

# POLICY ISSUE INFORMATION

April 7, 2009

SECY-09-0056

FOR: The Commissioners

FROM: R. W. Borchardt  
Executive Director for Operations

SUBJECT: STAFF APPROACH REGARDING A RISK-INFORMED AND  
PERFORMANCE-BASED REVISION TO PART 50 OF TITLE 10 OF THE  
*CODE OF FEDERAL REGULATIONS* AND DEVELOPING A POLICY  
STATEMENT ON DEFENSE-IN-DEPTH FOR FUTURE REACTORS

PURPOSE:

To inform the Commission of the staff's planned approach regarding the following:

1. rulemaking for a risk-informed and performance-based revision to Part 50 of Title 10 of the *Code of Federal Regulations* (10 CFR Part 50), "Domestic Licensing of Production and Utilization Facilities," for future reactors, and
2. development of a policy statement on defense-in-depth (DID) for future reactors.

SUMMARY:

In its staff requirements memorandum (SRM) on SECY-07-0101,<sup>1</sup> the Commission approved the staff's recommendation to defer rulemaking for risk-informed and performance-based 10 CFR Part 50 reactor requirements for advanced reactors until after the development of the licensing strategy for the Next Generation Nuclear Plant (NGNP) or receipt of an application for a Pebble Bed Modular Reactor (PBMR) design certification (DC) or combined license (COL).

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<sup>1</sup> SRM on SECY-07-0101, "SECY-07-0101 - Staff Recommendations Regarding a Risk-Informed and Performance-Based Revision to 10 CFR Part 50 (RIN 3150-AH81)," dated September 10, 2007 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML072530501). All documents referenced in this paper are available in ADAMS on the NRC's web page ([www.nrc.gov](http://www.nrc.gov)) under the accession number provided.

The Commission further directed the staff to develop a draft policy statement on DID for future plants for Commission consideration, stating that this draft policy could be evaluated using the insights gained through the development of the NGNP licensing strategy and completion of the PBMR pre-application review. In the same SRM, the Commission also directed the staff to publish the technology-neutral framework discussed in SECY-07-0101 and to test the concept of the technology-neutral framework on an actual design.

Although different approaches for a risk-informed, performance-based regulatory structure have been discussed and documented by the U.S. Nuclear Regulatory Commission (NRC) staff, reactor designers, and potential COL applicants since 2001, differences exist in important aspects of these proposals that have not been fully evaluated or resolved by the staff. Considerable further evaluation is needed to resolve the range of outstanding issues with these approaches. Therefore, the staff plans to continue to defer rulemaking for risk-informed and performance-based reactor requirements for future reactors until the review of a license application for the NGNP prototype design or other non-light-water reactor (LWR) design has progressed far enough to provide useful insights into the application of such an approach to an actual design. To respond to Commission direction, the staff plans to test the concepts and methods from a technology-neutral framework during the licensing review of a high-temperature gas-cooled reactor (HTGR). In addition, the staff plans to integrate its position on DID with its positions on other policy and key technical issues for future reactor designs. The staff plans to continue development of a position on DID along with development of other related Commission policy and technical positions, but will defer activities to finalize a DID policy statement until additional experience and related insights are gained from the NGNP or other non-LWR reviews.

#### BACKGROUND:

##### *Development of Risk-Informed, Performance-Based Regulations for Future Reactor Licensing*

In SECY-03-0059,<sup>2</sup> the staff discussed its plan to develop a technology-neutral, risk-informed structure for new plant licensing. In subsequent Commission papers, the staff provided status reports on these efforts, including identification and discussions of specific policy issues identified during this activity.

In its SRM on SECY-06-0007,<sup>3</sup> the Commission directed the staff to provide its recommendation on whether and, if so, how to proceed with rulemaking for risk-informed, performance-based technical requirements for future reactors. In SECY-07-0101,<sup>4</sup> the staff recommended that the Commission approve the deferral of such rulemaking until after the development of the licensing strategy for the NGNP or receipt of an application for DC or a license for the PBMR. The staff committed to provide the Commission with a recommendation on initiating rulemaking six months after the licensing strategy for the NGNP was finalized. In its SRM on SECY-07-0101,

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<sup>2</sup> SECY-03-0059, "NRC Advanced Reactor Research Program," dated April 18, 2003 (ADAMS Accession No. ML023310534)

<sup>3</sup> SRM on SECY-06-0007, "Staff Requirements – SECY-06-0007 – Staff Plan to Make a Risk-Informed and Performance-Based Revision to 10 CFR Part 50," dated March 22, 2006 (ADAMS Accession No. ML060810277)

<sup>4</sup> SECY-07-0101, "Staff Recommendations Regarding a Risk-Informed and Performance-Based Revision to 10 CFR Part 50 (RIN 3150-AH81)," dated June 14, 2007 (ADAMS Accession No. ML070790236)

the Commission approved the staff's recommendation to defer this rulemaking until after the development of the licensing strategy for the NGNP, or receipt of an application for a PBMR DC or COL. It directed the staff to publish the technology-neutral framework discussed in SECY-07-0101 and test the concept of this framework on an actual design. Further, in its SRM on COMSECY-08-0018,<sup>5</sup> consistent with the direction provided in the SRM to SECY-07-0101, the Commission directed the staff to plan how best to capture risk-informed, performance-based insights and lessons for use in a technology-neutral framework during the NGNP licensing process and test the concepts and methods prescribed in the staff's draft technology-neutral framework.

#### *Defense-in-Depth Policy Statement*

In SECY-03-0047,<sup>6</sup> the staff recommended that the Commission approve the development of a policy statement or description on DID for nuclear power plants. In its SRM on SECY-03-0047,<sup>7</sup> the Commission approved the staff's recommendation and stated that the staff should consider whether it can accomplish the same goals by updating the Commission Policy Statement on Use of Probabilistic Risk Assessment (PRA) Methods in Nuclear Regulatory Activities. In SECY-07-0101, the staff stated that stakeholders supported development of a separate policy statement on DID because they believed that DID is broader than, and not limited to, PRA. In its SRM on SECY-07-0101, the Commission directed the staff to develop a draft policy statement on DID for future plants for Commission consideration and stated that this draft policy could be evaluated using the insights gained through the development of the NGNP licensing strategy or completion of the PBMR pre-application review.

#### DISCUSSION:

In accordance with Commission direction, the staff issued the technology-neutral framework as NUREG-1860, "Feasibility Study for a Risk-Informed and Performance-Based Regulatory Structure for Future Plant Licensing," Volumes 1 and 2, in December 2007.<sup>8</sup> This NUREG documents a framework that provides an approach and criteria that (1) could be used to develop an alternative set of technical requirements to 10 CFR Part 50 applicable for future non-LWR nuclear power plants (the framework includes a proposed draft set of technical requirements), and (2) could be used to establish risk-informed licensing basis events and the safety classification of structures, systems, and components.

In its letter dated August 31, 2001,<sup>9</sup> Exelon submitted a white paper describing and documenting its proposed risk-informed and performance-based licensing approach to be used in a PBMR COL application. At the time that Exelon terminated its pre-application interactions with the staff, there remained a number of technical issues that had been identified and

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<sup>5</sup> SRM on COMSECY-08-0018, "Staff Requirements – COMSECY-08-0018 – Report to Congress on Next Generation Nuclear Plant (NGNP) Licensing Strategy," dated June 16, 2008 (ADAMS Accession No. ML081680501)

<sup>6</sup> SECY-03-0047, "Policy Issues Related to Licensing Non-Light-Water Reactor Designs," dated March 28, 2003 (ADAMS Accession No. ML030160002)

<sup>7</sup> SRM on SECY-03-0047, "Staff Requirements - SECY-03-0047 - Policy Issues Related to Licensing Non-Light-Water Reactor Designs," dated June 26, 2003 (ADAMS Accession No. ML031770124)

<sup>8</sup> ADAMS Accession Nos. ML073400763 and ML073400800

<sup>9</sup> ADAMS Accession No. ML012490160

remained unresolved. Subsequently, in 2006, to address these unresolved issues and to provide additional details on its proposed risk-informed licensing approach for the PBMR, PBMR (Pty) Ltd. submitted four follow-on, more detailed white papers to the NRC for consideration.<sup>10</sup> In its March 21, 2008, letter,<sup>11</sup> PBMR (Pty) Ltd. responded to staff requests for additional information<sup>12</sup> on these topics. Since then, however, the staff has not had the resources needed to review and document its evaluation of these aspects of the proposed PBMR licensing approach. The NRC needs to conduct additional technical evaluations on the different risk-informed, performance-based licensing approaches presented in NUREG-1860 and by PBMR (Pty), Ltd. The staff continues to evaluate how to develop a risk-informed and performance-based set of requirements that could be used to license the PBMR, or support rulemaking for risk-informed and performance-based reactor requirements for future reactors.

In the licensing strategy for the NGNP that was issued to Congress in August 2008, "Next Generation Nuclear Plant Licensing Strategy - A Report to Congress,"<sup>13</sup> the Secretary of Energy and the Commission jointly determined that the best option for licensing the NGNP prototype would be to use a risk-informed and performance-based technical approach that employs the use of deterministic judgment and analysis, complemented by NGNP-specific PRA information. This licensing approach would adapt the existing LWR technical requirements to address the acceptability of the NGNP design and to establish the NGNP-unique requirements that are not addressed by existing LWR requirements and guidance. However, the NGNP licensing strategy does not propose to apply PRA insights and information to the degree proposed by either PBMR (Pty) Ltd. for DC of the PBMR or to the degree described in NUREG-1860. In the NGNP licensing strategy, the Commission concluded that once NGNP technology is successfully demonstrated through operation and testing of the NGNP prototype, and a quality PRA that includes data from operation of the prototype becomes available, greater emphasis on a design-specific PRA to establish the licensing basis and requirements will be a more viable option for licensing a commercial version of the NGNP reactor.

Based on the above, the staff plans to continue to defer rulemaking for risk-informed and performance-based reactor requirements for future reactors until the review of a license application for the NGNP prototype design or other non-LWR design has progressed far enough to provide useful insights into the application of such an approach to an actual design. To respond to Commission direction, the staff plans to test the concepts and methods from the technology-neutral framework during the pre-application and license review of the NGNP prototype or other non-LWR design. The experiences gained during these future reviews will inform a staff recommendation to the Commission on the possible use of risk-informed and performance-based approaches within rulemakings to support the licensing of Generation IV reactors.

In addition, the staff has concluded that the PBMR pre-application review will need to progress significantly further once additional PBMR design information is provided by the designer, to provide an acceptable technical basis for a policy decision on adequate DID for the PBMR and

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<sup>10</sup> ADAMS Accession Nos. ML060950275, ML061930123, ML062400070, and ML063470549

<sup>11</sup> ADAMS Accession No. ML080810340

<sup>12</sup> "Requests for Additional Information Regarding Pebble Bed Modular Reactor (PBMR) Pre-Application White Papers," September 24, 2007, ADAMS Accession No. ML072190293.

<sup>13</sup> ADAMS Accession No. ML082290020

the development of a DID policy statement for future reactors. Moreover, the staff concludes that its position on DID should not be developed in isolation, but should be integrated with other related policy and key technical positions, such as its positions on containment functional performance requirements and emergency planning requirements. Therefore, the staff plans to continue development of a position on DID along with development of resolutions of other related issues, but will defer activities to finalize a DID policy statement until additional knowledge of these reactor designs and related insights are gained from the NGNP or other non-LWR reviews. When sufficient information and additional evaluation is available to support this effort, the staff will (1) consider positions previously developed on DID, including those developed by international bodies, such as the International Atomic Energy Agency's INSAG-12 for LWRs, "Basic Safety Principles for Nuclear Power Plants," International Nuclear Safety Advisory Group (October 1999), and the approach recommended by the Advisory Committee on Reactor Safeguards in its May 19, 1999 letter, "The Role of Defense-in-Depth in a Risk-Informed Regulatory System";<sup>14</sup> (2) determine the potential implications of DID policy issues on other policy and key technical issues for new advanced reactor designs; and (3) apply the concepts and methods discussed in NUREG-1860 and develop an integral approach to address these policy issues during a staff review of an actual design. Consistent with the approach used during the design reviews of larger evolutionary and passive LWRs, the staff will provide recommendations to the Commission on proposed resolutions to policy and key technical issues identified during the pre-application and license review of the NGNP or other HTGR, including proposed resolutions of issues such as DID, containment functional performance requirements, and emergency planning requirements.

#### FRAMEWORK TEST APPROACH:

The test will be performed in parts in a phased manner such that the results of each phase will be used to determine if continuation of the test is warranted. If the staff determines that the results of the test supports rulemaking, and if the Commission decides to proceed with rulemaking, the staff would proceed with the actual development of the regulations, advanced notice of proposed rulemaking, statements of consideration, regulatory analysis, and the associated regulatory guides and standard review plan.

In order for the staff to comply with the Commission's direction to test the concepts and methods from a technology-neutral framework on an actual design, an applicant would need to agree to participate in the test, as the NRC staff may need additional information and analysis from the applicant to support the test. To date, only PBMR (Pty) Ltd. has proposed a risk-informed, performance-based licensing approach for its PBMR design. In its March 22, 2007, letter,<sup>15</sup> PBMR (Pty) Ltd. has indicated that it may submit a DC application in the latter half of 2009, but that schedule could change if the U.S. Department of Energy (DOE) selects the PBMR design for the NGNP facility. If that occurs, PBMR (Pty) Ltd. would likely place the highest priority on the license application schedule documented in the NGNP licensing strategy, and place a lower priority on submitting an application for DC of the PBMR design.

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<sup>14</sup> ADAMS Accession No. 9905260038

<sup>15</sup> ADAMS Accession No. ML070890084

The staff could also conduct the framework test on the NGNP, regardless of the HTGR design chosen by DOE, provided that the applicant and DOE agree to participate in the test. Section 644(c) of the Energy Policy Act of 2005 directs that

The Secretary shall seek the active participation of the Nuclear Regulatory Commission throughout the duration of the Project to... (3) develop risk-based criteria for any future commercial development of a similar reactor architectures.

A test of the framework using the NGNP prototype design would provide input during the development of these criteria. Because no other designer has proposed that the staff use a risk-informed, performance-based licensing approach for its design, the staff has determined that other advanced reactors would not be good candidates for this test at this time.

Provided that the applicant agrees to participate in the test, the staff plans to use the following approach for conducting the test.

- (1) The staff will perform an initial test during the pre-application review of an HTGR. It is not likely that at this time there will be sufficient information to thoroughly test the framework. This test will examine the concepts and approach in light of an actual design to determine their feasibility. This test will identify, for example, whether additional work on the concepts are needed and identify what design information is needed to implement such an approach.
- (2) If the results of the initial test indicate that continuation of the test is warranted, the staff will perform a complete test of the framework once the NRC receives a licensing application for an HTGR. This test will be performed in parallel with the licensing review and, to the extent practicable, will take advantage of the license review of the design. However, although a license applicant is required to only provide a summary description and the results of the PRA, this test will require that the applicant submit the PRA. This test will determine if the technical requirements resulting from applying the framework would result in a more effective and efficient regulatory structure for future non-LWR nuclear power plants.

In addition, the staff will need to ensure that the review and resolution of any issues that the test review raises do not unnecessarily delay the expedited review schedule identified in the NGNP licensing strategy. The licensing strategy calls for a very aggressive 4-year review period ending in fiscal year (FY) 2017. Key safety issues raised by the test will have to be addressed. However, resolution of certain technical issues related to uncertainty questions may be delayed because test results required to address these issues may not be available. The staff expects that such issues will be addressed through the application of compensatory measures to the NGNP prototype. These compensatory measures may not be required for the commercial NGNP design if additional experimental data or confirmatory prototype plant testing justifies the change in design or operation of the commercial plant. The license review of an HTGR other than the NGNP may be delayed while such issues are resolved, unless compensatory measures are adopted by the vendor.

This approach to testing the framework will provide insights applicable to the NGNP prototype or other HTGR under review, future commercial reactor designs, and risk-informed, performance-based rulemaking activities, while ensuring that sufficient information, including a detailed PRA, is available to support that review. It will provide continuity and consistency in conducting the test due to the real-time interactions between test review and licensing review activities. The test approach will also allow for timely establishment of the risk-informed and performance-based requirements, if the Commission decided to proceed with rulemaking. If the test were conducted on the NGNP prototype, the first part of the test could start during the pre-application review of the NGNP prototype, and the second part in 2013 with the licensing review of the NGNP.

### RESOURCES:

In its June 11, 2008, SRM on SECY-08-0019,<sup>16</sup> the Commission directed that the staff specifically address the resources needed in FY 2009 and FY 2010 to ensure that the NRC remains a leader in developing the regulatory framework for advanced reactor designs and to minimize the need for dramatic spikes in resources. The following is a discussion of the resources needed to support the preparation and execution of the test discussed in this paper predicated on the assumption that the test will be conducted on the NGNP. If another reactor designer agrees to participate in the test review, the staff will reevaluate the time and resource efforts necessary to conduct the test.

Part 1 of the test will require approximately 4 years to complete beginning in FY 2009. The staff estimates that the total resources necessary to conduct these efforts will be 0.4 full-time equivalent (FTE) in FY 2009 that includes 0.1 FTE for the Office of New Reactors (NRO), 0.2 FTE for the Office of Nuclear Regulatory Research (RES), and 0.1 FTE for the Office of the General Counsel (OGC). The staff estimates the total resources necessary in FY 2010 would be 1.1 FTE that includes 0.5 FTE for NRO, 0.5 FTE for RES, and 0.1 FTE for OGC. The required resources are included in the FY 2009 budget and the FY 2010 budget request. Resources for FY 2011 and FY 2012 will be requested by the Planning, Budgeting, and Performance Management Process. At the end of Part 1 of the test, the staff will determine whether continuation of this effort is warranted and what changes, if any, should be made to the test approach. If the staff concludes that it should continue the test, the staff will assess its resource needs and determine the resources necessary to conduct Part 2 of the test. These resources would be addressed in the staff's development of future budget requests, including the appropriate prioritization of the test in comparison to other activities before the agency.

### CONCLUSIONS:

The staff plans to defer rulemaking activities for risk-informed and performance-based reactor requirements for future reactors until it conducts a test review of a license application for the NGNP prototype design or other non-LWR design in accordance with the proposed approach discussed in this paper. In addition, the staff plans to defer activities to finalize a DID policy statement until additional experience and related insights are gained from the NGNP or other

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<sup>16</sup> "Staff Requirements – SECY-08-0019 – Licensing and Regulatory Research Related to Advanced Nuclear Reactors," (ADAMS Accession No. ML081630507)

non-LWR reviews. However, the staff plans to continue to develop a position on DID that is integrated with other related policy and key technical positions, and test these proposed positions during the review of an actual design.

COORDINATION:

This paper has been coordinated with the OGC, which has no legal objection, and with the Office of the Chief Financial Officer.

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