



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

January 26, 2021

The Honorable Christopher T. Hanson,  
Chairman  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555-0001

SUBJECT: SUMMARY REPORT – 681<sup>st</sup> MEETING OF THE ADVISORY COMMITTEE  
ON REACTOR SAFEGUARDS, DECEMBER 1-4, 2020

Dear Chairman Hanson:

During its 681<sup>st</sup> meeting, December 1-4, 2020, which was conducted virtually due to the COVID-19 pandemic, the Advisory Committee on Reactor Safeguards (ACRS) discussed several matters. The ACRS completed the following correspondence:

**LETTERS**

Letters to Margaret M. Doane, Executive Director for Operations (EDO), NRC, from Matthew W. Sunseri, Chairman, ACRS:

- Design Review Guide: Instrumentation and Controls for Non-Light-Water Reactor (Non-LWR) Reviews, dated December 16, 2020, ADAMS Accession No. ML20349E838
- Safety Evaluation for Topical Report NEDC-33912P, "BWRX-300 Reactivity Control," dated December 18, 2020, ADAMS Accession No. ML20351A431

**MEMORANDA**

Memoranda 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 2020, dated December 9, 2020, ADAMS Accession No. ML20343A032
- Regulatory Guides, dated December 9, 2020, ADAMS Accession No. ML20343A035

## HIGHLIGHTS OF KEY ISSUES

### 1. Design Review Guide (DRG): Instrumentation and Controls (I&C) for Non-Light-Water Reactor (Non-LWR) Reviews

The proposed DRG builds on the mPower and NuScale design-specific review standards (DSRS), factors in lessons learned from new light water reactor (LWR) reviews and incorporates principles in Regulatory Guide (RG) 1.233.

This new guidance reorganizes the existing Standard Review Plan from a bottom-up to a top-down approach that focuses on ensuring the basic architecture of the I&C systems meets the fundamental design principles. These principles are independence, redundancy, diversity in support of defense-in-depth, and deterministic behavior (predictability and repeatability), as well as simplicity. In addition, it addresses management of internal and external physical and electronic access to in-plant systems and networks. Design characteristics and regulatory requirements are then assessed within each system.

The DRG specifies the following objectives of the overall staff review:

1. Ensure that a management system is in place to confirm that the completed I&C systems meet all regulatory requirements.
2. Ensure that the safety-significance of Structures, Systems and Components (SSCs) is considered in determining the level of detail of the review and that applicable domestic and/or international standards are met.
3. Ensure a thorough qualification program is in place.
4. Ensure that a systematic assessment of design basis or licensing basis hazards is incorporated.
5. Ensure that human factors assessments are incorporated.
6. Ensure that I&C digital communications systems are assessed for hazards associated with paths that could affect the reliability and robustness of the system.

This revision is a significant advancement to the standard review process for nuclear power plant reactor I&C systems. Its focus on a top down approach organized around an architecture that meets the framework of the critical fundamental I&C design principles of independence, redundancy, diversity in support of defense-in-depth to address common cause failures, deterministic processing (predictability and repeatability), and network and system data communication, all supported by evaluating simplicity provides a firm and easily understood basis for evaluating future safety I&C systems whether digital, analog or a hybrid combination. The proposed DRG should be issued.

That said, we have two concerns:

1. Section A.8, Multi-Unit Stations: As proposed, the DRG will state: "I&C design descriptions in the application provide assurance that safety-related I&C SSCs are not shared among units in multi-unit stations. If safety-related I&C SSCs are shared among nuclear power plant units, then the reviewer should confirm that the ability to simultaneously perform required safety functions in all units is not impaired."

The staff provided their basis for maintaining the shared option by noting that the text in question originates from Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix A, “General Design Criteria for Nuclear Power Plants,” General Design Criterion 5, “Sharing of Structures, Systems, and Components,” which is retained in RG 1.232, “Guidance for Developing Principal Design Criteria for Non-Light Water Reactors,” Appendix A, Criterion 5. They also note that 10 CFR 50.55a(h) invokes Institute of Electrical and Electronics Engineers (IEEE) Standard 603-1991, which provides similar language.

The Committee agrees that some I&C systems may be suitable for sharing. However, the sharing of reactor trip systems (RTS) or engineered safety features actuation systems (ESFAS) between multiple units potentially compromises plant safety. Sharing of these systems jeopardizes redundancy, independence, data communication, diversity and defense-in-depth, and simplicity, and should not be allowed.

2. The guide states that it applies only to Non-LWRs; we disagree with this narrow application. Its development was based on lessons learned from LWR design certification application reviews. This guide is technology neutral in all aspects and will streamline the review of I&C safety systems for any proposed LWR or Non-LWR reactor plant design and any proposed safety I&C system modifications in operating plants.

#### Committee Action

The Committee issued a letter on December 16, 2020, with the following conclusions and recommendations:

1. The DRG is a significant advancement to the standard review process for nuclear power plant (NPP) reactor instrumentation and control (I&C) systems. The DRG should be issued subject to incorporation of Recommendation 2.
2. Some I&C systems may be suitable for sharing among multiple units. However, the sharing of RTS or ESFAS between multiple units potentially compromises plant safety. Sharing should not be allowed for these two specific systems.
3. This guide is technology neutral in all aspects and would streamline the review of I&C safety systems for any proposed LWR or Non-LWR reactor plant design and any proposed safety I&C system modifications in operating plants

#### 2. Safety Evaluation for Topical Report NEDC-33912P, “BWRX-300 Reactivity Control”

Topical report NEDC-33912P provides the design requirements, acceptance criteria, and regulatory basis for the BWRX-300 reactivity control functions. It includes design requirements for the reactor protection system and safety systems with reactivity control functions. The U.S. Nuclear Regulatory Commission staff will evaluate the compliance of the BWRX-300 final design with these requirements during future licensing activities in accordance with 10 CFR Part 50 or Part 52, as applicable.

BWRX-300 is an evolutionary light water reactor based on the certified Economically Simplified Boiling Water Reactor (ESBWR) design and relies on the operating experience of the BWR fleet. Rated at 300 MWe, it is a natural-circulation small modular reactor. It is being developed by GE-Hitachi Nuclear Energy Americas, LLC (GEH). The Applicant has employed risk-

informed design principles with the goal of reducing overall plant size and minimizing the highest risk contributors from the ESBWR design. The major improvements to achieve these goals are: reduction in the number and size of reactor pressure vessel (RPV) nozzles to minimize the potential of loss-of-coolant accident (LOCA) events; addition of safety features to minimize the consequences of LOCAs; simplification of safety-significant structures, systems and components; improved control rod drive reliability; prioritization of the use of proven components and supply chain; and simplification of plant construction.

The BWRX-300 design uses plant-level defense-in-depth concepts based on five defense lines similar to those used by the International Atomic Energy Agency Specific Safety Requirements (SSR)-2/1. For each of the five defense lines, NEDC-33912P provides a brief description and a list of design features or measures associated with reactivity control. The staff did not specifically review or endorse IAEA SSR-2/1 but evaluated the design requirements as documented in NEDC-33912P. GEH and the staff have evaluated several reactivity control events, and how these affected the level of defense in depth of the BWRX-300 design.

The proposed design requirements, acceptance criteria, and regulatory basis for reactivity control functions documented in NEDC-33912P, subject to the staff-imposed limitations and conditions, are appropriate to evaluate the reactivity response of the reactor. The safety evaluation report should be issued.

#### Committee Action

The Committee issued a letter on December 18, 2020, with the following conclusion and recommendation:

- The proposed design requirements, acceptance criteria, and regulatory basis for reactivity control functions documented in NEDC-33912P, subject to the staff-imposed limitations and conditions, are appropriate to evaluate the reactivity response of the reactor.
- The safety evaluation report should be issued.

#### COMMISSION MEETING WITH THE ACRS

The Committee participated in a meeting with the Commission and discussed the following topics:

- Committee activities undertaken since the last meeting with the Commission on December 4, 2019
- Status of Transformation activities
- Status of the review of the NuScale small module reactor design certification application and standard design approval application
- Research activities
- Digital I&C activities

Chairman Sunseri, Vice Chairman Rempe, Member-at-large Kirchner, and Member Brown made presentations to the Commission. A transcript of this meeting may be found at the Commission meeting website.

#### SIGNIFICANT ACTIONS/DISCUSSIONS AT THE PLANNING AND PROCEDURES SESSION

Member Riccardella led a discussion about future interactions with the NRC staff on the subject of a proposed rulemaking that would extend the required intervals for conducting inservice inspection and inservice testing activities. The Committee recognized and discussed that ACRS wrote letters about 20 years ago opposing similar actions by the NRC staff, but differences between then and now, as well as safety improvements over time, were acknowledged. It was agreed that Member Riccardella would lead this issue and work with the ACRS staff to arrange a Subcommittee meeting at the appropriate time.

Member Ballinger led a discussion of the proposed path forward for the review of the SHINE operating license application. It was agreed that appropriate Subcommittee meetings be set up to discuss significant safety issues that need to be addressed by the Committee. It was also stressed that sufficient information from the staff is needed in a timely manner to support the Committee's review. It was also discussed that a consultant to support the SHINE operating license application review is being processed and should be able to support Committee activities by the time SHINE work increases in 2021.

It was also discussed that Member Ballinger will take the lead on an effort associate with that discussed in SECY-20-0098, "Path Forward and Recommendations for Certain Low-Level Radioactive Waste Disposal Rulemakings," dated October 21, 2020. In this correspondence the staff recommends consolidating ongoing revisions to 10 CFR Part 61 with a new proposed rulemaking to allow for shallow land disposal of some Greater-than-Class C (GTCC) low-level wastes. Member Petti will also participate in this effort as well as any other members who are interested.

In accordance with its bylaws, the Committee conducted its annual vote for ACRS leadership with the following results for the term January 1, 2021 – December 31, 2021:

- Chairman: Matthew Sunseri
- Vice-Chairman: Joy Rempe
- Member-at-large: Walter Kirchner

#### SCHEDULED TOPICS FOR THE 682<sup>nd</sup> ACRS MEETING

The following topics are on the agenda for the 681<sup>st</sup> special ACRS meeting scheduled for February 3-6, 2021:

- Advanced Reactor Computer Code Development,
- Draft Guide (DG-1141) (revision 4 to RG 1.105, "Setpoints for Safety Related Instrumentation,"

- GEH licensing topical report, NEDO-33911, Revision 0, "BWRX-300 Containment Performance,"
- NRC's Post-Halden Plans,
- Navy-related interaction, and
- Integrated Human Event Analysis System (PRA-related)

Sincerely,

Matthew W. Sunseri  
Chairman

January 26, 2021

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