPSH (required) = 23.0 feet (7 m) (from Table 5.4-1a)

There is 8.4 feet of margin in the NPSH at the minimum condition.

This determination of NPSH margin is conservative for several reasons. The NPSH (required) is based on full RCIC flow. It is expected that the operators would reduce flow because full flow is not needed to remove decay heat. Reducing flow decreases NPSH (required) which would increase NPSH margin. In addition, the H_F value is a "maximum value" from Table 5.4-1a and is not adjusted due to the lower water viscosity at higher temperature and the reduced RCIC flow. The NPSH (required) is also considered to be conservative. The pump vendor that will supply the STP 3&4 RCIC pump has indicated that the NPSH (required) will be significantly lower than 23 feet.

Given the conservatisms in this calculation, it is unlikely significant cavitation would occur during an ELAP event. Nevertheless, the operators will be carefully monitoring Reactor Pressure Vessel (RPV) level at the Remote Shutdown Panel and RCIC pump operation locally in the RCIC room and if there are indications of cavitation, the operators can switch RCIC suction to the CST at any time. In addition, if RCIC becomes unavailable for any reason, operators can reduce RPV pressure and shift injection to the AC Independent water Addition System

Based on discussions with the NRC staff, NINA will revise the STP 3 & 4 ABWR FLEX Integrated Plan as shown below in shaded text.

FLEX COPING STRATEGY

An overview of the phased strategy for maintaining core, containment, and spent fuel cooling after a simultaneous ELAP and LUHS is provided below:

Core Cooling

After the Suppression Pool level high alarm set point is reached, RCIC suction will automatically be switched to the Suppression Pool. RCIC suction will remain aligned to the Suppression Pool until the pool temperature approaches 250°F. During this period, containment overpressure will be credited to maintain RCIC net positive suction head. Operators will then shift RCIC suction back to the CST at approximately 10 hours. A plant cooldown to approximately 350 psig will be initiated.

The suppression pool temperature and pressure will continue to increase until the COPS rupture disk opens at a nominal pressure of approximately 90 psig. This will occur at approximately 20 hours. COPS will then vent the containment from the wetwell via the plant stack and provide containment cooling. At this point, core cooling is still being provided by RCIC with suction from the CST. When the CST approaches the end of its usable volume, operators will align the ACIWA system for injection into the RPV. If RCIC becomes unavailable prior to this time, operators can reduce RPV pressure and shift injection to the ACIWA system. The RPV will be depressurized by opening at least one SRV to discharge steam to the suppression pool and reducing pressure below the shutoff head of the ACIWA system. Once the ACIWA is injecting into the RPV, the

RCIC pump will be secured. This transition to ACIWA is predicted to occur at about 36 hours.

BWROG Project Task Report DRF 0000-0155-1541, "RCIC Pump and Turbine Durability Evaluation-Pinch Point Study," contains recommendations regarding extended RCIC system operation during an ELAP. This guidance addresses the typical BWR Terry Turbine and is not applicable to the integrated turbine-pump monoblock design utilized by STP 3 & 4..