INCREASING THE USE OF RISK-INFORMED AND PERFORMANCE-BASED EVALUATION TECHNIQUES AND REGULATORY GUIDANCE IN LICENSING COMMERCIAL ADVANCED NUCLEAR REACTORS

A Report for the
Senate Committee on Environment and Public Works and the
House Committee on Energy and Commerce

By the U.S. Nuclear Regulatory Commission

Enclosure 2

INTRODUCTION

The U.S. Nuclear Regulatory Commission (NRC) developed this report as required by Section 103(c) of the Nuclear Energy Innovation and Modernization Act (NEIMA), which requires the NRC to submit to the appropriate congressional committees a report for increasing, where appropriate, the use of risk-informed and performance-based evaluation techniques and regulatory guidance in licensing commercial advanced nuclear reactors within the existing regulatory framework. Section 103(c) includes requirements for coordination and seeking stakeholder input, providing cost and schedule estimates, and evaluating various policy and technical issues associated with advanced nuclear reactor technologies. The NRC has addressed each of the requirements of Section 103(c) in sections of this report with corresponding headings.

The NRC's mission is to license and regulate the Nation's civilian use of radioactive materials to provide reasonable assurance of adequate protection of public health and safety, to promote the common defense and security, and to protect the environment. A separate NRC report entitled "Approaches for Expediting and Establishing Stages in the Licensing Process for Commercial Advanced Nuclear Reactors," which is required by Section 103(b) of NEIMA, provides background information on past and ongoing NRC activities to achieve the NRC's strategic goal to assure NRC readiness in all aspects of regulatory operations needed to efficiently and effectively review and regulate advanced reactors.

BACKGROUND

The development of risk-informed and performance-based licensing approaches for advanced reactors began in the 1980s during the NRC's preapplication interactions with advanced reactor developers. These activities resulted in the publication of assessments, such as NUREG-1368, "Preapplication Safety Evaluation Report for the Power Reactor Innovative Small Module (PRISM) Liquid-Metal Reactor" (Ref. 1); and NUREG-1338, "Draft Preapplication Safety Evaluation Report for the Modular High-Temperature Gas-Cooled Reactor [MHTGR]" (Ref. 2). The NRC staff identified several potential policy issues during these assessments. The NRC staff proposed risk-informed approaches to resolve some of the policy issues in SECY-93-092, "Issues Pertaining to the Advanced Reactor (PRISM, MHTGR, and PIUS [Process Inherent Ultimate Safety]) and CANDU 3 [Canadian Deuterium Uranium] Designs and Their Relationship to Current Regulatory Requirements" (Ref. 3). In July 1993, the Commission approved the NRC staff's proposed approaches (Ref. 4).

The use of risk-informed and performance-based licensing approaches was furthered with publication of a Commission Policy Statement, "Use of Probabilistic Risk Assessment Methods in Nuclear Regulatory Activities," on August 16, 1995 (60 FR 42622) (Ref. 5) and a white paper, "Risk-Informed and Performance-Based Regulation," on March 1, 1999 (Ref. 6). In June 2003 (Ref. 7), the Commission approved NRC staff recommendations to improve the use of risk-informed and performance-based approaches that were described in SECY-03-0047, "Policy Issues Related to Licensing Non-Light-Water Reactor Designs," dated March 28, 2003 (Ref. 8). The NRC also addressed advanced reactor issues, such as event categories and assessing defense in depth, in an advanced notice of proposed rulemaking (ANPR) published on May 4, 2006 (71 FR 26267) (Ref. 9). In December 2007, the NRC staff issued NUREG-1860, "Feasibility Study for a Risk-Informed and Performance-Based Regulatory Structure for Future Plant Licensing" (Ref. 10), which explored the feasibility of developing a risk-informed and performance-based regulatory structure for the licensing of future nuclear power plants.

In August 2008, the NRC and the U.S. Department of Energy (DOE) jointly issued a report to Congress, "Next Generation Nuclear Plant (NGNP) Licensing Strategy" (Ref. 11). The NRC staff also continued interactions with stakeholders on policy issues related to advanced reactors. These interactions centered on the NGNP project and a series of white papers intended to help resolve key licensing issues, including those specifically listed in Sections 103(a)(2)(B) and 103(c)(4)(A)(i) of NEIMA. Following interactions with DOE, Idaho National Laboratory, and the Advisory Committee on Reactor Safeguards (ACRS), the NRC staff provided feedback on the white papers to DOE's Office of Nuclear Energy in July 2014 (Ref. 12).

Most recently, the NRC staff interacted with the Licensing Modernization Project (LMP), a cost-shared initiative led by the Southern Company, coordinated by the Nuclear Energy Institute (NEI), and supported by DOE, to prepare guidance on a technology-inclusive, risk-informed, and performance-based approach to developing the licensing basis for advanced reactors. The proposals from the LMP build on the accepted higher-level approaches described in SECY-03-0047 and the more detailed processes described in the NGNP white papers. A series of interactions, including draft white papers and public meetings, led to the development of an NEI guidance document on how to implement the LMP—NEI 18-04, "Risk-Informed Performance-Based Guidance for Non-Light-Water Reactor Licensing Basis Development," dated September 28, 2018 (Ref. 13)—and the related NRC Draft Regulatory Guide DG-1353, "Guidance for a Technology-Inclusive, Risk-Informed, and Performance-Based Methodology To Inform the Licensing Basis and Content of Applications for Licenses, Certifications, and Approvals for Non-Light-Water Reactors" (Ref. 14), which was published for public comment on May 3, 2019.

This report further describes the proposed approaches in NEI 18-04 and DG-1353, which consolidate several previous Commission decisions resolving policy issues for advanced reactors in a methodology for use by advanced reactor developers in the design process and in preparing applications for NRC licenses, certifications, and approvals.

COORDINATION AND STAKEHOLDER INPUT (Sec. 103(c)(2))

The NRC staff coordinated with DOE and other stakeholders in developing this report. Specifically, the NRC discussed plans for preparation of this report with DOE representatives on March 19, 2019, and sought DOE input on the draft report. The NRC also discussed plans for preparation of this report during a public meeting on March 28, 2019, to seek input from advanced reactor stakeholders, including the nuclear energy industry, a diverse set of technology developers, and other public stakeholders. DOE and other stakeholders noted that the NRC has appropriately identified ongoing and completed non-light-water reactor (non-LWR) readiness activities that are responsive to NEIMA and that the NRC should continue to implement the NRC's vision and strategy for advanced reactors (Ref. 15) and implementation action plans (IAPs) (Ref. 16 and Ref. 17) (discussed in detail in the NRC's report entitled "Approaches for Expediting and Establishing Stages in the Licensing Process for Commercial Advanced Nuclear Reactors") to achieve the agency's overarching strategic goals and objectives, including assuring readiness to effectively and efficiently review and regulate advanced reactors. The NRC will continue to interact with DOE and other stakeholders to gather information to inform the NRC's advanced reactor readiness activities.

Since July 2016, the NRC has held frequent public stakeholder meetings to discuss advanced reactor topics of interest. To maximize participation, stakeholders can participate in person or by phone and webinar. The NRC has conducted approximately 30 such meetings, beginning in

2016, many of which were specifically focused on the development of risk-informed and performance-based evaluation techniques and regulatory guidance. Additional examples of stakeholder engagement include a series of three advanced reactor workshops that were co-hosted by the NRC and DOE in 2015, 2016, and 2017, and advanced reactor sessions that were conducted at the NRC's annual Regulatory Information Conference. The NRC has also conducted several public briefings of the ACRS Future Plant Subcommittee and ACRS full committee. The NRC staff will continue to conduct public meetings with stakeholders approximately every 6 weeks. The NRC staff also has routine public meetings with developers of specific advanced reactor designs, including NuScale Power, LLC (a light-water small modular reactor (SMR)) and developers of non-LWR designs such as Oklo, X-Energy, and Kairos Power, related to specific designs and licensing issues. The NRC and the DOE Office of Science/Fusion Energy Sciences have initiated routine interactions to inform the NRC staff and develop longer-term strategies for the possible deployment of fusion reactors.

COST AND SCHEDULE ESTIMATES (Sec. 103(c)(3))

As discussed in the NRC's vision and strategy for advanced reactors (Ref. 15) and IAPs (Ref. 16 and Ref. 17) (discussed in detail in the NRC's report entitled "Approaches for Expediting and Establishing Stages in the Licensing Process for Commercial Advanced Nuclear Reactors"), the NRC plans to achieve its overarching advanced reactor readiness strategic goals and objectives by no later than 2025, including assuring readiness to effectively and efficiently review and regulate advanced reactors. However, to support potential near-term applications, the NRC staff prioritized activities to increase the use of technology-inclusive, risk-informed, and performance-based licensing approaches within the existing regulatory framework. The NRC is on schedule to issue final regulatory guidance on risk-informed and performance-based evaluation techniques within 2 years of the enactment of NEIMA (by January 14, 2021). The cost of these activities has been funded using the non-fee-recoverable appropriations that the NRC has received for advanced reactor regulatory infrastructure activities. The President's budget request for fiscal year (FY) 2020 requests funds that the NRC would use to continue these efforts related to risk-informed and performance-based evaluation techniques and guidance for licensing commercial advanced nuclear reactors. If additional funds are needed for these activities in FY 2021 to ensure completion by January 14, 2021, such funding would be sought through the budget process for FY 2021.

USE OF RISK-INFORMED AND PERFORMANCE-BASED EVALUATION TECHNIQUES AND REGULATORY GUIDANCE IN LICENSING COMMERCIAL ADVANCED NUCLEAR REACTORS (Sec. 103(c)(4)(A))

The NRC is fully capable of reviewing and making safety, security, or environmental findings on an advanced reactor design if an application were to be submitted today. The agency has acknowledged that the efficiency of existing processes and requirements could be improved. Based on input received from stakeholders and ACRS recommendations, the NRC prioritized its activities to significantly increase and focus on the use of risk-informed and performance-based techniques in support of the design review and licensing processes for advanced reactors. The following sections provide illustrative examples of such activities.

LICENSING BASIS EVENT SELECTION AND EVALUATION (Sec. 103(c)(4)(A)(i)(I))

In 2017, the NRC staff prioritized activities to support the development of technology-inclusive, risk-informed, and performance-based licensing approaches. As previously discussed, the LMP initiative led to the development of the guidance in NEI 18-04 and DG-1353, which use risk-

informed and performance-based approaches to describe a systematic and reproducible process for selecting licensing-basis events, classifying structure, system, and components, and assessing defense in depth for non-LWR designs. The development of NEI 18-04 and DG-1353 provides an opportunity to demonstrate the integration of past decisions and to request Commission approval of the resultant methodology supporting the design review and licensing of advanced reactors.

The NRC staff has in development a Commission paper, "Technology-Inclusive, Risk-Informed, and Performance-Based Methodology To Inform the Licensing Basis and Content of Applications for Licenses, Certifications, and Approvals for Non-Light-Water Reactors" (Ref. 18), describing the methodology, relationship to previous Commission decisions, and remaining policy issues. The ACRS reviewed the staff's draft paper and provided several conclusions and a recommendation in their March 19, 2019, letter (Ref. 19), including the recommendation that the Commission adopt the approach proposed by the NRC staff for a technology-inclusive, risk-informed, and performance-based methodology for licensing basis event selection and other topics related to the content of applications for non-LWRs. The NRC staff plans to send the final paper and recommendations to the Commission for its review and approval before the end of FY 2019.

The NRC staff is continuing to interact with stakeholders, including potential joint industry-DOE projects like the LMP, to provide additional risk-informed and performance-based guidance to non-LWR developers in areas such as the content (scope and level of detail) for applications and the assessment of potential radiological releases using design-specific mechanistic source term (MST) models. The NRC staff is gaining experience with the application of the LMP methodology through observation of the LMP tabletop exercise for the GE-Hitachi PRISM sodium-cooled reactor and the review of the LMP demonstration and pilot activities submitted by non-LWR designers. The NRC staff will also interact with developers as the LMP guidance is piloted for other non-LWR designs, such as the Westinghouse eVinci micro-reactor and the Kairos Power fluoride-salt-cooled high-temperature reactor.

USE OF MECHANISTIC SOURCE TERMS (Sec. 103(c)(4)(A)(i)(II))

In SRM-SECY-93-092 dated July 30, 1993 (Ref. 4), the Commission approved approaches for identifying event categories based on a combination of deterministic and probabilistic insights and using MSTs based on best-estimate phenomenological models of the transport of fission products from the fuel through all holdup volumes and barriers into the environment. The concept and development of MSTs for specific technologies and designs arose in recognition that the behavior and potential releases and consequences from events and accidents at advanced reactors may differ significantly from large LWRs. Advanced reactor developers and national laboratories have developed MST approaches and models for specific technologies, such as sodium-cooled fast reactors and gas-cooled reactors. Further development and incorporation of MSTs for the various advanced reactor technologies and designs are an important part of addressing other policy issues, such as containment performance, emergency planning, and siting. The NRC staff is interacting with stakeholders and engaging the national laboratories to develop additional MST-related guidance for advanced reactor developers and will have any additional guidance developed by January 2021.

CONTAINMENT PERFORMANCE (Sec. 103(c)(4)(A)(i)(III))

The NRC staff developed SECY-18-0096, "Functional Containment Performance Criteria for Non-Light-Water-Reactors," dated September 28, 2018 (Ref. 20). In SECY-18-0096, the NRC

staff proposed a methodology for establishing functional containment performance criteria for advanced reactors. The NRC staff developed this proposed methodology following interactions with stakeholders and the ACRS. Designers can use the methodology to define design-specific functional containment performance criteria, relying heavily on the identification and analyses of licensing-basis events. In SRM-SECY-18-0096, dated December 4, 2018 (Ref. 21), the Commission approved the proposed methodology. The NRC staff is incorporating the methodology for functional containment performance criteria in ongoing activities, such as the preparation of DG-1353, future revisions of Regulatory Guide 1.232 (Ref. 22), and interactions with specific designers.

EMERGENCY PREPAREDNESS (EP) (Sec. 103(c)(4)(A)(i)(IV))

On May 29, 2015, the NRC staff issued SECY-15-0077, "Options for Emergency Preparedness for Small Modular Reactors and Other New Technologies" (Ref. 23), which provided options for EP for SMRs and non-LWRs. The Commission issued SRM-SECY-15-0077 on August 4, 2015 (Ref. 24), which approved the NRC staff's recommendation to initiate a rulemaking and directed the NRC staff to consider exemptions in the interim (e.g., for the ongoing review of the early site permit application from the Tennessee Valley Authority) until completion of the EP rulemaking, which would resolve this as a policy issue.

The ongoing rulemaking addresses EP issues for future SMRs, non-LWRs, and other new technologies. The Commission received the proposed rule on October 12, 2018, for its consideration. The Commission is currently considering the proposed rule, and the NRC is interacting with the Federal Emergency Management Agency on implementation of the proposed rule, if approved.

QUALIFICATION OF ADVANCED NUCLEAR REACTOR FUEL (Sec. 103(c)(4)(A)(i)(V))

The NRC's report entitled "Approaches for Expediting and Establishing Stages in the Licensing Process for Commercial Advanced Nuclear Reactors" discusses the ongoing strategies to address fuel qualification across the various advanced reactor designs, as required by Section 103(b)(4)(A)(ii) of NEIMA, including tristructural isotropic (TRISO) particle fuel, metallic uranium alloys, and liquid salt fuels. The NRC is and will continue coordinating activities related to fuel qualification with DOE, national laboratories, individual reactor developers, and other stakeholders.

OTHER POLICY ISSUES (Sec. 103(c)(4)(A)(ii))

The NRC staff is routinely interacting with stakeholders to identify and resolve policy issues that impact regulatory reviews, siting, permitting, and/or licensing of advanced reactors. These activities are a major part of the NRC's vision and strategy for advanced reactors in order to improve regulatory predictability, effectiveness, and efficiency. The NRC staff is considering several policy issues related to the licensing of SMRs and non-LWRs. These policy issues have been discussed routinely in public stakeholder meetings. These discussions will continue in order for the NRC to obtain stakeholder input on the identification and resolution of policy issues and to help prioritize these issues. The NRC continues to provide the status of these policy issues in monthly and semiannual reports to Congress.

In addition to the policy issues that were specifically identified in Section 103(c)(4)(A)(i) of NEIMA and discussed above, the NRC staff has identified additional policy issues related to the ability of the NRC to develop and implement risk-informed and performance-based licensing

evaluation techniques and guidance for commercial advanced nuclear reactors within the existing regulatory framework as discussed below.

Siting, as Related to Population, for SMRs and non-LWRs

As discussed in SECY-16-0012 (Ref. 25), the NRC staff is engaging with interested stakeholders on the issue of how the use of an MST could affect siting. This paper concluded that using MST analysis methods would also allow future combined license applicants to consider reduced distances to exclusion area boundaries and low-population zones, as well as potentially increased proximity of SMRs and non-LWRs to population centers. The NRC staff developed a draft white paper summarizing the assessment of current siting regulations, Commission policy, and NRC guidance (Ref. 26) and discussed these topics in a public meeting on December 14, 2017.

The NRC staff is working with national laboratories on a technical report that will identify potential alternative siting criteria for advanced reactors, recognizing the possible reduced offsite releases for advanced reactor designs. The report and related changes to NRC siting-related guidance will be discussed with stakeholders and pursued using the NRC's usual processes, including deliberations by the ACRS and Commission, as appropriate.

Security and Safeguards Requirements for SMRs and non-LWRs

The NRC staff prepared SECY-18-0076, "Options and Recommendation for Physical Security for Advanced Reactors," dated August 1, 2018 (Ref. 27), to provide the Commission with options on possible changes to regulations and guidance related to physical security for advanced reactors, including light-water SMRs and non-LWRs. In SRM-SECY-18-0076, dated November 19, 2018 (Ref. 28), the Commission directed the NRC staff to initiate a limited-scope revision to regulations governing physical security for advanced reactors and approved, subject to edits, a related rulemaking plan. The NRC staff plans to issue the regulatory basis for public comment by the end of summer 2019.

Micro-Reactors

Micro-reactor designs vary, but most are intended to produce 1-20 megawatts of thermal energy that could be used directly as heat or converted to electric power. Instead of being defined by their fuel form or coolant, micro-reactors are defined as having three main attributes: (1) factory fabricated, (2) transportable, and (3) inherently safe. These attributes may introduce unique policy issues for licensing commercial micro-reactors, including issues related to application of the appropriate NRC licensing pathway, transportation and license transfer, security, emergency preparedness, siting considerations, appropriate number of licensed operators, and remote or autonomous operation. The NRC has remained engaged with the industry as there has been increasing interest in micro-reactors, and the NRC is considering micro-reactors in the identification and resolution of policy issues.

EXTENT TO WHICH COMMISSION ACTION IS NEEDED TO IMPLEMENT THIS REPORT (Sec. 103(c)(4)(B))

The NRC has not identified any Commission action or modification of policy that is needed to implement any part of this report beyond those previously identified and discussed above. As previously discussed, the policy issues that the NRC staff has been considering with regard to the licensing of SMRs and non-LWRs have been discussed routinely in public stakeholder

meetings. These discussions will continue in order for the NRC to obtain stakeholder input on the identification and resolution of policy issues and to help prioritize these issues. The NRC will also continue to communicate updates on advanced reactor policy issues to Congress via other periodic reports.

CONCLUSION

The NRC routinely interacts with stakeholders to identify and resolve policy issues that impact regulatory reviews, siting, permitting, and/or licensing of advanced reactors, and those interactions are a major part of the NRC's vision and strategy for advanced reactors in order to improve regulatory predictability, effectiveness, and efficiency. In 2017, the NRC staff prioritized activities to increase the use of technology-inclusive, risk-informed, and performance-based licensing approaches, where appropriate. The NRC is continuing to interact with industry 1initiatives such as the LMP. The NRC issued DG-1353 proposing to endorse NEI 18-04, and the NRC staff is gaining experience with the application of the LMP methodology through observation of LMP tabletop exercises and the review of LMP demonstration and pilot activities submitted by advanced reactor designers. The NRC will continue to engage with stakeholders to provide additional guidance to advanced reactor developers in areas such as the content (scope and level of detail) for applications and the assessment of potential radiological releases using design-specific MST models.

Acronyms:

ACRS	Advisory Committee on Reactor Safeguards
ANPR	advanced notice of proposed rulemaking
CANDU	Canadian Deuterium Uranium
DOE	U.S. Department of Energy
EP	emergency preparedness
FY	fiscal year
IAP	implementation action plan
LMP	Licensing Modernization Project
LWR	light-water reactor
MHTGR	Modular High-Temperature Gas-Cooled Reactor
MST	mechanistic source term
NEI	Nuclear Energy Institute
NGNP	Next Generation Nuclear Plant
non-LWR	non-light-water reactor
NRC	U.S. Nuclear Regulatory Commission
PIUS	Process Inherent Ultimate Safety
PRISM	Power Reactor Innovative Small Module
SMR	small modular reactor
SRM	Staff Requirements Memorandum
TRISO	tristructural isotropic

References:

1. NUREG-1368, “Preapplication Safety Evaluation Report for the Power Reactor Innovative Small Module (PRISM) Liquid-Metal Reactor,” February 1994 (ADAMS Accession No. ML063410561).
2. NUREG-1338, “Draft Preapplication Safety Evaluation Report for the Modular High-Temperature Gas-Cooled Reactor,” March 1989 (ADAMS Accession No. ML052780497).
3. SECY-93-092, “Issues Pertaining to the Advanced Reactor (PRISM, MHTGR, and PIUS) and CANDU 3 Designs and Their Relationship to Current Regulatory Requirements,” April 8, 1993 (ADAMS Accession No. ML040210725).
4. Staff Requirements Memorandum, “SECY-93-092, Issues Pertaining to the Advanced Reactor (PRISM, MHTGR, and PIUS) and CANDU 3 Designs and Their Relationship to Current Regulatory Requirements,” July 30, 1993 (ADAMS Accession No. ML003760774).
5. “Use of Probabilistic Risk Assessment Methods in Nuclear Regulatory Activities; Final Policy Statement,” August 16, 1995 (60 FR 42622).
6. “Staff Requirements – SECY-98-144 – White Paper on Risk-Informed and Performance-Based Regulation,” March 1, 1999 (ADAMS Accession No. ML003753601).
7. “Staff Requirements – SECY-03-0047 – Policy Issues Related to Licensing Non-Light-Water Reactor Designs,” June 26, 2003 (ADAMS Accession No. ML031770124).
8. SECY-03-0047, “Policy Issues Related to Licensing Non-Light-Water Reactor Designs,” March 28, 2003 (ADAMS Accession No. ML030160002).
9. “Approaches to Risk-Informed and Performance-Based Requirements for Nuclear Power Reactors,” May 4, 2006 (71 FR 26267).
10. NUREG-1860, “Feasibility Study for a Risk-Informed and Performance-Based Regulatory Structure for Future Plant Licensing,” December 2007 (ADAMS Accession No. ML073400763)
11. “Next Generation Nuclear Plant Licensing Strategy, A Report to Congress,” August 2008 (ADAMS Accession No. ML082290017).
12. G.M. Tracy, NRC, letter to Dr. J.E. Kelly, DOE, “Next Generation Nuclear Plant – Assessment of Key Licensing Issues,” July 17, 2014 (ADAMS Accession No. ML14174A734).
13. NEI 18-04, “Risk-Informed Performance-Based Guidance for Non-Light Water Reactor Licensing Basis Development,” September 28, 2018 (ADAMS Accession No. ML18271A172).
14. Draft Regulatory Guide DG-1353, “Guidance for a Technology-Inclusive, Risk-Informed, and Performance-Based Methodology To Inform the Licensing Basis and Content of Applications for Licenses, Certifications, and Approvals for Non-Light-Water Reactors,” April 30, 2019 (ADAMS Accession No. ML18312A242).
15. “NRC Vision and Strategy: Safely Achieving Effective and Efficient Non-Light Water Reactor Mission Readiness,” December 2, 2016 (ADAMS Accession No. ML16356A670).
16. “NRC Non-Light Water Reactor Near-Term Implementation Action Plans,” July 12, 2017 (ADAMS Accession No. ML17165A069).

17. “NRC Non-Light Water Reactor Mid-Term and Long-Term Implementation Action Plans,” July 12, 2017 (ADAMS Accession No. ML17164A173).

18. Draft SECY Paper, “Technology-Inclusive, Risk-Informed, and Performance-Based Methodology To Inform the Licensing Basis and Content of Applications for Licenses, Certifications, and Approvals for Non Light Water Reactors,” September 28, 2018 (ADAMS Accession No. ML18270A334).

19. ACRS Letter, “Draft SECY Paper and Guidance Documents to Implement a Technology-Inclusive, Risk-Informed, and Performance-Based Approach to Inform the Content of Applications for Licenses, Certifications, and Approvals for Non-Light-Water Reactors,” March 19, 2019 (ADAMS Accession No. ML19078A240).

20. SECY-18-0096, “Functional Containment Performance Criteria for Non-Light-Water-Reactors,” September 28, 2018 (ADAMS Accession No. ML18114A546).

21. SRM-SECY-18-0096, dated December 4, 2018 (ADAMS Accession No. ML18338A502).

22. Regulatory Guide 1.232, “Guidance for Developing Principal Design Criteria for Non-Light-Water Reactors,” April 3, 2018 (ADAMS Accession No. ML17325A611).

23. SECY-15-0077, “Options for Emergency Preparedness for Small Modular Reactors and Other New Technologies,” May 29, 2015 (ADAMS Accession No. ML15037A176).

24. “Staff Requirements – SECY-15-0077 – Options for Emergency Preparedness for Small Modular Reactors and Other New Technologies,” August 4, 2015 (ADAMS Accession No. ML15216A492).

25. SECY-16-0012, “Accident Source Terms and Siting for Small Modular Reactors and Non-Light Water Reactors,” February 7, 2016 (ADAMS Accession No. ML15309A319).

26. Draft White Paper, “Siting Considerations Related to Population for Small Modular and Non-Light Water Reactors” (ADAMS Accession No. ML17333B158).

27. SECY-18-0076, “Options and Recommendation for Physical Security for Advanced Reactors,” August 1, 2018 (ADAMS Accession No. ML18170A051).

28. “Staff Requirements – SECY-18-0076 – Options and Recommendation for Physical Security for Advanced Reactors,” November 19, 2018 (ADAMS Accession No. ML18324A469).