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10 CFR 50.46

**SUSQUEHANNA STEAM ELECTRIC STATION**  
**10 CFR 50.46 ANNUAL REPORT**  
**PLA-8012**

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

- References*
1. "Susquehanna Steam Electric Station 10 CFR 50.46 Annual Report (PLA-7947)," dated June 10, 2021 (ADAMS Accession No. ML21161A005)
  2. "2021 - Annual Reporting of Changes and Errors in Emergency Core Cooling Systems (ECCS) Evaluation Models" dated March 14, 2022 (ADAMS Accession No. ML22075A216)
  3. Framatome Record FS1-0058024, Revision 1.0, "10 CFR 50.46 PCT Error Reporting for the Susquehanna Units," dated August 27, 2021
  4. Framatome Record FS1-0058647, Revision 1.0, "10 CFR 50.46 PCT Error Reporting for the Susquehanna Units," dated September 29, 2021
  5. Framatome Record FS1-0062827, Revision 1.0, "10 CFR 50.46 PCT Error Reporting for Susquehanna Units," dated June 9, 2022

Pursuant to the reporting requirements of 10 CFR 50.46(a)(3)(ii), Susquehanna Nuclear, LLC, is submitting the Emergency Core Cooling System (ECCS) evaluation model annual report for Susquehanna Steam Electric Station (SSES) Units 1 and 2. The attached reports summarize the nature of and estimated effect of any modeling changes or error corrections in the ECCS models.

Attachment 1 provides a summary of the Framatome EXEM BWR-2000 LOCA (Loss of Coolant Accident) Methodology which is applicable to ATRIUM 10 fuel for the period April 10, 2021, through April 9, 2022, for SSES Units 1 and 2. Since the last 10 CFR 50.46 annual report dated June 10, 2021 (Reference 1), there were two non-impacting Peak Cladding Temperature (PCT) changes reported to SSES resulting from a modeling change or error correction to the EXEM BWR-2000 LOCA Methodology. The current licensing basis PCT remains in compliance with 10 CFR 50.46 requirements.

Attachment 2 provides a summary of the Framatome AURORA-B LOCA Methodology which is applicable to ATRIUM 11 fuel for the period April 10, 2021, through April 9, 2022, for SSES Units 1 and 2. Since the last 10 CFR 50.46 annual report dated June 10, 2021 (Reference 1), there were four non-impacting and one impacting PCT

changes reported to SSES resulting from a modeling change or error correction to the AURORA-B LOCA Methodology. The current licensing basis PCT remains in compliance with 10 CFR 50.46 requirements.

There are no new or revised regulatory commitments contained in this submittal.

If you have any questions regarding this letter, please contact Ms. Melisa Krick, Manager - Nuclear Regulatory Affairs, at (570) 542-1818.



K. Cimorelli

Attachments:

1. 10 CFR 50.46 ECCS Evaluation Model Annual Report for ATRIUM 10 Fuel
2. 10 CFR 50.46 ECCS Evaluation Model Annual Report for ATRIUM 11 Fuel

Copy: NRC Region I  
Ms. A. Klett, NRC Project Manager  
Mr. C. Highley, NRC Senior Resident Inspector  
Mr. M. Shields, PA DEP/BRP

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**Attachment 1 to PLA-8012**

**10 CFR 50.46 ECCS Evaluation Model  
Annual Report for ATRIUM 10 Fuel**

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**BACKGROUND**

In accordance with 10 CFR 50.46(a)(3)(ii), this annual report summarizes the nature of and estimated effect of any modeling changes or error corrections in the ECCS model for the period April 10, 2021, through April 9, 2022.

**DISCUSSION**

ATRIUM 10 and ATRIUM 11 fuel were co-loaded in the SSES Unit 2 Reactor for the reporting period April 10, 2021, through April 9, 2022. Prior to co-loading with ATRIUM 10 and ATRIUM 11 fuel in April 2022, SSES Unit 1 was loaded only with ATRIUM 10 fuel. The ECCS performance evaluation method applicable to ATRIUM 10 fuel for both SSES Units 1 and 2 is the Framatome EXEM BWR-2000 LOCA Methodology.

For the reporting period of April 10, 2021, through April 9, 2022, there have been two reportable 10 CFR 50.46 modeling changes or error corrections to the ECCS evaluation method since the previous 10 CFR 50.46 report (Reference 1).

1. An error correction was applied when utilizing the pellet roughness in the assessment of the potential impact of Thermal Conductivity Degradation (TCD). (Reference 2) This error is estimated to have zero impact on PCT. (Reference 4)
2. A correction was made to utilize the Rankine scale instead of the Fahrenheit scale when assessing the potential impact of TCD using the appropriate rod model codes. (Reference 2) This error is estimated to have zero impact on PCT. (Reference 4)

The errors have been captured in Framatome's Corrective Action Program. These individual items do not meet the significance threshold for change (50°F) identified in 10 CFR 50.46(a)(3)(i) for which a 30-day report is required.

The total cumulative change listed in the last column of Table 1 does not meet the significance threshold for change (50°F) identified in 10 CFR 50.46(a)(3)(i) for which a 30-day report is required.

## **IMPACT**

Table 1  
Non-Zero PCT Changes Resulting from Modeling Changes / Error Corrections in  
Calculated ECCS Performance  
Evaluation Model: Framatome EXEM BWR-2000 LOCA Methodology

Description of Change/Error		Estimated $\Delta$ PCT (°F)	Absolute Value of $\Delta$ PCT (°F)
HUXY capability enhancement to model each fuel rod individually (ADAMS Accession No. ML17158B382)		-1	1
Updated steam dryer information (ADAMS Accession No. ML19161A131)		+5	5
Total Since Initial PCT (Reference 5)		+4	6

## **CONCLUSION**

As documented in Table 1, SSES Units 1 and 2 ATRIUM 10 Loss of Coolant Accident Analysis PCT remains in compliance with 10 CFR 50.46(b)(1), which requires that the PCT not exceed 2200°F.

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**Attachment 2 to PLA-8012**

**10 CFR 50.46 ECCS Evaluation Model  
Annual Report for ATRIUM 11 Fuel**

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**BACKGROUND**

In accordance with 10 CFR 50.46(a)(3)(ii), this annual report summarizes the nature of and estimated effect of any modeling changes or error corrections in the ECCS model for the period April 10, 2021, through April 9, 2022.

**DISCUSSION**

ATRIUM 10 and ATRIUM 11 fuel were co-loaded in the SSES Unit 2 Reactor for the reporting period April 10, 2021, through April 9, 2022. Prior to co-loading with ATRIUM 10 and ATRIUM 11 fuel in April 2022, SSES Unit 1 was loaded only with ATRIUM 10 fuel. The ECCS performance evaluation method applicable to ATRIUM 11 fuel is the Framatome AURORA-B LOCA Methodology.

For the period of April 10, 2021, through April 9, 2022, there have been five reportable 10 CFR 50.46 modeling changes or error corrections to the ECCS evaluation method.

1. An incorrect input for the top of active fuel elevation. This error is estimated to have zero impact on PCT. (Reference 3)
2. An incorrect setpoint associated with the hot wall effect for flow pathways modeled in the fuel assembly lower tie plate was used. (Reference 2) The impact of this error is summarized in Table 2.
3. A code error was identified in S-RELAP5 associated with the calculation of the cladding thermal conductivity. This error is estimated to have zero impact on PCT. (Reference 5)
4. An incorrect initial hydrogen content in the zircaloy cladding was used to calculate fuel rod conditions. This error is estimated to have zero impact on PCT. (Reference 5)
5. An incorrect initial cladding oxide layer was used. This error is estimated to have zero impact on PCT. (Reference 5)

The errors and changes have been captured in Framatome's Corrective Action Program. These individual items do not meet the significance threshold for change (50°F) identified in 10 CFR 50.46(a)(3)(i) for which a 30-day report is required.

The total cumulative change listed in the last column of Table 2 does not meet the significance threshold for change (50°F) identified in 10 CFR 50.46(a)(3)(i) for which a 30-day report is required.

## **IMPACT**

Table 2  
Non-Zero PCT Changes Resulting from Modeling Changes / Error Corrections in  
Calculated ECCS Performance  
Evaluation Model: Framatome AURORA-B LOCA Methodology

Description of Change/Error		Estimated $\Delta$ PCT (°F)	Absolute Value of $\Delta$ PCT (°F)
Pellet-Cladding Mechanical Interaction routines in RODEX4 (ADAMS Accession No. ML21161A005)		-1	1
Lower tie plate bypass flow hole size increase (ADAMS Accession No. ML21161A005)		-3	3
Upper tie plate loss coefficient used in MICROBURN-B2 (ADAMS Accession No. ML21161A005)		+5	5
Hot wall effect temperature (Reference 4)		+5	5
Total Since Initial PCT (Reference 5)		+6	14

## **CONCLUSION**

As documented in Table 2, SSES Units 1 and 2 ATRIUM 11 Loss of Coolant Accident Analysis PCT remains in compliance with 10 CFR 50.46(b)(1), which requires that the PCT not exceed 2200°F.