



## MPSPEm Resource

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**From:** Clark, Phyllis  
**Sent:** Monday, March 26, 2018 1:59 PM  
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**Subject:** REF: WATERFORD STEAM ELECTRIC STATION, UNIT 3, LICENSE RENEWAL APPLICATION – RAI SET 18 (CAC NO. MF7492)  
**Attachments:** Waterford 3 LRA Draft RAI Set 18 Final.docx

UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

Mr. John C. Dinelli  
Site Vice President  
Entergy Operations, Inc.

SUBJECT: REQUESTS FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE WATERFORD STEAM ELECTRIC STATION, UNIT 3, LICENSE RENEWAL APPLICATION – SET 18 (CAC NO. MF7492)

Dear Mr. Dinelli:

By letter dated November 28, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17332A898), Entergy Operations, Inc. (Entergy) submitted a license amendment request for Waterford Unit 3 (Waterford 3). By letter dated December 7, 2017 (ADAMS Accession No. ML17341B295), Entergy clarified that Attachment 3 of this submittal was a supplement to their license renewal application (LRA), which was submitted by letter dated March 23, 2016 (ADAMS Accession No. ML16088A324). The LRA is pursuant to Title 10 of the *Code of Federal Regulations* Part 54, to renew the operating license NPF-38 for Waterford Steam Electric Station, Unit 3. The staff of the U.S. Nuclear Regulatory Commission (NRC or the staff) is reviewing the information contained in the license renewal application and the supplement and has identified areas where additional information is needed to complete the review.

The enclosed requests for additional information were discussed with Mr. Alan Harris and a mutually agreeable date for the response is within 30 days from the date of this letter. If you have any questions, please contact me at 301-415-6447 or by e-mail at [Phyllis.Clark@nrc.gov](mailto:Phyllis.Clark@nrc.gov).





Docket No. 50-382

Enclosure: As stated

cc: Listserv

**\*via email**

OFFICE	PM:MENB:DLMR	BC:DSS:SNPB	BC:MRPB:DLMR	PM:MENB:DLMR
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NAME	PClark	*SAnderson	*EOesterle	PClark
DATE	3/15/2018	3/15/2018	3/15/2018	3/26/2018

**Hearing Identifier:** NRR\_DMPS  
**Email Number:** 262

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**Subject:** REF: WATERFORD STEAM ELECTRIC STATION, UNIT 3, LICENSE RENEWAL APPLICATION – RAI SET 18 (CAC NO. MF7492)  
**Sent Date:** 3/26/2018 1:59:08 PM  
**Received Date:** 3/26/2018 1:59:14 PM  
**From:** Clark, Phyllis

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**WATERFORD STEAM ELECTRIC STATION, UNIT 3**  
**LICENSE RENEWAL APPLICATION**  
**REQUESTS FOR ADDITIONAL INFORMATION – SET 18**  
**(CAC NO. MF7492)**

**RAI 4.2.1-2:**

Background

By letter dated November 28, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17332A898), Entergy Operations, Inc. (Entergy) submitted a license amendment request for Waterford Unit 3 (Waterford 3). By letter dated December 7, 2017 (ADAMS Accession No. ML17341B295), Entergy clarified that Attachment 3 of this submittal was a supplement to their license renewal application (LRA), which was submitted by letter dated March 23, 2016 (ADAMS Accession No. ML16088A324). The NRC staff has reviewed the information in Attachment 3 of the November 28, 2017 submittal and determined that additional information is required in order to complete its review of the LRA supplement.

Issue

Regulatory Guide (RG) 1.190, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence," describes methods and assumptions acceptable to the U.S. Nuclear Regulatory Commission (NRC) staff for determining reactor pressure vessel (RPV) neutron fluence with respect to the General Design Criteria (GDC) contained in Appendix A of 10 CFR 50. In consideration of the guidance set forth in RG 1.190, GDC 14, 30, and 31 are applicable.

In addition to uncertainty quantification related to use of RAPTOR-M3G for reactor RPV fluence evaluations, Attachment 3 contains Section 3.1, "Validation by Comparison to Additional Operating Power Reactors," which provides support for the claim that RAPTOR-M3G calculations produce fluence values that meet the calculational uncertainty criterion specified in RG 1.190, Regulatory Position 1.4.3.

Section 3.1 states:

However, ex-vessel dosimetry off-midplane capsules are axially positioned near the ends of the active fuel. These dosimeters provide a comparison of measurement and calculation in an area of steep flux gradients which are highly dependent upon the axial power distribution. While not located at the nozzles themselves, these off-midplane capsules provide assurance that the flux gradients which characterize the nozzle region are being modeled appropriately.

Data from Westinghouse's ex-vessel neutron dosimetry (EVND) program has been shown to span from approximately 5 to 9 feet above the core midplane – a relatively wide range considering the change in flux gradients and magnitude of flux change in this 5 to 9 foot span.<sup>1</sup> Note that 5 and 9 feet above the core midplane corresponds to approximately 132 and 180 inches, respectively in Figure 1<sup>2</sup>, which shows actual PWR RPV neutron fluence profiles; corresponding regions for Waterford 3 are shown in Figure 2.

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<sup>1</sup> See WCAP-18100-NP (ADAMS Accession No. ML16130A645).

<sup>2</sup> From TLR-RES\_DE\_CIB-2013-01 (ADAMS Accession No. ML14318A177)

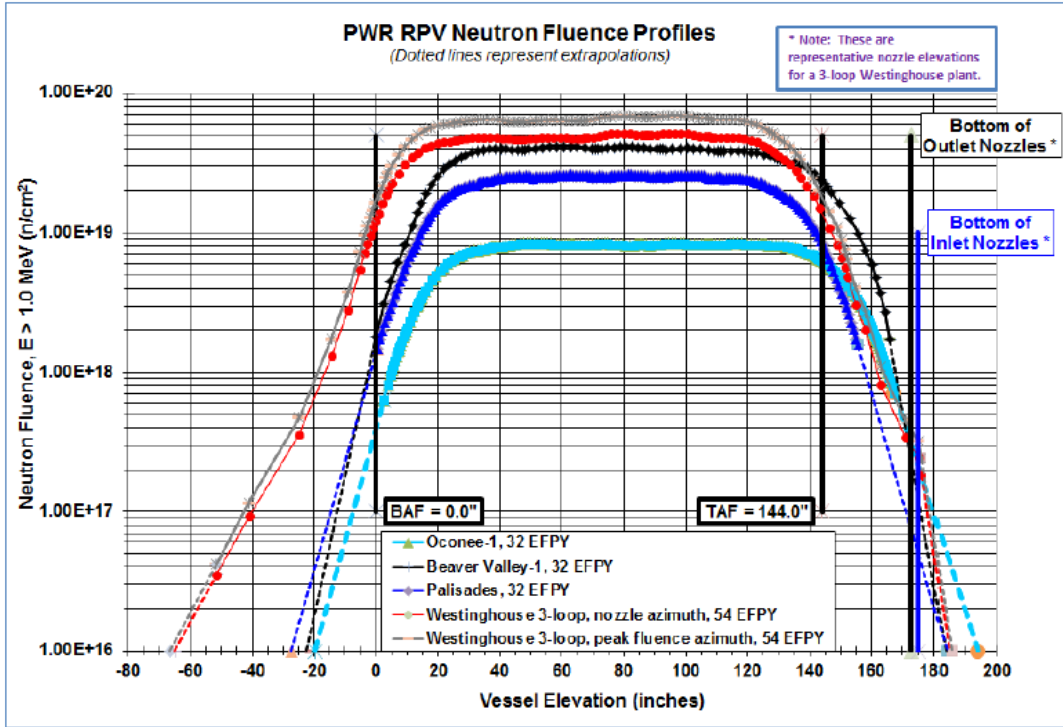


Figure 1: PWR RPV neutron fluence profiles.

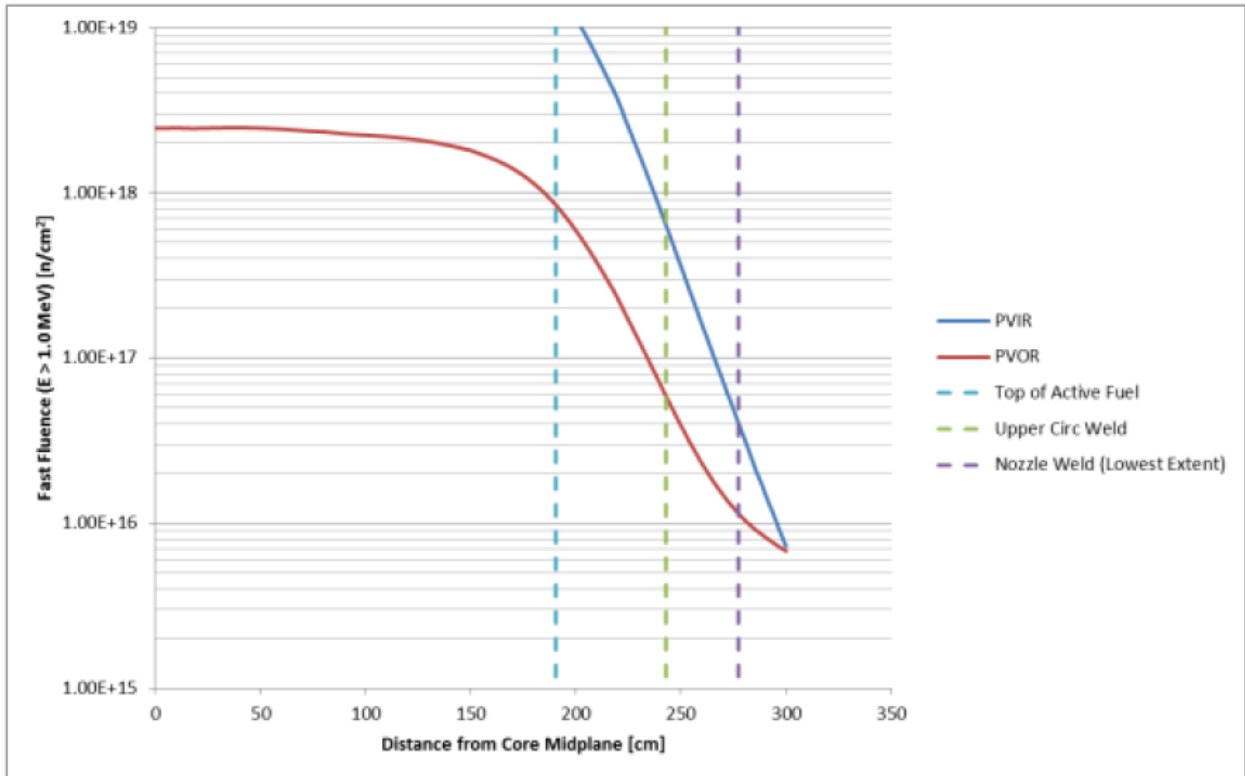


Figure 2: Waterford 3 Reactor Pressure Vessel Projected Fast Neutron ( $E > 1.0$  MeV) Fluence at 60 EFPY.

The applicant does not specifically identify where the “off-midplane capsules” are located in relation to “near the ends of the active fuel” for Waterford 3 (e.g., this could mean just below the

top end of the active fuel). Considering that specific locations of off-midplane capsules have not been provided, especially in relation to the upper-to-intermediate shell circumferential weld, which has the 55-EFPY adjusted reference temperature almost equivalent to that of the limiting beltline material, the NRC staff cannot determine whether the off-midplane capsules are actually providing the intended validation for this “area of steep flux gradients”.

#### Request

- a) Indicate the distance relative to the core midplane for each of the 44 EVND off-midplane capsules corresponding to Table 19 in Attachment 3 so that the NRC staff can verify that the data labeled as off-midplane is actually applicable to the above top of active fuel region (or area of steep flux gradients) being qualified. Include valid data not in the set of 44 that is at approximately 9 feet above the core midplane (e.g., Capsule ID BC, BE, and BG listed in Table 3-1 of WCAP-18100-NP).
  
- b) Provide summary tables with individual reaction measurement-to-calculated (M/C) and best-estimate-to-calculated (BE/C) ratios and fluence rate ( $E > 1$  MeV) BE/C ratios (e.g., Table C-1 of WCAP-18100-NP) for the subset of EVND capsules that correspond to the region nearest to the upper-to-intermediate shell circumferential weld so that the NRC staff can verify that the fluence calculational methodology used produces results at the upper-to-intermediate shell circumferential weld that remain within the calculational uncertainty allowance prescribed in RG 1.190, Regulatory Position 1.4.3.

