Enclosure 1 Contains Proprietary Information –
Withhold in Accordance with 10 CFR 2.390

Kevin Cimorelli
Site Vice President

Susquehanna Nuclear, LLC
769 Salem Boulevard
Berwick, PA 18603
Tel. 570.542.3795 Fax 570.542.1504
Kevin.Cimorelli@TalenEnergy.com

TALEN ENERGY

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

10 CFR 50.90

SUSQUEHANNA STEAM ELECTRIC STATION
NINETY-DAY RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION REGARDING PROPOSED LICENSE AMENDMENT REQUESTING APPLICATION OF ADVANCED FRAMATOME METHODOLOGIES
PLA-7853

Docket No. 50-387
and 50-388

References:
1) Susquehanna letter to NRC, "Proposed Amendment to Licenses NPF-14 and NPF-22: Application of Advanced Framatome Methodologies and TSTF-535 (PLA-7783)," dated July 15, 2019 (ADAMS Accession No. ML19196A270).

2) NRC letter to Susquehanna, "Requests for Additional Information for Susquehanna Steam Electric Station, Units 1 and 2 to Support Review of the License Amendment Request Regarding Application of Framatome Methodologies to Support Transition to ATRIUM 11 Fuel," dated January 6, 2020 (ADAMS Accession No. ML20010D201).

3) Susquehanna letter to NRC, "Request for Due Date Extension to Respond to a Request for Additional Information (PLA-7837)," dated January 16, 2020 (ADAMS Accession No. ML20016A337).

4) NRC email to Susquehanna, "Re: Susquehanna Request for RAI Response Due Date Extension," dated February 4, 2020.

5) Susquehanna letter to NRC, "Thirty-Day Response to Request for Additional Information Regarding Proposed License Amendment Requesting Application of Advanced Framatome Methodologies (PLA-7841)," dated February 6, 2020 (ADAMS Accession No. ML20037A098).

Pursuant to 10 CFR 50.90, Susquehanna Nuclear, LLC (Susquehanna), submitted, in Reference 1, a request for an amendment to the Technical Specifications (TS) for the Susquehanna Steam Electric Station (SSES), Units 1 and 2, Facility Operating License numbers NPF-14 and NPF-22. The proposed amendment would revise TS 5.6.5.b to allow application of Advanced Framatome Methodologies for determining core operating limits in support of loading Framatome fuel type ATRIUM 11, revise the low pressure safety limit in TS 2.1.1.1 and TS 2.1.1.2, and remove the neutronic methods penalties on Oscillation Power Range Monitor amplitude setpoint and the pin power distribution uncertainty and bundle power correlation coefficient.

The NRC provided a Request for Additional Information (RAI) in Reference 2 with required response dates of March 6, 2020, for Question 2 and February 6, 2020, for all other questions. In Reference 3, Susquehanna requested that the required response date for Question 2.1.a be extended to April 6, 2020, and stated that the responses to all other questions would be provided by February 6. In Reference 4, the NRC approved that request. In Reference 5, Susquehanna provided the response to all questions from the Reference 2 RAI except for Question 2.1.a.

Enclosures 1 and 2 to this letter provide Susquehanna's response to Question 2.1.a. The response is provided in the form of a revision to Framatome Topical Report ANP-3823P, which was transmitted as Attachment 1 to Reference 5 (non-proprietary version provided in Attachment 2 to Reference 5). The only changes from Revision 0 to Revision 1 of ANP-3823P are the inclusion of the response to RAI Question 2.1.a in Section 2.0 and resulting updates to the nomenclature section on pages iii and iv; no other changes were made to the document or the associated data files previously provided.

Information provided in Enclosure 1 is considered proprietary to Framatome. The proprietary information has been denoted therein by brackets. As owners of the proprietary information, Framatome has executed an affidavit for the document which identifies the information as proprietary, is customarily held in confidence, and should be withheld from public disclosure in accordance with 10 CFR 2.390. Enclosure 2 provides a non-proprietary version of Enclosure 1. The Framatome affidavit is included as Enclosure 3.

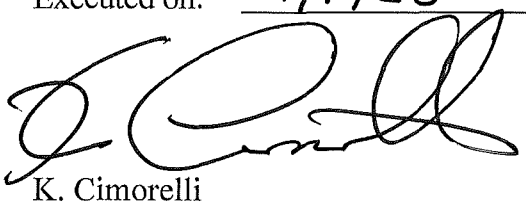
Susquehanna has reviewed the information supporting a finding of No Significant Hazards Consideration and the Environmental Consideration provided to the NRC in Reference 1 and determined the information provided herein does not impact the original conclusions in Reference 1.

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

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

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

Executed on: 4/1/20



K. Cimorelli

Enclosures:

1. Framatome Topical Report ANP-3823P, Revision 1, "Susquehanna ATRIUM 11 Advanced Methods Response to Request for Additional Information" **[Proprietary Information – Withhold from Public Disclosure in accordance with 10 CFR 2.390]**
2. Framatome Topical Report ANP-3823NP, Revision 1, "Susquehanna ATRIUM 11 Advanced Methods Response to Request for Additional Information" (Non-Proprietary Version)
3. Framatome Affidavit for ANP-3823P, Revision 1, "Susquehanna ATRIUM 11 Advanced Methods Response to Request for Additional Information"

Copy: NRC Region I
Ms. L. Micewski, NRC Sr. Resident Inspector
Ms. S. Goetz, NRC Project Manager
Mr. M. Shields, PA DEP/BRP (w/out Enclosure 1)

Enclosure 2 of PLA-7853

Framatome Topical Report ANP-3823NP, Revision 1

Susquehanna ATRIUM 11 Advanced Methods Response to Request for Additional Information

(Non-Proprietary Version)

framatome

Susquehanna ATRIUM 11 Advanced Methods Response to Request for Additional Information

ANP-3823NP
Revision 1

March 2020

Nature of Changes

Item	Section(s) or Page(s)	Description and Justification.
1	Section 2.0	Provided RAI Response 2.1.a on page 2-1.
2	Nomenclature	Updated nomenclature related to Item 1.

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Nomenclature

Acronym	Definition
AOO	Anticipated Operational Occurrence
ATWS	Anticipated Transients Without Scram
BOC	Beginning of Cycle
BWR	Boiling Water Reactor
CFR	Code of Federal Regulations
CHF	Critical Heat Flux
CPR	Critical Power Ratio
ECCS	Emergency Core Cooling System
EOC	End of Cycle
EOOS	Equipment out-of-service
FoM	Figure of Merit
FWCF	Feedwater Controller Failure
FSAR	Final Safety Analysis Report
GDC	General Design Criteria
HPCI	High Pressure Coolant Injection
LAR	License Amendment Request
LFWH	Loss of Feedwater Heating
LHGR	Linear Heat Generation Rate
LOCA	Loss of Coolant Accident
LRNB	Load Rejection No Bypass
LTR	Licensing Topical Report
LTSS	Long-Term Stability Solution
MAPLHGR	Maximum Average Planar Linear Heat Generation Rate
MCPR	Minimum Critical Power Ratio
MCPRf	Flow-dependent MCPR
MELLLA	Maximum Extended Load Line Limit Analysis
MSIV	Main Steam Isolation Valve
NRC	Nuclear Regulatory Commission

PCT	Peak Cladding Temperature
PRFO	Pressure Regulator Failure Open
PROOS	Pressure Regulator Out-of-Service
RCIC	Reactor Core Isolation Cooling
RHR	Residual Heat Removal
RSAR	Reload Safety Analysis Report
SLO	Single Loop Operation
SRV	Safety Relief Valve
TTNB	Turbine Trip No Bypass

INTRODUCTION

By letter dated July 15, 2019, Talen Energy submitted a license amendment request (LAR) for Susquehanna Steam Electric Station, Units 1 and 2 (Susquehanna) to allow application of the Framatome analysis methodologies necessary to support a planned transition to ATRIUM 11 fuel under the currently licensed Maximum Extended Load Line Limit Analysis (MELLLA) operating domain, Reference 1 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML19196A270). Upon review of the submittal, the NRC staff provided requests for additional information (RAIs) in an email dated 1/6/2020 (Reference 2). This document provides responses to those RAIs.

The proprietary information in this document is marked with single brackets such as **[ ]**.

1.0 CONTAINMENT

NRC RAI 1. *Regulatory Basis – Title 10, "Energy" of the Code of Federal Regulations (10 CFR), Section 50, General Design Criteria (GDCs) 16, 38, and 50*

*In Section 8.3 of ANP-3753P of the LAR, the licensee states that fuel design differences may impact the power and pressure excursion experienced during an anticipated transient without scram (ATWS) event. The licensee further stated that ATRIUM-10 analysis bounds the ATRIUM 11 fuel because **[***

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a. *Describe the analysis done to justify that **[***

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b. *Provide quantitative results for the containment pressure and suppression pool temperature response changes due to the change in fuel type. Describe the analyses performed to confirm the ATRIUM-10 analysis bounds the ATRIUM 11 fuel transition.*

Response 1.a:

Analysis to confirm that **[**

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Response 1.b:

The Framatome description of the approach for evaluating containment impacts and results of that evaluation are described in Section 8.3 of Reference 3. This approach is based on **[** **]**. A review of the current licensing basis for Susquehanna ATWS containment shows that peak suppression pool temperature for MELLLA was 206 °F and the peak containment pressure was 16.1 psig, Table 9-4 of Reference 6. **[**

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2.0 ANTICIPATED OPERATIONAL OCCURENCES (AOOS) AND ATWS

Regulatory Basis – 10 CFR 50, GDCs 10, 13, 15, 20, 25, 26, and ATWS acceptance criteria

NRC RAI 2.1 *ANP-3753P and ANP-3783P provide a subset of the events analyzed in the Susquehanna Chapter 15 Updated Final Safety Analysis Report (UFSAR) and covered by the AURORA-B AOO/ATWS methodology. To ensure the methodology is implemented appropriately for the events not covered in ANP-3753P and ANP-3783P, provide the following:*

a. *Describe how each Chapter 15 UFSAR event (that is covered by the AURORA-B AOO/ATWS methodology) will be analyzed in the AURORA-B AOO methodology framework (e.g., a table identifying UFSAR Section/Event Name/Disposition)*

b. *Describe how the methodology is implemented (including steps prior to the execution of the uncertainty analysis) to ensure nuclear power plant – specific options are covered in the analyses.*

c. *Void quality correlation uncertainties are discussed in Section 6.1 of ANP-3753P. Provide information about which parameters are sampled and which parameters are biased. How is a conservative approach ensured regarding the sampled and biased parameters?*

Response 2.1.a:

FSAR Section	Event Name	Disposition Status	Comments
15.1.1	Loss of Feedwater Heater (LFWH)	Address each reload	Potentially limiting AOO.
15.1.2	Feedwater Controller Failure (FWCF) - Maximum Demand	Address each reload	Potentially limiting AOO.

FSAR Section	Event Name	Disposition Status	Comments
15.1.3	Pressure Regulator Failure Open (PRFO)	Address for initial reload.	Consequences of this event, relative to AOO thermal operating limits are non-limiting. If the core voiding due to the depressurization rate is large enough, the sensed vessel water level trip set point (L8) may be reached initiating a turbine and feedwater pump trip early in the transient. Turbine trip will initiate reactor scram and shut down the reactor. Thermal margins will be better than a typical turbine trip event because of the power reduction initially experienced due to increased core voids in this event. This event must be evaluated to ensure that the current low MSIV pressure setpoint of 825 psig will protect the lower ACE/ATRIUM 11 pressure bound during the depressurization event.
15.1.4	Inadvertent Safety/Relief Valve Opening	No further analysis required	The event causes a mild depressurization. Thermal margins decrease only slightly through the transient and no fuel damage results from the transient. Consequences of this event are non-limiting.
15.1.6	Inadvertent RHR Shutdown Cooling Operation	No further analysis required	This event is not considered credible for power operation.
15.2.1	Pressure Regulator Failure - Closed	Address each reload	Consequences of this event, relative to one pressure regulator out-of-service (PROOS) may be limiting; therefore, this equipment out-of-service will be addressed each cycle.
15.2.2	Generator Load Rejection with and without bypass (LRNB)	Address each reload	This event without bypass operable is a potentially limiting AOO. Load rejection with bypass operable is bound by the load rejection without bypass. The LRNB and TTNB events can be combined into a single event with the turbine control valves and turbine stop valves being assumed to start their closure at the same time. This assumption can provide a single analysis with consequences that are equal to or bounding of both events.
15.2.3	Turbine Trip with and without bypass (TTNB)	Address each reload	This event without bypass operable is a potentially limiting AOO. Turbine trip with bypass operable is bound by the turbine trip with no bypass. The LRNB and TTNB events can be combined into a single event with the turbine control valves and turbine stop valves being assumed to start their closure at the same time. This assumption can provide a single analysis with consequences that are equal to or bounding of both events.

FSAR Section	Event Name	Disposition Status	Comments
15.2.4	MSIV Closures	No further analyses required	Consequences of this event, relative to thermal operating limits, are bound by the generator load rejection and turbine trip events which have much faster valve closure times (FSAR Sections 15.2.2 and 15.2.3, respectively).
15.2.5	Loss of Condenser Vacuum	No further analyses required	This transient is similar to a normal turbine trip with bypass operable. Consequences of this event are bound by the turbine trip event (FSAR Section 15.2.3).
15.2.6	Loss of AC Power	No further analysis required	The loss of AC power long-term water level response is bound by the loss of feedwater flow event (FSAR Section 15.2.7). If complete connection with the external grid is lost, the reactor will experience a generator load rejection. The coastdown of the recirculation pumps initiated at time = 0 will reduce the severity of the event, compared to the generator load rejection event, by reducing core power. Therefore the consequences of this event are bound by the LRNB event (FSAR Section 15.2.2).
15.2.7	Loss of Feedwater Flow	No further analyses required	This event does not pose any direct threat to the fuel in terms of a thermal power increase from the initial conditions. The fuel will be protected provided the water level inside the shroud does not drop below the top of active fuel. Previous evaluations for a different fuel design showed that the lowest level following a loss of feedwater event remained above L1. The MSIVs do not close and the system pressure remains low. Either the HPCI or RCIC system is capable of maintaining adequate core coverage and will provide inventory control. The long term water level transient is dependent upon the decay heat which is **[** **]**. This is a benign event.
15.2.9	Failure of RHR Shutdown Cooling	No further analysis required	Consequences of this event are benign.

FSAR Section	Event Name	Disposition Status	Comments
15.3.1	Recirculation Pump Trip	No further analyses required	For the single pump trip event, MCPR remains approximately at the operating limit, thus the fuel thermal margins are not violated. Level swell is not sufficient to cause turbine trip and scram. This is a benign event. The two pump trip does not directly initiate a scram. The vessel swell due to the rapid flow coastdown is expected to reach the high level trip thereby shutting down the main turbine and feed pump turbines, and indirectly initiating scrams as a result of the main turbine trip. Thus this event is bounded by the turbine trip with no bypass event (FSAR Section 15.2.3).
15.3.2	Recirculation Flow Control Failure - Decreasing Flow	No further analyses required	The consequences of this event cannot be more severe than the single or two Recirculation Pump Trip events (FSAR Section 15.3.1).
15.3.3	Recirculation Pump Seizure	Address each reload	While this event is classified as an accident, it will be conservatively analyzed using the AOO acceptance criteria.
15.3.4	Recirculation Pump Shaft Break	No further analyses required	The consequences of this accident are bounded by the effects of the pump seizure event (FSAR Section 15.3.3).
15.4.4	Abnormal Startup of Idle Recirculation Pump	No further analyses required	Consequences of this event are non-limiting.
15.4.5	Recirculation Flow Controller Failure with Increasing Flow	Address each reload	The slow run-up event determines the MCPRf limits.
15.5.1	Inadvertent HPCI Startup	Address each reload	This event is a potentially limiting AOO.
15.5.3	BWR Transients Which Increase Reactor Coolant Inventory	No further analysis required	These events are discussed in FSAR Sections 15.1 and 15.2.
15.6.1	Inadvertent Safety Relief Valve Opening	No further analysis required	This event is discussed in FSAR Section 15.1.4.
15.8	Anticipated Transient Without Scram	Address each reload	ATWS overpressurization analyses need to be addressed each reload.

Response 2.1.b:

Once the disposition of events has been completed, a calculation plan is constructed.

The calculation plan defines the minimum analysis set required to license a given cycle.

The events to be analyzed are defined by the disposition of events. The calculation plan will also define all operational flexibility options that are to be supported. These include items such as equipment out-of-service options (EOOS) and exposure windows. The calculation plan is generated on a cycle specific basis and is reviewed and approved by Talen. Note that the calculation plan defines the minimum set of analyses required to license a cycle. Additional analyses may be added during the evaluation process if unexpected trends arise. These are added on an as-needed basis to ensure that the limits are appropriately conservative.

The statepoints to be analyzed are also defined in the calculation plan. The initial transition to AURORA-B methods will include **[**

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Response 2.1.c:

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NRC RAI 2.2 *To ensure there is appropriate coverage of the parameters used in the uncertainty analysis and to ensure there is no significant trends with respect to the uncertainty parameters in the results such that the Susquehanna implementation of the AURORA-B methodology is sufficient, provide the following for the load rejection no bypass/turbine trip without bypass event at 100% power / 108% flow, main steam isolation valve closure ATWS event at 100% power and 99% flow, and high pressure coolant injection event at 100% power / 108% flow:*

a. *The sampled values of the uncertainty parameters for all cases executed in the set*

b. *The figure of merit results for all cases executed in the set*

Response 2.2.a:

Files containing the requested data have been provided. CKSUM identification is provided below.

```
3675706268 43303 100P108F_EOC_TTNB_LRNB.xlsx

2158763815 43650 100P99F_BOC_ATWS.xlsx

1416056480 49678 100P108F_EOC_HPCI.xlsx
```

Response 2.2.b:

See response 2.2.a.

NRC RAI 2.3 *Please provide the schedule for Reload Safety Analysis Report (RSAR) submittal. Discuss how the information in the RSAR is used to confirm the AURORA-B limitations and conditions in ANP-2637P, "Boiling Water Reactor Licensing Methodology Compendium, Rev. 8", are appropriately applied*.

Response 2.3:

The initial application cycle RSAR report is scheduled to be provided for information in November 2020. The approved AURORA-B AOO topical report, Reference 7, contains several limitations and conditions that require plant specific review. In addition those items that require plant-specific review are split into two categories: those that are provided as part of the initial submittal (initial LAR submittal) and those that are provided as part of the initial application (first transition licensing reports). The items that are provided with the initial submittal are generally found in References 3 and 8. There remains four plant specific L&Cs to be provided for the initial application, L&Cs 7, 11, 16, and 18a. The application of the L&Cs to the Susquehanna licensing evaluations are discussed below:

Limitation and Condition 7

> *As discussed in Section 3.6 of this SE, licensees should provide justification for the key plant parameters and initial conditions selected for performing sensitivity analyses on an event-specific basis. Licensees should further justify that the input values ultimately chosen for these key plant parameters and initial conditions will result in a conservative prediction of FoMs when performing calculations according to the AURORA-B EM described in ANP-10300P.*

As part of the initial preparations for licensing Susquehanna, Framatome will review the plant parameters document for the key parameters associated with the potentially limiting events. We would also look for parameters that have a range of values that may be allowed for operational flexibility. Likewise, for initial conditions, we will examine the range allowed during normal operation. This will include initial conditions such as power, flow, pressure, and inlet subcooling. We will perform sensitivity studies for all of

these key parameters/conditions for all FoM (MCPR, LHGR, and overpressure) and

[ ]

Limitation and Condition 11

> *AREVA will provide justification for the uncertainties used for the highly ranked plant specific PIRT parameters C12, R01, R02, and SL02 on a plant-specific basis, as described in Table 3.2 of this SE.*

The parameter C12 is the **[**

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Limitation and Condition 16

> ***[ ]*** *is not sampled as part of the methodology, justification should be provided on a plant-specific basis that a conservative flow rate has been assumed* ***[ ]***

The **[ ]** is provided by Talen in the plant parameters document. This flow accounts for **[ ]**. The AURORA-B model **[**

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Limitation and Condition 18a

> *Plant-specific licensing applications shall describe and provide justification for the method for determining and applying conservative measures in future deterministic analyses for each FoM (e.g. , biasing calculational inputs, postprocessing adjustments to calculated nominal results).*

For licensing calculations at Susquehanna, **[**

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For the LHGRFACp evaluations **[**

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NRC RAI 2.4 *Section 5.4 of ANP-3753P describes the safety limit minimum critical power ratio methodology at SUSQUEHANNA. This methodology is used to determine that 99.9% of the fuel rods are expected to avoid boiling transition during normal reactor operation and anticipated operation occurrences. The analysis provided by the licensee shows that* ***[***

] *Please provide the approach used to confirm the bounds will be checked in the appropriate assemblies of the core for future reloads. What process is applied if* ***[***
]*?*

Response 2.4:

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]. These uncertainties are used in SAFLIM3D to account for the nodal rod power uncertainty due to channel bow.

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NRC RAI 2.5 *In the AOO event analysis in ANP-3753P, the load rejection no bypass event is combined with the turbine trip without bypass event even though plant systems may respond differently for each event. Justify that one event bounds the other without doing explicit analysis for both events. Confirm that the bounding analysis can be determined by combining these two events.*

Response 2.5:

Per Section 15.2.3 of the Susquehanna FSAR:

> The turbine trip with the steam bypass system failed is defined as closure of the turbine stop valves followed almost immediately by closure of all turbine control valves with coincident failure of the turbine bypass valves to open. The generator load rejection without bypass is defined as the rapid closure of all of the turbine control valves followed by the closure of all of the turbine stop valves with coincident failure of the turbine bypass valves to open.

The differences between the load rejection without bypass and the turbine trip without bypass events which may impact the severity of the events is the order of the valve closures/closure characteristics and the resultant delay to scram.

By starting closure of the turbine control valves and turbine stop valves concurrently, the effective rate of steam flow isolation is increased resulting in more rapid core pressurization and a larger power spike than either of the non-concurrent events. Reactor scram mitigates the consequences of each of the events. Accounting for the time to reach the turbine stop valve position scram setpoint, the delay from the start of turbine stop valve motion to the start of reactor scram is the same as the delay from the start of turbine control valve motion to the start of reactor scram. For the combined event, reactor scram occurs at the same time as either of the non-combined events. Therefore, the severity of the combined event bounds either of the non-combined events.

3.0 FUEL: INTRODUCTION OF ATRIUM 11 FUEL TO SUSQUEHANNA

NRC RAI 3 *Regulatory basis –10 CFR 50, GDCS 10, 13, 15, 20, 25, 26, and ATWS Acceptance Criteria*

GDC 10 requires that specified acceptable fuel design limits are not exceeded during normal operation including the effects of AOOs. Oxidation and hydriding are two specified acceptable fuel design limits that ensure components maintain strength and ductility. Section 3.5.1 of ANP-3762P mentions that water chemistry is controlled to reduce oxidation in the fuel channel. Please describe what process is used to control the water chemistry and what are the key figures-of-merit monitored to ensure satisfactory performance of ATRIUM 11 fuel and the Z4B water channel.

Response 3:

In order to ensure satisfactory fuel and water channel performance, the utility is required to operate the plant water chemistry in accordance with the EPRI BWR Water Chemistry Guidelines (BWRVIP-190). The key figures of merit for water chemistry are those defined as “Needed” or “Control” parameters in Chapter 2 of BWRVIP-190, Volume 1. The measurement frequencies and operating limits for these parameters are defined in the Guidelines, as is the response timeline for any excursions. Any deviations from the Guidelines requirements for “Needed” or “Control” parameters must be justified by the utility and documented in the plant’s Strategic Water Chemistry Plan.

4.0 LOSS OF COOLANT ACCIDENT (LOCA)

Regulatory Basis –10 CFR 50, GDCS 10, 13, 15, 20, 25, 26, and ATWS Acceptance Criteria

The regulatory bases for the following LOCA related requests for additional information are the requirements contained in 10 CFR 50.46, “Acceptance Criteria for Emergency Core Cooling Systems for Light-Water Nuclear Power Reactors,” insofar as they establish the requirements and acceptance criteria for emergency core cooling system (ECCS) design, and for the evaluation models used to evaluate ECCS performance during a hypothetical LOCA. Specific considerations include:

- CFR 50.46(a)(1)(i) requires the use of an acceptable evaluation models to evaluate ECCS performance under the conditions of a hypothetical LOCA, and 10 CFR 50.46(a)(1)(ii) allows for the development of an evaluation models that conforms to the required and acceptable features specified in Appendix K to 10 CFR 50.
- CFR 50.46(a)(1)(i) also requires ECCS cooling performance to be calculated for a number of postulated LOCAs of different sizes, locations, and other properties sufficient to provide assurance that the most severe hypothetical LOCAs are calculated.
- Acceptance criteria set forth in paragraph (b) of 10 CFR 50.46, and the results of the ECCS evaluation must show that the acceptance criteria are met. Among others, these include requirements related to peak cladding temperature (PCT), maximum cladding oxidation, and maximum hydrogen generation.

NRC RAI 4.1 *For licensed operating domain and equipment-out-of-service, please provide justification to assure that the LOCA analysis has been performed conservatively to cover Susquehanna licensed operating domain and equipment out-of-service conditions.*

Response 4.1:

Table 4-1 summarizes the disposition of the operating domains and equipment out-of-service (OOS) conditions applicable to LOCA presented in ANP-3784P, Rev. 0.

Table 4-1 Disposition of Operating Domains and Equipment Out-of-Service

Operating Domain	Disposition	Result or Rationale
MELLLA	Analyzed	**[** **]**
SLO	Analyzed	**[** **]**

NRC RAI 4.2 *For, limiting PCT: Explain why the limiting PCT of* ***[*** ***]*** *of exposure-dependent LOCA analysis.*

Response 4.2:

The break spectrum calculations were performed **[**

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NRC RAI 4.3 *For local Cladding Oxidation (Table 9.1 of ANP-3784P): Explain why the change of local cladding oxidation from the assembly average planar exposure of **[***

***]*.**

Response 4.3:

The abrupt change in local oxidation is due to **[**

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Table 4-2 Local Oxidation [ ]

NRC RAI 4.4 *Linear heat generation rate (LHGR) and maximum average planar LGHR (MAPLHGR) Data Used in Exposure-Dependent Analysis*

a. *What is the process for determining the LHGR used, for both UO2 and Gd2O3-UO2 pellets during exposure-dependent analysis, in the AURORA-B LOCA analysis? Specifically, are the LHGR limit curves presented in Figures 2.2 and 2.3 shown in ANP-3784P, "Susquehanna ATRIUM 11 Introduction – Exposure-Dependent LOCA Analysis,"* ***[***

]

b. *Please demonstrate the analysis margin for the MAPLHGR limit in Figure 2.1 of ANP-3784P,* ***[***
]*.*

Response 4.4.a:

The LHGR limit curves presented in Figures 2.2 and 2.3 from the exposure analysis

[

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Figure 4-1 [ ] LHGR vs. Exposure

Figure 4-2 [ ] LHGR vs. Exposure

Response 4.4.b:

Figure 4-3 shows the **[** **]** MAPLGHR limit **[**

]

Figure 4-3 [**] MAPLHGR Limit**

5.0 DEGRADATION AFFECTS

NRC RAI 5 *Please address how the implementation of Atrium 11 fuel affects the aging degradation on the reactor vessel pressure and reactor pressure internal components.*

Regulatory Basis – 10 CFR 50, GDCS 10, 13, 15, 20, 25, 26, and ATWS Acceptance Criteria

If the neutron fluence values associated with Atrium 11 are higher than the Atrium 10 fuel, the licensee should provide a technical explanation how it intends to manage the aging degradation related to irradiation embrittlement, irradiation-assisted stress corrosion cracking, and, irradiation stress relaxation at Susquehanna units in the current licensing period.

Response 5:

To be provided by Talen.

6.0 REFERENCES

1. Talen Energy, *Susquehanna Steam Electric Station Proposed Amendment to Licenses NPF-14 AND NPF-22: Application of Advanced Framatome Methodologies And TSTF-535 PLA-7783*, July 15, 2019, (ADAMS Accession No. ML19196A270).

2. Email, (USNRC) to Shane Jurek (Talen Energy), *Requests For Additional Information for Susquehanna Steam Electric Station, Units 1 And 2 to Support Review of The License Amendment Request Regarding Application Of Framatome Methodologies to Support Transition to Atrium 11 Fuel*, (EPID: L-2019-LLA-0153), January 6, 2020.

3. ANP-3753P Revision 0, *Applicability of Framatome BWR Methods to Susquehanna with ATRIUM 11 Fuel*, Framatome Inc., May 2019.

4. BAW-10247PA Revision 0, *Realistic Thermal Mechanical Fuel Rod Methodology for Boiling Water Reactors*, AREVA NP Inc., February 2008.

5. ANP-10307PA Revision 0, *AREVA MCPR Safety Limit Methodology for Boiling Water Reactors*, AREVA NP, June 2011.

6. *Susquehanna Steam Electric Station Units 1 and 2 Safety Analysis Report for Constant Pressure Power Uprate*, ML062900401, October 2006.

7. ANP-10300P-A Revision 1, *AURORA-B: An Evaluation Model for Boiling Water Reactors; Application to Transient and Accident Scenarios*, Framatome Inc., January 2018.

8. ANP-3783P Revision 0, *Susquehanna ATRIUM 11 Transient Demonstration*, June 2019.

Enclosure 3 of PLA-7853

Framatome Affidavit for ANP-3823P, Revision 1, Susquehanna ATRIUM 11 Advanced Methods Response to Request for Additional Information

AFFIDAVIT

1. My name is Alan B. Meginnis. I am Manager, Product Licensing, for Framatome Inc. and as such I am authorized to execute this Affidavit.

2. I am familiar with the criteria applied by Framatome to determine whether certain Framatome information is proprietary. I am familiar with the policies established by Framatome to ensure the proper application of these criteria.

3. I am familiar with the Framatome information contained in the report ANP-3823P, Revision 1, "Susquehanna ATRIUM 11 Advanced Methods Response to Request for Additional Information," dated March 2020 and referred to herein as "Document." Information contained in this Document has been classified by Framatome as proprietary in accordance with the policies established by Framatome for the control and protection of proprietary and confidential information.

4. This Document contains information of a proprietary and confidential nature and is of the type customarily held in confidence by Framatome and not made available to the public. Based on my experience, I am aware that other companies regard information of the kind contained in this Document as proprietary and confidential.

5. This Document has been made available to the U.S. Nuclear Regulatory Commission in confidence with the request that the information contained in this Document be withheld from public disclosure. The request for withholding of proprietary information is made in accordance with 10 CFR 2.390. The information for which withholding from disclosure is requested qualifies under 10 CFR 2.390(a)(4) "Trade secrets and commercial or financial information."

6. The following criteria are customarily applied by Framatome to determine whether information should be classified as proprietary:

(a) The information reveals details of Framatome's research and development plans and programs or their results.

(b) Use of the information by a competitor would permit the competitor to significantly reduce its expenditures, in time or resources, to design, produce, or market a similar product or service.

(c) The information includes test data or analytical techniques concerning a process, methodology, or component, the application of which results in a competitive advantage for Framatome.

(d) The information reveals certain distinguishing aspects of a process, methodology, or component, the exclusive use of which provides a competitive advantage for Framatome in product optimization or marketability.

(e) The information is vital to a competitive advantage held by Framatome, would be helpful to competitors to Framatome, and would likely cause substantial harm to the competitive position of Framatome.

The information in the Document is considered proprietary for the reasons set forth in paragraphs 6(b), 6(d) and 6(e) above.

7. In accordance with Framatome's policies governing the protection and control of information, proprietary information contained in this Document have been made available, on a limited basis, to others outside Framatome only as required and under suitable agreement providing for nondisclosure and limited use of the information.

8. Framatome policy requires that proprietary information be kept in a secured file or area and distributed on a need-to-know basis.

9. The foregoing statements are true and correct to the best of my knowledge, information, and belief.

Alan Meginnis

STATE OF WASHINGTON)
) ss.
COUNTY OF BENTON)

SUBSCRIBED before me this 20th day of March, 2020.

Mary Anne Heilman
NOTARY PUBLIC, STATE OF WASHINGTON
MY COMMISSION EXPIRES: 6/6/2020

Mary Anne Heilman
Commission Expires
Notary Public
06-06-2020
State of Washington