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September 9, 2013  
U7-C-NINA-NRC-130051

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  
Revised Response to Request for Additional Information

Attached are revised responses to NRC Staff questions included in Request for Additional Information (RAI) letter number 420 related to Combined License Application (COLA) Part 2, Tier 2, Section 3.9.2. Attachments 1 and 2 provide responses to the RAI questions listed below. Where there are COLA markups, they will be made at the first routine COLA update following NRC acceptance of the RAI response.

03.09.02-52

03.09.02-53

There are no commitments in this letter.

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 9/9/13

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

jep

Attachments:

1. RAI 03.09.02-52, Revision 2
2. RAI 03.09.02-53, Revision 2

STI 33745257

DO9/  
MRB

cc: w/o attachment except\*  
(paper copy)

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**RAI 03.09.02-52, Revision 2****QUESTION:**

NRC Regulatory Guide 1.20, Revision 3, Section 3.1.2 states:

*“The vibration measurement program may be omitted if the inspection program is implemented. However the vibration measurement program related to the evaluation of the potential adverse flow effect from pressure fluctuations and vibrations in piping systems for both PWRs and BWRs, should not be omitted.”*

There is no mention of main steam line (MSL) instrumentation to monitor the acoustic resonance and the dryer load during power ascension in WCAP-17257, “STP Unit 4 Reactor Internals Flow-Induced Vibration Assessment Program,” Revision 1. The staff requests the applicant to clarify whether instrumentation will be installed on the STP Unit 4 MSLs to ensure that acoustic resonances do not occur that could cause concern for the structural integrity of the steam dryer and other MSL components during the start-up tests up to full LTP power level. In the response to this RAI, the applicant is requested to:

- (a) Provide the number of strain gages to be installed on each MSL and the measures taken to ensure sufficient redundancy.
- (b) Explain and justify the method which will be used to calibrate the strain gages mounted on the MSLs.
- (c) Include the provided information in the application.

**REVISED RESPONSE:**

Nuclear Innovation North America (NINA) provided the initial response to RAI 03.09.02-52 on February 13, 2013, in letter U7-C-NINA-NRC-130015, and Revision 1 to that response on May 7, 2013 in letter U7-C-NINA-NRC-130025. Subsequent discussion with NRC staff resulted in modifications to the power ascension plan for the steam dryers for STP Units 3&4. As a result, several documents referenced in the STP 3&4 Combined License Application (COLA) have been revised. Revision 2 to this RAI response updates the references to those documents. Changes from the Revision 1 responses are indicated with revision bars in the margins.

To address the concern identified in this RAI regarding monitoring the structural integrity of the STP Unit 4 steam dryer during power ascension, a vibration measurement program will be implemented for the Unit 4 steam dryer that is identical to the vibration measurement program for STP Unit 3 related to the steam dryer. The Unit 4 steam dryer instrumentation will be identical to that for Unit 3 as described in Section 6.4.2 of the STP Unit 3 Comprehensive Vibration Assessment Program (CVAP) report (WCAP-17256-P), and the power ascension will be performed as described in Section 6.6 of the Unit 3 CVAP report. The Unit 4 main steam lines

(MSLs) will be instrumented with strain gages, consistent with the approach described in Section 6.4.2 of the Unit 3 CVAP report.

- (a) As discussed above, the instrumentation used to monitor the response of the STP Unit 4 steam dryer is the same as that summarized in the STP Unit 3 CVAP report. Details of the instrumentation locations, basis for the locations, and number of instruments to be installed described in the STP Unit 3 Measurement, Test and Inspection Plan report (WCAP-17370-P) also apply to Unit 4. The discussion of the MSL instrumentation provided in Section 3.1.3 of that report for STP Unit 3 also applies to STP Unit 4.
- (b) Calibration of the MSL instrumentation will be performed in accordance with the instrument manufacturers' recommendations. Details of the installation and overall system testing and calibration will be included in the detailed power ascension test plan, which will be provided to NRC as discussed in the response to Revision 2 of RAI 03.09.02-53.
- (c) WCAP-17257-P has been revised to reflect the inclusion of the measurement program for the STP Unit 4 steam dryer. Specifically, a new Section 3 has been added to the WCAP, along with corresponding changes in the remainder of the report for improved clarity.

The STP 3&4 COLA Subsection 3.9.2.4 was revised in Revision 9 to reflect the inclusion of the vibration measurement program for the STP Unit 4 steam dryer. In addition, the COLA will be revised to reflect the revision changes of the reference reports in Subsection 3.9.8. The changes to Revision 9 of the COLA are shown in highlighted text below. These changes will be incorporated in the next revision of the STP 3&4 COLA.

#### **3.9.2.4 Preoperational Flow-Induced Vibration Testing of Reactor Internals**

For STP 4 reactor internals components, an inspection program will be implemented in lieu of a vibration measurement program as discussed in paragraph C.3.1.3 of Regulatory Guide 1.20. Subsection 3.9.2.3 identifies the assessment program for the STP 4 non-prototype. In addition, the vibration assessment program for STP Unit 4 will include a measurement program for the steam dryer.

#### **3.9.8 References**

- 3.9-13 "STP Unit 3 ABWR Prototype Reactor Internals Flow-Induced Vibration Assessment Program," WCAP-17256-P, Revision 56.
- 3.9-14 "STP Unit 4 Reactor Internals Flow-Induced Vibration Assessment Program," WCAP-17257-P, Revision 35.
- 3.9-25 "STP Unit 3 Steam Dryer Flow-Induced Vibration Assessment," WCAP-17385-P, Revision 56.

- 3.9-26 "South Texas Project Units 3 and 4 Reactor Internals Non-Dryer Component Flow-Induced Vibration Assessment," WCAP-17371-P, Revision 57.
- 3.9-27 "ABWR Dryer Operating Experience for STP Units 3 and 4," WCAP-17369-P, Revision 1.
- 3.9-28 "South Texas Project Unit 3 Comprehensive Vibration Assessment Program Measurement, Test, and Inspection Plan," WCAP-17370-P, Revision 57.

**RAI 03.09.02-53, Revision 2****QUESTION:**

The applicant is requested to propose detailed license conditions for the flow-induced vibration start-up test program of Unit 3. The license conditions should address the following items:

- (a) Hold point at 60% at which full measurement program will be completed and the stress predictive analysis will be re-benchmarked to update the frequency dependent end-to end bias error and uncertainties (B&U). The end-to-end B&U, which will be used in load trending and projection for the next power hold point and full power conditions, should be based on comparison of the measured and the predicted stress/strain on the dryer.
- (b) Acceptance criteria (limit curves) based on the measurements at 60% power level.
- (c) Additional specific hold points beyond the first one at 60% power level. During these hold points, full measurement program will be completed and the B&U and acceptance criteria (limit curves) will be updated based on the measured data.
- (d) Data trending and projection of pressure, strain and acceleration levels to the next hold point and full power level.
- (e) Explain the method which will be used to calibrate the strain gages mounted on the dryer.
- (f) Actions to be taken during power ascension of Unit 3 if the measured dryer stresses or pressures challenge the limit curves developed from the previous hold point.
- (g) Reporting of results to NRC at 60%, 80%, 90% and 100% during power ascension. The plant will not proceed to the next power level for at least 72 hours after reporting measurements to the NRC.
- (h) Providing a full stress analysis report and evaluation at full power level within 90 days after reaching full power level. The report should include the final dryer load definition using steam dryer instrumentation and associated end-to-end B&U.

The applicant is requested to include the provided information in the application.

**REVISED RESPONSE:**

Nuclear Innovation North America (NINA) provided the initial response to RAI 03.09.02-53 on February 13, 2013, in letter U7-C-NINA-NRC-130015, and Revision 1 to that response on May 7, 2013 in letter U7-C-NINA-NRC-130025. Subsequent discussion with NRC staff resulted in modifications to the power ascension plan for the steam dryers for STP Units 3&4.

Revision 2 to this RAI response addresses those modifications. Changes from the Revision 1 response are indicated with revision bars in the margins.

A proposed license condition for the flow-induced vibration power ascension test program for STP Unit 3 is provided below. Also, as discussed in the response to 03.09.02-54, this proposed license condition is also applicable to STP Unit 4. For the proposed license condition, please note that the cited reference (3.9-25) is the reference in Section 3.9.8 of the COLA (i.e., WCAP-17385-P Rev. 6).

#### PROPOSED LICENSE CONDITION

A Power Ascension Test (PAT) Plan for the STP Unit 3 steam dryer will be prepared and provided to the NRC no later than 30 days before start-up. The PAT Plan will reflect industry experience with the performance of steam dryer power ascension testing. The PAT Plan shall include the following, which shall be augmented or modified as appropriate to address industry experience:

1. The initial hold point will be 60% of full power, at which pressures, strains, and accelerations will be recorded from the dryer mounted instrumentation.
  - The minimum stress ratio and maximum stress will be computed from the predictive analysis using pressure transducer data from the dryer as described in Section 6.2 of FSAR Reference 3.9-25.
  - Level 1 and Level 2 limit curves will be generated for selected pressure transducer locations on the steam dryer as described in Section 6.2 of FSAR Reference 3.9-25.
  - Limit curves will include bias error and uncertainties (B&U) as described in Subsections 6.5.1 and 6.5.2 of FSAR Reference 3.9-25.
  - The B&U during power ascension will be based on a comparison of the measured and predicted pressures on the dryer as described in Section 6.5.2 of FSAR Reference 3.9-25.
2. Subsequent hold points will be at 70%, 80%, and 90% power levels. The revised limit curves at each hold point will be developed and provided to the NRC. Data trending and a projection of pressure levels will be generated for the next hold point and full power.
3. During power ascension, should a Level 2 limit curve be exceeded, the power will be held at that power level to perform a real-time stress analysis to develop new limit curves. Should a Level 1 limit curve be exceeded, the power will be reduced to a previous power level where Level 1 was not exceeded and either an offline or a real-time stress analysis will be performed to develop new limit curves (see Section 6.3 of FSAR Reference 3.9-25).

4. At the 80% and 90% power levels, an end-to-end comparison between the measured and predicted strains will be performed as described in Section 6.5.3 of FSAR Reference 3.9-25. If the result of the comparison at each of these power levels is that the measured strains are bounded by the predicted strains, power ascension may proceed to the next power level based on the revised limit curves. However, if the result indicates that the measured strains are not bounded by the predicted strains, the NRC will be promptly informed and power ascension to the next power level will not proceed until either an offline or a real-time stress analysis has been performed to develop new limit curves (see Section 6.3 of FSAR Reference 3.9-25).
5. At each hold point, power ascension will not proceed to the next power level for at least 72 hours after reporting to the NRC.
6. After full power has been achieved, a full stress analysis report and evaluation will be provided to the NRC within 90 days of reaching the full power level. The report will include the final dryer load definition using steam dryer instrumentation and associated bias and uncertainties. An end-to-end comparison between the measured and predicted strains will be performed as described in Section 6.5.3 of FSAR Reference 3.9-25 at 100% power and will be included in the report.
7. Details of the installation and calibration of the steam dryer strain gages will be provided. The strain gages will be mounted and calibrated in accordance with the manufacturers' instructions to accurately measure the dynamic response.