August 17, 2016

MEMORANDUM TO: Kevin Hsueh, Chief
Licensing Processes Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

FROM: Brian Benney, Senior Project Manager ***/RA/***
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SUBJECT: SUMMARY OF JUNE 8, 2016, MEETING WITH THE NUCLEAR ENERGY INSTITUTE TO DISCUSS THE ELECTRIC POWER RESEARCH INSTITUTE DEPLETION CODE VALIDATION APPROACH

On June 8, 2016, a Category 2 public meeting was held between the U.S. Nuclear Regulatory Commission (NRC) and representatives of the Nuclear Energy Institute (NEI) at NRC Headquarters, One White Flint North, 11555 Rockville Pike, North Bethesda, MD. The meeting notice, agenda, meeting attendee list, and other associated documents are available in the Agencywide Documents Access and Management System (ADAMS) under Package Accession No. ML16146A009.

The public meeting followed NRC staff concerns about the NEI responses to the NRC's follow-up request for additional information regarding Electric Power Research Institute (EPRI) Report 1022503 and EPRI Report 1022909. The NRC's concerns were specifically associated with the statistical assumptions and analysis performed in Attachment 2 referenced as part of those responses. The intent of the meeting was to:

(1) Discuss the open item on the underlying statistical assumptions in Attachment 2 (i.e., the "Attachment 2 open item")
(2) Determine a path forward to close the Attachment 2 open item
(3) Discuss the impact on the NRC's endorsement of NEI 12-16, "Guidance for Performing Criticality Analyses of Fuel Storage at Light-Water Reactor Power Plants," in light of the NRC's confirmatory analysis.

The NRC staff began by presenting its concerns regarding the Attachment 2 open item. The presentation focused on Slide 3 and 4 and subsequent discussions centered on resolving the discrepancy between NRC and NEI's interpretation of Title 10 of the *Code of Federal Regulations* (10 CFR) 50.68(b)(4) with respect to the statistical approach used in the EPRI depletion code validation report. Resolution was not reached regarding the disposition of the Attachment 2 open item. The specific point of disagreement is that NRC's position on compliance with the 95 percent probability/95 percent confidence specification required by 10 CFR 50.68(b)(4) indicates use of tolerance interval based uncertainties for the entire population of data, whereas the approach in the EPRI report used a confidence interval based

on uncertainties for the mean of the data. Associated with this point is disagreement over what constitutes the proper determination of the tolerance interval based uncertainty for the regression analysis performed in Attachment 2. NRC performed a draft confirmatory analysis, which is being peer-reviewed, in an attempt to demonstrate how an acceptable tolerance interval based uncertainty for the specific type of regression analysis performed by EPRI in Attachment 2 could be performed, while recognizing that similar but more statistically-precise approaches would also be acceptable.

NEI explained that it believes that bounding all uncertainty components (e.g., from the criticality code validation, the manufacturing tolerance uncertainties, etc.) is sufficient to meet the intent of 10 CFR 50.68(b)(4). NEI believes that the amount of conservatism in the bounding assumptions in depletion calculations and spent fuel pool (SFP) modeling are numerous and substantial and would more than offset any perceived deficiency in the statistical treatment of the reactivity decrement data as part of the EPRI depletion code validation approach. The NRC understands this position and conveyed that it would be acceptable to take credit for conservatism as long as it can be sufficiently quantified. However, this quantification was not provided in the EPRI report. In the absence of such quantification, the NRC believes that engineering judgment and qualitative justification do not provide sufficient basis for a reasonable assurance determination in future SFP criticality safety analyses submitted to the NRC.

In conclusion, the NRC re-emphasized that without explicit quantification of the regression analysis uncertainty proposed in the EPRI depletion code validation approach, the NRC would not be able to reach a reasonable assurance determination in future SFP criticality safety analyses submitted to the NRC that use the EPRI depletion code validation approach as part of the NEI 12-16 guidance framework. Therefore, the NRC cannot endorse the EPRI depletion code validation approach as currently proposed.

At the end of the meeting, NEI took an action to consider the NRC's perspective as discussed during the meeting and indicated that they would consider alternative arguments to demonstrate that the EPRI depletion code validation approach is consistent with the overall SFP criticality safety analysis framework (as proposed in NEI 12-16) in satisfying the explicit criteria set forth in 10 CFR 50.68(b)(4). Upon resolution of the Attachment 2 open item, the NRC will proceed with its review of the EPRI depletion code validation report and will begin finalizing its draft safety evaluation report.

Several members of the public attended the meeting and provided comments at the end of the meeting. One member of the public expressed concerns about how certain characteristics of fuel assemblies modeled in the SFP can be sufficiently known. Specifically, he asked how one could know the detailed neutron flux distribution for each of the specific fuel assemblies in the SFP to sufficient level of accuracy. The NRC acknowledged this concern and indicated that this is what drives the various modeling practices used by licensees when performing SFP criticality safety analyses. Arguably, the most significant modeling practice used by NRC licensee's to address the commenter's concern is the use of conservatively bounding assumptions that are often unquantified throughout the various aspects of the SFP criticality safety analysis. On this point, it can also be argued that the 95 percent probability/95 percent confidence criterion set forth in 10 CFR 50.68(b)(4) is the driver for licensee's use of bounding assumptions. As discussed, another driver is practicality and the fact that using bounding assumptions simplifies the modeling and results in cost benefits (i.e., it is more difficult and expensive to explicitly model every individual spent fuel assembly in its exact location and exact local environment).

During the meeting, NEI proposed to attempt to quantify the conservatism of some of the bounding assumptions so that it can demonstrate that a criticality safety analysis following NEI 12-16 meets the explicit requirements of 10 CFR 50.68(b)(4), thereby resolving NRC concerns regarding the Attachment 2 open item. The NRC expressed concern with this approach because without appropriately quantifying the regression analysis uncertainty, which is the subject of the Attachment 2 open item, NEI will not know how much conservatism they will need to take from bounding assumptions used elsewhere in the criticality safety analysis. This approach also introduces additional complications for licensee's who intend to use NEI 12-16 in that there could be additional restrictions in performing their criticality safety analyses. This decrease in flexibility could arise as a result of licensees having to change current practice that relies upon simplified, but bounding assumptions to more explicit modeling practices that are not necessarily straightforward and that require additional assumptions and justifications to be made. The NRC believes that this could lead to more fragile guidance in NEI 12-16 and more uncertainty in how licensees will implement this guidance. Furthermore, the NRC believes that this path may not provide the regulatory stability that is being sought by industry through NEI 12-16.

At the conclusion of the meeting, the NRC staff facilitated a discussion overview, action item identification, and meeting closeout.

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