April 27, 2017

MEMORANDUM TO: John W. Lubinski, Director
Division of Engineering
Office of Nuclear Reactor Regulation

FROM: Brian E. Thomas, Director **/RA/**
Division of Engineering
Office of Nuclear Regulatory Research

SUBJECT: IMPENDING PUBLICATION OF TECHNICAL LETTER REPORT, PNNL-26336, ENTITLED "VALIDATION OF ULTRASONIC NONDESTRUCTIVE EXAMINATION (NDE) COMPUTATIONAL MODELS – PHASE 1"

The Office of Nuclear Regulatory Research (RES) has completed Pacific Northwest National Laboratory (PNNL) - 26336, Technical Letter Report (TLR) entitled "Validation of Ultrasonic Nondestructive Examination (NDE) Computational Models – Phase 1," (ADAMS Accession ML17095A969). This report documents work performed under Task 1, "Modeling," in User Need Request (UNR) NRR-2013-009, "Evaluating the Reliability of Nondestructive Examinations of Vessels and Piping." This UNR focuses on assessing the reliability and effectiveness of nondestructive examination methods used in nuclear power plants. Specifically, Task 1 will provide the Office of Nuclear Reactor Regulation (NRR) with the technical basis to appropriately evaluate the adequacy of licensee submittals that rely on ultrasonic NDE computational models. Further, the task will provide guidance as to how ultrasonic models, sound maps, and simulated flaw responses should be carried out and interpreted when applied to a variety of materials and degradation mechanisms.

The Modeling Task is divided into three phases. This TLR provides a summary of the first phase during which a study is being performed to validate the computational models for ultrasonic testing (UT), and determine if ultrasonic computational models adequately represent reality. In Phase 1, simple geometrical reflectors in isotropic, fine-grained, homogeneous materials were examined with conventional ultrasonic transducers. Modeling of the ultrasonic testing was conducted with CIVA software, and the predictions were compared with the empirical data qualitatively and quantitatively. Results of this first phase showed that the models were able to give correct qualitative responses; however, the quantitative analysis demonstrated that it is challenging to develop definitive decisions on the detectability of flaws due to the large number of variables used in the modeling process. Specifically, the results of this work demonstrated the importance of correctly defining a model, as input errors could have a significant effect on the model's output. In Phase 2, PNNL will continue to assess UT modeling by studying various flaw morphologies on a variety of materials (wrought, austenitic and cast stainless steel) and dissimilar metal welds. Phase 3 will develop and document a standard method for NRC to use to evaluate ultrasonic models.

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The U.S. nuclear industry is beginning to rely on ultrasonic modeling as a basis to demonstrate that the examination techniques applied are acceptable. Specifically, the NRC has received relief requests where modeling is used to justify the ability to detect service-induced, surface-breaking cracks when limited coverage of the required ultrasonic inspection volume occurs. The PNNL modeling work will enable the NRC to confirm that a sound technical basis for conducting, interpreting and applying the results of ultrasonic models exists, and, further, that the licensee's models provide an acceptable level of quality and safety.

Staff representatives from the Division of Engineering in NRR reviewed a draft of this TLR, which was transmitted with a memorandum dated January 30, 2017 (ADAMS Accession Number ML16349A110), and the enclosed final TLR reflects the resolution of their comments. Nonetheless, please feel free to notify the responsible RES contact if you have any questions concerning the impending public release of this TLR.

If additional information is required, please contact Carol A. Nove of my staff at 301-415-2217 or can2@nrc.gov.

Enclosure:
As stated

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