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

October 14, 2020

MEMORANDUM TO: Mohamed Shams, Director
Division of Advanced Reactors and Non-Power
Production and Utilization Facilities
Office of Nuclear Reactor Regulation

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

Bowen, Jeremy signing on behalf of Lund, Louise on 10/14/20

SUBJECT: IMPENDING PUBLICATION OF TECHNICAL LETTER REPORT ENTITLED "ADVANCED NONLIGHT-WATER REACTORS SUMMARY OF GAP IDENTIFICATION AND RECOMMENDATIONS ON CONSENSUS CODES AND COMPUTATIONAL CODES" (TLR-RES/DE/CIB-2019-04)

The Office of Nuclear Regulatory Research (RES) has completed a Technical Letter Report (TLR-RES/DE/CIB-2019-04) entitled "Advanced Nonlight-Water Reactors Summary of Gap Identification and Recommendations on Consensus Codes and Computational Codes," (ADAMS Accession No. ML20254A155).

The TLR provides a summary of gap identification and recommendations on consensus codes and standards and computational codes relevant to the design and operation of advanced nonlight-water reactors (ANLWRs). This TLR does not assess American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (BPVC) Section III, Division 5, "High Temperature Reactors." The assessment of ASME BPVC Section III Division 5 is an ongoing effort within the agency.

The TLR identifies potential gaps in ASME BPVC Section XI. Gaps in Section XI include high-temperature crack growth and fracture rules, considerations for residual stress relaxation cracking, and the use of advanced finite element procedures to evaluate buckling limits for time-independent conditions. A summary of recent enhancements to the United Kingdom (UK) R5 fitness for service procedure is also presented in the report. R5 incorporates high-temperature fracture mechanics assessment procedures not available in the current ASME BPVC.

CONTACT: Matthew Gordon, RES/DE/CIB
(301) 415-2152

The TLR also details a crack assessment procedure being developed for Section XI by the ASME Working Group on High Temperature Flaw Evaluation. This procedure is similar to approaches in the French RCC-MRx, “Design and Construction Rules for Mechanical Components of Nuclear Installations: High-Temperature, Research and Fusion Reactors" and American Petroleum Institute report 579, "Fitness-for-Service.” The report recommends that Section XI incorporate leak-before-break assessments and that General Design Criterion 4, “Environmental and Dynamic Effects Design Bases,” in 10 CFR 50 Appendix A, “General

Design Criteria for Nuclear Power Plants” be relaxed for sodium-cooled reactors, because sodium-cooled reactors operate at lower pressures than light water reactors.

A high-level summary of the Reliability and Integrity Management (RIM) program recently included in ASME BPVC, Section XI, Division 2 is discussed in the report. The RIM program was inspired by experience with the Japanese System Based Code (JSBC) concept, which was applied to the Monju sodium-cooled prototype reactor. This report provides two examples of JSBC/RIM applied to Monju and the planned South African pebble bed reactor. The most notable gaps in the Section XI, Division 2, RIM program are the supplemental appendices for individual nonlight-water reactor designs in mandatory Appendix VII.

The final sections of this report examine computer codes applicable to the materials and component integrity in ANLWRs, which include commercially available finite-element computer codes, NRC-developed analytically based computer codes, open-source codes, and codes developed at the National Laboratories.

Staff representatives from the Division of Advanced Reactors and Non-Power Production and Utilization Facilities in NRR have reviewed a draft of this TLR, 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.

RES 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 RES Quality Survey. I would appreciate the responsible manager or supervisor completing this short—about 5 minutes—survey within the next 10 working days to present your office’s views of the delivered RES product.

If additional information is required, please contact Matthew Gordon of my staff at 415-2152 or mxg9@nrc.gov

Enclosure:
As stated

SUBJECT: IMPENDING PUBLICATION OF TECHNICAL LETTER REPORT ENTITLED "ADVANCED NONLIGHT-WATER REACTORS SUMMARY OF GAP IDENTIFICATION AND RECOMMENDATIONS ON CONSENSUS CODES AND COMPUTATIONAL CODES" (TLR-RES-DE-CIB-2019-4) DATED OCTOBER 14, 2020

DISTRIBUTION:
M. Mitchell, NRR
T. Lupold, NRR
A. Yeshnik, NRR
D. Rudland, NRR
R. Furstenau, RES
S. Frankl, RES
M. Case, RES
M. Cheok, RES
M. Thaggard, RES
K. Webber, RES
R. Tregoning, RES

ADAMS Accession No.: ML20254A154 ***Concurred via Email**

OFFICE	RES/DE/CIB	RES/DE/CIB/BC (A)	RES/DE/D
NAME	MGordon*	RIyengar	LLund (JBowen for)
DATE	09/10/2020*	10/09/2020	10/14/2020

OFFICIAL RECORD COPY