Exelon Generation
4300 Winfield Road
Warrenville, IL 60555

www.exeloncorp.com

Exelon. Nuclear

RS-08-145

10 CFR 50.90

October 31, 2008

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

LaSalle County Station, Units 1 and 2
Facility Operating License Nos. NPF-11 and NPF-18
NRC Docket Nos. 50-373 and 50-374

Subject: Additional Information Supporting the Request for a License Amendment to Revise Local Power Range Monitor Calibration Frequency

References:

1. Letter from Mr. P. R. Simpson (Exelon Generation Company, LLC) to U. S. NRC, "Request for a License Amendment to Revise Local Power Range Monitor Calibration Frequency," dated July 25, 2008

2. Letter from U. S. NRC to Mr. C. G. Pardee (Exelon Generation Company, LLC), "LaSalle County Station, Units 1 and 2 – Request for Additional Information Related to License Amendment Request to Revise Local Power Range Monitor Calibration Frequency (TAC Nos. MD9414 and MD9415)," dated October 1, 2008

In Reference 1, Exelon Generation Company, LLC (EGC) requested an amendment to the facility operating license for LaSalle County Station (LSCS), Units 1 and 2. Specifically, the proposed changes will revise Technical Specification (TS) 3.3.1.1, "Reactor Protection System (RPS) Instrumentation," Surveillance Requirement (SR) 3.3.1.1.8 and TS 3.3.1.3, "Oscillation Power Range Monitor (OPRM) Instrumentation," SR 3.3.1.3.2 to increase the frequency interval between Local Power Range Monitor (LPRM) calibrations from 1000 effective full power hours (EFPH) to 2000 EFPH.

In Reference 2, the NRC requested that EGC provide additional information in support of their review of Reference 1. The NRC request for additional information and the specific EGC responses are provided in the attachment to this letter.

EGC has reviewed the information supporting a finding of no significant hazards consideration that was previously provided to the NRC in Reference 1. The additional information provided in this submittal does not affect the bases for concluding that the proposed license amendment does not involve a significant hazards consideration. No new regulatory commitments are established by this submittal.

If you have any questions concerning this letter, please contact Mr. Timothy A. Byam at (630) 657-2804.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 31st day of October 2008.

Respectfully,

Patrick R. Simpson

Patrick R. Simpson
Manager – Licensing
Exelon Generation Company, LLC

Attachment: Additional Information Supporting the Request for a License Amendment to Revise Local Power Range Monitor Calibration Frequency

ATTACHMENT

Additional Information Supporting the Request for a License Amendment
to Revise Local Power Range Monitor Calibration Frequency

In reviewing the Exelon Generation Company's (Exelon's) submittal dated July 25, 2008. related to your request for a license amendment to revise Local Power Range Monitor (LPRM) calibration frequency, for LaSalle County Station (LSCS), Units 1 and 2, the NRC staff has determined that the following information is needed in order to complete its review:

1. *Provide the plant specific LPRM uncertainty analysis to demonstrate that the LPRM response uncertainty value used in the Minimum Critical Power Ratio (MCPR) safety limit analysis would remain bounding if the LPRM calibration interval were extended from 1000 Effective Full Power Hours (EFPH) to 2000 EFPH. This analysis should account for 25 percent extension (i.e., 2500 EFPH) allowed by SR 3.0.2.*

   1.1. *Include a description of the method and assumptions used for this analysis.*

Response:
As discussed in Reference 1, the LSCS LPRM calibration currents were collected for the period from 1996 through 2006. All the data collected was for the NA300 model LPRM detectors. Traversing Incore Probe (TIP) calibrations have been performed approximately every month during this time period. The TIP calibration determines the expected LPRM reading from the TIP scan data. This process determines a gain adjustment factor (GAF). LSCS adjusts the actual LPRM calibration current only if the GAF value is outside of the range from 0.95 to 1.05. Pseudo calibration currents were calculated by using the actual calibration currents and GAF values. In this way calibration currents are available for every LPRM at every calibration interval. These are all treated as measured calibration currents.

The NA300 detectors are doped with U-234 in order to extend the life of the LPRM. This allows the response to remain relatively constant for an extended period of time. Subsequent to this constant period of sensitivity, the sensitivity decays exponentially. The cutoff exposure at which the sensitivity begins to decay is typically around 1.0 snvt. The value currently used for LSCS is 1.81 snvt. Predicted calibration currents used by the core monitoring system for exposures beyond the cutoff exposure are determined by the following equation:

$$I_n = I_{n-1} e^{\lambda E} \qquad (1.1)$$

where I_n is the predicted calibration current

I_{n-1} is the previous calibration current

λ is the effective exposure decay factor

E is the accumulated LPRM exposure (snvt) since the previous calibration

Predicted calibration currents are calculated for the actual calibration interval as well as for hypothetical calibration intervals by skipping one or more of the intermediate calibrations. The actual calibration current is independent of the previous calibration so a predicted calibration current for an extended calibration interval is simulated by generating the predicted calibration current using the sum of the intermediate accumulated LPRM exposure values. This is illustrated in Tables 1 and 2 for a selected LPRM. Table 1, columns 1 through 5, are plant-collected data. A value of –99.0 in column 5 indicates that the calibration current was not modified from the previous calibration. Data in column 6 is determined by retaining the previous calibration current for detectors that did not adjust the calibration current at the time of the core calibration. This is presented primarily for convenience in determining the value in column 7. The calibration currents calculated from the actual calibration current and the core monitoring system GAF values are shown in column 7. These are the calibration currents that would have been used for setting the detector calibration current if they were adjusted. The core monitoring system makes this adjustment internally if the calibration current was not physically altered. Columns 8 through 11 show various methods to calculate an LPRM calibration exposure increment used for the purpose of calculating a predicted calibration current. The corresponding predicted calibration currents, based upon equation 1.1, are shown in Table 2, columns 3 through 6. The relative difference between the predicted and actual calibration currents are correlated with the corresponding cycle exposure calibration interval (shown in Table 3). The cycle exposure calibration interval is determined by taking the difference in the core average exposure between two calibration events. The data for all of the LPRM's are collected together. The resultant data covers a wide array of calibration intervals. In order to get a meaningful statistical approximation of the uncertainty at a particular calibration interval, a range of calibration intervals above and below the desired value are selected and the standard deviation of this population is calculated. This standard deviation is calculated for a variety of desired calibration interval values.

Additional Information Supporting the Request for a License Amendment
to Revise Local Power Range Monitor Calibration Frequency

Table 1
Illustration of Intermediate Calibration Interval Generation

Date	Core Avererage Exposure (MWd/MTU)	LPRM Exposure (SNVT)	LPRM GAF	Measure Calibration Current (mA)	Previous Calibration Current (mA)	Pseudo Calibration Current (mA)	Delta LPRM Exposure			
							Every Calibration	Skip One Calibration	Skip Two Calibrations	Skip Three Calibrations
8/9/1996	369	0.000	1.000	1103.0	1,103.0	1,103.0				
9/12/1996	1276	0.255	0.991	1060.0	1,060.0	1,060.0	0.255			
8/25/1998	2824	0.263	0.960	1104.2	1,104.2	1,104.2	0.008	0.263		
9/29/1998	3685	0.343	0.957	1153.8	1,153.8	1,153.8	0.080	0.088	0.343	
12/29/1998	5733	0.553	1.013	-99.0	1,153.8	1,139.0	0.210	0.290	0.298	0.553
2/4/1999	6618	0.649	1.014	-99.0	1,153.8	1,137.8	0.096	0.306	0.386	0.394
3/11/1999	7477	0.742	1.008	-99.0	1,153.8	1,144.6	0.093	0.189	0.399	0.479
4/15/1999	8305	0.836	1.009	-99.0	1,153.8	1,143.5	0.094	0.187	0.283	0.493
5/20/1999	9159	0.941	0.995	-99.0	1,153.8	1,159.6	0.105	0.199	0.292	0.388
6/24/1999	9908	1.026	1.001	-99.0	1,153.8	1,152.6	0.085	0.190	0.284	0.377
8/4/1999	10769	1.138	1.016	-99.0	1,153.8	1,135.6	0.112	0.197	0.302	0.396
9/17/1999	11716	1.273	0.984	-99.0	1,153.8	1,172.5	0.135	0.247	0.332	0.437
11/30/1999	12553	1.401	1.123	1027.4	1,027.4	1,027.4	0.128	0.263	0.375	0.460
12/27/1999	13220	1.455	1.002	-99.0	1,027.4	1,025.4	0.054	0.182	0.317	0.429
2/2/2000	14128	1.531	1.025	-99.0	1,027.4	1,002.3	0.076	0.130	0.258	0.393
3/8/2000	14988	1.602	1.010	-99.0	1,027.4	1,017.2	0.071	0.147	0.201	0.329
4/12/2000	15849	1.676	1.009	-99.0	1,027.4	1,018.2	0.074	0.145	0.221	0.275
5/10/2000	16540	1.735	1.016	-99.0	1,027.4	1,011.2	0.059	0.133	0.204	0.280
6/14/2000	17433	1.812	1.036	-99.0	1,027.4	991.7	0.077	0.136	0.210	0.281
7/20/2000	18363	1.891	1.045	-99.0	1,027.4	983.2	0.079	0.156	0.215	0.289
8/24/2000	19269	1.970	1.049	-99.0	1,027.4	979.4	0.079	0.158	0.235	0.294

Table 2
Illustration of Predicted Calibration Currents

Date	Pseudo Calibration Current (mA)	Predicted Calibration Current			
		Every Calibration	Skip One Calibration	Skip Two Calibrations	Skip Three Calibrations
8/9/1996	1,103.0				
9/12/1996	1,060.0	1103.0			
8/25/1998	1,104.2	1060.0	1103.0		
9/29/1998	1,153.8	1104.2	1060.0	1103.0	
12/29/1998	1,139.0	1153.8	1104.2	1060.0	1103.0
2/4/1999	1,137.8	1139.0	1153.8	1104.2	1060.0
3/11/1999	1,144.6	1137.8	1139.0	1153.8	1104.2
4/15/1999	1,143.5	1144.6	1137.8	1139.0	1153.8
5/20/1999	1,159.6	1143.5	1144.6	1137.8	1139.0
6/24/1999	1,152.6	1150.5	1123.7	1115.1	1099.1
8/4/1999	1,135.6	1140.8	1138.8	1112.2	1103.7
9/17/1999	1,172.5	1121.6	1126.7	1124.7	1098.4
11/30/1999	1,027.4	1158.8	1108.5	1113.5	1111.5
12/27/1999	1,025.4	1022.3	1153.1	1103.0	1108.0
2/2/2000	1,002.3	1018.2	1015.2	1145.0	1095.3
3/8/2000	1,017.2	995.8	1011.6	1008.6	1137.6
4/12/2000	1,018.2	1010.3	989.1	1004.7	1001.7
5/10/2000	1,011.2	1012.7	1004.9	983.7	999.3
6/14/2000	991.7	1004.1	1005.6	997.8	976.8
7/20/2000	983.2	984.5	996.8	998.3	990.5
8/24/2000	979.4	976.0	977.4	989.6	991.1

ATTACHMENT

Additional Information Supporting the Request for a License Amendment
to Revise Local Power Range Monitor Calibration Frequency

Table 3
Illustration of the Corresponding Calibration Interval

Date	Core Avererage Exposure (MWd/MTU)	Calibration Interval (Cycle Exposure, MWd/MTU)			
		Every Calibration	Skip One Calibration	Skip Two Calibrations	Skip Three Calibrations
8/9/1996	369				
9/12/1996	1276	907.2			
8/25/1998	2824	1547.5	2454.7		
9/29/1998	3685	861.0	2408.5	3315.7	
12/29/1998	5733	2048.0	2909.0	4456.5	5363.7
2/4/1999	6618	885.0	2933.0	3794.0	5341.5
3/11/1999	7477	859.0	1744.0	3792.0	4653.0
4/15/1999	8305	828.0	1687.0	2572.0	4620.0
5/20/1999	9159	854.0	1682.0	2541.0	3426.0
6/24/1999	9908	749.0	1603.0	2431.0	3290.0
8/4/1999	10769	861.0	1610.0	2464.0	3292.0
9/17/1999	11716	947.0	1808.0	2557.0	3411.0
11/30/1999	12553	837.0	1784.0	2645.0	3394.0
12/27/1999	13220	667.0	1504.0	2451.0	3312.0
2/2/2000	14128	908.0	1575.0	2412.0	3359.0
3/8/2000	14988	860.0	1768.0	2435.0	3272.0
4/12/2000	15849	861.0	1721.0	2629.0	3296.0
5/10/2000	16540	691.0	1552.0	2412.0	3320.0
6/14/2000	17433	893.0	1584.0	2445.0	3305.0
7/20/2000	18363	930.0	1823.0	2514.0	3375.0
8/24/2000	19269	906.0	1836.0	2729.0	3420.0

1.2. *Include the derivation of the values of the standard deviations summarized in Attachment 5 and provide an example of a calculation. This example should include the applicable LPRM calibration data and the associated data deduction that are used to calculate the exposure uncertainty for a LPRM.*

Response:
Standard deviations are calculated from the relative differences between the plant actual LPRM currents and the predicted LPRM currents that are calculated by the equation 1.1. The calculation was based on all available LPRM data for both units. Data from a single LPRM is used here to provide an example calculation.

Columns 6 through 9 of Table 4 show the relative differences between the calibration currents and the predicted currents for different exposure intervals based on the data represented in Table 2. Columns 2 through 5 are the corresponding cycle exposure intervals.

The standard deviation for exposure intervals between 500 and 1500 megawatt-days/metric ton uranium (MWd/MTU), between 1500 and 2500 MWd/MTU, and between 2500 and 3500 MWd/MTU which are representative of an average value of calibration intervals of 1000, 2000, and 3000 MWd/MTU, respectively, are shown in Table 5. These values were generated based upon a single LPRM detector shown in Table 1. The standard deviation presented in the LAR was based upon data from all of the LPRM's from LSCS.

These analyses were performed in terms of MWd/MTU since the data in Table 1 was provided in the units of MWd/MTU. Conversion to units of EFPH is discussed in the response to Question 1.5 below.

1.3. *Explain how the LPRM decay factor was obtained and provide an example calculation to show the result of the calculated decay factor from the exposure data for one LPRM. Also, provide information to demonstrate that the value specified in the attachments is adequate for determining the LPRM uncertainties.*

Response:
The uncertainty analysis was done for a fixed decay factor value of -0.092 for both units. By choosing a fixed sensitivity, one expects to maximize the uncertainty in the predicted response. The actual value currently in use for core monitoring is –0.1189.

Different decay factors were used to evaluate the impact on the uncertainty results. The results showed that the uncertainty increase is not very sensitive to different decay factors. In other words, the change in the predicted calibration uncertainties is independent of the choice in a fixed

Table 4
Example for Relative Difference Calculation for one LPRM

	Calibration Interval (Cycle Exposure, MWd/MTU)				Relative Difference (M/P-1*)			
Date	Every Interval	Skip One Calibration	Skip Two Calibrations	Skip Three Calibrations	Every Difference	Skip One Calibration	Skip Two Calibrations	Skip Three Calibrations
9/12/1996	907.2				-0.039			
8/25/1998	1547.5	2454.7			0.042	0.001		
9/29/1998	861.0	2408.5	3315.7		0.045	0.088	0.046	
12/29/1998	2048.0	2909.0	4456.5	5363.7	-0.013	0.032	0.075	0.033
2/4/1999	885.0	2933.0	3794.0	5341.5	-0.001	-0.014	0.031	0.073
3/11/1999	859.0	1744.0	3792.0	4653.0	0.006	0.005	-0.008	0.037
4/15/1999	828.0	1687.0	2572.0	4620.0	-0.001	0.005	0.004	-0.009
5/20/1999	854.0	1682.0	2541.0	3426.0	0.014	0.013	0.019	0.018
6/24/1999	749.0	1603.0	2431.0	3290.0	0.002	0.026	0.034	0.049
8/4/1999	861.0	1610.0	2464.0	3292.0	-0.005	-0.003	0.021	0.029
9/17/1999	947.0	1808.0	2557.0	3411.0	0.045	0.041	0.043	0.067
11/30/1999	837.0	1784.0	2645.0	3394.0	-0.113	-0.073	-0.077	-0.076
12/27/1999	667.0	1504.0	2451.0	3312.0	0.003	-0.111	-0.070	-0.075
2/2/2000	908.0	1575.0	2412.0	3359.0	-0.016	-0.013	-0.125	-0.085
3/8/2000	860.0	1768.0	2435.0	3272.0	0.022	0.006	0.009	-0.106
4/12/2000	861.0	1721.0	2629.0	3296.0	0.008	0.029	0.013	0.016
5/10/2000	691.0	1552.0	2412.0	3320.0	-0.001	0.006	0.028	0.012
6/14/2000	893.0	1584.0	2445.0	3305.0	-0.012	-0.014	-0.006	0.015
7/20/2000	930.0	1823.0	2514.0	3375.0	-0.001	-0.014	-0.015	-0.007
8/24/2000	906.0	1836.0	2729.0	3420.0	0.003	0.002	-0.010	-0.012

* M/P = Measured/Predicted

Table 5
Example of the Standard Deviation for one LPRM

Exposure Interval (MWd/MTU)	500-1500	1500-2500	2500-3500
Standard Deviation	0.030	0.038	0.041

decay constant. However, the analysis based on the plant LPRM calibration history data indicates that the decay factor used in the POWERPLEX-III input deck should be adjusted for 2500 EFPH extended calibration interval to be consistent with the plant historical data. Therefore, the POWERPLEX-III input deck will be adjusted as part of the implementation actions associated with this amendment. The average decay factors calculated from actual plant data are -0.10 for both units.

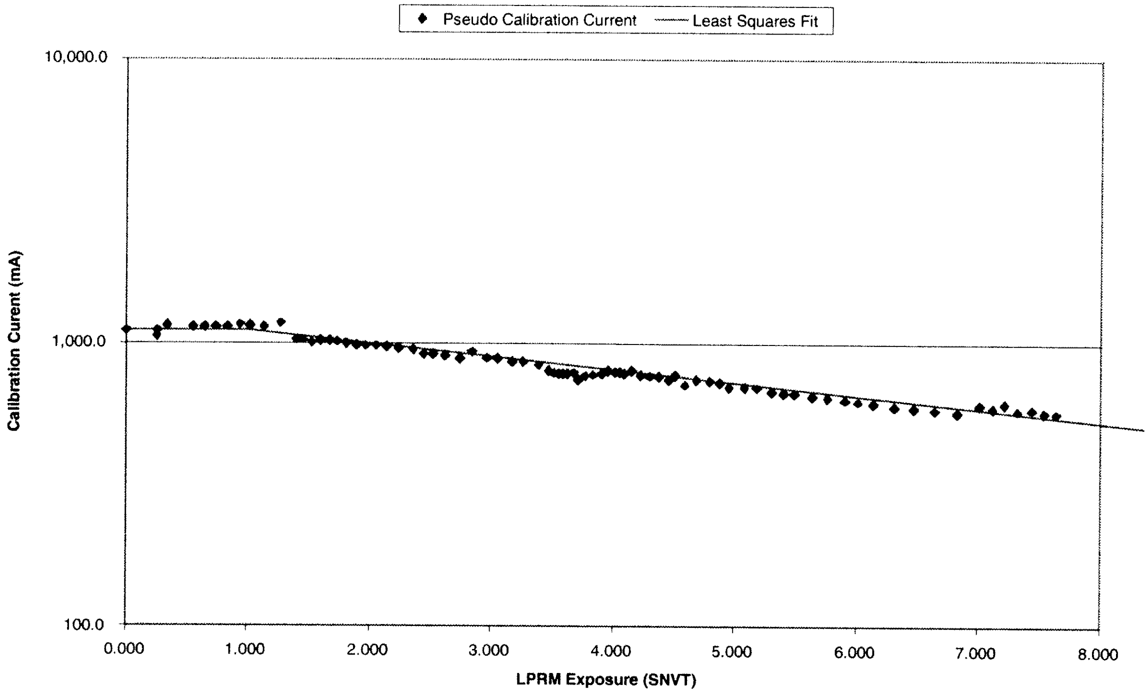
Table 6 provides the calculated uncertainty changes for different decay factors using only the Unit 1 data (Unit 2 data is consistent with Unit 1).

Table 6
Uncertainties for Different Decay Factors

Decay Factor	1000 MWd/MTU	2500 MWd/MTU	Uncertainty Increase
-0.080	0.0331	0.0398	0.0068
-0.092	0.0332	0.0406	0.0074
-0.100	0.0333	0.0412	0.0079
-0.1189	0.0335	0.0427	0.0092

The average decay constant value is determined by performing a least squares fit of the logarithm of the actual calibration currents as a function of detector exposure (SNVT). The data is illustrated in Figure 1 for an individual LPRM detector.

Figure 1
Calibration Current for LPRM #344



1.4. *Explain how the accumulated exposure values were obtained.*

Response:
The accumulated exposure values were obtained from the core monitor system (i.e., POWERPLEX-II and POWERPLEX-III). MICROBURN-B, which was implemented in POWERPLEX-II, calculates the flux at the LPRM location and integrates this value over time. MICROBURN-B2, which was implemented in POWERPLEX-III, has the same capability. The resultant values from both core simulators were demonstrated to produce similar results. The MICROBURN-B and MICROBURN-B2 methodologies have been reviewed and approved by the NRC as noted in Reference 1.

1.5. *The analysis summarized in Attachment 5 evaluates the increase in LPRM response uncertainty when accounting for the TS SR 3.0.2 allowed 25 percent extension of the calibration interval (i.e., 2500 EFPH), however the upper bound calibration interval used was of 2500 MWD/MT. This value equates to 2336 EFPH. When comparing the results shown in Attachment 4 to those in Attachment 5, it was noted that the difference between them increases as the exposure interval increases. Based in the information provided, the NRC staff does not have confidence that if the analysis was performed for 2500 EFPH instead of 2336 EFPH, the increase of standard deviation not would be significantly higher than stated in Attachment 5. Thus,* *the uncertainty value assumed in the MCPR analysis could be exceeded. Provide an analysis that confirms that the change in LPRM calibration frequency continues to allow the 25 percent extension.*

Response:
An additional analysis was performed for 2500 EFPH (i.e., 2675 MWd/MTU) instead of 2500 MWd/MTU. The results shown in Table 7 demonstrate that the uncertainty increase is still bounded by the value that is used in the MCPR safety limit analysis (an increase of 0.9%). However, based on the plant LPRM calibration history data and as part of implementation actions, the decay factor used in POWERPLEX-III input deck will be adjusted to -0.100 for a nominal 2000 EFPH extended calibration interval.

Table 7
Uncertainties for Different Decay Factors

Decay Constant	1000 MWd/MTU	2675 MWd/MTU	Uncertainty Increase
-0.080	0.0331	0.0407	0.0076
-0.092	0.0332	0.0415	0.0083
-0.100	0.0333	0.0422	0.0089
-0.1189	0.0335	0.0439	0.0103

2. *Provide a description of the method used to collect the data used by the analysis referenced in Attachments 4 and 5.*

   2.1. *Include the nature of the data points used by Attachment 5 for each interval and the reason of why the range selection of ±500 MWD/MT is conservative and acceptable.*

   Response:
   In Attachment 4 to Reference 1, the selected ranges fit the actual plant data better, the data with exposure intervals up to 1400 MWd/MTU (1000 EFPH x 1.07 x 125% = 1337 MWd/MTU) were used for 1000 EFPH with 25% extension, and the data with exposures from 1400 MWd/MTU to 2800 MWd/MTU (2000 EFPH x 1.07 x125% = 2675 MWd/MTU) were used for 2000 EFPH with 25% extension. Attachment 5 to Reference 1 documents the analysis that specifically quantifies the uncertainty at the upper end of the 25% extension. The value of 500 was chosen in order to balance actual plant calibration data around the desired calibration interval and provide sufficient data for a meaningful standard deviation. The results showed this approach is conservative compared to the analysis in Attachment 4 for a nominal value of 2000 EFPH.

2.2. *Explain the criteria for double counting the collected data used and how the double counting of data contributed to the total uncertainty.*

Response:
Intermediate calibration currents were calculated from the actual calibration current from a previous calibration current adjustment and the measured GAF values for calibration of interest. The GAF value is used to determine the adjustment to the LPRM calibration current when no physical change in the calibration current was made. Each calibration point is independent of the previous calibration point. Evaluation of the standard deviation of a collection of points measured the uncertainty of that population; in this case the parameter of interest is the calibration interval. Use of the same data points for a different standard deviation of a different collection of points is not really double counting but is used to identify a different population. For example, data between 1500 and 2500 MWd/MTU allows us to determine the expected value for 2000 MWd/MTU, while data between 1750 and 2750 MWd/MTU allows us to determine the expected value for 2250 MWd/MTU.

2.3. *The third paragraph on page 6 of Attachment 1 indicates that the calculation data between 2000 MWD/MT and 2500 MWD/MT were used to calculate the standard deviations for both 2000 MWD/MT and 2500 MWD/MT calibration intervals. Provide an analysis to quantify the effect of the use of overlapping data range on the calculated standard deviations for the 2000 MWD/MT and 2500 MWD/MT calibration intervals.*

Response:
There are the two data sets for representing calibration interval 2000 and 2500 MWd/MTU based on the ±500 MWd/MTU range. The standard deviations of 2000 and 2500 MWd/MTU intervals are compared separately to 1000 MWd/MTU. The overlapping data range has no effect on the uncertainty calculation. The independence of the data points is described in the response to RAI question 1.1.

3. *The first paragraph on page 5 of Attachment 1 states that "LSCS currently uses an improved POWERPLEX – III core monitoring system and newer design LPRM chambers that exhibit more consistent sensitivity behavior than the older LPRM detectors." Provide a comparison of the LPRM exposure uncertainties based on appropriate core monitoring systems (CMS) and LPRM calibration data to show that the newer CMS and LPRM detectors provides more accurate power indications than that based on the older CMS and LPRM detectors.*

Response:
All LPRM calibration data collected by LSCS for use in the LPRM uncertainty analysis are from NA300 LPRM detectors. The NA200 LPRM detectors are no longer used at LSCS and therefore their data was not applied in any of the analysis. The LPRM detector exposures were obtained from several versions of

the CMS. The latest POWERPLEX-III version calculates a more accurate neutron flux than POWERPLEX-II and therefore the exposure obtained for the LPRMs are more accurate but not significant enough to impact the results obtained by the analysis.

4. *Address the newer design of LPRM chambers in more detail. How was the plant exposure data collected from 1996 through 2006 applied to the new LPRM chambers?*

Response:
All LPRM calibration data collected by LSCS for use in the LPRM uncertainty analysis are from GE Reuter-Stokes NA300 LPRM detectors. The LPRM assembly consists of four sensors located at predetermined elevations and a calibration tube for the traversing incore probe detectors. The LPRM detector is a fission chamber with a mineral insulated coaxial signal cable. Improved seal technology improves detector signal reliability and ensures long detector life. The NA300 has an additional seal below the core and outside the fast neutron flux region. The fission chamber consists of a cathode and anode assembly with high-purity argon gas. These detectors are long life due to the cathode being metallurgically bonded with a mixture of U-234 and U-235 oxides. This particular bonding prevents fission product bombardment from causing the uranium coating to flake off of the cathode as observed in NA200 LPRMs. As U-235 is depleted, the U-234 is converted to U-235, so the fission chamber extends its life and output current.

5. *The last paragraph on page 4 of Attachment 1 states that the current frequency interval is based, in part, on operating experience with previous core monitoring systems and that LSCS currently uses an improved POWERPLEX – III core monitoring system. The NRC staff found several records that document LSCS issues regarding POWERPLEX – II from 1999 to 2002. Specifically, the issues are: POWERPLEX – II use of non-conservative steam tables for core monitoring; an error in one input into POWERPLEX – II calculation resulting in exceeding the authorized thermal power; feedwater flow input problems; and Unit 2 use of a revised POWERPLEX – II deck which did not contain all the gamma TIP data constants necessary to monitor core thermal limits to the correct accuracy. How does the LSCS transition to POWERPLEX – III assure that errors of this nature are not repeated?*

Response:
LSCS currently uses the POWERPLEX-III core monitoring system. The transition to POWERPLEX-III was thoroughly planned and executed. All validation and verifications were performed to ensure the appropriate outputs are obtained. POWERPLEX-III input decks are generated and verified to ensure that they are correct using approved procedures and processes to ensure issues like those previously identified are not encountered again. Exelon has a robust corrective action program, which identifies issues and ensures that the appropriate actions

are taken to prevent reoccurrence of issues. LSCS has operated with POWERPLEX-III installed since December 2003 and there have been no repeat occurrences of these issues.

6. *Provide a discussion to confirm that the OPRM and RBM systems will not be adversely affected by the requested extension of calibration frequency with respect to the LPRM input to these systems.*

Response:

Rod Block Monitor (RBM) System

A reduced LPRM (TIP Set) calibration frequency will not adversely affect the RBM function. The RBM uses the LPRM signals that are nulled prior to rod movement. When a rod is selected, the RBM will go through a null sequence that adjusts the LPRM gains to match the APRM power. Specifically, the LPRM outputs associated with the selected rod are averaged and then compared with the reference APRM signal. If the average LPRM signal is greater than or equal to the APRM reference signal it will be used, if it is less than the APRM reference signal the gain circuitry will increase the gain until it is equal or slightly greater than the reference. This new averaged LPRM signal is compared to the flow reference signal (i.e., Reactor Recirculation total flow signal). A rod block will be generated if the LPRM average power exceeds the flow reference set point. Therefore, since the actual LPRM signal gain is corrected/adjusted to the reference APRM signal, a reduced LPRM calibration frequency will not adversely affect the RBM function.

Oscillation Power Range Monitor (OPRM) System

The OPRM System trip depends on the relative change in LPRM average power and is not dependent on the specific LPRM gains.

The OPRM set point (Period Based) requires that oscillations be in frequency with that characterized by thermal-hydraulic oscillations (i.e., period of 1.0 to 3.5 seconds) and continue in this frequency for 14 counts. Then if the counts reach the set point, the amplitude is checked, and a trip signal is generated if the amplitude has increased to 1.11 times the prior 5 second LPRM average power. The next trip algorithm is the amplitude based, and its set point is 1.3 times the prior 5-second LPRM average power. The last algorithm is the growth rate based trip, which has a growth rate factor setpoint that is 1.3 times the prior 5-second average LPRM power.

Since the trips of the OPRM system are dependent on the relative change in LPRM average power and are not dependent on the specific LPRM gains, a reduced LPRM calibration frequency will not adversely affect the OPRM function.

7. *Demonstrate that there is no reduction in opportunity to detect the failure of the LPRM by the requested extension of calibration frequency. If there is a reduction in opportunity to detect the failure of the LPRM, demonstrate that the increased risk is small and acceptable.*

Response:
There are several ways that a LPRM detector failure can be detected.

The POWERPLEX core monitoring system monitors all installed LPRMs for electronic drift. Criteria have been established to detect and identify those detectors whose responses change unexpectedly. If the indication for a detector is outside of the acceptance band, a drift file (.DRF) is created and a message is sent to the POWERPLEX typer in the control room.

POWERPLEX monitoring cases run every two hours and any LPRM detector failure or detector change can impact calculated thermal limit values and preconditioning envelope values.

The plant process computer (PPC) also continuously monitors individual LPRM detectors and has a similar drift algorithm. If the acceptance criteria for an LPRM is violated, an alarm is sent to the PPC terminal in the main control room and the detector changes color on the PPC LPRM display.

In addition, there are two Technical Specification (TS) Surveillance Requirements (SR) that require Average Power Range Monitor (APRM) readings to be routinely checked. SR 3.3.1.1.1 requires a Channel Check of the APRM readings every 12 hours. SR 3.3.1.1.2 requires a weekly verification that the absolute difference between the APRM channel readings and the reactor power is not more than 2% of rated thermal power (RTP) while operating at greater than or equal to 25% RTP. Not only are these APRM readings recorded and checked twice daily during the operator rounds, the APRM GAFs are continuously calculated and displayed for the operators. Errors in detectors that are significant will cause the APRM values to change and the GAFs to change. Any GAFs that fall outside of the TS required 2% accuracy limit will change color and prompt an investigation by the operators.

Operators also have indication for all LPRM detectors above the LPRM cabinets in the control room. An indicator bulb illuminates if any of the detectors fail high or low during normal operation. This requires prompt investigation.

Finally, during the LPRM calibration, there is an opportunity to detect LPRM errors. LPRM GAFs are determined during the calibration process so that the detector gains may be adjusted to match the values corresponding to the incore probe traces. These GAFs are checked to make sure that they are not abnormal relative to those typically observed. Any GAF that falls outside of a range between 0.95 and 1.05 is investigated, and any GAF that falls outside of a range between 0.9 and 1.1 is corrected by changing the LPRM current.

Since the LPRM response is frequently monitored between calibration intervals, extending the calibration frequency from 1000 EFPH to 2000 EFPH will not have an adverse impact on the ability to identify a detector error.

References:

1. Letter from Mr. P. R. Simpson (Exelon Generation Company, LLC) to U. S. NRC, "Request for a License Amendment to Revise Local Power Range Monitor Calibration Frequency," dated July 25, 2008