



CLASS 1B LICENCE APPLICATION: MCMASTER UNIVERSITY - CENTRE FOR ADVANCED NUCLEAR SYSTEMS

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EXECUTIVE SUMMARY

The Centre for Advanced Nuclear Systems (CANS) facility was established to support research in materials science, alloy development and next generation nuclear technologies, and is also used to support medical isotope supply-chain activities. The facility is owned by McMaster University and is located near the Class 1A McMaster Nuclear Reactor and its adjacent Nuclear Research Building, which supports Nuclear Substances and Radiation Devices research, development and processing activities.

The CANS Facility was designed to handle and process high activity components from CANadian Deuterium Uranium (CANDU) reactors, and this work has been performed successfully, since the facility was commissioned in 2019. The facility has also been used to support the Canadian Lu-177 radiopharmaceutical supply chain, through the decanning of isotopes irradiated at CANDU reactors, making the university part of the largest Lu-177 supply chains in the world.

The CANS Facility currently operates under its own specific Nuclear Substances and Radiation Devices licence, for the Consolidated Uses of Nuclear Substances (Type 815), issued by the Canadian Nuclear Safety Commission (CNSC). On May 21, 2025, McMaster University applied for a time-limited exemption to the McMaster University NSRD licence possession limits for nuclear activities at the CANS facility. Specifically, McMaster University requested that the total activity possession limit set for the year would be increased above the limit for this licence type ($>10^{15}$ Bq), as defined in the [Class I Nuclear Facilities Regulations](#). This time-limited exemption ensured the uninterrupted Canadian supply of Lu-177, while McMaster applied for a Class 1B licence for the CANS facility.

McMaster University has a long history of safe and compliant nuclear activities, and believes that its experience, qualified staff and strong safety programs positions CANS well to continue to support nuclear research activities and the current Canadian and global supply chain as a Class 1B Facility. Specifically, the CANS facility at McMaster University is well positioned to help support the critical supply of Lu-177 to patients with advanced prostate cancer and the continued work will ensure patients maintain access to this life-saving therapy. Materials research, for which the facility was originally designed, will also support Canada's clean energy initiatives. The facility will also be utilized as an integral part of McMaster's nuclear education programs, ensuring that the next generation of nuclear workers will have an opportunity for hands-on experiential learning, as part of their undergraduate programs, graduate programs and research activities.

This application, together with its referenced supporting governance, is submitted to the CNSC to support the issuance of a Class 1B licence for research and operational activities of the McMaster University CANS Facility.

A licence period of 10 years is being requested, based on the facility already being established, McMaster University's decades of licensed activity experience, including more than 65 years operating a Class 1A research reactor, six years of CANS Facility Operating Experience already available and an experienced workforce supporting the licensed activity.

1.0 INTRODUCTION

1.1 Background

As Canada's Nuclear University, nuclear research activities have been a unique and integral part of the McMaster University research strategy and educational mandate. McMaster University has been performing nuclear research activities since the establishment of the Nuclear Research Building (NRB), as the 9th building on campus, in 1951. The university currently holds a range of licenses, from Class 1A and Class II to smaller Nuclear Substances and Radiation Devices (NSRD) and Human Research licenses. The university also supports the licensed activities of other organizations within the greater Hamilton Area, offering its nuclear and health physics expertise, to ensure the safe and compliant uses of nuclear substances for more than 1,000 Nuclear Energy Workers.

Nuclear activities on the McMaster University campus include the Center for Advanced Nuclear Systems (CANS) Facility, which is a suite of interconnected hot cells and a Scattering Electron Microscope/Focused Ion Beam (SEM/FIB) instrument for Post-Irradiation Examination of nuclear components. The facility was designed to support research in materials science, alloy development and next generation nuclear technologies, and is also used to support medical isotope supply-chain activities.

Primary construction of the CANS facility was completed in April of 2015. This included all walls, windows and shielding of the cells, ventilation, major in-cell and facility infrastructure (such as tables, pass-throughs, lifts, cranes and manipulators) but did not include in-cell equipment. In-cell equipment installation and initial cold operation was completed in late summer of 2018. Hot commissioning using T6061 Aluminum activated in the McMaster Nuclear Reactor (MNR) was completed in November of 2019 [1].

The CANS Facility currently operates under its own specific NSRD licence Type 815 [2], for the Consolidated Uses of Nuclear Substances, issued by the Canadian Nuclear Safety Commission (CNSC).

1.2 Facility Location

McMaster University acknowledges that it is located on the traditional territories of the Mississauga and Haudenosaunee nations, within the lands protected by the Dish with One Spoon Wampum agreement.

McMaster University is located at the western end of the City of Hamilton, west of the community of Westdale and east of the community of Dundas, as shown in Figure 1.



Figure 1: McMaster University campus in Hamilton, Ontario, Canada.

The campus is bounded on the west by Cootes Drive, on the east by Forsythe Avenue, on the south by Main Street, and on the North by Cootes Paradise. The University is situated on lands previously owned and maintained by the Royal Botanical Gardens. The address of the CANS Facility is:

McMaster University – Centre for Advanced Nuclear Systems
Tandem Accelerator Building #32
1280 Main Street West
Hamilton, Ontario, L8S 4K1, Canada

The McMaster CANS Facility is a research facility located within the Tandem Accelerator Building (TAB) on the campus of McMaster University in Hamilton, Ontario (Building #32), as shown in Figure 2.

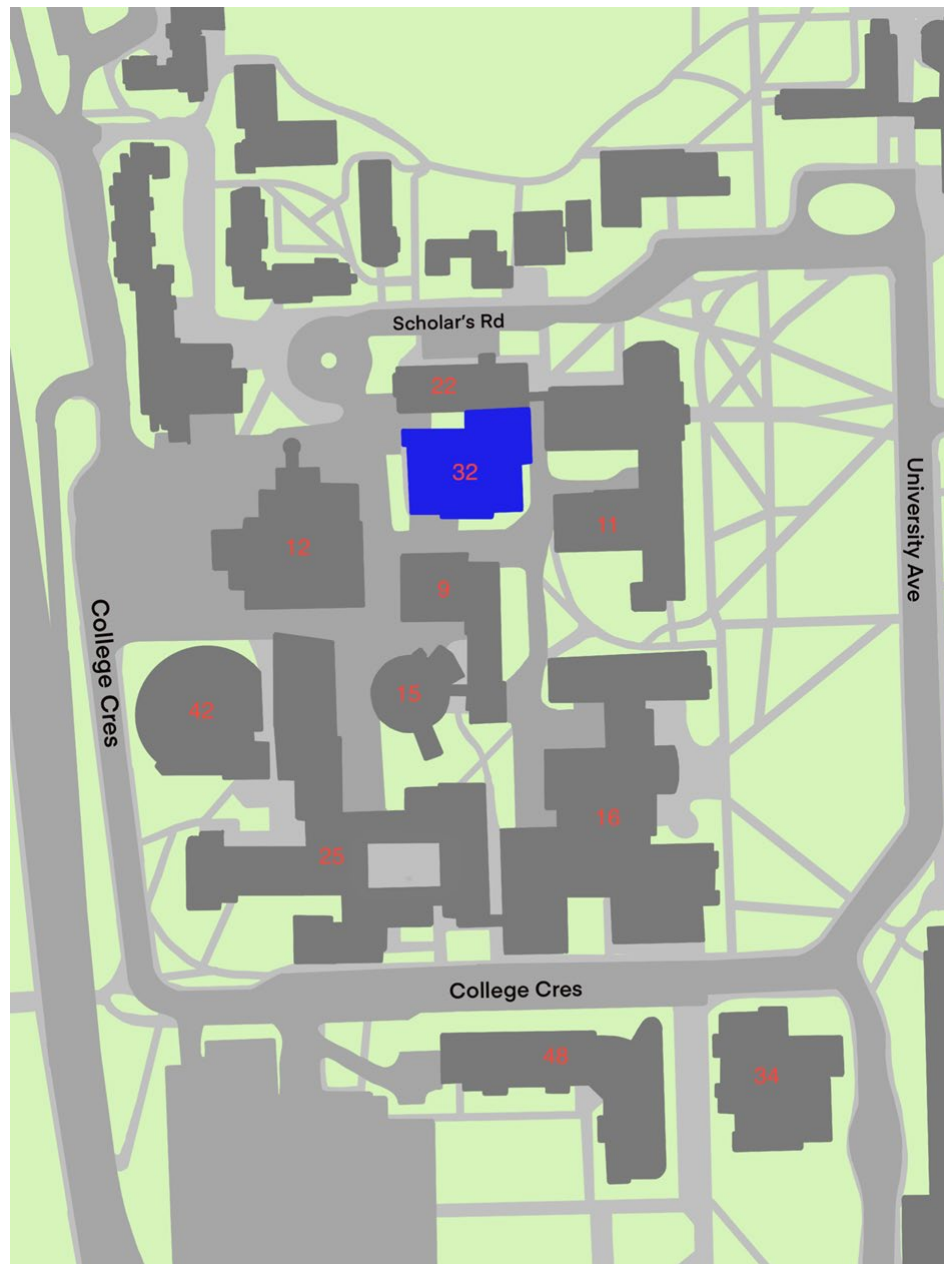


Figure 2: Location of the Tandem Accelerator Building (#32) on the McMaster campus.

The CANS Facility is located primarily in room 105 on the first floor of the Tandem Accelerator Building (TAB), which is Building #32 on campus. TAB is located on the west side of the McMaster University campus. All buildings and areas adjacent to TAB are owned and controlled by McMaster University.

Adjacent to the CANS Facility, within TAB, are the McMaster University Cyclotron Facility (MUCF) and the McMaster Accelerator Facility (MAL). The MUCF a licensed Class II Facility

and houses a 16.8 MeV Cyclotron which supports radioisotope research, development and production activities. The MAL is licensed as a Class II Facility and operationally houses a Tandatron accelerator, a D-D Generator and a Cs-137 Irradiator. MAL also includes two accelerators which have been removed from service and safe-stated, while McMaster plans for their decommissioning. TAB also contains x-ray devices, used for research activities under the regulatory control of the Province of Ontario, Ministry of Labour, Immigration, Training and Skills Development.

Other notable buildings near TAB are the McMaster Nuclear Reactor (MNR) and the Nuclear Research Building (NRB), which are both located just south of the CANS Facility. MNR is licensed as Class 1A Research Reactor. The NRB houses McMaster's High Level Laboratory Facility, which supports research and radioisotope development and processing activities under NSRD Consolidated Uses of Nuclear Substances and Processing licenses, respectively.

The McMaster University Medical Centre (MUMC) is also located on the south-east end of the campus, which includes a nuclear medicine clinic, which is separately licensed and managed by Hamilton Health Sciences (HHS). HHS was formed in 1996 through the amalgamation of several existing hospital systems. Today, it is one of Ontario's largest teaching hospitals, acting as the primary clinical partner for McMaster University's Michael G. DeGroote School of Medicine. McMaster University operates various research laboratories within the MUMC building, licensed under McMaster's NSRD Consolidated Uses of Nuclear Substances licence. The McMaster Nuclear Organization also supports and collaborates with AtomVie Global Radiopharma Inc., which performs radioisotope processing activities within MUMC under their own NSRD processing license.

1.3 Facility Ownership

The McMaster University Act is a provincial statute passed by the Legislative Assembly of Ontario that legally establishes McMaster University, grants it the authority to confer degrees, and defines its internal governance structure. The current governing legislation is the McMaster University Act, 1976.[3]

The legislation provides the foundational legal and operational framework for the university, including its Governance Structure, which makes the Board of Governors responsible for managing the university's property, finances, and business affairs, while the University Senate directs the institution's academic work.

The Act also provides McMaster University with corporate autonomy, establishing McMaster as a legal entity capable of holding property, entering into contracts, and providing the authority to govern its own faculty, staff, and student body. It also establishes the McMaster President and Vice-Chancellor as the responsible Executive under the Act.

McMaster University owns the McMaster campus and all the buildings on its land, including the CANS Facility, with the President and Vice-Chancellor being the authorized representative under the Act.

1.4 Facility Activities and Processes

The CANS Facility was designed to handle and process high activity components from CANadian Deuterium Uranium (CANDU) reactors, and this work has been performed successfully, since the facility was commissioned in 2019. The facility has also been used to support the Canadian Lu-177 radiopharmaceutical supply chain, through the decanning of isotopes irradiated at CANDU reactors.

The CANS Hot Cell Facility operates in a single, well-defined operating mode characterized by planned, campaign-based activities that include material receipt, machining, sample preparation, microscopy support, and radionuclide decanning, all performed within fully enclosed hot-cell confinement. The facility transitions through normal operation, maintenance, and shutdown/standby states, but does not employ multiple power states or production cycles. All work is performed under procedural control with ventilation, monitoring, and interlocks active whenever radioactive material is present. During maintenance or shutdown, hot cells remain under negative pressure with no active processing, and radioactive material is secured in shielded storage wells or removed from the facility. The consistent operating profile and absence of mode-dependent configurations ensure that safety functions, confinement, ventilation, monitoring, and shielding remain fully in effect throughout all operating conditions.

There are five (5) workstations in the hot cell complex: Receiving, Machining, Sample Preparation, Material Testing and Optical Microscopy. The exterior of the hot cell workstations are shown in Figure 3.



Figure 3: Center for Advanced Nuclear Systems Hot Cell exterior workstations.

The Receiving and Machining cells are designed to allow handling up to a maximum of 5.56 TBq (150 Ci) of Co-60 and the other cells for 0.56 TBq (15 Ci) of Co-60. The cells are all constructed of steel and high-density concrete and each workstation has a shielded optical window and a pair of mechanical manipulators. The hot cells are interconnected by pass-through openings, which support the transfer of materials between hot cells and out to the fume hood located in the microscopy room at the east end of the facility.

1.3.1 High Activity CANDU Component Handling Experience

High Activity CANDU components are transferred to the Receiving Cell through shielded vertical or horizontal transfer flasks, to reduce exposure and control contamination. The hoist and manipulator arms within the Receiving Cell are utilized to access, handle, inventory and characterize the component. Radiation monitors within the Receiving Cell support dose rate characterization and a shielded port within the hot cell provides storage capacity for high activity components.

A pass-through port allows characterized and inventoried high activity components to be transferred to the Machining Cell, where they can be segmented on the mill within the hot cell.

From the Machining Cell samples may be passed to the Sample Preparation Cell. The Sample Preparation Cell has individual pieces of equipment that are used for cutting, mounting and polishing samples. The preparation is mainly for microscopy work, but other end uses are possible. The Sample Preparation Cell also has a shielded storage well, in the event that radiologically hot components need to be stored.

The Canyon Cell is composed of two hot cells and manipulator arms, with no barrier between them. These hot cells may contain various equipment for handling of lower activity samples. Currently, these hot cells are dedicated to supporting Lu-177 decanning activities in the CANS Facility.

CANDU component samples have lower radiological activity as they are transitioned from the Receiving Cell to the Canyon cell, with samples reaching the Canyon Cell having low activity. These low activity samples may be transferred out to the SEM/FIB laboratory, through a passthrough connected to a fume hood. In the fume hood the samples are radiologically monitored, to confirm that any contamination present is controlled, before they are analyzed at CANS or packaged for further analysis at an external laboratory.

McMaster University has utilized the CANS Facility for performing three major CANDU pressure tube campaigns since 2021, with Collective Radiation Exposures of less than 1 mSv to all staff involved in each campaign.

1.3.2 Radioisotope Decanning Experience

McMaster University has partnered with external customers to perform Lu-177 decanning activities in the CANS facility, since August 2023. The unique infrastructure available in the CANS hot cells allowed the facility to become a part of one of the largest supply chains for this isotope in the world.

The process of handling high activity radioisotopes are divided into three stages: receiving, de-canning, and shipping. Ytterbium-175 (Yb-175) is irradiated at a CANDU nuclear power plant in glass ampules, which are located within an aluminum capsule. They are transferred to the CANS Facility in a shielded flask. The radiological external dose rates on the Class 7 package containing the irradiated capsules are too high to meet Class 7 shipping requirements for air transport (<2 mSv/h on contact), due to short-lived activated products within the aluminum capsules. When received at the CANS Facility, the lid of the flask, containing the irradiated capsules is removed, using an extension tool and the irradiated flask passed into the Canyon Cell through the fume hood pass through. Within the Canyon Cell, the capsules are dismantled and the ampules transferred to plastic holders. The plastic holders are passed back into the fume hood, where they are characterized, before being returned to the shielded shipping flask.

The Lu-177 is only repackaged at the CANS Facility and is in McMaster's possession for less than 24 hours, before being sent to the airport as a Class 7 shipment with dose rates <2 mSv/h. No processing of the Lu-177 takes place at the CANS Facility.

McMaster University has utilized the CANS Facility for performing radioisotope decanning, with annual Collective Radiation Exposures of less than 3 mSv to all staff involved. This is expected to increase in 2026, due to an increase in the number of decanning runs planned.

McMaster University decanning activities provides enough Lu-177 for more than 140,000 patient doses annually.

1.5 Organizational Structure

The CANS Facility is owned by McMaster University and reports to the Vice President of Research as a Nuclear Facility through the Associate Vice-President Research – Nuclear and Chief Nuclear Officer (CNO). The Applicant Authority for the CANS Facility will be the McMaster University President and Vice-Chancellor, who currently maintains this responsibility for all CNSC licenses issued to the organization. The primary regulatory point of contact for the CANS Facility will be the CNO. An organizational chart for the facility is shown in Figure 4.

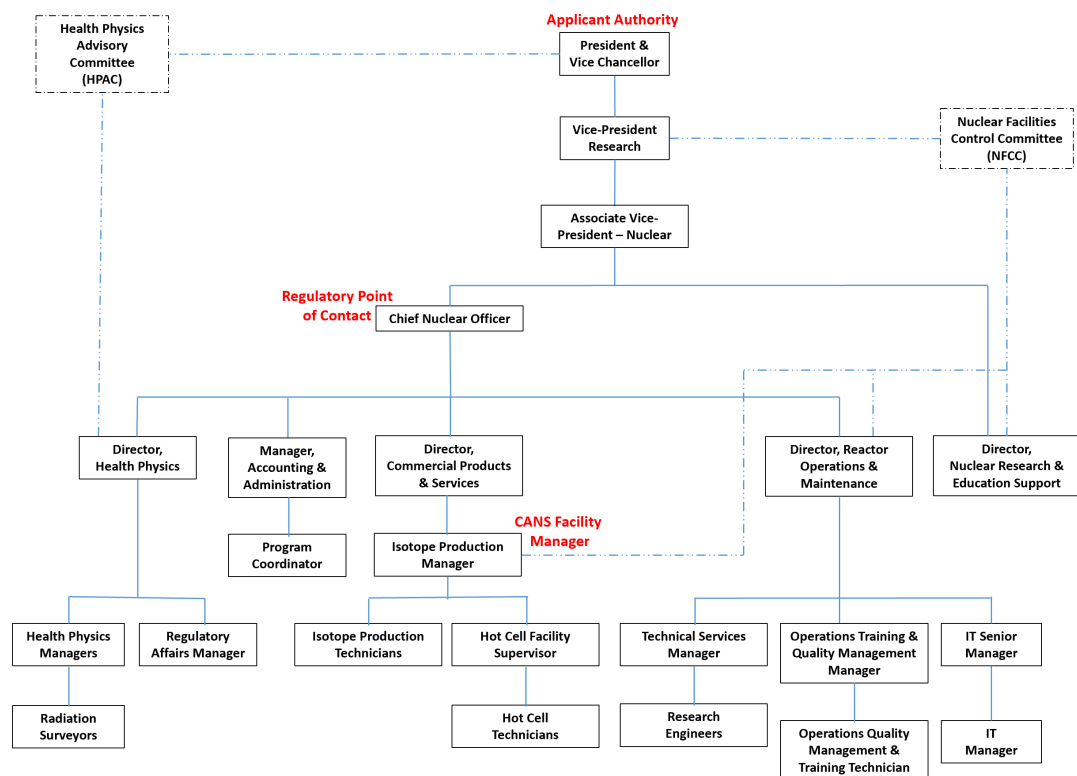


Figure 4: CANS Facility Operational Organizational Chart.

The responsibility and authority of each position in the line organization, along with other supporting organizations, is documented and described in governance and specified in the CANS Organizational Structure (CANS-AP-1130).

The Health Physics Advisory Committee (HPAC) derives its authority from the McMaster University President, as the Applicant Authority. The committee is charged with establishing and, on an ongoing basis, reviewing the radiation safety program for McMaster University. All work involving radiation or radioactive material conducted at McMaster University is subject to approval by the HPAC and shall be conducted in a manner which complies with HPAC requirements. The HPAC is an established committee at McMaster University, with its authority and responsibilities documented in McMaster University's Risk Management Manual ([RMM 107](#)).

The Nuclear Facilities Control Committee (NFCC) reports to the Vice-President, Research and serves as McMaster's internal regulatory body concerning all issues of operational safety in the University's nuclear facilities. This includes monitoring and reviewing operating practices and procedures, ensuring compliance with CNSC requirements and alignment with industry good practices, and approval of all CNSC licence applications or amendments related to McMaster nuclear facilities. The NFCC is an established committee at McMaster University, with its authority and responsibilities documented in McMaster University's Risk Management Manual ([RMM 108](#)).

The CANS Facility Manager is responsible for all radiological research and work activities, along with the operations and maintenance of the facility. They work closely with Health Physics and Nuclear Operations to ensure that CANS Facility governance is implemented by all individuals and monitor for compliance.

In some cases, the CANS Facility may be utilized by external organizations. All external organizations working within the CANS Facility are supported by CANS Facility staff for the training, planning, execution and close out of all radiological work activities. The use of the CANS Facility for work by external organizations is governed through formal agreements with McMaster University, which stipulate that the use of the facility requires compliance with applicable CNSC licenses and supporting Radiation Safety Program requirements.

1.6 Licensing History

Pursuant to Section 24 of the Nuclear Safety and Control Act, the CANS facility currently operates under CNSC licence 01495-19-27 [2], which authorizes McMaster University to:

- (a) possess, transfer, export, use and store the nuclear substances listed in the Appendix: Nuclear Substances and Radiation Devices of the licence.
- (b) conduct licensed activities in the location(s) specified in the Appendix: Locations of Licensed Activities of the licence.

This licence is issued for the consolidated uses of nuclear substances (Type 815) and is currently used only for radioisotope decanning activities.

The CANS Facility was originally licensed and commissioned in 2019 under the larger McMaster University NSRD Consolidated Uses of Nuclear Substances research licence, 01495-2-25.8 [4]. This licence authorized hot commissioning activities to be performed, as part of the phased in approach for commissioning of the CANS Facility. The results of CANS Facility commissioning were documented in the *Commissioning of the McMaster University CANS Facility* [1]

During hot commissioning activities and a Type II Inspection of licensed activities in 2019, the CNSC identified that as the CANS Facility moved towards operating at full-capacity it would require an increased level of regulatory oversight, in comparison to other activities being conducted under the University's Consolidated Uses of Nuclear Substances licence [5].

In February 2021, the CNSC provided McMaster University with a Technical Gap Analysis for the CANS Facility [6]. This analysis identified areas where additional information was needed to define an operating envelope for CANS Facility and address regulatory requirements that were identified as being applicable to the facility, when operating at full capacity. Using a graded approach and working with technical specialists, CNSC staff reviewed every Safety Control Area (SCA) in the regulatory framework, to identify areas where more information would be needed to support future CANS Facility Activities. Closure of the gaps required the development of a more dedicated and robust governance framework, than that needed for other activities in lower-risk laboratories on campus. McMaster University started to develop this governance framework, providing its first set of documents in March 2021.

The first use of the CANS Facility for processing of CANDU pressure tubes occurred in July 2021, under CNSC licence 10495-2-25.22 [7] and its associated CANS-5 Health Physics Advisory Committee (HPAC) permit. During this campaign, a flaw was scraped into prepared pressure tube samples, using a specialized tool. This pressure tube campaign, along with the following campaigns performed at the CANS Facility provided integral information required to inform CANDU pressure tube degradation models, supporting the safety assessments of operating CANDU reactors world-wide.

Incorporating CNSC feedback and recognizing the CANS Facility activities as being unique in comparison to other activities being conducted under the University's Consolidated Uses of Nuclear Substances licence and to support radioisotope decanning activities, McMaster University applied for a separate CANS Facility licence in September 2024 [8]. This separate licence ensured that the CANS Facility and its supporting licensed documents were aligned with the SCA review feedback received from the CNSC in 2021, permitting radioisotope decanning activities to be performed.

McMaster University received its specific licence (01495-19-26.0) for the CANS Facility on December 4, 2024, which authorized radioisotope decanning activities to be performed in the facility hot cells. The licence did not permit any pressure tube activities, as additional

governance and processes were required to support the closure of SCA gaps identified by the CNSC in 2021 for this specific activity and allow full utilization of the CANS Facility. The scope of decanning activities under this NSRD licence type was limited to being $<10^{15}$ Bq annually. With the increased demand of Lu-177 world-wide, it was identified that McMaster University would need to apply for and obtain a Class 1B licence, in order to meet the global demands and support the Canadian radioisotope supply chain.

1.7 Class 1B Licence Application Purpose

On May 21, 2025, McMaster University applied for a time-limited exemption to the McMaster University NSRD licence possession limits for nuclear activities at the CANS facility [9]. Specifically, McMaster University requested that the total activity possession limit set for the year would be increased above the limit for this licence type ($>10^{15}$ Bq), as defined in the Class I Nuclear Facilities Regulations. This time-limited exemption ensured the uninterrupted Canadian supply of Lu-177, while McMaster applied for a Class 1B licence for the CANS facility.

The CNSC issued its Record of Decision [10] regarding McMaster University's request for a Temporary exemption under Section 7 of the Nuclear Safety and Control Act to increase the total activity limits of Nuclear Substances and Radiation Devices Licence No. 01495-19-26.3 on September 29, 2025. Based on the information provided, the CNSC identified that the temporary exemption would not pose an unreasonable risk to the environment or the health and safety of persons, would not pose an unreasonable risk to national security and would not result in a failure to achieve conformity with measures of control and international obligations to which Canada has agreed. The exemption incorporated enhanced regulatory oversight during the exemption period and specified an expiry date of September 30, 2027.

The exemption provided the time required for McMaster University to develop and submit its application for a Class 1B licence for the operation of the CANS Facility. On May 26, 2026, McMaster University committed to submitting its application for a Class 1B licence by June 30, 2026 [11].

McMaster University has a long history of safe and compliant nuclear activities, and believes that its experience, qualified staff and strong safety programs positions CANS well to continue to support nuclear research activities and the current Canadian and global supply chain as a Class 1B Facility. Specifically, the CANS facility at McMaster University is currently the most suitable location available in Ontario to help support the critical supply of Lu-177 to patients with advanced prostate cancer and the continued work will ensure patients maintain access to this life-saving therapy. Materials research, for which the facility was originally designed, will also support Canada's clean energy initiatives. The facility will also be utilized as an integral part of McMaster's nuclear education programs, ensuring that the next generation of nuclear workers will have an opportunity for hands-on

experiential learning, as part of their undergraduate programs, graduate programs and research activities.

This licence application has been prepared by McMaster University as the Applicant and CANS Facility Owner, in accordance with the requirements outlined in CNSC REGDOC-1.2.2 [Licence Application Guide: Class 1B Processing Facilities](#), the [General Nuclear Safety and Control Regulations](#), the [Class 1 Nuclear Facilities Regulations](#), the [Nuclear Substances and Radiation Devices Regulations](#), and the [Nuclear Security Regulations](#).

This application, together with its referenced supporting governance, is submitted to the CNSC to support the issuance of a Class 1B licence for research and operational activities of the McMaster University CANS Facility.

A licence period of 10 years is being requested, based on the facility already being established, McMaster University's decades of licensed activity experience, including more than 65 years operating a Class 1A research reactor, six years of CANS Facility Operating Experience already available and an experienced workforce supporting the licensed activity.

2.0 SAFETY AND CONTROL AREAS

2.1 General

CANS Facility Program Documents have been prepared per the required Safety and Control Areas (SCAs) outlined in REGDOC-1.2.2 Licence Application Guide: Class 1B Processing Facilities. A summary of all Program Documents submitted to the CNSC in support of this licence application is provided in Section 5.1

2.2 Management System

McMaster University operates the CANS Facility in accordance with the CANS Operating Limits and Conditions (OLC) Policy, for the purposes of research and education. This CANS Facility Policy Manual (**CANS-AP-1000**) was developed in accordance with Canadian Standards Association (CSA) [Management System Requirements for Nuclear Facilities](#) (N286-12) guidance for research and isotope processing facilities.

Commercial products or services compatible with the research and education usage are offered to offset the operating costs of this academic facility. The CANS Facility Policy Manual sets out the general policies for the operation of the CANS Facility and for describing its governing Management System. Policies set out in the Policy are intended to ensure that facility operation will be in accordance with University policies, and with terms and conditions of the operating licence.

This document communicates the requirements for operating the facility and ensures that applicable processes are defined and implemented for the performance of nuclear activities at the CANS facility. It also documents the quality principles, management commitment to safety, training, education and good continuous improvement requirements, which ensure that the organization has a low tolerance for risk and strong Safety Culture across the organization.

2.3 Human Performance Management

The purpose of this Human Performance Management Policy (**CANS-AP-1151**) is to establish a systematic approach for enhancing human performance, reducing the likelihood of human error, strengthening nuclear Safety Culture, and ensuring personnel are fit, qualified, and capable of performing their assigned duties safely and effectively.

The Human Performance Management Policy integrates human factors engineering, training, staffing, fitness-for-duty, event learning and organizational effectiveness. The principles that guide the policy are:

1. People are fallible and even the best make mistakes.
2. Error-likely situations are predictable, manageable, and preventable.
3. Individual behavior is influenced by organizational processes and values.
4. People achieve high levels of performance due largely to the encouragement and reinforcement received from leaders, peers, and subordinates.
5. Events can be avoided through an understanding of the reasons mistakes occur and application of the lessons learned from past events (or errors).

The Human Performance Management Policy includes Human Performance Tools, Training, Minimum Staff Complement, Fitness for Duty, Operating Experience and Performance Monitoring requirements to ensure a strong safety culture and establish a continuously learning organization that identifies issues and implements lessons learned to prevent repeat errors.

2.4 Operating Performance

The CANS Facility Operating Limits and Conditions (**CANS-AP-1111**) provide clearly defined limits for safe and efficient operation. Within these limits, detailed procedures are written to clearly define operating requirements. These Operating Limits and Conditions (OLCs) establish controls intended to prevent accidents and mitigate the consequences of an accident, should one arise.

Administrative controls including staffing, training, procedural adherence, reviews, audits and reporting requirements, support the safe operation of the facility and provide surveillance methods for monitoring to ensure that OLCs are not exceeded.

In the event that an OLC is exceeded or another regulatory reporting requirement is not met, Facility Reporting (**CANS-HP-0001**) ensures that required notifications are made and prescribed reports are made submitted. CANS Facility Reporting requirements align with REGDOC-3.1.2 [Reporting Requirements, Volume I: Non-Power Reactor Class I Nuclear Facilities and Uranium Mines and Mills, Version 1.1](#).

2.5 Safety Analysis

The CANS Facility Safety Analysis Report (**CANS-LBD-0002**) describes the approaches, systems and measures the CANS facility incorporates to allow the conduct of work in a safe and effective manner. The core concepts of the CANS SAR include:

- Establishing limits for the safe operation of the facility
- Assessing proposed changes to the facility
- Developing and maintaining the licensee's policies, processes and procedures for the safe conduct of the licensed activities, and
- Confirming that the design of the facility meets design and safety requirements

The development of the CANS Facility Safety Analysis report is guided by CNSC REGDOC-2.4.4 [Safety Analysis for Class 1B Nuclear Facilities](#) and Section 6(c) of the [Class 1 Nuclear Facilities Regulations](#).

The CANS Safety Analysis was performed based on

The CANS Facility Operating Limits and Conditions (**CANS-AP-1111**) and the CANS Safety Analysis (**CANS-LBD-0002**) are based on the maximum quantity of solid nuclear substances that are associated with the research, processing and radioactive material handling activities in the Facility annually, specifically:

Fission products (solid):	8E3 MBq
Activated materials (solid):	1E8 TBq
Lu-177 (solid):	7.30E4 TBq
Yb-175 (solid):	1.83E4 TBq
Cs-137 (solid):	Up to 500 GBq per sealed source

Although radiological hazards will be the most limiting in the facility, there are also electrical hazards, chemical hazards, compressed gas hazards and the potential for fires in the hot cells or flooding within the building, which are all addressed in the Safety Analysis and supporting CANS Facility governance.

2.6 Physical Design

McMaster University established the CANS Facility under an NSRD licence, after receiving a major infrastructure grant by the Canada Foundation for Innovation and the Ontario Ministry for Research and Innovation. The Design Basis Document for the CANS Facility (**7035-DBD-001**) documents the physical design of the Facility, at the time it was built, along with the applicable codes and standards the design was based on.

Design changes, component replacement and facility modification activities at the CANS Facility are managed through the Change Control procedure (**CANS-AP-1010**). The Change Control procedure ensures that any modifications to the facility are properly planned, reviewed, approved, implemented and assessed.

2.7 Fitness for Service

The Fitness for Service Program (**CANS-MT-1300**) defines the safety-significant structures, systems, and components (SSCs) within the CANS Facility and ensures that they are maintained appropriately to fulfill intended safety functions. The program establishes the methodology, acceptance criteria, inspection philosophy, and assessment processes necessary to demonstrate continued fitness for service in accordance with the design of the facility and applicable regulatory requirements.

Requirements for inspection, testing, and monitoring activities required to demonstrate Fitness for Service are defined under the Maintenance Program (**CANS-MT-4000**) and associated procedures.

2.8 Radiation Protection

The CANS Radiation Safety Program (**CANS-HP-9000**) provides CANS-specific guidelines and requirements for managing personnel radiation exposures, implementing radiological safety controls, radiation safety training, handling radioactive materials, contamination control, radioactive waste handling procedures, surveillance within the facility, workplace monitoring, environmental monitoring and basic accident response procedures. The program also establishes Administrative Control Levels (ACLs), specifies the requirements and responsibilities for radiological surveys, inventory control, retention of records and calibration of equipment.

2.9 Conventional Health and Safety

As a division within McMaster University, the Nuclear Organization is required to adhere to organizational programs and policies designed to implement and support the Risk Management System, as approved by the McMaster University Board of Governors. Requirements are documented in the McMaster University Risk Management Manual

(RMM), with the Workplace and Environmental Health and Safety Policy ([RMM 100](#)) as the overarching governance document. The RMM includes the following supporting governance, which is applicable to the CANS Facility:

- McMaster University Joint Health and Safety Committees ([RMM 105](#))
- Work Refusal Program ([RMM 114](#))
- Hot Work Program ([RMM 201](#))
- Health and Safety Training Program ([RMM 300](#))
- Work Alone Program ([RMM 304](#))
- Confined Space Entry Program ([RMM 305](#))
- Lockout / Tagout Program ([RMM 306](#))
- Eye Protection Program ([RMM 310](#))
- Working at Heights Program ([RMM 314](#))
- Electrical Safety Program ([RMM 316](#))
- Asbestos Management Control Program ([RMM 401](#))
- Noise Control and Hearing Program ([RMM 403](#))
- Ergonomics Safety Program ([RMM 405](#))
- Hazardous Materials Management Systems Including WHIMS Program ([RMM 501](#))
- Hazardous Waste Management Program ([RMM 502](#))
- Compressed and Liquified Gas Program ([RMM 504](#))
- Spills to the Environment – Emergency Response and Reporting Program ([RMM 1202](#))
- First Aid Program ([RMM 1204](#))

These over-arching University governance conventional safety procedures are referenced, as applicable, within CANS Facility governance and support the management of conventional hazards within the facility, including hazardous substances and compressed gas.

2.10 Environmental Protection

McMaster University has completed a Screening Level Risk Assessment, in accordance with CSA [Environmental Risk Assessments at Nuclear Facilities and Uranium Mines and Mills](#) (N288.6:22). This methodology forms the basis of the CANS Environmental Risk Assessment (ERA) (**CANS-LBD-0003**). The ERA identifies, quantifies, and characterizes the risk posed by contaminants and physical stressors from the CANS facility on biological receptors in the surrounding environment. Exposure and environmental monitoring data has been collected for more than 4 years and confirms that there is minimal risk to the public or the environment from facility operational activities. This report documents site characteristics, a review of hazardous materials present, radiological source term, public emissions, effluents and the ecological risk assessment for the facility.

The CANS Facility environmental monitoring and effluent surveillance requirements are documented in the CANS Radiation Safety Program (**CANS-HP-9000**). The objective of environmental monitoring and surveillance is to ensure that effluent pathways from the CANS Facility to the environment are monitored, results are recorded and actions are taken to limit releases and prevent uncontrolled releases. The proposed CANS facility protection policies and procedures are outlined in CANS Derived Release Limits and Transfer Parameters (**CANS-ENV-00002**).

2.11 Emergency Management and Fire Protection

The CANS Facility Emergency Response Plan (**CANS-EP-7000**) ensures that personnel are prepared to identify and respond to possible emergencies arising in or affecting the facility. The goal of these preparations is the protection of personnel, the public, the environment and the facility from radiological and non-radiological hazards. This plan establishes guidelines and designates areas of responsibility for CANS Facility emergency response staff should an accident or incident occur that may affect public health and safety. Additionally, the plan identifies both the on-site and off-site support organizations that would participate in the response to an emergency and provides an overview of the detailed procedures to be followed. The plan includes measures to assure that appropriate emergency supplies and equipment will be available and useable. The CANS Facility Emergency Response Plan is part of the McMaster University Crisis Management Response Plan ([RMM 1200](#)), which manages all emergencies that may impact the university as a whole.

McMaster's Business Continuity Plan Policy ([RMM 1206](#)) is a strategic tool designed to prepare for potential disruptions that could threaten McMaster University's essential operations. These disruptions may include internal events such as building fires, floods, labour disputes, security incidents, or system downtimes; regional incidents like network outages, severe weather, or critical infrastructure failures; and broader events such as public health crises. Each department or Faculty is required to develop and maintain its own continuity plan, which collectively contributes to a comprehensive institutional Business Continuity Plan. The Nuclear Organization and the Health Physics Division each have Business Continuity Plans, which align with the institutional policy and ensure that adequate resources and materials are in place to ensure essential CANS Facility operations, along with that of other nuclear facilities and activities on campus.

With the CANS Facility expanding outside of the TAB 105 and including a radiological waste storage area in an adjacent room, a new Fire Hazard Analysis and Code Assessment (**CANS-LBD-0010**) was performed by an external expert to support this licence application and transitioning to a Class 1B Facility. The combined analysis identified nine (9) deviations, three (3) of which were resolved as acceptable solutions. The remaining six (6) deviations require actions to be resolved. The assessment concluded that with the exception of the

noted deviations and deviations which require action to be resolved, the CANS Facility will be provided with adequate measures to mitigate the fire hazards present and satisfy the safety objectives of CSA [Fire protection for facilities that process, handle, or store nuclear substances](#) (N393) and meet the intent of the applicable codes and standards.

2.12 Waste Management

The CANS Waste Management Program (**CANS-HP-9700**) provides CANS-specific guidelines and requirements for the management of radioactive waste, including generation, handling, processing, storage, transportation, and disposal. The CANS Facility generates minimal conventional waste, which is managed through McMaster University waste management plans. Any non-radiological hazardous waste generated is processed in accordance with the University Hazardous Waste Management Program ([RMM 502](#)).

All radiological waste generated at the facility is stored within the CANS Facility for decay until such time as they can be transferred to another licensed facility or a facility licensed for the processing and management of radioactive waste. All radiological waste generated at the facility by external users of the facility (e.g. decanning or pressure tube activities) is the responsibility of the external user to manage. This generally includes all radioactive waste being returned to the external user's facility licence or the waste being sent to a licensed radioactive waste processing facility that is identified by the external organization.

The CANS Facility Preliminary Decommissioning Plan (**CANS-LBD-0011**) documents the projected activities required to decommission the CANS facility. Decommissioning includes all administrative and technical actions required for the removal of regulatory controls. The decommissioning cost estimate is based on immediate decommissioning with an end-state involving facility restoration and unrestricted release by McMaster University. Immediate decommissioning was selected as the preferred strategy based on the expected source term, the facility's design features that support efficient decontamination, and the benefit of minimizing long-term liability while enabling re-use of the area by the University.

2.13 Security

The CANS Facility Nuclear Security Plan (**CANS-HP-9999**) outlines the measures, systems, and administrative controls implemented by McMaster University to protect the facility, nuclear substances, equipment, and sources against theft, sabotage, unauthorized access, and other malicious acts. The plan establishes the security framework used to meet the requirements of the CNSC [Nuclear Security Regulations](#) and the guidance provided in [Security of Nuclear Substances: Sealed Sources and Category I, II, or III Nuclear Materials](#) (REGDOC-2.12.3), using a graded approach commensurate with the risks associated with the CANS Facility and a Class 1B license.

2.14 Safeguards and Non-Proliferation

The current CANS Facility does not currently plan to handle or process safeguarded material, but it is recognized that the facility is of interest to the CNSC and IAEA from a non-proliferation perspective. The CANS Facility Safeguards Program (**CANS-AP-1930**) specifies the information, access and support that shall be provided to the CNSC and the IAEA to facilitate Canadian compliance with Canada's safeguards agreements with the IAEA, and with licensee obligations established in the General Nuclear Safety and Control Regulations.

2.15 Packaging and Transport

The CANS Facility Shipping Radioactive Material procedure (**CANS-OP-5820**) provides guidance for the packaging and shipment of Class 7 packages in accordance with the CNSC Packaging and Transport of Nuclear Substances Regulations and the International Atomic Energy Association (IAEA) Regulations for the Safe Transport of Radioactive Material. This procedure applies to all shipments of radioactive substances, including sealed and unsealed sources, waste, samples, and equipment containing radioactive material. It addresses the classification, proper packaging and labeling, radiation surveys, contamination checks, and completion of shipping documentation. This procedure also encompasses the roles and responsibilities of facility personnel to ensure that shipments are conducted safely, securely, and in accordance with radiation protection principles (ALARA), security controls, and emergency preparedness requirements

3.0 OTHER MATTERS OF REGULATORY INTEREST

3.1 Indigenous Engagement

The publication of the Truth and Reconciliation Commission of Canada's Calls to Action set in motion a shift in the way all Canadian institutions relate to Indigenous peoples. McMaster University has a desire and responsibility to enhance the experience of Indigenous Peoples on campus and beyond. The Indigenous Education Council and the McMaster Indigenous Research Institute developed an Indigenous Strategic Directions document for McMaster University to demonstrate their support for reconciliation efforts. The McMaster Nuclear organization supports the strategic initiatives of the University and aligns itself with the University Indigenous Strategic Direction.

McMaster has informed the following Nations of its intent to transition the CANS Facility to a Class 1B Facility via letters sent to their respective Chiefs on June 6, 2026:

- Six Nations of the Grand River
- Mississauga of the Credit First Nation

McMaster is actively reaching out to both Indigenous Nations to set-up meetings to discuss this and other nuclear activities on campus. Outcomes from Indigenous Engagement activities will be communicated to the CNSC through the Project Officer for this licensed activity.

3.2 Financial Guarantee

McMaster University is committed to providing a financial resource for all administrative and technical decommissioning actions required for the removal of regulatory controls from the CANS Facility, if the decision is made to do so. The CANS Financial Guarantee (**CANS-LBD-0005**) ensures that adequate dedicated funds are available to carry out decommissioning or termination of activities.

3.3 Public Information Program

The CANS Facility Public Information Program and Disclosure Protocol (**CANS-AP-1901**) effectively communicates information related to the health, safety, and security of people and the environment, and issues pertinent to the lifecycle of the facility that are related to the operation of the CANS facility at McMaster University.

The disclosure of information is intended to inform the public about and alleviate any concerns about the processes being undertaken at the CANS facility. The Nuclear Organization also offers tours of the CANS Facility to members of the public, so that they can familiarize themselves with the facility and better understand its activities.

4.0 REFERENCES

4.1 Glossary

Action Level: A specific dose of radiation or other parameter that, if reached, may indicate a loss of control of part of a licensee’s radiation protection program and triggers a requirement for specific action to be taken.

Applicant Authority: A position within an applicant’s organizational structure with power to direct the application of financial and human resources.

Class 1B Nuclear Facility: Any of the following nuclear facilities:

- a. a facility that includes a particle accelerator, other than a particle accelerator described in paragraphs (d) and (e) of the definition “Class II prescribed equipment” in section 1 of the Class II Nuclear Facilities and Prescribed Equipment Regulations ;
- b. a plant for the processing, reprocessing or separation of an isotope of uranium, thorium or plutonium;
- c. a plant for the manufacture of a product from uranium, thorium or plutonium;
- d. a plant, other than a Class II nuclear facility as defined in section 1 of the Class II Nuclear Facilities and Prescribed Equipment Regulations, for the processing or use, in a quantity greater than 1015 Bq per calendar year, of nuclear substances other than uranium, thorium or plutonium;
- e. a facility for the disposal of a nuclear substance generated at another nuclear facility; and
- f. a facility prescribed by paragraph 19(a) or (b) of the General Nuclear Safety and Control Regulations.

Derived Release Limit: the release rate that would cause an individual of the most highly exposed group to receive and be committed to a dose equal to the regulatory annual dose limit due to release of a given radionuclide to air or surface water during normal operation of a nuclear facility over the period of a calendar year.

Environmental Risk Assessment: A process that identifies, quantifies and characterizes the risk posed by contaminants (nuclear or hazardous substances) and physical stressors in the environment.

Safety Analysis: A systematic evaluation of the potential hazards that is associated with the conduct of a proposed activity or facility and that considers the effectiveness of preventive measures and strategies in reducing the effects of such hazards.

Safety Culture: The characteristics of a work environment, such as values, rules and common understandings, that influence worker perceptions and attitudes about the importance that the organization places on safety.

4.2 Acronyms

Acronym	Description
ACL	Administrative Control Levels
ALARA	As Low As Reasonably Achievable
AP	Administrative Procedure
CANDU	CANadian Deuterium Uranium
CANS	Centre for Advanced Nuclear Systems
CNO	Chief Nuclear Officer
CNSC	Canadian Nuclear Safety Commission
CORR	Correspondence
CSA	Canadian Standards Association
DBD	Design Basis Document
ENV	Environment
EP	Emergency Preparedness
HHS	Hamilton Health Sciences
HP	Health Physics
HPAC	Health Physics Advisory Committee
IAEA	International Atomic Energy Association
LBD	Licence Basis Document
MAL	McMaster Accelerator Facility
MNR	McMaster Nuclear Reactor
MT	Maintenance
MUCF	McMaster University Cyclotron Facility
MUMC	McMaster University Medical Centre
NFCC	Nuclear Facilities Control Committee
NRB	Nuclear Research Building
NSRD	Nuclear Substances and Radiation Devices
OLC	Operating Limits and Conditions
OP	Operations Procedure
REGDOC	Regulatory Document
RMM	Risk Management Manual
SCA	Safety and Control Area
SEM/FIB	Scattering Electron Microscope/Focused Ion Beam
TAB	Tandem Accelerator Building
TRA	Threat and Risk Assessment

4.3 References

1. McMaster University, “Commissioning of the McMaster University Centre for Advanced Nuclear Systems Post Irradiation Facility”, CANS-HP-REP-0003, Revision 0, January 8, 2020.
2. CNSC Licence, S. Faille to C. Malcolmson, “Consolidated Uses of Nuclear Substances (815) Licence”, 01495-19.27.5, April 28, 2026.
3. Ontario Provincial Legislature, “An Act Respecting McMaster University (The McMaster University Act, 1976), as amended by Bill 173, Chapter 5, S.O., 2016”, April 19, 2016.
4. CNSC Licence, S. Faille to J. Zic, “Consolidated Uses of Nuclear Substances (815) Licence”, 01495-2.25.8, April 16, 2019.
5. Regulatory Correspondence, N. Babcock to C. Heyssel, “CNSC Commissioning Plan Request for the Processing of Pressure Tubes at the Centre for Advanced Nuclear Systems”, e-Doc: 6077497, HP-CORR-CANS-00011, December 27, 2019.
6. Regulatory Correspondence, S. Faille and C. Pike to J. Zic, “Technical Assessment Gap Analysis for the McMaster University CANS Facility”, e-Doc: 6489179, HP-CORR-CANS-00038, February 12, 2021.
7. CNSC Licence, S. Faille to J. Zic, “Consolidated Uses of Nuclear Substances (815) Licence”, 01495-2-25.22, June 18, 2021.
8. Regulatory Correspondence, J. Zic to S. Faille, “Centre for Advanced Nuclear Systems NSRD Licence Application”, HP-CORR-CANS-00055, September 25, 2024.
9. Regulatory Correspondence, J. Zic to P. Tremblay, “Centre for Advanced Nuclear Systems NSRD Licence Exemption Request”, HP-CORR-CANS-00057, May 21, 2025.
10. Regulatory Correspondence, P. Tremblay to J. Zic, “Record of Decision in the Matter of McMaster University”, DEC 25-H113, September 29, 2025.
11. Regulatory Correspondence, J. Zic to CNSC Registry, “Notification of Intent to Submit a Class 1B Licence Application”, HP-CORR-CANS-00068, May 27, 2026

5.0 APPENDICES

5.1 Program Documents

CANS Facility Program Documents have been prepared per the required Safety and Control Areas (SCAs) outlined in REGDOC-1.2.2 [Licence Application Guide: Class 1B Processing Facilities](#). The table below lists the Program Documents submitted to the CNSC in support of this licence application:

REGDOC-1.2.2 Section	Safety and Control Area	Document Title	Document Number	Submission Date
3.1	Management System	CANS Policy Manual	CANS-AP-1000	2026 Apr 30
3.2	Human Performance Management	CANS Human Performance Policy	CANS-AP-1151	2026 Jun 30
3.3	Operating Performance	CANS Operating Limits and Conditions	CANS-AP-1111	2026 Jun 30
3.4	Safety Analysis	CANS Safety Analysis Report	CANS-LBD-0002	2026 Apr 30
3.5	Physical Design	CANS Facility DesignChange Control	7035-DBD-001	2026 Jun 30
			CANS-AP-1010	2026 Jun 30
3.6	Fitness for Service	CANS Fitness for Service CANS Maintenance Procedure	CANS-AP-1300	2026 Jun 30
			CANS-MT-4000	2026 Jun 30
3.7	Radiation Protection	CANS Radiation Protection Program	CANS-HP-9000	2026 Apr 30
3.8	Conventional Health and Safety Document	McMaster University Workplace Environmental Health and Safety Policy	RMM100	2026 Apr 30
3.9	Environmental Protection	CANS Environmental Risk Assessment (ERA);	CANS-LBD-0003	2026 Apr 30
		CANS Derived Release Limits (DRL) and Transfer Parameters	CANS-ENV-0002	2026 Apr 30

REGDOC- 1.2.2 Section	Safety and Control Area	Document Title	Document Number	Submission Date
3.10	Emergency Management and Fire Protection	CANS Emergency Preparedness Plan CANS Fire Hazard Assessment	CANS-EP-7000 CANS-LBD-0010	2026 Apr 30 2026 Jun 30
3.11	Waste Management	CANS Waste Management Program CANS Preliminary Decommissioning Plan CANS Financial Guarantee	CANS-HP-9700 CANS-LBD-0011 CANS-LBD-0005	2026 Apr 30 2026 Jun 30 2026 Jun 30
3.12	Security	CANS Security Plan** Nuclear Facilities Cyber Security Program CANS Threat and Risk Assessment	CANS-HP-9999 AP-1421 CANS-LBD-0012	2026 Jun 30 2026 Jun 30 2026 Dec 31*
3.13	Safeguards and Non- Proliferation	CANS Safeguards Program	CANS-AP-1930	2026 Apr 30
3.14	Packaging and Transport	Shipping Radioactive Materials	CANS-OP-5820	2026 Jun 30
3.15	Reporting	CANS Reporting	CANS-HP-0001	2026 Jun 30
3.16	Public Information and Disclosure Program	CANS Public Information Program & Disclosure Protocol	CANS-AP-1901	2026 Apr 30

* McMaster commits to providing the CANS Threat and Risk Assessment (TRA) by December 31, 2026.

** The CANS security plan and TRA will be submitted electronically to the CNSC separately via a secure method.

5.2 Class 1B Application Compliance Mapping

The Table below maps the requirements from the CNSC Act and Regulations to this Class 1B licence application, in alignment with CNSC REGDOC-1.2.2 [Licence Application Guide: Class 1B Processing Facilities](#).

Regulation	Requirement	McMaster Class 1B Application Section
Nuclear Safety & Control Act	Applicant 4 (a) is qualified to carry on the activity that the licence will authorize the licensee to carry on	1.3 1.5
	Applicant 4 (b) will, in carrying on that activity, make adequate provision for the protection of the environment, the health and safety of persons and the maintenance of national security and measures required to implement international obligations to which Canada has agreed.	2.5 2.8 2.9 2.10 2.11 2.14
General Nuclear Safety & Control Regulations	3 (a) the applicant's name and business address	1.2 1.4
	3 (b) the activity to be licensed and its purpose	1.3 1.6
	3 (c) the name, maximum quantity and form of any nuclear substance to be encompassed by the licence	2.5
	3 (d) a description of any nuclear facility, prescribed equipment or prescribed information to be encompassed by the licence	1.3 2.5 2.6
	3 (e) the proposed measures to ensure compliance with the Radiation Protection Regulations, the Nuclear Security Regulations and the Packaging and Transport of Nuclear Substances Regulations, 2015	2.8 2.13 2.15
	3 (f) any proposed action level for the purpose of section 6 of the Radiation Protection Regulations	2.8
	3 (g) the proposed measures to control access to the site of the activity to be licensed and the nuclear substance, prescribed equipment or prescribed information	2.13
	3 (h) the proposed measures to prevent loss or illegal use, possession or removal of the nuclear substance, prescribed equipment or prescribed information	2.8 2.13
	3 (i) a description and the results of any test, analysis or calculation performed to substantiate the information included in the application	2.5 2.6 2.10 3.2

	3 (j) the name, quantity, form, origin 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	2.12
	3 (k) the applicant's organizational management structure insofar as it may bear on the applicant's compliance with the Act and the regulations made under the Act, including the internal allocation of functions, responsibilities and authority	1.4
	3 (l) a description of any proposed financial guarantee relating to the activity to be licensed	3.2
	(m) any other information required by the Act or the regulations made under the Act for the activity to be licensed and the nuclear substance, nuclear facility, prescribed equipment or prescribed information to be encompassed by the licence	1.0 2.0 3.0
Class I Nuclear Facilities Regulations	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	1.2 2.5 2.10 2.11
	3 (b) plans showing the location, perimeter, areas, structures and systems of the nuclear facility	2.5
	3 (c) evidence that the applicant is the owner of the site or has authority from the owner of the site to carry on the activity to be licensed	1.2 1.6
	3 (d) the proposed management system for the activity to be licensed, including measures to promote and support safety culture	2.2
	3 (d.1) the proposed human performance program for the activity to be licensed, including measures to ensure workers' fitness for duty.	2.3
	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	2.5 2.9
	3 (f) the proposed worker health and safety policies and procedures	2.9
	3 (g) the proposed environmental protection policies and procedures	2.8 2.10
	3 (h) the proposed effluent and environmental monitoring programs	2.10

3 (i) if the application is in respect of a nuclear facility referred to in paragraph 3(b) of the Nuclear Security Regulations, the information and documents required by sections 4 and 27 of those Regulations	2.13
3 (j) 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	3.3
3 (k) the proposed plan for the decommissioning of the nuclear facility or of the site.	2.12
6 (a) a description of the structures at the nuclear facility, including their design and their design operating conditions	2.5
6 (b) a description of the systems and equipment at the nuclear facility, including their design and their design operating conditions	2.5 2.6
6 (c) a final safety analysis report demonstrating the adequacy of the design of the nuclear facility	2.5
6 (d) the proposed measures, policies, methods and procedures for operating and maintaining the nuclear facility	2.4 2.5 2.7
6 (e) the proposed procedures for handling, storing, loading and transporting nuclear substances and hazardous substances	2.8 2.12 2.15
6 (f) the proposed measures to facilitate Canada's compliance with any applicable safeguards agreement	2.14
6 (g) the proposed commissioning program for the systems and equipment that will be used at the nuclear facility	1.5
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	2.5 2.8 2.9 2.10 2.12
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	2.5 2.10 2.12

	6 (j) the proposed measures to control releases of nuclear substances and hazardous substances into the environment	2.5 2.10
	6 (k) 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 (i) assist off-site authorities in planning and preparing to limit the effects of an accidental release, (ii) notify off-site authorities of an accidental release or the imminence of an accidental release, (iii) report information to off-site authorities during and after an accidental release, (iv) assist off-site authorities in dealing with the effects of an accidental release, and (iv) test the implementation of the measures to prevent or mitigate the effects of an accidental release;	2.2 2.11
	6 (l) the proposed measures to prevent acts of sabotage or attempted sabotage at the nuclear facility, including measures to alert the licensee to such acts	2.13
	6 (m) the proposed responsibilities of and qualification requirements and training program for workers, including the procedures for the requalification of workers	2.3
	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.	1.3 2.3 2.7
Nuclear Substances and Radiation Devices Regulations	3 (1) (e) the roles, responsibilities, duties, qualifications and experience of workers	1.3 1.4 2.2 2.3
	3 (1) (g) the proposed instructions for dealing with accidents, including fires and spills, in which the nuclear substance may be involved	2.5 2.11
Nuclear Security Regulations	4 (a) a nuclear security plan that contains (i) a description of the proposed nuclear security system, including each nuclear security measure and any characteristics of the design of the nuclear facility that improve its security,	2.13

	(ii) a list that identifies each nuclear security measure that is a critical security measure and that sets out the compensatory measures that will be implemented in the event that it becomes degraded, in operative or compromised, (iii) a description of the areas where Category I nuclear material, Category II nuclear material or Category III nuclear material or other nuclear substances are to be produced, used, processed, stored or transported and the location of those areas, (iv) the written arrangements made between the applicant and any off-site response force, (v) the plan and procedures to assess and respond to nuclear security events at the nuclear facility, (vi) the process for controlling access to the nuclear facility and verifying the identity of each person who accesses it, (vii) the processes for determining who, on entering or exiting the nuclear facility, will be searched or screened, and (viii) the cyber security program consisting of the plans, policies and procedures for the protection of the computer systems and electronic components of the nuclear facility against cyber security threats identified in the threat and risk assessment.	
	4 (b) threat and risk assessment	2.13