POLICY ISSUE

(Notation Vote)

April 4, 2014 SECY-14-0038

FOR: The Commissioners

FROM: Mark A. Satorius
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SUBJECT: PERFORMANCE-BASED FRAMEWORK FOR NUCLEAR POWER PLANT EMERGENCY PREPAREDNESS OVERSIGHT

PURPOSE:

This paper presents results of the U.S. Nuclear Regulatory Commission (NRC) staff study of the potential to enhance the oversight of nuclear power plant emergency preparedness (EP) programs. The staff began exploring methods to enhance oversight in SECY-06-0200, "Results of the Review of Emergency Preparedness Regulations and Guidance," dated September 20, 2006 (see Agencywide Documents Access and Management System (ADAMS) Accession No. ML061910707). As part of implementing the agency EP program, the staff continually collects and evaluates oversight insights and makes EP programmatic improvements when practicable and consistent with regulations. This paper presents additional options for the Commission's consideration. The staff committed to develop this SECY paper for Commission consideration (WITS 200700042). There are no outstanding commitments related to this action and no new commitments are proposed in this paper.

SUMMARY:

A systematic review and revision of EP requirements to employ a more performance-based oversight regimen (regulation, inspection, and enforcement) has the potential to enhance many aspects of emergency response and oversight. A performance-based oversight regimen could simplify EP regulations and focus inspection more fully on response-related performance rather than the current focus on plan maintenance and compliance. However, displacement of higher

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priority work in EP would be required to fully develop and implement such an approach. Options presented in this paper include proceeding to rulemaking to implement a performance-based EP oversight regimen or applying the insights gained during this study to the current regimen.

Although the proposed regimen could enhance EP oversight, the staff recognizes that existing programs provide reasonable assurance of protection of public health and safety; therefore, the staff recommends maintaining the current EP regimen.

BACKGROUND:

In SECY-06-0200, "Results of the Review of Emergency Preparedness Regulations and Guidance," the staff presented a conceptual outline for enhancing EP oversight through performance-based measures. In a Staff Requirements Memorandum (SRM) to SECY-06-0200, dated January 8, 2007 (ADAMS Accession No. ML070080411), the Commission approved the staff's request to further explore the potential for a performance-based oversight regimen. The staff developed a more detailed description of a performance-based EP oversight regimen for the onsite program and presented it at a public meeting conducted on March 5, 2008 (see ADAMS Accession No. ML080940393 for a meeting summary).

In the September 11, 2008, SRM to COMDEK-08-0005, "FY 2010 NRC Performance Budget Proposal," the Commission provided further direction and funding related to this effort. The SRM directed the staff to:

> ...support the development of a performance-based approach to emergency preparedness. These resources would be utilized to work with local communities and the Department of Homeland Security to begin the next major EP enhancement of working to quantify the protection that emergency preparedness plans and procedures should result in and codify them in regulations that are transparent, objective, and measurable.

DISCUSSION:

Nuclear power plant EP provides a layer of defense-in-depth that complements reactor and spent fuel safety efforts. NRC-approved EP programs provide the capability to identify emergency conditions, assess radiological impact, communicate protective action recommendations, and mitigate the event. Offsite response organizations' (ORO) EP programs provide the capability to alert and notify the public, implement protective actions and independently assess radiological conditions to protect public health and safety. The NRC regulates licensee programs and the Federal Emergency Management Agency (FEMA) evaluates ORO programs but does not have a regulatory role.

The NRC's deterministic EP regulations that require these programs were developed and issued as a final rule in 1980, 18 months after the Three Mile Island accident. This regulatory structure requires that site-specific emergency plans be developed and maintained in compliance with 16 planning standards and supporting regulatory guidance. This structure does not provide requirements for response outcomes, but rather regulations and guidance for an organization that can respond. Exercises are required to demonstrate response capability and critiques are required to address weaknesses. This regimen provides for reasonable assurance that protective actions can and will be taken should the need arise. The NRC and FEMA issued the first major revision to the EP regulations in November 2011, but the underlying 1980 regulatory approach remains. Additionally, some response elements such as event assessment and mitigation capability are not directly addressed in the regulations. The staff believes it is appropriate to examine the potential to enhance EP oversight through performance-based oversight concepts that focus oversight on licensee and ORO response to simulated accident scenarios.

The staff conducted three studies to explore performance-based EP regulatory approaches consistent with the 2007 and 2008 Commission direction:

1. NUREG/CR-7160, "Emergency Preparedness Significance Quantification Process: Proof of Concept" (ADAMS Accession No. ML13164A285). This study accomplished two objectives: (1) quantify the protection provided by a compliant EP program; and (2) determine the relative significance of program elements. The study evaluated a suite of event scenarios to assess the protection provided by current EP programs. The site-specific evacuation time estimate, population, source term and protective action strategy were modeled using the MELCOR Accident Consequence Code System (MACCS) as was done in NUREG-1935, "State-of-the-Art Reactor Consequence Analysis (SOARCA) Report" (ADAMS Accession No. ML12332A057), and the "Draft Report, Consequence Study of a Beyond-Design-Basis Earthquake Affecting the Spent Fuel Pool for a U.S. Mark I Boiling Water Reactor" (ADAMS Accession No. ML13133A132). Two fully compliant nuclear power plant EP programs were modeled as previously demonstrated in biennial exercises. The staff then modeled the response to the same accidents that could be expected from "all hazards" emergency response programs as generally found nation-wide in communities that do not support nuclear plant programs. The projected population dose difference between the two modeled response programs represents the quantitative protection afforded by nuclear power plant EP programs for the event scenarios selected.

   This process can quantify the significance of specific EP program elements for regulatory oversight purposes. The study was a "proof of concept" effort and is not a finished regulatory tool, nor would it be sufficient by itself to determine compliance. Further analysis of appropriate event scenarios would be necessary prior to use of the concept as a regulatory tool. It is thought possible to develop generic accident source terms appropriate for each reactor type and then develop site-specific MACCS models in order to support a performance-based oversight regimen. The site-specific MACCS models would have to be maintained to update changes in evacuation time estimates, population

data, and weather data. A site-specific emergency response model would then be used in a manner similar to the way the Standardized Plant Analysis Risk (SPAR) model is used in the reactor oversight process significance determination process.

2. NUREG/CR-7154, "Risk Informing Emergency Preparedness: Evaluation of Emergency Action Levels: A Pilot Study of Peach Bottom, Surry and Sequoyah" (ADAMS Accession No. ML13031A500). The NRC Office of Nuclear Security and Incident Response and the Office of Nuclear Regulatory Research staff used the plant-specific SPAR models to evaluate the risk implications of emergency action levels (EALs). The conditional core damage probability (CCDP) was determined for each EAL evaluated and then compared to other EALs within its corresponding emergency classification level (i.e., Notification of Unusual Event, Alert, Site Area Emergency, or General Emergency). The study analyzed three plant-specific approved EAL schemes. The SPAR models were used to evaluate equipment malfunction-related EALs (approximately 25 percent of the EAL set). This was the first effort to use quantified probabilistic risk analysis to evaluate EALs. This study showed that, in general, increasing emergency classification levels indicated a higher risk as measured by CCDP. However, inconsistencies were identified in the emergency classification ranking of some EALs. Revision 6 to Nuclear Energy Institute 99-01, "Methodology for Development of Emergency Action Levels" (ADAMS Accession No. ML110240324) was informed by the study. This document, issued in November 2012, included the addition of a General Emergency EAL for immediate loss of alternating current and direct current power and the removal or downgrade of several EALs that showed a very low CCDP. It should be noted that the need for this General Emergency EAL was first identified in the SOARCA Report and this study verified that need.

3. "Risk-Informed Performance-Based Radiological Emergency Response Program Oversight" (ADAMS Accession No. ML13274A531). The staff coordinated with FEMA to conduct a study of the potential to use performance-based methods for evaluation of ORO programs. The study identified the most risk-significant elements of ORO programs based on a qualitative assessment of their contribution to ensuring adequate protection of public health and safety during the plume release phase of a radiological event and proposed performance-based evaluation methods. While FEMA evaluation of OROs differs from licensee inspection, both can assess performance to determine if a high level of EP exists. The study will be provided to FEMA.

The staff recognized it may be possible to apply the regulatory insights gained from these studies to the development of EP regulations for small modular reactors. SECY-11-0152, "Development of an Emergency Planning and Preparedness Framework for Small Modular Reactors," presents the staff efforts and plans in the small modular reactor EP area. The staff has been engaging stakeholders on these matters, and will engage the Commission as efforts mature.

The staff engaged FEMA staff during the effort to explore a more performance-based oversight regimen and FEMA was significantly involved with the scope of work for the performance-based ORO oversight study. The staff provided a draft of the SECY paper to FEMA in consideration of the two agencies' shared responsibilities. Applied research from the effort was presented at the 2013 International Topical Meeting on Probabilistic Safety Assessment Conference in Columbia, South Carolina, and at the 2013 American Nuclear Society Winter Meeting in Washington, DC. In addition, the staff discussed the effort at the Nuclear Energy Institute November 2013 EP Working Group meeting. Communication of regulatory adequacy to the public may be improved through the use of more easily understood language.

Staff plans, as a knowledge management activity, to review the efforts that went into the NUREG studies to capture and document staff observations for potential performance-based conceptual approaches. For example, a regulatory structure could be conceived in which most aspects of oversight are accomplished through required performance demonstrations in response to specified initiating events and periodic submission of a limited number of program elements for approval. The most risk-significant aspects of EP (for example, classification, notification, protective action recommendation, mitigation, and ORO protective action decision making) would be the drivers for the oversight of the performance demonstrations. Inspection would consist of observation of drill and exercise critiques, review of performance indicator data, review of corrective actions, and periodic approval of specific program elements.

OPTIONS:

The staff concluded, based in part on the studies described in this paper, that a new performance-based EP oversight regimen could be developed and codified. The staff developed a method to quantify the protection provided by EP programs, and the staff worked with FEMA to explore enhancement of the EP regulatory regimen. However, the staff's assessment is that there are difficulties in moving beyond a conceptual stage. This paper presents two options for Commission consideration.

1. Proceed to rulemaking

   The staff's study of performance-based oversight methods identified potential regulatory changes for consideration. The advantages to rulemaking include the potential to enhance oversight by focusing licensee, ORO, and regulatory efforts on response outcomes in areas that are the most risk significant. It is likely that licensee and ORO flexibility would be increased because response solutions that maintain a high level of EP would be acceptable if demonstrated in an inspected drill or exercise.

   There are, however, considerable disadvantages to the rulemaking option. A rulemaking necessary to fully develop and implement the performance-based EP regulatory regimen would be lengthy and controversial. Significant unbudgeted full-time equivalent staff and contract support would be necessary. The process could take more than 5 years to complete when resources are dedicated and, as the existing regulations are adequate, the rulemaking would not be of high priority. A reasonable implementation period would

also be necessary to ensure consistent licensee compliance. Should this option be chosen, the staff would need to consider any EP-related rulemaking in response to the recommendations of the Near-Term Task Force (NTTF) in establishing a rulemaking schedule. A NTTF EP-related rulemaking effort is scheduled to begin in 2016. The staff does not recommend adding these concepts to that rulemaking, because they would complicate and delay that effort.

Most importantly, the staff believes that proceeding to rulemaking would divert NRC, FEMA, ORO, and industry effort away from current high-priority work in EP such as: implementation of the November 2011 revision to the EP regulations; revision of NUREG-0654, "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants" (ADAMS Accession No. ML12339A625); implementation of Supplement 3 to NUREG-0654, "Guidance for Protective Action Strategies" (ADAMS Accession No. ML113010596); implementation of the recommendations of the NTTF; and developing guidance for EP programs at decommissioning reactors. Further, the proposed regimen may not result in long-term resource savings for licensees, OROs, FEMA, or the NRC. Initial input from licensee, ORO and FEMA stakeholders is quite negative regarding the wholesale revision of the EP regulatory regimen because current EP programs are stable and continue to provide reasonable assurance of public health and safety.

2. Continue to apply insights to the current regulatory regimen

The staff would not conduct any further systematic exploration of a revised EP oversight regimen, but would use insights to improve the existing program where practical. The advantages to this option include maintenance of regulatory stability for a program that is currently adequate and there would be no need for additional resources. The work completed to date has already been used to enhance EAL guidance through the insights of NUREG/CR-7154, and the concepts developed in the study "Risk-Informed Performance-Based Radiological Emergency Response Program Oversight" may provide insights for the FEMA evaluation program. The quantification technique developed in NUREG/CR-7160 may provide insights to the current EP significance determination process. Most importantly, this option would allow the staff to focus on higher priority work currently underway as mentioned above.

The disadvantages to this option include maintaining regulatory focus on emergency plan maintenance rather than response outcomes. The current regulations were rapidly developed in 1980 and the regimen has not been substantially updated since, although improvements have been made. Portions of the regulations minimally impact response capability and some areas, such as demonstration of mitigation capability, are not directly addressed. Implementation of the performance-based regimen would have allowed streamlining, clarification and focus on regulatory elements that enhance response.

RECOMMENDATION:

The staff recommends Option 2. Although the performance-based regimen could enhance EP oversight, it would require the commitment of resources that would be better used to resolve higher priority issues. Given the recent changes in EP regulations and guidance, rulemaking would detract from regulatory stability. Additionally, the existing regulatory oversight program provides reasonable assurance that public health and safety can be protected. FEMA staff reviewed this paper and agrees with this recommendation.

RESOURCES:

The resource implications associated with each option are addressed in the Enclosure, which is not publicly available.

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 and has no objection.

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Enclosure:
Resources for Options (Non-public)