



[Canada.ca](#) › [Canadian Nuclear Safety Commission](#) › [Nuclear safety - Acts and regulations](#)

› [Regulatory documents](#) › [html](#)

REGDOC-2.2.4, Fitness for Duty: Managing Worker Fatigue

Preface

This regulatory document is part of the CNSC's Human Performance Management series of regulatory documents, which covers human factors, personnel training, personnel certification, and fitness for duty. The full list of regulatory document series is included at the end of this document and can also be found on the CNSC's website at [nuclearsafety.gc.ca/eng/acts-and-regulations/regulatory-documents](https://www.nuclearsafety.gc.ca/eng/acts-and-regulations/regulatory-documents).

Regulatory document REGDOC-2.2.4, *Fitness for Duty: Managing Worker Fatigue*, sets out requirements and guidance of the CNSC with respect to managing worker fatigue for workers at high security sites, as defined in the *Nuclear Security Regulations*. For the purpose of this regulatory document, nuclear safety encompasses security.

This document is intended to form part of the licensing basis for a regulated facility or for a regulated activity, either as part of the conditions and safety and control measures in a licence, or as part of the safety and control measures to be described in a licence application and the documents needed to support that application.

For proposed new facilities, this document will be used to assess new licence applications. For existing facilities, the requirements contained in this document do not apply unless they have been included, in whole or in part, in the licence or licensing basis.

Guidance contained in this document provides information on how requirements may be met. Licensees and applicants are expected to review and consider guidance; should they choose not to follow it, they should explain how their chosen alternate approach meets regulatory requirements.

The CNSC's regulatory framework provides an interlinked set of regulatory requirements for the management of nuclear facilities and activities. The management system established in the licensing basis for a regulated facility or activity provides an overall management framework and direction to develop and implement sound management practices and controls for the licensing basis. This regulatory document does not duplicate generic management system requirements. However, it provides more specific direction for those requirements as they apply to managing worker fatigue.

A graded approach, commensurate with risk, may be defined and used when applying the requirements and guidance contained in this regulatory document. The use of a graded approach is not a relaxation of requirements. With a graded approach, the application of requirements is commensurate with the risks and particular characteristics of the facility or activity.

Important note: Where referenced in a licence either directly or indirectly (such as through licensee-referenced documents), this document is part of the licensing basis for a regulated facility or activity.

The licensing basis sets the boundary conditions for acceptable performance at a regulated facility or activity, and establishes the basis for the CNSC's compliance program for that regulated facility or activity.

Where this document is part of the licensing basis, the word "shall" is used to express a requirement to be satisfied by the licensee or licence applicant. "Should" is used to express guidance or that which is advised. "May" is used to express an option or that which is advised or permissible within the limits of this regulatory document. "Can" is used to express possibility or capability.

Nothing contained in this document is to be construed as relieving any licensee from any other pertinent requirements. It is the licensee's responsibility to identify and comply with all applicable regulations and licence conditions.

Table of Contents

- 1. Introduction
 - 1.1 Purpose
 - 1.2 Scope
 - 1.3 Relevant legislation
- 2. Background
- 3. Programmatic Elements Applicable to the Broad Population
 - 3.1 Establishing limits on hours of work and recovery periods
 - 3.2 Identifying and managing worker fatigue
 - 3.3 Authorities, accountabilities and responsibilities
 - 3.4 Training and education
 - 3.5 Control of changes to shift schedules
 - 3.6 Problem identification and resolution

- 3.7 Assessment and continual improvement
- 4. Limits on Hours of Work and Recovery Periods Applicable to Safety-Sensitive Positions
 - 4.1 Identification of safety-sensitive positions
 - 4.2 Limits on hours of work applicable to safety-sensitive positions
 - 4.3 Recovery periods applicable to safety-sensitive positions
 - 4.4 Exceptional circumstances
 - 4.5 Records
- Appendix: Hours of Work and Recovery Periods for Safety-Sensitive Positions
- Glossary
- References
- Additional Information

1. Introduction

Human performance is a key contributor to the safety and security of nuclear facilities, so the CNSC requires licensees to implement and maintain human performance programs. These programs address a broad range of factors that affect human performance, with the aim of minimizing the potential for errors that could affect nuclear safety and security. One of these factors is a worker's fitness for duty.

Fatigue is widely recognized to affect fitness for duty because of its potential to degrade several aspects of human performance. Therefore, licensees must address fatigue as part of their approach to ensure that workers are fit for duty.

1.1 Purpose

This regulatory document specifies requirements and gives guidance for managing worker fatigue with the aim of minimizing the potential for errors that could affect nuclear safety and security. For the purpose of this regulatory document, managing worker fatigue encompasses measures to manage risks associated with fatigue, including measures to manage the level of fatigue that workers experience at work and to reduce the likelihood and consequences of fatigue-related errors.

1.2 Scope

This regulatory document applies to high-security sites, as defined in the *Nuclear Security Regulations*.

The requirements and guidance in section 3 of this regulatory document apply to the population of workers who have the potential through their work activities to pose a risk to nuclear safety or security, also referred to as the broad population.

Requirements and guidance in section 4 apply to a smaller subset of workers who fill safety-sensitive positions, as described in section 4.1.

1.3 Relevant legislation

The following provisions of the *Nuclear Safety and Control Act* (NSCA) and regulations made under the NSCA are relevant to this regulatory document:

- Sub-paragraph 9(a)(i) of the NSCA states that one of the objects of the Commission is "to regulate the development, production and use of nuclear energy and the production, possession and use of nuclear substances, prescribed equipment and prescribed information in order to prevent unreasonable risk, to the environment and to the health and

safety of persons, associated with that development, production, possession or use".

- Paragraph 12(1)(a) of the *General Nuclear Safety and Control Regulations* requires that every licensee shall "ensure the presence of a sufficient number of qualified workers to carry on the licensed activity safely and in accordance with the Act, the regulations made under the Act and the licence".
- Paragraph 12(1)(b) of the *General Nuclear Safety and Control Regulations* states that every licensee shall "train the workers to carry on the licensed activity in accordance with the Act, the regulations made under the Act and the licence".
- Paragraph 17(b) of the *General Nuclear Safety and Control Regulations* states that every worker shall "comply with the measures established by the licensee to protect the environment and the health and safety of persons, maintain security, control the levels and doses of radiation, and control releases of radioactive nuclear substances and hazardous substances into the environment".
- Sub-paragraph 17(c)(i) of the *General Nuclear Safety and Control Regulations* states that every worker shall "promptly inform the licensee or the worker's supervisor of any situation in which the worker believes there may be a significant increase in the risk to the environment or the health and safety of persons".
- Paragraph 17(e) of the *General Nuclear Safety and Control Regulations* states that every worker shall "take all reasonable precautions to ensure the worker's own safety, the safety of the other persons at the site of the licensed activity, the protection of the environment, the protection of the public and the maintenance of the security of nuclear facilities and of nuclear substances".

- Paragraph 6(d) of the *Class I Nuclear Facilities Regulations* states that an application for a licence to operate a Class I nuclear facility shall contain "the proposed measures, policies, methods and procedures for operating and maintaining the nuclear facility".
- Paragraph 6(n) of the *Class I Nuclear Facilities Regulations* states that an application for a licence to operate a Class I nuclear facility shall contain "the results that have been achieved in implementing the program for recruiting, training and qualifying workers in respect of the operation and maintenance of the nuclear facility".
- Section 38 of the *Nuclear Security Regulations* states that "every licensee shall develop a supervisory awareness program and implement it on an ongoing basis to ensure that its supervisors are trained to recognize behavioural changes in all personnel, including contractors, that could pose a risk to security at a facility at which it carries on licensed activities".

[Top of page](#)

2. Background

Worker fatigue is a state of reduced mental or physical performance capability resulting from sleep loss, extended wakefulness, phase of the circadian rhythm or workload. As fatigue increases, declines occur in many aspects of human performance, especially alertness. Alertness is fundamental to many cognitive tasks. Recovery from fatigue, particularly the recovery of cognitive function, requires sufficient sleep.

Work schedules are an important factor when managing fatigue since they set the boundaries for the timing and duration of sleep. Key aspects of a work schedule that affect fatigue are night work, extended shifts, the number of consecutive shifts, and time off between blocks of shifts.

Even when complying with limits on hours of work, a worker may be fatigued. Since factors at work and outside of work affect fatigue, workers share responsibility with the employer for managing fatigue. Programmatic requirements and guidance in this document address a broad range of elements necessary for managing fatigue-related risks.

[Top of page](#)

3. Programmatic Elements Applicable to the Broad Population

Licensees shall manage risks associated with fatigue of workers who have the potential through their work activities to pose a risk to nuclear safety or security (also referred to as the broad population) in accordance with their management system as defined in the licensee's licensing basis. Safety-sensitive positions, which are identified in section 4.1, are a sub-set of the broad population. The following sections specify how the management system's generic requirements apply to managing worker fatigue.

Licensees shall identify positions in the broad population in their management system's governing documents.

Guidance

All activities related to managing worker fatigue should be developed and implemented using a management system that meets the requirements of CSA N286, *Management system requirements for nuclear facilities*. [1]

Licensees may exclude workers from the broad population if they do not have the potential through their work activities to pose a risk to nuclear safety or security. Licensees should have a documented rationale to justify the exclusion of workers from the broad population.

3.1 Establishing limits on hours of work and recovery periods

For the broad population of workers, licensees shall document and implement limits on hours of work and recovery periods that:

1. provide sufficient time for sleep daily
2. restrict consecutive shifts to limit the build-up of sleep debt
3. provide sufficient time off to allow for recovery from sleep debt
4. limit average weekly hours as a safeguard against cumulative fatigue

Licensees shall document the rationale that justifies their limits on hours of work and recovery periods, and the rationale shall be based on scientific principles and knowledge.

Guidance

Licensees may apply different limits on hours of work and recovery periods to different workers in a graded manner commensurate with risk.

3.2 Identifying and managing worker fatigue

Licensees shall establish, implement and maintain a process to identify and manage workers who have temporary or ongoing fatigue-related limitations that may make them incapable of competently and safely performing their assigned duties. This process shall address:

1. expectations for self-reporting when workers believe they are too fatigued to competently and safely perform their assigned duties
2. actions for workers to take if they are experiencing a temporary or ongoing circumstance(s) or condition(s) that increase their risk of experiencing fatigue at work
3. actions for supervisors to take if they believe, through self-reporting or observation, that a worker may be unable to competently and safely perform his or her assigned duties because of fatigue

4. expectations related to rest periods that include an opportunity to sleep, if permitted
5. schedules that allow for a planned period of restorative sleep in appropriate accommodations, if permitted

Guidance

Licensees should define and implement a range of measures to manage risks associated with fatigue, including those to manage the level of fatigue workers experience at work and to reduce the likelihood and consequences of fatigue-related errors, such as:

- allowing rest periods or an opportunity to sleep with appropriate conditions defined (for example, turnover of duties, acceptable location(s), and duration)
- nurturing an environment that encourages self-reporting when workers believe they are too fatigued to perform their duties competently and safely (for example, freedom from reprisal)
- providing a work environment designed to enhance alertness (for example, appropriate lighting, temperature, and humidity)
- employing additional supervisory oversight and independent verification when the risk of fatigue is highest (for example, during the night shift, near the end of a shift, working beyond 12 hours)
- scheduling safety-critical tasks outside of peak times for fatigue (especially between the hours of 2 a.m. and 6 a.m.) when possible
- rotating workers between tasks of varying cognitive and physical workloads when possible

3.3 Authorities, accountabilities and responsibilities

Licensees shall define and document the authorities, accountabilities, and responsibilities for those involved with managing worker fatigue.

Guidance

Authorities, accountabilities, and responsibilities should be defined and documented for the following:

1. senior management
2. supervisors of workers who could pose a risk to nuclear safety or security
3. workers who could pose a risk to nuclear safety or security
4. key support positions involved with managing worker fatigue, such as medical, human resources, and workforce planning and scheduling personnel
5. contractor organizations

3.4 Training and education

With respect to managing fatigue, licensees shall ensure that those with authorities, accountabilities, and responsibilities for managing worker fatigue receive initial and ongoing training commensurate with their authorities, accountabilities, and responsibilities.

Guidance

Training and education about fatigue and measures for managing risks associated with worker fatigue should address the following topics:

- causes, risks and consequences of fatigue (for example, effects of fatigue and circadian rhythms on alertness and performance; importance of sleep and strategies to maximize the benefits of recovery opportunities; sleep disorders and their treatment; symptoms of fatigue; measures to minimize the effects of fatigue; commuting)
- measures for managing worker fatigue (for example, authorities, accountabilities and responsibilities for managing worker fatigue and

controlling hours of work; process to follow when a performance impairment due to fatigue is suspected)

- regulatory requirements related to fatigue and hours of work

Requirements and guidance for training systems are found in REGDOC-2.2.2, *Personnel Training*. [2]

3.5 Control of changes to shift schedules

Licensees shall control changes to shift schedules, such as modifications to start times or shift length.

After significant changes to shift schedules have been implemented, licensees shall review their impact on fatigue levels and nuclear safety and security.

Guidance

Before implementing changes to a shift schedule, the proposed schedule should be assessed against factors known to affect fatigue.

Licensees should define and implement a method for monitoring the impact of changes to shift schedules on fatigue levels and on nuclear safety and security.

3.6 Problem identification and resolution

Licensees shall identify and resolve problems related to worker fatigue.

When an act or omission by a worker may have caused or contributed to a safety significant incident, licensees shall record the work schedule of workers directly involved, when known, for at least one week prior to the incident. These data shall be assessed periodically to determine the effectiveness of the limits on hours of work and recovery periods.

Guidance

In addition to the requirements related to safety significant incidents, when an act or omission by a worker may have caused or contributed to an incident, the incident analysis team should consider and record fatigue-related factors of the workers directly involved (for example, work schedule; sleep obtained prior to the incident compared to sleep normally obtained; consecutive hours awake at the time of the incident) and should determine if performance was consistent with the effects of fatigue. Licensees should capture this information as part of the incident report.

3.7 Assessment and continual improvement

Licensees shall conduct periodic assessments to:

1. determine the effectiveness of the management system in managing the risks associated with worker fatigue and identify opportunities for continual improvement
2. verify that staffing levels are sufficient for enabling adherence to limits on hours of work and recovery periods

Licensees shall carry out trend analyses of problems and causes related to fatigue or work schedules.

Guidance

Licensees should use multiple methods to assess the effectiveness of the management system in managing the risks associated with worker fatigue, such as performance indicators, trend analyses, internal and external operating experience, benchmarking, self-assessments, independent assessments, and worker surveys.

A licensee's periodic assessment schedule may include a greater frequency of assessments for safety-sensitive positions than for the broad population.

4. Limits on Hours of Work and Recovery Periods Applicable to Safety-Sensitive Positions

4.1 Identification of safety-sensitive positions

Licensees shall list all safety-sensitive positions in their governing documents.

Safety-sensitive positions shall include:

1. certified workers
2. the following security personnel: nuclear security officers, onsite nuclear response force (NRF) members, and designated non-NRF personnel

In addition, licensees shall perform a risk-informed analysis to identify any other safety-sensitive positions.

Positions that are part of the minimum staff complement at high-power reactor facilities shall be considered as safety-sensitive unless documented as not safety-sensitive through the analysis.

Guidance

The risk-informed analysis to identify workers who fill safety-sensitive positions should consider risks related to the following:

- tasks of the worker during normal and emergency operating conditions
- nature of equipment and material that the worker handles or could handle

- actions assigned to the workgroup that could directly cause or contribute to a significant incident or could result in an inadequate response to a significant incident

4.2 Limits on hours of work applicable to safety-sensitive positions

Hours of work limits in section 4.2 and recovery periods in section 4.3 shall apply to workers filling safety-sensitive positions. Limits on hours of work and recovery periods are summarized in the tables in the appendix.

Licensees shall ensure that the hours worked do not exceed the following limits:

1. 16 hours in a 24-hour period
2. 28 hours in a 48-hour period
3. 60 hours in a fixed 7-day period OR 120 hours in a rolling 14-day period
4. 54 hours per week on average over a fixed period not exceeding 13 weeks OR a rolling period not exceeding 18 weeks

With the exception of shift turnover, all time present at work shall be included when determining compliance with the limits on hours of work in section 4.2 and the recovery periods in section 4.3.

Guidance

As part of the fatigue management provisions, licensees should establish administrative limits that prevent workers from consistently working the maximum allowable hours of work.

A normal work shift should not exceed 12 hours. As far as reasonably practicable, night shifts should not extend beyond 12 hours.

It is acknowledged that the transfer of information and responsibilities between individuals or work units during shift turnovers is important for ensuring nuclear safety. For this reason, the duration of shift turnover may vary, but should typically be completed within 30 minutes per shift.

Licensees' governing documents should specify which time periods will be implemented for items 3 and 4 in section 4.2.

Hours of work limits in section 4.2 and recovery periods in section 4.3 are not applicable to workers temporarily assigned to a position that is not safety-sensitive for a minimum period of two weeks. A licensee's governing documents should define the process for managing fatigue when transitioning workers between positions that are safety-sensitive and those that are not.

4.3 Recovery periods applicable to safety-sensitive positions

The recovery periods in this section apply to persons working straight day or night shifts or shifts that rotate between days and nights.

A worker shall be given a minimum recovery period of 8 consecutive hours free from work between shifts.

1. For persons working shifts **from 8 to 10 hours:**

1. a maximum of 5 consecutive night shifts shall not be exceeded
2. a minimum recovery period of 48 hours shall follow a block of 4 or more consecutive night shifts

2. For persons working shifts over **10 hours and up to 12 hours:**

1. a maximum of 6 shifts on consecutive calendar days shall not be exceeded
2. a maximum of 4 consecutive night shifts shall not be exceeded
3. if shifts on consecutive calendar days include day and night shifts, a maximum of 3 consecutive night shifts shall not be exceeded

4. a minimum recovery period of 72 hours shall follow a block of 3 or more consecutive night shifts; where only 2 consecutive night shifts are worked, a minimum recovery period of 48 hours shall follow

Staffing levels shall be sufficient to ensure that training activities, sickness, vacation or staff turnover do not lead to non-compliance with limits on hours of work in section 4.2 and recovery periods in section 4.3, as far as reasonably practicable.

Guidance

A worker should normally be given 11 consecutive hours free from work between shifts. A recovery period of 8 hours should be rarely used (for example, if necessary to fill a minimum staff complement position; when the recovery period occurs at night when the body's circadian rhythm promotes sleep).

For persons working shifts **from 8 to 10 hours:**

- a minimum recovery period of 36 hours should occur in any 7-day period
- the direction of shift rotation should be clockwise

For persons working shifts **over 10 hours and up to 12 hours:**

- a normal work schedule should include 3 or fewer consecutive night shifts.
- if day shifts are followed by night shifts on consecutive calendar days, a limit of 2 night shifts should apply (for example, 2 day shifts followed by 2 night shifts followed by 48 hours off)
- the following deviations from recovery periods following a block of consecutive shifts may be applied:

- the minimum recovery period following a block of night shifts in Section 4.3, 2d may be reduced by 24 hours when a worker is transitioning to a sequence of classroom training on days or when a worker who normally works day shifts works only one block of consecutive night shifts
- to maintain minimum staff complement, the requirement for 72 hours off following a block of 3 or more 12-hour night shifts may be reduced to 48 hours off once every three months per worker
- recovery periods following a block of consecutive shifts may be reduced occasionally to enable night shift workers to attend important meetings during the day

Should exceptional circumstances require variance with limits of hours of work in Section 4.2 or recovery periods in Section 4.3 for those in safety-sensitive positions, licensees should consult Section 4.4: Exceptional circumstances.

Licensees can propose alternative equivalent limits to those contained in sections 4.2 and 4.3. Proposed changes to the limits must demonstrate an equivalent level of safety, must be science-based, and must be approved by the Commission.

4.4 Exceptional circumstances

Licensees may determine that certain exceptional circumstances warrant exceeding the limits in section 4.2 and 4.3 to prevent unreasonable risk to nuclear safety and security.

1. Licensees shall document and implement measures during exceptional circumstances above and beyond those applied during routine operations as per section 3.2, including:

1. measures to manage the risks associated with fatigue, including to manage the level of worker fatigue and to reduce the likelihood and consequences of fatigue-related errors
 2. a process for authorizing and recording exceedances
2. For exceptional circumstances when workers remain onsite longer than 16 hours, licensees shall document and implement measures to manage the risks associated with fatigue, including:
1. provision of sufficient accommodations appropriate for restorative sleep (for example, horizontal sleeping surface, darkened environment, minimal intrusive noise)
 2. duty periods and mandatory rest periods that will be provided to enable workers to obtain restorative sleep during extended shifts
 3. delays to non-essential maintenance, testing and operations activities
 4. recovery periods following the extended period onsite
3. The rationale for the measures to be implemented during exceptional circumstances shall be based on scientific principles and knowledge.

Guidance

For exceptional circumstances when workers remain onsite longer than 16 hours, licensees should provide workers with reasonable opportunities to obtain restorative sleep. Licensees should provide workers with at least 8 hours of rest in every 24-hour period. Rest periods should be divided into no more than two periods and, if possible, include time at night when the body's circadian rhythm promotes sleep.

4.5 Records

For workers filling safety-sensitive positions, licensees shall retain records of:

1. shifts worked
2. non-compliance(s) with the limits on hours of work and recovery periods, including those that occur during exceptional circumstances

Guidance

Records of non-compliance(s) should include the date and extent of the non-compliance(s), name or unique identifier, position title(s), reason for non-compliance(s) and, if applicable, measures implemented to reduce fatigue or the risk of fatigue-related errors.

[Top of page](#)

Appendix: Hours of Work and Recovery Periods for Safety-Sensitive Positions

Table 1: Summary of hours of work requirements applicable to safety-sensitive positions from Section 4.2

Time frame	Limits on hours of work
24 hours	16
48 hours	28
Fixed 7 days OR rolling 14 days	60 OR 120
Fixed period up to 13 weeks OR rolling period up to 18 weeks	54 (average per week)

Table 2: Summary of minimum recovery period requirements applicable to safety-sensitive positions from Section 4.3

Time frame	Consecutive hours off
Between shifts	8
Recovery periods for shifts from 8 to 10 hours	
Following a block of 4 or more consecutive night shifts	48
Recovery periods for shifts over 10 and up to 12 hours	
Following a block of 3 or more consecutive night shifts	72
Following a block of 2 consecutive night shifts	48

Table 3: Summary of limits on the number of consecutive shifts from Section 4.3

Consecutive shifts	Number of shifts
Shifts from 8 to 10 hours	
Maximum number of consecutive night shifts	5
Shifts over 10 and up to 12 hours	
Maximum number of shifts on consecutive calendar days	6
Maximum number of consecutive night shifts	4
If shifts on consecutive calendar days include day and night shifts, maximum number of consecutive night shifts	3

Glossary

block of consecutive shifts

Set of consecutive shifts with the same start and end times followed by a minimum recovery period and a subsequent set of consecutive shifts.

broad population

Population of workers who have the potential through their work activities to pose a risk to nuclear safety or security.

certified

Certified by the Commission under paragraph 21(1)(i) of the NSCA or by a designated officer authorized under paragraph 37(2)(b) of the Act.

contractor

An organization or individual providing services to another organization in accordance with agreed-upon specifications, terms, and conditions.

designated non-nuclear response force personnel

Designated non-nuclear response force personnel are security staff that are authorized under the *Public Agents Firearms Regulations* to possess or have access to prohibited and restricted firearms, items or devices on behalf of and under the authority of the CNSC for the purpose of carrying out his or her duties. These duties may encompass the storage, transport, handling, maintenance and use of firearms related to NRF functions.

fatigue

A state of reduced mental or physical performance capability resulting from sleep loss, extended wakefulness, phase of the circadian rhythm or workload.

high-power reactor facilities (also known as high-energy reactor facilities)

Power production and research reactors greater than 10 MWt.

high-security site

A nuclear power plant or a nuclear facility where Category I or II nuclear material is processed, used or stored.

human performance

The outcomes of human behaviours, functions and actions in a specified environment, reflecting the ability of workers and management to meet the system's defined performance, under the conditions in which the system will be employed.

incident

Any unintended event, including operating errors, equipment failures, initiating events, accident precursors, near misses or other mishaps, or unauthorized act, malicious or non-malicious, the consequences or potential consequences of which are not negligible from the point of view of protection or safety (IAEA Safety Glossary, 2007).

licensing basis

A set of requirements and documents for a regulated facility or activity comprising:

- the regulatory requirements set out in the applicable laws and regulations
- the conditions and safety and control measures described in the facility's or activity's licence and the documents directly referenced in that licence
- the safety and control measures described in the licence application and the documents needed to support that licence application.

minimum staff complement

The minimum number of qualified workers who must be present at all times to ensure the safe operation of the nuclear facility and to ensure adequate emergency response capability.

night shift

Shift that includes any time at work between 2 a.m. and 6 a.m.

nuclear security officer

A person whose function is to provide security at a high-security site and to whom an authorization referred to in subsection 18(2) of the *Nuclear Security Regulations* has been issued.

onsite nuclear response force

- (a) a team of nuclear security officers whose members are
 - (i) trained in the use of firearms, authorized to carry firearms in Canada and qualified to use them, and
 - (ii) permanently located at a high-security site; or
- (b) a local, provincial or federal police service, a Canadian Forces unit or any other force
 - (i) under contract to a licensee,
 - (ii) whose members are trained in the use of firearms, authorized to carry firearms in Canada and qualified to use them, and
 - (iii) whose members are permanently located at a high-security site.

safety-sensitive position

A position which has a role in the operation, where impaired performance could result in a significant incident affecting the environment, the public, the health and safety of workers and others at site, or the safety and security of the facility. This includes all workers who are regularly required to rotate through or regularly relieve in safety-sensitive positions.

Those who directly supervise the working level positions, or who may perform the same duties or exercise the same responsibilities as safety-sensitive positions are deemed to hold safety-sensitive positions.

safety significance

The significance of a situation, event or issue with respect to the impact on meeting the nuclear safety objectives as defined by the International Atomic Energy Agency in document SF1, *Fundamental Safety Principles*. In

general, a situation, event or issue has safety significance if it denotes a deviation from the safety case accepted in the licence, in a direction detrimental to safety, such as but not limited to:

- reducing margins to (or exceeding) the accepted limits
- increasing risk to the health, safety and security of persons and the environment
- impairments (various degrees) of the special safety systems or of the safety functions for accident mitigation
- reduction in defence in depth
- events causing radioactive releases and spills of hazardous substances, injuries to workers or the public, etc.

shift turnover

Transfer of information and responsibilities between individuals or work units, one of which is relieving the other. Shift turnover activities may include, but are not limited to, discussions of the status of plant equipment, and the status of ongoing activities, such as extended tests of safety systems and components.

sleep debt

The difference between the amount of sleep an individual needs and the amount of sleep that the individual actually obtains.

supernumerary day shifts

Periodic sequences of eight-hour day shifts that are built into a shift worker's schedule.

worker

A person who performs work that is referred to in a licence.

Note: This definition applies to workers directly employed by a licensee, as well as to contractors and to subcontractors.

[Top of page](#)

References

1. CSA Group, CSA N286-12, *Management system requirements for nuclear facilities*, Mississauga, 2012.
2. Canadian Nuclear Safety Commission, REGDOC-2.2.2, *Personnel Training*, Ottawa, 2014.

Additional information

The following documents contain additional information related to managing worker fatigue.

1. CSA Group, CSA Z1600-14, *Emergency and continuity management program*, Mississauga, 2014.
2. Canadian Nuclear Safety Commission, RD-204, *Certification of Persons Working at Nuclear Power Plants*, Ottawa, 2008.
3. CNSC, G-323, *Ensuring the Presence of Sufficient Qualified Staff at Class I Nuclear Facilities – Minimum Staff Complement*, Ottawa, 2007.
4. Smiley, A. and C. Rudin-Brown, RSP-0289, *Review of Criteria for Assessing Shift Schedules in the Nuclear Industry*, Ottawa, 2013.
5. Kulp, K., RSP-0096, *Development of a Regulatory Monitoring Program for Shiftwork Systems at Canadian Nuclear Power Plants*, Ottawa, 1999.
6. Smiley, A. and N. Moray, INFO-0318, *A Review of 12-Hour Shifts at Nuclear Generating Stations*, Atomic Energy Control Board, Ottawa, 1989.
7. Lerman, S., et al., "Fatigue Risk Management in the Workplace," *Journal of Occupational and Environmental Medicine* 54, 2 (2012): 231–58.

CNSC Regulatory Document Series

Facilities and activities within the nuclear sector in Canada are regulated by the Canadian Nuclear Safety Commission (CNSC). In addition to the *Nuclear Safety and Control Act* and associated regulations, these facilities and activities may also be requirements to comply with other regulatory instruments such as regulatory documents or standards.

Effective April 2013, the CNSC's catalogue of existing and planned regulatory documents has been organized under three key categories and twenty-five series, as set out below. Regulatory documents produced by the CNSC fall under one of the following series:

- **1.0 Regulated facilities and activities**
- Series 1.1 Reactor facilities
 - 1.2 Class IB facilities
 - 1.3 Uranium mines and mills
 - 1.4 Class II facilities
 - 1.5 Certification of prescribed equipment
 - 1.6 Nuclear substances and radiation devices
- **2.0 Safety and control areas**
- Series 2.1 Management system
 - 2.2 Human performance management
 - 2.3 Operating performance
 - 2.4 Safety analysis
 - 2.5 Physical design
 - 2.6 Fitness for service
 - 2.7 Radiation protection
 - 2.8 Conventional health and safety
 - 2.9 Environmental protection
 - 2.10 Emergency management and fire protection

- 2.11 Waste management
- 2.12 Security
- 2.13 Safeguards and non-proliferation
- 2.14 Packaging and transport
- **3.0 Other regulatory areas**
- Series 3.1 Reporting requirements
 - 3.2 Public and Aboriginal engagement
 - 3.3 Financial guarantees
 - 3.4 Commission proceedings
 - 3.5 CNSC processes and practices
 - 3.6 Glossary of CNSC terminology

Note: The regulatory document series may be adjusted periodically by the CNSC. Each regulatory document series listed above may contain multiple regulatory documents. For the latest list of regulatory documents, visit the [CNSC's website](#).

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