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

January 20, 2022

Dr. Joy L. Rempe, Chairman
Advisory Committee on Reactor Safeguards
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT: STAFF RESPONSE TO ACRS LETTER DATED DECEMBER 20, 2021, IN REGARD TO RESEARCH INFORMATION LETTER 2021-13 ON THE INTERPRETATION OF RESEARCH ON FUEL FRAGMENTATION, RELOCATION, AND DISPERSAL AT HIGH BURNUP

Dear Dr. Rempe:

The purpose of this memorandum is to provide the U.S. Nuclear Regulatory Commission (NRC) staff's response to the Advisory Committee on Reactor Safeguards (ACRS or the Committee) letter dated December 20, 2021 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML21347A940), on Research Information Letter (RIL) 2021-13, "Interpretation of Research on Fuel Fragmentation, Relocation, and Dispersal at High Burnup."

During the 691st meeting of the ACRS that took place November 30–December 2, 2021, the ACRS reviewed a draft of RIL 2021-13 (ADAMS Accession No. ML21309A013). Previously, the ACRS Metallurgy and Reactor Fuels Subcommittee reviewed this topic on November 17, 2021. In the letter dated December 20, 2021, the ACRS provided conclusions and recommendations on RIL 2021-13. The NRC staff appreciates the ACRS feedback and has made several changes to RIL 2021-13, including the addition of a foreword to the final version published on December 17, 2021 (ADAMS Accession No. ML21313A145). Specific NRC staff responses to the ACRS conclusions and recommendations follow.

ACRS Conclusion and Recommendation 1:

> *The current data set on FFRD has been expanded. However, there remains a significant degree of uncertainty in large part because the problem is multivariate and the experiments from which the data were developed did not always represent actual light water reactor (LWR) conditions. Our letter suggests a number of cautions that should be considered when applying this RIL. They are described in detail in our final thoughts section.*

NRC Staff Response 1:

The NRC staff appreciates the ACRS feedback and agrees that one should use caution when applying the results of the experiments described in RIL 2021-13 to loss-of-coolant accident (LOCA) analyses for operating LWRs. To some extent, the RIL addresses the cautions identified in the ACRS letter. The RIL acknowledges that there are some differences between the experimental conditions and the conditions expected during a LOCA, it recognizes the potential for hydraulic forces to impact dispersal, and it identifies gaps in the existing

experimental database, notably in sections titled “Prototypicality and Representativeness of Empirical Database,” “Appendix A: A Model Predicting Dispersal,” and “Limitations of the Empirical Database,” respectively. Furthermore, as noted in the foreword to the RIL, the staff of the Office of Nuclear Regulatory Research (RES) is actively following domestic and international research on fuel fragmentation, relocation, and dispersal (FFRD) dedicated to addressing the remaining gaps in the empirical database. The staff will consider the Committee’s observations and cautions when participating in these research programs or when reviewing future industry submittals related to high burnup fuel.

ACRS Conclusion and Recommendation 2:

> *The staff recognized, and we agree, that this document would benefit from additional context by identifying the entire scope necessary to resolve the safety issues related to FFRD and describing the role of the RIL as a specific piece of that overall scope.*

NRC Staff Response 2:

The NRC staff appreciates the ACRS feedback and in response added a new foreword to the RIL. The foreword provides additional context about RIL 2021-13 and how information in the RIL can be used when evaluating the safety issues related to FFRD. More specifically, the RIL describes the RES staff’s interpretation of FFRD research available to date and does not communicate official NRC positions or regulatory guidance to external stakeholders.

ACRS Conclusion and Recommendation 3:

> *A risk informed approach should be undertaken that examines both the likelihood of expected event conditions combined with a more complete modeling evaluation of FFRD consequences. This activity could add substantial value to future research program development and to the regulatory decision-making process.*

NRC Staff Response 3:

The NRC staff appreciates the ACRS feedback and is aware that industry may pursue a risk-informed approach to addressing FFRD. The staff will continue to follow the progress of risk-informed efforts related to FFRD through early interactions with vendors and licensees. The staff will also continue to participate in the Electric Power Research Institute’s Collaborative Research on Advanced Fuel Technologies (CRAFT) program for LWRs that includes representatives from the nuclear industry and the U.S. national laboratories. The purpose of the

CRAFT program is to foster research cooperation, collaboration, and coordination for LWR advanced fuel technologies, including higher burnup fuel.

Sincerely,

Signed by Furstenau, Raymond on 01/20/22

Raymond V. Furstenau, Director
Office of Nuclear Regulatory Research

cc: Chairman Hanson
Commissioner Baran
Commissioner Wright
SECY

Staff Response To Acrs Letter Dated December 20, 2021, In Regard To Research Information Letter 2021-13 On Interpretation Of Research On Fuel Fragmentation, Relocation, And Dispersal At High Burnup
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