

U.S. NUCLEAR REGULATORY COMMISSION

REGULATORY GUIDE 5.99, Revision 0



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FATIGUE MANAGEMENT FOR NUCLEAR POWER PLANT PERSONNEL AT COMMERCIAL NUCLEAR PLANTS LICENSED UNDER 10 CFR PART 53

A. INTRODUCTION

Purpose

This regulatory guide (RG) describes methods that the U.S. Nuclear Regulatory Commission (NRC) staff considers acceptable for addressing fatigue-management aspects of fitness-for-duty (FFD) programs required under Title 10 of the *Code of Federal Regulations* (10 CFR) Part 26, “Fitness for Duty Programs” (Ref. ¹), for commercial nuclear facilities licensed under 10 CFR Part 53, “Risk-Informed, Technology-Inclusive Regulatory Framework for Commercial Nuclear Plants” (Ref. ²).

Applicability

This RG applies to applicants and licensees under 10 CFR Part 53 required to maintain a fatigue management program under 10 CFR Part 26.

Applicable Regulations

- 10 CFR Part 26 prescribes requirements and standards for the establishment, implementation, and maintenance of FFD programs.
 - 10 CFR 26.4, “FFD program applicability to categories of individuals,” specifies the categories of individuals who are subject to 10 CFR Part 26 FFD programs.
 - 10 CFR 26.5, “Definitions,” explains the relevant terminology.
 - 10 CFR 26.189, “Determination of fitness,” provides requirements related to the determination whether an individual is fit to safely and competently perform the duties that require individuals to be subject to 10 CFR Part 26.

Written suggestions regarding this guide or development of new guides may be submitted through the NRC’s public Web site in the NRC Library at <https://www.nrc.gov/reading-rm/doc-collections/reg-guides/index.html>, under Document Collections, in Regulatory Guides, at <https://www.nrc.gov/reading-rm/doc-collections/reg-guides/contactus.html>. During the development process of new guides suggestions should be submitted within the comment period for immediate consideration. Suggestions received outside of the comment period will be considered if practical to do so or may be considered for future updates.

Electronic copies of this RG, previous versions of RGs, and other recently issued guides are available through the NRC’s public website under the Regulatory Guides document collection of the NRC Library at <https://www.nrc.gov/reading-rm/doc-collections/reg-guides/index.html>. The RG is also available through the NRC’s Agencywide Documents Access and Management System (ADAMS) at <http://www.nrc.gov/reading-rm/adams.html>, under Accession No. ML25232A010. The regulatory analysis may be found in ADAMS under Accession No. ML26042A230. The associated draft guide DG-5078, Revision 0, may be found in ADAMS under Accession No. ML22264A109. The staff responses to the public comments on DG-5078 may be found under ADAMS Accession No. ML26042A228.

- o 10 CFR Part 26, Subpart I, “Managing Fatigue,” establishes requirements for managing personnel fatigue at nuclear power plants.
 - 10 CFR 26.205, “Work hours,” establishes controls on the work hours and rest-break periods of select categories of workers who perform duties that directly affect safety and security.
 - 10 CFR 26.207, “Waivers and exceptions,” specifies the conditions under which licensees are permitted to waive the work-hour and rest-break requirements in 10 CFR 26.205.
 - 10 CFR 26.209, “Self-declarations,” establishes the requirements for licensee actions in response to an individual’s self-declaration of fatigue.
 - 10 CFR 26.211, “Fatigue assessments,” specifies the conditions under which licensees shall conduct fatigue assessments. It also includes specific provisions regarding the scope of the assessments and the associated documentation requirements placed on licensees.
- 10 CFR Part 53 provides an alternative risk-informed and technology-inclusive regulatory framework for the licensing, construction, operation, and decommissioning of commercial nuclear plants.

Related Guidance

- RG 5.73, “Fatigue Management for Nuclear Power Plant Personnel” (Ref. ³), describes methods the NRC staff has determined to be acceptable for complying with NRC regulations for managing personnel fatigue at nuclear power plants. With certain clarifications, additions, and exceptions, RG 5.73 endorses Nuclear Energy Institute (NEI) guidance document NEI 06-11, “Managing Personnel Fatigue at Nuclear Power Reactor Sites,” Revision 1, issued October 2008 (Ref. ⁴).

Purpose of Regulatory Guides

The NRC issues RGs to describe methods that are acceptable to the staff for implementing specific parts of the agency’s regulations, to explain techniques that the staff uses in evaluating specific issues or postulated events, and to describe information that the staff needs in its review of applications for permits and licenses. Regulatory guides are not NRC regulations and compliance with them is not required. Methods and solutions that differ from those set forth in RGs are acceptable if supported by a basis for the issuance or continuance of a permit or license by the Commission.

Paperwork Reduction Act

This RG provides voluntary guidance for implementing the mandatory information collections in 10 CFR Parts 26 and 53 that are subject to the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et. seq.). These information collections were approved by the Office of Management and Budget (OMB), under control number 3150-0146 and 3150-0274, respectively. Send comments regarding this information collection to the FOIA, Library, and Information Collections Branch (T6-A10M), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by email to Infocollects.Resource@nrc.gov, and to the OMB Office of Information and Regulatory Affairs, (3150-0146 and 3150-0274), Attn: Desk Officer for the Nuclear Regulatory Commission, 725 17th Street, NW Washington, DC 20503.

Public Protection Notification

The NRC may not conduct or sponsor, and a person is not required to respond to, a collection of information unless the document requesting or requiring the collection displays a currently valid OMB control number.

B. DISCUSSION

Reason for Issuance

Previously issued guidance related to fatigue management was developed for administering programs implemented at large light-water reactor (LLWR) facilities, and the prescriptive nature of some portions of this guidance may not fully (or efficiently) support fatigue management at facilities using non-LLWR technologies. Therefore, to support a technology-inclusive licensing framework, the NRC has developed methods for addressing certain unique aspects of fatigue management programs for new technologies or designs. Such methods could be used at facilities for applicants seeking licensing or certification under 10 CFR Part 53. This RG, in conjunction with the existing guidance of RG 5.73, provides comprehensive guidance regarding methods acceptable to the NRC staff for developing and implementing licensee fatigue management programs at facilities licensed or certified under 10 CFR Part 53, as required in accordance with 10 CFR Part 26.

Background

The NRC issued regulations associated with the management of fatigue at nuclear power facilities under 10 CFR Part 26, Subpart I, in March 2008. In March 2009, the NRC issued guidance for implementing 10 CFR Part 26, Subpart I, in RG 5.73. This RG endorsed—with certain clarifications, additions, and exceptions, the guidance contained in NEI 06-11, Revision 1.

Subpart I, as initially issued in 2008, along with its accompanying guidance, focused on LLWR technologies licensed under 10 CFR Part 50, “Domestic Licensing of Production and Utilization Facilities” (Ref. ⁵), and 10 CFR Part 52, “Licenses, Certifications, and Approvals for Nuclear Power Plants” (Ref. ⁶). With the issuance of 10 CFR Part 53, the NRC addressed the licensing of other technologies with an alternative technology-inclusive framework for commercial nuclear plants. In support of such a framework, the NRC also revised 10 CFR Part 26. Additionally, the NRC developed new and updated guidance to support technology-inclusive methodologies for meeting the applicable regulatory requirements.

The following paragraphs provide background information on the regulatory positions discussed in section C of this RG:

1. *Applicability of fatigue management requirements to categories of individuals*

In 10 CFR 26.4, categories of individuals are identified for the purpose of determining the applicability of certain FFD requirements. In particular, 10 CFR 26.4(a) identifies individuals performing certain safety- and security-significant duties that warrant controlling the work hours of these individuals in accordance with 10 CFR 26.205. The categorization language contained in 10 CFR 26.4(a)(1)–(5) is suitable for administering work-hour controls within the FFD programs for facilities licensed under 10 CFR Part 53. However, to account for certain technology-inclusive considerations, clarification on certain points is warranted.

- a. Not all duties described in 10 CFR 26.4(a) will necessarily be performed at all facilities licensed under 10 CFR Part 53. For example, certain facilities may be able to demonstrate (through their risk-informed evaluation) that facility operators (e.g., generally licensed reactor operators) would not be expected to operate systems or components that are determined to be significant to public health and safety, and therefore would not be subject to work-hour controls in accordance with 10 CFR 26.205 because they do not perform duties as listed in

10 CFR 26.4(a)(1). Additionally, 10 CFR Part 53 facilities may not necessarily have the same emergency response and security organizations as traditional LLWR facilities, which could impact whether individuals would perform duties described in 10 CFR 26.4(a)(2) and (a)(5) and therefore be subject to work hour controls. Regulatory position C.1.a addresses the potential for certain duties to not be performed at sites licensed under 10 CFR Part 53.

- b. Some facilities licensed under 10 CFR Part 53 might implement staffing strategies wherein individuals could perform duties that fit into more than one category discussed within 10 CFR 26.4(a). In such instances, the work hours for these individuals should be controlled in a manner that meets the requirements for all duties performed by a given individual. Regulatory position C.1.b addresses such circumstances.

2. *Facilities with a site organization that differs from traditional LLWR facilities*

Section 5.2 of NEI 06-11, Revision 1, as endorsed by RG 5.73, discusses the responsibilities for certain personnel positions within the site's organization. Proposed facility designs for applicants under 10 CFR Part 53, however, may include non-light-water reactors and other designs that do not necessarily warrant the same organization of personnel employed for traditional LLWR facilities. Regulatory position C.2 addresses such circumstances.

3. *Minimum onsite staffing for operating units*

The table included within regulatory position C.11 of RG 5.73 lists the minimum number of reactor operators and senior operators per shift who should have the operating reactor as their primary responsibility and should not be permitted to work outage hours, in accordance with 10 CFR 26.205(d)(4). However, requirements in 10 CFR Part 53 may not require the same minimum shift staffing necessary for units licensed under 10 CFR Part 50 and 10 CFR Part 52. Furthermore, the number of units at a given site may exceed three, which is the maximum number addressed within regulatory position C.11 of RG 5.73.

Regulatory positions C.3.a and C.3.b address circumstances in which the figures included in the table within regulatory position C.11 of RG 5.73 may not apply.

4. *Consideration of "face-to-face" assessments*

As stated in 10 CFR 26.207(a) and 10 CFR 26.211(b), supervisory assessments and fatigue assessments, respectively, must be performed using face-to-face interactions. However, based on recent research, the NRC staff has determined that remotely conducted fitness determinations (including fatigue assessments and supervisory assessments) may be appropriate if those determinations and assessments are augmented by an appropriately qualified individual who is present in person with the individual being assessed (Ref. ⁷).

Regulatory position C.4 addresses considerations regarding face-to-face interactions to support assessments associated with managing fatigue.

5. *Considerations for facilities with smaller staff sizes*

Supervisory assessments under 10 CFR 26.207(a) and fatigue assessments under 10 CFR 26.211 must be conducted face to face. Additionally, 10 CFR 26.209(a) requires that, following a self-declaration of fatigue, if a subject individual must continue performing duties until relieved, the licensee must immediately take action to relieve the individual.

Some facilities licensed under 10 CFR Part 53 may have a small number of onsite staff, compared to staff levels at traditional LLWR facilities. Additionally, certain facilities licensed under 10 CFR Part 53 may implement staffing plans wherein staff are supervised by an individual from a remote location. Such circumstances may pose challenges regarding the immediate conduct of face-to-face fatigue assessments and the removal of individuals when necessary. Regulatory positions C.5.a and C.5.b address such circumstances.

6. *Facilities that regularly maintain one or more units in refueling status*

Some facilities may be designed such that a site will undergo refueling outages more frequently than traditional LLWRs. For example, certain small modular reactor facilities may stagger the refueling cycles of individual units so that one or more units is regularly out of service for refueling or replacement. In these circumstances, certain site staff may regularly perform work that would be characterized as “working on outage activities,” as discussed in 10 CFR 26.205(d)(4). Regulatory position C.6 addresses such circumstances.

7. *Facility designs that utilize online refueling*

Some facilities may be designed with reactor units that use online refueling capabilities and would therefore not need to periodically undergo a “unit outage” (as defined in 10 CFR 26.5) for the purpose of refueling. In such cases, the work-hour controls discussed in 10 CFR 26.205(d)(4) and (d)(5) may not apply for the purposes of refueling. Regulatory position C.7 addresses such cases.

Consideration of International Standards

The International Atomic Energy Agency (IAEA) works with member states and other partners to promote the safe, secure, and peaceful use of nuclear technologies. The IAEA develops Safety Requirements and Safety Guides for protecting people and the environment from harmful effects of ionizing radiation. This system of safety fundamentals, safety requirements, safety guides, and other relevant reports, reflects an international perspective on what constitutes a high-level of safety. To inform its development of this RG, the NRC considered IAEA Safety Requirements and Safety Guides pursuant to the Commission’s International Policy Statement (Ref. ⁸) and Management Directive and Handbook 6.6, “Regulatory Guides” (Ref. ⁹). The NRC staff did not identify any IAEA Safety Requirements or Guides with information related to the topic of this RG.

C. STAFF REGULATORY GUIDANCE

1. Applicability of Fatigue Management Requirements to Categories of Individuals

- a. Potential for certain duties to not be performed at sites licensed under 10 CFR Part 53

FFD programs for facilities licensed under 10 CFR Part 53 should explicitly indicate any duties described in 10 CFR 26.4(a) that the applicant or licensee has determined, through appropriate analyses, will not be performed at its facility.

- b. Potential for a single individual to perform multiple duties listed within 10 CFR 26.4(a)

If multiple minimum-days-off requirements in 10 CFR 26.205 are applicable to a single individual, based on the duties performed by that individual, then the licensee should provide that individual with a number of days off that is equal to or greater than the largest minimum number of days off applicable for that individual. For example, a licensee's staffing model could potentially include field technicians who perform both operations and maintenance duties under 10 CFR 26.4(a)(1) and (a)(4), respectively. In such cases, a licensee controlling work hours using minimum days off in accordance with 10 CFR 26.205(d)(3) would apply the minimum number of days off established for operations personnel in 10 CFR 26.205(d)(3)(iii) to the individual because this regulation would require more days off than the minimum number of days off established for maintenance personnel by 10 CFR 26.205(d)(3)(iv).

2. Facilities with a Site Organization that Differs from Traditional LLWR Facilities

If the positions discussed in Section 5 of NEI 06-11 are not employed at a particular facility, the responsibilities designated for each of those positions should be allocated as appropriate to the defined personnel positions at the facility. Applicants should clearly outline this allocation of responsibilities within their FFD program procedures.

3. Minimum Onsite Staffing for Operating Units

- a. If the staffing figures outlined within regulatory position C.11 of RG 5.73 would not be applicable, the number of operators that a licensee assigns to work non-outage hours should be adequate to meet the site-specific needs of the facility, as discussed in the facility operations staffing plan. In general, as reflected in regulatory position C.11 of RG 5.73, a site should have at least the following number of operations staff on site and under non-outage work-hours controls:

- the number of reactor operators required to be at the controls to attend to units in non-outage status, plus one additional operator for each control room in which an operator is required to be at the controls at all times to attend to a non-outage unit (e.g., to fill in for necessary breaks), or
- the number of senior operators required to be in each control room to oversee non-outage units, plus one additional senior operator at the site to serve as a backup for any one senior operator overseeing non-outage units (e.g., to fill in for necessary breaks).

- b. If a licensee were able to demonstrate through a risk-informed evaluation that operators at its facility were not subject to work-hour controls, then the guidance in regulatory position C.11 of RG 5.73 and expanded herein would not be applicable at that facility. Furthermore, if a facility's staffing plan does not require an operator to be at the controls at all times, then there may not be a need for an additional operator to maintain non-outage work-hour controls (e.g., to fill in for necessary breaks). Additionally, if a facility's staffing plan does not require an on-shift senior reactor operator, then the guidance for senior operators would not apply.

4. Consideration of Face-to-Face Assessments

- a. Communication exclusively through electronic means (e.g., a phone or video call) may be appropriate to conclude that an individual should be permitted (or required) to take a rest following a self-declaration, as described in 10 CFR 26.211(a)(2). However, any formal assessments either conducted for cause, in accordance with 10 CFR 26.211(a)(1), or used to support the determination that an individual can safely continue to perform duties must be conducted or augmented by appropriately qualified licensee staff, trained in accordance with the requirements of either 10 CFR 26.29, "Training," and 10 CFR 26.203(c), or 10 CFR 26.608, "FFD program training," and 10 CFR 26.202(c) and present in-person with the individual being assessed. Such in-person assessments or augmentations of assessments are necessary to justify reassigning an individual to duties following a self-declaration, made in accordance with 10 CFR 26.209(b)(1), or to justify granting a waiver from the work-hour requirements of 10 CFR 26.205, in accordance with the provisions of 10 CFR 26.207.
- b. In the case of granting a waiver, the supervisor assessing the individual for whom a waiver is being considered, in accordance with the provisions of 10 CFR 26.207(a)(1)(ii), may conduct their assessment from a remote location, so long as their assessment is augmented by an individual who is (1) present in person with the individual being assessed, (2) trained in accordance with the requirements of either 10 CFR 26.29 and 10 CFR 26.203(c), or 10 CFR 26.608 and 10 CFR 26.202(c), and (3) able to independently determine that there is reasonable assurance that the individual being assessed will be able to safely and competently perform their duties during the additional work period for which the waiver will be granted. In such cases, the supervisor conducting the remote assessment should also be trained in accordance with the requirements of either 10 CFR 26.29 and 10 CFR 26.203(c), or 10 CFR 26.608 and 10 CFR 26.202(c).

5. Considerations for Facilities with Smaller Staff Sizes

- a. Licensees should ensure that fatigue assessments, when needed, are performed as soon as possible. As required by 10 CFR 26.209(a), following a self-declaration of fatigue, if a subject individual must continue performing duties until relieved, the licensee must immediately take action to relieve the individual. This immediate action should ensure that the necessary turnover of duties and assessment of fatigue can be performed as soon as the licensee is reasonably able to do so. Licensees should discuss the process for promptly conducting face-to-face assessments, and for relieving individuals as necessary, within their FFD program procedures.
- b. If relieving a single individual responsible for safety- or security-significant duties (to address impairment due to fatigue) would leave a reactor unit with no other qualified

persons present to fulfill those duties, the licensee should have measures in place to replace that individual immediately. For licensees that depend on a single individual to perform certain safety- or security-significant duties continuously (e.g., continuously monitoring plant operations or conducting security surveillance), if there is the possibility within the licensee's FFD program for a potential gap in coverage for that duty due to the removal of a single individual, then the acceptability of such a temporary complete loss of coverage for the duty should be addressed within that facility's licensing basis.

6. Facilities that Regularly Maintain One or More Units in Refueling Status

If an individual is transitioning from working on one unit outage to another unit outage at the same site, these individuals should be treated in the same manner as individuals going from an outage at one site to an outage at an additional site. As discussed in regulatory position C.10 of RG 5.73, if the period between successive unit outages worked by an individual is less than 9 days, the licensee should ensure that the individual has had a break period of at least 34 hours within the 9 days that precede the day on which the individual begins working on the subsequent outage.

7. Facility Designs that Use Online Refueling

For facility designs that use online refueling, individuals specified in 10 CFR 26.4(a)(1)–(a)(5) are subject to the non-outage minimum-days-off specifications of 10 CFR 26.205(d)(3) or the work hour limits of 10 CFR 26.205(d)(7). However, if the unit were to undergo a planned shutdown (e.g., for periodic maintenance purposes) or an unplanned shutdown (e.g., to address an emergent maintenance issue), the minimum days off specified in 10 CFR 26.205(d)(4) and (d)(5) could be applied while the unit is offline, and the 60-day limit discussed within those sections would apply, along with the potential to extend the 60-day period as permitted by 10 CFR 26.205(d)(6).

D. IMPLEMENTATION

The NRC staff may use this regulatory guide as a reference in its regulatory processes, such as licensing, inspection, or enforcement. However, the NRC staff does not intend to use the guidance in this regulatory guide to support NRC staff actions in a manner that would constitute backfitting as that term is defined in 10 CFR 53.1590, "Backfitting," and as described in NRC Management Directive 8.4, "Management of Backfitting, Forward Fitting, Issue Finality, and Information Requests" (Ref. ¹⁰), nor does the NRC staff intend to use the guidance to affect the issue finality of an approval under 10 CFR Part 53, Subpart H, "Licenses, Certifications and Approvals." The staff also does not intend to use the guidance to support NRC staff actions in a manner that constitutes forward fitting as that term is defined and described in Management Directive 8.4. If a licensee believes that the NRC is using this RG in a manner inconsistent with the discussion in this Implementation section, then the licensee may file a backfitting or forward fitting appeal with the NRC in accordance with the process in Management Directive 8.4.

REFERENCES¹

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- ¹ Publicly available NRC published documents are available electronically through the NRC Library on the NRC's public website at <http://www.nrc.gov/reading-rm/doc-collections/> and through the NRC's Agencywide Documents Access and Management System (ADAMS) at <http://www.nrc.gov/reading-rm/adams.html>. The documents can also be viewed online or printed for a fee in the NRC's Public Document Room (PDR) at 11555 Rockville Pike, Rockville, Maryland. For problems with ADAMS, contact the PDR staff at 301-415-4737 or (800) 397-4209; fax (301) 415-3548; or email pdr.resource@nrc.gov.
- 2 Publications from the Nuclear Energy Institute (NEI) are available at their website (<http://www.nei.org/>) or by contacting the headquarters at Nuclear Energy Institute, 1776 I Street NW, Washington, DC 20006-3708, Phone: 202-739-800, Fax 202-785-4019.

- ¹.U.S. *Code of Federal Regulations* (CFR), “Fitness for Duty Programs,” Part 26, Chapter I, Title 10, “Energy.”
- ².CFR, “Risk-Informed, Technology-Inclusive Regulatory Framework for Commercial Nuclear Plants,” Part 53, Chapter I, Title 10, “Energy.”
- ³.U.S. Nuclear Regulatory Commission (NRC), Regulatory Guide (RG) 5.73, “Fatigue Management for Nuclear Power Plant Personnel,” Washington, DC.
- ⁴.Nuclear Energy Institute (NEI), NEI 06-11, “Managing Personnel Fatigue at Nuclear Power Reactor Sites,” Revision 1, October 2008. (Agencywide Documents Access and Management System (ADAMS) Accession No. ML11196A106)
- ⁵. CFR, “Domestic Licensing of Production and Utilization Facilities,” Chapter 1, Title 10, Part 50.
- ⁶. CFR, “Licenses, Certifications, and Approvals for Nuclear Power Plants,” Chapter 1, Title 10, Part 52.
- ⁷.NRC, “Risk-Informed, Technology-Inclusive Regulatory Framework for Advanced Reactors,” *Federal Register*, Vol. XX, No. XXX, X X, 2026, pp. XXXXX–XXXXX.
- ⁸.NRC, “Nuclear Regulatory Commission International Policy Statement,” *Federal Register*, Vol. 79, No. 132, July 10, 2014, pp. 39415–39418.
- ⁹.NRC, Management Directive (MD) 6.6, “Regulatory Guides,” Washington, DC.
- ¹⁰.NRC, MD 8.4, “Management of Backfitting, Forward Fitting, Issue Finality, and Information Requests,” Washington, DC.