# POLICY ISSUE
## (Notation Vote)

August 1, 2018 SECY-18-0076

FOR: The Commissioners

FROM: Margaret M. Doane
Executive Director for Operations

SUBJECT: OPTIONS AND RECOMMENDATION FOR PHYSICAL SECURITY FOR ADVANCED REACTORS

PURPOSE:

The purpose of this paper is to provide options and a recommendation to the Commission on possible changes to regulations and guidance related to physical security for advanced reactors, including light-water small modular reactors (SMRs) and non-light-water reactors (non-LWRs). The staff's recommendation is to pursue a limited-scope rulemaking.

SUMMARY:

This paper provides options for revising the U.S. Nuclear Regulatory Commission's (NRC's) regulations and guidance related to physical security for advanced reactors. The staff is recommending the Commission authorize a rulemaking effort to establish alternative physical security requirements for advanced reactors that are commensurate with the potential consequences to public health and safety and common defense and security from the possession and use of special nuclear material at these facilities. The current physical security framework for large light-water reactors (LWRs) is designed to protect the plant features needed to provide fundamental safety functions, such as cooling of the reactor core. The loss of plant features providing these safety functions can lead to damage to a reactor core or spent nuclear fuel, with a subsequent release of radioactive materials. The designs and behavior of advanced

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reactors are significantly different from large LWRs. Advanced reactor designs are expected to include attributes that result in smaller and slower releases of fission products following the loss of safety functions. Accordingly, these designs may warrant different physical security requirements commensurate with the risks posed by the technology.

The staff recommends a rulemaking action to further assess and, if appropriate, revise a limited set of NRC regulations and guidance to provide an alternative to current physical security requirements for license applicants for advanced reactors.[1] The limited scope rulemaking effort would evaluate possible performance criteria and alternative security requirements for advanced reactors that have incorporated the reactor attributes defined in the NRC's Policy Statement on the Regulation of Advanced Reactors, specifically designs that incorporate "enhanced margins of safety and/or use simplified, inherent, passive, or other innovative means to accomplish their safety and security functions." The alternative physical security requirements and related guidance would support efforts to better address security concerns within the design process, and thereby reduce reliance on armed responders. A rulemaking could also provide regulatory stability, predictability, and clarity in the licensing process by reducing reliance on case-by-case exemption requests.

BACKGROUND:

The NRC developed the existing physical security requirements to ensure that the physical protection programs and equipment at commercial power reactors provide high assurance[2] of protection against the design-basis threat (DBT) of radiological sabotage. The DBT describes the adversary force that the licensee must defend against. The Commission-approved DBT is based on realistic assessments of the tactics, techniques, and procedures used by international and domestic terrorist groups and organizations. The physical security requirements for licensees of nuclear power reactors to protect against the DBT of radiological sabotage can be found in Title 10 of the *Code of Federal Regulations* (CFR) 73.55, "Requirements for Physical Protection of Licensed Activities in Nuclear Power Reactors against Radiological Sabotage." Other sections in 10 CFR Part 73, "Physical Protection of Plants and Materials," set forth requirements for the protection of various forms of special nuclear material from theft or diversion.[3] The NRC defines the DBTs used to design safeguards systems to protect against acts of radiological sabotage and to prevent the theft or diversion of special nuclear material in 10 CFR 73.1, "Purpose and Scope."

The 10 CFR Part 73 requirements for physical security for nuclear power plants and other types of licensed facilities include performance and prescriptive requirements. The performance requirements provide applicants and licensees with the flexibility to determine how to meet the

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1 The staff was not in complete alignment on recommending rulemaking; the differing views expressed by some staff are further discussed below in the advantages and disadvantages of the proposed options.

2 The Commission stated in SRM-SECY-16-0073 – Options and Recommendations for the Force-On-Force Inspection Program in Response to SRM-SECY-14-0088, dated October 5, 2016, that "the concept of 'high assurance' of adequate protection found in our security regulations is equivalent to 'reasonable assurance' when it comes to determining what level of regulation is appropriate."

3 For example, 10 CFR 73.20 and 73.46 provide requirements for licensees authorized to possess or use a formula quantity of strategic special nuclear material (Category I quantity) to protect against the DBT of theft or diversion, and 10 CFR 73.67 provides requirements for licensees authorized to possess or use special nuclear material of moderate or low strategic significance (Category II or Category III quantity) to protect against unauthorized removal of special nuclear material.

established performance objectives. The physical security requirements across different classes of licensees reflect a graded approach that applies the appropriate level of physical security, commensurate with potential radiological consequences or concerns about theft or diversion of special nuclear material. The physical security requirements for large LWRs, which use low enriched nuclear fuel, are established to protect against the DBT for radiological sabotage, without additional requirements specifically to address theft or diversion of special nuclear material. The focus of this paper (and associated options) is on the physical requirements related to protection against radiological sabotage for advanced reactors, and not theft or diversion. (See footnote 4 for additional discussion on activities related, in part, to theft and diversion.)

The NRC first issued its Policy Statement on the Regulation of Advanced Reactors on July 8, 1986, in Volume 51 of the *Federal Register*, page 24643 (51 FR 24643), with an objective to provide all interested parties, including the public, with the Commission's views concerning the desired characteristics of advanced reactor designs. The policy statement identifies attributes that should be considered in advanced designs, including highly reliable and less-complex heat removal systems, longer time constants before reaching safety system challenges, reduced potential for severe accidents and their consequences, and use of the defense-in-depth philosophy of maintaining multiple barriers against radiation release. The staff recognized the potential implications of these attributes on security requirements and made the following observation in NUREG-1226, "Development and Utilization of the NRC Policy Statement on the Regulation of Advanced Nuclear Power Plants," issued June 1988 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13253A431):

> The Commission intends to make use of the existing and future regulations in reviewing advanced reactors. As such, the vulnerability of advanced reactors to sabotage is an important consideration and advanced reactors will be required to meet the same regulations regarding physical protection as LWRs. It is expected that, in many cases, advanced reactors, due to their inherent safety characteristics and simplified safety systems, will be less reliant upon physical security systems and procedures for protection against sabotage than current generation plants. Accordingly, at the conceptual design stage, advanced reactor designers should submit a short description of the advantage and disadvantages their design provides in protection from insider and outsider sabotage as compared to a current generation LWR.

The NRC revised the policy statement in 2008 (73 FR 60612; October 14, 2008) to specifically include attributes related to physical security that should be considered in advanced designs, as follows:

> Designs that include considerations for safety and security requirements together in the design process such that security issues (e.g., newly identified threats of terrorist attacks) can be effectively resolved through facility design and engineered security features, and formulation of mitigation measures, with reduced reliance on human actions.

In addition to defining favorable attributes for advanced reactor designs, the Commission observed the following with regard to the possible implementation of the policy statement:

> Finally, the NRC also believes that it will be in the interest of the public as well as the design vendors and the prospective license applicants to address security issues early in the design stage to achieve a more robust and effective security posture for future nuclear power reactors.

The staff noted in SECY-10-0034, "Potential Policy, Licensing, and Key Technical Issues for Small Modular Nuclear Reactor Designs," dated March 28, 2010 (ADAMS Accession No. ML093290245), that establishing physical security requirements and guidance for SMRs and non-LWRs were key policy issues of high importance. Stakeholders raised concerns during interactions with the staff about the appropriate number of security personnel and size of the protected area, which may be important factors for reducing recurring operating costs. Also, designers and other potential applicants have indicated that the physical security requirements will be a key factor in the business case for advanced reactor feasibility and development. The staff reiterated the need to resolve policy issues in the document "NRC Vision and Strategy: Safely Achieving Effective and Efficient Non-Light Water Reactor Mission Readiness," issued December 2016 (ADAMS Accession No. ML16356A670), and the related "NRC Non-Light Water Reactor Near-Term Implementation Action Plans," issued July 2017 (ADAMS Accession No. ML17165A069).

The staff reported to the Commission in SECY-11-0184, "Security Regulatory Framework for Certifying, Approving, and Licensing Small Modular Nuclear Reactors," dated December 29, 2011 (ADAMS Accession No. ML112991113), that the current security regulatory framework is adequate for SMRs, including related elements of the nuclear fuel cycle. In the case of non-LWRs, the staff's assessment of the suitability of the current security regulatory framework discussed in SECY-11-0184 was based on the limited information that was available at the time on reactor and fuel designs and operations of these technologies. Based on the information available, the staff stated in SECY-11-0184 that it was not aware of any area in which the existing security regulatory framework would not apply to non-LWRs and that the staff would continue to assess the suitability and adequacy of the security and material control and accountability (MC&A) requirements for proposed non-LWRs technologies, in order to identify any regulatory gaps and potential technical or policy issues pertaining to certifying, approving, or licensing non-LWR technologies.[4]

The staff also indicated in SECY-11-0184 that the alternative measures provision in 10 CFR 73.55(r) allows SMR and non-LWR designers and potential applicants to propose alternative methods or approaches that are equivalent in performance and meet the intended

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[4] This paper focuses on the physical security requirements for an advanced nuclear power plant. Other activities within the industry and the NRC are also addressing possible policy and technical issues, including security requirements, for other parts of the fuel cycle. Many non-LWR designs are expected to use higher assay low-enriched uranium (i.e., between 5- and 20-percent enrichments) and fuel forms other than the traditional uranium dioxide pellets used for LWRs. The different fuel forms also introduce the possible need to develop new approaches to MC&A practices and protections against theft and diversion throughout the fuel cycle, including at reactor facilities. These and other issues related to higher assay low-enriched uranium and the nuclear fuel cycle will be the subject of future interactions between the staff and stakeholders as well as ongoing NRC activities such as rulemakings (i.e., "Amendments to Material Control and Accounting Regulations" (Regulation Identification Number (RIN) 3150-AI61) and "Enhanced Security for Special Nuclear Material" (RIN 3150-AJ41)).

functions of the performance-based and prescriptive security and material control and accounting requirements. These alternative methods or approaches may include increased reliance on engineered systems that reduce reliance on operational requirements and staffing to meet the intent of the regulatory requirements. The question at hand is whether some type of generic regulatory action would be preferable to the case-by-case approach described in SECY-11-0184.

The NRC published preliminary draft guidance, "Non-Light Water Reactor Security Design Considerations," in the *Federal Register* (82 FR 13511, March 13, 2017), for comment. The staff developed the draft guidance in parallel with activities related to developing advanced reactor design criteria[5] to reflect the inclusion of security matters in the Advanced Reactor Policy Statement. Activities related to the security design considerations were suspended in order to focus on assessing potential changes to regulatory requirements related to physical security for advanced reactors. Initial interactions related to a possible rulemaking involved meetings on the Nuclear Energy Institute (NEI) white paper "Proposed Physical Security Requirements for Advanced Reactor Technologies," dated December 14, 2016 (ADAMS Accession No. ML17026A474). The white paper suggested high-level criteria for determining when an advanced reactor design would be a candidate for alternative security requirements. The paper includes the following observation about the perceived need to revise NRC regulations related to physical security for advanced reactors:

> The rule changes proposed herein would promote the establishment of a clear, predictable and stable licensing process for advanced reactor technologies, and avoid the inefficiency and uncertainty associated with achieving compliance through alternative measures, exemptions and license conditions. Absent a change to existing regulations, advanced reactor technologies will be subject to the existing physical security requirements delineated in § 73.55, which would impose an unnecessary regulatory burden on applicants and licensees. Compliance with § 73.55 requirements will diminish the cost competitiveness of advanced reactor technologies, thus hindering their development and deployment.

The staff's development of this Commission paper related to physical security is part of broader efforts to align regulatory requirements with the potential risks posed by advanced reactor designs. For example, SECY-15-0077, "Options for Emergency Preparedness for Small Modular Reactors and Other New Technologies," dated May 29, 2015 (ADAMS Accession No. ML15037A176), discusses changes to NRC requirements related to offsite emergency planning zones in light of potentially reduced consequences from advanced reactors following a loss of safety functions. In the SRM for SECY-15-0077, dated August 4, 2015 (ADAMS Accession No. ML15216A492), the Commission provided the following direction to the staff:

> The Commission has approved the staff's recommendation to initiate a rulemaking to revise regulations and guidance for emergency preparedness (EP) for small modular reactors (SMRs) and other new technologies, such as non-light-water reactors (non-LWRs) and medical isotope production facilities.

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5 Draft regulatory guide DG-1330, "Guidance for Developing Principal Design Criteria for Non-Light Water Reactors," dated February 3, 2017 (ADAMS Accession No. ML16301A307); subsequently issued on April 3, 2018, as Regulatory Guide 1.232 (ADAMS Accession No. ML17325A611).

The staff should keep the Commission's previous direction from the Staff Requirements Memorandum (SRM) for SECY-14-0038, “Performance-Based Framework for Nuclear Power Plant Emergency Preparedness Oversight,” in mind.

SRM-SECY-14-0038 stated “The staff should be vigilant in continuing to assess the NRC's emergency preparedness program and should not rule out the possibility of moving to a performance-based framework in the future. The Commission notes the potential benefit of a performance-based emergency preparedness regimen for small modular reactors.” This rulemaking provides an opportunity for the staff to further explore the pros and cons of a performance-based EP framework.

The staff subsequently provided to the Commission SECY-16-0069, “Rulemaking Plan on Emergency Preparedness for Small Modular Reactors and Other New Technologies,” dated May 31, 2016 (ADAMS Accession No. ML16020A388). The Commission approved the rulemaking plan in SRM-SECY-16-0069 dated June 22, 2016 (ADAMS Accession No. ML16174A166). The staff is likewise moving to performance-based approaches in other areas of licensing advanced reactor technologies, including current efforts to explore potential alternatives to physical security requirements.

DISCUSSION:

In the SRM, “Staff Requirements – Briefing on Small Modular Reactors, 9:00 a.m., Tuesday, March 29, 2011, Commissioners’ Conference Room, One White Flint North, Rockville, Maryland (Open to Public, Attendance),” dated April 14, 2011 (ADAMS Accession No. ML111040091), the Commission directed the staff to “think expansively about upcoming issues and to engage the Commission early if they are uncertain whether an issue is a matter of policy. Early engagement will allow the Commission to help staff narrow a range of options, if necessary, and prevent subsequent redirection.” Therefore, the staff is using this paper to request Commission approval to proceed with a rulemaking action to further assess and, if appropriate, pursue revising NRC regulations related to physical security requirements for advanced reactors.

The staff gained insights from previous interactions with stakeholders on this topic, including interactions related to the NEI white paper submitted in December 2016. Following several public meetings during which participants discussed the suggestions in the NEI paper, the NRC staff issued and made public “Draft White Paper on Potential Changes to Physical Security Requirements for Small Modular and Advanced Reactors,” in November 2017 (ADAMS Accession No. ML17333A524), for the purpose of supporting a public meeting held on December 13, 2017. The staff’s interactions with stakeholders resulted in identifying the following four options related to addressing physical security requirements for advanced reactors.

***Option 1***:

Option 1 is to maintain the status quo, with no changes to the current physical security regulations and no staff efforts to develop guidance to support requests for proposed alternatives or exemptions. Developers and subsequent applicants for operating licenses may propose innovative methods or approaches to providing security for advanced reactor designs.

The alternative methods or approaches may be requested in accordance with 10 CFR 73.55(r) with regard to alternative measures, or may take the form of exemptions from NRC regulations using provisions such as 10 CFR 73.5, "Specific Exemptions." Some efficiency gains over a purely case-by-case approach could be achieved if an advanced reactor developer or other entity submitted and had approved a topical report justifying specific alternative measures or exemptions for a specific design. An NRC-approved topical report provides a referenceable staff finding for license applications but does not constitute a final agency position with the related finality and backfit protections provided by a rulemaking.

The NRC has no ongoing reviews of license applications or preapplication submittals of topical reports for advanced reactors related to physical security and so the staff does not have a specific example of a proposed alternative or exemption.[6] However, based on stakeholder interactions related to the NEI white paper, the staff anticipates that applications would include proposed alternatives to or exemptions from the prescriptive requirements currently defined in 10 CFR 73.55 for the minimum number of armed responders and onsite secondary alarm stations. The staff would review and decide upon such proposed alternatives or exemption requests as part of each application or design-specific topical report. The staff notes that even if a rulemaking is pursued, an application or design-specific topical report would likely be submitted before completion of the rulemaking. In such cases, the staff would coordinate and, as necessary, prioritize the related activities.

*Advantages:* Agency resources would not be spent on a rulemaking and developing the related guidance documents within the current planning horizon. A rulemaking intended to address multiple non-LWR technologies could be complex. The staff could use existing guidance and procedures, to the extent applicable, to evaluate potential future applications for proposed alternatives or exemptions. The staff has experience applying these procedures and guidance to assess the physical security needed to protect large LWRs from the DBT for radiological sabotage. The staff may be better able to identify and assess potential changes to physical security regulations for advanced reactors following the review of an initial application for a license, certification, or approval for such a design.

*Disadvantages:* Addressing physical security for advanced reactors on a case-by-case basis does not reduce the regulatory uncertainties the staff and some stakeholders identified to support the Commission's goal for security issues to be addressed early in the design stage to achieve a more robust and effective security posture for future nuclear power reactors. These uncertainties complicate the ability of reactor developers and potential applicants to make design and business decisions as they assess potential design features and programmatic measures to prevent or mitigate various events, including attempts of radiological sabotage. Additionally, the NRC has traditionally attempted to avoid regulating by exemption when an issue can be addressed through a generic action such as rulemaking. Case-by-case decisionmaking may not support the goals for (1) efficiency and clarity described in the Principles of Good Regulation; (2) consideration of safety and security in the early stages of design as stated in the Policy Statement on the Regulation of Advanced Reactors; and (3) timely resolution of policy issues as discussed in more recent documents defining vision, strategies, and implementation action plans for non-LWR regulatory readiness.

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[6] Interactions between the staff and Babcock and Wilcox Nuclear Energy related to security approaches for the mPower Reactor design were suspended before the staff completed reviews of several reports submitted during preapplication activities.

Some stakeholders, namely the Union of Concerned Scientists (UCS), and some NRC staff favor Option 1, as discussed in public meetings on May 3, 2017, and December 13, 2017. UCS questioned whether or when applications for advanced reactors would be submitted and noted that uncertainties exist with regard to the presumed attributes of advanced reactor technologies, i.e., how plants will respond to losses of safety functions. The NRC staff favoring this option do not see a case-by-case review process for advanced reactor designs as a barrier to efficiently addressing potentially innovative security approaches.

***Option 2***:

Option 2 does not involve changes to NRC regulations; instead, the staff would prepare guidance for processing requests for proposed alternatives or exemptions related to physical security requirements for advanced reactors. Alternatively, the staff could review and approve guidance prepared by advanced reactor developers or other parties (e.g., a generic topical report or industry guidance document endorsed in a regulatory guide). In the absence of an industry-generated guidance document, the staff could interact with stakeholders to develop and issue a standalone guidance document. Applicants for licenses could propose alternatives in accordance with 10 CFR 73.55(r) or request exemptions from NRC regulations using provisions such as 10 CFR 73.5. Such submittals and the related NRC reviews would be supported by NRC-issued guidance as either endorsement of industry documents or an NRC standalone document.

The staff expects that an important part of the guidance would involve developing performance criteria for applying alternative physical security requirements that are associated with attributes of reactor designs (e.g., potential accident consequences and timelines). In addition, the staff could prepare technical guidance on methods or approaches acceptable for design of physical security systems. An example of technical guidance for designers and potential license applicants is NUREG/CR-7201, “Characterizing Explosive Effects on Underground Structures” (ADAMS Accession No. ML15245A640), which might be useful for designs of advanced reactors that would be located underground. The staff has identified several topics during recent interactions with stakeholders that may also warrant investigating and developing technical guidance for advanced reactors. These topics include the possible use of remotely operated weapon systems, the application of vulnerability assessment tools, and the location of secondary alarm stations. The staff would leverage already developed standards and guidance that are available from the Department of Energy, Department of Defense, and other Federal agencies; available security industry best practices; and interactions with stakeholders to identify and develop technical guidance documents.

*Advantages:* The agency would save some resources in comparison to undertaking a rulemaking and preparing related guidance documents. The staff would consider applications for proposed alternatives or exemptions using existing procedures and the newly issued guidance documents. The guidance documents and possible review of generic submittals for a design or class of designs would reduce regulatory uncertainties. The NRC process for preparing and issuing guidance documents includes the opportunity for public engagement on the issues related to physical security for advanced reactors.

*Disadvantages:* This option only partially addresses the regulatory uncertainties identified by the staff and some stakeholders. This option would require a signicant fraction of the resources

associated with a rulemaking to prepare guidance documents, but would not provide the same degree of certainty or finality of agency decisions that are provided by a rulemaking. This option also promotes using exemptions from existing regulations rather than establishing requirements that are more commensurate with the risks posed by advanced reactors. Proceeding with guidance rather than a rulemaking would ultimately still require case-by-case decisionmaking, which raises concerns about consistency, clarity, and predictability of the NRC regulatory process.

None of the stakeholders expressing views during interactions with the staff preferred Option 2. However, the option was recognized as a possible compromise between those preferring no action and those preferring a rulemaking.

***Option 3***:

Option 3 is a limited-scope rulemaking that retains the current overall framework for security requirements but provides alternatives for advanced reactors to specific regulations and guidance related to physical security. The staff would interact with stakeholders to identify specific requirements within existing regulations that would play a diminished role in providing physical security for advanced reactors while at the same time contributing significantly to reduced capital and/or operating costs. For example, design attributes of advanced reactors may justify less reliance on human actions such as those provided by armed responders during attempts to sabotage a plant. The NEI white paper describes the most likely focus of this option and suggests an assessment and associated criteria for an alternative to the prescribed minimum number of armed responders currently defined in 10 CFR 73.55(k)."[7] Alternative requirements could eliminate the need for armed responders, as currently defined in the regulations, or could establish a performance-based approach for determining an appropriate number of armed responders. NEI conducted a survey of its members and estimates the current requirement adds at least $5 million per year to the operating costs of a nuclear power plant (ADAMS Accession No. ML18134A300). Additional savings could be realized in areas such as training programs, weapons, and administrative costs. A more detailed estimate of potential benefits and costs would be developed as part of preparing the regulatory basis for a proposed rule.

The staff believes it is reasonable to consider incorporating alternatives for some physical security requirements into the NRC's regulations to address advanced reactor designs and their associated design features (e.g., smaller cores or passive safety systems). The advanced reactor designs are expected to include attributes that result in smaller and slower releases of

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[7] The NEI white paper includes performance-based criteria for determining the applicability of alternative security requirements for a specific design or facility. A criterion suggested in the white paper involves delayed radiological consequences such that offsite resources could address the security event and the potential loss of safety functions resulting from the DBT. The NEI white paper notes that this criterion is related to an ongoing staff activity assessing physical security requirements for operating reactors, and in particular the potential role of crediting Federal, State, or local law enforcement response to establish coping times (see SRM-SECY-16-0073, "Options and Recommendations for the Force-on-Force Inspection Program in Response to SRM-SECY-14-0088," dated October 5, 2016 (ADAMS Accession No. ML16279A345), and SECY-17-0100, "Security Baseline Inspection Program Assessment Results and Recommendations for Program Efficiencies," dated October 4, 2017 (ADAMS Accession No. ML17240A360).

fission products following a loss of safety functions from malfunctions or malicious acts.[8] The staff anticipates that the specific requirements and alternatives in a "limited-scope" rulemaking would result from assessments and interactions with stakeholders during the rulemaking process. As noted above, representatives from the industry have indicated that their evaluations have identified requirements related to the minimum number of armed responders as the most likely candidate for developing alternative requirements. Another potential candidate identified by stakeholders relates to the prescriptive requirements defined in 10 CFR 73.55 for onsite secondary alarm stations. In addition to the rulemaking to provide alternatives to identified regulatory requirements for advanced reactors, the staff would develop guidance for applicants. The staff expects that the level of effort to prepare guidance supporting the rulemaking would be comparable to that needed for Option 2.

The staff would use the rulemaking plan provided as an enclosure to this paper if the limited-scope option is approved by the Commission. The enclosed rulemaking plan was developed in accordance with SRM-SECY-15-0129, "Commission Involvement in Early Stages of Rulemaking," dated February 3, 2016 (ADAMS Accession No. ML16034A441).

The staff notes that even if a rulemaking is pursued, an application or design-specific topical report could be submitted before completion of the rulemaking. In such cases, the staff would coordinate and, as necessary, prioritize the related activities.

*Advantages:* The advantages of pursuing a limited-scope rulemaking related to physical security for advanced reactors are similar to those described for changes to regulatory requirements for emergency planning zones in SECY-16-0069. Changes to a limited scope of requirements related to physical security for advanced reactors would (1) promote regulatory stability, predictability, and clarity, (2) eliminate the need for future applicants to propose alternatives or request exemptions from physical security requirements, (3) recognize technology advancements and design features associated with the NRC-recommended attributes of advanced reactors, and (4) replace prescriptive regulations with risk-informed, performance-based requirements. The rulemaking process includes the greatest opportunity for public engagement on the issues related to physical security for advanced reactors. Public notice and comment during rulemaking would provide the widest range of viewpoints for Commission consideration in the development of the proposed rule.

*Disadvantages:* This option requires rulemaking and the creation of new guidance for the revised physical security requirements for advanced reactors, which would require resource expenditures. The range of possible advanced reactor technologies and sizes introduces the possibility of requests for exemptions or proposed alternatives to physical security requirements beyond those addressed by a limited-scope rulemaking.

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[8] The fuel forms, coolants, and other attributes of non-LWRs may result in plant damage states different from LWRs and may require use of different surrogate measures related to potential releases of radioactive material. For example, 10 CFR 73.55(b) states that "(3) The physical protection program must be designed to prevent significant core damage and spent fuel sabotage," and specific requirements also refer to core damage. The development of requirements and guidance for non-LWRs, including for physical security, may include defining or adopting alternative surrogate measures or consequence measures related to offsite releases.

During interactions with the NRC staff, NEI, NuScale Power, and the Tennessee Valley Authority identified Option 3 as their preferred option. The stakeholders favoring this option cite the goal of reducing regulatory uncertainties and providing a process for reactor developers to incorporate security into designs to reduce reliance on human actions.

The NRC staff recommends Option 3.[9] Option 3 best meets the goals for timely resolution of policy issues defined in "NRC Vision and Strategy: Safely Achieving Effective and Efficient Non-Light Water Reactor Mission Readiness." Option 3 also promotes (1) consideration of safety and security in the early stages of design as recommended in agency policies related to advanced reactors; (2) risk-informed, performance-based regulations commensurate with the risks posed by advanced reactor designs; and (3) efficiency and clarity as described in the Principles of Good Regulation. A rulemaking would allow for a consequence-based approach to physical security for advanced reactors, consistent with the approach to emergency preparedness described in SECY-16-0069. Enclosure 2 provides resources for this option, and thus is "Official Use Only – Sensitive Internal Information".

***Option 4***:

Option 4 involves a broad-scope rulemaking to assess and define physical security requirements for advanced reactor designs. The staff envisions a performance-based approach with physical security requirements defined in terms of advanced reactor attributes and design features, including inherent design characteristics, to address the variety of technologies and designs being contemplated. This option might also include threat assessments to determine whether different DBTs may be warranted for advanced reactors. The NRC would interact with stakeholders and consult with experts on both security and advanced reactors to identify possible performance-based requirements. The anticipated range of possible designs—many currently at the conceptual design stage—and broad consideration of security requirements (e.g., capabilities to detect, assess, interdict, and neutralize) would complicate evaluating and developing a new set of security regulations for advanced reactors. While, theoretically, this option would best integrate security considerations into the reactor design process (with respect to all four options), the level of effort for Option 4 would be significant, and it is doubtful such an activity would be completed in time to help current reactor developers make critical design decisions. The research and rule development would likely take 8 years or longer to complete. The staff estimates the level of effort for this activity would likely be comparable to major rulemakings such as the activities related to issuing the 2011 final emergency preparedness rule.

*Advantages:* This option would best integrate performance-based security requirements into the processes for developing advanced reactor plant designs. Option 4 would provide developers with the flexibility associated with risk-informed, performance-based approaches and incorporate the best available knowledge from research and experience into the regulations as described in the Principles of Good Regulation.

*Disadvantages:* This option would require significant resources and would be unlikely to support current reactor developers that need to make critical design decisions.

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[9] As previously noted, some NRC staff members preferred recommending options other than rulemaking.

No stakeholders supported this option during interactions with the staff. The staff will prepare a rulemaking plan for Option 4 if directed to do so by the Commission.

COMMITMENT:

If the Commission approves initiation of the rulemaking, the staff would add the rule to the Common Prioritization of Rulemaking during the next budget formulation cycle and initiate the rulemaking effort described in the enclosed rulemaking plan.

RECOMMENDATION:

The staff recommends that the Commission approve Option 3, which consists of a limited-scope revision of regulations and guidance related to physical security for advanced reactors, and the enclosed rulemaking plan.

COORDINATION:

The Office of the General Counsel has reviewed this paper and has no legal objection. The Office of the Chief Financial Officer has reviewed this paper for resource implications and has no objection.

***/RA/***

Margaret M. Doane
Executive Director
for Operations

Enclosures:
1. Rulemaking Plan
2. Rulemaking Plan Resources (OUO-SII)

OPTIONS AND RECOMMENDATION FOR PHYSICAL SECURITY FOR ADVANCED REACTORS DATED AUGUST 1, 2018.

**ADAMS Accession No.**: ML18170A051 *Via e-mail SECY-012

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