



Human Performance Management: **Personnel Training**

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Preface

This regulatory document is part of the CNSC's Human Performance Management series of regulatory documents, which also covers human performance programs and personnel certification. The full list of regulatory document series is included in the back of this document and can be found on the CNSC's Web site at nuclearsafety.gc.ca/regulatory-documents

REGDOC-2.2.2, *Personnel Training* sets out requirements and guidance for the analysis, design, development, implementation, evaluation, documentation and management of training at nuclear facilities within Canada, including the principles and elements essential to an effective training system.

As one of many management programs used within an organization's management system, the training system supports the organization's operational capability by providing workers with the training they require to perform their jobs effectively. In addition, a training system permits organizations to respond rapidly to strategic guidance when an assessment of need indicates that a performance or personnel issue can best be addressed by training.

Consistent with the CNSC's regulatory philosophy and with international practice, licensees are responsible for the safe operation of their respective nuclear facilities. Consequently, licensees are responsible for training and assessing their workers to ensure that they are fully qualified to perform the duties of their position in accordance with current regulatory requirements.

This document is intended to form part of the licensing basis for a regulated facility or activity. It is intended for inclusion in licences as either 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.

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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Personnel Training

1. Introduction

The purpose of training in the nuclear industry is to ensure that workers are competent and qualified to perform the duties of their position. As required by the *General Nuclear Safety and Control Regulations*, workers shall be trained to carry on the licensed activity.

A training system provides the basis for defining, designing, developing, implementing, evaluating, recording and managing training for workers at nuclear facilities. It provides a method for meeting the training needs of workers and ensuring that the right people receive the right training at the right time. With a training system, as defined in this regulatory document, it can be demonstrated that all required knowledge, skills, abilities and attitudes have been attained, through the process of performance-based assessment and program evaluation. Without a training system, there is the risk that important elements of training will be omitted and the operating state of the facility will not be reflected in the training programs.

1.1 Purpose

This regulatory document sets out the requirements of the Canadian Nuclear Safety Commission (CNSC) for licensees regarding the development and implementation of a training system. It also provides guidance on how these requirements should be met.

1.2 Scope

This regulatory document applies to all workers in nuclear facilities who are employed in safety-sensitive occupations and/or safety-sensitive positions.

In addition, this regulatory document applies to the entire lifecycle of the facility including site selection, design, construction, commissioning, operation, refurbishment and decommissioning. It can apply to individual structures, systems and components, as well as to the entire facility.

1.3 Relevant legislation

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

1. paragraph 12(1)(a) of the *General Nuclear Safety and Control Regulations*, which states 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”
2. paragraph 12(1)(b) of the *General Nuclear Safety and Control Regulations*, which states 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”

2. Principles

The training system developed and implemented by each licensee shall adhere to the following three fundamental principles:

1. **Performance oriented:** Training is preparation for performance on the job. All instruction shall focus on essential knowledge, skills, abilities and attitudes required to meet job requirements and nuclear-safety-specific needs over the lifecycle of the facility.
2. **Systematically developed:** Training shall be defined, produced and maintained through an iterative and interactive series of steps, leading from the identification of a training requirement to the confirmation that the requirement has been satisfied.
3. **Tailored to audience:** Training shall be tailored to the needs and the learning characteristics of the target population.

3. Requirements for a training system for nuclear facilities

Licensees shall use a training system to systematically define, design, develop, implement, evaluate, record and manage all training, including continuing training, for all workers who are employed in safety-sensitive occupations and/or safety-sensitive positions.

The licensee shall propose to the CNSC, through their license application, all safety-sensitive occupations and/or safety-sensitive positions to which this regulatory document applies and the CNSC will review and approve these occupations and/or positions through the licensing process.

The training system shall be applied during the analysis, design, development, implementation, evaluation, documentation and management of new training or the revision of existing training. It shall be used whether the training is defined, designed, developed, implemented, evaluated, recorded and managed internally by licensees or externally through vendors or contractors.

The level of analysis, documentation and actions may vary in proportion to the relative importance to safety, safeguards and security; the magnitude of any hazard involved; the lifecycle stage of the facility; the mission of the facility; the particular characteristics of the facility; and any other relevant factors.

Licensees shall:

1. establish and implement a training system that ensures their training programs are systematically defined, designed, developed, implemented, evaluated, recorded and managed
2. use a training system to provide a logical progression from an analysis of the training requirements and identification of the qualifications and competencies required for performing a job, to the design, development, implementation, evaluation and management of training. This shall include the respective training materials, and the subsequent evaluation and continuous improvement of the training courses and training programs
3. identify all performance requirements of a capability, job or duty by conducting a job analysis to determine all of the tasks, subtasks and task elements involved
4. define and document the necessary general worker training, initial job training and continuing training requirements for workers, based on a task analysis of the knowledge, skills, abilities and attitudes required to perform the duties of their position
5. ensure that appropriate training is designed, developed and implemented to meet the qualification and competency requirements
6. ensure that trainers meet and maintain documented qualification and competency requirements, particularly in the areas of subject matter expertise and instructional skills
7. ensure that formal evaluations are used to confirm and document that each trained worker is qualified and competent to perform the duties of his or her position

8. implement a training change management process that will systematically analyze procedural and equipment changes, changes in job descriptions, and operating experience feedback (including facility and industry-wide events) in order to identify changes to the tasks and task lists, and to assess potential training implications leading to modifications in the training programs
9. ensure continuing training is provided to workers and that it includes updates to training programs stemming from the change management process
10. evaluate the training programs regularly and incorporate the results of the evaluations into a training program improvement process
11. ensure that workers have been trained in current procedures and in relevant system and equipment configurations and are competent to perform the duties of their position
12. ensure that workers' records in support of training and qualifications are established and maintained
13. ensure that workers have a level of training related to nuclear safety including but not limited to radiation safety, fire safety, onsite emergency arrangements, and conventional health and safety corresponding to the duties of their position and employment

4. Record management for a training system

Licensees shall develop and manage documentation related to all phases of their training including but not limited to task lists, task-to-training matrices, training objectives, training plans, training delivery plans, lesson plans, verification tools, program evaluation data and records and decision documents regarding any changes to the training courses and training programs.

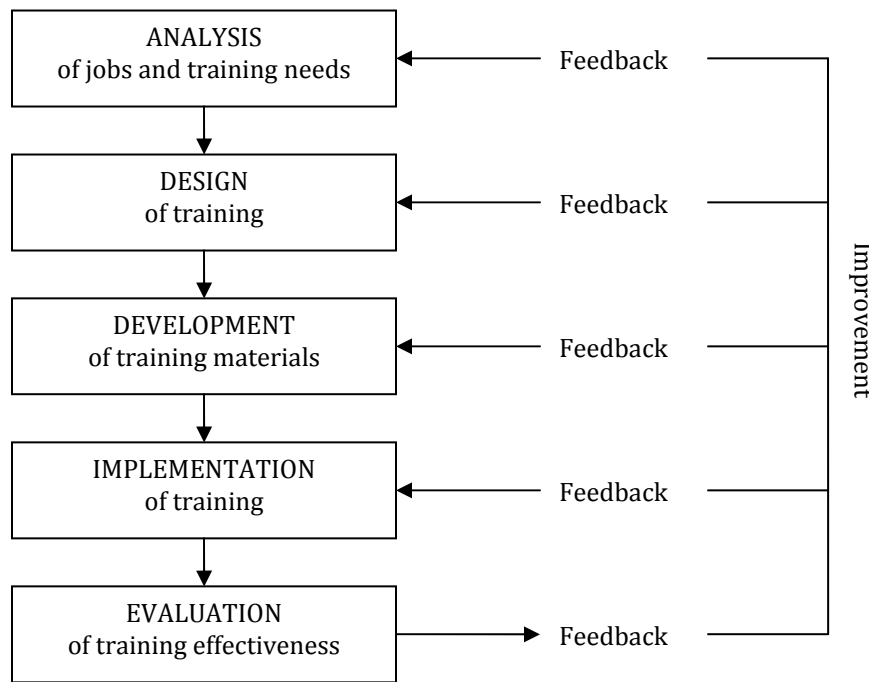
Licensees shall also maintain training records on the training and qualifications of all workers. These records shall be managed and controlled, and may be requested by CNSC staff at any time. Additionally, workers' supervisors and managers shall have immediate, unencumbered and readily available access to the records. The training record for each worker, including temporary workers and contractors, shall include all qualifications and certifications held, the expiration dates for time-sensitive qualifications and certifications, and all requalification or recertification requirements.

5. Guidance on the systematic approach to training

Licensees may adopt the systematic approach to training (SAT) methodology to meet the requirements in section 3.0 of this document. SAT is a proven and highly successful education and training methodology, which, when implemented as outlined below, will meet the requirements of this regulatory document. It is also widely known as the instructional systems design model (ISDM).

The SAT methodology is the industry standard for training development and is the most widely practiced model in existence today. SAT is a holistic process and a proven best practice for the analysis, design, development, implementation, evaluation and management of training.

A SAT-based training system provides interdependent functions consisting of analysis, design, development, implementation and evaluation. It is this cyclic process, as depicted in Figure 1, that enables training to be systematically defined, designed, developed, implemented and evaluated in order to not only meet operational and organizational requirements, but also to react quickly to changes in those requirements.

Figure 1: Overview of a systematic approach to training

5.1 Analysis phase

The analysis phase is the foundation of any training course or training program and includes inputs from operational staff, end-users, subject matter experts (SMEs) and training development experts. Its purpose is to specify the required outcome of the training in terms of essential on-the-job performance as defined by role documents, procedures or written instructions. The analysis should consider the following points:

- rationale and purpose of training
- scope of the training
- target audience
- training method
- location of the training
- timeframe by when the training must be complete

There are various components required to facilitate a full training analysis as described in the following paragraphs.

5.1.1 Training needs analysis

A training needs analysis (TNA) is normally triggered by a performance gap or deficiency which has identified training as the solution. Engineering design and equipment changes, operational changes, revised procedures, and modifications to regulatory requirements are examples of changes that would generate performance gaps. A TNA systematically assesses the job performance requirements against actual existing performance (gap analysis) and identifies specific areas that require training.

5.1.2 Job and task analysis

To identify all performance requirements of a capability, job or duty, a job analysis should be conducted to determine all of the tasks, subtasks and task elements involved with all states of the nuclear facility, including normal operations, accident conditions and emergency situations. The end result of a job analysis is a list of tasks that should be completed to perform the job correctly. Task difficulty, importance and frequency are considered to determine which tasks need to be part of training and to determine the initial and continuing training content. Task analysis should be conducted to determine the method of task performance and associated knowledge, skills and abilities.

5.1.3 Learning objectives

Learning objectives (LOs) are statements of the desired knowledge, skills, abilities and attitudes that workers must be able to demonstrate after completing the training. LOs should be measurable and define exactly when, what and how well the trainee must be capable of performing on the job upon completion of the training.

A learning objective should include:

1. a performance statement: states the task to be performed using one observable action verb
2. a condition statement: describes conditions under which the performance must be completed
3. standards: state at least one measurable criterion which describes how well the performance should be completed

5.1.4 Target audience analysis

A target audience analysis determines the numbers and categories of workers to be trained and, where possible, the characteristics of the individuals who will receive the training (e.g., current job experience and prior background, experience, education and training). This information ensures that the training is designed, developed and implemented at the correct level, and assists with determining any necessary training prerequisites.

5.2 Design phase

The design phase should include the selection and description of the training and an environment that will enable the trainees to achieve the LOs determined in the analysis phase. The design phase starts with the results of the analysis phase and ends with a plan for the development of the training. The design phase takes the output from the analysis phase and specifies how the information will be presented and how the knowledge, skills, abilities and attitudes will be tested.

The fundamental processes of the design phase are briefly described in the following paragraphs.

5.2.1 Trainee characteristics

As a result of the analysis phase, the target audience should have been broadly defined. Trainee characteristics should be described in terms of their entry-level knowledge, skills, abilities and attitudes, and those characteristics likely to affect their responses to particular instructional activities. Information obtained in this process will guide subsequent decisions such as those regarding appropriate instructional sequences, methods and media.

5.2.2 Instructional program design

The instructional program design determines in more detail the knowledge, skills, abilities and attitudes required to perform a task which is defined in enabling objectives (EOs). These enabling objectives are then grouped and sequenced into the order most suitable for learning.

5.2.3 Enabling objectives

EOs are the principal units of learning and constitute a major step towards achieving the associated LOs. EOs are sub-components of the LOs. EOs represent manageable units of work: units that are coherent in terms of logic, learning of work, have a suitable scope and are appropriate for testing learning progress. Like the LO, the EO is composed of three essential parts:

1. The performance statement; an observable action such as “Operate a global positioning system” or “Install the Personnel Record Management software.” It should be stated as one action associated with a single verb. If the action is complicated or if more than one verb is used, then the task needs to be broken down further into other EOs with simple actions.
2. The conditions statement; a description of the setting or conditions under which the task is to be performed (e.g., “given a PC with presentation software”, “denied reference” and “without supervision”). Ideally, the conditions should mirror those in the workplace where the operation is performed.
3. The standard; one or more measurable criterion stating the level of acceptable performance of the task in terms of quantity, quality or time limitations. It should answer questions such as: “How many?” “How fast?” or “How well?” (e.g., the italicized portion of “Given a PC with presentation software, *create a presentation with at least six slides in less than 30 minutes*”).

5.2.4 Learning assessment plan

A learning assessment plan describes the use of testing in support of the training and formal evaluation. The learning assessment plan determines how progress toward, and achievement of, the required performance is checked and verified. While an assessment should be based upon the performance defined in the LO, limiting factors, such as time, may not permit direct observation of the full range of the desired performance. The assessment plan describes how a valid and reliable sample of trainee performance will be measured and evaluated.

5.2.5 Instructional strategies

The instructional strategy is the combination of media, methods and environment used in the delivery of training. The advantages and disadvantages of each instructional strategy, as applied to the LOs, should be examined to ensure that the most effective solution is selected to produce graduates capable of performing tasks as indicated in the LOs.

5.2.6 On-the-job training

On-the-job training (OJT) requirements should be considered when one or more of the LOs may not be suitable for traditional instruction methods. However, additional OJT requirements may arise in the design phase when there is a shortfall between the LOs and the EOs. This typically occurs when the training environment cannot simulate the operational task. If OJT is necessary, then OJT learning objectives, complete with performance statements, conditions and standards, should be produced. Subsequently, each OJT learning objective should be formally assessed using on-the-job evaluation (OJE).

5.2.7 Training plan

The training plan describes the training and documents the decisions made during the design phase on items such as the EOs, teaching points, method of instruction for each EO, key learning events, sequence of instruction, and assessment procedures.

5.3 Development phase

The development phase involves the procurement or production of effective instructional materials in accordance with the training plan.

The development phase incorporates the following processes.

5.3.1 Procurement/production of instructional materials

The instructional materials should support the learning activities. Such items include instructor lesson plans, interactive courseware such as computer-based training (CBT) and training aids of all types including equipment, references, job aids and testing materials. The instructional materials should include the following, where necessary:

1. Trainee manuals: These are reference handbooks to be used and retained by the trainees.
2. Instructor guides: These are instructional specifications for use by the instructor during training preparation and delivery. They outline the specific training steps that must be provided to satisfy the training plan. EOs are linked to detailed steps and procedures in the trainee manuals, user guides and any online documentation.
3. Handouts: These additional aids can supplement the trainee manuals in areas identified as difficult and/or particularly important.
4. CBT or other media: These are to be used where they are a recommended solution based on the instructional analysis and the selection of the instructional strategy.
5. Question banks and some sample tests in a numbered sequence: When used during the training, these should include guidance on where and when they should be used.

5.3.2 Assessment tests

Assessment tests, which address the requirement for formal evaluation, cover both progress and final testing. In general, there are two types and both should be developed.

Knowledge or cognitive assessments: Usually written, these tests can include multiple choice, multiple response, dichotomous or binary (i.e., yes/no; true/false), matching, resequencing, and open-ended questions.

Performance or skill-based assessments: These are practical tests based on realistic scenarios of the most important and significant skills and abilities derived from the LOs and EOs.

5.3.3 Conduct of trials (pilot courses)

To assess the effectiveness of the training and related materials, these materials should be reviewed by SMEs, tested with individuals who are representative of the target training audience, and approved by the appropriate managers. The training and instructional materials should be revised according to the findings of the trials.

5.4 Implementation phase

The implementation phase is to enable the trainees to successfully perform the tasks to the standards defined in the LOs. This phase encompasses both the instructor preparation phase as well as the actual delivery of the training.

It should include:

1. detailed lesson plans (produced by the instructors) based on the training plan and the instructor guides prepared during the development phase
2. set-up of the training environment
3. continual monitoring to ensure that learning is taking place
4. arrangements for follow-on training, where necessary

5.5 Evaluation phase

The evaluation phase involves the assessment of the effectiveness and efficiency of the training as delivered and verification of whether the trainees have mastered the LOs and acquired the competence needed to perform the job safely.

The evaluation phase includes the following:

1. Formal trainee evaluation: The trainees' abilities to perform the tasks, as defined in the LOs, should be measured through tests and assessments. This activity can be included as a process within the implementation phase.
2. Content and delivery: All instructional activities are monitored so that corrective actions, including trainee evaluations, can be taken if necessary. Sources of feedback include the trainees, the instructors, the support staff and the responsible managers and supervisors.
3. Effectiveness: This means the graduates' ability to perform, in the workplace, the tasks for which they were trained. The primary sources of this information are the graduates and their supervisors. Additionally, information may be available through various sources ranging from needs assessments and lessons-learned reports to incident reports and rework statistics. Managers and supervisors should have continuous input to the training.
4. Change management: In accordance with the principles of a SAT methodology, inputs such as new or revised regulatory requirements, engineering design and equipment changes, operational changes, revised procedures, modifications and operating experience feedback (including facility and industry-wide events) should be regularly fed into the appropriate processes through the analysis phase.

Abbreviations

CBT	computer-based training
CNSC	Canadian Nuclear Safety Commission
EO	enabling objective
LO	learning objective
OJE	on-the-job evaluation
OJT	on-the-job training
NSCA	<i>Nuclear Safety and Control Act</i>
SAT	systematic approach to training
SME	subject matter expert
TNA	training needs analysis

Glossary

ability

The competence or state of being able to perform a task to a specified standard.

attitude

The personal feelings, perceptions, values and interests of an individual that allow a job or task to be performed safely and in accordance with the ethics of the organization, to the best ability of that individual.

continuing training

A structured curriculum that maintains and enhances knowledge, skills, abilities and attitudes and addresses areas such as equipment changes and procedure changes; skill weaknesses; infrequently used and difficult knowledge, skills and abilities; and lessons learned from operating experiences. Update training, requalification training and refresher training are also considered continuing training.

course

A series of learning events.

duty

One of the job incumbent's main activities, or a grouping of closely related tasks.

instructional strategy

The combination of media, methods and environment used in the delivery of training:

- method: the type of learning activity or instructional event
- media: the means of delivering instructional activities to the trainee, such as computers or printed texts
- environment: where learning activities take place, i.e., classroom, workplace, home

job

The work performed by the incumbent in a position, or by a group of incumbents in a position who perform essentially the same duties and tasks and require similar knowledge, skills, abilities and attitude to perform those tasks.

knowledge

The theoretical and/or practical understanding of a subject matter required to perform work.

learning

A change in behaviour that occurs as a result of the acquisition of knowledge, skill, abilities or attitude.

lesson plan

A guide, used by instructors, to ensure that instruction follows a specific, goal-oriented plan.

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

nuclear facility

A facility as defined in the *Nuclear Safety and Control Act*.

on-the-job evaluation

Performance demonstration by a trainee of knowledge, skills and work practice standards required to perform a task using the approved procedure and the prescribed standards. The evaluation is conducted on the job as a part of job performance.

on-the-job training

The training undertaken in the actual work environment to obtain required job-related knowledge and skills.

pilot course

A full trial of an instructional program prior to its implementation in training.

program evaluation

An assessment of the merit or value of an instructional program. Program evaluation is a systematic process designed to collect data to assess whether instruction has satisfied the objectives of the instructional program in the most effective and efficient manner:

- formative evaluation is conducted on an ongoing basis during the development and implementation of new instructional programs, to make improvements to the program and to correct errors and deficiencies
- summative evaluation occurs after an instructional program has been implemented, to report on the effectiveness and efficiency of the design, development and implementation of instruction. Summative evaluation examines all aspects of an instructional program

qualification

A recognized level of ability in a work-related field, which is normally acquired through successful completion of training.

safety-sensitive occupation

An occupation in a nuclear facility, the impaired performance of which, by any worker in the occupation, could result in a significant incident affecting the health and safety of persons, property or the environment. This occupation also includes all employees who are regularly required to rotate through or regularly provide relief to persons in safety-sensitive positions.

safety-sensitive position

A position in a nuclear facility, the impaired performance of which could result in a significant incident affecting the health and safety of persons, property or the environment.

skill

A mental and/or physical activity that requires a measured degree of proficiency.

task

A discrete segment of work having two or more steps, performed by an individual, which has a definite beginning and end, and which constitutes a logical and necessary part of a duty and/or job.

task list

The list of tasks that make up the requirements in a job. The list should also include critical supporting elements that provide insight into the scope and difficulty of the tasks.

teaching points

The elements that make up an evaluation objective: discrete steps, abilities, factors or concepts requiring separate demonstration or explanation that the trainee must master/learn/do.

test

An event during which a trainee is asked to demonstrate an aspect of task performance, skill, knowledge or attitude.

trainee characteristics

The target population for whom the proposed training is intended as well as relevant information about the trainees concerned, such as the aptitudes, special skills, education, previous related training and personal data (e.g., age, rank). Defining trainee characteristics is a component of the task analysis and instructional analysis processes.

trainee evaluation

The assessment of progress made by participants during an instructional program (formative evaluation) and of their achievement at the end of the program (summative evaluation).

training/instruction

Learning that is provided in order to improve performance on the job.

training plan

A document that describes how a training program is intended to meet the requirements of the learning objectives.

training program

A structured collection of courses required to achieve a qualification or certification to perform work.

vendor/contractor

A person who is either contracted by a licensee to develop or deliver training, or who delivers training to a licensee's staff with the intent of meeting a required qualification or competency being granted upon completion of the training.

workplace

Any place where work is done.

Additional Information

The following documents contain additional information that may be of interest to persons involved in training systems for nuclear facilities.

1. Canadian Nuclear Safety Commission (CNSC), RD-204, *Certification of Persons Working at Nuclear Power Plants*, Ottawa, Canada, 2008
2. CNSC, G-229, *Certification of Exposure Device Operators*, Ottawa, Canada, 2004
3. CNSC, G-313, *Radiation Safety Training Programs for Workers Involved in Licensed Activities with Nuclear Substances and Radiation Devices, and with Class II Nuclear Facilities and Prescribed Equipment*, Ottawa, Canada, 2006
4. CSA Group, N286-12, *Management system requirements for nuclear facilities*, Toronto, Canada, 2012
5. International Atomic Energy Association (IAEA), TECDOC- 1057 *Experience in the use of Systematic Approach in Training (SAT) for Nuclear Power Plant Personnel*, Vienna, 1999
6. United States Nuclear Regulatory Commission (U.S. NRC), Regulatory Guide 1.8, *Qualification and Training of Personnel for Nuclear Power Plants*, Washington, D.C., 2000
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8. U.S. NRC, NUREG-0711, *Human Factors Engineering Program Review Model*, Revision 2, Washington, D.C., 2004
9. U.S. NRC, NUREG-1021, *Operator Licensing Examination Standards for Power Reactors*, Revision 9, Washington, D.C., 2004
10. U.S. NRC, NUREG-1220, *Training Review Criteria and Procedures*, Revision 1, Washington, D.C., 1993
11. Department of National Defence, A-A9-05000 (all volumes) *Canadian Forces Individual Training and Education System*, Ottawa, Canada
12. North Atlantic Treaty Organization, Bi-SC Directive 75-7, *Education and Individual Training*, Brussels, Belgium, 2009

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, there 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
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	2.5	Physical design
	2.6	Fitness for service
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	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

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