



Introduction

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Regulatory Guide 5.73

Fatigue Management for Nuclear Power Plant Personnel



U.S.NRC

United States Nuclear Regulatory Commission

Protecting People and the Environment

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Overview

- ❁ Rulemaking History
- ❁ Effects of Fatigue on Performance
- ❁ Development of Guidance
- ❁ Key Rule Provisions & Corresponding Guidance



History

- 1982 NRC published GL 82-12, Policy on Worker Fatigue
- 1991 NRC issued IN 91-36, Nuclear Plant Staff Working Hours
- 1999 NRC received concerns from Congress and UCS
- 2001 NRC staff reviewed adequacy of policy implementation
- 2002 Commission approved rulemaking
- 2002-2008 public meetings held on draft requirements and implementation development
- 2008 Final Rule Published



History

Sample of Worker Fatigue Incidents/Issues

- ❁ Sleeping operators
- ❁ Inattentive STA
- ❁ Inattentive security officers
- ❁ Inadequate overtime controls
- ❁ Continued self-declaration concerns



Performance Degradation from Fatigue

- ❁ Occurs *Before* sleep onset
- ❁ Effects comparable to blood alcohol concentrations that are prohibited in other parts of Part 26
- ❁ Impairs attention, communication skills, decision making, teamwork



What to do?

- How to minimize fatigue and sustain adequate fitness for duty, with various contributors to fatigue in the nuclear industry





Comply with the Rule!



Major Rule Provisions:

- Work hour controls
- Periodic performance based assessments
- Training
- Self-declarations
- Waivers
- Behavioral observation
- Fatigue assessments
- Annual reporting

Addresses Contributors to Fatigue including:

- Tasks - work hour limits based on duties performed
- Rest - Requires days off & permits napping



Implementation

- NRC staff and stakeholders agreed on need for implementation guidance
- Various public meetings and correspondence during the development of NEI 06-11, Managing Personnel Fatigue at Nuclear Power Reactor Sites, Revision 1 and the NRC's regulatory guide
- Draft Final Regulatory Guide (RG 5.73) endorses NEI 06-11, with exceptions, additions and clarifications

<http://www.nrc.gov/reactors/operating/ops-experience/fitness-for-duty.html>



Implementation

**Implement Requirements
in 10 CFR Part 26,
Subpart I**

Utilize method
set forth in RG 5.73

or

Develop Site/Licensee
Specific Method of compliance
with Regulations

Accepted

NRC reviews
Implementation method
for acceptability



RG 5.73

Fatigue Management for Nuclear Power Plant Personnel

- Substantive Issues General Description
 - Work Hour Controls
 - Minimum Day Off (MDO) Requirements
 - Individuals Eligible for Outage Controls
- General clarifications and revisions to NEI-0611 and stated as NRC implementation guidance



Work Hour Controls

Who?

- Maintenance, Operations (risk significant)
- Chemistry, Health Physics (emergency response only)
- Responsible Fire Brigade (FB) Member(s)
- Security Force (non-administrative)



Work Hour Controls

What?

- Work Hour Scheduling
- Work Hour Limits
- Break Requirements
- Minimum Day Off (MDO) Requirements

RG 5.73

- Gives specific guidance and clarifications in these areas in lieu of endorsing various sections of NEI 06-11 in totality



Work Hour Controls

Specific Guidance - MDO



Work Hour Scheduling

- The concept of periodic overtime introduced in NEI 06-11 is not endorsed in RG 5.73
- Normal variation in vacation and training demands may occasionally require additional work hours to be used



Work Hour Controls

Specific Guidance - MDO

MDO Requirements

- Unscheduled hours will be worked while meeting all work hour rules (including MDO)
- Accumulation of unscheduled work hours over a shift cycle may affect the MDO requirement that applies to individuals or crews
- MDO requirements are based on average hours worked by individuals over a shift cycle



Work Hour Controls

Specific Guidance - MDO

MDO Requirements

- Built in flexibility exists for individuals to work more hours on some days as permitted in 10 CFR 26.205(d)(1)
- Individuals actual hours worked determine which MDO requirement is applicable



Work Hour Controls

Specific Guidance - MDO

- Guidance on average hours worked and applicable MDO Requirements for 8 and 10 hour shiftwork

○ ≤ 9 avg hrs \rightarrow 8hr MDO Reqs \Rightarrow 1day off

○  $9 < \leq 11$ avg hrs \rightarrow 10hr MDO Reqs \Rightarrow 2days off



Work Hour Controls

Specific Guidance - MDO

- Guidance on average hours worked and applicable MDO Requirements based on job function up to 13 average hours
 - Performing duties described in 26.4(a)(1)-(3)
Operations, ERO, FB → 2.5 days off
 - Performing duties described in 26.4(a)(4)
Maintenance Workers → 2 days off
 - Performing duties described in 26.4(a)(5)
Security Force → 3 days off



Work Hour Controls

Specific Guidance - MDO

- MDO requirements for Individuals transitioning shift schedules
 - Calculate the average duration of the shifts (worked and scheduled to work) during a period ≤ 6 weeks (encompassing the transition)
 - Termination of shift cycles can be used for transitions



Work Hour Controls

Specific Guidance - MDO

- MDO requirements for Individuals transitioning schedules
 - Ensures MDO requirements are met for individuals before transition occurs
 - Ensure individuals meet MDO requirements going forward



Work Hour Controls

Specific Guidance - Outages

- ❁ MDO requirements during outage
10 CFR 26.205(d)(4)
- ❁ Relaxation applicable to individuals “while working on outage activities,” as stated in regulations
- ❁ Eligible Workers for Relaxation during outage
 - Individuals composing the minimum shift complement of operators, should not work the longer work hours that outage work hour controls allow



Work Hour Controls

- MDO Requirements During Outages
 - Minimum complement tied to 10 CFR 50.54(m) requirements
 - Retaining only one RO and one SRO on non-outage MDO was not adequate to meet the intent of the rule
 - Staff position includes provisions for relief, transition and ability to participate in outage activities



Work Hour Controls

Specific Guidance - Outages

Minimum Number of Individuals Per Shift Working Nonoutage Schedules for Onsite Staffing of Operating Nuclear Power Units during Outages¹

Number of operating nuclear power units ²	Position	Two-unit site		Three-unit site				
		One Control Room	Two Control Rooms	Two control rooms				Three Control Rooms
				Single Control Room Unit in Outage	Single Control Room Unit and One Unit Served by Dual Control Room in Outage	One of the Two Units Served by Dual Control Room in Outage	Two Units Served by Dual Control Room in Outage	
One	Senior Operator	2(2)	2(2)		2(2)		2(2)	2(2)
	Operator	2(3)	2(3)		2(3)		2(4)	2(4)
Two	Senior Operator			2(2)		3(3)		3(3)
	Operator			3(4)		4(5)		4(5)

¹ Numbers in parentheses are minimum shift complement required by 10 CFR 50.54(m)

² For the purpose of this table, a nuclear power unit is considered to be operating when it is connected to the grid.



Work Hour Controls

Specific Guidance - Outages

- MDO Requirements During Outages
 - Examples in NEI 06-11 describing individuals affected by outage work hour limitations were revised and presented in RG 5.73



Work Hour Controls

Specific Guidance - Outages

- **Example 1**—A maintenance or operations worker at a multiunit site who has responsibilities for outage activities, except if the operations worker is a member of the minimum shift complement for an operating unit, as described in this section. The maintenance worker and the operations worker who is not a member of the minimum shift complement for an operating unit, as described in this section, are eligible for outage work-hour limitations.
- **Example 4**—An operator at a multiunit site with responsibilities for activities on the operating unit, outage unit, and common systems, who is not a member of the minimum shift complement for an operating unit, as described in this section. This operator is eligible for outage work-hour limitations.



Work Hour Controls

Specific Guidance - Outages

- **Example 9**—An operator at a multiunit site who is performing activities on the outage unit and is following outage work-hour requirements who is assigned to activities on an operating unit, except if the operator is a member of the minimum shift complement for an operating unit, as described in this section. The operator who is on outage work-hour limitations should not provide relief to the operator at the controls or the senior operator in the control room for an operating unit, unless another operator who has been on nonoutage work hours is not immediately available and the operator has had 2 days off in the preceding 7-day period. If the operator has not had 2 days off in the preceding 7-day period and no other operator who has had 2 days off is immediately available, the operator may provide short-term relief (up to 2 hours) to the operator at the controls or the senior operator in the control room for an operating unit or long-term relief (more than 2 hours) under a waiver of the MDO requirement that is applicable to the shift schedule (i.e., 8-, 10-, or 12-hour shifts) for personnel assigned to the operating unit.



RG 5.73 in Summary

- General endorsement of various portions of NEI 06-11 as a method of implementation
- Examples
 - Before implementing the guidance in any example in NEI 06-11, ensure example is applicable to and consistent with the requirements of the rule
- Sections excepted
 - MDO guidance in NEI 06-11 via periodic overtime concept
 - Outage Work Hour Controls
- Other Regulatory Positions
 - NEI 03-04, Predictive Maintenance, Emergency Response Personnel, Waivers, Reviews



Thank You



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Questions

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