POLICY ISSUE
NOTATION VOTE

June 9, 2011 SECY-11-0076

FOR: The Commissioners

FROM: R. W. Borchardt
Executive Director for Operations

SUBJECT: IMPROVING THE PUBLIC RADIATION SAFETY CORNERSTONE OF THE REACTOR OVERSIGHT PROCESS

PURPOSE:

To obtain Commission approval of a staff proposal to enhance performance assessment tools within the Public Radiation Safety cornerstone of the Reactor Oversight Process (ROP) to emphasize defense in depth in preventing, detecting and mitigating groundwater contamination. This proposal would involve obtaining input from internal and external stakeholders to ensure that enhancements to ROP tools are guided by the founding principles of the ROP, consistent with Commission policy.

SUMMARY:

Based on the calendar year (CY) 2010 ROP self-assessment and concerns expressed by both internal and external stakeholders, the staff perceives an opportunity to enhance the ROP in the Public Radiation Safety cornerstone. The existing ROP tools focus on the potential public dose impacts of leaks. The defense-in-depth concept is applied by setting limits for the Performance Indicator (PI), in the Public Radiation Safety cornerstone, below the NRC's annual as low as reasonably achievable (ALARA) design objectives. The industry has implemented initiatives to emphasize prevention, detection and mitigation of groundwater contamination and the staff has identified an opportunity to use these initiatives to further enhance the defense-in-depth concept in the Public Radiation Safety cornerstone. The staff recommends the Commission endorse its efforts to enhance ROP tools by leveraging these ongoing voluntary initiatives, resulting in more consistent and reliable regulatory outcomes that further emphasize the defense-in-depth

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approach in protecting public health and safety. With the Commission's approval, the staff is committed to work with internal and external stakeholders to ensure that enhancements are guided by the founding principles of the ROP, consistent with Commission policy. The staff believes that the recommended activities can be accomplished within the current budget request.

BACKGROUND:

Before adopting the ROP, the U.S. Nuclear Regulatory Commission (NRC) staff relied heavily on the enforcement of regulatory requirements as an input into its assessment of licensee performance. In addition, the staff used other, more subjective and less transparent, indicators of performance to supplement the enforcement history of individual licensees.

When developing the ROP, the staff recognized that the reactors were designed and built in accordance with the concept of defense-in-depth with redundant, diverse means to protect critical barriers to radiological release. The staff further acknowledged that enforcement actions were not necessarily informed by the availability of other required structures, systems, and components (SSCs); mitigation strategies reflected in station operating procedures; and operator actions that could be taken to reduce the impact to safety. As such, enforcement actions could be misleading indicators of the actual safety significance of licensee performance issues. The staff concluded that its compliance-based approach to performance assessment did not always achieve outcomes that improved safety. In fact, enforcement actions might be taken even in cases where there was a marginal impact on safety.

In public workshops and correspondence that took place while the NRC was developing the ROP, the industry pointed out that many aspects of performance at all sites not only meet, but often exceed, the minimum regulatory requirements. Although exceeding requirements in one area does not justify a failure to meet them in another area, it does provide insight into overall, integrated plant risk and serves as one indicator of plant performance.

Consistent with a desire to have objective and transparent inputs into the assessment process, the industry proposed that the NRC base the ROP on PIs, some of which were linked to regulatory requirements. For PIs linked to regulatory requirements, thresholds were set well below the requirements. Examples include Reactor Coolant System (RCS) Specific Activity, RCS Identified Leak Rate, and Radiological Effluent Occurrence. Other PIs were based on performance attributes that the regulation did not address but that the industry and the staff considered to be valid, objective measures of safety performance; examples include Unplanned Scrams per 7,000 Critical Hours, Unplanned Power Changes per 7,000 Critical Hours, and Unplanned Scrams with Complications. The staff agreed to adopt PIs as one of the two major inputs to the ROP's performance assessment process and regulatory response as determined by the ROP Action Matrix.

The other major input to the performance assessment process involves NRC inspection findings, which represent performance deficiencies with more-than-minor significance. Because of the ROP's emphasis on safety as opposed to mere compliance, inspection findings are not always tied to regulatory requirements. The significance of an inspection finding is based on probabilistic risk insights (where possible) and qualitative (deterministic) methods that result in a significance characterization commensurate with the finding's impact to safety. Therefore, a performance deficiency does not need to involve a violation of regulatory requirements to

prompt the NRC's regulatory response to performance issues, consistent with the ROP Action Matrix.

The NRC seeks to achieve continuous improvement of the ROP through the ROP self-assessment process, which provides a systematic approach to evaluating the overall effectiveness of the ROP in meeting pre-established goals and intended outcomes. This ROP self-assessment process also reveals improvement opportunities. As part of the ROP self-assessment process, the NRC staff has continuously sought opportunities to refine existing PIs and explore potential new PIs for ROP implementation. The staff furthered this ongoing effort by preparing an NRC staff white paper, "A Comparison of International and US Nuclear Industry Performance Indicators to the Current ROP Performance Indicator Program," issued November 2009 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML093490170). The white paper considered the potential applicability of candidate PIs for ROP purposes. The staff shared the white paper with internal and external stakeholders in an effort to initiate dialogue and solicit insights, feedback, and suggestions on the value and viability of candidate PIs.

On April 21, 2010, the NRC held a Category 2 public meeting to discuss a framework for considering new PIs. The initial approach focused on potential new PIs that would supplement the existing suite of indicators. However, after the meeting, the NRC and industry agreed that a well-defined problem statement should be crafted to guide efforts and focus resources in an efficient manner. The NRC agreed to perform a gap analysis, with the goal of revealing potential areas of the ROP that warrant consideration of new or revised inspection tools or PIs. On December 28, 2010, the staff issued a draft report, "Gap Analysis of the Reactor Oversight Process (ROP)" (ADAMS Accession No. ML103620319), and solicited comments from internal and external stakeholders. The staff incorporated comments to the extent practicable and completed a final version of the analysis on April 8, 2011, (ADAMS Accession No. ML110810078). In its gap analysis, the staff identified an opportunity to enhance ROP tools within the Public Radiation Safety cornerstone.

In SECY-11-0054, "Reactor Oversight Process Self-Assessment for Calendar Year 2010," dated April 8, 2011, (ADAMS Accession No. ML110550749), the staff indicated that the NRC could leverage the ROP to affirm licensee efforts to ensure the protection of public health and safety through the implementation of industry initiatives. In the spirit of continuous improvement, the staff contemplated changes to or the development of ROP tools (e.g., inspection guidance, significance determination process (SDP), PIs) to consider industry activities and performance in meeting voluntary commitments to industry initiatives. Because such changes involve matters of policy, the staff committed to request Commission policy direction on possible changes to the ROP in the Public Radiation Safety cornerstone. This paper responds to that commitment.

DISCUSSION:

The Public Radiation Safety cornerstone of the ROP addresses licensee activities to protect the public from exposure to radioactive material released into the public domain from routine civilian nuclear reactor operations.

Recent Events

In recent years, concerns over groundwater contamination caused by leaks from degraded system components and structures have increased significantly, and the Public Radiation Safety cornerstone has attracted stakeholder attention and scrutiny. Leaks and unplanned releases of radioactive liquid have resulted in groundwater contamination, even though none of the leaks, based on available records (ADAMS Accession No. ML101270439), has posed a hazard to human health. Recent activities, listed below, collectively indicate that the ROP's ability to address licensee performance in monitoring and controlling releases to groundwater could be enhanced.

Action Matrix Deviations—The NRC has approved two Action Matrix deviations, in part because of groundwater contaminations: Vermont Yankee in 2010 (ADAMS Accession No. ML100960321) and Indian Point from 2005 to 2009 (ADAMS Accession No. ML083590057).

When tritium was identified from a groundwater monitoring well at Vermont Yankee in 2010, the licensee developed a plan to identify, mitigate, characterize, and remediate the source of contamination. Later, the NRC issued a Demand for Information regarding certain employees who might have provided misleading information to the State of Vermont about underground piping at Vermont Yankee. To respond to these two issues, and the level of interest and concerns expressed by stakeholders, the NRC staff applied additional inspection resources to Vermont Yankee. This deviation will remain in effect pending further inspection within the planned baseline activities to ascertain if Vermont Yankee's station procedures and modeling of groundwater movement are sufficient to monitor remediation of the existing groundwater contamination plume.

The NRC applied additional inspection resources for Indian Point in 2005, and the deviation was renewed in CY 2006, CY 2007, and CY 2008. The deviation was initiated, in part, because radionuclides (tritium, nickel-63, cesium-137, strontium-90, and cobalt-60) were detected in an on-site test well and attributed to leakage from the Unit2 spent fuel pool. The deviation was warranted to monitor the licensee's efforts to evaluate and correct the leakage. The deviation was renewed three times, in part to ensure that the licensee met the exit criteria of the deviation, which included resolution of groundwater remediation efforts and establishing a long-term program for monitoring groundwater contamination.

Groundwater Task Force (GTF)— The GTF acknowledged that the leakage of radioactive material, regardless of the hazard to individuals, is of significant public interest. The GTF observed that, although systems are designed to confine radioactive material, the NRC's regulations do not explicitly prohibit leakage. In public meetings, stakeholders expressed to the GTF a desire for NRC to proactively ensure licensees prevent spills and leaks rather than react to contamination events after they have occurred and been detected. In its final report in June 2010 (ADAMS Accession No. ML101680435), the GTF further observed that the NRC's response to incidents varied widely, noting that the agency took no action for some contamination incidents, but for others it increased inspection resources in various ways, including the Vermont Yankee and Indian Point deviations discussed in the preceding paragraphs. The GTF concluded that the NRC's response to contamination incidents could be enhanced to be more consistent and reliable. The GTF report states that the current radiological effluent PI does not address leaks or spills per se and suggests that "An effective PI for groundwater protection would change as a function of the number, quantity, and type(s) of

radionuclide, and/or locations of leaks/spills for groundwater protection." The Senior Management Review Group did not evaluate an associated recommendation to revise the current ROP guidance governing the effluent PI and a related baseline inspection procedure (ADAMS Accession No. ML110050525), deferring to the CY 2010 ROP self-assessment.

The GTF also noted that some stakeholders view radiological releases as a public health issue, whereas the NRC's regulatory focus is on risk as defined by dose to individuals. By focusing on risk, the NRC is not always prompt, effective, and clear in communicating its assessment of and response to leaks and unplanned releases to the environment. This has led some stakeholders to question the agency's actions to date and whether those actions were adequate.

Industry Initiatives—In response to leakage and groundwater contamination incidents, the nuclear industry developed three initiatives to address stakeholder concerns.

The first initiative is Nuclear Energy Institute (NEI) 07-07, "Industry Ground Water Protection Initiative—Final Guidance Document," issued August 2007 (ADAMS Accession No. ML072600295). This document was developed to provide guidance on improving utilities' management of, and response to, instances in which the inadvertent release of radioactive substances may result in low but detectible levels of radioactive materials in subsurface soils and water. The guidance set by NEI 07-07 addresses situations in which tritium concentrations are below the NRC limits and design objectives.

The second industry initiative is the Buried Piping Integrity Initiative, dated November 20, 2009 (ADAMS Accession No. ML093350032), and later superseded by the third industry initiative, the Underground Piping and Tanks Integrity Initiative, dated September 27, 2010, (ADAMS Accession No. ML103410507). The Underground Piping and Tanks Integrity Initiative targets the prevention of leaks by improving the maintenance and inspection (and possible replacement) of SSCs.

The staff notes that the industry has fully committed to appropriate and reasonable efforts in this area. However, as indicated by representatives of State government and public interest groups at the Commission meeting on February 24, 2011, this investment is not earning the confidence of the public because it is voluntary, and individual licensees are not required to follow through on the commitments.

Internal Feedback—Internal feedback received through the ROP feedback process and the 2010 ROP survey suggested improvements to the Public Radiation Safety cornerstone. For example, the submitter of one ROP feedback form stated that, in the original development of the PI, the NRC and NEI considered a broader field of effluent program performance issues, including process radiation monitor performance, offsite dose, and other Offsite Dose Calculation Manual (ODCM) reportable issues. However, after considering the desire for a risk-informed indicator, the PI definition was revised before implementation, and only the offsite dose component remained. In its current definition, a PI occurrence is equivalent to exceeding, in a calendar quarter, one-half of the NRC's annual ALARA design objectives for liquid or gaseous effluents, listed in Appendix I, "Numerical Guides for Design Objectives and Limiting Conditions for Operation To Meet the Criterion 'as Low as Is Reasonably Achievable' for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents," to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing for Production and Utilization

Facilities." Because radiation monitor performance and other ODCM reportable issues were dropped from the PI, the submitter questioned the accuracy and validity of the PI.

This feedback form reveals a perspective that the current PI is a "risk-based" PI rather than a "risk-informed" one, since the PI does not capture the performance of barriers to releases (e.g., pipe and tank integrity) or mitigation (e.g., on-site monitoring wells or prompt identification of leaks and timely implementation of corrective actions); it only monitors dose for leaks that migrate off-site.

10 CFR 2.206 Petitions—In 2010, the NRC received three separate petitions filed under 10 CFR 2.206, "Requests for Action Under This Subpart," asking the agency to take actions with regard to the groundwater contamination at Vermont Yankee (ADAMS Accession No. ML103350566). Collectively, the petitioners expressed concerns that the NRC's ROP failed to capture, anticipate, and prevent operational issues that have manifested themselves in a series of high-profile groundwater contamination incidents. The petitions may reflect a view that the ROP does not adequately focus on licensee performance in preventing and mitigating spills and leaks.

Current ROP Tools

The Public Radiation Safety cornerstone has only one PI: Radiological Effluent Technical Specifications/ODCM Radiological Effluent Occurrence. This PI monitors the performance of the radiological effluent treatment and monitoring program. The PI is based on radiation dose resulting from effluent releases and does not evaluate the performance of the processing, handling, storage, or transportation of solid radioactive materials; radiological environmental monitoring; or corrective actions and mitigation. The thresholds were based on a review and graphical analysis of Licensee Event Report data associated with process radiation monitoring system activities provided by all sites for the period from January 1995 through December 1997. Based on these data, an expert panel composed of NRC and industry representatives agreed to the following thresholds for radiological effluent releases in excess of PI limits: more than one release for Green to White, and more than three releases for White to Yellow. A threshold for Yellow to Red was not established.

The Public Radiation Safety cornerstone includes three baseline inspection procedures related to liquid effluents: inspection of the radiological environmental monitoring program, inspection of the radioactive gaseous and liquid effluent treatment, and inspection of radioactive solid waste processing and radioactive material handling, storage, and transportation. Like the PI, the SDP used to evaluate the significance of findings identified during these instructions addresses the licensee's ability to assess dose from radioactive effluents and maintain radiation doses to a member of the public within Appendix I design objectives. An inspection finding is characterized as White if it involves a failure to implement the effluent program or public dose exceeds the Appendix I ALARA criterion or limits established in 10 CFR 20.1301(e). The thresholds for Yellow and Red significance are doses in excess of 0.1 rem and 0.5 rem, respectively.

Groundwater contamination events are of concern to internal and external stakeholders because processes, systems and structures that were designed to control or confine nuclear material fail to function as barriers against inadvertent release to the environment. The current ROP tools focus on the potential public health and safety impacts of leaks and spills rather than

prevention, prompt detection, and early mitigation. The current tools are not optimized to address aspects of licensee performance that compromised controls and barriers to release; nor are they applicable to assessments of licensee performance in successfully implementing the voluntary initiatives aimed at prevention, detection, and mitigation articulated in the NEI documents referenced earlier in this paper.

Opportunities for Enhancement

Based on the CY 2010 ROP self-assessment and concerns expressed by both internal and external stakeholders, the staff perceives an opportunity to enhance the ROP. Currently, the staff invokes the Action Matrix deviation process to address licensee performance involving groundwater contamination at certain plants. To some stakeholders, applying this deviation process compromises the predictability and objectivity of the ROP. The NRC could efficiently modify one or more key program areas of the ROP (e.g., inspection program, PIs, SDP) to minimize reliance on Action Matrix deviations and yield more consistent, reliable regulatory outcomes. New requirements or standards would not be imposed; rather, the staff proposes to leverage existing ROP methods to consider licensees' efforts to enhance protection of public health and safety through implementation of voluntary industry initiatives on groundwater protection. The staff does not anticipate the level of significance of a finding or PI associated with the voluntary initiatives to approach the Yellow or Red threshold established for the current ROP tools, since the initiatives emphasize prevention, detection, and mitigation instead of public exposure to radionuclides; the NRC would continue to apply the current ROP tools to assess these more serious potential impacts to public health and safety in terms of dose. Because it is efficient and would improve ROP reliability, the proposal furthers these two principles of good regulation.

The NRC can collaborate with industry in the established ROP Working Group, which meets regularly to discuss ROP-related issues, to evaluate potential modifications to the PI in the Public Radiation Safety cornerstone. The ROP uses PI information, which licensees report voluntarily, as an input for assessing plant performance and establishing an appropriate regulatory response. By providing an avenue for the industry to have a role in developing and interpreting ROP and PI guidance, the PI program can serve as an incentive to the industry to maintain performance associated with self-imposed standards and requirements well below thresholds for increased regulatory response.

The NRC could also use the inspection program and SDP to improve the predictability of NRC actions in the Public Radiation Safety cornerstone. The NRC inspects aspects of licensee performance, in part, to verify that licensees are meeting self-imposed standards and complying with regulatory requirements. The ROP uses the inspection program and SDP to identify and determine the significance of performance deficiencies, verify licensee's corrective actions, and apply additional inspection resources if the corrective actions are not effective. The staff has made a point of engaging external stakeholders when developing or modifying SDP tools, but it retains the authority to establish appropriate tools for inspecting and assessing licensee performance in a manner that is more risk-informed, objective, predictable, and understandable than the previous oversight processes, consistent with Commission policy and the founding principles of the ROP.

In summary, the staff proposes modifications to the ROP that would leverage the industry's voluntary groundwater protection initiatives. The objective would be to work with internal and

external stakeholders to define an efficient and reliable approach, consistent with these two principles of good regulation, to assessing licensee performance in enhancing defense-in-depth in this area and determining regulatory responses.

RECOMMENDATION:

The staff recommends the Commission endorse its efforts to enhance ROP tools within the Public Radiation Safety cornerstone to emphasize defense in depth through prevention, detection, and mitigation of groundwater contamination. Inherent in this recommendation is a staff commitment to work with internal and external stakeholders to ensure that this enhancement to the PI program, inspection program, SDP program, or other ROP guidance is guided by the founding principles of the ROP, consistent with Commission policy.

RESOURCES:

The staff estimates that approximately 0.3 full-time equivalent staff will be needed to implement the recommendation. These resources are included as part of the continuous ROP improvement process in the fiscal year 2011 budget and the fiscal year 2012 budget request in the subprogram for Reactor Oversight; Planned Activity: Reactor Inspection and Assessment Management-Oversight.

The staff does not anticipate that the recommended activities will require additional resources beyond those already included in the current budget requests. The Commission's direction to the staff in the resulting staff requirements memorandum related to this SECY will determine whether the budgeted resources will be allocated to this effort.

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 objections.

/RA by Martin J. Virgilio for/

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