Canada's Nuclear Regulator

# Operating Performance
# **Periodic Safety Reviews**

REGDOC-2.3.3

April 2015

Canadian Nuclear Safety Commission
Commission canadienne de sûreté nucléaire

Canada

**Operating Performance: Periodic Safety Reviews**
Regulatory Document REGDOC-2.3.3


PWGSC catalogue number CC172-120/2015E-PDF

ISBN 978-1-100-25942-0



*Également publié en français sous le titre : Bilans périodiques de la sûreté*

## Document availability

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## Publishing history

April 2015 Version 1.0

# Preface

This regulatory document is part of the CNSC's operating performance series of regulatory documents, which also covers commissioning, construction and severe accident management. 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.

Regulatory document REGDOC-2.3.3, *Periodic Safety Reviews*, sets out the CNSC's requirements for the conduct of a periodic safety review (PSR) for a nuclear power plant (NPP). It is consistent with the International Atomic Energy Agency's Safety Standards Series, Specific Safety Guide No. SSG-25, *Periodic Safety Review for Nuclear Power Plants* [1]. REGDOC-2.3.3 supersedes RD-360, *Life Extension of Nuclear Power Plants*, published in February 2008.

A PSR involves an assessment of the current state of the plant and its performance to determine the extent to which it conforms to applicable modern codes, standards and practices, and to identify any factors that would limit safe long-term operation.

Operating experience in Canada and around the world, new knowledge from research and development activities, and advances in technology, are taken into account. This enables the determination of reasonable and practical improvements that should be made to structures, systems and components, and to existing programs, to ensure the safety of the facility to a level approaching that of modern nuclear power plants, and to ensure continued safe operation. A PSR is a rigorous safety assessment that is complementary to, and does not replace, routine and non-routine regulatory reviews, inspections, mid-term reports, event reporting and investigations, or other CNSC compliance and verification activities.

Conduct of a PSR is intended to be a requirement that can be aligned with licence renewals and form part of the licensing basis for a regulated facility or activity within the scope of this document. It is intended for inclusion in licences, 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 existing nuclear power plants, 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.

An applicant or licensee may put forward a case to demonstrate that the intent of a requirement is addressed by other means and demonstrated with supportable evidence.

The requirements and guidance in this document are consistent with modern national and international practices addressing issues and elements that control and enhance nuclear safety.

Guidance contained in this document exists to inform the applicant, to elaborate further on requirements or to provide direction to licensees and applicants on how to meet requirements. It also provides more information about how CNSC staff evaluate specific problems or data during their review of licence applications. Licensees 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.

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.

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# Periodic Safety Reviews

## 1. Introduction

REGDOC-2.3.3, *Periodic Safety Reviews*, sets out the CNSC's requirements for the conduct of a periodic safety review (PSR). A PSR is a comprehensive evaluation of the design, condition and operation of a nuclear power plant (NPP, plant). It is an effective way to obtain an overall view of actual plant safety and the quality of the safety documentation, and to determine reasonable and practical improvements to ensure safety until the next PSR or, where appropriate, until the end of commercial operation.

PSRs have been effective in achieving improvements in safety. Adopting PSRs in support of licence renewal will ensure the continued improvement of NPP safety. Past experience with life-extension projects gives the CNSC and the Canadian nuclear industry a large degree of familiarity with the PSR process. As such, the application of a PSR in Canada represents an evolution of a current practice, as opposed to the adoption of a new one.

### 1.1 Purpose

This regulatory document sets out the CNSC's requirements for the conduct of a PSR. Guidance is also provided on how these requirements may be met.

### 1.2 Scope

This document is intended for nuclear power plants. However, it can be used by other nuclear facilities applying a graded approach.

### 1.3 Relevant regulations

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

1. Subsection 24(4) of the NSCA states that "No licence shall be issued, renewed, amended or replaced − and no authorization to transfer one given − unless, in the opinion of the Commission, the applicant (*a*) is qualified to carry on the activity that the licence will authorize the licensee to carry on; and (*b*) will, in carrying on that activity, make adequate provision for the protection of the environment, the health and safety of persons and the maintenance of national security and measures required to implement international obligations to which Canada has agreed"
2. Subsection 24(5) of the NSCA states that "A licence may contain any term or condition that the Commission considers necessary for the purposes of this Act…"
3. Section 3 of the *General Nuclear Safety and Control Regulations* states the general licence application requirements
4. Paragraphs 12(1)(*c*), (*f*) and (*i*) of the *General Nuclear Safety and Control Regulations* state that "Every licensee shall
   (*c*) take all reasonable precautions to protect the environment and the health and safety of persons and to maintain security of nuclear facilities and of nuclear substances; …
   (*f*) take all reasonable precautions to control the release of radioactive nuclear substances or hazardous substances within the site of the licensed activity and into the environment as a result of the licensed activity; …
   (*i*) take all necessary measures to facilitate Canada's compliance with any applicable safeguards agreement;"

5. Sections 3 and 6 of the *Class I Nuclear Facilities Regulations* state the general licence application requirements specific to Class I nuclear facilities and the information required to apply for a Class I nuclear facility operating licence

### 1.4 National and international standards

Key principles and elements used in developing this regulatory document are consistent with national and international standards, guides and practices. In particular, this regulatory document is consistent with the International Atomic Energy Agency's (IAEA) Safety Standards Series, Specific Safety Guide No. SSG-25, *Periodic Safety Review for Nuclear Power Plants* (SSG-25) [1].

## 2. General Requirements

The licensee shall conduct a PSR in accordance with this regulatory document for the period until the next PSR or, if applicable, until the end of commercial operation of the plant. The PSR shall be conducted according to the following four phases:

1. preparation of a PSR basis document
2. conduct of the safety factors reviews and identification of findings
3. analysis of the findings and their integral impact on the NPP's safety (global assessment)
4. preparation of a plan of safety improvements (integrated implementation plan)

**Guidance**

The objectives of a PSR are to determine:

1. the extent to which the facility conforms to modern codes, standards and practices
2. the extent to which the licensing basis remains valid for the next licensing period
3. the adequacy and effectiveness of the programs and the structures, systems and components (SSCs) in place to ensure plant safety until the next PSR or, where appropriate, until the end of commercial operation
4. the improvements to be implemented to resolve any gaps identified in the review and timelines for their implementation

The PSR approach is outlined in SSG-25. The complex process of conducting a PSR can be facilitated by subdividing it into tasks that are identified as safety factors. These safety factors are intended to cover all aspects that are important to the safety of an operating nuclear power plant. The terms "safety factor" and "safety factor reports" are an adoption of the SSG-25 terms, with the addition of a safety factor for radiation protection. Safety factor reports are discussed further in sections 3 and 4.

The licensee first prepares the PSR basis document which defines the scope and methodology for the PSR. This is then used to conduct the review, prepare the safety factor reports, and the global assessment report. The results of the PSR are used to establish the corrective actions and safety improvements to be included in the integrated implementation plan.

The documentation submitted to the CNSC includes:

1. PSR basis document
2. reports on the review of each safety factor (safety factor reports)
3. global assessment report (GAR)
4. integrated implementation plan (IIP)

In accordance with SSG-25 and international practice, 10 years is considered an appropriate interval between PSRs to identify any factors that would limit the NPP's continued safe operation and determine the extent to which it conforms to applicable modern codes, standards and practices. The next PSR interval may deviate from 10 years when it includes the end of commercial operation. The licensee may propose an alternative interval when the proposed operating strategy includes the end of commercial operations within or shortly after the 10-year interval.

It is expected that the effort necessary to carry out a second (or subsequent) PSR of an NPP will often be considerably less than for the first. In general, subsequent PSRs will focus on changes in requirements, facility conditions, operating experience and new information, rather than repeating the activities of previous reviews.

The PSR is complementary to, and does not replace, regulatory activities required and/or performed by the CNSC, including routine and non-routine regulatory reviews and inspections, mid-term reports, event reporting and investigations, or any other CNSC licensing and verification activities.

## 3. Periodic Safety Review Basis Document

The PSR basis document is an essential instrument that governs the conduct of the PSR. It ensures that the licensee and the CNSC have the same expectations for the PSR's scope, methodology and outcomes.

The PSR basis document shall be submitted to CNSC staff for acceptance. The required elements of the PSR basis document are:

1. statement of current licensing basis, including exemptions and acceptable deviations
2. statement of the proposed operating strategy of the facility
3. description of scope of the PSR
4. description of the methodology for the performance of the PSR, including the period for which the PSR is valid
5. statement of applicable modern codes, standards and practices
6. description of the methodology for the identification, dispositioning and tracking of gaps
7. description of the methodology for the global assessment
8. PSR governance

### 3.1 Current licensing basis

The licensee shall provide a description of the current nuclear power plant licensing basis at the time of initiation of the PSR, which will be used as a baseline for the conduct of the PSR.

### 3.2 Proposed operating strategy of the nuclear power plant

In the PSR basis document, the licensee shall state the proposed operating strategy of the plant.

**Guidance**

The PSR is performed to assess the condition of the NPP and the adequacy of the programs, including aging management programs, which are in place to maintain reactor safety. The review is forward-looking and the operating strategy of the plant should be considered to identify potentially lifetime-limiting features of the plant. The licensee is expected to identify whether the operating strategy is operation beyond the next 10-year interval or the end of commercial operations.

The operating strategy is expected to be reflected in the methodologies described in the PSR basis document.

### 3.3 Scope of the periodic safety review

The licensee shall describe the scope of the PSR in the PSR basis document. The licensee shall:

1. address all safety factors of the NPP including any interdependencies
2. identify all facilities and associated SSCs to be covered by the PSR
3. address unit-specific and site-specific issues
4. for multi-unit NPPs, address interdependencies on common SSCs not covered by item 1
5. consider all expected modes of operation; for a multi-unit facility, taking into consideration the operational state of each unit
6. include a comprehensive review of current licensing issues applicable to the safety factors

**Guidance**

The scope of the PSR should include a review of each of the following safety factors:

1. plant design
2. actual condition of SSCs important to safety
3. equipment qualification (environmental and seismic)
4. aging
5. deterministic safety analysis
6. probabilistic safety assessment
7. hazard analysis
8. safety performance
9. use of experience from other NPPs and research findings
10. organization, the management system and safety culture
11. procedures
12. human factors
13. emergency planning
14. radiological impact on the environment
15. radiation protection

SSG-25 describes 14 safety factors that have been selected on the basis of international experience and are intended to cover all factors important to NPP safety. The scope, tasks and methodologies of these 14 safety factors are considered to meet the CNSC's expectations for corresponding safety factors 1–14 listed above. The CNSC has included an additional safety factor on radiation protection; the licensee should refer to Appendix A for guidance on the scope and tasks for the review of this safety factor. The PSR basis document should include, in the scope and tasks, how the intent of each task listed for a safety factor will be addressed.

It is expected that the required effort to carry out a subsequent PSR of an NPP will often be considerably less than for the first; however, the subsequent PSR should consider explicitly if the earlier PSR conclusions remain valid (for example, in light of the time elapsed since it was performed).

### 3.4 Methodology for the performance of the periodic safety review

The licensee shall specify the methodology for:

1. conducting assessments that confirm that the plant will continue to meet its licensing basis until the next PSR cycle or, where appropriate, the end of commercial operation
2. conducting assessments against applicable modern codes, standards and practices
3. conducting a global assessment of facility safety in view of all PSR gaps and strengths
4. identifying any corrective actions and safety improvements that are necessary to address PSR findings to improve the level of safety

**Guidance**

The methodologies that will be applied for the PSR should be described in the PSR basis document to show how the licensee plans to achieve the PSR objectives as stated in section 2. The methodologies outlined in SSG-25 for performing safety factor reviews provide an acceptable approach.

Since processes and programs have many levels of interdependencies and interrelationships, the reviews should be conducted using internal documents that correctly represent these dependencies and relationships. To ensure this, a freeze date should be established for the internal documents used in the safety factor reviews. The reviews are then carried out using documents that are applicable to the document freeze date.

### 3.5 Applicable modern codes, standards and practices

The licensee shall state what modern national and international codes, standards and practices will be used in the reviews, including their effective dates, as well as:

1. the criteria for their selection
2. the PSR cut-off date beyond which changes to codes and standards and new information will not be considered
3. the type of review to be performed (clause-by-clause, high level or alternative)

**Guidance**

An integral element of the PSR is the assessment of the extent to which the NPP would satisfy requirements and expectations set out in applicable modern codes, standards and practices. A list of modern codes, standards and practices with their cut-off dates, should be established before any work is carried out. This ensures a common and consistent expectation for the reviews.

Modern codes, standards and practices should be selected, taking into consideration CNSC's regulatory documents as well as modern international practices and operational experience. Primary consideration for selection of codes and standards should rest with those referenced in licences and applicable CNSC regulatory documents. IAEA documents and other appropriate international standards should also be considered. If an appropriate Canadian code or standard is not available, the licensee should propose a reasonable substitute.

It is expected that all mandatory clauses in a code or standard will be reviewed to determine if the identified requirements are met. Any applicable sub-tier referenced sections in the mandatory clauses to other codes, standards and licensee documentation should also be reviewed and addressed. A clause-by-clause type review should also be performed for new versions of codes and standards referenced by the licence and licence condition handbook. For other codes and standards, licensees may propose other types of reviews.

### 3.6 Methodology for the identification, dispositioning and tracking of gaps

The licensee shall describe the process and methodology for identifying, categorizing, prioritizing and dispositioning gaps. The licensee shall state what decision-making process will be used to evaluate and decide on the various alternatives to disposition the gaps.

To the extent practicable, the licensee shall resolve identified gaps with respect to applicable modern codes, standards and practices. The licensee shall use established processes to resolve identified gaps with the current licensing basis. The licensee shall track dispositioning and resolution of all gaps identified during the PSR through to their resolution.

**Guidance**

The PSR review should identify the following types of findings:

- **strengths** – current practices are equivalent to or better than those established in modern codes and standards, practices
- **gaps –** current practices are not equivalent to those established in modern codes and standards practices, or do not meet the current licensing basis, or are inconsistent with the operational documentation for plant

The rationale behind identifying the findings and their disposition should be justified using valid arguments and supporting evidence. All gaps should be categorized and prioritized according to their safety significance. While assessing gaps for safety significance, the licensee should consider deterministic and probabilistic safety analyses, engineering judgment or a combination thereof. Suitability for assessment via selected means should be determined by the nature of the finding.

Depending on the nature of the gaps, the licensee may also include considerations such as public radiation safety, plant operability, occupational radiation safety, emergency preparedness, and the environment when prioritizing gaps. The overall priority of a gap should inform the course of action to be taken to establish its recommended disposition. Any gaps representing the plant's non-compliance against the current licensing basis may be resolved through the existing plant programs. The licensee should establish and maintain a database of all gaps identified during the PSR.

### 3.7 Methodology for the global assessment

The methodology for performing the global assessment shall be described in the PSR basis document. The methodology shall address and include:

1. results of the safety factor reviews, in particular, the findings (both gaps and strengths) of NPP design and operation
2. the interdependencies between gaps and the significance of their aggregate effects
3. recommended corrective actions and safety improvements to address individual and consolidated gaps
4. the extent to which the safety requirements of defence in depth are fulfilled
5. an estimate of global risk associated with facility operation with any unresolved gaps

The results from the global assessment shall be documented in the global assessment report.

**Guidance**

The objective of the global assessment is to present an overall evaluation of facility safety taking into account a balanced assessment of all findings identified in the PSR. The global assessment should

take into account all the strengths and gaps from the PSR, and the corrective actions and/or safety improvements proposed to improve the overall level of safety.

The review of individual safety factors may indicate that the NPP's safety is acceptable; however, when a review of the interactions, overlaps and gaps between safety factors is performed, new findings may be identified that have an impact on overall level of safety.

### 3.8 Periodic safety review governance

In the PSR basis document, the licensee shall establish, and describe governance for the conduct of the PSR.

**Guidance**

The licensee's governance for the conduct of PSR should address that:

1. the PSR team is qualified to carry out the review
2. provisions have been made for peer or independent review of work done
3. controls are in place to ensure that information and data are used consistently across the review
4. requirements for the preparation and verification of documentation are satisfied
5. results are recorded in a systematic and auditable manner

The licensee should develop a project plan for the conduct of the PSR that includes established project management processes and quality management provisions.

## 4. Performance of the Periodic Safety Review

The licensee shall conduct the PSR in accordance with the accepted PSR basis document following its acceptance by CNSC staff.

**Guidance**

It is recommended that the licensee does not undertake substantive work on the PSR until such time as CNSC staff has accepted the PSR basis document.

### 4.1 Safety factor reports

Upon completion of the safety factor reviews, the licensee shall prepare reports for submission to CNSC staff in accordance with the accepted PSR basis document. The licensee shall ensure that each safety factor report documents:

1. objective, scope, tasks and methodology for the review
2. applicable codes , standards and practices
3. overview of applicable facility programs and processes
4. findings of the review which identify gaps and strengths
5. categorized and prioritized gaps
6. interfaces with other safety factor report findings
7. options for corrective actions for each gap

**Guidance**

The safety factor reports document the findings for specific review tasks. The findings of the assessments and the comparison against applicable modern codes, standards, and practices are included. Any gaps are identified, recorded, categorized, prioritized and dispositioned.

The overall structure of each report should be a summary of the review followed by detailed reporting and conclusions. The report should:

1. clearly indicate the type of review conducted for each review element: a clause-by-clause review, a high-level review or a combination thereof, and provide the rationale for selecting the type of review
2. provide systematic coverage of the expected review tasks with detailed analysis of how the licensee addressed requirements to fulfill licensing bases, as well as the expectations for satisfying applicable, modern codes, standards and practices set out in the basis document
3. clearly indicate the licensee's acceptance of any work done by an outsourced contractor
4. provide enough information to allow CNSC staff to make a regulatory determination based on the information contained in the report

The licensee should prepare the safety factor reports to be as self-contained as practicable, avoiding excessive referencing. Where a code, standard or practice addresses more than one review element, the findings of such reviews should be cross-referenced.

Safety factor reports should be submitted concurrently or in a single package because some reports may be inter-related. For example, the report for aging may be inter-related with the reports on the actual condition of SSCs important to safety and deterministic safety analysis.

## 5. Global Assessment Report

The licensee shall prepare a report that documents the results of the global assessment. The global assessment report (GAR) shall present the findings of the PSR, both strengths and gaps, to provide an overall assessment of the safety of plant. The GAR shall document the overall conclusions, corrective actions and safety improvements to be considered. It shall be submitted to CNSC staff for review.

**Guidance**

The GAR should provide a living database that captures the current state of the gaps. The database should be fully traceable so that a change in a gap, or in the assessment of a gap, can be easily tracked to its resolution. The GAR should include the following elements:

1. summaries of the safety factor reports and identified gaps and strengths
2. overlaps, omissions, and interface issues of the findings from the safety factor reports
3. consolidation of gaps into global issues where appropriate
4. safety significance and risk ranking of all gaps (individual and consolidated)
5. corrective actions, safety improvements and appropriate dispositions proposed for all gaps and global issues
6. a global assessment based on the aggregate effect of the findings resulting from all safety factor reports, taking the proposed corrective actions and safety improvements into account, and defence in depth
7. statement of the licensee's assessment of the overall acceptability of operation of the NPP

## 6. Integrated Implementation Plan

The licensee shall develop an integrated implementation plan (IIP) that addresses the results of the global assessment. The IIP shall be submitted to CNSC staff for acceptance.

In the IIP, the licensee shall:

1. list the corrective actions and safety improvements (including necessary physical NPP modifications) that will address all gaps identified in the PSR, and findings
2. specify the schedule for implementing the corrective actions and safety improvements

**Guidance**

An overview of the acceptability of safe operation of plant in view of the proposed changes should be included in the IIP, to demonstrate that the outcome of safety improvements serves the intended purpose of the PSR.

In the IIP, the licensee should:

1. demonstrate traceability and provide references to the GAR
2. specify the processes used for determining the detailed scope, including prioritization and scheduling of corrective actions and safety improvements
3. schedule and implement corrective actions and safety improvements commensurate with their safety significance
4. specify processes for identification and management of project risks and controls
5. specify the process to be used to track the progress and completion of the corrective actions and safety improvements

It is encouraged to organize the IIP according to the CNSC's safety and control areas so as to facilitate the CNSC's review. See Appendix B for more information on CNSC's safety and control areas.

To ensure the IIP's success, the licensee should have the following in place:

1. a project organization, structured to execute the IIP
2. governance for IIP delivery
3. scope, schedules and dependencies, at least for the earlier tasks
4. definition of resources and a resourcing plan
5. a mechanism for overall integration, peer or independent review and oversight

# Appendix A: Safety Factor for Radiation Protection

As stated in section 3.3 of this document, the scope of the PSR should address the following 14 safety factors set out in the International Atomic Energy Agency's Safety Standards Series, Specific Safety Guide No. SSG-25, *Periodic Safety Review for Nuclear Power Plants* (SSG-25) [1]:

1. reactor facility design
2. actual condition of structures, systems and components important to safety
3. equipment qualification
4. aging
5. deterministic safety analysis
6. probabilistic safety assessment
7. hazard analysis
8. safety performance
9. use of experience from other plants and research findings
10. organization, the management system and safety culture
11. procedures
12. human factors
13. emergency planning
14. radiological impact on the environment

SSG-25 does not address radiation protection (RP) as a separate safety factor because it is considered as a review element of several other safety factors. It is expected that RP-related elements will be integrated into the relevant safety factor reports as described in SSG-25, including safety factors 8 (safety performance), 10 (organization, the management system and safety culture) and 11 (procedures).

Based on experience from previous CNSC reviews, the licensee should address four RP-related review elements separately. These elements are outlined in the following text.

## A.1 Objective

The objective of the review of RP is to determine:

- the extent to which RP has been accounted for in the design and operation of the reactor facility
- whether RP provisions (including design and equipment) provide adequate protection of persons from the harmful effects of radiation, and ensures that contamination and radiation exposures and doses to persons are monitored and controlled, and maintained as low as reasonably achievable (ALARA)

## A.2 Scope and tasks

The scope of this review will depend on the extent of changes in standards and/or the licensing basis since the previous PSR or the start of operation. The review of RP should include the following tasks:

- reactor design features for RP
- RP equipment and instrumentation for radiation monitoring
- RP aspects during nuclear emergencies
- RP operating experience

## A.3 Methodology

The review should be performed systematically by reviewing national and international requirements and standards listed in the PSR basis document and other requirements and standards identified as relevant during the course of the review.

### A.3.1 Review of the reactor design features for radiation protection

The review should identify all sources of radiation and radiation exposure pathways, with an evaluation of radiation doses that could be received by workers at the facility with consideration of contained and fixed sources, and potential sources of airborne radioactive material. The review should demonstrate that the ALARA principle has been incorporated in the reactor design and operational programs and arrangements, in order to minimize the number and locations of radiation sources and the radiation fields associated with them.

The review should determine that the design and layout of the reactor facility meets CNSC regulatory requirements and expectations for reactor facilities in the area of RP (e.g., REGDOC-2.5.2, *Design of Reactor Facilities: Nuclear Power Plants* and RD/GD-369, *Licence Application Guide: Licence to Construct a Nuclear Power Plant*). The review should include RP principles, and how they are incorporated into the reactor design and are of a sufficient depth to demonstrate the following:

- suitable provisions have been made in the design and layout of the reactor facility to keep occupational radiation doses below regulatory limits and ALARA, including:
  - classification of areas (zoning) and access control
  - aging of all materials and obsolescence of technology that could impair the radiological safety functions of SSCs
  - radiological hazard control
  - decontamination of personnel, equipment and structures
  - radiological monitoring (in-plant)
- SSCs have been adequately designed so that radiation exposures during all activities are optimized and justified

### A.3.2 Review of radiation protection equipment and instrumentation for radiation monitoring

The review of RP equipment and instrumentation for radiation monitoring should demonstrate adequate provisions for monitoring all significant radiation sources, in all activities throughout the lifetime of the reactor facility. These should cover operational states and accident conditions and, as practicable, beyond-design-basis accidents, including severe accidents. The review of the physical condition of RP instrumentation and equipment should be confirmed by walk downs where practicable to verify continued utility and functionality.

### A.3.3 Review of radiation protection aspects for nuclear emergencies

The review of RP aspects for nuclear emergencies should demonstrate the effectiveness of RP measures during a nuclear emergency. These measures may be significantly impacted by facility configuration and controls; or for example, the review should consider access controls, habitability controls, communications systems, adequate radiation monitoring capabilities, portable emergency response RP equipment, and radiation personnel protective equipment.

### A.3.4 Review of radiation protection related to operating experience

The review of RP-related operating experience (OPEX) should identify OPEX reports from other reactor facilities and relevant national and international experience and research findings. The review should verify that this information has been properly considered in the routine evaluation of OPEX and research developments and that appropriate action has been taken. The review of OPEX should seek to identify good practices and lessons learned elsewhere, and to take advantage of improved knowledge derived from research, in the area of RP.

# Appendix B:CNSC Safety and Control Areas

| Safety and Control Area | Description |
|---|---|
| Management system | The framework that establishes the processes and programs required to ensure an organization achieves its safety objectives, continuously monitors its performance against these objectives, and fosters a healthy safety culture. |
| Human performance management | The activities that enable effective human performance through the development and implementation of processes that ensure a sufficient number of licensee personnel are in all relevant job areas and have the necessary knowledge, skills, procedures and tools in place to safely carry out their duties. |
| Operating performance | This includes an overall review of the conduct of the licensed activities and the activities that enable effective performance. |
| Safety analysis | Maintenance of the safety analysis that supports the overall safety case for the facility. Safety analysis is a systematic evaluation of the potential hazards associated with the conduct of a proposed activity or facility and considers the effectiveness of preventative measures and strategies in reducing the effects of such hazards. |
| Physical design | The activities that impact the ability of structures, systems and components to meet and maintain their design basis given new information arising over time and taking changes in the external environment into account. |
| Fitness for service | The activities that impact the physical condition of structures, systems and components to ensure that they remain effective over time. This area includes programs that ensure all equipment is available to perform its intended design function when called upon to do so. |
| Radiation protection | The implementation of a radiation protection program in accordance with the *Radiation Protection Regulations*. This program must ensure that contamination levels and radiation doses received by individuals are monitored and controlled, and maintained as low as reasonably achievable (ALARA) |
| Conventional health and safety | The implementation of a program to manage workplace safety hazards and to protect personnel and equipment. |
| Environmental protection | The programs that identify, control and monitor all releases of radioactive and hazardous substances and effects on the environment from facilities or as the result of licensed activities. |
| Emergency management and fire protection. | The emergency plans and emergency preparedness programs which exist for emergencies and for non-routine conditions. This area also includes any results of participation in exercises. |
| Waste management | The internal waste-related programs that form part of the facility's operations up to the point where the waste is removed from the facility to a separate waste management facility. This area also covers the planning for decommissioning. |
| Security | The programs required to implement and support the security requirements stipulated in the regulations, in the license, in orders, or in expectations for the facility or activity. |
| Safeguards and non-proliferation | The programs required for the successful implementation of the obligations arising from the Canada/IAEA safeguards agreements, as well as all other measures arising from the *Treaty on the Non-Proliferation of Nuclear Weapons.* |
| Packaging and transport | The programs that manage the safe packaging and transport of nuclear substances and radiation devices to and from the licensed facility. |

# Glossary

**aging management**
Engineering, operations, inspection, and maintenance actions to control, within acceptable limits, the effects of physical aging and obsolescence of structures, systems and components.

**ALARA (as low as reasonably achievable)**
A principle of radiation protection that holds that exposures to radiation are kept as low as reasonably achievable, social and economic factors taken into account. Section 4 of the *Radiation Protection Regulations* stipulates licensee requirements with respect to ALARA.

**corrective actions**
Measures taken to eliminate the cause of a detected nonconformity or other undesirable situation to prevent reoccurrence.

**global assessment**
An overall risk judgment on the acceptability of continued operation of a nuclear facility.

**integrated implementation plan (IIP)**
A plan that considers the scope and schedule of safety improvements to support continued operation of a facility, based on the results of a periodic safety review.

**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

**management system**
A set of interrelated or interacting elements (system) for establishing policies and objectives and enabling the objectives to be achieved in an efficient and effective way. The management system integrates all elements of an organization into one coherent system to enable all of the organization's objectives to be achieved. These elements include the structure, resources, and processes. Personnel, equipment, and organizational culture as well as the documented policies and processes are parts of the management system. The organization's processes have to address the totality of the requirements on the organization as established in, for example, IAEA safety standards and other international codes and standards.

**nuclear power plant**
A nuclear facility consisting of any nuclear fission reactor installation that has been constructed to generate electricity on a commercial scale.
**Note:** An NPP may include more than one nuclear reactor.

**periodic safety review (PSR)**
A comprehensive assessment of nuclear power plant design and operation that deals with the cumulative effects of aging, modifications, operating experience, technical developments and siting factors, and aims at ensuring a high level of safety throughout the operating life of plant.

**periodic safety review (PSR) basis document**
The information that sets out the scope and methodology for the conduct of the periodic safety review.

**safety improvements**
Measures taken that result in more effective implementation of the safety objectives of a nuclear power plant.

**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 IAEA in document No. SF-1 *Fundamental Safety Principles* [2]. 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.

**structures, systems and components (SSCs)**
A general term encompassing all of the elements (items) of a facility or activity that contribute to protection and safety. Structures are the passive elements: buildings, vessels, shielding, etc. A system comprises several components, assembled in such a way as to perform a specific (active) function. A component is a discrete element of a system. Examples are wires, transistors, integrated circuits, motors, relays, solenoids, pipes, fittings, pumps, tanks, and valves.

# References

1. International Atomic Energy Agency (IAEA), Safety Standards Series, Specific Safety Guide No. SSG-25, *Periodic Safety Review for Nuclear Power Plants*, Vienna, Austria, 2013.
2. IAEA, Safety Standards Series, Safety Fundamentals No. SF-1, *Fundamental Safety Principles*, Vienna, Austria, 2006.

## Additional Information

1. Canadian Nuclear Safety Commission (CNSC), REGDOC-3.1.1, *Reporting Requirements for Nuclear Power Plants*, Ottawa, 2014.
2. CNSC, REGDOC-2.6.3, *Aging Management*, Ottawa, 2014.
3. CNSC, P-242, *Considering Cost-benefit Information*, Ottawa, 2000.
4. IAEA, Safety Reports Series No. 57, *Safe Long Term Operation of Nuclear Power Plants*, Vienna, Austria, 2008.
5. IAEA, Safety Standards Series, Safety Guide NS-G-2.12, *Ageing Management for Nuclear Power Plants*, Vienna, Austria, 2009.
6. IAEA, Safety Standards Series, Safety Guide NS-G-2.6, *Maintenance, Surveillance and In-Service Inspection in Nuclear Power Plants*, Vienna, Austria, 2002.
7. IAEA, INSAG 12, *Basic Safety Principles for Nuclear Power Plants*, 75-INSAG-3 Rev.1, A report by the International Nuclear Safety Advisory Group, Vienna, Austria, 1999.

# 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 required 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 Information dissemination

**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.