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Written submission from Saskatchewan Research Council

Mémoire du Saskatchewan Research Council

In the Matter of

À l'égard de

SLOWPOKE-2 Reactor Facility

Installation nucléaire SLOWPOKE-2

Request by the Saskatchewan Research Council to authorize the decommissioning of the SLOWPOKE-2 reactor

Demande du Saskatchewan Research Council afin d'autoriser le déclassement du réacteur SLOWPOKE-2

Hearing in writing based solely on written submissions

Audience fondée uniquement sur des mémoires

July 2019

Juillet 2019

Canada

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December 14, 2018

Mr. Marc Leblanc, Commission Secretary
Canadian Nuclear Safety Commission
280 Slater Street
PO Box 1046, Station B
Ottawa, Ontario KIP 5S9
email: marc.leblanc@canada.ca

Dear Mr. Marc Leblanc:

Re: Application for an Amendment to the NPROL 19.00/2023 for the SRC SLOWPOKE-2 Facility (SRCSF)

The SRC SLOWPOKE-2 Reactor has a non-power reactor operating licence, NPROL-19.00/2023, which is valid until June 2023. The objective of this letter is to request that an amendment to the NPROL 19.00/2023 be issued which will allow the SRC to perform the decommissioning work and achieve end-state.

Our request is supported by this Application for NPROL amendment that will facilitate the Decommissioning of the SRCSF. This letter includes the following attachments:

a) Part 1 of the Application (see Attachment 1) for the NPROL amendment to allow the decommissioning of the SRCSF, which shows how each of the CNSC requirements regarding the content of the Application for the NPROL amendment is addressed in this Application and in the licensing support documents referenced in this Application. In particular, Part 1 of the application for NPROL amendment addresses, Section 3, Section 6 and Section 7 of the General Nuclear Safety and Control Regulations, and, Section 3, Section 6 and Section 7 of the Class 1 Nuclear Facilities Regulations;
and;
b) Part 2 of the Application (see Attachment 2) for the NPROL amendment to allow the decommissioning of the SRCSF, which together with the licensing support documents referenced in it, provides the information requested for addressing the CNSC requirements identified in Part 1.

The licensing support documents referenced in Part 2 of the Application are listed in Attachment 3 to this letter. This attachment identifies the documents that are enclosed with the Application and also the planned submission dates for the documents that will be submitted at a later date.

Key points that support the application by the SRC for the NPROL amendment in order to perform decommissioning are listed below as follows:

1. The footprint of the building that houses the SRCSF will not be changed.
2. The Environmental Survey has confirmed that activities that will be undertaken during the decommissioning process are neutral to the current environmental footprint.
3. Historically there has been a very low public interest in the SRCSF, however, in the recent months due to communication updates there has been a positive public perception and a slight increase in the public interest. There have been no concerns raised at this time.
4. Through the detailed planning phase for the project there have not been any emerging risks or environmental issues that would impact public safety.
5. The decommissioning of the SLOWPOKE-2 and declared re-use of the space after completion of the full decommissioning program will not negatively impact the safety of the public.
6. The personnel involved in leading and performing the decommissioning are experienced from the 2011 decommissioning of the Dalhousie University SLOWPOKE-2 Reactor (DUSR) and University of Alberta SLOWPOKE-2 Facility (UASF) decommissioning in 2017 and have incorporated lessons learned in their processes.
7. During the decommissioning activities, it is planned NOT to use any new technology for the dismantling and removal of the radioactive reactor components. All the tools utilized will be the same as were used during the decommissioning of UASF and DUSR.
8. The hazards assessment for the SRCSF decommissioning has been updated based on the lessons learned from the decommissioning of the DUSR and UASF.
9. SRCSF continues to support the financial guarantee and both the security and access agreements are in place.

In summary, the nature of the operations of SRCSF has remained the same and the operations are supported by comprehensive programs and procedures. The potential risks and hazards of decommissioning the SRCSF remain very low.

If you have any comments or questions about this request or the attached documents, please do not hesitate to contact us.

Yours sincerely,

Dr. Laurier Schramm, President & CEO

cc: Ismail Erdebil (Senior Project Officer, NPFD)
Haidy Tadros (Director General, DNCFR) and Caroline Ducros (Director, NPFD)

Attachments:

1. Application for a Licence to Decommission the SRCSF-Part 1.
2. Application for a Licence to Decommission the SRCSF-Part 2.
3. Table "Licensing Support Documents for the Application for the Licence to Decommission the SRCSF".

Saskatchewan Research Council
Application for the Licence to Decommission SRCSF – Part 1

CNSC Document and associated Requirements	Section of the Application addressing the requirement	SRCSF Decommissioning Project Support Document (Note: If edition, date or revision number is not specifically mentioned below, the documents applicable to the SRCSF decommissioning project will at the latest revision issued as "approved for use".)
General Nuclear Safety and Control Regulations		
3. (1) An application for a licence shall contain the following information:		
(a) the applicant's name and business address;	A.1	N/A
(b) the activity to be licensed and its purpose;	C	N/A
(c) the name, maximum quantity and form of any nuclear substance to be encompassed by the licence;	D.4	- SRC SLOWPOKE Radiation Physics Assessment,147-03320-ASD-004, Rev. 0: Tables 10, 11, 21, 22 - SRC SLOWPOKE Waste Management Plan, 147-01622-REPT-002, Rev. 0: Section 3 and Appendix B.
(d) a description of any nuclear facility, prescribed equipment or prescribed information to be encompassed by the licence;	D.1, D.2, D.3	- SRC SLOWPOKE-2 Facility Preliminary Decommissioning Plan, 12736-1E12. - Detailed Decommissioning Plan for SRC SLOWPOKE-2 Facility, 147-01600-DDP-002, Rev. 0. - SLOWPOKE-2 Nuclear Reactor Commissioning and Nuclear Maintenance, CPSR-361 Rev. 1, Atomic Energy of Canada Limited, February 1981. - "CPR-26, Rev. 1, Description and Safety Analysis for the SLOWPOKE-2 Reactor", M.E. wise and R.E. Kay, Atomic Energy of Canada, Ltd. February, 1981. - "Site Description and Operating Manual", SRC SLOWPOKE-2 Facility, Rev.7, October 2015.
(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;*	E F D.6.1	- SRC SLOWPOKE Decommissioning Action Levels and Radiation Protection Requirements, Candu Report, 147-03400-REPT-002, Rev. 0. - Site Security Plan – submitted separately as classified information. - Detailed Decommissioning Plan for SRC SLOWPOKE-2 Facility, 147-01600-DDP-002, Rev 0. - SRC SLOWPOKE Decommissioning Waste Management Plan, 147-01622-REPT-002, Rev 0.

CNSC Document and associated Requirements	Section of the Application addressing the requirement	SRCSF Decommissioning Project Support Document (Note: If edition, date or revision number is not specifically mentioned below, the documents applicable to the SRCSF decommissioning project will at the latest revision issued as "approved for use".)
(f) any proposed action level for the purpose of section 6 of the *Radiation Protection Regulations;*	E.3	- SRC SLOWPOKE Decommissioning Action Levels and Radiation Protection Requirements, Candu Report, 147-03400-REPT-002, Rev 0.
(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;	F	- Site Security Plan – submitted separately as classified information.
(h) the proposed measures to prevent loss or illegal use, possession or removal of the nuclear substance, prescribed equipment or prescribed information;	F	- Site Security Plan – submitted separately as classified information.
(i) a description and the results of any test, analysis or calculation performed to substantiate the information included in the application;	G	- SRC SLOWPOKE Decommissioning Radiation Physics Assessment, 147-03320-ASD-004, Rev 0. - Hazard Assessment Report for Decommissioning SRC SLOWPOKE-2 Facility, 147-01600-HA-002, Rev 0. - Environmental Impact Statement- Saskatchewan Research Council SLOWPOKE-2 Reactor Decommissioning, 147-01600-R027-371-9001, Rev. 1, Matrix Solutions document, 27464-514 EIS R 2018-11-06. - SRC SLOWPOKE–2 Decommissioning Radiological Consequences Assessment, 147-03600-ASD-003, Rev 0. - SRC SLOWPOKE–2 Decommissioning Out-of-Reactor Criticality Assessment, 147-03340-ASD-002, Rev 0. - "CPR-26, Rev. 1, Description and Safety Analysis for the SLOWPOKE-2 Reactor", M.E. wise and R.E. Kay, Atomic Energy of Canada, Ltd. February, 1981. - "Site Description and Operating Manual", SRC SLOWPOKE-2 Facility, Rev. 7, October 2015. - SLOWPOKE-2 Nuclear Reactor Commissioning and Nuclear Maintenance, CPSR-361 Rev. 1, Atomic Energy of Canada Limited, February 1981. - SLOWPOKE-2 Nuclear Reactor Operation and Routine Maintenance, CPSR-362 Rev. 2, Atomic Energy of Canada Limited, February 1984.

CNSC Document and associated Requirements	Section of the Application addressing the requirement	SRCSF Decommissioning Project Support Document (Note: If edition, date or revision number is not specifically mentioned below, the documents applicable to the SRCSF decommissioning project will at the latest revision issued as "approved for use".)
		- SLOWPOKE-2 Nuclear Reactor Generic Decommissioning Procedure, (formerly CPR-32), by G.A. Burbidge of Nordion International Inc. dated November 1, 1991.
(j) the name, quantity, form, origin and volume of any radioactive waste or hazardous waste that may result from the activity to be licenced, including waste that may be stored, managed, processed or disposed of at the site of the activity to be licenced, and the proposed method for managing and disposing of that waste;	D.6	- Detailed Decommissioning Plan for SRC SLOWPOKE-2 Facility, 147-01600-DDP-002, Rev 0. - SRC SLOWPOKE Decommissioning Waste Management Plan, 147-01622-REPT-002, Rev 0. - SRC SLOWPOKE Radiation Physics Assessment, 147-03320-ASD-004, Rev 0.
(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;	A.2	- Saskatchewan Research Council (SRC) SLOWPOKE-2 Decommissioning-Quality Assurance Plan, 147-912020-QAP-004, Rev. 0.
(l) a description of any proposed financial guarantee relating to the activity to be licenced	H	- Detailed Decommissioning Plan for SRC SLOWPOKE-2 Facility, 147-01600-DDP-002, Rev. 0. - Letter from Schramm (SRC) to Erdebil (CNSC), "SRC SLOWPOKE-2 Facility Financial Commitment for Decommissioning", September 26, 2018.

CNSC Document and associated Requirements	Section of the Application addressing the requirement	SRCSF Decommissioning Project Support Document (Note: If edition, date or revision number is not specifically mentioned below, the documents applicable to the SRCSF decommissioning project will at the latest revision issued as "approved for use".)
(m) any other information required by the Act or the regulations made under the Act for the activity to be licenced and the nuclear substance, nuclear facility, prescribed equipment or prescribed information to be encompassed by the licence; and	None	None
(n) – Repealed by SOR/2008-119, s.2 (1.1) The Commission or a designated officer authorized under paragraph 37(2)(c) of the act may require any other information that is necessary to enable the Commission or the designated officer to determine whether the applicant (i) is qualified to carry on the activity to be licenced, or (ii) 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.	N/A	N/A

CNSC Document and associated Requirements	Section of the Application addressing the requirement	SRCSF Decommissioning Project Support Document (Note: If edition, date or revision number is not specifically mentioned below, the documents applicable to the SRCSF decommissioning project will at the latest revision issued as "approved for use".)
Application for Amendment, Revocation or Replacement of Licence		
6. An application for the amendment, revocation or replacement of a licence shall contain the following information:		
• **(a)** a description of the amendment, revocation or replacement and of the measures that will be taken and the methods and procedures that will be used to implement it;	C, E, F, I, J,K, M, N	- Detailed Decommissioning Plan for SRC SLOWPOKE-2 Facility, 147-01600-DDP-002, Rev. 0. - Environmental Impact Statement- Saskatchewan Research Council SLOWPOKE-2 Reactor Decommissioning, 147-01600-R027-371-9001, Rev. 1, Matrix Solutions document, 27464-514 EIS R 2018-11-06. - SRC SLOWPOKE Decommissioning Action Levels and Radiation Protection Requirements, Candu Report, 147-03400-REPT-002, Rev. 0. - SRCSF Decommissioning Environment Protection Requirements, Candu Report, 147-03700- REPT-002, Rev. 0. - Site Security Plan – submitted separately as classified information. - SRC - IAEA Design Information Questionnaire – submitted separately as classified information. - Decommissioning Training Plan for SRC SLOWPOKE-2 Facility, 147-01600-TPL-003, Rev. 0 - SRC SLOWPOKE–2 Decommissioning Facility Emergency Response Plan, 147-01600-ERP-002, Rev. 0.
• **(b)** a statement identifying the changes in the information contained in the most recent application for the licence;	C, M	- Detailed Decommissioning Plan for SRC SLOWPOKE-2 Facility, 147-01600-DDP-002, Rev. 0. - "Application for the Renewal of the SLOWPOKE-2 Reactor Operating Licence", SRC Publication No. 12736-4E12, August 2012.

CNSC Document and associated Requirements	Section of the Application addressing the requirement	SRCSF Decommissioning Project Support Document (Note: If edition, date or revision number is not specifically mentioned below, the documents applicable to the SRCSF decommissioning project will at the latest revision issued as "approved for use".)
• **(c)** a description of the nuclear substances, land, areas, buildings, structures, components, equipment and systems that will be affected by the amendment, revocation or replacement and of the manner in which they will be affected; and	D	- Detailed Decommissioning Plan for SRC SLOWPOKE-2 Facility, 147-01600-DDP-002, Rev. 0.
• **(d)** the proposed starting date and the expected completion date of any modification encompassed by the application.	C, M.2	- Detailed Decommissioning Plan for SRC SLOWPOKE-2 Facility, 147-01600-DDP-002, Rev. 0
Incorporation of Material in Application		
7. An application for a licence or for the renewal, suspension in whole or in part, amendment, revocation or replacement of a licence may incorporate by reference any information that is included in a valid, expired or revoked licence.		- Non Power Operating Reactor License, NPROL-19.00/2023, valid to June 30, 2023.
Class I Nuclear Facilities Regulations		
3. An application for a licence in respect of a Class I nuclear facility, other than a licence to abandon, shall contain the following information in addition to the information required by section 3 of the General Nuclear Safety and Control Regulations:		

CNSC Document and associated Requirements	Section of the Application addressing the requirement	SRCSF Decommissioning Project Support Document (Note: If edition, date or revision number is not specifically mentioned below, the documents applicable to the SRCSF decommissioning project will at the latest revision issued as "approved for use".)
(a) a description of the site of the activity to be licenced, including the location of any exclusion zone and any structures within that zone;	B.1	- "Site Description and Operating Manual", SRC SLOWPOKE-2 Facility, Rev.7, October 2015. - Detailed Decommissioning Plan for SRC SLOWPOKE-2 Facility, 147-01600-DDP-002, Rev 0. - SRC SLOWPOKE-2 Facility Preliminary Decommissioning Plan, 12736-1E12.
(b) plans showing the location, perimeter, areas, structures and systems of the nuclear facility;	B.1, B.2, D.1	- Detailed Decommissioning Plan for SRC SLOWPOKE-2 Facility, 147-01600-DDP-002, Rev. 0. - SRC SLOWPOKE-2 Facility Preliminary Decommissioning Plan, 12736-1E12.
(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 licenced;	B.3	- Detailed Decommissioning Plan for SRC SLOWPOKE-2 Facility, 147-01600-DDP-002, Rev. 0. - Letter from Schramm (SRC) to Erdebil (CNSC), "SRC SLOWPOKE-2 Facility Decommissioning", dated October 11, 2018.
(d) the proposed quality assurance program for the activity to be licenced;	A.3	- Saskatchewan Research Council (SRC) SLOWPOKE-2 Decommissioning-Quality Assurance Plan, 147-912020-QAP-004, Rev. 0.
(e) the name, form, characteristics and quantity of any hazardous substances that may be on the site while the activity to be licenced is carried on;	D.5, D.6	- Detailed Decommissioning Plan for SRC SLOWPOKE-2 Facility, 147-01600-DDP-002, Rev. 0. - SRC SLOWPOKE-2 Facility Preliminary Decommissioning Plan, 12736-1E12.
(f) the proposed worker health and safety policies and procedures;	I	- Detailed Decommissioning Plan for SRC SLOWPOKE-2 Facility, 147-01600-DDP-002, Rev. 0. - SRC SLOWPOKE Decommissioning Action Levels and Radiation Protection Requirements, Candu Report, 147-03400-REPT-002, Rev. 0. - Occupational Health and Safety Manual, OHS-MAN-1, SRC, February 2018. - Radiation Safety Manual, OHS-MAN-2, SRC, February 2018. - Saskatchewan Research Council (SRC) SLOWPOKE-2 Decommissioning-Quality Assurance Plan, 147-912020-QAP-004, Rev. 0. - Hazard Assessment Report for Decommissioning SRC SLOWPOKE-2 Facility, 147-01600-HA-002, Rev. 0.

CNSC Document and associated Requirements	Section of the Application addressing the requirement	SRCSF Decommissioning Project Support Document (Note: If edition, date or revision number is not specifically mentioned below, the documents applicable to the SRCSF decommissioning project will at the latest revision issued as "approved for use".)
(g) the proposed environmental protection policies and procedures;	E.2	- SRCSF Decommissioning Environment Protection Requirements, Candu Report, 147-03700- REPT-002, Rev. 0. - Environmental Impact Statement- Saskatchewan Research Council SLOWPOKE-2 Reactor Decommissioning, 147-01600-R027-371-9001, Rev. 1, Matrix Solutions document, 27464-514 EIS R 2018-11-06.
(h) the proposed effluent and environmental monitoring programs;	E.2; E.3, E.4	- Environmental Impact Statement- Saskatchewan Research Council SLOWPOKE-2 Reactor Decommissioning, 147-01600-R027-371-9001, Rev. 1, Matrix Solutions document, 27464-514 EIS R 2018-11-06. - SRCSF Decommissioning Environment Protection Requirements, Candu Report, 147-03700-REPT-002, Rev. 0. - Detailed Decommissioning Plan for SRC SLOWPOKE-2 Facility, 147-01600-DDP-002, Rev. 0.
(i) if the application is in respect of a nuclear facility referred to in paragraph 2(b) of the Nuclear Security Regulations, the information required by section 3 of those Regulations;	N/A	
(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 licenced; and	L	- SRC SLOWPOKE-2 Decommissioning Communications Plan and Public Disclosure Protocol, September 2018.
(k) the proposed plan for the decommissioning of the nuclear facility or of the site.	M.1	- Detailed Decommissioning Plan for SRC SLOWPOKE-2 Facility, 147-01600-DDP-002, Rev. 0. - SRC SLOWPOKE-2 Facility Preliminary Decommissioning Plan, 12736-1E12.

CNSC Document and associated Requirements	Section of the Application addressing the requirement	SRCSF Decommissioning Project Support Document (Note: If edition, date or revision number is not specifically mentioned below, the documents applicable to the SRCSF decommissioning project will at the latest revision issued as "approved for use".)
6. **An application for a licence to operate a Class I nuclear facility shall contain the following information in addition to the information required by section 3:**		- Detailed Decommissioning Plan for SRC SLOWPOKE-2 Facility, 147-01600-DDP-002, Rev. 0. - Non Power Operating Reactor License, NPROL-19.00/2023, valid to June 30, 2023.
(*a*) a description of the structures at the nuclear facility, including their design and their design operating conditions;	B.1, B.2; D.1	- CPR-26, Rev. 1, Description and Safety Analysis for the SLOWPOKE-2 Reactor". M.E. wise and R.E. Kay, Atomic Energy of Canada, Ltd. February, 1981. - "Site Description and Operating Manual", SRC SLOWPOKE-2 Facility, Rev. 7, October 2015. - SLOWPOKE-2 Nuclear Reactor Commissioning and Nuclear Maintenance, CPSR-361 Rev. 1, Atomic Energy of Canada Limited, February 1981. - SLOWPOKE- 2 Nuclear Reactor Operation and Routine Maintenance, CPSR-362 Rev. 2, Atomic Energy of Canada Limited, February 1984. - SLOWPOKE-2 Nuclear Reactor Generic Decommissioning Procedure, (formerly CPR-32), by G.A. Burbidge of Nordion International Inc. dated November 1, 1991. - SRC SLOWPOKE-2 Facility Preliminary Decommissioning Plan, 12736-1E12.
(*b*) a description of the systems and equipment at the nuclear facility, including their design and their design operating conditions;	D.1	Same as above.
(*c*) a final safety analysis report demonstrating the adequacy of the design of the nuclear facility;	G	- "CPR-26, Rev. 1, Description and Safety Analysis for the SLOWPOKE-2 Reactor", M.E. wise and R.E. Kay, Atomic Energy of Canada, Ltd. February, 1981.

CNSC Document and associated Requirements	Section of the Application addressing the requirement	SRCSF Decommissioning Project Support Document (Note: If edition, date or revision number is not specifically mentioned below, the documents applicable to the SRCSF decommissioning project will at the latest revision issued as "approved for use".)
(*d*) the proposed measures, policies, methods and procedures for operating and maintaining the nuclear facility;	G M.1	- SRC SLOWPOKE-2 Facility Preliminary Decommissioning Plan, 12736-1E12. - Detailed Decommissioning Plan for SRC SLOWPOKE-2 Facility, 147-01600-DDP-002, Rev. 0. - "Site Description and Operating Manual", SRC SLOWPOKE-2 Facility, Rev. 7, October 2015. - SLOWPOKE- 2 Nuclear Reactor Operation and Routine Maintenance, CPSR-362 Rev. 2, Atomic Energy of Canada Limited, February 1984. - SRC SLOWPOKE-2 Facility License # NPROL-19.00/2023 Annual Compliance Report for the period from January 1, 2017 to December 31, 2017, SRC Publication No. 12736-1E18, March 2018.
(*e*) the proposed procedures for handling, storing, loading and transporting nuclear substances and hazardous substances;	M.1 D.6.1	- Detailed Decommissioning Plan for SRC SLOWPOKE-2 Facility, 147-01600-DDP-002, Rev. 0. - SRC SLOWPOKE Decommissioning Waste Management Plan, 147-01622-REPT-002, Rev. 0.
(*f*) the proposed measures to facilitate Canada's compliance with any applicable safeguards agreement;	J	- SRC - IAEA Design Information Questionnaire – submitted separately as classified information.
(*g*) the proposed commissioning program for the systems and equipment that will be used at the nuclear facility;	G	- SLOWPOKE-2 Nuclear Reactor Commissioning and Nuclear Maintenance, CPSR-361.

CNSC Document and associated Requirements	Section of the Application addressing the requirement	SRCSF Decommissioning Project Support Document (Note: If edition, date or revision number is not specifically mentioned below, the documents applicable to the SRCSF decommissioning project will at the latest revision issued as "approved for use".)
(*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;	G E.4	- Occupational Health and Safety Manual, OHS-MAN-1, SRC, February 2018. - Radiation Safety Manual, OHS-MAN-2, SRC, February 2018. - Fire Safety Manual, OHS-STD-11, SRC, February 2016. - "CPR-26, Rev. 1, Description and Safety Analysis for the SLOWPOKE-2 Reactor"; - Environmental Impact Statement- Saskatchewan Research Council SLOWPOKE-2 Reactor Decommissioning, 147-01600-R027-371-9001, Rev. 1, Matrix Solutions document, 27464-514 EIS R 2018-11-06. - Hazard Assessment Report for Decommissioning SRC SLOWPOKE-2 Facility, 147-01600-HA-002, Rev. 0. - SRC SLOWPOKE–2 Decommissioning Facility Emergency Response Plan, 147-01600-ERP-002, Rev. 0.
(*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;	G E.2 E.4	- Environmental Impact Statement- Saskatchewan Research Council SLOWPOKE-2 Reactor Decommissioning, 147-01600-R027-371-9001, Rev. 1, Matrix Solutions document, 27464-514 EIS R 2018-11-06. - SRCSF Decommissioning Environment Protection Requirements, Candu Report, 147-03700- REPT-002, Rev. 0. - SRC SLOWPOKE Decommissioning Radiation Physics Assessment, 147-03320-ASD-004, Rev. 0.
(*j*) the proposed measures to control releases of nuclear substances and hazardous substances into the environment;	G E	- SRCSF Decommissioning Environment Protection Requirements, Candu Report, 147-03700-REPT-002, Rev. 0. - SRC SLOWPOKE Decommissioning Action Levels and Radiation Protection Requirements, Candu Report, 147-03400-REPT-002, Rev. 0. - Environmental Impact Statement- Saskatchewan Research Council SLOWPOKE-2 Reactor Decommissioning, 147-01600-R027-371-9001, Rev. 1, Matrix Solutions document, 27464-514 EIS R 2018-11-06. - Detailed Decommissioning Plan for SRC SLOWPOKE-2 Facility, 147-01600-DDP-002, Rev. 0.

CNSC Document and associated Requirements	Section of the Application addressing the requirement	SRCSF Decommissioning Project Support Document (Note: If edition, date or revision number is not specifically mentioned below, the documents applicable to the SRCSF decommissioning project will at the latest revision issued as "approved for use".)
(*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 (v) test the implementation of the measures to prevent or mitigate the effects of an accidental release;	G N	- Occupational Health and Safety Manual, OHS-MAN-1, SRC, February 2018. - Radiation Safety Manual, OHS-MAN-2, SRC, February 2018. - Fire Safety Manual, OHS-STD-11, SRC, February 2016. - CPR-26, Rev. 1, Description and Safety Analysis for the SLOWPOKE-2 Reactor". M.E. wise and R.E. Kay, Atomic Energy of Canada, Ltd. February, 1981. - SRC SLOWPOKE–2 Decommissioning Facility Emergency Response Plan, 147-01600-ERP-002, Rev. 0 - Hazard Assessment Report for Decommissioning SRC SLOWPOKE-2 Facility, 147-01600-HA-002, Rev. 0. - SRC SLOWPOKE–2 Decommissioning Radiological Consequences Assessment, 147-03600-ASD-003, Rev. 0. - SRC SLOWPOKE–2 Decommissioning Out-of-Reactor Criticality Assessment, 147-03340-ASD-002, Rev. 0.
(*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;	F.	- Site Security Plan – submitted separately as classified information. - SRC SLOWPOKE–2 Decommissioning Facility Emergency Response Plan, 147-01600-ERP-002, Rev. 0. - Detailed Decommissioning Plan for SRC SLOWPOKE-2 Facility, 147-01600-DDP-002, Rev. 0.

CNSC Document and associated Requirements	Section of the Application addressing the requirement	SRCSF Decommissioning Project Support Document (Note: If edition, date or revision number is not specifically mentioned below, the documents applicable to the SRCSF decommissioning project will at the latest revision issued as "approved for use".)
(*m*) the proposed responsibilities of and qualification requirements and training program for workers, including the procedures for the requalification of workers; and	K.	- Decommissioning Training Plan for SRC SLOWPOKE-2 Facility, 147-01600-TPL-003, Rev. 0.
(*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.	K.	- Decommissioning Training Plan for SRC SLOWPOKE-2 Facility, 147-01600-TPL-003, Rev. 0.
7. An application for a licence to decommission a Class I nuclear facility shall contain the following information in addition to the information required by section 3:		
(a) a description of and the proposed schedule for the decommissioning, including the proposed starting date and the expected completion date of the decommissioning and the rationale for the schedule;	M.2	- Detailed Decommissioning Plan for SRC SLOWPOKE-2 Facility, 147-01600-DDP-002, Rev. 0.
(b) the nuclear substances, hazardous substances, land, buildings, structures, systems and equipment that will be affected by the decommissioning;	D.4, D.5, B.1, B.2 and D.1	- Detailed Decommissioning Plan for SRC SLOWPOKE-2 Facility, 147-01600-DDP-002, Rev. 0. - CPR-26, Rev. 1, Description and Safety Analysis for the SLOWPOKE-2 Reactor", M.E. wise and R.E. Kay, Atomic Energy of Canada, Ltd. February, 1981. - SRC SLOWPOKE Decommissioning Radiation Physics Assessment, 147-03320-ASD-004, Rev. 0. - Environmental Impact Statement- Saskatchewan Research Council SLOWPOKE-2 Reactor Decommissioning, 147-01600-R027-371-9001, Rev. 1, Matrix Solutions document, 27464-514 EIS R 2018-11-06.

CNSC Document and associated Requirements	Section of the Application addressing the requirement	SRCSF Decommissioning Project Support Document (Note: If edition, date or revision number is not specifically mentioned below, the documents applicable to the SRCSF decommissioning project will at the latest revision issued as "approved for use".)
(c) the proposed measures, methods and procedures for carrying on the decommissioning;	M.1	- Detailed Decommissioning Plan for SRC SLOWPOKE-2 Facility, 147-01600-DDP-002.
(d) the proposed measures to facilitate Canada's compliance with any applicable safeguards agreement;	J	- SRC - IAEA Design Information Questionnaire – submitted separately as classified information.
(e) the nature and extent of any radioactive contamination at the nuclear facility;	N	- Environmental Impact Statement- Saskatchewan Research Council SLOWPOKE-2 Reactor Decommissioning, 147-01600-R027-371-9001, Rev. 1, Matrix Solutions document, 27464-514 EIS R 2018-11-06. - Hazard Assessment Report for Decommissioning SRC SLOWPOKE-2 Facility, 147-01600-HA-002, Rev. 0. - SRC SLOWPOKE–2 Decommissioning Radiological Consequences Assessment, 147-03600-ASD-003, Rev. 0.
(f) the effects on the environment and the health and safety of persons that may result from the decommissioning, and the measures that will be taken to prevent or mitigate those effects;	E.4 N	- Environmental Impact Statement- Saskatchewan Research Council SLOWPOKE-2 Reactor Decommissioning, 147-01600-R027-371-9001, Rev. 1, Matrix Solutions document, 27464-514 EIS R 2018-11-06. - Hazard Assessment Report for Decommissioning SRC SLOWPOKE-2 Facility, 147-01600-HA-002, Rev. 0. - SRC SLOWPOKE–2 Decommissioning Radiological Consequences Assessment, 147-03600-ASD-003, Rev 0. - SRC SLOWPOKE–2 Decommissioning Out-of-Reactor Criticality Assessment, 147-03340-ASD-002, Rev. 0. - Occupational Health and Safety Manual, OHS-MAN-1, SRC, February 2018. - Radiation Safety Manual, OHS-MAN-2, SRC, February 2018. - Fire Safety Manual, OHS-STD-11, SRC, February 2016.

CNSC Document and associated Requirements	Section of the Application addressing the requirement	SRCSF Decommissioning Project Support Document (Note: If edition, date or revision number is not specifically mentioned below, the documents applicable to the SRCSF decommissioning project will at the latest revision issued as "approved for use".)
(g) 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;	G E.2 E.4	- Environmental Impact Statement- Saskatchewan Research Council SLOWPOKE-2 Reactor Decommissioning, 147-01600-R027-371-9001, Rev. 1, Matrix Solutions document, 27464-514 EIS R 2018-11-06. - SRCSF Decommissioning Environment Protection Requirements, Candu Report, 147-03700- REPT-002, Rev. 0. - SRC SLOWPOKE Radiation Physics Assessment, 147-03320-ASD-004, Rev. 0. - SRC SLOWPOKE Waste Management Plan, 147-01622-REPT-002, Rev 0.
(h) the proposed measures to control releases of nuclear substances and hazardous substances into the environment;	E.2	- SRCSF Decommissioning Environment Protection Requirements, Candu Report, 147-03700- REPT-002, Rev. 0. - Environmental Impact Statement- Saskatchewan Research Council SLOWPOKE-2 Reactor Decommissioning, 147-01600-R027-371-9001, Rev. 1, Matrix Solutions document, 27464-514 EIS R 2018-11-06. - Detailed Decommissioning Plan for SRC SLOWPOKE-2 Facility, 147-01600-DDP-002, Rev. 0. - Hazard Assessment Report for Decommissioning SRC SLOWPOKE-2 Facility, 147-01600-HA-002, Rev. 0.
(i) 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 security, including an emergency response plan;	N	- CPR-26, Rev. 1, Description and Safety Analysis for the SLOWPOKE-2 Reactor". M.E. wise and R.E. Kay, Atomic Energy of Canada, Ltd. February, 1981. - Hazard Assessment Report for Decommissioning SRC SLOWPOKE-2 Facility, 147-01600-HA-002, Rev. 0. - SRC SLOWPOKE–2 Decommissioning Radiological Consequences Assessment, 147-03600-ASD-003, Rev. 0. - SRC SLOWPOKE–2 Decommissioning Out-of-Reactor Criticality Assessment, 147-03340-ASD-002, Rev. 0. - SRC SLOWPOKE–2 Decommissioning Facility Emergency Response Plan, 147-01600-ERP-002, Rev. 0. - Occupational Health and Safety Manual, OHS-MAN-1, SRC, February 2018. - Radiation Safety Manual, OHS-MAN-2, SRC, February 2018. - Fire Safety Manual, OHS-STD-11, SRC, February 2016.

CNSC Document and associated Requirements	Section of the Application addressing the requirement	SRCSF Decommissioning Project Support Document (Note: If edition, date or revision number is not specifically mentioned below, the documents applicable to the SRCSF decommissioning project will at the latest revision issued as "approved for use".)
(j) the proposed qualification requirements and training program for workers; and	K	- Decommissioning Training Plan for SRC SLOWPOKE-2 Facility, 147-01600-TPL-003, Rev. 0.
(k) a description of the planned state of the site on completion of the decommissioning.	M.1	- Detailed Decommissioning Plan for SRC SLOWPOKE-2 Facility, 147-01600-DDP-002, Rev. 0.

SASKATCHEWAN RESEARCH COUNCIL
APPLICATION FOR THE LICENCE TO DECOMMISSION THE SASKATCHEWAN RESEARCH COUNCIL SLOWPOKE-2 FACILITY–PART 2

DECEMBER 2018

TABLE OF CONTENTS

A. DATA ABOUT THE APPLICANT

A.1 Applicant's Name and Business Address

Applicant's Full Name: The Saskatchewan Research Council

Head Office Address:
125-15 Innovation Boulevard
Saskatoon, Saskatchewan
S7N 2X8

Business Address:
125-15 Innovation Boulevard
Saskatoon, Saskatchewan
S7N 2X8

Saskatchewan Research Council (SRC) SLOWPOKE-2 Physical Location:
SRC Environmental Analytical Laboratories

Address:
102 - 422 Downey Road,
Saskatoon, Saskatchewan S7N 4N1

SRC Facility Manager's Address:
Philip Rees
CSO & Facilities Manager
Saskatchewan Research Council
125 - 15 Innovation Boulevard
Saskatoon, SK, Canada S7N 2X8
Voice: +1.306.385.4024
Philip.Rees@src.sk.ca

A.2 Applicant's Organizational Structure

This section presents the organization structure of the SRC SLOWPOKE-2 Facility (SRCSF) Decommissioning project. The roles and responsibilities for each position in the organization structure are described and the descriptions provided are consistent with the QA plan for decommissioning [1]. The organizational management for the SRCSF Decommissioning is presented in Figure A-1 and Figure A-2. SRC's organizational structures are integrated in the overall organization of the SRC Decommissioning Project. Figure A-3 presents the organization structure of the decommissioning site team.

A.2.1 Roles and Responsibilities – SRC

SRC is the legal owner of the SLOWPOKE-2 reactor. This organisation is responsible for the operation of SLOWPOKE-2 and all administrative matters pertaining to the operation, decommissioning, monitoring, safety and control of the facility. The President/CEO of the SRC is the ultimate authority in all matters pertaining to the facility.

A.2.1.1 SRC Decommissioning Facility Authority (SRC-DFA)

The President and CEO of SRC, Dr. Laurier Schramm is the SRC DFA. The SRC DFA is responsible/accountable for the safe operation, maintenance and decommissioning of the SRC reactor in compliance with all applicable licences, permits, laws and regulations, policies and procedures.

The SRC DFA is responsible, while providing oversight of activities that are Candu's responsibility, for:

- Ensuring the overall safe operation, maintenance and decommissioning of the facility;
- Ensuring adherence to the requirements of all licences, permits, regulations, and any applicable federal or provincial legislation;
- Communicating and interfacing with external groups, such as CNSC, Canadian Nuclear Laboratories (CNL) Freight forwarders for SLOWPOKE-2 Nuclear Fuel. However, Candu will facilitate all communication;
- Accepting and authorizing the use and implementation of the SRC Decommissioning QA Plan;
- Identifying QA audit requirements, facilitating the required audits, and following through on the results;
- Ensuring all facility-related corrective actions due to site errors are implemented in a timely manner;
- Being familiar with the facility, the employees' roles and responsibilities, operations, and major work in progress and in planning, as per Candu's project schedule;
- Being familiar with the facility hazards, environmental impacts, operations, and licensing requirements;
- Interfacing with stakeholders and the contractor concerning project issues;
- Authorizing decommissioning work and stopping work, when it is deemed necessary;
- Acting as the official contact with the regulatory authorities in matters that relate to the operation, maintenance and decommissioning of the facility; and
- Appointing the SRC Decommissioning Facility Manager.

A.2.1.2 SRC Decommissioning Facility Manager (SRC-DFM)

Philip Rees is the SRC-DFM. The SRC DFM reports to the SRC DFA and is responsible for operating the facility and conducting work in the facility within the safe operating envelope defined in the documents listed in the licence and in accordance with regulatory, health, safety, and environmental requirements.

The SRC DFM has the following responsibilities, while providing oversight of activities that are Candu's responsibility:

- Approval and execution oversight of both normal operating activities and decommissioning work in accordance with this QA Plan;
- Acting as the Work Permit Authorizer;
- Ensuring all applicable safety procedures and Radiation Work Assessments or Radiation Work Plans are being adhered to;
- Managing the facility to be decommissioned to ensure that operations (if applicable), maintenance, monitoring, surveillance, assessments verification, and work processes are performed in a safe and compliant manner until the final decommissioning end state is achieved;
- Implementing the SRC Decommissioning QA Program in managing the facility being decommissioned;
- Provide status reports to SRC DFA, as required;
- Having the authority to take appropriate actions to rectify problem areas within the SRC QA Program identified by, e.g., program surveillance, audits, self-assessments, and program reviews;
- Day-to-day protection of Health, Safety, Security, & Environment (HSSE) within SRC;
- Being knowledgeable about and ensuring the maintenance of documents listed in the license; and
- Monitoring and periodically reviewing the functioning and effectiveness of the operations and decommissioning QA program and that of the supporting services and nuclear programs in the Facility.

A.2.1.3 SRC Decommissioning Project Manager (SRC-DPM)

Philip Rees is the SRC-DPM. The responsibilities of SRC DPM, in addition to providing oversight of activities that are Candu Energy's responsibility, are as follows:

- Ensuring the overall safe operation, maintenance and decommissioning of the facility;
- Ensuring adherence to the requirements of all licenses, permits, regulations, and any applicable federal or provincial legislation;
- Communicating and interfacing with external groups, including the CNSC;
- Accepting and authorizing the use and implementation of the SRC Decommissioning QA Plan;
- Ensuring all assigned staff are properly qualified, trained and authorized to perform the jobs they are assigned;
- Identifying QA audit requirements, facilitating required audits, and following through on the results;
- Ensuring all applicable safety procedures and Radiation Work Assessments or Radiation Work Plans are being adhered to;
- Authorizing decommissioning work and stopping work, when it is deemed necessary;
- Ensuring all facility-related corrective actions due to site errors are implemented in a timely manner; and
- Acting as the Single Point of Contact (SPOC) for all communications regarding technical, administrative or project management issues.

A.2.1.3 SRC Decommissioning Nuclear Material Transportation and Safeguards Manager (SRC-DTSM)

Dave Chorney is the SRC-DTSM. Reporting to the SRC-DFA for the SRC decommissioning project purposes, the SRC - DTSM has the following responsibilities:

- Arranging for the shipment of all radioactive waste, equipment and materials arising from the decommissioning activities;
- Obtaining the necessary licences and permits to ship all radioactive materials;
- Providing RAM shipper services;

- Arranging transportation services (e.g., trucks) to ship radioactive materials;
- Arranging all necessary equipment to facilitate removal of shipping containers;
- Ensuring compliance with IAEA safeguards requirements; and

Ensuring adherence with the manuals/procedures associated with the SRC decommissioning QA Plan in the performance of the work scope under his/her responsibilities.

A.2.2 Roles and Responsibilities – Candu Energy Inc.

SRC has appointed Candu Energy Inc. to plan, execute and provide licensing support for decommissioning the SLOWPOKE-2 reactor. The following sections outline the roles and functional responsibilities for Candu Energy Inc. and are described in the SRC decommissioning QA program [1].

A.2.2.1 Candu Director, Field Services

Nat Natesan is Candu Director, Field Services. The Director, Field Services Project Management reports to the VP, Project Delivery and leads a team of dedicated Project Managers, Project Planners and Account Specialists in securing, planning, and delivering Candu Services projects on schedule, within budget and to the required quality.

A.2.2.2 Candu Decommissioning Project Manager (Candu DPM)

Jarek Goszczynski is the Candu-DPM. Reporting to the Director, Field Services, the Candu DPM is the SPOC within Candu and has the overall responsibility and authority for the implementation of the project QA program. In addition, the Project Manager is responsible for:

- Managing the successful delivery of the project;
- Managing all aspects of project management and contract administration, and ensuring the correct balance of delivery and commercial success is maintained;
- Leveraging the skills of the project control staff to ensure that the project is properly planned and controlled;
- Ensuring performance against plan is monitored regularly and cost, schedule and other variances are promptly detected in time for corrective actions;
- Providing commercial direction as needed to the Functional Manager(s);
- Working directly with the customer and/or partners to resolve project issues, and facilitating technical communication between Candu and the customer as needed; and
- Coordinating inputs to fiscal budgeting/forecasting.

A.2.2.3 Candu Decommissioning Technical & Training Lead (Candu DTTL)

Shahzad Alim is the Candu DTTL. Reporting to the Candu DPM, the DTTL has the following responsibilities:

- Leading the execution of the work, ensuring that all technical work is coordinated, integrated and properly verified, and is completed according to the budget, schedule and quality program;
- Reporting on the project's progress and providing estimates to complete the work to the project planner as requested;
- Identifying technical scope/schedule changes, changes in risk, or any other potential commercial issues to the PM for commercial resolution;
- Assisting the Project Manager in ensuring decommissioning is being performed safely and in accordance with approved working plans and procedures;
- Oversee the development of training based on staff needs for any additional work including preparatory work, vessel disassembly and component removal, auxiliary systems operation, disassembly and components removal;

- Day-to-day oversight of SRC maintenance activities related to decommissioning;
- Day-to-day supervision of the SRC decommissioning operating personnel;
- Preparation/review of documents required for decommissioning activities; and
- Ensuring that operations, maintenance, monitoring, surveillance, assessments verification, and work processes are performed in a safe and compliant manner until the final decommissioning end-state is achieved.

A.2.2.4 Candu Decommissioning Radiation Protection & Environmental Protection Manager (Candu DRP&EPM)

Yahui Zhuang is the Candu DRP&EPM. Supporting the decommissioning of the SRC reactor, the DRP&EPM has the following responsibilities:

- Ensuring that Candu Energy Inc.'s radiation & environmental protection requirements are satisfied at the SRC decommissioning site;
- Design and performance of radiological characterization and release surveys;
- Ensuring calibration of radiological instrumentation;
- Provide the necessary radiation protection training for SRC staff;
- Provision of radiological hazard assessments to support decommissioning plans, procedures and end-state documentation;
- Provision of radiation monitoring and decontamination equipment;
- Verify the radioactive level of the waste resulting from the decommissioning activities; and
- Ensuring adherence with the procedures associated with the decommissioning of the SRC QA Plan in the performance of the work scope under his/her responsibilities.

A.2.2.5 Candu Decommissioning Licensing Manager (Candu DLM)

Nicu Anghelidis is the Candu DLM. Reporting to the Candu DPM for SRC decommissioning project purposes, the DLM has the following responsibilities:

- Providing guidance and direction for activities necessary to obtain regulatory approvals for proposed decommissioning activities;
- Assist SRC with communications with CNSC for licensing work; and
- Ensuring adherence with the procedures associated with the QA Plan for SRC decommissioning in the performance of the work scope under his/her responsibilities.

A.2.2.6 Candu Decommissioning Licensing Lead (Candu DLL)

Shyam Ramachandran is the Candu DLL. Reporting to the Candu DLM, the DLL is responsible for:

- Preparation of the licensing documentation which includes the Applications for the Licence to Decommission and for the License to Abandon the SRC reactor;
- Assist SRC with communications with CNSC for licensing work;
- Participate in the meetings regarding licensing matters; and
- Ensuring adherence with the procedures associated with the decommissioning of SRC QA Plan in the performance of the work scope under his/her responsibilities.

A.2.2.7 Candu Decommissioning Waste Management Manager (Candu DWMM)

Yahui Zhuang is the Candu DWMM. Reporting to the Candu DPM for the project scope the DWMM has the following responsibilities:

- Preparation of the Waste Management Plan;
- Defining the process, procedures and performance measures;

- Assigning responsibilities to the Waste Management staff;
- Verifying that waste management practices are in compliance with the applicable requirements;
- Ensuring implementation of waste minimization and pollution prevention, related to waste management; and
- Ensuring adherence with the procedures associated with the decommissioning of SRC QA Plan in the performance of the work scope under his/her responsibilities.

A.2.2.8 Candu Decommissioning Quality Assurance Manager (Candu DQAM)

Woldetsadik Gelan is the Candu DQAM. Reporting to the Candu DPM for the project scope, the DQAM assigned for the SRC decommissioning project maintains independence from budget and schedule considerations.

The DQAM has the following responsibilities:

- Developing a procedural system supporting the project QA program;
- Establishing quality measures that provide an overview of the quality of work being performed and allowing the determination of quality trends;
- Identifying quality-related problems and initiating actions leading to their resolution;
- Monitoring activities to assure conformance to quality assurance standards, manuals, and procedures applicable to the project;
- Monitoring the effectiveness of the project's QA program via assessments (audits);
- Monitoring and verifying the quality of items and services supplied by suppliers and their sub-suppliers; and
- Providing guidance on the interpretation of applicable standards, manuals and procedural documents.

A.2.2.9 Candu Decommissioning Planning and Control Representative (Candu DPCR)

Mehdi Mohadi and Roxana Amarioarei are the Candu DPCR. Reporting to the Candu DPM for the project scope, the DPCR is responsible for the following:

- Collecting and organizing data on cost, schedule, and scope changes;
- Monitoring performance against plans, budgets, and forecasts and reporting on variances to management;
- Controlling and integrating scope changes into work programs, schedules, accounts and document baselines;
- Preparing target plans, carrying out risk management analyses, and monitoring and controlling schedules, budgets, resources, and identified risk items;
- Attending project meetings, reporting on project status, trends, progress, and risk-item management; and
- Interfacing with Candu Finance, providing staffing hours and expense information, and setting up related control processes.

A.3 Quality Assurance Program

The SRC Decommissioning Project Quality Assurance Plan (QAP) [1] describes the Quality Assurance Program applied to the decommissioning activities of SRCSF. The purpose of the QAP is to document the specific processes, resources, planning and control of activities relevant to the decommissioning of SRCSF project ensuring compliance with the quality program standards referenced in the contractual documents (including CSA N286-12). The QAP provides additional information regarding the organization of the SRC decommissioning project and the internal allocation of functions, responsibilities and authority.

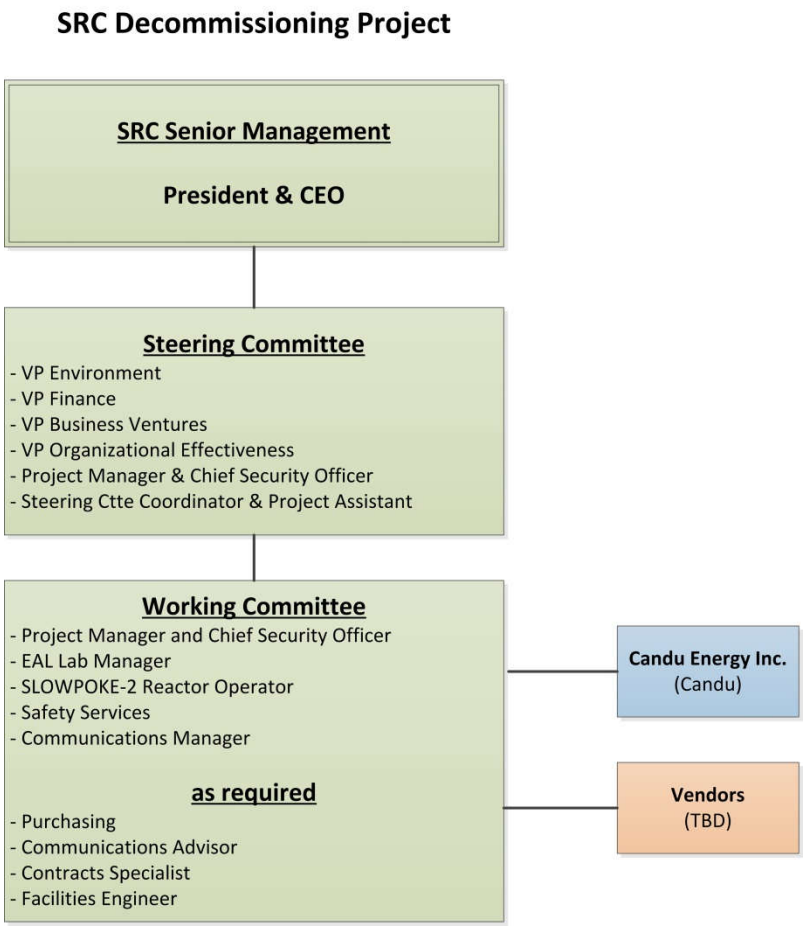

Figure A-1 SRC Decommissioning Organization Management

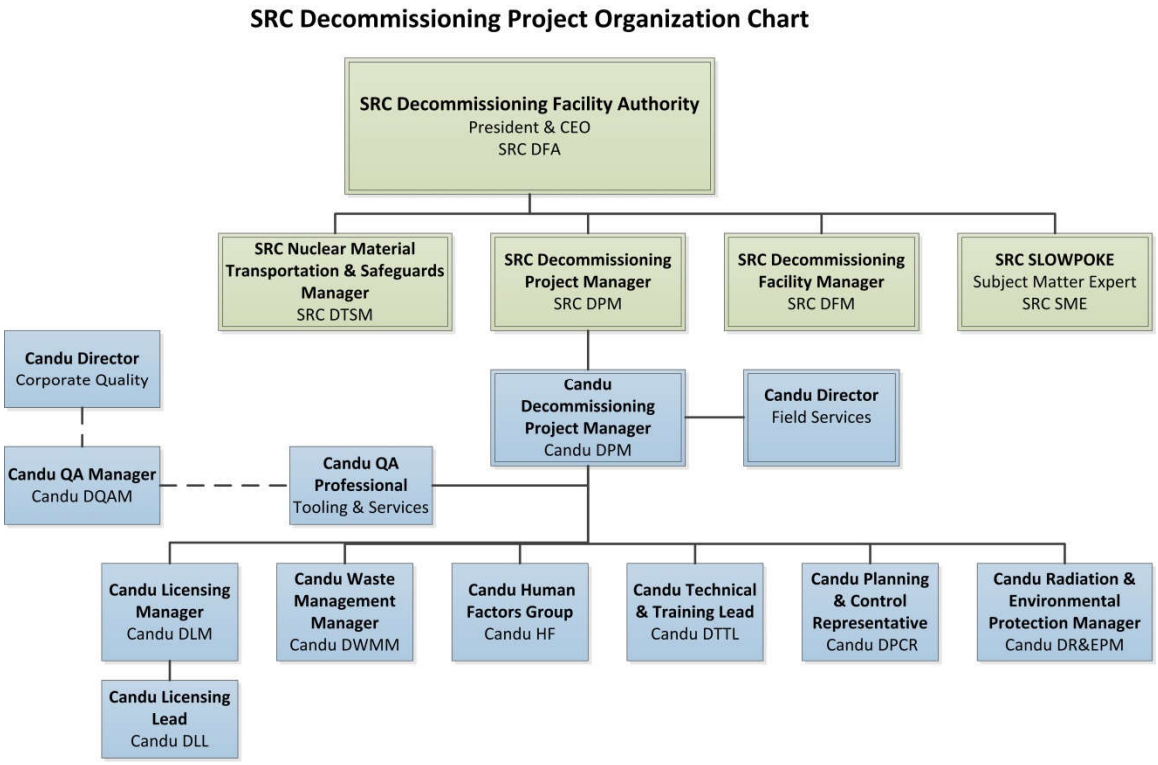

Figure A-2 SRC Decommissioning Organisation

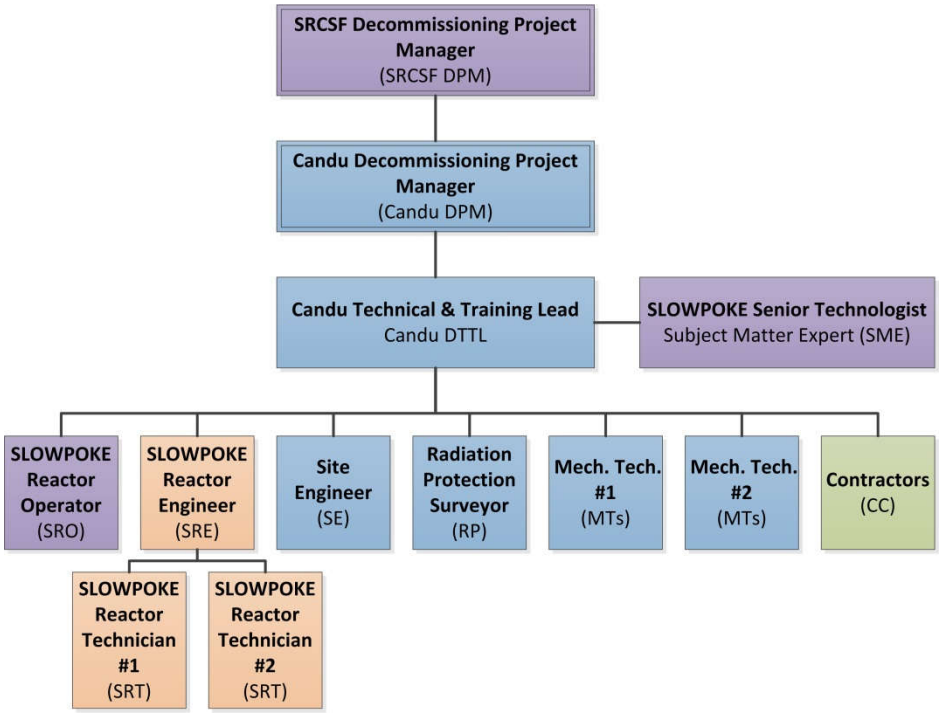

Figure A-3 SRC SLOWPOKE-2 Decommissioning Site Team

B. DATA ABOUT THE SITE

B.1 Site Description

The SRCSF is located in Saskatoon, Saskatchewan. As per the 2016 census, the city of Saskatoon had a population of 245,181. The SRCSF is installed in the SRC Environmental Analytical Laboratories complex located in the Innovation Place Research Park. The Environmental Analytical Laboratories complex was originally constructed simultaneously with the Council's Multi-purpose Pilot Plant and shared the same building which is known as the Resources Research Center (RRC building). The laboratory complex has since expanded and now occupies the former pilot plant area. The RRC building also houses Potash Corporation of Saskatchewan pilot plant which is independently accessed. The location of this building within the Innovation Place Research Park is shown in Figure B-1 and Figure B-2 . The Research Park is bounded by the University of Saskatchewan Campus to the south and west, the Sutherland-Saskatoon CPR tracks to the north and Preston Avenue to the east. The location is about 0.4 km from the South Saskatchewan River. The nearest residential area, located in Sutherland, is about 0.8 km away, directly to the east. The description provided in Section B is consistent with the detailed Site Description is provided in **[2**].

B.2 Location

The SRCSF is part of the SRC's Environmental Analytical Laboratories located in the Resources Research Centre building at 422 Downey Road in the Innovation Place Research Park in Saskatoon. The SRCSF occupies approximately 1400 square feet in the south end of the building.

Figure B-3 shows the floor plan of the SRCSF. Within the SRC Environmental Analytical Laboratories building, the SLOWPOKE-2 Facility comprises of: Reactor Room, Uranium Analysis Laboratory, Neutron Activation Analysis Laboratory, and Sample Storage Room. This area is shown in Figure B-4. There is only one entrance to the facility and this is through the doors leading from the Radiochemical Laboratory into the Uranium Analysis Laboratory. These doors are kept locked and area motion sensors are armed during non-working hours. Access to the Reactor Room is through the doors between it and the Uranium Analysis Laboratory. These doors are kept locked at all times unless a Licenced Operator has control of the area. There are no windows, skylights or other means of access to the Reactor Room. All walls of the Reactor Room are a minimum of 20 cm masonry construction. The floor is an on-grade concrete slab with no crawl space underneath. The roof over the Reactor Room is heavy gauge steel. .
The location of the reactor pool within the Reactor Room is shown in Figure B-4. Service trenches extend to and along the south wall. The reactor container demineralizer (L) and pool demineralizer (J) are installed along this south wall. The control console projects outwards from the north wall (I) and faces the doors to the Reactor Room. Trenches for transfer lines and other services extend from either side of the pool to the east wall and to the west wall. These trenches project under the walls into the adjacent rooms to provide routing of the transfer lines. Provision has been made for the conversion of the Plasma Spectrometer Laboratory to a Neutron Activation Laboratory.
The remote shutdown button is located on the left wall exterior to the doors between the Uranium Analysis Room and the Radiochemistry Laboratory.

The reactor pool is covered by six concrete blocks 75 cm high, 55 cm wide, and 300 cm long. These pool cover sections are moved individually by hydraulically lifting each end on dollies that traverse a set of tracks extending from the east wall to the west wall. One track is on the north side of the pool and the other is on the south side.

The sample handling areas consist of the Uranium Analysis Laboratory, the Neutron Activation Laboratory and the Sample Storage Room. Samples are normally weighed and sealed in capsules before they are brought into these laboratories for analysis. However, limited facilities (a fume hood) are available for performing some encapsulations within the two SLOWPOKE-2 laboratories. At the present time, all irradiations for neutron activation analysis are performed manually using controllers C, E and F (see Figure B-4). If not counted immediately these irradiated samples are stored in the storage room until required for analysis. The storage room has solid concrete walls 40 cm thick which helps maintain low radiation fields in the areas surrounding the room. Low to medium activity samples (up to 20 mR/h at 10 cm) are stored on open shelves. Higher activity samples are stored in a sub-floor pit G (see Figure B-4) that has a wheeled, 10

cm thick lead cover. Gamma spectroscopy measurements are performed in the Neutron Activation Analysis Laboratory. Lead shielding 10 cm thick is provided for all detectors.
The uranium analysis system A (see Figure B-4)) in the Uranium Analysis Laboratory automatically transfers samples to and from the reactor, performs the delayed neutron counting and then ejects the analyzed sample to a container in the storage room. The only handling of irradiated samples required in this operation is to store the collected batch of analyzed samples on the shelving in the storage area.

Access to the Uranium and Neutron Activation Laboratories is controlled by a Licenced Operator or Authorized User. Access to the Reactor Room is strictly controlled by a Licenced Operator.

B.2.1 Seismology of Saskatoon

Saskatoon falls in the low hazard area for earthquakes to occur, based on the probability of experiencing damaging ground motions, as shown in the earthquake hazard map (Figure B-5).

The damage potential of an earthquake is determined by how the ground moves and how the buildings within the affected region are constructed. Expected ground motion can be calculated on the basis of probability, and the expected ground motions are referred to as seismic hazard. The seismic hazard map layer indicates the relative seismic hazard across Saskatchewan. This map is a simplification of the National Building Code of Canada seismic hazard map for spectral acceleration at a 0.2 second period (5 cycles per second), and shows the ground motions that might damage one- to two-storey buildings. The probability of strong shaking (strong enough to cause significant damage in a fraction of these buildings) is more than 30 times greater in the regions of highest hazard (at least a 30 per cent chance of significant damage within towns of these regions every 50 years) than in the regions of lowest hazard (less than 1 per cent chance in 50 years). Saskatoon falls in the low hazard region [3].

No damage from earthquake tremors is expected in SRCSF. Nonetheless, the reactor pool is designed to minimize the effects of minor lateral movements.

B.2.2 Soil Conditions, Ground Water and Drainage

The discussion in this section is based upon the Environmental Impact statement (EIS) [4], which reviews the geology, the hydrogeology and the groundwater from other studies. The following is a summary of the discussion in the EIS. The unconsolidated sediment below the site is approximately 60 m high over bedrock. The surface deposits comprise of sand, silt and clay deposited in glacial lakes. The EIS also discusses in detail about the geology in Saskatoon, from the bedrock of Bearpaw formation.

The City of Saskatoon sources its municipal water from the South Saskatchewan River, which originates in the Rocky Mountains. This water is purified at Saskatoon's water treatment plant and is distributed for human consumption.

Since municipal water is readily available, groundwater usage in the vicinity of the SRC's buildings in Innovation Park is likely limited. The two nearest water wells are 680 m north and 1,200 m northeast of Innovation Park and were both drilled for research purposes for than 40 years ago. Both wells are in agricultural areas and it is possible these wells are used for agricultural purposes.

Given that the aquifer vulnerability is considered low throughout much of Saskatoon, groundwater contamination is not expected to pose a risk during decommissioning. Notwithstanding, decommissioning activities are also unlikely to affect local groundwater since water from the reactor pool will be cleaned and disposed of in the sanitary sewer, not discharged to surface or groundwater.

Detailed information on drainage systems are provided in Section 4.4. of the Site Description and Operating Manual [2].

B.2.3 SRC SLOWPOKE-2 Site Plan

The SRCSF is a self-contained facility within SRC Analytical. The floor plan of the SRC Analytical is shown in Figure B-3. The SRCSF consists of four rooms (Figure B-4):

- Uranium analysis laboratory (room 143);
- Gamma spectroscopy laboratory (room 144);
- Radiation sample storage room (room 145); and
- Reactor room (room 146).

The only entrance to the SRCSF is through the doors leading from the Radiochemical Laboratory (room 139) into the Uranium Analysis Laboratory (room 143).

The SRC Radiochemical Laboratory uses parts of the SRCSF. For example, radioactive materials used by the laboratory are stored in the SRCSF's room 145 and gamma spectroscopy measurements are performed in room 144. It is anticipated that the operation of the SRC Environmental Analytical Laboratories will continue during and after the decommissioning. However; no laboratory operations will take place in room 146.

B.3 Site Ownership

SRC is the legal owner of the SLOWPOKE-2 reactor. This organisation is responsible for the operation of the Reactor and all administrative matters pertaining to the operation, monitoring, safety and control of the SRCSF. The organisational structure for the facility as applicable to decommissioning is provided in Section A of this document. A complete description of the operating organisation is provided in Section 5 of the Site Description and Operating Manual [2].

SRC is governed by the Research Council Act [5] and abides by all federal provincial and municipal regulations. Of particular relevance to the SRCSF are the Occupational Health and Safety Act (Saskatchewan) and the standards set forth by the Canadian Association for Laboratory Accreditation, Inc. (CALA)

SRC provided a letter to CNSC [6] providing evidence that SRC has the authority of the owner of the site, Ministry of Central Services, formerly Saskatchewan Property Management Corporation, a treasury board corporation to operate the facility at 422 Downey Rd as encompassed by the license granted by the CNSC, which would include decommissioning the facility as this is governed by the CNSC.

Figure B-1 Aerial View of the SRC Environmental Analytical Laboratories

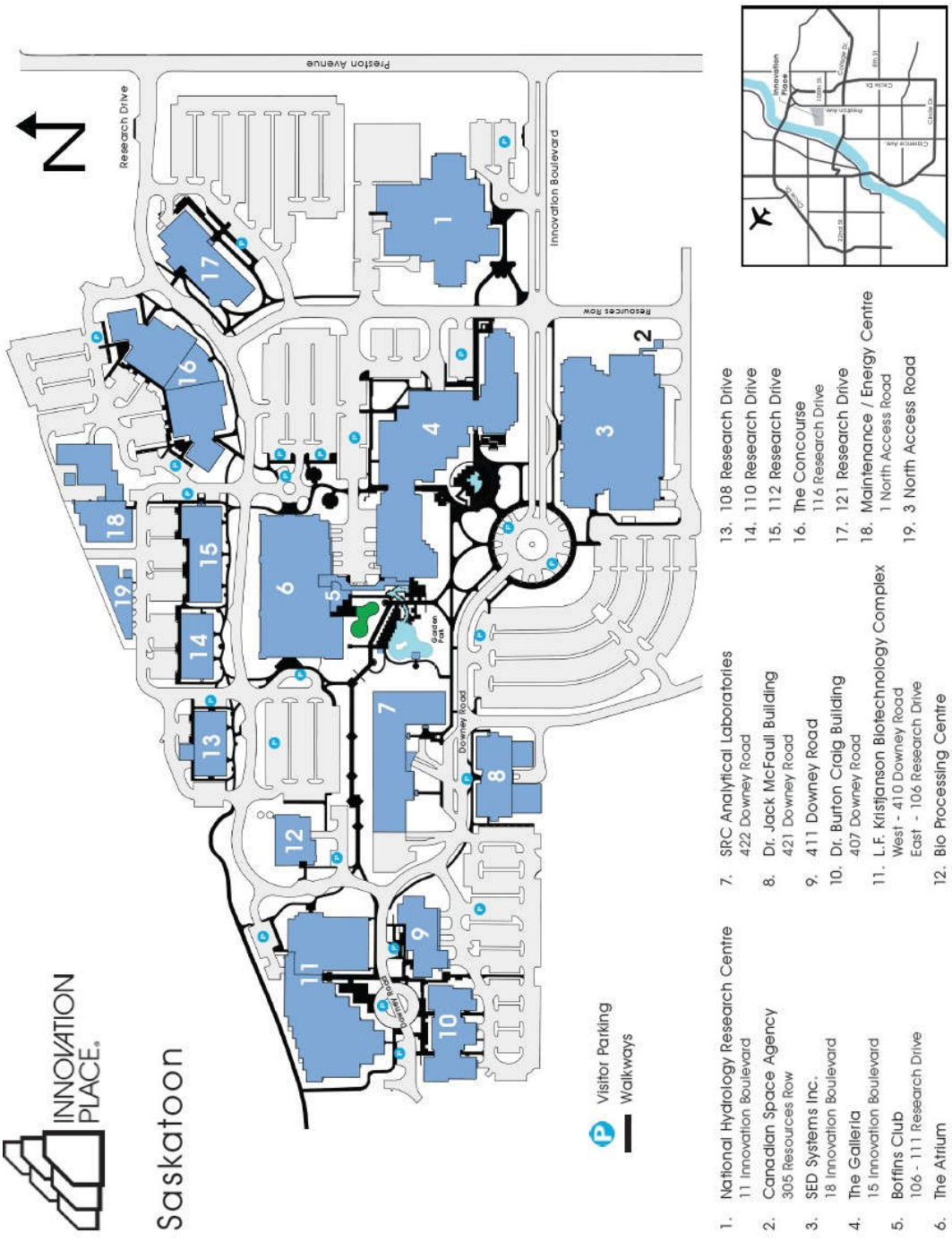

Figure B-2 Location of Reactor and RRC Building in the Innovation Park

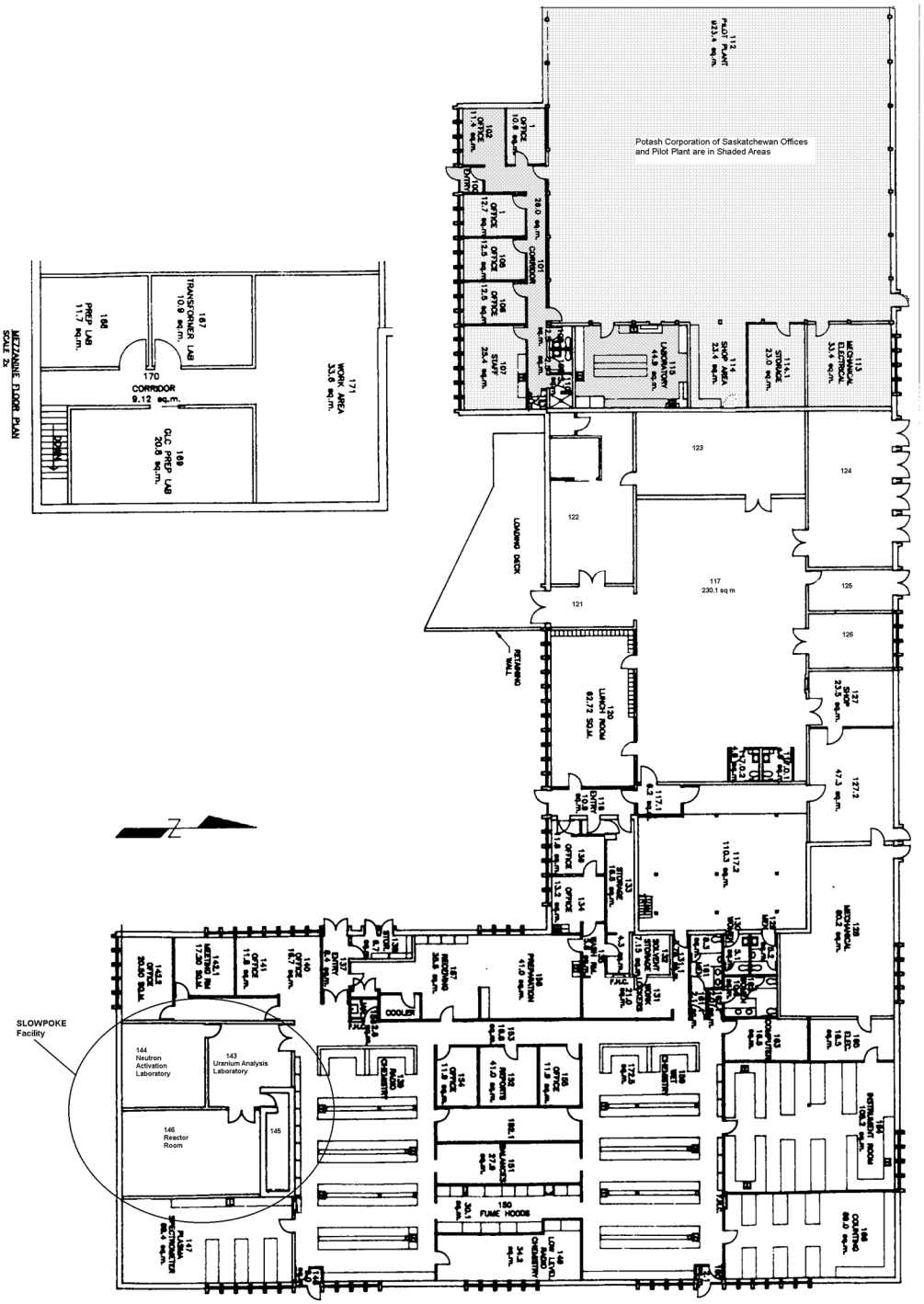

Figure B-3 SRC Analytical Floor Plan

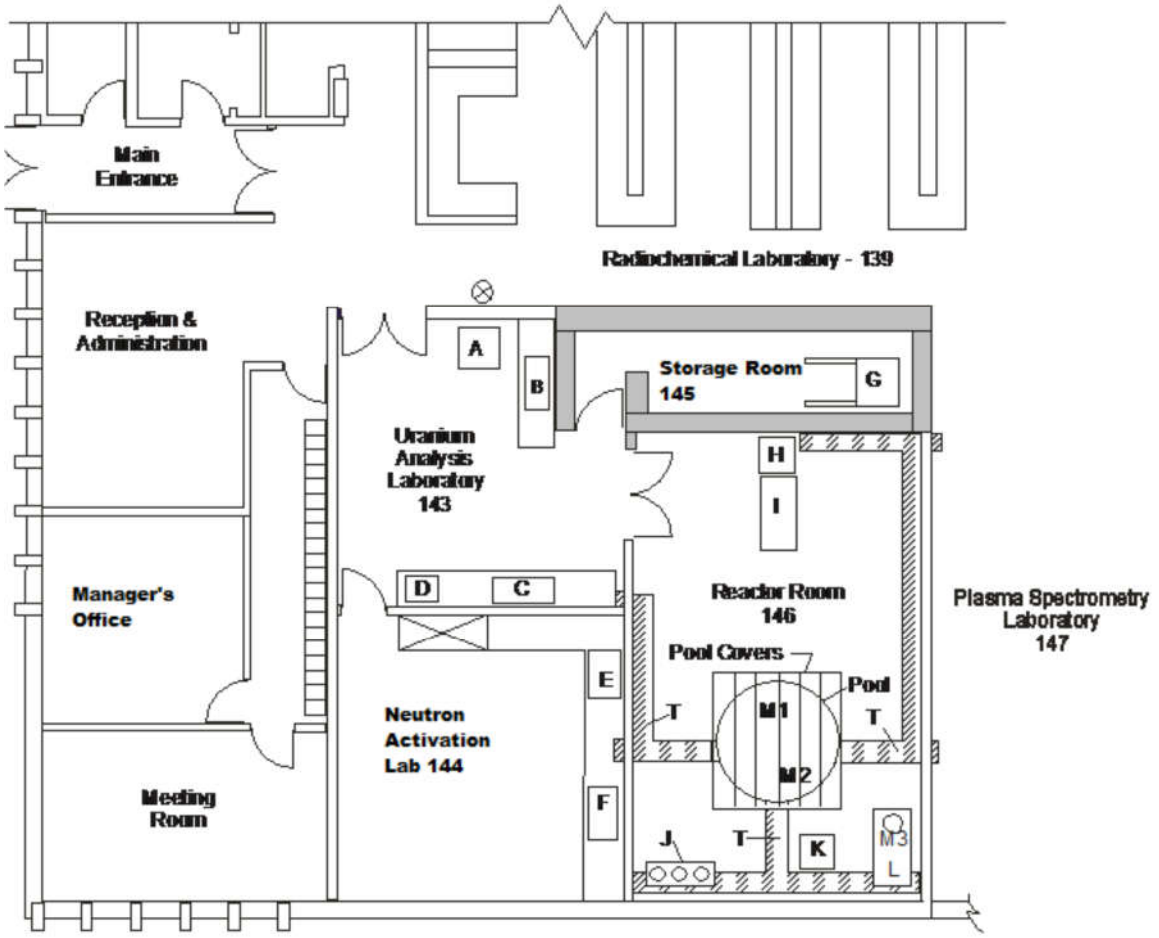

Figure B-4 Layout of SRCSF Reactor Room and Associated Labs

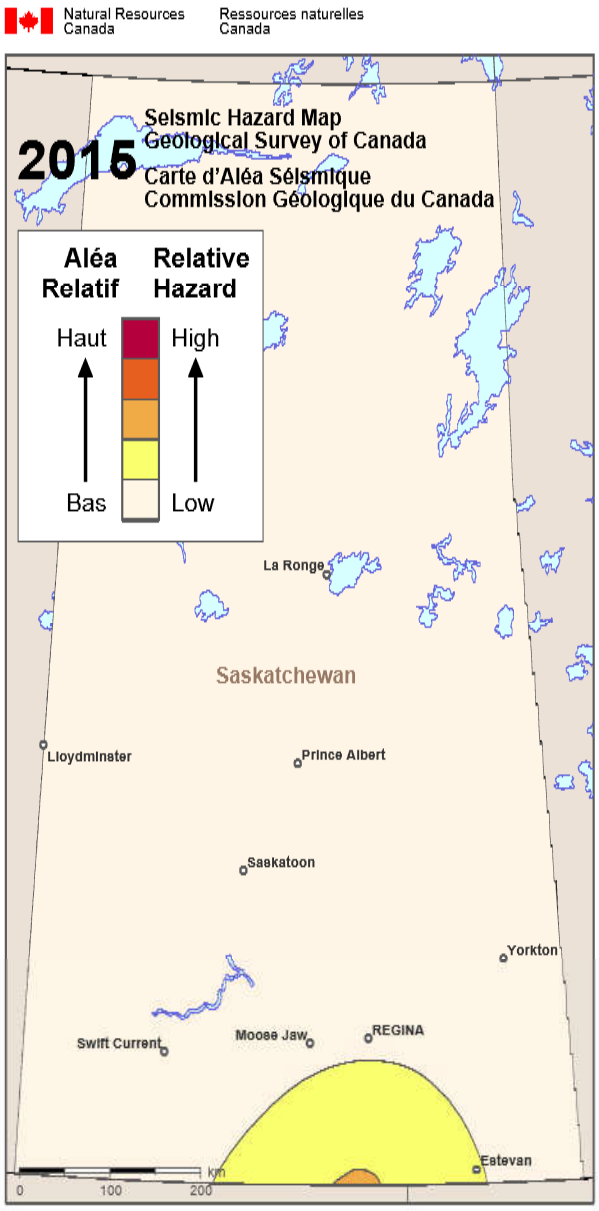

Figure B-5 Seismic Hazard Map of Saskatchewan
Source: Natural Resources of Canada website

C. ACTIVITIES TO BE LICENSED

SRCSF currently operates under the Non-Power Reactor Operating Licence, NPROL 19.0/2023 **[7]**. This application supports an amendment to the existing license (NPROL 19.0/2023 **[7]**) to allow the following licensable activities associated with the decommissioning of the SRCSF:

a) Decommission the SRC SLOWPOKE-2 reactor located in SRC Analytical, and comprising the facilities described in References [8] and [2];
b) Operate, only for the purposes of decommissioning the SRC SLOWPOKE-2 reactor and associated facilities – the uranium analysis laboratory, neutron activation laboratory and storage room –located in the SRC Environmental Analytical Laboratories (EAL) in the Saskatoon Research Park (Innovation Place), in Saskatoon, Saskatchewan, in accordance with the Decommissioning Instructions associated with the Decommissioning Work Packages 1 and 2 identified in the Detailed Decommissioning Plan (Reference [9]);
c) Produce, possess, transfer, use, package, manage, and store the nuclear substances that are required for, associated with or arise from the activities described in a) and b);
d) Possess, use, produce, store and transfer prescribed equipment that is required for, associated with, or arises from, the activities described in a) and b); and
e) Possess, use and transfer prescribed information that is required for, associated with, or arises from, the activities described in a) and b).

The objective for the decommissioning of the SRCSF is to achieve conditions that will allow SRC the unrestricted use of the building and services remaining in the facility.
The operation of the SRCSF under the amended licence will be consistent with the provisions of References [2], [8], [10] and [11]. These activities will be conducted in accordance with the Decommissioning Instructions associated with the Decommissioning Work Packages identified in the Detailed Decommissioning Plan (Reference [9]) by personnel currently certified as SLOWPOKE-2 Reactor Engineer and SLOWPOKE-2 Reactor Technician.
This application is for an amendment of the current operating licence issued by the CNSC for the operation of the SRC SLOWPOKE-2 reactor at SRC (NPROL 19.0/2023 [7]). The scope of the amendment is to allow the SRCSF to perform activities that are required for the decommissioning of the facility. In this respect the information presented in this application supplements the information presented in the most recent application for the renewal of the operating licence, "Application for Renewal of the SLOWPOKE-2 Reactor Operating Licence", SRC Publication No. 12736-4E12, August, 2012 **[12]**. The information is presented in a format that follows the requirements in the General Nuclear Safety and Control Regulations (Section 3, Section 6 and Section 7), and, the Class 1 Nuclear Facilities Regulations (Section 3, Section 6 and Section 7).
The proposed effective date for the amended licence (NPROL amendment) is expected to be August 01, 2019. Although, it is expected that the amended licence should be valid until June 30, 2023, it is anticipated that the conditions necessary for the issuance of a Licence to Abandon the SRC SLOWPOKE-2 facility would be met in a shorter timeframe.

D. DATA ABOUT THE FACILITY, PRESCRIBED EQUIPMENT AND ABOUT NUCLEAR AND HAZARDOUS SUBSTANCES

D.1 Facility Description

The SRCSF is a self-contained unit within the space occupied by SRC EAL in the Resources Research Center building. The building is an L-shaped structure. The eastern wing, which houses the SRSCSF, is a single story. The northern wing was originally intended to be a pilot plant and is approximately double the height of the eastern wing; however it does not contain a second floor. A floor plan of the building and SRC EAL is provided in Figure B-3. The SRCSF consists of the reactor room (room 146), uranium analysis laboratory (room 143), neutron activation laboratory (room144), and sample storage room (room 145). This area is detailed in Figure B-4. There is one entrance to the facility, through the doors leading from the radiochemical laboratory (room 139) into the uranium analysis laboratory. These doors are kept locked during non-working hours. Access to the reactor room is through the doors between it and the uranium analysis laboratory. These doors are kept locked at all times unless a licenced operator is in attendance. There are no windows, skylights or other means of access to the reactor room. All walls of the reactor room are a minimum of 20 cm masonry construction. The floor is an on-grade concrete slab with no crawl space underneath. The roof over the reactor room is heavy gauge steel.
The rooms immediately adjacent to the SRCSF are:

- To the west side of the neutron activation and uranium analysis laboratories are the manager's office, a meeting room, and the reception and administration office. The east wall of the meeting room is shared with the SRCSF, and a hallway separates the SRCSF from the manager's office and reception and administration office.
- To the north was the radiochemical laboratory (room 139). The equipment in this room has now been moved to a different location outside this building and this area is currently vacant.
- To the east of the reactor room was the plasma spectrometry laboratory (room 147). The equipment in this room has now been moved to a different location outside this building and this area is currently vacant.
- The south walls of the reactor room and the neutron activation laboratory are the exterior building wall. A pedestrian sidewalk is situated approximately 3m south of this exterior wall.

The reactor room, neutron activation laboratory and uranium analysis laboratory are connected to the building ventilation system and receive about 8 air changes per hour. The reactor room is equipped with an exhaust duct connected to an extraction blower located on the roof. This exhaust system receives the exhaust gases from the pneumatic transfer systems and the reactor headspace purge system. The fume hood located in the neutron activation laboratory has its own dedicated exhaust fan system.
The building heating and cooling system consists of steam and chilled water distributed from the Innovation Place energy center. Heating/cooling ducts are situated in the building sub-ceiling.

Electrical power is supplied via the building electrical distribution system at 110 and 220 VAC to the reactor room and adjacent laboratories. Electrical breakers for the supply are located in the reactor room and in room 139. Power for emergency lighting in the SRCSF is supplied by rechargeable batteries that are continuously charged by the building electrical supply. The emergency lighting system is checked monthly. In the event of a power failure, backup power for the reactor water temperature recorder, neutron flux control rod position recorder, neutron flux meter, and radiation monitors is supplied by a series of three rechargeable 12 VDC lead-acid batteries located in an acid resistant, leak-proof container on the floor behind the reactor control console.
A water main is situated under the floor near the perimeter of the SRCSF. A single waterline enters the reactor room in the service trench in the floor along the south wall. This line supplies the pool make-up water and cooling systems. A line from the building cooling system is also connected to the pool cooling system to provide additional cooling when the domestic water supply is too warm to provide effective cooling. Each of the service trenches extending from the east, south and west sides of the reactor pool are connected to drains to the building sanitary sewer system. In addition, there is an acid proof drain in the floor of the reactor room. The overflow pipe from the reactor pool drains into a sump near the east wall of the reactor room. A water-level activated sump pump discharges from the sump into the building sanitary sewer system.

The reactor room contains little in the way of combustible materials with fire resistant materials being used for the pool covers and building structures. Each room in the SRCSF is equipped with smoke detectors which are directly connected to the building alarm system. The smoke detectors are tested annually. The building is equipped with several fire extinguishers. A fire extinguisher is located beside the entrance doors to the SRCSF.

SRC EAL analyzes environmental samples for a variety of chemical, radiochemical and microbiological constituents. The related hazards are similar to what can be expected in chemical analysis laboratories of similar size and type. They include hazards that can arise from the storage of compressed gases, storage and handling of organic solvents, and storage and handling of small quantities of toxic or reactive chemicals. Natural gas is plumbed throughout the building for use in standard laboratory applications. Compressed gas cylinders are stored in designated areas and secured with safety straps or chains. Organic solvents are stored in ventilated cabinets or rooms equipped with explosion proof wiring and automatic fire extinguishing capabilities. SRC EAL maintains a complete chemical storage inventory which is updated regularly. Material Safety Data Sheets are available for all hazardous materials.
The SRCSF itself has a small inventory of non-radioactive hazardous materials. Within the reactor room, three standard 12V lead-acid automotive batteries provide the auxiliary power system for the reactor. In the neutron activation laboratory liquid nitrogen is used on a routine basis and there is provision for the storage of one large (165L) cylinder. Capsules containing cadmium for the reactor auxiliary shut down system are stored in this room and the uranium analysis laboratory. Lead bricks and other lead shielding are used extensively in the neutron activation laboratory. In the radioactive storage room, beryllium plates used for periodic reactor re-shimming operations are stored in a locked box in the lead-lined underground storage pit.
A description of the reactor structures, configuration and design is presented in CPR-26, part 3 [8] and in the Site Description and Operating Manual, section 3[2]. A description of the nuclear components (fuel, lattice configuration, reflector, irradiation sites, control rod, moderator and cooling configuration) is provided in CPR-26, part 3[8]. Additional information on the cooling system is given in CPR-26, part 4.1.2 [8]. The Reactor General Assembly, Critical Assembly and the reactor containers are illustrated in Figure D-1 to Figure D-4. Information on the configuration of irradiation tubes installed in the Reactor is provided in the Site Description and Operating Manual section 4.3 [2]. Detailed discussions of the site location and reactor description are also provided in Section 2 of the DDP [9].

Safety features of the Reactor are described in the Site Description and Operating Manual sections 1.3 and 1.4.[2]. Additional information can be found in CPR-26 part 1 [8]. Information on the current status of reactor systems is provided in annual compliance reports which are submitted to the CNSC in June of each year. The 2017 SRC SLOWPOKE-2 Facility Annual Compliance Report [13] provides information on reactor utilization in section 1.3, reflector shims in section 1.3.5, and the range of radioactivity levels in the reactor container water in section 2.3.1.4.

There are no experimental facilities or test equipment connected to the Reactor beyond the irradiation systems referenced above.

D.2 Prescribed Equipment

As part of the decommissioning activities associated with the SRCSF the reactor core comprising the fuel elements and the fuel cage will be removed, packaged in a Type B container (the F-257 flask) and transported for disposal to another licensed site. The other reactor internal components, including the beryllium reflector assembly, the beryllium shim tray, the reactor vessel, the irradiation tubes, the control rod and drive assembly, the neutron detectors, the radiation monitoring system, will be removed, packaged in accordance with the CNSC Packaging and Transport of Nuclear Substances Regulations [14] and transported for long term storage to CNL in Type A containers.

Summary descriptions for the equipment presented in this section are provided in Section 2 of Reference [9]. Detailed descriptions are provided in References **[2]**, **[8]**,**[10]** and **[11]**.

D.3 Prescribed Information

A site security plan is prepared for the decommissioning of the SRCSF. More information on this topic is provided in Section F of the application. The site security plan has been submitted to the CNSC as Classified Information and has been accepted by the CNSC.

Information associated with the SRCSF reactor core (the IAEA Design Information Questionnaire form) will be handled in compliance with applicable safeguards agreements. More information on this topic is provided in Section J of the application. The IAEA Design Information Questionnaire associated with the SRCSF is on file with the CNSC.

The security plan for the transfer of the reactor core to the licensed site designated for disposal is handled as part of the transportation arrangements and is not enclosed with this application.

D.4 Nuclear Substances

Nuclear substances are present in the following components of the SRCSF:

a) Irradiated fuel core;

b) Beryllium reflector assembly;

c) Interior reactor components and reactor container sections;

d) Reactor container water and reactor pool water;

e) The deioniser column associated with the reactor container water treatment system; and

f) Reactor pool concrete and rebar.

The calculated activity of the SLOWPOKE reactor components is identified in Table D-1. The activity estimates were calculated using SCALE ORIGEN-S module using the neutron flux profile estimate from MCNP neutron transport simulations as inputs. Details of the activity calculations are given in Reference [15]. The fuel actinide inventory and fuel fission product inventory are presented Table D-2 and Table D-3 and in Reference [15]. The radionuclide inventory estimates were obtained using the following SRC operating core history:

- Total recorded up to April 2018 is 97,929.5 flux hours ($x10^{11}$ $n.cm^{-2}.s^{-1}$)
- Estimated at operation hours prior to decommissioning in July 2019 is 100,714 flux hours (10^{11} $n.cm^{-2}.s^{-1}$)
- Estimated total cumulative burn-up prior to decommissioning in July 2019 is 161,143 kWh

These values were used in determining the values presented in Table D-2 and Table D-3. The additional neutron fluence seen by the components and fuel leading up to the decommissioning, following the cessation of operation for the purpose of irradiating samples, would result in a negligible increase in activity relative to the values indicated in [15], when they are removed from the facility.

The beryllium reflector assembly is subject to neutron flux when the reactor is operating. Thus, neutron activation of the beryllium, or more importantly impurities in the beryllium, will produce a number of radioactive activation products (notably ^{60}Co) within the beryllium. At the time of decommissioning, the beryllium will be very radioactive. The radiation field outside of the beryllium is dictated by the ^{60}Co decay gammas. The radioactivity in the beryllium reflector assembly and shim tray are presented in Table D-4 (from Reference [15]). The radioactivity from activated reactor components that will be packaged inside the LRC container is presented in Table D-5. The radioactivity in the pool and reactor container water are listed in Table D-6. The values were taken from Reference [13].

During the decommissioning process, separation of the upper and lower sections of the reactor container results in the mixing of the reactor container water with the pool water. The pool water provides about a 20 times dilution of the reactor container water (1,380 L). The resultant contaminated pool water (about 27,000 L) will be treated using the container water deionizer system prior to releasing the pool water to the sanitary sewer. The mixture of reactor container water and reactor pool water will be discharged into the

Saskatoon city sewer system after it had been treated to reduce the activity to below the release limits which comply with the CNSC regulatory requirements and the City of Saskatoon by-laws **[16]**.

The Room 145 (Radioactive Storage Room) contains radioactive materials. It is used as a storage room for the previously used ion exchange columns of the reactor purification system and the previously used beryllium shims. The ion exchange columns and the radioactive beryllium shims will be packaged in approved Type A Transport Containers for transportation to a site licensed for long term storage (Canadian National Laboratories (CNL).

The reactor pool is a cylindrical pool with an internal diameter of 260 cm and internal height of 640 cm. The thickness of the concrete forming the pool wall and floor is 25 cm (wall) and 30 cm (floor). The bulk nuclide inventory in the 25 cm thick pool wall is listed in Table D-7 from Reference [15]. The bulk content of the pool wall meets the unconditional clearance levels given in Schedule 2 of SOR/2000-207 [17]. The distance between the SRCSF fuel cage bottom surface to the pool floor surface is 64 cm. Due to the closer proximity of the pool floor to the core versus the pool side wall, the pool floor is exposed to higher neutron flux level than the pool side walls. Without removal of any part of the pool floor, the bulk nuclide activity exceeds the unconditional clearance level limit (see Table D-8 from Reference [15]). To reduce the bulk activity of the pool concrete to within the unconditional clearance level limit (i.e. to reduce the ratio to below 1.0), the pool floor portion underneath the SRCSR core needs to be removed (excavated) and excluded from the bulk-average activity. Removal of 80-cm diameter x 12-cm thickness concrete floor will reduce the bulk activity of the pool concrete within the unconditional clearance level limit, as shown in Table D-9 from Reference [15]. Sampling at representative sites in the pool floor shall be performed to confirm the calculated specific activities. The SRCSF pool will remain in place and will be filled with concrete after it has been confirmed that the overall radioactivity of the remaining concrete is within the unconditional clearance level. For more detailed discussion and assessment see Reference [15].

D.5 Non-Radiological Hazardous Substances

A variety of non-radiological work hazards are expected during the decommissioning of the SRCSF. The Hazard Assessment report for SRC decommissioning project [18] has systematically identified and addressed all work hazards during the decommissioning process.

The SRCSF is situated within the EAL building. Access is controlled, and security measures are in place at all times to detect unauthorized access to the SRCSF.

It is not anticipated that the building structural weight bearing walls will be affected by the decommissioning of the SRCSF.

Hazardous substances present in operating areas of the SRCSF are as follows. Within the reactor room, a series of three standard 12V lead-acid automotive batteries provide the auxiliary power system for the Reactor. In the neutron activation laboratory (room 144), liquid nitrogen is used on a routine basis and there is provision for the storage of one large (165L) cylinder containing liquid nitrogen. Capsules containing cadmium for the reactor auxiliary shut down system are stored in this room, as well as in the uranium analysis laboratory. Lead bricks and other lead shielding are used extensively in the neutron activation laboratory and reactor room. In the radioactive storage room, beryllium plates used for periodic reactor re-shimming operations are stored in a locked box inside the lead-lined underground storage pit.

Hazardous substances within the Reactor itself include toxic materials such as beryllium and cadmium. Beryllium is used for the reflector material and cadmium is used in the control rod and in the lining of one irradiation tube.

Of the hazardous substances in the SRCSF, the lead-acid batteries last for several years and are returned for recycling at the end of their useful life. Other materials, namely cadmium capsules and lead bricks, are retained for use as required. Room 144 is equipped with a low-oxygen monitor/alarm to alert staff in the event of a leak from the
liquid nitrogen cylinder.

There are no known hazardous substances contained in the building structures.

The reactor room contains little in the way of combustible materials with fire resistant materials being used for the pool covers and building structures. Each room in the SRCSF is equipped with smoke detectors which are directly connected to the building alarm system. The smoke detectors are tested annually. The building is equipped with several fire extinguishers. A fire extinguisher is located beside the entrance doors to the SRCSF. A variety of chemicals are stored in the laboratories of the SRCSF. Those which are not required for the decommissioning work will be removed prior to the start of the decommissioning work, and either used in other facilities, or disposed according to SRC procedures.
SRC EAL analyzes environmental samples for a variety of chemical, radiochemical and microbiological constituents. The related hazards are similar to what can be expected in chemical analysis laboratories of similar size and type. They include hazards that can arise from the storage of compressed gases, storage and handling of organic solvents, and storage and handling of small quantities of toxic or reactive chemicals. Natural gas is plumbed throughout the building for use in standard laboratory applications. Compressed gas cylinders are stored in designated areas and secured with safety straps or chains. Organic solvents are stored in ventilated cabinets or rooms equipped with explosion proof wiring and automatic fire extinguishing capabilities. SRC EAL maintains a complete chemical storage inventory which is updated regularly. Material Safety Data Sheets are available for all hazardous materials.

No contamination is expected to be spread as a result of movement of non-radioactive hazardous materials present in SRCSF as they will be handled according to the procedures specified in the Decommissioning Instructions.

During the decommissioning activities, hazardous materials may be used, including sodium hydroxide, hydrochloric acid, and proprietary cleaning and contamination control compounds. The MSDS for all hazardous materials associated with the decommissioning work will be maintained in a binder in the SRCSF.

The primary chemical hazard associated with the decommissioning work arises from the beryllium which is contained in the lower reactor container. It presents both a chemical and radiological hazard.

D.6 Nuclear and Hazardous Waste

As discussed in Reference [19], the waste generated at SRCSF during the decommissioning process can be categorized as:

- Radioactive waste
- Non-radioactive hazardous waste
- Non-radioactive and non-hazardous waste.

The radioactive waste produced at SRCSF will include: removed reactor components including the fuel, mixed reactor water and pool water, rags from wiping contaminated surfaces, temporary plastic covers used for decontamination and placed on the floors of the reactor room, and reactor water deionizer columns. Additional potentially contaminated parts include metal chips from cutting the reactor component for fitting into designated containers, beryllium oxide from the residue on the reactor parts, or contaminated Personal Protective Equipment (PPE). Any waste found to be contaminated above the normal background level and for which no re-use has been identified will be characterized and volume reduced to the extent possible and packaged in containers for removal from the SRCSF.

Prior to the decommissioning process, all materials deemed unnecessary to the decommissioning work will have been removed from the SRCSF. During the decommissioning process, some non-radioactive materials may be re-useable by the SRC or other SLOWPOKE facilities. As much as possible, such materials will be made available for re-use. All other non-radioactive waste materials will be disposed to appropriate waste facilities, depending on the nature of the materials.

Hazardous chemical waste will be sent to a licensed hazardous waste management SRCSF, in accordance with Transport of Dangerous Goods regulations.

Non-radioactive demolition debris will be determined to be free of contamination, as defined by allowable release limits, and transported to a landfill authorized to accept the particular type of waste, in accordance with Transport of Dangerous Goods regulations.

Wastes verified as being free of radiological contamination or activation will be disposed of in the following ways and in this order of priority:

1. Reuse
2. Recycle
3. Landfill disposal

D.6.1 Solid Radioactive Waste

The solid radioactive waste expected to be generated as part of the SRC SLOWPOKE-2 decommissioning activities is identified in Table D-10. Additional low level waste such as cleaning equipment or materials (paper, plastic, rubber/vinyl) and contaminated PPE is estimated to be 100 to 200 kg, with an approximate volume of 2 m^3 (Reference [19]).

Beryllium reflector assembly and shims will be placed in the beryllium shielding container. The lower portion of reactor components will be placed in the Lower Reactor Container shielding container.

The beryllium material used in the reflectors is subject to a steady neutron flux when the reactor is operating. Thus neutron activation of the beryllium, or more importantly the impurities in the beryllium, will produce a number of radioactive activation products (notably ^{60}Co) within the beryllium. At the time of decommissioning, the beryllium is expected to be significantly radioactive. Much of the radioactivity will be from the high-energy gamma emissions of ^{60}Co. The instructions for handling and packaging beryllium will be defined accordingly. Beryllium readily forms an oxide layer upon exposure to air. The beryllium oxide is toxic and readily dispersed as dust if proper handling techniques are not observed. Therefore removal and disposal of the beryllium reflector will be carried out in a manner which minimizes the risk of dispersal of beryllium dust, as is routinely done while performing reactivity adjustments on operational SLOWPOKE reactors. Appropriate protective clothing and equipment will be utilized to minimize the internal uptake via inhalation and skin contamination.

The irradiated reactor core will be safely transported in a Type B container (the F-257 flask) from the SRCSF to the Savannah River Site (SRS) in South Carolina. The F-257 flask requires approval from the CNSC.

SRC will submit an application to the CNSC for an export licence, to export SLOWPOKE Nuclear Fuel to the United States. An application will also be submitted to the USNRC in order to obtain an import permit to the United States and to approve the use of F-257 flask for the transportation of irradiated core in USA. SRC requires route approval from the USNRC from SRC in Saskatoon to the final consignee for the irradiated fuel, the US Department of Energy-National Nuclear Security Administration (NNSA), South Carolina. The transportation details are provided in the "SRCSF Decommissioning Radioactive Waste Transportation Plan" prepared in support of the transportation licence (separate application).

SRC requires approval from the CNSC to obtain the transport licence for transportation of the irradiated core in Canada. This transport license application will be made to the CNSC upon receiving the export license well before the transport of irradiated core.

All remaining radioactive waste will be transported to CNL using pre-approved (certified) Type A package(s) that meet IAEA transportation requirements. No additional permits are required from the CNSC. Appropriate security arrangements will be established for this purpose.

D.6.2 Liquid Radioactive Waste

The main source of liquid wastes is the water from the reactor container. The reactor container water contains small quantities of radionuclides from fission products. Upon separation of the reactor container sections, water from the container will mix with water from the reactor pool. The mixture will be processed using the reactor purification system until the release limits to the sewer system are met. The mixture of reactor container water and reactor pool water will be discharged into the Saskatoon city sewer system after it had been treated to reduce the activity to below the release limits which comply with the CNSC regulatory requirements and the city of Saskatoon bylaws. Contaminated

liquids, if any, arising from decontamination activities, will be placed in approved containers and transported for storage.

D.6.3 Airborne Emissions

Airborne emissions will be monitored by air sampling in the SRCSF, and the air continuously vented to the outside via the ventilation exhaust system. Any particulate releases from the decommissioning work site will be captured locally on particulate filters in the exhaust ventilation system. Routine monitoring of the radiation fields throughout the history of the facility has not indicated any elevated radiation fields near the exhaust filters. Air quality in the reactor room will be monitored utilizing an air sampling monitoring device for radiation protection purposes.

The airborne contamination limit for the decommissioning staff should not exceed 1 DAC, without respiratory protection, according to the Radiation Protection Program Requirements.

In terms of airborne releases to the public, there is a potential release of airborne material to the environment through the hatches, however, the following mitigation actions will be in place to ensure that the airborne emissions from decommissioning to the environment is non-existent or minimal:

- The reactor room will be under negative air pressure, thus preventing any potential airborne release.
- The reactor room ventilation exhaust system will include a HEPA filter to ensure air will be filtered prior to release to the environment.
- The iCAM (integrated continuous air monitor) will be used to detect any airborne radioactivity which may include particulate or gaseous radionuclides.

The OPEX has shown that there has been no situation that an airborne radioactivity was present during the decommissioning work.

Table D-1 Calculated Activation for the Major SRCSF Reactor Components

Component	SRCSF Room	Mass (kg)	Volume (m^3)[b]	Activity (Bq)
Fuel assembly	146[a]	3.6	0.01	1.1E+13
Be reflector assembly, including the Be shims	146	70.8	0.037	2.7E+10
Shim tray	146	1	<0.001	6.1E+08
Lower reactor vessel	146	59	0.022	1.2E+09
Upper reactor vessel	146	300	0.103	-
Irradiation tubes	146	0.87	<0.001	6.9E+08
Control rod	146	0.07	<0.001	1.7E+08
Neutron flux detector	146	0.01	<0.001	4.0E+05
Water thermocouple	146	0.02	<0.001	6.7E+08

Notes:
[a] Room 146 is the reactor room.
[b] The quoted volume is the physical volume of components and not including cavity

Table D-2 SRCSF Post-Irradiation Fuel Actinide Inventory

Actinide inventory (grams)					
No	**Nuclide**	**grams**	**No**	**Nuclide**	**grams**
1	U-230	5.03E-16	14	Pu-236	9.87E-12
2	U-232	1.60E-07	15	Pu-237	7.91E-15
3	U-233	5.32E-07	16	Pu-238	4.72E-06
4	U-234	6.26E-04	17	Pu-239	6.81E-02
5	U-235	8.16E+02	18	Pu-240	4.41E-04
6	U-236	2.37E+00	19	Pu-241	4.13E-06
7	U-237	1.26E-09	20	Pu-242	1.40E-08
8	U-238	6.08E+01	21	Pu-244	1.30E-17
9	Np-235	3.21E-14	22	Am-241	2.04E-06
10	Np-236	2.10E-11	23	Am-242m	1.06E-09
11	Np-237	1.87E-03	24	Am-2-42	1.37E-14
12	Np-238	7.59E-14	25	Am-243	2.46E-11
13	Np-239	5.61E-10	26	Total	8.79E+02

Table D-3 SRCSF Post-Irradiation Fuel Fission Product Inventory

Fission product inventory (Curies)								
No	**Nuclide**	**Curies**	**No**	**Nuclide**	**Curies**	**No**	**Nuclide**	**Curies**
1	H-3	6.50E-02	76	Rh-105	3.46E-05	151	Xe-135m	4.25E-17
2	Ni-66	1.59E-11	77	Ag-105	1.08E-17	152	Cs-135	5.17E-04
3	Cu-66	1.59E-11	78	Ru-106	2.45E+00	153	Ba-135m	1.01E-12
4	Cu-67	1.14E-10	79	Rh-106	2.45E+00	154	La-135	1.47E-20
5	Zn-69	2.80E-18	80	Ag-106m	1.05E-16	155	Cs-136	9.04E-04
6	Zn-69m	2.61E-18	81	Pd-107	4.23E-06	156	Ba-136m	1.00E-04
7	Ge-71	3.74E-14	82	Ag-108	2.01E-11	157	Cs-137	2.51E+01
8	Zn-72	3.13E-09	83	Ag-108m	2.31E-10	158	Ba-137m	2.38E+01
9	Ga-72	4.50E-09	84	Pd-109	7.20E-11	159	La-137	2.32E-11
10	Ga-72m	1.11E-10	85	Ag-109m	1.32E-10	160	La-138	5.89E-14
11	Ge-73m	9.81E-14	86	Cd-109	5.95E-11	161	Ce-139	3.06E-06
12	As-73	9.81E-14	87	Ag-110	9.03E-07	162	Ba-140	6.80E-01
13	As-74	1.72E-11	88	Ag-110m	6.64E-05	163	La-140	7.83E-01
14	Se-75	3.40E-13	89	Ag-111	1.08E-04	164	Pr-140	7.79E-18
15	As-76	2.42E-12	90	In-111	1.89E-19	165	Nd-140	7.79E-18
16	Ge-77	5.67E-13	91	Pd-112	7.41E-09	166	Ce-141	8.28E+00
17	As-77	5.78E-07	92	Ag-112	8.70E-09	167	Pr-142	4.32E-10
18	Se-77m	1.92E-09	93	Cd-113	2.15E-16	168	Ce-143	1.24E-04
19	Br-77	1.27E-18	94	Cd-113m	7.20E-04	169	Pr-143	9.37E-01
20	Se-79	2.84E-05	95	In-113m	5.75E-14	170	Pm-143	7.22E-19
21	Kr-79	1.38E-19	96	Sn-113	5.75E-14	171	Ce-144	3.21E+01
22	Kr-81	9.29E-13	97	In-114	1.70E-07	172	Pr-144	3.21E+01
23	Br-82	3.52E-09	98	In-114m	1.75E-07	173	Pr-144m	3.07E-01
24	Kr-83m	6.81E-10	99	Cd-115	2.34E-06	174	Nd-144	4.39E-13
25	Rb-83	9.16E-10	100	Cd-115m	1.48E-03	175	Pm-144	7.47E-15
26	Rb-84	3.23E-08	101	In-115	5.19E-15	176	Pr-145	5.55E-18
27	Kr-85	1.92E+00	102	In-115m	2.72E-06	177	Pm-145	3.07E-09
28	Sr-85	2.38E-10	103	Cd-116	8.05E-20	178	Sm-145	4.26E-09
29	Rb-86	2.43E-05	104	Sn-117m	3.93E-06	179	Pm-146	6.79E-07
30	Rb-87	1.01E-08	105	Sn-119m	2.60E-03	180	Sm-146	8.12E-13
31	Sr-87m	5.88E-15	106	Sb-119	2.33E-16	181	Nd-147	1.24E-01
32	Y-87	5.68E-15	107	Sb-120m	8.80E-13	182	Pm-147	1.53E+01
33	Y-88	2.95E-07	108	Sn-121	2.44E-03	183	Sm-147	3.56E-09
34	Zr-88	2.70E-15	109	Sn-121m	3.14E-03	184	Pm-148	1.34E-04
35	Sr-89	1.19E+01	110	Te-121	1.16E-12	185	Pm-148m	2.73E-03
36	Y-89m	1.15E-03	111	Te-121m	1.08E-12	186	Sm-148	1.84E-16
37	Zr-89	7.70E-12	112	Sb-122	4.39E-09	187	Pm-149	2.20E-04
38	Sr-90	2.43E+01	113	Sn-123	5.00E-03	188	Eu-149	8.97E-11
39	y-90	2.43E+01	114	Te-123m	1.27E-08	189	Nd-150	1.54E-17
40	Sr-91	1.34E-11	115	Sb-124	6.26E-05	190	Pm-151	3.18E-06
41	Y-91	1.72E+01	116	Sn-125	2.82E-04	191	Sm-151	6.51E-01
42	Y-91m	8.64E-12	117	Sb-125	2.32E-01	192	Gd-151	8.15E-10
43	Nb-91	1.81E-15	118	Te-125m	5.54E-02	193	Eu-152	2.08E-02
44	Nb-91m	4.19E-16	119	I-125	3.79E-11	194	Eu-152m	3.67E-15
45	Nb-92	1.30E-16	120	Sn-126	4.55E-05	195	Gd-152	2.06E-15
46	Bb-92m	1.05E-13	121	Sb-126	9.11E-05	196	Sm-153	2.10E-05
47	Y-93	5.12E-11	122	Sb-126m	4.55E-05	197	Gd-153	1.86E-04
48	Zr-93	7.74E-04	123	I-126	1.85E-09	198	Eu-154	9.70E-03

Fission product inventory (Curies)								
No	**Nuclide**	**Curies**	**No**	**Nuclide**	**Curies**	**No**	**Nuclide**	**Curies**
49	Nb-93m	3.87E-04	124	Sb-127	1.17E-04	199	Eu-155	2.16E-01
50	Mo-93	5.28E-12	125	Te-127	1.16E-01	200	Tb-155	8.81E-19
51	Nb-94	2.32E-09	126	Te-127m	1.19E-01	201	Sm-156	1.91E-14
52	Zr-95	2.04E+01	127	Xe-127	1.22E-11	202	Eu-156	3.52E-03
53	Nb-95	3.25E+01	128	Sb-128	1.11E-14	203	Tb-156	5.72E-17
54	Nb-95m	2.33E-01	129	Te-128	7.41E-18	204	Eu-157	6.60E-11
55	Zr-96	5.91E-17	130	Te-129	8.59E-02	205	Tb-157	1.24E-11
56	Nb-96	8.64E-10	131	Te-129m	1.36E-01	206	Tb-158	2.48E-10
57	Tc-96	9.46E-20	132	I-129	6.58E-06	207	Gd-159	1.43E-10
58	Zr-97	2.44E-07	133	Xe-129m	2.93E-11	208	Dy-159	1.47E-12
59	Nb-97	2.45E-07	134	I-130	2.68E-13	209	Tb-160	8.21E-06
60	Nb-97m	2.32E-07	135	Te-131	2.22E-06	210	Tb-161	3.51E-07
61	Tc-97	8.81E-15	136	Te-131m	8.45E-06	211	Ho-163	3.48E-15
62	Tc-97m	4.76E-10	137	I-131	2.87E-02	212	Dy-166	2.23E-10
63	Ru-97	2.85E-18	138	Xe-131m	7.13E-03	213	Ho-166	3.31E-10
64	Tc-98	5.06E-11	139	Cs-131	1.81E-11	214	Ho-166m	3.29E-11
65	Mo-99	2.25E-03	140	Ba-131	1.45E-17	215	Tm-167	4.20E-19
66	Tc-99	5.43E-03	141	Te-132	2.29E-03	216	Tm-168	3.40E-14
67	Tc-99m	2.17E-03	142	I-132	2.36E-03	217	Er-169	6.65E-10
68	Mo-100	1.61E-16	143	Cs-132	2.04E-09	218	Yb-169	3.82E-17
69	Rh-101	7.09E-10	144	I-133	3.53E-06	219	Tm-170	1.21E-09
70	Rh-101m	3.56E-14	145	Xe-133	1.01E-02	220	Tm-171	2.13E-08
71	Rh-102	6.55E-07	146	Xe-133m	5.92E-05	221	Er-172	2.87E-13
72	Rh-102m	4.27E-07	147	Ba-133	1.05E-09	222	Tm-172	1.90E-12
73	Ru-103	5.66E+00	148	Cs-134	1.02E-01		Total	2.90E+02
74	Rh-103m	5.60E+00	149	I-135	2.48E-16			
75	Pd-103	3.59E-10	150	Xe-135	1.46E-11			

Table D-4 Radionuclide Inventory in Beryllium Container

Mass of components inside the package			**Be Reflector - Side = 43740 g Be Reflector - Bottom = 15697 g Be Shims = 11330 g Shim Tray = 1022 g**
Sum of ratio			**1.75E-02**
Sum of ratio less than 1?			**YES**
No	**Nuclide**	**A_2 limit (TBq)**	**Ratio of package TBq to A_2 limit**
1	Co-60	4.00E-01	1.12E-02
2	Pu-239	1.00E-03	4.40E-03
3	H-3	4.00E+01	5.35E-04
4	Sc-46	5.00E-01	3.96E-04
5	Ce-144	2.00E-01	2.85E-04
6	Y-90	3.00E-01	1.37E-04
7	Sr-90	3.00E-01	1.37E-04
8	Pu-240	1.00E-03	1.20E-04
9	Cs-137	6.00E-01	7.42E-05
10	Nb-95	1.00E+00	5.81E-05
11	Ru-106	2.00E-01	4.68E-05
12	Sr-89	6.00E-01	3.40E-05
13	Be-10	6.00E-01	3.28E-05
14	Ce-141	6.00E-01	2.52E-05
15	Pm-147	2.00E+00	1.38E-05
16	Fe-55	4.00E+01	6.71E-06
17	Ru-103	2.00E+00	6.02E-06
18	Pu-241	6.00E-02	5.86E-06
19	Am-241	1.00E-03	5.74E-06
20	Ba-140	3.00E-01	4.30E-06

Table D-5 Radionuclide Inventories of Components in the Lower Reactor Container

Mass of components inside the package			**Lower Section of Reactor Container = 59330 g** **Thermocouple = 19 g** **Flux Detector = 9 g** **Irradiation Tube (small, inner) = 645 g** **Irradiation Tube (large, outer) = 926 g** **Irradiation Tube (small, outer) = 129 g** **Irradiation Tube (small, pool side) = 139 g** **Guide tube (Neutron Flux) = 14 g** **Guide tube (Thermocouple) = 36 g** **Control Rod (Al sheath) = 61 g** **Control Rod (Cd tube) = 8 g** **Lower Support Rods = 5308 g** **Bottom Plate = 3937 g** **Support Ring = 2484 g** **Bottom Platform = 1610 g**
Sum of ratio			**4.48E-04**
Sum of ratio less than 1?			**YES**
No	**Nuclide**	**A_2 limit (TBq)**	**Ratio of package TBq to A_2 limit**
1	Co-60	4.00E-01	1.54E-04
2	Cd-113M	5.00E-01	1.32E-04
3	Cd-115M	5.00E-01	4.13E-05
4	Fe-55	4.00E+01	4.04E-05
5	Cr-51	3.00E+01	2.33E-05
6	Fe-59	9.00E-01	1.44E-05
7	Cd-109	2.00E+00	1.27E-05
8	Co-58	1.00E+00	1.08E-05
9	Mn-54	1.00E+00	6.12E-06
10	Ni-63	3.00E+01	5.57E-06
11	Sc-46	5.00E-01	3.78E-06
12	Sb-124	6.00E-01	1.40E-06
13	Eu-152	1.00E+00	5.50E-07
14	Rh-102	5.00E-01	4.27E-07
15	Cs-134	7.00E-01	3.33E-07
16	Ca-45	1.00E+00	2.49E-07
17	Cd-115	4.00E-01	1.64E-07
18	Eu-154	6.00E-01	1.07E-07
19	Rh-102m	2.00E+00	7.96E-08
20	In-115m	1.00E+00	7.39E-08

Table D-6 Radionuclide Concentrations in Reactor Container Water and Pool water before Purification [13]

Note: data were obtained from gamma spectroscopy measurements given in Table 5 of the SRCSF Annual Compliance Report

Nuclide	Activity in reactor water (Bq/L)	Activity in pool water (Bq/L)	Activity in reactor water	Activity in pool water	Activity in liquid waste (reactor + pool)	Limit from REGDOC 1.6.1, App. R, ver.2	Activity C vs. Limit D
-	Bq/L	Bq/L	MBq	MBq	MBq	MBq/year	-
			A (Bq/L * 1380 L)	B (Bq/L * 27,000 L)	C = A+B	D	Yes: C<=D, No: C>D
Ar-41	16	<1	0.022	0.027	0.049	N/A	Yes
Ba-140	7190	<3	9.922	0.081	10.003	-	-
Be-7	<50	<8	0.069	0.216	0.285	-	-
Cd-109	<300	<20	0.414	0.540	0.954	10	Yes
Ce-139	<7	<0.4	0.010	0.011	0.020	1	Yes
Ce-144	100	<8	0.138	0.216	0.354	-	-
Co-57	<9	<0.5	0.012	0.014	0.026	1000	Yes
Co-58	<8	<0.9	0.011	0.024	0.035	100	Yes
Co-60	11	2	0.015	0.054	0.069	0.1	Yes
Cr-51	<80	<7	0.110	0.189	0.299	100	Yes
Cs-134	<3	<0.8	0.004	0.022	0.026	0.1	Yes
Cs-136	<6	<1	0.008	0.027	0.035	-	-
Cs-137	80	<0.6	0.110	0.016	0.127	1	Yes
Eu-152	<30	<2	0.041	0.054	0.095	-	-
Fe-59	<20	<2	0.028	0.054	0.082	1	Yes
Hg-203	<3	<0.8	0.004	0.022	0.026	10	Yes
I-131	3450	<1	4.761	0.027	4.788	10	Yes
I-132	364	<1	0.502	0.027	0.529	-	-
I-133	2520	<1	3.478	0.027	3.505	-	-
I-135	60	<6	0.083	0.162	0.245	-	-
K-40	<50	<6	0.069	0.162	0.231	-	-
La-140	2210	<2	3.050	0.054	3.104	0.1	No
Mn-54	<7	<1	0.010	0.027	0.037	1	Yes
Mo-90	<5	<0.5	0.007	0.014	0.020	-	-
Mo-99	83	<1	0.115	0.027	0.142	100	Yes
Na-24	307	<2	0.424	0.054	0.478	100	Yes
Nb-94	<20	<2	0.028	0.054	0.082	-	-
Nb-95	31	<1	0.043	0.027	0.070	-	-
Nb-97	48	<1	0.066	0.027	0.093	-	-
Ra-226	<200	<20	0.276	0.540	0.816	1	Yes
Rh-106	<60	<10	0.083	0.270	0.353	-	-
Ru-103	61	0.8	0.084	0.022	0.106	-	-
Sb-124	<4	<1	0.006	0.027	0.033	0.1	Yes
Sb-125	<9	<2	0.012	0.054	0.066	-	-
Se-75	<10	<0.9	0.014	0.024	0.038	1	Yes
Sn-113	<5	<1	0.007	0.027	0.034	-	-
Sr-85	<5	<0.7	0.007	0.019	0.026	1	Yes
Sr-91	420	<2	0.580	0.054	0.634	-	-
Tc-99M	9990	<1	13.786	0.027	13.813	1000	Yes
Te-132	181	<1	0.250	0.027	0.277	-	-
U-235	<10	<8	0.014	0.216	0.230	-	-

Nuclide	**Activity in reactor water (Bq/L)**	**Activity in pool water (Bq/L)**	**Activity in reactor water**	**Activity in pool water**	**Activity in liquid waste (reactor + pool)**	**Limit from REGDOC 1.6.1, App. R, ver.2**	**Activity C vs. Limit D**
-	**Bq/L**	**Bq/L**	**MBq**	**MBq**	**MBq**	**MBq/year**	**-**
			A (Bq/L * 1380 L)	**B** (Bq/L * 27,000 L)	C = A+B	D	**Yes: C<=D, No: C>D**
W-187	<30	<2	0.041	0.054	0.095	-	-
Xe-133	76100	<3	105.018	0.081	105.099	N/A	Yes
Xe-133m	<400	<50	0.552	1.350	1.902	-	-
Xe-135	4620	<7	6.376	0.189	6.565	-	-
Y-88	<3	<1	0.004	0.027	0.031	0.1	Yes
Y-91M	<9	<2	0.012	0.054	0.066	-	-
Zn-65	<10	<2	0.014	0.054	0.068	1	Yes
Zr-95	60	<2	0.083	0.054	0.137	-	-
Zr-97	34	<0.9	0.047	0.024	0.071	-	-

Table D-7 Pool Wall Nuclide Inventory

No	Nuclide	Pool wall bulk concentration (Bq/g)	Unconditional clearance level activity limit (Bq/g)	Ratio of inventory to limit
1	Eu-152	1.97E-03	1.00E-01	1.97E-02
2	Sc-46	6.22E-04	1.00E-01	6.22E-03
3	Cs-134	4.36E-04	1.00E-01	4.36E-03
4	K-40	1.09E+00	1.00E+01	1.09E-01
5	Co-60	3.46E-04	1.00E-01	3.46E-03
6	Eu-154	1.40E-04	1.00E-01	1.40E-03
7	Mn-54	1.21E-04	1.00E-01	1.21E-03
8	Zn-65	2.21E-05	1.00E-01	2.21E-04
9	Fe-59	5.01E-05	1.00E+00	5.01E-05
10	Tb-160	7.89E-06	1.00E+00	7.89E-06
11	Fe-55	6.28E-03	1.00E+03	6.28E-06
12	Ca-45	5.74E-04	1.00E+02	5.74E-06
13	Nb-95	2.49E-06	1.00E+00	2.49E-06
14	Zr-95	1.56E-06	1.00E+00	1.56E-06
15	C-14	1.54E-06	1.00E+00	1.54E-06
16	Sb-124	1.43E-06	1.00E+00	1.43E-06
17	H-3	4.61E-05	1.00E+02	4.61E-07
18	Cl-36	9.17E-08	1.00E+00	9.17E-08
19	Na-22	1.59E-09	1.00E-01	1.59E-08
20	Co-58	3.49E-09	1.00E+00	3.49E-09
21	S-35	8.21E-08	1.00E+02	8.21E-10
22	Sc-48	1.64E-10	1.00E+00	1.64E-10
23	Sb-122	1.60E-09	1.00E+01	1.60E-10
24	Ca-47	8.83E-10	1.00E+01	8.83E-11
25	Sc-47	5.60E-09	1.00E+02	5.60E-11
26	Ni-63	5.15E-09	1.00E+02	5.15E-11
27	Y-91	3.93E-09	1.00E+02	3.93E-11
28	Zr-93	1.71E-10	1.00E+01	1.71E-11
29	Sr-90	4.51E-12	1.00E+00	4.51E-12
30	Nb-93M	7.29E-11	1.00E+01	7.29E-12
31	Cs-132	8.34E-11	1.00E+01	8.34E-12
32	Sr-89	1.28E-09	1.00E+03	1.28E-12
33	K-42	3.71E-12	1.00E+02	3.71E-14
34	Y-90	5.49E-11	1.00E+03	5.49E-14
			Sum of ratio	**1.46E-01**
			Less than 1?	**Yes**

Table D-8 Pool Floor Nuclide Inventory (Without Removal)

No	Nuclide	Pool floor bulk concentration (Bq/g)	Unconditional clearance level activity limit (Bq/g)	Ratio of inventory to limit
1	Eu-152	6.71E-01	1.00E-01	6.77E+00
2	Sc-46	2.14E-01	1.00E-01	2.14E+00
3	Cs-134	1.50E-01	1.00E-01	1.50E+00
4	Co-60	1.19E-01	1.00E-01	1.19E+00
5	Eu-154	4.82E-02	1.00E-01	4.82E-01
6	Mn-54	4.17E-02	1.00E-01	4.17E-01
7	Zn-65	7.60E-03	1.00E-01	7.60E-02
8	K-40	1.09E+00	1.00E+01	1.09E-01
9	Fe-59	1.72E-02	1.00E+00	1.72E-02
10	Tb-160	2.71E-03	1.00E+00	2.71E-03
11	Fe-55	2.16E+00	1.00E+03	2.16E-03
12	Ca-45	1.97E-01	1.00E+02	1.97E-03
13	Nb-95	8.56E-04	1.00E+00	8.56E-04
14	Zr-95	5.37E-04	1.00E+00	5.37E-04
15	C-14	5.28E-04	1.00E+00	5.28E-04
16	Sb-124	4.92E-04	1.00E+00	4.92E-04
17	H-3	1.58E-02	1.00E+02	1.58E-04
18	Cl-36	3.15E-05	1.00E+00	3.15E-05
19	Na-22	5.67E-07	1.00E-01	5.67E-06
20	Co-58	1.21E-06	1.00E+00	1.21E-06
21	S-35	2.82E-05	1.00E+02	2.82E-07
22	Sc-48	7.90E-08	1.00E+00	7.90E-08
23	Sb-122	5.69E-07	1.00E+01	5.69E-08
24	Ca-47	3.15E-07	1.00E+01	3.15E-08
25	Sc-47	1.94E-06	1.00E+02	1.94E-08
26	Ni-63	1.79E-06	1.00E+02	1.79E-08
27	Y-91	1.36E-06	1.00E+02	1.36E-08
28	Zr-93	8.27E-08	1.00E+01	8.27E-09
29	Sr-90	7.90E-09	1.00E+00	7.90E-09
30	Gd-153	5.20E-08	1.00E+01	5.20E-09
31	Nb-93M	4.12E-08	1.00E+01	4.12E-09
32	Eu-155	2.91E-09	1.00E+00	2.91E-09
33	Cs-132	1.43E-08	1.00E+01	1.43E-09
34	Na-24	1.19E-09	1.00E+00	1.19E-09
35	Sr-89	4.55E-07	1.00E+03	4.55E-10
36	K-42	6.50E-09	1.00E+02	6.50E-11
37	Mn-53	2.30E-09	1.00E+02	2.30E-11
38	Y-90	1.49E-08	1.00E+03	1.49E-11
39	Sm-151	1.30E-09	1.00E+03	1.30E-12
40	Cs-131	2.17E-10	1.00E+03	2.17E-13
			Sum of ratio	**12.6**
			Less than 1?	**No**

Table D-9 Bulk Pool Concrete Nuclide Inventory (with 80 cm x 12 cm Portion below Core Removed)

No	Nuclide	Pool concrete bulk inventory (Bq/g)	Unconditional clearance level activity limit (Bq/g)	Ratio of inventory to limit
1	Eu-152	3.79E-02	1.0E-01	3.79E-01
2	Sc-46	1.20E-02	1.0E-01	1.20E-01
3	Cs-134	8.38E-03	1.0E-01	8.38E-02
4	Co-60	6.65E-03	1.0E-01	6.65E-02
5	Eu-154	2.70E-03	1.0E-01	2.70E-02
6	Mn-54	2.33E-03	1.0E-01	2.33E-02
7	Zn-65	4.25E-04	1.0E-01	4.25E-03
8	K-40	1.09E+00	1.0E+01	1.09E-01
9	Fe-59	9.64E-04	1.0E+00	9.64E-04
10	Tb-160	1.52E-04	1.0E+00	1.52E-04
11	Fe-55	1.21E-01	1.0E+03	1.21E-04
12	Ca-45	1.10E-02	1.0E+02	1.10E-04
13	Nb-95	4.79E-05	1.0E+00	4.79E-05
14	Zr-95	3.00E-05	1.0E+00	3.00E-05
15	C-14	2.96E-05	1.0E+00	2.96E-05
16	Sb-124	2.75E-05	1.0E+00	2.75E-05
17	H-3	8.87E-04	1.0E+02	8.87E-06
18	Cl-36	1.76E-06	1.0E+00	1.76E-06
19	Na-22	3.17E-08	1.0E-01	3.17E-07
20	Co-58	6.78E-08	1.0E+00	6.78E-08
21	S-35	1.58E-06	1.0E+02	1.58E-08
22	Sc-48	4.36E-09	1.0E+00	4.36E-09
23	Sb-122	3.18E-08	1.0E+01	3.18E-09
24	Ca-47	1.76E-08	1.0E+01	1.76E-09
25	Sc-47	1.09E-07	1.0E+02	1.09E-09
26	Ni-63	1.00E-07	1.0E+02	1.00E-09
27	Y-91	7.64E-08	1.0E+02	7.64E-10
28	Zr-93	4.57E-09	1.0E+01	4.57E-10
29	Sr-90	4.21E-10	1.0E+00	4.21E-10
30	Gd-153	4.67E-09	1.0E+01	4.67E-10
31	Nb-93M	2.27E-09	1.0E+01	2.27E-10
32	Eu-155	2.58E-10	1.0E+00	2.58E-10
33	Cs-132	8.30E-10	1.0E+01	8.30E-11
34	Na-24	6.02E-11	1.0E+00	6.02E-11
35	Sr-89	2.54E-08	1.0E+03	2.54E-11
36	K-42	3.47E-10	1.0E+02	3.47E-12
37	Mn-53	1.20E-10	1.0E+02	1.20E-12
38	Y-90	8.40E-10	1.0E+03	8.40E-13
39	Sm-151	6.58E-11	1.0E+03	6.58E-14
40	Cs-131	8.15E-12	1.0E+03	8.15E-15
			Sum of ratio	0.81
			Less than 1?	**Yes**

Table D-10 Major Reactor Components Radioactive Waste

Item #	Description	Estimated quantity of waste	Package description	Final disposition
1	Fuel assembly	Mass: 3.6 kg Volume: 0.01 m^3 Activity: 1.1E+13 Bq	F-257 flask	SRS
2	Beryllium reflector assembly including shims	Mass: 70.8 kg Activity: 2.7E+10 Bq	Be shielding container Interior volume: 0.25 m^3	CNL
3	Shim tray	Mass: 14.4 kg Activity: 6.1E+08 Bq		
4	Lower reactor container	Mass: 59.3 kg Activity: 1.2E+09 Bq	LRC shielding container Interior volume: 0.57 m^3	CNL
5	Irradiation tubes	Activity: 6.9E+08 Bq		
6	Control rod	Activity: 1.7E+08 Bq		
7	Neutron detectors	Activity: 4.0E+05 Bq		
8	Thermocouple	Activity: 6.7E+08 Bq		
9	Upper reactor container	Volume: 2.5 m^3	Type A container Dimension: 76"x50"x50"	CNL
10	Reactor water purification system	Volume: 0.3 m^3		
11	Reactor container water level monitor	Volume: <0.001 m^3		
12	Reactor headspace gas purge system	Volume: 0.1 m^3		
13	Pool water level monitor	Volume: <0.001 m^3		
14	Cd capsules for auxiliary shutdown	Volume: <0.001 m^3		
15	Solid waste such as cleaning equipment or materials (paper, plastic, rubber/vinyl) and contaminated PPE	Mass: 100-200 kg Volume: 2 m^3		
16	Radiation Monitoring Devices	Volume: <0.001 m^3	n/a, UR	CNL
17	Capsule Transfer System	Volume: <0.001 m^3	n/a, UR	Recycling
18	Control Console	Volume: 1.5 m^3	n/a, UR	Recycling
19	Battery Assembly	Volume: 2 m^3	n/a, UR	Recycling
20	Sample Stations	Volume: 1.6 m^3	n/a, UR	Recycling
Total predicted volume of radioactive waste		Volume: 8 m^3		

Notes:
SRS – Savannah River Site, U.S. Department of Energy
CNL – Canadian Nuclear Laboratories, Waste Management Facility
SRC – Saskatchewan Research Council
UR – Unconditional Release
n/a – not applicable
For transportation, the Be shielding container and the LRC shielding container will be transferred into Type A containers.

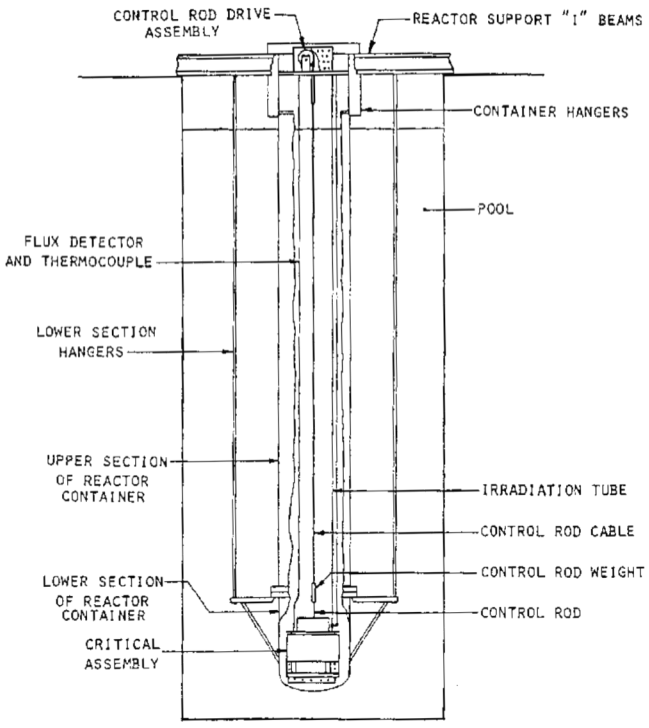

Figure D-1 Reactor General Assembly

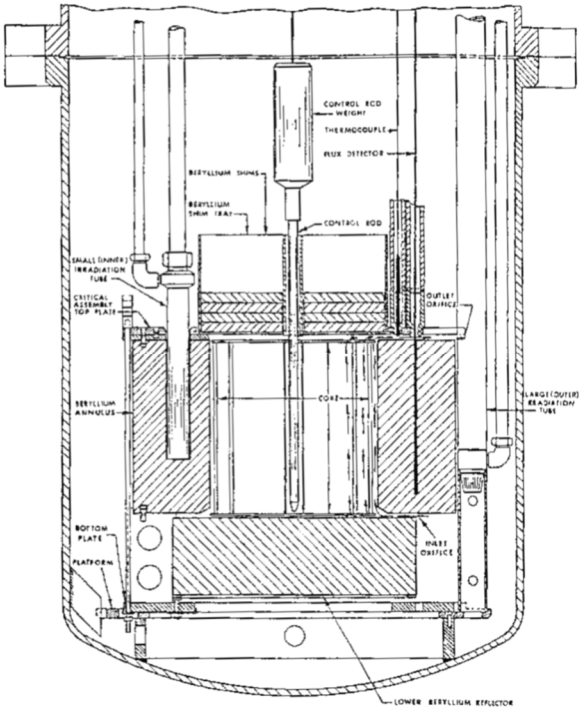

Figure D-2 Critical Assembly (Cross-Section)

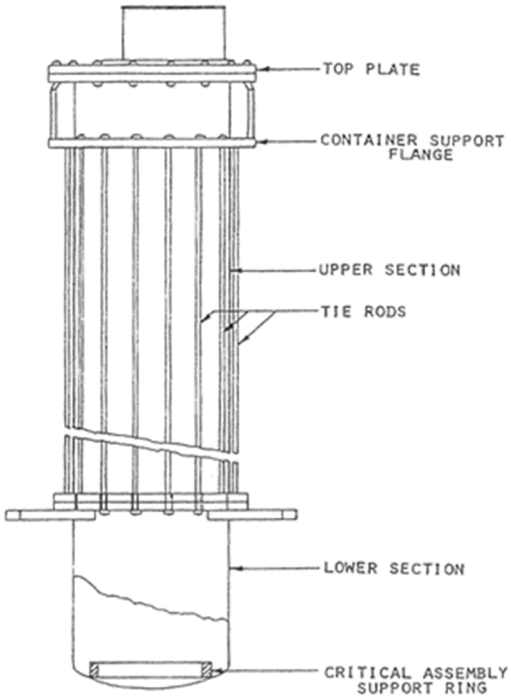

Figure D-3 Reactor Container

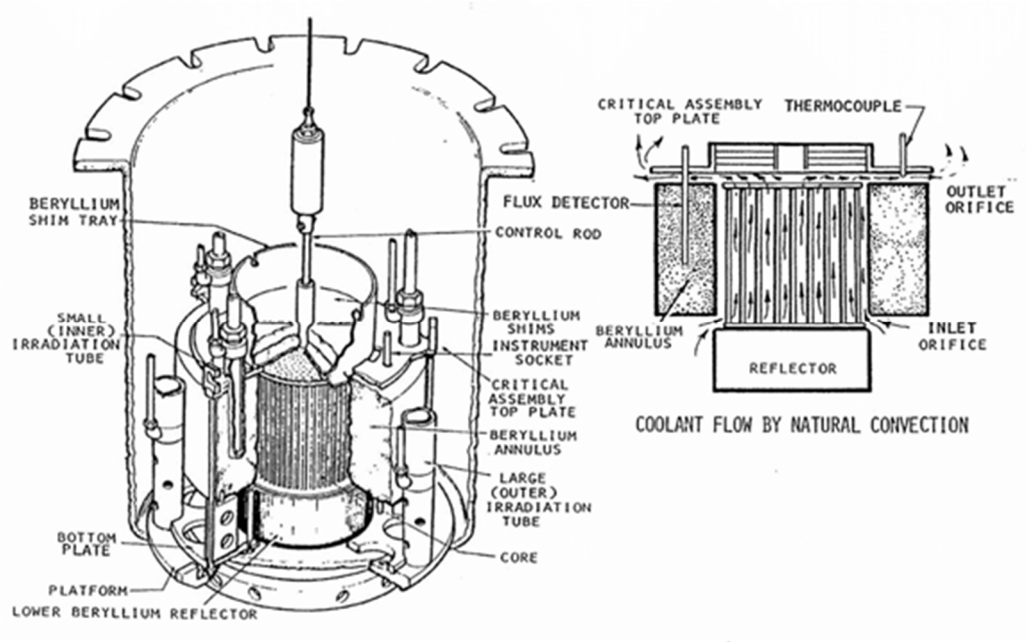

Figure D-4 Lower Reactor Container

E. RADIATION PROTECTION AND ENVIRONMENTAL PROTECTION PLANS

E.1 Radiation Protection Plan

The Radiation Protection Plan for decommissioning of the SRCSF is based on Candu's RP program requirements used for Candu licensed sites, which provides assurance that the SRCSF Decommissioning Project complies with, or exceeds, the level of radiation safety required by relevant regulations pursuant to the Nuclear Safety and Control Act (NSCA). This document provides an overview and explains how requirements from Candu's RP program (as discussed in **[21**]) and the SRC Radiation Safety **[22**] are to be applied and implemented for the SRCSF Decommissioning Project .

The Candu Radiation Protection Program (as discussed in **[21**]) covers the laws and regulations to be addressed. For the SRCSF Decommissioning Project, the same laws and regulations apply. For clarity, they are reproduced below.

- General Nuclear Safety and Control (GNSC) Regulations [23];
- Radiation Protection (RP) Regulations [24]; and
- Nuclear Substances and Radiation Devices (NSRD) Regulations [25];

The Candu Radiation Protection Program (as discussed in **[21**]) becomes applicable when Candu staff perform activities related to decommission. Provisions in this document shall apply to radiation safety activities conducted within the SRCSF, to the transfer of the core in the flask, and radioactive components from the reactor and pool in transportation containers to trucks for removal from the SRCSF.

As shown in the organisation chart the Figure A-2 Candu Decommissioning Radiation Protection and Environmental Protection Manager (DRP and EPM) is responsible for Radiation Protection. The roles and responsibilities of this position are specified in the Decommissioning Quality Assurance Plan [1].

SRCSF Decommissioning Project personnel who, in the course of their work, have a reasonable probability to receive a dose of ionizing radiation in excess of dose limits for members of the public are to be designated as NEW (Nuclear Energy Workers).

E.2 Environmental Protection and Monitoring Plan

Within the SRCSF Decommissioning Project organization Figure A-2, the responsible position for Environmental Protection is Candu Decommissioning Radiation Protection and Environmental Protection Manager (DRP and EPM).

Candu has been contracted by SRC to conduct the decommissioning project. The SRCSF Detailed Decommissioning Plan [9] includes the steps necessary to ensure the health, safety and protection of workers, the public and the environment during the facility's decommissioning. In conducting the decommissioning activities at the SRCSF, Candu shall comply with the applicable SRC environmental health and safety regulations, policies and procedures.

The Environmental Protection Requirements [26] mandates compliance with applicable federal legislation in addition to Saskatchewan Research Council Occupational Health & Safety Manual [27], the applicable CNSC regulations and Saskatchewan requirements and regulations. These include, but are not limited to, the acts, regulations and regulatory documents listed in Table E-1.

Table E-1

Applicable Federal and Provincial Environmental Protection Legislation and Regulations

Applicable federal legislation and regulations include but are not necessarily restricted to the:

- Nuclear Safety and Control Act;
- Export and Import Permits Act; and
- Transportation of Dangerous Goods Act

Applicable CNSC Regulations, Standards and Guidelines applicable to the SRCSF decommissioning include:

- REGDOC-2.2.2, Personnel Training, Version 2
- REGDOC-3.5.1, Licensing Process for Class 1 Nuclear Facilities and Uranium Mines and Mills
- REGDOC-2.2.3,Personnel Certification: Radiation Safety Officers
- REGDOC 2.2.4, Fitness for Duty, Volume III: Nuclear Security Officer Medical, Physical and Psychological Fitness
- G-323, Ensuring Presence of Sufficient Qualified Staff at Class 1 Nuclear Facilities – Minimum Staff Complement
- REGDOC-2.3.2, Accident Management, Version 2
- RD-327, Nuclear Criticality Safety
- GD-327, Guidance for Nuclear Criticality Safety
- G-276, Human Factors Engineering Program Plans
- G-278, Human Factors Verification and Validation Plans
- R-85, Radiation Protection Requirements for the Exemption of Certain Radioactive Materials from Further Licensing upon Transferral for Disposal
- G-91, Ascertaining and Recording Radiation Doses to Individuals
- G-219, Decommissioning Planning for Licensed Activities
- G-129, Keeping Radiation Exposures and Doses "As Low as Reasonably Achievable (ALARA)"
- G-228, Developing and Using Action Levels
- S-106, Technical and Quality Assurance Requirements for Dosimetry Services, Rev.1.
- GD-314, Radiation Protection Programs for the Transport of Nuclear Substances
- P-223, Protection of the Environment
- REGDOC-2.9.1, Environmental Protection: Policies, Programs and Procedures
- P-325, Nuclear Emergency Management
- REGDOC-2.10.1, Nuclear Emergency Preparedness and Response, Version 2
- REGDOC-2.11.1, Waste Management, Volume II: Assessing the Long Term Safety of Radioactive Waste Management
- REGDOC-2.12.2, Site Access Security Clearance
- REGDOC-2.12.3, Security of Nuclear Substances: Sealed Sources
- REGDOC-2.13.1, Safeguards and Nuclear Material Accountancy
- REGDOC-2.13.2, Import and Export, Version 2

- G-205, Entry to Protected and Inner Areas
- Packaging and Transport of Nuclear Substances Regulations, 2015
- G-208, Transportation Security Plans for Category I, II or III Nuclear Material
- REGDOC-2.13.1, Safeguards and Nuclear Material Accountancy
- RD-364, Joint Canada-United States Guide for Approval of Type B(U) and Fissile Material Transportation Packages
- G-217, Licensee Public Information Programs
- REGDOC-3.2.1, Public Information and Disclosure
- G-206, Financial Guarantees for the Decommissioning of Licensed Activities
- CNSC Form, Application for a Licence to Export Nuclear and Nuclear-Related Dual-Use Items

Local requirements include:

- Conventional health and safety, The Occupational Health and Safety Regulations, 1996 (Saskatchewan);
- Building Code, Building Bylaw No. 9455;
- Industrial waste management, The Waste Bylaw No. 8310;
- Sewage management, The Sewer Use Bylaw No. 9466;
- Radiation Protection, The Radiation Health and Safety Regulations, 2005.

Applicable Canadian Standards Association (CSA) Standards include:

- CSA N294, Decommissioning of facilities containing nuclear substances
- CSA N286, Management system requirements for nuclear facilities
- CSA N288.6, Environmental risk assessment at class I nuclear facilities and uranium mines and mills
- CSA N393, Fire protection for facilities that process, handle, or store nuclear substances
- CSA N1600, General requirements for nuclear emergency management programs
- CSA N292.0, General principles for the management of radioactive waste and irradiated fuel
- CSA N292.3, Management of low—and intermediate—level radioactive waste
- CSA N292.5, Guideline for the exemption or clearance from regulatory control of materials having a potential to contain nuclear substances

E.3 Action Levels Proposed for the SRCSF Decommissioning Project

Action Levels for the SRCSF decommissioning are prepared in accordance with Paragraph 3(1)(f) of the General Nuclear Safety and Control Regulations [23] and Section 6 of the Radiation Protection Regulations [24]. SRC supported by Candu has used the guidance provided by G-228, Developing and using Action Levels and G-129, Keeping Radiation Exposures and Doses "As Low As Reasonably Achievable (ALARA)", in the development of Action Levels (see Table E-1).

Section 6(1) of the Radiation Protection Regulations defines an Action Level to be "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".

Action Levels for the SRCSF Decommissioning Project are provided for Radiation Protection and Environmental Protection **[21]**.

E.3.1 Action Levels for Radiation Protection

SRC SLOWPOKE Decommissioning Action Levels and Radiation Protection Requirements (Reference [21]) covers activities involving ionizing radiation that are to be carried out under the Licence to Decommission. The Radiation Protection Program is designed to ensure that the work performed under the Licence to Decommission complies with, or exceeds, the level of radiation safety that is required by the relevant regulations pursuant to the Nuclear Safety and Control Act (Reference **[28]**).

The processes and activities of concern under the SRCSF Decommissioning Radiation Protection Plan are radiation work undertaken at the SRCSF facility. Action Levels for Radiation Protection are specified in terms of dose to decommissioning personnel, all of whom are to be Nuclear Energy Workers (NEWs). These levels are significantly below the dose limits defined in CNSC's Radiation Protection Regulations.

E.3.2 Action Levels for Environmental Protection

Releases of radioactive material to the environment are expected to be below the Exemption Levels and Unconditional Clearance Levels for radioisotopes listed in Schedules 1 and 2 respectively of the Nuclear Safety and Control Act, Nuclear Substances and Radioactive Devices Regulations (Reference [28] and [25]). These are proposed to be the Action Levels for Environmental Protection. Monitoring will be conducted within the facility to confirm airborne concentrations remain below the Exemption Levels.

E.3.3 Reporting Requirements

Reporting and subsequent investigations in the event of any Action Level being exceeded will be in accordance with Radiation Protection Regulations [24]. Details are provided in References [21].

E.4 Environmental Impact Statement (EIS)

SRC informed the CNSC on December 08, 2017, of its intent to defuel and decommission the SRCSF. On May 14, 2018 SRC submitted a letter the CNSC entitled, *"Initial Application for Authorization to Decommission Saskatchewan Research Council SLOWPOKE-2 Reactor".* The objective of that letter was to confirm SRC's decision to proceed with the decommissioning of its SLOWPOKE-2 facility, and to inform the CNSC about the plans, activities and schedule related to decommissioning and to request clarification about the formal process that the CNSC intends to follow in order to make a determination with regard to the environmental assessment that may be associated with this project under the CEAA 2012.

By letter to SRC on the May 29, 2018 and followed by regular meetings with Candu and SRC, CNSC confirmed that that: "CEAA 2012 no longer requires an EA for decommissioning projects regulated by the CNSC on existing licensed sites. Based on the information that Saskatchewan Research Council (SRC) has provided to the CNSC to date, there is no requirement for an EA under the CEAA 2012. A formal determination will be completed, once SRC submits a decommissioning application."

An EIS has been prepared for the SRCSF decommissioning project **[4]** by Matrix Solutions Inc.

This EIS assesses the environmental impact of decommissioning SRCSF by means of a risk characterization and an assessment of various risks to the workers, public and environment. Normal operations, malfunctions and potential for accidents are taken into consideration. The risks are assessed by means of a hazard assessment, an exposure assessment and by means of risk characterization.

The EIS states that the SRCSF decommissioning project has the benefit of drawing from the experiences gained from the successful decommissioning of SLOWPOKE facilities at University of Alberta, Dalhousie University and University of Toronto, therefore, it is a low risk project. Given that the same personnel

from Candu are involved, the risks are significantly reduced due to greater awareness and training that resulted from the recent experience. The following conclusions are made in the Environmental Impact Statement:

- Releases of contaminants to the environment are expected to be low and no residual adverse effects are expected.
- No cumulative effects are expected in the environment.
- The decommissioning process is expected to have very little impact on the surrounding natural and social environment.
- No need to modify the SRC building and therefore no need to change the surrounding natural environment.
- Adequate provision is being made for the protection of workers, the public, and for the protection of the environment.
- No harmful effects (short term and long term) are expected to the environment.

F. PHYSICAL PROTECTION/SECURITY

The SRCSF is located at the Environmental Analytical Laboratory in the Saskatoon Research Park (Innovation Place), in Saskatoon, Saskatchewan. Access to SRCSF is controlled, and security measures are in place at all times to detect unauthorized access to the SRCSF.

Security for the SRC during the decommissioning work will continue to be in place as established under the NPROL-19 .00/2023; Non-Power Reactor Operating Licence SLOWPOKE-2 Reactor **[7]**. In addition, a Site Security Plan for the Decommissioning of the SRCSF has been prepared to address specific configurations and conditions that will exist during the execution of the decommissioning activities. This plan complements and supplements the security measures that are already in place at SRCSF. The Site Security Plan has been submitted to the Nuclear Security Division of the CNSC **[29]**.

A separate plan will be agreed with CNSC Security officials, prior to the transportation of the core. This plan is not enclosed with this application.

G. ANALYSIS REPORTS/TECHNICAL REPORTS

The technical documents, that support the operation of the SRCSF are identified in the SRC, NPROL-19.00/2023; Non-Power Reactor Operating Licence SLOWPOKE-2 Reactor [7]. These reports, which provide technical information regarding the design, safety analysis, commissioning, operation, testing and maintenance of the SRCSF are listed as References [2], [8], [10] and [11].

The following technical documents include evaluations and technical calculations that support the information regarding the SRC decommissioning activities provided in this application:

- Environmental Impact Statement- Saskatchewan Research Council SLOWPOKE-2 Reactor Decommissioning, 147-01600-R027-371-9001 , Rev. 1, Matrix Solutions document, 27464-514 EIS R 2018-11-06;
- "Detailed Decommissioning Plan for SRC SLOWPOKE-2 Facility", 147-01600-DDP-002;
- "SRC SLOWPOKE Decommissioning Radiation Physics Assessment", 147-03320-ASD-004;
- "Hazard Assessment Report for Decommissioning SRC SLOWPOKE-2 Facility", 147-01600-HA-002;
- "SRC SLOWPOKE–2 Decommissioning Radiological Consequences Assessment", 147-03600-ASD-003;
- "SRC SLOWPOKE–2 Decommissioning Out-of-Reactor Criticality Assessment", 147-03340-ASD-002.

The results and conclusions of these technical documents are presented in various sections of this application. References to relevant sections of these technical reports are made to identify the source of specific information provided throughout the application.

H. FINANCIAL GUARANTEE

The SRC Board of Directors approved a motion at its meeting held on, December 01, 2017, the total funding amount of up to $7.5 million for the completion of the decommissioning project. The formal motion is reproduced in a letter from Dr. Schramm (SRC) to the CNSC Project Officer, Mr. Ismail Erdebil, and dated September 26, 2018 [30].

I. OCCUPATIONAL SAFETY AND HEALTH

All decommissioning work in the SRC will be performed in accordance with the Canada Labour Code [31], Canada Occupational Health and Safety Regulations [32], with the Saskatchewan Employment Act, 2014 [33] and the Occupational Health and Safety Regulations, 1996 (Saskatchewan)[34] and applicable provincial Regulations.

The primary measures to mitigate industrial hazards are provided in Reference [9] and [27]. Specific industrial hazards and precautions will be described in the respective Decommissioning Work Plans (DWPs). SRC and Candu Occupational Health & Safety representatives will be consulted as and when required by the project team to provide direction for precautions to be observed.

J. SAFEGUARDS

The CNSC Office of International Affairs (OIA) will be kept informed of planned transfer and schedule both for safeguards during reactor core removal and for safeguards associated with the reactor core transportation to the site licensed for disposal. The existing IAEA Design Information Questionnaire **[35**] was provided to the CNSC Safeguards Officer as a support document for the current Operating Licence of the SRC.

Agreements will be established with the CNSC/IAEA regarding the planned safeguards, the notification requirements and the form of these notifications.

Regulatory Document RD-336 became effective January 1, 2011. Since that date, Nuclear Material Reporting Forms have been submitted as required by the regulations. Prior to January, 2011, a physical inventory logbook was maintained, recording the SRCSF fuel inventory on an annual basis. Annual updates are submitted under the IAEA Additional Protocol. Physical Inventory Inspections were conducted by IAEA in September, 2004, and October, 2011. The RD-336 has since been superseded by REGDOC-2.13.1-Safe Guards and Nuclear Material Accountancy. A safeguards inspection was conducted in Nov 2018 in accordance with REGDOC 2.13.1.

K. TRAINING PROGRAM

The SRCSF is a relatively simple structure of modest size and its disassembly will involve correspondingly simple manual processes. These processes will be carefully structured to address well-recognized hazards and will be documented in detailed instructions that will form the basis of the staff training program.

SRCSF decommissioning operations will be performed by a small team directed by the Technical Lead and executed by the currently-authorized SLOWPOKE Reactor Engineer (SRE), the SLOWPOKE Reactor Technician (SRT), and specialists such as radiation protection surveyors, nuclear materials shipment specialists and mechanical technicians.

The SRC Decommissioning Training Program is documented in Reference [36]. The basic principles governing the SRC decommissioning training program are presented below:

- All staff assigned to the project will receive knowledge training to provide a basic understanding of the layout and configuration of the SLOWPOKE reactor and its systems.
- All staff assigned to the project will receive training to familiarize them with the step-by-step Decommissioning Instructions prepared for the project that are applicable to the work they will be assigned.
- All staff will perform a walk down a few weeks before the commencement of decommissioning work. This will help the staff to get familiar with the work environment.
- Staff providing specialist support will be selected for their relevant knowledge, skills and experience (KSE). This KSE will be complemented by project-specific training so that the specialists are familiar with the workplace, the tasks involved in the decommissioning project and how they interact with those tasks.
- For the higher risk activities, the core removal, and the removal of the beryllium components, the tasks will be carried out by the SRE and the SRT, supported by selected specialists. The SRE and the SRT are certified by the CNSC to perform various nuclear activities as detailed in Reference [9] and Reference [36].

As a condition of employment, all Candu staff are required to complete basic industrial safety and radiological training. Specific personnel qualification forms are used to document the qualification requirements for each category of staff in Candu. A review of training and qualifications will be conducted concerning employees assigned to work at the SRCSF. Minimum training levels will be confirmed and any additional training requirements will be addressed.

Personnel in direct operating positions will be qualified and trained in accordance with Candu's Systematic Approach to Training (SAT), unless their current CNSC certification is extended to cover the activities which they will perform during the decommissioning work. As mentioned in Reference [36], the SAT process follows a well-structured and documented process that starts with a Training Needs Analysis to examine the tasks involved and the personnel assigned or available to perform the tasks. The analysis produces training recommendations in the form of a matrix of training modules or courses that personnel will receive to fill any gaps in their required knowledge and skills.

It is expected that everyone working in the SRCSF during the time up to and including the execution of the final survey will be qualified as Nuclear Energy Workers (NEWs). The training and qualification requirements of the Candu Radiation Surveyor, the SLOWPOKE Reactor Engineer, the SLOWPOKE Reactor Technician and other staff are provided in Reference [9] and Reference [36]. More details regarding the radiation protection training requirements are provided in Reference [21].

L. PUBLIC INFORMATION AND DISCLOSURE PROGRAM

SRC has developed a public information and disclosure program as described in the Decommissioning Communications Plan and Public Disclosure Protocol [37]. This program addresses public information through a variety of mechanisms including communications updates **[38**], website, blog updates and planned public meetings.

SRC has a dedicated web page for the SLOWPOKE 2 reactor, which includes a dedicated section for decommissioning, the website provides blog updates. In addition, SRC conducted a public meeting on December 05, 2018, to provide ongoing communication to the general public. Feedback from this public meeting will be provided as input to the licensing process.

The goals and objectives of the public information and disclosure program are to:

- Communicate openly and clearly the process of decommissioning the SRCSF; and
- Proactively provide information including technical detail, background and safety precautions in an effort to address possible concerns (subject to security requirements).

The information products and methods used to distribute information concerning the

SRC decommissioning project include:

- Articles in the website about the SRCSF Decommissioning process, history of reactor and contribution to research at SRC;
- Neighbourhood notice to neighbours and community at large, hand delivered to neighbourhoods surrounding campus;
- Media release - distributed electronically ;
- Updates posted to SRC social media websites;
- Backgrounder/fact sheet - to be made available to media as well as posted to SRC News. The fact sheet will also be used as a handout as needed;
- Public Service Announcements - for distribution to media with background information and details on the decommissioning process; and
- Public consultation, at each stage public meetings will be held with both the internal community and neighbours.

Throughout this process SRC will provide detailed information that addresses environmental and safety concerns. Information on the Project will be published in newsletters, where readers are invited to submit comments or their thoughts, and SRC will respond to these comments. SRC also plans to use much of the time in public information sessions to respond directly to questions.

SRC will monitor media coverage of the decommissioning process, social network discussion centres and feedback vehicles. The feedback received to date has indicated no significant objections or concerns exist with regard to the decommissioning of the SRCSF.

In the public meeting held on December 05, 2018 in Saskatoon, SRC provided information to the public about their plans for decommissioning the SLOWPOKE reactor. SRC representatives were on hand to answer questions from members of the public. The reason for decommissioning the SLOWPOKE reactor, the regulatory process, the timeline for decommissioning process and the future plans for the building will be presented to the members of the public through information boards. The open house presentation is available in the SRC website. The public information meeting was widely publicized including to the stakeholders as mentioned below. Interest from the members of the public will be assessed (to date the interest has been minimal). The feedback received from the members of the public who attended this meeting was collected and will be provided to the CNSC as feedback for the licensing process. Based on feedback received to date, it is expected that no significant objections or concerns will be raised about health and safety of members of the public or employees of SRC due to the decommissioning.

The President & CEO will be SRC's official spokesperson. Exceptions may include clients who call the lab manager directly or employees who may have basic, technical questions for their Manager or Vice-

President. All media interviews will be handled by the President & CEO. In the event that the President & CEO is unavailable, the Chair of the Steering Committee will be the spokesperson. The President & CEO may also designate a SLOWPOKE Decommissioning Spokesperson as required.

L.1 Stakeholders

The key stakeholders are provided below:

- Government of Saskatchewan/Ministers responsible for SRC
- City of Saskatoon, Mayor and Ward Councillor
- Fedoruk Centre, Executive Director and Operations Manager
- Aboriginal leaders from Metis Nation of Saskatoon, Saskatoon Tribal Council, Muskeg Cree nation Urban Reserve and Prince Albert grand Council
- Canadian Nuclear Safety Commission
- Clients
- SRC Board
- SRC Employees
- Elected officials (City Councillor, Provincial MLA, Federal MP)
- Ministry of Central Services (landlord)
- Saskatchewan Opportunities Corporation - Innovation Place (security and maintenance)
- Emergency Responders
- Saskatoon Fire Department and the University of Saskatchewan Protective Services
- University of Saskatchewan
  - Vice-President Research, Physics Department Professor, Facilities and other U of S staff.
- Media
- General Public

SRC is not situated directly in a residential area (the closest residential area is over 800 metres away from the reactor)

M. DECOMMISSIONING PLAN

M.1 Detailed Decommissioning Plan

The Detailed Decommissioning Plan (DDP) for the SRC is documented in Reference [9]. The DDP includes the steps necessary to ensure the health, safety and protection of workers, the public (including university staff and students), and the environment during the SRCSF decommissioning process. The decommissioning process proposed for the SRCSF is the prompt removal of the fuel and all radioactive materials, in order to obtain a Licence to Abandon, permitting unrestricted use of the remaining facility.

Additionally, the Canadian Nuclear Safety Commission (CNSC) has issued a decommissioning planning document, CNSC Regulatory Guide G-219 [39], providing guidelines for the content and structure of DDPs that are to be submitted to the CNSC for acceptance prior to the commencement of physical decommissioning activities. The DDP is structured to meet the requirements outlined in the CNSC guidelines and meets the requirements of CSA N286-12 [40] and CSA N294-09 [41]. The plan assumes that the building that houses the SRCSF will be retained for future reuse by the SRC, and at the completion of the decommissioning work, a Licence to Abandon, allowing unrestricted use of the facility, will be issued by the CNSC.

Under the existing NPROL [7] the work leading up to removal of irradiated fuel and reactor components can be performed. This application requests CNSC for an amendment to the existing licence to allow decommissioning. Upon approval by the commission and the issuance of a licence amendment which will allow the decommissioning of the SRCSF. This requires that the reactor be operated at low power and maintained critical during part of the defueling process. The spent fuel core will be removed from the SRCSF, and all other radioactive materials will be transferred for storage at a licensed facility. The decommissioning work will also include obtaining concrete core samples from the reactor pool for activation assessment. End state radiation surveys will be performed to ensure no contamination is present above the acceptable levels prior to filling the reactor pool with concrete. CNSC will perform an inspection to verify the End State Report.

The structural restoration work will commence after the Licence to Abandon is issued.

The irradiated core and all other radioactive materials will be removed from SRCSF and will be transferred for disposition or storage at licensed facilities. The decommissioning work in the SRCSF has been divided into seven Decommissioning Work Packages (DWPs). Each DWP comprises the documentation which is necessary to fully define the work that is to be performed under the scope of that DWP, the objectives and requirements to be met, the personnel and equipment/tooling required, and the precautions and procedures to be followed. Dose estimates associated with the execution of each DWP will be developed based on [15] and [21]. Typically, the DWP documentation will include, as applicable: Action levels and radiation protection requirements, Decommissioning Instructions, Decontamination Procedures, Hazard Assessment, Radioactive waste and quantities, Waste Management Data Sheets, Work Permits and Dose Estimates. An overview of the activities and scope associated with each DWP is provided below:

• DWP-1 Defueling Preparations - The preparations for defueling the reactor core are a critical step to ensure that all safety checks have been completed prior to core removal:

- Operating the reactor at low power to verify the proper operation of all necessary instrumentation and control equipment.
- Verify existing excess reactivity of the core by performing a period measurement.
- Surveys of Rooms 143, 144, 145, and 146 (reactor room), similar to operational surveys performed previously, to verify that they are free of radioactive contamination.
- Removal of equipment from Rooms 145, 143 and 144 which is not needed for the subsequent operation of the reactor and the decommissioning process, and which has not previously been removed as permitted under the Operating Licence. Such items will be surveyed to ensure that they meet criteria for release.
- A systematic survey will be conducted of Room 146, including the remaining equipment, the floors, and the walls, to verify that there is no loose contamination present. Any removable contamination which is found will be decontaminated, and any fixed contamination will be documented.

- DWP-2 Core Removal - The core removal work, under DWP 2, will commence after establishing a rubber area in Room 146, and will include: achieving reactor sub-criticality conditions, configure the reactor for core removal, removal of the irradiated core and removal of beryllium components.

- DWP-3 Reactor Components Removal - The main activities under DWP-3 include: removal of the upper reactor container, removal of the lower reactor container, remove remaining components, and the disposal of pool water.

- DWP-4 Auxiliary Component Removal - The auxiliary component removal work, under DWP 4, will commence following the transfer of irradiated core into F-257 flask and will proceed in parallel with the removal of the reactor components (DWP 3). Some components that are not radioactive may be released to SRC for recycling to other SLOWPOKE facilities.

The radioactive components will be packaged in Type A containers and disposed as radioactive waste. Components with activity below the release limits will be disposed as non-radioactive waste.

- DWP-5 Pool Cleanup - The pool cleanup work, under DWP 5, will start when the pool water has been processed to achieve the release criteria and pumped into the sewer. The major activities of DWP-5 involve: systematic pool liner survey and concrete and re-bar sampling.

- DWP-6 Final Survey- A systematic final status survey will be performed in Room 146 to verify that no residual contamination is present following the decommissioning activities. The other rooms of the SRCSF will be ensured to be free of contamination, by means of a general survey as has been performed routinely during the operation of the SRCSF. The results of both surveys will be included in the End State Decommissioning Report.

- DWP-7 Civil Work and Restoration - The civil work and restoration, under DWP 7, will commence upon completion of DWP 6 and will include the following activities:

In Room 146, Filling and covering the pool with concrete, filling the trenches with concrete, and general cleaning of the room. All other rooms will be cleaned to original condition as was received prior to decommissioning.

All instructions utilized in the execution of the DWPs will be prepared in accordance with applicable SRC and Candu procedures and reviewed by experienced tradesmen and/or subject matter experts prior to implementation. Once approved and accepted for implementation by the SRC, they will become part of the formal project documentation.

A Human Factors Engineering Program Plan (HFEPP) is prepared for the SRC decommissioning project [42], in accordance with the guidance provided in the CNSC Regulatory Guide, Decommissioning Plans for Licensed Facilities, G-219 (Reference [43],see Section 6.2 and Section 11). The purpose of the activities described in the HFEPP is to ensure that human abilities and limitations are given appropriate consideration in the planning and execution of the decommissioning work. The content and format of the HFEPP follow the guidelines provided in documents issued by the CNSC, and the U.S. NRC as identified in References [43] and [44].

The end state objective for the decommissioning of the SRCSF is to obtain a Licence to Abandon, which will allow SRC the unrestricted use of the building and services remaining in the space occupied by the facility. At the completion of the decommissioning of the SRCSF, all contaminated equipment and other equipment associated with the operation of the SRCSF will have been removed from the SRCSF. The structure of the SRCSF will be confirmed as being free of contamination, below the clearance criteria accepted by the CNSC and defined in the Schedule 2 of SOR/2000-207- CNSC's Nuclear Substances and Radiation Devices Regulations [17].

M.2 Proposed Decommissioning Schedule

The site work to decommission the SRCSF is expected to be about 4 months based on previous experience, from the start of work to the completion of the civil work and restoration. A Summary Schedule is provided in Figure M-1 (Reference [9]).

Figure M-1 : Schedule Summary

PROTECTED - SENSITIVE	SRC SLOWPOKE Decommissioning PO No.: 255905	SNC·LAVALIN Candu

Activity ID	WBS	Activity Name	Start	Finish
SRC SLOWPOKE Decommissioning			18-Apr-18 A	22-Jun-20
NPROL Amendment Supporting Activities			19-Apr-18 A	16-Jun-20
Initial Application for NPROL Amendment			19-Apr-18 A	14-May-18 A
Application for NPROL Amendment - Complete Package			09-Oct-18 A	12-Jul-19
Quality Assurance (QA) Plan			26-Jun-18 A	09-Aug-18 A
Human Factors Engineering Program Plan (HFEPP)			25-Jun-18 A	04-Sep-18 A
Environmental Protection (EP) Requirements			25-Jun-18 A	14-Aug-18 A
Out of Reactor Criticality Assessment (ORCA) Report			25-Jul-18 A	11-Oct-18 A
Radiation Physics Assessment (RPA) Report			25-Jun-18 A	15-Oct-18 A
Radiology Consequences Assessment (RCA) Report			22-Aug-18 A	27-Nov-18 A
Radiation Protection (RP) Requirements & Action Levels (AL)			22-Aug-18 A	27-Nov-18 A
Decommissioning Instructions (DIs)			07-May-18 A	15-Feb-19
Radioactive Waste Transportation (RWT) Plan			21-Sep-18 A	18-Dec-18
Waste Management Plan (WMP)			28-Sep-18 A	20-Nov-18 A
Emergency Response Plan (ERP)			01-Oct-18 A	21-Jan-19
Public Information & Disclosure Plan (PIDP) - SRC Scope			03-Jul-18 A	16-Jun-20
Hazard Assessment (HA) Report			03-Aug-18 A	16-Jan-19
Environment Impact Statement (EIS) - Subcontract			19-Jun-18 A	16-Jan-19
Decommissioning Work Packages (DWP)			20-Aug-18 A	16-Jan-19
Site Security Plan (SSP) - SRC Scope			03-Jul-18 A	13-Sep-18 A
Training Plan (TP)			10-Sep-18 A	18-Apr-19
Human Factors Engineering (HFE) Summary Report			20-Aug-18 A	27-Jun-19
Detailed Decommissioning Plan (DDP)			22-Aug-18 A	18-Dec-18
Radiation Work Plan (RWP)			09-Oct-18 A	14-Dec-18
Job Safety Analysis (JSA) - Candu Internal Requirement			21-May-19	27-Jun-19
Licence to Transport Fuel			03-Jul-18 A	10-Dec-19
Application for Licence to Transport Fuel			04-Feb-19	27-Jun-19
Fuel Transportation Security (FTS) Plan - Canada			07-Jan-19	21-Jun-19
Fuel Transportation Security (FTS) Plan - U.S.			03-Apr-19	26-Jul-19
Type B Transportation Flask (F-257)			01-Aug-18 A	15-Jul-19
DoE Fuel Acceptance Requirements			27-Aug-18 A	16-Sep-19
Fuel Export Licence			01-Mar-19	26-Jun-19
Freight Forwarder (STS)			03-Jul-18 A	20-Aug-18 A
NRC Route Clearance			30-Jul-18 A	31-Jan-19
U.S. DoT Endorsement			30-Jul-18 A	31-Jan-19
SRS Carrier Clearance			03-Jun-19	27-Jun-19
Fuel Transportation			15-Aug-19	10-Dec-19
Source ERAP Vendor			09-Oct-18 A	28-Feb-19
Application for ERAP Registration to Transport Canada (TC)			15-Feb-19	02-Apr-19
Licence to Abandon (LA)			07-Oct-19	15-Jun-20
Application for Licence to Abandon			21-Oct-19	15-Jun-20
End State Decommissioning Report (ESDR)			07-Oct-19	15-Jan-20
Equipment & Tooling			15-Jun-18 A	26-Jul-19
Lower Reactor Container (LRC) Shielding Package			15-Jun-18 A	04-Feb-19
Beryllium (Be) Shielding Package			15-Jun-18 A	04-Feb-19
Low Level Waste Transport Containers (Type A)			19-Nov-18 A	12-Jul-19
Fuel Tagging Tool			18-Jun-18 A	11-Feb-19
Standard Tooling			04-Feb-19	19-Jun-19
Process Equipment for Water Treatment			22-Oct-18 A	12-Jul-19
SLOWPOKE Specific Tooling (SST)			01-Aug-18 A	26-Jul-19
Radiation Monitoring & PPE			04-Feb-19	12-Jul-19
Radiation Area Personal Protective Equipment & Clothing (PPE&C)			04-Feb-19	19-Jun-19
Radiation Monitoring Equipment (RME)			04-Feb-19	19-Jun-19
Standard Personal Protective Equipment & Clothing (PPE&C)			25-Mar-19	12-Jul-19
Site Preparation-SRC Scope			02-Jul-19	14-Jul-19
Site Work			15-Jul-19	19-Oct-19
Project Management			18-Apr-18 A	22-Jun-20

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N. SAFETY ASSESSMENT AND EMERGENCY RESPONSE PREPAREDNESS

During the operation of the SRC SLOWPOKE-2, measures are established in order to prevent accidental releases of radioactive or hazardous substances or to mitigate the effects of such releases on the SRC personnel and on the environment. These measures are consistent with the conditions expected to occur during SRC SLOWPOKE-2 operation and are identified in the documents supporting the SRC SLOWPOKE-2 Operating Licence [7].

The decommissioning activities will create hazards that are not present during the normal operation of the SRC SLOWPOKE-2. A Hazard Analysis (HA) of the SRCSF decommissioning activities has been conducted in order to identify the potential radiological, chemical, and industrial hazards that could be encountered during the decommissioning of the SRCSF. The results of this review are documented in the Hazard Analysis of SRCSF Decommissioning Project [18]. The HA document also identifies the measures intended to prevent accidental releases of radioactive or hazardous materials or to mitigate the effects of such releases on the health and safety of the workers involved in the execution of the decommissioning activities. The potential radiological consequences associated with the SRC decommissioning activities are presented in [45].

An out-of-core criticality assessment for the removal of the SRC core based on CNSC acceptance criteria given in Nuclear Criticality Safety, RD-327 and the Guidance for Nuclear Criticality Safety, GD-327 is documented in Reference [46].

An assessment of the potential impact of the decommissioning activities on the environment is documented in the Environmental Impact statement report prepared by Matrix Solutions [4]. The document describes the potential environmental effects from the entire decommissioning, the mitigation measures applied to minimize these effects, and the significance of any environmental effects after the application of mitigation measures.

In order to address the additional hazards and events that could arise during decommissioning of the SRC facility, a specific Emergency Response Plan has been developed [47]. These procedures build on the SRCSF Emergency Procedures ([48] and [49]), the facility specific emergency procedures are described in Reference [2].

The hazardous conditions addressed by the emergency response plan developed by the SRCSF decommissioning project include:

- Fire;
- Flood;
- Bomb threat/Suspicious package;
- Loss of Electric Power;
- Spills and gas leak;
- High radiation alarms; and Radiological contamination

During the decommissioning of SRCSF, signs detailing emergency procedures and contact numbers will be posted throughout the facility. Specific emergency procedures will be recorded in the applicable Decommissioning Work Packages to reflect possible hazards associated with the each decommissioning activity. All staff will be trained on emergency procedures prior to beginning work in the SRCSF.

O. REFERENCES

[1] 147-912020-QAP-004, Rev. 0 (or latest revision issued as "approved for use"), Saskatchewan Research Council (SRC) SLOWPOKE-2 Decommissioning-Quality Assurance Plan.

[2] "Site Description and Operating Manual", SRC SLOWPOKE-2 Facility, Rev.7, October 2015.

[3] Natural Resources Canada Website, http://www.seismescanada.rncan.gc.ca

[4] Environmental Impact Statement- Saskatchewan Research Council SLOWPOKE-2 Reactor Decommissioning, 147-01600-R027-371-9001, Rev. 1, Matrix Solutions document, 27464-514 EIS R 2018-11-06.

[5] "The Research Council Act", Government of Saskatchewan.

[6] Letter from Schramm (SRC) to Erdebil (CNSC), "SRC SLOWPOKE-2 Facility Decommissioning", dated October 11, 2018.

[7] Non Power Operating Reactor License, NPROL-19.00/2023, valid to June 30, 2023.

[8] "CPR-26, Rev. 1, Description and Safety Analysis for the SLOWPOKE-2 Reactor". M.E. wise and R.E. Kay, Atomic Energy of Canada, Ltd. February, 1981.

[9] 147-01600-DDP-002, Rev. 0 (or latest revision issued as "approved for use"), Detailed Decommissioning Plan for SRC SLOWPOKE-2 Facility.

[10] SLOWPOKE-2 Nuclear Reactor Commissioning and Nuclear Maintenance, CPSR-361 Rev, 1, Atomic Energy of Canada Limited, February 1981.

[11] SLOWPOKE- 2 Nuclear Reactor Operation and Routine Maintenance, CPSR-362 Rev. 2, Atomic Energy of Canada Limited, February 1984.

[12] "Application for the Renewal of the SLOWPOKE-2 Reactor Operating Licence", SRC Publication No. 12736-4E12, August 2012.

[13] SRC SLOWPOKE-2 Facility License # NPROL-19.00/2023 Annual Compliance Report for the period from January 1, 2017 to December 31, 2017, SRC Publication No. 12736-1E18, March 2018.

[14] Packaging and Transport of Nuclear Substances Regulations, 2015, SOR/2015-145, Government of Canada department of Justice.

[15] 147-03320-ASD-004, Rev. 0 (or latest revision issued as "approved for use"), SRC SLOWPOKE Decommissioning Radiation Physics Assessment.

[16] Saskatoon: Bylaw No. 9466, "The Sewer Use Bylaw", 2017;

[17] SOR/2000-207, "Nuclear Substances and Radiation Devices Regulations", Canada Minister Of Justice, June 6, 2016.

[18] 147-01600-HA-002, Candu Report, Rev. 0 (or latest revision issued as "approved for use"), Hazard Assessment Report for Decommissioning SRC SLOWPOKE-2 Facility.

[19] 147-01622-REPT-002, Rev. 0 (or latest revision issued as "approved for use"), SRC SLOWPOKE Decommissioning Waste Management Plan.

[20] Saskatchewan Research Council (SRC) SLOWPOKE-2 Facility Preliminary Decommissioning Plan", Revision 4, April 2012.

[21] 147-03400-REPT-002, Rev.0 (or latest revision issued as "approved for use"), SRC SLOWPOKE Decommissioning Action Levels and Radiation Protection Requirements.

[22] Radiation Safety Manual, OHS-MAN-2, SRC, February 2018.

[23] SOR/2000-202, General Nuclear Safety and Control Regulations, Minister of Justice.

[24] SOR/2000-203, Radiation Protection Regulations, Minister of Justice.

[25] SOR/2000-207, Nuclear Substances and Radiation Devices Regulations, Minister of Justice.

[26] 147-03700- REPT-002, Rev. 0, SRCSF Decommissioning Environment Protection Requirements.

[27] Saskatchewan Research Council Occupational Health & Safety Manual, OHS-MAN-1, SRC Safety Services, January, 2010.

[28] Nuclear Safety and Control Act (S.C. 1997, c. 9).

[29] Security Plan SRC SLOWPOKE-2 Reactor Decommissioning, submitted separately as classified information on November 22, 2018.

[30] Letter from Schramm (SRC) to Erdebil (CNSC), "SRC SLOWPOKE-2 Facility Financial Commitment for Decommissioning", September 26, 2018.

[31] Canada: R.S.C; Canada Labour Code 1985, c. L-2; http://laws-lois.justice.gc.ca/PDF/L-2.pdf.

[32] Canada: SOR/86-304, Canada Occupational Health and Safety Regulations; http://laws.justice.gc.ca/PDF/SOR-86-304.pdf

[33] The Saskatchewan Employment Act, 2014 (Saskatchewan),

[34] The Occupational Health and Safety Regulations, 1996 (Saskatchewan)

[35] IAEA SRC Design Information Questionnaire, on file with CNSC.

[36] 147-01600-TPL-003, Rev. 0 (or latest revision issued as "approved for use"), Decommissioning Training Plan for SRC SLOWPOKE-2 Facility.

[37] SRC SLOWPOKE-2 Decommissioning Communications Plan and Public Disclosure Protocol, September 2018 or latest revision issued.

[38] SRC SLOWPOKE-2 Decommissioning Communications Plan Update, October 2018 or latest revision issued.

[39] CNSC Regulatory Guide G-219- Decommissioning Planning for Licensed Activities.

[40] CSA N286-12, 2012 (Reaffirmed 2017), Management system requirements for nuclear facilities.

[41] N294-09 (R2014), Decommissioning of facilities containing nuclear substances.

[42] 147-01600-HFP-002, Rev. 1, Human Factors Engineering Program Plan for Decommissioning SRC SLOWPOKE–2 Reactor, .

[43] CNSC G-276, Regulatory Guide, Human Factors Engineering Program Plans.

[44] NUREG-0711, Rev 3, Human Factors Engineering Program Review Model.

[45] 147-03600-ASD-003, Candu Report, Rev. 0 (or latest revision issued as "approved for use"), SRC SLOWPOKE–2 Decommissioning Radiological Consequences Assessment.

[46] 147-03340-ASD-002 Rev. 0 (or latest revision issued as "approved for use"), SRC SLOWPOKE–2 Decommissioning Out-of-Reactor Criticality Assessment.

[47] 147-01600-ERP-002, (planned for submission to CNSC on Jan 20, 2019 as "approved for use"), SRC SLOWPOKE–2 Decommissioning Facility Emergency Response Plan.

[48] Saskatchewan Research Council Emergency Response Plan OHS-STD-02, SRC Safety Services, February, 2011.

[49] Facility-Specific Emergency Response Procedures-SRC Resources Research Centre Building, SRC Safety Services, May, 2012.

Attachment #3: Licensing Support Documentation for Application for an Amendment to the NPROL 19.00/2023 for the SRC SLOWPOKE-2 Facility (SRCSF)

S. No	Document Title	Document Code/Revision	Date when submitted or planned to'be submitted to the CNSC
1	Saskatchewan Research Council (SRC) SLOWPOKE-2 Decommissioning-Quality Assurance Plan,	147-912020-QAP-004, Rev. 0	Enclosed with the Application
2	Detailed Decommissioning Plan for SRC SLOWPOKE-2 Facility,	147-01600-DDP-002, Rev. 0	Enclosed with the Application
3	SRC SLOWPOKE Decommissioning Radiation Physics Assessment,	147-03320-ASD-004, Rev. 0	Enclosed with the Application.
4	SRC SLOWPOKE Decommissioning Waste Management Plan,	147-01622-REPT-002, Rev. 0	Enclosed with the Application.
5	SRC SLOWPOKE Decommissioning Action Levels and Radiation Protection Requirements,	147-03400-REPT-001, Rev. 0	Enclosed with the Application.
6	SRCSF Decommissioning Environment Protection Requirements,	147-03700-REPT-002, Rev. 0	Enclosed with the Application.
7	"Environmental Impact Statement- Saskatchewan Research Council SLOWPOKE-2 Reactor Decommissioning",	147-01600-R027-371-9001, Rev. 1 Matrix Solutions document Number: 27464-514 EIS R 2018-11-06	Enclosed with the Application.
8	Security Plan SRC SLOWPOKE-2 Reactor Decommissioning		Submitted to the CNSC Nuclear Security Division on November 22, 2018.
9	IAEA Design Information Questionnaire		Submitted to the CNSC Safeguard Project Officer on October 2016.
10	Decommissioning Training Plan for SRC SLOWPOKE-2 Facility,	147-01600-TPL-003, Rev. 0	Enclosed with the Application.
11	SRC SLOWPOKE-2 Decommissioning Communications Plan and Public Disclosure Protocol		Enclosed with Application
12	Human Factors Engineering Program Plan For Decommissioning SRC SLOWPOKE–2 Reactor,	147-01600-HFP-002, Rev. 1	Enclosed with the Application.

S. No	Document Title	Document Code/Revision	Date when submitted or planned to be submitted to the CNSC
13	Hazard Assessment Report for Decommissioning SRC SLOWPOKE-2 Facility,	147-01600-HA-002, Rev. 0	Enclosed with the Application.
14	SRC SLOWPOKE–2 Decommissioning Radiological Consequences Assessment,	147-03600-ASD-003 Rev. 0	Enclosed with the Application.
15	SRC SLOWPOKE–2 Decommissioning Out-of-Reactor Criticality Assessment,	147-03340-ASD-002 Rev. 0	Enclosed with the Application
16	SRC SLOWPOKE–2 Decommissioning Facility Emergency Response Plan,	147-01600-ERP-002, Rev. 0	Planned for Submission on Jan 20, 2019.
17	Human Factors Engineering Summary Report	147-01600-HFR-002, Rev. 0	Planned for Submission on June 27, 2019
18	Saskatchewan Research Council (SRC) SLOWPOKE-2 Facility Preliminary Decommissioning Plan"	Revision 4, April 2012.	On file with the CNSC submitted on May 2012.
	Documents listed in the SRC Operating Licence NPROL-19.00/2023		
19	"CPR-26, Rev. 1, Description and Safety Analysis for the SLOWPOKE-2 Reactor". M.E. Wise and R.E. Kay, Atomic Energy of Canada, Ltd. February, 1981.. Energy of Canada Limited, dated April 1977	CPR-26	On file with the CNSC.
20	"Site Description and Operating Manual", SRC SLOWPOKE-2 Facility, Rev.7, October 2015.	SRC Publication Number: 12736-3E15	On file with the CNSC submitted on Oct 2015.
21	SLOWPOKE-2 Nuclear Reactor Commissioning and Nuclear Maintenance, CPSR-361 Rev, 1, Atomic Energy of Canada Limited, February 1981.G.A. Burbidge and.R.E. Kay of Atomic Energy of Canada Limited, dated September 1975	CPSR-361 Rev. 0	On file with the CNSC.
22	SLOWPOKE- 2 Nuclear Reactor Operation and Routine Maintenance, CPSR-362 Rev. 2, Atomic Energy of Canada Limited, February 1984.Atomic Energy of Canada Limited, dated November 1975	CPSR-362 Rev. 1	On file with the CNSC.
	Letters		

S. No	Document Title	Document Code/Revision	Date when submitted or planned to'be submitted to the CNSC
23	Ownership of lands or authority from owner	Letter from Schramm (SRC) to Erdebil (CNSC), "SRC SLOWPOKE-2 Facility Decommissioning", dated October 11, 2018.	Enclosed with the Application.
24	Financial Guarantee for the decommissioning of the SRC facility	Letter from Schramm (SRC) to Erdebil(CNSC), "SRC SLOWPOKE-2 Facility Financial Commitment for Decommissioning", September 26, 2018.	Enclosed with the Application.