



**UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS  
WASHINGTON, DC 20555 - 0001**

February 04, 2020

The Honorable Kristine L. Svinicki  
Chairman  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555-0001

SUBJECT: SUMMARY REPORT – 669<sup>th</sup> MEETING OF THE ADVISORY COMMITTEE  
ON REACTOR SAFEGUARDS, DECEMBER 4-6, 2019

Dear Chairman Svinicki:

During its 669<sup>th</sup> meeting, December 4-6, 2019, the Advisory Committee on Reactor Safeguards (ACRS) discussed several matters and completed the following correspondence:

**LETTER REPORT**

Letter Report to Kristine L. Svinicki, Chairman, U.S. NRC, from Peter C. Riccardella, Chairman, ACRS:

- Report on the Safety Aspects of the Subsequent License Renewal Application Review of the Peach Bottom Atomic Power Station, Units 2 and 3, dated December 19, 2019, ADAMS Accession No. ML19353D382.

**LETTERS**

Letters to Margaret M. Doane, Executive Director for Operations (EDO), NRC, from Peter C. Riccardella, Chairman, ACRS:

- Safety Evaluation of the NuScale Power, LLC, Topical Report TR- 0915-17565, Revision 3, "Accident Source Term Methodology," and Source Term Area of Focus Review for the NuScale Small Modular Reactor, dated December 20, 2019, ADAMS Accession No. ML19354A031.
- Safety Evaluation for Global Nuclear Fuel – Americas, LLC, Licensing Topical Report NEDE-33885P, REVISION 0, "GNF CRDA Application Methodology," dated December 19, 2019, ADAMS Accession No. ML19353D148.

## MEMORANDA

Memorandum to Margaret M. Doane, EDO, NRC, from Scott W. Moore, Executive Director, ACRS:

- “Documentation of Receipt of Applicable Official NRC Notices to the Advisory Committee on Reactor Safeguards for December 2019,” dated January 15, 2020, ADAMS Accession No. ML20021A227

Memoranda to Ho K. Nieh, Director, Office of Nuclear Reactor Regulation (NRR), NRC, from Scott W. Moore, Executive Director, ACRS:

- ACRS Review of NuScale Power, LLC, Design Certification Application – Safety Evaluation with No Open Items for Chapters 2, 8 and 12, dated January 8, 2020, ADAMS Accession No. ML20006G325
- ACRS Review of Framatome Topical Report ANP-3753P, “Applicability of Framatome BWR Methods to Susquehanna With Atrium™ 11 Fuel Report”, dated December 19, 2019, ADAMS Accession No. ML19353A021

## HIGHLIGHTS OF KEY ISSUES

1. Report on the Safety Aspects of the Subsequent License Renewal Application Review of the Peach Bottom Atomic Power Station, Units 2 and 3

The staff reviewed the Exelon application for Subsequent License Renewal (SLR) in accordance with the Generic Aging Lessons Learned (GALL-SLR) and the Standard Review Plan (SRP-SLR) guidance documents. Conformance with this guidance provides bases for a conclusion that an applicant for life extension of 20 additional years beyond 60 years will assure adequate protection of the public through the Subsequent Period of Extended Operation (SPEO).

The most significant generic issues challenging operation beyond 60 years are: reactor pressure vessel embrittlement; irradiation-assisted stress corrosion cracking of reactor internals; concrete structures and containment degradation; and electrical cable environmental qualification, condition monitoring, and assessment. Each of these items has been addressed by Exelon and evaluated by the staff through the review process. The Committee agreed with the staff's safety evaluation report regarding these issues.

The staff conducted license renewal audits, and the audits verified the appropriateness of the Exelon scoping and screening methodology for AMPs, the appropriateness of the aging management review, and the acceptability of the plant-specific time limited aging analyses. The staff audit reports confirm the validity of the Peach Bottom aging management program. The Post-Approval Site Inspection for License Renewal verified that the current license renewal requirements are implemented appropriately. The audits and inspection were comprehensive, and the corresponding reports were thorough. The License Renewal Program inspections demonstrated that the AMPs associated with the initial license renewal are being implemented appropriately and have resulted in no findings.

Based on these audits, inspections, and the staff reviews, the staff concluded that Exelon has demonstrated that the effects of aging at Peach Bottom will continue to be adequately managed. Safety functions will be maintained consistent with Peach Bottom's licensing basis for the SPEO, as required by 10 CFR 54.21(a)(3). The staff's review of the SLRA identified one confirmatory item related to the BWR vessel internals inspection plan and no open items. Exelon submitted documentation that supplements the SLRA and committed to additional actions to resolve the staff's concerns. This confirmatory item is now closed. The Committee agreed with the staff's conclusion that there are no issues related to the matters described in 10 CFR 54.29(a)(1) and (a)(2) that preclude renewal of the operating license for Peach Bottom.

### Committee Action

The Committee issued a report to the EDO on December 19, 2019, with the following conclusion and recommendation:

- a) The established programs and the commitments made by Exelon to manage age-related degradation provide reasonable assurance that Peach Bottom can be operated in accordance with its current licensing basis for the subsequent period of extended operation without undue risk to the health and safety of the public.
  - b) The Exelon application for subsequent license renewal of the operating license for Peach Bottom should be approved.
2. Safety Evaluation of the NuScale Power, LLC, Topical Report TR- 0915-17565, Revision 3, "Accident Source Term Methodology," and Source Term Area of Focus Review for the NuScale Small Modular Reactor

In its topical report, NuScale uses 10 times the failed fuel fraction value (660 ppm) to establish the design basis primary coolant activity that is used in shielding analysis and for design-basis accidents (DBAs). This level of activity corresponds to the failure of about 6-7 fuel rods in the NuScale Power Module (NPM) core. NuScale includes an iodine spike (washout of iodine deposited on the inside of cladding) within this source term that is meant to bound expected releases during a DBA. It is an empirical factor of 500 increase in iodine release rate for eight hours. The resultant source term is used to evaluate DBAs including a control rod ejection accident, a main steam line break outside of containment, a steam generator tube rupture, and small breaks outside of containment.

NuScale also uses a core damage source term based on several severe accident scenarios that are selected to encompass most of the risk dominant sequences for their design. The severe accident progression and associated source term were calculated by MELCOR to derive a surrogate radiological source term into the containment for a core damage event. Fission product transport and removal in the containment is calculated using MELCOR thermal hydraulics and only natural phenomena (agglomeration/coagulation, settling, thermophoresis and diffusiophoresis) in the STARNAUA code.

The approach in the topical report aligns with Commission guidance noting that design-specific source terms for light-water small modular reactors may not necessarily follow all guides that currently pertain to large light-water reactors (LWRs).

As part of the Committee's focus area review, the staff presented their resolution to source term related open items in the relevant chapters of the SER. These items are related to regulations

for post-accident sampling and hydrogen and oxygen monitoring. Staff discussed the technical basis for NuScale's requested exemption from post-accident sampling of the reactor coolant and containment atmosphere. The staff also discussed their evaluation of the possibility of leakage from the post-accident hydrogen and oxygen monitoring system and their dose evaluations performed to assess potential consequences if this were to occur following the postulated core damage event.

As detailed in the Committee's letter on this subject, the Committee has concerns related to the need and capability for long-term post-accident hydrogen and oxygen (combustible gas) monitoring. The Committee will address these issues in more detail as part of our Phase 5 SER reviews.

### Committee Action

The Committee issued a report to the EDO on this topic via letter dated December 20, 2019, with the following conclusions and recommendation:

- a) Given its unique design attributes, the NuScale DCA uses alternative source terms for both normal operation and accident conditions for siting, safety analysis, control room and technical support center habitability, and equipment qualification and survivability. This approach aligns with Commission guidance noting that design-specific source terms for light-water small modular reactors may not necessarily follow all guides that currently pertain to large light-water reactors (LWRs).
- b) The exclusion area boundary (EAB) and low-population zone (LPZ) are anticipated to be close to a NuScale plant. The traditional dose model to calculate radiological consequences for LWRs is inaccurate at short distances from the reactor. Therefore, NuScale has modified an NRC computer code that is more accurate at these reduced distances to address dose evaluations at the EAB and LPZ. The staff has found this approach acceptable.
- c) The overall approach to establish the source term for NuScale is acceptable with the conditions and limitations noted by the staff. The SER on the topical report methodology should be issued.
- d) Important design differences in NuScale compared to a conventional pressurized-water reactor call into question the prescriptive application of the post-accident requirements for long-term hydrogen and oxygen monitoring. The risk tradeoff between unisolating the NuScale containment to enable long-term hydrogen and oxygen monitoring should be weighed against alternatives that may not require such monitoring. We will continue to explore this issue in our NuScale review.

### 3. Safety Evaluation for Global Nuclear Fuel – Americas, LLC, Licensing Topical Report NEDE-33885P, REVISION 0, "GNF CRDA Application Methodology"

Topical report NEDE-33885P documents the newest GNF-A methodology for evaluation of control rod drop accident (CRDA) events in reload analyses. It extends the CRDA methodology by using the previously approved TRACG and PANACEA codes and the PRIME fuel thermal-mechanical code for fuel rod properties. The staff SE addresses the applicability of the

CRDA licensing topical report to boiling water reactor (BWR) product lines and fuel types for which the TRACG and PANACEA have previously been approved, and it also considers transition cores with more than one fuel type.

The staff reviewed the applicability of the TRACG and PANACEA models to calculate the prompt enthalpy rise that occurs in the fuel during postulated CRDA events. The staff also reviewed the GNF-A qualification of the analysis methodology against the Special Power Excursion Reactor Test (SPERT) reactivity transient tests. The staff concluded that the methodology is applicable and adequately reproduced experimental data from these tests.

The GNF-A methodology for CRDA evaluation is sound and provides more flexibility to accommodate licensees with different control rod operating strategies.

#### Committee Action

The Committee issued a report to the EDO on this topic via letter dated December 19, 2019, with the following conclusion and recommendation:

- a) The GNF-A methodology for evaluation of control rod drop accidents is sound and provides additional flexibility that will accommodate licensees with different control rod operating strategies. Results from application of this methodology can be used to verify compliance with updated acceptance criteria such as those proposed in draft regulatory guide DG-1327, "Pressurized Water Reactor Control Rod Ejection and Boiling Water Reactor Control Rod Drop Accidents."
- b) The SE should be published.

#### NUSCALE PHASE 5 DISCUSSIONS

As documented in the memorandum, dated January 8, 2020, from Scott Moore, ACRS Executive Director, to Ho Nieh, Director, NRR, the Committee decided that no further briefing by the staff is needed to support the Committee's Phase 5 review as it pertains to Chapters 2, 8 and 12 of the NuScale design certification application. The Committee plans to complete its review of the electric power systems during its review of Safety Evaluation Report Section 1.4.3.2, "Applicability of Topical Report TR 0815-16497-P-A, 'Safety Classification of Passive Nuclear Power Plant Electrical Systems'." The Committee requests a briefing by the staff on its finding in Section 1.4.3.2. The Committee will inform the Commission of its findings on these matters relative to the requirements of 10 CFR 52.53 in a subsequent letter. The Committee identified its approach to the Phase 5 review in its letter dated September 25, 2019 (ADAMS Accession No. ML19269B682).

#### LICENSE AMENDMENT REQUEST FOR SUSQUEHANNA TO OPERATE WITH ATRIUM™ 11 FUEL AND APPLY FRAMATOME METHODS FOR CORE RELOAD EVALUATIONS

The Committee considered a license amendment request (LAR) that the staff is reviewing, submitted by Talen Energy for Susquehanna Steam Electric Station (Susquehanna) Units 1 and 2, to operate with ATRIUM™ 11 fuel and adopt Framatome methods for core reload evaluations. Associated with this LAR are several licensing topic reports (LTRs), the most significant of which is ANP-3753P, "Applicability of Framatome BWR Methods to Susquehanna with ATRIUM™ 11 Fuel Report," dated May 2019.

As documented in the memorandum dated December 19, 2019, the Committee accepted the conclusions of the lead ACRS reviewer that the Susquehanna LAR application uses Framatome methodologies that have been approved by the staff and reviewed by ACRS for another licensee. Consequently, the Committee agreed that no additional ACRS review or briefing by the staff or licensee is required for Susquehanna's LAR.

#### RECONCILIATION OF ACRS COMMENTS AND RECOMMENDATIONS

- The Committee considered the correspondence from the Director of the Office of Nuclear Reactor Regulation (NRR), dated October 27, 2019, ADAMS Accession No. ML19305C804, in response to the Committee's letter dated October 7, 2019, ADAMS Accession No. ML19275E747. The topic was the report on the safety aspects of the subsequent license renewal application of the Turkey Point Nuclear Generating Units 3 and 4. The Committee accepted the staff's response.
- The Committee also considered the correspondence from the Deputy Director for New Reactors, NRR, dated October 31, 2019, ADAMS Accession No. ML19309F698, in response to the Committee's letter dated September 24, 2019, ADAMS Accession No. ML19268A109. The topic was the staff's safety evaluation of the NuScale topical report on the applicability of AREVA method for the evaluation of fuel assembly structural response to externally applied forces. The Committee accepted the staff's response.
- The Committee also considered the correspondence from the Deputy Director for New Reactors, NRR, dated October 31, 2019, ADAMS Accession No. ML19309F628, in response to the Committee's letter dated September 25, 2019, ADAMS Accession No. ML19269B682. The topic was the proposed focus area review approach of the advanced safety evaluation report with no open items for the design certification application of the NuScale small modular reactor. The Committee accepted the staff's response.
- The Committee also considered the letter from the Director, NRR, dated November 6, 2019, ADAMS Accession No. ML19302F289, in response to the Committee's letter dated October 7, 2019, ADAMS Accession No. ML19277H031. The topic was review of draft SECY paper on population-related siting considerations for advanced reactors. The Committee accepted the staff's response.
- Finally, the Committee considered the correspondence from the Deputy Director for New Reactors, NRR, dated October 31, 2019, ADAMS Accession No. ML193098F774, in response to the Committee's letter dated September 20, 2019, ADAMS Accession No. ML19266A463. The topic was the safety evaluation of the NuScale topical report on the evaluation methodology for stability analysis of the NuScale power module. The Committee understands the staff's response and will pursue any further issues with the staff during the Phase 5 focus area review.

### ACRS OFFICER ELECTIONS

In accordance with Section 8 of the ACRS Bylaws, the annual election of officers was conducted during the planning and procedures portion of the December 2019 Full Committee meeting. As a result, the following ACRS members were elected to serve from January 1, 2020, until December 31, 2020:

ACRS Chairman, Matthew Sunseri  
ACRS Vice-Chairman, Joy Rempe  
ACRS Member-at-Large, Walter Kirchner

### SCHEDULED TOPICS FOR THE 670<sup>th</sup> ACRS MEETING

The following topics were placed on the agenda for the 670<sup>th</sup> ACRS meeting which is scheduled for February 5 - 8, 2020:

- Briefing with representatives of the Institute for Nuclear Power Operations
- Biennial review of NRC safety research program
- Quality review of selected Office of Regulatory Research projects
- Further discussion of various safety evaluation reports related to the NuScale design certification application review and the Phase 5 review

Sincerely,

/RA/

Matthew W. Sunseri,  
Chairman

February 04, 2020

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