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A Licence Renewal

Renouvellement d'un permis

McMaster Nuclear Reactor

Réacteur nucléaire de McMaster

Hearing in writing based solely on
written submissions

Audience par écrit fondée uniquement
sur des mémoires

Scheduled for:
April 2024

Prévue pour :
Avril 2024

Submitted by:
CNSC Staff

Soumis par :
Le personnel de la CCSN

Replacement CMD

This replacement CMD has been prepared to update the references throughout the document.

Summary

This Commission member document (CMD) presents information about the following matters of regulatory interest with respect to the McMaster Nuclear Reactor (MNR):

- Renewal of the Class IA non-power reactor operating licence NPROL-01.00/2024 to operate the McMaster Nuclear Reactor for a period of 20 years.

CNSC staff recommend the Commission consider taking the following actions:

- Renew McMaster University's non-power reactor operating licence for a period of 20 years, with a requirement for the licensee to provide a performance update to the Commission at the mid-point of the licence term.
- Accept the financial guarantee as set out in section 5.2 of this CMD.
- Authorize the delegation of authority as set out in section 5.5 of this CMD.

The following items are attached:

- Current Licence NPROL-01.00/2024
- Proposed Licence NPROL-01.00/2044
- Draft Licence Conditions Handbook

CMD de remplacement

Ce CMD de remplacement a été préparé afin de mettre à jour les références qui figurent dans l'ensemble du document.

Résumé

Le présent document à l'intention des commissaires (CMD) présente de l'information sur un ensemble de questions d'ordre réglementaire concernant le réacteur nucléaire de McMaster (RNM):

- Renouvellement du permis d'exploitation d'un réacteur de faible puissance NPROL-01.00/2024 pour permettre l'exploitation du réacteur nucléaire de McMaster pour une période de 20 ans.

La Commission pourrait considérer prendre les mesures suivantes :

- Renouveler le permis d'exploitation d'un réacteur de faible puissance de l'Université McMaster pour une période de 20 ans, avec l'obligation pour le titulaire de permis de fournir à la Commission une mise à jour de la performance à mi-parcours de la période de durée du permis.
- Accepter la garantie financière tel qu'elle est établie à la section 5.2 du présent mémoire.
- Déléguer les pouvoirs tel qu'il est établi à la section 5.5 du présent mémoire.

Les pièces suivantes sont jointes :

- Permis actuel NPROL-01.00/2024
- Permis proposé NPROL-01.00/2044
- Ébauche du manuel des conditions de permis

Signed/signé le
16 February 2024

Luc Sigouin

Director General
Directorate of Nuclear Cycle and Facilities Regulation

Directeur général de la
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EXECUTIVE SUMMARY

McMaster University is situated on the traditional territory of the Haudenosaunee and Anishinaabe Nations. McMaster University and the Canadian Nuclear Safety Commission (CNSC) acknowledge the significance of these lands to Indigenous peoples.

The McMaster Nuclear Reactor (MNR) is an open-pool research reactor housed in a stand-alone containment building located on the McMaster University campus in Hamilton, Ontario. It has been in operation since 1959 and provides neutron-based services in support of applications in the health, materials, energy, and environmental science sectors.

McMaster University applied to renew its non-power reactor operating licence NPROL-01.00/2024 on April 19, 2023 [1]. In its application, McMaster University requested a 20-year licence to continue operating the MNR, with no changes to the authorized activities. The current operating licence for the facility was issued on July 1, 2014 [2] and will expire on June 30, 2024.

During the current licence period, CNSC staff verified McMaster University's compliance with regulations and licence conditions through various compliance activities. There were no incidents that compromised the safety of the reactor, personnel, the public or the environment over the current licence period, and McMaster University has maintained satisfactory performance in all 14 safety and control areas (SCAs). Since 2014, the CNSC has reported on the licensee's compliance performance to the Commission in regulatory oversight reports on 3 occasions (2016, 2018 and 2021).

In Part 1 of this Commission member document (CMD), CNSC staff present the conclusions of their review of the licence application and of the licensee's performance during the current licence period. Based on these reviews, CNSC staff determined that the application complies with regulatory requirements and that McMaster University's performance during the licensing term was satisfactory and met regulatory requirements.

On the basis of these conclusions, CNSC staff recommend that the Commission take the following actions:

1. Conclude, pursuant to paragraphs 24(4)(a) and (b) of the [*Nuclear Safety and Control Act*](#), that McMaster University:
 - i. is qualified to carry on the activities authorized by the licence;
 - ii. will 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. Accept the financial guarantee as set out in section 5.2 of this CMD.
3. Authorize the delegation of authority as set out in section 5.5 of this CMD.
4. Renew the proposed 20-year licence, NPROL-01.00/2044, for the operation of the McMaster Nuclear Reactor, effective July 1, 2024, to June 30, 2044, with a requirement that McMaster University provide a performance update to the Commission at the mid-point of the licence term.

Part 2 of this CMD provides licensing-related documentation pertaining to this hearing, such as the current licence, the proposed licence changes and the proposed licence. A draft licence conditions handbook is also included for information only. Referenced documents in this CMD are available to the public upon request, subject to confidentiality considerations.

CMD STRUCTURE

This Commission Member Document (CMD) is presented in 2 parts.

Part 1 of this CMD includes:

1. An overview of the matter being presented;
2. Overall conclusions and overall recommendations;
3. General discussion pertaining to the safety and control areas (SCAs) that are relevant to this submission;
4. Discussion about other matters of regulatory interest; and
5. Addenda material that complements items 1 through 4.

Part 2 of this CMD provides all available information pertaining directly to the current and proposed licence, and the proposed Licence Conditions Handbook (LCH).

1. OVERVIEW

1.1 Background

McMaster University (McMaster) currently operates the McMaster Nuclear Reactor (MNR) under the non-power reactor operating licence NPROL-01.00/2024. The research reactor is an open-pool, materials test reactor (MTR) located in a stand-alone containment building on the campus of McMaster University, in Hamilton, Ontario.

Construction of MNR began in 1957 and the reactor achieved criticality on April 4, 1959, becoming the first nuclear reactor operating in a university in Canada. The reactor is licensed to operate to a power of 5 MW thermal.

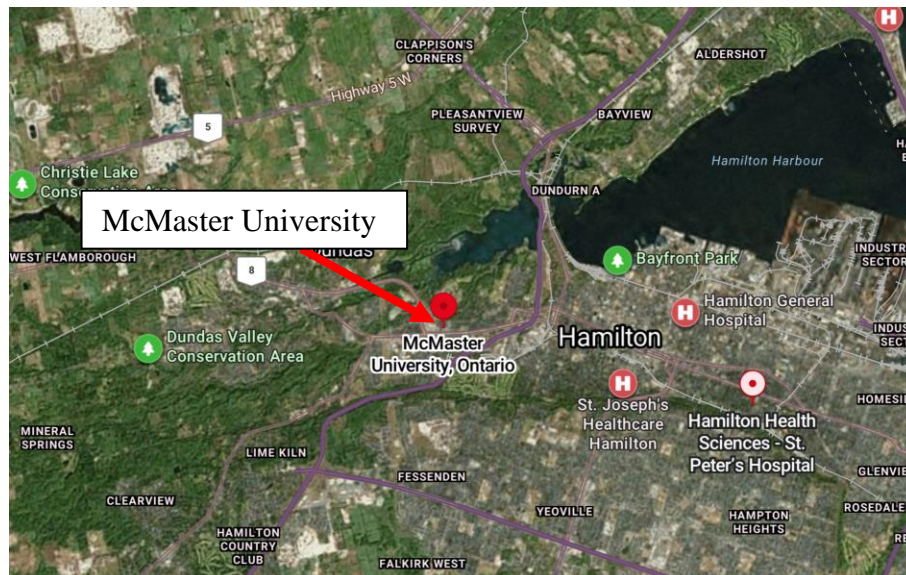
The reactor is an important producer of the Iodine-125 (I-125) and other isotopes for medical use in Canada, the U.S. and other countries around the world. MNR is also used for neutron radiography, which is performed daily for testing of aircraft engine components. In addition to supporting research work of McMaster University students, MNR is also used for the irradiation of thousands of samples every year for biomedical research, material science and geological surveys.

The current non-power reactor operating licence NPROL-01.00/2024 was issued on July 1, 2014, and expires on June 30, 2024.

MNR Location and Layout

Figure 1-1 shows an aerial view of the Hamilton area in Southern Ontario with the location of McMaster University indicated, west of the downtown area and the Hamilton Harbour. Figure 1-2 shows an outside view of MNR and its containment building.

Figure 1-1: Location of the McMaster Campus



(Source: Google Maps)

Figure 1-2: McMaster Nuclear Reactor



(Source: McMaster University)

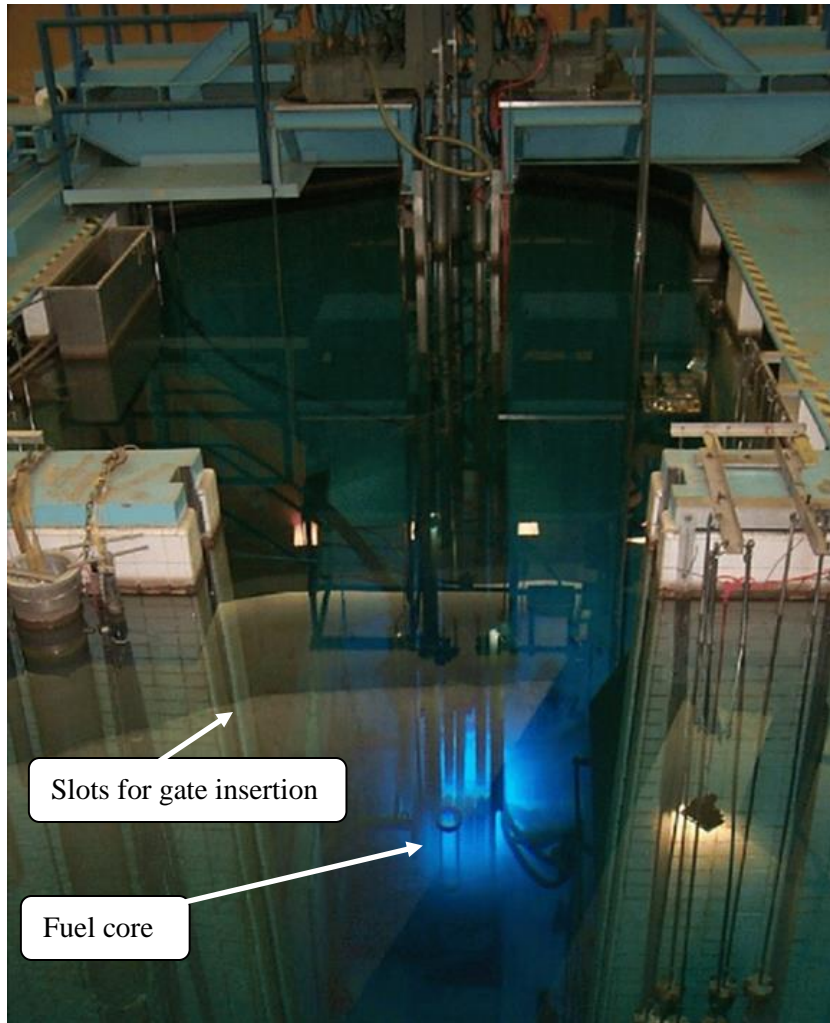
Reactor Design

MNR is one of many similar pool reactors operated around the world. They are known for their safe, robust design and flexible operating capability. The reactor is light water moderated and cooled. The pool is divided in 2 sections, 1 for the reactor itself and the other is used mainly to store spent fuel. The 2 sections can be isolated through the insertion of a gate, and the reactor core can be moved to the other section if needed. The live core can be observed safely from the top of the pool without any special protection, as seen in figure 1-3.

The reactor uses low enriched uranium fuel at 19.75% U-235 enrichment. The fuel core is cooled by forced gravity flow, where pool water flows downward by gravity through the reactor core and is circulated through heat exchangers and back to the pool in a closed loop.

The reactor is housed within a reinforced concrete containment building held under negative pressure relative to the outside atmosphere.

Figure 1-3: The McMaster Nuclear Reactor



(Source: McMaster University)

1.2 Activities to be licensed

There are no changes to McMaster's proposed activities for the proposed licence period. Part IV of the proposed licence lists the authorized activities, as follows:

- (i) Operate the McMaster Nuclear Reactor and associated facilities, located in the Reactor Building and Nuclear Research Building at the McMaster University Campus, in Hamilton, Ontario;
- (ii) Operate the reactor at a power not exceeding 5 MW thermal except for the purpose of testing the high power scram, which shall be set no higher than the neutron flux equivalent of 6.25 MW thermal power;
- (iii) Produce, possess, process, transfer, use, package, manage, and store the nuclear substances that are required for, associated with or arise from the activities described in (a);

- (iv) Possess and use prescribed equipment and prescribed information required for, associated with or arise from the activities described in (a);
- (v) Import or export any nuclear substance with atomic number 2 to 89 that is required for or associated with the activities described in (a). This licence does not authorize the licensee to import or export any quantity of a controlled nuclear substance for which the application requirements are set out in the *Nuclear Non-proliferation Import and Export Control Regulations*.

In the proposed licence, standardized licence condition G.1 requires the licensee, unless otherwise approved in writing by the CNSC, to conduct the activities described in Part IV of the licence in accordance with the licensing basis for the facility, defined as:

- (i) the regulatory requirements set out in the applicable laws and regulations;
- (ii) the conditions and safety and control measures described in the facility's licence and the documents directly referenced in that licence; and
- (iii) the safety and control measures described in the licence application and the documents in support of the licence application.

Standardized licence condition G.2 requires the licensee to give written notification of changes to the facility or its operation, including deviation from design, operating conditions, policies, programs and methods referred to in the licensing basis.

McMaster University requested the renewal of its Class IA non-power reactor operating licence for a period of 20 years, which differs from the current 10-year period. This is discussed in detail in section 5.6.

1.3 Highlights

Between 2014 and 2024, CNSC staff conducted 11 inspections (see Appendix D) and several other compliance activities, such as safeguards inspections and desktop reviews of program documents, covering all 14 SCAs and other areas of regulatory interest, such as the Public Information and Disclosure Program (PIDP). Radiation exposures have been well below the regulatory limits and action levels for nuclear energy workers (NEW) and members of the public.

McMaster complied with all conditions of the licence. McMaster reported 7 events (Table 3-1) related to reactor operations over the licence period, none of which compromised the safety of the public, personnel or the reactor. CNSC rated McMaster's performance as satisfactory in all 14 SCAs, as reported in CNSC's regulatory oversight reports in 2016, 2018 and 2021 [3, 4, 5].

1.4 Assessment of McMaster's Licence Application

CNSC staff reviewed all aspects of McMaster's application [1] for the renewal of its licence and determined that it complies with regulatory requirements for a Class IA licence application. McMaster's licence renewal application demonstrates that McMaster will make adequate provisions 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. McMaster provided all supporting documents to demonstrate that appropriate safety and control measures are in place to meet CNSC's regulatory requirements.

1.5 Overall Conclusions

CNSC staff have reviewed McMaster's application, including documentation, annual compliance reports, all written submissions and the results of CNSC compliance activities, including inspections. CNSC staff determined that McMaster's performance during the licensing term was satisfactory and consistently met regulatory requirements.

McMaster has made adequate provisions for the protection of the environment, the health and safety of persons and the maintenance of national security. McMaster has implemented all required measures to meet international obligations to which Canada has agreed. CNSC staff determined that McMaster has all the programs in place to continue to safely carry out the activities requested in its licence application.

CNSC staff concluded that McMaster is qualified and capable of performing the activities authorized in the proposed licence.

1.6 Overall Recommendations

CNSC staff recommend that the Commission:

1. Conclude, pursuant to paragraphs 24(4)(a) and (b) of the NSCA, that McMaster University:
 - i. is qualified to carry on the activities authorized by the licence;
 - ii. will 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. Accept the financial guarantee as set out in section 5.2 of this CMD.
3. Authorize the delegation of authority as set out in section 5.5 of this CMD.
4. Renew the proposed 20-year licence, NPROL-01.00/2044, for the operation of the McMaster Nuclear Reactor, effective July 1, 2024, to June 30, 2044, with a requirement that McMaster University provide a performance update to the Commission at the mid-point of the licence term.

2. ENVIRONMENTAL PROTECTION REVIEW

CNSC staff reviewed the application for a licence renewal to identify the type of environmental review required. As part of this process, CNSC staff must assess whether an integrated impact assessment or a federal lands review under the [Impact Assessment Act](#) is required. For this licence renewal application, neither are required because the application does not include activities listed in the *Impact Assessment Act* [Physical Activities Regulations](#) that require an impact assessment or that meet the definition of a project on federal lands.

CNSC staff conduct environmental protection reviews (EPR) for all licence applications with potential environmental interactions, in accordance with the CNSC's mandate under the NSCA and associated regulations. The EPRs help support the Commission's conclusion on whether the information submitted provides adequate protection of the environment and the health of people. CNSC staff conducted an EPR for this licence renewal application, which can be found in section 3.9 of this CMD.

CNSC staff have found that the information provided by McMaster University regarding environmental protection is sufficient to meet the applicable regulatory requirements under the NSCA and associated regulations for the licence renewal. CNSC staff will continue to verify and ensure that, through ongoing licensing and compliance activities and reviews, the environment and the health of persons are protected and will continue to be protected over the proposed licence period.

3. GENERAL ASSESSMENT OF SCAs

The functional areas of any licensed facility or activity consist of a standard set of safety and control areas (SCA). Each SCA is comprised of “specific areas” of regulatory interest, which may vary between facility types. The SCA framework is defined in Appendix C, and the specific areas that comprise the SCAs for this facility are identified in Appendix C.2.

The following sections discuss the review and assessment of McMaster’s proposed measures and controls and past performance in each SCA. The sections also discuss the compliance verification activities that were conducted over the current licence period. A list of inspections, and the SCAs verified for each inspection, is provided in Appendix D.

3.1 Management System

The management system SCA covers 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.

The specific areas that comprise this SCA at MNR are discussed in this CMD and include:

- Management System
- Organization
- Performance Assessment, Improvement and Management Review
- Operating Experience (OPEX)
- Change Management
- Safety Culture
- Configuration Management
- Records Management
- Management of Contractors
- Business Continuity

3.1.1 Trends

The following table indicates the overall rating trends for the management system SCA over the current licensing period:

MANAGEMENT SYSTEM								
OVERALL COMPLIANCE RATINGS								
2014	2015	2016	2017	2018	2019	2020	2021	2022
SA	SA	SA	SA	SA	SA	SA	SA	SA
<p style="text-align: center;">Comments</p> <p>McMaster has implemented a management system that meets the requirements of CSA standard N286-12, <i>Management System Requirements for Nuclear Facilities</i> [6]. The management system SCA at MNR met applicable CNSC requirements and received a “satisfactory” rating during the entire licence period.</p>								

3.1.2 Discussion

Regulatory Requirements

Paragraph 3(d) of the [Class I Nuclear Facilities Regulations](#) (CINFR) states that an application for a licence to operate a Class I nuclear facility shall contain “the proposed management system for the activity to be licensed”.

The [General Nuclear Safety and Control Regulations](#) (GNSCR), section 3 contain requirements that form the basis of a management system.

During the licence period, the CNSC published [REGDOC-2.1.1, Management System](#), which refers to CSA N286-12 *Management system requirements for nuclear facilities* [6], and [REGDOC-2.1.2, Safety Culture](#). Both documents apply to the MNR facility.

3.1.3 Summary

A summary of the licensee’s past performance, regulatory focus and proposed improvements are presented in the following subsections.

3.1.3.1 Past Performance

CNSC staff conducted 5 inspections with compliance verification items related to the management system SCA over the licence period, including a focused inspection in 2021. This inspection resulted in 2 notices of non-compliance (NNC) in the area of work and change control package information completeness, and internal audits. The non-compliances were of low safety significance, as they did not directly impact the safety of the facility, personnel, the public or the environment. McMaster implemented corrective actions which CNSC staff reviewed and assessed as appropriate.

In 2018, CNSC staff requested McMaster to implement the requirements of CSA N286-12 [6]. This standard has requirements for management systems to include topics on organization, performance assessment, improvement and management review, operating experience (OPEX), change management, safety culture, configuration management, records management, management of contractors and business continuity, which apply to the MNR facility. Also in 2018, CNSC published REGDOC-2.1.2, *Safety Culture*. McMaster updated its Policy Manual in 2018 to include the requirements of N286-12 and REGDOC-2.1.2, which CNSC staff have since assessed as satisfactory.

In 2019, CNSC staff published REGDOC-2.1.1, *Management System*, which refers to CSA N286-12 [6]. This regulatory document does not duplicate the specific requirements of CSA N286-12 but provides generic expectations and guidance for licensees regarding management systems. The 2021 inspection of McMaster's management system confirmed that McMaster meets the applicable requirements of CSA N286-12, REGDOC 2.1.2 and the guidance provided in REGDOC-2.1.1.

CNSC staff concluded that McMaster's management system meets all regulatory requirements and expectations.

3.1.3.2 Regulatory Focus

CNSC staff will continue to monitor McMaster's performance in this SCA through the conduct of regulatory oversight activities, focusing on continued compliance with the CSA N286-12 standard and CNSC's regulatory documents.

3.1.3.3 Proposed Improvements

The current management system and programs at MNR are considered adequate. There are no improvements being proposed for this SCA at this time.

3.1.4 Conclusion

CNSC staff concluded that McMaster continues to maintain and implement a documented management system in accordance with CNSC regulatory requirements.

Based on CNSC staff assessments of the licence application, supporting documents and performance, CNSC staff concluded that McMaster has implemented appropriate measures and programs to meet CNSC expectations under this SCA.

CNSC staff will continue to monitor McMaster's performance through desktop reviews and onsite compliance verification activities.

3.1.5 Recommendation

One standardized licence condition is included in the proposed licence for this SCA. Licence condition 1.1 requires McMaster to implement and maintain a management system. Compliance verification criteria (CVC) are included in the proposed LCH for this licence condition, including REGDOC-2.1.2 and CSA N286-12. REGDOC-2.1.1 is included as guidance.

3.2 Human Performance Management

The human performance management SCA covers 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 these personnel have the necessary knowledge, skills, procedures and tools in place to safely carry out their duties.

The specific areas that comprise this SCA at MNR include:

- Personnel Training
- Personnel Certification

3.2.1 Trends

The following table indicates the overall rating trends for the human performance management SCA over the current licensing period:

HUMAN PERFORMANCE MANAGEMENT								
OVERALL COMPLIANCE RATINGS								
2014	2015	2016	2017	2018	2019	2020	2021	2022
SA	SA	SA	SA	SA	SA	SA	SA	SA
Comments								
<p>McMaster has implemented and maintains a training system and programs based on a Systematic Approach to Training (SAT). The satisfactory trend for this SCA has remained stable over the licensing period. McMaster has ensured that the training programs are updated and improved over the course of the current licensing period. McMaster continues to develop satisfactory initial certification examinations and requalification tests with the assistance of CNSC staff. McMaster maintains proper CNSC certification for their Reactor Operators and provides their operators with continuing training. The licensee has also continued to request renewal of their reactor operators' certifications in a timely manner.</p>								

3.2.2 Discussion

Regulatory Requirements

Paragraphs 12(1)(a) and 12(1)(b) of the [GNSCR](#) require that a 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; and shall train the workers to carry on the licensed activity in accordance with the Act, the regulations made under the Act and the licence.

Paragraphs 6(m) and 6(n) of the [CINFR](#) require that licence applications include the proposed responsibilities of and qualification requirements and training program for workers, including the procedures for the requalification of workers; and the results that have been achieved in implementing the program for recruiting, training and qualifying workers in respect of the operation and maintenance of the nuclear facility.

Paragraph 14(2)(e) of the [CINFR](#) requires every licensee to keep a record of the status of each worker's qualifications, requalification and training, including the results of all tests and examinations completed in accordance with the licence.

The licensee is required to implement and maintain training programs for workers in accordance with the requirements set out in [REGDOC-2.2.2, Personnel Training](#).

McMaster maintains training system documentation that meets regulatory training and qualification requirements, including processes for implementing the various phases of a SAT training system in accordance with the requirements of REGDOC-2.2.2.

Overall, McMaster has provided a robust methodology to assure that workers are qualified to perform their duties safely. CNSC staff concluded that McMaster is performing satisfactorily with respect to this SCA.

3.2.3 Summary

The MNR facility has a staff of approximately 70 full time employees who support the licensed activities, including 6 certified reactor operators and 2 qualified supervisors. Over the next licence period, McMaster plans on increasing the number of staff to support increased operating hours and capacity of the reactor. CNSC staff have no concerns regarding the human performance SCA at MNR. Details of the licensee's past performance, challenges and proposed improvements are presented in the following subsections.

3.2.3.1 Past Performance

The following paragraphs summarize McMaster's performance in the areas of personnel training and personnel certification.

Personnel Training

McMaster implements and maintains a SAT-based training system and program to provide assurance that workers are qualified to perform their duties safely.

McMaster maintains training system documentation that addresses regulatory training and qualification requirements, including processes for implementing the various phases of a SAT-based training system in accordance with the requirements of REGDOC-2.2.2. A SAT-based training system provides interdependent functions consisting of analysis, design, development, implementation and evaluation.

During the current licensing period, CNSC staff conducted compliance verification activities focused on Personnel Training as well as numerous document reviews of the training programs at MNR to ensure that a SAT-based training system was adequately implemented.

In March 2020, CNSC staff conducted a focused inspection on the implementation of McMaster's personnel training programs. CNSC staff identified areas of non-compliance with internal documentation and raised 3 NNCs. The NNCs pertained to maintenance of training system documentation for training needs analysis, training design and development, and implementation of the training program. The non-compliances were of low safety significance and are not an impediment to the licence renewal. McMaster's corrective action plan was reviewed and accepted by CNSC staff, and all NNCs have been closed.

Overall, McMaster has provided a robust methodology to assure that workers are qualified to perform their duties safely. CNSC staff concluded that McMaster is performing satisfactorily with respect to personnel training.

Personnel Certification

The MNR licence requires that any person appointed to the position of Reactor Operator holds a certification issued under the NSCA and its regulations.

To become a certified Reactor Operator, a candidate must meet personnel selection criteria and successfully complete the training program and certification requirements described in the MNR licence and LCH and complete a CNSC certification examination administered by McMaster. Upon successful completion of the certification examination, the CNSC then certifies the candidates who meet these requirements and who have demonstrated their competence to safely perform the duties of the certified position. Once certified by the CNSC, certified workers undergo continuing training to ensure that they maintain the knowledge and skills to safely perform their duties.

During the current licensing period, McMaster has developed initial certification examinations and requalification tests under the oversight of CNSC staff and in accordance with the requirements of the licence and LCH.

Because CNSC staff are directly involved in the process of developing and grading the examinations/tests, there were no additional compliance verification activities related to personnel certification during the current licensing period, and there were no concerns raised by CNSC staff regarding McMaster's personnel certification program. All the examinations and tests have been developed, administered and graded to the satisfaction of CNSC staff, and the certification program at MNR has been successful in certifying Reactor Operators.

McMaster University has indicated its intention to operate on a schedule of 24-hr, 5-days/week in the future. McMaster has operated on a similar schedule in the past, and this is authorized under the current licensing basis. Over the next few years, this is expected to result in an increased demand on the licensee's training program for Reactor Operators. Once these individuals have completed the training program, they will then be expected to take their CNSC certification examination, which is administered by McMaster and overseen by the CNSC. McMaster is also qualifying additional Reactor Supervisors to meet the increased production schedule.

3.2.3.2 Regulatory Focus

During the next licensing period, CNSC staff will continue to assess McMaster's training program and oversee the development and grading of certification examinations and requalification tests. CNSC staff will also continue to monitor and evaluate McMaster's compliance with regulatory requirements through regulatory oversight activities including inspections, review of compliance reports, and updates to licensing basis program documentation.

3.2.3.3 Proposed Improvements

The current programs at MNR are considered adequate for this SCA and no improvements for the personnel training or personnel certification specific areas are proposed. CNSC staff will continue to assess McMaster's regulatory compliance through inspections and other compliance verification activities, and through the oversight of certification examinations and requalification tests in the next licensing period.

3.2.4 Conclusion

McMaster has strengthened the training program over the licensing period and provided a robust methodology to assure that workers are qualified to perform their duties safely. McMaster has also maintained a sufficient number of certified Reactor Operators while ensuring that workers remain competent and current in reactor operations.

CNSC staff are satisfied with McMaster's performance in the personnel training and certification over the course of the current licensing period. CNSC staff concluded that McMaster is performing satisfactorily with respect to the human performance SCA.

3.2.5 Recommendation

Three licence conditions are included in the proposed licence for this SCA. Licence condition 2.1 requires the licensee implement and maintain a training program. Licence condition 2.2 requires the licensee to ensure that persons appointed to the position of Reactor Operator hold a certification in accordance with the requirements of the NSCA. Licence condition 2.3 requires that persons appointed to the position of Reactor Supervisor are qualified and maintain a valid certification as Reactor Operator.

CVCs for these licence conditions are included in the proposed LCH.

3.3 Operating Performance

The operating performance SCA covers the conduct of the licensed activities and the programs that enable safe and effective performance of the facility. The specific areas that comprise this SCA at MNR include:

- Conduct of Licensed Activity
- Procedures
- Reporting and Trending
- Outage Management Performance
- Safe Operating Envelope

3.3.1 Trends

The following table indicates the overall rating trends for the operating performance SCA over the current licensing period:

OPERATING PERFORMANCE								
OVERALL COMPLIANCE RATINGS								
2014	2015	2016	2017	2018	2019	2020	2021	2022
SA	SA	SA	SA	SA	SA	SA	SA	SA
Comments								
McMaster has maintained an operating program in accordance with CNSC regulatory requirements over the licence period. McMaster continues to be rated SA in this SCA								

3.3.2 Discussion

Regulatory Requirements

The [NSCA](#) and its regulations require the licensee to ensure that policies, programs, practices and procedures are in place for the safe operation and maintenance of its nuclear facility.

Paragraph 6(d) of the [CINFR](#) requires that an application for a licence to operate a Class I nuclear facility contain the proposed measures, policies, methods and procedures for operating and maintaining the nuclear facility. The occupational and industrial safety aspects of McMaster's operations are regulated under the [Canada Labour Code](#), and its associated [Canada Occupational Health and Safety Regulations](#).

[REGDOC-3.1.2, Reporting Requirements, Volume I: Non-Power Reactor Class I Facilities and Uranium Mines and Mills](#) was published in 2018 and revised in 2022, and provides requirements for reporting on operating performance.

Additional requirements under this SCA are provided by national codes and standards, including the [National Building Code of Canada](#) (NBCC), the [National Fire Code of Canada](#) (NFCC) for structural design, and CSA N393-22, *Fire protection for facilities that process, handle, or store nuclear substances* [7].

3.3.3 Summary

A summary of the licensee's past performance, regulatory focus and proposed improvements are presented in the following subsections.

3.3.3.1 Past Performance

Conduct of Licensed Activity

During the current licence term, McMaster operated its facility in compliance with its licensing basis. CNSC staff verified McMaster's compliance with the requirements of this SCA as part of compliance activities, which included desktop reviews of annual reports, operation reports and inspections. CNSC staff confirmed through these activities that McMaster has implemented and maintained an effective operating program, ensuring licensed activities are conducted safely and in compliance with regulatory requirements.

Reporting and Trending

In December 2018, CNSC staff requested McMaster to implement the requirements of REGDOC-3.1.2. This regulatory document sets out regulatory requirements and guidance for routine compliance reporting, as well as non-routine reporting such as unplanned events and action level exceedances. Prior to the implementation of REGDOC-3.1.2, detailed requirements for reporting unplanned situations or events were included in the MNR LCH and were based on section 29 of the [GNSCR](#). Over the licence period, McMaster reported 7 events, listed in table 3-1 below. Other events specific to transportation, such as damaged packages during transport, are discussed under the packaging and transport SCA, section 3.14. CNSC staff assessed McMaster's response to all events, and the actions were subsequently closed.

Table 3-1: Events reported to the CNSC

Date	Event
2014-10-08	Fueling error
2015-06-01	Failed limit switch on the guide tube lifted circuit
2016-07-07	Fire at the Clarke Building
2017-07-04	Reactor started with fission products monitor not operational
2020-07-24	Reactor operated with flapper position scram unavailable
2020-08-29	Hacked email
2023-06-23	IAEA seal removal

CNSC's and licensees' response to events depends on a number of factors, including the safety significance, potential impact on health and safety of the personnel, the public and the environment, and recurrence or systemic nature of the event. Based on the significance, some events require a root cause analysis (RCA) whereas other events of less significance require a notification to the CNSC with details of the occurrence. CNSC staff then assess the significance and implications of the event and follow up with the licensee as appropriate.

CNSC staff deemed the fueling error of 2014 as of sufficient interest and significance that it was brought to the Commission's attention as an Event Initial Report (EIR) in CMD 14-M73 [8]. This event also triggered a reactive inspection on-site, where CNSC staff verified the corrective actions put in place by McMaster as well as the broader aspects of fueling operations. As a result, CNSC staff issued 5 additional recommendations.

All reportable events are reported to the Commission as part of regulatory oversight reports which are presented in public proceedings every 3 years. In addition to event reporting, McMaster has submitted annual compliance reports required by the licence, as well as several other types of reports such as Operations Reports, Nuclear Facilities Control Committee minutes of meetings, Document Listing Reports, etc., which serve in CNSC staff's desktop compliance verification of McMaster's operations.

Regulatory Oversight

CNSC staff conducted 4 inspections with CVC under operating performance. There were no non-compliances noted for this SCA but CNSC staff issued 5 recommendations pursuant to the reactive inspection on the fueling error, as stated above. CNSC staff also exercised regulatory oversight as part of desktop reviews of operations reports, annual reports, program documents and other correspondence.

Procedures

McMaster's management system consists of high-level program documents supported by lower-level procedures and work instructions. Programs and documentation are subject to periodic auditing by McMaster management to ensure that programs remain adequate and effective.

The LCH identifies the information regarding version control of licensing basis documents, including codes, standards or other documents that are used as CVC, and it stipulates requirements for providing change notification, which triggers reviews by CNSC staff. This ensures that changes continue to align with regulatory requirements and the MNR licensing basis. Program documents and procedure adherence are standard verification items in all inspections that CNSC staff conducted at MNR. For example, during the current licence term, proper change notification around activities related to facility changes and reactor fuel were noted.

Based on the reviews conducted during the current licence period and as part of this licence application, CNSC staff concluded that McMaster maintains an adequate set of program documents and procedures to ensure the safe operation of the MNR facility.

Outage Management Performance

MNR has been operating typically 16 hours a day, 5 days a week. Scheduled maintenance is performed daily, weekly, monthly and annually. Individual fuel assemblies are shuffled or replaced as needed. MNR goes into an outage typically at the end of December for a period of 2 to 4 weeks for annual maintenance where more significant maintenance items and tests can be carried out. CNSC staff are satisfied with McMaster's performance with outage management.

Safe Operating Envelope

The operating limits and conditions (OLC) define the conditions that must be met to prevent situations or events that might lead to accidents, or to mitigate the consequences of accidents, should they occur. McMaster maintains a set of OLCs in the *MNR Operating Limits and Conditions*, that CNSC staff have reviewed and accepted. The document is part of the licensing basis and cannot be changed without CNSC staff's approval. CNSC staff have assessed the potential impact of a change in operating schedule against the current OLCs and have found no impact. McMaster has not exceeded or contravened any of the OLCs during the current licence period.

3.3.3.2 Regulatory Focus

CNSC staff continue to monitor McMaster's performance in this SCA through regulatory oversight activities including inspections, desktop reviews of relevant program documentation and periodic reports. CNSC staff have no concerns with the proposed 24-hrs, 5 days/week schedule, as MNR has operated under this schedule in the past and this is authorized under the current licence. CNSC staff will however increase their focus to ensure that all aspects of this operating regime are managed adequately, including higher demand on human performance.

3.3.3.3 Proposed Improvements

The current programs at MNR are considered adequate for this SCA. No improvement projects have been identified by McMaster for the requested licence period. The NBCC and NFCC codes were updated in 2022, effectively replacing the 2010 versions that are listed in the current LCH. Also, CSA N393-22, *Fire protection for facilities that process, handle, or store nuclear substances* [7] is being introduced in the proposed LCH for this SCA, replacing [NFPA-801, Standard for Fire Protection for Facilities Handling Radioactive Materials](#). McMaster has committed to submit a gap analysis and an implementation plan for these codes and standard, until which time they are listed as guidance.

3.3.4 Conclusion

Based on CNSC staff assessments of McMaster's application, supporting documents and past performance, CNSC staff concluded that McMaster University continues to implement and maintain an effective operating program for MNR in accordance with regulatory requirements.

3.3.5 Recommendation

Two standard licence conditions are included in the proposed licence for this SCA. Licence condition 3.1 requires McMaster to implement and maintain an operating program, which includes a set of operating limits.

Licence condition 3.2 requires McMaster to implement and maintain a program for reporting to the Commission or a person authorized by the Commission. Delegation of authority with respect to “a person authorized by the Commission” is discussed in section 5.5 of this CMD. CVCs for both licence conditions are included in the proposed LCH.

3.4 Safety Analysis

The safety analysis SCA covers the 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. The results of the safety analysis are documented in the licensee’s Safety Analysis Report (SAR).

The specific areas that comprise this SCA at MNR are:

- Deterministic Safety Analysis
- Hazard Analysis
- Nuclear Criticality Safety

3.4.1 Trends

The following table indicates the overall rating trends for the safety analysis SCA over the current licensing period:

SAFETY ANALYSIS								
OVERALL COMPLIANCE RATINGS								
2014	2015	2016	2017	2018	2019	2020	2021	2022
SA	SA	SA	SA	SA	SA	SA	SA	SA
Comments								
The MNR SAR effectively identifies facility hazards and structures, systems and components (SSC) relied upon for safety to control or mitigate these hazards. McMaster’s performance continues to be rated SA for this SCA.								

3.4.2 Discussion

Regulatory Requirements

Paragraph 3(1)(i) of the [GNSCR](#) requires a description and the results of any test, analysis or calculation performed to substantiate the information included in the application. Paragraph 6(a) of the [CINFR](#) requires that an application for a licence to operate include a description of the structures at the nuclear facility, including their design and their design operating conditions. Paragraph 6(b) of the CINFR requires that an application for a licence to operate include a description of the systems and equipment at the nuclear facility, including their design and their design operating conditions. Paragraph 6(c) of the CINFR requires that an application for a licence to operate include a final SAR. A safety analysis must include an analysis of the postulated sequences and consequences of conditions that could arise from initiating events and associated hazards.

The CNSC published [REGDOC-2.4.1, *Deterministic Safety Analysis*](#) in 2014, and [REGDOC-2.4.3, *Nuclear Criticality Safety*](#) in September 2020, both of which apply to MNR.

3.4.3 Summary

A summary of the licensee's past performance, regulatory focus and proposed improvements are presented in the following subsections.

3.4.3.1 Past Performance

McMaster's supporting documentation for the licence renewal application includes a SAR for the MNR facility. The SAR provides a description of the facility and building layouts, processes, operating limits, and scenarios based on hazards and postulated initiating events. In addition, the SAR provides an assessment of potential consequences and demonstrates the safety case through defence in depth.

CNSC staff assessed the information provided in the SAR and determined that McMaster has adequately assessed the hazards associated with licensed activities and demonstrated an adequate level of protection over a broad range of operating conditions. McMaster has not requested any changes with respect to operations of the reactor that could affect the SAR.

During the current licence period, CNSC staff monitored McMaster's compliance with conditions imposed by the SAR through adherence to OLCs and operating practices. There were no non-compliances related to safety analysis, and there were no events related to this SCA.

Deterministic safety analysis

McMaster has performed several safety assessments to ensure the safety of its operations as part of the continued improvement of the safety analysis. These assessments have included updates to safety assessments for aircraft impacts, flooding, earthquakes and tornadoes.

Selection of these accident conditions have been performed using a hazard analysis approach. Demonstration of safety in credible scenarios was performed using deterministic approaches.

Hazard analysis

The MNR SAR provides information on site characterization, including details on the geology, seismology, meteorology, hydrology, etc. This information is taken into consideration in the safety assessment and design of the facility.

The hazard analysis is part of the SAR and covers a number of factors that could be hazardous to the facility, its staff and the public. In June 2023, CNSC staff requested McMaster to update the SAR to provide additional details on events such as tornadoes, airplane crashes and floods. McMaster submitted a revised SAR in September 2023. CNSC staff reviewed the revised SAR and concluded that these hazards are adequately described and analyzed, and that McMaster's conclusions are supported. Floods were also analyzed as part of the lessons learned from the 2011 Fukushima event. The analysis demonstrated that potential flooding is mitigated by design and by the location of the facility, where the water could not realistically rise to reach the reactor level due to the natural ground elevation of approximately 100 m above sea level.

Nuclear Criticality Safety

In September 2020, REGDOC-2.4.3, *Nuclear Criticality Safety* was published, replacing CNSC regulatory document RD-327 *Nuclear Criticality Safety*. McMaster performed a criticality safety assessment and identified the applicable nuclear criticality safety requirements based on REGDOC-2.4.3. McMaster's operations criticality safety program is based on this assessment and meets CNSC requirements.

During the current licence period, CNSC staff conducted desktop reviews of the safety analysis documentation and programs, which included verification that the licensee has been maintaining the safety barriers and protective systems as specified in the MNR facility's SAR and in the Nuclear Criticality Safety Program documentation. CNSC staff performed a compliance inspection of the MNR refueling activity and processes, which included verification of the criticality safety practices and training. There were no non-compliances identified as part of this inspection.

3.4.3.2 Regulatory Focus

CNSC staff continue to monitor McMaster's performance in this SCA through regulatory oversight activities, including onsite inspections, desktop reviews and revisions to relevant program documentation pertaining to safety analysis.

3.4.3.3 Proposed Improvements

The current programs at MNR for this SCA are acceptable. The SAR was updated as part of this licence renewal and in response to CNSC comments. No other improvements are being proposed.

3.4.4 Conclusion

McMaster has identified and assessed all potential safety hazards associated with the operation of the facility. CNSC staff assessed McMaster's documentation under the safety analysis SCA and found that it meets regulatory requirements.

3.4.5 Recommendation

Two standardized licence conditions are included in the proposed licence for this SCA. Standardized licence condition 4.1 requires McMaster to implement and maintain a safety analysis program and nuclear criticality safety program. Licence condition 4.2 requires McMaster to implement and maintain a nuclear criticality safety program. CVCs for these licence conditions are included in the proposed LCH.

3.5 Physical Design

The physical design SCA relates to activities that impact the ability of systems, components and structures to meet and maintain their design basis given new information arising over time and taking changes in the external environment into account.

The specific areas that comprise this SCA at MNR include:

- Design Governance
- Site Characterization
- Facility Design
- Structure Design
- System Design
- Components

3.5.1 Trends

The following table indicates the overall rating trends for the physical design SCA over the current licensing period:

PHYSICAL DESIGN								
OVERALL COMPLIANCE RATINGS								
2014	2015	2016	2017	2018	2019	2020	2021	2022
SA	SA	SA	SA	SA	SA	SA	SA	SA
Comments								
McMaster has maintained a physical design program in accordance with CNSC requirements over the previous licence period. McMaster's performance continues to be rated SA for this SCA.								

3.5.2 Discussion

Regulatory Requirements

McMaster is required to implement and maintain a physical design program such that the design of its facility and any subsequent changes remain within the licensing basis. Paragraph 3(1)(d) of the [GNSCR](#) requires that an application for a licence shall contain a description of any nuclear facility, prescribed equipment or prescribed information to be encompassed by the licence.

The [CINFR](#) require that an application for a licence shall contain, under paragraphs:

- 3(a), a description of the site of the activity to be licensed, including the location of any exclusion zone and any structures within that zone;
- 3(b), plans showing the location, perimeter, areas, structures and systems of the nuclear facility;
- 6(a), a description of the structures at the nuclear facility, including their design and their design operating conditions;
- 6(b), a description of the systems and equipment at the nuclear facility, including their design and their design operating conditions;
- 6(c), a final safety analysis report demonstrating the adequacy of the design of the facility; and
- 6(d), proposed measures, policies, methods and procedures for operating and maintaining the facility.

Additional requirements under this SCA are provided by national codes and standards, including the [NBCC](#) and the [NFCC](#) for structural design, and CSA N393-22, *Fire protection for facilities that process, handle, or store nuclear substances* [7].

McMaster is required to notify the CNSC of any proposed changes with a potential to impact the fire protection program and submit an assessment of the potential impact of these changes.

3.5.3 Summary

A summary of the licensee's past performance, regulatory focus and proposed improvements are presented in the following subsections.

3.5.3.1 Past Performance

Design Governance

The Vice-President, Research is responsible for overseeing all research activities at the University, including the MNR operations. Design governance is assured through oversight and control of changes at MNR, for which the responsibility is delegated to the Nuclear Facilities Control Committee, which provides oversight of safety, design and change control processes. System design, modifications and procurement are governed by McMaster's change control process, under the management system. McMaster's Policy Manual describes the policies and process governing change control, which are implemented under the management system and in compliance with CSA N286-12 [6].

There have been no physical changes to the design of the reactor over the current licence period.

Site Characterization

The MNR SAR provides the information on site characterization, including details on the geology, seismology, meteorology and hydrology of the site. This information is considered in the safety assessment of the facility. Complementary information on site characterization is included in the MNR Environmental Risk Assessment [9].

The University's main campus is located at an elevation of approximately 100 m above sea level in a mostly flat area, at the western end of the City of Hamilton, west of the community of Westdale and east of the town of Dundas. It is located within 5 km of Highway 403 and approximately 10 km from the Hamilton International Airport.

The aerial view of the site location shown in figure 3-1 shows the MNR facility on the McMaster University campus, surrounded by Cootes Paradise to the north, Cootes Drive to the west and Main Street to the south.

Figure 3-1: McMaster Nuclear Reactor



Facility, structure, components and system design

The MNR is an open-pool type materials test reactor with a core of low enriched uranium fuel that is moderated and cooled by light water. Two external cooling towers are used to remove the heat, through a primary and a secondary heat transport system. The reactor pool is divided in 2 sections which can be isolated from one another, and the core can be moved to either sections. The reactor is housed under a full concrete containment building, kept under low atmospheric pressure relative to the outside.

Several beam tubes provide neutron beams used for experiments and neutron radiography. The reactor building contains the iodine facility, used for I-125 production, and a hot cell, used for the manipulation of radioactive materials.

There were no changes to the design of the reactor over the current licence period. CNSC staff have provided regulatory oversight around the addition of experimental devices that use the existing neutron beams around the reactor, such as the Small Angle Neutron Scattering (SANS) facility and the McMaster Intense Positron Beam Facility (MIPBF). These experimental devices have not been fully commissioned yet.

3.5.3.2 Regulatory Focus

CNSC staff monitor McMaster's performance in this SCA through regulatory oversight activities including onsite inspections and desktop reviews of relevant program documentation, operations reports, annual reports, Nuclear Facilities Control Committee minutes of meetings, etc. Design change and the change control process were inspected during 2 onsite inspections in 2017 and 2021. One NNC and a recommendation were issued concerning the change control process, as part of the broader management system inspection of 2021. The findings were deemed of low safety significance as the findings involved administrative aspects of records management.

CNSC staff will continue to monitor McMaster's regulatory compliance in the physical design SCA as part of CNSC's compliance verification program.

3.5.3.3 Proposed Improvements

The current programs for the physical design SCA at MNR are acceptable and McMaster has not indicated any plans to modify the facility or make significant design changes over the future licence term. Any proposed changes that are within the licensing basis will be assessed by CNSC staff. Changes that may be outside the safety boundaries of the current licensing basis would be brought to the Commission's attention for decision.

During the licence period, the 2020 editions of the NBCC and NFCC were published, effectively replacing the 2010 versions listed in the current MNR LCH. Also, CSA N393-22, *Fire protection for facilities that process, handle, or store nuclear substances* [7] is being introduced in the proposed LCH, replacing [NFPA-801, Standard for Fire Protection for Facilities Handling Radioactive Materials](#). CNSC staff requested McMaster to complete a gap analysis between their current programs and the recent revision of these codes and standard. CSA N393-22, NBCC and NFCC 2020 are included in the proposed LCH as guidance for this SCA, and McMaster will submit a gap analysis and an implementation plan, expected in December 2024.

3.5.4 Conclusion

McMaster has implemented and maintained an adequate physical design program, including a change control process which ensures changes are executed safely and within the MNR licensing basis. Based on CNSC staff assessments of McMaster University's application, supporting documents and past performance, CNSC staff concluded that McMaster continues to implement and maintain programs for physical design in accordance with regulatory requirements.

3.5.5 Recommendation

CNSC staff are recommending one standardized condition in the proposed licence for this SCA. Licence condition 5.1 requires the licensee to implement and maintain a design program. CVCs for this licence condition are included in the proposed LCH.

3.6 Fitness for Service

The fitness for service SCA covers activities that impact the physical condition of SSCs to ensure that they remain effective over time. This area includes programs that verify all equipment is available to perform its intended design function when called upon.

The specific areas that comprise this SCA at MNR include:

- Equipment Fitness for Service/Equipment Performance
- Maintenance
- Aging Management
- Periodic Inspection and Testing

3.6.1 Trends

The following table indicates the overall rating trends for the fitness for service SCA over the current licensing period:

FITNESS FOR SERVICE								
OVERALL COMPLIANCE RATINGS								
2014	2015	2016	2017	2018	2019	2020	2021	2022
SA	SA	SA	SA	SA	SA	SA	SA	SA
Comments								
McMaster has maintained a fitness for service program in accordance with CNSC requirements over this licence period. McMaster continues to be rated as SA in this SCA.								

3.6.2 Discussion

Regulatory Requirements

McMaster is required to implement and maintain a fitness for service program to cover activities that affect the physical condition of SSC to ensure that they remain effective over time.

Paragraph 6(d) of the [CINFR](#) requires that an application to operate a Class I nuclear facility contain the proposed measures, policies, methods and procedures for operating and maintaining the nuclear facility. Further requirements are provided under the [NBCC](#) and the [NFCC](#). Specific aspects of CSA N286-12 [6] and CSA N393-22, *Fire protection for facilities that process, handle, or store nuclear substances* [7] are also applicable for this SCA.

[REGDOC-2.6.3, Aging Management](#), published in 2014, sets out guidance and the requirements of the CNSC for managing aging of SSCs for reactor facilities, and applies to MNR.

3.6.3 Summary

A summary of the licensee's past performance, regulatory focus and proposed improvements are presented in the following subsections.

3.6.3.1 Past Performance

Equipment Performance, Maintenance

CNSC staff verified that McMaster has a maintenance program that ensures equipment continues to function as designed, remains available, meets the designed intent of the safety analysis and minimizes equipment failures.

Preventive maintenance is used to detect early warning signs of aging infrastructure by identifying assets requiring maintenance, refurbishment or replacement due to factors such as obsolescence, or deterioration.

During the current licensing period, CNSC staff performed 5 inspections that included compliance verification items related to fitness for service. There were no non-compliances identified in this area. CNSC staff verified that preventative maintenance and tests for the reactor and structures supporting the reactor and auxiliary equipment are done in accordance with procedures and on daily, weekly, monthly and annual schedules. McMaster maintains a database of equipment maintenance items and unusual events related to fitness for service, which is used for operating experience and predictive maintenance.

McMaster reported 2 events involving equipment performance (see table 3-1). The first event occurred in 2015, when a limit switch failed on a guide tube. The guide tubes guide the adjuster rods in and out of the reactor core. The limit switches are used to detect whether these guide tubes are up, or out of position for operation of the reactor, and will trigger a scram signal if the guide tubes are not in the fully down position. There were no consequences, but the reed switches are part of the safety system and their failure could have impaired the ability to scram the reactor should a guide tube have been out of position and for this reason, the event was reportable. However, the risk of actual consequences was low since there are other verifications that take place to ensure the guide tubes are in position, and other safety systems remained fully functional. The switches were replaced, and other repairs were made on the circuit that led to the switch failures.

The second event occurred in 2020 when the reactor operated with the scram signal unavailable on the flapper valve position. The flapper valve automatically changes the forced cooling to convection cooling when a flow reduction occurs. When the flapper closes, a pushrod actuates an electrical signal, which scrams the reactor. The pushrod was damaged during maintenance at the reactor bridge, effectively disabling the scram signal. Although an equipment failure, the event was caused by human error. Several other independent trip signals remained available and therefore, the risk associated with this event was low. However, the unavailability of a safety system constituted a reportable event. In their corrective action plan, McMaster included additional controls to the maintenance procedure and pre-job briefs, and CNSC were satisfied with McMaster's response to the event.

Equipment Fitness for Service/Aging Management

Aging management issues are reviewed and reported periodically by McMaster. Aging, obsolescence and unusual equipment performance are handled under the authority of the Director, Reactor Operations and Maintenance, and are brought to the attention of McMaster's Nuclear Facilities Control Committee for any safety-related concerns and decisions. MNR maintenance and inspections confirmed that there have been no unusual aging issues related to the SSCs of the reactor facility that would require additional measures.

Over the current licence period, MNR operated mostly on a 16-hrs, 5-days/week at 3 MW. McMaster University has indicated its intention to operate on a schedule of 24-hrs, 5-days/week at 5 MW. This is authorized under the current licence and MNR has operated under the proposed schedule in the past. In transitioning toward this schedule, MNR operated at 24-hrs, 5 days/week at 3 MW for a period of 6 weeks between October and November 2023, with the objective to identify any problems or areas for improvement and address them before shifting to this schedule permanently in 2024. McMaster reported no issues, and raising the power to 5 MW is not expected to cause any challenge since MNR is licensed to operate at this power.

CNSC staff assessed the proposal from the perspective of all applicable SCAs, including fitness for service. CNSC staff determined that this operating schedule should not have a measurable impact on fitness for service, or on the safety of the public, the personnel or the environment. However, CNSC staff will monitor any developing trends and will increase their focus on this SCA.

Periodic Inspection and Testing

The MNR maintenance program identifies the equipment, the tests and calibration that must be performed periodically. In addition, the OLC specify certain tests for the safety systems that must be carried out on a determined schedule. These include shim rod drop-time, safety channel high power scram test, calibration of power instruments, reactor building leakage test, secondary coolant activity, pool water chemistry, etc.

Tests for special systems, such as the fire suppression system, backup generator and other systems shared by the university are conducted by campus maintenance services as well as by contractors with the appropriate expertise.

CNSC staff verified during 5 inspections that equipment tests, inspections and calibrations are done as scheduled and there were no non-compliances noted for this SCA. CNSC staff also review operations reports to ensure that equipment tests are performed as required. CNSC staff have also reviewed the MNR maintenance and aging management programs and concluded that McMaster's fitness for service program meets regulatory requirements.

3.6.3.2 Regulatory Focus

CNSC staff will continue to monitor McMaster's performance in this SCA through regulatory oversight activities including inspections and desktop reviews of relevant program documentation, operations reports and meeting minutes. CNSC staff will also monitor any developing trends related to the longer operating schedule and will increase their focus on this SCA.

3.6.3.3 Proposed Improvements

REGDOC-2.6.3 is included in the proposed LCH as CVC. No other improvements are proposed within this SCA.

3.6.4 Conclusion

Based on CNSC staff assessments of McMaster's application, supporting documents and past performance, CNSC staff concluded that McMaster implements and maintains an effective fitness for service program in accordance with regulatory requirements, and appropriate processes are in place to ensure that MNR remains fit for service.

3.6.5 Recommendation

One standardized licence condition is included in the proposed licence for this SCA. Licence condition 6.1 requires the licensee to implement and maintain a fitness for service program. CVCs for this licence condition are included in the proposed LCH.

3.7 Radiation Protection

The radiation protection SCA covers the implementation of a radiation protection (RP) program in accordance with the [Radiation Protection Regulations](#) (RPR). The program must ensure that contamination levels and radiation doses received by individuals are monitored, controlled, and maintained as low as reasonably achievable (ALARA).

The specific areas that comprise this SCA at MNR include:

- Application of ALARA
- Worker Dose Control
- Radiation Protection Program Performance
- Radiological Hazard Control

3.7.1 Trends

The following table indicates the overall rating trends for the radiation protection SCA over the current licensing period:

RADIATION PROTECTION								
OVERALL COMPLIANCE RATINGS								
2014	2015	2016	2017	2018	2019	2020	2021	2022
SA	SA	SA	SA	SA	SA	SA	SA	SA
Comments								
<p>McMaster has implemented and maintained an effective RP program at MNR, as required by the RPR. Over the current licensing period, no worker received a radiation dose in excess of regulatory dose limits as a result of the licensed activities conducted at MNR. McMaster continued to perform satisfactorily in this SCA. Overall, CNSC staff are satisfied with the implementation of the RP program at MNR.</p>								

3.7.2 Discussion

Regulatory Requirements

The RPR require licensees to implement a RP program. As part of that program, licensees must keep effective and equivalent doses received by, and committed to, persons ALARA, taking into account social and economic factors. This is achieved through the implementation of management control over work practices, personnel qualification and training, control of occupational and public exposures to radiation, and planning for unusual situations. The RPR also prescribe dose limits for Nuclear Energy Workers (NEWs) and persons who are not NEWs. [REGDOC-2.7.1, Radiation Protection](#), and [REGDOC-2.7.2, Dosimetry, Volume I: Ascertainig Occupational Dose](#), were published in 2021 and provide guidance on how to meet these regulations.

CNSC staff confirmed that McMaster University has implemented and continues to maintain an RP program that ensures contamination levels and radiation doses received by individuals are monitored, controlled, and maintained ALARA. Over the licensing period, CNSC staff conducted an inspection focused on RP in 2022, and 3 general inspections contained elements of the RP program. Details of CNSC staff's assessment in this SCA are presented in the following sections.

3.7.3 Summary

A summary of the licensee's past performance, regulatory focus and proposed improvements are presented in the following subsections.

3.7.3.1 Past performance

McMaster University has developed an RP Program which provides MNR-specific requirements and guidelines for personnel exposures and safety precautions, describes the responsibilities of individuals managing and overseeing the program; the procedures to be followed; and the training requirements for all workers in the facility. The different aspects of McMaster University's RP program are discussed below.

Application of ALARA

McMaster's commitment to the ALARA principle has been demonstrated through the implementation of the RP program at MNR. The program requires that all levels of the organization be involved in ensuring that ALARA is integrated into planning, scheduling, and work control. The program also requires the establishment and monitoring of ALARA performance targets for radiological work activities conducted at the site.

The ALARA program consists of the following:

- establishment of radiation safety objectives, annual dose targets and ALARA goals
- annual assessment of the dose results against dose targets and of the performance with respect to the radiation safety objectives and ALARA goals
- the concept of ALARA and its application are incorporated into personnel RP training
- establishment of a radiological design criteria and a change control process for equipment/facility modifications which consider ALARA
- establishment of RP Committees responsible for reviewing the RP program, and reviewing and auditing McMaster's facility operations

Two Radiation Safety Committees are in place at MNR; the Health Physics Advisory Committee (HPAC) and the Nuclear Facilities Control Committee. The HPAC is responsible for establishing and reviewing the radiation safety program while the Nuclear Facilities Control Committee is responsible for reviewing and auditing McMaster's facility operations. The HPAC meets twice a year to review health physics (HP) reports and to be informed of the status of the Radiation Safety Program. Through the information provided, the HPAC performs an independent review of the radiation safety performance. Monthly operating reports detailing operations and RP performance are documented and reviewed by the Nuclear Facilities Control Committee. These are important sources of information and CNSC staff receive and review the operations reports, as well as the minutes of meeting from this committee as well as from HPAC. CNSC staff have no concerns in this area.

CNSC staff are satisfied with McMaster University's efforts in applying the ALARA principle to keep doses to workers ALARA over the current licensing period. CNSC staff concluded that McMaster University meets regulatory requirements in this specific area.

Worker Dose Control

CNSC staff confirmed that the RP program implemented at MNR is designed to ensure that doses to workers are controlled and do not exceed CNSC regulatory dose limits.

McMaster University uses a combination of action levels; staff training and qualification; and dose management tools (e.g., work planning and reviews of dosimetry results) to ensure radiation doses to workers are controlled, monitored, and maintained ALARA. Engineered and administrative controls such as shielding and mandatory use of personal protective equipment are also established to ensure the protection of workers at MNR.

All personnel granted unescorted access to MNR are identified as NEWs. Contractors may also be identified as NEWs depending on the nature of their work activities.

The RP program is primarily designed for 3 different categories of NEWs; namely: operations personnel, iodine production personnel, and neutron radiographers. The operations personnel are responsible for the operation and maintenance of the reactor; the iodine production personnel are responsible for the production of I-125, which is the most important isotope produced at MNR; and the neutron radiographers use the neutron radiography facility in the reactor to conduct quality assurance testing on objects. Typical applications of neutron radiography include the testing of turbine blades for aircraft engines and corrosion of aircraft components.

McMaster University uses a licensed dosimetry service to monitor, assess, record and report doses of ionizing radiation received by workers as a result of the licensed activities at MNR. Doses received by NEWs are reported to the National Dose Registry. McMaster ascertains external doses using whole body and extremity dosimetry. In addition, direct reading dosimeters are used to monitor doses daily. Internal exposure is assessed through routine thyroid screening for the workers working with volatile I-125. The potential for internal dose to workers from exposure to other radionuclides is assessed through the review of results from contamination monitoring of surfaces, airborne contamination monitoring, and personnel contamination monitoring.

During the current licensing period, there were no radiation exposures reported at the MNR for exceeding a CNSC regulatory effective dose limit for a NEW or for a person who is not a NEW. From 2014 to 2022, the maximum annual effective dose received by a NEW was 4.36 mSv (approximately 9% of the annual 50 mSv regulatory dose limit). This dose was received in 2019 by a neutron radiographer.

Table 3-2 provides the average and maximum effective doses for NEWs at MNR between 2014 and 2022. The data shows that the average effective doses ranged from 0.27 mSv to 0.42 mSv, and the maximum individual effective doses received by a NEW ranged from 3.34 mSv to 4.36 mSv.

Table 3-2: Average and maximum effective doses received by NEWs over the current licensing period

Dose Statistic	2014	2015	2016	2017	2018	2019	2020	2021	2022	Regulatory Dose Limit
Average (mSv)*	0.39	0.40	0.36	0.37	0.41	0.42	0.35	0.27	0.32	Not applicable
Maximum (mSv)	3.34	3.52	3.64	3.91	4.18	4.36	3.53	3.79	3.94	50 mSv/year
Number of NEWs monitored	119	112	118	129	114	128	120	149	189	Not applicable

* Arithmetic average dose values include individuals with zero reported dose values.

As defined in the RPR, the 5-year dosimetry period is a fixed period of 5 calendar years, at the end of which a new period begins. The 5-year dosimetry periods that are applicable over this licensing period are the dosimetry periods of 2011 to 2015 and 2016 to 2020. Table 3-3 provides the maximum individual effective doses received by a NEW during the applicable 5-year dosimetry periods.

Table 3-3: Maximum effective dose received by a NEW over the applicable 5-year dosimetry periods

Dose Statistic	From 2011 to 2015	From 2016 to 2020	Regulatory Dose Limit in five consecutive years
Maximum (mSv)	20.39	18.62	100 mSv

The trend of effective doses received by NEWs over the current licensing period are reflective of the work activities at MNR and are influenced by factors such as production levels and the scope of radiological work activities.

Annual average and maximum equivalent doses to the skin and extremities for NEWs at MNR from 2014 to 2022 are provided in Tables 3-4 and 3-5. Table 3-4 shows that the maximum annual equivalent dose to the skin that was received by as NEW at MNR during the current licensing period was 11.75 mSv in 2019.

Table 3-4. Equivalent doses to the skin for NEWs at MNR, 2014-2022

Dose (mSv)	2014	2015	2016	2017	2018	2019	2020	2021	2022	Regulatory Dose Limit
Average	0.46	0.48	0.45	0.50	0.55	0.59	0.59	0.36	0.48	Not applicable
Maximum	4.18	5.80	4.28	4.23	6.25	11.75	11.09	6.74	4.84	500 mSv/year

Table 3-5 shows that the maximum annual equivalent dose to the extremities that was received by a NEW at MNR during the current licensing period was 47.24 mSv in 2019.

Table 3-5: Equivalent doses to the extremities for NEWs at MNR, 2014-2022

Dose (mSv)	2014	2015	2016	2017	2018	2019	2020	2021	2022	Regulatory Limit
Average	5.91	6.46	6.90	6.21	5.84	6.86	4.78	3.79	2.62	Not applicable
Maximum	27.25	34.74	42.00	43.96	38.09	47.24	29.24	28.06	24.96	500 mSv/year

Doses to the skin and extremities at MNR were well below the CNSC's regulatory equivalent dose limit for NEWs of 500 mSv in a 1-year dosimetry period respectively.

Exposures to site visitors and contractors that are not considered as NEWs are monitored using direct reading dosimeters. Between 2014 and 2022, the maximum individual effective dose received by a site visitor or contractor that was not a NEW was 0.05 mSv received in 2016, which is well below the CNSC's regulatory effective dose limit of 1 mSv per calendar year for a person who is not a NEW.

CNSC staff are satisfied with McMaster University's efforts over the current licensing period in controlling the effective and equivalent doses to workers at MNR. CNSC staff concluded that McMaster University meets regulatory requirements in this specific area.

Radiation Protection Program Performance

RP program performance at MNR was assessed during the current licensing period through various CNSC staff compliance verification activities, including assessment of annual compliance reports. In addition to the focused RP inspection conducted in 2022 at MNR, aspects of the implementation of the RP program were verified during 3 general inspections. CNSC staff's assessment of McMaster University's RP program performance through the inspections has confirmed ongoing compliance with the RPR during the current licensing period. During the RP-specific inspection of 2022, 1 NNC and 5 recommendations were issued concerning some deficiencies that were found in the application of some of McMaster University's program expectations, such as in the completion of the continuing training for respiratory protection, the documentation of the thyroid screening records and the documentation of the method to ascertain and record doses to the lens of the eye. McMaster University established appropriate corrective actions to address these areas and implemented enhancements to the associated procedures. CNSC staff are satisfied with the corrective actions taken by McMaster University.

Action levels for radiological exposures are established as part of McMaster University's RP program. Reaching an action level triggers an investigation to determine the cause, and corrective measures must be implemented to restore the effectiveness of the RP program. During the current licensing period, no action levels for worker exposures were reached at MNR.

CNSC staff are satisfied with the performance of McMaster University's RP program at MNR over the current licensing period. CNSC staff concluded that McMaster University meets regulatory requirements in this specific area.

Radiological Hazard Control

CNSC staff confirmed that McMaster University's RP program ensures there are adequate measures in place to monitor and control radiological hazards. This includes contamination control, radiation dose rate control and airborne radiation monitoring and control. Radiological hazards are either eliminated (if possible) or controlled with engineered barriers and signage identifying the level and extent of the hazards. Shielding is used to reduce exposures to workers during operational and maintenance activities.

The contamination control program at MNR ensures contamination spread is prevented from radiologically controlled areas, and the spread of contamination within these areas is minimized. Access to radiologically controlled areas is restricted to authorized personnel. Radiologically controlled areas are posted with the required radiation warning signage, routine monitoring for contamination is performed, and monitoring of personnel and material prior to leaving contaminated or potentially contaminated areas is conducted as required. Airborne contamination monitoring, conducted in designated areas, provides timely notification of changing conditions. All these measures are in place to minimize the potential for intakes of nuclear substances by workers. During the current licensing period, no adverse trends were reported by McMaster University as a result of the radiological hazard surveys.

Radiological monitoring programs confirm the effectiveness of contamination control and include a combination of direct and indirect contamination monitoring of areas (e.g., floors, corridors, and railings), footwear, work clothing and personal. CNSC staff are satisfied with McMaster University's efforts in monitoring and controlling the radiological hazards at MNR over the current licensing period. CNSC staff concluded that McMaster University meets regulatory requirements in this specific area.

3.7.3.2 Regulatory Focus

CNSC staff will continue to monitor McMaster University's performance and verify compliance in all aspects of the radiation protection SCA through regulatory oversight activities including inspections and desktop reviews.

3.7.3.3 Proposed Improvements

The current RP program at MNR is considered acceptable for this SCA. No specific improvements are being proposed. [REGDOC-2.7.1, Radiation Protection](#) and [REGDOC-2.7.2, Dosimetry, Volume I: Ascertainning Occupational Dose](#) were published in 2021 and provide guidance on how to meet the regulations. They are introduced as guidance in the proposed LCH.

3.7.4 Conclusion

CNSC staff assessed McMaster University's application and documentation under the radiation protection SCA and found them to be acceptable. McMaster University's performance, based on the outcome of compliance verification activities, has been satisfactory. CNSC staff concluded that the overall performance for this SCA is satisfactory, and that McMaster University is qualified to carry out the activities in the proposed licence. Over the next licensing period, CNSC staff will continue to monitor the effectiveness of the RP program to ensure it meets CNSC expectations.

3.7.5 Recommendation

One standardized licence condition is included in the proposed licence for the RP SCA. Licence condition 7.1 requires the licensee to implement and maintain a radiation protection program, which includes a set of action levels. As part of this licence condition, the licensee is required to notify the Commission within 7 days of becoming aware that an action level has been exceeded. CVCs for this licence condition are provided in the proposed LCH.

3.8 Conventional Health and Safety

The conventional health and safety SCA covers the implementation of a program to manage workplace safety hazards and to protect workers.

The specific areas that comprise this SCA at MNR include:

- Performance
- Practices
- Awareness

3.8.1 Trends

The following table indicates the overall rating trends for the conventional health and safety SCA over the current licensing period:

CONVENTIONAL HEALTH AND SAFETY								
OVERALL COMPLIANCE RATINGS								
2014	2015	2016	2017	2018	2019	2020	2021	2022
SA	SA	SA	SA	SA	SA	SA	SA	SA
Comments								
McMaster has maintained a conventional health and safety program that meets the requirements of the NSCA and in accordance with CNSC requirements over the licence period.								

3.8.2 Discussion

Regulatory Requirements

McMaster must have, under the NSCA and its associated regulations, policies, programs, methods and procedures in place for the safe operation and maintenance of its facilities. The [CINFR](#) require that an application for a licence shall contain, under paragraph 3(f), the proposed worker health and safety policies and procedures.

In addition, McMaster's activities must comply with the [Canada Labour Code](#), and the associated [Canada Occupational Health and Safety Regulations](#).

Conventional health and safety programs at Class 1A facilities fall under the dual regulatory oversight of the CNSC and Employment and Social Development Canada. McMaster must submit hazardous-occurrence investigation reports to both regulators, in accordance with their respective reporting requirements. As required by paragraph 29(1)(h) of the [GNSCR](#), licensees are to report serious illnesses or injuries incurred or possibly incurred as a result of a licensed activity to the CNSC.

McMaster's occupational health and safety program applies to all work performed by McMaster employees and contractors. In addition to reporting of serious illnesses, injuries and safety occurrences, McMaster is subject to compliance reporting in accordance with [REGDOC-3.1.2, Reporting Requirements, Volume I: Non-Power Reactor Class I Facilities and Uranium Mines and Mills](#).

In 2019 the CNSC published [REGDOC-2.8.1, Conventional Health and Safety](#), which also applies to McMaster.

3.8.3 Summary

A summary of the licensee's past performance, regulatory focus and proposed improvements are presented in the following subsections.

3.8.3.1 Past Performance

Performance

McMaster follows McMaster University's *Risk Management Manuals* which contain the programs and policies designed to implement and support the Risk Management System. CNSC staff verified that the program conforms with Part II of the [Canada Labour Code](#) and to Canada's [Occupational Health and Safety Regulations](#).

McMaster has not reported any lost-time injuries during the current licence period. During the COVID-19 pandemic, McMaster developed a hazard prevention procedure, which included reduced workplace attendance and various control measures for anyone entering the facility, including mask use, infection prevention, disinfection, and other workplace controls. Throughout the pandemic, McMaster has provided updates to CNSC staff on the status of workers and

control measures being put in place to protect workers and visitors entering the facility. There were no reported outbreaks of the COVID-19 virus at MNR.

In addition to ongoing desktop reviews of operations reports, program documents and McMaster health and safety inspection reports, CNSC staff conducted 4 inspections which included CVC related to conventional health and safety over the current licence period. There were no non-compliances identified against this SCA.

Practices

McMaster's conventional health and safety program rests on McMaster University's Health and Safety Program, which is administered by the university's Health and Safety Team. This central committee supports the university's compliance with all policies for occupational health and safety, loss prevention and mitigation. The university provides employee access to training on health and safety, such as hazard awareness and Workplace Hazardous Materials Information System (WHMIS), in addition to specific worker training for McMaster employees.

Through onsite inspections and desktop reviews, CNSC staff verify that health and safety inspections are performed as required, and maintenance is performed periodically on safety equipment. Annual inspections of safety equipment, are completed by specialized companies, such as for fire protection systems, or by facility personnel for fume hoods, eyewash stations, safety showers, etc.

CNSC staff verified during onsite inspections that chemicals, corrosive agents, and cleaning agents are properly controlled to ensure proper storage, handling and use. Flammable samples and chemicals are stored in locked cabinets that comply with safety standards.

CNSC staff are satisfied with the performance and practices for conventional health and safety at MNR.

Awareness

All employees and contractors at the MNR must attend training on WHMIS, hazard awareness, and radiation safety. Recurrent safety awareness training is also mandatory for all employees.

3.8.3.2 Regulatory Focus

CNSC staff continue to assess McMaster's performance in this SCA through regulatory oversight activities including inspections and desktop reviews of program documentation, operations reports and health and safety inspection reports.

3.8.3.3 Proposed Improvements

REGDOC-2.8.1, *Conventional Health and Safety* is included in the proposed LCH as CVC. No other improvements related to this SCA are proposed.

3.8.4 Conclusion

Based on CNSC staff's assessment of McMaster's application, supporting documents and past performance, CNSC staff concluded that McMaster continues to implement and maintain an effective conventional health and safety program in accordance with regulatory requirements and CNSC expectations.

3.8.5 Recommendation

One standardized licence condition is included in the proposed licence for this SCA. Licence condition 8.1 requires the licensee to implement and maintain an occupational health and safety program. CVCs for this licence condition are included in the proposed LCH.

3.9 Environmental Protection

The environmental protection SCA covers programs that identify, control and monitor all releases of nuclear and hazardous substances and effects on the environment from facilities or as the result of licensed activities.

The specific areas that comprise this SCA at MNR include:

- Effluent and Emissions Control (releases)
- Environmental Management System (EMS)
- Assessment and Monitoring
- Protection of People
- Environmental Risk Assessment (ERA)

3.9.1 Trends

The following table indicates the overall rating for the environmental protection SCA over the current licensing period:

ENVIRONMENTAL PROTECTION								
OVERALL COMPLIANCE RATINGS								
2014	2015	2016	2017	2018	2019	2020	2021	2022
SA	SA	SA	SA	SA	SA	SA	SA	SA
Comments								
McMaster has developed, implemented and maintained an effective environmental protection program that protects the environment and the public in accordance with CNSC regulatory requirements. McMaster's performance in this SCA has been satisfactory.								

3.9.2 Discussion

Regulatory Requirements

The [NSCA](#) requires licensees to make adequate provisions for the protection of the environment. Licensees achieve this by developing and maintaining an environmental protection program to control releases of nuclear and hazardous substances and to assess the effects of these releases on the environment.

Paragraphs 12(1)(c) and (f) of the [GNSCR](#) require that licensees take all reasonable precautions to protect the environment and the health and safety of persons, and to control the release of radioactive nuclear substances and hazardous substances within the site of the licensed activity and into the environment.

Subsection 1(3) of the [RPR](#) prescribe dose limits for the general public, which is 1 mSv per calendar year.

The [CINFR](#) require that an application for a licence contain:

- 3(e), the name, form, characteristics and quantity of any hazardous substances that may be on the site while the activity to be licensed is carried on.
- 3(g), the proposed environmental protection policies and procedures.
- 3(h), the proposed effluent and environmental monitoring programs.
- 6(e), the proposed procedures for handling, storing, loading and transporting nuclear substances and hazardous substances.
- 6(h), the effects on the environment and the health and safety of persons that may result from the operation and decommissioning of the nuclear facility, and the measures that will be taken to prevent or mitigate those effects.
- 6(i), the proposed location of points of release, the proposed maximum quantities and concentrations, and the anticipated volume and flow rate of releases of nuclear substances and hazardous substances into the environment, including their physical, chemical and radiological characteristics.
- 6(j), the proposed measures to control releases of nuclear substances and hazardous substances into the environment.

In 2013, the CNSC published REGDOC-2.9.1, *Environmental Protection: Policies, Programs and Procedures*. The document was revised in 2020 and renamed as [REGDOC-2.9.1, 2020 Environmental Principles, Assessments and Protection Measures](#).

3.9.3 Summary

Details of CNSC staff's assessment of McMaster's performance in this SCA are presented in the following sections.

3.9.3.1 Past performance

The design and implementation of the environmental protection program at the MNR facility is in accordance with REGDOC-2.9.1, 2013 *Environmental Protection: Policies, Programs and Procedures*. During the current licence period, CNSC staff verified McMaster's performance with respect to environmental protection through 2 general inspections and desktop reviews. CNSC staff also conducted a focused environmental protection inspection at MNR in December 2021. There were no NNC relating to environmental protection that came out of these inspections.

From these compliance verification activities, CNSC staff concluded that McMaster's implementation of the environmental protection program at the MNR facility meets CNSC's regulatory requirements and expectations.

A summary of the licensee's past performance, challenges, regulatory focus and proposed improvements are presented in the following subsections.

Effluent and Emissions Control (releases)

The MNR facility monitors and controls its airborne emissions and liquid effluent to the environment by implementing its environmental protection program. McMaster's effluent and emissions monitoring program includes monitoring of radiological substances.

Atmospheric Emissions

McMaster routinely monitors the exhaust ventilation from the Reactor Building for I-125 and Argon-41 (Ar-41) which are the only nuclear substances routinely released to the environment in measurable quantities (i.e., above detection limits). Radioactive particulates are also monitored for gross beta to ensure that no unexpected radionuclides are present in the air stream. Samples are collected weekly and analyzed by windowless proportional counting for gross beta and by gamma spectrometry for I-125. During operation of the reactor, daily measurements of Ar-41 concentrations in the exhaust are made using a gas counting chamber.

Controls are in place to ensure that airborne releases of nuclear substances to the environment are minimized. These include the use of activated charcoal filters to minimize the release of I-125, and the use of filters to ensure releases of radioactive particulates are controlled. The annual total airborne releases from MNR are shown in table 3-6.

Table 3-6: Total annual releases from MNR

Year	Argon-41 (Bq) ¹	Iodine-125 (Bq) ²	Gross Beta/Gamma (Bq) ³
2014	9.3E+11	1.7E+08	2.6E+05
2015	8.4E+11	1.7E+08	3.1E+05
2016	7.1E+11	2.5E+08	5.0E+05
2017	6.9E+11	8.2E+08	1.3E+06
2018	7.7E+11	4.0E+08	1.9E+05
2019	8.4E+11	1.3E+08	6.4E+05
2020	6.9E+11	1.3E+08	3.6E+05
2021	6.3E+11	2.8E+07	1.0E+05
2022	9.0E+11	3.7E+07	3.3E+05

1. Derived release limit for Ar-41: 4.79E+14 Bq/year
2. Derived release limit for I-125: 3.93E +12 Bq/year
3. Action level for gross Beta/Gamma: 5.0E +08 Bq/year

The derived release limits (DRL) above have been established for airborne releases of Ar-41 and I-125 at MNR, based on the regulatory public dose limit of 1 mSv/year.

McMaster also maintains environmental action levels in accordance with CSA N288.8, *Establishing and implementing action levels for releases to the environment from nuclear facilities* [10] for their airborne releases corresponding to a small fraction of the DRL. McMaster calls them administrative control levels. Exceedance of an action level triggers a notification to the CNSC and an investigation which may result in corrective actions or preventative measures being put in place. There were no exceedances of any environmental action level or regulatory limit at MNR during the licensing period. The releases shown in table 3-6 above have been consistently low during the licence period, producing a maximum dose of 1.9 µSv to a hypothetical person standing at the point of maximum ground level concentration for a full year [11].

Liquid effluent

At MNR, the 2 potential pathways for liquid releases are deliberate pump out from the building sumps to the municipal sewer and breakthrough of primary water to the secondary side of the heat exchanger. There were no releases of contaminated liquids to the municipal sewer system during the licensing period. Any liquid effluent generated by MNR continues to be captured and then it is processed or evaporated in the facility.

Environmental Management System (EMS)

As a part of the overall management of the facility, environmental protection is reviewed periodically as part of the annual radiation safety program assessment and the annual management review. Both of these are also re-visited periodically throughout the year. CNSC staff review the results of the EMS during compliance inspections. CNSC staff are satisfied that McMaster's EMS meets regulatory requirements.

Assessment and Monitoring

McMaster samples the air for particulates and I-125 in several locations surrounding the Reactor Building as per McMaster's environmental monitoring program. Samples are collected weekly and analyzed for gross beta activity using a windowless proportional counter. Charcoal cartridges are collected and sampled monthly for I-125 via gamma spectrometry.

CNSC staff assessed the environmental monitoring results as part of compliance inspections and reviews of the annual compliance reports. The maximum concentration for gross beta-emitting particulate over the licence period has been 0.02 Bq/m³. For I-125, the highest concentration has been less than 0.03 Bq/m³. Together, these concentrations could produce a maximum exposure of 4 µSv/yr. The results confirm that the environment and the health and safety of people around MNR are protected.

CNSC Independent Environmental Monitoring Program

CNSC staff conducted an Independent Environmental Monitoring Program (IEMP) campaign at MNR in 2023. The levels of radioactivity measured in air and soil were below available guidelines and CNSC's screening levels. Screening levels are based on conservative assumptions about the exposure that would result in a dose of 0.1 mSv per year (one-tenth of the regulatory public dose limit of 1 mSv per year). The measurements indicate that the levels of radioactivity in the environment are low and well within the range of natural background radiation levels. As a result, no effects on human health are expected. The results are posted on the CNSC's [IEMP web page](#).

It is a priority for the CNSC that the sampling plan is meaningful to local Indigenous Nations and communities. In March 2023, CNSC staff held a meeting with the Six Nations of the Grand River to discuss the IEMP and the draft sampling plan. The Six Nations of the Grand River did not have any feedback on the sampling plan, nor were they available to observe the 2023 sampling campaign. CNSC staff will continue to work with the Six Nations of the Grand River and other local Indigenous Nations and communities in future IEMP sampling campaigns.

Protection of People

McMaster's effluent and environmental monitoring programs are developed in accordance with regulatory requirements, ensuring that releases do not impact the environment. The results demonstrate that releases of radiological substances do not result in environmental concentrations that may affect public health. There have been no spills or environmental occurrences that occurred at the MNR during the licensing term.

The maximum effective dose to the public is equal to the sum of the doses associated with I-125 and Ar-41 releases. McMaster conservatively estimates the dose to human receptors as 0.0098 mSv per year for continuous operation (24 hours per day, 7 days per week) at 5 MW [9]. This represents a small fraction (1%) of the public dose limit of 1 mSv per year. For comparison, the average person in Canada incurs a dose of approximately 1.8 mSv per year associated with natural background radiation.

CNSC staff concluded that there are no significant risks to the public from the operations at MNR, and the public continues to be protected.

Environmental Risk Assessment (ERA)

In 2020, the CNSC published [REGDOC-2.9.1, 2020 Environmental Principles, Assessments and Protection Measures](#), which includes the requirements for an ERA in accordance with CSA N288.6, *Environmental Risk Assessments at Nuclear Facilities and Uranium Mines and Mills* [12]. The ERA document must detail the facility's interactions with the environment along with any potential impacts. An ERA is a systematic process used by licensees to identify, quantify, and characterize the risk posed by releases of radiological and hazardous substances and physical stressors on representative human and non-human biota receptors, including the magnitude and extent of the potential effects associated with a facility. The ERA serves as the basis for the development of site-specific environmental protection measures, including the Environmental Monitoring Program which is developed in accordance with CSA N288.4, Environmental monitoring programs at nuclear facilities and uranium mines and mills [13], using a graded approach. The results of these programs, in turn, inform and refine future revisions of the ERA.

In April 2023, McMaster submitted an ERA to the CNSC as part of the application for a licence renewal. CNSC staff assessed the submission against requirements in REGDOC-2.9.1 (2020) and CSA N288.6-22 [12] and provided feedback to McMaster to ensure that the ERA meets regulatory requirements. McMaster submitted a revised ERA [9] to the CNSC in September 2023. CNSC staff determined that McMaster's revised ERA meets the requirements of REGDOC-2.9.1 (2020) and CSA N288.6-22.

The ERA conservatively estimates the dose to human receptors as 0.0098 mSv per year for continuous operation, which constitutes less than 1% of the public dose limit of 1 mSv per year. Moreover, the ERA compared MNR exhaust emissions to benchmark concentrations for the protection of non-human biota and found that exposure to undiluted emissions would pose a negligible risk to biota. CNSC staff determined that the ERA effectively demonstrates that people and the environment remain protected. The ERA is posted on McMaster University's [website](#).

3.9.3.2 Regulatory Focus

CNSC staff will continue to monitor performance in this area through regulatory oversight activities, inspections, and desktop reviews of McMaster's compliance reporting and revisions to relevant program documentation pertaining to this SCA.

3.9.3.3 Proposed Improvements

The following CVCs are included in the proposed LCH for the environmental protection SCA:

- CSA N288.1, *Guidelines for modelling radionuclide environmental transport, fate, and exposure associated with the normal operation of nuclear facilities* [14]
- CSA N288.6-22, *Environmental Risk Assessments at Nuclear Facilities and Uranium Mines and Mills* with an implementation date of December 2023 [12]
- CSA N288.8, *Establishing and implementing action levels for releases to the environment from nuclear facilities* [10].

The following standards and REGDOC are included as guidance in the proposed LCH:

- REGDOC-2.9.1, *Environmental Protection: Environmental Principles, Assessments and Protection Measures*, Version 1.2 (2020)
- CSA N288.4, *Environmental monitoring programs at nuclear facilities and uranium mines and mills* [13].
- CSA N288.5, *Effluent and emissions monitoring programs at nuclear facilities* [15].

3.9.4 Conclusion

McMaster has implemented and maintained an environmental protection program that adequately protects the environment and the public in accordance with regulatory requirements. CNSC staff expect no adverse effects on human health and the environment during the operation of the facility.

3.9.5 Recommendation

Standardized licence condition 9.1 has been included in the proposed licence for this SCA. This licence condition requires the licensee to implement and maintain an environmental protection program, which includes a set of action levels. CVCs for this licence condition are included in the proposed LCH.

3.10 Emergency Management and Fire Protection

The emergency management and fire protection SCA covers emergency plans and emergency preparedness programs that exist for emergencies and for non-routine conditions. This area also includes any results of participation in exercises.

The specific areas that comprise this SCA at MNR include:

- Nuclear Emergency Preparedness and Response
- Fire Protection

3.10.1 Trends

The following table indicates the overall rating trends for the emergency management and fire protection SCA over the current licensing period:

EMERGENCY MANAGEMENT AND FIRE PROTECTION								
OVERALL COMPLIANCE RATINGS								
2014	2015	2016	2017	2018	2019	2020	2021	2022
SA	SA	SA	SA	SA	SA	SA	SA	SA
Comments								
The compliance rating for this area is satisfactory. During the licence period, McMaster has maintained appropriate measures in place to intervene effectively in the unlikely event of a fire or emergency.								

3.10.2 Discussion

This SCA covers the emergency plans and emergency preparedness programs that licensees must implement for emergencies and for non-routine conditions.

This SCA also includes the requirement for the licensee to have a comprehensive fire protection program to minimize the risk to the health and safety of persons and to the environment from fire, through appropriate fire protection system design, fire safety analysis, fire safe operation and fire prevention.

Regulatory Requirements

Paragraph 24(4)(b) of the [NSCA](#) requires the applicant to 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. In addition, paragraph 12(1)(c) of the [GNSCR](#) states that every licensee shall “take all reasonable precautions to protect the environment and the health and safety of persons and to maintain security”. Paragraph 12(1)(f) of the GNSCR states that every licensee shall “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 of the licensed activity”.

Paragraph 6(k) of the [CINFR](#) requires that an application for a licence shall contain information on the licensee’s proposed measures to prevent or mitigate the effects of accidental releases of nuclear substances and hazardous substances on the environment, the health and safety of persons and the maintenance of national security, including measures to:

- Assist offsite authorities in planning and preparing to limit the effects of an accidental release;
- Notify offsite authorities of an accidental release or the imminence of an accidental release;
- Report information to offsite authorities during and after an accidental release;
- Assist offsite authorities in dealing with the effects of an accidental release;
- Test the implementation of the measures to prevent or mitigate the effects of an accidental release.

[REGDOC-2.10.1, Nuclear Emergency Preparedness and Response](#), was published in 2016 and sets out the emergency preparedness requirements and guidance of the CNSC related to the development of emergency measures for licensees and licence applicants of Class I nuclear facilities and uranium mines and mills.

Further requirements are also provided under the [NBCC](#), the [NFCC](#) and CSA N393-22, *Fire protection for facilities that process, handle, or store nuclear substances* [7].

3.10.3 Summary

A summary of the licensee’s past performance, regulatory focus and proposed improvements are presented in the following subsections.

3.10.3.1 Past Performance

Nuclear Emergency Preparedness and Response

Based on the compliance verification of annual reports and other documents related to this SCA, CNSC staff have assessed McMaster's performance as satisfactory during this licensing period, with a stable trend over the current licence period.

McMaster implements an emergency preparedness program which ensures that appropriate response and direction are available should an accident occur, and that responders are trained, responsibilities are defined, and resources are available.

The emergency risk associated with MNR is considered low, given that there are no credible accidents that would challenge MNR's containment and produce a spread of contamination before emergency measures could be implemented, as demonstrated in the MNR SAR.

In its *Emergency Preparedness Plan*, McMaster defines emergency categories as:

- Type A: Any unusual occurrence which actuates the Reactor Trouble Alarm;
- Type B: Fire or major pool leakage in the Reactor Building;
- Type C: An emergency which has resulted in significant and widespread contamination and or radiation hazards within the containment building which cannot be effectively managed through normal practices and procedures;
- Type D: an incident that might create a hazard of radiation exposure to persons outside the Reactor Building. Hazard of radiation exposure is interpreted as an exposure that could lead to an effective dose in excess of 1 mSv or the introduction of a gamma radiation field greater than 0.25 mSv/hr at 25 meters from the Reactor Building.

McMaster University conducts every year a Type-D Emergency Plan Review with all stakeholders, including the Hamilton Fire Department, the Hamilton Police, city officials and CNSC staff. McMaster has never had a need to implement the Type-B, C or D procedures for a real emergency. These procedures are periodically reviewed by CNSC staff as part of desktop reviews and inspections.

A Type-B fire response drill was completed virtually in 2021 due to the COVID-19 pandemic, which CNSC staff attended remotely. CNSC staff were satisfied of how the exercise unfolded and issued recommendations, which McMaster subsequently addressed. Annual building fire evacuation drills are also completed regularly for all campus buildings including the Reactor Building.

Over the licence period, CNSC staff conducted 4 inspections that incorporated CVCs related to emergency management and fire protection, including an emergency exercise in 2014 that McMaster organized and which CNSC staff inspected. CNSC staff issued 2 NNCs and 4 recommendations further to this exercise. One NNC highlighted the need to follow approved RP practices when entering an emergency situation. The other NNC aimed at improving training on

cooperation with external organizations. CNSC staff issued 2 other NNCs during a general inspection in 2018, for McMaster to produce a training and qualification plan for the MNR Emergency Organization, and to develop a list of emergency supplies and locations. All NNCs were of low safety significance. The results of the exercise, reviews and inspections demonstrated an acceptable emergency preparedness response capability and adequate interaction with responders to deal with a credible nuclear emergency.

McMaster University conducted a transportation emergency response plan (TERP) exercise in conjunction with City of Hamilton emergency responders in November 2023, and CNSC staff conducted an inspection of the exercise. There were no non-compliances noted for this SCA and CNSC staff noted the high level of proficiency of all participants. A full-scale Type-D emergency exercise is planned for 2024, which will include all internal and external emergency response organizations. CNSC staff plan to attend this exercise to assess compliance with regulatory requirements.

CNSC staff have confirmed McMaster University's preparedness and competence in responding to an emergency with the involvement of different stakeholders. Over the licence period, McMaster University has significantly improved its ability to respond to an emergency by having readily available emergency equipment (including personal protection, access control point and communication equipment) and involving more mutual aid partners in the exercise (i.e., the Hamilton Fire Department, the Paramedics, the Hospital and the Hamilton Police). These improvements were clearly observed during the emergency exercises, where McMaster University, with the support of the Hamilton Fire Department and the Paramedics, successfully achieved its objectives.

Fire Protection

Fire protection practices at MNR have been based on the application of [NBCC](#), and [NFCC](#) and [NFPA 801 Annex B](#) standards for fire protection at facilities handling radioactive materials. Accordingly, the Fire Protection Program implemented at MNR ensures that personnel and equipment are protected from fire through the following practices:

- control of sources of ignition
- control of flammable and combustible material
- mitigation of the consequences of fire through detection, suppression and response
- conducting fire drills
- maintaining the safety basis of the reactor

CNSC staff have assessed the MNR Fire Protection Program, including the procedures, plans and assessments that describe how protection from fire is achieved. The program demonstrates the implementation and control of activities related to fire safety, which are conducted by various departments within McMaster University, ensuring that any potential fires do not significantly increase the risk of radiological release to public and that personnel and assets are protected.

Based on their review of McMaster's application, program documents and inspection results, CNSC staff concluded that McMaster maintains an Emergency Management and Fire Protection Program in accordance with the current licence and applicable codes and standards. CNSC staff concluded that McMaster is performing satisfactorily with regard to this SCA.

3.10.3.2 Regulatory Focus

Specific compliance and verification activities performed during this past licensing period included reviews of McMaster's emergency response plan and fire safety plan, annual compliance reports, and inspections.

CNSC staff will continue to monitor McMaster's performance in this area through regulatory oversight activities including onsite inspections, exercises and desktop reviews of program documentation pertaining to this SCA.

3.10.3.3 Proposed Improvements

The NBCC and NFCC were updated to the 2020 versions during the licence period. CSA N393-22, *Fire protection for facilities that process, handle, or store nuclear substances* [7] was also updated in 2022. McMaster is conducting a gap analysis between the new versions of these codes and standard and McMaster's emergency management and fire protection program. The gap analysis will lead to an implementation plan, until which time these codes and standard are listed as guidance in the proposed LCH. REGDOC-2.10.1 is also included as CVC in the proposed LCH, with an implementation date of August 31, 2024.

3.10.4 Conclusion

CNSC staff have assessed McMaster's emergency management and fire protection programs and concluded that the programs adequately protect workers, the public and the environment from any credible emergency conditions.

CNSC staff concluded that McMaster's performance for this SCA is satisfactory and that McMaster is qualified to carry out the activities proposed in the licence.

3.10.5 Recommendation

Two standard licence conditions are included in the proposed licence for this SCA. Licence condition 10.1 requires McMaster to implement and maintain an emergency management program. Licence condition 10.2 requires McMaster to implement and maintain a fire protection program. The CVCs for these licence conditions are included in the proposed LCH.

3.11 Waste Management

The waste management SCA covers internal waste-related programs that form part of the facility's operations up to the point where the waste is removed from the facility for storage, treatment, or disposal at another licensed location. This area also covers the planning for decommissioning.

The specific areas that comprise this SCA at MNR include:

- Waste Characterization
- Waste Minimization
- Waste Management Practices
- Decommissioning Plans

3.11.1 Trends

The following table indicates the overall rating trends for the waste management SCA over the current licensing period:

WASTE MANAGEMENT								
OVERALL COMPLIANCE RATINGS								
2014	2015	2016	2017	2018	2019	2020	2021	2022
SA	SA	SA	SA	SA	SA	SA	SA	SA
Comments								
McMaster's waste management program met applicable CNSC regulatory and performance objectives. CNSC staff continue to monitor McMaster's implementation of this program through regular compliance verification activities.								

3.11.2 Discussion

Regulatory Requirements

Paragraph 3(1)(j) of the [GNSCR](#) require that an application for a licence include the name, quantity, form and volume of any radioactive waste or hazardous waste that may result from the activity to be licensed, including waste that may be stored, managed, processed, or disposed of at the site of the activity to be licensed, and the proposed method for managing and disposing of that waste.

Also, paragraph 3(k) of the [CINFR](#) requires a licensee to maintain a decommissioning plan throughout the life of the facility.

In 2021, the CNSC published [REGDOC-2.11.1, Management of Radioactive Waste](#), [REGDOC-2.11.2, Decommissioning](#) and [REGDOC-3.3.1 Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities](#). These REGDOCs replaced the Regulatory Guides [G-219, Decommissioning Planning for Licensed Activities](#) and [G-206, Financial Guarantees for the Decommissioning of Licensed Activities](#), and are included as CVCs in the proposed LCH for the MNR.

3.11.3 Summary

A summary of the licensee's past performance, challenges and proposed improvements are presented in the following subsections.

3.11.3.1 Past Performance

Waste Characterization, Minimization, and Management Practices

The McMaster application for a licence renewal included in the *MNR Radiation Safety Program*, HP-9000. This document implements the radiation safety program, including guidelines and requirements for radioactive waste handling procedures, in addition to other activities. The *MNR Radiation Safety Program* describes the roles and responsibilities for the management of solid and liquid waste. CNSC staff also reviewed additional information regarding the handling of radioactive waste as described in the operating procedure OP-3710, *Radioactive Waste Handling*.

During the current licence term CNSC staff conducted 2 inspections at the MNR that included CVCs associated with the waste management SCA. There were no non-compliances. CNSC staff have also verified elements of McMaster's waste management program through desktop reviews of the program documents, operations reports and annual reports.

CNSC staff assessed the waste management program and associated supporting documentation submitted by McMaster with the licence renewal application for the SCA and found that McMaster's waste management program meets regulatory requirements.

Decommissioning plans

The CNSC requires licensees to maintain a Preliminary Decommissioning Plan (PDP) and revise it at a minimum every 5 years or when required by the Commission.

McMaster submitted a PDP that was updated in December 2021, which includes a cost estimate for decommissioning of the MNR facility. Since the version of the PDP predated CNSC's deployment of REGDOC-2.11.2 and REGDOC-3.3.1, the PDP was reviewed against the regulatory requirements of regulatory guides G-219, G-206, and CSA Standard N294-09, *Decommissioning of facilities containing nuclear substances* [16].

Decommissioning must be conducted in a manner that ensures that the health, safety, and security of workers, the public, and the environment are protected. McMaster has selected a prompt decommissioning strategy for the MNR where all radioactive materials will be removed from the facility. The desired end-state is green-field state where McMaster University can use the site for other purposes. However, at the current time, there is no projected end-of-life for MNR.

The previous revision of the PDP stated that spent fuel from the reactor would be sent to the United States to be received by the Department of Energy (DoE) for disposal. This was the arrangement for previous transfers of spent reactor fuel. However, McMaster stated in this latest revision of the PDP that this arrangement is no longer available and as such, a new pathway will be required for future spent reactor fuel. McMaster is currently investigating potential licensed waste management organizations who could provide interim management of the fuel. Interim waste management is acceptable until a permanent solution becomes available, such as the deep geologic repository (DGR) proposed by the Nuclear Waste Management Organization (NWMO). McMaster reports its inventory of spent fuel to the NWMO on a yearly basis.

From an operational perspective, McMaster has enough space for spent fuel for another 2 years or until 2026. McMaster plans to build additional storage racks in the existing pool to increase storage space for an additional 4 years, providing sufficient storage until 2030. Adding storage racks would be subject to CNSC staff review and expected to be within McMaster's licensing basis, under the change control process.

McMaster has committed to revising the PDP when a licensed waste receiver has been identified, which will include a revision to the cost estimate for decommissioning to reflect the cost of interim storage and eventual disposal. The next revision of the PDP will be assessed against the requirements of REGDOC-2.11.2 and REGDOC-3.3.1.

The current PDP was revised to reflect a new cost estimate, taking into account the inflation and a contingency for fuel disposal and active waste management. McMaster estimates the cost of management of spent fuel based on the previous arrangement with the DoE with a 20% contingency. Since the previous decommissioning plan, the total cost for decommissioning has increased from \$14 million to \$18.4 million, which includes a \$3.7 million contingency.

CNSC staff determined that the cost estimate is credible and that it can be used for the purposes of the financial guarantee (see section 5.2). CNSC staff concluded that the PDP meets the applicable regulatory requirements of CSA standard N294-09 and CNSC regulatory guide G-219.

3.11.3.2 Regulatory Focus

CNSC staff will continue to monitor and evaluate McMaster's waste management program through regulatory oversight activities, including onsite inspections and reviews of compliance reports and revisions to relevant program documentation.

3.11.3.3 Proposed Improvements

REGDOC-2.11.1, *Waste Management Volume I: Management of Radioactive Waste* was published in January 2021 and is included in the proposed LCH as CVC, with an implementation date of January 1, 2025. REGDOC-2.11.2, *Decommissioning*, was also published in January 2021 and is included in the proposed LCH as CVC.

CSA N292.0-19, *General Principles for the Management of Radioactive Waste and Irradiated Fuel* [17], and CSA N292.3-14, *Management of low and intermediate-level radioactive waste* [18] apply to McMaster and are also referenced in the proposed LCH as CVCs.

3.11.4 Conclusion

Based on CNSC staff's assessment of the licence renewal application, supporting documents, the PDP and McMaster's past performance in this SCA, CNSC staff concluded that McMaster implements and maintains a waste management program in accordance with CNSC regulatory requirements, and McMaster has demonstrated satisfactory performance for this SCA.

3.11.5 Recommendation

Two standardized licence conditions are included in the proposed licence for the waste management SCA. Licence condition 11.1 requires McMaster to implement and maintain a waste management program. Licence condition 11.2 requires McMaster to maintain a decommissioning plan. CVCs for these licence conditions are included in the proposed LCH.

3.12 Security

The security SCA covers the programs required to implement and support the security requirements stipulated in the regulations, the licence, orders, or expectations for the facility or activity.

Specific performance evaluation for security is identified as sensitive information and has been designated as Prescribed Information. This information is not available for public release.

The specific areas that comprise this SCA at MNR include:

- Facilities and Equipment
- Response Arrangements
- Security Practices

3.12.1 Trends

The following table indicates the overall rating trends for the security SCA over the current licensing period:

SECURITY								
OVERALL COMPLIANCE RATINGS								
2014	2015	2016	2017	2018	2019	2020	2021	2022
SA	SA	SA	SA	SA	SA	SA	SA	SA
Comments								
McMaster has implemented and maintained a security program that meets regulatory requirements under the GNSCR and Part 2 of the Nuclear Security Regulations (NSR) to prevent the loss, unauthorized removal and sabotage of nuclear substances, nuclear materials, prescribed equipment or information.								

3.12.2 Discussion

A summary of the licensee's performance, regulatory focus and proposed improvements are presented in the following subsections.

Regulatory Requirements

McMaster is subject to the GNSCR, which provide obligations for licensees across all SCAs. Specific obligations that distinctly encompass the security SCA include:

- GNSCR p. 12(1)I *Every licensee shall take all reasonable precautions to protect the environment and the health and safety of persons and to maintain the security of nuclear facilities and of nuclear substances;*
- GNSCR p.12(1)(g) *Every licensee shall implement measures for alerting the licensee to the illegal use or removal of a nuclear substance, prescribed equipment or prescribed information, or the illegal use of a nuclear facility;*
- GNSCR p.12(1)(h) *Every licensee shall implement measures for alerting the licensee to acts of sabotage or attempted sabotage anywhere at the site of the licensed activity; and*
- GNSCR p.12(1)(j) *Every licensee shall instruct the workers on the physical security program at the site of the licensed activity and on their obligations under that program.*

Furthermore, sections 21 to 23 of the GNSCR provide obligations for all licensees on the identification, storage, handling, and transfer requirements of information designated as "prescribed information".

In addition to the regulatory requirements stipulated in the GNSCR, this facility is identified as a named entity within Schedule 2 of the NSR. As such, and as identified by paragraph 40(1)(b) of the NSRs, McMaster is subject to Part 2 of the NSR, specifically sections 39 to 48.

In 2020, the CNSC published [REGDOC-2.12.3, Security of Nuclear Substances: Sealed Sources and Category I, II and III Nuclear Material](#) which provides regulatory expectations and guidance under the GNSCR for security for licensees.

3.12.3 Summary

A summary of the licensee's past performance, regulatory focus and proposed improvements are presented in the following subsections.

3.12.3.1 Past Performance

McMaster has implemented and maintained a security program that meets regulatory requirements under the GNSCR and Part 2 of the NSR to prevent the loss, unauthorized removal and sabotage of nuclear substances, nuclear materials, prescribed equipment or information. The facility's security program includes administrative and technical measures that meet current CNSC regulatory requirements for nuclear security.

McMaster's compliance with the security SCA include ensuring adequate provisions for the security of nuclear substances, the implementation of measures to alert the licensee to the illegal use or removal of nuclear substances, and sabotage or attempted sabotage, anywhere at the site, and that all workers will be instructed on the facility's security program and their obligations therein.

To verify that the licensee complies with regulations and to assess the effectiveness of the licensee's security measures, CNSC staff conducted a focused security inspection and 2 general inspections that included CVCs associated with the security SCA during the licence period. There were no non-compliances noted and 3 recommendations for improvement were made.

In 2015, McMaster was selected to participate in the International Atomic Energy Agency (IAEA) International Physical Protection Advisory Service (IPPAS) Mission to Canada. The purpose of the IPPAS Mission is to evaluate the country's nuclear security regime with regard to international instruments, guidelines and best practices in order to provide recommendations and suggestions for improvements and acknowledge good practices. There were no recommendations, and 1 suggestion was made as part of the report, which McMaster has since implemented.

Facilities and Equipment

McMaster has maintained a security program that provides sufficient security systems and devices for the facility and the areas that involve the processing, use, or storage of nuclear substances. The security program includes a combination of intrusion detection systems, security cameras, physical barriers and the presence of on-site security guards from the campus. It also includes measures to prevent the unauthorized removal of nuclear substances from the facility. In addition, McMaster has processes for effectively testing and maintaining the security measures and equipment.

Response Arrangements

Alarm detection and assessment systems are continuously monitored by on-site security staff. McMaster has established a response protocol with the local law enforcement agency to ensure timely off-site armed response, should a security-related incident occur.

Security Practices

McMaster maintains effective measures for controlling access to persons to prevent unauthorized access to the nuclear facility and nuclear substances. McMaster University implements a security clearance process that includes a criminal record check for individuals. In addition, McMaster University implements a security awareness program for all staff and managers to enhance capabilities in identifying and responding to changes in employee behaviour.

3.12.3.2 Regulatory Focus

During the current licence period, CNSC staff performed a variety of compliance activities, including inspections and document reviews to verify that McMaster complies with regulations and to assess the effectiveness of security measures. CNSC staff will continue to monitor McMaster's performance for the security SCA through regulatory oversight activities, including onsite inspections and technical assessments of relevant program documentation.

3.12.3.3 Proposed Improvements

In 2020, the CNSC revised REGDOC-2.12.3, *Security of Nuclear Substances: Sealed Sources and Category I, II and III Nuclear Material*. Part A of REGDOC-2.12.3, sets out the minimum security measures that licensees must implement to prevent the loss, sabotage, illegal use, illegal possession or illegal removal of sealed sources during their entire lifecycle, including while the sources are in storage, transport or being stored during transportation. Part B of this document provides information and guidance on how licensees can comply with the minimum security measures, including measures related to transport vehicles, containers and security plans for Categories I, II or III Nuclear Material.

REGDOC-2.12.3 was listed as guidance in the previous LCH and is now included as CVC in the proposed LCH for this SCA. Specific improvements for the security SCA are considered sensitive and are designated as Prescribed Information. This information is not available for public release.

3.12.4 Conclusion

CNSC staff concluded that McMaster meets the regulatory requirements for the security SCA and that the performance rating of "Satisfactory" is supported.

CNSC staff will continue to monitor and provide regulatory oversight of McMaster's implementation and operation of their security program.

3.12.5 Recommendation

One standardized licence condition is included in the proposed licence for this SCA. Licence condition 12.1 requires the licensee to implement and maintain a security program. CVCs for this licence condition are included in the proposed LCH.

3.13 Safeguards and Non-Proliferation

The safeguards and non-proliferation SCA covers the programs and activities required for the successful implementation of the obligations arising from the Canada/IAEA safeguards agreements ([INFCIRC/164](#) and [INFCIRC/164/Add.1](#)), as well as other measures arising from the [Treaty on the Non-Proliferation of Nuclear Weapons](#).

Licensees require a licence, separate from the licensing of their operations, for the import and export of controlled nuclear substances, equipment and information identified in the [Nuclear Non-proliferation Import and Export Control Regulations](#).

The scope of the non-proliferation program for McMaster is limited to the tracking and reporting of foreign obligations and origins of nuclear material. This tracking and reporting assists the CNSC in the implementation of Canada's bilateral Nuclear Cooperation Agreements with other countries.

The specific areas that comprise this SCA with respect to this licensee are:

- Nuclear Material Accountancy and Control
- Access and Assistance to the IAEA
- Operational and Design Information
- Import and Export
- Safeguards Equipment, Containment and Surveillance

3.13.1 Trends

The following table indicates the overall rating trends for the safeguards and non-proliferation SCA over the current licensing period:

SAFEGUARDS AND NON-PROLIFERATION								
OVERALL COMPLIANCE RATINGS								
2014	2015	2016	2017	2018	2019	2020	2021	2022
SA	SA	SA	SA	SA	SA	SA	SA	SA
Comments								
McMaster continues to perform satisfactorily in this SCA. CNSC staff concluded McMaster's program for safeguards and non-proliferation meets regulatory requirements.								

3.13.2 Discussion

Regulatory Requirements

The [Canada-IAEA Comprehensive Safeguards Agreement](#) (Safeguards Agreement), which came into force on February 21, 1972 and the [Canada-IAEA Additional Protocol](#) (Additional Protocol), which came into force on September 8, 2000, are 2 legally binding treaty-level agreements Canada made with the IAEA.

The Safeguards Agreement lays out the safeguards system that Canada shall adhere to, while the Additional Protocol contains further requirements for the provision of information and access and the obligation to provide information on and access to certain nuclear fuel cycle related manufacturers and researchers.

In addition, the following regulatory requirements apply:

- Subparagraph 9(a)(iii) of the [NSCA](#) establishes that one of the objects of the Commission is to “achieve conformity with measures of control and international obligations to which Canada has agreed”.
- Paragraph 24(4)(b) 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 or, in the case of an application for an authorization to transfer the licence, the transferee...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”.
- Paragraph 27(b) of the NSCA states that “every licensee and every prescribed person shall make the prescribed reports and file them in the prescribed manner”.
- Paragraph 12(1)(i) of the [GNSCR](#) states that “every licensee shall...take all necessary measures to facilitate Canada’s compliance with any applicable safeguards agreement”.
- Section 30 of the GNSCR identifies situations in which safeguards reports shall be provided by licensees to the Commission.

In February 2018, the CNSC published [REGDOC-2.13.1, *Safeguards and Nuclear Material Accountancy*](#). This document sets out requirements and guidance for safeguards programs for applicants and licensees who possess nuclear material, operate a uranium and/or thorium mine, carry out specified types of nuclear fuel-cycle related research and development work, and/or carry out specified types of nuclear-related manufacturing activities. The requirements and guidance in this document are essential to Canadian compliance with the [Safeguards Agreement](#) entered into with the IAEA, and are consistent with modern national and international practices. This document supersedes regulatory document RD-336, *Accounting and Reporting of Nuclear Material*, and GD-336, *Guidance for Accounting and Reporting Nuclear Material*, published in June 2010.

3.13.3 Summary

A summary of the licensee’s past performance, regulatory focus and proposed improvements are presented in the following subsections.

3.13.3.1 Past Performance

Nuclear Material Accountancy and Control

During the licence period, McMaster provided the CNSC and the IAEA with all reports and information necessary to comply with their safeguards and non-proliferation regulatory requirements, including those related to nuclear material accounting and reporting.

Access and Assistance to the IAEA

McMaster provided the necessary access and assistance to the IAEA and the CNSC to perform all inspections, routine evaluations and short-notice activities. During the licence period, the IAEA performed 11 inspections. These included 8 physical inventory verifications (PIVs) and design information verifications (DIVs) in 2017, 2021 and 2023, 2 complementary access (CA) in 2015 and 2023, and 1 interim inventory verification (IIV) in 2023. The CNSC performed 1 physical inventory taking evaluation (PIT-E) in 2016 to ensure the licensee's compliance with their safeguards and non-proliferation regulatory requirements.

The following table shows the number of compliance activities led by the IAEA and by the CNSC over the licence period at MNR.

Table 3-7 Compliance activities during the licence period

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Total
IAEA Activity	0	1	0	4	0	0	0	2	0	4	11
CNSC Activity	0	0	1	0	0	0	0	0	0	0	1
Total	0	1	1	4	0	0	0	2	0	4	12

Operational and Design Information

During this licensing period, McMaster provided the CNSC and the IAEA with the required operational and design information updates, including annual updates to its operational program required by the Additional Protocol (*INFCIRC/164/Add.1*), and design information updates through revisions of the MNR design information questionnaire. However, in 2022, McMaster did not report the information in accordance with the reporting schedule specified in REGDOC-2.13.1, and CNSC staff issued a NNC to McMaster in December 2022 for the late reporting of design information and nuclear material accountancy forms to the CNSC. This non-compliance is not risk significant and McMaster took adequate corrective actions to address the root cause of this issue.

Import and Export

The scope of the non-proliferation program under this license is limited to the tracking and reporting of foreign obligations and origins of nuclear material. CNSC staff determined that the licensee complied with all regulatory requirements in this respect.

Safeguards Equipment, Containment and Surveillance

There is no safeguards surveillance equipment installed at MNR, and containment equipment such as IAEA seals are rarely used.

One reportable event under section 30(1)(a) of the GNSCR occurred at MNR in 2023, relating to the breakage of a safeguards seal. This caused no impact to the environment, health and safety, or national and international security. The IAEA successfully performed an IIV in May 2023 to inspect the broken seal and related nuclear material. McMaster took adequate corrective actions to prevent similar events from occurring, including the development of the *MNR Safeguards Program Document*, which CNSC staff have since assessed as satisfactory.

3.13.3.2 Regulatory Focus

CNSC staff will continue to monitor and evaluate the licensee's performance through participation in IAEA inspections, CNSC evaluations, and ongoing assessments of compliance with licensing requirements.

3.13.3.3 Proposed Improvements

REGDOC-2.13.1, *Safeguards and Nuclear Material Accountancy* was published in 2018 and is included in the proposed LCH as CVC. No other improvements are proposed under this SCA.

3.13.4 Conclusion

Based on the review of licensee's performance over the licence period, CNSC staff concluded that McMaster has an acceptable safeguards program and the overall performance of this SCA is satisfactory.

3.13.5 Recommendation

One standardized licence condition is included in the proposed licence. Licence condition 13.1 requires that the licensee implement and maintain a safeguards program. CVCs for this licence condition are included in the proposed LCH.

3.14 Packaging and Transport

The specific areas that comprise the packaging and transport SCA at MNR include:

- Package Design and Maintenance
- Packaging and Transport

3.14.1 Trends

The following table indicates the overall rating trends for the packaging and transport SCA over the current licensing period:

PACKAGING AND TRANSPORT								
OVERALL COMPLIANCE RATINGS								
2014	2015	2016	2017	2018	2019	2020	2021	2022
SA	SA	SA	SA	SA	SA	SA	SA	SA
Comments								
McMaster continues to perform satisfactorily in this SCA. Overall, CNSC staff concluded that McMaster's packaging and transport SCA meets regulatory requirements.								

3.14.2 Discussion

Regulatory Requirements

The [Packaging and Transport of Nuclear Substances Regulations, 2015](#) (PTNSR) and the [Transportation of Dangerous Goods Regulations](#) (TDGR) apply to the packaging and transport of nuclear substances at MNR, including the design, production, use, inspection, maintenance and repair of packages, and the preparation, consigning, handling, loading, carriage and unloading of packages.

McMaster is required to have appropriate training for personnel involved in the handling, offering for transport and transport of dangerous goods, and is required to issue a training certificate to those workers in accordance with these regulations.

3.14.3 Summary

A summary of the licensee's past performance, regulatory focus and proposed improvements are presented in the following subsections.

3.14.3.1 Past Performance

McMaster has developed and implemented a packaging and transport program to ensure all shipments to and from their facility are in compliance with the PTNSR and the TDGR. McMaster's packaging and transport program covers elements of package design and maintenance as required by the regulations. Details of CNSC's staff assessment are presented in the following paragraphs.

The PTNSR applies to the packaging and transport of nuclear substances, including the design, production, use, inspection, maintenance and repair of packages, and the preparation, consigning, handling, loading, carriage and unloading of packages. McMaster is also required to have appropriate training for personnel involved in the handling, offering for transport and transport of dangerous goods, and is required to issue a training certificate to those workers in accordance with the TDGR.

McMaster reported 9 packaging and transport related events under the PTNSR during the current licence period. Eight of the 9 incidents were as a result of minor damage sustained to the outer package during transport. There was no damage to the inner containers and there was no impact to the public or the environment. The other event was as a result of a package reported lost during transport. The package was eventually located in the carrier's warehouse. All events were reported as required by the regulations. McMaster implemented corrective actions and CNSC staff assessed these as satisfactory.

McMaster University conducted a transportation emergency response plan (TERP) exercise in conjunction with City of Hamilton emergency responders in November 2023. CNSC staff conducted an inspection of the exercise, with a focus on packaging and transport. There were no non-compliances noted for this SCA.

CNSC staff concluded that McMaster's packaging and transport program meets regulatory requirements and expectations.

3.14.3.2 Regulatory Focus

CNSC staff will continue to monitor McMaster's compliance with regulatory requirements for the packaging and transport SCA through onsite inspections and reviews of annual compliance reporting and packaging and transportation program updates.

3.14.3.3 Proposed Improvements

Transport Canada has recently published a number of amendments to the TDGR. Although regulatory changes are minor, McMaster will need to review its packaging and transport program to ensure continued compliance with the revised regulations. CNSC staff have notified McMaster and are following-up through normal compliance. The amendments are included in the proposed LCH as CVC.

3.14.4 Conclusion

Based on CNSC staff assessments of McMaster's licence application, supporting documents and past performance, McMaster's implementation of the packaging and transport SCA has met and continues to meet all applicable regulatory requirements.

3.14.5 Recommendation

One standardized licence condition is included in the proposed licence. Licence condition 14.1 requires that the licensee implements and maintains a packaging and transport program. CVCs for this licence condition are included in the proposed LCH.

4. INDIGENOUS AND PUBLIC CONSULTATION AND ENGAGEMENT

4.1 Indigenous Consultation and Engagement

The common-law duty to consult with Indigenous Nations and communities applies when the Crown contemplates actions that may adversely affect potential or established Indigenous and/or treaty rights. The CNSC ensures that all of its licence decisions under the [NSCA](#) uphold the honour of the Crown and consider Indigenous peoples' potential or established Indigenous and/or treaty rights pursuant to section 35 of the [Constitution Act, 1982](#).

Throughout the current operating licence of the MNR facility, the CNSC has not been made aware of any direct interest or concern with regards to the MNR facility and its operations by Indigenous Nations and/or communities. However, to ensure that Indigenous Nations and communities with a potential interest in the MNR facility were aware of the licence renewal application and to provide the opportunity to participate in the regulatory review and Commission hearing process, CNSC staff identified the following Indigenous Nations and communities, based on Indigenous or treaty rights, traditional territory and proximity to MNR. These Indigenous Nations and communities include: the Mississaugas of the Credit; Six Nations of the Grand River; Métis Nation of Ontario (MNO) – Region 9 and the Haudenosaunee Confederacy Chiefs Council. These Indigenous Nations and communities were notified of the licence application and the opportunity for funding through the Participant Funding Program (PFP) to support their participation in the Commission hearing. Notification of the September 11, 2023, webinar on the MNR licence renewal and information about how to register was also provided to the identified Indigenous Nations and communities, and the Six Nations of the Grand River elected council attended the webinar. CNSC staff have regular scheduled meetings with MNO, as per the existing Terms of Reference for Long-Term Engagement. The MNR licence renewal application was raised through these scheduled meetings.

In addition, in December 2022, CNSC staff sent notifications to potentially interested Indigenous Nations and communities regarding the Independent Environmental Monitoring Program (IEMP) sampling that occurred on the MNR site in May 2023. Six Nations of the Grand River expressed an interest in participating in the IEMP sampling. In March 2023, CNSC staff met with Six Nations of the Grand River to provide additional information about the IEMP, opportunities to participate in the sampling around the MNR site, and to inform them that the CNSC was expecting to receive an application to renew the MNR licence. The Six Nations of the Grand River were not available to participate in the sampling event this year but requested to be kept informed of future opportunities to participate in CNSC IEMP activities of interest. CNSC staff are committed to continuing to provide Indigenous Nations and communities with opportunities to participate in the IEMP.

The identified Indigenous Nations and communities have been encouraged to participate in the regulatory review process and in the public hearing to advise the Commission directly of any concerns they may have in relation to this licence renewal application. To date, CNSC staff have not been made aware of any specific concerns with regards to the MNR licence renewal application, however, CNSC staff remain open to meeting with Indigenous Nations and communities to discuss this licence renewal application, as well as ongoing operations at the MNR facility and to encourage and maintain productive and respectful relationships.

CNSC staff are committed to ongoing engagement and collaboration with interested Indigenous Nations and communities and will continue to provide opportunities for meaningful long-term engagement over the proposed licensing term.

Licensee Engagement Activities

[REGDOC-3.2.2, *Indigenous Engagement*](#) sets out requirements and guidance for licensees whose proposed projects may raise the Crown's Duty to Consult. Although McMaster's licence renewal application does not raise the formal requirements of REGDOC-3.2.2, CNSC staff encouraged McMaster to conduct engagement activities with potentially interested Indigenous Nations and communities in relation to their licence renewal application.

In February 2023, McMaster sent letters to the identified Indigenous Nations and communities to provide notification of the licence renewal and offer to meet. McMaster met with Six Nations of the Grand River in April 2023 and discussed the history of the site, the licence renewal and other topics of interest, including waste management and the potential for future Small Modular Reactors (SMR). McMaster also offered to have Six Nations of the Grand River visit and tour the reactor. McMaster has indicated that they are committed to building relationships with the interested Indigenous Nations and communities beyond the licence renewal process and working to incorporate feedback received into the facilities goals and actions.

McMaster University issued its *Indigenous Strategic Directions* [19] in response to the Truth and Reconciliation Commission's Calls to Action and the United Nations Declaration on the Rights of Indigenous People. This was developed by the University's Indigenous Education Council (IEC) and the McMaster Indigenous Research Institute (MIRI). McMaster also issued its Indigenous Engagement Program [20] in April 2023.

McMaster University hosted the March 2023 meeting of the Indigenous Advisory Council (IAC) on Canada's SMR Action Plan. This provided opportunities for the IAC to learn about McMaster University and MNR's areas of research and education in the nuclear space, and for McMaster University to learn about IAC's engagement in the nuclear industry.

In April 2023, McMaster staff from within the Nuclear Operations and Health Physics attended a workshop titled Working Effectively with Indigenous Peoples offered by Indigenous Corporate Training Inc. which helps to support McMaster staff's knowledge and understanding of Indigenous peoples' history, culture and rights.

Overall, CNSC staff are satisfied with McMaster's engagement efforts in relation to their licence renewal application and encourage McMaster to continue to engage with interested Indigenous Nations and communities and keep the CNSC informed of their engagement, as appropriate.

4.1.1 Conclusion

Based on the information received and reviewed to date, CNSC staff do not expect this licence renewal to cause any new adverse impacts to potential or established Indigenous and/or treaty rights.

CNSC staff have informed and engaged all identified Indigenous Nations and communities of the licence renewal application and provided opportunities to apply for participant funding and participate in the regulatory review and Commission hearing process providing Indigenous Nations the opportunity to advise the Commission directly of any concerns they may have in relation to this request. In addition, CNSC staff verified that McMaster has informed and engaged with the identified Indigenous Nations and communities of their application to renew the MNR operating licence and are overall satisfied with their engagement efforts.

The CNSC remains committed to meaningful, ongoing engagement with Indigenous Nations and communities who have an interest in CNSC-regulated facilities and activities, including the MNR facility.

4.2 CNSC Public Engagement

Part of CNSC's mandate is to provide objective scientific and regulatory information to the public concerning nuclear activities. The availability and clarity of information pertaining to nuclear activities is essential to establishing an atmosphere of openness, transparency and trust between the licensee and the public. Licensees have an important role to inform the public about their nuclear facility and activities. Since 2012, the CNSC requires major licensees to develop and implement a public information and disclosure program (PIDP) supported by a robust disclosure protocol that addresses local communities and stakeholders' needs, discussed fully in section 4.3.

4.2.1 Discussion

In accordance with section 17 of the [Canadian Nuclear Safety Commission Rules of Procedure](#), a [Notice of Public Hearing](#) was issued and posted on the CNSC website inviting written comments and requests for appearances before the Commission. CNSC staff also informed the public of McMaster's application, the public Commission hearing, and participant funding availability, via the CNSC's website, email subscription list, and social media channels. CNSC staff also sent notifications to specific stakeholders, including the City of Hamilton and the Hamilton Chamber of Commerce [21].

CNSC staff report to the Commission on a 3-year cycle on the regulatory oversight of research reactors [3,4,5]. Funding through CNSC's PFP was made available for participation, and the public and Indigenous Nations and communities had the opportunity to review, question and comment on the regulatory oversight reports. PFP was also made available for participation in this licence renewal CMD (see section 4.4).

CNSC staff held a webinar on the MNR licence renewal application in September 2023, which provided an overview of the CNSC, the regulatory framework, the licensing process, key information in McMaster's application, and guidance on how to participate in a licensing hearing. Awareness for this webinar was ensured by posting notification to the CNSC website, emails to CNSC info list subscribers, direct emails to Indigenous Nations and communities, targeted emails and CNSC social media. A total of 39 participants joined the webinar from the public and external organizations, including 1 participant from the Six Nations of the Grand River Elected Council.

CNSC staff verified that McMaster has engaged with Indigenous Nations and communities, and the public with regard to its licence application.

4.2.2 Conclusion

The CNSC is committed to keeping interested communities informed of regulatory activities occurring in regard to the MNR facility and will continue to look for ways to enhance the involvement of interested groups.

4.3 Licensee Public Information Program

All licensees are required to maintain and implement a PIDP, in accordance with [REGDOC-3.2.1, Public Information and Disclosure](#). This program is supported by disclosure protocols that outline the type of facility, information to be shared with the public, as well as details on how that information is to be shared. This ensures that timely information about the health, safety and security of persons and the environment, and other issues associated with the lifecycle of nuclear facilities, is effectively communicated to the public.

4.3.1 Discussion

CNSC staff assessed McMaster's implementation of its PIDP for MNR to verify that it communicates regularly with its audiences in a way that is meaningful to them. CNSC staff also review yearly program updates to verify McMaster is taking audience feedback into consideration and taking steps to implement program adjustments to meet the evolving needs of its audiences. In accordance with McMaster's PIDP, communication activities included:

- posting the PIDP and disclosure on McMaster's [website](#)
- updating McMaster's website with the latest information on nuclear operations
- posting updates and information on McMaster's social media channels
- distributing information via online newsletters, email lists and conference booths
- hosting visits for students, researchers, contractors, inspectors and the public
- engaging with local and national media upon request

4.3.2 Conclusion

CNSC staff reviewed McMaster's PIDP and concluded that McMaster continues to meet the requirements under REGDOC-3.2.1. McMaster has demonstrated acceptable communications activities to the public and community members related to the facility. Future improvements should include implementing mechanisms for audiences to give feedback on the PIDP as well as providing a summary of public or media inquiries and examples of communication products, including in-person and online communications.

4.3.3 Recommendation

One standardized licence condition is included in the proposed licence. Licence condition G.4 requires that the licensee implement and maintain a PIDP. CVC for this licence condition are included in the proposed LCH.

4.4 Participant Funding Program

The CNSC made funding available through its PFP to assist Indigenous Nations and communities, members of the public, and stakeholders in participating in the regulatory process for the licence renewal for the MNR facility and to provide value-added information to the Commission through informed and topic-specific interventions. This funding was offered to review McMaster's licence application and associated documents, prepare interventions and participate in the Commission's public hearing.

4.4.1 Discussion

The [Notice of Public Hearing](#), posted on August 14, 2023, included notification of a PFP opportunity in the amount of \$15,000. The participant funding opportunity was also advertised on the CNSC website and was included in notification emails. Those interested in obtaining participant funding were invited to submit a completed participant funding application before October 2, 2023.

CNSC's Funding Review Committee reviewed the applications and made recommendations on the allocation of funding to the eligible recipients for the provision of new, distinctive and valuable information to the CNSC through informed and topic-specific interventions. Funding criteria are listed in the [PFP guide](#). Based on recommendations from the Funding Review Committee, the CNSC awarded the following amounts in participant funding to the following applicants:

- David Winfield - \$1,500
- Paul Sedran - \$1,500

4.4.2 Conclusion

The PFP was offered to assist interested Indigenous Nations and communities, members of the public and other stakeholders to prepare for and participate in the Commission's public hearing process. CNSC staff will continue to encourage the public and Indigenous Nations and communities to participate in the Commission's public proceedings with value-added information and perspectives.

5. OTHER MATTERS OF REGULATORY INTEREST

5.1 Cost Recovery

Paragraph 24(2)(c) of the [NSCA](#) requires that a licence application is accompanied by the prescribed fee. The CNSC [Cost Recovery Fees Regulations](#) (CRFR) set out the specific requirements based on the activities to be licensed. An applicant for a Class I facility licence is subject to Part 2 of CRFR, Regulatory Activity Plan Fees. However, in accordance with the CRFR, McMaster is exempt from any fees associated with the planned regulatory efforts.

5.1.1 Discussion

As with other academic institutions, McMaster has been and continues to be exempt under the CRFR. Paragraph 2 of the CRFR stipulates:

These Regulations do not apply to: (a) a secondary school or a specified educational institution as defined in subsection 2(1) of the [Canada Student Loans Act](#); (b) a not-for-profit organization that carries out research and is wholly owned by an institution referred to in paragraph (a).

5.1.2 Conclusion

There is no concern over the payment of future cost recovery fees as the MNR continues to be exempt under the CRFR.

5.2 Financial Guarantees

Subsection 24(5) of the NSCA stipulates that a licence may contain any term or condition that the Commission considers necessary for the purposes of this Act, including a condition that the applicant provide a financial guarantee in a form that is acceptable to the Commission.

McMaster maintains a financial guarantee for decommissioning of the facility in the form of a Nuclear Reactor Restricted Reserve (NRRR) Fund as per condition G.3 of its current licence.

5.2.1 Discussion

Requirements and guidance for establishing a financial guarantee for decommissioning are provided in [REGDOC-3.3.1, Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities](#), which was published in January 2021, superseding [G-206, Financial Guarantees for the Decommissioning of Licensed Activities](#).

McMaster University's current and proposed financial guarantees for MNR include a *Deed of Trust* and the *Financial Security and Access Agreement with the CNSC*. The *Deed of Trust* establishes the NRRR fund for the sole purpose of decommissioning the MNR, while the Access Agreement outlines the requirements for the licensee to allow the CNSC to access the funds, should it be determined that the licensee is not meeting the terms of the agreement.

The value of the financial guarantees for nuclear facilities must be linked to the cost estimate set out in the most recent decommissioning plan for the nuclear facility (see section 3.11.3). The current cost of decommissioning is estimated at \$19.25 million (2023 dollars). The safe shutdown cost is estimated at \$5.6 million and constitutes the minimum value that the NRRR fund must be able to cover.

McMaster University must provide an annual independent assessment of the fair market value of the fund to the CNSC. The last assessment of April 30, 2023 determined the value of the NRRR fund at \$15,893,000.

McMaster University's financial guarantee was last brought to the Commission's attention in 2016 and was accepted as documented in a [Record of Decision](#), issued on January 19, 2017. The financial guarantee must be updated every 5 years and whenever the PDP is updated, or whenever it is requested by the Commission.

As part of this licence renewal, McMaster updated the financial guarantee instruments and submitted them to the CNSC. CNSC staff assessed the instruments against the requirements of REGDOC-3.3.1 and found them acceptable.

5.2.2 Conclusion

CNSC staff concluded that McMaster currently has in place a financial guarantee that is valid and sufficient to fund the decommissioning obligations for MNR. Based on CNSC staff's assessment, the proposed updated financial guarantee is acceptable and meets regulatory requirements.

5.2.3 Recommendation

CNSC staff recommend that the Commission accepts McMaster's proposed financial guarantee of \$19.25 million (2023 dollars). Standardized licence condition G.3 has been included in the proposed licence, which requires that McMaster maintain a financial guarantee for decommissioning that is acceptable to the Commission. REGDOC-3.3.1 is included in the proposed LCH as CVC.

5.3 Improvement Plan and Significant Future Activities

McMaster University has indicated its intention to operate on a schedule of 24-hr, 5-days/week at 5 MW. It should be noted that MNR has operated under the proposed schedule in the past and this is authorized under the current licence. CNSC staff assessed this proposal on the perspective of all applicable SCAs, including human performance, operating performance, safety analysis, fitness for service, radiation protection, environmental protection and waste management. CNSC staff determined that this operating schedule does not have a measurable impact on the safety of the public, the personnel or the environment.

McMaster has not identified any significant future activities or improvements for the requested licence period, beyond those described throughout this CMD.

5.4 Nuclear Liability Insurance

The [Nuclear Liability and Compensation Act](#) (NLCA) establishes civil liability and compensation provisions for damages resulting from a nuclear incident. The MNR facility is identified as a nuclear installation in Schedule 2 of the [Nuclear Liability Compensation Regulations](#) (NLCR) and is therefore required to maintain valid insurance for the liability amount defined in those regulations.

5.4.1 Discussion

The Department of Natural Resources oversees the enforcement of the *Nuclear Liability Compensation Regulations*, and the CNSC ensures that applicants have the required financial security in place to cover their respective liability amount prior to granting a licence, as established by the NLCA and the NLCR.

McMaster complies with its nuclear liability insurance obligations. As part of their application for a licence renewal, McMaster submitted a certificate of nuclear liability insurance, and a proof of payment for the Indemnity Fees in accordance with the NLCA to the Department of Natural Resources.

5.4.2 Conclusion

CNSC staff are satisfied that McMaster University meets the requirements under the NLCA for MNR.

5.5 Delegation of Authority

The Commission may include in licences any conditions that it considers necessary for the purposes of the NSCA. The Commission may delegate authority to CNSC staff with respect to the administration of licence conditions, or portions thereof [22].

In the proposed licence, licence condition 3.2 requires that *The licensee shall implement and maintain a program for reporting to the Commission or a person authorized by the Commission*. CNSC staff recommend that the Commission delegate its authority for the purposes described in this licence condition to the following staff:

- Director, Nuclear Processing Facilities Division
- Director General, Directorate of Nuclear Cycle and Facilities Regulation
- Executive Vice-President and Chief Regulatory Operations Officer, Regulatory Operations Branch

5.6 Proposed Licence Period

The current licence was issued for a period of 10 years. McMaster requested the renewal of its licence for a period of 20 years. McMaster justifies this longer licence period stating that over the current licence period, MNR has operated safely, securely, effectively and in compliance with all required regulations. The following sections provide CNSC staff's assessment of the request and recommendations.

5.6.1 Discussion

CNSC staff developed an approach to recommending appropriate licence periods, based on international practices. This approach, outlined in CMD 02-M12 [23], provides a risk-informed process that CNSC staff have used to support recommendations to the Commission regarding licence periods in past. Since 2002, CNSC's regulatory framework has continued to evolve and the typical licence period for Class I facilities has gradually lengthened to longer terms. Some recent examples for which longer licence terms were granted are shown in the Table 5-1.

Table 5-1: Recent licence terms granted for Class I facilities

Licensee	Previous licence term	Period requested	Period granted	Reference
SRB Technologies	7 years	15 years	12 years	Record of Decision
Point Lepreau Generating Station	5 years	25 years	10 years	Record of Decision
Cameco Fuel Manufacturing	10 years	20 years	20 years	Record of Decision
Royal Military College	10 years	20 years	20 years	Record of Decision e-Doc 7055532
Rabbit Lake	10 years	20 years	15 years	Announcement
Key Lake	10 years	20 years	20 years	
McArthur River	10 years	20 years	20 years	

CNSC staff reviewed McMaster's request against the criteria from CMD 02-M12 [23] and summarized the results in table 5-2.

Table 5-2: CNSC staff assessment of the proposed 20-year licence term against the criteria of CMD 02-M12

CMD 02-M12 Licence Period Criteria	CNSC Staff Position for 20-year Licence
<i>The recommended duration of the licence should be commensurate with the licensed activity.</i>	There are no changes to the activities requested in the licence application. MNR operations have been stable and consistent since it began operating the facility. There is no predetermined end of life for MNR. There is no specific limitation on the licence term on the basis of the licensed activity or facility life stage.
<i>A longer licence period can be recommended when the hazards associated with the licensed activity are well characterized and their impacts well predicted, and they are within the scope considered in the environmental safety case.</i>	<p>McMaster has successfully characterized and mitigated hazards associated with facility operations through the implementation of controls that ensure the protection of the health and safety of persons and the environment.</p> <p>Key documents describing MNR's safety case include the Safety Analysis Report (SAR), the Environmental Risk Assessment (ERA) and a Fire Hazard Assessment (FHA). These documents are part of the licensing basis and McMaster is required to maintain all documentation valid and up-to-date, regardless of licence period. CNSC staff have reviewed McMaster's ERA and concluded that the environment and the health and safety of persons continue to be protected.</p> <p>Regardless of licence term, CNSC staff will continue to verify and ensure that, through ongoing compliance activities and reviews, McMaster provides adequate protection of the environment and the health and safety of persons.</p>
<i>A longer licence period can be recommended when licensees have in place a management system, such as a quality assurance program, to provide assurance that their safety-related activities are effective and maintained.</i>	<p>McMaster has a management system that meets the requirements of CSA N286-12 [6]. The various requirements of N286-12, such as those in the areas of Self Assessments, Independent Assessments, Continual Improvement, Problem Identification and Resolution, Design and Change Control, and Maintenance provide a framework to ensure that all work activities are effective and maintained.</p> <p>McMaster's safety performance over the previous licence period provides further demonstration that effective programs are maintained to ensure safety while performing the licensed activities, regardless of licence period.</p>

<p><i>A longer licence period can be recommended when effective compliance programs are in place on the part of both the applicant/licensee and the CNSC.</i></p>	<p>McMaster has established programs that provide controls to ensure that facility operations remain in compliance with its licensing basis. CNSC staff review these programs periodically to confirm regulatory expectations continue to be met as the regulations and standards evolve.</p> <p>During the previous licence period, CNSC staff updated compliance requirements through publication of new/revised regulatory documents and adoption of the new standards. In each case, McMaster has reviewed and revised its programs where necessary to implement these requirements.</p> <p>The CNSC has a robust and effective compliance verification program to ensure there is adequate regulatory oversight over the licensed activities at MNR. CNSC staff verify compliance through desktop reviews of documentation and reports and through inspections. CNSC staff issue notices of non-compliance where required and verify that McMaster implements appropriate corrective actions, where necessary, to prevent recurrence and ensure that adequate provisions ensuring protection of the health and safety of persons and the environment remain in place.</p>
<p><i>A longer licence period can be recommended when the licensee has shown a consistent and good history of operating experience and compliance in carrying out the licensed activity.</i></p>	<p>During the previous licence period CNSC staff rated McMaster's performance as satisfactory across all SCAs each year. These ratings and other compliance highlights have been published and reported to the Commission in public meetings, through the regulatory oversight reports (RORs).</p> <p>Worker dose and dose to the public have been kept well below regulatory limits at all times. McMaster has also demonstrated excellent performance in the conventional health and safety SCA, having never experienced any lost time injuries.</p>
<p><i>The licence period must be consistent with the requirements of the CNSC Cost Recovery Fees Regulations.</i></p>	<p>As an academic institution, McMaster is not subject to the CNSC Cost Recovery Fees Regulations.</p>
<p><i>The licence period should take account of the planning cycle of the facility and the licensee's plans for any significant change in licensed activity.</i></p>	<p>In its application McMaster has not identified any specific project, contract, or milestone which is currently planned or ongoing that should warrant a shorter licence term. There is no predetermined end of life for MNR.</p> <p>McMaster has kept up with the evolving regulatory environment including implementation of regulatory documents and standards, and is expected to continue to do so moving forward.</p>

In addition to the criteria listed above, CNSC staff incorporated other considerations before making a recommendation on the proposed licence period. These include considerations on international practices, CNSC's regulatory oversight framework, ongoing communication and engagement, and Commission engagement opportunities.

International Approach to Research Reactor Licensing

Internationally, research reactors are issued licences for periods ranging from a few years to the entire life cycle of the facility. The CNSC is an active participant on the international scene, including with the IAEA, the Organization for Economic Co-operation and Development's Nuclear Energy Agency (NEA), the U.S. Nuclear Regulatory Commission (USNRC) and others, which inform CNSC's regulatory framework and licensing recommendations.

CNSC staff concluded that a longer licence term such as 20 years for a research reactor with a medium risk profile such as MNR would remain aligned with international practices.

CNSC Regulatory Oversight

The CNSC regulatory compliance program is effective and independent of the licence period granted by the Commission. Each year CNSC staff review the compliance plan as well as the licensee's planned activities to determine if additional verification activities should be added or moved. This approach is flexible and agile to ensure that appropriate, risk-informed regulatory oversight is in place, regardless of the licence period.

CNSC requirements are updated through changes in regulations made under the NSCA and updates to REGDOCs and standards. The LCH process ensures regulatory requirements can be updated within the licence term. LCH updates ensure that modern codes, standards and practices are implemented continually.

Ongoing Communication and Engagement

CNSC remains committed to openness and transparency through effective communication and engagement. Licensing hearings currently represent an opportunity to engage with Indigenous Nations and communities as well as the public (see section 4), although this type of engagement has limitations. Other opportunities for engagement have been implemented such as the RORs. The RORs have proven to be an effective means for Indigenous Nations and communities and the public to engage with CNSC's regulatory process. For research reactors, the RORs are published on a 3-year frequency.

Though to date public interest in MNR has remained low, to ensure that an opportunity for meaningful engagement remains available with a longer licence term such as 20 years, CNSC staff recommend that McMaster provide a performance update to the Commission at the mid-term point of the licence period. This recommendation is in alignment with recent decisions of the Commission, as referenced in Table 5-1 above.

Commission Engagement Opportunities

CNSC's capability to deliver on its mandate is not impacted by a longer licence period. Irrespective of the period of a licence granted by the Commission, the powers of the Commission will not be impacted. The Commission has the authority to conduct proceedings on any matter within its jurisdiction or any matter relating to the purpose of the NSCA if doing so would be in the public interest. In addition, the Commission may, at any time, amend, suspend, revoke or replace a licence under the conditions prescribed in the [GNSCR](#).

Any concerns identified by CNSC staff can be raised to the Commission for consideration and any requested changes by McMaster that are deemed to be outside the licensing basis are subject to additional Commission approvals, regardless of the licence period. Additionally, for issues raised by members of the public, CNSC has an established [external complaint process](#) in place to ensure the issues raised are reviewed and addressed as appropriate.

5.6.2 Conclusion

With the above considerations, CNSC staff's assessment identified no concerns with the 20-year term that McMaster requested. This conclusion is also supported by the performance of the licensee during the current licence term and reinforced by CNSC's strong regulatory oversight and the periodic updates provided to the Commission through the RORs and the recommended mid-term update.

5.6.3 Recommendation

CNSC staff recommend the Commission accept the requested licence term of 20 years. If a 20-year licence term is granted, CNSC staff recommend that McMaster provide a performance update to the Commission at the mid-point of the licence term that would enable Indigenous Nations and communities and the public to provide input directly to the Commission.

6. OVERALL CONCLUSIONS AND RECOMMENDATIONS

CNSC staff's conclusions and recommendations are based on the assessment of McMaster's compliance with the NSCA and its regulations during the current licence period (2014 – present), and the assessment of the licence application, including all program documents in support of the application. CNSC staff determined that McMaster's performance during the current licensing term was satisfactory and met regulatory requirements. CNSC staff assessed McMaster's application and determined that it complies with regulatory requirements.

CNSC staff concluded that McMaster implements the programs, resources, and measures to ensure the health and safety of persons and the environment are protected, and to ensure appropriate measures related to security and Canada's international obligations are in place during the proposed licence period.

Based on above conclusions, CNSC staff recommend that the Commission take the following actions:

1. Conclude, pursuant to paragraph 24(4)(a) and (b) of the NSCA, that McMaster University:
 - i. is qualified to carry on the activities authorized by the licence;
 - ii. will 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. Accept the financial guarantee as set out in section 5.2 of this CMD.
3. Authorize the delegation of authority as set out in section 5.5 of this CMD.
4. Renew the proposed 20-year licence NPROL-01.00/2044 for operation of the McMaster Nuclear Reactor, effective July 1, 2024 to June 30, 2044, with a requirement that McMaster University provide a performance update to the Commission at the mid-point of the licence term.

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20. AP-1920, MNR Indigenous Engagement Program, (e-Doc 7039879).
21. Notification: Licence Renewal for the McMaster Nuclear Reactor, September 7, 2023, (e-Doc 7122090).
22. Briefing Note, Delegation of Authority, February 1, 2017, (e-Doc 5177736).
23. CNSC, CMD 02-M12 New Staff Approach to Recommending Licence Periods, March 2002 (e-Doc 3007783).

GLOSSARY

For definitions of terms used in this document, see [REGDOC-3.6, *Glossary of CNSC Terminology*](#), which includes terms and definitions used in the Nuclear Safety and Control Act and the Regulations made under it, and in CNSC regulatory documents and other publications.

ALARA	As low as reasonably achievable
CINFR	<i>Class I Nuclear Facilities Regulations</i>
CMD	Commission Member Document
CNSC	Canadian Nuclear Safety Commission
CRFR	<i>Cost Recovery Fees Regulations</i>
CSA	Canadian Standard Association
CVC	Compliance Verification Criteria
EMS	Environmental Management System
EPR	Environmental Protection Review
ERA	Environmental Risk Assessment
GNSCR	<i>General Nuclear Safety and Control Regulations</i>
IAEA	International Atomic Energy Agency
LCH	Licence Conditions Handbook
MW	Megawatt
NBCC	<i>National Building Code of Canada</i>
NEW	Nuclear energy worker
NFCC	<i>National Fire Code of Canada</i>
NFPA	National Fire Protection Association
NLCA	<i>Nuclear Liability and Compensation Act</i>
NNC	Notice of non-compliance
NPROL	Non-Power Reactor Operating Licence
NSCA	<i>Nuclear Safety and Control Act</i>
NSR	<i>Nuclear Security Regulations</i>
OLC	Operating Limits and Conditions
OPEX	Operating Experience
PDP	Preliminary Decommissioning Plan
PFP	Participant Funding Program
PIDP	Public Information and Disclosure Program
PIT-E	Physical Inventory Taking Evaluations

PTNSR	<i>Packaging and Transport of Nuclear Substances Regulations, 2015</i>
REGDOC	Regulatory Document
RP	Radiation Protection
SAR	Safety Analysis Report
SAT	Systematic Approach to Training
SCA	Safety and Control Area
SSC	Structures, systems and components
TDGR	<i>Transportation of Dangerous Goods Regulations</i>
TERP	Transportation Emergency Response Plan
WHMIS	Workplace Hazardous Materials Information System

A. SAFETY PERFORMANCE RATING LEVELS

Satisfactory (SA)

Licensee meets all of the following criteria:

- Performance meets CNSC staff expectations
- Licensee non-compliances or performance issues, if any, are not risk-significant
- Any non-compliances or performance issues have been, or are being, adequately corrected

Below Expectations (BE)

One or more of the following criteria apply:

- Performance does not meet CNSC staff expectations
- Licensee has risk-significant non-compliance(s) or performance issue(s)
- Non-compliances or performance issues are not being adequately corrected

Unacceptable (UA)

One or both of the following criteria apply:

- Risk associated with a non-compliance or performance issue is unreasonable
- At least one significant non-compliance or performance issue exists with no associated corrective action

Note: Starting in 2019, facility performance assessment ratings were simplified and the “Fully Satisfactory (FS)” was replaced by the “Satisfactory (SA)” rating. It is important to recognize that a facility that received an SCA performance rating of FS in previous regulatory oversight report and now has a rating of SA, does not necessarily indicate a reduction in performance.

B. BASIS FOR THE RECOMMENDATION(S)

B.1 Regulatory Basis

The recommendations presented in this CMD are based on compliance objectives and expectations associated with the relevant SCAs and regulatory requirements.

CNSC's staff assessment of McMaster's licence application included a completeness check, a sufficiency check, and a technical assessment against regulatory requirements. The completeness check verified that the application included the prescribed information in accordance with the Nuclear Safety and Control Act and applicable regulations.

The sufficiency check verified that the application included sufficient and quality information in order for CNSC staff to conduct the technical assessment. The technical assessment verified that the application included adequate safety and control measures to address CNSC requirements. Documents originally submitted as part of the application may have been revised, updated, or replaced over the course of the assessment to address CNSC requirements.

The regulatory basis for the matters that are relevant to this CMD are as follows.

Management System

The regulatory foundation for the recommendation(s) associated with Management System includes the following:

- The [Class I Nuclear Facilities Regulations](#) require that an application for a licence shall contain, under paragraph:
 - 3(d), the proposed management system for the activity to be licensed, including measures to promote and support safety culture.
- The [GNSCR](#) require that an application for a licence shall contain, under paragraphs:
 - 3(1)(k), the applicant's organizational management structure insofar as it may bear on the applicant's compliance with the NSCA and the regulations made under the NSCA, including the internal allocation of functions, responsibilities and authority.
 - 15(a), the persons who have the authority to act for them (the applicant/licensee) in their dealings with the Commission.
 - 15(b), the names and position titles of the persons who are responsible for the management and control of the licensed activity and the nuclear substance, nuclear facility, prescribed equipment or prescribed information encompassed by the licence.

Human Performance Management

The regulatory foundation for the recommendation(s) associated with Human Performance Management includes the following:

- The [CINFR](#) require that an application for a licence shall contain, under paragraphs:

- 3(d.1), the proposed human performance program for the activity to be licensed, including measures to ensure workers' fitness for duty.
- 6(m), the proposed responsibilities of and the qualification requirements and training program for workers, including the procedures for the requalification of workers
- 6(n), the results that have been achieved in implementing the program for recruiting, training and qualifying workers in respect of the operation and maintenance of the nuclear facility.
- 9(2), The Commission or a designated officer authorized under paragraph 37(2)(b) of the [NSCA](#) may certify a person referred to in paragraph 44(1)(k) of the NSCA for a position referred to in a licence after receiving from the licensee an application stating that the person
 - (a) meets the applicable qualification requirements referred to in the licence;
 - (b) has successfully completed the applicable training program and examination referred to in the licence; and
 - (c) is capable, in the opinion of the licensee, of performing the duties of the position.
- 9(3), The Commission or a designated officer authorized under paragraph 37(2)(b) of the NSCA may renew a certification after receiving from a licensee an application stating that the certified person
 - (a) has safely and completely performed the duties of the position for which the person was certified;
 - (b) continues to receive the applicable training referred to in the licence;
 - (c) is capable, in the opinion of the licensee, of performing the duties of the position.
- 9(4), A certification expires five years after the date of its issuance or renewal
- 14(2)(e), every licensee who operates a Class I nuclear facility shall keep a record of the status of each worker's qualifications, requalification and training, including the results of all tests and examinations completed in accordance with the licence.
- The GNSCR require that licensees, under paragraphs:
 - 12(1)(a), 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.
 - 12(1)(b), train the workers to carry on the licensed activity in accordance with the Act, the regulations made under the Act and the licence.
 - 12(1)(e), require that every person at the site of the licensed activity to use equipment, devices, clothing and procedures in accordance with the Act, the regulations made under the Act and the licence.

Operating Performance

The regulatory foundation for the recommendation(s) associated with operating performance includes the following:

- The CINFR require that an application for a licence to operate a Class I nuclear facility shall contain, under paragraph:
 - 6(d), the proposed measures, policies, methods and procedures for operating and maintaining the nuclear facility.

Safety Analysis

The regulatory foundation for the recommendation(s) associated with safety analysis includes the following:

- The GNSCR require that an application for a licence shall contain, under paragraph:
 - 3(1)(i), a description and the results of any test, analysis or calculation performed to substantiate the information included in the application.
- The CINFR require that an application for a licence shall contain, under paragraphs:
 - 6(a), a description of the structures at the nuclear facility, including their design and their design operating conditions;
 - 6(b), a description of the systems and equipment at the nuclear facility, including their design and their design operating conditions;
 - 6(c), a final safety analysis report demonstrating the adequacy of the design of the nuclear facility.
 - 6(h) the effects on the environment and the health and safety of persons that may result from the operation and decommissioning of the nuclear facility, and the measures that will be taken to prevent or mitigate those effects;

Physical Design

The regulatory foundation for the recommendation(s) associated with physical design includes the following:

- Paragraph 3(1)(d) of the GNSCR requires that an application for a licence shall contain a description of any nuclear facility, prescribed equipment or prescribed information to be encompassed by the licence.
- The CINFR require that an application for a licence shall contain, under paragraphs:
 - 3(a), a description of the site of the activity to be licensed, including the location of any exclusion zone and any structures within that zone;
 - 3(b), plans showing the location, perimeter, areas, structures and systems of the nuclear facility;
 - 6(a), a description of the structures at the nuclear facility, including their design and their design operating conditions;
 - 6(b), a description of the systems and equipment at the nuclear facility, including their design and their design operating conditions;

- 6(c), a final safety analysis report demonstrating the adequacy of the design of the facility; and
- 6(d), proposed measures, policies, methods and procedures for operating and maintaining the facility.

Fitness for Service

The regulatory foundation for the recommendation(s) associated with fitness for service includes the following:

- The CINFR require that an application for a licence shall contain, under paragraph:
 - 6(d), the proposed measures, policies, methods and procedures for operating and maintaining the nuclear facility.

Radiation Protection

The regulatory foundation for the recommendation(s) associated with radiation protection includes the following:

- The GNSCR require, under subsection 3(1), that a licence application contain the following information under paragraphs:
 - 3(1)(e), the proposed measures to ensure compliance with the [RPR](#).
 - 3(1)(f), any proposed action level for the purpose of section 6 of the RPR.
- The RPR
- The CINFR require that an application for a licence to operate a Class I nuclear facility shall contain, under paragraphs:
 - 6(e), the proposed procedures for handling, storing, loading and transporting nuclear substances and hazardous substances.
 - 6(h), the effects on the environment and the health and safety of persons that may result from the operation and decommissioning of the nuclear facility, and the measure that will be taken to prevent or mitigate those effects.

Conventional Health and Safety

The regulatory foundation for the recommendation(s) associated with Conventional Health and Safety includes the following:

- The CINFR require that an application for a licence shall contain, under paragraph:
 - 3(f), the proposed worker health and safety policies and procedures.
- McMaster's activities and operations must comply with the [Canada Labour Code, Part II: Occupational Health and Safety](#).

Environmental Protection

The regulatory foundation for the recommendation(s) associated with Environmental Protection includes the following:

- The GNSCR, under paragraphs 12(1)(c) and (f), require that each licensee take all reasonable precautions to protect the environment and the health and safety of persons, and to control the release of radioactive nuclear substances and hazardous substances within the site of the licensed activity and into the environment.
- The RPR prescribe dose limits for the general public, which under Subsection 1(3) is 1 mSv per calendar year.
- The CINFR require that an application for a licence shall contain, under paragraphs:
 - 3(e), the name, form, characteristics and quantity of any hazardous substances that may be on the site while the activity to be licensed is carried on.
 - 3(g), the proposed environmental protection policies and procedures.
 - 3(h), the proposed effluent and environmental monitoring programs.
 - 6(e), the proposed procedures for handling, storing, loading and transporting nuclear substances and hazardous substances.
 - 6(h), the effects on the environment and the health and safety of persons that may result from the operation and decommissioning of the nuclear facility, and the measures that will be taken to prevent or mitigate those effects.
 - 6(i), the proposed location of points of release, the proposed maximum quantities and concentrations, and the anticipated volume and flow rate of releases of nuclear substances and hazardous substances into the environment, including their physical, chemical and radiological characteristics.
 - 6(j), the proposed measures to control releases of nuclear substances and hazardous substances into the environment.

Emergency Management and Fire Protection

The regulatory foundation for the recommendation(s) associated with Emergency Management and Response includes the following:

- 12(1)(c) of the GNSCR states that every licensee shall “take all reasonable precautions to protect the environment and the health and safety of persons and to maintain security”.
- 12(1)(f) of the GNSCR states that every licensee shall “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 of the licensed activity”.
- The CINFR require that an application for a licence shall contain, under paragraph:
 - 6(k) information on the licensee’s proposed measures to prevent or mitigate the effects of accidental releases of nuclear substances and hazardous substances on the environment, the health and safety of persons and the maintenance of national security, including measures to:
 - Assist offsite authorities in planning and preparing to limit the effects of an accidental release;

- Notify offsite authorities of an accidental release or the imminence of an accidental release;
- Report information to offsite authorities during and after an accidental release;
- Assist offsite authorities in dealing with the effects of an accidental release; and
- Test the implementation of the measures to prevent or mitigate the effects of an accidental release.

Waste Management

The regulatory foundation for the recommendation(s) associated with Waste Management includes the following:

- The GNSCR require that an application for a licence include, under paragraph:
 - 3(1)(j), the name, quantity, form and volume of any radioactive waste or hazardous waste that may result from the activity to be licensed, including waste that may be stored, managed, processed, or disposed of at the site of the activity to be licensed, and the proposed method for managing and disposing of that waste.

Security

The regulatory foundation for the recommendation(s) associated with Security includes the following:

- GNSCR p. 12(1)(c) Every licensee shall take all reasonable precautions to protect the environment and the health and safety of persons and to maintain the security of nuclear facilities and of nuclear substances;
- GNSCR p.12(1)(g) Every licensee shall implement measures for alerting the licensee to the illegal use or removal of a nuclear substance, prescribed equipment or prescribed information, or the illegal use of a nuclear facility;
- GNSCR p.12(1)(h) Every licensee shall implement measures for alerting the licensee to acts of sabotage or attempted sabotage anywhere at the site of the licensed activity; and
- GNSCR p.12(1)(j) Every licensee shall instruct the workers on the physical security program at the site of the licensed activity and on their obligations under that program.
- GNSCR sections 21 to 23 provide obligations for all licensees on the identification, storage, handling, and transfer requirements of information designated as “prescribed information”.
- All Class I licensees must comply with the [Nuclear Security Regulations](#).

Safeguards and Non-Proliferation

The regulatory basis for the recommendation is as follows:

- Subparagraph 9(a)(iii) of the NSCA establishes that one of the objects of the Commission is to "achieve conformity with measures of control and international obligations to which Canada has agreed".
- Paragraph 24(4)(b) 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 or, in the case of an application for an authorization to transfer the licence, the transferee...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".
- Paragraph 27(b) of the NSCA states that "every licensee and every prescribed person shall (b) make the prescribed reports and file them in the prescribed manner".
- Paragraph 12(1)(i) of the GNSCR states that "every licensee shall...take all necessary measures to facilitate Canada's compliance with any applicable safeguards agreement".
- Section 30 of the GNSCR identifies situations in which safeguards reports shall be provided by licensees to the Commission. Regulatory document series 3.1, Reporting Requirements, sets out the CNSC's requirements for event and compliance monitoring reporting by licensees, and can be found on the CNSC's website.

Packaging and Transport

The regulatory foundation for the recommendation(s) associated with Packaging and Transport includes the following:

- The [Packaging and Transport of Nuclear Substances Regulations, 2015](#); and
- Transport Canada's [Transportation of Dangerous Goods Regulations](#).

Decommissioning Strategy and Financial Guarantees

The regulatory foundation for the recommendation(s) associated with McMaster's Decommissioning Strategy and Financial Guarantees includes:

- The GNSCR require that an application for a licence shall contain, under paragraph:
 - 3(1)(l), a description of any proposed financial guarantee relating to the activity to be licensed.
- The CINFR require that an application for a licence shall contain, under paragraph:
 - 3(k), the proposed plan for the decommissioning of the nuclear facility or of the site.

Licensee's Public Information Program

- The CINFR require that an application for a licence shall contain, under paragraph:
 - 3(j), information on the licensee's public information program.

B.2 Technical Basis

The technical basis for recommendations, including guidance documents, national standards and regulatory documents is presented in this CMD under each SCA and addressed in detail in the LCH.

C. SAFETY AND CONTROL AREA FRAMEWORK

C.1 Safety and Control Areas Defined

The safety and control areas discussed in sections 3.1 through 3.14 are comprised of specific areas of regulatory interest which vary between facility types.

The following table provides a high-level definition of each SCA. The specific areas within each SCA are to be identified by the CMD preparation team in the respective areas within section 3 of this CMD

SAFETY AND CONTROL AREA FRAMEWORK		
Functional Area	Safety and Control Area	Definition
Management	Management System	Covers the framework which establishes the processes and programs required to ensure an organization achieves its safety objectives and continuously monitors its performance against these objectives and fostering a healthy safety culture.
	Human Performance Management	Covers activities that enable effective human performance through the development and implementation of processes that ensure a sufficient number of licensee personnel are in 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.
Facility and Equipment	Safety Analysis	Maintenance of the safety analysis that supports that 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	Relates to activities that impact on the ability of systems, components and structures 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	Covers activities that impact on the physical condition of systems, components and structures to ensure that they remain effective over time. This includes programs that ensure all equipment is available to perform its intended design function when called upon to do so.
Core Control Processes	Radiation Protection	Covers the implementation of a radiation protection program in accordance with the Radiation Protection Regulations. This program must ensure that contamination and radiation doses received are monitored and controlled and maintained ALARA.

SAFETY AND CONTROL AREA FRAMEWORK		
Functional Area	Safety and Control Area	Definition
	Conventional Health and Safety	Covers the implementation of a program to manage workplace safety hazards and to protect workers.
	Environmental Protection	Covers 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	Covers emergency plans and emergency preparedness programs which exist for emergencies and for non-routine conditions. This also includes any results of exercise participation.
	Waste Management	Covers internal waste-related programs which 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. Also covers the planning for decommissioning.
	Security	Covers the programs required to implement and support the security requirements stipulated in the regulations, in their licence, in orders, or in expectations for their facility or activity.
	Safeguards and Non-Proliferation	Covers the programs and activities required for the successful implementation of the obligations arising from the Canada/IAEA safeguards agreements as well as all other measures arising from the <i>Treaty on the Non-Proliferation of Nuclear Weapons</i> .
	Packaging and Transport	Programs that cover the safe packaging and transport of nuclear substances and radiation devices to and from the licensed facility.

C.2 Specific Areas for this Facility Type

The following table identifies the specific areas that comprise each SCA for MNR:

SPECIFIC AREAS FOR THIS FACILITY TYPE		
Functional Area	Safety and Control Area	Specific Areas
Management	Management System	<ul style="list-style-type: none"> ▪ Management System ▪ Organization ▪ Performance Assessment, Improvement and Management Review ▪ Operating Experience (OPEX) ▪ Change Management ▪ Safety Culture ▪ Configuration Management ▪ Records Management ▪ Management of Contractors ▪ Business Continuity
	Human Performance Management	<ul style="list-style-type: none"> ▪ Human Performance Programs ▪ Personnel Training ▪ Personnel Certification ▪ Work Organization and Job Design ▪ Fitness for Duty
	Operating Performance	<ul style="list-style-type: none"> ▪ Conduct of Licensed Activity ▪ Procedures ▪ Reporting and Trending ▪ Outage Management Performance ▪ Safe Operating Envelope ▪ Accident Management and Recovery
Facility and Equipment	Safety Analysis	<ul style="list-style-type: none"> ▪ Deterministic Safety Analysis ▪ Hazard Analysis ▪ Criticality Safety
	Physical Design	<ul style="list-style-type: none"> ▪ Design Governance ▪ Site Characterization ▪ Facility Design ▪ Structure Design ▪ System Design ▪ Components Design
	Fitness for Service	<ul style="list-style-type: none"> ▪ Equipment Fitness for Service/Equipment Performance ▪ Maintenance ▪ Aging Management ▪ Periodic Inspection and Testing

SPECIFIC AREAS FOR THIS FACILITY TYPE		
Functional Area	Safety and Control Area	Specific Areas
Core Control Processes	Radiation Protection	<ul style="list-style-type: none"> ▪ Application of ALARA ▪ Worker Dose Control ▪ Radiation Protection Program Performance ▪ Radiological Hazard Control
	Conventional Health and Safety	<ul style="list-style-type: none"> ▪ Performance ▪ Practices ▪ Awareness
	Environmental Protection	<ul style="list-style-type: none"> ▪ Effluent and Emissions Control (releases) ▪ Protection of People ▪ Environmental Management System (EMS) ▪ Assessment and Monitoring ▪ Environmental Risk Assessment
	Emergency Management and Fire Protection	<ul style="list-style-type: none"> ▪ Conventional Emergency Preparedness and Response ▪ Nuclear Emergency Preparedness and Response ▪ Fire Emergency Preparedness and Response
	Waste Management	<ul style="list-style-type: none"> ▪ Waste Characterization ▪ Waste Minimization ▪ Waste Management Practices ▪ Decommissioning Plans
	Security	<ul style="list-style-type: none"> ▪ Facilities and Equipment ▪ Response Arrangements ▪ Security Practices ▪ Drills and Exercises ▪ Cyber Security
	Safeguards and Non-Proliferation	<ul style="list-style-type: none"> ▪ Nuclear Material Accountancy and Control ▪ Access and Assistance to the IAEA ▪ Operational and Design Information ▪ Import and Export
	Packaging and Transport	<ul style="list-style-type: none"> ▪ Packaging and Transport

D. SUPPORTING DETAILS

D.1 Inspections (2014 – 2024)

The following table includes inspections conducted at MNR during the 2014 – 2024 licence period and the SCAs included for each inspection.

Year	Type	Management System	Human Performance	Safety Analysis	Operating Performance	Physical Design	Fitness for Service	Radiation Protection	Conventional Health and Safety	Environmental Protection	Emergency and Fire Protection	Waste Management	Security	Safeguards and Non-proliferation*	Packaging and Transport**	Public Information and Disclosure
2014	Emergency Exercise		X								X					
2015	Reactive: Fueling Event	X	X	X	X		X	X	X							
2016	General	X	X		X		X									
2017	General	X	X		X	X	X	X	X	X	X	X	X			X
2018	General	X	X		X		X	X	X	X	X	X	X			X
2019	Security		X										X			
2020	Training Inspection		X													
2021	Management System Specific	X	X			X										
2021	Environmental Protection Specific									X						
2022	Radiation Protection Specific		X					X								
2023	General						X		X		X				X	

* Safeguards inspections are conducted and accounted separately. These are discussed under section 3.13, Safeguards and Non-Proliferation.

** Packaging and transport is usually assessed as part of the transport permit process and is discussed in section 3.14.

PART 2

Part 2 of this CMD provides all relevant information pertaining directly to the licence, including:

- The current licence;
- Any proposed changes to the conditions, licensing period, or formatting of an existing licence;
- The proposed licence; and
- The proposed licence conditions handbook.

CURRENT LICENCE



NON-POWER REACTOR OPERATING LICENCE MCMASTER NUCLEAR REACTOR

MCMASTER UNIVERSITY

- I) LICENCE NUMBER:** NPROL-01.00/2024
- II) LICENSEE:** Pursuant to section 24 of the *Nuclear Safety and Control Act*, this licence is issued to
- McMaster University**
1280 Main Street West
Hamilton, ON L8S 4K1
- III) LICENCE PERIOD:** This licence is valid from **July 1, 2014**, to **June 30, 2024**, unless otherwise suspended, amended, revoked, replaced or transferred.
- IV) LICENSED ACTIVITIES:**
- This licence authorizes the licensee to:
- (a) Operate the McMaster Nuclear Reactor and associated facilities (hereinafter “the facility”), located in the Reactor Building and Nuclear Research Building at the McMaster University Campus, in Hamilton, Ontario
 - (b) Operate the reactor at a power not exceeding 5 MW thermal except for the purpose of testing the high power scram, which shall be set no higher than the neutron flux equivalent of 6.25 MW thermal power
 - (c) Produce, possess, process, transfer, use, package, manage, and store the nuclear substances that are required for, associated with or arise from the activities described in (a)

- (d) Possess and use prescribed equipment and prescribed information required for, associated with or arise from the activities described in (a)
- (e) Import or export any nuclear substance with atomic number 2 to 89 that is required for, or associated with the activities described in (a). This licence does not authorize the licensee to import or export any quantity of a controlled nuclear substance for which the application requirements are set out in the *Nuclear Non-proliferation Import and Export Control Regulations*

V) EXPLANATORY NOTES:

- (a) Unless otherwise provided for in this licence, words and expressions used in this licence have the same meaning as in the *Nuclear Safety and Control Act* (NSCA) and associated Regulations.
- (b) The McMaster Nuclear Reactor Licence Conditions Handbook (LCH) provides:
 - (i) Compliance verification criteria and guidance for meeting the conditions listed in this licence
 - (ii) Information regarding delegation of authority to CNSC staff
 - (iii) Applicable documents and a process for version control of codes, standards or other documents that are used as compliance verification criteria and guidance for meeting the conditions listed in the licence

VI) CONDITIONS:

1. GENERAL:

- 1.1 The licensee shall conduct the activities described in Part IV of this licence in accordance with the licensing basis for the facility, defined as:
- (i) The regulatory requirements set out in the applicable laws and regulations
 - (ii) The conditions and safety and control measures described in the facility's licence and the documents directly referenced in that licence
 - (iii) The safety and control measures described in the licence application and the documents needed to support that licence application

unless otherwise approved in writing by the Commission.

- 1.2 The licensee shall give written notification of changes made to the facility or its operation, such as deviation from design operating conditions, policies, programs and methods referred to in the licensing basis.
- 1.3 The licensee shall maintain a preliminary decommissioning plan for the facility, and shall review and revise the plan every five years.
- 1.4 The licensee shall maintain in effect a financial guarantee for decommissioning that is acceptable to the Commission.
- 1.5 The licensee shall implement and maintain a public information and disclosure program.

2. MANAGEMENT SYSTEM

- 2.1 The licensee shall implement and maintain a management system for activities carried out under this licence.

3. HUMAN PERFORMANCE MANAGEMENT

- 3.1 The licensee shall ensure that persons appointed to the position of reactor operator hold a certification in accordance with the requirements of the NSCA.
- 3.2 The licensee shall ensure that persons appointed to the position of reactor supervisor are qualified and maintain a valid certification as reactor operator.
- 3.3 The licensee shall establish and maintain a training program.

4. OPERATING PERFORMANCE

- 4.1 The licensee shall operate the facility subject to the terms and conditions of this licence.
- 4.2 The licensee shall ensure that permanent and temporary modifications to systems, structures, equipment, components and software important to safety are adequately designed, reviewed, controlled and implemented, including the compliance with relevant safety requirements.
- 4.3 The licensee shall operate the facility in accordance with operating limits and conditions, ensuring the MNR facility is operated in accordance with design assumptions and design intent as documented in applicable safety analyses.
- 4.4 The licensee shall implement and maintain a nuclear criticality safety program.

- 4.5 The licensee shall maintain an accurate inventory of their sealed sources, both in use and in storage.
- 4.6 The licensee shall report to the Commission unplanned situations or events at the facility.
- 4.7 The licensee shall submit annual compliance monitoring and operational performance reports to the Commission.

5. SAFETY ANALYSIS

- 5.1 The licensee shall conduct and maintain safety analyses that are representative of the current hazards of the facility or process analyzed.

6. PHYSICAL DESIGN

- 6.1 The licensee shall ensure that the defence-in-depth principle is applied to the design, or to any modification of the nuclear facility.

7. FITNESS FOR SERVICE

- 7.1 The licensee shall implement and maintain a maintenance program.
- 7.2 The licensee shall implement and maintain an aging management program.

8. RADIATION PROTECTION

- 8.1 The licensee shall implement and maintain a radiation protection program, which includes a set of action levels.

9. CONVENTIONAL HEALTH AND SAFETY

- 9.1 The licensee shall implement and maintain an occupational health and safety program.

10. ENVIRONMENTAL PROTECTION

- 10.1 The licensee shall implement and maintain an environmental protection program, which includes a set of action levels.

11. EMERGENCY MANAGEMENT AND FIRE RESPONSE

- 11.1 The licensee shall implement and maintain an emergency management program, which includes fire response.
- 11.2 The licensee shall implement and maintain a fire protection program.

12. WASTE MANAGEMENT

- 12.1 The licensee shall implement and maintain a waste management program.

13. SECURITY

- 13.1 The licensee shall implement and maintain a security program.

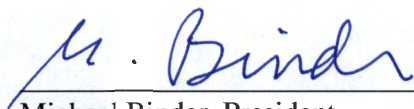
14. SAFEGUARDS AND NON-PROLIFERATION

- 14.1 The licensee shall implement and maintain a safeguards program.

15. PACKAGING AND TRANSPORT

- 15.1 The licensee shall implement and maintain a packaging and transport program.

SIGNED at OTTAWA, this 26th day of June, 2014.



Michael Binder, President
on behalf of the Canadian Nuclear Safety Commission

PROPOSED LICENCE CHANGES

Overview

McMaster University currently operates the MNR facility under a non-power reactor operating licence, NPROL-01.00/2024. The proposed licence incorporates standardized licence conditions in a standard format. The licensed activities remain the same.

Licence Conditions

The proposed licence incorporates the standardized licence conditions that are applicable to MNR as a non-power operating reactor, as developed by CNSC staff.

Licence Format

The current licence was drafted in 2014 and reflects the format and conditions that were used in CNSC licences at that time. CNSC has since modified the generic licence format and have introduced a set of standardized conditions for each SCA. The MNR licence proposed for 2024 has been prepared using the current standardized licence condition format.

Licence Period

The current licence was issued for a term of 10 years. In its application, McMaster University requested a term of 20 years. As discussed in section 5.6 of this CMD, CNSC staff have assessed the 20-year term requested, and CNSC staff recommend that a 20-year licence term be granted.

PROPOSED LICENCE



NON-POWER REACTOR OPERATING LICENCE MCMASTER NUCLEAR REACTOR

MCMASTER UNIVERSITY

- I) LICENCE NUMBER:** **NPROL-01.00/2044**
- II) LICENSEE:** Pursuant to section 24 of the *Nuclear Safety and Control Act*, this licence is issued to
- McMaster University**
1280 Main Street West
Hamilton, ON L8S 4K1
- III) LICENCE PERIOD:** This licence is valid from **July 1, 2024**, to **June 30, 2044**, unless otherwise suspended, amended, revoked or replaced.
- IV) LICENSED ACTIVITIES:**
- This licence authorizes the licensee to:
- (i) Operate the McMaster Nuclear Reactor and associated facilities (hereinafter “the facility”), located in the Reactor Building and Nuclear Research Building at the McMaster University Campus, in Hamilton, Ontario
 - (ii) Operate the reactor at a power not exceeding 5 MW thermal except for the purpose of testing the high power scram, which shall be set no higher than the neutron flux equivalent to 6.25 MW thermal power
 - (iii) Produce, possess, process, transfer, use, package, manage, and store the nuclear substances that are required for, associated with or arise from the activities described in (i)
 - (iv) Possess and use prescribed equipment and prescribed information required for, associated with or arise from the activities described in (i)
 - (v) Import or export any nuclear substances with atomic number 2 to 89 that are required for or associated with the activities described in (i). This licence does not authorize the licensee to import or export any quantity of a controlled nuclear substance for which the application requirements are set out in the Nuclear Non-proliferation Import and Export Control Regulations

V) EXPLANATORY NOTES:

- (i) Nothing in this licence shall be construed to authorize non-compliance with any other applicable legal obligation or restriction.
- (ii) Unless otherwise provided for in this licence, words and expressions used in this licence have the same meaning as in the [Nuclear Safety and Control Act](#) and associated regulations.
- (iii) The McMaster Nuclear Reactor Licence Conditions Handbook (LCH) provides compliance verification criteria and guidance for meeting the conditions listed in this licence, information regarding version control of licensing basis documents, including codes, standards or other documents that are used as compliance verification criteria.

VI) CONDITIONS:

The licensee shall comply with the following conditions, established pursuant to subsection 24(5) of the Nuclear Safety and Control Act.

G. GENERAL

- G.1 The licensee shall conduct the activities described in Part IV of this licence in accordance with the licensing basis for the facility, defined as:
- (i) the regulatory requirements set out in the applicable laws and regulations;
 - (ii) the conditions and safety and control measures described in the facility licence and the documents directly referenced in that licence; and
 - (iii) the safety and control measures described in the licence application and the documents in support of the licence application;
- unless otherwise approved in writing by the Canadian Nuclear Safety Commission (hereinafter “the Commission”).
- G.2 The licensee shall give written notification of changes to the facility or its operation, including deviation from design, operating conditions, policies, programs and methods referred to in the licensing basis.
- G.3 The licensee shall maintain a financial guarantee for decommissioning that is acceptable to the Commission.
- G.4 The licensee shall implement and maintain a public information and disclosure program.

1. MANAGEMENT SYSTEM

1.1 The licensee shall implement and maintain a management system.

2. HUMAN PERFORMANCE MANAGEMENT

2.1 The licensee shall implement and maintain a training program.

2.2 The licensee shall ensure that persons appointed to the position of reactor operator hold a certification in accordance with the requirements of the [*Nuclear Safety and Control Act*](#).

2.3 The licensee shall ensure that persons appointed to the position of reactor supervisor are qualified and maintain a valid certification as reactor operator.

3. OPERATING PERFORMANCE

3.1 The licensee shall implement and maintain an operating program, which includes a set of operating limits.

3.2 The licensee shall implement and maintain a program for reporting to the Commission or a person authorized by the Commission.

4. SAFETY ANALYSIS

4.1 The licensee shall implement and maintain a safety analysis program.

4.2 The licensee shall implement and maintain a nuclear criticality safety program.

5. PHYSICAL DESIGN

5.1 The licensee shall implement and maintain a design program.

6. FITNESS FOR SERVICE

6.1 The licensee shall implement and maintain a fitness for service program.

7. RADIATION PROTECTION

7.1 The licensee shall implement and maintain a radiation protection program, which includes a set of action levels. When the licensee becomes aware that an action level has been reached, the licensee shall notify the Commission within seven days.

8. CONVENTIONAL HEALTH AND SAFETY

8.1 The licensee shall implement and maintain a conventional health and safety program.

9. ENVIRONMENTAL PROTECTION

9.1 The licensee shall implement and maintain an environmental protection program, which includes a set of action levels. When the licensee becomes aware that an action level has been reached, the licensee shall notify the Commission within seven days.

10. EMERGENCY MANAGEMENT AND FIRE RESPONSE

10.1 The licensee shall implement and maintain an emergency management program.

10.2 The licensee shall implement and maintain a fire protection program.

11. WASTE MANAGEMENT

11.1 The licensee shall implement and maintain a waste management program.

11.2 The licensee shall implement and maintain a decommissioning plan.

12. SECURITY

12.1 The licensee shall implement and maintain a security program.

13. SAFEGUARDS AND NON-PROLIFERATION

13.1 The licensee shall implement and maintain a safeguards program.

14. PACKAGING AND TRANSPORT

14.1 The licensee shall implement and maintain a packaging and transport program.

SIGNED at OTTAWA, this _____ day of _____ 2024.

XXXXXXXXX, President
on behalf of the Canadian Nuclear Safety Commission

DRAFT LICENCE CONDITIONS HANDBOOK



e-Doc 7043081 (Word)
e-Doc 7043087 (PDF)

DRAFT

LICENCE CONDITIONS HANDBOOK

LCH-NPROL-01.00/2044

MCMASTER NUCLEAR REACTOR

Revision 0



Licence Conditions Handbook
LCH-NPROL-01.00/2044
McMaster Nuclear Reactor
Non-Power Reactor Operating Licence

Effective: July 1, 2024

SIGNED at OTTAWA this Xth day of month 2024

Andrew McAllister, Director
Nuclear Processing Facilities Division
Directorate of Nuclear Cycle and Facilities Regulation
Canadian Nuclear Safety Commission

Revision History:

Effective Date	Rev. #	Section(s) changed	Description of the Changes
July 1, 2024	0		Original document

DRAFT

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INTRODUCTION

The purpose of the licence conditions handbook (LCH) is to identify the regulatory requirements and other relevant parts of the licensing basis to help ensure that the licensee maintains facility operation in accordance with the licensing basis for the McMaster Nuclear Reactor facility and the Non-Power Reactor Operating Licence, NPROL-01.00/2044. The LCH provides compliance verification criteria for conditions set out in the licence. The LCH should be read in conjunction with the licence.

The LCH typically has three parts under each licence condition (LC): the Preamble, Compliance Verification Criteria (CVC), and Guidance. The Preamble explains, as needed, the regulatory context, background, and/or history related to the LC. CVC are criteria used by Canadian Nuclear Safety Commission (CNSC) staff to verify and oversee compliance with the LC. Guidance is non-mandatory information, including direction on how to comply with the LC.

E-doc numbers indicated in the LCH are references to the internal CNSC electronic filing system, and these documents cannot be opened from outside of the CNSC network.

CNSC documents referenced in the LCH are available through the [CNSC Website](#). Documents listed on CNSC website may contain prescribed information as defined by the [General Nuclear Safety and Control Regulations](#) (GNSCR). Information in these documents will be made available only to stakeholders with appropriate security clearance with the need to know.

Domestic and international standards, in particular consensus standards produced by the Canadian Standards Association (CSA), are an important component of the CNSC's regulatory framework. Standards support the regulatory requirements established through the [Nuclear Safety and Control Act](#) (NSCA), its regulations and licences by setting out the necessary elements for acceptable design and performance at a regulated facility or a regulated activity. Standards are used by the CNSC as a reference in evaluating licensees' compliance against certain licensed activities.

The CNSC offers complimentary access to the CSA Group suite of nuclear standards through the CNSC website. This platform allows stakeholders to view these standards online through any device that can access the Internet. Standards applicable to the licensees are documented in the CVC or guidance sections of the LCH as appropriate.

Appendices attached to the LCH provide detailed criteria and clarifications where needed, and are integral and mandatory parts of the LCH.

- Appendix A: provides glossary of terms and acronyms used throughout the LCH
- Appendix B: provides a list of Version Controlled Documents, including codes, standards, regulatory documents and licensee documents referenced in the LCH
- Appendix C: provides certification requirements for Reactor Operators
- Appendix D: provides qualification requirements for Reactor Supervisors

The mailing address is:

McMaster University
1280 Main Street West
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GENERAL

Licence Condition G.1: Licensing Basis for Licensed Activities

The licensee shall conduct the activities described in Part IV of this licence in accordance with the licensing basis for the facility, defined as:

- (i) the regulatory requirements set out in the applicable laws and regulations;**
- (ii) the conditions and safety and control measures described in the facility licence and the documents directly referenced in that licence; and**
- (iii) the safety and control measures described in the licence application and the documents in support of the licence application;**

unless otherwise approved in writing by the Canadian Nuclear Safety Commission (hereinafter “the Commission”).

Preamble

The licensing basis sets the boundary conditions for acceptable performance at a regulated facility or activity, and thus establishes the basis for the CNSC’s compliance program with respect of that regulated facility or activity. The degree to which the regulatory requirements are applied to the McMaster Nuclear Reactor (MNR) facility should reflect their importance to the health and safety of persons, environment, national security, international obligations to which Canada has agreed, licensee’s quality and economic expectations, the complexity of facility or activity, and the possible consequences if accidents occur or the activity is carried out incorrectly.

Where the LC requires the licensee to implement and maintain a particular program, the documents submitted by the licensee to support their application that describe and implement the program are part of the licensing basis.

Compliance Verification Criteria

Regulatory Role of the Licensing Basis

The licensing basis is established when the Commission renders its decision regarding the licence application. LC G.1 requires the licensee to conduct the licensed activities in accordance with the licensing basis. For activities that are not in accordance with the licensing basis, the licensee shall take action as soon as practicable to return to a state consistent with the licensing basis, taking into account the risk significance of the situation.

The licensing basis is not intended to unduly inhibit the ongoing management and operation of the facility or the licensee’s ability to adapt to changing circumstances and continuously improve, in accordance with its management system.

Part (i) of the Licensing Basis

Part (i) of the licensing basis refers to applicable laws and regulations. There are many federal and provincial acts and regulations, and international laws, agreements, guidelines, etc., applicable to activities performed at the MNR facility.

The laws, regulations and international agreements for which CNSC has a regulatory role are:

- [*Nuclear Safety and Control Act*](#) (NSCA) and its Regulations
- [*Impact Assessment Act*](#) and its Regulations
- [*Canadian Environmental Protection Act, 1999*](#)
- [*Nuclear Liability and Compensation Act*](#)
- [*Transportation of Dangerous Goods Act, 1992*](#) and its Regulations
- [*Radiation Emitting Devices Act*](#)
- [*Canada/International Atomic Energy Agency \(IAEA\) Safeguards Agreements*](#)
- [*Canada Labour Code, Part II*](#)

Part (ii) of the Licensing Basis

Part (ii) of the licensing basis refers to the conditions and the safety and control measures included in the licence and in the documents directly referenced in the licence.

Part (iii) of the Licensing Basis

Part (iii) of the licensing basis consists of the safety and control measures described in the licence application and in the documents in support of that licence application. The safety and control measures include important aspects of that documentation, as well as important aspects of analysis, design, operation, etc. They may be found in high-level, programmatic licensee documents but may also be found in lower-level, supporting licensee documentation. LC G.1 requires the licensee to conform to, and/or implement, all these safety and control measures.

Part (iii) of the licensing basis also includes the safety and control measures in the standards, codes and CNSC regulatory documents referenced in the application or in the licensee's supporting documentation. Note, however, this does not mean that all details in these referenced documents are part of the licensing basis. Some of these documents may contain administrative, informative or guidance sections that are not considered to be part of the licensing basis.

Applicable licensee documents are listed in the LCH under the heading "Licensee Documents that Require Notification of Change". Applicable CNSC regulatory documents, CSA standards and other documents are listed in the LCH under the heading "Licensing Basis Publications". The documents listed in the LCH could cite other documents that also contain safety and control measures. Applicable licensing basis publications are listed in tables in this LCH under the most relevant LC. All "shall" or normative statements in licensing basis publications are considered

CVC unless stated otherwise. If any “should” or informative statements in licensing basis publications are also considered CVC, this is also explained under the most relevant LC.

Details that are not directly relevant to safety and control measures for facilities or activities authorized by the licence are excluded from the licensing basis. Details that are relevant to a different safety and control area (i.e., not the one associated with the main document), are only part of the licensing basis to the extent they are consistent with the main requirements for both safety and control areas.

In the event of any conflict or inconsistencies between elements of the licensing basis, the licensee shall consult CNSC staff to determine the approach to resolve the issue. If the conflict cannot be resolved, the disagreement will be brought to the next level of authority, including the appropriate CNSC Directors, Directors General or Vice-Presidents, as required. Any unresolved issue will be referred to the Commission.

CNSC Staff’s Approach to Assessing the Licensing Basis

In accordance with LC G.2, the licensee shall submit relevant documentation for CNSC staff review regarding proposed changes to the facility or its operation, including deviation from design, operating conditions, policies, programs and methods referred to in the licensing basis. This includes, but is not limited to changes to equipment, processes, supporting activities, specific licensee documentation or any other item considered a safety or control measure under the licensing basis. There are specific licensee documents listed in the LCH, which require written notification every time a new version of the document is issued by MNR. CNSC staff will review the information submitted to confirm that the proposed change remains within the licensing basis. CNSC staff assess whether a proposed change is within the licensing basis based on changes and impact on the overall safety at the MNR facility. MNR may proceed with the proposed initiatives if they are found to be within the licensing basis.

Any proposed change considered to be outside the licensing basis will be referred to the Commission for consideration. If the Commission grants approval to the change, it will become part of the licensing basis and will be reflected in updates to the LCH as appropriate.

The licensee should consider that certain changes may require significant lead times before CNSC staff can make recommendations and/or the Commission can properly consider them.

Compliance Verification Criteria

Licensed Activities

The licensed activities are identified under part IV of the licence and are reproduced below.

This licence authorizes the licensee to:

- (i) Operate the McMaster Nuclear Reactor and associated facilities (hereinafter “the facility”), located in the Reactor Building and Nuclear Research Building at the McMaster University Campus, in Hamilton, Ontario
- (ii) Operate the reactor at a power not exceeding 5 MW thermal except for the purpose of testing the high power scram, which shall be set no higher than the neutron flux equivalent to 6.25 MW thermal power
- (iii) Produce, possess, process, transfer, use, package, manage, and store the nuclear substances that are required for, associated with or arise from the activities described in (i)
- (iv) Possess and use prescribed equipment and prescribed information required for, associated with or arise from the activities described in (i)
- (v) Import or export any nuclear substances with atomic number 2 to 89 that are required for or associated with the activities described in (i). This licence does not authorize the licensee to import or export any quantity of a controlled nuclear substance for which the application requirements are set out in the Nuclear Non-proliferation Import and Export Control Regulations

Licensing Basis Publications

Document Title	Document #	e-Doc
Non-Power Reactor Operating Licence, McMaster Nuclear Reactor	NPROL-01.00/2044	7041280

Licensee Documents

Date	Document Title	e-Doc
April 2023	McMaster University, Non-Power Operating Licence Renewal Application	7021967

Guidance

Guidance Documents

Document Number	Document Title	Version
REGDOC-3.5.1	Information Dissemination: Licensing Process for Class I Nuclear Facilities and Uranium Mines and Mills, Version 2.1	2022
REGDOC-3.5.3	Regulatory Fundamentals	2023

Licence Condition G.2: Notification of Changes

The licensee shall give written notification of changes to the facility or its operation, including deviation from design, operating conditions, policies, programs and methods referred to in the licensing basis.

Preamble

The objective of the licensing basis, as defined in the LCH under LC G.1, is to set the boundary conditions for acceptable performance at the facility. The licensee is encouraged to make continuous improvements to their programs and documents throughout the licensing period as long as they remain within the licensing basis authorized by the Commission.

Compliance Verification Criteria

Written notification is a physical or electronic communication from a person authorized to act on behalf of the licensee to the CNSC.

Under the licensee's management system, a change control process requires justifying changes and the review of changes by relevant stakeholders. Proposed changes with the potential to negatively impact designs, operating conditions, policies, programs, methods, or other elements that are integral to the licensing basis, are documented and written notification of the change shall be provided to the CNSC. Written notifications shall include a summary description of the change, the rationale for the change, expected duration (if not a permanent change), and a summary explanation of how the licensee has concluded that the change remains in accordance with the licensing basis (e.g., an evaluation of the impact on health, safety, security, the environment and Canada's international obligations). A copy of the revised document shall accompany the notification. All written notifications shall be transmitted to CNSC per established communications protocols.

The LCH identifies specific documents that require written notification under the relevant LC. However, other documents identified in the application or in the licensee's supporting documentation may require notification of change if they describe safety and control measures applicable to the licensing basis.

The documents needed to support the licence application may include documents produced by third parties (e.g., reports prepared by third party contractors). Changes to these documents require written notification to the CNSC only if the new version continues to form part of the licensing basis. That is, if the licensee implements a new version of a document prepared by a third party, it shall inform the CNSC of the change(s), per LC G.2. On the other hand, if a third party has updated a certain document, but the licensee has not adopted the new version as part of its safety and control measures, the licensee is not required to inform the CNSC that the third party has changed the document.

Licensee documents listed in the CVC of the LCH are subdivided in two groups having different requirements for notification of change:

Category	Definition
PN	Prior notification - The licensee shall submit the notice to the CNSC prior to implementing the change. Typically, the requirement is to submit the proposed changes 30 days prior to planned implementation. However, the licensee shall allow sufficient time for the CNSC to review the change proportionate to its complexity and the importance of the safety and control measures being affected
NT	Notification - The licensee shall submit the notice at time of making the change

Notification of some proposed changes (i.e., engineered physical changes, new processes/activities for the facility) may not be best captured through an update to a licensee document. In these cases, a standalone submission may be made that includes the summary description of the change, the rationale for the change, expected duration (if not a permanent change), and a summary explanation of how the licensee has concluded that the change remains in accordance with the licensing basis.

Changes that are not clearly in the safe direction require further assessment of impact to determine if Commission approval is required in accordance with LC G.1.

Guidance

Please see LC G.1 for further clarification on the licensing basis.

Licence Condition G.3: Financial Guarantee

The licensee shall maintain a financial guarantee for decommissioning that is acceptable to the Commission.

Preamble

The [General Nuclear Safety and Control Regulations](#) requires under paragraph 3(1)(1) that a licence application contain a description of any proposed financial guarantee relating to the activity to be licensed.

LC G.3 requires the licensee to maintain a financial guarantee (FG) for decommissioning that is acceptable to the Commission. The FG shall remain valid, in effect and adequate to fund the activities described in the preliminary decommissioning plan (PDP). If the PDP is revised and significantly impacts the cost estimate for the FG, the expectation is that the FG is revised and submitted to the Commission for acceptance. In addition, the financial guarantee for decommissioning is to be reviewed and revised by the licensee every five years, and when the Commission requires.

McMaster University has provided a PDP and an associated cost estimate. For the purpose of providing a financial guarantee for the decommissioning of MNR, McMaster University has entered a *CNSC Financial Security Agreement* with the CNSC, and it maintains a *Nuclear Reactor Restricted Reserve* (NRRR) fund, established under a *Deed of Trust*. The NRRR fund is audited independently annually to certify the actual value of the fund.

Compliance Verification Criteria

1. The licensee shall maintain in effect a financial guarantee for decommissioning acceptable to the Commission which shall remain valid, in effect and adequate to fund the activities described in the PDP.
2. The financial guarantee for decommissioning shall be reviewed and revised by McMaster University every five years, when the Commission requires, or following a revision of the PDP. The current PDP is expected to be revised in December 2026 (see LC 11.2).
3. The licensee shall provide to the CNSC no later than October 31 of each year an independent assessment of the fair market value of the NRRR Fund as of April 30 of that year to confirm that the financial guarantee remains valid, in effect and adequate to fund the decommissioning of the facility.
4. The licensee shall maintain its financial guarantee based on the requirements and guidance provided in REGDOC-3.3.1.

Licensing Basis Publications

Document Title	Document #	Version
Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities	REGDOC-3.3.1	2021
Decommissioning	REGDOC-2.11.2	2021

Licensee Document that Requires Notification of Change

Document Title	Document #	Prior Notification
CNSC Financial Security and Access Agreement	e-Doc 7032446	PN
Deed of Trust	e-Doc 7032447	PN
Preliminary Decommissioning Plan	TN-2002-08	PN

Guidance

None provided.

Licence Condition G.4: Public Information and Disclosure

The licensee shall implement and maintain a public information and disclosure program.

Preamble

The [Class I Nuclear Facilities Regulations](#) requires that an application for a licence contain the proposed program to inform persons living in the vicinity of the site of the general nature and characteristics of the anticipated effects on the environment and the health and safety of persons that may result from the activity to be licensed.

The primary goal of a public information and disclosure program is to ensure that information related to the health, safety and security of persons and the environment, and other issues associated with the lifecycle of the nuclear facilities are effectively communicated to the public. In addition, the program shall include a commitment to a disclosure protocol for ongoing, timely communication of information related to the licensed facility during the course of the licence period.

This LC requires the licensee to implement and maintain a public information and disclosure program to improve the public’s level of understanding about MNR’s activities.

Compliance Verification Criteria

Licensing Basis Publications

Document Number	Document Title	Version
REGDOC-3.2.1	Public Information and Disclosure	2018

Licensee Documents that Require Notification of Change

Document Title	Document #	Notification
Public Disclosure Protocol	AP-1901	NT

Guidance

None provided.

1. SCA – MANAGEMENT SYSTEM

Licence Condition 1.1: Management System

The licensee shall implement and maintain a management system.

Preamble

The [Class I Nuclear Facilities Regulations](#) require that a licence application contain information on the proposed management system for the activity to be licensed, including the measures to promote and support safety culture.

The [General Nuclear Safety and Control Regulations](#) requires that a licence application contain the applicant’s organizational management structure, including the internal allocation of functions, responsibilities and authority.

CSA N286 *Management System Requirements for Nuclear Facilities* contains the requirements for a management system throughout the lifecycle of a nuclear facility and extends to all safety and control areas.

CSA N286.0.1 *Commentary on N286-12, Management System Requirements for Nuclear Facilities* provides background information concerning certain clauses and requirements in CSA N286. This background information can help the user clarify the context of the CSA N286 requirements.

Compliance Verification Criteria

Licensing Basis Publication

Document Number	Document Title	Version
REGDOC-2.1.2	Safety Culture	2018
CSA N286	Management System Requirements for Nuclear Facilities	2012 (R2022)

Licensee Documents that Require Notification of Change

Document Title	Document #	Notification
Policy Manual	AP-1000	PN

Guidance

Guidance Documents

Document #	Document Title	Version
REGDOC-2.1.1	Management System	2019
CSA N286.0.1	Commentary on N286-12, Management system requirements for nuclear facilities	2021

2. SCA – HUMAN PERFORMANCE MANAGEMENT

Licence Condition 2.1: Training Program

The licensee shall implement and maintain a training program.

Preamble

This LC requires the licensee to develop and implement training programs for workers. It also provides the requirements regarding the program and processes necessary to support qualification and requalification training of persons at the nuclear facility.

As defined by the [General Nuclear Safety and Control Regulations](#), a worker is a person who performs work that is referred to in a licence. This includes contractors and temporary employees. Training requirements apply equally to these types of workers as to the licensee’s own employees. The GNSCR require that licensees ensure that there are a sufficient number of properly trained and qualified workers to conduct the licensed activities safely.

The [Class I Nuclear Facilities Regulations](#) require that licence applications include the proposed responsibilities of and qualification requirements and training program for workers, including the procedures for the requalification of workers and the results that have been achieved in implementing the program for recruiting, training and qualifying workers in respect of the operation and maintenance of the nuclear facility.

The *Class I Nuclear Facilities Regulations* contain provisions for the certification of persons, and require every licensee to keep a record of the status of each worker’s qualifications, requalification and training, including the results of all tests and examinations completed in accordance with the licence.

Compliance Verification Criteria

Licensing Basis Publications

Document Number	Document Title	Version
REGDOC-2.2.2	Personnel Training, Version 2	2016

Licensee Documents that Require Notification of Change

Document Title	Document #	Notification
Training of Staff	AP-1150	PN
Training Plan: Reactor Operator & Reactor Supervisor	AP-1140	PN
Supplementary Facility-Specific Training for Reactor Supervisors	TP-6009	PN
Training and Qualification Guide for Health Physics Staff at MNR	HP-9004	NT

1. The Licensee shall comply with the conditions and certification requirements for the Reactor Operator (RO) specified in Appendix C of the LCH.
2. The Licensee shall comply with the conditions and qualification requirements for the Reactor Supervisor (RS) specified in Appendix D of the LCH.

Guidance

None provided.

Licence Condition 2.2: Personnel Certification

The licensee shall ensure that persons appointed to the position of reactor operator hold a certification in accordance with the requirements of the *Nuclear Safety and Control Act*.

Preamble

This condition requires that any person that the licensee appoints to the position of reactor operator (RO) must hold a certification issued pursuant to the NSCA, and that the authority or responsibility of these certified persons can only be delegated to another person who holds the same certification. In addition, the certified persons must maintain their competency through continuing training and experience carrying out the duties of the position for which they are certified.

Paragraphs 12(1)(a) and 12(1)(b) of the [General Nuclear Safety and Control Regulations](#) require that a 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, and train the workers to carry on the licensed activity in accordance with the Act, the Regulations made under the Act and the licence.

Paragraphs 6(m) and 6(n) of the [Class I Nuclear Facilities Regulations](#) require that licence applications include the proposed responsibilities, qualification requirements, training program, including the procedures for the requalification of workers, and the results that have been achieved in implementing the program for recruiting, training and qualifying workers.

Subsection 14(2) of the *Class I Nuclear Facilities Regulations* require every licensee to keep a record of the status of each worker’s qualifications, requalification and training, including the results of all tests and examinations completed in accordance with the licence.

The certification requirements for the RO are specified in Appendix C of the LCH.

Compliance Verification Criteria

Licence Documents that Require Notification of Change

Document Title	Document #	Notification
Evaluations: Preparing, Conducting and Grading	TP-6006	PN
Certification Examinations	TP-6008	PN

1. The Licensee shall comply with the conditions and certification requirements for the RO specified in Appendix C of the LCH.

Licence Condition 2.3: Personnel Certification

The licensee shall ensure that persons appointed to the position of reactor supervisor are qualified and maintain a valid certification as reactor operator.

Preamble

This condition requires that any person appointed to the position of Reactor Supervisor (RS) is qualified for RS duties and maintains a valid certification as Reactor Operator. The authority and responsibility of these persons can only be delegated to another person qualified as RS. The qualification requirements for the RS are specified in Appendix D of the LCH.

Compliance Verification Criteria

Licence Documents that Require Notification of Change

Document Title	Document #	Notification
Evaluations: Preparing, Conducting and Grading	TP-6006	PN
Supplementary Facility-Specific Training for Reactor Supervisors	TP-6009	PN

1. The Licensee shall comply with the conditions and qualification requirements for the RS specified in Appendix D of the LCH.

3. SCA – OPERATING PERFORMANCE

Licence Condition 3.1: Operating Program

The licensee shall implement and maintain an operating program, which includes a set of operating limits.

Preamble

The [*Class I Nuclear Facilities Regulations*](#) require that a licence application contain the proposed measures, policies, methods and procedures for operating and maintaining the nuclear facility. The [*Nuclear Substances and Radiation Devices Regulations*](#) have requirements for records to be kept and retained for nuclear substances.

An operating program includes an up-to-date set of operating limits for the facility and activities authorized under the licence, which may include: production limits and limits for the possession, use, management, transfer, storage of nuclear substances, and an inventory of nuclear substances possessed under the licensees' operating licence.

In addition, the operations program should ensure that any building modifications are made in accordance with the *National Building Code* and the *National Fire Code of Canada*.

In March 2022, the fifteenth edition of the National Building Code of Canada 2020 (NBCC) and the eleventh edition of the National Fire Code of Canada 2020 (NFCC) were published. Additionally, in September 2022, the second edition of CSA N393-22 *Fire Protection for Facilities that Process, Handle or Store Nuclear Substances* was published. This CSA standard sets out the fire protection requirements and guidance for the design, construction, commissioning, operation, and decommissioning of facilities that process, handle, or store nuclear substances, including structures, systems and components, and other hazardous substances that directly relate to the nuclear substances being regulated. It also includes specific reporting and follow-up requirements for fire incidents and fire protection program audits.

In June 2023, CNSC staff requested (e-Doc 7069840) that McMaster University provide a gap analysis and an implementation plan for meeting the requirements of NBCC 2020, NFCC 2020, and CSA N393-22. McMaster University responded (e-Doc 7091410) that a gap analysis would be prepared by December 31, 2024.

Compliance Verification Criteria

Licensing Basis Publications

Document #	Document Title	Version
NFCC 2010*	National Fire Code of Canada	2010
NBCC 2010*	National Building Code of Canada	2010
REGDOC-2.12.3	Security of Nuclear Substances: Sealed Sources and Category I, II and III Nuclear Material	2020

* The NFCC and NBCC 2010 are listed as CVC until McMaster University completes a gap analysis of the 2020 versions, to be submitted by December 31, 2024.

Licensee Documents that Require Notification of Change

Document Title	Document #	Notification
Reactor Operating Policies	AP-1120	NT
Change Control	AP-1010	PN
MNR Operating Limits and Conditions	AP-1111	PN

Criteria for Facility Operations

- 1) Operations, tests and routine maintenance shall be performed by a person holding a certification as RO or under the supervision of a certified RO.
- (2) The licensee shall operate the facility using up-to-date procedures that have been developed and approved for use through a formal process.
- (3) The licensee shall not operate the facility without appropriate disposition and approval by the Commission or a person authorized by the Commission when:
 - (a) Any problem or potential problem is discovered that represents a potential hazard to the health and safety of persons, security or the environment that is different in nature, greater in probability, or greater in magnitude than was previously presented to the Commission in licensing documents
 - (b) The facility operates in a state that was not considered in the Safety Analysis Report
 - (c) An unexplained or unexpected behaviour of the reactor core or of a safety system occurs; or

- (d) A nuclear substance or a hazardous substance is released in a quantity or at a rate that is greater than that predicted in the bounding case analyzed in the Safety Analysis Report
- (4) The licensee shall not return the facility to operation following an unplanned shutdown until it has been shown to be safe to do so.
- (5) The licensee shall ensure that work carried out by contractor personnel is approved and monitored by a qualified member of the licensee's personnel or an approved service provider.

Change Control

- (1) The licensee can make changes to structures, systems and components (SSC) and the facility if these are within the boundary conditions set by the licensing basis (see licence condition G.1). Changes shall be made in accordance with the licensee's change control process.
- (2) The change control process shall ensure that all permanent and temporary modifications are properly designed, reviewed, controlled and implemented, and that all relevant safety requirements are met. The change control process, shall include:
 - (a) reason and justification for the modification
 - (b) safety assessment
 - (c) updating facility documentation and training
 - (d) fabrication, installation and testing; and
 - (e) commissioning of the modification.
- (3) Changes that would result in an impact on health and safety of persons, environment, national security, or to measures of control and international obligations to which Canada has agreed that is different in nature, greater in magnitude or in probability are considered outside the licensing basis and require prior approval of the Commission or a person authorized by the Commission. The licensee shall submit documents in support of the change, demonstrating that the change has been thoroughly developed, designed, analyzed, reviewed and approved by the licensee, and is in compliance with all regulatory requirements.
- (4) The licensee shall review the site description, operating manual and safety analysis report and revise the documents as necessary to reflect changes to structures, systems, equipment, components and procedures.

Operating Limits and Conditions

The operating limits and conditions define the conditions that must be met to prevent situations or events that might lead to accidents, or to mitigate the consequences of accidents should they occur. The operating limits and conditions for MNR are documented in the MNR document AP-1111, *MNR Operating Limits and Conditions*.

- (1) The licensee shall base each OLC on facility design, safety analysis and commissioning tests.
- (2) The permanent or temporary modifications to operating limits and conditions shall be adequately justified by safety analyses and an independent safety review.
- (3) The operating personnel shall be knowledgeable of the operating limits and conditions and their technical basis.
- (4) The operating limits and conditions shall cover all operational states, any intermediate conditions between these states, and temporary situations arising from maintenance and testing.
- (5) Adequate margins shall be established between operating limits and the established safety system settings to avoid undesirably frequent actuation of safety systems.
- (6) Safety limits shall be established using a conservative approach to take uncertainties in the safety analyses into account.
- (7) If the actions taken to correct a deviation from operating limits and conditions have not been completed successfully in the allowable time, the facility shall be deemed to have operated in noncompliance with operating limits and conditions.
- (8) If operating personnel cannot ascertain that the facility is operating within operating limits, or the facility behaves in an unexpected way, measures shall be taken without delay to bring the facility to a safe and stable state.
- (9) The licensee shall investigate breaches of compliance with the operating limits and conditions and shall implement corrective actions to prevent repeat events in the future.

Sealed source tracking

1. Subsections 18(3) and 30(2) of the [*Nuclear Substances and Radiation Devices Regulations*](#) stipulate situations related to exposure devices or sealed sources that require notification and reporting. In addition, sections 35 and 38 of the same regulations specify situations related to nuclear substances and radiation devices that require notification and reporting. Subsection 36 provides requirements on records to be kept.
2. Reporting requirements on sealed sources are discussed under LC 3.2.

Guidance

Document #	Document Title	Version
NFCC 2020*	National Fire Code of Canada	2020
NBCC 2020*	National Building Code of Canada	2020
CSA N393*	Fire Protection for Facilities that Process, Handle or Store Nuclear Substances	2022

* Currently the subject of a gap analysis by McMaster University, to be completed by December 31, 2024. These codes and standard will be implemented as CVC under an implementation plan following the gap analysis.

Licence Condition 3.2: Reports to the Commission

The licensee shall implement and maintain a program for reporting to the Commission or a person authorized by the Commission.

Preamble

This condition requires the licensee to implement and maintain a program for reporting information to the Commission. This includes compliance monitoring and operational performance, responses to unusual events, and sealed-source tracking reports, and notifications of various types.

The statement “a person authorized by the Commission” in the LCs or the LCH indicates that the Commission may delegate certain authority to CNSC staff. Unless specified otherwise, the delegation of authority by the Commission to act as a person authorized by the Commission is applied to the incumbents in the following positions:

- Director, Nuclear Processing Facilities Division
- Director, Personnel Certification Division
- Director General, Directorate of Nuclear Cycle and Facilities Regulations
- Executive Vice-President and Chief Regulatory Operations Officer, Regulatory Operations Branch

The NSCA and applicable regulations describe reporting to the Commission or a person authorized by the Commission. Some reporting requirements are found in sections 29 - 32 of the *General Nuclear Safety and Control Regulations* and section 27 of the NSCA.

The CNSC has strengthened its regulatory controls on sealed sources, principally through establishment of a sealed source tracking system within an upgraded national sealed source registry and enhanced export and import controls for high-risk sealed sources. High-risk sealed sources are recorded in the CNSC database (the Sealed Source Tracking System) that tracks the location of each significantly hazardous radioactive source (IAEA Category 1 and 2 sources) in Canada.

McMaster’s reporting program consists of requirements described within several documents under McMaster’s management system, including AP-1000, *Policy Manual* and HP-9000, *MNR Radiation Safety Program*.

Compliance Verification Criteria

Licensing Basis Publications

Document	Document Title	Version
REGDOC-3.1.2	Reporting Requirements, Volume I: Non-Power Reactor Class I Nuclear Facilities and Uranium Mines and Mills	2022
REGDOC-2.12.3	Security of Nuclear Substances: Sealed Sources and Category I, II and III Nuclear Material	2.1 (2020)

Reporting requirements

1. The licensee shall provide an annual compliance report by March 31 of each year, covering the operation for the 12-month period from January 1 to December 31 of the previous year, following the requirements of REGDOC-3.1.2.
2. The licensee shall report in writing, any transfer, receipt, export or import of a sealed source whose corresponding activity is equal or greater than the values prescribed in REGDOC-2.12.3. The written report shall comply with the requirements described in REGDOC-3.1.2.

Guidance

None provided.

4. SCA – SAFETY ANALYSIS

Licence Condition 4.1: Safety Analysis Program

The licensee shall implement and maintain a safety analysis program.

Preamble

The [*General Nuclear Safety and Control Regulations*](#) requires that a licence application contains information that includes a description and the results of any test, analysis or calculation performed to substantiate the information included in the application.

The [*Class I Nuclear Facilities Regulations*](#) requires that a licence application contains information that includes a final safety analysis report demonstrating the adequacy of the design of the nuclear facility, and the proposed measures, policies, methods and procedures for operating and maintaining the nuclear facility.

The implementation and maintenance of a safety analysis program includes a process to identify and assess hazards and risks on an ongoing basis. This includes identifying and evaluating new or unforeseen risks that were not considered at the planning and design stages and updating previous risk assessments by replacing important assumptions with performance data. The results of this process will be used to set objectives and targets and to develop preventative and protective measures.

McMaster's safety analysis program consists of the MNR Safety Analysis Report and documents referenced therein.

Compliance Verification Criteria

Licensing Basis Publications

Document #	Document Title	Version
REGDOC-2.4.1	Deterministic Safety Analysis	2014

Licensee Documents that Require Notification of Change

Document Title	Document #	Notification
MNR Safety Analysis Report	OPS-LBD-MNR-0002	PN
Defence-in-Depth of the McMaster Nuclear Reactor	TR-2011-01	PN

1. The licensee shall periodically review, revise and update the safety analysis report to reflect modifications, new regulatory requirements and standards, or operational information.

Guidance

Guidance Publications

Document #	Document Title	Version
IAEA SSR-3	Safety of Research Reactors	2016

Licence Condition 4.2: Nuclear Criticality Program

The licensee shall implement and maintain a nuclear criticality safety program.

Preamble

This licence condition requires the licensee to develop, implement and maintain a nuclear criticality safety program to ensure that the upper subcritical limits established in the criticality safety documents will not be exceeded under both normal and credible abnormal conditions (events or event sequences having the frequency of occurrence equal to or more than 10^{-6} /year) during operations with fissionable materials outside the reactor.

Compliance Verification Criteria

Licensing Basis Publications

Document #	Document Title	Version
REGDOC-2.4.3	Nuclear Criticality Safety	2020

Licensee Documents that Require Notification of Change

Document Title	Document #	Notification
Nuclear Criticality Safety Program	AP-1600	PN
MNR Nuclear Criticality Safety Analysis	TN-2009-01	PN

1. The licensee may implement the requirements of a nuclear criticality safety program in a graded manner, as follows:
 - (a) The work areas operating with exempted quantities of fissionable materials and that are neutronically isolated from other areas may be exempted from the nuclear criticality safety requirements.
 - (b) The work areas operating with small quantities of fissionable materials and that are neutronically isolated from other areas may be exempted from the requirements for:
 - Establishing the upper subcritical limits
 - Evaluating the need for and installing criticality alarm systems
 - Establishing and maintenance of emergency procedures

Guidance

None provided.

5. SCA – PHYSICAL DESIGN

Licence Condition 5.1: Design Program

The licensee shall implement and maintain a design program.

Preamble

The [*Class I Nuclear Facilities Regulations*](#) require that a licence application contain the proposed measures, policies, methods and procedures to maintain the nuclear facility. The *Class I Nuclear Facilities Regulations* require that a licence application contain a description of the structures, systems and equipment, including the relevant design information for the facility.

A design program ensures that the design of the facility is managed using a well-defined systematic approach. This LC requires that the licensee implement and maintain a design program to confirm that safety-related SSCs and any modifications to them continue to meet their design basis given new information arising over time and taking changes in the external environment into account. It also confirms that SSCs continue to be able to perform their safety functions.

This LC requires that the licensee implement and maintain a design control process to ensure that design outputs (both interim and final) are reviewed, verified and validated against the design inputs and performance requirements, and to ensure that the design inputs are selected such that safety, performance and dependability of the design item are achieved.

In March 2022, the fifteenth edition of the National Building Code of Canada 2020 (NBCC) and the eleventh edition of the National Fire Code of Canada 2020 (NFCC) were published. Additionally, in September 2022, the second edition of CSA N393-22, *Fire Protection for Facilities that Process, Handle or Store Nuclear Substances* was published. This CSA standard sets out the fire protection requirements and guidance for the design, construction, commissioning, operation, and decommissioning of facilities that process, handle, or store nuclear substances, including structures, systems and components, and other hazardous substances that directly relate to the nuclear substances being regulated. It also includes specific reporting and follow-up requirements for fire incidents and fire protection program audits.

McMaster's design program consists of requirements described in several documents, including AP-1000, *Policy Manual*, MT-4000, *MNR Maintenance Program* and TR-2011-01, *Defence-in-Depth of the McMaster Nuclear Reactor*.

Compliance Verification Criteria

Licensing Basis Publications

Document Number	Document Title	Version
RD-367	Design of Small Reactor Facilities	2011
NBCC 2010*	National Building Code of Canada	2010
NFCC 2010*	National Fire Code of Canada	2010

* The NFCC and NBCC 2010 are listed as CVC until McMaster University completes a gap analysis of the 2020 versions, to be submitted by December 31, 2024.

Licensee Documents that Require Notification of Change

Document Title	Document #	Notification
Defence-in-Depth of the McMaster Nuclear Reactor	TR-2011-01	PN
MNR Safety Analysis Report	OPS-LBD-MNR-0002	PN

- (1) The licensee shall not construct, install or modify any facility, building, structure, component or equipment that would result in an impact on health, safety or the environment that is different in nature or greater in probability than that described in the licensing documents without prior approval of the Commission, or a person authorized by the Commission.
- (2) The licensee shall comply in a graded manner with the requirements set out in CNSC document RD-367 *Design of Small Reactor Facilities*.
- (3) The licensee shall ensure that all designs, including changes to the designs, meet all relevant safety, code, standard and regulatory requirements.

Guidance

Guidance Publications

Document #	Document Title	Version
REGDOC-2.5.1	General Design Considerations: Human Factors	2019
REGDOC-2.5.2	Design of Reactor Facilities	2023
NFCC 2020*	National Fire Code of Canada	2020
NBCC 2020*	National Building Code of Canada	2020
CSA N393*	Fire Protection for Facilities that Process, Handle or Store Nuclear Substances	2022

* Currently the subject of a gap analysis by McMaster University, to be completed by December 31, 2024. These codes and standard will be implemented as CVC under an implementation plan following the gap analysis.

6. SCA – FITNESS FOR SERVICE

Licence Condition 6.1: Fitness for Service Program

The licensee shall implement and maintain a fitness for service program.

Preamble

The [*Class I Nuclear Facilities Regulations*](#) requires that a licence application contain information including the proposed measures, policies, methods and procedures for operating and maintaining the nuclear facility. It is expected that the licensee will conduct routine maintenance, inspection and testing to ensure that the availability, reliability and effectiveness of facilities and equipment that may impact the health, safety and protection of the environment.

McMaster’s fitness for service program consists of requirements described in MT-4000, *MNR Maintenance Program* and other documents listed below.

Compliance Verification Criteria

Licensing Basis Publications

Source	Document Title	Version
REGDOC-2.6.3	Aging Management	2014

Licence Documents that Require Notification of Change

Document Title	Document #	Notification
MNR Maintenance Program	MT-4000	PN
Calibration of Equipment	AP-1190	NT
Status of MNR Structures, Systems and Components	TN-2010-04	PN

1. The licensee shall carry out testing and maintenance sufficient to ensure the reliability and effectiveness of all structures, systems and components, and safety-related equipment, in accordance with MT-4000, *MNR Maintenance Program*.

Guidance

Document #	Document Title	Version
IAEA NS-G-4.2	Maintenance, Periodic Testing and Inspection of Research Reactors	2006
IAEA SSG-10	Ageing Management for Research Reactors	N/A

7. SCA – RADIATION PROTECTION

Licence Condition 7.1: Radiation Protection Program

The licensee shall implement and maintain a radiation protection program, which includes a set of action levels. When the licensee becomes aware that an action level has been reached, the licensee shall notify the Commission within seven days.

Preamble

The [Radiation Protection Regulations](#) requires that the licensee implement a radiation protection program and also ascertain and record doses for each person who performs any duties in connection with any activity that is authorized pursuant to the [Nuclear Safety and Control Act](#) or is present at a place where that activity is carried on. This program must ensure that doses to workers do not exceed prescribed dose limits and are kept as low as reasonably achievable (ALARA), social and economic factors being taken into account.

The regulatory dose limits are explicitly provided in the *Radiation Protection Regulations*.

Action levels are designed to alert licensees before regulatory dose limits are reached. By definition, if an action level is reached, a loss of control of some part of the associated radiation protection program may have occurred, and specific action is required, as defined in the *Radiation Protection Regulations*. Action levels are not intended to be static and should be adjusted to reflect operating conditions in the facility.

Compliance Verification Criteria

Licence Documents that Require Notification of Change

Document Title	Document #	Notification
MNR Radiation Safety Program	HP-9000	PN

1. When the licensee becomes aware that an action level has been reached, it shall notify the CNSC within seven days.
2. If an action level has been reached, the licensee shall file a final report with the CNSC within 21 days of becoming aware of the matter.
3. The licensee shall review and if necessary, revise the action levels at a frequency of once per five years to validate their effectiveness.
4. Action levels are listed in the MNR Radiation Safety Program, HP-9000.

Guidance

Guidance Publications

Document #	Document Title	Version
REGDOC-2.7.1	Radiation Protection	2021
REGDOC-2.7.2	Dosimetry, Volume I: Ascertaining Occupational Dose	2021

8. SCA – CONVENTIONAL HEALTH AND SAFETY

Licence Condition 8.1 Conventional Health and Safety Program

The licensee shall implement and maintain a conventional health and safety program.

Preamble

The [Class I Nuclear Facilities Regulations](#) requires that a licence application contain information including the proposed worker health and safety policies and procedures. MNR is also subject to the requirements of Part II of the [Canada Labour Code](#) and [Canada Occupational Health and Safety Regulations](#).

Compliance Verification Criteria

Licensing Basis Publications

Document #	Document Title	Version
REGDOC-2.8.1	Conventional Health and Safety	2019

Licencee Documents that Require Notification of Change

Document Title	Document #	Notification
Workplace and Environmental Health and Safety Policy	RMM-100	NT

- (1) The following requirements shall be addressed:
 - (a) The workplace is maintained in a safe, clean, and orderly manner
 - (b) Hazards are evaluated, and eliminated or controlled, and the consequences of exposure to personnel are minimized
 - (c) Hazardous conditions are identified and, where practicable, physical barriers are installed; and
 - (d) Hazardous materials are labeled.
- (2) The licensee shall control the bulk chemicals, laboratory chemicals, corrosive agents, and cleaning agents to ensure proper handling, storage, and use.
- (3) MNR employees shall be trained to recognize and protect themselves against hazards that may be encountered in the facility.

Guidance

None provided.

9. SCA – ENVIRONMENTAL PROTECTION

Licence Condition 9.1 : Environmental Protection Program

The licensee shall implement and maintain an environmental protection program, which includes a set of action levels. When the licensee becomes aware that an action level has been reached, the licensee shall notify the Commission within seven days.

Preamble

The [Class I Nuclear Facilities Regulations](#) require that a licence application contain the proposed environmental protection policies, procedures, effluent and environmental monitoring programs. The [General Nuclear Safety and Control Regulations](#) require that every licensee take all reasonable precautions to protect the environment and the health and safety of persons and to maintain the security of nuclear facilities and of nuclear substances. The [Radiation Protection Regulations](#) prescribe the radiation dose limits for the general public of 1 mSv per calendar year.

The release of hazardous substances is regulated by the CNSC as well as both the Ontario Ministry of the Environment, Conservation, and Parks and Environment and Climate Change Canada through various acts and regulations.

CSA N288.6, *Environmental Risk Assessments at Nuclear Facilities and Uranium Mines and Mills*, provides requirements for the conduct and review cycle of an environmental risk assessment at Class I nuclear facilities.

The Environmental Management System (EMS) captures the environmental protection policies, programs, and procedures of the licensed activity, and ensures that environmental protection is managed via an integrated set of documented activities that have the support and commitment of all levels of management within the licensee's organization. It shall be designed in a way that is appropriate to the nature, scale and environmental impacts of its activities with a commitment to pollution prevention and continuous improvement, such that environmental issues are identified, monitored, interpreted and acted upon in a manner that demonstrates "adequate precaution" to protect the environment and the health and safety of persons. Components of an EMS include Environmental Policy, Planning, Implementation and Operation, Checking, and Management Review.

McMaster's environmental protection program and EMS consist of the licensee documents referenced below.

Compliance Verification Criteria

Licensing Basis Publications

Document #	Document Title	Version
REGDOC-3.1.2	Reporting Requirements, Volume I: Non-Power Reactor Class I Facilities and Uranium Mines and Mills	2022
CSA N288.0	Environmental management of nuclear facilities: Common requirements of the CSA N288 series of Standards	2022
CSA N288.1	Guidelines for modelling radionuclide environmental transport, fate, and exposure associated with the normal operation of nuclear facilities	2020
CSA N288.6	Environmental risk assessments at nuclear facilities and uranium mines and mills	2022
CSA N288.8	Establishing and implementing action levels for releases to the environment from nuclear facilities	2022

Licensee Documents that Require Notification of Change

Document Title	Document #	Notification
MNR Radiation Safety Program	HP-9000	PN
Workplace and Environmental Health and Safety Policy	RMM-100	NT
Environmental Protection Act of Ontario and Other Federal, Provincial and Municipal Environmental Statutes	RMM-103	PN
Derived Release Limits for the McMaster Nuclear Reactor	HP-REP-MNR-00006	PN
Environmental Risk Assessment	OPS-LBD-MNR-0003	PN

1. The MNR Environmental Management System consists of the documents listed above.
2. The licensee shall review annually and, if necessary, revise the environmental action levels in order to validate and maintain their effectiveness.
3. In accordance with REGDOC-2.9.1, the Environmental Risk Assessment (ERA) is subject to periodic reviews and revisions in accordance with CSA N288.6. The next

revision shall address CNSC comments shared with MNR, entitled DERPA Technical Assessment of McMaster Nuclear Reactor Environmental Risk Assessment, e-Doc 7143805.

4. The environmental action levels and derived release limits for liquid and airborne releases are specified in HP-9000, MNR Radiation Safety Program. Release limits are based on 1 mSv dose to a representative person in a calendar year. Action levels are converted from activity concentration based on a continuous nominal flow rate of 1.65 m³/s.

Guidance

Document #	Document Title	Version
REGDOC-2.9.1	Environmental Principles, Assessments and Protection Measures	2020
CSA N288.4	Environmental monitoring programs at nuclear facilities and uranium mines and mills	2019
CSA N288.5	Effluent and emissions monitoring programs at nuclear facilities	2022

10. SCA – EMERGENCY MANAGEMENT AND FIRE PROTECTION

Licence Condition 10.1 Emergency Management Program

The licensee shall implement and maintain an emergency management program.

Preamble

The [Class I Nuclear Facilities Regulations](#) requires that an application for a licence to operate a Class I nuclear facility include the proposed measures to prevent or mitigate the effects of accidental releases of nuclear substances and hazardous substances on the environment, the health and safety of persons and the maintenance of national security, including measures to assist, notify, report to off-site authorities including the testing of the implementation of these measures.

This LC requires the licensee to establish an emergency preparedness program to prepare for, to respond to, and to recover from the effects of accidental radiological/nuclear and/or hazardous substance release. As part of the emergency preparedness program, the licensee shall prepare an onsite emergency plan and establish the necessary organizational structure for clear allocation of responsibilities, authorities, and arrangements for coordinating onsite activities and cooperating with external response organizations throughout all phases of an emergency.

Compliance Verification Criteria

Licensing Basis Publication

Document Number	Document Title	Version	Implementation
REGDOC-2.10.1	Nuclear Emergency Preparedness and Response	2016	August 31, 2024

Licence Documents that Require Notification of Change

Document Title	Document #	Notification
MNR Emergency Preparedness Plan	EP-7000	PN

Guidance

None provided.

Licence Condition 10.2: Fire Protection Program

The licensee shall implement and maintain a fire protection program.

Preamble

Licensees shall prepare and implement a fire protection program (a set of planned, coordinated, controlled and documented activities) to ensure that the licensed activities do not result in an unreasonable risk to the health and safety of persons and to the environment due to fire and to ensure that the licensee is able to efficiently and effectively respond to emergency fire situations.

In June 2023, CNSC staff requested (e-Doc 7069840) that McMaster University provide a gap analysis and an implementation plan for meeting the requirements of NBCC 2020, NFCC 2020, and CSA N393-22. McMaster University responded (e-Doc 7091410) that a gap analysis would be prepared by December 31, 2024

Compliance Verification Criteria

Licensing Basis Publications

Document Number	Document Title	Version
NFCC 2010*	National Fire Code of Canada 2010	2010
NBCC 2010*	National Building Code of Canada 2010	2010
NFPA-801	Standard for Fire Protection for Facilities Handling Radioactive Materials	N/A

* The NFCC and NBCC 2010 are listed as CVC until McMaster University completes a gap analysis of the 2020 versions, to be submitted by December 31, 2024.

Licensee Documents that Require Notification of Change

Document Title	Document #	Notification
Fire Protection Program	EP-7400	PN
Inspection, testing and maintenance of the MNR Fire Systems	MT-4520	PN
Fire Hazard Assessment	N/A	PN
Fire Safe Shutdown Analysis	TR-2009-01	PN

Guidance

Document Number	Document Title	Version
NFCC 2020*	National Fire Code of Canada 2020	2020
NBCC 2020*	National Building Code of Canada 2020	2020
CSA N393*	Fire Protection for Facilities That Process, Handle, or Store Nuclear Substances	2022

- * Currently the subject of a gap analysis by McMaster University, to be completed by December 31, 2024. These codes and standard will be implemented as CVC under an implementation plan following the gap analysis.

11. SCA – WASTE MANAGEMENT

Licence Condition 11.1: Waste Management Program

The licensee shall implement and maintain a waste management program.

Preamble

The waste management safety and control area covers 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.

CNSC Regulatory Document REGDOC-2.11, [Framework for Radioactive Waste Management and Decommissioning in Canada](#), describes the national framework and philosophy underlying the CNSC’s approach to regulating the management of radioactive waste.

CNSC Regulatory Document REGDOC-2.11.1, [Waste Management, Volume I: Management of Radioactive Waste](#) defines radioactive waste as any material (liquid, gaseous, or solid) that contains a radioactive nuclear substance, as defined in section 2 of the NSCA, for which no further use is foreseen. In addition to containing nuclear substances, radioactive waste may also contain hazardous substances that are not radioactive, as defined in section 1 of the [General Nuclear Safety and Control Regulations](#).

McMaster’s waste management program consists of requirements under HP-9000, *MNR Radiation Safety Program*, referenced below.

Compliance Verification Criteria

Licensing Basis Publications

Document Number	Document Title	Version	Implementation
REGDOC-2.11.1	Waste Management, Volume I: Management of Radioactive Waste	2021	January 1, 2025

Licencee Documents that Require Notification of Change

Document Title	Document #	Notification
MNR Radiation Safety Program	HP-9000	PN

Guidance

Guidance Publications

Document #	Document Title	Version
CSA N292.0	General Principles for the Management of Radioactive Waste and Irradiated Fuel	2019
CSA N292.3	Management of Low- and Intermediate-Level Radioactive Waste	2014

Licence Condition 11.2: Decommissioning Plan

The licensee shall implement and maintain a decommissioning plan.

Preamble

CNSC Regulatory Document REGDOC-2.11, [Framework for Radioactive Waste Management and Decommissioning in Canada](#), describes the national framework and philosophy underlying the CNSC’s approach to regulating decommissioning.

CNSC Regulatory Document REGDOC-2.11.2, [Decommissioning](#) defines decommissioning as the administrative and technical actions taken to allow the removal of some or all of the regulatory controls from a facility, location or site where nuclear substances are managed, used, possessed or stored. Decommissioning actions are the procedures, processes and work activities (e.g., storage with surveillance, decontamination, dismantling or cleanup) that are taken to retire a facility, location or site from service with due regard for the health and safety of people and the environment.

Compliance Verification Criteria

Licensee Documents that Require Notification of Change

Licensing Basis Publication

Document Number	Document Title	Version
REGDOC-2.11.2	Decommissioning	2021
CSA N294	Decommissioning of Facilities Containing Nuclear Substances	2019

Licensee Documents that Require Notification of Change

Document Title	Document #	Notification
Preliminary Decommissioning Plan	TN-2002-08	PN

1. In accordance with REGDOC-2.11.2, the licensee shall review and, as necessary, update the PDP and submit it to the CNSC every five years or as requested by the CNSC. The current PDP is dated December 2021 and therefore, MNR shall submit a revised PDP no later than December 31, 2026.

Guidance

None provided.

12. SCA – SECURITY

Licence Condition 12.1: Security Program

The licensee shall implement and maintain a security program.

Preamble

The [General Nuclear Safety and Control Regulations](#) requires that a licence application contain information including the proposed measures to control access to the site of the activity to be licensed and the nuclear substance, prescribed equipment or prescribed information.

The [Class I Nuclear Facilities Regulations](#) requires that a licence application to operate a Class I nuclear facility contain information including the proposed measures to prevent acts of sabotage or attempted sabotage at the nuclear facility, including measures to alert the licensee to such acts.

Part 2 of the [Nuclear Security Regulations](#) also applies to this licensee, as it is listed in Schedule 2 of these regulations. Part 2 of the *Nuclear Security Regulations* requires that an application in respect of a nuclear facility listed in Schedule 2 contain a description of the physical protection measures to be undertaken to ensure compliance with Part 2.

CNSC Regulatory Document REGDOC-2.12.3, *Security of Nuclear Substances: Sealed Sources* sets out the minimum security measures that licensees must implement to prevent the loss, sabotage, illegal use, illegal possession, or illegal removal of sealed sources during their entire lifecycle, including while the sources are in storage, transport or being stored during transportation.

Compliance Verification Criteria

Licensing Basis Publications

Document #	Document Title	Version
REGDOC-2.12.3	Security of Nuclear Substances: Sealed Sources and Category I, II and III Nuclear Material	2.1 (2020)

Licensee Documents that Require Notification of Change

Document Title	Document #	Notification
Site Security Report	AP-1420	PN

1. The licensee shall maintain the operation, design and analysis provisions specified in the security plan, including that they ensure adequate engineered safety barriers are in place for protection against malevolent acts.
2. Technical and administrative security measures shall be documented by the licensee in a site security plan.
3. The licensee shall implement and maintain a facility security plan, and ensure it is designated as prescribed information. The site security plan must be reviewed by the licensee when changes occur within the licensed facility and/or to address an increased threat level and updated if required.
4. The licensee shall implement satisfactory security measures to prevent the loss, sabotage, illegal use, illegal possession, or illegal removal of sealed sources while under licensee's control, including while the sources are in storage, transport or being stored during transportation.

Guidance

Guidance Publications

Document #	Document Title	Version
IAEA Nuclear Security Series # 9	Security of Radioactive Material in Transport	2020
IAEA Nuclear Security Series # 11	Security of Radioactive Material in Use and Storage and of Associated Facilities	2019
IAEA Nuclear Security Series # 14	Nuclear Security Recommendation on Radioactive Material and Associated Facilities	2011
IAEA Nuclear Security Series # 15	Nuclear Security Recommendations on Nuclear and Other Radioactive Material out of Regulatory Control	2011

13. SCA – SAFEGUARDS AND NON-PROLIFERATION

Licence Condition 13.1: Safeguards and Non-Proliferation

The licensee shall implement and maintain a safeguards program.

Preamble

The GNSCR require the licensee to take all necessary measures to facilitate Canada’s compliance with any applicable safeguards agreement, and defines reporting requirements for safeguards events.

The [Class I Nuclear Facilities Regulations](#) require that a licence application contain information on the licensee’s proposed measures to facilitate Canada’s compliance with any applicable safeguards agreement.

This LC requires that the licensee implement and maintain a safeguards program. Safeguards is a system of inspection and other verification activities undertaken by the IAEA in order to evaluate a Member State’s compliance with its obligations pursuant to its safeguards agreements with the IAEA.

Canada has entered into a Safeguards Agreement and an Additional Protocol (hereinafter referred to as “safeguards agreements”) with the IAEA pursuant to its obligations under the [Treaty on the Non-Proliferation of Nuclear Weapons](#) (INFCIRC/140). The objective of the Canada-IAEA safeguards agreements is for the IAEA to provide assurance on an annual basis to Canada and to the international community that all declared nuclear materials are in peaceful, non-explosive uses and that there is no indication of undeclared nuclear materials or activities. This conclusion confirms that Canada is in compliance with its obligations under the following Canada-IAEA safeguards agreements:

- (i) *Agreement between the Government of Canada and the International Atomic Energy Agency for the Application of Safeguards in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons; and*
- (ii) *Protocol Additional to the Agreement between Canada and the International Atomic Energy Agency for the Application of Safeguards in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons.*

These are reproduced in information circulars [INFCIRC/164](#) and [INFCIRC/164/Add.1](#).

In addition, the import and export of controlled nuclear substances, equipment and information identified in the [Nuclear Non-proliferation Import and Export Control Regulations](#) require separate authorization from the CNSC, consistent with subsection 3(2) of the GNSCR.

Compliance Verification Criteria

Licensing Basis Publications

Document #	Document Title	Version
REGDOC-2.13.1	Safeguards and Nuclear Material Accountancy	2018

Licensee Documents that Require Notification of Change

Document Title	Document #	Notification
MNR Policy Manual	AP-1000	PN
MNR Safeguards Program	AP-1930	PN

Guidance

None provided.

14. SCA – PACKAGING AND TRANSPORT

Licence Condition 14.1: Packaging and Transport Program

The licensee shall implement and maintain a packaging and transport program.

Preamble

Every person who transports radioactive material, or requires it to be transported, shall act in accordance with the requirements of the [Transportation of Dangerous Goods Regulations](#) (TDGR) and the [Packaging and Transport of Nuclear Substances Regulations, 2015](#) (PTNSR).

The TDGR and PTNSR provide specific requirements for the design of transport packages, the packaging, marking and labeling of packages and the handling and transport of nuclear substances.

Compliance Verification Criteria

Licence Documents that Require Notification of Change

Document Title	Document #	Notification
Shipping Radioactive Materials	IP-5820	NT

MNR shall implement and maintain a packaging and transport program that will ensure compliance with the requirements set out in the TDGR and PTNSR for all shipments of nuclear substances to and from MNR. Shipments of nuclear substances within the nuclear facility where access to the property is controlled are exempted from the application of TDGR and PTNSR.

Guidance

Document Number	Document Title	Version
REGDOC-2.14.1	Volume I, Information Incorporated by Reference in Canada’s Packaging and Transport of Nuclear Substances Regulations, 2015	2021

APPENDIX A – Definitions and Acronyms

A.1. Definitions

The following is a list of definitions of words or expressions used in the LCH that may need clarification; they are defined for the purpose of the LCH only. All other terms and expressions used in the LCH are consistent with the definitions provided in the NSCA, the regulations made pursuant to the NSCA, or in the CNSC regulatory document [REGDOC-3.6, *Glossary of CNSC Terminology*](#).

Accept/ed/able/ance – meets regulatory requirements, which mean it is in compliance with the documents referenced in the LCH.

Approval – Commission’s permission to proceed, for situations or changes where the licensee would be:

- not compliant with a regulatory requirement set out in applicable laws and regulations
- not compliant with a licence condition; and
- not in the safe direction but the objective of the licensing basis is met.

Boundary Conditions – procedural, administrative rules and operating limits for ensuring safe operation of the facility based on safety analyses and any applicable regulatory requirements.

Compliance Verification Criteria – regulatory criteria used by CNSC staff to verify compliance with the licence conditions.

Design Basis – the entire range of conditions for which the nuclear facility is designed, in accordance with established design criteria, and for which damage to the fuel and/or the release of radioactive material is kept within authorized limits.

Guidance – guidance in the LCH is non-mandatory information, including direction, on how to comply with the licence condition.

Notification Document – a document which is submitted to the CNSC at the time of implementing the change.

Prior Notification Document – a document which is submitted to the CNSC prior to implementing the change.

Person authorized by the Commission – The statement “a person authorized by the Commission” in the LCs or the LCH indicates that the Commission may delegate certain authority to CNSC staff. Unless specified otherwise, the delegation of authority by the Commission to act as a person authorized by the Commission is applied to the incumbents listed under LC 3.2.

Program(s) – a documented group of planned activities, procedures, processes, standards and instructions coordinated to meet a specific purpose.

Qualified Staff – trained licensee staff, deemed competent and qualified to carry out tasks associated with their respective positions.

Safe Direction – changes in facility safety levels that would not result in:

- (a) a reduction in safety margins
- (b) a breakdown of barrier
- (c) an increase (in certain parameters) above accepted limits
- (d) an increase in risk
- (e) impairment(s) of safety systems
- (f) an increase in the risk of radioactive releases or spills of hazardous substances
- (g) injuries to workers or members of the public
- (h) introduction of a new hazard
- (i) reduction of the defence-in-depth provisions
- (j) causing hazards or risks different in nature or greater in probability or magnitude than those stated in the safety analysis of the nuclear facility.

Safety and Control Measures – measures or provisions which demonstrate that the applicant:

- (i) is qualified to carry on the licensed activities; and
- (ii) has made adequate provision for the protection of the environment, the health and safety of persons, the maintenance of national security and any measures required to implement international obligations to which Canada has agreed.

Written Notification – a physical or electronic communication between CNSC staff and a person authorized to act on behalf of the licensee.

A.2. Acronyms List

The following is the list of acronyms used in this document:

ALARA	As Low As Reasonably Achievable, social and economic factors taken into consideration
CNSC	Canadian Nuclear Safety Commission
CSA	Canadian Standards Association
CVC	Compliance Verification Criteria
DNCFR	Directorate of Nuclear Cycle and Facilities Regulation
DRL	Derived Release Limits
EMS	Environmental Management System
ERA	Environmental Risk Assessment
FG	Financial Guarantee
GNSCR	<i>General Nuclear Safety and Control Regulations</i>
IAEA	International Atomic Energy Agency
LC	Licence Condition
LCH	Licence Conditions Handbook
MNR	McMaster Nuclear Reactor
NBCC	<i>National Building Code of Canada</i>
NFCC	<i>National Fire Code of Canada</i>
NPFD	Nuclear Processing and Facilities Division
NPROL	Non-Power Reactor Operating Licence
NRRR	Nuclear Reactor Restricted Reserve
NSCA	<i>Nuclear Safety and Control Act</i>
NT	Notification
OLC	Operating Limit and Condition
PDP	Preliminary Decommissioning Plan
PN	Prior Notification
PTNSR	<i>Packaging and Transport of Nuclear Substances Regulations</i>
REGDOC	Regulatory Document
RO	Reactor Operator
RS	Reactor Supervisor
RP	Radiation Protection

SAT	Systematic Approach to Training
SCA	Safety and Control Area
SSC	Structures, Systems and Components
TDG	<i>Transportation of Dangerous Goods</i>
TDGR	<i>Packaging and Transport of Nuclear Substances Regulations</i>
TN	Notification

APPENDIX B – Version Controlled Documents

B.1 Codes, Standards and Regulatory Documents

Document #	Document Title	Version	Licence Conditions
CSA N286	Management systems requirements for nuclear facilities	2012 (R2022)	1.1
CSA N286.0.1	Commentary on N286-12, Management system requirements for nuclear facilities	2021	1.1
CSA N288.0	Environmental management of nuclear facilities: Common requirements of the CSA N288 series of Standards	2022	9.1
CSA N288.1	Guidelines for modelling radionuclide environmental transport, fate, and exposure associated with the normal operation of nuclear facilities	2020	9.1
CSA N288.4	Environmental monitoring programs at nuclear facilities and uranium mines and mills	2019	9.1
CSA N288.5	Effluent and emissions monitoring programs at nuclear facilities	2022	9.1
CSA N288.6	Environmental risk assessments at nuclear facilities and uranium mines and mills	2012	9.1
CSA N288.8	Establishing and implementing action levels for releases to the environment from nuclear facilities	2022	9.1
CSA N292.0	General principles for the management of radioactive waste and irradiated fuel	2019	11.1
CSA N292.3	Management of Low and Intermediate-Level Radioactive Waste	2014	11.1
CSA N294	Decommissioning of Facilities Containing Nuclear Substances	2019	11.2
CSA N393	Fire Protection for Facilities that Process, Handle or Store Nuclear Substances	2022	3.1, 5.1, 10.2
IAEA Nuclear Security Series # 9	Security in Transport of Radioactive Material	2020	12.1

Document #	Document Title	Version	Licence Conditions
IAEA Nuclear Security Series # 11	Security of Radioactive Material in Use and Storage and of Associated Facilities	2019	12.1
IAEA Nuclear Security Series # 14	Nuclear Security Recommendation on Radioactive Material and Associated Facilities	2011	12.1
IAEA Nuclear Security Series # 15	Nuclear Security Recommendations on Nuclear and Other Radioactive Material out of Regulatory Control	2011	12.1
IAEA NS-G-4.2	Maintenance, Periodic Testing and Inspection of Research Reactors	2006	6.1
IAEA SSG-10	Ageing Management for Research Reactors	N/A	6.1
IAEA SSR-3	Safety of Research Reactors	2016	4.1
NBCC	National Building Code of Canada	2010/2020*	3.1, 5.1, 10.2
NFCC	National Fire Code of Canada	2010/2020*	3.1, 5.1, 10.2
NFPA-801	Standard for Fire Protection for Facilities Handling Radioactive Materials	N/A	10.2
RD-367	Design of Small Reactor Facilities	2011	5.1
REGDOC-2.1.1	Management System	2019	1.1
REGDOC-2.1.2	Safety Culture	2018	1.1
REGDOC-2.10.1	Nuclear Emergency Preparedness and Response	2016	10.1
REGDOC-2.11.1	Waste Management, Volume II: Assessing the Long-Term Safety of Radioactive Waste Management	2021	11.1
REGDOC-2.11.2	Decommissioning	2021	G.3, 11.2
REGDOC-2.12.3	Security of Nuclear Substances Sealed Sources and Category I, II and III Nuclear Material	2020	3.1, 3.2, 12.1
REGDOC-2.13.1	Safeguards and Nuclear Material Accountancy	2018	13.1

Document #	Document Title	Version	Licence Conditions
REGDOC-2.14.1	Volume I, Information Incorporated by Reference in Canada's Packaging and Transport of Nuclear Substances Regulations, 2015	2021	14.1
REGDOC-2.2.2	Personnel Training	2016	2.1
REGDOC-2.4.1	Deterministic Safety Analysis	2014	4.1
REGDOC-2.4.3	Nuclear Criticality Safety	2020	4.2
REGDOC-2.5.1	General Design Considerations: Human Factors	2019	5.1
REGDOC-2.5.2	Design of Reactor Facilities	2023	5.1
REGDOC-2.6.3	Aging Management	2014	6.1
REGDOC-2.7.1	Radiation Protection	2021	7.1
REGDOC-2.7.2	Dosimetry, Volume I: Ascertaining Occupational Dose	2021	7.1
REGDOC-2.8.1	Conventional Health and Safety	2019	8.1
REGDOC-2.9.1	Environmental Principles, Assessments and Protection Measures	2020	9.1
REGDOC-3.1.2	Reporting Requirements for Non-Power Reactor: Class I Facilities and Uranium Mines and Mills	2022	3.2, 9.1
REGDOC-3.2.1	Public Information and Disclosure	2018	G.4
REGDOC-3.3.1	Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities	2021	G.3
REGDOC-3.5.1	Information Dissemination: Licensing Process for Class I Nuclear Facilities and Uranium Mines and Mills, Version 2.1	2022	G.1
REGDOC-3.5.3	Regulatory Fundamentals	2018	G.1
REGDOC-3.6	Glossary of CNSC Terminology	2022	Appendix A

* NBCC and NFCC 2010 are currently listed as CVC. The 2020 versions are the subject of a gap analysis by McMaster University, to be completed by December 31, 2024. The 2020 versions will be implemented as CVC under an implementation plan following the gap analysis.

B.2 Licensee Documents

Documents referenced by the licensee in support of the licence application and ongoing licensing requirements that are referenced within the LCH.

Document Title	Document #	Notification	Licence Conditions
McMaster University, Non-Power Operating Licence Renewal Application	e-Doc 7021967	N/A	G.1
CNSC Financial Security and Access Agreement	e-Doc 7032446	PN	G.3
Deed of Trust	e-Doc 7032447	PN	G.3
Public Disclosure Protocol	AP-1901	NT	G.4
Policy Manual	AP-1000	PN	1.1, 13.1
Training of Staff	AP-1150	PN	2.1
Training Plan: Reactor Operator & Reactor Supervisor	AP-1140	PN	2.1
Supplementary Facility-Specific Training for Reactor Supervisors	TP-6009	PN	2.1, 2.3
Training and Qualification Guide for Health Physics Staff at MNR	HP-9004	NT	2.1
Evaluations: Preparing, Conducting and Grading	TP-6006	PN	2.2, 2.3
Certification Examinations	TP-6008	PN	2.2
Reactor Operating Policies	AP-1120	NT	3.1
Change Control	AP-1010	PN	3.1
MNR Operating Limits and Conditions	AP-1111	PN	3.1
MNR Safety Analysis Report	OPS-LBD-MNR-0002	PN	4.1
Defence-in-Depth of the McMaster Nuclear Reactor	TR-2011-01	PN	4.1, 5.1
Nuclear Criticality Safety Program	AP-1600	PN	4.2
MNR Nuclear Criticality Safety Analysis	TN-2009-01	PN	4.2

Document Title	Document #	Notification	Licence Conditions
MNR Maintenance Program	MT-4000	PN	6.1
Calibration of Equipment	AP-1190	NT	6.1
Status of MNR Structures, Systems and Components	TN-2010-04	PN	6.1
MNR Radiation Safety Program	HP-9000	PN	7.1, 9.1, 11.1
Workplace and Environmental Health and Safety Policy	RMM-100	NT	8.1, 9.1
Environmental Protection Act of Ontario and Other Federal, Provincial and Municipal Environmental Statutes	RMM-103	PN	9.1
Derived Release Limits for the McMaster Nuclear Reactor	HP-REP-MNR-00006	PN	9.1
Environmental Risk Assessment	OPS-LBD-MNR-0003	PN	9.1
MNR Emergency Preparedness Plan	EP-7000	PN	10.1
Fire Protection Program	EP-7400	PN	10.2
Inspection, testing and maintenance of the MNR Fire Systems	MT-4520	PN	10.2
Fire Hazard Assessment	N/A	PN	10.2
Fire Safe Shutdown Analysis	TR-2009-01	PN	10.2
Preliminary Decommissioning Plan	TN-2002-08	PN	G.3, 11.2
Site Security Report	AP-1420	PN	12.1
MNR Safeguards Program	AP-1930	PN	13.1
Shipping Radioactive Materials	IP-5820	PN	14.1

APPENDIX C – Certification Requirements for Reactor Operators

1. QUALIFICATION REQUIREMENTS

A person seeking certification by the CNSC as Reactor Operator (RO) at MNR shall, at the time of certification, meet the certification requirements specified in sections 1.1 to 1.3.

- 1.1 **Education:** College diploma or university degree which includes credits in science and mathematics.
- 1.2 **Experience:** Minimum of twelve months of experience at MNR or an equivalent nuclear facility.
- 1.3 **Training:** A person seeking certification as RO at MNR shall, at the time of the certification, meet the requirements specified in section 2.

2. INITIAL TRAINING REQUIREMENTS

A person seeking certification as RO for the MNR shall, at the time of certification, meet the requirements specified in this section.

Training

2.1 The candidate RO must have successfully completed training covering:

- (a) Science fundamentals relevant to the operation at the facility
- (b) Principles of operation of facility equipment
- (c) Radiation fundamentals
- (d) Radiation hazards
- (e) Radiation protection theory and practices
- (f) Radiation protection procedures used during normal, abnormal and emergency operation at the facility
- (g) Design and operation of facility systems
- (h) Integrated operation of facility systems including, where applicable, interactions between the systems of the nuclear reactor
- (i) Expected response of facility systems to accident conditions
- (j) Technical bases for emergency operating procedures
- (k) Diagnosis of equipment failures and assessment of abnormal facility conditions
- (l) Phenomena that may significantly affect core reactivity and neutron flux shape

- (m) Reactor fueling, fueling limitations, fuel handling and storage, and irradiated fuel cooling
- (n) Configuration of systems and equipment isolation required for maintenance activities
- (o) Safety culture
- (p) Principles of nuclear safety and their application
- (q) The facility licence and documents referenced in the licence
- (r) Situations that may result in the violation of conditions in the facility licence and OLCs
- (s) Administrative procedures related to facility operation and maintenance; and
- (t) The responsibilities and authority of a RO and of other facility personnel who interface with the RO.

This training shall include written examinations that confirm and document that, at the completion of the training, the person has the required knowledge and skills to perform the duties of a RO. The person must complete this training before taking the certification examination specified in section 3.

On-The-Job Training

2.2 The person must have completed on-the-job training, covering:

- (a) Standard control room operating practices
- (b) Authorization of maintenance and repair of facility systems

This training shall include formal performance evaluations that confirm and document that, at the completion of the training, the person has the required knowledge and skills to perform the duties of a RO. The person must complete this training before taking the certification examination specified in section 3.

Performing Duties under Supervision

2.3 Has successfully performed RO duties under the supervision of a certified RO for a minimum of 160 hours, after the person has met the requirements of sections 2.1 to 2.2.

Facility Management Interview

2.4 Has successfully completed an interview administered by facility management that confirms and documents the person's competence to perform the duties of RO. The person must complete this interview after having met the requirements specified in sections 2.1 to 2.3 and prior to the certification examination specified in section 3.

3. COMMISSION EXAMINATIONS FOR INITIAL CERTIFICATION

A person seeking certification as RO at MNR shall, at the time of certification, have successfully completed a Commission examination for Reactor Operators within one year prior to certification. This examination covers topics specified in sections 2.1 to 2.4 and those aspects of facility operation, both normal and abnormal, that may result in the discharge of radioactivity to the environment, or which could affect the safety of facility personnel or of members of the public.

4. CONTINUING TRAINING

- 4.1 Each RO must complete, on a regular basis over a cycle not exceeding five years, continuing training, covering:
- (a) A review of the knowledge learned during initial training that is not maintained through the day-to-day operation of the facility and that is required to work competently in the applicable position
 - (b) Drill exercises that cover infrequent normal operations
 - (c) Drill exercises that cover a varied number of situations that challenge the diagnostic and decision-making abilities of the certified person and ensure that the person is, at all times, proficient in selecting and using abnormal and emergency operating procedures; and
 - (d) Exercises and drills conducted at the facility, on a regular basis, to ensure that each certified person is ready to respond to accidents and emergencies
- 4.2 Each RO must complete update training promptly following changes in the facility or events, covering:
- (a) Changes to facility systems
 - (b) Changes to licensee's and facility policies, standards and procedures
 - (c) Changes to regulatory requirements
 - (d) Changes to the facility licence or to documents referenced in the licence; and
 - (e) Research reactor and industry experience and operating events
- 4.3 Each RO must complete at least once every five years knowledge and performance evaluations that confirm and document that the person possesses the knowledge and the skills covered during continuing training.

Requalification tests

- 4.4 During the period of certification, each RO seeking renewal of certification shall complete a written re-qualification test administered by the licensee. The test shall sample the topics in subsections 2.1 and 2.2 above, and those aspects of facility operation, both normal and abnormal, that may result in the discharge of radioactivity to

the environment, or which could affect the safety of facility personnel or of members of the public.

5. TRAINING PROGRAM AND PROCESS REQUIREMENTS FOR CERTIFICATION

Training and qualification of persons

- 5.1 The licensee shall establish and document policies and procedures for training, qualifying, and maintaining qualification of persons seeking or holding certifications for the position of RO.
- 5.2 The licensee shall establish and implement a training program for certified positions in accordance with the principles of a systematic approach to training. The licensee shall establish and document:
 - (a) Initial training programs to address the training requirements specified in section 2.1, for the position of RO
 - (b) Continuing training programs to address the training requirements for the refresher and update training, specified in sections 4.1 and 4.2, for each position of RO

Evaluation of persons during training

- 5.3 The licensee shall administer the evaluations, specified in sections 2.1 and 2.2 in accordance with a documented process covering:
 - The requirements applicable to the different types of evaluations
 - The number and scope of the evaluations associated with the different segments of training
 - The procedures covering the development, conduct and grading of:
 - (a) The written and oral evaluations associated with initial training
 - (b) The performance evaluations associated with initial on-the-job training
 - (c) The knowledge evaluations associated with continuing training; and
 - (d) The performance evaluations associated with continuing training
 - The requirements and procedures for ensuring the security of the evaluations; and
 - The qualification requirements of the persons responsible for the development, conduct and grading of:
 - (a) The written and oral evaluations associated with initial training
 - (b) The performance evaluations associated with initial on-the-job training
 - (c) The knowledge evaluations associated with continuing training; and
 - (d) The performance evaluations associated with continuing training

Facility management interviews

- 5.4 The licensee shall establish and document procedures for preparing and conducting the facility management interviews specified in sections 2.4.

Commission examinations for initial certification

- 5.5 The licensee shall establish and document procedures for the certification examinations specified in section 3. These must include the scheduling, preparing the draft examination, obtaining CNSC approval of the certification examination, conducting and grading examinations.

Requalification tests

- 5.6 The licensee shall establish and document procedures to develop, conduct and grade the re-qualification tests specified in section 4.4.

Removal of a person from the duties of a position

- 5.7 The licensee shall immediately remove a person from the duties of RO under the conditions specified in sections 5.7.1 to 5.7.4.
- 5.7.1 The person has failed any of the re-qualification tests referred to in section 4.3.
- 5.7.2 The person is not capable, in the opinion of the licensee, of performing the duties of the position of RO for any reason, including a physical or mental limitation.
- 5.7.3 The person and the licensee have been informed in writing that the CNSC has initiated procedures for the decertification of the person.

Reinstatement of a person to the duties of a position

- 5.8 The licensee may reinstate a person who has been removed from the duties of RO under section 5.7, to the duties of the position if:
- The basis for removing the person from the duties of the position is no longer applicable; and
 - The person meets the requirements specified in sections 5.8.1 to 5.8.5.
- 5.8.1 The person must have completed update training specified in section 4.2 covering changes or events that have occurred during the absence of the person from the position, including a performance evaluation as specified in section 4.3.
- 5.8.2 The person must have completed training covering selected topics that shall be based on a documented assessment by the licensee of the impact of the person's absence from the position on the knowledge and competence of the person. This training shall include written and performance evaluations that confirm and document that, at the completion of

the training, the person has the required knowledge and skills to perform the duties of the position.

- 5.8.3 The person has successfully completed, within a two-year period prior to returning to the duties of the position, one written re-qualification test specified in section 4.4.
- 5.8.4 The person has performed the duties of the position under the supervision of a certified incumbent of the position for the number of shifts that the licensee considers necessary to confirm that the person can perform those duties competently and safely.
- 5.8.5 The person has completed an interview administered by facility management that confirms and documents the person's competence to perform the duties of the position. The person must complete this interview after having met the requirements specified in sections 5.8.1 to 5.8.4.
- 5.8.6 The licensee may reinstate a person who has been removed from the duties of Reactor Operator, under section 5.7.3, to the duties of the position upon being informed in writing of the CNSC decision not to decertify the person after the person or the licensee has been heard in accordance with the procedure referred to in section 13 of the *Class I Nuclear Facilities Regulations*.

6. RETENTION OF RECORDS

The licensee shall retain the records specified in sections 6.1 to 6.3 for a minimum period of ten years.

Governing Documentation

- 6.1 The licensee shall retain the policies, standards and procedures for training and qualifying persons seeking a certification and for training and maintaining the qualification of persons holding a certification, including:
- (a) The procedures for reviewing and approving the outcome of each phase of the systematic approach to training
 - (b) The procedures for administering evaluations to persons seeking or holding a certification
 - (c) Interviews to persons seeking a certification
 - (d) The procedures for administering re-qualification tests and interviews to persons seeking renewal of a certification; and
 - (e) The procedures for the retention of training records for persons seeking or holding a certification

Responsibilities

- 6.2 The licensee shall retain records of the responsibilities of the line organization and those of personnel in the training organization with respect to training and qualification of persons seeking or holding a certification.

Documentation of Training Programs

- 6.3 For each position that requires a certification, the licensee shall retain records of:
- The outcome of the analysis performed to identify training needs, including:
 - (a) A description of the process followed to conduct the analysis
 - (b) The names and qualifications of the persons who participated in the analysis
 - (c) The task list obtained from the analysis
 - (d) The criteria used in selecting tasks for training; and
 - (e) The list of the knowledge and skills required to perform the selected tasks
 - The outcome of the design of training programs, including the training objectives.
 - The outcome of the development of training programs, including:
 - (a) The lesson plans, training guides; and
 - (b) The training manuals and any other training material used by the trainers and the trainees
 - The outcome of the implementation of training programs, including for each course or session in a program:
 - (a) The names of the trainees
 - (b) The dates when the training was delivered
 - (c) The names and positions of the persons who delivered the course or session
 - (d) A copy of the evaluations of trainees conducted, with the expected answers or performance, as applicable; and
 - (e) The names and positions of the people, who developed, conducted and graded the evaluations of trainees
 - The outcome of the formal evaluations of training programs conducted by the licensee or by external organizations.

Personal records

- 6.4 The licensee shall retain the records specified in sections 6.4.1 to 6.4.7 for each person seeking or holding a certification. These records shall be kept for the period that the worker is employed by the licensee and for five years after the worker ceases to be employed, as specified in subsection 14(5) of the *Class I Nuclear Facilities Regulations*.

Records of Education

6.4.1 The licensee shall retain the name and address of the educational establishments where the certificates or degrees required for the position were obtained.

Records of Experience

6.4.2 The licensee shall retain the name and address of the facilities where the experience required for the position was obtained, indicating the type and the number of years of experience.

Training Records

6.4.3 The licensee shall retain records of the initial training and continuing training received, including the dates when training was received.

Records of Evaluations and Interviews

6.4.4 The licensee shall retain the dates and the results of all evaluations and interviews required for the position.

Temporary Removals from Position

6.4.5 The licensee shall retain records of any temporary removal of the person from the position by the licensee, the reasons for the removal and actions taken to reinstate the person in the position.

Certification examination Records

6.4.6 The licensee shall retain the certification examination records.

Requalification Test Records

1.4.7 The licensee shall retain the re-qualification test records.

APPENDIX D – Qualification Requirements for Reactor Supervisors

1. QUALIFICATION REQUIREMENTS

A person seeking an appointment in a position of Reactor Supervisor (RS) at MNR shall, at the time of the appointment, meet the qualification requirements specified in sections 1.1 to 1.4.

- 1.1 **Education:** Baccalaureate in engineering or science from a recognized university.
- 1.2 **Experience:** Minimum of eighteen months of experience at MNR or an equivalent nuclear facility.
- 1.3 **Training:** Supplemental Training Requirements specified in section 2.
- 1.4 **Certification:** A person seeking an appointment as RS at MNR shall hold and maintain a certification as RO.

2. SUPPLEMENTAL TRAINING REQUIREMENTS

- 2.1 In addition to the initial training required for the RO, the candidate for the RS position must have successfully completed the supplemental facility-specific training covering:
 - (a) Reactor physics, principles of reactor operation and fueling strategies
 - (b) Phenomena that may significantly affect core reactivity and neutron flux shape
 - (c) Properties of irradiated fuel, principles of fuel cooling and physics of fuel failures
 - (d) Operating constraints and limits associated with reactor fueling and irradiated fuel cooling
 - (e) Reactor safety, heat transfer mechanisms and fluid mechanics
 - (f) Primary and back-up heat sinks
 - (g) Conventional and radiation hazards to facility personnel and to the public, including hazards from postulated accident conditions
 - (h) Handling of conventional and radiation emergencies
 - (i) Design requirements of safety-related equipment and systems
 - (j) Design features and limitations of facility equipment and systems
 - (k) Chemical control of systems
 - (l) Diagnosis of equipment failures and assessment of abnormal facility conditions
 - (m) Expected response of facility systems to accident conditions
 - (n) Operating strategies
 - (o) Facility safety analyses, including major assumptions in the facility accident analyses and technical bases for emergency operating procedures

- (p) Configuration of systems and equipment isolation required for maintenance activities
- (q) Design and operation of facility systems for which the ROs do not have direct operational control, including fuel handling
- (r) The licensee's policies, standards and procedures
- (s) The facility licence and documents referenced in the licence
- (t) Situations that may result in the violation of conditions in the facility licence and OLCs
- (u) Requirements pertaining to facility operation in federal and provincial acts and regulations, and in relevant standards and codes
- (v) Responsibilities and authority of the RS, and of other facility personnel who report to or interface with the RS; and
- (w) Qualification requirements of facility personnel who report to the RS

This training shall include written and oral evaluations confirming and documenting that the person has the required knowledge skills to perform the duties of a RS.

2.2 The person must have completed on-the-job training, covering:

- (a) Operation and monitoring of facility systems by the RS under normal, abnormal and emergency conditions; and
- (b) Supervision and direction of facility operations in the control room under normal, abnormal and emergency conditions

This training shall include performance evaluations, confirming and documenting that the person has the required knowledge and skills to perform the duties of a RS.

2.3 The candidate for the RS position must have successfully performed RS duties under the supervision of a certified RS for a minimum of 160 hours, after the person has met the requirements of sections 2.1 to 2.2.

2.4 The candidate for the RS position must have successfully completed an interview administered by facility management, confirming and documenting the person's competence to perform the duties of a RS. The person must complete this interview after having met the requirements specified in sections 2.1 to 2.3.

3. QUALIFICATION OF REACTOR SUPERVISORS

The licensee may appoint a candidate to the position of RS once the candidate has met all the training, experience and certification requirements specified in sections 1 and 2, and that the licensee is satisfied that the candidate is competent to perform the duties of a RS.

4. CONTINUING TRAINING

- 4.1 Each RS must complete, on a regular basis over a cycle not exceeding five years, continuing training, covering:
- (a) A review of the knowledge learned during initial training that is not maintained through the day-to-day operation of the facility and that is required to work competently in the applicable position
 - (b) Drill exercises that cover infrequent normal operations
 - (c) Drill exercises that cover a varied number of situations that challenge the diagnostic and decision-making abilities of the RS and ensure that the person is, at all times, proficient in selecting and using abnormal and emergency operating procedures; and
 - (d) Exercises and drills conducted at the facility, on a regular basis, to ensure that the RS is ready to respond to accidents and emergencies
- 4.2 Each RS must complete update training for RS promptly following changes in the facility or events, covering:
- (a) Changes to facility systems
 - (b) Changes to licensee's and facility policies, standards and procedures
 - (c) Changes to regulatory requirements
 - (d) Changes to the facility licence or to documents referenced in the licence; and
 - (e) Research reactor and industry experience and operating events
- 4.3 Each RS must complete at least once every five years, knowledge and performance evaluations confirming and documenting that the person possesses the knowledge and the skills covered during continuing training.

5. REMOVAL OF A PERSON FROM THE DUTIES OF A POSITION

- 5.1 The licensee shall immediately remove a person from the duties of RS under the conditions specified in sections 5.1.1 to 5.1.3.
- 5.1.1 The person has failed to maintain their certification as RO in accordance with the requirements of Appendix C.
 - 5.1.2 The person is not capable, in the opinion of the licensee, of performing the duties of the position of RS for any reason, including a physical or mental limitation.
 - 5.1.3 The person has failed to pass any of the evaluations related to the qualification of the RS.

6. REINSTATEMENT OF A PERSON TO THE DUTIES OF A POSITION

- 6.1 The licensee may reinstate a person who has been removed from the duties of RS under section 5, to the duties of the position if:
- 6.1.1 The basis for removing the person from the duties of the position is no longer applicable
 - 6.1.2 The person must have completed update training specified in section 4.2 covering changes or events that have occurred during the absence of the person from the position, including a performance evaluation as specified in section 4.3
 - 6.1.3 The person has completed an interview administered by facility management that confirms and documents the person's competence to perform the duties of the position

Retention of Records

- 7.0 The licensee shall retain the records specified in section 7.1 for a minimum period of ten years.

Governing Documentation

- 7.1 The licensee shall retain the policies, standards and procedures for training and qualifying persons as RS, including:
- (a) The procedures for reviewing and approving the outcome of each phase of the systematic approach to training
 - (b) The procedures for administering evaluations to persons seeking or holding a qualification as RS
 - (c) Interviews to persons seeking a qualification as RS
 - (e) The procedures for the retention of training records for persons seeking or holding a qualification as RS

Documentation of Training Programs

- 7.2 The licensee shall document the training program for RS in accordance with the dispositions under Appendix C, section 6.3.

Personal records

- 7.3 The licensee shall retain the records specified in sections 7.3.1 to 7.3.5 for each person seeking or holding a certification. These records shall be kept for the period that the worker is employed by the licensee and for five years after the worker ceases to be employed.

Records of Education

7.3.1 The licensee shall retain the name and address of the educational establishments where the certificates or degrees required for the position were obtained.

Records of Experience

7.3.2 The licensee shall retain the name and address of the facilities where the experience required for the position was obtained, indicating the type and the number of years of experience.

Training Records

7.3.3 The licensee shall retain records of the initial training, supplementary and continuing training received, including the dates when training was received.

Records of Evaluations and Interviews

7.3.4 The licensee shall retain the dates and the results of all evaluations and interviews required for the position.

Temporary Removals from Position

7.3.5 The licensee shall retain records of any temporary removal of the person from the position by the licensee, the reasons for the removal and actions taken to reinstate the person in the position.