



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

May 4, 2020

MEMORANDUM TO: Anna Bradford, Director
Division of New and Renewed Licenses
Office of Nuclear Reactor Regulation

FROM: Louise Lund, Director */RA Jeremy Bowen for/*
Division of Engineering
Office of Nuclear Regulatory Research

SUBJECT: IMPENDING PUBLICATION OF TECHNICAL LETTER
REPORT ENTITLED "MODELING AND SIMULATION OF
AUSTENITIC WELDS AND COURSE-GRAINED SPECIMENS"
(PNNL-29889) (UNR NRR- 2013-009)

The Office of Nuclear Regulatory Research (RES) has completed a technical letter report entitled "Modeling and Simulation of Austenitic Welds and Course-Grained Specimens," (ADAMS Accession ML20122A252) under contract with Pacific Northwest National Laboratory (PNNL). This Technical Letter Report (TLR) documents work performed under User Need Requests (UNR) NRR-2013-009 "Evaluating the Reliability of Nondestructive Examinations of Vessels and Piping" and NRR-2020-002, "Update of the User Need Request for Evaluating the Reliability of Nondestructive Examinations of Vessels and Piping." These UNRs focus on assessing the reliability and effectiveness of nondestructive examination methods used in nuclear power plants. Task 1 (of both UNRs) on ultrasonic (UT) modeling and simulation requests that the Office of Research establish a standard method for evaluating UT modeling and simulation results for a variety of materials and degradation mechanisms.

The work documented in this TLR is part of a multi-phase effort at PNNL under Task 1 to define best practices required for using computational models to simulate UT testing scenarios being conducted on nuclear power plant components. In addition to model validation (i.e., the ability of a model to accurately reproduce all relevant conditions for a particular application) this work assessed: operational and functional inputs to the models, computational complexity and model run-times, material microstructures, flaw morphology, uncertainty in model predictions, and the ability to extrapolate findings from model predictions to realistic scenarios. PNNL focused on evaluating the use of both beam models and flaw response models for simulating coarse-grained materials in austenitic and dissimilar metal weld examinations and cast austenitic stainless-steel materials.

As shown in this TLR, two important concepts must be developed to answer the fundamental question, "under what conditions do simulations provide useful predictions of flaw detection?" The first concept is that robust models are required that are built on sound mathematical framework and use appropriate approximations, including the user-supplied input parameters

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and specimen descriptions. As shown in this TLR, the specimen descriptions are extremely important and cannot be overlooked or oversimplified. The second concept is that empirical studies are required in order to validate the models by testing simulated scenarios. Without laboratory-based true-state information, the predictive qualities of models can never be assessed.

For this phase of Task 1, Modeling and Simulation, PNNL developed more realistic austenitic weld and CASS specimen models and compared beam simulation results to empirical beam maps in order to determine the quality of the specimen models. In the final phase of Task 1, PNNL will work to better understand the impacts to beam and flaw response simulations of noise, attenuation, and realistic flaws such as primary water stress corrosion cracking.

Staff representatives from the Division of New and Renewed Licenses in the Office of Nuclear Reactor Regulation (NRR) reviewed a draft of this TLR. The Staff agreed with the key findings and conclusions of the report, and stated, "the TLR is of high quality and contains sufficient detail and rigor to be used as a reference in future NRR activities and the information in the report is being used for ASME Code Activities and Rulemaking."

RES has established an online quality survey to collect feedback from user offices on the usefulness of RES products and services. This survey can be found online at the hyperlink: [RES Quality Survey](#). I would appreciate the responsible manager completing this short survey within the next 10 working days to present your office's views of the delivered RES product. If you cannot provide a rating of 'Exceptional' in all areas of the survey, please reach out the RES/DE contact person prior to the completion of the survey and allow us the opportunity to address your concern.

If additional information is required, or there are any concerns with the impending public release of this TLR, please contact Carol A. Nove of my staff at 301-415-2217 or can2@nrc.gov.

Enclosure:
As stated

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ADAMS Package Accession No.: ML20122A250***Concurrence via email**

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