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September 21, 2007

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

Peach Bottom Atomic Power Station, Units 2 and 3
Renewed Facility Operating License Nos. DPR-44 and DPR-56
Docket Nos. 50-277 and 50-278

Subject: Response to Request for Additional Information Concerning License Amendment Request to Revise Local Power Range Monitor Calibration Frequency

References:

1) Letter from P. B. Cowan, Exelon Generation Company, LLC, to U.S. Nuclear Regulatory Commission, "License Amendment Request - Revise Local Power Range Monitor Calibration Frequency," dated November 17, 2006

2) U.S. Nuclear Regulatory Commission e-mail dated August 15, 2007, for Peach Bottom Atomic Power Station, Units 2 and 3, draft Request for Additional Information Related to Exelon License Amendment Request Regarding Revisions to the Local Power Range Monitor Calibration Frequency (TAC Nos. MD3717/3718)

In Reference 1, Exelon Generation Company, LLC (Exelon) requested changes to the Technical Specifications (TS), Appendix A of Renewed Facility Operating License Nos. DPR-44 and DPR-56 for Peach Bottom Atomic Power Station (PBAPS), Units 2 and 3, respectively. The proposed changes would increase the interval between Local Power Range Monitor (LPRM) calibrations from 1000 megawatt-days/ton (MWD/T) to 2000 MWD/T.

In Reference 2, the NRC requested additional information concerning the PBAPS License Amendment Request (LAR). In particular, the NRC requested that Exelon provide additional information pertaining to the supporting analysis for extending the LPRM calibration frequency to 2500 MWD/T; thereby, assuring that the LPRM response uncertainty remains bounded when considering the 25 percent extension in calibration interval permitted by the provisions of Technical Specifications (TS) Surveillance Requirement (SR) 3.0.2. The questions identified in Reference 2 were further discussed during a subsequent telephone conversation on August 23, 2007, between representatives of the NRC and Exelon. During this telephone conversation, it was agreed that Exelon would provide a written response to the questions identified in Reference 2 by September 21, 2007. The attachment to this letter restates each of the NRC's questions followed by Exelon's response.

Exelon has concluded that the information provided in this response does not impact the conclusions of the: 1) Technical Analysis, 2) No Significant Hazards Consideration under the standards set forth in 10 CFR 50.92(c), or 3) Environmental Consideration as provided in the original submittal (Reference 1).

There are no regulatory commitments contained within this letter. If you have any further questions or require additional information, please contact Richard Gropp at 610-765-5557.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 21st day of September 2007.

Respectfully,

BAK 

Pamela B. Cowan
Director – Licensing and Regulatory Affairs
Exelon Generation Company, LLC

Attachment: Response to Request for Additional Information

cc: Regional Administrator - NRC Region I w/ attachment
NRC Senior Resident Inspector - PBAPS "
NRC Project Manager, NRR - PBAPS "
Director, Bureau of Radiation Protection - Pennsylvania Department of Environmental Protection "

ATTACHMENT

Peach Bottom Atomic Power Station
Units 2 and 3
Docket Nos. 50-277 and 50-278

License Amendment Request
Response to Request for Additional Information

Revise LPRM Calibration Interval

By letter dated November 17, 2006, Exelon Generation Company, LLC (Exelon) requested changes to the Technical Specifications (TS), Appendix A of Renewed Facility Operating License Nos. DPR-44 and DPR-56 for Peach Bottom Atomic Power Station (PBAPS), Units 2 and 3, respectively. The proposed changes would increase the interval between Local Power Range Monitor (LPRM) calibrations from 1000 megawatt-days/ton (MWD/T) to 2000 MWD/T.

Subsequently, in an e-mail dated August 15, 2007, the NRC requested additional information concerning certain issues regarding the PBAPS, Units 2 and 3, License Amendment Request (LAR). In particular, the NRC requested that Exelon provide additional information pertaining to the supporting analysis for extending the LPRM calibration frequency to 2500 MWD/T; thereby, assuring that the LPRM response uncertainty remains bounded when considering the 25 percent extension in calibration interval permitted by the provisions of Technical Specifications (TS) Surveillance Requirement (SR) 3.0.2. The issues identified in the August 15, 2007, e-mail were further discussed during a telephone conversation on August 23, 2007, between representatives of the NRC and Exelon. During this telephone conversation, it was agreed that Exelon would provide a written response to the questions by September 21, 2007. The specific questions are restated below followed by Exelon's response along with additional supporting information. Prior to the Questions/Responses, a general discussion is provided.

Discussion

The overall LPRM signal uncertainty component of the total nodal power distribution uncertainty results from four factors. These factors are: (1) uncertainty from axial interpolation in between detectors; (2) random signal noise; (3) system non-linearity; and (4) instrument sensitivity decay arising from the period between LPRM calibrations. Of these four factors, only item (4), instrument sensitivity decay arising from the period between LPRM calibrations (hereafter referred to as the "LPRM update" subcomponent of the overall LPRM signal uncertainty), is affected by the requested revision to the LPRM calibration frequency.

Reference 1 states that an LPRM calibration interval of 2000 Effective Full Power Hours (EFPH) has been evaluated and it has been concluded that the small increase in "LPRM update" uncertainty arising from an increase to a 2000 EFPH calibration interval does not violate the total nodal power distribution uncertainty limit. This is referenced in several places in the document, in particular in Section 3.2, "Uncertainty due to LPRM Updates and Instrument Failure." The NRC has accepted this conclusion as documented in Reference 2.

The increase in LPRM signal uncertainty as a function of LPRM calibration interval length is presented in Reference 3. The LPRM signal uncertainty is shown to be 2.1% for an LPRM calibration interval of 265 EFPH, 3.7% for 976 EFPH, 4.2% for 2078 EFPH, and 4.3% for 2991 EFPH. This data demonstrates that the LPRM update subcomponent of the overall LPRM signal uncertainty increases by approximately 0.1% over the range of 2000 to 2500 MWD/T. This conclusion is further validated by information in the Reference 1 conclusion discussion that the total bundle power uncertainty value due to the LPRM update process for a 2000 EFPH LPRM calibration interval is 0.30%. Therefore, it is evident, that in this range the overall LPRM signal uncertainty component of the total nodal power distribution uncertainty does not significantly change with increasing LPRM exposure.

This small LPRM update uncertainty increase of 0.1% when increasing the LPRM calibration interval from 2000 to 2500 MWD/T is offset with significant margin by a number of other conservatisms in the total nodal power distribution uncertainty analysis which include:

- The PANAC11 version of 3D MONICORE is substantially more accurate and contains less uncertainty than do the previous versions of PANACEA, which were the basis for Reference 1. Reference 4 demonstrates that for PANAC11 3D MONICORE plants such as Peach Bottom Atomic Power Station (PBAPS), Units 2 and 3, the overall bundle power uncertainty is 2.69%. This is significantly less than the bundle power design basis uncertainty of 3.19% in Reference 1.

- As discussed in Reference 4, the bundle power uncertainty allowance for an LPRM calibration with one missing Traversing In-Core Probe (TIP) machine is 0.10%. This is considered conservative because PBAPS routinely completes LPRM calibrations with zero missing TIP strings. The redundant nature of the PBAPS, Units 2 and 3, TIP machine-to-LPRM string correspondence makes it unlikely that an incomplete TIP set will be obtained during an LPRM calibration.

- As discussed in Reference 4, the bundle power uncertainty allowance for the failure of 25% of the LPRMs is 0.14%. This is considered conservative because PBAPS, Units 2 and 3, routinely operates with significantly fewer (approximately 5 to 10 of a total of 172) failed LPRMs.

- The total TIP signal nodal uncertainty is evaluated experimentally once per cycle and is a measure of TIP signal asymmetry arising from instrument tube orientation and the placement of fuel in the core loading pattern. As discussed in Reference 1, the total TIP signal nodal uncertainty limit is 6.0%. This value is typically demonstrated to be in the range of 2 - 3%.

- The LPRM update uncertainty increase of 0.1% assumes that the detector sensitivity is decreasing with increasing neutron exposure. In fact, due to the sensitivity plateau of the advanced General Electric (GE) LPRMs which breed U-235 from U-234, the LPRM update uncertainty could be effectively zero in the detector exposure range where U-235 generation approximately equals U-235 depletion.

- The total nodal power distribution uncertainty evaluation also contains conservatisms associated with neutron TIPs, core loading pattern asymmetries, control rod pattern asymmetries, and control rod pattern changes between LPRM calibrations. Typical PBAPS, Units 2 and 3, practice is to operate with symmetric control rod patterns and core loading patterns, and relatively long intervals between significant control rod pattern adjustments. PBAPS, Units 2 and 3, also use gamma TIPs, which are more accurate than neutron TIPs.

- The practice at PBAPS, Units 2 and 3, is to avoid the routine use of TS grace (i.e., application of TS SR 3.0.2), and therefore, it is likely that LPRM calibrations will infrequently occur at intervals greater than 2000 MWD/T.

It is important to note, that the cited references are not specific to any particular plant, but rather are based upon the use of 3D MONICORE reactor analysis software and advanced NA-200 and NA-300 LPRM detectors, which are used at PBAPS, Units 2 and 3.

NRC Question 1

In its November 17, 2006, submittal, the licensee stated that "the GE evaluation confirms that the LPRM calibration interval may be increased to 2000 MWD/T without exceeding the total power distribution uncertainty limit of 8.7% cited in the original GETAB analysis." The licensee substantiates this conclusion by referencing "detailed statistical evaluations of the uncertainties associated with LPRM-adaptive 3D MONICORE core monitoring calculations. Based on the data examined, it has been shown that the nodal power distribution uncertainty does not significantly change with LPRM exposure." The NRC staff understands this statement to be in reference to NEDC-32694P-A, where discussion appears on Page A-40 about the LPRM update process. This analysis is based on a calibration interval of 2000 EFPH, which does not bound a 2000 MWD/T calibration interval. Please clarify and provide the exact text and reference of the "detailed statistical analysis" to which you are referring.

Response

The *"detailed statistical analysis"* which is referred to in the November 17, 2006, LAR is the information contained in References 1, 2, and 3 as discussed above. The analysis information specifically refers to the Reference 3 table entitled "Comparison of LPRM Case Results Without OD-1 and LPRM Calibration to TIP Case Results," and to Reference 1, Section 3.2, as stated above. The NRC indicated that 2000 EFPH does not equal 2000 MWD/T. The correlation is not exact; 2000 EFPH is approximately equal to 1940 MWD/T. However, the justification presented in the November 17, 2006, LAR and in this response to the NRC's request for additional information does demonstrate that operation up to and beyond a 2500 MWD/T LPRM calibration interval is acceptable. Note that the Reference 3 value of 2991 EFPH corresponds to a cycle exposure interval of approximately 2900 MWD/T.

NRC Question 2

The November 17, 2006, submittal indicates that another basis justifying the calibration interval extension is that the increase in total power distribution uncertainty will remain within the 8.7% uncertainty value cited in the original GETAB analysis. However, this uncertainty was reduced with the 1999-approved GE SLMCPR methodologies which are also referenced in the licensee's submittal. Confirm that this 8.7% total power distribution uncertainty remains a part of the licensed SLMCPR at Peach Bottom Atomic Power Station, Units No. 2 and 3. If it is not, provide an uncertainty evaluation showing that potential increases in the LPRM calibration uncertainty remain bounded by uncredited conservatisms in the total power distribution uncertainty.

Response

At the time of the original 3D MONICORE application at PBAPS, Units 2 and 3, standard GETAB uncertainties were applied in accordance with Reference 5. The acceptance criterion for this Standard Uncertainty analysis is a total nodal power distribution uncertainty of 8.7%. Currently, PBAPS, Units 2 and 3, use Reduced Uncertainties in accordance with Reference 1. The acceptance criterion for this Reduced Uncertainty analysis is a total nodal power distribution uncertainty of 6.5%. However, the choice of uncertainty analysis does not affect the validity of the justification presented in the November 17, 2006, LAR for the increase in the LPRM calibration interval. The justification provided in the LAR submittal, and this response to the NRC's request for additional information, demonstrate that the increase in uncertainty when extending the calibration interval is very small and is offset with significant margin by a number of other conservatisms in the total nodal power distribution uncertainty analysis. This is independent of the type of licensing basis uncertainty analysis chosen for a given fuel cycle. Extending the calibration interval does not violate the Reduced Uncertainty acceptance criterion of 6.5%, nor would it violate the Standard Uncertainty acceptance criterion of 8.7%.

NRC Question 3

Confirm that the change in LPRM calibration frequency continues to allow the 25 percent extension of the calibration interval as stated in the TS provisions of SR 3.0.2.

Response

The detailed information presented above demonstrates that, even in the unlikely event of an interval of 2500 MWD/T between LPRM calibrations, the total nodal power distribution uncertainty limits are not violated. The components of the overall LPRM signal uncertainty are either unaffected or are negligibly affected and the licensing basis requirements are satisfied.

NRC Question 4

Provide the analysis that shows that the LPRM response uncertainty remains bounded by the minimum critical power ratio (MCPR) safety limits at 2500 MWD/T.

Response

As discussed in response to Question 3 above, the detailed information presented above demonstrates that, even in the unlikely event of an interval of 2500 MWD/T between LPRM calibrations, the total nodal power distribution uncertainty limits are not violated. The components of the overall LPRM signal uncertainty are either unaffected or are negligibly affected and the licensing basis requirements are satisfied.

References

1. General Electric Licensing Topical Report NEDC-32694P-A, "Power Distribution Uncertainties for Safety Limit MCPR Evaluations," dated August 1999

2. Letter from F. Akstulewicz (NRR) to G.A Watford (GE), “Acceptance for Referencing of Licensing Topical Reports NEDC-32601P, ‘Methodology and Uncertainties for Safety Limit MCPR Evaluations’; NEDC-32694P, ‘Power Distribution Uncertainties for Safety Limit MCPR Evaluation’; and ‘Amendment 25 to NEDE-24011-P-A on Cycle-Specific Safety Limit MCPR’ (TAC Nos. M97490, M99069 and M97491), dated March 11,1999

3. General Electric Report entitled "Justification for Operating 2000 EFPH Between OD-1 and LPRM Calibration (Rev 3) and Justification for Allowing LPRM GAF Range of .85 to 1.15 Following LPRM Calibration (Rev 3)," prepared by G. R. Parkos, dated October 7, 1993, revised June 16, 1994

4. GE Nuclear Energy Report NEDC-32773P, Revision 1, "Advanced Methods Power Distribution Uncertainties for Core Monitoring," dated January 1999

5. General Electric Licensing Topical Report NEDO-10958-P-A, “General Electric BWR Thermal Analysis Basis (GETAB) Data, Correlation and Design Application,” dated January 1977