

RULEMAKING ISSUE
(Notation Vote)

June 22, 2001

SECY-01-0113

FOR: The Commissioners

FROM: William D. Travers
Executive Director for Operations

SUBJECT: FATIGUE OF WORKERS AT NUCLEAR POWER PLANTS

PURPOSE:

To inform the Commission of the staff's findings from the assessment of the NRC's "Policy on Factors Causing Fatigue of Operating Personnel at Nuclear Reactors."

To inform the Commission of the staff's proposed resolution of a petition for rulemaking concerning fatigue of workers at nuclear power plants.

To request Commission approval for the staff to proceed in accordance with the recommendations detailed in the attached rulemaking plan to develop a rule that addresses the regulatory issue of fatigue of workers at nuclear power plants.

BACKGROUND:

On February 18, 1982, the Nuclear Regulatory Commission (NRC) published the "Policy on Factors Causing Fatigue of Operating Personnel at Nuclear Reactors" (policy). The objective of the policy was to ensure, to the extent practicable, that personnel were not assigned to shift duties while in a fatigued condition that could significantly reduce their mental alertness or their decisionmaking ability. The NRC subsequently revised the policy to incorporate minor changes and clarifications and disseminated the policy via Generic Letter (GL) 82-12, "Nuclear Power Plant Staff Working Hours," dated June 15, 1982. In GL 82-12, the NRC requested that licensees take action as necessary to revise the administrative section of their technical specifications to ensure that plant administrative procedures were consistent with the revised working hours guidelines. The policy has been incorporated, directly or by reference, into the

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technical specifications at all but three nuclear power plant units.¹ The control of working hours in accordance with these technical specifications was monitored through routine periodic inspections but was discontinued with the implementation of the revised reactor oversight process (RROP). This change continues to be considered appropriate and consistent with the general design of the RROP which is to identify indications of plant performance problems and initiate more focused licensee analyses and NRC inspections when program performance thresholds are exceeded.

In a letter dated February 25, 1999, Congressmen Dingell, Klink, and Markey expressed concerns to former NRC Chairman Shirley Ann Jackson that low staffing levels and excessive overtime may present a serious safety hazard at some commercial nuclear power plants. Similar concerns were expressed in a letter dated March 18, 1999, from David Lochbaum of the Union of Concerned Scientists (UCS) to Chairman Jackson, and in the UCS report "Overtime and Staffing Problems in the Commercial Nuclear Power Industry." The NRC staff conducted a preliminary review of inspection reports and licensee event reports from 1994 through April 1999. In conducting this review, the staff found that few events at nuclear power plants had been attributed to fatigue, and in all instances, automated safety systems or other barriers were available to prevent events that may have had safety consequences. However, the staff acknowledged that the number of events attributable to fatigue could not be reported with certainty, given the difficulty of making such determinations, and that NRC inspectors had identified several instances each year in which licensee use of overtime appeared to be inconsistent with the general objectives or specific guidelines of the NRC's policy statement. In a letter dated May 18, 1999, the Chairman informed the Congressmen of the staff's findings and stated that the staff would assess the need to revise the policy.

While the staff was beginning to reassess the policy, the Commission received a petition for rulemaking (PRM-26-2), dated September 28, 1999, from Barry Quigley. The petition requests that the NRC amend 10 CFR Parts 26 and 55 to establish clear and enforceable work hour limits to mitigate the effects of fatigue for nuclear power plant personnel performing safety-related work. The PRM was published in the *Federal Register* for public comment on December 1, 1999 (64 FR 67202). The staff subsequently formed a working group to concurrently assess the policy and respond to PRM-26-2. The assessment of the policy is provided as Attachment 1.

DISCUSSION:

The staff reviewed PRM-26-2 and considered the public comments received in response to the petition. A summary of the comments and the staff's analysis are provided in Attachment 2. The NRC received 176 comment letters in response to the petition. The majority of the comments (157) were in favor of a rule. These comments were principally from individuals and public interest groups. Comments received from licensees, the Nuclear Energy Institute (NEI) and Winston and Strawn, a law firm representing several utilities, were opposed to PRM-26-2.

Although the staff received many comments concerning the specific requirements proposed in PRM-26-2, in general, letters in support of the rulemaking (1) cited the importance of ensuring that personnel who perform safety-related functions are not impaired by fatigue, (2) expressed concern that the NRC did not have a regulation limiting working hours and the perception that

¹The three units that do not have technical specifications concerning work hours have administrative procedures that are largely consistent with the policy.

the NRC lacked the authority to enforce the policy guidelines, (3) asserted that the guidelines were ambiguous and interpreted as not applicable when the plant is in an outage, (4) asserted that “the NRC appears to look the other way” when licensee work scheduling practices appear inconsistent with the guidelines, and (5) expressed the concern that utility restructuring and cost competition will cause reductions in staffing levels and increased working hours and fatigue. Several commenters noted that the Federal Government had established work hour limits for personnel in other industries and suggested that similar limits should apply to nuclear power plant workers.

In general, comments that opposed the petition expressed the opinion that existing regulatory requirements (i.e., technical specifications and Part 26, “Fitness for Duty Programs”) were adequate to ensure that personnel were not impaired by fatigue, that the proposed requirements would impose unnecessary and excessive burden that could not be justified through a backfit analysis, and that industry performance data refute the petitioner’s argument that a rule is necessary to prevent fatigued personnel from performing safety-related work.

In evaluating the merits of the comments concerning PRM-26-2, the staff considered the findings from the staff’s assessment of the policy statement. The staff’s assessment included (1) an assessment of the technical adequacy of the guidelines for ensuring that personnel are not impaired, (2) a review of the implementation of the policy through technical specifications, (3) an assessment of the adequacy of plant technical specifications and Part 26 fitness for duty requirements for enforcement actions related to plant personnel working hours and fatigue, (4) a comparison of work scheduling practices at nuclear power plants relative to the policy guidelines, (5) an assessment of the incidence of events attributed to fatigue at nuclear power plants, (6) a preliminary assessment of the sensitivity of plant core damage frequencies to fatigue-induced impairment of plant personnel, and (7) a survey of limits and controls for addressing fatigue in other regulated industries and for nuclear plant personnel in other countries. In addition, the staff held public meetings on February 23 and September 14, 2000, to discuss concerns with the implementation of the policy and to solicit stakeholder input to the assessment process. The staff’s principal findings from the policy assessment are as follows:

- a. There are only a limited number of events at U.S. nuclear plants that have been attributed to fatigue. In addition, the overall number of events at nuclear power plants has been declining for the past several years. However, several factors limit the ability of the staff and licensees to come to a finding that fatigue is a cause of an event, including the level of detail provided in event reports and the depth of the event analysis conducted. More importantly, whereas the effects of fatigue can be observed and documented (e.g., inattention to detail, non-conservative decisionmaking), fatigue cannot be objectively proven as the underlying cause. Given these considerations, the staff concludes that the number of events attributed to fatigue should be interpreted with caution and can not be reported with certainty.
- b. The policy provides for authorized deviations from the NRC’s work and rest guidelines in “very unusual circumstances.” NEI conducted a survey during June – July, 2000, concerning guideline deviations. Approximately one-third of the survey respondents are authorizing more than a thousand, to as many as 7,500, approvals in a year to exceed the policy guidelines. The frequency of deviations does not appear to be consistent with either the specific guidelines or the general objective of the policy. NEI has presented calculated averages to the staff that suggest that, on average, the number of deviations per person is quite small. However, neither the NRC nor, to the

staff's knowledge, NEI has data to indicate whether the calculated averages are representative of actual individual use of deviations. In addition, the staff believes that an analysis of deviations based on averages is not technically sound, given the fact that fatigue is experienced on an individual basis, not a group basis, and at a specific time, not averaged over time.

- c. The policy states that "enough plant operating personnel should be employed to maintain adequate shift coverage without routine heavy use of overtime." The staff has reviewed the data collected by NEI concerning overtime and found that 8 of 36 sites providing data had more than 20 percent of the personnel covered by the policy working in excess of 600 hours of overtime per year. Considering all plants that provided data, the percentage of personnel working in excess of 600 hours of overtime increased from 7 percent in 1997 to 11 percent in 1999. The percentage of licensed operators working in excess of 600 hours increased from 13 percent in 1997 to more than 16 percent in 1999.
- d. There is variation in plant technical specifications that implement the policy. Three nuclear plant units have no technical specifications to implement the policy. The policy applies to personnel who perform safety-related functions. The staff found variation in the numbers and types of personnel covered by individual plant administrative controls. A limited number of sites may not be applying work hour controls to all personnel performing safety-related functions, including at least two nuclear plant sites that do not apply the work hour controls to any maintenance personnel. Although the observed variability in the controls does not by itself present a safety concern, the staff believes that such variability is inconsistent with establishing a uniform level of assurance that personnel are not in a fatigued condition that could significantly reduce their mental alertness and decisionmaking capability.
- e. The language in plant technical specifications and Part 26 is largely advisory with respect to limiting working hours and addressing fatigue and includes terms that may be broadly interpreted. As a result, the NRC's current regulatory framework does not support efficient and effective enforcement on matters concerning excessive working hours and personnel fatigue.
- f. The staff reviewed the current and proposed Federal limits on work hours for personnel in six other industries in the United States and Canada, as well as nuclear plant workers in eight other countries. Although many factors influence specific regulatory limits, and requirements for other industries should be considered in context, the staff found that the NRC's guidelines were collectively the least restrictive.
- g. Studies in both laboratory and diverse work settings concerning work scheduling, extended work hours, human circadian physiology, and human performance indicate that scheduling of personnel at or near the NRC policy limits for controlling work hours during outages (e.g., no more than 16 hours of work in any 24-hour period) can result in degraded human performance from work-related fatigue. The research also suggests that when personnel exceed the policy guidelines (e.g., when guideline deviations are authorized), they are more likely to exhibit degraded alertness and decisionmaking and are more susceptible to committing fatigue-induced errors. Studies have shown that the incidence of errors by nuclear power plant personnel varies as a function of their daily variations in alertness. In addition, studies

concerning extended work hours (e.g., more than 12 hours) suggest that in a broad range of industries fatigue-induced personnel impairment can increase human error probabilities by a factor of more than 2 to 3 times baseline human error probabilities. Although a more detailed analysis would be necessary to characterize the amount of time such fatigue effects would be operative and the types of tasks affected in nuclear plant operations, preliminary sensitivity studies indicate that if increased levels of fatigue can be shown to increase human error probabilities applied in nuclear plant PRAs by factors of this magnitude, substantial increases in core damage frequency may be predicted.

Having considered these findings, the staff recommends rulemaking to address specific issues with the NRC's regulatory framework and industry control of work hours as they relate to personnel fatigue. The staff's objective is to achieve a uniform level of assurance across the U.S. commercial nuclear power industry that personnel whose duties may affect nuclear power plant operational safety are not in a fatigued condition that could significantly reduce their alertness or decisionmaking ability.

Many of the public comments concerning PRM-26-2 addressed specific requirements proposed by the petitioner, including their potential effectiveness, burden, and consequences. After reviewing the requirements proposed in PRM-26-2, and following consideration of public comment, the staff developed three additional rulemaking options and two alternatives to rulemaking. The requirements proposed by the petitioner, the rulemaking options and alternative approaches developed by the staff, and the evaluation of these options are described in detail in the rulemaking plan presented in Attachment 3. The rulemaking options are also summarized in a table to provide an overview of their major elements and facilitate their comparison (see Attachment 3, Appendix 1). The staff evaluated these options in accordance with the following criteria: (1) maintaining safety by ensuring personnel are not impaired, (2) maintaining safety by being responsive to plant risk and the likelihood of personnel impairment, (3) reducing unnecessary regulatory burden, (4) increasing regulatory efficiency and effectiveness by establishing clear expectations, and (5) increasing public confidence. The staff believes that these criteria are effectively tailored to this regulatory issue while remaining appropriately aligned with the NRC's performance goals for nuclear reactor safety.

On the basis of its evaluation, the staff has concluded that the petitioner has proposed a comprehensive set of requirements that could reasonably be expected to effectively address fatigue from individual and programmatic causes. However, the staff believes that it is also possible to achieve these objectives through alternative requirements that are more flexible, more directly focused on risk, and more aligned and integrated with current regulatory requirements. Accordingly, the staff recommends that this petition be granted, in part, and that the staff develop a rule as described in Option 2 of the rulemaking plan, considering the guidelines concerning risk-informed regulation described in SECY-00-0213, "Risk-Informed Regulation Implementation Plan." The staff recommends that any rulemaking to address worker fatigue should only apply to licensees authorized to operate nuclear power reactors, and that materials licensees otherwise subject to Part 26 should be excluded from the scope of this rulemaking for the reasons described in the rulemaking plan.

The staff believes that the proposed rulemaking would have backfit implications and would require a backfit analysis under 10 CFR 50.109(a)(4). As stated in the rulemaking plan, the staff will conduct an analysis to determine whether the recommended regulatory changes in this

rulemaking plan would result in a substantial increase in protection to public health and safety, and whether the costs of the proposed rule would be justified.

STAKEHOLDER INVOLVEMENT:

The staff plans to hold stakeholder workshops during the development of the proposed rule.

COORDINATION:

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

RESOURCES:

The total NRR resource estimate for the staff to complete this rulemaking is approximately 2.6 full-time equivalent (FTE) positions, which are available within the current budget. FTE usage is estimated to be 1.0 FTE in FY 2002, 0.8 FTE in FY 2003, and 0.8 in FY2004. RES FTE usage to provide continued technical assistance is estimated to be 0.3 FTE in FY 2002 and FY 2003 and is available within the current budget. Contractor technical assistance would include:(1) development of a regulatory guide supporting a rule, (2) development of a regulatory analysis, and (3) development of a backfit analysis. It is estimated that these items will cost \$300,000. The staff would anticipate initiating a technical assistance contract in FY 2002 with the majority of the expenditures in FY 2002 and FY 2003. Upon Commission approval of rulemaking, NRR will address needed contract funding in their internal budgeting and planning process.

RECOMMENDATIONS:

That the Commission approve the staff plan to grant, in part, PRM-26-2 by undertaking rulemaking to address fatigue of workers at nuclear power plants.

That the Commission approve the development of a rule using Option 2 of the attached rulemaking plan.

Note that:

- a. Should the Commission approve undertaking rulemaking, stakeholder comments on the petition and the staff's analysis would be addressed in the *Federal Register* notice for the proposed rulemaking.
- b. The staff will take no further action until the SRM is issued.
- c. The staff is currently preparing a related paper for the Commission, "Final Rule Amending Fitness for Duty Rule." The paper proposes options for amending 10 CFR Part 26 to accomplish a variety of objectives, including reducing unnecessary regulatory burden. The staff will coordinate, as appropriate, the resolution of PRM-26-2 with these other proposed revisions to 10 CFR Part 26.

/RA/

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for Operations

- Attachments:
1. Assessment of the NRC's "Policy on Factors Causing Fatigue of Operating Personnel at Nuclear Reactors"
 2. Analysis of Public Comments on the Petition for Rulemaking Filed by Barry Quigley, September 28, 1999 (64 FR 67202)
 3. Rulemaking Plan to Address Fatigue of Nuclear Power Plant Workers

RECOMMENDATIONS:

That the Commission approve the staff plan to grant, in part, PRM-26-2 by undertaking rulemaking to address fatigue of workers at nuclear power plants.

That the Commission approve the development of a rule using Option 2 of the attached rulemaking plan.

Note that:

- a. Should the Commission approve undertaking rulemaking, stakeholder comments on the petition and the staff's analysis would be addressed in the *Federal Register* notice for the proposed rulemaking.
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DOCUMENT TITLE: RULEMAKING PLAN TO ADDRESS FATIGUE OF WORKERS AT
 NUCLEAR POWER PLANTS

ORIGINATOR: C. GOODMAN

SECRETARY: R. CARMON

DATE: NOVEMBER 29, 2000

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