~~PROPRIETARY INFORMATION~~

Sent to Mr. Shane Jurek Talen Energy via Box on Jan 9

Dear Mr. Jurek,

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 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML19196A270).

The Nuclear Regulatory Commission's (NRC) staff has reviewed your LAR and has determined that additional information is needed to complete its review. The specific questions are in the attachment to this letter.

Your response to these questions is due by February 6, except for question 2, which is due to the NRC by March 6, 2020.

Sujata Goetz
Project Manager, Susquehanna Steam Electric Station

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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

Facility	Docket	EPID
Susquehanna Steam Electric Station, Unit 1	50-387	L-2019-LLA-0153
Susquehanna Steam Electric Station, Unit 2	50-388	

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 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML19196A270). The staff has reviewed the LAR and has the following requests for additional information.

The proprietary information in this document is marked with double brackets and bold font such as **[[Example]]**.

1.0 CONTAINMENT

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 **[[**

]].

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.

2.0 ANTICIPATED OPERATIONAL OCCURENCES (AOOS) AND ATWS

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

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?

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

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.

2.4 Section 5.4 of ANP-3753P describes the safety limit minimum critical power ratio methodology at SUSQUEHANN. 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 [[ ]]?

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.

3.0 FUEL: INTRODUCTION OF ATRIUM 11 FUEL TO SUSQUEHANN

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.

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:

- 10 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.

- 10 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.

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.

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

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 [[

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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 UO_2 and Gd_2O_3-UO_2 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," [[

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

5.0 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.