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

October 14, 2022

MEMORANDUM TO: Brian Smith, Director
Division of New and Renewed Licenses
Office of Nuclear Reactor Regulation

FROM: Louise Lund, Director
Division of Engineering
Office of Nuclear Regulatory Research

Signed by Lund, Louise on 10/14/22

SUBJECT: IMPENDING PUBLICATION OF THE JOURNAL ULTRASONICS ARTICLE ENTITLED "MACHINE LEARNING FOR ULTRASONIC NONDESTRUCTIVE EXAMINATION OF WELDING DEFECTS: A SYSTEMATIC REVIEW," (UNR-2020-002)

The Office of Nuclear Regulatory Research (RES) has completed a journal article to be published in the journal Ultrasonics entitled "Machine Learning for Ultrasonic Nondestructive Examination of Welding Defects: A Systematic Review," (ADAMS Accession ML 22284A071) under contract with Pacific Northwest National Laboratory (PNNL) and subcontract with Oak Ridge National Laboratory (ORNL). This journal article documents work performed under User Need Request (UNR) NRR-2020-0023, "Update of the User Need Request for Evaluating the Reliability of Nondestructive Examinations of Vessels and Piping." This UNR focused on assessing the reliability and effectiveness of nondestructive examination methods used in nuclear power plant. Task 7 on Automated Data Analysis requested that RES provide a technical basis describing the current capabilities of machine learning (ML) and automated data analysis systems.

In light of the rapid growth in ML methods and diversity of possible approaches for applying ML for nondestructive examination (NDE), a thorough literature review was conducted to understand the current state-of-the-art in the application of ML for automated analysis of NDE data and to identify an appropriate path for empirical studies that will be used to quantify and validate the performance of ML methods for ultrasonic NDE. The results of the literature review were analyzed and compiled to develop the journal article, "*Machine Learning for Ultrasonic Nondestructive Examination of Welding Defects: A Systematic Review*." On September 20, 2022, this article was accepted for publication in the journal, Ultrasonics, and was made available via the link https://doi.org/10.1016/j.ultras.2022.106854 on September 26, 2022. The print version of this article will be available in Ultrasonics, Volume 127, January 2023, 106854.

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Staff representatives from the Division of New and Renewed Licenses in the Office of Nuclear Reactor Regulation (NRR) reviewed a draft of this journal article and stated, “the paper is of very high quality and is a good report on the research.”

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 or supervisor completing this short survey within the next 10 working days to present your office’s views of the delivered RES product.

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

Enclosure:
As stated

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