Confirming Competence of Operators - A Regulatory Approach to Fuel Cycle Facilities

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Abstract

Stemming from the implementation of risk-informed regulatory oversight activities as well as a formal suggestion from the IAEA – International Regulatory Review Service, a regulatory approach to confirming the competence of operators at Fuel Cycle Facilities (FCF) has been initiated by CNSC. In the first stage of implementation, the CNSC had Cameco Corporation implement an internal qualification program for UF_6 operators at its Port Hope Conversion Facility. Following a review of the results of the qualification program at the PHCF, CNSC will evaluate the requirement for a similar regulatory approach to confirm the competence of operators at other FCF.

1 Background

The CNSC has a long history of certifying workers at nuclear power plants and non-power research reactor facilities. The requirement for certified personnel at these facilities has ensured that workers assigned to positions that have a direct impact on the safe operation of the facility are qualified to perform their duties.

Prior to the coming into force of the *Nuclear Safety and Control Act* (NSCA) [1] in 2000, the CNSC issued certifications to workers that remained valid until the worker ceased to be employed at the facility. When the NSCA came into force, the *Class I Nuclear Facilities Regulations[2]*, made pursuant to the NSCA, defined the requirement that a certification for a worker at a Class IA nuclear facility, i.e., a nuclear power plant (NPP) or a non-power research reactor facility, is valid for a period of five years. In addition to this new requirement to renew a person's certification every five years, in 2003 the CNSC introduced the requirement for the knowledge- and performance-based requalification testing of all certified shift workers.

In addition to the certification of workers at nuclear reactor facilities, pursuant to the *Nuclear Substances and Radiation Devices Regulations[3]*, the CNSC also certifies Exposure Device Operators who use nuclear substances for the purposes of industrial radiography. Since industrial radiography has the potential for high radiation doses, prior to operating an exposure device, all workers must complete each phase of a multi-step certification process to ensure that they possess the required knowledge and skills to safely operate the device.

The *Class I Nuclear Facilities Regulations* do not require the certification of any Fuel Cycle Facilities (FCF) workers. However, the *General Nuclear Safety and Control Regulations[4]* require all FCF licensees to ensure that they employ a sufficient number of qualified workers to safely perform the activity permitted by their FCF operating licence. In addition, these regulations require FCF licensees to train their workers in order to ensure that they can perform the duties of their positions safely. As a result, it is the responsibility of the licensee to ensure that all of their workers are trained, qualified and competent. The methods used by the FCF licensees to ensure that their workers are trained, qualified and competent vary significantly between the various facilities.

2 Introduction

Over the past ten years, the CNSC has been implementing improvement programs in order to continue to ensure that the health and safety of Canadians is protected. These improvement initiatives stem from two external audits of the CNSC: an audit by the Office of the Auditor General of Canada and an audit by an International Regulatory Review Service.

Between 1999 and 2000, the Office of the Auditor General of Canada (OAG) conducted an audit of the CNSC's approach to the regulation of Power Reactors. The OAG audit report [5] recommended areas where the CNSC needed to improve its regulatory regime for power reactors to ensure that the CNSC continued to protect the health and safety of Canadians. One of the findings of the audit was that the CNSC's regulatory activities were "not based on a rigorous, well-documented system of risk analysis".

In response to the OAG audit, the CNSC committed to implement a risk-informed approach to all of its regulatory activities [6]. The CNSC then embarked on an ambitious multi-year improvement program in all regulatory areas to improve its policies and programs to ensure that the resources allocated to regulatory activities were based on a risk-informed approach [7, 8]. In a follow-up audit conducted in 2003 and 2004, the OAG found that the CNSC had made significant progress toward implementing a

risk-managed approach to the allocation of resources which included the development of a systematic, risk-informed approach for the regulation of FCFs [9].

This systematic, risk-informed approach to FCF resource allocation was developed by CNSC staff following a series of internal workshops. These workshops produced a matrix that ranked the risk of each FCF in each of the 14 CNSC Safety and Control Areas. The CNSC Safety and Control Areas (SCA) are the technical topics that CNSC staff use across all regulated facilities and activities to evaluate, verify and report on regulatory requirements and performance. The risk ranking for the FCFs is then used by CNSC staff to ensure that the regulatory effort allocated to each facility is based on the facility's risk ranking in each SCA. The use of this structured risk-informed approach to the planning of regulatory activities for FCFs has significantly improved how resources are allocated within the CNSC.

The second major CNSC improvement initiative for FCFs stemmed from an external audit by an International Regulatory Review Service (IRRS). In 2009, the CNSC welcomed a peer review of its regulatory regime and regulatory processes by an international team of experts selected by the International Atomic Energy Agency (IAEA). This IRRS team reviewed the CNSC regulatory operations and identified opportunities for improvement as suggestions, recommendations or good practices. One of the suggestions presented by the IRRS team was that CNSC staff should review their current approach and continue to adopt a consistent process for confirming the competence of operators at FCFs commensurate with the risks and hazards posed by the facilities [10].

The risk-informed approach to the regulation of FCFs recommended by the OAG report and the recent IRRS suggestion led CNSC staff to initiate the development and implementation of a new regulatory approach to confirm the competence of operators at fuel cycle facilities.

3 Regulatory Approach

3.1 The regulatory approach to confirming competence of operators at fuel cycle facilities

In December 2010, CNSC staff in the Training Program Evaluation Division and the Personnel Certification Division initiated the development of a regulatory approach that would provide additional assurance that the operators at FCFs are competent to safely perform the duties of their positions. To accomplish this goal, CNSC staff determined that operator qualification programs are to be implemented at FCFs and decided that these qualification programs are to be based on the following principles:

1. The degree of rigour of the operator qualification program will be defined by the risk posed by the facility and the impact the operators have on the safe operation of the facility;
2. The degree of CNSC involvement in the operator qualification program (i.e., the requirement for CNSC examinations or certification) will be defined by the risk posed by the facility and the impact the operators have on the safe operation of the facility; and
3. The operator qualification program will align with the main components of the well-defined certification process at NPPs.

Depending on the risk posed by the FCF in the Human Performance Management SCA and on the impact the operators have on the safe operation of the facility, the qualification program could encompass anything from a simple qualification process administered by the licensee at a lower-risk

facility, to a very rigorous, multi-step process that includes CNSC examinations and the requirement for CNSC certification at a higher-risk facility.

As the first stage of the implementation of this new regulatory approach to FCFs, CNSC staff decided to implement the approach at one of the higher-risk FCFs. Following this initial implementation, CNSC staff will evaluate the results of the qualification program and implement the approach for all FCFs. CNSC staff will then conduct periodic evaluations and will adjust the regulatory approach based on the lessons learned and any changes to the risk rankings of the facilities.

3.2 The application of the regulatory approach at the PHCF

A CNSC staff review of the FCF risk rankings in the area of Human Performance Management identified that one of the highest ranked facilities was Cameco's Port Hope Conversion Facility (PHCF). The PHCF, owned and operated by Cameco Corporation, is a Class IB facility that produces UO_2 and UF_6. The facility is located on Lake Ontario in the town of Port Hope, Ontario. Due to the nature of its activities, its location and the legacy of the PHCF site, the facility is allocated substantial CNSC resources for licensing and compliance activities. Furthermore, the role that operators play in the safe operation of the facility and in the protection of the environment is significant.

In addition, in the three months following an extended shutdown of almost two years, Cameco reported that seven minor events had occurred at the UF_6 plant. A Cameco investigation of these events discovered that operator error was a contributing factor in many of the incidents. Following an analysis by a Cameco consultant, it was reported that the training activities in support of the restart of the facility did not meet the needs of the workers and the job and tasks that they performed. The consultant's report also noted that Cameco had underestimated the skill that was lost by the operators during the extended shutdown.

Consequently, based on the risk ranking of the facility and the recent events involving operator errors, CNSC staff determined that a more rigorous approach to ensure the competence of operators was needed at the PHCF. Following a series of meetings between PHCF and CNSC staff, it was agreed that the PHCF would be subject to an internal qualification program in line with the CNSC's new regulatory approach.

Commensurate with the risks and hazards posed by the PHCF, and the impact that operators have on the safe operation of the facility, Cameco and CNSC staff determined that this internal qualification program would be overseen by Cameco and that the facility operators would not require either CNSC examinations or CNSC certification. Since the production of UF_6 constitutes the highest risk activity on site, the operators of the UF_6 plant at the PHCF were chosen for the internal qualification program.

CNSC staff then collaborated with Cameco to develop an internal qualification process for UF_6 operators at the PHCF site that would align with the key aspects of the CNSC's certification process for NPP workers.

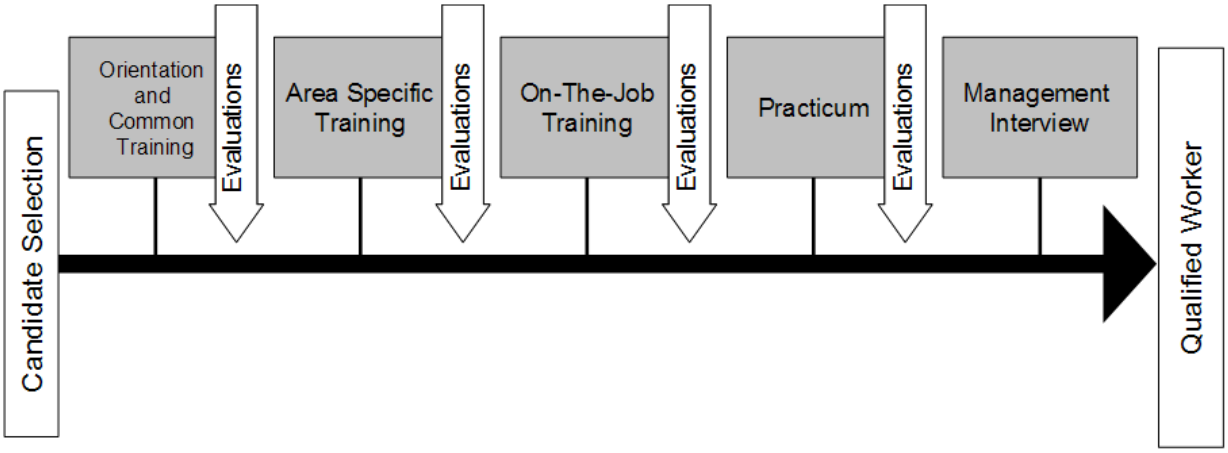
3.3 PHCF internal qualification process

The new internal qualification process implemented at the PHCF contains three main qualification processes for its UF_6 operators: the process for initial qualification, the process for the renewal of qualification and the process to maintain a qualification during an extended plant shutdown.

3.3.1 The process for initial qualification

The initial qualification process is the process that the PHCF follows to provide a new candidate with the knowledge and skills required to be a qualified worker. An outline of this qualification process is provided in figure 1.

Figure 1 – The process for the initial qualification of a worker



This initial qualification process begins with the PHCF selecting a candidate that meets the entry level education and experience requirements. To be eligible to enter the qualification program, a candidate requires a High School Diploma and a minimum of three years of relevant chemical process operating experience.

In-class training programs are then completed to provide the candidate with an overview of the safe operation of the facility and in-depth knowledge focusing on the area of the facility where the candidate will be operating. These in-class sessions include formal written evaluations that each candidate is required to successfully complete prior to commencing the next phase of the training program.

Following the successful completion of the in-class training, the candidate then applies their knowledge in an on-the-job training program which covers the operation of the equipment, the performance of routine job tasks and the safety practices required to work safely in the area of the facility where they will be working. The candidate is required to complete on-the-job evaluations to ensure that they have achieved the appropriate level of knowledge and skill to safely perform each task.

To ensure that all of the training programs adequately impart the required knowledge and skills to the candidates, these training programs are required to be based on a systematic approach to training (SAT). A SAT is a methodology that provides a logical progression from the identification of the competencies required to perform a job, to the design, development, implementation, and maintenance of the training programs to achieve these competencies, and to the subsequent evaluation and continuous improvement of the training programs. This methodology minimizes the risk that important elements of training are omitted and ensures that successful candidates possess all of the required competencies.

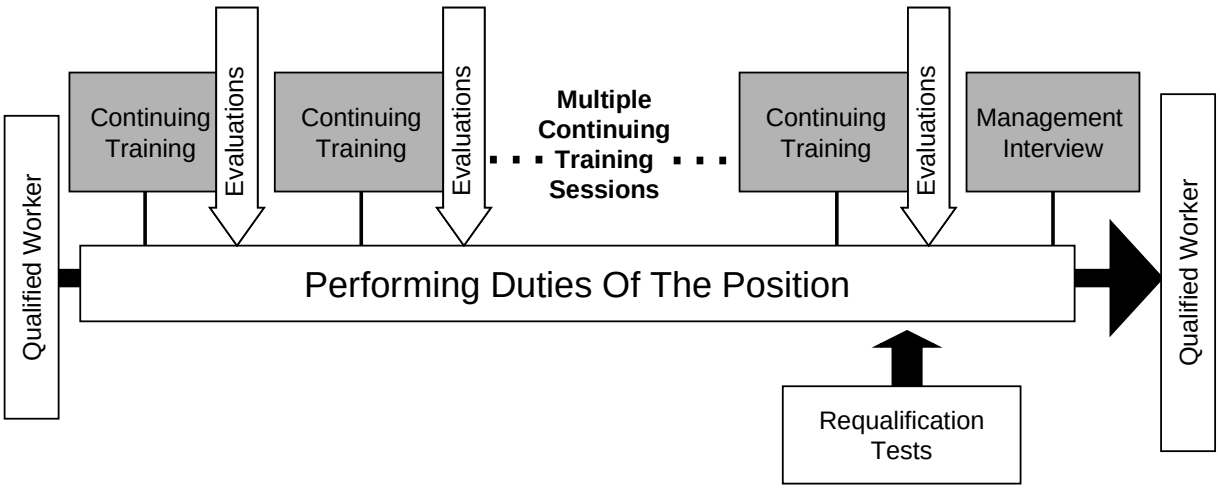
The candidate is then required to put into practice all of the training that they received by completing a requisite number of hours on shift under the supervision of a qualified worker. Following the completion of these supervised hours, or “practicum”, the candidate completes a final scenario-based

oral evaluation and an area walk-through. PHCF management then reviews the training and evaluations that the candidate has completed and interviews the candidate to confirm that he or she has the knowledge and skills required to perform the duties of a qualified worker. Cameco management then issues each candidate a qualification to perform the duties of their position for a period of five years.

3.3.2 The process for the renewal of qualification

The process for the renewal of qualification ensures that a qualified worker continues to have the required knowledge and skills to perform the duties of their position. A diagram of the process for the renewal of qualification is provided in figure 2.

Figure 2 – The process for the renewal of a worker's qualification



During the five year validity period of their qualification, each qualified worker is required to complete SAT-based continuing training. This continuing training consists of two components: update training and refresher training. The update training component addresses the changes in the facility, including modifications to the facility and the changes to the plant policies, standards and procedures. The refresher training is the training to maintain the proficiency of each qualified person. This training covers, among other topics, a review of the knowledge acquired during the initial training, infrequently performed tasks or procedures and the response to emergency or upset conditions. Over a five year period, qualified workers complete continuing training sessions which include written and practical evaluations to ensure that each worker continues to have the requisite knowledge and skills to continue to be capable of safely performing the duties of the position.

In addition to successfully completing the continuing training, each qualified worker is required to successfully complete a knowledge-based written requalification test, an oral scenario-based test and an area walk-through during the five year period of their qualification. These requalification tests are conducted to ensure that all qualified personnel maintain the knowledge and skills required to perform their duties.

A failure of a requalification test results in the person being immediately removed from their duties for remedial training. This person cannot be returned to the duties of their position until they have successfully completed another requalification test and until PHCF management is completely satisfied that they possess the requisite knowledge and skills.

Following the successful completion of the requalification tests, PHCF management reviews the training and evaluations that the worker has completed and interviews the worker to confirm that he or she has the knowledge and skills required to continue to perform the duties of a qualified worker. Cameco management then renews the qualification of the worker for a period of five years.

3.3.3 The process to maintain a qualification during an extended plant shutdown.

The process to maintain a qualification during an extended plant shutdown ensures that qualified workers do not lose the required knowledge or skills to safely perform their duties.

During an extended plant shutdown, each qualified worker is required to complete a continuing training program for each area of the plant in which they hold a qualification. This training program includes a review of the startup procedures, the normal operating procedures, information concerning any changes to the facility that may have occurred during the shutdown and a procedural walk-through in the facility.

In addition to the completion of the training program, each qualified worker is required to successfully complete a knowledge-based written requalification test to ensure that they have maintained the knowledge and skills required to safely perform their duties. Following the successful completion of the requalification test, each worker is then permitted to perform their duties.

3.3.4 Comparison of the PHCF internal qualification process to the NPP certification process

The regulatory approach to the process for internal qualification and the renewal of qualification were formulated based on the lessons learned from the certification processes for shift workers at Canadian NPPs. In line with the principles of the regulatory approach listed in section 3.1, since the risk posed by the PHCF and the impact the PHCF operators have on the safe operation of the facility is lower than that for NPPs, the qualification processes for PHCF were designed to be less rigorous and have less CNSC involvement than the certification process for NPPs.

Additional information concerning the processes used for the initial certification and the renewal of certification of workers at Canadian NPPs is provided in the appendix to this paper.

There are two main differences between the initial certification process at NPPs and the qualification process implemented at the PHCF. The first difference is that at NPPs, in addition to successfully completing the formal evaluations during the SAT-based in-class and hands-on training programs, each candidate is required to successfully complete knowledge-based written certification examinations and a performance-based simulator certification examination which are overseen by CNSC staff. At NPPs, the additional assurance provided by certification examinations is necessary to ensure that each candidate has the knowledge and skills required to safely perform their duties. At the PHCF, due to the lower risk significance of the facility in comparison to that of NPPs, certification examinations are not required in the initial qualification program.

The second difference is that NPP licensees must submit an application for certification to the CNSC on behalf of the candidate that documents that the candidate has satisfied all of the regulatory requirements and that states the licensee is fully confident that the candidate is capable of performing the duties of the certified position. Based on the licensee's submission and the training and examinations completed, the CNSC may then certify the candidate allowing the candidate to perform the duties of their certified position. At the PHCF, an independent CNSC review of the candidate's training and examination is not

required. Instead, since the FCF poses a lower risk than the NPPs, the PHCF management is allowed to perform this review and issue a candidate's qualification.

The process at the PHCF for the renewal of qualification is very similar to the process at NPPs for the renewal of certification. The difference between these processes is that at NPPs no management interviews are conducted prior to the renewal of certification. As described in section 3.3.2, at the PHCF, each worker is required to successfully complete a management interview prior to having their qualification renewed. At NPPs, instead of completing a management interview, following the successful completion of the requalification tests, the licensee applies to the CNSC to renew the certification of the certified person. Based on the licensee's submission and the training and tests completed, the CNSC may then renew the certification of the worker and the worker can continue to perform their duties. Since this independent CNSC review of the worker's training and testing is not performed for workers at the PHCF, the requirement to conduct a management interview was introduced in order to ensure that PHCF management provides sufficient assurance that all workers possesses the required knowledge and skills.

4 The future implementation of the regulatory approach to all fuel cycle facilities

As discussed in sections 3.1 and 3.2, the first stage of the implementation of the regulatory approach to confirm the competence of FCF operators was to implement a formal qualification program for the UF_6 operators at the PHCF. Once this qualification program has been in place for at least two years, CNSC staff will evaluate whether the program provides sufficient assurance that the UF_6 operators have and maintain the knowledge and skills required to perform their duties. Based on this evaluation, CNSC staff may refine and update the requirements for the PHCF qualification program.

The other FCFs in Canada currently have risk rankings which are lower than that of the PHCF. Recent regulatory inspections conducted by CNSC staff from the Training Program Evaluation Division have focused on evaluating the qualification programs for workers at these other FCFs. At this time, the qualification of operators at these facilities is managed by the licensee and is generally less onerous then the new qualification program implemented at the PHCF. Based on the lessons learned from the implementation of the qualification program at PHCF, CNSC staff will review the risk rankings of other FCFs and determine the level of rigour and the degree of CNSC involvement required for the implementation of similar qualification programs at these facilities.

Due to the dynamic nature of the Canadian nuclear industry, CNSC staff periodically revisits their regulatory approaches. As a result, CNSC staff will conduct periodic evaluations of the qualification programs at FCFs and will update the regulatory approach based on the lessons learned. In addition, due to changes in the industry or to changes in the operation of a facility, the risk rankings of FCFs are periodically reviewed by CNSC staff. Should a risk ranking for a facility change, CNSC staff will revisit its regulatory approach for the confirmation of the competence of operators.

5 Conclusion

Over the past ten years, the CNSC has made significant progress in the allocation of its resources to regulatory activities based on a risk-informed approach. Using this experience with a risk-informed approach, CNSC staff developed a new regulatory approach to confirm the competence of operators at FCFs. CNSC staff is confident that the implementation of this approach will provide additional assurance that the operators at FCF have and maintain the required knowledge and skills to safely perform their duties.

6. References

[1] Nuclear Safety and Control Act (NSCA), Canada Gazette Part III, May 9, 1997.

[2] Class I Nuclear Facilities Regulations, Extract Canada Gazette, Part II June 21, 2000.

[3] Nuclear Substances and Radiation Devices Regulations, Extract Canada Gazette, Part II June 21, 2000.

[4] General Nuclear Safety and Control Regulations, Extract Canada Gazette, Part II June 21, 2000.

[5] 2000 December Report of the Auditor General of Canada, Chapter 27 – Canadian Nuclear Safety Commission - Power Reactor Regulation, December 2000. http://www.oag-bvg.gc.ca/internet/English/parl_oag_200012_27_e_11214.html

[6] Canadian Nuclear Safety Commission Action Plan – Report of the Auditor General of Canada – Power Reactor Regulation, February 2001. http://www.nuclearsafety.gc.ca/eng/pdfs/OAG_Report.pdf

[7] 2002 Report of the Canadian Nuclear Safety Commission in response to the Report of the Auditor General entitled Canadian Nuclear Safety Commission – Power Reactor Regulation, February 2002. http://www.nuclearsafety.gc.ca/eng/pdfs/oag_report_02.pdf

[8] 2003 Report of the Canadian Nuclear Safety Commission in response to the Report of the Auditor General entitled Canadian Nuclear Safety Commission – Power Reactor Regulation, February 2003. http://www.nuclearsafety.gc.ca/eng/pdfs/OAG_Report_03.pdf

[9] 2005 February Status Report of the Auditor General of Canada, February 15, 2005. http://www.oag-bvg.gc.ca/internet/English/parl_oag_200502_06_e_14926.html

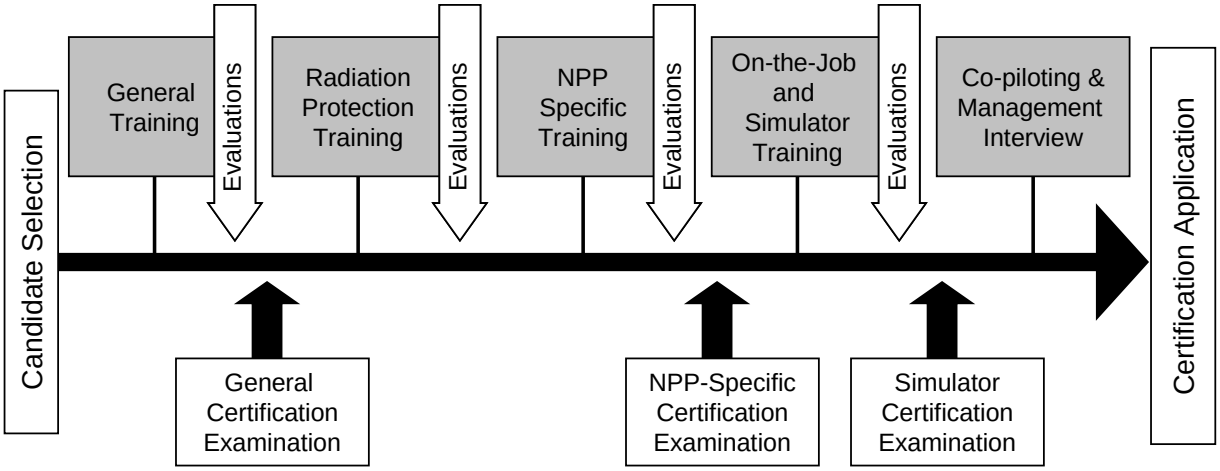
[10] Report - International Regulatory Review Service (IRRS) – Report to the Government of Canada, 31 May to 12 June 2009, IAEA-NS-IRRS-2009/02, October 2009.

Appendix – The Certification Processes at Canadian Nuclear Power Plants

1 The process for initial certification

A typical initial certification process for a reactor operator at a Canadian Nuclear Power Plant (NPP) is shown in figure A.1.

Figure A.1 – A typical initial certification process for a reactor operator at a NPP



The initial certification process at NPPs begins with a licensee selecting a candidate that meets the entry level education and experience requirements. In-class training programs are then completed to provide the candidate with in-depth knowledge in the areas of science fundamentals for nuclear reactors, radiation protection, and the design, operation and interaction of the plant systems. Following the successful completion of the in-class training, the candidate then applies their knowledge in a hands-on simulator-based training program and an on-the-job training program which cover the operation and monitoring of the plant systems under normal, abnormal and emergency conditions. Each of these SAT-based training programs includes formal evaluations that are conducted to ensure that each candidate is appropriately acquiring the requisite knowledge and skills.

The candidate is then required to put into practice all of the training that they received by performing a number of hours on shift under the supervision of a certified worker. Following the completion of these hours on shift, also known as a 'co-piloting period', NPP management reviews the training and examinations that the candidate has completed and interviews the candidate to confirm that he or she has the knowledge and skills required to perform the duties of a certified position.

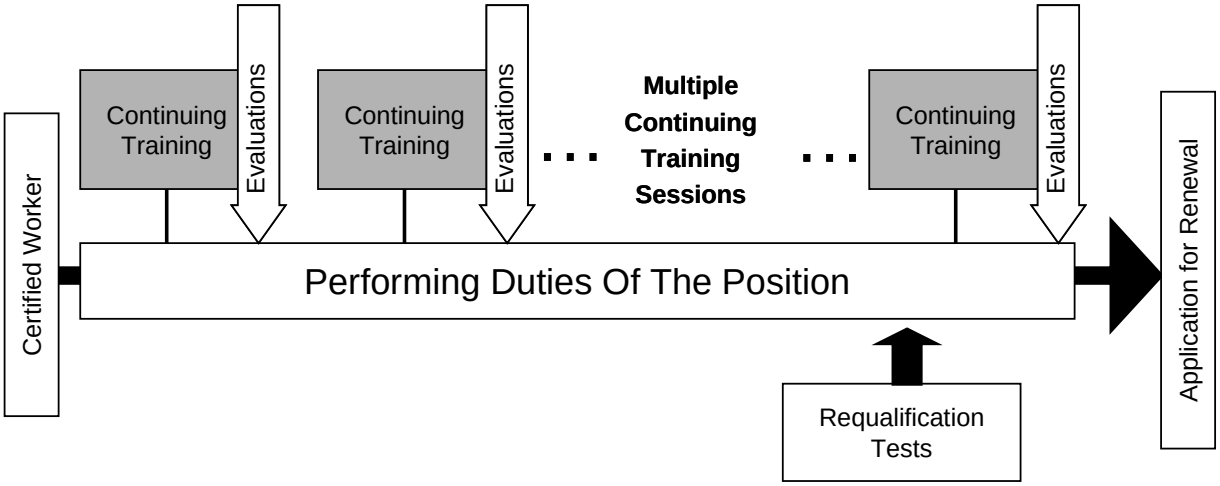
The NPP licensee then submits an application for certification to the CNSC on behalf of the candidate that documents that the candidate has satisfied all of the regulatory requirements and that states the licensee is fully confident that the candidate is capable of performing the duties of the certified position. If the submission meets the applicable regulatory requirements, the CNSC issues a certification to the candidate that is valid for a period of five years.

Following the selection of the candidate, it takes approximately 4 years for a candidate to complete all of the training programs and examinations required in the initial certification process.

2 The process for the renewal of certification

The process for the renewal of certification for shift workers at a Canadian NPP is provided in figure A.2.

Figure A.2 –The process for the renewal of certification for shift workers at a NPP



During the five year validity period of their certification, each certified person is required to complete SAT-based continuing training on a regular basis. This continuing training consists of two components: update training and refresher training. The update training component addresses the changes in the plant, including changes to the plant systems and the changes to the plant policies, standards and procedures. The refresher training is the training to maintain the proficiency of each certified person. This training covers, among other topics, a review of the knowledge acquired during the initial training and simulator-based exercises that challenge the person's diagnostic and decision-making abilities. Over a five year period, certified workers complete continuing training sessions which include formal evaluations that are conducted to ensure that each worker has retained the necessary knowledge and skills.

In addition to successfully completing the continuing training, each certified worker is required to successfully complete a knowledge-based written requalification test and performance-based simulator requalification tests during the 5 year period of their certification. These knowledge-based and simulator-based tests are conducted to ensure that all certified personnel maintain the knowledge and skills required to perform their duties.

A failure of a requalification test results in the person being immediately removed from their shift duties to be retrained. This person cannot be returned to shift duties until they have successfully completed another requalification test and until the plant management is completely satisfied that they possess the requisite knowledge and skills.

Following the successful completion of the requalification tests, the licensee then applies to the CNSC to renew the certification of the certified person. If the submission meets the applicable regulatory requirements, the CNSC renews the certification of the person for a period of five years.