

UNITED STATES NUCLEAR REGULATORY COMMISSION WASHINGTON, D.C. 20555-0001

May 19, 2015

Mr. Bryan C. Hanson President and Chief Nuclear Officer Exelon Nuclear 4300 Winfield Road Warrenville, IL 60555

SUBJECT: PEACH BOTTOM ATOMIC POWER STATION, UNIT 2 - APPROVAL OF REVISION TO METHODOLGY FOR ESTABLISHING REPLACEMENT STEAM DRYER STRAIN LIMITS (TAC NO. MF4792)

Dear Mr. Hanson:

On August 25, 2014, the Nuclear Regulatory Commission (NRC) issued Amendment Nos. 293 and 296 to Renewed Facility Operating License Nos. DPR-44 and DPR-56 for Peach Bottom Atomic Power Station (PBAPS), Units 2 and 3 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML14133A046). These amendments authorized an increase in the maximum licensed thermal power level for PBAPS, Units 2 and 3, from 3514 megawatts thermal (MWt) to 3951 MWt, which is an increase of approximately 12.4%. This change in power level is considered an extended power uprate (EPU).

The NRC staff approval of the EPU was based, in part, on the capability for Exelon Generation Company, LLC (Exelon, the licensee) to monitor, evaluate, and take prompt action in response to potential adverse flow effects as a result of EPU operation on plant structures, systems, and components (including verifying the continued structural integrity of the replacement steam dryer (RSD)). License condition 2.C(15) was added to the facility operating license for each unit, as part of the EPU amendment, to provide the necessary requirements associated with potential adverse flow effects. This license condition requires, in part, that the licensee benchmark the RSD stress analysis methodology using data collected at or near 3514 MWt. This benchmarking effort establishes the PBAPS, Unit 2, RSD strain limits that will be used as acceptance criteria for power ascension above 3514 MWt. The license condition also requires that the methodology for establishing the RSD strain limits shall not be made less restrictive without prior NRC approval. Also, the license condition requires that a report be submitted to the NRC within 90 days upon completion of EPU power ascension testing. The report will include a final load definition and stress report, based on the results of a complete re-analysis using the end-to-end bias errors and uncertainties determined at EPU conditions using actual measured data and an approved methodology.

Exelon implemented the EPU during the fall 2014 refueling outage for PBAPS, Unit 2. In December 2014, during initial benchmarking of the RSD methodology with data collected at about 3514 MWt (89% of the current licensed power level of 3951 MWt, or 100% of the pre-EPU license power level), RSD strain gauge measurements identified strain responses

in the low frequency range that were not previously predicted by the approved methodology. The licensee determined that the RSD methodology approved during the EPU review (which used an acoustic only technique) could not appropriately predict the loads in the low frequency range (0 - 50 Hertz (Hz)). As a result, the licensee developed an approach to quantify the magnitude of the unpredicted loads and integrate the results into the original methodology. In a

letter dated February 3, 2015 (ADAMS Accession No. ML15034A573), Exelon requested NRC approval for this revision to the methodology for establishing the RSD strain limits, as required by PBAPS, Unit 2, license condition 2.C(15)(d)3.¹ Exelon provided supplemental information in a letter dated March 24, 2015 (ADAMS Accession No. ML15083A559). Exelon's request was submitted to support the continuation of EPU power ascension above 3514 MWt.

By letter dated March 27, 2015 (ADAMS Accession No. ML15033A489), the NRC approved power ascension from 100% to 104% of 3514 MWt for PBAPS, Unit 2. The NRC's letter stated, in part, that:

The NRC staff has reviewed the information provided in Exelon's letters dated February 3, 2015, and March 24, 2015. The revised methodology contains a certain degree of conservatism that provides reasonable assurance of the structural integrity of the RSD for power ascension up to 104% of 3514 MWt. Nonetheless, the technical approach involves approximations leading to uncertainties that preclude a finding of assurance, at this time, of satisfactorily maintaining the required American Society of Mechanical Engineers (ASME) *Boiler and Pressure Vessel Code* (Code), Section III endurance limit of 13,600 pounds-force per square inch (psi) at the full EPU level.

Based on the above considerations, the NRC staff approves the resumption of power ascension for PBAPS Unit 2 to the next hold point specified in license condition 2.C(15) (i.e., 104% of 3514 MWt). Further power ascension of PBAPS Unit 2 beyond 104% of 3514 MWt will be contingent upon continued demonstration of the structural integrity of the RSD in accordance with the provisions in license condition 2.C(15). In addition, the staff has determined that additional information, as described in Enclosure 1, needs to be provided to help inform the staff's decision on the acceptability of power ascension beyond 104% of 3514 MWt. This request for additional information (RAI) was provided in draft form to Exelon on March 19, 2015. In addition, the RAI was discussed during a meeting between Exelon and the NRC on March 26, 2015. Based on a discussion between the NRC staff (Mr. Richard Ennis) and Exelon (Mr. Ken Ainger) on March 27, 2015, Exelon agreed to provide the RAI response no later than the date that the steam dryer evaluation, performed based on data collected at 104% of 3514 MWt, is provided to the NRC in accordance with license condition 2.C(15).

¹ The license condition requires prior NRC approval of a less restrictive change to the methodology for establishing the RSD limits. The proposed change in methodology is considered less restrictive because, using the approved methodology and the actual measured data; the minimum alternating stress ratio would be less than 1.0 at EPU conditions.

In a letter dated April 5, 2015 (ADAMS Accession No. ML15096A008), Exelon submitted the response to the NRC staff's RAI dated March 27, 2015, regarding the proposed change to the RSD methodology. Exelon also provided the steam dryer stress evaluation for the 104% hold point on April 5, 2015.

On April 9, 2015, the NRC staff sent Exelon an e-mail documenting its review of the steam dryer stress evaluation at the 104% hold point (ADAMS Accession No. ML15099A748). The e-mail also documented the staff review of the April 5, 2015, RAI response pertaining to the proposed change to the steam dryer stress analysis methodology. The NRC staff's e-mail stated that Exelon's response to the RAI did not provide sufficient information to provide the NRC with reasonable assurance regarding the structural integrity of the steam dryer at higher power levels. As such, the staff determined that power ascension above 104% was not warranted at that time. The staff stated it would reconsider this determination following submittal of supplemental information from Exelon.

On April 10, 2015, Exelon submitted supplemental information. By e-mail dated April 10, 2015 (ADAMS Accession No. ML15110A098), the NRC stated that the additional information:

...provides reasonable assurance regarding the structural integrity of the steam dryer up to 108% of 3514 MWt. Therefore, the NRC staff has no objection to the resumption of power ascension for PBAPS Unit 2 to the next hold point specified in license condition 2.C(15) (i.e., 108% of 3514 MWt). Further power ascension of PBAPS Unit 2 beyond 108% of 3514 MWt will be contingent upon continued demonstration of the structural integrity of the replacement steam dryer in accordance with the provisions in license condition 2.C(15).

The NRC staff's e-mail requested that Exelon provide additional information with the steam dryer evaluation at the 108% hold point including strain trending data and stresses calculated for non-main steam line acoustic loads in the low frequency range.

After reaching 108% of 3514 MWt, Exelon collected data regarding steam dryer structural integrity in accordance with EPU license condition 2.C(15). On April 22, 2015, Exelon provided the data and additional information requested by the NRC staff for review.

On April 25, 2015, the NRC staff sent Exelon an e-mail documenting its review of the steam dryer stress evaluation and other information provided on April 22, 2015, for the 108% hold point (ADAMS Accession No. ML15125A168). Based on review of the information, the NRC staff informed Exelon that it had objections to further power ascension beyond 108% of 3514 MWt. The e-mail also stated that additional information was needed to help inform the staff's decision on the acceptability of the proposed change in methodology, as well as power ascension beyond 108% of 3514 MWt. The staff sent Exelon an RAI on April 25, 2015 (ADAMS Accession No. ML15127A518), which detailed the additional information that needed to be submitted. By letter dated May 15, 2015 (ADAMS Accession No. ML15135A402), Exelon provided a response to the staff's RAI dated April 25, 2015.

The NRC staff and its contractors have reviewed the proposed change to the methodology for establishing the RSD strain limits for PBAPS, Unit 2, as described in the licensee's letters dated February 3, March 24, April 5, and May 15, 2015. Based on this review, the NRC staff finds that:

- 1) The proposed methodology conservatively accounts for non-main steam line acoustic loads in the low frequency range (i.e., 0 50 Hz).
- 2) The method of combining the non-main steam line acoustic and main steam line acoustic stresses is acceptable.

Based on the above findings, the NRC staff concludes that the proposed methodology is acceptable for establishing the RSD strain limits for PBAPS, Unit 2. As such, the staff approves the proposed methodology, for use at PBAPS, Unit 2, consistent with the requirements in license condition 2.C(15)(d)3.

The licensee's analysis, using the proposed methodology, predicts that the RSD minimum alternating stress ratio (MASR) will remain greater than 1.0 at full EPU operating conditions (i.e., stresses are below the ASME Code endurance limit of 13,600 psi). Based on use of an approved methodology and a predicted MASR greater than 1.0, the NRC concludes that there is reasonable assurance that the PBAPS, Unit 2, RSD will maintain its structural integrity at full EPU operating conditions. Therefore, the NRC staff has no objections toward resumption of power ascension at PBAPS, Unit 2, to the full approved EPU power level (i.e., 112.4% of 3514 MWt).

The NRC staff informed Exelon of the approval of the methodology and that there were no objections to further power ascension via e-mail on May 15, 2015 (ADAMS Accession No. ML15135A437).

As discussed in a conference call between the NRC staff and Exelon on May 15, 2015, the licensee agreed to include the following information as part of the report to be submitted within 90 days following completion of EPU power ascension testing, pursuant to PBAPS, Unit 2, license condition 2.C(15)(e):

- 1) A consolidated stand-alone document detailing the RSD methodology as approved by the NRC (i.e., since portions of the approved methodology are currently contained in each of the letters February 3, March 24, April 5, and May 15, 2015).
- 2) A discussion of the conservatisms and margin contained in the PBAPS, Unit 2, RSD stress analysis.

If you have any questions regarding this matter, you may contact the PBAPS Project Manager, Mr. Richard Ennis, at 301-415-1420.

Sincerely,

Louis Lund

Louise Lund, Acting Director Division of Operating Reactor Licensing Office of Nuclear Reactor Regulation

Docket No. 50-277

cc: Distribution via Listserv

If you have any questions regarding this matter, you may contact the PBAPS Project Manager, Mr. Richard Ennis, at 301-415-1420.

Sincerely,

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Louise Lund, Acting Director Division of Operating Reactor Licensing Office of Nuclear Reactor Regulation

Docket No. 50-277

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