

POLICY ISSUE
INFORMATION

July 22, 2011

SECY-11-0098

FOR: The Commissioners

FROM: Michael R. Johnson, Director
Office of New Reactors

SUBJECT: OPERATOR STAFFING FOR SMALL OR MULTI-MODULE NUCLEAR
POWER PLANT FACILITIES

PURPOSE:

The purpose of this memorandum is to inform the Commission of the staff's ongoing efforts and plans for the resolution of an issue concerning the application of the U.S. Nuclear Regulatory Commission's (NRC's) on-site licensed operator staffing requirements to small or multi-module nuclear power plants. This paper does not address any new commitments or resource implications.

SUMMARY:

This paper provides the Commission with the staff's proposed approach to resolving the issue of the appropriate number of on-site licensed operators and potential requests for exemptions from the on-site operator staffing requirements in Title 10 of the *Code of Federal Regulations* (10 CFR) 50.54(m). The staff anticipates receiving such requests in the applications for design certifications (DCs) under 10 CFR Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants," and for operating licenses (OLs) under 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," for small modular reactors (SMRs). The staff believes that processing a limited number of SMR DC and OL applications using exemption requests to address staffing is the best near-term solution for handling the staffing proposals for small or

CONTACT: Ross Moore, NRO/ARP
(301) 415-6061

multi-module reactor facilities. The NRC has established guidance for the review of requests for exemptions to the staffing requirements in 10 CFR 50.54(m). This will help the staff to develop clear regulatory language that would be adequate to support rulemaking. The long-term solution is to then refine review guidance and initiate rulemaking to change the rule to support the broad range of designs and technologies that the NRC may receive for review.

BACKGROUND:

As discussed in SECY-10-0034, "Potential Policy, Licensing, and Key Technical Issues for Small Modular Nuclear Reactor Designs," dated March 28, 2010 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML093290245), the NRC staff has engaged in public preapplication activities with the U.S. Department of Energy and with individual SMR designers to discuss potential policy, licensing, and key technical issues for SMR designs. One key issue identified in SECY-10-0034 is the application of current on-site operator staffing requirements to small or multi-module facilities.

The current requirements for operator staffing outlined in 10 CFR 50.54(m) prescribe the number of operators required per unit and per control room. As an example, for three operating nuclear power units, the minimum staffing table in 10 CFR 50.54(m)(2)(i) assumes there are at least two control rooms, and mandates a total of eight licensed operators. The regulation does not address a situation where three or more units are controlled from a single control room. The number of licensed operating personnel that the rule prescribes are based on assumptions and operating experience from the operation of large light-water reactors.

In response to SECY-10-0034 and its associated staff requirements memorandum, the staff established an issue identification and ranking program (IIRP) in January 2011. The IIRP was tasked with looking further into SMR design characteristics and modes of operation to identify potential control room staffing issues that may not have been recognized previously. The IIRP compiled its results and recommendations in a report titled, "Control Room Staffing Final Report," issued in June 2011 (ADAMS Accession No. ML111470784).

In addition to identifying specific technical issues, a primary concern identified by the IIRP is how the NRC will address SMR operator staffing reviews in the future without making every SMR a special case. In place of forecasting all possible SMR designs that the agency might receive for review, the IIRP recommended that the staff enhance its guidance for staffing and revise 10 CFR 50.54(m).

The staff has also received comments from various stakeholders (e.g., American Nuclear Society (ANS), Nuclear Energy Institute (NEI), and reactor designers) stating their positions regarding operator staffing in SMRs.

ANS released a report, "Interim Report of the American Nuclear Society President's Special Committee on Small and Medium Sized Reactor (SMR) Generic Licensing Issues," in July 2010, (ADAMS Accession No. ML110040946) to promote discussion on multiple licensing issues for SMR designs, including control room staffing issues. The ANS report discusses the potential for SMR designs to call for a much smaller number of staff per reactor than existing large reactors because the operation of an SMR is simpler, relying on more passive reactivity control, heat removal, and automated control systems. The ANS report concludes with a recommendation that the NRC update its regulatory guidance to better accommodate the changes to staffing requirements that may be appropriate for SMRs, and that current guidance and requirements

are adequate to address the submittal of staffing exemptions by early applicants and their review by the NRC. The staff has been informed that it will receive a position paper from NEI that evaluates approaches to determining appropriate control room staffing levels for SMRs. The staff expects to receive the paper in the third quarter of calendar year 2011 and will review it for any insights; however, the staff will rely on its own analysis of the issue in determining its resolution.

Interactions with NEI and SMR designers all indicate their support of the ANS report. SMR designers have indicated that they are considering whether their designs can operate with a staffing complement that is less than that currently required by the Commission's regulations. One SMR designer has expressed interest in having as many as 12 modules operated from a single control room. The staff believes that early resolution of this issue, or identification of a clear path to resolution, is essential, both so that designers can incorporate appropriate changes during the development of their designs, task analyses, and staffing plans before submitting a design review or license application, and to support the staff's review of the design and license applications.

DISCUSSION:

The staff expects to use a two step approach to address operator staffing requirements for SMRs. In the near-term, applicants can request exemptions to the current operator staffing requirements in 10 CFR 50.54(m) and the staff will review the request using existing or modified guidance. Once experience is gained, the staff would initiate the long-term solution which is to revise the regulations to provide specific control room staffing requirements for SMRs. Below is a summary description of the policy issue and the staff's activities to support the near-term and long-term solutions.

Guidance currently exists that the staff intends to apply in the review of SMR designers' proposed on-site operator staffing. Chapter 18, "Human Factors Engineering," of NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition," (Revision 2, issued March 2007) and NUREG-0711, "Human Factors Engineering Program Review Model," Revision 2, issued February 2004, provide guidance for the staff's review of the 12 elements of an applicant's human factors engineering (HFE) program (HFE program management, operating experience review, functional requirements analysis and function allocation, task analysis, staffing and qualifications, human reliability analysis, human/system interface design, procedure development, training program development, human factors verification and validation, design implementation, and human performance monitoring). This guidance does not presume a specific technology or control room configuration, and therefore it provides a means for addressing the challenge of applying the NRC's staffing requirements to facilities that do not meet the assumptions or limited scope of 10 CFR 50.54(m). The staff's review and approval of these 12 elements permits a finding of reasonable assurance of safety and compliance regarding the HFE aspects of a plant, including staffing plans.

In addition to NUREG-0800 and NUREG-0711, NUREG-1791, "Guidance for Assessing Exemption Requests from the Nuclear Power Plant Licensed Operator Staffing Requirements Specified in 10 CFR 50.54(m)," issued July 2005, provides guidance for reviewing and assessing requests for exemptions from the NRC's licensed operator staffing requirements in 10 CFR 50.54(m). Specifically NUREG-1791 includes guidance for the review of the applicant's concept of operations, operational conditions analyzed, applicable operating experience, functional requirements and function allocation, task analysis, job definitions, and staffing plan.

Critical to this review is the task analysis. Task analysis is the identification of task requirements for accomplishing the functions allocated to plant personnel, that is, for specifying the requirements for the displays, data processing, controls, and job support aids needed to accomplish tasks. As such, the results of the task analysis provide the basis for other HFE activities, such as the analysis of staffing, qualification, and job design requirements.

The introduction of advanced reactor designs and the increased use of advanced automated control systems can substantially affect the task analysis and, ultimately, the roles, responsibilities, composition, and size of the crews required to control plant operations. As a result, rather than prescribing specific licensed operator staffing requirements, NUREG-1791 provides guidance for the review of licensed operator staffing exemption requests by using a methodology that is sensitive to the differences in plant designs with regard to the tasks and demands that are placed on plant staff.

Near-Term Solution: Allow SMRs to Vary from Existing Regulations through Exemption Requests

Although NUREG-0800, NUREG-0711, and NUREG-1791 provide a general framework and guidance for conducting these reviews, the staff expects the reviews of staffing plans and potential exemption requests to be challenging for SMR designs because of the differences between the SMR designs and previously licensed reactor designs. The staff's initial evaluation has identified the following differences between the SMR design and operating philosophy and the reactor designs currently licensed or being evaluated for licensing:

- The SMRs may require different operator tasks. The task requirements will include operating multiple units in different modes of operation. A major challenge will be to identify tasks that may be omitted and those that could substantially affect operator workload.
- Very limited operational experience will be available to use as a resource, as these designs are first of a kind. The use and observation of simulator activities will be important to the verification of the task analyses and staffing plans. Parallels in other industries may be useful, if they exist.
- Integration challenges exist in defining not only tasks required for operating the unit but also for interacting with other on-site maintenance and support organizations for multiple units.
- The skill set for control room operators may require a different distribution of qualifications (e.g., more senior reactor operators, fewer reactor operators).
- For some SMR designs, operators will face the challenge of managing the operation of additional units as they are placed on line. As the number of modules increases, the demands on the operators will change, and potentially the number of operators required for safe operation (i.e., multiple staffing plans may be needed to address the addition of up to 11 more units during the construction period or subsequent operating period).

In addition, each exemption request is expected to be unique as it will reflect the specific demands and capabilities of the design for which it is being requested. This will present an added complication for the reviewers to understand the full scope of each design and the operator's roles and responsibilities. To assist with these challenges, the staff solicited the assistance of the Office of Nuclear Regulatory Research (RES) to update and enhance the NRC's technical basis and guidance documents for the review of control room staffing associated with advanced designs, specifically SMRs. RES plans to update the guidance in NUREG-0711 to better prescribe the scope of tasks the staff would expect in a thorough task analysis. Upon completion of the update to NUREG-0711, staff would then update NUREG-1791 with examples of full-range task analyses for SMRs. Staff will also continue efforts to identify differences in advanced reactor designs that could impact operator performance and staffing levels.

Processing a limited number of requests by DC and OL applicants from the existing regulations will allow the staff to gain insights about the range of acceptable methods and the level of information needed to support a staff review. This will help the staff to develop clear regulatory language that would be adequate to support rulemaking.

Long-Term Solution: Establish Rulemaking to Change Staffing Requirements for SMRs

Updating NRC's on-site licensed operator staffing requirements is expected to ensure that the NRC staff does not regulate new designs through exemption but rather through a stable and predictable regulatory structure. Waiting to propose rulemaking will better allow the staff to understand the operator staffing requirements as they pertain to SMRs. Working through a limited number of requests for exemption, coupled with ongoing research efforts and stakeholder engagement, will ensure that the staff is prepared to make an informed rulemaking proposal. Following the review of an initial set of requests for exemption, the staff will submit a specific rulemaking proposal for Commission consideration and approval.

Next Steps

To support this approach, the NRC established a separate internal working group (WG), comprising members from RES, the Office of New Reactors, and more recently the Office of Nuclear Reactor Regulation. The WG will undertake the following activities:

- oversight of revisions to NUREG-0800, NUREG-0711, and NUREG-1791
- identification of differences in the advanced reactor designs that could impact operator performance and in turn impact staffing levels
- oversight of any new issues identified by the Commission, following their review of the Near-Term Task Force's "Recommendations for Enhancing Reactor Safety in the 21st Century" (ML111861807), issued July 13, 2011
- oversight of proposed regulatory revisions

The staff will continue to engage external stakeholders to discuss the near- and long-term solutions and will further develop the specific aspects involved in both solutions.

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COORDINATION:

The Office of the General Counsel has reviewed this paper and has no legal objection.

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Michael R. Johnson, Director
Office of New Reactors