## NRR-PMDAPEm Resource

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| **From:** | Galvin, Dennis |
| **Sent:** | Wednesday, September 07, 2016 12:10 PM |
| **To:** | Arthur.Zaremba@duke-energy.com |
| **Cc:** | Joshua.Duc@duke-energy.com; Anzalone, Reed; Dean, Jeremy; Barillas, Martha; Wheeler, Larry; Forsaty, Fred |
| **Subject:** | Harris and Robinson RAIs – LAR to Adopt DPC-NE-1008-P, Revision 0 (MF6648 and MF6649) |
| **Attachments:** | Harris Robinson DPC-NE-1008P LAR Final RAIs 2016-09-07 MF6648-6649.pdf |

Art,

By letter dated August 19, 2015 (Agencywide Documents Access and Management System (ADAMS) Accession Number ML15236A044), Duke Energy Progress, Inc., the licensee for Shearon Harris Nuclear Power Plant, Unit 1 (HNP) and H. B. Robinson Steam Electric Plant, Unit 2 (RNP), submitted a license amendment request (LAR) to request plant-specific review and approval of a reactor core design methodology report DPC-NE-1008-P, Revision 0, ""Nuclear Design Methodology Using CASMO-5/SIMULATE-3 for Westinghouse Reactors," for adoption into the HNP and RNP technical specifications (TS). By letter dated May 4, 2016 (ADAMS Accession Number ML16125A420), the licensee submitted a supplement to the LAR that supersedes the August 19, 2015 submittal in its entirety. The purpose of the supplement was to also request plant-specific review and approval of reactor core design methodology reports DPC-NF-2010, Revision 3, "Nuclear Physics Methodology for Reload Design," and DPC-NE-2011-P, Revision 2, "Nuclear Design Methodology Report for Core Operating Limits of Westinghouse Reactors," for adoption into the HNP and RNP TS. The supplement did not identify any changes to DPC-NE-1008-P.

The U.S. Nuclear Regulatory Commission (NRC) staff has determined that additional information is needed to complete its review regarding DPC-NE-1008-P. The NRC staff will provide any RAIs regarding DPC-NF-2010 and DPC-NE-2011-P as necessary by a separate correspondence. The enclosed requests for additional information (RAIs) were e-mailed to the licensee in draft form on August 29, 2016, (ADAMS Accession No. ML16243A005). An RAI clarification call was held on September 7, 2016. On the September 7, 2016, call, the licensee agreed to provide the responses to these RAIs by October 7, 2016. The NRC staff agrees with this date.

If you have any questions, please contact me at (301) 415-6256.

Respectfully,

Dennis Galvin
Project Manager
U.S Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Division of Operating Reactor Licensing
Licensing Project Branch 2-2
301-415-6256

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REQUEST FOR ADDITIONAL INFORMATION

LICENSE AMENDMENT REQUEST TO ADOPT DPC-NE-1008-P,

"NUCLEAR DESIGN METHODOLOGY USING CASMO-5/SIMULATE-3

FOR WESTINGHOUSE REACTORS"

DUKE ENERGY PROGRESS, INC.

SHEARON HARRIS NUCLEAR POWER PLANT, UNIT 1

H.B. ROBINSON STEAM ELECTRIC PLANT, UNIT 2

DOCKET NOS. 50-400 AND 50-261

By letter dated August 19, 2015[1], Duke Energy Progress, Inc. (Duke Energy), the licensee, submitted a license amendment request (LAR) seeking NRC review and approval of its nuclear design methodology, documented in DPC-NE-1008-P, "Nuclear Design Methodology Using CASMO-5/SIMULATE-3 for Westinghouse Reactors,"[2] and incorporation of this methodology into the Shearon Harris Nuclear Power Plant, Unit 1 (HNP) and H. B. Robinson Steam Electric Plant, Unit 2 (RNP) technical specifications (TS). By letter dated May 4, 2016[3] the licensee submitted a supplement to the LAR that supersedes the August 19, 2015 submittal in its entirety. The purpose of the supplement was to also request plant-specific review and approval of reactor core design methodology reports DPC-NF-2010, Revision 3, "Nuclear Physics Methodology for Reload Design," and DPC-NE-2011-P, Revision 2, "Nuclear Design Methodology Report for Core Operating Limits of Westinghouse Reactors," for adoption into the HNP and RNP TS. The supplement did not identify any changes to DPC-NE-1008-P.

This request regards DPC-NE-1008-P. Any requests regarding DPC-NF-2010 and DPC-NE-2011-P will be provided by a separate correspondence.

The DPC-NE-1008-P methodology is considered by Duke Energy to be an evolution of the previously-approved nuclear design methodologies for the Catawba, McGuire, and Oconee Nuclear Stations (CNS, MNS, and ONS, respectively), documented in DPC-NE-1005-PA, Revision 1, "Duke Power Nuclear Design Methodology Using CASMO-4/SIMULATE-3 MOX,"[4] and DPC-NE-1006-PA, "Oconee Nuclear Design Methodology Using CASMO-4 / SIMULATE-3."[5] The primary difference between the DPC-NE-1008-P methodology and the previously-approved CASMO-4/SIMULATE-3-based methodologies is the use of the CASMO-5 nuclear fuel lattice physics code, which has not been reviewed or approved by the NRC staff.

Guidance for the NRC staff in reviewing nuclear physics calculations is provided in Chapter 4.3, "Nuclear Design," of NUREG-0800, "Standard Review Plan for the Review of Safety Analysis

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[1] Agencywide Documents Access and Management System (ADAMS) Accession No. ML15236A044
[2] ADAMS Accession No. ML15236A044
[3] ADAMS Accession No. ML16125A420
[4] ADAMS Accession No. ML051010321
[5] ADAMS Accession No. ML091630713

Reports for Nuclear Power Plants: LWR Edition"[6] (hereafter referred to as SRP 4.3). In general, acceptance criteria in Section II are based on the concept that fuel design limits may be met when adhering to specified power distribution limits, and that these power distribution limits account for uncertainties in the analytical methods. The review procedures discussed in Section III provide guidance to the NRC staff in reviewing the analytical methods.

The NRC staff performed a regulatory audit for this review in July 2016, in accordance with an audit plan submitted to the licensee[7]. As discussed in the audit[8], the staff came away from the audit with several requests for additional information (RAIs) in order to document several items discussed at the audit.

1. Section 3.2.1 of DPC-NE-1008-P discusses comparisons of CASMO-5/SIMULATE-3 calculations of critical boron concentration (CBC) to measurements taken at HNP, RNP, and MNS. Critical boron concentration is a parameter that may be used as a surrogate for core reactivity. The report states that a boron-10 concentration of 19.76 atom percent is used in the CASMO-5/SIMULATE-3 calculations and the CBC measurements are "corrected" for boron-10 depletion effects to set it at the same boron-10 abundance as the calculations.

   Section III.7 of SRP 4.3 asks NRC staff to ensure that analytical methods are verified "by comparing calculated results with measurements obtained from critical experiments and operating reactors." The SRP then asks the reviewer to ascertain that "the conclusions of the applicant are acceptable" regarding the analytical methods. In order to ensure that Duke Energy's conclusions regarding the accuracy of the CBC predictions – and thus the reactivity predictions – are acceptable, the NRC staff must understand how the CBC measurements are put on an equal basis to the predictions for comparison. Describe how CBC measurements are corrected for boron-10 depletion?

2. The error in CBC predictions presented in Figures 3-4 through 3-7 of DPC-NE-1008-P appears to depend on both burnup and the plant at which the measurements are taken. As discussed throughout SRP 4.3, thorough understanding of the uncertainty associated with code predictions of physics parameters is necessary so that they may be accounted for in determining whether design limits are met. At the audit, Duke Energy stated that the error in CBC calculations is characterized with burnup-dependent CBC biases for each power plant. Describe the methodology used to calculate these biases.

3. Section 3.2.3 of DPC-NE-1008-P presents comparisons between control bank worths as predicted by CASMO-5/SIMULATE-3 and those measured at HNP, RNP, and MNS. The NRC staff examined the measured and predicted data provided in Table 3-5 and found that the error is not consistent between the three plants and is seemingly not able to be statistically pooled.

   As discussed in the previous RAI, SRP 4.3 indicates the need for the uncertainty associated with analytical methods to be understood so that the uncertainty may be accounted for in evaluating design limits. Given that the control bank worth measurements do not appear to be poolable among the different sites discussed in

[6] ADAMS Accession No. ML070740003
[7] ADAMS Accession No. ML16180A098
[8] An audit report is under preparation and is anticipated to be issued within 90 days of the end of the audit.

DPC-NE-1008-P, clarify the control bank uncertainty to be used in the safety analysis and provide a basis for this uncertainty.

4. The previous questions in part are to ensure that the analytical methods for core physics analyses are sufficiently described such that DPC-NE-1008-P is acceptable to be included in the COLR section of the TS. Duke Energy will need to submit a revision to DPC-NE-1008-P that incorporates applicable portions of the responses of the preceding questions so that the neutronics analysis methodology is sufficiently described.