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**SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 AND 2 LICENSE RENEWAL APPLICATION (LRA)
AMENDMENT TO SECTION 4.2.2
PLA-6370**

**Docket Nos. 50-387
and 50-388**

- References:
- 1) *PLA-6110, Mr. B. T. McKinney (PPL) to Document Control Desk (USNRC), "Application for Renewed Operating License Numbers NPF-14 and NPF-22," dated September 13, 2006.*
 - 2) *Letter, R. Guzman (NRC) to B. T. McKinney (PPL), "Request for Additional Information (RAI) - Susquehanna Steam Electric Station, Units 1 and 2 (SSES 1 and 2) - Extended Power Uprate Application Re: Vessels and Internals Technical Review (TAC Nos. MD3309 and MD3310)," dated March 29, 2007.*
 - 3) *PLA-6186, B. T. McKinney (PPL) to USNRC, "Proposed License Amendment Number No. 285 for Unit 1 Operating License No. NPF-14 and Proposed License Amendment No. 253 for Unit 2 Operating License No. NPF-22 - Extended Power Uprate Application - Re: Vessels and Internals Technical Review - Request for Additional Information Responses," dated April 26, 2007.*

In accordance with the requirements of 10 CFR 50, 51, and 54, PPL requested the renewal of the operating licenses for the Susquehanna Steam Electric Station (SSES) Units 1 and 2 in Reference 1.

As described in the enclosure, a revision was made to the PPL calculation that served as the basis for the reactor pressure vessel (RPV) upper shelf energy (USE) evaluation included in the SSES license renewal application (LRA). The calculation was revised in response to a request for additional information during the NRC review of the SSES extended power uprate (EPU) application. The revised calculation evaluates values for all of the RPV beltline plates and welds. The attached amendment for LRA Section 4.2.2 is provided to reflect the results of this revised evaluation and to ensure consistency with the information provided in Reference 3 for review of the EPU application. The conclusions in the LRA regarding upper shelf energy of RPV beltline material have not changed. All of the RPV beltline materials will remain in compliance with Appendix G of 10 CFR 50 for the period of extended operation.

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There are no new regulatory commitments contained herein as a result of the attached amendment to the SSES LRA.

If you have any questions, please contact Mr. Duane L Filchner at (610) 774-7819.

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

Executed on: 6/9/2008


B.T. McKinney

Enclosure: Basis for LRA Changes

Attachment: SSES LRA Amendment (Section 4.2.2)

Copy: NRC Region I

Ms. E. H. Gettys, NRC Project Manager, License Renewal, Safety

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**Enclosure to PLA-6370
Basis for LRA Changes**

The Upper Shelf Energy (USE) Evaluation originally presented in the License Renewal Application (LRA), Section 4.2.2 addressed only the limiting beltline plates and welds for SSES Units 1 and 2, as identified in the SSES FSAR Section 5.3.1.5.1.5. The evaluation consisted of completing the BWRVIP-74-A Equivalent Margin Analysis (EMA) Plant Applicability Verification Forms to demonstrate that the limiting beltline plates and welds are bounded by the EMA for 54 Effective Full Power Years (EFPY). The evaluation was documented in a PPL calculation prepared in December of 2005 to support the submittal of the LRA in September of 2006.

In March of 2007, during the review of the Extended Power Uprate Application for SSES, the NRC requested PPL to provide a table of information that demonstrated how the end-of-license USE values were calculated for all beltline materials (Reference 2). In response to the NRC's request, the December 2005 calculation was revised in April 2007 to document the evaluation of the USE values for all beltline plates and welds, not just the limiting plates and welds. The results of the revised calculation were provided to the NRC in Reference 3.

The current revision of the calculation (April 2007) documents how the changes in USE were projected for 54 EFPY in accordance with Regulatory Guide (RG) 1.99, Revision 2. For the plates and welds with projected USE values of 50 ft-lb or greater at 54 EFPY, the criterion of 10 CFR 50, Appendix G, was met and no further evaluation was required. For plates and welds that do not meet the 50 ft-lb criterion, the BWRVIP-74-A EMA was employed to demonstrate that the 54 EFPY USE values remain in compliance with 10 CFR 50, Appendix G.

Due to the broader scope (all beltline materials vs. only the limiting materials) and the different methodology employed (RG 1.99, Rev. 2, vs. only BWRVIP-74-A EMA), the results of the revised calculation do not directly match the information originally provided in the LRA. As such, the LRA is revised to present the latest information in the format that is supported by the controlling calculation revision.

**Attachment to PLA-6370
SSES LRA Amendment
(Section 4.2.2)**

4.2.2 Upper Shelf Energy Evaluation

- The following text under Section 4.2.2 (on LRA page 4.2-4) is revised by addition (***bold italics***) and deletion (strikethrough).

10 CFR 50, Appendix G requires that Upper Shelf Energy (USE) values for RPV materials include the effects of neutron radiation. It states that USE for the beltline materials including plates and welds be maintained at no less than 50 ft-lb for the life of the reactor vessel. Calculated fluence values for EPU and extended operation to 54 EFPY exceed previously determined fluence based on materials surveillance program information for Units 1 and 2. Therefore, projections of changes in USE for the period of extended operation are required in accordance with 10 CFR 50, Appendix G.

~~BWRVIP-74-A (Reference 4.8.2) documents an equivalent margin analysis which establishes the minimum 54 EFPY USE limits for BWR/2-6 vessel beltline materials required for compliance with 10 CFR 50, Appendix G. The equivalent margin analysis assumes that the percent decreases in USE prescribed by Regulatory Guide (RG) 1.99 (Reference 4.8.3) are appropriate for a given vessel's beltline materials. The SSES Unit 1 and Unit 2 vessel beltline materials are bounded by the equivalent margin analysis. Limiting vessel beltline plates and welds were evaluated using data from surveillance capsule reports and 54 EFPY fluence values. Using this information the predicted decrease in USE was obtained from RG 1.99, Figure 2 and compared to the decreases assumed in the equivalent margin analysis. The evaluations utilized the equivalent margin analysis plant applicability verification forms from BWRVIP-74-A. The completed forms are presented in Table 4.2-3, Table 4.2-4, Table 4.2-5, and Table 4.2-6.~~

The projections of changes in USE for the period of extended operation for the RPV beltline plates and welds for Units 1 and 2 were determined in accordance with Regulatory Guide (RG) 1.99, Revision 2 (Reference 4.8.3) and are presented in Table 4.2-3 and Table 4.2-5, respectively. For the plates and welds with projected USE values of 50 ft-lb or greater at 54 EFPY, the criterion of 10 CFR 50, Appendix G, has been met and no further evaluation is required.

For plates and welds that do not meet the 50 ft-lb criterion, BWRVIP-74-A (Reference 4.8.2) documents equivalent margin analyses (EMA) to demonstrate that the 54 EFPY USE values for BWR/2-6 vessel beltline materials remain in compliance with 10 CFR 50, Appendix G. To credit the BWRVIP-74-A EMA, the applicability of the EMA needs to be verified for the vessel beltline materials. This is accomplished, as prescribed in BWRVIP-74-A, by comparing the predicted decrease in USE from RG 1.99, Figure 2, to the decrease assumed in the EMA for each vessel beltline plate and weld that fails to meet the 50 ft-lb criterion. Table 4.2-4 and Table 4.2-6 present the BWRVIP-74-A EMA applicability verifications for the SSES plates and welds having a projected USE value of less than 50 ft-lb for Units 1 and 2, respectively. The results demonstrate that all evaluated plates and welds are bounded by the BWRVIP-74-A equivalent margin analyses.

Therefore, the effects of neutron radiation have been evaluated, and all RPV beltline materials for Units 1 and 2 have been demonstrated to remain in compliance with Appendix G of 10 CFR 50 for the period of extended operation.

➤ Table 4.2-3 under Section 4.2.2 (on LRA page 4.2-5) is replaced with the following:

**Table 4.2-3
Unit 1 RPV Beltline USE Assessment for 54 EFPY**

| Part Name | ID | Heat | Lot | %Cu | Unirr. C _v USE (ft-lbs) | 1/4t Fluence (10 ¹⁹ n/cm ²) | % Drop in C _v USE | C _v USE @ 1/4t ⁽¹⁾ (ft-lbs) | Requires EMA? ⁽²⁾ |
|---------------------|------|----------|-----------|------|---------------------------------------|---|---------------------------------|--|---------------------------------|
| Lower Shell #1 | 21-1 | B5083-1 | --- | 0.14 | 48.1 (4) | 0.0808 | 12.8 | 41.9 | YES |
| Lower Shell #2 | 21-2 | C0770-2 | --- | 0.14 | 68.9 (4) | 0.0808 | 12.8 | 60.1 | NO (3) |
| Lower Shell #3 | 21-3 | C0814-2 | --- | 0.13 | 78.0 (4) | 0.0808 | 12.2 | 68.5 | NO |
| Lower-Int. Shell #1 | 22-1 | C0803-1 | --- | 0.09 | 52.7 (4) | 0.0974 | 10.9 | 47.0 | YES |
| Lower-Int. Shell #2 | 22-2 | C0776-1 | --- | 0.12 | 36.4 (4) | 0.0974 | 12.2 | 32.0 | YES |
| Lower-Int. Shell #3 | 22-3 | C2433-1 | --- | 0.10 | 87.8 | 0.0974 | 10.9 | 78.2 | NO |
| Weld #1 | --- | 629616 | L320A27AG | 0.04 | 114.0 | 0.0808 | 10.5 | 102.0 | NO |
| Weld #2 | --- | 411L3071 | L311A27AF | 0.03 | 109.0 | 0.0808 | 10.5 | 97.6 | NO |
| Weld #3 | --- | 494K2351 | L307A27AD | 0.04 | 192.0 | 0.0808 | 10.5 | 171.8 | NO |
| Weld #4 | --- | 401S0371 | B504B27AE | 0.03 | 127.0 | 0.0808 | 10.5 | 113.7 | NO |
| Weld #5 | --- | 402K9171 | K315A27AE | 0.03 | 109.0 | 0.0808 | 10.5 | 97.6 | NO |
| Weld #6 | --- | 402C4371 | C115A27A | 0.02 | 92.0 (4) | 0.0808 | 10.5 | 82.3 | NO |
| Weld #7 | --- | 412P3611 | J417B27AF | 0.03 | 140.0 | 0.0808 | 10.5 | 125.3 | NO |

- Notes:
1. C_vUSE at 1/4t computed as (Unirr. C_vUSE)(100 - % Drop in C_vUSE), in accordance with Regulatory Guide 1.99, Rev. 2.
 2. If C_vUSE < 50 ft-lbs, then "YES", and assessment for this material will be performed in accordance with BWRVIP-74-A.
 3. Although EMA is not required for this plate (since C_vUSE > 50 ft-lbs), this plate is identified for EMA in RVID2. Therefore, EMA is conservatively performed.
 4. Value is conservatively based on 10°F data. Refer to SSES FSAR Section 5.3.1.5.1.2.

- Table 4.2-4 under Section 4.2.2 (on LRA page 4.2-6) is replaced with the following:

Table 4.2-4
Unit 1 RPV Beltline USE Equivalent Margin Analyses for 54 EFPY

| BWRVIP-74-A Applicability Verification | | SSES-1 Plates B5083-1 and C0770-2 | SSES-1 Plate C0803-1 | SSES-1 Plate C0776-1 |
|--|---|---|---------------------------------------|---------------------------------------|
| Surveillance Plate USE: | %Cu | 0.09 | 0.09 | 0.09 |
| | Capsule Fluence | $0.14 \times 10^{18} \text{ n/cm}^2$ | $0.14 \times 10^{18} \text{ n/cm}^2$ | $0.14 \times 10^{18} \text{ n/cm}^2$ |
| | Measured % Decrease (Charpy Curves) | -2 (increase) | -2 (increase) | -2 (increase) |
| | RG1.99 Predicted % Decrease (RG1.99, Figure 2) | 6 | 6 | 6 |
| Lower Beltline Plate USE: | %Cu | 0.14 | 0.09 | 0.12 |
| | 54 EFPY Peak ID Fluence | $1.17 \times 10^{18} \text{ n/cm}^2$ | $1.41 \times 10^{18} \text{ n/cm}^2$ | $1.41 \times 10^{18} \text{ n/cm}^2$ |
| | 54 EFPY 1/4t Fluence | $0.808 \times 10^{18} \text{ n/cm}^2$ | $0.974 \times 10^{18} \text{ n/cm}^2$ | $0.974 \times 10^{18} \text{ n/cm}^2$ |
| | RG1.99 Predicted % Decrease | 12.8 | 10.9 | 12.2 |
| | Adjusted % Decrease (RG1.99, Position 2.2) | N/A | N/A | N/A |
| Criteria for Plates | % Decrease \leq 23.5% | $12.8 \leq 23.5$ (1) | $10.9 \leq 23.5$ (1) | $12.2 \leq 23.5$ (1) |

Note 1. The SSES material is bounded by the BWRVIP-74-A equivalent margin analysis.

➤ Table 4.2-5 under Section 4.2.2 (on LRA page 4.2-7) is replaced with the following:

**Table 4.2-5
Unit 2 RPV Beltline USE Assessment for 54 EFPY**

| Part Name | ID | Heat | Lot | %Cu | Unirr. C _v USE (ft-lbs) | 1/4t Fluence (10 ¹⁹ n/cm ²) | % Drop in C _v USE | C _v USE @ 1/4t ⁽¹⁾ (ft-lbs) | Requires EMA? ⁽²⁾ |
|---------------------|------|------------|-----------|------|---------------------------------------|---|---------------------------------|--|---------------------------------|
| Lower Shell #1 | 21-1 | 6C956-1-1 | --- | 0.11 | 125.1 (3) | 0.0815 | 11.1 | 111.2 | NO |
| Lower Shell #2 | 21-2 | 6C980-1-1 | --- | 0.10 | 93.9 (3) | 0.0815 | 10.5 | 84.0 | NO |
| Lower Shell #3 | 21-3 | 6C1053-1-1 | --- | 0.10 | 76.1 (3) | 0.0815 | 10.5 | 68.1 | NO |
| Lower-Int. Shell #1 | 22-1 | C2421-3 | --- | 0.13 | 52.0 (3) | 0.0981 | 12.8 | 45.3 | YES |
| Lower-Int. Shell #2 | 22-2 | C2929-1 | --- | 0.13 | 83.9 | 0.0981 | 12.8 | 73.2 | NO |
| Lower-Int. Shell #3 | 22-3 | C2433-2 | --- | 0.10 | 48.1 (3) | 0.0981 | 11.0 | 42.8 | YES |
| Weld #1 | --- | 629616 | L320A27AG | 0.04 | 114.0 | 0.0815 | 10.5 | 102.0 | NO |
| Weld #2 | --- | 624263 | E204A27A | 0.06 | 73.0 (3) | 0.0815 | 11.2 | 64.8 | NO |
| Weld #3 | --- | 09M057 | C109A27A | 0.03 | 44.0 (3) | 0.0815 | 10.5 | 39.4 | YES |
| Weld #4 | --- | 659N315 | F414B27AF | 0.04 | 137.0 | 0.0815 | 10.5 | 122.6 | NO |
| Weld #5 | --- | 411L3071 | L311A27AF | 0.03 | 125.0 | 0.0815 | 10.5 | 111.9 | NO |
| Weld #6 | --- | 494K2351 | L307A27AD | 0.04 | 192.0 | 0.0815 | 10.5 | 171.8 | NO |
| Weld #7 | --- | 401S0371 | B504B27AE | 0.03 | 125.0 | 0.0815 | 10.5 | 111.9 | NO |
| Weld #8 | --- | 402K9171 | K315A27AE | 0.03 | 134.0 | 0.0815 | 10.5 | 119.9 | NO |
| Weld #9 | --- | 402C4371 | C115A27A | 0.02 | 92.0 (3) | 0.0815 | 10.5 | 82.3 | NO |
| Weld #10 | --- | 412P3611 | J417B27AF | 0.03 | 140.0 | 0.0815 | 10.5 | 125.3 | NO |

- Notes: 1. C_vUSE at 1/4t computed as (Unirr. C_vUSE)(100 - % Drop in C_vUSE), in accordance with Regulatory Guide 1.99, Rev. 2.
 2. If C_vUSE < 50 ft-lbs, then "YES", and assessment for this material will be performed in accordance with BWRVIP-74-A.
 3. Value is conservatively based on 10°F or 40°F data. Refer to SSES FSAR Section 5.3.1.5.1.2.

➤ Table 4.2-6 under Section 4.2.2 (on LRA page 4.2-8) is replaced with the following:

**Table 4.2-6
Unit 2 RPV Beltline USE Equivalent Margin Analyses for 54 EFPY**

| BWRVIP-74-A Applicability Verification | | SSES-2 Plate C2421-3 | SSES-2 Plate C2433-2 | SSES-2 Weld 09M057 |
|---|---|---------------------------------------|---------------------------------------|---------------------------------------|
| Surveillance Plate/Weld USE: | %Cu | 0.12 | 0.12 | 0.02 |
| | Capsule Fluence | $0.13 \times 10^{18} \text{ n/cm}^2$ | $0.13 \times 10^{18} \text{ n/cm}^2$ | $0.13 \times 10^{18} \text{ n/cm}^2$ |
| | Measured % Decrease (Charpy Curves) | -4 (increase) | -4 (increase) | 4 |
| | RG1.99 Predicted % Decrease (RG1.99, Figure 2) | 8 | 8 | 5 to 6 |
| Lower Beltline Plate/Weld USE: | %Cu | 0.13 | 0.10 | 0.03 |
| | 54 EFPY Peak ID Fluence | $1.42 \times 10^{18} \text{ n/cm}^2$ | $1.42 \times 10^{18} \text{ n/cm}^2$ | $1.18 \times 10^{18} \text{ n/cm}^2$ |
| | 54 EFPY 1/4t Fluence | $0.981 \times 10^{18} \text{ n/cm}^2$ | $0.981 \times 10^{18} \text{ n/cm}^2$ | $0.815 \times 10^{18} \text{ n/cm}^2$ |
| | RG1.99 Predicted % Decrease | 12.8 | 11.0 | 10.5 |
| | Adjusted % Decrease (RG1.99, Position 2.2) | N/A | N/A | N/A |
| Criteria for Plates | % Decrease \leq 23.5% | $12.8 \leq 23.5$ (1) | $11.0 \leq 23.5$ (1) | N/A |
| Criteria for Welds | % Decrease \leq 39% | N/A | N/A | $10.5 \leq 39$ (1) |

Note 1. The SSES material is bounded by the BWRVIP-74-A equivalent margin analysis.

- The following text under Section 4.2.2 (on LRA page 4.2-8) is revised by deletion (strikethrough).

~~For the vessel beltline plates, the maximum decrease in USE was found to be 10.9% for Unit 1 and 13.8% for Unit 2. This is less than the assumed decrease of 23.5% in the equivalent margin analysis. Therefore, the maximum predicted decreases in USE for 54 EFPY for the beltline plates for both units are bounded by the generic equivalent margin analysis documented in BWRVIP-74-A, and the projected USE for the vessel beltline plates is acceptable for the period of extended operation.~~

~~For the welds associated with the vessel beltline plates, the maximum decrease in USE was found to be 10.4% for Unit 1 and 10.8% for Unit 2. This is less than the assumed decrease of 39% in the equivalent margin analysis. Therefore, the maximum predicted decreases in USE for the welds in the vessel beltline region are bounded by the BWRVIP-74-A equivalent margin analysis, and the projected USE for the welds is acceptable for the period of extended operation.~~