Canadian Nuclear Laboratories | Laboratoires Nucléaires Canadiens

Supplier Document

Gentilly-1 Waste Facility Licence Amendment Application Environmental Protection Measures for Decommissioning and Demolition

61-03710-ENA-005514

Revision 1.0

Accepted by:	Julie Therrien	2026/04/08
	G1 & DP, Facility Authority	Date

REPORT

Canadian Nuclear Laboratories
Gentilly-1 Waste Facility Licence Amendment Application: Environmental Protection Measures for Decommissioning and Demolition

Revision 1

April 2026

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1 INTRODUCTION

Canadian Nuclear Laboratories Ltd. (CNL) is submitting an application to the Canadian Nuclear Safety Commission (CNSC) to amend the current Waste Facility Decommissioning Licence WFDL-W4-331.00/2034 of Gentilly-1 Waste Facility (G1WF) [1-1] to allow the new physical activities of Decommissioning and Demolition (D&D) of the G1WF.

The applicant is responsible for ensuring that the licence application demonstrates that the applicant:

- is qualified to carry on the licensed activity; and
- will make adequate provision to protect the health, safety and security of persons and the environment.

If granted, the licence amendment application and supporting documentation (including this document) will form the licensing basis for the new physical activities of D&D.

Throughout this document, the new physical activities of D&D will be referred to as “the Project”, and reference to the “G1WF Decommissioning” will refer to all activities performed under licence.

1.1 Purpose of Report

Environmental protection reviews for nuclear facilities, including G1WF, and its activities are conducted in accordance with the Nuclear Safety and Control Act (NSCA) [1-2] and the regulations made under it. This legislation includes provisions to ensure that licensees adequately protect the environment and the health, safety and security of persons.

The CNSC requires the environmental effects of all nuclear facilities or activities to be considered and evaluated when licensing decisions are made. In addition to the NCSA, when nuclear facilities are located on federal lands, as defined under the Impact Assessment Act (IAA) [1-3], the proponent or licence applicant may also be required to ensure that their project also complies with sections 81 – 91 of the IAA [1-3], as in the case of the Project. More details on the applicability of the IAA to the Project is found in Section 1.5.1 of this document.

This Environmental Protection Measures Report (EPMR) provides the information necessary to illustrate the environmental protection measures that, when implemented by CNL:

- Are commensurate with the level of risk associated with the activity.
- Account for uncertainty by keeping all releases to the environment As Low As Reasonably Achievable (ALARA) and apply the best available technology and techniques that are economically available.
- Implement corrective actions to eliminate the identified root causes and verify completion to prevent recurrence.
- Provide adequate information to identify, assess and mitigate significant adverse environmental effects.

The EPMR further demonstrates that CNL has established programs that identify, control and monitor all releases of radioactive and hazardous substances and effects on the environment from the G1WF or as a result of licensed activities at the G1WF, as required by CNSC Regulatory Documents (REGDOCs) 2.9.1 [1-4] and 2.9.2 [1-5].

1.2 Project Overview and Scope

Atomic Energy of Canada Limited (AECL), as a federal Crown corporation, has a mandate to enable nuclear science and technology and manage Canada's radioactive waste and decommissioning responsibilities. It fulfils this mandate through a contractual arrangement with CNL for the management and operation of AECL's sites, facilities, and assets, and for the performance of AECL's waste and decommissioning responsibilities under a Government-owned, Contractor-operated (GoCo) model. CNL is Canada's leading nuclear science and technology organization and a world leader in developing innovative applications from nuclear technology. Services offered through CNL include research and development, design and engineering, specialized technology, waste management, and site decommissioning.

The Gentilly-1 Nuclear Generating Station (G-1 NGS) (250 megawatt electrical [MWe]) is located at the Gentilly Nuclear Complex (also referred to as the Gentilly site) and is currently known as the G1WF. The G-1 NGS was put into service in 1972 and attained full power only twice. It was operated intermittently for a total of 183 effective full power days until 1978, when it was determined that certain modifications and considerable repairs would be required. The reactor was then put into a layup (i.e., shutdown) state in 1980, and it was decided not to rehabilitate the plant in 1982. The decision to decommission the reactor was made in 1983.

The G1WF currently consists of a permanently shut down, partially decommissioned prototype Canadian Deuterium Uranium (CANDU) Reactor and support structures. The G1WF is being decommissioned following a three phased approach that has been established for reactor decommissioning by Canadian and International standards. After its complete shutdown in 1982 and attaining the Phase 1 Decommissioning (i.e., Safe Shutdown State) in 1986, the G1WF has been maintained under Phase 2 Decommissioning (i.e., Storage with Surveillance [SWS] phase). The Phase 3 Decommissioning (i.e., D&D) is the last phase and will involve the removal of the building structures and associated components and equipment and land remediation to an end state will be agreed upon with Hydro-Québec. Figure 1-1 shows the G1WF site layout.

The Project will involve the D&D of the Reactor Building (i.e., clear out including calandria and bioshield, decommissioning of the dome and containment structure, and underground pipeline tunnel), portions of the Turbine Building, the Service Building basement and the Spent Resin Storage Area with the megadome. In addition, since the above grade section of the Service Building is owned by Hydro-Québec, the decommissioning scope for this building is limited to the internal decommissioning and decontamination of the AECL owned portion of the building. Remediation activities will occur throughout the G1WF footprint to satisfy an end state that will be agreed upon with Hydro-Québec.

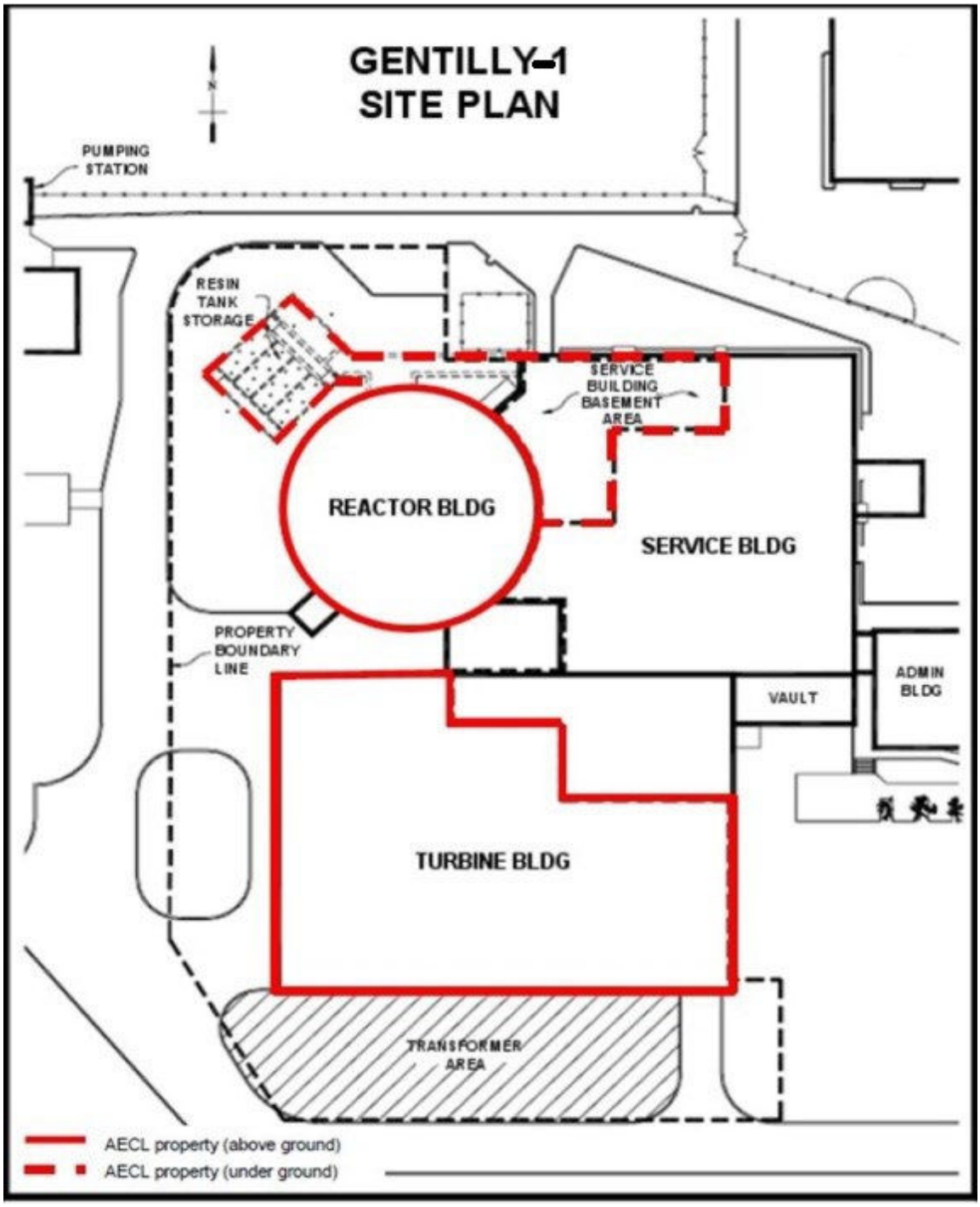


Figure 1-1: Gentilly-1 Site Layout

1.3 Out of Scope Elements

The Project does not include activities or work in respect of the following:

- Buildings or portions of the buildings that are owned by Hydro-Québec, including, without limitation, the above-grade section of the Service Building.
- The lands which comprise the Gentilly site that do not form the G1WF.
- Buried services or process systems that are 1 m away from a building's footprint perimeter.
- Buildings associated with the operation of Gentilly-2 Nuclear Generating Station (G-2 NGS).
- The North volume of the Turbine Building.
- Activities currently permitted by the G1WF licence.
- Remediation or restoration of the G1WF to a final end state that enables the land to be used for industrial purposes.
- Transportation of waste resulting from the execution of the Project.
- Storage or disposal of waste resulting from the execution of the Project.

Many of the elements described above are excluded from the Project as they relate to aspects of the Gentilly site which are currently or will be owned or controlled by Hydro-Québec as discussed further in this EPMR (see for example Sections 1.4 and 2 of this EPMR).

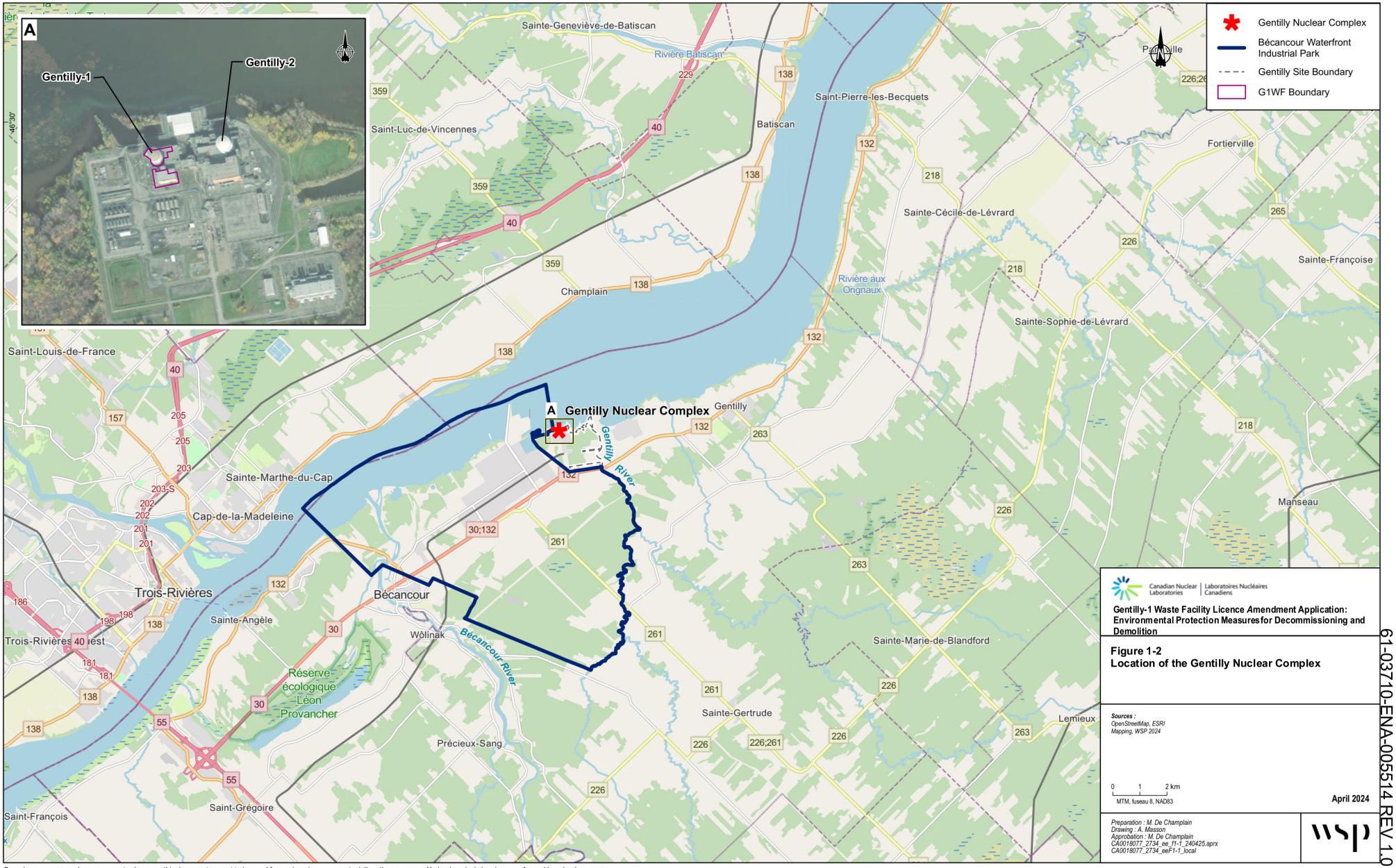
Transportation activities are regulated by federal and provincial authorities having jurisdiction under separate licencing and regulatory frameworks. For example, the transportation of dangerous goods, such as radioactive materials, is regulated pursuant to the authority granted to the Minister of Transport under the Transportation of Dangerous Goods Act, 1992 [1-6] and its associated regulations. Transport Canada and the CNSC jointly regulate the packaging and transport of nuclear substances in Canada in accordance with applicable laws and regulations. The CNSC is responsible for certifying transport packages when required, and issuing transport licences under specific circumstances only. CNL has not applied to the CNSC for a licence to transport the waste resulting from the Project, and therefore transportation is not part of the assessment described in this EPMR.

The storage or disposal of waste resulting from the execution of the Project is not considered a part of the Project as the activity to consolidate waste at other sites is assessed and considered as part of the permitting or licencing processes applicable to such other sites. It is therefore not part of the assessment described in this EPMR.

1.4 Project Location

The Gentilly Nuclear Complex is located on Pointe-aux-Roches, on the south bank of the St. Lawrence River. The Gentilly site location (i.e., 46°25'19'' N and 72°21'30'' W) is in the Municipality of Bécancour, County of Nicolet, approximately 15 km east from the city of Trois-Rivières in the Province of Québec (Figure 1-2). The Gentilly site is located in the traditional territory of the W8banaki Nation. The Odanak community is approximately 60 km from the G1WF and the Wôlinak community is within 15 km of the G1WF. The Gentilly site is also located in the traditional territory of the Wendat Nation. The community of Wendake is located around 140 km northeast of the G1WF.

The Gentilly site hosts two shutdown nuclear reactors; the G-1 NGS (now the G1WF) and the G-2 NGS. The G- 2 NGS is owned by Hydro-Québec, and the G1WF is owned by AECL and operated by CNL. The Gentilly site consists of 240 hectares of land and provides an exclusion radius of 914 m on land from the units. The exclusion of all unauthorized persons from the Gentilly site limits exposure of the surrounding population and prevents any habitation, in accordance with the requirements and regulations of the CNSC. The Gentilly site is owned by Hydro-Québec and AECL occupies the G1WF pursuant to an emphyteutic lease with Hydro-Québec, thereby granting AECL analogous rights as if AECL was the owner of the lands in question.



Boundary accuracy and measurements shown on this document are not to be used for engineering or property delineation purposes. No land analysis has been performed by a land surveyor.

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Figure 1-2
Location of the Gentilly Nuclear Complex

Sources :
OpenStreetMap, ESRI Mapping, WSP 2024

April 2024

Preparation : M. De Champlain
Drawing : A. Masson
Approbation : M. De Champlain
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The Gentilly site is located close to the Bécancour Waterfront Industrial Park, which is situated on 7,000 hectares of land (Figure 1-3). The Gentilly site is connected to Highway 30 and to Route 132. The bridge on Highway 55 allows access across the St. Lawrence River and connects the Bécancour Waterfront Industrial Park to the city of Trois-Rivières. The Bécancour Waterfront Industrial Park is served daily by the Canadian National Railway and the Gentilly site has its own railhead.

Limits
- Exclusion bourdary (914 m)
- Hydro-Québec property

Infrastructures
- Flood protection dike
- Fence
- Transmission lines
- Substation
- National or Regional Road
- Local Road
- Railroad

Hydrography
- Permanent stream
- Intermittent stream
- Waterbody

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Gentilly-1 Waste Facility Licence Amendment Application: Environmental Protection Measures for Decommissioning and Demolition

Figure 1-3
Gentilly Nuclear Complex Site Layout

Sources :
OpenStreetMap, ESRI
Mapping, WSP 2024

0 0,09 0,18 km
MTM, fuseau 8, NAD83

April 2024

Preparation : M. De Champlain
Drawing : A. Masson
Approbation : M. De Champlain
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CA0018077_2734_eeF1-2_Site_layout_240425

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Boundary accuracy and measurements shown on this document are not to be used for engineering or property delineation purposes. No land analysis has been performed by a land surveyor.

1.5 Licensing and Regulatory Requirements

1.5.1 Impact Assessment Act

The IAA [1-3] came into force on August 28, 2019. The physical activities associated with the Project are not identified in the *Physical Activities Regulations* made pursuant to the IAA, and therefore, the proposed **Project** is not considered a Designated Project as defined under **paragraph 109(b) of the IAA**.

A "project" for purposes of **sections 81 – 91 of the IAA** [1-3] requires a physical activity associated with a physical work, carried out on federal lands. The proposed Project involves physical activities associated with a physical work to be performed on federal lands The activities associated with the Project meet the definition of a **"project" as defined under section 81 of the IAA** and therefore are subject to the requirements under **sections 81 - 91 of the IAA** [1-3].

Pursuant to **section 82 of the IAA**, an authority must not carry out a project on federal lands or exercise any power or perform any duty or function conferred on it under any act of Parliament other than the IAA that could permit the project to be carried out, in whole or in part, on federal lands unless the authority determines that the carrying out of the project is not likely to cause significant adverse environmental effects, or **section 82(b) of the IAA** is complied with.

AECL is a "federal authority" as defined in **section 2 of the IAA**, and an "authority" as defined in **section 81 of the IAA** and is ultimately responsible for carrying out the proposed Project through the GoCo model. The CNSC is also an authority for purposes of **section 81 of the IAA** [1-3] in respect of the proposed Project due to its responsibilities under the NSCA, discussed further in this EPMR. For the purpose of this EPMR, the determination to be made by each authority for purposes of **section 82 of the IAA** will be referred to as an Environmental Effects Determination.

The Government of Canada has issued "Projects on federal lands and outside Canada Guidance document on Sections 81 – 91 of the *Impact Assessment Act*" (IAA Guidance Document) [1-7] to provide authorities with information to better understand their duties under the IAA. The IAA Guidance Document indicates that the statutory requirements provide discretion to authorities to implement a determination process that is appropriate to the project and its context. The IAA Guidance Document also establishes a common set of principles to guide an authority's implementation of the statutory requirements. Examples of these principles include, without limitation, accountability, sustainability, transparency and a participatory approach. The IAA Guidance Document has been utilized to support aspects of the assessment described in this EPMR.

Sections 1-5 and 7, Appendices 1-5, and Attachment A of this EPMR include analysis and information to support the Environmental Effects Determination to be made by each authority.

1.5.2 Nuclear Safety and Control Act

CNL is applying to the CNSC for an amendment to the G1WF licence to authorize CNL to proceed with the new activity of physical D&D of G1WF. Prior to issuing an amendment to the G1WF licence, in accordance with section 24(4) of the NSCA [1-2], the CNSC must be satisfied that the applicant (a) is qualified to carry on the activity that the licence will authorize the licensee to carry on; and (b) will, in carrying on that activity, make adequate provision for the protection of the environment, the health and safety of persons and the maintenance of national security and measures required to implement international obligations to which Canada has agreed.

The CNSC REGDOCS provide guidance on the requirements for protecting the environment and the health and safety of persons, among other things, for the purpose of satisfying the NSCA [1-2] requirements. These include specific requirements, such as considering the potential for accidents and malfunctions.

As discussed previously, one of the purposes of this EPMR is to assist the CNSC in making its licensing decision pursuant to the NSCA [1-2]. Sections 1-2 and 4-7, Appendices 1-4 and Attachment A of this EPMR include analysis and information to support the CNSC in making its licencing decision

1.5.3 Applicable Federal Legislation

Federal acts and regulations that may be applicable to the Project or the G1WF Decommissioning activities include without limitation:

- Nuclear Safety and Control Act, S.C. 1997. c. 9, Canada
- General Nuclear Safety and Control Regulations, SOR/2000-202, Canada
- Class I Nuclear Facilities Regulations, SOR/2000-204, Canada
- Radiation Protection Regulations, SOR/2000-203, Canada
- Nuclear Substances and Radiation Devices Regulations, SOR/2000-207, Canada
- Nuclear Security Regulations, SOR/2000-209, Canada
- Canadian Environmental Protection Act, 1999, Canada
- Fisheries Act, S.C. 1985, c. F-14, Canada
- Species at Risk Act, S.C. 2002, c. 29, Canada
- Migratory Birds Convention Act, S.C. 1994, c. 22, Canada.
- Packaging and Transport of Nuclear Substances Regulations, SOR/2000-208, 2015, Canada
- Transportation of Dangerous Goods Regulations, SOR/2001-286, Canada
- Impact Assessment Act (S.C. 2019, c.28, s. 1), Canada.

1.5.4 Provincial Requirements

The Project is not anticipated to trigger Schedule 1 List of Projects that are Subject to the Environmental Assessment and Review Procedure under the Environmental Quality Act of Québec. However, Québec's Land Protection and Rehabilitation Regulation (Q-2, r. 37) provides requirements for soil remediation and contaminant levels in water. As the Gentilly site is owned by Hydro-Québec, AECL and Hydro-Québec must agree on an end state for the G1WF lands to be returned to Hydro-Québec. CNL anticipates that acceptance of the remediated land is likely to be conditioned on the land being compliant with Quebec's environmental requirements and will remediate the G1WF lands in accordance with the agreement made between AECL and Hydro-Québec.

1.5.5 Other Applicable Requirements

CNL maintains a consolidated listing of codes, regulations, standards, and other documents, including Management System documentation, that must be complied with. The Management System provides identification of functional governance and compliance expectations through its documentation. The Project and G1WF Decommissioning shall comply with the requirements of all applicable codes, standards, acts, and

associated regulations, and all regulatory requirements, such as those contained in the G1WF Licence Conditions Handbook [1-8].

For example, CNSC REGDOCs considered include, without limitation:

- CNSC REGDOC-2.9.1, Version 1.2, Environmental Principles, Assessments and Protection Measures [1-4]
- CNSC REG DOC-2.9.2. Controlling Releases to Environment[1-5]
- CNSC REGDOC-3.2.1, Public Information and Disclosure [1-9]
- CNSC REGDOC-3.2.2, Version 1.2, Indigenous Engagement [1-10]
- CNSC REGDOC-2.11.2, Decommissioning [1-11]

For example, Canadian Standards Association (CSA) documents considered include, without limitation:

- CSA N286-12 (R2022) Management System Requirements for Nuclear Facilities [1-12]
- CSA N288.4-19 Environmental Monitoring Programs at Nuclear Facilities and Uranium Mines and Mills [1-13]
- CSA N288.5-22 Effluent and Emissions Monitoring Programs at Nuclear Facilities [1-14]
- CSA N288.6-22 Environmental Risk Assessments at Nuclear Facilities and Uranium Mines and Mills [1-15]
- CSA N288.7-15 Groundwater Protection Programs at Class I Nuclear Facilities and Uranium Mines and Mills [1-16]
- CSA N294:19 Decommissioning of Facilities Containing Nuclear Substances [1-17]

1.6 References

1.6.1 Acts and Regulations

- Impact Assessment Act (S.C. 2019, c.28, s. 1), Canada.
- Land Protection and Rehabilitation Regulation (Q-2, r. 37), Québec.
- Nuclear Safety and Control Act (S.C. 1997, c.9), Canada.

1.6.2 Literature Cited

- [1-1] CNL (Canadian Nuclear Laboratories). 2019, Waste Facility Decommissioning Licence, Gentilly-1 Waste Facility, WFDL-W4-331.00/2034, 61-508760-13-000-0005, Revision 0, February.
- [1-2] Government of Canada. 2017. Nuclear Safety and Control Act, S.C.1997, c. 9, January.
- [1-3] Government of Canada. 2025. Impact Assessment Act, S.C.2019, c. 28, s. 1, June.
- [1-4] CNSC (Canadian Nuclear Safety Commission). 2020. REGDOC-2.9.1 Environmental Protection: Environmental Principles, Assessments and Protection Measures, version 1.2, September.
- [1-5] CNSC. 2024. REGDOC-2.9.2 Controlling Releases to Environment. February.
- [1-6] Canada. 1992. Transportation of Dangerous Goods Act, 1992, S.C. , c. 34.

- [1-7] Impact Assessment Agency of Canada. 2021. Projects on Federal Lands and Outside of Canada Guidance document on Sections 81 to 91 of the Impact Assessment Act, Impact Assessment Agency of Canada, c2021.
- [1-8] CNL (Canadian Nuclear Laboratories). 2019. Licence Conditions Handbook. Prototype Waste Facilities – Waste Facility Decommissioning Licence Gentilly-1 Waste Facility. WFDL-LCH-W4-331.00/2034. Rev 1.
- [1-9] CNSC. 2018. REGDOC-3.2.1 Public Information and Disclosure. May.
- [1-10] CNSC. 2019. REGDOC-3.2.2 Indigenous Engagement, Version 1.1, August.
- [1-11] CNSC. 2021. REGDOC-2.11.2, Decommissioning.
- [1-12] CSA Group (Canadian Standards Association). 2022. CSA N286-22 (R2022) Management System Requirements for Nuclear Facilities.
- [1-13] CSA Group. 2019. CSA N288.4-19 Environmental Monitoring Programs at Nuclear Facilities and Uranium Mines and Mills.
- [1-14] CSA Group. 2022. CSA N288.5-22 Effluent and Emissions Monitoring Programs at Nuclear Facilities.
- [1-15] CSA Group. 2022. CSA N288.6-22 Environmental Risk Assessments at Nuclear Facilities and Uranium Mines and Mills.
- [1-16] CSA Group. 2023. CSA N288.7-15 Groundwater Protection Programs at Class I Nuclear Facilities and Uranium Mines and Mills.
- [1-17] CSA Group. 2024. CSA N294:19 Decommissioning of Facilities Containing Nuclear Substances.

2 PROJECT DESCRIPTION

2.1 Introduction

2.1.1 Project Overview

For decommissioning planning and prioritization of the work that constitutes the Project, buildings and structures at G1WF are divided into two planning envelopes (i.e., PE-A and PE-B) (Table 2-1). The PE-A consists of the basement portions of the Service Building including Spent Resin Storage Area and the southern portion of the Turbine Building including the Spent Fuel Canister Area (SFCA). The PE-B consists of the Reactor Building clear-out including calandria and bioshield, dome, and Containment Structure. An associated Detailed Decommissioning Plan (DDP) for each planning envelope will be prepared and submitted to the CNSC for review and acceptance. No Project activity shall be executed in any planning envelope prior to the acceptance of its DDP by the CNSC.

Figure 2-1 shows the licence boundary and the planning envelopes for G1WF. The licence boundary represents the total G1WF footprint, while the planning envelopes encompass the buildings and structures planned for decommissioning.

Table 2-1: Decommissioning Planning Envelopes of G1WF

Planning Envelope	Structure/System	Nuclear/Non-Nuclear
Planning Envelope A (PE-A)	Decommissioning of: ▪ Southern portion of the Turbine Building including the tunnel to the Reactor Building and SFCA ▪ Basement portion of the Service Building including spent resin storage area ▪ Aboveground cable bridge	Nuclear
Planning Envelope B (PE-B)	Reactor Building: ▪ Clear-out including calandria and bioshield ▪ Decommissioning of dome and containment structure ▪ Underground pipeline tunnel	Nuclear

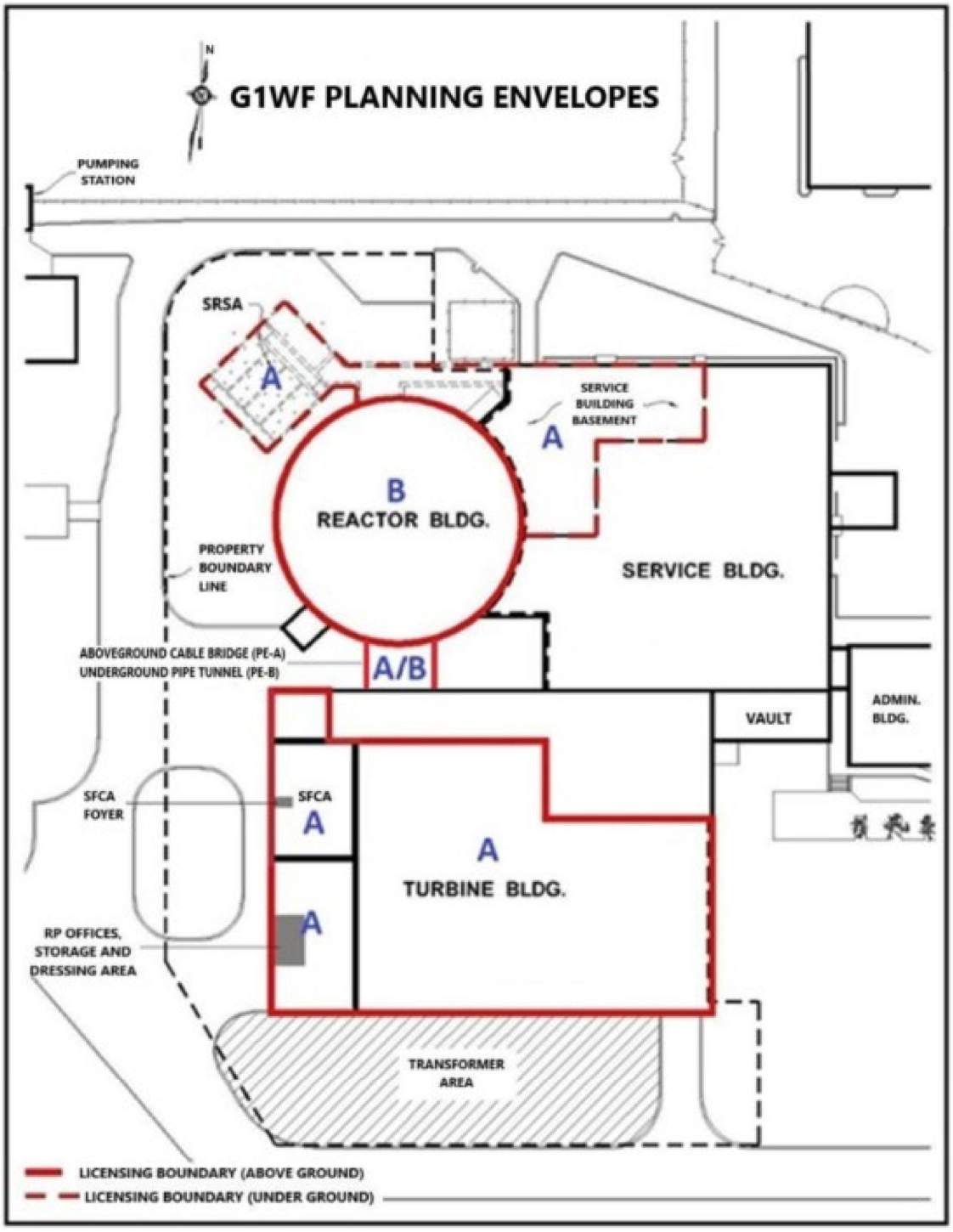

Figure 2-1: General Layout of G1WF showing Licensing Boundary and Planning Envelopes

2.1.2 Project Schedule

The planned Project milestones for the G1WF Decommissioning are provided in Table 2-2.

Table 2-2: Planned Project Milestones for the Phase 3 Decommissioning

Event	Year
Planning Envelope A	
Preparation, Submission, and Acceptance of the Detailed Decommissioning Plan (DDP Volume 2) describing the work to be performed during Dismantling, Demolition, Disposal, and Site Restoration, along with other supporting documentation, including EPMR.	2023-2026
End of Safe Storage and beginning of preparations for Dismantling, Demolition, Disposal, and Site Restoration for: ▪ The south section of the Turbine Building, including the SFCA; and underground tunnel from Turbine Building to Reactor Building ▪ Service Building Basement, including Resin Storage Vaults.	2026
End of decommissioning, demolition, and completion of site restoration.	2030
Survey and Close-Out Documentation/Interim End-State Report.	2030
Planning Envelope B	
Preparation, Submission, and Acceptance of the Detailed Decommissioning Plan (DDP Volume 3) describing the work to be performed during Reactor Building clear-out and decommissioning of Reactor Building dome and containment structure, along with other supporting documentation, including EPMR.	2025-2027
End of Safe Storage and beginning of preparations for Dismantling, Demolition, Disposal, and Site Restoration for Reactor Building clear-out.	2027
End of decommissioning, demolition, and completion of site restoration.	2034
Final Survey and Close-Out Documentation	2034

2.2 Gentilly-1 Waste Facility Overview

The G1WF is presently in the long-term SWS phase of a deferred-decommissioning program. The purpose of the SWS phase at G1WF is to safely maintain the existing building structures and systems to allow radioactive material decay until completion of the Project. Operation of the G1WF currently consists of the maintenance and monitoring of these buildings, structures, and systems to maintain their integrity and functionality. These activities are in place to protect the environment and the health and safety of workers and the public. Systems are also in place to provide physical protection and security of the facility.

The G1WF includes the:

- Reactor Building
- Service Building
- Turbine Building
- Spent Resin Storage Area

The details of the G1WF buildings and structures are described in the following subsections.

2.2.1 Current Status of the Gentilly-1 Waste Facility

Since the start of Phase 2 Decommissioning (i.e., SWS) activities in 1986, the G1WF has been maintained in a safe, sustainable, secure and static state. The SWS activities have continued and include routine inspections and regular monitoring of the facility to ensure that the facility is kept in a safe static condition and that there is no hazard to the public at large or negative impact on the environment.

The G1WF licence permits the continued SWS activities. CNL maintains a systematic monitoring and inspection program and implements the surveillance and Life Management Program activities according to the schedules listed in the Gentilly-1 Waste Facility Decommissioning Storage with Surveillance Plan [2-1].

The SWS phase will continue to be substantially applicable to the care and maintenance of the G1WF during the Project activities to return the G1WF to a defined end state. However, surveillance activities and efforts will decrease as more buildings and/or structures, systems, and components (SSCs) are removed from the G1WF, or as the hazards within the buildings and/or SSCs are reduced/eliminated. As such, the prescribed care and maintenance activities related to a building, area or structure as noted in the Gentilly-1 Waste Facility Decommissioning Storage with Surveillance Plan [2-1] will cease once that building, area or structure has been demolished.

Following a building removal (demolition) or facility change, the G1WF surveillance activities and their schedules will be reviewed for their continued applicability and safety relevance, and the Gentilly-1 Waste Facility Decommissioning Storage with Surveillance Plan [2-1] will be updated as needed. Planned reductions in activities, discontinued activities, and any other changes to the remaining SWS activities or their schedules will also be described in the individual Detailed Decommissioning Plan covering those buildings/structures. The changes to SWS commitments, such as reducing the frequency of surveillance activities, ageing-related structural evaluations, or even abandoning a pre-scheduled activity altogether, will be subject to the CNL Facility Authority's approval and require notification to the CNSC.

2.2.2 Radiological Safety Zones

Radiological safety zoning is used to organize the facility areas in an effective way, and to optimize the provision of radiation protection measures and controls (Figure 2-2). The zoning reflects the type and level of radiological hazards in an area, as well as the degree of radiation protection measures required to control contamination and radiation exposure. CNL's zoning system categorizes work areas into 1 of 5 radiological safety zones that reflect the external radiation and contamination hazards in a work area. The higher the zone level, the greater the potential hazard and the more operational measures are needed to control radiation exposures and contamination.

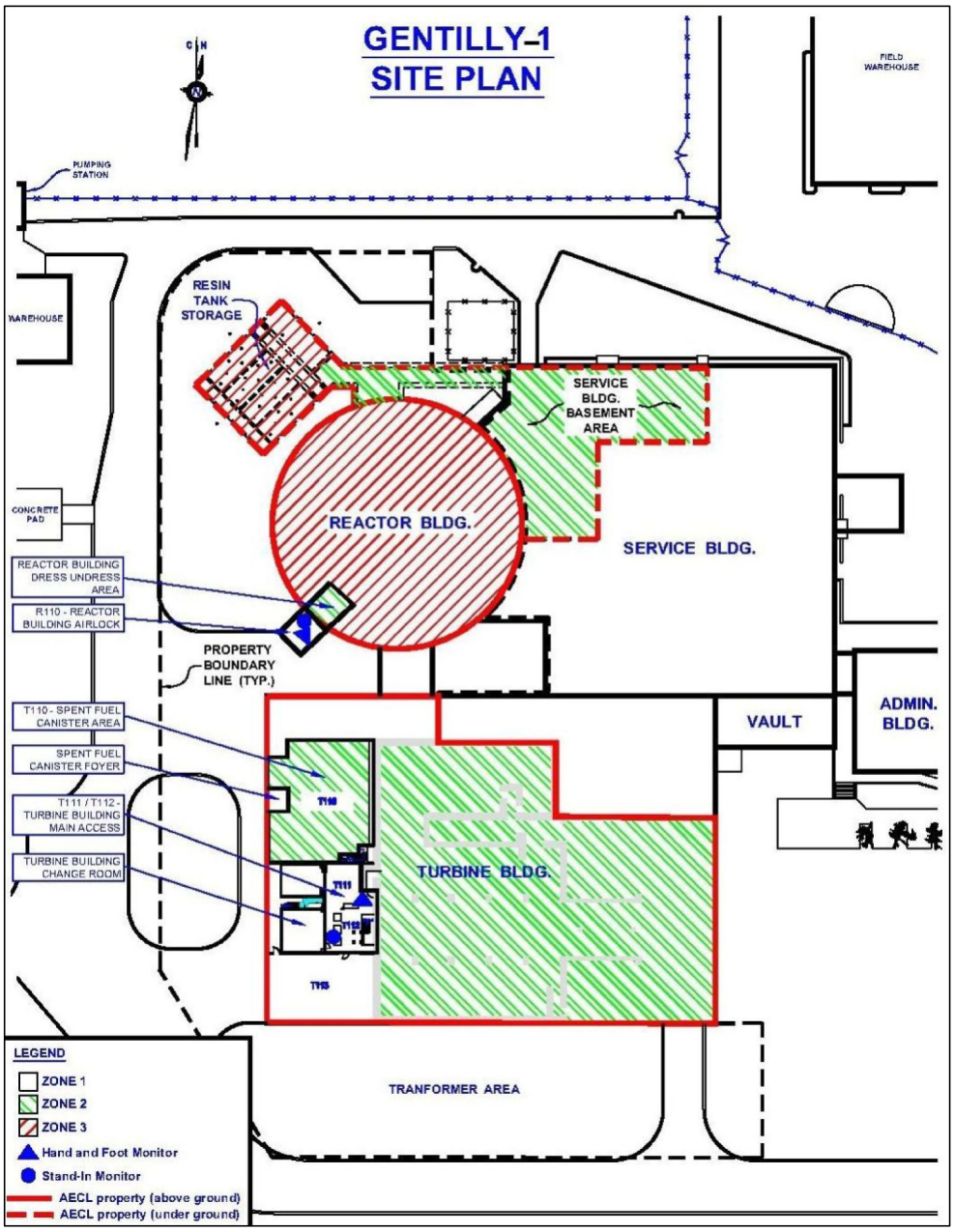

Figure 2-2: Gentilly-1 Waste Facility Layout and Zoning Plan

2.2.3 Reactor building

The main purpose of the Reactor Building was to house the reactor and its associated equipment, and to provide containment. The Reactor Building consists of a permanently shutdown, partially decommissioned 250 MW prototype CANDU reactor. The reactor was fuelled with natural uranium and moderated by deuterium oxide (i.e., heavy water). The reactor vessel (i.e., calandria) is a vertical cylindrical vessel that contained the heavy water moderator and was traversed by 308 pressure tubes.

The Reactor Building was designed with an exterior containment structure and a separate internal structure that supports the reactor and its associated systems. The external containment structure of the Reactor Building has a dual functionality: to prevent the escape of radioactive particles, and to prevent the ingress of water from outside of the building. The containment structure of the Reactor Building comprises three structural components: a concrete base slab founded on rock, a cylindrical concrete outer wall, and a concrete dome. Enclosing a total volume of 52,000 m^3, the building was designed to withstand snow, wind, and earthquake conditions.

The internal structures serve to support the reactor core, heat transport systems, shielding, and safety systems, as well as associated equipment. During the initial decommissioning, the fuel was removed from the reactor core and was stored in the SFCA, which is a dry storage facility located in the Turbine Building. Furthermore, the heat transport systems and moderator systems were drained and dried and transferred to Chalk River Laboratories (CRL). During static state of the G1WF, the facility's equipment, operations tools, and supplies were disconnected, dismantled, and removed. The resulting waste materials were stored within the Reactor Building at different floors and in the Turbine Building.

These legacy waste materials, totalling approximately 423,000 kg, were removed from the Reactor Building between 2017 and 2022. No other activities, other than the regular SWS activities including hazard reduction campaigns, have been performed inside the Reactor Building since the completion of the initial decommissioning (1986). As the fuel was removed and the process systems are out of operation, many of the functions and loads for which the structure was originally designed are now absent. The main radiation hazard found in the Reactor Building is due to the inventory of radionuclides associated with the reactor core components, biological shield, heat transport system and moderator system [2-2].

The Reactor Building general layout is shown in Figure 2-3.

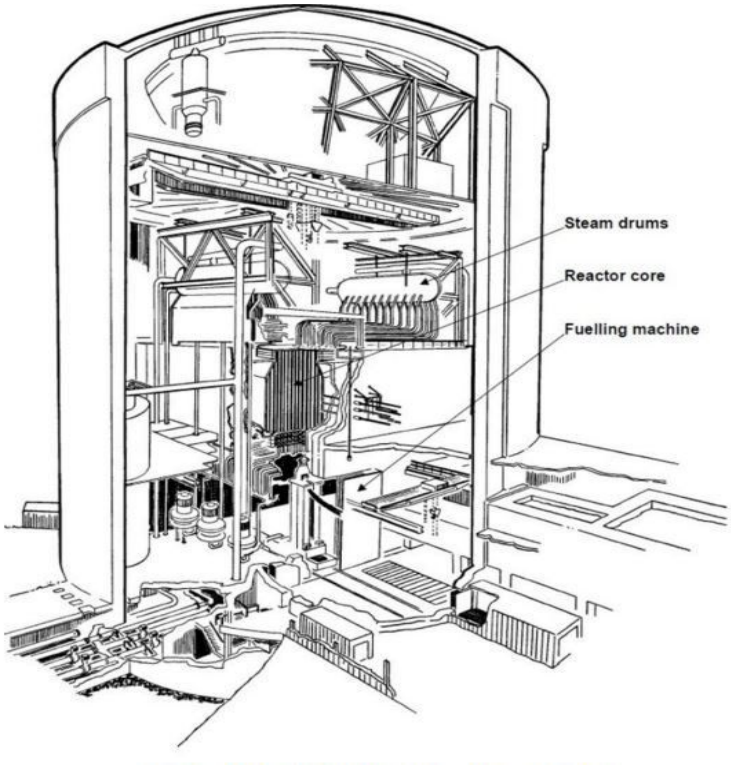

Figure 2-3: Gentilly-1 Waste Facility Reactor Building General Layout

An underground, non-radioactive drainage system for groundwater remains operative to maintain the structural integrity of the Reactor Building. A dehumidifier is operated in the summer months to reduce humidity in the Reactor Building in order to prevent corrosion of the metal components and prevent condensation on the walls and other surfaces. No radioactive contamination from the Reactor Building is expected in this system.

The Reactor Building's concrete walls serve as a containment structure, preventing the release of residual contamination (radiological and non-radiological) to the environment and providing shielding against any gamma radiation. There is no forced ventilation in the Reactor Building, such that airborne emissions from the Reactor Building to the outdoor environment are highly unlikely to release either radiological or non-radiological airborne contaminants. However, there is one louver (2 feet x 2 feet) that could provide for a passive exchange of indoor/outdoor air such that fugitive radioactive emissions are a possibility. Estimates of these fugitive emissions show that they are negligible, and it would require an implausible passive exhaust rate through the one building louver of 3,500 m^3/s in order to trigger the monitoring criterion of 0.0005 mSv/a.

2.2.4 Turbine Building

The Turbine Building is a rectangular structure with a partial basement. The concrete foundations are built on solid bedrock, and the superstructure has six levels. The Turbine Building was designed for a combination of dead load, live load, wind, and earthquake loading conditions. The building is divided into the following three independent entities (Figure 2-4):

- SFCA
- South Volume
- North Volume

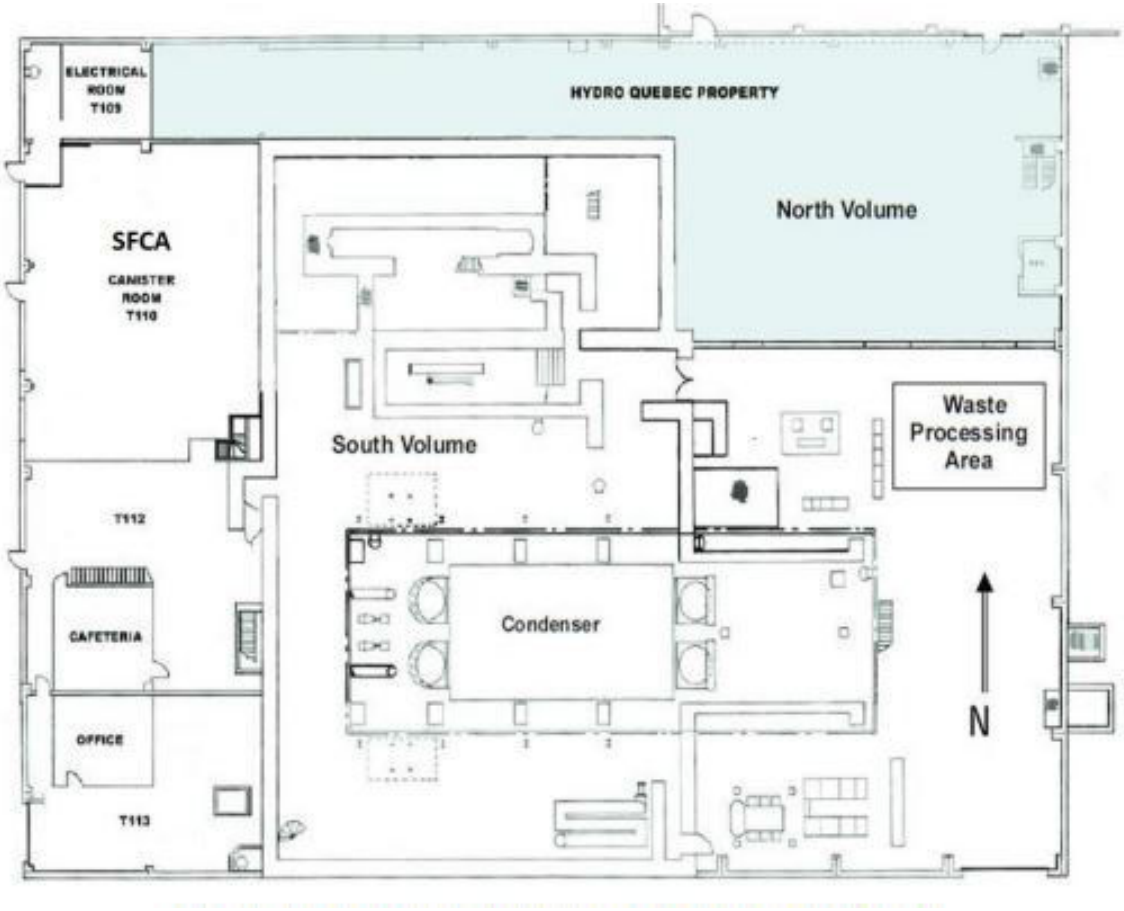

Figure 2-4: Turbine Building Layout (Ground Floor)

The SFCA is owned by AECL and is a dry storage facility that was constructed to store the inventory of spent fuel generated by the G-1 NGS over its operating lifetime. All process systems within the SFCA have been removed. There are 11 concrete canisters in the SFCA that were used to house the spent fuel baskets. Each concrete canister is a cylindrical reinforced concrete shell with an internal liner of standard-weight carbon steel pipe. The internal surface of the steel liner of each concrete canister is coated with epoxy paint to prevent corrosion and facilitate decontamination, should it be required. To ensure the integrity of the canisters, each canister is provided with a closed circuit air circulating sampling system to allow monitoring of the internal space between the canister liner and the sealed fuel baskets. The South Volume is owned by AECL and hosts the turbine generators (i.e., turbine systems and their associated equipment). The turbine systems are made up of metals and concrete. The South Volume of the Turbine Building also includes the tunnel, which leads to the Reactor Building. This tunnel is a confined space that is not easily accessible. There are two louvres in the south portion of the Turbine Building.

The North Volume was previously within the AECL property boundary but has since transferred to Hydro-Québec after being decontaminated to meet the Hydro-Québec Zone 1 (uncontaminated area) criteria.

Since 1986, the AECL portion of the Turbine Building has been under regular SWS activities. During the 2014-2015 period, approximately 293,500 kg of legacy waste was removed from the Turbine Building. Some

asbestos repairs were also conducted to ensure the safe storage during the ongoing SWS phase. In 2017, a detailed characterization survey of the Turbine Building was conducted to evaluate the non-radiological (i.e., chemical and hazardous substances) and radiological contaminations on equipment, systems, and components, including process piping [2-3]. The survey indicated a small amount of low contamination in the South Volume of the Turbine Building.

2.2.5 Service Building

The structure of the Service Building consists of a conventional steel frame with reinforced concrete basement and floors. The Service Building is supported on a concrete foundation anchored to the bedrock. The outer walls are constructed of concrete blocks covered with an external metal cladding. The Service Building is divided into two sections (i.e., north and south). The north section is two storeys high with a basement, while the south section is four storeys high (without a basement). The original purpose of the Service Building was to provide storage, maintenance, overhaul, repair, and decontamination of equipment for the efficient operation of the nuclear generating station. This building housed the Spent Fuel Bay, control room, helium storage tank, aqua-ammonia storage tank, radiation waste management facilities, laboratories, personnel change rooms, and station ventilation equipment.

The Service Building was isolated from other structures, and all process systems were removed during the initial decommissioning activities (1984-1986). AECL and Hydro-Québec agreed in 1993 that only the basement of the Service Building remained as AECL property and part of the G1WF. All the remaining areas transferred to Hydro-Québec were remediated to meet the Hydro-Québec Zone 1 (uncontaminated area) criteria. All process systems which traversed the boundaries were severed on AECL's side and capped if contaminated. In the AECL portion of the Service Building, only the sump systems are operative. The sumps have been decontaminated and are manually pumped when high water levels are detected during visual inspection. No other activities, other than regular SWS activities including hazard reduction campaigns and characterization, have been performed inside the Service Building since the completion of the initial decommissioning (1984-1986).

In 2020, a characterization survey of the materials and equipment in the Service Building basement was conducted to identify radiological and non-radiological/chemical hazards [2-4]. The surveys showed the presence of radionuclides in the liquid waste system, active ventilation system, shield walls, disconnected piping, and liquids within the tanks and pumps.

2.2.6 Spent Resin Storage Area

The Spent Resin Storage Area is located adjacent to the basements of the Service Building and the Reactor Building and consists of two reinforced concrete vaults and one stainless steel tank. The southern part of the Spent Resin Storage Area is the Heat Transport Purification System (HTPS) resin storage tank, which is a reinforced concrete vault. The floors and walls of the HTPS resin storage tank are covered with fibre glass reinforced epoxy lining consisting of a primer coat and several body coats with two layers of cloth and two finishing coats of white gloss epoxy seal. Attached to the north side of the north gallery is the Moderator Purification System (MPS) resin storage vault which contained a stainless steel tank. The HTPS and MPS resin storage tanks contained spent ion-exchange resins used for deionizing the HTPS cooling water and the MPS water. The spent resins were removed in 2018 and sent to CRL for storage. To facilitate the removal of resins from the HTPS vaults and the MPS tank, an engineered containment structure referred to as the 'Megadome' was erected over the Spent Resin Storage Area in 2018. The MPS tank was removed from the site, and any contaminated metal was sent to CRL for storage. The Megadome will be removed after the completion of the decommissioning of the Spent Resin Storage Area structures.

2.2.7 Other G1WF Auxiliary and Service Systems

Currently, the G1WF has various systems that are required to operate for the occupation, surveillance, inspection, and maintenance of the facility. These systems are described in the following sections.

2.2.7.1 Fire Protection System

The firefighting service is provided by the municipal fire departments of the town of Bécancour. The Fire Protection System at G1WF consists of a fire detection and alarm system, portable fire extinguishers and on-site fire hydrants. The portable fire extinguishers are located inside all buildings, at specific locations. In the event of a fire at G1WF, the on-site fire hydrants would be used. Hydro-Québec is responsible for the operation and maintenance of fire hydrants.

2.2.7.2 Drainage System

The G1WF drainage system consists of the following:

- Building Drainage System
- Groundwater Drainage System

The building drainage system consists of seven sumps that are located indoors at a low elevation and as such, collect any water from within the buildings. Water accumulated in the building sumps is manually pumped into totes using portable pumps. The collected water is then sampled, analysed for tritium and beta/gamma emitting radionuclides, and eventually transferred overland to Hydro-Québec. If the analysed collected water meets the Hydro-Québec acceptance criteria (i.e., beta/gamma = 5.3E+13 Bq/a and tritium 1.1E+19 Bq/a) then it is disposed of via Hydro-Québec's Outfall Discharge Pipe. However, if the analysed collected water does not meet the criteria, then it is sent to CRL for processing and disposal.

Two underground drainage sumps are located around the periphery of the Reactor Building with permanently installed pumps. The sumps collect any precipitation and groundwater from around and underneath the Reactor Building. A weeping tile system also directs groundwater from the Spent Resin Storage Vaults to the Reactor Building underground sumps. These sumps are automatically drained upon high level water detection to the storm water system of Hydro-Québec's G-2 NGS, which ultimately discharges to the St. Lawrence River.

2.2.7.3 Heating and Ventilation System

The workshop and Radiation Protection equipment room, located in the Turbine Building, are provided with electrical heaters. The change room is equipped with an air exchanger and air conditioning unit. There is no forced ventilation at the G1WF. However, there are three louvres at the facility, which can potentially contribute to fugitive airborne emissions. One is located in the Reactor Building and two are located in the southern part of the Turbine Building.

2.2.7.4 Electrical Power Supply

The G1WF electrical power (Class IV) is supplied by Hydro-Québec via distribution panels located in the Turbine Building electrical room. The distribution panel DP-1 is normally kept powered on and supplies lighting in the canister area, the panel DP-1E, and the lighting and heating in the electrical room. All circuits supplied by DP-1E are kept powered on including the fire alarm system, drainage system, and microwave transmission control unit. The distribution panel DP-2 has only two circuit breakers kept powered on: reactor building sump pumps and heating in the electrical room. The other circuit breakers of DP-2 are powered off. Local distribution panels are also located in different areas of the facility.

2.2.7.5 Security System

Security services are provided by Hydro-Québec in accordance with the Nuclear Security Regulations. Road access to the G1WF requires that visitors pass the fence boundaries of the Gentilly site via security gates staffed and controlled by Hydro-Québec personnel. Visitors to the Gentilly site and the G1WF require authorization in accordance with established Hydro-Québec procedures.

2.3 Decommissioning Plan

2.3.1 Decommissioning Strategy

After attaining full power for two short periods in 1972 followed by the intermittent operation of 183 full power days in 1978, it was determined that the G-1 NGS (currently G1WF) required certain modifications and considerable repairs. As such, the G-1 NGS was put into a lay-up state in 1980. In 1982, the decision was made not to rehabilitate G-1 NGS. In 1983, decommissioning alternatives were evaluated to determine which would provide the most benefit, based on protection of the public and the environment and economic considerations. At that time, the following options recognized by the Internation Atomic Energy Agency (IAEA) were available and discussed:

- Storage With Surveillance (Stage I)
- Restricted Site Release (Stage II)
- Unrestricted Site Usage (Stage III)

In 1984, a two-year decommissioning program was initiated to bring the G-1 NGS to a state meeting the IAEA definition of Stage II. Portions of the G-1 NGS hosting the major inventories of radionuclides would be isolated and the remainder of the G-1 NGS would be used for other purposes, as appropriate, or be retired in a safe condition as part of Stage II.

2.3.2 Decommissioning Approach

2.3.2.1 Phase 1 Establishing a Safe Shutdown State

Phase 1 Decommissioning brought the G1WF to a safe, sustainable, shutdown state. This was achieved by 1986. The heavy water was drained and all major radioactive or radioactively contaminated components were consolidated and securely stored on-site in the Reactor Building and Turbine Building pending transfer to off-site facilities. Other non-radioactive hazardous materials were also identified and removed. All other G1WF buildings/structures that possessed no major residual contamination or radioactive materials were decontaminated followed by appropriate radiological surveys. These buildings/structures were classified as uncontaminated areas and have since become Hydro-Québec property.

The primary radiological hazards upon completion of the Phase I Decommissioning at the G1WF were associated with the following:

- SFCA
- Reactor and its associated components stored within the Reactor Building
- Turbine System
- Spent Resin Tank and Vaults

2.3.2.2 Phase 2 Storage with Surveillance

Phase 2 SWS began in 1985 and is expected to last for 51 years until 2035. During this timeframe, the G1WF has and will be monitored and maintained prior to final decommissioning.

Routine inspection and monitoring activities of the buildings and areas of G1WF are performed/supervised by G1WF staff and include:

- Inspections or assessments of buildings, structures, or components in the interests of ensuring and maintaining effectiveness and safety over both the immediate and longer term.
- Inspections to detect undesirable activity (such as trespassing, damage to property, exposure to, or theft of nuclear substances in general and spent nuclear fuel in particular).
- Programs to detect and measure radioactive releases (solid, liquid, or gaseous) from G1WF to the environment, if any, and any correspondingly related impacts on the environment and public.

The inspection types and frequencies are established based on regulatory requirements, associated codes and standards, the Life Management Program, annual assessments of the instrumentation data, facility operational experience, and good industry practices.

The SWS activities will continue as required until the entire G1WF is decommissioned and remediated, and the land returned to Hydro-Québec.

2.3.2.3 Phase 3 Decommissioning and Demolition

This is the final phase of decommissioning, being the Project and will consist of D&D of all above ground and underground buildings and structures of G1WF as described in Sections 1.2 and 2.1.1 of this EPMR.

2.4 Project-Specific Activities

As discussed in Section 2.1 of this EPMR, two planning envelopes (PE-A and PEB) have been identified, and both are classified as nuclear (see Figure 2-1 and Table 2-1). The PE-A consists of the basement portions of the Service Building including spent resin storage area and southern portion of the Turbine Building, including the SFCA. The PE-B consists of the Reactor Building including calandria and bioshield, dome, and containment structure. An associated DDP for each planning envelope will be prepared and submitted to the CNSC for their acceptance. No Project activity shall be executed in any planning envelope prior to the acceptance of its associated DDP by the CNSC.

To assist in the preparation of the DDP, a characterization report will be prepared which will document the current radiological, chemical, and industrial conditions that will be encountered during the proposed decommissioning activities. Unlike the standard CANDU design, the Gentilly-1 reactor design is unique. It is a boiling light water reactor with vertically oriented pressure tubes containing light water as coolant and moderated with heavy water. Due to the use of light water, the tritium hazard should be low as tritium should only be present in the moderator system. In addition, the Gentilly-1 reactor was only operational for 183 days and therefore, the tritium concentration is lower compared to reactors that would have operated for a typical life cycle.

Decontamination will be performed prior to dismantling and demolition, whenever cost effective, to reduce worker exposure, to render equipment acceptable for reuse, or to release materials for non-radioactive waste disposal. Appropriate contamination control measures will be used when work is performed, including the use of temporary enclosures, local ventilation, personal protective equipment, and contamination monitoring.

Decommissioning will be complete when all of the buildings, structures and system located within the planning envelopes (PE-A and PE-B) are removed and resulting wastes are sent to either an off-site storage facility or an approved off-site disposal facility, if available, or are sent for recycling. In addition, the impacted footprint area will have been restored to a state acceptable to Hydro-Québec. Surveys will be conducted to verify that the G1WF site meets the necessary clearance levels to confirm the Project is complete.

Once the Project is complete (i.e., decommissioning and restoration of the G1WF footprint), CNL will update the end-state conditions in a project close-out report and apply to the CNSC seeking termination of the G1WF licence. The G1WF lands will then be returned to Hydro-Québec to take further action with respect to the entire Gentilly site.

2.4.1 Work Packages

The D&D of nuclear buildings/structures in each planning envelope of G1WF will be achieved by implementing a systematic approach to decommissioning [2-5], which includes four distinct stages:

- Stage 1: Project Planning
- Stage 2: Completion of Pre-requisites to Decommissioning and Demolition
- Stage 3: Physical Execution of Work Package(s)
- Stage 4: Interim Site Restoration and Project Close-Out

Each DDP volume covering a planning envelope will provide the applicable information related to all four stages of the work.

2.4.2 Generation of Waste

This section provides a summary of the waste types and estimated quantities of the waste that is currently stored at G1WF and the waste that will be generated due to the Project. This section also provides an overview of CNL's waste management practices and how they will be applied to transportation, storage and/or disposal activities for waste generated by the Project or G1WF Decommissioning. For clarity, transportation, storage and/or disposal of waste generated by the Project or previous G1WF Decommissioning do not form a part of the Project as discussed previously in Section 1.2 of this EPMR. Waste generated by the execution of the Project (i.e., undertaking D&D activities) is referred to in the remainder of this Section as decommissioning waste. Waste generated by the execution of the Project (i.e., undertaking D&D activities) is referred to in the remainder of this Section.

2.4.2.1 Waste Management Practices

Stored waste and decommissioning waste at G1WF will be managed as outlined below:

- Both stored and decommissioning wastes will be reduced in volume to the extent practicable by following the ALARA principle and packaged appropriately for their intended destination. The disposition of the waste will be determined, using the following list of options, in the order of decreasing preference:
  - Reuse or Recycle (off-site)
  - Salvage (off-site)
  - Send to an off-site inactive landfill, or
  - Transfer to an appropriate off-site waste management facility

- Prior to commencing the demolition of G1WF buildings and structures, the stored waste present within these buildings will be monitored, segregated, packaged, or contained, and shipped for either processing, storage, or disposal as appropriate and in accordance with the Waste Management Plan for the Gentilly-1 Prototype Reactor Site [2-8].
- Consideration will be given to control dismantling techniques, decontamination, contamination control, segregation of waste materials, reduction of active secondary wastes, and effective processing to reduce the amount of materials that need to go to a licensed waste management facility. Wherever possible, materials will be decontaminated to allow for unrestricted release or disposal in an inactive landfill.
- Wherever practical, dismantled debris will be released for recycling and reuse.
- Waste will be monitored, segregated, packaged, or contained, and shipped for either processing, storage, or disposal as appropriate and in accordance with a specific waste management plan, referred to as Waste Enquiry Form (WEF) [2-9].
- All waste will be adequately characterized to meet CNL's Waste Management Program requirements [2-10].
- The characterized waste will be classified as clearable, hazardous, radioactive, and mixed waste [2-11] [2-12].
- Clearable waste will be separated by material type and dispositioned utilizing the CNL's disposal strategy (i.e., prevent, reduce, re-use, recycle, dispose), which is consistent with the requirements of the WEF and CNL's Integrated Waste Strategy [2-13].
- Hazardous/designated materials will be removed completely before the commencement of decommissioning work. Therefore, hazardous/designated waste is not expected as a part of decommissioning waste. However, if hazardous/designated materials (e.g., hazardous building materials that remain as part of the building structure) are discovered during decommissioning, these will be removed, packaged, and disposed in accordance with the WEF and CNL's Hazardous and Mixed Waste Management [2-12], Management of Designated Toxic Substances [2-14], and Controlling Asbestos Hazard [2-15] procedures.
- The Intermediate Level Waste (ILW) and Low Level Waste (LLW) will be segregated, packaged, and shipped for consolidation at the CRL Waste Management Areas for interim storage or to a licensed off-site facility for processing in accordance with CNL Waste Management Program [2-10], Radiation Protection Program [2-16], and Transportation of Dangerous Goods Program requirements [2-17].
- To meet the requirements of CNL's Transportation of Dangerous Goods Program [2-17] and the regulatory requirements for waste transport, necessary packages will be identified, designed, tested, and procured prior to the Project commencing. The required licences, approvals, and certifications will also be obtained before the packages are put into service.

2.4.2.2 Stored Waste Inventory

The stored wastes defined herein as inventory consist of loose materials stored in the G1WF. It excludes all equipment (e.g., reactor, turbine, generator, tanks, pumps, motors, pipes, cabinets, conduits, cables) that are installed in the various buildings at G1WF. Table 2-3 summarizes the LLW and ILW waste stored in G1WF as of 31 December 2024.

The stored waste removed from the G1WF through hazard reduction campaigns must satisfy the CNSC regulatory requirements pertaining to waste management, as well as CNL procedures [2-1] [2-18] [2-19].

Table 2-3: Stored Waste Inventory at G1WF

Waste Type	Source	Total Estimated Volume (m^3)	Total Estimated Radioactivity (Bq)	Primary Radionuclides
LLW	Four drums located in Reactor Building Room 107 suspected to contain legacy LLW resins.	1	Unknown	Unknown
	One drum located in Reactor Building Room 107 that contains a few inches of liquids	0.01	Unknown	Unknown
ILW	One shielded flask located in Reactor Building Room 009[(a)] suspected to be containing central structural tubes and flux detectors.	1	Unknown	Unknown
	One shielded flask located in Reactor Building Room 403[(b)] suspected to be containing central structural tubes.	1	Unknown	Unknown

Notes:

(a) This flask is suspected to contain ILW, as found during historical documentation research to identify Reactor Building Room 009 flask content.

(b) This flask was discovered while removing the waste from Room 009 vault in the Reactor Building as part of the hazard reduction campaign. It was left in place until further investigation is conducted.

2.4.2.3 Decommissioning Waste

At G1WF, the waste generated from the Project, (i.e. decommissioning activities) will be identified and accounted for under the following three categories:

- Potentially Clearable Waste (i.e., clean waste or likely clean waste)
- Radioactive Waste (ILW and LLW)
- Hazardous Waste (e.g., asbestos containing material, lead, polychlorinated biphenyls (PCBs), mercury, silica)

Furthermore, wastes generated in each category mentioned above will be grouped into the following waste streams:

- concrete
- masonry waste (i.e., bricks, concrete blocks)
- miscellaneous construction materials (e.g., wood, door/window, floor tiles, roofing, siding, counters, cupboards)
- mechanical and electrical waste (e.g., piping, ductworks, wirings, light fixtures, systems, equipment)
- rebar
- structural steel and miscellaneous metals
- hazardous waste (e.g., asbestos containing material, lead, PCBs, mercury, silica)
- excavated material (i.e., excavated soil to expose foundation)

The hazardous waste will be removed and disposed of prior to the commencement of the Project activities and does not form part of the Project. Therefore, decommissioning waste inventory is expected to include radioactive waste (ILW and LLW) and potentially clearable waste only.

Estimates have been prepared of the types and quantities of materials and waste that will be generated from the Project (i.e., the decommissioning of the equipment and structures at G1WF). Table 2-4 provides a summary of the waste streams along with their quantities for each planning envelope.

Table 2-4: Project Waste Estimate

Planning Envelope (PE)	PE-A					PE-B					Total Waste
Waste Stream	Potentially Clearable Waste	Hazardous Waste	Radioactive Waste		Total	Potentially Clearable Waste	Hazardous Waste	Radioactive Waste		Total	
			LLW	ILW				LLW	ILW		
Concrete (m^3)	12,574	0	428	0	13,002	14,883	0	0	260	15,143	28,145
Masonry (m^3)	205	0	0	0	205	20	0	0	0	20	225
Misc. Construction waste (m^3)	935	0	0	0	935	164	0	0	0	164	1,099
Excavated Materials (m^3)	20,291	0	0	0	20,291	4,353	0	0	0	4,353	24,644
Total (m^3)	34,005	0	428	0	34,433	19,420	0	0	260	19,680	54,113
Structural Steel and Misc. Metals (MT)	1,638	0	0	0	1,638	1,363	0	0	238	1,601	3,239
Rebar (MT)	1,259	0	0	0	1,259	2,317	0	0	25	2,342	3,601
Mechanical & Electrical (MT)	1,234	0	157	0	1,391	851	0	214	108	1,173	2,564
Total (MT)	4,131	0	157	0	4,288	4,531	0	214	371	5,116	9,404
Note: MT stands for metric ton											

The radioactive waste (LLW and ILW) generated during the Project will consist of concrete, process components (e.g., mechanical, electrical and communications) and architectural and structural materials. The principal sources are:

- component parts of the reactor assembly
- calandria shell and tubes, pressure tubes, and biological shield
- heat transport system
- moderator system
- pumps and piping
- resin tanks and vault

In total, the Project will produce approximately 54,113 m^3 of waste with an estimated weight of 9,404 MT. Out of the 54,113 m^3 waste volume, 98.7% of waste is expected to be clearable and 1.3% is expected to be radioactive, of which 62.2% is expected to be LLW and 37.8% is expected to be ILW. Out of the 9,404 MT waste weight, 92.1% of waste is expected to be clearable and 7.9% is expected to be radioactive, of which 50% is expected to be LLW and 50% is expected to be ILW.

The Project will produce seven waste streams. A summary of the estimated amounts of the seven decommissioning waste streams and the expected amount for each category of waste is given below:

- 28,145 m^3 concrete waste (97.6% potentially clearable and 2.4% radioactive, which is 62.2% LLW and 37.8% ILW)

- 225 m^3 masonry waste (100% potentially clearable)
- 1,099 m^3 miscellaneous construction waste (100% potentially clearable)
- 24,644 m^3 excavated materials (100% potentially clearable)
- 3,239 MT structural steel and miscellaneous metals (92.7% potentially clearable and 7.3% radioactive, which is 100% ILW)
- 3,601 MT rebar (99.3% potentially clearable and 0.7% radioactive, which is 100% ILW)
- 2,564 MT mechanical and electrical waste (81.3% potentially clearable, and 18.7% radioactive, which is 77.4% LLW and 22.6% ILW)

2.4.2.4 Soil

Soil quality assessments for the Project may identify radiological and non-radiological contaminants, which may result in additional waste. The management of soils, including soil characterization, is governed by CNL's Environmental Site Assessment and Remediation [2-20] and Soil Management Process [2-21].

2.4.3 Remediation Strategy

2.4.3.1 Interim End-State Objectives

The interim end-state objectives for the buildings and areas of each planning envelope include:

- Service Building Basement will be decontaminated.
- Turbine Building, Reactor Building, and Resin Storage Area will be decommissioned.
- Radiation surveys confirm that impacted areas have no contamination above the reference background level (or Derived Concentration Guideline Levels [DCGLs]).
- In the freshly uncovered footprint area and the one meter vicinity, all holes, voids, and channels deeper than one meter from the grade level will be sealed with grout to an elevation that is one metre below grade.
- Backfill and grading of the area with clean gravel/soil and topsoil, and landscaping the areas.

2.4.3.2 Final End-State Objectives

An agreement between AECL and Hydro-Québec will be reached in alignment with CNL's Land Use Program [2-22] requirements on the expected conditions for returning the land to Hydro-Québec. For planning purposes, CNL assumes that the Gentilly site will be available for industrial re-use after decommissioning and, therefore, the clean-up criteria will be based on the following radiological, chemical, and physical objectives in alignment with CNL's Land Use Program [2-22]:

- In terms of radiological activity, the intent is to remove all contaminated structures or clean them to free release level [2-16]. However, if contamination has entered the geosphere and it is impractical to completely decontaminate, CNL will use a cleanup criterion that meets a dose constraint of no more than 300 µSv in a year as recommended in the International Commission on Radiological Protection (ICRP) Publication 82, Protection of the public in situations of prolonged radiation exposure [2-23].
- With respect to chemical contaminants, Québec Contaminated Sites cleanup criteria listed in Schedule IV of the Land Protection and Rehabilitation Regulation will be used.

- Regarding the physical end state of the G1WF site, all above ground structures and underground structures, including foundations to a depth of one meter below grade, will be removed, and the site will be backfilled and graded with gravel and topsoil, and landscaped. Upon completion of the Project and achieving the final end-state as agreed with Hydro-Québec, AECL will return G1WF land to Hydro-Québec.

2.4.3.3 End State Survey

At the completion of the Project, a Final Status Survey of the G1WF site will be performed to ensure the protection of future receptors on the property. The affected footprint area within each planning envelope is expected to be free of soil contamination (i.e., radiological and non-radiological). If a survey/sampling (radiological and non-radiological) discovers contamination in the impacted area, soil having contamination level above the background level (or cleanup criteria) will be removed, packed in suitable containers, and shipped to a licensed waste management facility. If interim storage is necessary prior to shipping, the contaminated soil will be stored in a suitable location within the G1WF.

A radiation survey (i.e., surface scan) of the footprint area of the buildings and the surrounding soil (minimum 1 m from the building perimeter) will be performed for each planning envelope following the completion of its decommissioning activities. The survey ensures that the radiation fields are at the background level and there are no ‘hot spots’ in the impacted area. Any contaminated soil above background level will be removed and stored in suitable containers for interim storage and managed appropriately as per CNL procedure [2-6]. The excavated area will be backfilled with clean gravel/soil and topsoil.

If contamination has entered the geosphere and it is impractical to completely decontaminate the impacted area, CNL will develop release criteria in accordance with the ICRP recommended dose constraint of no more than 300 µSv in a year to future human receptors on the site and in the vicinity. Compliance with the dose constraint (i.e., dose objective of 300 µSv/year) will be demonstrated through site-appropriate intake pathway modelling for the critical population group. The modelling will determine the DCGLs for various radioisotopes that are contributing to the residual radioactivity on site. The Final Status Survey sampling and analyses results will compare against the respective DCGLs and demonstrate compliance (or lack thereof) with respect to the selected site release criteria. If the Final Status Survey fails to pass the release criteria, additional remediation measures may become necessary. Following a successful Final Status Survey outcome, CNL will request to the CNSC to terminate CNL’s G1WF decommissioning licence and return the G1WF land to Hydro-Québec. The termination of the G1WF licence is not within the scope of the current regulatory decisions being made by either the CNSC or AECL.

2.4.4 Institutional Control

The G1WF site is leased by AECL pursuant to the emphyteutic lease and is operated by CNL. The Gentilly site land is owned by Hydro-Québec. Therefore, upon completion of the Project and meeting the Hydro-Québec agreed upon end-state objectives, CNL will submit a request to the CNSC to terminate the G1WF decommissioning licence. Upon acceptance of G1WF licence termination request, AECL will return the G1WF land to Hydro-Québec. Hydro-Québec, as the Gentilly site landowner, will be responsible for the G1WF land as well as G-2 NGS decommissioning, site remediation for future land use, and long-term institutional controls, if required by the CNSC after the termination of the G1WF decommissioning licence.

2.4.5 Monitoring and Follow-up

Decommissioning work undertaken shall comply with the requirements of CNL’s Environmental Protection Program [2-24]) to ensure the protection of the environment and the public with respect to CNL’s activities, products, and services.

- The Gentilly-1 Waste Facility Effluent Monitoring Plan [2-25] (G1WF EMP) operates under the CSA N288.5, Effluent and Emissions Monitoring Programs at Nuclear Facilities [2-26].
- The G1WF EMP reflects the current facility status, objectives of the verification monitoring program, sources of airborne or liquid releases and monitoring criteria, and updated references.

The EMP at G1WF consists of:

- An annual check against the National Pollutant Release Inventory reporting requirements.
- An annual check against the Greenhouse Gas Reporting Program reporting requirements.
- Monitoring and reporting any losses of halocarbon refrigerants and fire suppressants over 10 kg, in compliance with the Federal Halocarbon Regulations.

The Gentilly-1 Waste Facility Groundwater Protection:

The assessment of Groundwater Protection and Groundwater Monitoring Requirements [2-18] under CSA N288.7-15, determined that G1WF does not require the implementation of either a Groundwater protection or monitoring program based on criteria from CSA N288.7-15, Groundwater protection programs at Class I Nuclear Facilities and Uranium Mines and Mills [2-27].

Emissions from the facility during routine operations are minimal and do not meet the reporting thresholds for non-radiological effluent monitoring. The facility continues to provide substantial protection of the environment.

Environmental reviews of decommissioning activities for each planning envelope will be conducted, including need-for-monitoring assessments as required, and the proposed mitigation measures will be put in place to eliminate or reduce any negative environmental impact.

2.5 CNL Management System

Company-wide programs are in place to protect personnel, the public and the environment from activities performed at all CNL facilities in Canada, including the G1WF.

CNL has a management system comprising an integrated set of documented policies, expectations, standards, procedures, and responsibilities for managing and executing work across all CNL sites. The Quality Assurance activities are integrated into work procedures to provide confidence that products and services shall meet specifications and perform as expected. At CNL, this is achieved by aligning its Management System [2-28] with the CSA N286:12 (R2022) Management System Requirements for Nuclear Facilities [2-29], and International Organization for Standardization (ISO) standards including ISO 9001 Quality Management Systems Requirements [2-30] and ISO 1400 Environmental Management System – Requirements with Guidance for Use [2-31].

G1WFDecommissioning has been and will be conducted in accordance with the CNL Cleanup Function program requirements and associated processes, while complying with applicable CNL Management System policies, protocols, and HSSE&Q programs and procedures including, without limitation, as applicable:

- Environmental Protection
- Emergency Preparedness
- Fire Protection

- Nuclear Materials and Safeguards Management
- Occupational Safety and Health
- Performance Assurance
- Quality
- Radiation Protection
- Security
- Transportation of Dangerous Goods
- Waste Management

Decommissioning work at G1WF is managed through the IWC process [2-32], and is performed safely in accordance with the programs, policies and procedures noted above. If the work is contracted out with a contractor assuming the responsibility for the work site, hazard identification, and work controls, the contractor will follow their health and safety programs and procedures that are acceptable to CNL and comply with applicable provincial regulations.

A general description of CNL's HSSE&Q programs that may be applicable to the proposed Project activities is provided in the following sub-sections.

2.5.1 Environmental Protection Program

CNL's Environmental Protection Program ensures protection of the natural environment in and around CNL sites. It provides the framework to implement CNL's Environment Policy [2-33]. CNL is governed by federal regulation and legislation and, where applicable, provincial and municipal regulation and legislation in the jurisdictions where CNL operated or managed sites are located. The Environmental Protection Program ensures compliance with environmental, legal and other requirements applicable at CNL managed or operated sites, including, without limitation, the G1WF. As such, CNL's Environment Policy [2-33] and Environmental Protection Program [2-24] requirements are designed to ensure protection of the environment and the public with respect to its activities, products, and services. A graded approach to requirements is applied based upon environmental risks/events that could occur at any given location. The Environmental Protection Program also applies to all employees as well as other personnel (e.g., contractors, consultants, attached staff) conducting work at CNL operated sites.

At all CNL operated sites, the requirements of the Environmental Protection Program are applied to protect the environment and the public with respect to its activities, products, and services. Decommissioning work undertaken shall comply with CNL's Environmental Protection Program [2-24].

2.5.2 Emergency Preparedness Program

The CNL Emergency Preparedness Program provides an operational framework to implement CNL's Health and Safety and Environmental Policies [2-34] with respect to necessary emergency response measures and compliance with company priorities identified in AECL's Strategic Emergency Management Plan [2-35]. The Emergency Preparedness Program focuses on prevention and mitigation of, preparedness for, response to, and recovery from abnormal or emergent events.

The Emergency Preparedness Program [2-36] is required at all CNL operated sites. A graded approach to the Emergency Preparedness Program requirements is applied based upon an assessment of the most credible events that could occur at any given location.

The Emergency Preparedness Program:

- Ensures a state of readiness to mitigate the effects of an emergency/abnormal situation in order to protect the health and safety of workers, the public, and the environment.
- Confirms CNL's commitment to safely operate facilities and projects to a standard consistent with the type and degree of hazard associated with various operations.
- Prepares employees for emergency responses through training, documentation, exercises, and drills.
- Establishes liaison and coordination with federal, provincial, and municipal officials and support response actions by off-site authorities and emergency organizations.
- Establishes emergency plans and procedures for the mitigation of harmful effects of emergencies.

At the G1WF, CNL takes the overall responsibility to ensure the facility/building hazards are identified with strategies to respond to abnormal and emergent events. An Officer-in---Charge is assigned by CNL for the overall preparedness and management of emergent events. Employees are responsible to be familiar with their work area and building emergency procedures and promptly respond to emergencies as trained or as requested. CNL personnel conduct their work and use equipment, devices, and facilities in accordance with the program requirements [2-36]. Any contractors working in the G1WF must be working under their own supervision with CNL oversight.

2.5.3 Fire Protection Program

CNL's Fire Protection Program [2-37] is detailed in the program description and program requirements documents. The Fire Protection Program applies a risk graded approach to its operations and activities in so far as they may affect fire protection. The program applies to all CNL employees and contractors working at CNL operated sites.

As identified in the Licence Conditions Handbook [2-38], the G1WF is also required to adhere to the CSA N393-13 [2-39], Fire protection of facilities that process, handle, or store nuclear substances. A fully functional fire protection system at the G1WF remains response-ready- at all times and ensures adherence to the CSA N39-13 and CNL's Fire Protection Program requirements [2-36].

2.5.4 Nuclear Materials and Safeguards management Program

The Nuclear Materials and Safeguards Management Program [2-40] enables tracking of fissionable materials and supports internationals non-proliferation agreements. The Nuclear Materials and Safeguards Management Program applies- to all nuclear materials and safeguard management activities performed across all CNL operated sites.

As identified in the Licence Conditions Handbook [2-38], the G1WF is required to have this program implemented and maintained to ensure safeguarding fissionable materials on site. All routine and non-routine work, including any decommissioning activities at the G1WF, meets the Nuclear Materials and Safeguards Management Program requirements. The G1WF is also subject to periodic compliance and safeguards inspections/verifications by authorities having appropriate jurisdiction (i.e., IAEA and CNSC).

2.5.5 Occupational Safety and Health Program

The Occupational Safety and Health (OSH) Program [2-41] applies to all work performed by CNL employees and to work performed by others on sites or workplaces operated or controlled by CNL. The OSH Program [2-41] does not apply to workplaces controlled by contractors of CNL as they are required to implement their own programs which are compliant with applicable laws. In such cases, CNL uses its contract management process [2-13] to co-ordinate, manage, and oversee the work executed by external contractors. It is a requirement that contractors demonstrate adequate health and safety programs of their own that are based on applicable laws and regulations through a program of comprehensive qualification, coordination, and oversight.

The OSH Program is based on the principles of identification and control of hazards, prevention, and continual improvement. The OSH Program [2-41] defines the working level documentation, procedures, supporting documents, records, forms, and training to be used to achieve the objectives of the OSH Program. These allow for site and project specific needs, while still ensuring consistency with the requirements of the OSH Program.

2.5.6 Performance Assurance Program

The Performance Assurance Program [2-42] documents serve as a single repository of all applicable regulatory, quality, safety, contractual requirements and industry standards and practices that apply to CNL for the Performance Assurance Program.

The Program consists of the following elements:

- Operating Experience and Corrective Action Program
- Assessment
- Human Performance
- Continual Improvement
- Performance Measures and Analysis

2.5.7 Quality Program

The Quality Program [2-43] describes the requirements of the Management System and Quality Program for CNL. The Management System and Quality Program are applicable across all CNL locations and reflect the activities carried out at the various locations.

2.5.8 Radiation Protection Program

CNL's Radiation Protection Program [2-16] is designed to protect workers and members of the public from the harmful effects of radiation exposure arising from CNL activities and to ensure that CNL complies with the level of radiation safety that is required by the NSCA and its associated regulations. The objective of the Program is to define the requirements, processes, and procedures for:

- Organization and administration of the program
- Radiation protection training and qualification of workers and radiation protection personnel
- Dose limitation
- Radiation protection provision in facility design
- Workplace radiation and contamination monitoring

- Control of radiation and contamination exposure
- Monitoring of workers for radiological exposure
- Provision of radiation protection instrumentation and equipment
- Management of radioactive materials and radiation emitting devices
- Response to radiological unplanned events and emergencies

2.5.9 Security Program

CNL recognizes the need to ensure security is considered in all aspects of its business activities. CNL supports Canada's interest in ensuring the protection of assets, information, safeguarding of the public and personnel and resumption of business. The Security Program [2-44] requirements apply to operations and activities that may affect security in and around CNL sites and apply to all employees and other personnel (e.g., visitors, contractors, attached staff) conducting work at CNL sites.

CNL maintains processes to prevent unauthorized disclosure, destruction, removal, modification, or loss of classified, sensitive, designated, or valuable assets, whether in physical or electronic form.

Work at the G1WF is subject to CNL's Security Program requirements as mandated by the facility's licence conditions. All contractors must be security cleared through CNL Security before working at the G1WF and must comply with facility's access control requirements. The physical security at the site is provided by Hydro-Québec security personnel, whose program meets the requirements of CNL's Security Program. Since road access to G1WF requires that all personnel pass through the Hydro-Québec security gate, visitors and contractors to the G1WF also require authorization in accordance with established Hydro-Québec procedures. CNL periodically performs site security and threat risk assessments for the G1WF and acts on the findings as required. Inspections, testing, and maintenance of security systems at the G1WF are performed routinely.

2.5.10 Transportation of Dangerous Goods Program

The Transportation of Dangerous Goods Program [2-17] provides an operational framework for the safe transport of dangerous goods by conforming to all applicable laws, regulations, company policies, and procedures. It enables an effective, consistent, and comprehensive application of domestic requirements and international standards.

Compliance with the Transportation of Dangerous Goods Program is mandatory for all off-site transport of dangerous goods (i.e. outside a CNL controlled or operated site), and it encompasses all operations associated with the movement of dangerous goods including classification, documentation, packaging, safety marks, security, emergency response, training, and regulatory permits and licences.

2.5.11 Waste Management Program

The Waste Management Program [2-10] applies to all operations and activities that result in the generation, transportation, treatment, storage, and/or disposal of wastes (i.e., the lifecycle of waste) generated by CNL or received by CNL from a third-party. The Program applies to all CNL employees, including other personnel (e.g., contractors) for waste management activities conducted by or on behalf of CNL.

2.6 Environmental Monitoring and Protection at Gentilly-1 Waste Facility

2.6.1 Effluent Monitoring Plan

The G1WF EMP [2-25] is designed in accordance with the Monitoring Programs at Nuclear Facilities [2-26]. The G1WF EMP [2-25] reflects the current facility status, objectives of the verification monitoring program, sources of airborne or liquid releases and monitoring criteria.

An annual compliance monitoring report is produced to comply with licence condition 5.1 of the Waste Facility Decommissioning Licence WFDL-W4-331.00/2034 of G1WF [2-45], in accordance with the Licence Conditions Handbook [2-38], and REGDOC-3.1.2, Reporting Requirements, Volume I: Non-Power Reactor Class I Nuclear Facilities and Uranium Mines and Mills [2-46].

2.6.1.1 Airborne Emission Monitoring

The G1WF EMP [2-25] confirms that there continues to be minimal or no source of airborne radioactivity release from routine operations at G1WF. There were no projects at G1WF requiring airborne emissions monitoring in 2022.

The non-radiological Effluent Monitoring Program at G1WF consists of:

- An annual check against the National Pollutant Release Inventory (NPRI) reporting requirements.
- An annual check against the Greenhouse Gas Reporting Program (GHGRP) reporting requirements.
- Monitoring and reporting any losses of halocarbon refrigerants and fire suppressants over 10 kg, in compliance with the Federal Halocarbon Regulations.

The G1WF site operational activities were reviewed for 2022 with respect to the need for reporting under the 2022 National Pollutant Release Inventory Notice [2-47]. The G1WF site did not meet the reporting threshold of 20,000 hours worked during 2022 [2-48]. As a result, reporting to the NPRI was not required.

The G1WF is required to report releases under the 2022 Greenhouse Gas Emissions Notice [2-47] provided that the facility emitted ≥ 10,000 Carbon Dioxide equivalent (CO_2e) tonnes within the 2022. Sources of Greenhouse Gases emissions at G1WF in the 2022 included on-site transportation which were minimal (less than 1 tonne CO_2e) and were therefore not reportable under the Greenhouse Gas Reporting Program reporting requirements [2-45].

2.6.1.2 Liquid Effluent Monitoring

There was no liquid effluent from G1WF in 2022 [2-49]. Liquid collected in facility sumps is considered waste and is transferred into totes, which are sampled, analyzed, and then transported overland and accepted as waste by Hydro-Québec at Gentilly-2. Given that the contents of these sumps are not discharged to the environment by G1WF but are instead handled as liquid waste subject to Hydro-Québec waste acceptance criteria and disposed of by Hydro-Québec according to their specifications, they are not considered a liquid effluent stream for G1WF.

2.6.1.3 Groundwater Monitoring

CNL's Standard for Protection and Monitoring of Groundwater [2-50] requires that the need for a groundwater protection and groundwater monitoring program is assessed for each CNL operated site in Canada and documented with technical justification on whether groundwater protection and monitoring programs are required. The requirement is based on the CSA N288.7-15 Groundwater Protection Programs at Class 1 Nuclear Facilities and Uranium Mines and Mills [2-51].

The Gentilly-1 Waste Facility: Determination of Groundwater Protection and Groundwater Monitoring Requirements [2-52] demonstrates that G1WF does not meet the criterion from CSA N288.7-15, Groundwater Protection Programs at Class I Nuclear Facilities and Uranium Mines and Mills [2-51], and CNSC REGDOC-2.9.1, Environmental Principles, Assessments and Protection Measures [2-53], for the need of a Groundwater Protection Program or a Groundwater Monitoring Program.

2.7 References

2.7.1 Acts and Regulations

- Nuclear Safety and Control Act (S.C. 1997. c. 9), Canada
- Quebec Land Protection and Rehabilitation Regulation (Q-2, r. 37), Québec.

2.7.2 Literature Cited

- [2-1] CNL (Canadian Nuclear Laboratories). 2024. Gentilly-1 Waste Facility Decommissioning – Storage with Surveillance Plan, 61-508330-SWS-001, Revision 30, September.
- [2-2] CNL. 2019. Safety Analysis Report for the Gentilly-1 Waste Facility, 61-03610-SAR-001, Revision 2, July.
- [2-3] CNL. 2019. G-1 Turbine and Ancillary Systems Characterization Report, 61-509410-REPT-001, Revision 0, March.
- [2-4] CNL. 2020. Characterization Report for materials and equipment in the G-1 Service Building Basement, 61-79000-REPT-004, Revision 1, November.
- [2-5] CNL. 2025. Decommissioning Process, 900-508300-STD-003, Revision 1.1, January.
- [2-6] CNL. 2022. Management of Waste, 900-508600-MCP-004, Revision 3, December.
- [2-7] CNL. 2018. Radiological Survey Processes for Facilities Decommissioning, 3600-508740-PRO-002, Revision 1, May.
- [2-8] CNL. 2020. Waste Management Plan for the Gentilly-1 (G-1) Prototype Reactor Site, 61-508600-WMP-001, Revision 3, April.
- [2-9] CNL. 2023. Waste Enquiry Form, 900-508600-FM-013, Revision 1.1, July.
- [2-10] CNL. 2023. Waste Management, 900-508600-PRD-001, Revision 4, April.
- [2-11] CNL. 2015. Waste Acceptance Criteria for On-Site Generators, WMA-508600-WAC-001, Revision 0, February.
- [2-12] CNL. 2022. Waste Management Plan for Hazardous and Mixed Waste at CNL, CW-508600-WMP-003, Revision 0.1, December.
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- [2-14] CNL. 2022. Management of Designated Toxic Substances, 900-509200-STD-013, Revision 1, August.
- [2-15] CNL. 2023. Asbestos Management, 900-510400-STD-026, Revision 0.1, December.
- [2-16] CNL. 2025. Radiation Protection, 900-508740-PRD-001, Revision 6.0, January.

- [2-17] CNL. 2023. Transportation of Dangerous Goods, 900-508520-PRD-001, Revision 3.1, February.
- [2-18] CNL. 2021. Gentilly-1 Waste Facility: Determination of Groundwater Protection and Groundwater Monitoring Requirements, 61-509200-PLA-002, Revision 0, May.
- [2-19] CNL. 2025. Environmental Review of Routine Activities, 900-509200-MCP-002, Revision 1.1, May.
- [2-20] CNL. 2025. Environment Site Assessment and Remediation Process, 900-508300-STD-001, Revision 2, April.
- [2-21] CNL. 2025. Soil Management Process, 900-508300-STD-001427, Revision 1.1, July.
- [2-22] CNL. 2025. Cleanup, 900-508300-PRD-001, Revision 6, December.
- [2-23] ICRP (International Commission on Radiological Protection). 1999. Protection of the public in situations of prolonged radiation exposure, ICRP Publication 82, September.
- [2-24] CNL. 2023. Environmental Protection, 900-509200-PRD-001, Revision 5, May.
- [2-25] CNL (Canadian Nuclear Laboratories). 2024. Gentilly-1 Waste Facility Effluent Monitoring Plan, 61-509200-PLA-001, Revision 1.1, December.
- [2-26] CSA (Canadian Standards Association) Group. 2022. CSA N288.5-22, Effluent and Emissions Monitoring Programs at Nuclear Facilities.
- [2-27] CSA Group. 2023. CSA N288.7-15, Groundwater Protection Programs Nuclear Facilities and Uranium Mines and Mills.
- [2-28] CNL. 2023. CNL Management System, 900-514100-GDI-001, Revision 3.1, June.
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- [2-32] CNL. 2024. Integrated Work Control, 900-514100-STD-002, Revision 4.1, April.
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- [2-34] CNL. 2024. Safety and Health, CNL Corporate policy, 900-510400-POL-001, Revision 4.2, November.
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- [2-37] CNL. 2023. Fire Protection, 900-508720-PDD-001, Revision 4, September.
- [2-38] CNL. 2019. Licence Conditions Handbook WFDL-LCH-W4-331.00/2034 Prototype Waste Facilities – Waste Facility Decommissioning Licence, Gentilly-1 Waste Facility, 61-00580-HBK-001, Revision 0, July.

- [2-39] CSA. 2018. CSA N393-13 Fire protection for facilities that process, handle, or store nuclear substances, December.
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- [2-41] CNL. 2024. Occupational Safety and Health, 900-510400-PDD-001, Revision 4.0, February.
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- [2-43] CNL. 2024. Quality, Program Description Document, 900-514200-PDD-001, Revision 3.0, May.
- [2-44] CNL. 2023. Security, 900-508710-PDD-001, Revision 5.1, March.
- [2-45] CNL. 2019. Licence Conditions Handbook for Gentilly-1 Waste Facility, WFDL-W4-331.00/2034, 61-00580-HBK-001, Revision 0, July.
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- [2-47] Canada Gazette. 2022. Canada Gazette, Part I, Notice with respect to the substances in the National Pollutant Release Inventory for 2020, 2022, 2023, and 2024, Volume 156, No 7, February 12.
- [2-48] Canada Gazette. 2023. Canada Gazette Part I, Notice with respect to reporting of greenhouse gases (GHGs) for 2022 and 2023, Vol. 157, No. 4, January 28.
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- [2-50] CNL. 2020. Protection and Monitoring of Groundwater, 900-509200-STD-015, Revision 0, October.
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- [2-52] CNL. 2021. Gentilly-1 Waste Facility: Determination of Groundwater Protection and Groundwater Monitoring Requirements, 61-509200-PLA-002, Revision 0, May.
- [2-53] CNSC (Canadian Nuclear Safety Commission). 2020. REGDOC-2.9.1 Environmental Protection: Environmental Principles, Assessments and Protection Measures, version 1.2, September.

3 INDIGENOUS AND PUBLIC ENGAGEMENT

The IAA regulatory process related to the G1WF includes a requirement for Indigenous and public participation and engagement. In accordance with **section 86 of the IAA**, before making an Environmental Effects Determination, an authority must:

- Post on the Canadian Impact Assessment Registry (Registry) a Notice of Intent to make a determination on the environmental effects of the proposed Project; and
- Invite comments for a period of at least 30 days.

Once the comment period has closed, the authority must consider the information received. This Section of the EPMR describes engagement related to the G1WF, the Project and the licencing process and the feedback received.

CNL's corporate Public Information Program (PIP) covers activities of public interest that occur at all CNL sites including G1WF. The PIP [3-1] has been prepared in accordance with the requirements of CNSC Regulatory Documents, REGDOC-3.2.1, Public Information and Disclosure [3-2] and REGDOC-3.2.2, Indigenous Engagement [3-3]. Additional information regarding how the PIP meets the regulatory requirements and identified activities for each target audience can be found in the PIP for Canadian Nuclear Laboratories [3-1]. The PIP informs the general public, local communities surrounding the various sites, the news media, elected and appointed government officials, the supply chain and other stakeholders such as industry, academia and science and technology audiences about the activities ongoing at CNL sites, including G1WF, the potential impacts of these activities on the health and safety of workers, members of the public and on the environment. The PIP [3-1] also ensures community input is sought, received, considered and implemented when possible and reasonable.

CNL has been engaging on the G1WF to ensure the public and Indigenous Nations, communities and organizations have access to information related to the Project and its activities and the licencing process. Key audiences included, without limitation, the following:

- Indigenous Nations, communities, and organizations with established or asserted Aboriginal and/or treaty rights in relation to the G1WF site (W8banaki, formerly the Grand Conseil de la Nation WabanAki Inc. and the Abenaki bands of Odanak and Wôlinak, and the Wendat Nation), as well as Indigenous Nations, communities, and organizations that have interests in relation to the G1WF site.
- CNL employees.
- Residents of Québec; Bécancour, Nicolet-Saurel, Saint-Maurice Champlain, Gentilly District, and target the surrounding Bécancour region.
- Environmental non-governmental organizations and citizens groups.
- Federal and provincial authorities.
- Relevant regulatory bodies.
- Industry stakeholders.

CNL's engagement with the public and Indigenous Nations, communities and organizations in the G1WF region began in 2023, focussing on public and Indigenous awareness around CNL's plans to decommission the G1WF and the regulatory processes required to complete this work. CNL's engagement also emphasized opportunities for the public and Indigenous Nations, communities and organizations to participate in regulatory processes and

provide input into CNL's decommissioning plans for the G1WF. CNL received feedback from Indigenous Nations, communities and organizations and the public through this engagement and through written comments submitted during the public comment period required by the IAA. Feedback received through the latter is outlined in Section 3.1.

Engagement activities included public webinars, community information sessions, meetings, media outreach, advertising, and mail outs. These activities are described further in Appendix 5.

CNL continues ongoing outreach and engagement with the public, and Indigenous Nations, communities, and organizations on matters of interest related to the Project and the G1WF.

3.1 IAA Factors for Consideration

In making their respective Environmental Effects Determinations, the authorities must consider the factors listed in **section 84(1) of the IAA**. Each of these factors, and the information received relating to each factor, are discussed in the subsections that follow. The factors listed in **section 84(1) of the IAA** are:

a) any adverse impact that the project may have on the rights of the Indigenous Peoples of Canada recognized and affirmed by Section 35 of the Constitution Act, 1982;

b) Indigenous knowledge provided with respect to the project;

c) community knowledge provided with respect to the project;

d) comments received from the public under subsection 86(1); and

e) the mitigation measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the project that the authority is satisfied will be implemented.

Multiple engagement activities and opportunities occurred to gather public and Indigenous perspectives. CNL remains strongly committed to meaningful engagement with interested Indigenous Nations, communities, and organizations, the public, and community regarding the G1WF throughout the duration of the Project.

3.1.1 Comments Received from the Public with Respect to the Project

Pursuant to **subsection 84(1)(d) of the IAA**, in making its determination, a federal authority must consider comments received from the public under **subsection 86(1) of the IAA**. **Section 86(1) of the IAA** requires a federal authority to post a notice of intent on the IAA registry and invite the public to provide comments respecting the determination(s) to be made. A notice of intent for the decommissioning of the G1WF was posted on the IAA registry on December 15, 2025 (Reference Number 90092). The public comment period remained open for 52 days and closed as of February 05, 2026. Due to the level of interest and in consideration of the holiday period, the comment period was longer than the minimum 30 calendar days required by the IAA.

During the comment period with respect to the Project, 48 separate submissions were received. This Section summarizes the information received in these submissions for consideration by the authorities for purposes of their Environmental Effects Determinations. In addition, it is noted that a separate process will be undertaken by the CNSC to solicit feedback and comments for purposes of the licencing decision to be made pursuant to the NSCA.

Comments, interests, concerns, and requests related to the Project are summarized in Table 3-1, and where a response is available within the EPMR, this is also addressed. Language consistent with the received comment has been maintained.

Table 3-1: Summary of Comments/Interests/Concerns Related to the Project

Comment/Interest/Concern related to the Project	Discussion in EPMR
Demolition activities and contaminated materials may have potential impact to adjacent lands and the St. Lawrence River	See Sections 5.4-5.6 of this EPMR.
First-ever decommissioning of a CANDU reactor, potential for mistakes	Concern is recognized and why the Project will be managed through the application of and compliance with the programs, standards, codes, rules, laws, regulations and industry practices described in this EPMR and through regulatory oversight. For clarity, G1WF is not the first-ever CANDU reactor to be decommissioned and previous industry experience will be utilized.
Safety of nuclear workers due to exposure to radioactive dust	See Sections 5.4-5.6 of this EPMR.
Examination of alternatives, including on-site storage of waste or delay decommissioning until a long-term waste storage or disposal facility is available to avoid double handling of waste	The proposed Project will implement the final phase of a previously determined decommissioning plan, as discussed in Section 2 of this EPMR. Avoiding double handling of waste is a generally accepted industry practice, however, delaying decommissioning of the G1WF will delay the overall remediation and restoration of the Gentilly site.
Availability of waste characterization information, including characterization of radionuclides present in the G1WF	Data from characterization and monitoring is available to CNL and to the extent applicable to the assessment of the significance of environmental effects as a result of the Project, are discussed or provided further in this EPMR.

In addition to the above, many comments included within the submissions were considered by the drafters to be related to the Project, but are in fact related to matters outside the scope of the Project as defined previously in this EPMR. These are summarized using language consistent with the received comment as follows:

- Concern that the impacts of transportation, storage and disposal of waste as a result of the Project are not included in the assessment.
- Concern that the transfer of used fuel from the G1WF to CRL occurred without an IAA process.
- Public transparency regarding transportation of waste, including consultation with affected communities.
- Consultation with Indigenous rightsholders regarding the transportation, storage and/or disposal of waste in or through their communities and/or traditional territory.
- Transportation to and/or storage of waste at CRL generally, and impacts to the local environment.
- Safety and security concerns regarding transportation of nuclear waste and potential mitigations, including sufficiency of waste packaging.
- Coordination of remediation with Hydro-Québec for the entire Gentilly site.

As these items are outside of the scope of this Project and the IAA and licencing decisions to be made, discussion is not included in this EPMR on these topics. However, CNL remains committed to engaging on these topics.

In addition, while outside the scope of this Project, the submissions included comments and concerns regarding the IAA process and the CNSC hearing process, notably the length of the IAA comment period, and included the following, using language consistent with the received comment:

- Requests to provide information related to the assessment of environmental effects for review during the comment period.
- Requests to establish a review panel for the Project, or to coordinate an assessment with the Province of Quebec.
- Requests for public engagement, government oversight and First Nations' consent.
- Concerns regarding the independence of parties, including CNL, as well as the decision-making process between the two federal authorities.
- Requests that the decision-making process requires collaboratively developed assessment methodologies with rightsholders to determine Indigenous impacts.

Finally, the submissions included the following concerns, using language consistent with the received comment, which are also outside the scope of the Project:

- Management of CNL by a U.S. consortium and the GoCo model.
- U.S. consortiums not being subject to the Access to Information Act.
- Protection of Canadian information and data against use or abuse by the U.S., including for weapons development purposes.
- The Nuclear Waste Management Organization's proposed deep geological repository (DGR).
- Hydro-Quebec's licence renewal application for the G-2 NGS.

Some of the submissions provided comments regarding the CNSC licence amendment process. To the extent comments received relate to matters outside the scope of the Project, CNL has not provided a comment, response or position within this EPMR.

3.1.2 Adverse Impacts on the Rights of Indigenous Peoples of Canada

Pursuant to **subsection 84(1)(a) of the IAA**, in making its determination, an authority must consider adverse impacts on the rights of Indigenous Peoples of Canada which are recognized and affirmed by Section 35 of the Constitution Act, 1982.

Information received from Indigenous Peoples in support of the Environmental Effects Determination to be made by the authorities is summarized in this Section. It is intended to capture specific comments that may support the authorities' consideration of the factors set forth in **section 84 of the IAA**, specifically **subsections 84(1)(a) and 84(1)(b)**.

The Indigenous Nations with established or asserted Aboriginal and/or treaty rights in relation to the G1WF site are W8banaki Nation and Wendat Nation. In addition, Indigenous Nations, communities and organizations who have established or asserted Aboriginal and/or treaty rights in relation to other AECL-owned sites, such as CRL, provided comments regarding elements which are out of scope for this Project. These include comments from the Algonquins of Pikwàkanagàn First Nation and Kebaowek First Nation. Further, the Passamaquoddy Recognition Group Inc. also provided comments regarding elements which are out of scope for this Project.

3.1.2.1 Feedback from W8banaki Nation

The W8banaki Nation, formerly the Grand Conseil de Nation Waban-aki, currently have more than 3,000 community members throughout Québec, Canada, and the United States [3-4]. Within their traditional territory, also referred to as the Ndakina (“Our Territory”), there are two communities: Odanak and Wôlinak [3-4]. Both communities are located in close proximity to the G1WF, on the shores of the Saint-François (Alsig8ntegw) and Bécancour (W8linaktegw) rivers [3-4].

Odanak is approximately 60 kilometres from the G1WF and Wôlinak is within 15 km of the G1WF.

See Figure 3-1 from the W8banaki Nation website, showing the Ndakina (Territory).

Multiple engagements occurred with the W8banaki Nation, which are described in Appendix 5 of this EPMR. No comments, feedback or concerns were received in respect of the Project. CNL continues to share information on the G1WF.

Figure 3-1: Map of the W8banaki Territory (Ndakina)

3.1.2.2 Feedback from Wendat Nation

Formerly referred to as the Huron-Wendat, the Wendat Nation has 5,233 community members [3-5]. 1,495 community members live in the Wendake community, and 3,738 community members live throughout Québec, across Canada, and around the world [3-5].

The Wendat traditional territory, or Onyionhwentsïio, spans 66,065 square km from the Saguenay River to the St. Maurice River, and the St Lawrence River to the Saint John River. The community of Wendake is itself 2,258 square km within the larger Onyionhwentsïio [3-5]. Wendake is located around 140 km northeast of the G1WF.

See Figure 3-2 which indicates the location of Wendake in proximity to Bécancour.

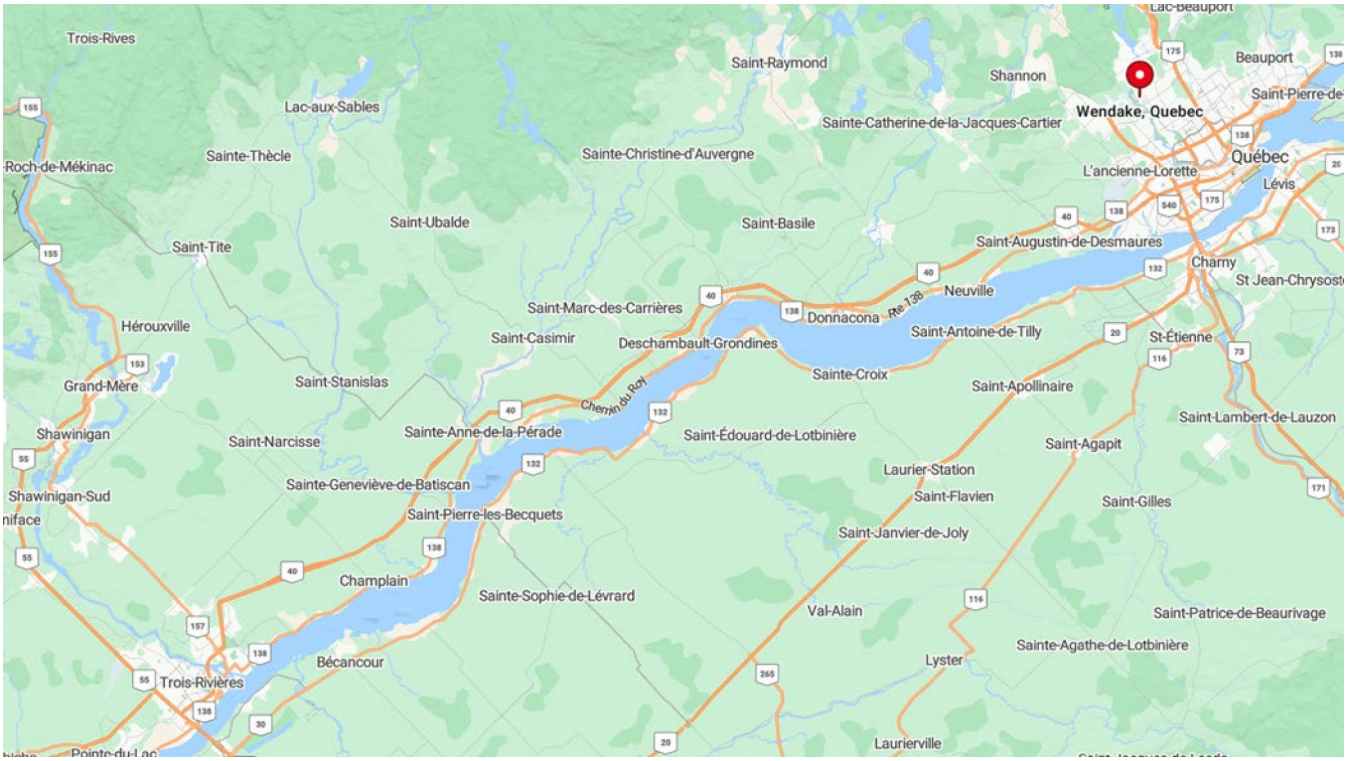

Figure 3-2: Location of the Wendake Community of the Wendat Nation

Multiple engagements occurred with the Wendat Nation, which are described in Appendix 5 of the EPMR. Representatives indicated an interest in economic development and procurement opportunities. Wendat Nation and CNL have held an initial meeting to discuss procurement opportunities and CNL's Indigenous Relations Procurement Strategy. CNL has standing quarterly meetings to continue to discuss these areas of interest between Wendat Nation and CNL.

3.1.2.3 Feedback from Algonquins of Pikwàkanagàn First Nation

AECL, CNL and the Algonquins of Pikwàkanagàn First Nation (AOPFN) signed a long-term relationship agreement (LTRA) in May 2023. The agreement has established multiple working groups for ongoing collaboration, including the Neyagada Wabandangaki Guardian Program that supports a regular AOPFN monitoring presence at designated AECL sites, among other environmental, cultural, and economic protection and promotion activities and programs. In accordance with the LTRA, CNL, AECL and AOPFN continue to develop processes for early engagement, including for activities related to the acceptance and consolidation of radioactive waste at CRL, which is located within AOPFN's unceded and unsurrendered traditional territory.

AOPFN is a signatory of the Algonquins of Ontario Agreement-in-Principle (2016), as well as the earlier issued Algonquins of Ontario Comprehensive Land Claim (1983). AOPFN, in association with the Algonquins of Ontario, are working towards reaching a settlement over a comprehensive land claim including an area of over 3.6 million hectares within the Kichi-Sibi (Ottawa River) and Mattawa River watersheds in Eastern Ontario. Figure 3-3 shows

the area of the Algonquins of Ontario land claim, with the addition of a circle to indicate the approximate location of the CRL site. Figure 3-44 shows an AOPFN traditional territory map. Negotiations towards a final agreement are still underway. Members of AOPFN, and of the various Indigenous Nations and communities that form part of the Algonquins of Ontario, continue to practice traditional land use activities throughout the Algonquins of Ontario land claim region and AOPFN traditional territory. However, the CRL site is not generally accessible to the public or Indigenous peoples and is not used for traditional purposes by Indigenous peoples.

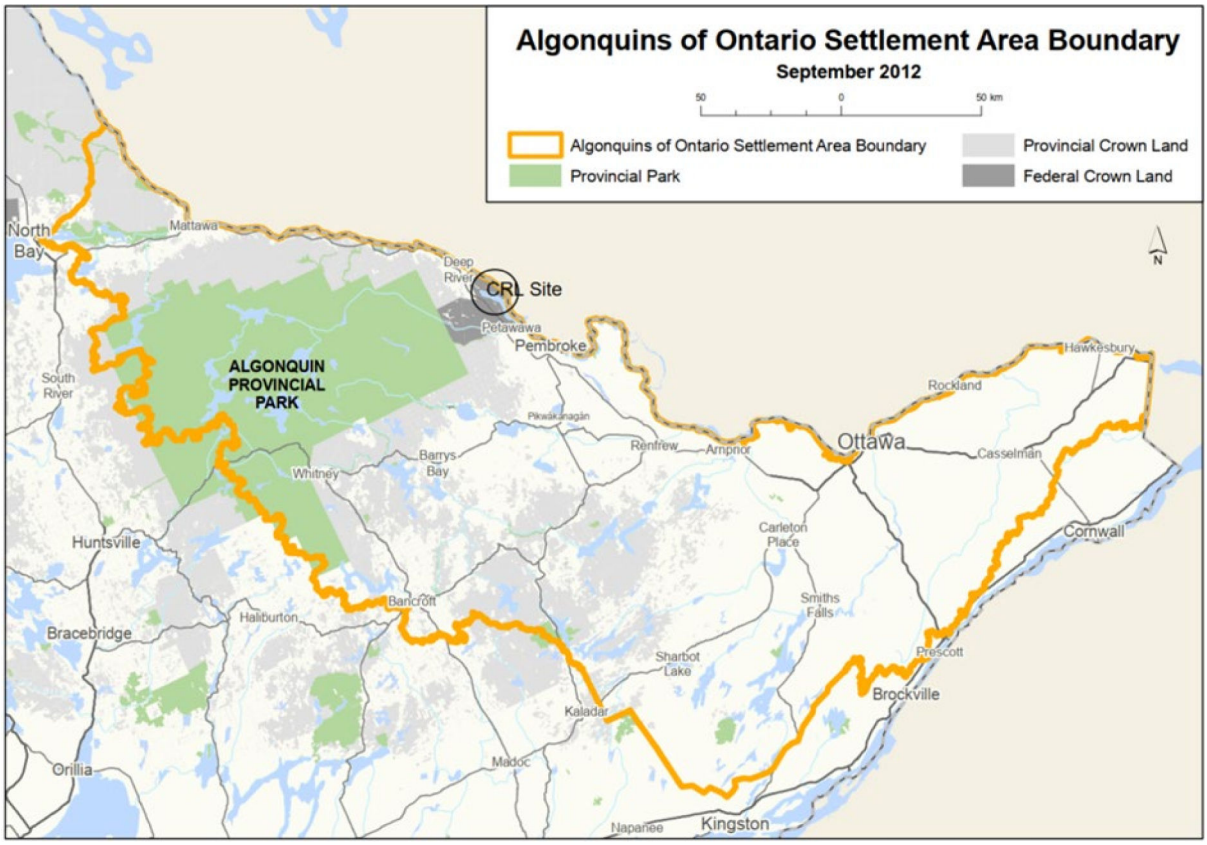

Figure 3-3: Map showing Algonquins of Ontario Settlement Area Boundary

Given the relationship between AOPFN, AECL and CNL, CNL wished to acknowledge the feedback received from AOPFN which focused on the proposed transportation and storage and/or disposal of waste generated at G1WF at CRL.

AOPFN's longstanding, principled position, is that they are opposed to the transportation or importation of radioactive waste in AOPFN's traditional territory. AOPFN is therefore opposed to the importation of any radioactive waste from other Canadian and/or any other jurisdictions into their territory. This includes waste originating at G1WF being brought to CRL for storage and/or disposal.

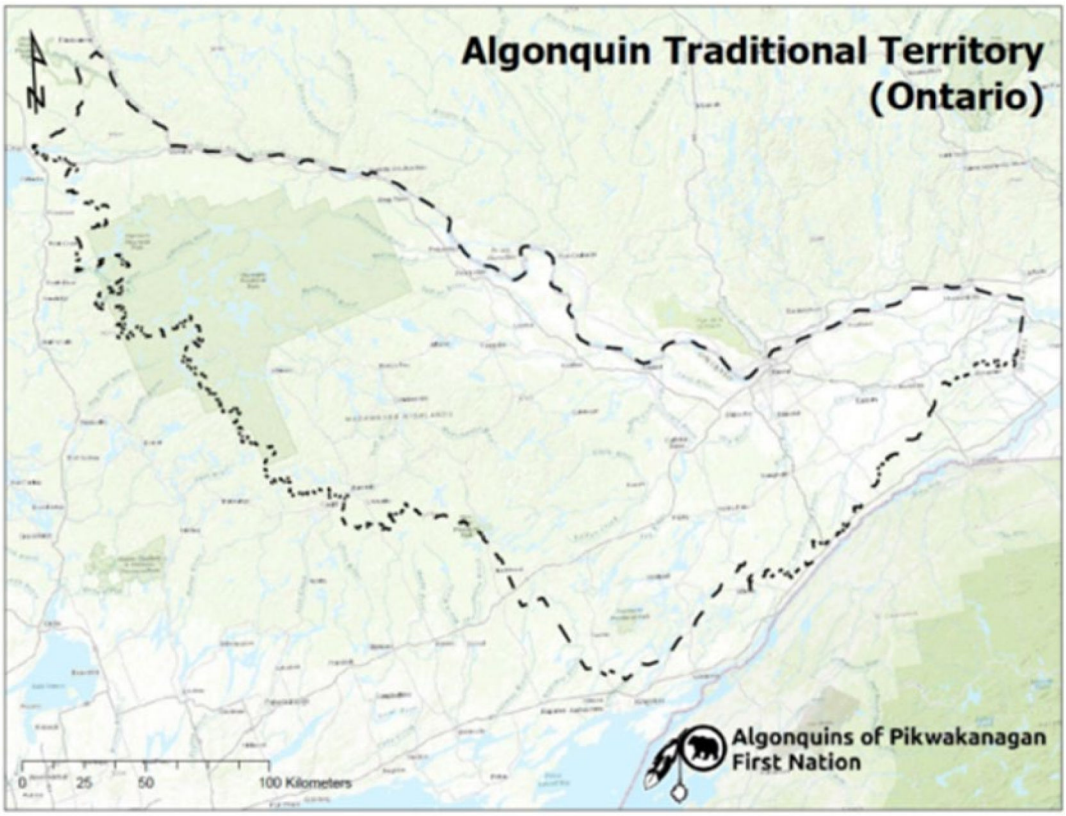

Figure 3-4: Map showing Algonquin Traditional Territory (Ontario)

AOPFN has also expressed a need to be deeply consulted by the CNSC and engaged with meaningfully by site operators and all radioactive waste generators in accordance with Article 29(2) of the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) regarding the transportation, storage or disposal of radioactive waste in AOPFN's territory and that AOPFN's free, prior and informed consent (FPIC) must be obtained prior to decisions being made by both proponents and regulators. AOPFN expressed that the importation, production, use and disposal of radioactive materials has had adverse impacts on the environment within their traditional territory, which constitutes an infringement of their Algonquin rights, title and interests in ways and to a degree that continues to be assessed. AOPFN expressed concern regarding real and perceived health risks related to the nuclear sector which lead to alienation and fear associated with wildlife, vegetation and waters used by their members to practice their Algonquin culture. AOPFN has conducted traditional use, culture and rights and diet and harvest studies to determine impacts to its members due to the stigma of contamination related to the nuclear industry.

Finally, AOPFN expressed concern that the approvals contemplated by the regulatory processes to be undertaken by AECL and CNSC will enable CNL to proceed with the decommissioning of the G1WF and permit the movement of the waste, irrespective of whether AOPFN's FPIC has been sought or granted.

As noted above, the transportation of waste, and the proposed storage or disposal of waste at CRL, are not part of the Project or the requested licence amendment. However, discussions continue between AOPFN, CNL and AECL in accordance with the LTRA. Engagement with AOPFN regarding the Project is described further in Appendix 5 of this EPMR.

3.1.2.4 Feedback from Kebaowek First Nation

Kebaowek First Nation (KFN), CNL and AECL entered into a Consultation and Engagement Framework Agreement in January 2023, and a working group meets monthly to share information and engage on projects and activities of interest. Engagement with KFN regarding the Project is described further in Appendix 5 of this EPMR.

KFN, along with two other Algonquin First Nations, Wolf Lake First Nation and Timiskaming First Nation, has asserted Aboriginal title and rights over a broad area that straddles the Kichi-Sibi basin on both sides of the Quebec-Ontario boundary, as shown in Figure 3-5. This map, as well as a corresponding Statement of Asserted Rights and Title was provided to the Government of Canada, Québec and Ontario in January 2013. The map is also included in the Consultation and Engagement Framework Agreement to define KFN's traditional territory and the area over which KFN enjoys and asserts constitutionally protected Aboriginal and/or treaty rights. The map is without prejudice to KFN's right to expand or alter its definition or depiction in any other forum, proceedings or agreement. CNL has not been made aware of any such changes to the map.

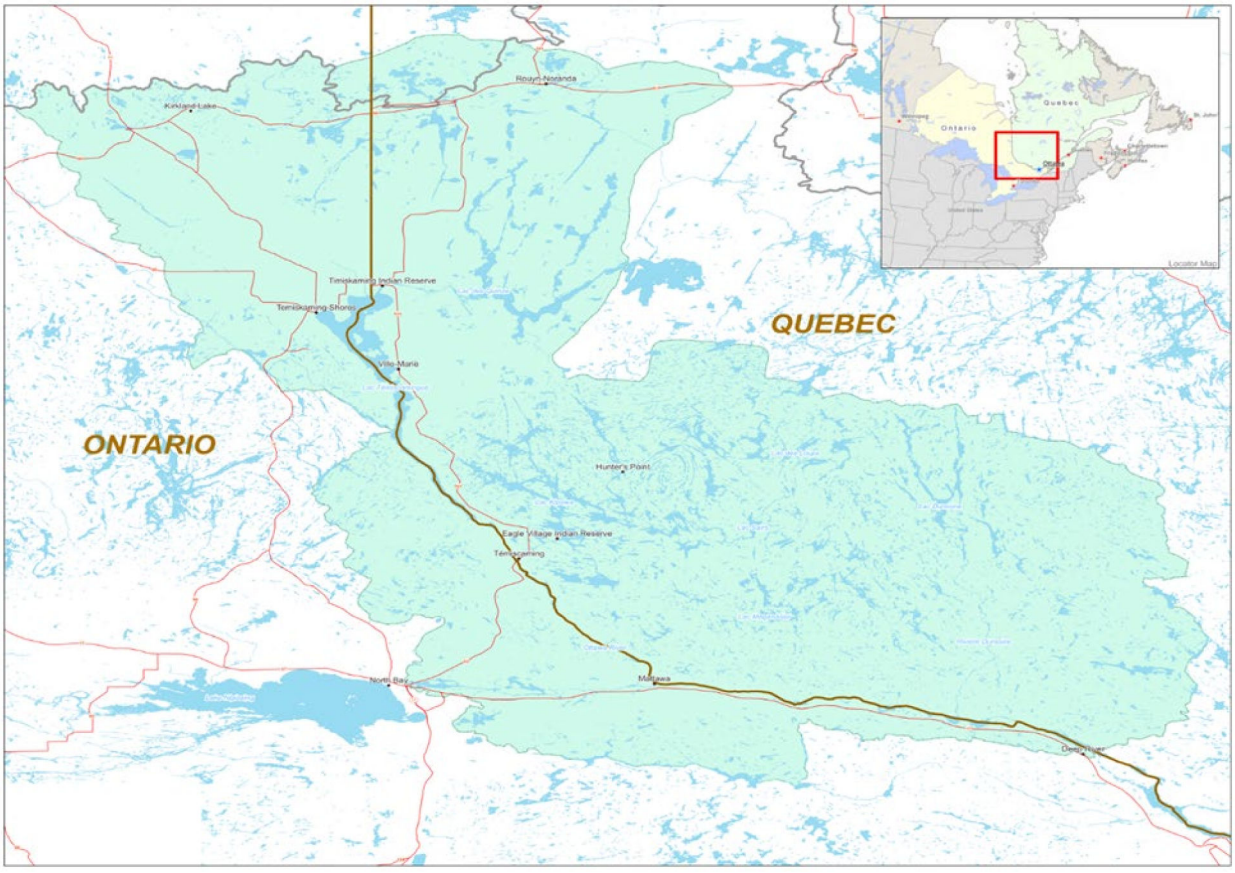

Figure 3-5: Map Showing KFN's Traditional Territory

Neither the CRL site, nor the Gentilly site, are included in the claimed title area.

KFN expressed many concerns, most related to consultation and KFN's requirement for FPIC. These concerns do not articulate an adverse impact on KFN's right as a result of the Project but given a collective commitment to ongoing engagement and consultation, they are included below.

KFN alleges that the G1WF decommissioning has the potential to cause negative impacts to their Section 35 rights, title and jurisdiction that are intergenerational, irreparable and profound as the waste will be brought to CRL for storage and/or disposal, which is alleged to be within their traditional territory. KFN also alleges that Canada is required to obtain KFN's FPIC pursuant to Article 29(2) of UNDRIP. As a result, KFN also alleges that the duty to consult is triggered at the deepest end and includes a requirement to obtain KFN's consent.

KFN expressed concern regarding deficiencies in the CNSC's approach to consultation related to the regulatory processes, and their view that consultation has been inadequate. Examples provided by KFN include, without limitation:

- Lack of a meaningful section 82 process framework to carry out the duty to consult, the relationship between both processes and perceived process deficiencies.
- Failure to appropriately consider cumulative effects when evaluating impacts to Section 35 rights.
- Failure to consider foreseeable projects and the relationship between the G1WF and other proposed projects in KFN's traditional territory.
- Engagement and consultation deficiencies as a result of rushed and arbitrary timelines.
- Failure to recognize capacity constraints.
- Lack of responsiveness.
- Failure to meaningfully consider Aboriginal perspectives, voices and knowledge.
- Failure to consider implications for The United Nations Declaration on the Rights of Indigenous Peoples Act (UNDA) Action Plan.
- Inconsistency with and failure to incorporate or engage with principles of FPIC.
- Lack of meaningful process for incorporating Indigenous knowledge.
- Failure to communicate regarding the transportation of spent fuel bundles from G1WF to CRL.

KFN has also expressed a requirement for a proponent or the Crown to comply with KFN's Rights and Responsibilities Assessment Law to determine KFN's FPIC position wherever a physical activity may result in effects on KFN territory or impacts to KFN rights and responsibilities. KFN has expressed a need for the steps articulated by the law to take its course and inform the regulatory processes, but specifically the CNSC's Environmental Effects Determination.

While the transportation of waste, and the proposed storage or disposal of waste at CRL, are not part of the Project or the requested licence amendment, CNL and AECL are engaging separately with KFN on these matters

3.1.2.5 Feedback from the Passamaquoddy Recognition Group Inc. on behalf of the Peskotomuhkati Nation

The Passamaquoddy Recognition Group Inc. (PRGI) represents the interests of rights holders and the Peskotomuhkati ecosystem. A relationship or other similar agreement does not exist between CNL, AECL and PRGI as CNL does not manage or operate nuclear facilities on behalf of AECL within the rights holders' traditional territory.

The concerns expressed by PRGI relate to perceived procedural and legal deficiencies in the regulatory process and engagement with the Nation. For example, PGRI indicated that the CNSC's decisions related to the G1WF will influence future regulatory proceedings, including for Point Lepreau, which PGRI notes lies within their territory. The concerns do not articulate an adverse impact on the Nation's rights as a result of the Project or associated project activities.

In accordance with the PIP, CNL will continue to share information with PRGI regarding the Project based on PRGI's interest and priorities.

3.1.3 Indigenous Knowledge Provided with Respect to the Project

Pursuant to **subsection 84(1)(b) of the IAA**, in making its determination, a federal authority must consider Indigenous knowledge provided with respect to the Project. As noted in the IAA Guidance Document, Indigenous knowledge is holistic and can provide invaluable insights related to all aspects of a potential project.

CNL has been engaging the W8banaki Nation and the Wendat Nation since 2023 to share information about the Project and to seek input on interests, concerns, traditional land use, and Indigenous knowledge relevant to the Project. Feedback received to date regarding this factor has been limited, and may be in part due to the access restrictions applicable to the Gentilly site

CNL remains open to receiving information from Indigenous Peoples to incorporate into the Project, to the extent applicable, including, without limitation, facilitating environmental monitoring by local Indigenous Nations, communities or organizations to the G1WF. CNL remains committed to sharing information based on Indigenous Nation's, communities' and organizations' needs, interests and priorities.

3.1.4 Community Knowledge Provided with Respect to the Project

Pursuant to **subsection 84(1)(c) of the IAA**, in making its determination, a federal authority must consider community knowledge provided with respect to the Project. As the G1WF site is secured and not generally accessible to the public, and has been for the past 50 years approximately, there may be a lack of information specific to the G1WF site that can help inform the evaluation of environmental effects and the development of mitigation measures. As described previously, the comments received do not include community knowledge with respect to the Project.

3.1.5 Technically and Economically Feasible Mitigation Measures

To make a determination on the significance of environmental effects as a result of the proposed Project, each authority is required to consider the mitigation measures that are technically and economically feasible that would mitigate any significant adverse environmental effects of the Project that the authority is satisfied will be implemented, pursuant to **Section 84(1)(e) of the IAA**.

The mitigation measures to be implemented as part of the Project are described throughout the remainder of this EPMR and have been considered as part of the assessment. These mitigation measures are all technically and economically feasible, unless expressly noted otherwise. CNL is committed to implementing the mitigation measures set forth in this EPMR.

3.2 Crown's Duty to Consult and Accommodate

In accordance with Section 35 of the Constitution Act, 1982, the Crown has a duty to consult Indigenous Peoples where the Crown has knowledge of the potential existence of an Aboriginal or treaty right and contemplates conduct that may adversely impact that right. The federal government enacted UNDA on June 21, 2021. The impact of UNDA is currently before the courts.

The duty to consult is separate and distinct from a federal authority's obligations under the IAA and, the licencing decision to be made by the CNSC pursuant to the NSCA. The information contained in Section 3 and Appendix 5 of this EPMR may be utilized by the Crown in its assessment of the duty to consult.

Engagement has occurred with various Indigenous Nations, communities and organizations regarding the proposed Project. Appendix 5 describes each interaction with Indigenous Nations, communities and organizations regarding the proposed Project. The interests, concerns and feedback raised by Indigenous Nations, communities and organizations and the public during the engagement on the proposed Project, and CNL's responses, are described in this EPMR.

3.3 References

3.3.1 Acts and Regulations

- Constitution Act, 1982
- Impact Assessment Act (S.C. 2019, c.28, s. 1), Canada.
- United Nations Declaration on the Rights of Indigenous Peoples Act
- United Nations Declaration of the Rights of Indigenous Peoples

3.3.2 Literature Cited

- [3-1] CNL (Canadian Nuclear Laboratories). 2024. Public Information Program for Canadian Nuclear Laboratories, CW-513430-REPT-001, Revision 10.0, October. [Online]. Available: https://www.cnl.ca/cnl_report/public-information-program/
- [3-2] CNSC (Canadian Nuclear Safety Commission). 2018. REGDOC-3.2.1 Public Information and Disclosure, May.
- [3-3] CNSC. 2022. REGDOC-3.2.2 Indigenous Engagement, Version 1.2, January.
- [3-4] W8banaki. 2026. History of the Nation. [Online] Available: https://gcnwa.com/histoire-de-la-nation/
- [3-5] Wendat Nation. 2026. History and Culture. [Online] Available: https://www.wendake.ca/histoire-et-culture
- [3-6] CNL. 2024. History Public Information Program for Canadian Nuclear Laboratories, CW513430REPT001, Revision 10.0, September.

4 DESCRIPTION OF THE EXISTING ENVIRONMENT

This section describes the existing baseline condition for the G1WF and its surrounding area. This description provides a basis for evaluating potential effects of the Project on the environmental components. Information sources include published and unpublished material, data from baseline and other monitoring programs as part of CNL's routine and non-routine environmental protection program at the Gentilly site.

4.1 Atmospheric Environment

4.1.1 Air Quality

The following sections provide an overview of the remaining radiological and non-radiological air quality conditions within key buildings at the G1WF. Based on the information provided below, routine monitoring of the airborne release was no longer considered necessary due to the absence of a major source of airborne activity. The current G1WF EMP [4-1] confirms this statement is still valid, that there is no need for routine radiological effluent (airborne and liquid) (Section 2.6) [4-2].

4.1.1.1 Radiological Air Quality

Most potential emission sources at the G1WF have already been decommissioned. With the ventilation system removed, the only remaining atmospheric releases are minor fugitive emissions from louvres in the turbine building and reactor vault, which are considered insignificant.

Reactor Building

Residual radioactivity is still present, mostly contained within internal reactor structures rather than on external surfaces. The concrete walls of the building act as an effective containment barrier, preventing radiological and non-radiological contaminants from escaping. As the building has no forced ventilation, significant airborne emissions to the environment are not possible.

Turbine Building

Spent fuel was removed during early decommissioning and transferred to dry storage. The northern section of the turbine building was decontaminated to Hydro-Québec's Zone 1 standard and handed over to the utility; staff entering this space are Nuclear Energy Workers operating under Hydro-Québec safety programs. In the southern section, residual radioactivity remains primarily within piping and equipment. Although loose surface contamination could theoretically become airborne, modelling shows that fugitive emissions would still be negligible, even requiring an unrealistically high passive exhaust rate to produce a minimal public dose.

Service Building

This building is classified as Contamination Zone 2 but has no pathways for air to exit to the outdoors, eliminating the possibility of airborne emissions.

4.1.1.2 Non-Radiological Air Quality

Non-radiological air releases from the G1WF are negligible. Some hazardous materials, such as asbestos within equipment or building materials, have been identified but do not contribute to atmospheric emissions.

4.1.2 Meteorology

The meteorology of the site and region is typical of the St. Lawrence River, which is influenced by prevailing westerly winds. The cold temperate climate is humid and relatively invariant because of the proximity to the river. The meteorology of the Gentilly site is monitored by Hydro-Québec for the G-2 NGS.

4.1.2.1 Temperature

Table 4-1 details the monthly temperature data for Bécancour for the period of 2009 to 2022 taken from World Weather Online (WWO) [4-3]. Over the 2009-2022 period, January and February are the coldest months while July and August are the hottest months (as shown in bold in Table 4-1) So far, the lowest temperature observed in Bécancour during the last 25 years (1998-2022) was -36.8°C in 2014 January and the highest temperature was +35.4°C in 2020 July [4-4].

Table 4-1: Monthly Temperature (°C) in Bécancour for a 14-year Period (2009-2022) [4-3]

Month	Temperature Minimum	Temperature Maximum	Temperature Minimum Avg.	Temperature Maximum Avg.
January	-21	-4	**-15**	-7
February	**-22**	-2	-14	-5
March	-14	4	-8	0
April	-4	12	0	8
May	5	20	7	17
June	11	23	12	21
July	14	26	16	**24**
August	14	**27**	15	**24**
September	9	22	11	19
October	2	16	5	12
November	-6	7	-2	4
December	-14	2	-9	-3

Note:
Maximum and minimum values shown in **bold.**

4.1.2.2 Precipitation

The monthly data for maximum rainfall, snowfall, and precipitation in Bécancour is shown in Table 4-2 for the period of 2009 to 2022 [4-3]. The total monthly precipitation is the total of the monthly snowfall and monthly rainfall, with 1 cm of snowfall equivalent to 1 mm of rainfall. In Bécancour, over the 2009-2022 period, maximum monthly rainfall was 301.15 mm in 2011 August, maximum monthly snowfall was 77.9 cm in 2020 February, and maximum monthly precipitation was 301.15 mm in 2011 August (as shown in bold in the Table 4-2).

Table 4-2: Maximum Rainfall, Snowfall, and Precipitation in Bécancour for a 14-year Period (2009-2022) [4-3]

Month	Rainfall (mm)	Snowfall (cm)	Precipitation (mm)
January	109.61	64.60	174.21
February	157.42	**77.90**	235.32
March	143.14	76.20	219.34
April	182.57	38.70	221.27
May	185.07	2.90	187.97
June	163.04	0	163.04
July	175.14	0	175.14
August	**301.15**	0	**301.15**
September	233.32	0	233.32
October	191.65	10.00	201.65
November	142.56	32.80	175.36
December	148.90	75.18	224.00

Note:
Maximum values shown in **bold.**

4.1.2.3 Wind

Table 4-3 details the annual wind speed at Bécancour for the period of 2009 to 2022 [4-5]. Over the 2009-2022 period, the highest maximum annual wind speed at Bécancour was 71 km/h in 2021 with an hourly mean speed of 11.2 km/h (as shown in bold in the Table 4-3). The schematic of the records of origin and speed of the winds at Bécancour for 2022 is presented in Figure 4-1 [4-4]. The records of origin and speed of the winds at Bécancour was made through the meteorological tower belonging to the Ministère de l'Environnement, de la Lutte contre les Changements Climatiques, de la Faune et des Parcs (MELCCFP). The instrumentation battery of this tower is at a height of 10 meters. The raw data set of the MELCCFP tower was made available by the Quebec Cooperative Meteorological Network. The three prevalent wind directions capable of dispersing atmospheric emissions from G-2 towards Farm No. 1, the human receptor location closest to the site, are winds coming from the north, the north-northwest and the northwest. This data is also applicable to the G1WF. These three wind directions represent about 24% of all winds.

Table 4-3: Annual Wind Speed in Bécancour for a 14 year Period (2009-2022) [4-4]

Year	Maximum (km/h)	Hourly Mean (km/h)
2009	57	13.0
2010	56	**13.4**
2011	70	**13.4**
2012	59	12.9
2013	50	12.1
2014	50	12.5
2015	55	11.9
2016	52	12.1
2017	46	11.8
2018	45	11.9
2019	59	12.0
2020	45	11.3
2021	**71**	11.2
2022	65	12.2

Note:
Maximum values shown in **bold.**

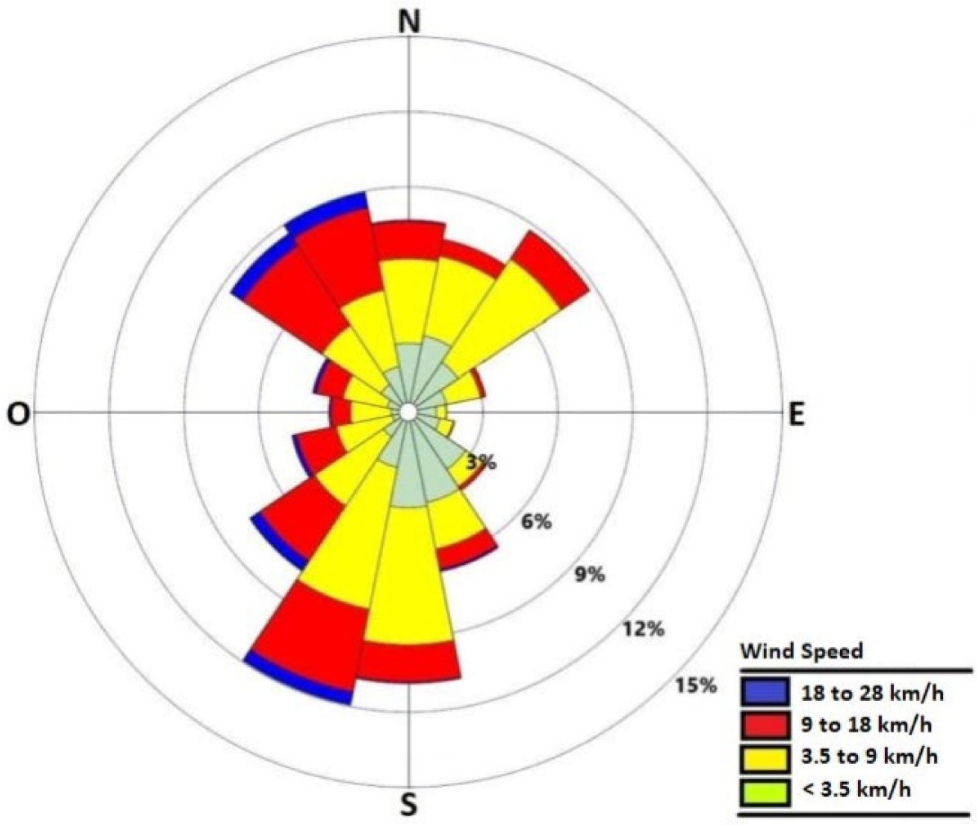

Figure 4-1: Rose of the origin of the winds at the MELCCFP instrumented site in Bécancour for the year 2022 [4-4]

4.1.2.4 Climate Change Impacts

Climate change refers to the hazards induced by the change in external environmental conditions, including external flooding, tornadoes, severe winds, extreme weather, and seismic activities. Climate change refers to the hazards induced by the change in external environmental conditions, including external flooding, tornadoes, severe winds, extreme weather, and seismic activities. See section 6.2.7 for details.

4.2 Geologic and Hydrogeologic Environment

4.2.1 Geology

The Gentilly site is located in the St. Lawrence lowlands tectonic region. The bedrock consists of horizontally bedded shale with small amounts of sandstone and limestone. Bedrock in the area is covered by shallow overburden. Four sedimentary units are defined in the study region shown in Figure 4-2. In chronological order of formation, these are till (Till de Gentilly), Champlain sea clay (Argile de la mer de Champlain), high terrace sands (Sable des hautes terrasses), and low terrace sands (Sables des basses terrasses) [4-6]. The low terrace sands is the unit covering the Gentilly site and is composed of sands, till, silts, and organic deposits [4-7]. The sand unit at the G1WF site is described as shallow overburden of silty sand [4-8]. Excavation for remediation of the underground storage tanks next to the Reactor Building showed an overburden thickness of 6.5 m [4-9].

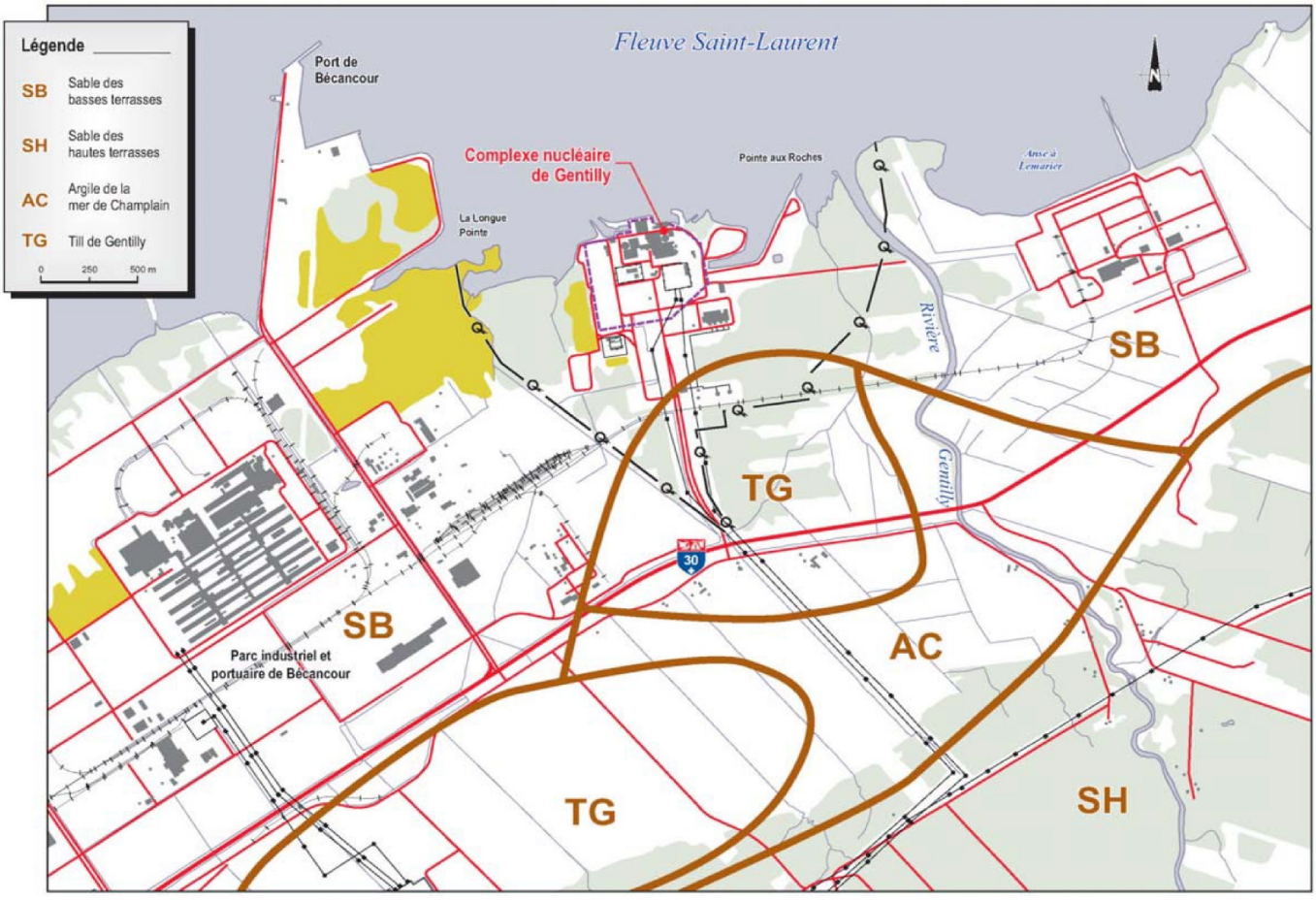

Figure 4-2: Overburden Sediments in the Regional Area (SB - Low Sand Terraces, SH – High Sand Terraces, TG – Gentilly Till, AC – Champlain Clay).

The lithology in the Bécancour region is characterized by soft rocks [4-10]. These rocks generally have low permeability (i.e. the hydraulic conductivity is rarely above 10^{-9} m/s). However, when these formations are exposed to the surface, they can crack near the bedrock surface, which increases their permeability. The transmissivity of the top five meters of this bedrock is between 10^{-5} and 10^{-4} m^2/s, mainly due to the presence of sub-horizontal fractures at the surface.

Stratigraphic cross-sections surrounding the Gentilly site are provided for the transects A-A through E-E in Figure 4-3. The stratigraphic cross-sections shown in Figure 4-4 provide information on stratigraphy in the area but do not extend to the Gentilly site. The north-south stratigraphic cross-section D-D extends to the Dry Fuel Storage Area (ASSCI) located immediately south of the G1WF. The stratigraphic cross-sections show overburden to the south of the G1WF comprised of a layer of fill at the surface overlying a till layer up to a few meters thick [4-6].

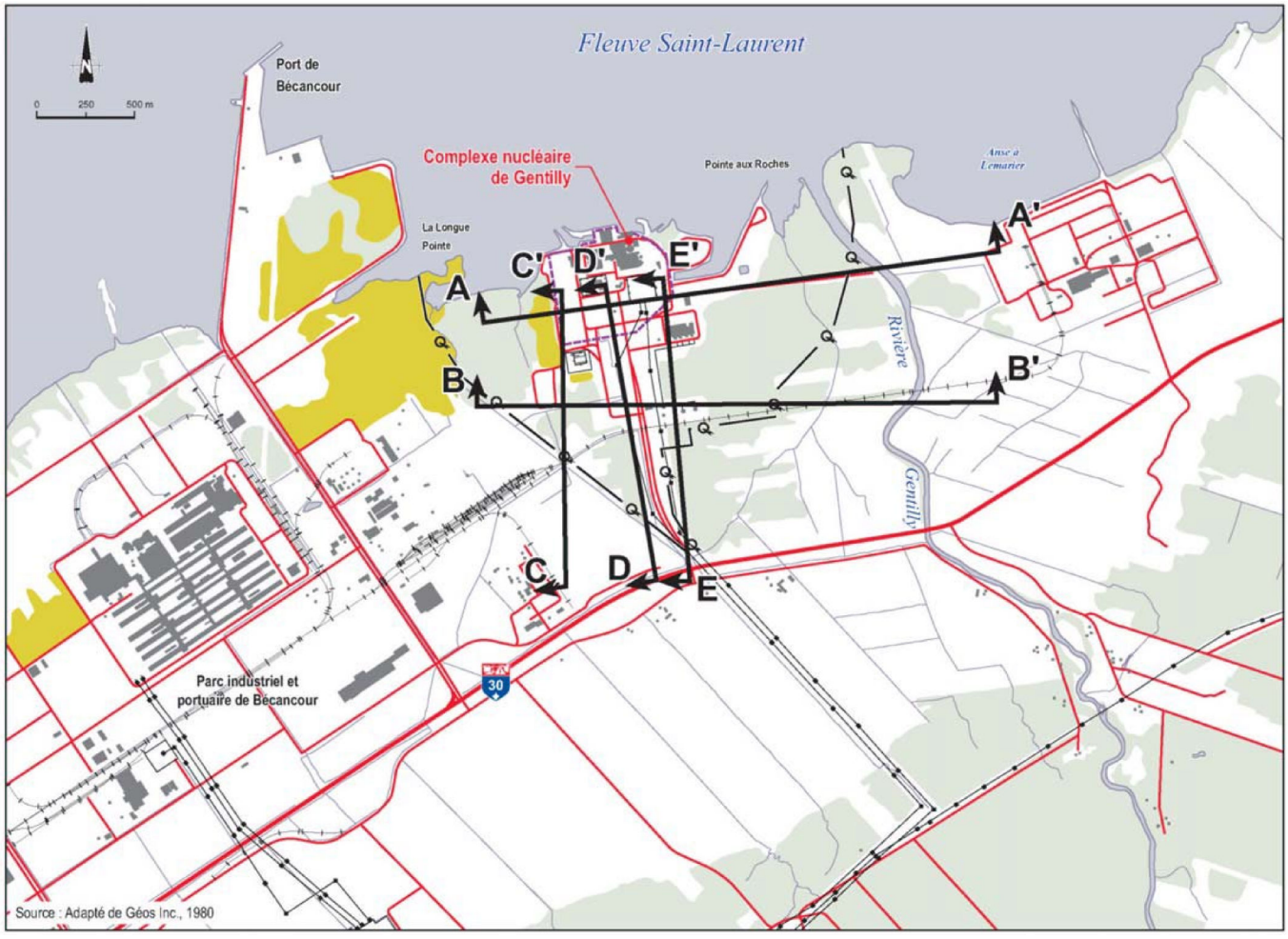

Figure 4-3: Location of Stratigraphic Cross-Sections.

Site investigations at the G-2 Solid Radioactive Waste Management Site (IGDRS) to the west of G1WF show overburden up to 8 m thick [4-11] [4-12]. The overburden in this area was composed of sandy backfill. A layer of fine soil made up of clay silt, sand, and traces of organic material and a layer of granular soil composed of silty sand with little traces of clay are present under the backfill in several places [4-6].

Two valleys, one to the east of the nuclear complex coinciding with the Gentilly River, and the second to the west of the nuclear complex are filled with permeable sediments as shown in cross-sections A-A and B-B of Figure 4-4. The eastern valley has a depth to bedrock of approximately 25 m and the western valley has a depth to bedrock of approximately 15 m [4-6].

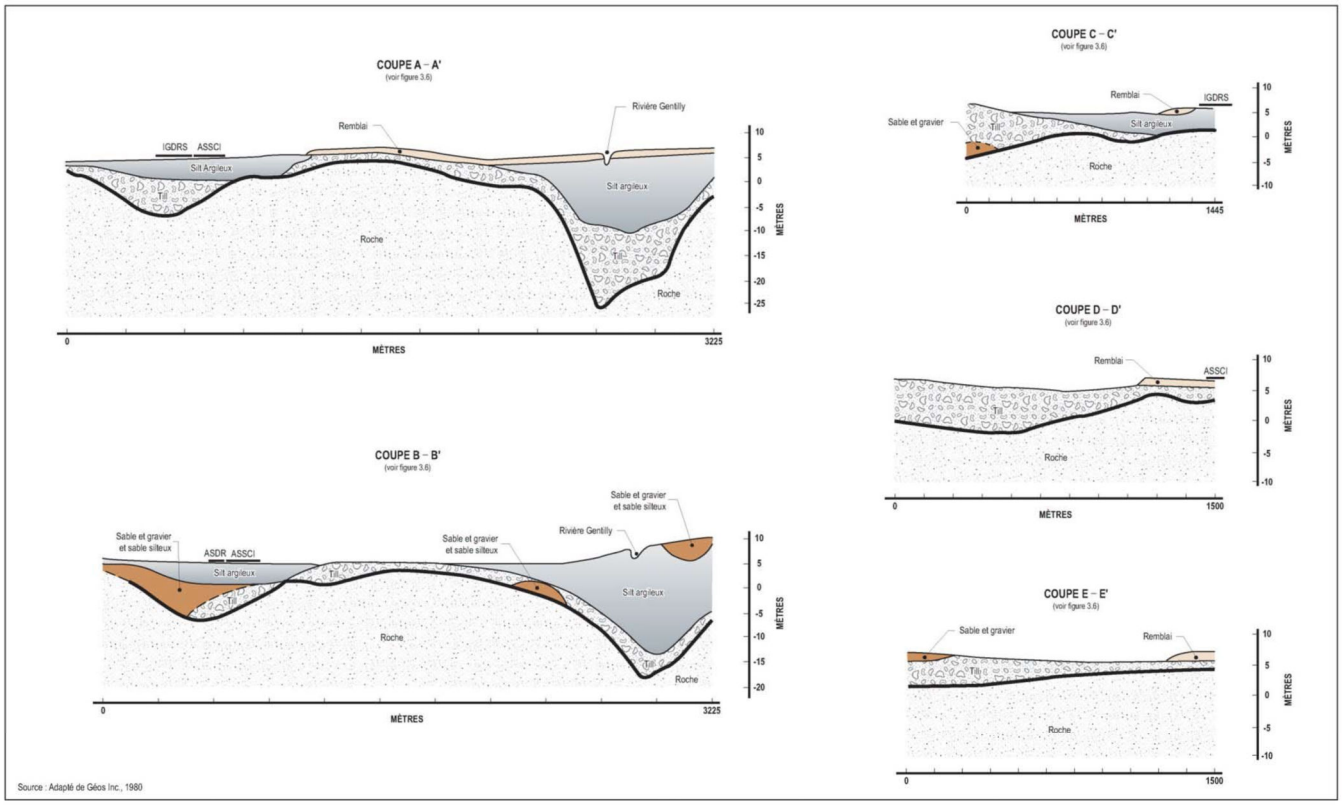

Figure 4-4: Stratigraphic Cross-section along Transects A-A to E-E.

The competence of the rock at the Gentilly site was carefully examined in the field and the laboratory, and this work is fully reported in Section 2.6 of reference [4-13]. Thus, the rock characteristics affecting design are well known in general.

There is no faulting in the rock underlying the Gentilly site. Expert opinions were obtained, and it was concluded that with regards to the presence of faults believed to exist in the general area, there was no possibility of major fault movement near the site.

4.2.2 Hydrogeology

4.2.2.1 Groundwater Quantity

Three aquifers are present within an 8-km radius of the Gentilly site: the sands of the high terraces, glacial sediments under the Champlain Sea clays, and glacial sediments on the superficial part of the bedrock. Only the latter aquifer affects the Gentilly site. It consists of the fissured part of the bedrock, locally associated with the more or less silty sand that covers it. Depending on the rock cover, the water in this aquifer is either captive or unconfined. It is partially captive to the south of the G1WF, under a layer of clayey silt. The groundwater is unconfined beneath the G1WF, as there is no clay deposit [4-13].

Hydraulic conductivity (Figure 4-5) of the sands in the vicinity of the G1WF have an assessed horizontal and vertical permeability of 10-4 m/s and a porosity of 0.3 [4-6]. The till layer has horizontal permeability, the vertical estimate is 10-6 m/s, and the porosity is 0.2. This is characteristic of semi-permeable formations [4-7]. The clayey silt layer is considered relatively impermeable with horizontal permeability of 10-8 m/s, vertical permeability of 10-7 m/s, and porosity of 0.5 [4-6].

Hydrogeological studies were conducted for the Gentilly site to determine [4-14]:

- The height and thickness of the aquifer.
- The direction, speed, and rate of discharge of groundwater.
- The influence of the tidal variation on the groundwater levels.

Thirty (30) holes were installed at the G-2 NGS's Solid Radioactive Waste Management Site, immediately to the west of the G1WF, with six (6) of them equipped with automatic water level recording. Piezometric readings in the site indicated that the groundwater level in the overburden is almost at the surface (typically 1.5 to 3 m below grade). The influence of the tidal variation in the soil was considered to be negligible because of the low permeability of the soil. For the aquifer, no tidal variation effect was observed.

Regionally, groundwater flow is towards the St. Laurence River [4-2]. A groundwater recharge zone is located immediately to the south of the G1WF and the G-2 NGS. Groundwater flow from this recharge zone is towards the G1WF and the G-2 NGS and the two valleys to the east and west. The highest water table conditions are observed from the end of April to mid-May, corresponding to seasonal snow melt. The lowest levels occur in mid-August [4-2In terms of contaminant transport, any releases to ground in the immediate vicinity of the G1WF would migrate towards the building sumps as opposed to migrating towards the river [4-2].

Groundwater flow and the water table at the G1WF are strongly influenced by the groundwater pumping system, which acts as a local groundwater sink. These pumps are located at the base of the Reactor Building, approximately 7 m below grade and 2.64 m below sea level, well below the natural water table elevation as noted above. The groundwater pumping system maintains the groundwater table below the foundation of the Reactor Building and draws groundwater flow radially inward to the sumps from around the Reactor Building.

The G1WF drainage system consists of two underground drainage sumps (7172-P3 and 7172-P4), located around the periphery of the Reactor Building, one sump for the Resin Spent Vaults, two sumps in the Service Building (S-001 and S-012), and four sumps in the Turbine Building (T-002, T-004, T-005, and T-007). The groundwater pit sumps' water level check is performed weekly while building drainage sump (i.e., S-001, S-012, T-002, T-004, T-005, and T-007) water level check performed weekly and liquid sampling/pumping done as required. The most recent exception was in May of 2012, when the Service Building basement area was flooded. This led to one of the four sampling points containing water with concentrations of 481 Bq/L tritium and 2.6 Bq/L gross beta [4-15].

The two groundwater sampling points around the periphery of the Reactor Building consist of two underground sumps approximately 30 feet below ground level [4-16]. The sumps collect any precipitation and groundwater from around and underneath the Reactor Building. A weeping tile system also directs groundwater from the spent resin underground concrete vaults to the Reactor Building underground sumps. Each sump is equipped with two (2) pumps which automatically start and alternate to pump the groundwater to the Hydro-Québec's Gentilly site storm water system, which ultimately discharges to the St. Lawrence River.

The Spent Resins Vault sump collects groundwater infiltrating the MPS spent resin vault which is not diverted anywhere and thus remains into the HTPS spent resin vaults [4-16]. Water, which could enter the MPS vault, will flow by gravity to the sump located in Room S-012. Both sumps require the use of portable pumps for drainage. Water, which could enter the HTPS spent resin vaults, will flow by gravity to the Spent Resin Vaults sump.

The four sumps (T-002, T-004, T-005, and T-007) are located within the Turbine Building and collect condensate and groundwater infiltration from within the Turbine Building [4-16]. Additionally, sump T-005 collects condensate from the Reactor Building. The sumps T-002, T-004, and T-007 accumulate so little water that they rarely require draining. However, sump T-005 requires drainage.

The water from two Service Building sumps and the four Turbine Building sumps are manually pumped into the totes [4-16]. The samples from each tote were sent to Hydro-Québec's laboratory for analysis. Upon meeting the Hydro-Québec's waste acceptance criteria (Gross beta/gamma = 5.3E+13 Bq/a & Tritium = 1.1E+19 Bq/a), the totes are then transported overland to Hydro-Québec's G-2 NGS facility for discharge into the St. Lawrence River. The Annual Compliance Reports indicate that all water samples collected from the sumps met Hydro-Québec's waste acceptance criteria for discharge into the St. Lawrence River.

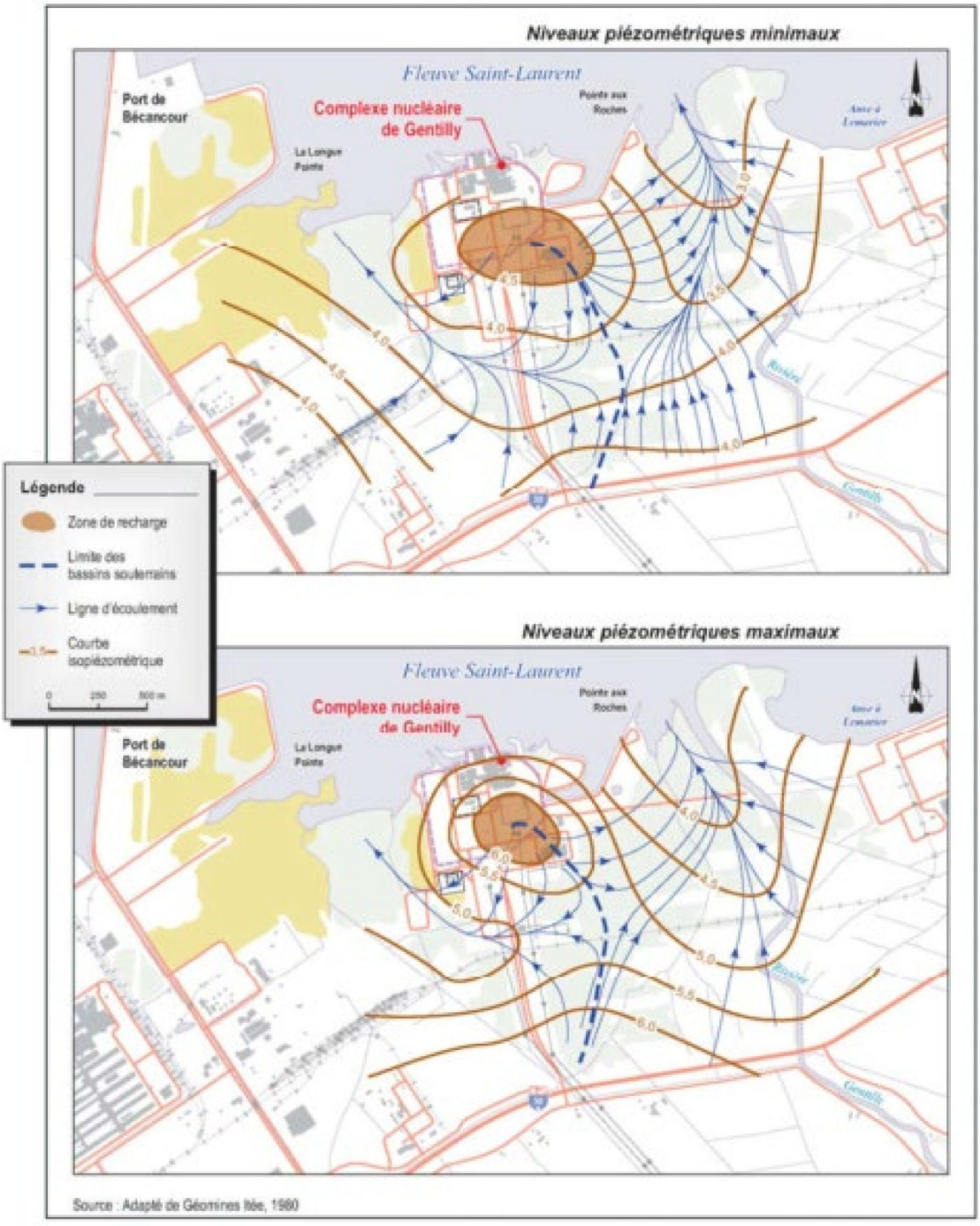

Figure 4-5: Hydraulic Head Contours for Minimum (top figure) and Maximum (bottom figure) Conditions

4.2.2.2 Groundwater Quality

Although some of the sumps and pumps associated with the G1WF drainage system are isolated from operation, several are still operational in the Turbine Building, Spent Resin Storage Area, and Reactor Building [4-1].

There are also sumps associated with the various buildings that are drained using portable pumps and handled either at the discretion of the G-2 facility. The liquid from these sumps is drained into totes and transferred overland as liquid waste to Hydro-Québec to be handled at the discretion of the G-2 facility.

A groundwater pumping system is located outside the Reactor Building and the system collects precipitation and groundwater from around and underneath the Reactor Building and the Spent Resin Storage Area using a weeping tile system. These sumps are automatically drained by permanently installed pumps, upon high level detection to the storm water system of Hydro-Québec 's G-2 NGS, which ultimately discharges to the St. Lawrence River.

Given that the contents of these sumps are not discharged to the environment by the G1WF but are instead handled as liquid waste subject to Hydro-Québec waste acceptance criteria and disposed of by Hydro-Québec according to their specifications, they are not considered a waterborne effluent source term of G1WF [4-1]

The waterborne releases at the G1WF are of precipitation and groundwater and are diverted away from the Reactor Building by the groundwater pumping system (North Pit (P3) and South Pit (P4)). No significant contamination is expected in this water, and it discharges into the G-2 facility's stormwater management system. Effluent sampling performed in 2015 confirmed that concentrations of contaminants relevant to the G1WF were less than corresponding criteria. Therefore, no non-radiological contaminants were retained for further analysis. Groundwater monitoring is performed twice per year [4-1].

4.3 Surface Water Environment

The Gentilly site is located on the south bank of the St. Lawrence River. The flow of the St. Lawrence River varies seasonally and is strongly affected by the spring flood. The portion of the St. Lawrence River within the region where the Gentilly site is located is known as a fluvial estuary and is approximately 2 km wide. The average flow rate of the St. Lawrence River, as measured in Trois-Rivières, is 11,600 m3/s. Salt water does not reach this portion of the St. Lawrence River, and the tidal influence is less than 0.3 m. There are long stretches of shallow marshland along the southern shore of the St. Lawrence River in this region that are often flooded [4-9].

The St. Lawrence River has two tributaries on the south shore close to the Gentilly site: the Bécancour River is located to the west, and the Gentilly River is located to the east (Figure 1-3). At the mouth of the Bécancour River, the St. Lawrence River is 3 km wide and reaches a 5 km width at the mouth of the Gentilly River. The annual average flow of the Bécancour River and the Gentilly River is 61 m3/s and 6.1 m3/s respectively. The highest water levels occur in April and the lowest water levels are in August and December. Some small streams, gullies and drainage ditches also drain into the St. Lawrence River. The mean tide in Bécancour is 0.6 m and the maximum rise and fall of the tide is approximately 0.8 m. The Gentilly site is at 6.1 m elevation, approximately 2.7 m higher than the average water level in the St. Lawrence River.

4.3.1 Radiological Surface Water Quality

In 1993, AECL1 and Hydro-Québec agreed that all areas, with the exception of the basement of the Service Building, be transferred to Hydro-Québec. The affected areas were cleaned to meet Hydro-Québec Zone 1 (uncontaminated area) criteria. CNL maintains the basement of the Service Building as part of the G1WF. All process systems that traversed the boundaries between the Hydro-Québec and CNL controlled areas were severed on CNL's side and capped if contaminated [4-17]. On CNL's side, only the sump systems are operational. The sumps have been decontaminated and are manually operated when high water levels are detected during visual inspection [4-17].

The water collected in the sumps is sampled and analyzed for beta/gamma-emitting radionuclides and tritium prior to acceptance by Hydro-Québec. The total annual activity in sump liquids has been relatively low; for example, in 2017, the total gross beta/gamma activity in sump liquids was measured by Hydro-Québec to be 1.14 MBq for a volume of 20,000 L [4-18].

As mentioned, although there are no liquid emissions (release) from the G1WF and therefore, no requirement for effluent monitoring at the G1WF, water from sumps S-001, S-012 and T-005 are collected in touts, analyzed, and upon meeting Hydro-Québec's release criteria, transported overland as waste to Hydro-Québec for release into the St. Lawrence River [4-16].

4.3.2 Non-Radiological Surface Water Quality

The primary non-radiological contaminants of concern are hazardous substances identified in the G1WF [4-2]. These have the potential to impact the surrounding environment and include asbestos insulation on piping and on mechanical insulation, lead-based paint on the structures, lead wool used to seal wall openings, lead-containing batteries, PCBs in fluorescent light ballasts, mercury in fluorescent and high intensity lights, and silica in poured concrete floors and concrete block walls.

4.4 Aquatic and Terrestrial Environment

4.4.1 Aquatic Environment

The aquatic flora is mainly composed of aquatic herbarium, which provides an optimal habitat for many aquatic and semi-aquatic species, such as muskrat. The humid region, due to the St. Lawrence River and its tributaries, results in swamps adjacent to the site. The areas flooded by the rivers are inhabited by many fish species. In the area of the Gentilly site, fish are attracted to the warm water. Sensitive aquatic species such as the Lake sturgeon, Eastern sand darter, bridle shiner, and channel darter have been identified in the St. Lawrence River. The St. Lawrence River is home to a wide variety of fish species. In 2022, Hydro-Québec carried out experimental fishing in the vicinity of these facilities [4-4]. A total of 15 different species of fish were caught, all of which are common in southwestern Quebec.

4.4.2 Terrestrial Environment

The Gentilly site is located within the larger Mixedwood Plains Ecozone in the ecoregion of St. Lawrence Lowlands [4-11]. The vegetation in this ecoregion is characterized by mixedwood forests dominated by sugar maple (*Acer saccharum*), yellow birch (*Betula alleghaniensis*), eastern hemlock (*Tsuga canadensis*), eastern white pine (*Pinus strobus*) and American beech (*Fagus grandifolia*) [4-19]. The region surrounding the Gentilly

[1] On November 3, 2014, Canadian Nuclear Laboratories (CNL), a wholly-owned subsidiary of Atomic Energy of Canada Limited (AECL), became responsible for the management and operation of AECL's sites. AECL is used in this document to refer to CNL activities prior to November 3, 2014.

site provides a variety of habitat. Common wildlife include white-tailed deer (*Odocoileus virginianus*), American black bear (*Ursus americanus*), moose (*Alces americanus*), coyote (*Canis latrans*), red fox (*Vulpes vulpes*), bobcat (*Lynx rufus*), snowshoe hare (*Lepus americanus*), North American porcupine (*Erethizon dorsatum*), American beaver (*Castor canadensis*), American marten (*Martes americana*), raccoon (*Procyon lotor*), least chipmunk (*Neotamias minimus*), waterfowl and other birds, including pileated woodpecker (*Dryocopus pileatus*) and yellow warbler (*Setophaga petechia*) [4-19].

The Gentilly site is located on the south bank of the St. Lawrence River (Figure 1-2), at an elevation of approximately 7.5 meters above the sea level. The flats located along the shoreline are ideal for migrating birds, as demonstrated by the presence of wildlife concentration areas in the vicinity of the Gentilly site. Wildlife concentration areas are sectors where birds gather during migration. The St. Lawrence River is an important migratory corridor for many species including those groups: gulls, dabbling and diving ducks [4-13]. Wildlife habitats in the vicinity of the Gentilly site are:

- Waterfowl concentration areas (903–Ile Montesson, 904-Pointe-aux-Roches, 905-Baie Lemarier, 912-Pte.Paul Rivière aux orignaux, and 917-Lac Saint-Paul-Rivière Godefroy).
- White-tailed deer concentration areas (1323-Bécancour and 1328-Dumoulin) [4-20].

It is important to distinguish the G1WF site from the Gentilly site and the surrounding area. There is no natural area within the G1WF site. The G1WF site is entirely comprised of buildings and hardscape (e.g., concrete, asphalt and packed gravel areas). Thus, the following descriptions of the natural environment apply to the area outside of the G1WF site, and in most cases, to the area outside of the Gentilly site altogether. There is a high degree of diversity in terrestrial habitats in the vicinity of the Gentilly site. The area is characterized by several types of wetland and terrestrial environments. Among the terrestrial environments are deciduous, coniferous and mixed forests. There are also various wetland types, the river, and waterbodies in the area. Among disturbed habitats, agricultural land represents the largest area. Other disturbed habitats include anthropogenic structures, gravel pits and other wooded, wasteland or bare areas.

The AONQ database documented the presence of 146 birds during the nesting season [4-20]. There are also several nests of migratory Cliff Swallow observed on the Reactor Building at the G1WF.

There are few formal wildlife inventories within the area of the Gentilly site available online. Among those studies available, there is AECOM [4-21] where data collection was carried out between 2011 and 2013 (Groupe Hemisphere 2013 [4-22] in AECOM 2015 [4-21]), Morin and Boulanger [4-23] with data collected from 2001 to 2007, and Nove Environnement in 2001 for Gentilly-2 Sector [4-24]. The focus of this assessment is based on those studies, but also known ranges of wildlife species, habitat suitability, a literature review of available databases such as Quebec Natural Heritage Data Center [Centre de données du patrimoine naturel du Québec (CDPNQ)] [4-25], eBird, and Quebec breeding birds Atlas [Atlas des oiseaux nicheurs du Québec (AONQ)] [4-20].

Waterfowl Concentration Areas (WCAs) are present near the site. The Baie Lemarier and Pointe-aux-Roches WCAs are located within a 1 km radius of Gentilly-1, and the Gentilly Beaches and the Champlain-Batiscan Beach WCAs are within a 5 km radius of the site.

Species at risk with distribution ranges in the vicinity of the Gentilly site are shown in Table 4-4.

Table 4-4: Species At Risk With Distribution Ranges In The Vicinity Of The Gentilly Site

Common Name	Scientific Name	At Risk Designation		
		COSEWIC	SARA	Québec
Vascular Plants				
Green dragon	*Arisaema dracontium*	SC	NAR	THR
Cattail sedge	*Carex typhina*	NAR	NAR	LDTV
Parker's pipewort	*Eriocaulon parkeri*	NAR	NAR	THR
Shreve's iris	*Iris virginica var. shrevei*	NAR	NAR	LDTV
Butternut	*Juglans cinerea*	END	END	LDTV
Pale-green orchid	*Platanthera flava var. herbiola*	NAR	NAR	LDTV
American ginseng	*Panax quinquefolius*	END	END	THR
Victorin's water-hemlock	*Cicuta maculata var. victorinii*	SC	SC	THR
Virginia chainfern	*Anchistea virginica*	NAR	NAR	LDTV
Amphibian and Reptiles				
Four-toed salamander	*Hemidactylium scutatum*	NAR	NAR	LDTV
Wood turtle	*Glyptemys insculpta*	THR	THR	VUL
Northern map turtle	*Graptemys geographica*	SC	SC	VUL
Northern Dusky salamander	*Desmognathus fuscus*	NAR	NAR	LDTV
Pickerel frog	*Lithobates palustris*	NAR	NAR	LDTV
Common snapping turtle	*Chelydra serpentina*	SC	SC	LDTV
Midland Painted turtle	*Chrysemys picta marginata*	SC	SC	LDTV
Western chorus frog	*Pseudacris triseriata*	NAR	THR	VUL
Eastern milksnake	*Lampropeltis triangulum*	SC	SC	NAR
Spiny softshell turtle	*Apalone spinifera*	THR	THR	THR
Blanding's turtle	*Emydoidea blandingii*	THR	SC	THR
Eastern musk turtle	*Sternotherus odoratus*	THR	THR	END
Snapping turtle	*Chelydra serpentina*	SC	SC	NAR
Spotted turtle	*Clemmys guttata*	END	END	LDTV
Mammals				
Gray fox	*Urocyon cinereoargenteus*	THR	THR	NAR
Eastern wolf	*Canis sp. cf. lycaon*	THR	THR	NAR
Little brown myotis	*Myotis lucifugus*	END	END	THR
Northern myotis	*Myotis septentrionalis*	END	END	THR
Silver-haired bat	*Lasionycteris noctivagans*	END	NAR	LDTV
Hoary bat	*Lasiurus cinereus*	END	NAR	LDTV
Tri-colored Bat	*Perimyotis subflavus*	END	END	THR
Eastern red bat	*Lasiurus borealis*	END	NAR	VUL
Birds				
Peregrine falcon anatum/tundrius	*Falco peregrinus anatum/tundrius*	NAR	NAR	VUL
Wood thrush	*Hylocichla mustelina*	THR	THR	NAR
Bank swallow	*Riparia riparia*	THR	THR	NAR
Barn swallow	*Hirundo rustica*	SC	SC	LDTV
Chimney swift	*Chaetura pelagica*	THR	THR	THR
Canada warbler	*Cardellina canadensis*	SC	THR	LDTV
Bald eagle	*Haliaeetus leucocephalus*	NAR	NAR	VUL
Eastern meadowlark	*Sturnella magna*	THR	THR	NAR
Short-eared owl	*Asio flammeus*	SC	SC	LDTV
Bobolink	*Dolichonyx oryzivorus*	SC	THR	NAR

Table 4-4: Species At Risk With Distribution Ranges In The Vicinity Of The Gentilly Site

Common Name	Scientific Name	At Risk Designation		
		COSEWIC	SARA	Québec
Great blue heron	*Ardea herodias*	SC	SC	NAR
Common nighthawk	*Chordeiles minor*	SC	THR	NAR
Eastern whip-poor will	*Antrostomus vociferus*	SC	THR	LDTV
Eastern woodpewee	*Contopus virens*	SC	SC	NAR
Evening grosbeak	*Coccothraustes vespertinus*	SC	SC	NAR
Grasshopper sparrow	*Ammodramus savannarum pratensis*	SC	SC	LDTV
Olive-sided flycatcher	*Contopus cooperi*	SC	SC	NAR
Red-headed woodpecker	*Melanerpes erythrocephalus*	END	THR	THR
Rusty blackbird	*Euphagus carolinus*	SC	SC	LDTV
Least bittern	*Ixobrychus exilis*	SC	THR	VUL
Fish				
Bridle shiner	*Notropis bifrenatus*	SC	SC	LDTV
Channel darter	*Percina copelandi*	NAR	NAR	VUL
Rosyface shiner	*Notropis rubellus*	NAR	NAR	LDTV
Eastern sand darter	*Ammocrypta pellucida*	SC	THR	THR
Stonecat	*Noturus flavus*	NAR	NAR	VUL
Invertebrates				
Monarch	*Danaus Plexippus*	END	END	NAR

Note:

SC: Special Concern; NAR: Not at Risk; END: Endangered; THR: Threatened; LDTV: Likely to be Designated Threatened or Vulnerable; VUL: Vulnerable.

Data Sources: [4-13], [4-14], [4-20], [4-25], [4-4], [4-21], [4-22], [4-23], [4-24] and [4-26].

Table 4-5 categorizes the habitat type for each migratory bird species identified in Table 4-4. Habitat are categorized by the following generic types:

- Anthropogenic: is any environment that has been created, heavily modified, or maintained by human activities, rather than occurring naturally [4-27].
- Forests: an ecosystem dominated by trees and woody vegetation, forming a largely continuous canopy that shapes the area's microclimate, understory structure, and ecological processes [4-28].
- Grasslands: a naturally occurring ecosystem where the vegetation is dominated by grasses with few or no trees or large shrubs [4-29].
- Shorelines : the transition zone where land and water meet, forming an ecotone influenced by both terrestrial and aquatic processes [4-30]
- Wetlands : an ecosystem where the soil is saturated with water, either permanently or seasonally, creating conditions that support hydrophytic (water-adapted) vegetation [4-31].

Table 4-5: Habitat Types for Bird Species At Risk With Distribution Ranges In The Vicinity Of The Gentilly Site

Common Name	Habitat Type Category [(a)]
Peregrine falcon	Shorelines / Anthropogenic
Wood thrush	Forests
Bank swallow	Shorelines
Barn swallow	Anthropogenic / Grasslands
Chimney swift	Anthropogenic
Cliff swallow	Anthropogenic / Shorelines
Canada warbler	Forests
Bald eagle	Forested
Eastern meadowlark	Grasslands
Short-eared owl	Grasslands
Bobolink	Grasslands
Great blue heron	Wetlands
Common nighthawk	Anthropogenic / Grasslands
Eastern whip-poor will	Forests
Eastern woodpewee	Forests
Evening grosbeak	Forests
Grasshopper sparrow	Grasslands
Olive-sided flycatcher	Forests
Red-headed woodpecker	Forests
Rusty blackbird	Wetlands
Least bittern	Wetlands

(a) Source: https://www.allaboutbirds.org/guide [4-32]

4.5 Surrounding Communities and Land Uses

Populations in the vicinity of the Gentilly site include those living within the Regional County Municipality of Bécancour on the south shore of the St. Lawrence River (population ~20,000), within the Regional County Municipality of Les Chenaux on the north shore of the St. Lawrence River (population ~18,000), and in the city of Trois-Rivières (population ~136,000) [4-33]. Land use in the immediate vicinity of the Gentilly site (i.e., within 5 to 10 km from the site) is rural residential, agricultural, and industrial. Agriculture in the area consists of dairy farming and fodder crops.

The Bécancour Waterfront Industrial Park [4-34] is situated immediately to the west of the Gentilly-2 boundary, and hosts approximately 30 companies, ranging from professional services companies to electrometallurgy and electrochemistry manufacturers which produce aluminum, metallic silicon, and other chemical products.

The majority of the population is located within 10 to 20 km from the Gentilly site, primarily in the city of Trois-Rivières (Figure 4-6). The area within 5 to 10 km is mostly rural, with the majority of the population residing in the town of Bécancour. Very few people live within 5 km of the Gentilly site as this area is comprised of industrial land and the St. Lawrence River.

Aside from the high industrial presence in the Bécancour Waterfront Industrial Park and in Trois-Rivières, this region continues to be predominantly agricultural. The main farming activity on the north and south shores of the St. Lawrence River is dairy farming. The main field crop in the region is fodder. In the region surrounding the

Gentilly site, there are no mining activities and no major institutions, such as convents, hospitals, military facilities, or detention facilities.

Through its engagement, CNL will continue to seek input from the indigenous people on Traditional Land Use or Indigenous Knowledge and consider it in the decommissioning project. See Section 3.1.2 for details.

Figure 4-6: Surrounding Region of the Gentilly Complex

4.6 References

4.6.1 Acts and Regulations

None

4.6.2 Literature Cited

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5 ENVIRONMENTAL EFFECTS ASSESSMENT

The environmental assessment process relies on information gathered from the existing environment (see Section 4 of this EPMR), the identification of changes to the environment as a result of the project activities (see Section 5.3 and Table 5-1 of this EPMR Project-Environment Interactions) and the impact of these changes on the workers, members of the public, Indigenous Nations and communities, the environment, health, social or economic conditions. This information and subsequent analysis are provided by data from CNL's comprehensive compliance programs and the required documents assessing the environmental risks at the G1WF. For example, the G1WF has an established Effluent Monitoring Program [5-1] with the purpose of demonstrating compliance with regulatory emission limits and any other regulatory requirements (e.g., Action Levels) concerning the emission of nuclear/hazardous substances from the source. A set of monitoring criteria [5-1] was established that are specific to the G1WF effluent streams to be monitored and the parameters to be measured. Each effluent stream at the G1WF, be it a fugitive/diffuse stream or a designed stream, is assessed against the monitoring criteria.

5.1 Assessment Approach

The assessment of environmental effects of a project is often an iterative process. Consistent with common accepted practice, quantitative and qualitative methods are used to predict and describe potential effects of normal conditions. Abnormal conditions are generally considered separately in the Accidents and Malfunctions section of this EPMR (Section 6), though are mentioned in this section.

To assess the environmental effects of a proposed activity, and the significance of any environmental effects, the following process was followed:

1. Identify changes to the existing environment that are a direct result of the proposed Project activities (see Section 4 for a description of the existing environment) and within a defined assessment boundary (See Section 5.2 of the EPMR).
2. If adverse changes to the environment are identified as a direct result of the proposed Project activities, establish technically and economically feasible mitigation measures to reduce or eliminate the adverse effects on the environment.
3. If after the technically and economically feasible mitigation measures are applied to reduce or eliminate the adverse environmental effects, adverse impacts still remain, the proposed activities are determined to cause adverse environmental effects (i.e. those that persist, despite efforts to avoid or minimize them).
4. If adverse environmental effects are predicted, determine the significance of the effects.

Although described with reference to certain environmental components, CNL's consideration of technical and feasible mitigation measures for each environmental component assumes and includes CNL's established and standard controls, policies and procedures will be implemented and enforced as applicable to the proposed Project.

As these are numerous in nature, they have not been specifically articulated in this EPMR. Additional mitigation measures may be developed and implemented as the Project proceeds, on an as needed basis, or as a result of further engagement with Indigenous peoples and the public. When required, future environmental reviews will be conducted by the Environmental Protection Program, as is typical of project activities that span over a long time frame.

The analysis assumes compliance with all applicable laws, regulations, codes, standards, and regulatory requirements, as well as CNL policies and procedures, and as such, is not stated in each assessment of a particular environmental component.

In making an Environmental Effects Determination, it is best practice to consider the potential for cumulative effects to occur. While an individual project may not result in significant adverse environmental effects, as a direct result of them being carried out on the federal lands, cumulative effects from surrounding activities, occurring presently or in the future, may influence whether adverse effects remain insignificant and therefore are considered in this EPMR.

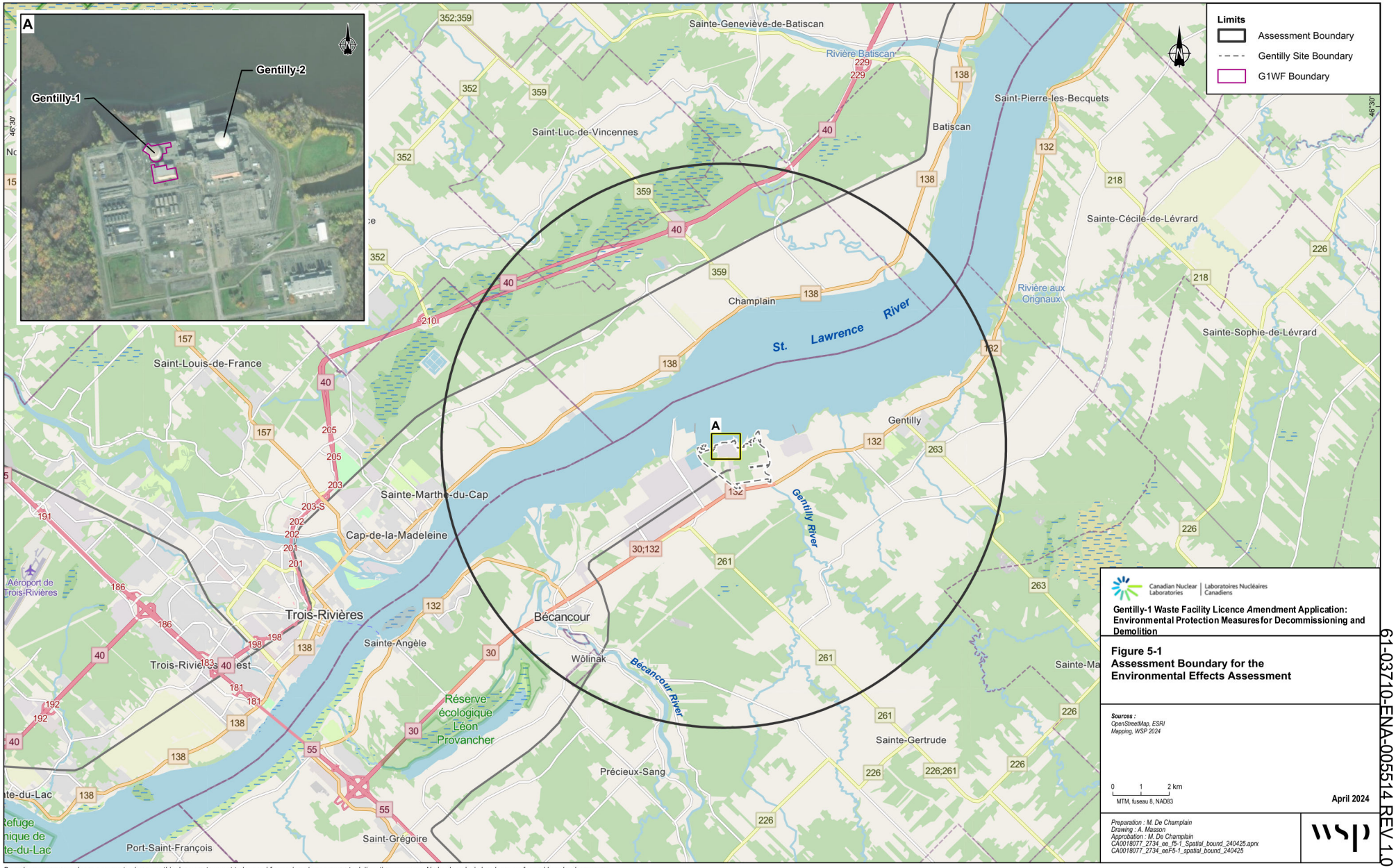
The existing conditions described in Section 4 of this EPMR include the combined effects from prior development and existing activities at the G1WF. This provides the basis for which the potential environmental effects from the Project are assessed. There are no other decommissioning activities occurring other than the Project at the G1WF. There are no reasonably foreseeable developments (i.e., those that are currently under application review or that have officially entered a regulatory application process) that would have overlapping effects with the Project.

Furthermore, the proposed activities are to occur within an existing, licensed, and comprehensively regulated nuclear facility and therefore, assuming this EPMR will conclude that it is unlikely that significant adverse effects will result from the proposed activities, the potential for cumulative effects to meaningfully inform the determination under section 82 of the IAA is negligible.

5.2 Assessment Boundary

An Assessment Boundary is used to define the geographic scope or limits of the analysis of effects from the Project on the environment. This boundary encompasses the area within which the Project is expected to interact with the environmental components. The Assessment Boundary for the environmental effects assessment is equivalent to the air quality assessment boundary, which is equivalent to approximately a 10 km radius circle centered on the Gentilly site.

The Assessment Boundary was intentionally aligned with the air quality assessment because the potential environmental effects are primarily related to changes in air quality and the limited areas of direct habitat disturbance. Establishing a single, consistent boundary across disciplines keeps the assessment focused on the factors most relevant to the Project’s scale and anticipated impacts. The Assessment Boundary is presented on Figure 5-1.



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Gentilly-1 Waste Facility Licence Amendment Application: Environmental Protection Measures for Decommissioning and Demolition

Figure 5-1
Assessment Boundary for the Environmental Effects Assessment

Sources :
OpenStreetMap, ESRI
Mapping, WSP 2024

0 1 2 km
MTM, fuseau 8, NAD83

April 2024

Preparation : M. De Champlain
Drawing : A. Masson
Approbation : M. De Champlain
CA0018077_2734_ee_f5-1_Spatial_bound_240425.aprx
CA0018077_2734_eeF5-1_spatial_bound_240425

wsp

Boundary accuracy and measurements shown on this document are not to be used for engineering or property delineation purposes. No land analysis has been performed by a land surveyor.

5.3 Project-Environment Interactions and Mitigation

5.3.1 Project-Environment Interactions Identification

Project-environment interactions identification is a process used to develop an understanding of how the Project activities may affect environmental components within the Assessment Boundary. A Project environment interactions matrix was developed that identified potential interactions among key Project facilities/activities and environmental components (i.e., atmospheric, geological, hydrogeological, surface water, terrestrial, and socio-economic environments, as well as land and resource use) for each planning envelope (Table 5-1).

The components that are not marked with a ✔ in the table are not expected to interact with a key Project component or activity. It is important to reiterate that the scope of the Project is limited to the decommissioning and demolition of the Southern portion of the Turbine Building, the basement portion of the Service Building, and the Reactor Building. As such, the interaction between the Project and the environmental components is limited. For example, the Project does not involve authorized releases to the surface water environment and does not interact with hydrology and hydrogeology.

Project environment interactions that are marked with a ✔ are then evaluated (Table 5-2) to determine whether the interaction has the potential to cause adverse environmental effects.

Based on the result of the Project environment interactions identification (Table 5-1), the potential for adverse environmental effects were identified for air quality (i.e., emissions), human and ecological health (i.e., changes to air quality) and wildlife (species at risk and migratory birds). However, adverse environmental effects may be limited through technically and economically feasible mitigation measures and are discussed further in this EPMR (Section 5.3.2).

Table 5-1: Project Environment Interactions

Key Project Component / Activity	Atmospheric Environment		Geologic And Hydrogeologic		Surface Water Environment			Terrestrial Environment		Human Environment			Land And Resource Use		
	Air Quality	Noise	Soil Quality	Groundwater Quality/ Quantity	Hydrology	Surface Water Quality/ Quantity	Aquatic Biota	Vegetation	Wildlife (Species at Risk and Migratory Birds)	Human Health Worker	Human Health Public	Ecological Receptors	Heritage And Cultural Resources	Traditional Land And Resource Use	Recreational Use
Planning Envelope-A: -Southern portion of the Turbine Building including the tunnel to the Reactor Building and SFCA; and Basement portion of the Service Building including spent resin storage area															
Removal of Equipment and non-structural components	✓	✓				✓	✓	✓	✓	✓		✓			
Dismantle and/or demolish building structures and removal of underground structures	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓		✓	✓
Backfill and landscape	✓	✓							✓						
Waste generation and management	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓		✓	✓
Planning Envelope-B: Reactor Building clear-out including calandria and bioshield; and dome and containment structure															
Removal of Equipment and non-structural components	✓	✓				✓	✓		✓	✓		✓			
Dismantle and/or demolish building structures	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓		✓	✓
Backfill and landscape	✓	✓							✓						
Waste generation and management	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓		✓	✓

5.3.2 Project-Environment Interactions Evaluation

To focus the assessment of effects on the most important and meaningful changes from the Project, Project environment interactions identified in Table 5-1, are evaluated to determine if there is the potential to cause an adverse effect for each environmental component. Each potential Project-environment interaction was evaluated, after the implementation of environmental design features and/or mitigation and was categorized as one of the following:

- **No interaction:** The interaction could be removed (i.e., effect would be avoided) by avoidance measures and/or additional mitigation so that the Project would result in no measurable environmental change relative to existing conditions or guideline values (e.g., air, soil, or water quality guidelines) and therefore would have no adverse effect on an environmental component.
- **Minor interaction:** With the application of mitigation measures, the interaction could result in a measurable but minor environmental change relative to existing conditions or guideline values, but the change is sufficiently small (i.e., negligible) that it would not have an adverse effect on an environmental component (e.g., an increase in an air quality parameter that is negligible compared to the range of existing values and is well within the air quality guideline for that parameter.
- **Primary interaction:** Even with the application of mitigation measures, the interaction is likely to result in an environmental change relative to existing conditions or guideline values that could cause a greater than negligible adverse effect on an environmental component.

Activities with no interaction with an environmental component, either because there was no interaction initially or because environmental design features or mitigation would remove the interaction, are described but not advanced to the adverse environmental effects assessment (Section 5.4). Interactions that were assessed to be minor are demonstrated to have a negligible adverse effect on an environmental component through simple qualitative or semi quantitative evaluation and were also described but not advanced for further assessment. Interactions that would result in changes to the environment and have the potential to cause a greater than negligible adverse effect on an environmental component were carried forward to the significant adverse environmental effects assessment (Section 5.4).

The results of the Project-environment interactions evaluation are provided in Table 5-2. For each Project-environment interaction, environmental design features and/or mitigation to be implemented to eliminate/reduce adverse environmental effects are described, and the resulting assessment of the interaction is identified.

Table 5-2: Potential Project Environment Interactions: Environmental Design Features, Mitigations, and Interaction Assessment

Interaction ID	Project Components/Activities	Project-Environment Interaction	Environmental Design Features And Mitigation	Interaction Assessment
01 (A, B)	▪ Decommissioning activities, including: ▪ use of vehicles and equipment that combust fuel and emit indicator compounds; ▪ removal of equipment and non-structural components; ▪ dismantle and/or demolish building structures and removal of underground structures ▪ backfilling and landscaping.	**01A** ▪ Changes in air quality from fugitive dust emissions may decrease the quality of soils, surface water, vegetation, and wildlife habitat, which may in turn affect traditional land and resource use and recreational use of the area. **01B** ▪ Changes in air quality from fugitive dust emissions may result in health effects to workers and the public, and ecological receptors.	▪ Implementation of dust management techniques (e.g., watering) to control dust generated by the Project. ▪ Use of dust suppression methods during building demolition activities to control airborne emissions and nuisance dust during building. Methods may include: ▪ wetting techniques during demolition to limit mobility of dust; and ▪ wind restrictions during demolition to stop work or apply wetting techniques. ▪ Curtailment of activities during periods of adverse meteorological conditions (e.g., during periods of high winds). ▪ Road watering and sweeping when necessary. ▪ Removal of accumulations of particulates (e.g., dirt) on road as soon as possible. ▪ Limit idling of vehicles on-site and speed on roads. ▪ Use of tarps or 3-sided enclosures for raw material storage.	**Minor Interaction – 01A** ▪ Soil Quality ▪ Surface Water Quality ▪ Aquatic Biota ▪ Vegetation ▪ Wildlife (SAR and migratory birds) ▪ Traditional Land and Resource Use ▪ Recreational Land Use **Primary Interaction – 01B** ▪ Air Quality ▪ Human Health – Worker ▪ Human Health – Public ▪ Ecological Health
02 (A, B)	▪ Decommissioning activities, including: ▪ removal of equipment and non-structural components; and ▪ dismantle and/or demolish building structures and removal of underground structures.	**02A** ▪ Changes in air quality from non-radiological and radiological emissions may decrease the quality of soils, surface water, vegetation and wildlife habitat, which may in turn affect traditional land and resource use and recreational use of the area. **02B** ▪ Changes in air quality from non-radiological and radiological emissions may result in health effects to workers and the public, and ecological receptors.	▪ Environmental Reviews of decommissioning activities for each planning envelope will be conducted and will include need-for-monitoring assessments, as applicable. ▪ Use of contamination immobilization agents, containment, ventilation and HEPA filters to control generation of airborne emissions during decontamination or removal of contaminated systems or structures. ▪ Curtailment of activities during periods of adverse meteorological conditions (e.g., during periods of high winds). ▪ Use of tarps or 3-sided enclosures for raw material storage (e.g., cement). ▪ Packaging of wastes in appropriate containers.	**Minor Interaction – 02A** ▪ Air Quality ▪ Soil Quality ▪ Surface Water Quality ▪ Aquatic Biota ▪ Vegetation ▪ Wildlife (SAR and migratory birds) ▪ Traditional Land and Resource Use ▪ Recreational Land Use **Primary Interaction – 02B** ▪ Air Quality ▪ Human Health – Worker ▪ Human Health – Public ▪ Ecological Health
03	▪ Decommissioning activities, including ▪ use of vehicles and equipment that combust fuel and emit indicator compounds; ▪ removal of equipment and non-structural components; ▪ dismantle and/or demolish building structures and removal of underground structures; ▪ waste generation and management; and ▪ backfilling and landscaping.	▪ Decommissioning activities may result in worker injury due to conventional hazards, and exposure to radiation hazards, and hazardous materials.	▪ Radiation exposure to workers is managed under CNL's Radiation Protection Program to ensure doses remain below regulatory limits. ▪ Administrative controls include use of dose control points, which are assigned to workers and which if exceeded, trigger management review. ▪ Worker radiation doses will be monitored throughout the Project to ensure that doses do not exceed dose control points and are within regulatory limits. ▪ Operational control measures will be implemented to mitigate worker exposure to radiation. Examples of measures that may be implemented are: ▪ Protective clothing such as respirators and other protective measures; ▪ Shielding to reduce radiation fields; ▪ Workplace isolation – ventilated enclosures equipped with HEPA filtration units; ▪ Air monitoring; and ▪ Use of electronic personal dosimeter. ▪ The Work Permit System and Occupational Health and Safety Program will be applied to minimize the risk to workers from conventional industrial hazards.	**Minor Interaction** ▪ Human Health – Worker

Table 5-2: Potential Project Environment Interactions: Environmental Design Features, Mitigations, and Interaction Assessment

Interaction ID	Project Components/Activities	Project-Environment Interaction	Environmental Design Features And Mitigation	Interaction Assessment
04 (A, B)	▪ Decommissioning activities, including : ▪ use of vehicles and equipment; ▪ removal of equipment and non-structural components; ▪ dismantle and/or demolish building structures and removal of underground structures ▪ waste generation and management; and ▪ backfilling and landscaping.	**04A** ▪ Sensory disturbance from increased noise levels created by decommissioning activities, backfilling and landscaping may affect the health of nearby off-site human receptors, traditional land and resource use, and recreational use. **04B** ▪ Sensory disturbance has the potential to affect the quality of wildlife habitat, causing displacement of wildlife.	▪ Ensure all equipment is in proper working order and mufflers working properly. ▪ Decommissioning activity will be primarily limited to daytime hours and noise will be short-term and sporadic. ▪ Decommissioning of the buildings will be completed in a controlled manner, and the loudest activities will be limited to the interior of the building envelope, which will serve to reduce the level of noise outside the building, and in the surrounding area. ▪ Regularly train workers and contractors to use equipment in ways that minimize noise. ▪ Limit idling and turn off equipment when it is not being used for extended periods of time. ▪ Municipal and provincial noise regulations and guidelines may be implemented in addition to those required by Federal law.	**Minor Interaction – 04A** ▪ Traditional Land and Resource Use ▪ Recreational Land Use **Primary Interaction – 04B** ▪ Wildlife (SAR and migratory birds)
05 (A, B)	▪ Decommissioning activities, including : ▪ removal of equipment and non-structural components; and ▪ dismantle and/or demolish building structures and removal of underground structures.	**05A** ▪ Potential loss or alteration of wildlife habitat from surface water runoff, which may in turn affect traditional land and resource use and recreational use of the area. **05B** ▪ Potential loss or alteration of wildlife habitat from demolition of the above ground buildings.	▪ Pre-disturbance surveys by suitably trained and experienced biologists or environmental specialists will be conducted to confirm potential for presence/absence of bat roosts and cliff swallow nests prior to removal of suitable nesting areas. ▪ As a precaution, pre-disturbance searches for hibernating bats will also be conducted during the winter prior to the initiation of decommissioning to confirm the absence of hibernating individuals inside the below-grade floors of the G1WF buildings, taking ALARA into consideration. ▪ If active bat maternity roosts are identified in any structure to be affected by decommissioning, initiate erection of species-appropriate barriers once individuals have left the structure and roosts/nests are no longer active. ▪ Avoid carrying out potentially destructive or disruptive activities during sensitive periods and in sensitive locations in order to reduce the risk of affecting birds, their nests and eggs. If activities cannot be avoided, develop and implement appropriate preventive and mitigation measures to minimize the risk of bycatches and help maintain sustainable migratory bird populations. Bird nesting periods normally range from mid-April to mid-August. ▪ Erosion and sediment control practices (e.g., silt fences, runoff management) already in place will be used during decommissioning activities around disturbed areas, where appropriate.	**No Interaction - 05A** ▪ Wildlife (SAR and migratory birds) **Primary Interaction – 05B** ▪ Wildlife (SAR and migratory birds)
06 (A, B)	▪ Decommissioning activities, including: ▪ use of vehicles and equipment; ▪ removal of equipment and non-structural components; ▪ dismantle and/or demolish building structures and removal of underground structures; and ▪ waste generation and management	**06A** ▪ Liquid release of chemical and radiological contaminants may decrease the quality of soils, groundwater, surface water quality, aquatic biota, vegetation, and wildlife habitat, which may in turn affect traditional land and resource use and recreational use of the area. **06B** ▪ Liquid release of chemical and radiological contaminants may result in health effects to workers, the public, and ecological receptors.	▪ A characterization survey will confirm the presence of contaminated liquids and sludge in soil, tanks, pipes, or drums and abandoned chemical and/or active drains. ▪ Approved work plans, waste management plan(s) and a related Work Authorization must be in place for decommissioning activities in order to assess the need for additional mitigation measures. ▪ If discovered, any radiological waste will be monitored and characterized to determine appropriate disposal route prior to transport. ▪ Vehicles/equipment will be maintained in good working order. ▪ If water accumulates in soil excavation areas, (e.g., rainwater, surface water, groundwater), the water must be sampled and analyzed to determine disposal route following Acceptability Criteria for Routine and Non-Routine Discharge of Liquids. ▪ Building and/or storm drains will be isolated and or covered to prevent the release of any spilled contaminated water and fluids outside of the buildings. ▪ Non-routine liquid discharges must meet requirements of Acceptability Criteria for Routine and Non-Routine Discharge of Liquids. In the event of any accidents and/or spills involving mobile equipment and hazardous material of radioactive waste, contamination will be cleaned up in accordance with CNL emergency procedures and processes. ▪ Standalone spill kits are to be made readily available and stocked to ensure appropriate use. Mobile spill kits should be carried on all heavy equipment and mobile equipment immediately shutdown (and spill contained) in the event of a hydraulic oil leak or fuel spill. ▪ Environmental monitoring around the Gentilly site is required and will continue for the Project.	**No Interaction – 06A** ▪ Soil Quality ▪ Hydrogeology ▪ Surface Water Quality ▪ Aquatic Biota ▪ Vegetation ▪ Wildlife (SAR and migratory birds) ▪ Traditional Land and Resource Use ▪ Recreational Land Use ▪ Human Health – Worker **Primary Interaction – 06B** ▪ Human Health – Public ▪ Ecological Health

Table 5-2: Potential Project Environment Interactions: Environmental Design Features, Mitigations, and Interaction Assessment

Interaction ID	Project Components/Activities	Project-Environment Interaction	Environmental Design Features And Mitigation	Interaction Assessment
07 (A, B)	▪ Decommissioning activities, including: ▪ removal of equipment and non-structural components; ▪ dismantle and/or demolish building structures and removal of underground structures; and ▪ waste generation and management	**07A** ▪ The generation and management of liquid and solid, non-radioactive, hazardous and non-hazardous waste may decrease the quality of soils, surface water quality, aquatic biota, vegetation, and wildlife habitat, which may in turn affect traditional land and resource use and recreational use of the area. **07B** ▪ The generation and management of liquid and solid, non-radioactive, hazardous and non-hazardous waste may result in health effects to workers, the public, and ecological receptors.	▪ All waste including contaminated soil (if encountered) from excavations will be characterized and managed according to the approved Waste Management Plan. ▪ All liquid waste containers will be clearly labelled with the appropriate information (e.g., contents, radioactivity, chemical reactivity, contact person). ▪ Waste sorting and size reduction (including packaging) will be practiced to the extent possible during all activities. ▪ Radioactive or chemically contaminated sludge and soil must be stored and transported in drums or other suitable containers with no stockpiling in the field. ▪ Asbestos containing material will be managed in accordance with CNL's procedure Controlling Asbestos Hazard. ▪ Hazardous waste will be managed according to Waste Management Plans developed from characterization surveys and relevant procedural requirements.	**No Interaction – 07A, B** ▪ Soil Quality ▪ Surface Water Quality ▪ Aquatic Biota ▪ Vegetation ▪ Wildlife (SAR and migratory birds) ▪ Human Health – Worker ▪ Human Health – Public ▪ Ecological Health ▪ Traditional Land and Resource Use ▪ Recreational Land Use

5.3.2.1 No Interaction

The following interaction was assessed as having no measurable environmental change and therefore, would have no adverse effect on the environment.

05A – Potential loss or alteration of wildlife habitat from surface water runoff, which may in turn affect traditional land and resource use and recreational use of the area.

06A- Liquid release of chemical and radiological contaminants during decommissioning activities may decrease the quality of soils, groundwater, surface water quality, aquatic biota, vegetation, and wildlife habitat, which may in turn affect traditional land and resource use and recreational use of the area.

Equipment removal, hazard abatement, demolition activities, waste disposal, on-site transportation activities and fuel equipment operation may cause liquid radiological and non-radiological hazardous releases to the environment. The activities of draining, pumping and transporting residual liquid and sludge from piping, tanks and sumps may also result in radiological and non-radiological releases that have the potential to change soil quality, groundwater quality, surface water quality, the quality of and abundance of aquatic and terrestrial vegetation, the quality of wildlife habitat, and traditional land and resource use and recreational land use through decrease of the water and land quality.

A characterization survey will confirm the presence of contaminated liquids and sludge in soil, tanks, pipes or drums and abandoned chemical and/or active drains. Workers must obtain related clearance forms in the IWC process [5-5] to ensure proper controls and monitoring are used for abatement activities of all hazardous materials including asbestos containing material, mercury, PCBs and lead. Qualified asbestos abatement workers will be used to complete the work following Québec Regulation (R.Q.c.S-2.1, r.13, Division IX.I).

Approved work plans, waste management plan(s) and a related Work Authorization must be in place for decommissioning activities to assess the need for additional mitigation measures [5-5]. All activities including workplace air monitoring will be conducted according to an approved Radiological Work Assessment. If discovered, any radiological waste will be monitored and characterized to determine appropriate disposal route prior to transport. Vehicles/equipment will be maintained in good working order. Equipment using fuel and generating emissions should not be left idling when not in use. Dust suppression techniques (water spray/misting during demolition) will be used for controlling airborne particulate emissions without causing surface runoff into the nearby storm drain or erosion impacts. In addition, storm drains are to be covered during demolition water spraying activities to prevent release of contaminated water and fluids outside of the building.

With the implementation of the above mitigation measures, the potential release of chemical or radiological contaminants during decommissioning is expected to result in no measurable environmental change in Soil Quality, Hydrogeology, Surface Water Quality, Aquatic Biota, Vegetation, Wildlife, Traditional Land and Resource Use, and Recreational Land Use.

07A, 07B – The generation and management of liquid and solid, non-radioactive, hazardous and non-hazardous waste may decrease the quality of soils, surface water quality, aquatic biota, vegetation, and wildlife habitat, which may in turn affect traditional land and resource use and recreational use of the area.

Project activities that may result in the generation of waste could occur through the following sources:

- The generation of liquid and solid, non-radioactive, hazardous and non-hazardous waste during decommissioning activities.
- Soil excavation, backfilling and concrete removal activities could result in generation of contaminated waste.
- Hazardous waste will be generated from the removal of asbestos containing material, mercury, PCBs, and lead.
- Radioactive waste from legacy contamination could be generated/encountered during soil excavation work.

Generation of decommissioning waste has the potential to decrease the quality of soil, surface water, aquatic and terrestrial vegetation, and wildlife habitat, which can subsequently affect traditional land and resource use and recreational land use. In addition, the generation of liquid and solid, non-radioactive, hazardous and non-hazardous waste may, if not handled appropriately, result in health effects to workers, the public, and ecological receptors.

At G1WF, the waste generated from the decommissioning activities will be identified and accounted for under the following three categories:

- Potentially Clearable Waste (i.e., clean waste or likely clean waste)
- Radioactive Waste (i.e., ILW and LLW), or
- Hazardous Waste (e.g., asbestos containing material, lead, PCBs, mercury, silica)

The hazardous waste will be removed and disposed of before the commencement of the decommissioning and demolition activities; therefore, decommissioning waste inventory is expected to include radioactive waste (ILW and LLW) and potentially clearable waste only. However, if hazardous/designated materials (e.g., hazardous building materials that remain as part of the building structure) are discovered during decommissioning, these will be removed, packaged, and disposed in accordance with the project specific Waste Enquiry Form and CNL's Hazardous and Mixed Waste Management [5-6], Management of Designated Toxic Substances [5-7], and Controlling Asbestos Hazard [5-8] procedures. High level waste is not anticipated to be generated during decommissioning.

Prior to commencing the Project and the demolition of G1WF buildings and structures, the stored waste present within these buildings will be monitored, segregated, packaged or contained, and shipped for either processing, storage, or disposal as appropriate and in accordance with the Waste Management Plan for the Gentilly-1 Prototype Reactor Site [5-9]. Consideration will be given to control dismantling techniques, decontamination, contamination control, segregation of waste materials, reduction of active secondary wastes, and effective processing in order to minimize the amount of materials that need to go to a licensed waste management facility. Wherever possible, materials will be decontaminated to allow for unrestricted release or disposal in an inactive landfill.

The radioactive waste (LLW and ILW) generated during the decommissioning of G1WF buildings and structures will consist of concrete, process components (mechanical, electrical and communications) and architectural and structural materials. Radioactive waste (ILW and LLW) will be shipped to an appropriate off site waste management facility for processing/storage/disposal. The off-site waste management facilities will be designated

in each DDP and Decommissioning Work Plans. Transportation and the processing, storage or disposal of waste generated by the Project activities is not a part of the Project.

After completion of the demolition activities, the radiation surveys of the affected areas including building footprint of each of the buildings and structures will be conducted to ensure the affected areas are cleared of contamination and meet the criteria for Radiological Safety Zone 1 designation (i.e., very low level radiological hazard workplace and considered as a “Clean” zone). If radiation surveys reveal no contamination or contamination below the clearance level in the soil, then the areas will be backfilled and/or graded. On the other hand, if contamination is found in the soil above the clearance level, the contaminated soil will be removed, categorized, and packaged in appropriate containers for interim storage and subsequent transfer to a radioactive waste storage or disposal facility as per the CNL procedure, Management of Waste [5-10]. If the excavated gravel/soil is free of contamination but not suitable for re-use (i.e., for backfilling), it will be hauled away and, for proper compaction, new gravel/soil will be used to backfill the excavated areas. Any deep voids (i.e., below bedrock level) created by the removal of building foundations, footings, and/or buried services will be filled with grout up to the level of the bedrock.

The LLW and ILW will be segregated, packaged, and consolidated at one of the CRL Waste Management Areas for interim storage or to a licensed off-site facility for processing in accordance with the CNL Waste Management Program [5-11], Radiation Protection Program [5-12], and the Transportation of Dangerous Goods Program [5-13] requirements. To meet the requirements of CNL’s Transportation of Dangerous Goods Program [5-13] and the regulatory requirements for waste transport, necessary packages will be identified, designed, tested, and procured prior to the decommissioning project. The required licences, approvals, and certifications will also be obtained before the packages are put into service.

Waste generated during decommissioning activities will be managed in accordance with the Waste Management Program [5-11], which applies all operations and activities that result in the generation, transportation, treatment, storage, and/or disposal of wastes (i.e., the lifecycle of waste) by CNL. As such, the generation and management of waste is expected to result in no measurable environmental change to Air Quality, Soil Quality, Surface Water Quality, Aquatic Biota, Vegetation, Wildlife, Human Health – Worker, Human Health – Public, and Ecological Health.

5.3.2.2 Minor Interaction

The following interactions were assessed as having a negligible environmental change and therefore, would not have an adverse effect on the environment.

01A - Decommissioning activities will alter concentrations of fugitive dust indicator compounds, that may affect the environment.

Project activities will result in fugitive dust emissions associated with the operation of vehicles and equipment, as well as material handling emissions from demolition, backfilling, landscaping, and transportation of waste to the segregation area. Significant adverse environmental effects on air quality, in turn, have the potential to change soil quality, surface water quality, the quality and abundance of aquatic and terrestrial vegetation, the quality of wildlife habitat, and traditional land and resource use, as well as recreational land use, through decreased water and land quality.

Examples of mitigation practices implemented to limit predicted significant adverse environmental effects to air quality from fugitive dust include:

- Wetting techniques during demolition to limit mobility of dust.
- Wind restrictions during demolition to stop work or apply wetting techniques.
- Road watering and sweeping when necessary.
- Removal of accumulations of particulates (e.g., dirt) on road as soon as possible.
- On site vehicles and equipment engines will meet a minimum of Tier 4 emission standards, where possible, and be maintained in good working order.
- Limit idling of vehicles on site and limit speed on roads.
- Use of tarps or 3 sided enclosures for raw material storage.

The predicted fugitive dust emissions were estimated to increase because of the Project. Fugitive dust from demolition and material handling of the demolished material are the largest contributor to SPM, PM_{10} and $PM_{2.5}$ emissions. Non road equipment exhaust emissions are the largest contributors to NO_x (as NO_2), SO_2 and CO emissions. Predicted concentrations from decommissioning activities are below applicable air quality guidelines and/or standards. With the exception of asbestos materials and residual lead-based paints, the buildings are not known to contain measurable quantities of non-radiological hazardous substances with the potential to generate airborne emissions.

Through the implementation of the dust management techniques for the Project, fugitive dust and subsequent deposition are not expected to result in an adverse effect on Soil Quality, Surface Water Quality, Aquatic Biota, Vegetation, Wildlife, Traditional Land and Resource Use and Recreational Land Use.

02A - Decommissioning activities will alter concentrations of non-radiological and radiological emissions that may affect the environment.

Project activities will result in non-radiological and radiological emissions associated with the decommissioning activities material handling, and transportation of the wastes to the segregation area. Significant adverse environmental effects to air quality, in turn, have the potential to change soil quality, surface water quality, the quality of and abundance of aquatic and terrestrial vegetation, the quality of wildlife habitat, and traditional land and resource use and recreational land use through decrease of the water and land quality.

Materials such as insulating material and asbestos are handled through existing strict procedures outlined in the Management Control Procedure, Controlling Asbestos Hazards [5-8]. With the exception of asbestos materials and residual lead-based paints, the buildings are not known to contain measurable quantities of non-radiological hazardous substances with the potential to generate airborne emissions. Asbestos will be removed in accordance with CNL's procedure for control of asbestos hazards [5-8]. The requirements are consistent with those of provincial regulations (R.Q. c. S- 2.1, r.13, Division IX.I).

Radioactive particulates from concrete scabbling and cutting will be mitigated using dust suppression techniques (e.g. workplace isolation using enclosures and/or air filtration units), air monitoring and application of fixatives to seal contamination to surfaces and reduce particulate generation during dismantling and cutting operations. A building enclosure with HEPA filtration may be included as part of decommissioning to prevent release of

radioactive particulate. Emissions of radioactive particulates during waste transfer operations to waste management facilities will be mitigated through packaging of wastes in appropriate containers. The Waste Management Plan defines packaging requirements for each type of waste (i.e., concrete waste, scrap metal, soil).

Radiological air monitoring is completed, as per CNL's Radiation Protection Requirements [5-12], to confirm that airborne alpha and beta/gamma contamination levels in the work environment are acceptably low. The deployment of appropriate types of Continuous Air Monitors at various strategic locations, as specified in Radiological Work Plans provide adequate airborne activity monitoring throughout the decommissioning period.

The Management and Monitoring of Effluents and Emissions [5-15] outlines the key management practices that limit air quality emissions effects. In addition, through the implementation of the mitigation measures for the Project, non fugitive, non-radiological and radiological air emissions are not expected to result in an adverse effect on Air Quality, Soil Quality, Surface Water Quality, Aquatic Biota, Vegetation, Wildlife, Traditional Land and Resource Use and Recreational Land Use.

03 - Decommissioning activities may result in worker injury due to conventional hazards, and exposure to radiation hazards, and hazardous materials.

The primary risk to workers is from possible exposure to the residual radioactive contamination in the buildings. Project activities with the potential to expose workers to radiation are:

- Removal of equipment and hazards.
- Dismantling of building structures and components.
- Site remediation.
- Segregation and management of waste.

Radiation exposure to workers will be mitigated through compliance with administrative and operational controls. Radiation exposure to workers is managed under CNL's Radiation Protection Program [5-12] to ensure doses remain below regulatory limits. Administrative controls include use of dose control points, which are assigned to workers and which if exceeded, trigger management review. Worker radiation doses will be monitored throughout the project to ensure that doses do not exceed dose control points and are within regulatory limits.

Operational control measures will be implemented to mitigate worker exposure to radiation. Examples of measures that may be implemented are:

- Protective clothing such as respirators and other protective measures.
- Shielding to reduce radiation fields.
- Workplace isolation – ventilated enclosures equipped with HEPA filtration units.
- Air monitoring.
- Use of electronic personal dosimeter.

Mitigation measures to prevent airborne contamination and release of particulates (dust suppression techniques and application of fixatives to seal contamination to surfaces) will also serve to reduce worker radiation exposure. The exact preventive measures will be defined through the use of CNL's Work Permit System [5-5] and the ALARA program [5-16]. The work permit system is also used to ensure that potential radiological hazards are assessed.

The ALARA program [5-16] formalizes the planning processes applied to radiation work to maintain radiation doses ALARA. These planning processes include a review of radiation and industrial hazards, estimation of individual and collective doses, selection of appropriate tools and instruments, protection measures and dosimetry.

Conventional hazards exist for all decommissioning activities. The hazards that workers are exposed during these decommissioning activities include:

- Confined space entry
- Working at heights
- Slips, trips and falls
- Electrical hazards
- Pressurized systems
- Power tool injuries during decommissioning activities
- Lifting and moving heavy items
- Overhead hazards due to hoisting and rigging
- Noise

The Work Permit System [5-5] and Occupational Health and Safety Program [5-17] will be applied to minimize the risk to workers from conventional industrial hazards. The Work Permit System [5-5] provides a systematic approach to identifying hazards and planning work, thus ensuring that staff is appropriately qualified and equipped. Adherence to these procedures and operational measures identified will ensure no potential impacts on worker health from conventional industrial hazards.

Hazardous materials are limited to small quantities of asbestos, silica dust, lead-based paints, lead bricks and sheets, mercury from mercury switches and PCBs from light ballasts. Potential exposure to hazardous materials may occur during removal of equipment and hazards.

Risk of worker exposure to the hazardous materials present (i.e., asbestos, lead, silica dust, mercury and PCBs) will be minimized through application of CNL's Work Permit System [5-5] and adherence to CNL's Occupational Health and Safety Program [5-17]. The protective measures for exposure to asbestos dust and lead dust during asbestos and paint removal are similar to those for radioactive particulates (e.g., dust suppression, ventilated enclosures with air filtration and PPE&C for workers). Asbestos hazards will be mitigated through adherence to CNL's procedure for Controlling Asbestos Hazards [5-8]. These include use of dust suppression, air sampling and protective clothing and respirators, as required.

Radiation doses to workers will be kept below regulatory limits through adherence to CNL's Radiation Protection Program [5-12]. Risk to workers from conventional/industrial hazards and hazardous material will be minimized through adherence to CNL's Occupational Health and Safety Program [5-17]. As such, worker injury due to conventional hazards, and exposure to radiation hazards, and hazardous materials is considered to be negligible.

04A - Sensory disturbance from increased noise levels created by decommissioning activities, backfilling and landscaping may affect the health of nearby off-site human receptors, traditional land and resource use, and recreational use.

CNL expects potential noise emissions during its decommissioning planning processes and will implement appropriate prevention and mitigation measures. Decommissioning activities are expected to increase the level of nuisance noise in the immediate vicinity of the Gentilly site. However, they are not expected to have an effect on the health of nearby off-site human receptors, traditional land and resource and recreational land users in the area because of mitigation and management practices put in place for the Project. Decommissioning activity will typically be limited to daytime hours, where possible, and noise will be short-term and sporadic. Decommissioning of the buildings will be completed in a controlled manner, and no blasting will be required. The loudest decommissioning activity will likely be noise from a percussion hammer on an excavator, which will be used to break up reinforced concrete walls and floors during demolition. This activity will be limited to the interior of the building envelope, which will serve to reduce the level of noise outside the building, and in the surrounding area.

The Gentilly Nuclear Complex, which includes Gentilly-2, is located within a controlled exclusion zone of approximately 900 m that restricts unauthorized access and habitation. Activities are limited in scale and duration. Noise levels decrease significantly with distance due to geometric spreading and atmospheric absorption. The site is adjacent to the Bécancour Waterfront Industrial Park, an area already characterized by heavy industrial activity. Given the separation between the Project activities and the nearest receiver, any incremental increase in noise or vibration from decommissioning is likely to be indistinguishable from existing industrial operations.

Project activities are not expected to introduce new dominant sources or exceed Health Canada's guideline thresholds. As such, Health Canada's guidelines are unlikely to be exceeded given the distance to the nearest potential receptor and the use of standard mitigation measures (e.g., equipment maintenance, restricted work hours). This buffer limits human exposure to sensory disturbance from on-site activities. As such, effects from physical stressors such as noise, on the health of nearby off-site human receptors, are considered to be negligible.

Project activities will increase noise levels, which could affect the distribution of wildlife species harvested by resource users [5-18]. Changes to the distribution of wildlife species could in turn affect traditional land and resource use, as they constitute some of the resources on which these activities are dependent. There is already anthropogenic activity ongoing at the Gentilly site that wildlife would have become habituated to since the inception of the site. In addition, the predicted level and nature of noise associated with decommissioning activities (with the loudest activity occurring inside the building), and the attenuation of noise that occurs with distance and tree cover. Due to the nature of the noise produced by Project activities (sporadic, short term, no blasting), noise is not expected to result in changes of wildlife distribution that could affect traditional land and resource use, and recreational use.

5.3.2.3 Primary Interaction

The following interactions were assessed as having a measurable environmental change and subsequently, a adverse effect on an environmental component. As such, these interaction were carried forward to the Assessment of Adcverse Environmental Effects (Section 5.4).

- **01B – Changes in air quality from fugitive dust emissions may result in health effects to workers and the public, and ecological health.**
- **02B – Changes in air quality from non-radiological and radiological emissions may result in health effects to workers and the public, and ecological health.**
- **04B - Sensory disturbance has the potential to affect the quality of wildlife habitat, causing displacement of wildlife.**

- **05B – Potential loss or alteration of wildlife habitat from demolition of the above ground buildings.**
- **06B- Liquid release of chemical and radiological contaminants during decommissioning activities may affect human health – workers and public, and ecological health.**

5.4 Assessment of Adverse Environmental Effects

Adverse environmental effects are those effects that remain after mitigation measures have been applied with known or expected success and are expected to create a measurable effect on an environmental component. These effects are not negligible; rather, they are anticipated to have enough magnitude, duration, or extent to warrant detailed consideration. Accordingly, each identified adverse effect is fully assessed, and a determination of its significance is provided to clearly communicate the potential implications of the Project on the environment.

Based on the results of the Project environment interactions analysis, the Project was determined to have greater than negligible adverse environmental effects on air quality (Section 5.4.1), human and ecological health (Section 5.4.2) and wildlife species at risk and migratory birds (Section 5.4.3).

For those interactions where a greater than negligible adverse environmental effect was identified, an environmental effects assessment is completed to determine if the Project is likely to cause significant adverse environmental effects. The adverse environmental effects are classified using direction, magnitude, geographic extent, duration, reversibility, frequency, and probability of occurrence as criteria to determine if the adverse effect is significant (Table 5-3).

Table 5-3: Criteria Used for the Determination of Significance

Significance Criteria	Criteria Rankings
Magnitude: a measure of the intensity or the degree of change caused by the Project, relative to existing conditions.	**Low**: no measurable changes from existing conditions. **Moderate**: could result in a measurable but minor environmental change relative to existing conditions but this change would be sufficiently small that it would have a negligible adverse effect, or the change remains below criteria. guidelines or standards. **High**: changes are above criteria, guidelines or standards.
Geographic Extent: refers to the area or distance covered by the effect on environmental components.	**Small**: effects that are confined to the Project footprint. **Medium**: effects that may extend beyond the Project footprint but are confined to the Gentilly site. **Large:** effects that may extend beyond the Gentilly site but are confined to the Assessment Boundary.
Duration: the amount of time between the start and end of a Project activity and the time required for the effect on the environmental component to be reversed.	**Short-term**: the adverse effect ends immediately following cessation of the activity. **Medium-term**: the adverse effect may last for less than 1 month following cessation of the activity. **Long-term**: the adverse effect may last for more than 1 month following cessation of the activity.
Frequency: refers to how often an adverse environmental effect would occur during the Project.	**Rare:** once or a few times. **Often**: occurs consistently at regular intervals. **Continuous**: occurs continuously.
Reversibility: after removal of the Project activity, reversibility describes whether the Project would no longer influence an environmental component.	**Reversible**: the adverse effect is reversible within a defined period of time. **Irreversible:** the adverse effect lasts indefinitely.

Using scientific knowledge, feedback from community engagement, logic, experience with similar developments, and an understanding of the effectiveness of mitigation measures (i.e., level of certainty that the proposed mitigation measures would work), the Project is determined as one of the following:

- Not likely to cause significant adverse environmental effects.
- Likely to cause significant adverse environmental effects.

5.4.1 Air Quality

Project activities are expected to generate minor radiological and non-radiological airborne emissions; fugitive dust emissions may also be produced. These could include particulates from the demolition of the buildings and structures, material handling, and transportation of the wastes to the on-site segregation area.

All emissions from the decommissioning activities are monitored as part of G1WF EVMP where both direct and indirect (i.e. ambient) effluent emissions in air are measured and reported at and around the G1WF site.

5.4.1.1 Radiological Emissions

Project-Environment Interaction

Project activities that may result in the potential release of radioactive airborne emissions include the following:

1) Removal of equipment and hazards inside buildings;

2) Dismantling of building structures and components; and

3) Segregation and transport of waste to on-site waste management facilities.

Environmental Design Features and Mitigation

Radiation exposure to workers is managed under CNL's Radiation Protection Program [5-12] so that doses remain below regulatory limits. Examples of mitigation measures include:

- Administrative controls include use of dose control points, which are assigned to workers and which if exceeded, trigger management review.
- Worker radiation doses will be monitored throughout the Project so that doses do not exceed dose control points and are within regulatory limits.
- Operational control measures will be implemented to mitigate worker exposure to radiation. Examples of measures that may be implemented are:
  - Protective clothing such as respirators and other protective measures.
  - Shielding to reduce radiation fields.
  - Workplace isolation – ventilated enclosures equipped with HEPA filtration units.
  - Air monitoring.
  - Use of electronic personal dosimeters.

- Operational control measures will be implemented to mitigate environmental effects. Examples of measures that may be implemented are:
  - Dust suppression techniques.
  - Work place isolation.
  - Use of enclosures and appropriate packaging of wastes for transport.

Radioactive particulates from concrete scabbling and cutting will be mitigated using dust suppression techniques (e.g. work-place isolation using enclosures and/or air filtration units), air monitoring (as per CNL's Environmental Protection Management and Monitoring of Effluents and Emissions [5-15]) and application of fixatives to seal contamination to surfaces and reduce particulate generation during dismantling and cutting operations. A building enclosure with HEPA filtration may be included as part of decommissioning to prevent release of radioactive particulate. Emissions of radioactive particulates during waste transfer operations to on-site waste management facilities will be mitigated through packaging of wastes in appropriate containers. The Waste Management Plan [5-9]9] defines packaging requirements for each type of waste (i.e., concrete waste, scrap metal, and soil).

Radiological air monitoring will be done, as per CNL's Environmental Protection Management [5-14] and Monitoring of Effluents and Emissions [5-15], to confirm that airborne alpha and beta/gamma contamination levels in the work environment are acceptably low. The deployment of appropriate types of Continuous Air Monitors at various strategic locations, as specified in Radiological Work Plans provide adequate airborne activity monitoring throughout the Project. CNL's Management and Monitoring of Effluents and Emissions [5-15] outlines the key management practices that limit air quality emissions effects, as well as the current monitoring requirements.

5.4.1.2 Non-Radiological Emissions

Project-Environment Interaction

Project activities that may result in the potential release of non-radiological airborne emissions include the following:

1) Removal of equipment and hazards
2) Dismantling of building structure components
3) Segregation and management of waste at on-site waste management facilities

With the exception of asbestos materials and residual lead-based paints, it is anticipated that there will be minimal non-radiological hazardous materials in the buildings as most will have been removed/abated through hazard reduction campaigns prior to the commencement of the Project.

Environmental Design Features and Mitigation

Mitigation measures to prevent the release of non-radiological airborne emissions will include:

- Dust suppression techniques.
- Work place isolation.
- Use of enclosures and appropriate packaging of wastes for transport.

The hazardous materials at the G1WF are handled in accordance with the Land Protection and Rehabilitation Regulation [5-18] and CNL procedures [5-6] [5-7] [5-8] [5-19].

During the ongoing SWS phase, designated substances and asbestos assessments have been conducted in the Reactor Building, Turbine Building, and Service Building [5-20] [5-21] [5-22] [5-23] [5-24]. The Asbestos Containing Material has been removed from the Turbine Building and Service Building. The asbestos abatement campaign for the Reactor Building is in progress. Asbestos will be removed in accordance with CNL's procedure for control of asbestos hazards [5-8] and consistent with the Land Protection and Rehabilitation Regulation [5-18].

5.4.1.3 Fugitive Dust Emissions

Project-Environment Interaction

Project activities that may result in the potential release fugitive dust emissions include the following:

1) Removal of equipment and hazards
2) Dismantling of building structure components
3) Segregation and management of waste at on-site waste management facilities
4) Backfilling and landscaping

Environmental Design Features and Mitigation

Mitigations to be implemented to limit fugitive dust emissions include measures such as:

- Continued implementation of Gentilly-1 Waste Facility Effluent Monitoring Plan [5-1].
- Implementation of dust management techniques to control dust generated by the Project.
- Use of dust suppression methods during building demolition activities to control airborne emissions and nuisance dust during building. Methods may include:
  - Wetting techniques during demolition to limit mobility of dust.
  - Wind restrictions during demolition to stop work or apply wetting techniques.
- Curtailment of activities during periods of adverse meteorological conditions (e.g., during periods of high winds).
- Road watering and sweeping when necessary.
- Removal of accumulations of particulates (e.g., dirt) on road as soon as possible.
- On site vehicles and equipment engines will meet Tier 4 emission standards, where possible and be maintained in good working order.
- Limits on idling of vehicles on site and speed on roads.

5.4.1.4 Predicted Adverse Environmental Effects

A quantitative assessment of air quality was completed to predict changes in the concentrations of selected non-radiological indicator compounds. These indicator compounds represent compounds that are expected to be emitted from the Project and are generally accepted as indicators of changing air quality and for which relevant air quality criteria exist. The selected indicator compounds for fugitive dust fall into two categories:

- **particulate matter**: suspended particulate matter (SPM), particles nominally smaller than 10 micrometres (µm) in diameter (PM_{10}) and particles nominally smaller than 2.5 µm in diameter ($PM_{2.5}$)

- **combustion gases**: nitrogen oxides (NO_X) represented by nitrogen dioxide (NO_2), sulphur dioxide (SO_2) and carbon monoxide (CO)

These compounds are associated with various Project activities. Particulate matter is typically associated with airborne dust from demolition and decommissioning activities including non-road equipment (such as construction vehicles) and vehicles travelling over on-site paved roads, as well as material handling activities. Products of combustion (NO_X, SO_2 and CO) are associated with the exhaust from on-site vehicles. Ozone was assessed for use in the estimation of NO_2 concentrations resulting from the Project. Emissions of ozone are not quantified for the Project's activities as it is not directly emitted into the atmosphere from the Project.

The emissions assessment focused on parameters with the greatest potential to influence air quality and human health based on regulatory criteria and modeling significance. The parameters of NOx, SO_2, CO, PM_{10}, and $PM_{2.5}$ were prioritized because they are the primary indicators for compliance and dispersion modeling. Other combustion by-products such as PAHs, VOCs, and trace metals were considered during the screening phase. These were excluded from detailed modeling because emission factors for Tier 4-compliant equipment (as assumed for all onsite vehicles and non-road equipment) indicate very low emission rates for these compounds, often below detection thresholds. In 2023, the Government of Canada collected air, water, soil, sediment, sand, vegetation, and food samples in publicly accessible areas outside the Gentilly Nuclear Complex perimeter as part of the Independent Environmental Monitoring Program (IEMP).

The levels of radioactivity measured in those samples were below available guidelines and screening levels. The screening levels are based on conservative assumptions about the exposure that would result in a dose of 0.1 millisievert (mSv) per year (one-tenth of the regulatory public dose limit of 1 mSv per year). Measurements conducted by the IEMP to date have consistently found levels of radioactivity in the environment to be low, and well within the range of natural background radiation levels. As a result, no effects on human health are expected (Government of Canada 2025 [A-1]). Given the nature of this Project, these results are not expected to change.

Emissions quantification and dispersion modelling were completed for fugitive dust emissions. The emission estimation methods used in the air quality assessment follow generally accepted practices for conducting environmental assessments and, where appropriate, guidance in Appendix C of REGDOC-2.9.1, Environmental Principles, Assessments and Protection Measures [5-25]. Scientifically accepted by QC MELCCFP [5-26] and well-documented emission factors, such as AP-42 from the United States Environmental Protection Agency [5-27] were used to estimate maximum and average emission rates. Details of the specific emission calculation methods and resulting emission estimates are provided in Appendix 2.

The dispersion modelling approach used to predict emission levels follows generally accepted practices for conducting environmental assessments and modelling guidance. The MELCCFP dispersion modelling guidance included in the Guide de la Modélisation de la Dispersion Atmosphérique (the Guidelines) was used in the assessment and was supported with additional guidance documents, as appropriate. The air dispersion modelling for the Project entailed the use of AERMOD dispersion modelling to assess predicted concentrations from all emissions sources and paved roads. Details regarding the dispersion modelling, including receptor grids and source input parameters are provided in Appendix 3.

In accordance with REGDOC-2.9.1 [5-25], maximum emission rates have been provided for the Project. Table 5-4 summarizes the maximum daily emission rates in grams per second (g/s) for the Project activities.

Ground level concentrations resulting from the Project for the air quality indicator compounds were predicted with the aid of the estimated emission rates and AERMOD dispersion models. The Maximum Scenario predicted ground level concentrations at the Gentilly site boundary for the Project is presented in Table 5-5. The maximum predicted incremental ground level concentration represents the incremental effect of the Project, without taking into consideration existing concentrations. The predicted ground level concentrations for the Project represent the combined concentrations of the existing concentrations at the Gentilly site, plus the incremental concentrations from the Project (i.e., Base Case plus Maximum Predicted Incremental Concentration).

As shown in Table 5-4 and Table 5-5, the largest contributors to the emissions of contaminants are as follows:

- SPM, PM_{10} and $PM_{2.5}$: demolition and material handling
- NO_X (as NO_2), SO_2, and CO: non-road equipment exhaust

Overall, concentrations of each contaminant remain below the applicable guideline or standard.

Table 5-4: Maximum Scenario Summary of Daily Emissions Rates

Planning Envelope	Duration	Project Component	Emission Source Type[c]	Maximum Emission Rates [g/s]					
				SPM[a]	PM_{10}[a]	$PM_{2.5}$[a]	NO_X[b]	SO_2[b]	CO[b]
Planning Envelope A	2026-2030	Decommissioning of Southern portion of the Turbine Building including the tunnel to the Reactor Building and SFCA	Non-road Equipment Exhaust	4.36E-03	4.36E-03	4.23E-03	3.14E-01	5.22E-03	2.72E+00
		Decommissioning of Basement portion of the Service Building including spent resin storage area	Demolition and Material Handling	4.66E-01	4.56E-01	4.61E-02	—	—	—
			Road Exhausts	7.49E-05	7.49E-05	2.66E-05	2.79E-04	2.80E-06	1.08E-03
Planning Envelope B	2027-2034	Reactor Building clear-out including calandria and bioshield and decommissioning of dome and containment structure	Paved Roads	6.98E-02	1.34E-02	3.24E-03	—	—	—

Notes:

(a) Daily Emission Rates [g/s]

(b) Hourly Emission Rates [g/s]

(c) Each emission source type is applicable to each Project component

SPM = suspended particulate matter; PM_{10} = particles nominally smaller than 10 µm in diameter; $PM_{2.5}$ = particles nominally smaller than 2.5 µm in diameter; NO_X = oxides of nitrogen; SO_2 = sulphur dioxide; CO = carbon monoxide; g/s = grams per second

Table 5-5: Maximum Scenario Predicted Fugitive Dust Emissions from the Project

Contaminant		Chemical Abstracts Service Number	Averaging Period	Applicable Air Quality Guideline Or Standard[a] (µg/m³)	Base Case Concentration[b] (µg/m³)	Maximum Predicted Incremental Concentration (µg/m³)	Project Activity Concentration (µg/m³)	Project Activity Concentration Percent Of Applicable Air Quality Guideline Or Standard
Suspended Particulate Matter	SPM	N/A-1	24-hour	120	41.8	10.2	52	43.4%
Particulate Matter <10 µm	PM_{10}	N/A-2	24-hour	50	23.2	9.71	32.9	65.9%
Particulate Matter <2.5 µm	$PM_{2.5}$	N/A-3	24-hour	30	12.5	1.07	13.6	45.4%
Nitrogen Dioxide[c]	NO_2	10102-44-0	1-hour	414	20.7	87.6	108	26.2%
Nitrogen Dioxide[c]	NO_2	10102-44-0	24-Hour	207	17.5	7.88	25.4	12.2%
Nitrogen Dioxide[c]	NO_2	10102-44-0	Annual	103	8.94	0.629	9.57	9.29%
Sulfur Dioxide	SO_2	7446-09-5	4-Minute	1050[d]	2.99[d]	2.88	5.86	< 1%
Sulfur Dioxide	SO_2	7446-09-5	24-Hour	288	1.60	0.131	1.73	< 1%
Sulfur Dioxide	SO_2	7446-09-5	Annual	52	0.753	0.0105	0.764	1.47%
Carbon Monoxide	CO	630-08-0	1-Hour	34,000	0.355	789	790	2.32%
Carbon Monoxide	CO	630-08-0	8-Hour	12,700	0.444	182	183	1.44%

(a) Table 24 in Appendix 1 identifies which guideline or standard was used in the screening of effects to air quality.

(b) The 90th percentile background concentrations; values for SPM and PM_{10} are calculated from the $PM_{2.5}$ values as described in Appendix 1. Data measured in parts per billion (ppb) or parts per million (ppm), were converted to µg/m³ assuming standard temperature and pressure (25°C and one atmosphere of pressure). Although ozone was assessed as part of baseline conditions to calculate the NO_2 emissions from the Project, these are not presented in this table as emissions of ozone are not quantified for the Project's activities since they are not directly emitted into the atmosphere from the Project.

(c) Calculated using the Ozone Limiting Method. Refer to Appendix 3.

(d) 4-min SO_2 values were obtained from 1-hour values using a conversion factor of 1.9 [5-26].

µg/m³ = micrograms per cubic metre.

5.4.1.5 Determination of Significance

Table 5-6 summarizes the potential adverse environmental effects on air quality that may result from the Project.

Table 5-6: Determination of Significance for Air Quality

Project Activity	Environmental Effect	Significance Criteria	Determination Of Significance
▪ Removal of equipment and non-structural components; ▪ Dismantle and/or demolish building structures and removal of underground structures; ▪ Waste generation and management; and ▪ Backfilling and landscaping	Adverse effect on Air Quality from the generation of: ▪ radioactive airborne emissions; ▪ non-radioactive airborne emissions; and ▪ fugitive dust emissions	Magnitude: Moderate Geographic Extent: Small Duration: Short-term Frequency: Rare Reversibility: Reversible	No significant effect

Although there may be a minor change in radioactive airborne and fugitive dust emissions, concentrations would remain below guidelines and criteria and therefore would have a negligible adverse effect on air quality (**Moderate**). The geographic extent of the adverse effect would be confined to the G1WF footprint (**Small**), and the duration of the effect on air quality would be **Short-term** (i.e., changes in radiological airborne and fugitive dust emissions would cease immediately following cessation of Project activities). Changes in radiological airborne and fugitive dust emission concentrations that would exceed guidelines are **Rare** during the Project, and significant adverse environmental effects to air quality would be **Reversible** following cessation of Project activities.

Because most of the non-radiological hazardous materials will have been removed/abated through hazard reduction campaigns prior to the commencement of Project activities, no measurable changes in non-radiological concentrations from existing conditions are anticipated. With the implementation of CNL's Management and Monitoring of Effluents and Emissions requirements [5-15], and through the implementation of the above listed mitigation measures, radiological airborne, non-radiological airborne and fugitive dust emissions associated with the Project activities are **not expected to result in significant adverse environmental effects** to air quality.

5.4.1.6 Prediction Confidence and Uncertainty

Table 5-7 outlines the areas where conservatism was assumed in the emission rate calculations for air quality and GHG emissions, which results in an assessment that is not likely to underpredict the emissions associated with the Project.

Table 5-7: Areas of Conservatism in the Emission Rate Calculations

Project Activity	Conservatism
Non-road Equipment	It is conservatively assumed that all non-road equipment is operating simultaneously during the daily operating hours for the Project and for the entire duration. In reality, it is unlikely that all equipment would operate simultaneously and that the same type of equipment will operate simultaneously for different components of the Project.
Fugitive Dust from Paved Roads	Roadway segments at the Project were assessed based on the type of roadway and anticipated traffic. Emission estimation equations from Chapters 13.2.1 of the AP-42 Emission Factor [5-27] were used for fugitive road dust from paved roads. These emission estimates are conservative and will overestimate emissions from facility roadways for the following reasons. ▪ The US EPA AP-42 equations were developed from measured emissions from public roadways and as a result will tend to over-estimate low speed vehicle traffic from construction and industrial sites. ▪ All roadways at the Project were modelled assuming simultaneous and continuous use; however, it is unlikely that this situation will occur in reality. ▪ As the dust best management practices are revised through continuous improvements, the emissions from the on-site roadways are likely to decrease. ▪ Seasonal variability for fugitive dust emissions was not considered in the assessment.

Table 5-8 outlines the areas where conservatism was assumed in the dispersion modelling approach, which results in an assessment that is not likely to underpredict the air quality associated with the Project, and provide confidence in the prediction that Project activities are **not expected to result in significant adverse environmental effects** to air quality.

Table 5-8: Areas of Conservatism in the Dispersion Modelling Approach

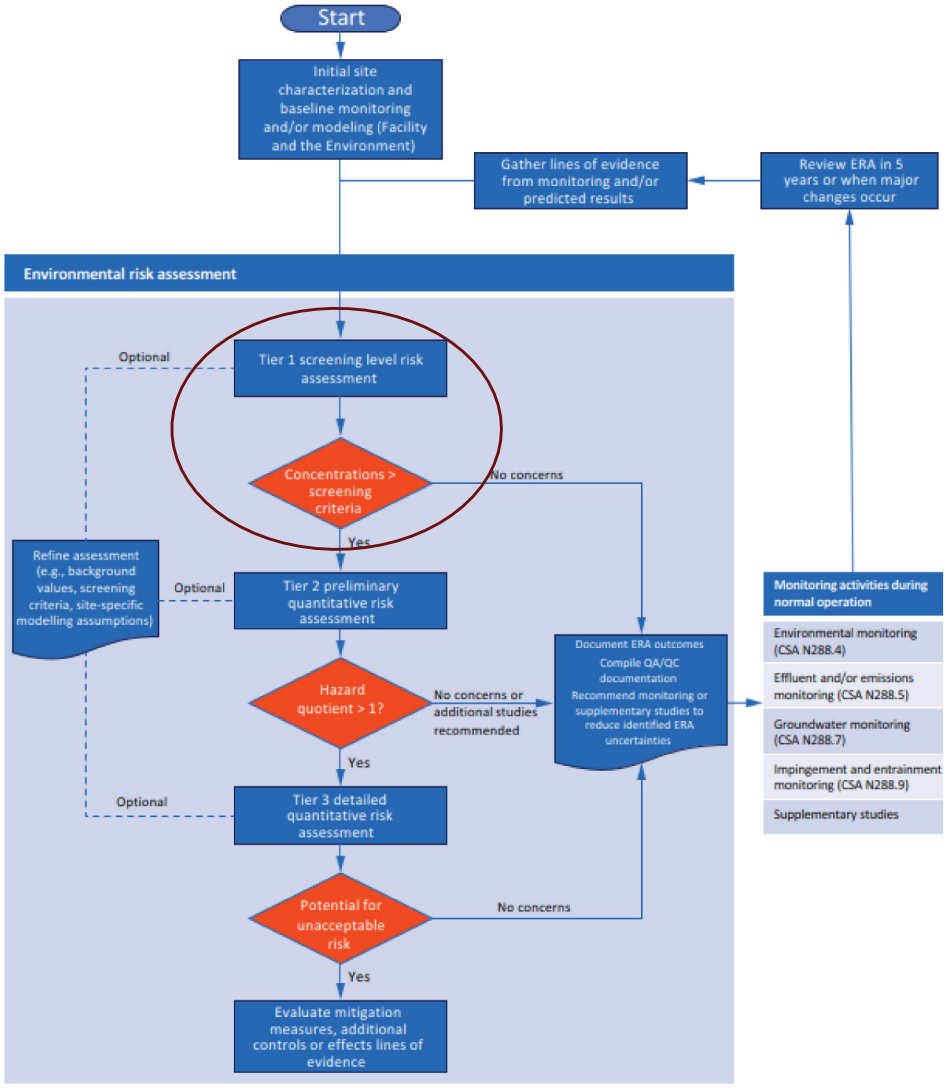
Area	Conservatism
All operations for the G1WF were assumed to occur simultaneously	The modelling assessment includes all operations occurring simultaneously and continuous over the entire modelling period.
Fugitive Dust Modelling	The parameters that were required for fugitive dust modelling from paved roads include the locations of the roadway segments, base elevations, effective heights of the emissions, and the initial plume size in the lateral and vertical directions. It is recognized that this modelling approach will result in higher predicted concentrations close to the roadways than actual values for the following reason: ▪ When the roads are wet or snow-covered, the emissions will be reduced or eliminated. AERMOD has the capacity to have a variable emission rate that could account for actual meteorological emissions; however variable emission rates were not used in this assessment for conservatism. Despite the limitations of the emission rate estimates and dispersion modelling, these are the best estimates available.

The air quality modelling for the Project incorporates highly conservative assumptions, and the proposed mitigation measures are well-established, proven, and specifically tailored to the conditions at the G1WF. As a result, there is strong confidence that effects on air quality have not been underestimated, which reinforces the overall confidence in the prediction that Project activities are **not expected to result in significant adverse environmental effects** to air quality.

5.4.2 Human and Ecological Health

Project activities may result in non-radiological, radiological, and fugitive dust emissions associated with material handling, transportation of the wastes to the segregation area, operation of vehicles and equipment, demolition, backfilling and landscaping. Significant adverse environmental effects on air quality, in turn, have the potential to impact (i.e., dose and exposure) human health, of both workers and the public, Indigenous Nations and communities, and ecological health.

The assessment of predicted significant adverse environmental effects on human and ecological health is completed in accordance with CNSC's REGDOC 2.9.1 – Environmental Protection: Environmental Principles, Assessments, and Protection Measures [5-25] and CSA Standard N288.6-22 Environmental Risk Assessments at Nuclear Facilities and Uranium Mines and Mills [5-28]. Specifically, a tiered approach was used to determine the level of risk assessment required for the Project as shown in Figure 5-2 [5-28].



Note: *For some physical stressors, there are no screening criteria or benchmarks and thus HQ does not apply. However, the overall process of using a tiered approach might still apply.*

Figure 5-2: ERA Progression Through Tiers of Assessments [5-28]

The first step in the process is the **site characterization** (Section 2) and the environment (Section 4). Using this information, potential Project-Environment interactions are identified, and mitigation measures implemented to reduce or avoid significant adverse environmental effects (referred to as the Tier 1 Screening Level Risk Assessment in Figure 5-2).

Results of the screening indicated that there is a potential for adverse environmental effects on human and ecological health; therefore, an adverse effects assessment was completed for human and ecological health.

5.4.2.1 `Radiological Emissions

Project-Environment Interaction

Project activities that may result in the potential release of radioactive airborne emissions include the following:

1) Removal of equipment and hazards inside buildings

2) Dismantling of building structures and components

3) Segregation and transport of waste to on-site waste management facilities

Environmental Design Features and Mitigation

Radiation exposure to workers is managed under CNL's Radiation Protection Program [5-12] to ensure doses remain below regulatory limits. Examples of mitigation measures include:

- Administrative controls include use of dose control points, which are assigned to workers and which if exceeded, trigger management review.
- Worker radiation doses will be monitored throughout the Project so that doses do not exceed dose control points and are within regulatory limits.
- Operational control measures will be implemented to mitigate worker exposure to radiation. Examples of measures that may be implemented are:
  - Protective clothing such as respirators and other protective measures.
  - Shielding to reduce radiation fields.
  - Workplace isolation – ventilated enclosures equipped with HEPA filtration units.
  - Air monitoring.
  - Use of electronic personal dosimeters.
- Operational control measures will be implemented to mitigate environmental effects. Examples of measures that may be implemented are:
  - Dust suppression techniques.
  - Work place isolation.
  - Use of enclosures and appropriate packaging of wastes for transport.

Radioactive particulates from concrete scabbling and cutting will be mitigated using dust suppression techniques (e.g., workplace isolation using enclosures and/or air filtration units), air monitoring and application of fixatives to seal contamination to surfaces and reduce particulate generation during dismantling and cutting operations. A

building enclosure with HEPA filtration may be included as part of decommissioning to prevent release of radioactive particulate. Emissions of radioactive particulates during waste transfer operations to on-site waste management facilities will be mitigated through packaging of wastes in appropriate containers. The Waste Management Plan [5-11] defines packaging requirements for each type of waste (i.e., concrete waste, scrap metal, soil).

Radiological air monitoring will be implemented, if required, by following CNL's Environmental Protection Requirements [5-14], to confirm that airborne alpha and beta/gamma contamination levels in the work environment are acceptably low. The deployment of appropriate types of Continuous Air Monitors at various strategic locations, as specified in Radiological Work Plans, provide adequate airborne activity monitoring throughout the Project.

5.4.2.2 Non-Radiological Emissions

Project-Environment Interaction

Project activities that may result in the potential release of non-radioactive airborne emissions include the following:

1) Removal of equipment and hazards inside buildings

2) Dismantling of building structures and components

3) Segregation and transport of waste to on-site waste management facilities

Environmental Design Features and Mitigation

Mitigation measures to prevent the release of non-radiological airborne emissions will include:

- Continued implementation of Gentilly-1 Waste Facility Effluent Monitoring Plan [5-1].
- Implementation of dust management techniques to control dust generated by the Project.
- Use of dust suppression methods during building demolition activities to control airborne emissions and nuisance dust during building. Methods may include:
  - Wetting techniques during demolition to limit mobility of dust.
  - Wind restrictions during demolition to stop work or apply wetting techniques.
- Curtailment of activities during periods of adverse meteorological conditions (e.g., during periods of high winds).
- Road watering and sweeping when necessary.
- Removal of accumulations of particulates (e.g., dirt) on road as soon as possible.
- On site vehicles and equipment engines will meet Tier 4 emission standards, where possible and be maintained in good working order.
- Limits on idling of vehicles on site and speed on roads.

Materials such as insulating material and asbestos are removed and handled through existing procedures outlined in the CNL's standard, Controlling Asbestos Hazards [5-8]. With the exception of asbestos materials and residual lead-based paints, the buildings are not known to contain measurable quantities of non-radiological

hazardous substances with the potential to generate airborne emissions. The requirements are consistent with those of provincial regulations (e.g., R.Q. c. S- 2.1, r.13, Division IX.I).

5.4.2.3 Fugitive Dust Emissions

Project-Environment Interaction

Project activities that may result in the potential release fugitive dust emissions include the following:

1) Removal of equipment and hazards
2) Dismantling of building structure components
3) Segregation and management of waste at on-site waste management facilities

Environmental Design Features and Mitigation

Mitigations to be implemented to limit fugitive dust emissions include measures such as:

- Continued implementation of Gentilly-1 Waste Facility Effluent Monitoring Plan [5-1].
- Implementation of dust management techniques to control dust generated by the Project.
- Use of dust suppression methods during building demolition activities to control airborne emissions and nuisance dust during building. Methods may include:
  - Wetting techniques during demolition to limit mobility of dust.
  - Wind restrictions during demolition to stop work or apply wetting techniques.
- Curtailment of activities during periods of adverse meteorological conditions (e.g., during periods of high winds).
- Road watering and sweeping when necessary.
- Removal of accumulations of particulates (e.g., dirt) on road as soon as possible.
- On site vehicles and equipment engines will meet Tier 4 emission standards, where possible and be maintained in good working order.
- Limits on idling of vehicles on site and speed on roads.

5.4.2.4 Release of Chemical and Radiological Contaminants

Project-Environment Interaction

Equipment removal, hazard abatement, demolition activities, onsite waste management, onsite transportation activities and fuel equipment operation may cause radiological and non-radiological hazardous releases to the environment. The activities of draining, pumping and transporting residual liquid and sludge from piping, tanks and sumps may also result in radiological and non-radiological releases that have the potential to change soil quality, groundwater quality, surface water quality, which may affect off-site human and ecological health.

Environmental Design Features and Mitigation

A characterization survey will confirm the presence of contaminated liquids and sludge in soil, tanks, pipes or drums and abandoned chemical and/or active drains. Workers must obtain related clearance forms in the IWC process to ensure proper controls and monitoring are used for abatement activities of all hazardous materials

including asbestos containing material, mercury, PCBs and lead. Qualified asbestos abatement workers will be used to complete the work following Québec Regulation (R.Q.c.S-2.1, r.13, Division IX.I).

Approved work plans, waste management plan(s) and a related Work Authorization must be in place for decommissioning activities to assess the need for additional mitigation measures. All activities including workplace air monitoring will be conducted according to an approved Radiological Work Assessment. If discovered, any radiological waste will be monitored and characterized to determine appropriate disposal route prior to transport. Vehicles/equipment will be maintained in good working order. Equipment using fuel and generating emissions will not be left idling when not in use. Dust suppression techniques (water spray/misting during demolition) will be used for controlling airborne particulate emissions without causing surface runoff into the nearby storm drain or erosion impacts. In addition, storm drains are to be covered during demolition water spraying activities.

For off-site human receptors, mitigation is achieved through:

- Engineering and administrative controls that prevent releases of contaminants beyond the site boundary (e.g., containment systems, dust suppression, and air emission controls).
- Radiological protection measures ensuring doses remain well below the public dose limit of 1 mSv/year, as confirmed by monitoring programs such as the IEMP.
- Environmental monitoring and reporting, which includes transparency and engagement with the public to verify that conditions remain protective of health and the environment.

These measures collectively ensure that any off-site exposures remain within safe limits, and no additional project-specific mitigation is required beyond these established controls.

5.4.2.5 Predicted Adverse Effects

The predicted fugitive dust emissions are estimated to increase because of the Project (Section 5.4.1.3). Emissions quantification and dispersion modelling were completed for fugitive dust emissions. Fugitive dust from demolition and material handling of the demolished material are the largest contributor to SPM, PM_{10} and $PM_{2.5}$ emissions. Non-road equipment exhaust emissions are the largest contributors to NO_x (as NO_2), SO_2 and CO emissions (Section 5.4.1.3). Predicted concentrations from Project activities were screened against applicable air quality guidelines and/or standards. Results indicated that fugitive dust emissions are expected to be below the guidelines and/or standards.

5.4.2.6 Determination of Significance

The Gentilly-1 Waste Facility Effluent Monitoring Plan [5-1] outlines the current monitoring requirements. In addition, the Management and Monitoring of Effluents and Emissions [5-15] outlines the key management practices that limit air quality emissions (i.e., radiological and non-radiological) effects. Through the implementation of engineered controls and regulatory procedures, radiological, non-radiological and fugitive dust emissions are expected to remain well below applicable health and environmental standards. Airborne contaminants will be mitigated using enclosures, filtration systems, and dust suppression techniques, while waste will be properly packaged and managed according to approved plans. As a result, no significant adverse environmental effects to human or ecological health are anticipated from the proposed Project activities.

With the implementation of approved work plans, regulatory controls, and mitigation measures, the potential for radiological or non-radiological chemical releases to adversely affect off-site human or ecological health is also considered negligible based on conservative screening assumptions and compliance with regulatory dose limits.

Additionally, the consistency of the proposed activities with the existing Radiological Work Assessment and the containment of potential releases within previously characterized and controlled areas ensures no new or significant risks to off-site human or ecological health.

Overall, no significant adverse environmental effects to off-site human or ecological health are anticipated from the proposed Project activities and a determination of significance is not required.

5.4.2.7 Prediction Confidence and Uncertainty

The air quality modelling completed for the Project (Section 5.4.1.4) incorporates a high degree of conservatism and confidence in the predications that the Project activities are not expected to result in significant adverse environmental effects to air quality. Specifically, the emissions inventory used in the modelling was developed based on the highest-intensity operational scenarios—such as assuming peak fuel consumption and continuous operation of equipment at high loads—even though actual operations are expected to be less intensive. Additionally, the dispersion modelling used conservative assumptions regarding meteorological conditions and emission source characteristics. This conservative approach extends to the post-processing of model results, where assumptions were made to reflect worst-case scenarios.

These layers of conservatism are intentionally built into the modelling framework to provide a robust margin of safety so that the predicted effects on human and ecological health are not underestimated and reinforces the confidence in the predictions of no significant adverse environmental effects on both human and ecological health.

There is strong confidence in the predictions of no significant adverse environmental effects to human or ecological health because all potentially hazardous decommissioning activities are governed by the precautionary principle, approved work plans, regulatory controls, and site-specific mitigation measures. These include proper hazardous material handling, air and dust monitoring, and containment of potential releases. The use of qualified personnel and adherence to established procedures further reinforces the confidence in the predictions of no significant adverse environmental effects on both human and ecological health.

5.4.2.8 Influences on the Existing Environment Risk Assessment

For purposes of the NSCA regulatory decision, an Environmental Risk Assessment (ERA) for the G1WF, including a Human Health Risk Assessment and Ecological Risk Assessment, was completed for both radiological and chemical/physical stressors [5-29]. The assessment is for current conditions under normal operations conditions and is consistent with the following guidance documents:

- REGDOC 2.9.1, Environmental Principles, Assessments and Protection Measures, Version 1.2, [5-25].
- Nuclear Safety and Control Act [5-30]
- Radiation Protection Regulations [5-31].
- CSA Standard N288.6-22, Environmental Risk Assessments at Nuclear Facilities and Uranium Mines and Mills [5-28].
- CSA Standard N288.1-20, Guidelines for calculating derived release limits for radioactive material in airborne and liquid effluents for normal operation of nuclear facilities [5-32].
- CSA N288.0:22, Environmental management of nuclear facilities: Common requirements of the CSA N288 series of standards” [5-33], Section 7.1.2 (Quality Assurance [QA] Program).

- International Standard for Standardization (ISO) 9001:2015 Quality management systems [5-34].
- Act Respecting Threatened or Vulnerable Species, R.R.Q., E-12.01, r.4, Québec [5-35].
- Regulation respecting Threatened or Vulnerable Wildlife Species and Their Habitats, CQLR c E-12.01, r. 2, Québec [5-36].

Results of the ERA concluded that, under current conditions and based on the data available for the G1WF and surrounding area, no unacceptable risk is expected to human or non-human biota from exposure to radiological or non-radiological contaminants, or physical stressors. The facility has negligible airborne releases, and waterborne releases are of precipitation and groundwater diverted away from the reactor building [5-29[5-29]. No contamination is expected in this water, and it discharges into the G-2 NGS's stormwater management system. Effluent sampling confirmed that radionuclide levels were less than the corresponding criteria. Because the proposed Project activities are not expected to result in significant adverse environmental effects to human or ecological health, the conclusions of the existing ERA remain valid. The nature and extent of emissions and potential exposures are consistent with those previously assessed, and no new or unanticipated risks have been identified.

5.4.3 Wildlife - Species at Risk and Migratory Birds

On a federal level, designations for species at risk occurring in Canada are initially determined by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). If approved by the federal Minister of the Environment, species are added to the federal List of Wildlife Species at Risk under Schedule 1 of SARA. Once included on Schedule 1, it is prohibited to kill, harm, harass, capture, possess, collect, buy, sell, or trade individuals, as well as damage or destroy the residence of a species listed as Extirpated, Endangered or Threatened. Furthermore, species that are included on Schedule 1 as Extirpated, Endangered or Threatened are afforded protection of species specific critical habitat on federal lands (such as the G1WF site) once critical habitat is defined in a recovery strategy.

The SARA and migratory bird species with confirmed observation records within and adjacent to G1WF, as well as all species returned from the Québec legislation (species at risk) with the potential to occur within and in the vicinity of the G1WF, were considered in the environmental effects assessment. Each species was evaluated to determine whether or not its presence was likely within and adjacent to the Gentilly site. Species with a very low likelihood of occurrence, for which habitat was not present within and adjacent to the Gentilly site, or for which measurable effects from the Project were unlikely or suitably considered by another indicator species, were excluded in the assessment of effects.

Wildlife species at risk and migratory birds considered in the environmental effects assessment are listed in Table 5-8. Avian species such as barn swallow, bobolink [*Dolichonyx oryzivorus]* and cliff swallow are protected by additional federal legislation Migratory Birds Convention Act [MBCA]). Section 5 of the MBCA prohibits the disturbance, destruction or removal of a nest or related shelter, or egg of a migratory bird, or possession of a live migratory bird, or a carcass, nest or egg of a migratory bird. The Project has the potential to affect migratory birds and adherence to the MBCA is required as part of the Project activities. Because the G1WF is a federal site, the applicable legislation for wildlife species protection is SARA and the MBCA. However, CNL also recognizes the importance of protecting species designated under provincial legislation (i.e., the *Provincial Threatened or Vulnerable Species Act*, chapter e 12.01).

Since it is generally an impractical task to assess the potential effects of the Project on all SAR and migratory birds, representative species were chosen for the assessment of effects. These species were selected because they are known to exist on the Gentilly site, are representative of major taxonomic groups, or have a special importance or value (Table 5-9). As per REGDOC-2.9.1, Environmental Principles, Assessments and Protection Measures, species selection focused on providing a “full accounting of effects on species with elevated conservation status and their habitat” [5-37].

Table 5-9: Wildlife Species at Risk and Migratory Birds Selected for the Effects Assessment

Species	Rationale for Selection
Barn Swallow	▪ Barn swallow is listed as Special Concern by COSEWIC and under SARA (as amended February 2022) and is listed under the MBCA. It has legal individual, nest and habitat protection provisions under SARA and individual and nest protection under the MBCA. ▪ The residence of the species is afforded protection. ▪ More specifically, AERMOD is recognized as one of the regulatory default dispersion models and is suitable to model construction activities, waste disposal operations, and fugitives [5-3] (for the species, the nest, occupied or not, is considered a residence: (for the species, the nest, occupied or not, is considered a residence: ▪ In provinces: from May 1st or the date when adults are first seen building or occupying the nest, whichever is earlier, to August 31st or the date when a bird is last seen at the nest, whichever is later. ▪ There is the potential for barn swallow to be indirectly and directly affected by the Project through sensory disturbance and habitat loss.
Cliff Swallow	▪ The cliff swallow is afforded protection under the MBCA. ▪ There is the potential for barn swallow to be indirectly and directly affected by the Project through sensory disturbance and habitat loss.
Bats: Little-brown Myotis Northern Myotis	▪ A bat inventory was carried out in 2012 in the vicinity of G1WF [5-4] and *Myotis* sp., big-brown bat (*Eptesicus fuscus*), silver-haired bat (*Lasionycteris noctivagans*), and hoary bat (*Lasiurus cinereus*) have been detected. ▪ Silver-haired bat and hoary bat are federally listed as Endangered species. *Myotis* sp. could be either eastern small-footed myotis (*Myotis leibii*), little-brown myotis (*M. lucifugus*) and or northern myotis (*M. septentrionalis*). Little-brown myotis and northern myotis are both federally listed as Endangered species and have legal individual protection provisions under SARA. The two species more likely to be affected by the project are little-brown myotis and northern myotis, and therefore, were selected for the assessment. ▪ These bat species are afforded protection of critical habitat because they are listed as Endangered on Schedule 1 of SARA. ▪ Critical habitat has only been “partially identified”, for one life history requirement and habitat type (overwintering habitat), as the largest threat to these species is associated with that habitat type. No active hibernacula have been identified in the G1WF. The geological conditions make the presence of caves or exposed bedrock possible in the vicinity of G1WF but in small surface areas. ▪ Other critical habitat types that are identified, but not yet legally defined and protected as “critical habitat”, include: roosting, foraging and swarming habitat. ▪ Maternity roost habitat for little-brown myotis and northern myotis is potentially present in the treed areas in the vicinity of G1WF and would be considered a residence. There is the potential for both species to be indirectly affected by the Project through sensory disturbance and related habitat avoidance (caused by noise associated with decommissioning activities and potential roost abandonment). ▪ Maternity roost habitat for little brown myotis is also potentially present in the G1WF, and little brown myotis have the potential to be indirectly and directly affected by the through sensory disturbance, habitat loss and reduced habitat quality.

Notes:

COSEWIC = Committee on the Status of Endangered Wildlife in Canada; SARA = Species at Risk Act; MBCA = Migratory Birds Convention Act, 1994.

5.4.3.1 Sensory Effects from decommissioning activities

Project-Environment Interaction

Adverse environmental effects to wildlife species at risk and migratory birds, are evaluated in terms of habitat loss and decrease in habitat suitability, which may affect movement and behaviour. Project activities identified as potentially having a adverse effect on wildlife species at risk and migratory birds due to sensory disturbance are:

1) Removal of equipment and hazards

2) Dismantling of building structure components

3) Segregation and management of waste at on-site waste management facilities

4) Backfilling and landscaping

Increased sensory disturbance can affect habitat quality for barn swallow, cliff swallow, and bats. Project activities are expected to generate noise from the operation of the power tools and heavy equipment required to accomplish the decommissioning of the buildings and transportation of waste to onsite waste management facilities. Noise levels greater than 50 dB can negatively affect local birds and may lead to temporary displacement if birds avoid otherwise suitable habitat in areas of the Assessment Boundary [5-38], including the G1WF, where decommissioning activities create noise levels greater than 50 dB. It should be noted that this displacement would only occur if noise at that level is propagated to the required distance to suitable habitat. Sensory disturbance can have both positive and negative effects on barn swallow and cliff swallow breeding habitat availability. Past and present anthropogenic development has most likely increased the amount of nesting habitat in the Assessment Boundary, including the Gentilly site by providing suitable substrate for nest building (e.g., buildings).

The MBCA includes provisions regarding harassment, which is defined as actions with the intent to capture or harm migratory birds. While sensory disturbance—such as noise—can be considered a form of harassment, it is important to note that the G1WF is located within an established industrial park. As such, construction noise in this area represents a consistent and long-standing baseline condition. Species present in this environment, including migratory birds, have likely adapted to these anthropogenic noise levels. Therefore, the sensory disturbance caused by Project activities may not meet the threshold of harassment as defined by the MBCA, given the absence of intent to harm and the habituation of local wildlife to industrial noise.

Sensory disturbance associated with the Project could lead to site abandonment and indirect losses of bat roosting or foraging habitat [5-40] [5-41] [5-42]. Available research has not resulted in definition of measurable thresholds that may negatively affect bat activity (e.g., dB levels); however, bats may avoid areas of higher disturbance by up to 100 m [5-43]. The effect of this interaction is limited by the primary work period (during daylight hours, when bats are inactive), and because bats are highly mobile, they are also able to avoid areas with elevated noise. Noise could also result in adverse changes to the availability of potential bat maternity roosting habitat in the Assessment Boundary outside of the Gentilly site if the level of disturbance causes avoidance and abandonment of occupied maternity roosts. Detailed information on how bats respond to anthropogenic noise is limited and varies among species; bats have been found to abandon roosts when they are directly disturbed by human activity, especially those causing loud and sudden noises [5-44].

The creation of noise likely represents more of a potential effect on habitat availability for birds and bats and any wildlife species in proximity to the Gentilly site, if the noise causes individuals to avoid previously occupied breeding or maternity roost habitat that is in or around areas with high noise levels. However, this potential effect is reduced by a number of factors. There is already anthropogenic activity ongoing at the Gentilly site that bats

would have become habituated to since the inception of the site. Similarly, for birds, there is mapped suitable habitat present in the area surrounding the Gentilly site, as well as, on the G1WF in the case of cliff swallow; however, the ongoing anthropogenic activity has likely habituated birds to ongoing noise levels and disturbance. In addition, the predicted level and nature of noise associated with Project activities (with the loudest activity occurring inside the building), and the attenuation of noise that occurs with distance and tree cover.

Environmental Design Features and Mitigation

The Project will be completed in a controlled manner, and no blasting will be required. Best practices and industry standards for limiting noise will be implemented and inspections completed to confirm equipment is in proper working order and mufflers working properly. The loudest decommissioning activity will likely be noise from a percussion hammer on an excavator, which will be used to break up reinforced concrete walls and floors during demolition. This activity will be limited to the interior of the building envelope, which will serve to reduce the level of noise outside the building, and in the surrounding area.

5.4.3.2 Demolition of Above Ground Buildings

Project-Environment Interaction

Project activities identified as potentially having a adverse effect on wildlife species at risk and migratory birds due to habitat loss are:

1) Removal of equipment and hazards

2) Dismantling of building structure components

The breeding range of barn swallow overlaps the Assessment Boundary. Both barn swallow and cliff swallow nests are typically found inside or outside of buildings, under bridges and in road culverts. These structures offer vertical surfaces with overhangs, which protect nests from rain and predators. There is approximately 7,000 ha of suitable habitat for barn swallow and cliff swallow available in the Assessment Boundary, and 3.62 ha within the Gentilly site (Table 1, Appendix 4). There is the potential for nesting sites for barn swallow within the G1WF buildings; however, no nests or nesting pairs have been observed within the G1WF buildings or within the Gentilly site. There is confirmed nesting activity on infrastructure such as the Reactor Building at the G1WF, where Cliff Swallows continue to nest without interfering with operations. Pre-demolition visual surveys will be conducted in all G1WF buildings.

Anthropogenic structures such as buildings, bridges and bat boxes are used for maternity roosts by little-brown myotis and less commonly by northern myotis [5-2]. All mapped buildings within the Gentilly site were considered potential suitable maternity roost habitat for little-brown myotis. This represents 3.61 ha of suitable natural maternity roost habitat and artificial (buildings) for little-brown myotis and northern myotis within the Gentilly site (Table 4, Appendix 4). Within the Gentilly site, the clearing, building construction and maintenance of large turfgrass covered lawns, and the presence of roads and associated infrastructure have likely reduced natural maternity roosting habitat availability within the site.

Although little-brown myotis occasionally hibernate in anthropogenic structures (like houses), it is unlikely that this is occurring within the G1WF buildings, as there are likely few gaps between the outer walls and below-grade floors that would permit entry, as there was shielding and barrier installation of the below-grade floors to limit the release of radioactivity during the time when the reactor was functional. As a final confirmation to ensure their absence, pre-demolition visual surveys will be conducted in all below-grade floors of the G1WF buildings.

Environmental Design Features and Mitigation

CNL commits to implementing best practices and mitigations during the Project for the protection of wildlife species at risk, and migratory birds and their nests. Best practices and mitigation will be implemented in accordance with the requirements of SARA, and in accordance with the MBCA [5-4]. For example, there is the potential for barn swallow nest sites and bat roosts, and known occurrences of cliff swallow nests, therefore, pre-demolition visual surveys will be conducted in all G1WF buildings. In addition, regulatory requirements for other migratory birds will be implemented should nests be encountered (e.g., nests on equipment, nests on gravel). For example, if nesting prevention measures are to be implemented, they will be in place prior to the Cliff Swallow nesting season.

5.4.3.3 Determination of Significance

Table 5-10 summarizes the potential adverse environmental effects that may result on wildlife species at risk and migratory birds from the Project.

Table 5-10: Determination of Significance for Wildlife Species at Risk and Migratory Birds

Project Activity	Environmental Effect	Significance Criteria	Determination Of Significance
Decommissioning activities	Sensory effects from increased noise levels created by decommissioning activities can decrease habitat suitability, which may affect wildlife movement and behaviour	Magnitude: Moderate Geographic Extent: Large Duration: Short-term Frequency: Continuous Reversibility: Reversible	No significant adverse environmental effect
Demolition of above ground buildings	Habitat loss for wildlife	Magnitude: Moderate Geographic Extent: Small Duration: Medium-term Frequency: Continuous Reversibility: Reversible	No significant adverse environmental effect

Displacement of species at risk and migratory birds from sensory disturbance is expected to be minor compared to existing conditions and would have a negligible adverse effect on these species (**Moderate**). The noise expected to be produced by the Project activities will attenuate outside of the Gentilly site (i.e., **Large** geographic extent); however, the duration of the sensory effect on the movement and behaviour of these species would be **Short-term** (i.e., movement and behaviour would resume immediately after cessation of activities). The effect on movement and behaviour would occur continuously (**Continuous**) during the Project and the effects would be **Reversible** following cessation of Project activities. Overall, sensory disturbance from the Project is **not expected to result in significant adverse environmental effects** on the movement and behaviour of wildlife species at risk and migratory birds.

The potential habitat loss for barn swallow, cliff swallow and little-brown myotis and northern myotis from the demolition of buildings may alter the movement and behaviour of these species; however, pre-demolition visual surveys will be conducted in all G1WF buildings. As such, this change is expected to be minor compared to existing conditions and would have a negligible adverse effect on these species (**Moderate**). For example, of the suitable habitats in the Assessment Boundary available to barn swallow and cliff swallow (7,162 ha), and bats (1,275 ha), less than 1% is located within the Gentilly site. Furthermore, the loss of habitat is expected to be confined to the G1WF footprint (i.e., **Small** geographic extent). The duration of the effect on the movement and behaviour of these species would be **medium-term** (i.e., movement and behaviour would resume shortly after

cessation of activities). This change in movement and behaviour would occur continuously (**Continuous**) during the Project; however, the effects would be **Reversible** following cessation of Project activities. Overall, loss of habitat from the Project is **not expected to result in significant adverse environmental effects** on the movement and behaviour of wildlife species at risk and migratory birds.

5.4.3.4 Prediction Confidence and Uncertainty

There is high confidence in the prediction of no significant adverse environmental effects to wildlife species at risk and migratory birds from Project activities because the mitigation measures proposed are well-established, practical, and tailored to the specific conditions of the G1WF. These measures include limiting the loudest activities—such as concrete demolition with a percussion hammer—to the interior of buildings, which naturally dampens noise propagation. Work will be conducted during daylight hours, minimizing overlap with bat activity, and all equipment will be maintained to industry standards to reduce unnecessary noise. In addition, pre-demolition visual surveys will be conducted in all G1WF buildings. If active bat maternity roosts are identified in any structure to be affected by decommissioning, initiate erection of species-appropriate barriers once individuals have left the structure and roosts/nests are no longer active.

Project activities will avoid sensitive periods and in sensitive locations to reduce the risk of affecting birds, their nests and eggs. If activities cannot be avoided, preventative and appropriate mitigation measures will be developed and implemented to minimize the risk of bycatches and help maintain sustainable migratory bird populations. These factors support the predicted effects on wildlife species at risk and migratory birds are not underestimated, reinforcing confidence that there will be no significant impacts on their movement or behaviour.

5.5 References

5.5.1 Acts and Regulations

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- Migratory Birds Convention Act (S.C. 2014, c.22), Canada.
- Species at Risk Act (S.C. 2002, c.29), Canada.
- Nuclear Safety and Control Act, S.C. 1997, c. 9, Canada.
- Radiation Protection Regulations (SOR/2000-203), Canada.
- Land Protection and Rehabilitation Regulations, Québec.
- Québec Regulation (R.Q.c.S-2.1, r.13, Division IX.I), Quebec.
- Act Respecting Threatened or Vulnerable Species, chapter e 12.01, Québec

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6 ACCIDENTS AND MALFUNCTIONS AND EXTERNAL HAZARDS

This section of the EPMR seeks to provide an understanding of the potential effects due to characterized malfunctions and accidents of the Project. The three objectives of the effects assessment for accidents and malfunctions are as follows:

- Identification of the primary hazards for potential accidents and malfunctions in the G1WF that could affect the environment, public safety or worker safety.
- Identification of planned mitigation, including prevention measures that would reduce the probability of these hazards from occurring, and control measures to mitigate the severity of consequences from an accident or malfunction.
- Estimation of the risks following the implementation of mitigation, and prioritization of the resources for risk management based on the levels of risks identified.

Accidents and malfunctions could take place as internally initiated events and externally initiated events. Internal events are defined as those that are initiated within the G1WF and are under CNL's direct control (e.g., equipment failures or other unplanned releases). External hazards are those events that are initiated outside the G1WF and are outside of CNL's direct control (i.e., external environmental hazards).

Analyses of these accidents, malfunctions and hazards are conducted qualitatively and quantitatively, where appropriate.

6.1 Hazards During Decommissioning

Hazards associated with the Project are identified and assessed for adverse effects on the workers, the public and the environment. These hazards will be removed, or the risks mitigated to an acceptable level before embarking on building demolition activities. To ensure safety of workers, the public and the environment, decommissioning activities will be carried out strictly in accordance with CNL's programs and all applicable laws, rules, regulations, standards and guidelines.

All decommissioning and demolition field work will be prepared and controlled following the IWC process [6-1]. Potential accidents and malfunctions associated with the Project will be identified and assessed for adverse effects on the workers, the public and the environment. Where potential adverse effects are identified from an accident or malfunction, or an effect from the environment, feasible environmental design features and/or mitigation measures will be implemented to avoid and minimize any potential significant adverse environmental effects.

In the IWC process [6-1], controls are selected to mitigate or eliminate the risk of a hazard using the following hierarchy:

- Eliminate the hazard(s).
- Control the hazards through engineered controls (preference should be given to passive controls over the active controls).
- Control the hazards through administrative controls.
- Control the hazards using PPE&C to protect the workers from the hazard.

Therefore, hazards related to the Project will be identified, analysed, and mitigated/controlled via the IWC process to protect workers, on-site personnel, the public, and the environment. General hazards are routinely encountered within a facility, and workers are trained in general health and safety requirements and expected to apply appropriate controls to address such hazards. In addition, a Decommissioning Safety Assessment will be completed for the DDP. The Decommissioning Safety Assessment will evaluate the hazards of the planned work and ensure that mitigation measures are included in the planned work.

6.1.1 Hazard Identification

Essential to the assessment of potential accidents and malfunctions is identification of the sources of hazards currently present within the G1WF. Internally or externally initiated events could result in radiological and/or non-radiological accidents. Radiological accidents refer to those that could result in the acute release of radioactivity to the environment and potentially affect the environment, the public or workers. Non-radiological accidents refer to those that involve only non-radiological substances and will not have any adverse radiological effects on the environment and humans (e.g., the spill of chemicals, lubricants, and oils).

The hazards associated with the Project are grouped into two categories:

- Radiological hazards
- Non-radiological hazards

A comprehensive characterization plan will be prepared to identify all hazards, both radiological and non-radiological, associated with the buildings/structures located within each planning envelope. The comprehensive characterization plan can include scan/survey of all remaining process equipment/systems and building materials/structure, collection of samples as required and analyse them for contaminants of potential concern. The results of the characterization surveys including gaps or uncertainties will be captured in a characterization report. These results will be the guiding factors to evaluating the risks and their mitigation measures, work controls, and selecting the waste management strategy.

A high-level overview of the radiological and non-radiological hazards anticipated to be encountered during the Project is presented below.

6.1.1.1 Radiological Hazards

Currently, radiological hazards are located in the Reactor Building, Service Building, Turbine Building including SFCA and Spent Resin Storage Area. Figure 2-2 shows the radiological zoning for each of the listed area.

Reactor Building: The main radiation hazard found in the Reactor Building is due to the inventory of radionuclides associated with the reactor core components, biological shield, heat transport system and moderator system. The other systems that were activated and contaminated during the operation of the reactor include the fuelling machine, operational control systems, building services systems and safety systems. The Reactor Building is characterized as a moderate level radiological hazard workplace.

Service Building: Radiological surveys of the Service Building material and equipment are being conducted as per the requirement of the Radiation Protection Program [6-2]. The surveys showed the presence of radionuclides in liquid waste system, active ventilation system, shield walls, disconnecting piping, and liquids within the tanks and pumps. The Service Building is characterized as a low-level radiological hazard workplace.

Turbine Building: A characterization survey [6-3] was performed which indicated the presence of a small amount and low contamination levels in south volume of the Turbine Building. The south volume of the Turbine Building is

characterized as a very low-level radiological hazard workplace. The tunnel from the Turbine Building to the Reactor Building is not accessible but will be characterized during the decommissioning planning process.

SFCA: The main radiation hazard present in the SFCA is fixed and loose contaminations in the empty canisters due to the inventory of the radionuclides associated with the spent fuel bundles that were transferred from the Fuel Storage Bay in 1987; the spent fuel has been transferred to CRL. The SFCA is characterized as a low-level radiological hazard workplace.

Spent Resin Storage Area: The HTPS and the MPS spent resins were removed from the G1WF in 2018. The upper accessible area is characterized as a very low-level radiological hazard workplace. The lower vaults of the Spent Resin Storage Area are characterized as a moderate level radiological hazard workplace.

The following internal and external radiological hazards may be present during the Project activities:

- Radiation fields produced by the fission products and activation products that remain in systems and components.
- Radiation fields produced by the radionuclides in the LLW and ILW.
- Fixed contamination on SSCs.
- Loose surface contamination on tools, equipment, and systems that are opened during the decommissioning work.
- Airborne contamination generated during the decontamination/D&D work or the packaging of the waste.

Estimated radiological inventory in the Reactor System, the Heat Transport System, the Moderator System, and the Turbine System includes the following radionuclides:

- H-3
- C-14
- Fe-55
- Ni-59
- Co-60
- Ni-63
- Nb-94
- Zr-95
- Cd-113
- Sn-121m
- Sb-125
- Eu-152
- Cs-137

Based on the Occupational Dose Estimate, which will be conducted as part of the decommissioning planning of each Planning Envelope and provided in the respective DDPs, necessary mitigation measures will be provided in the associated DWPs and implemented during the Project so that the dose to the workers and the public remain within the dose acceptance criteria.

The G1WF continues to ensure that the doses to the workers and the members of the public due to ionizing radiation remained well below regulatory limits and ALARA. Work involving ionizing radiation is performed as per the company-wide standard ALARA [6-4] which follows the requirements of the CNSC REGDOC- 2.7.1 Radiation Protection [6-5].

6.1.1.2 Non-radiological Hazards

During the Project, the following non-radiological hazards may be present:

- Conventional industrial hazards
- Chemical hazards
- Biological hazards
- External environmental hazards

Conventional industrial hazards were largely removed during Phase 1 Decommissioning (i.e., establishing a safe state) and are being removed on an ongoing basis during Phase 2 Decommissioning (i.e., SWS) through hazard reduction campaigns. Conventional industrial hazards associated with the Project activities are typical of a demolition project and include occupational accidents (e.g., slips/trips/falls, ergonomics, working at heights, hoisting and rigging and falling objects). The use of power tools (e.g., saws, drills, compressors) represent potential sources of physical injury to the operators. Changes in site conditions (e.g., excavations and trenching) also represent potential sources of physical injury.

Hazardous chemical materials present within the G1WF include asbestos, lead, PCBs, mercury, silica-containing materials (e.g., concrete, slate, asphalt) and ozone depleting refrigerants. Although most of these hazardous chemical substances will be removed as part of the hazard reduction campaigns and the decontamination activities, some hazardous waste will remain and become part of the decommissioning waste. Therefore, based on the level of hazards, the decommissioning workers will handle the hazardous waste in accordance with the relevant federal and provincial codes and standards.

The most likely chemical hazards expected during the Project are the following:

- Cleaning agents used for decontamination work.
- Concrete dust generated due to dismantling work.
- Airborne lead/mercury due to grinding of material covered with lead based paints.
- Leaks and spills from heavy vehicles/equipment.

The mitigation measures for these chemical hazards will be put in place so that the workers, on-site personnel, the public and the environment are protected during the implementation of the Project. For example, during the ongoing SWS phase, designated substances and asbestos assessments have been conducted in the Reactor Building, Turbine Building, and Service Building. The Asbestos Containing Material has been removed from the Turbine Building and Service Building. The asbestos abatement campaign for the Reactor Building is in progress.

Biological hazards (e.g., mold, stings and bites from insects) during the Project are not different from those that are currently present at the G1WF, and do not have any significant effect on the type and quantity of the waste that will be generated during decommissioning and demolition activities. The risks associated with these biological hazards will be mitigated by using proper technique and/or PPE&C [6-6], which will be determined through the IWC process; as such they are not assessed further.

External environmental hazards exist primarily from natural phenomenon. The impact of an event resulting from extreme environmental conditions (e.g. heavy precipitation, flood, tornado) is expected to be mitigated by prompt emergency response actions, such as rescheduling planned work to avoid working outside during extreme environmental conditions or covering the contaminated areas within the G1WF. Project specific Emergency Procedures will be prepared and referenced in the DWPs.

6.1.2 Risk Measurement and Evaluation

Each event is assigned a qualitative frequency, as described below:

- Extremely rare (Beyond-Design-Basis Accident BDBA)) – accident is not expected to occur during the lifetime of the facility.
- Rare (Design-Basis Accident (DBA)) – accident has a slight chance of occurring during the lifetime of the facility.
- Occasional (Anticipated Operational Occurrence [AOO]) – accident may occur a few times during the lifetime of the facility.

The risks are based on frequency ratings as shown in Table 6-1, and severity classifications as shown in Table 6-2. With both frequency and consequence evaluated, the corresponding risk acceptability of the scenario can be determined using the matrix shown in Table 6-3, which are qualitatively described in Table 6-4.

Table 6-1: Frequency Ratings

Frequency Class	Frequency Range (Events/Year)	Definition
F0	10^{-6} to < 10^{-5}	An extremely rare event, selected BDBA that is very unlikely to occur, almost implausible.
F1	≤ 10^{-5} to < 10^{-2}	A rare event, DBA that is unlikely to occur over the lifetime of the facility but is considered plausible.
F2	≤ 10^{-2}	An occasional event, AOO, upset condition, this event is expected to occur over the lifetime of the facility, but is not considered a normal operation.

Table 6-2: Severity Classifications

Severity Rating	Definition
S0 (Negligible effect)	**Radiological consequences**: Effective doses up to 1 mSv (on-site) and/or 0.1 mSv (off-site). **Environmental Consequences**: Negligible release to the environment, impact may be measurable. Impacts to the environment are very small/negligible and localized (on-site)/short duration.
S1 (Minor effect)	**Radiological consequences**: Effective doses in the range of 1 to 5 mSv (on-site) and/or 0.1 to 0.5 mSv (off-site). **Environmental Consequences**: Minor release to the environment, impact is measurable. Impacts to the environment are moderately extensive (on-site, may be off-site) and moderate duration.
S2 (Moderate effect)	**Radiological consequences**: Effective doses in the range of 5 to 50 mSv (on-site) and/or 0.5 to 5 mSv (off-site). **Environmental Consequences**: Moderate release to the environment. Impacts to the environment are extensive (on-site and off-site) and long duration.
S3 (Severe effect)	**Radiological consequences**: Effective doses > 50 mSv (on-site) and/or > 5 mSv (off-site). **Environmental Consequences**: Major release to the environment. Impacts to the environment are catastrophic.

Table 6-3: Risk Matrix

	Frequency	Severity			
		S0	S1	S2	S3
F0	Extremely Rare (i.e. < 10^{-5}/a)	R0	R0	R0	R1
F1	Rare (i.e. ≥ 10^{-5}/a) to < 10^{-2}/a)	R0	R0	R1	R2
F2	Occasional (i.e. ≥ 10^{-2}/a)	R0	R1	R2	R3

Table 6-4: Guidelines for Interpreting Risk Rankings

Risk Ranking	Definition
R0	The risk is negligible; no further action necessary.
R1	The risk is tolerable; further protective measures are not essential but should be considered.
R2	The risk is unacceptable; engineered solutions must be put in place to protect against the hazard.
R3	The risk is unacceptable; the proposed process or equipment is inherently unsafe, major modifications to the proposed design are required.

6.2 Accidents and Malfunctions

The following sub-sections provide an assessment of the potential effects of accidents and malfunctions that have a reasonable probability of occurring during the execution of the Project. The accidents and malfunctions that have been identified are:

- Conventional Occupational Accidents
- Spills and Leaks
- Material Handling Accidents
- System and Equipment Failure
- External Environmental Hazards

6.2.1 Conventional Occupational Accidents

Conventional industrial hazards associated with the Project activities are limited to on-site personnel who are working under controlled and monitored conditions, and do not pose a threat to the public or the environment. Occupational health and safety aspects are heavily regulated and programs must be compliant with federal laws and regulations, ensuring that occupational hazards are appropriately managed.

Potential worker accidents and injury may arise from non-radiological hazards such as conventional industrial hazards, including slips/trips/falls, working at heights, working with energized systems, and the potential for falling objects. Failure to isolate all energized systems (e.g., electrical, pressurized) during building isolation, either through improper isolation or accidental exclusion, may result in electrocution or physical shock hazards for workers. The Project activities involve the use of power tools and excavations. The use of saws, drills and compressors represent potential sources of physical injury to the operator, as well as changes in site condition (e.g., excavations).

In addition to the potential injury or accident itself, initiating incidents during decommissioning activities may result in increased exposures to other hazards present within the workplace. For example, if injured personnel require the assistance of rescuers or face delays in being removed from an unsafe location this could increase hazard exposure magnitude and timeframe. In particular, accidents or injuries in confined spaces increase potential exposure of the worker and rescuers to confined space hazards, such as exposure to poor air quality, chemicals and radiation. The hazard initiating the accident or injury may also pose a particular threat to rescuers.

Predicting the human factor that is central to occupational health and safety accidents is not always possible; however, assessment of human factors and performance and their influence on the work safety is a key part of the work planning process at CNL. The conventional occupational hazards are systematically identified and assessed through CNL's OSH Program [6-7]. The decommissioning activities will be carefully executed and will be completed in accordance with CNL's compliance based programs including Radiation Protection [6-2], Environmental Protection [6-8], Fire Protection [6-9], OSH [6-7], and Quality [6-10]. Furthermore, CNL has a rigorous Emergency Preparedness Program [6-11], and personnel are adequately trained to prevent and respond to occupational accidents.

The IWC process [6-1] provides that all work steps are identified and reviewed against possible risks. As part of the IWC process [6-1], a WCP will be developed for each planned activity at the site. Within the WCP, occupational hazards and risks, including those influenced by human factors, associated with the work are systematically identified, consequences are considered, and appropriate engineered and procedural controls are

applied. Proven workplace controls (e.g., job scope and safety analysis, signage, training, standard work procedures and controlled access where applicable) and PPE&C (e.g., hard hats, gloves, fall protection and hearing protection) are expected to mitigate these hazards to an acceptable level. The WCP also considers different factors that affect the complexity and hazardous nature of each task/procedure so that the potential hazards associated with each task/procedure can be identified and controlled in a safe and cost effective manner to protect workers, the public, and the environment.

From 2018 to 2024, there have been no hazardous occurrences at G1WF that were reported to Employment and Social Development in Canada [6-12], [6-13]. Table 6-5 provides a summary of injury rate data for the seven years (2018 to 2024).

Table 6-5: Summary of G1WF Injury Rate Data

	2018	2019	2020	2021	2022	2023	2024
G1WF Employees							
Person Hours Worked	9,320	9,040	16,448	20,350	11,250	17,685	23175
Lost-Time Injuries	0	0	0	0	0	0	0
Working Days Lost	0	0	0	0	0	0	0
Frequency [(a)]	0	0	0	0	0	0	0
Severity [(b)]		0	0	0	0	0	0
G1WF Contractors [(c)]							
Lost-Time Injuries		0	0	0	0	0	0
Working Days Lost		0	0	0	0	0	0

Notes:

(a) Frequency rate equals # of Lost-Time Injuries x 200,000 hrs of exposure divided by person hours worked (based on 100 Full Time workers)

(b) Severity rate equals # of Working Days Lost x 200,000 hrs of exposure divided by person hours worked (based on 100 Full Time workers)

(c) The # of Person Hours worked are not divulged by Contractors, as such, Frequency and Severity rates cannot be calculated.

Potential worker incidents and injuries may arise from conventional occupational accidents such as working at heights, with energized systems, falling objects, and heavy equipment. Management actions in place to reduce the likelihood and consequence of potential worker incidents are consistent with the safety management system and safety culture already in effect at the G1WF, where regular assessment of safety performance is conducted and lessons learned from experience are applied. The likelihood of a worker injury is classified as an **Occasional Event (F2)**, which is to be expected at an industrial operation. However, with the management systems currently in place, coupled with CNL's strong safety culture that includes regular assessments of safety performance and human performance, the consequence of a worker injury is expected to be **Minor (S1)**. A consequence severity of **Minor (S1)**, combined with a likelihood of **Occasional Event**, results in a risk evaluation of **Tolerable (R1)**, where appropriate management actions will reduce the risk associated with occupational accidents.

6.2.2 Spills and Leaks

Spills and leaks of hazardous substances are possible during all stages of Project, including hydraulic fluid or fuel leaks from vehicles or heavy equipment, failure of storage equipment (e.g., Low Level Waste Collection system). For example, during demolition or other dismantling work, unknown or greater than expected quantities of radiological and non-radiological hazardous substances may be encountered. Accidental cuts or breaks of contaminated piping during decommissioning may also release radioactive substances from these systems. Non-radiological hazardous materials in excess of the regulated exemption quantities will be removed and disposed of at an appropriate disposal site prior to the Project. However, spills and leaks are possible during

removal and handling of these materials, including friable asbestos, lead, and chemicals of various degrees of toxicity.

Hazardous materials are limited to small quantities of asbestos, silica dust, lead-based paints, lead bricks and sheets, mercury from mercury switches and PCBs from light ballasts. However, potential exposure to hazardous materials may occur during removal of equipment and hazards. Risk of worker exposure to the hazardous materials present (i.e., asbestos, lead, silica dust, mercury and PCBs) will be minimized through application of CNL's Work Permit System [6-1] and adherence to CNL's OSH Program [6-7]. The protective measures for exposure to asbestos dust and lead dust during asbestos and paint removal are similar to those for radioactive particulates (e.g., dust suppression, ventilated enclosures with air filtration and PPE&C for workers). Asbestos hazards will be mitigated through adherence to CNL's procedure for Controlling Asbestos Hazards [6-14]. These include use of dust suppression, air sampling and protective clothing and respirators, as required.

The following mitigation measures will be in place to prevent an environmental impact from spills and leaks:

- A spill response plan will be in place, and all workers shall be aware of how to respond to a spill or leak.
- Appropriate spill response equipment will be available to promptly recover hazardous liquids leaking onto the ground at the G1WF.
- Trained and qualified contractors and workers who are knowledgeable in managing potential leaks or spills.
- Secondary containment or confinement systems will be utilized to collect leakage or spillage in a manner that prevents direct release to the environment.
- Shut-off switches on vehicles to ensure the engines can be quickly turned off.
- Preventive maintenance and inspections of equipment prior to use to ensure it is in good operating condition (e.g., hydraulic hoses).

CNL's Emergency Preparedness Program [6-11], provides an analysis of potential emergencies that could occur and focuses on planned response to a release of hazardous material. As part of the Emergency Preparedness Program [6-11], this plan is revised annually to identify any changes required to keep the plan current. CNL employees have basic training in the management of emergencies, while other personnel at the site have been highly trained to respond to incidents involving contamination dispersion.

Radiation exposure to workers will be mitigated through compliance with administrative and operational controls. Administrative controls include use of dose control points, which are assigned to workers and which if exceeded, trigger management review. All work will be executed following the procedures and practices of CNL's Radiation Protection Program [6-2]. Procedures developed under CNL's Environmental Protection Program [6-8], Waste Management Program [6-15], and OSH Program [6-7] will also aid in protecting workers and the environment from radiological and non-radiological hazards. CNL's Radiation Protection Program [6-2] is designed and implemented to ensure CNL complies with, or exceeds, the level of radiation safety that is required by the relevant regulations pursuant to the Nuclear Safety and Control Act [6-16] and CNL's Safety and Health policy [6-17]. Worker radiation doses will be monitored throughout the Project so that doses do not exceed dose control points and are within regulatory limits.

Operational control measures will be implemented to mitigate worker exposure to radiation. Examples of measures that may be implemented are:

- PPE&C such as respirators and other protective measures.

- Shielding to reduce radiation fields.
- Workplace isolation – ventilated enclosures equipped with HEPA filtration units.
- Air monitoring (iCAMs).
- Use of electronic personal dosimeter.

Mitigation measures to prevent airborne contamination and release of particulates (dust suppression techniques and application of fixatives to seal contamination to surfaces) will also serve to reduce worker radiation exposure. A combination of Action Levels and dose management tools are used to keep radiation doses to workers below regulatory limits and ALARA. The ALARA [6-4] program formalizes the planning processes applied to radiation work to maintain radiation doses ALARA. These planning processes include a review of radiation hazards, estimation of individual and collective doses, selection of appropriate tools and instruments, protection measures and dosimetry.

CNL's Environmental Protection Program [6-8] also provides compliance with applicable environmental regulatory requirements and requirements that CNL has adopted as a matter of policy to provide protection to workers, the public and the environment.

With implementation of mitigation measures and operation procedures in effect, spills and leaks of hazardous substances and exposure to radiation will be mitigated to prevent release to the environment. On-site spills are not considered a risk to public safety given there is no public access to the Gentilly site. CNL's Emergency Preparedness Program [6-11], Radiation Protection Program [6-2], Environmental Protection Program [6-8], Waste Management Program [6-15], Fire Protection Program [6-9] and OSH Program [6-7] aid in protecting workers, the public and the environment from radiological and non-radiological hazardous substances.

There were no incidents at G1WF in 2018 through 2024 where the Emergency Operations Centre/Site Emergency Protocol was activated [6-12] [6-13]. Based on the mitigation measures and operational procedures in effect, the likelihood of a spill or leak during Project activities is classified as **Occasional (F2)**. With the management systems currently in place, coupled with CNL's strong safety culture that includes regular assessments of safety performance and human performance, the consequence of a spill or leak on the environment and to worker safety is classified as **Negligible (S0)**. A consequence severity of **Negligible (S0)**, combined with a likelihood of **Occasional (F2)**, results in a risk evaluation of **Negligible (R0)**, where implementation of appropriate mitigation measures will reduce the risk associated with spills and leaks.

6.2.3 Material Handling Accidents

The Project activities may involve lifting and moving of large, potentially contaminated materials. Drops of, or effects from, large objects pose physical hazards for workers nearby, and dropped objects could also damage other equipment or structures, resulting in leaks and spills. Cleanup or remediation required following such an incident could result in higher worker exposures. Dropping of contaminated rubble or concrete could cause fine, radioactive particles to be suspended in air, posing an internal exposure hazard. Drops and ruptures of waste containers, or contaminated equipment could also spread contamination and cause it to become airborne.

The exposure hazards associated with a material handing accident are limited to on-site personnel performing the activity and do not pose a threat to the public or the environment. During decommissioning activities, operational procedures pertaining to the prevention of spreading contamination will be in effect (i.e., Radiation Protection Program [6-2] and WCP [6-1] development). Contamination release as a result of accidents during the bulk of the demolition activities to be completed is anticipated to be limited because the G1WF will have previously been

decontaminated and the majority of contaminated waste removed. In addition, the use of stabilizing and immobilizing agents prior to demolition can reduce the spread of any remaining contaminants present in the G1WF.

CNL's Emergency Preparedness Program [6-11] focusses on prevention and mitigation of, preparedness for, response to, and recovery from abnormal or emergent events and is designed to respond to any emergency at G1WF. The Emergency Preparedness Program [6-11] provides guidelines for CNL's emergency management staff to ensure that adequate staff and materials are available to meet the federal, provincial and municipal emergency plan requirements. CNL has developed a site specific Emergency Preparedness Procedure [6-18] for G1WF that aims to reduce the personnel and environmental consequences of an accidental event occurring at G1WF.

Contamination release as a result of a material handling accident is anticipated to be limited because the majority of the contamination will be removed and the G1WF decontaminated prior to demolition activities. In addition, the use of stabilizing and immobilizing agents prior to demolition can reduce the spread of any remaining contaminants present in the G1WF. There were no incidents at G1WF in 2018 through 2024 where the Emergency Operations Centre/Site Emergency Protocol was activated [6-12] [6-13]. As such, the likelihood of a material handling accident occurring, considering controls and mitigation, and adherence to the CNL procedures, is classified as **Rare (F1)**. Although it is unlikely that a material handling accident would occur, the consequence severity of a loss of control on worker safety could be **Moderate (S2)**. A consequence severity of **Moderate (S2)**, combined with a likelihood of **Rare (F1)**, results in a risk evaluation of **Tolerable (R1)**. Risk reduction activities will reduce the risk associated with a material handling accident, but monitoring and active management will be required. The required management actions are consistent with the safety management system and safety culture already in place at the G1WF, where regular assessment of safety performance is conducted, and lessons learned from experience are applied.

6.2.4 Improper Management of Decommissioning Waste

Improper management, storage and disposal of decommissioning waste may result in increased exposures to radiological and non-radiological hazards for on-site workers. The Project activities will result in the generation of waste through the following sources:

- The generation of liquid and solid, non-radioactive, hazardous and non-hazardous waste during decommissioning activities.
- Soil excavation, backfilling and concrete removal activities could result in generation of contaminated waste.
- Hazardous waste will be generated from the removal of asbestos containing material, mercury, PCBs, and lead.
- Radioactive waste from legacy contamination could be generated/encountered during soil excavation work.

At G1WF, the waste generated from the decommissioning activities will be identified and accounted for under the following three categories:

- Potentially Clearable Waste (i.e., clean waste or likely clean waste)
- Radioactive Waste (i.e., ILW and LLW)
- Hazardous Waste (e.g., asbestos containing material, lead, mercury, silica)

The hazardous waste will be removed and disposed of before the commencement of the decommissioning and demolition activities; therefore, decommissioning waste inventory is expected to include radioactive waste (ILW and LLW) and potentially clearable waste only. However, if hazardous/designated materials (e.g., hazardous building materials that remain as part of the building structure) are discovered during decommissioning, these will be removed, packaged, and disposed in accordance with the project-specific Waste Enquiry Form and CNL's Hazardous and Mixed Waste Management [6-19], Management of Designated Toxic Substances [6-20], and Controlling Asbestos Hazard procedures [6-14]. High level waste is not anticipated to be generated during decommissioning.

Prior to commencing the demolition of G1WF buildings and structures, the stored waste present within these buildings will be monitored, segregated, packaged, or contained, and shipped for either processing, storage, or disposal as appropriate and in accordance with the Waste Management Plan for the Gentilly-1 Prototype Reactor Site 6.3.2]. Consideration will be given to control dismantling techniques, decontamination, contamination control, segregation of waste materials, reduction of active secondary wastes, and effective processing in order to minimize the amount of materials that need to go to an active licensed waste management facility. Wherever possible, materials will be decontaminated to allow for unrestricted release or disposal in an inactive landfill.

The radioactive waste (LLW and ILW) generated during the decommissioning of G1WF buildings and structures will consist of concrete, process components (mechanical, electrical and communications) and architectural and structural materials. Radioactive waste (ILW and LLW) will be shipped to an appropriate off-site waste management facility for processing/storage/disposal.

After completion of the demolition activities, the radiation surveys of the affected areas including building footprint of each of the buildings and structures will be conducted to ensure the affected areas are cleared of contamination and meet the criteria for Radiological Safety Zone 1 designation (i.e., very low-level radiological hazard workplace and considered as a "Clean" zone). If radiation surveys reveal no contamination or contamination below the clearance level in the soil, then the areas will be backfilled and/or graded. On the other hand, if contamination is found in the soil above the clearance level, the contaminated soil will be removed, categorized, and packaged in appropriate containers for interim storage and subsequent transfer to a radioactive waste storage or disposal facility as per the CNL procedure, Management of Waste [6-23]. If the excavated gravel/soil is free of contamination but not suitable for re-use (i.e., for backfilling), it will be hauled away and, for proper compaction, new gravel/soil will be used to backfill the excavated areas. Any deep voids (i.e., below bedrock level) created by the removal of building foundations, footings, and/or buried services will be filled with grout up to the level of the bedrock.

The LLW and ILW will be segregated, packaged, and shipped to CRL for interim storage or to a licensed off-site facility for processing in accordance with requirements of CNL's Waste Management Program [6-24], Radiation Protection Program [6-25], and Transportation of Dangerous Goods Program [6-26]. To meet the requirements of CNL's Transportation of Dangerous Goods Program [6-26] and the regulatory requirements for waste transport [6-27], necessary packages will be identified, designed, tested, and procured prior to the commencement of decommissioning activities. The required licences, approvals, and certifications will also be obtained before the packages are put into service.

Waste generated during decommissioning activities will be managed in accordance with the Waste Management Program [6-15], which applies all operations and activities that result in the generation, transportation, treatment, storage, and/or disposal of wastes (i.e., the lifecycle of waste) generated by CNL. As such, the likelihood of workers being exposed to non-radiological and radiological decommissioning waste through improper waste management, considering controls and mitigation, and adherence to the CNL procedures, is classified as **Rare (F1)**. Although it is unlikely that decommissioning waste would be improperly stored, the consequence severity of a loss of control on worker safety could be **Moderate (S2)**. A consequence severity of **Moderate (S2)**, combined with a likelihood of **Rare (F1)**, results in a risk evaluation of **Tolerable (R1)**. Risk reduction activities will reduce the risk associated with improper waste management, but monitoring and active management will be required. The required management actions are consistent with the safety management system and safety culture already in place at the G1WF, where regular assessment of safety performance is conducted, and lessons learned from experience are applied.

6.2.5 System and Equipment Failure

Equipment failure and malfunctions may result from improper operation or maintenance or loss of services. Safety systems and equipment, including alarm and monitoring systems (e.g., continuous air monitors), contamination collection and confinement (e.g., Low Level Liquid Waste Collection system, active ventilation system, storage tanks), could potentially be affected. Such failures could result in the accumulation or release of airborne or liquid contaminants potentially affecting worker dose exposures. As secondary containment and the Emergency Preparedness Program [6-11] already exist, the hazards associated with the Project activities are limited to on-site personnel performing the activity and do not pose a threat to the public.

Procedures developed under CNL's Environmental Protection Program [6-8], and Management and Monitoring of Effluents and Emissions [6-29], describe the use of secondary containment as standard design features of equipment containing hazardous materials. For instance, CNL's Gentilly-1 Waste Facility Effluent Monitoring Plan [6-30] indicates that secondary containment systems shall be provided for containers or systems containing radioactive or non-radioactive contaminants (e.g., chemicals, oils, solvents, or other hazardous or nuclear substances) that are stored outdoors or indoors near a storm drain or open draining trench. The exact design of the containment varies from equipment to equipment, but in general, takes the form of spill trays and ventilation ducts connected to effluent collection systems, or spill trays with sufficient volume capacity to contain the potential spill.

Failures of systems or equipment could result in radiological and non-radiological hazards through the accumulation or release of airborne and liquid contaminants, as well as increased worker exposure. Failure of alarm and monitoring systems could put workers at higher risks of exposures or fail to provide notification of unsafe conditions. Worker injuries and accidents are also possible with failed equipment such as crane failure. Preventative maintenance is performed to prevent failures from occurring and to assure the continuing capability to perform designed function. Design of equipment with fail-safe modes, use of reliable power supplies, maintenance programs and Defence-in-Depth reduce the likelihood or effects of failures. Use of PPE&C and adherence to OSH procedures, contingency planning, and safe back-out procedures provide protection to workers from system and equipment failure.

From 2018 to 2024, there were no instances which resulted in system/or equipment failure at G1WF. As such, the likelihood of a system and/or equipment failure causing radiological and non-radiological exposure hazards to workers is considered to be a **Rare Event (F1)**. Use of personal protective equipment and clothing and adherence to OSH procedures, contingency planning and safe back-out procedures provide protection to workers from system and equipment failure. Therefore, the consequence severity of a loss of system and equipment function

would be **Minor (S1)** for worker safety. A consequence severity of **Minor (S1)**, combined with a likelihood of **Rare Event (F1)**, results in a risk evaluation of **Negligible (R0).** Management actions are already in place at the G1WF and will continue for the Project, where regular assessment of safety performance is conducted, and lessons learned from experience are applied.

6.2.6 External Environmental Hazards

External hazards exist primarily from natural phenomenon, such as extreme weather events and seismic events. These events can produce extreme conditions affecting the performance of facilities and management systems.

The weather events include:

- Design-Basis (DB) tornadoes (≤EF2) and severe winds
- DB external flooding
- Beyond-Design-Basis (BDB) tornadoes (>EF2) and severe winds
- BDB external flooding
- BDB extreme weather

The seismic events include:

- DB seismic activity
- BDB seismic activity

In the event of any conventional emergencies, the G1WF emergency procedure [6-18] will provide direction for emergency evacuation, which applies to all G1WF staff, contractors, and visitors on site.

6.2.6.1 Extreme Weather Events

Design-Basis Tornadoes (≤EF2) and Severe Winds

Tornadoes (≤EF2) and severe winds are DBA events with an estimated probability of less than 1.2E-04 per year for the G1WF (i.e., **Rare Event (F1)**). Canisters are designed to withstand design basis tornadoes (≤EF2) and severe winds. Therefore, any potential damage to the concrete canisters would be limited because of their robust design (i.e., metallic rebars and concrete), which would only have a minor impact on the shielding. The radiological risk severity due to anticipated negligible release conditions from empty canisters with fixed and loose contaminations to the G1WF workers, the off-site public, and the environment is assessed as **Negligible (S0)**. The mitigated risk for damages to the canisters resulting from DB tornadoes (≤EF2) or severe winds is **Negligible (R0)**.

Tornado strikes can produce missiles, which may impact the canisters. The concrete canister area is located inside the Turbine Building with controlled access, and the canisters are empty. In addition, traffic at the G1WF site is very low. Hence, there is an extremely low probability of an accident from a vehicle or explosion-generated missile impact. The 0.864 m thickness of the G1WF concrete canisters would provide resistance to a DB missile impact. Even an impact more severe than DB would produce only minor damage to the reinforced concrete shielding wall. The radiological risk severity due to anticipated negligible release conditions from empty canisters with fixed and loose contaminations by DB tornadoes (≤EF2) or severe winds induced missile impacts to the G1WF workers, the off-site public, and the environment is assessed as **Negligible (S0)**. The mitigated risk for damages to the canisters is **Negligible (R0)**.

Design-Basis External Flooding

The Gentilly Nuclear Complex site is 6.1 m above sea level, which is 2.7 m higher than the average water level in the St. Lawrence River. The risk of flooding is further reduced by an earth dyke built along the perimeter of the site. The top of the earth dyke is located at 7.93 m above sea level. The floor level of the G1WF fuel canister room is 7.75 m above sea level. The height of the dyke was chosen such that the frequency of flooding the site due to natural variation in the St. Lawrence River, based on historical data, is 1E-04 per year. This frequency may rise (or fall) in the future as a result of the impact of climate change, but in either case, the frequency would remain within the **F1** range (**Rare Event**).

The effect of severe flooding would be an uplift in pressure under the raft foundation of the canisters. A 7.93 m high flood would not result in the uplifting and toppling of the canisters. The radiological severity to the G1WF workers, the off-site public, and the environment is assessed as **Negligible (S0)**. Mitigation measures include the emergency response plans [6-18] and the dyke around the Gentilly Nuclear Complex site. Therefore, the mitigated risk is **Negligible (R0)**.

Design-Basis Tornadoes (>EF2) and Severe Winds

Tornadoes greater than EF2 on the Enhanced Fujita scale and severe winds more than the National Building Code of Canada (NBCC) wind speeds are Design Extension Conditions (DEC). A DEC wind/tornado event may result in extensive damage to the canister surface due to an impact with tornado-generated missiles.

The highest force tornado that has been recorded near the G1WF vicinity is F0 on the Fujita scale, which has winds between 64 km/h to 116 km/h. Winds of this speed will not affect the structural integrity of the facility. Tornadoes with wind speeds high enough to affect the structural integrity of the facility have never been recorded in Québec.

Tornadoes greater than EF2 on the Enhanced Fujita scale and severe winds more than the NBCC wind speeds could result in structural collapse. A tornado greater than EF2 on the Enhanced Fujita scale could result in extensive damage to the outside surfaces of canisters due to tornado-induced missiles, with the possibility of toppling one or more empty canisters. Since spent fuel has been transferred to the CRL Waste Management Areas, the current source of radiation from empty canisters is fixed and loose contamination that is present on their inner surface. The radiological severity to the G1WF workers, the off-site public, and the environment is assessed as **Negligible (S0)**.

Tornadoes (>EF2) and severe winds are DECs with an expected frequency of **F0 (Extremely Rare)**. The radiological severity to the G1WF workers, the off-site public, and the environment is assessed as **Negligible (S0)**. The risk ranking for damages to the canisters resulting from tornadoes (>EF2) or severe winds is **Negligible (R0)**.

After a DEC tornado, access controls [6-18] will mitigate worker exposure, and an assessment will be completed to determine the extent of contamination and the remediation methodology for managing the impact.

BDB External Flooding

As assessed for DB external flooding above, the 7.93 m severe external flooding would not result in the uplifting and toppling of the canisters. The frequency of external flooding exceeding 7.93 m above the sea level is estimated as **Extremely Rare (F0)**. The radiological severity to the G1WF workers, the off-site public, and the environment is assessed as **Negligible (S0)**. Mitigation measures include the emergency response plans [6-18] and the dyke around the Gentilly Nuclear Complex site. Therefore, the mitigated risk is **Negligible (R0)**.

6.2.6.2 Seismic Events

DB Seismic Activity

The G1WF site was classified as Zone 2 in the seismic zoning system of the NBCC 2020. During the early stages of the G-1 NGS site design, earthquake probability was examined for the site. It was established that regional faults form an East-Northeast pattern on both sides of the St-Lawrence River. A member of this group is the St-Angele fault near the G-1 NGS site. It was also established that the G-1 NGS site lies between two epicenters of high seismic activity: one east of Québec City and the other at Montreal. The investigation concluded that there were no indications of active faulting at or near the site. During the G-2 NGS facility design phase, it was also concluded that there was no justification for assumptions of major fault movement in the immediate locality of the Gentilly Nuclear Complex site. The Turbine Building was qualified for the seismic event during the G-1 NGS site design phase. A Design Basis Earthquake (DBE) ground acceleration value of 0.15 g was used for the G-2 NGS facility and is also used for seismic qualification of the canisters. During the DBE event, quasi-static overturning calculations indicate that a horizontal acceleration of 0.15 g would not overturn the canisters and would not cause an impact against the Turbine Building steel structure. Therefore, the Turbine Building and canisters are qualified for the earthquake event, and the G-1 NGS site building design seismic events are assessed as **Rare Events (F1)**. Since the residual contamination in the buildings and structures at the G1WF is negligible, any spread of contamination by a seismic event would be **Negligible (S0)**. A consequence of radiological severity to the G1WF workers, the off-site public, and the environment is assessed as **Negligible (S0)**, combined with a likelihood of **Rare Events (F1)**, results in a risk evaluation of **Negligible (R0)**.

BDB Seismic Activity

Given that the original design basis for the G1WF was a ground acceleration of 0.04 g, significant structural failure for DEC would not be expected until the event resulted in ground accelerations exceeding 0.04 g (the original design basis). The BDB seismic event is DEC with an anticipated frequency of **Extremely Rare (F0)**. The canisters are only designed to sustain a DBE. Therefore, a BDB earthquake could result in a canister containment failure and partial loss of shielding, which would produce hazardous radiation fields for the G1WF workers with a radiological severity assessed as **Minor (S1)**. The spread of extensive surface contamination into the environment is not expected due to the BDB earthquake. The risk ranking for this BDB earthquake event is evaluated as **Negligible (R0)**.

6.2.7 Fire Hazards

The Turbine Building has been identified as having the potential for an external fire event due to a fire in an adjacent building. The frequency of such fire is classified as **Occasional (F2)**. The frequency of an external fire event due to a vehicle accident or equipment fire is also classified as **Occasional (F2)**.

If an external fire is detected, the Project will be immediately stopped, the facility will be placed into a safe state, and the G1WF emergency procedures [6-18] will be followed. The severity of the radiological consequence to the Project workers, the off-site public, and the environment is assessed as **Negligible (S0)**.

Safety measures to mitigate the consequences of this event include the fire alarm and detection system, pre-use inspection and monitoring of the area and equipment, control of combustible materials, fire screening processes, response from the Bécancour Site Emergency Services, radiological surveys to identify and remove the presence of radioactive material, contractor safety orientation, equipment maintenance program, and vehicle maintenance. Therefore, the mitigated risk is assessed as **Negligible (R0)**.

6.3 References

6.3.1 Acts and Regulations

- Nuclear Safety and Control Act (S.C. 1997, c. 9), Canada.
- Transportation of Dangerous Goods Regulations (SOR/2001-286), Canada.
- Packaging and Transport of Nuclear Substance Regulations (SOR/2015-145), Canada.
- Regulations for the Safe Transport of Radioactive Material, 2018, SSR-6 (Revision 1), IAEA.

6.3.2 Literature Cited

- [6-1] CNL (Canadian Nuclear Laboratories). 2024. Integrated Work Control, 900-514100-STD-002, Revision 4.1, April.
- [6-2] CNL. 2023. Radiation Protection, 900-508740-PDD-001, Revision 3.1, October.
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7 CONCLUSIONS

The purpose of this EPMR is to assess the environmental effects of the proposed Project activities to support the Environmental Effects Determinations and the requirements of section 24(4)(b) of the NSCA. This EPMR Report assesses the likely effects of the Project for normal conditions and the G1WF Decommissioning as a result of accidents and malfunctions. The scope of the EPMR is applicable to Planning Envelopes A and B.

This EPMR provides the information necessary to illustrate the environmental protection measures that, when implemented by CNL:

- Are commensurate with the level of risk associated with the activity.
- Account for uncertainty by keeping all releases to the environment as low as reasonably achievable and apply the best available technology and techniques that are economically available.
- Implement corrective actions to eliminate the identified root causes and verify completion to prevent recurrence.
- Provide adequate information to identify, assess and mitigate significant adverse environmental effects.

The EPMR demonstrated that CNL has established programs that identify, control and monitor all releases of radioactive and hazardous substances and effects on the environment from the G1WF or as a result of licensed activities at the G1WF.

The Project is a remediation project and is limited to decommissioning and demolition of the Southern portion of the Turbine Building, the basement portion of the Service Building, and the Reactor Building. As such, the interaction between the Project and the environmental components is limited. Based on the result of the Project-Environment interactions analysis, potential adverse environmental effects were identified for air quality (i.e., emissions), human and ecological health and wildlife species at risk and migratory birds (i.e., sensory disturbance and loss of habitat); however, these adverse environmental effects are expected to be limited through technically and economically feasible mitigation measures.

Project activities associated with the removal of equipment, dismantling of building structures, material handling and vehicles travelling on on-site roads have the potential to result in fugitive dust, non-radiological and radiological emissions that could have significant adverse environmental effects on air quality. Emissions quantification and dispersion modelling were completed for fugitive dust emissions. Overall, the predicted ground level concentrations remain below guidelines and criteria, and therefore are expected to have a negligible adverse effect on air quality. With the implementation of CNL's Management and Monitoring of Effluents and Emissions [7-1] and CNL's Radiation Protection Program [7-2] requirements, non-radiological, radiological, and fugitive dust emissions associated with the Project activities, the Project activities are **not expected to result in significant adverse environmental effects to air quality** (and subsequently the biophysical environment) or **on the health of workers, the public and ecological health.**

With the implementation of approved work plans, regulatory controls, and mitigation measures—including proper hazardous material handling, air monitoring, and dust suppression— the potential for radiological or non-radiological chemical releases to adversely affect human or ecological health is considered negligible. Additionally, the consistency of the proposed activities with the existing Radiological Work Assessment and the containment of potential releases within previously characterized and controlled areas ensures **no new or significant risks to human or ecological health**.

Adverse environmental effects to wildlife species at risk and migratory birds were evaluated in terms of habitat loss and decrease in habitat suitability, which ultimately effects wildlife movement and behaviour. Of the suitable habitats in the Assessment Boundary available to barn swallow, cliff swallow, and little-brown myotis and northern myotis, less than 1% is located within the Gentilly site. Furthermore, pre-demolition visual surveys will be conducted in all G1WF buildings. If active bat maternity roosts are identified in any structure to be affected by the Project, the erection of species-appropriate barriers once individuals have left the structure and roosts/nests are no longer active will be implemented. Decommissioning activities will also avoid sensitive periods and sensitive locations to reduce the risk of affecting birds, their nests and eggs.

Increased sensory disturbance can affect habitat quality for barn swallow, cliff swallow, and bats. Project activities are expected to generate noise from the operation of the power tools and heavy equipment required to accomplish the decommissioning of the buildings and transportation of waste to on-site storage and disposal facilities. The Project will be completed in a controlled manner and best practices for limiting noise will be implemented. There is already anthropogenic activity ongoing at the Gentilly site that bats would have become habituated to since the inception of the site. Similarly, for birds, there is mapped suitable habitat present in the area surrounding the Gentilly site; however, the ongoing anthropogenic activity has likely habituated birds to ongoing noise levels and disturbance. As such, displacement of species at risk from sensory disturbance is expected to be minor compared to existing conditions. Overall, loss of habitat and decrease in habitat suitability from the Project is **not expected to result in significant adverse environmental effects on the movement and behaviour of wildlife species at risk and migratory birds**.

Mitigation and environmental design features implemented for the Project are well-understood and include existing practices at the G1WF. CNL's existing Environmental Protection Program [7-3] and the G1WF Effluent Monitoring Plan [7-4] already include requirements for airborne effluent monitoring and management of habitat and wildlife. As such, a Project-specific Environmental Assessment Follow-up for the Project is not required and the existing program and plans are sufficient for validating the finding that no significant adverse environmental effects are expected to result from the Project.

All Project work will be prepared and controlled following the IWC process [7-5]. Potential accidents and malfunctions and external hazards associated with the Project were assessed for adverse effects on the workers, the public and the environment as a result of the Project. Where potential adverse effects are identified from an accident, malfunction, or external hazard, feasible environmental design features and/or mitigation measures will be implemented to avoid and minimize these potential adverse effects.

The EPMR has considered, among other things, the baseline environmental conditions of the proposed Project site, the risk of potential interactions between the Project and the environment and the efficacy of implemented mitigation measures to manage any identified risk to the environment. The EPMR has also identified the feedback and comments received from the public and Indigenous Nations, communities and organizations for purposes of section 84 of the IAA.

Through this EPMR, CNL, as the applicant, has also demonstrated that it is qualified to carry on the licensed activity being applied for, and will make adequate provision to protect the health, safety and security of persons and the environment.

The assessment has found that any changes to the existing environment as a result of the Project are predicted to negligible, and therefore, the Project is not likely to cause significant adverse environmental effects.

Notwithstanding the foregoing, the final determination regarding the likelihood that the proposed Project activities will cause significant adverse environmental effects must be made by each federal authority in accordance with the IAA and by the CNSC in accordance with the NSCA.

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Signature Page

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APPENDIX 1

Baseline Air Quality and Meteorology

1. INTRODUCTION

This Appendix was prepared to support the EPMR for the proposed CNL's Phase 3 Decommissioning of G1WF (Project) at the Gentilly Nuclear Complex Site (Gentilly site). This Appendix presents the meteorology and air quality baseline data used in the assessment to predict changes in non-radiological indicator compound emissions. This Appendix was prepared using available ambient air quality monitoring data from air quality monitoring stations (Figure 1) located near the Project, as well as the meteorological conditions at the Gentilly site and surrounding area.

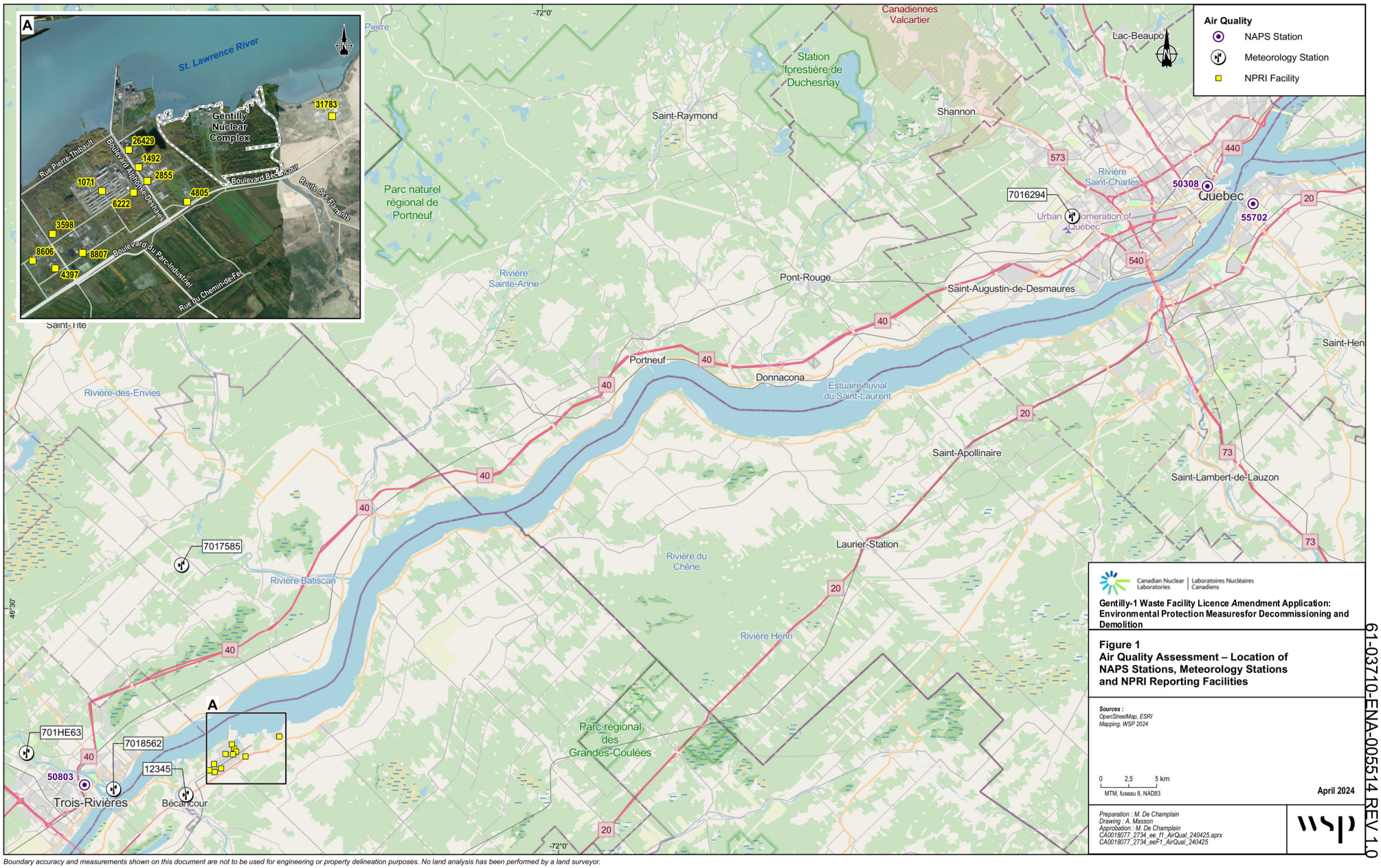
An assessment boundary is used to define the geographic scope or limits of the analysis of effects from the Project on the environment. This boundary encompasses the area within which the Project is expected to interact with the environmental components. The assessment boundary for the environmental effects assessment is equivalent to approximately a 10 km radius centered on the Gentilly site. The assessment boundary is presented on Figure 2.

This Appendix documents the methods, data and assumptions that were used to assess the background meteorology and air quality at the Project and assessment boundary. The background meteorology documented in this Appendix provides a summary of the review of the:

- climate data sources; and
- weather parameters, including temperature, relative humidity, precipitation, wind speed and direction, atmospheric pressure, and solar radiation.

The background air quality assessment was carried out by:

- identifying the non-radiological indicator compounds expected to be emitted from the Project;
- identifying and comparing air quality guidelines in Québec and Canada for the indicator compounds;
- identifying existing emission sources located within 5 km of the G1WF with shared indicator compounds;
- assessing air quality data sources for use in the background air quality assessment; and
- comparing air quality monitored data to the applicable air quality guidelines.



Boundary accuracy and measurements shown on this document are not to be used for engineering or property delineation purposes. No land analysis has been performed by a land surveyor.

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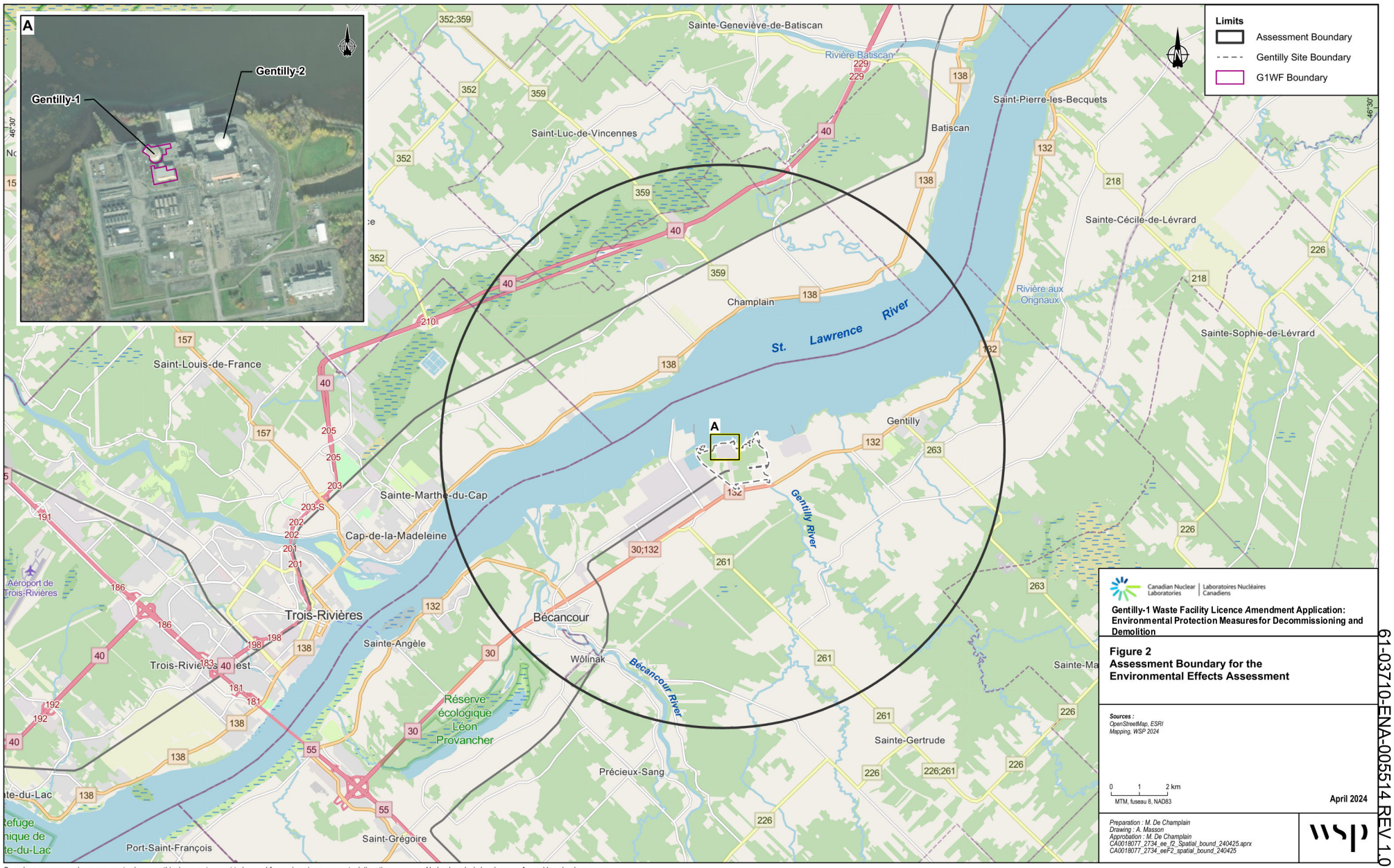

Boundary accuracy and measurements shown on this document are not to be used for engineering or property delineation purposes. No land analysis has been performed by a land surveyor.

2. METEOROLOGY BASELINE ASSESSMENT

This Meteorology Baseline Assessment summarizes the current climate conditions at the Gentilly site and assesses the suitability of the dispersion meteorological dataset provide by the ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs (MELCCFP). The Gentilly site is located on the south bank of the St. Lawrence River in the Municipality of Bécancour, approximately 15 km east from the city of Trois-Rivières in Québec.

Meteorological parameters considered in this study follow the Canadian Nuclear Safety Commission (CNSC) REGDOC-2.9.1, Environmental Protection: Environmental Principles, Assessments and Protection Measures (REGDOC-2.9.1). The meteorological parameters include temperature, precipitation, wind speed and direction, relative humidity, atmospheric pressure, and solar radiation. The occurrences of extreme and rare meteorological phenomena were considered as required by REGDOC-2.9.1 for the characterization of the atmospheric baseline environment [1].

The section describes the methods, data and assumptions that were used to validate the meteorological dataset used in the dispersion modelling assessment of the Project. The purpose of the validation of dispersion meteorology is to address the following:

- Is the 5-year MELCCFP dataset for the Project representative of long-term climate in the area?
- Is the 5-year MELCCFP dataset for the Project representative of on-site meteorological conditions?

The validation was carried out by:

- Obtaining a pre-processed meteorological dataset for air dispersion modelling from the MELCCFP for the Project in order to have a dataset ready to use for dispersion modelling and future permitting purposes.
- Comparing the MELCCFP dataset to regional climate data to demonstrate that the dataset is comparable to long-term averages at the Project site.

These steps are detailed in Sections 2.1 and 2.2.

2.1 Climate Normals Data Sources

Weather data is continuously collected at several climate stations across Canada and Québec alike. Federal and provincial governments provide the meteorological information from these climate stations in efforts to keep the public informed, and to improve research and predictive environmental tools. The current study utilizes weather data from these climate stations to determine the baseline meteorological conditions at the Project site. This assessment involves determining which datasets to include and then a consequential comparison of the datasets. Datasets are selected based on several factors, such as proximity to site and availability of data. The dataset sources are from the following:

- Canadian Climate Normals published by Environment and Climate Change Canada;
- Historical Data published by Environment and Climate Change Canada; and
- Meteorological Dataset provided by the MELCCFP.

2.1.1 Climate Normals

Climate normals are used to summarize and describe the characteristic climatic conditions of a specific location using long-term averages of observed climate data that meet the data quality standards. Climate normals published by Environment and Climate Change Canada (ECCC) from climate stations located near the Project are used in this assessment to describe the long-term general climatic conditions in the region and are used to validate the MELCCFP dispersion meteorological dataset. It is important to note that these long-term averages are determined for an approximate 30-year period, which typically occurs from 1981 through 2010 as per ECCC.

For this study, the relevant climate stations were selected based on several factors, including proximity of the station to the Gentilly site, availability of relevant climatic parameters, and time period of the data. Table 1 presents the location of the climate stations considered in this analysis. It should be noted that only the stations selected for study are included in Table 1.

Table 1: Location of Climate Stations

Station Name	Climate ID	Distance and Direction from Project Site (km)	Elevation (m)	Period (years)
St Narcisse	7017585	16.7 NNW	46	1981 – 2010[(a)]
Trois-Rivières Aqueduc	701HE63	20.0 W	55	1981 – 2010[(a)]
Québec/Jean Lesage Intl A	7016294	87.0 NE	74	1981 – 2010[(a)]
Trois-Rivières	7018562	12.9 WSW	6	2005 – 2009[(b)]

Notes:

(a) Normal period as defined by ECCC.

(b) Station did not record climate normals. Climate data was used as validation where data for Trois-Rivieres Aqueduc was not available.

St Narcisse station is located approximately 16.7 km north-northwest of the Project site and has published climate normals for the 1981 through 2010 period. As outlined in Table 2, St Narcisse station is relatively inland compared to the Project site and only records temperature and precipitation monitoring data and therefore does not meet the requirements for meteorological parameters set forth in CNSC REGDOC-2.9.1. To satisfy the requirements, two other climate stations were considered for the wind speed and direction, relative humidity, atmospheric pressure, and solar radiation.

Trois-Rivières Aqueduc station was selected as the next closest climate station and is located west of the site, along the Saint-Maurice River, a tributary that feeds into the St. Lawrence River. It monitors temperature, precipitation, wind speed and direction. This station is located 20 km west of the Project site and has monitoring data for the 1981 through 2010 period.

Québec City Jean Lesage International Airport station (also referred to as “Quebec/Jean Lesage Intl A”) was selected as the third climate station as it records the full list of climate normals and is located along the St. Lawrence River. This station is located 87 km northeast of the Project site and has monitoring data for the 1981 through 2010 period. A comparative assessment of three climate stations is deemed sufficient to determine the baseline weather conditions and climate patterns at the Project site.

Trois-Rivières station was selected as the fourth climate station and is located west of the Project site, on the north shore of the St. Lawrence River. Please note Trois-Rivières station is a separate station to Trois-Rivières Aqueduc station. Trois-Rivières station is located the closest in proximity to the Project site at 12.9 km away. It is important to note that this station does not have published climate normals, however it was included in this assessment to fill in data gaps where climate normals were not available for the Trois-Rivières Aqueduc station, specifically for wind speed and direction, relative humidity, and solar radiation. The hourly meteorological data for a five-year period from 2005 through 2009 is considered for comparison.

Table 2: Availability of Climate Normals for Meteorological Parameters

Station Name	Available Parameters						
	Wind Speed	Wind Direction	Temperature	Precipitation	Relative Humidity	Atmospheric Pressure	Solar Radiation[(b)]
St Narcisse	No	No	Yes	Yes	No	No	No
Trois-Rivières Aqueduc	No[(a)]	No[(a)]	Yes	Yes	No[(a)]	No	No
Québec /Jean Lesage Intl A	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Trois-Rivières	Yes[(b)]	Yes[(b)]	No	No	Yes[(b)]	No	Yes

Notes:

(a) Climate normals not available at the ECCC station.

(b) Five-year averages used in place of 30-year climate normals due to limitations of climate normal data at Trois-Rivieres Aqueduc.

Climate normals can provide an idea of meteorological conditions at the Project site; however they remain general and thus tend to be more representative of the regional climatic patterns (and not necessarily local climatic patterns). Furthermore, the datasets may be limited as not all climate stations nearest the Project site have published climate normals for any or all meteorological parameters. Therefore, it is important to also consider the MELCCFP dataset provided for dispersion modelling.

2.1.2 MELCCFP Dataset

The MELCCFP previously provided a meteorological dataset for dispersion modelling for a nearby site. This dataset has been deemed appropriate for use on the Project site based on proximity and similarity of surrounding land cover. The MELCCFP dataset is for the Bécancour station as shown in Table 3. Bécancour station is located at the Project site in the southwestern quadrant, approximately 0.8 km from the shoreline of the St. Lawrence River. However, Bécancour station only provides hourly data for the years 2005 through 2009. Furthermore, the hourly data does not include precipitation, relative humidity, nor solar radiation, as outlined in Table 4.

Table 3: Location of MELCCFP Dataset

Station Name	Climate ID	Distance And Direction From Project Site (km)	Elevation (m)	Period (Years)
Bécancour	12345	0.0 S	7	2005 – 2009

It is important to note that the values presented for Bécancour are based on five years of hourly data, whereas the values presented for the other stations are typically based on 30-year climate normals. Where available, the meteorological data from Bécancour are compared to St Narcisse, Trois-Rivières Aqueduc, and Québec City Jean Lesage International Airport.

Table 4: Availability of Climate Data for Meteorological Parameters

Station Name	Available Parameter						
	Wind Speed	Wind Direction	Temperature	Precipitation	Relative Humidity	Atmospheric Pressure	Solar Radiation
Bécancour	Yes	Yes	Yes	No	No	Yes	No

2.2 Climate and Meteorology for the Project

This section presents the available climate normals for the four climate stations and compares the MELCCFP Dataset to the appropriate climate normals. The weather parameters, including temperature, precipitation, wind speed and direction, relative humidity, atmospheric pressure, and solar radiation can be expressed in terms of normal values obtained from the long-term averages.

2.2.1 Temperature

A summary of the monthly temperature distribution for the climate normals from St Narcisse station is shown in Table 5. The daily average temperature in the winter season (December through February) is approximately -10.4ºC. The daily average temperature in the summer season (June through August) is 18.3ºC. The extreme minimum temperature during the 30-year period was -41ºC observed in January. The extreme maximum temperature during the 30-year period was 35.5ºC observed in May.

A summary of the monthly temperature distribution for the climate normals from Trois-Rivières Aqueduc station is shown in Table 6. The daily average temperature in the winter season (December through February) is approximately -9.7ºC. The daily average temperature in the summer season (June through August) is 18.8ºC. The extreme minimum temperature during the 30-year period was -41.1ºC observed in January. The extreme maximum temperature during the 30-year period was 36.1ºC observed in August.

A summary of the monthly temperature distribution for the climate normals from Québec City Jean Lesage International Airport station is shown in Table 7. The daily average temperature in the winter season (December through February) is approximately -10.7ºC. The daily average temperature in the summer season (June through August) is 17.9ºC. The extreme minimum temperature during the 30-year period was -36.1ºC observed in February. The extreme maximum temperature during the 30-year period was 35.6ºC observed in July.

A summary of the monthly temperature distribution from Bécancour station is shown in Table 8. The daily average temperature in the winter season (December through February) is approximately -8.1ºC. The daily average temperature in the summer season (June through August) is 19.3ºC. The extreme minimum temperature during the five-year period was -34.9ºC observed in January. The extreme maximum temperature during the five-year period was 32.5ºC observed in July.

The daily average temperature conditions between St Narcisse, Trois-Rivières Aqueduc, Québec City Jean Lesage International Airport and Bécancour are comparable. On average, all daily average temperatures, climate normal or not, are within 4% of each other. Bécancour station tends to show the greatest temperature variation from October to February as a result of observing milder temperatures in the fall and winter months. This may be attributed to the different periods of study; Three stations express temperature as 30-year climate normals, and the fourth station expresses temperature as a five-year daily average from hourly data. A graph displaying the different temperatures is shown in Figure 3. It is expected that the climatic conditions at the Project site are most comparable to the Bécancour station as this climate station is located at the Project site. Therefore, the five-year MELCCFP dataset for the Project is representative of temperature trends in the area.

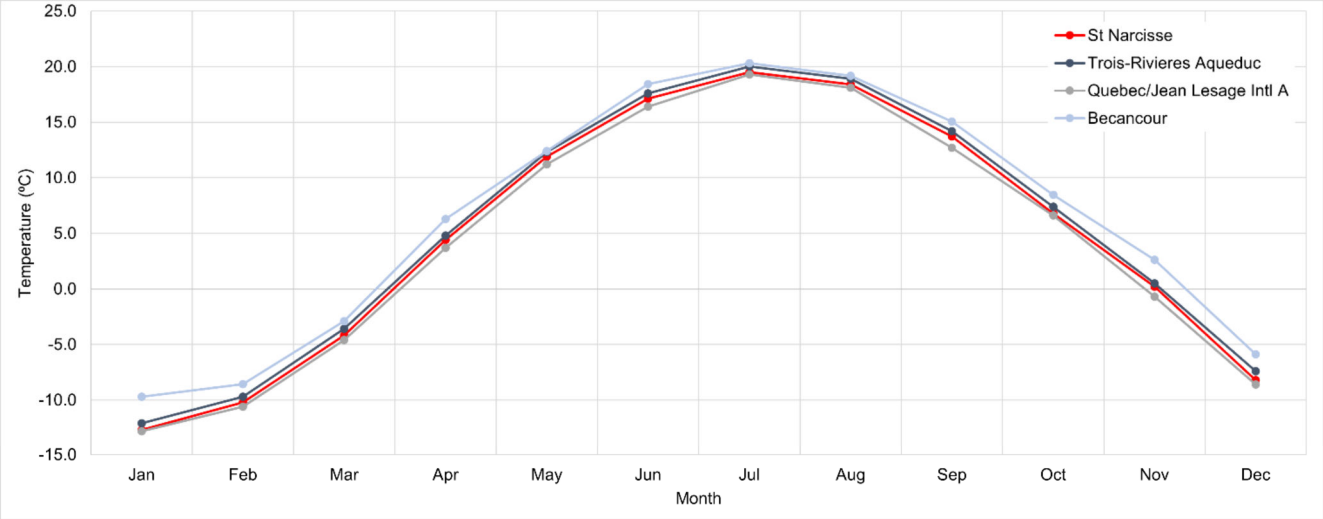

Figure 3: Graph of Daily Average Temperature for Each Month During the 30-Year Period

Table 5: Monthly Temperature Distribution for St Narcisse Station (°C)

Climate Normals Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual[(a)]
Daily Average	-12.7	-10.2	-4.2	4.4	11.9	17.1	19.5	18.4	13.7	6.8	0.2	-8.2	4.7
Standard Deviation	3.3	2.8	2.2	1.5	1.6	1.2	1.0	1.1	1.4	1.3	1.7	3.2	1.2
Daily Maximum	-7.2	-4.5	1.2	9.5	18.3	23.3	25.6	24.6	19.4	11.8	4.0	-3.6	10.2
Daily Minimum	-18.1	-15.9	-9.6	-0.9	5.6	10.8	13.5	12.3	7.9	1.9	-3.6	-12.8	-0.8
Extreme Maximum	11.0	10.5	17.0	32.0	35.5	35.0	35.0	34.4	33.5	26.1	21.5	13.0	–
Extreme Minimum	-41.0	-36.0	-31.0	-18.0	-6.7	-1.7	2.2	1.0	-6.0	-9.4	-24.0	-35.0	–
Days with Maximum Temperatures Above 30ºC	0.0	0.0	0.0	0.0	0.4	2.0	2.9	1.3	0.3	0.0	0.0	0.0	6.9
Days with Minimum Temperature Below -10ºC	24.4	20.6	13.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	3.6	17.6	79.9

Note:

(a) The annual data average may not match the average of the presented monthly values due to rounding; however, the annual number days with maximum temperatures above 30°C and below -10°C would match the total of the monthly values.

Table 6: Monthly Temperature Distribution for Trois-Rivières Aqueduc Station (°C)

Climate Normals Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual[(a)]
Daily Average	-12.1	-9.7	-3.6	4.8	12.3	17.6	20.0	18.9	14.2	7.4	0.5	-7.4	5.2
Standard Deviation	3.2	2.5	1.9	1.4	1.6	1.2	1.0	1.1	1.4	1.4	1.6	3.1	2.8
Daily Maximum	-7.1	-4.4	1.4	9.9	18.2	23.3	25.5	24.4	19.4	11.9	4.1	-3.1	10.3
Daily Minimum	-17.1	-14.9	-8.6	-0.3	6.3	11.8	14.4	13.4	8.9	2.8	-3.1	-11.6	0.2
Extreme Maximum	13.0	11.0	17.5	31.5	32.2	34.5	34.5	36.1	32.5	27.2	20.0	12.5	–
Extreme Minimum	-41.1	-35.6	-35.0	-17.2	-6.1	-1.5	3.5	1.1	-7.2	-10.6	-25.6	-35.5	–
Days with Maximum Temperatures Above 30ºC	0.0	0.0	0.0	0.0	0.2	1.9	2.2	1.0	0.2	0.0	0.0	0.0	5.5
Days with Minimum Temperature Below -10ºC	23.3	19.8	11.2	0.6	0.0	0.0	0.0	0.0	0.0	0.0	3.0	16.2	74.0

Note:

(a) The annual data average may not match the average of the presented monthly values due to rounding; however, the annual number days with maximum temperatures above 30°C and below -10°C would match the total of the monthly values.

Table 7: Monthly Temperature Distribution for Québec City Jean Lesage International Airport Station (ºC)

Climate Normals Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual[(a)]
Daily Average	-12.8	-10.6	-4.6	3.7	11.2	16.4	19.3	18.1	12.7	6.6	-0.7	-8.6	4.2
Standard Deviation	3.2	2.9	1.9	1.5	1.1	1.1	1.1	1.3	1.2	1.4	1.5	3.0	0.6
Daily Maximum	-7.9	-5.6	0.2	8.3	17.0	22.3	25.0	23.6	17.9	11.1	2.9	-4.2	9.2
Daily Minimum	-17.7	-15.6	-9.4	-1.0	5.4	10.5	13.5	12.5	7.5	2.0	-4.2	-12.8	-0.8
Extreme Maximum	10.0	11.7	17.8	29.9	33.0	33.9	35.6	34.4	33.9	28.3	20.0	13.9	–
Extreme Minimum	-35.4	-36.1	-30.0	-18.9	-7.8	-0.6	3.9	2.2	-4.8	-10.0	-24.0	-32.3	–
Days with Maximum Temperatures Above 30ºC	0.0	0.0	0.0	0.0	0.2	1.3	2.6	0.8	0.1	0.0	0.0	0.0	5.1
Days with Minimum Temperature Below -10ºC	25.2	21.9	13.5	0.9	0.0	0.0	0.0	0.0	0.0	0.0	4.1	19.3	84.8

Note:

(a) The annual data average may not match the average of the presented monthly values due to rounding; however, the annual number days with maximum temperatures above 30°C and below -10°C would match the total of the monthly values.

Table 8: Monthly Temperature Distribution for Bécancour Station (ºC)

Climate Normals Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual[(a)]
Daily Average	-9.7	-8.6	-2.9	6.3	12.4	18.4	20.3	19.2	15.1	8.5	2.6	-5.9	6.3
Standard Deviation	–	–	–	–	–	–	–	–	–	–	–	–	–
Daily Maximum	-5.6	-4.4	1.2	10.9	17.1	23.3	25.0	24.2	20.3	12.1	5.8	-2.8	10.6
Daily Minimum	-14.2	-13.3	-7.6	1.8	7.5	13.3	15.7	14.1	9.8	4.9	-0.5	-9.6	1.8
Extreme Maximum	10.8	9.2	18.2	28.6	32.0	32.4	32.5	32.2	30.6	26.6	19.2	9.4	–
Extreme Minimum	-34.9	-27.4	-24.8	-5.5	0.4	2.2	9.2	4.8	0.4	-4.1	-13.9	-22.5	–
Days with Maximum Temperatures Above 30ºC	0.0	0.0	0.0	0.0	0.6	2.8	1.6	1.2	0.4	0.0	0.0	0.0	6.6
Days with Minimum Temperature Below -10ºC	21.4	20.6	10.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	15.0	68.6

Note:

(a) The annual data average may not match the average of the presented monthly values due to rounding; however, the annual number days with maximum temperatures above 30°C and below -10°C would match the total of the monthly values.

In this study, precipitation monitoring data refers to both rainfall and snowfall. It is standard for rainfall to be measured in millimetres and snowfall to be measured in centimetres. Snowfall measurements may be ambiguous as snow depth depends on several atmospheric and ground conditions, such as snow density. Snowfall is converted to millimetres equivalent using an assumed snow-to-rain ratio of 10:1. This conversion allows total precipitation to be expressed in millimetres equivalent. A summary of the monthly and seasonal precipitation monitoring data for the climate normals from the St Narcisse station are shown in Table 9 and Table 10, respectively.

The 30-year climate normals from the St Narcisse station display an average annual precipitation of approximately 1063 mm[eq] for the region. The highest precipitation is rainfall that occurs in July, while the least precipitation occurs in February. In general, the area observes the most precipitation in the summer months of June through August. On average, this region experiences 165 days of snowfall or rainfall per year.

Table 9: Monthly Precipitation Summary for St Narcisse Station

Month	Rainfall (mm)	Snowfall (cm)	Total Precipitation[(a)] (mm[eq])	Extreme Daily Precipitation (m)	Days With Measurable Precipitation[(b)]
January	19.0	42.3	61.4	40.4	13.9
February	16.1	33.9	50.0	35.8	12.3
March	33.3	30.0	63.3	29.6	12.2
April	71.7	6.8	78.4	66.0	12.7
May	96.0	0.3	96.2	41.0	13.7
June	105.3	0.0	105.3	66.4	15.0
July	116.5	0.0	116.5	70.0	15.2
August	104.5	0.0	104.5	70.1	13.5
September	111.5	0.0	111.5	102.0	13.2
October	104.2	1.5	105.7	64.6	13.9
November	75.3	18.1	93.4	54.2	14.3
December	31.8	45.0	76.9	49.0	15.1
Annual	**885.1**	**178.0**	**1063.1**	**–**	**165.1**

Notes:

(a) Total precipitation in mm [eq] is calculated by adding the snowfall in cm (a ratio of 10:1 to convert snow to rain) to the rainfall in mm.

(b) Greater or equal to 0.2 mm.

mm[eq] = millimetres equivalent

Table 10: Seasonal Precipitation Summary for St Narcisse Station

Season	Total Precipitation (mm)
Winter (December – February)	188.3
Spring (March – May)	237.9
Summer (June – August)	326.3
Fall (September – November)	310.6
Total	**1063.1**

Note:

mm[eq] = millimetres equivalent.

Comparatively, a summary of the monthly and seasonal precipitation for the climate normals from the Trois-Rivières Aqueduc station are shown in Table 11 and Table 12, respectively. The highest precipitation is rainfall that occurs in July, while the least precipitation occurs in February. Similar to St Narcisse, the area observes the most precipitation in the summer months of June through September. On average, the region experiences 161 days of snowfall or rainfall per year. This station has an annual total precipitation of 1,123 mm[eq], which is slightly greater than the St Narcisse station. This difference is attributed to Trois-Rivières Aqueduc observing both greater snowfall and slightly greater rainfall, particularly over the winter months. Overall, the annual total precipitation is comparable to St Narcisse station.

Table 11: Monthly Precipitation Summary for Trois-Rivières Aqueduc Station

Month	Rainfall (mm)	Snowfall (cm)	Total Precipitation[(a)] (mm[eq])	Extreme Daily Precipitation (mm)	Days With Measurable Precipitation[(b)]
January	24.5	58.5	82.9	44.4	13.9
February	19.5	49.3	68.8	58.1	11.9
March	32.0	43.6	75.6	47.0	11.1
April	66.8	12.5	79.2	43.4	11.9
May	96.3	0.0	96.3	36.9	14.4
June	107.0	0.0	107.0	68.8	14.4
July	116.8	0.0	116.8	69.0	15.0
August	101.3	0.0	101.3	58.8	12.8
September	100.6	0.0	100.6	94.4	12.8
October	95.7	2.8	98.4	56.1	14.3
November	75.4	27.1	102.4	79.4	14.4
December	28.1	65.3	93.4	57.5	14.2
Annual	**864.0**	**259.1**	**1122.7**	**–**	**161.1**

Notes:

(a) Total precipitation in mm [eq] is calculated by adding the snowfall in cm (a ratio of 10:1 to convert snow to rain) to the rainfall in mm.

(b) Greater or equal to 0.2 mm.

mm[eq] = millimetres equivalent

Table 12: Seasonal Precipitation Summary for Trois-Rivières Aqueduc Station

Season	Total Precipitation (mm)
Winter (December – February)	245.1
Spring (March – May)	251.1
Summer (June – August)	325.1
Fall (September – November)	301.4
Total	**1122.7**

Note:

mm[eq] = millimetres equivalent.

Comparatively, a summary of the monthly and seasonal precipitation for the climate normals from the Québec City Jean Lesage International Airport station are shown in Table 13 and Table 14, respectively. The highest precipitation is rainfall that occurs in the month of May, while the least precipitation occurs in the month of February. This region generally experiences 175 days of snowfall or rainfall per year. The area observes the most precipitation in the summer months, which agrees with St Narcisse and Trois-Rivières Aqueduc stations. This station has an annual total precipitation of 1,189 mm[eq], which is slightly greater than the St Narcisse station. This difference is attributed to Québec City observing both greater snowfall and slightly greater rainfall, particularly in the winter months. Overall, the annual total precipitation is comparable to St Narcisse station.

Precipitation is a required element for the Air Quality assessment, as indicated in Appendix B of REGDOC-2.9.1; However, it is not one of the parameters included in the MELCCFP dataset for Bécancour station nor is it required for dispersion modelling. Given the proximity of St Narcisse station and Trois-Rivières station to the Project site, precipitation recorded these stations is considered representative for the Project site.

Table 13: Monthly Precipitation Summary for Québec City Jean Lesage International Airport Station

Month	Rainfall (mm)	Snowfall (cm)	Total Precipitation[(a)] (mm[eq])	Extreme Daily Precipitation (mm)	Days With Measurable Precipitation[(b)]
January	22.7	71.9	86.6	53.4	17.1
February	15.2	63.6	74.5	53.4	14.3
March	30.2	46.4	76.1	63.5	13.4
April	67.5	13.2	83.5	55.4	12.1
May	115.9	0.0	115.9	54.2	15.4
June	111.4	0.0	111.4	78.0	13.4
July	121.4	0.0	121.4	59.9	13.5
August	104.2	0.0	104.2	55.4	13.4
September	115.5	0.0	115.5	81.2	13.4
October	94.6	3.2	98.3	56.9	14.4
November	69.1	32.7	102.5	45.7	16.0
December	31.7	72.4	99.9	49.6	18.5
Annual	**899.4**	**303.4**	**1189.8**	**–**	**174.9**

Notes:

(a) Total precipitation in mm[eq] is calculated by adding the snowfall in cm (a ratio of 10:1 to convert snow to rain) to the rainfall in mm.

(b) Greater or equal to 0.2 mm.

mm[eq] = millimetres equivalent.

Table 14: Seasonal Precipitation Summary for Québec City Jean Lesage International Airport Station

Season	Total Precipitation (mm[eq])
Winter (December – February)	261.0
Spring (March – May)	275.5
Summer (June – August)	337.0
Fall (September - November	316.3
Total	1189.8

Notes:

mm[eq] = millimetres equivalent.

2.2.3 Wind Speed and Direction

Large scale winds are driven by global climate patterns, however localized winds are dictated by topography, surface roughness, and surface characteristics. Climate normals for wind speed and wind direction were not available at St Narcisse station, nor at Trois-Rivières Aqueduc station. Therefore, the climate normals from Québec City Jean Lesage International Airport station were used to present the general long-term wind conditions.

The climate normals for monthly wind speed and predominant wind direction are displayed in Table 15. Wind directions listed are the direction from which the wind originates, referred to as “blowing from” direction. Winds were typically observed from the west at the station, with an average wind speed of 13.7 km/hr. During springtime (March through May), the climate pattern changes, and the predominant wind direction blows from the east.

Table 15: Monthly Wind Meteorology Data from Québec City Jean Lesage International Airport Station

Month	Season	Average Wind Speed (km/hr)	Most Frequent Wind Direction
January	Winter	16.1	W
February		15.6	W
March	Spring	15.4	E
April		15.0	E
May		14.2	E
June	Summer	12.3	W
July		11.1	W
August		10.7	W
September	Fall	11.5	W
October		13.1	W
November		14.5	W
December	Winter	15.2	W
Annual	–	13.7	–

As previously mentioned, the Trois-Rivières Aqueduc station does not report climate normals for wind. However, the Trois-Rivières station nearby the Project site does report the hourly the wind speed and direction. It is important to note that a five-year period from 2005 through 2009 was considered as this period coincides with the period for the MELCCFP dataset for Bécancour station. The hourly data is included in the analysis because this station is closer in proximity to the Project site than Québec City Jean Lesage International Airport station. Thus, Trois-Rivières station may better resemble the surface roughness and encounter local winds that align more closely with the Project site. Wind speed and direction for Trois-Rivières station are shown in Table 16.

Table 16: Monthly Wind Meteorology Data from Trois-Rivières Station

Month	Season	Average Wind Speed (km/hr)	Most Frequent Wind Direction
January	Winter	13.9	SW
February		13.9	SW
March	Spring	14.3	NE
April		14.5	NE
May		14.3	NE
June	Summer	12.6	SSW
July		12.5	SSW
August		11.8	SSW
September	Fall	12.5	SSW
October		13.5	SW
November		13.9	SW
December	Winter	15.0	SW
Annual	–	13.6	–

Trois-Rivières station and area is characterized by winds predominantly blowing from the southwest and south-southwest directions in summer, fall, and winter. During springtime, the predominant wind direction is from the northeast as a result of air pressure differences from seasonal changes. The average annual wind speed is 13.6 km/hr which agrees with Québec City Jean Lesage International Airport station. Over the five-year period, there were “calms” (defined as a wind speed of less than 0.3 m/s) recorded 7.2% of the time. There were “model calms” (defined as hours having a wind speed less than 3.6 km/hr or 1 m/s) recorded 7.7% of the time. Winds blowing from the northeast were generally of higher than winds from other directions.

In addition to Québec City Jean Lesage International Airport station and Trois-Rivières station, wind parameters from Bécancour station were also assessed. Similar to Trois-Rivières station, Bécancour station only considers a five-year period from 2005 through 2009 and records hourly data for wind speed and direction. The MELCCFP dataset is included in the analysis to use as a comparison against the climate normals from other stations. Bécancour station is located on the Project site and therefore will better represent local winds that align with the Project site.

As outlined in Table 17, Bécancour station is characterized by winds predominantly blowing from the northeast in the fall, winter, and spring. The average annual wind speed is 9.4 km/hr. Over the five-year period, there were “calms” (defined as a wind speed of less than 0.3 m/s) recorded 6.2% of the time. There were “model calms” (defined as hours having a wind speed less than 3.6 km/hr or 1 m/s) recorded 19.0% of the time. Winds were generally strongest in the winter and spring months.

Table 17: Monthly Wind Meteorology Data from Bécancour Station

Month	Season	Average Wind Speed (km/hr)	Most Frequent Wind Direction
January	Winter	9.7	NE
February		13.5	SW
March	Spring	10.4	NE
April		10.8	NE
May		10.2	NE
June	Summer	8.3	NE
July		7.0	SSW
August		6.4	SW
September	Fall	7.1	SSW
October		8.8	NE
November		9.7	NE
December	Winter	11.2	NE
Annual	–	9.4	–

Overall, the pattern of wind direction between Québec City Jean Lesage International Airport station and Trois-Rivières station are similar as they both observe drastic wind direction change in the springtime from March through May. Québec City Jean Lesage International Airport station and Trois-Rivières station also display similar average wind speeds with annual averages of 13.7 km/hr and 13.6 km/hr, respectively, with higher winds recorded in spring and winter seasons.

The average monthly wind speeds recorded at Bécancour station are lower than Trois-Rivières station, measuring at an annual average of 9.4 km/hr. This can be attributed to the location of the stations; Trois-Rivières sits along the north shore of the St. Lawrence River and thus is unblocked from the southwestern and northeastern winds travelling along the open river, whereas Bécancour station sits 800 metres inland from the south shore of the St. Lawrence River with forests surrounding the west side and actively blocking the wind.

Furthermore, Trois-Rivières station and Bécancour station show agreement with predominant wind directions from the northeast, southwest, and south-southwest. Although the wind patterns may be different, the predominant winds at Bécancour can be attributed to the same topographical features and location of the climate station as previously mentioned. Therefore, it is expected that the climatic conditions at the Project site are most comparable to the Bécancour station as this climate station is located at the Project site. The five-year MELCCFP dataset for the Project is representative of wind in the area.

2.2.4 RELATIVE HUMIDITY

Relative humidity is the ratio of the actual water vapour in the air to the maximum amount the air can hold at a given temperature [2]. Relative humidity is discussed for Québec City Jean Lesage International Airport station and Trois-Rivières station. As previously mentioned, the Trois-Rivières Aqueduc station does not report climate normals for relative humidity so data from Trois-Rivières station was used in place. It is important to note that only a five-year period from 2005 through 2009 was considered for Trois-Rivières station.

The climate normals for relative humidity are presented on at 6:00am and 3:00pm local time for Québec City Jean Lesage International Airport station in Table 18. Although the station is located 87 km away from the Project site, it can be used as a regional comparison. Based on the provided climate normals, the annual average relative humidity is 78.7% at 6:00am local time and 61.9% at 3:00pm. The peak morning relative humidity occurs in September at 86.3%, whereas the peak afternoon relative humidity occurs in December at 73.2%.

Table 18: Monthly and Annual Average Relative Humidity from Québec City Jean Lesage International Airport Station

Month	Average Relative Humidity (%)	
	6:00 a.m.	3:00 p.m.
January	72.7	67.8
February	72.8	64.6
March	73.7	60.7
April	73.8	55.9
May	74.1	51.6
June	78.8	56.0
July	84.2	59.1
August	85.3	59.1
September	86.3	61.8
October	83.1	63.1
November	81.1	70.4
December	79.0	73.2
Annual	**78.7**	**61.9**

The average relative humidity is presented in Table 19 for Trois-Rivières station. The annual average relative humidity is 82.7% at 6:00am local time and 67.1% at 3:00pm. The peak morning relative humidity occurs in September at 88.5%, whereas the peak afternoon relative humidity occurs in December at 75.6%. Typically, the Trois-Rivières station experiences greater humidity likely a result of the station's location on the bank of the St. Lawrence River and at a lower elevation. The relative humidity between stations is comparable.

Relative humidity is a required element for the Air Quality assessment, as indicated in Appendix B of REGDOC-2.9.1; However, it is not one of the elements included in the MELCCFP dataset for Bécancour Station. Given the proximity of Trois-Rivières station to the Project site, relative humidity records from this station are considered representative for the Project site.

Table 19: Monthly and Annual Average Relative Humidity from Trois-Rivières Station

Month	Average Relative Humidity (%)	
	6:00 am	3:00 pm
January	81.2	73.1
February	80.2	69.9
March	78.0	63.7
April	77.6	60.7
May	77.3	60.2
June	83.8	67.6
July	86.5	66.9
August	86.6	62.0
September	88.5	63.3
October	86.7	69.7
November	83.6	72.8
December	82.9	75.6
Annual	**82.7**	**67.1**

2.2.5 ATMOSPHERIC PRESSURE

Atmospheric pressure is the force exerted by the atmosphere on a surface. Atmospheric pressure is closely related to both air temperature and altitude. As temperature increases air becomes warm and thus less dense than colder air. Additionally, the higher the altitude, the lower the atmospheric pressure as a result of the thinning of the atmosphere. The monthly average atmospheric pressure from the Québec City Jean Lesage International Airport station is presented in Table 20.

Although Québec City Jean Lesage International Airport station is located just over 87 km from the Project, it has been used as a regional comparison as there is no closer station reporting long-term atmospheric pressure climate normals. It should be noted that the Project site, which sits at roughly 9 m, whereas the Québec City Jean Lesage International Airport station sits at 76 m. As outlined in Table 20, the annual average atmospheric pressure at the station is 100.6 kPa. It fluctuates with the lowest atmospheric pressures are in June and July at 100.4 kPa, and the greatest atmospheric pressures recorded in October at 100.8 kPa.

Table 20: Monthly and Annual Average Atmospheric Pressure from Québec City Jean Lesage International Airport Station

Month	Atmospheric Pressure (kPa)
January	100.6
February	100.7
March	100.6
April	100.5
May	100.5
June	100.4
July	100.4
August	100.6
September	100.7
October	100.8
November	100.7
December	100.7
Annual	**100.6**

Note:
kPa = kilopascal.

For comparison, the atmospheric pressures observed at Bécancour station are shown in Table 21. This climate station is at an altitude of 15 m, which is closer to the Project site altitude of 9 m. Furthermore, these averages were determined using the hourly data from the period of 2005 through 2009. The annual average atmospheric pressure is 101.4 kPa, with maximum pressure observed in the colder months of December and January at 101.6 kPa and minimum pressure observed in the warmer months of June and July at 101.1 kPa.

It is evident that Bécancour station experiences greater atmospheric pressure than Québec City Jean Lesage International Airport station at all times. This can be attributed to the altitude of the Bécancour station, which sits at roughly 6 m, whereas the Québec City Jean Lesage International Airport station sits at 76 m. The atmospheric pressure at Bécancour station is more representative of the Project site as the station is situated on the Project site. It can be concluded that the five-year MELCCFP dataset for the Project is representative of atmospheric pressure in the area.

Table 21: Monthly and Annual Average Atmospheric Pressure from Bécancour Station

Month	Atmospheric Pressure (kPa)
January	101.6
February	101.4
March	101.5
April	101.3
May	101.3
June	101.1
July	101.1
August	101.3
September	101.6
October	101.5
November	101.5
December	101.6
Annual	**101.4**

2.2.6 Solar Radiation

Solar radiation refers to the energy produced by the sun sent through electromagnetic waves. There are no ECCC stations that record solar radiation climate normals. However, solar radiation data are available through RETScreen [3]. RETScreen allows the user to select an ECCC station and provides the site reference conditions for the station selected, including daily solar radiation based on data from the National Aeronautics and Space Administration (NASA).

Solar radiation data were available for two climate stations: Québec City Jean Lesage International Airport station and Trois-Rivières. Please note solar radiation was recorded at Trois-Rivières station rather than the Trois-Rivières Aqueduc station. Solar radiation measured at Québec City Jean Lesage International Airport station and Trois-Rivières station are outlined in Table 22 and Table 23, respectively.

Québec City Jean Lesage International Airport averages slightly greater solar radiation on an annual basis, with a peak value of 5.72 kWh/m^2/day in June as compared to Trois-Rivières at 5.51 kWh/m^2/day in the same month. The annual average daily solar radiation of both stations falls within 4% of each other.

Solar radiation is a required element for the Air Quality assessment, as indicated in Appendix B of REGDOC-2.9.1; However, it is not one of the elements included in the MELCCFP dataset for Bécancour Station. Given the proximity of Trois-Rivières station to the Project site, solar radiation from this station is considered representative for the Project site.

Table 22: Daily Solar Radiation for the Québec City Jean Lesage International Airport Station

Month	Daily Solar Radiation – Horizontal (kWh/m^2/day)
January	1.62
February	2.66
March	4.09
April	4.92
May	5.46
June	5.72
July	5.65
August	4.83
September	3.49
October	2.25
November	1.40
December	1.25
Annual	**3.62**

Note:
kWh/m^2/day = kilowatt-hour per square metre per day.

Table 23: Daily Solar Radiation for the Trois-Rivières Station

Month	Daily Solar Radiation – Horizontal (kWh/m2/day)
January	1.57
February	2.53
March	3.66
April	4.62
May	5.06
June	5.51
July	5.26
August	4.76
September	3.55
October	2.28
November	1.45
December	1.24
Annual	**3.46**

Note:
kWh/m^2/day = kilowatt-hour per square metre per day.

2.3 Extreme Weather Phenomena

Extreme weather conditions, including extreme temperature (either high or low), precipitation and winds, have been discussed in Section 2.2. In addition, REGDOC-2.9.1 indicates that extreme weather phenomena should also be included in the Air Quality assessment. Thunderstorm winds and tornadoes have been identified as an extreme weather phenomenon of particular concern for the Project site.

2.4 Summary of Meteorology

The meteorological parameters discussed in this assessment characterize the meteorological climate for the baseline environment, as required by REGDOC-2.9.1. Of the parameters discussed in the sections above; temperature, precipitation, wind speed, wind direction, relative humidity, atmospheric pressure and solar radiation influence the atmospheric dispersion of the indicator compounds emitted in the assessment boundary and from the Project. Results of the air quality assessment will incorporate meteorological effects.

Comparisons between the ECCC climate normals for St Narcisse, Trois-Rivieres Aqueduc, and Québec City Jean Lesage International Airport station, to the MELCCFP dataset for Bécancour station show that climatic conditions at the Project site can be appropriately represented by the MELCCFP dataset. The five-year dispersion meteorological dataset appears to be representative of long-term climate in the region when compared to the 30-year climate normals for the 1981 to 2010 period. Furthermore, the MELCCFP dataset for Bécancour station is located at the Project site and thus is representative of the on-site meteorological conditions. Based on the analyses presented in Section 2.2 of this Baseline Meteorology Assessment, the MELCCFP dataset is suitable for dispersion modelling at the Project site.

3. AIR QUALITY BASELINE ASSESSMENT

This section summarizes the current air quality baseline for non-radiological indicator compounds at the G1WF. The results presented in this section represent the existing air quality concentrations that are used in the ERR to assess changes to air quality from the Project.

3.1 Non-Radiological

The assessment of air quality focused on predicting changes in the concentrations of selected non-radiological indicator compounds. These indicator compounds represent compounds that are expected to be emitted from the Project and are generally accepted as indicators of changing air quality and for which relevant air quality criteria exist. None of these compounds are radiological. The selected indicator compounds fall into the following two categories:

- **particulate matter**: suspended particulate matter (SPM), particles nominally smaller than 10 µm in diameter (PM_{10}) and particles nominally smaller than 2.5 µm in diameter ($PM_{2.5}$); and
- **combustion gases**: nitrogen oxides (NO_X) represented by nitrogen dioxide (NO_2), sulphur dioxide (SO_2) and carbon monoxide (CO).

These compounds are associated with various Project activities. Particulate matter is typically associated with airborne dust from demolition and decommissioning activities including vehicles travelling over on-site paved roads, as well as material loading and unloading activities. Products of combustion (NO_2, SO_2 and CO) are associated with the exhaust from on-site vehicles.

While ozone (O_3) is not directly emitted into the atmosphere from the Project, it is associated with the reaction of NO_X and volatile organic compounds (VOCs) to create NO_2 [4]. Ozone will be assessed as part of baseline conditions due to the availability of air quality monitoring data; however, emissions of ozone will not be quantified for the Project's air quality assessment. Ozone baseline data will be used to calculate the NO_2 emissions from the Project. The VOCs, while a criteria air contaminant, are not considered indicator compounds for this Project. VOCs are not expected to be emitted from the decommissioning activities with the exception of some VOC emissions from fuel combustion; and therefore, were not retained for the air quality baseline assessment.

3.1.1 Applicable Guidelines

The relevant air quality criteria used for screening air quality effects in the region is the Quebec Atmospheric Quality Standards and Criteria. The Province of Québec, MELCCFP has set guidelines related to ambient air concentrations that are summarized in *Quebec Atmospheric Quality Standards and Criteria* (QAQSC) [5]. The Quebec QAQSCs are maximum concentration levels set for the protection and preservation of ambient air quality within Québec.

There is also a set of federal objectives and criteria presented as the Canadian Ambient Air Quality Standards (CAAQSs; formerly Canada Wide Standards). The CAAQSs have been developed under the *Canadian Environmental Protection Act* (CEPA) and include standards for $PM_{2.5}$, NO_2, SO_2 and ozone that must be achieved by 2020 (all pollutants) and 2025 (all pollutants except $PM_{2.5}$). In 2015 the standard was phased in, with the final standard phase in date in 2025 [6]. The CAAQSs are not regulatory limits but, rather, are used as national targets for $PM_{2.5}$, NO_2, SO_2, and ozone, excluding Québec. Although Québec supports the general objectives of the CAAQS, it will not implement the system since it includes federal industrial emission requirements that duplicate Québec's regulation [6], therefore, the CAAQS are presented but not used in this assessment.

The QAQSC and CAAQS do not include standards or criteria for PM_{10}, which is an indicator compound for this assessment. As a result, the Ontario Ambient Air Quality Criteria (AAQC) for PM_{10} was used for comparison to the maximum modelled concentrations. The Ontario Ministry of the Environment, Conservation and Parks (MECP) AAQCs are characterized as concentrations of a contaminant in air that is protective against potential adverse effects on health and/or the environment. Ambient Air Quality Criteria are used to assess general (ambient) air quality resulting from all sources of a contaminant to air. Ambient Air Quality Criteria are most commonly used in environmental assessments, special studies using ambient air monitoring data, assessment of general air quality in a community and annual reporting on air quality across the province [7].

CNL has compared predicted emissions of $PM_{2.5}$, NO_2 and SO_2 from the Project to the CAAQS and predicted emissions of PM_{10} to the World Health Organization Air Quality Guidelines. The CAAQS models were completed using the CAAQS statistical forms to compare to the CAAQS. Results indicated that all three parameters were below the CAAQS levels for each averaging period and the PM_{10} results were below the World Health Organization guidelines for each averaging period.

Monitoring data in Canada periodically exceeds these criteria, objectives, and standards at different locations for different periods of time. Measured concentrations above these values does not necessarily result in an immediate effect but serves as a guidance for areas where air quality could potentially be improved and to take actions to reduce or limit exposure.

A summary of the Québec, Ontario and federal objectives and criteria is listed in Table 24.

Table 24: Quebec and Canadian Regulatory Air Quality Objectives and Criteria

Contaminant	Criteria Classification	Averaging Period	Quebec Atmospheric Quality Standards and Criteria[(a)] (µg/m³)	Ontario Ambient Air Quality Criteria[(b)] (µg/m³)	Canadian Ambient Air Quality Standards[(c)] (µg/m³)
SPM	Standard	24-hr	**120**	120	—
PM_{10}	Criteria	24-hr	—	**50**	—
$PM_{2.5}$	Standard	24-hr	**30**	27	27[(d)]
CO	Standard	1-hr	**34,000**	36,200	—
CO	Standard	8-hr	**12,700**	15,700	—
NO_2	Standard	1-hr	**414**	400	79[(e)]
NO_2	Standard	24-hr	**207**	200	—
NO_2	Standard	Annual	**103**	—	22.6
SO_2	Standard	4-min	**1050**	—	—
SO_2	Standard	24-hr	**288**	—	—
SO_2	Standard	Annual	**52**	10.64 (4 ppb)	10.5

(a) Quebec QAQSC [5].

(b) Ontario AAQC [7]

(c) CAAQS published in the Canada Gazette Volume 147, No. 21 - May 25, 2013. Final standard phase in date of 2025 used.

(d) The 24-hour CAAQS for $PM_{2.5}$ is based on the three-year average of the annual 98th percentile of the daily averaged monitored data. The annual CAAQS for $PM_{2.5}$ is based on the three-year average of annual averaged monitored data.

(e) The 1-hour CAAQS for NO_2 is based on the 3-year average of the annual 98th percentile of the daily maximum 1-hour average concentrations.

Bold – Bolded values were used in the assessment

µg/m^3 = micrograms per cubic metre; SPM = suspended particulate matter; PM10 = particles nominally smaller than 10 µm in diameter; PM2.5 = particles nominally smaller than 2.5 µm in diameter; CO = carbon monoxide; NO_2 = nitrogen dioxide; O_3 = ozone; SO_2 = sulphur dioxide; — = No guideline available.

3.1.2 Existing Emissions Sources

There are 11 industrial facilities that report indicator compounds releases, disposals and transfers for recycling under Part 1A to the National Pollutant Release Inventory (NPRI) within 5 km of the Project [8]. These emissions contribute to the local air quality and the consideration of cumulative effects. Reporting facilities and emission totals are summarized in Table 25. These sources are minor contributors to the Projects indicator compounds provincial totals, as their total emissions for the six indicator compounds contribute from less than 3% to 12% to their respective provincial total emissions.

Table 25: 2022 Air Emission Totals for Industry Reported to National Pollutant Release Inventory within 5 km of the Project

Company Name (NPRI ID)	Distance to the Project (km)[a]	Direction from the Project	Emissions (tonnes)					
			NOX	SO2	CO	SPM	PM10	PM2.5
			11104-93-1	7446-09-5	630-08-0	NA-M08	NA-M09	NA-M10
Arkema Canada Inc. (1492)	1.7	SW	—	—	—	5.32	5.32	5.32
CEPSA Chimie Bécancour (4805)	1.7	SW	38.40	—	—	—	—	—
Olin Canada ULC (2855)	1.8	SW	19.71	0.87	2.81	4.94	0.65	0.08
Viterra Inc. (26429)	1.8	SW	75.47	24.76	100.56	11.72	2.79	1.46
Air Liquide Canada Inc. (6222)	2.2	SW	56.21	—	—	—	1.92	1.77
Canadian Nuclear Laboratories (31783)	2.5	E	—	—	—	—	1.84	—
Aluminerie de Bécancour (1071)	2.6	SW	52.39	5,863.03	48,063.82	750.31	570.40	446.90
Silicium Québec SEC (8807)	3.8	SW	871.15	998.77	409.62	206.58	180.27	132.14
Alubar Métaux Inc. (3598)	4	SW	—	—	—	—	5.10	0.29
Services de Transformation Bécancour Inc. (4397)	4.3	SW	—	—	—	0.87	0.87	0.68
TransCanada Energy Ltd. (8606)	4.7	SW	—	—	9.81	—	—	—
Facilities Total			1,113	6,887	48,587	980	769	589
Québec Total			38,276	92,696	407,611	21,494	13,737	8,751
Percent Facilities Total of Québec Total			3%	7%	12%	5%	6%	7%

Notes:

(a) Approximate distance from Gentilly-1 as reported to NPRI

SE = southeast; NW = northwest; NE = northeast; NO_X = nitrogen oxides; SO_2 = sulphur dioxide; CO = carbon monoxide; SPM = suspended particulate matter; PM_{10} = particles nominally smaller than 10 µm in diameter; $PM_{2.5}$ = particles nominally smaller than 2.5 µm in diameter; — = Below NPRI reporting threshold.

3.2 Data Sources

In Québec, regional air quality is monitored through a network of air quality monitoring stations operated by the ECCC NAPS. These stations are operated under strict quality assurance and quality control procedures. Existing air quality was characterized using background air concentrations from monitoring data sources near the Project.

There are no air quality monitoring stations within the assessment boundary; however, three air quality monitoring stations located within approximately 100 km of the Project were used in this assessment: Trois-Rivières (École Mees), Lévis (Parc Georges Maranda), and Québec (Vieux-Limoilou). The Trois-Rivières station was the only air quality monitoring station located within 15 km of the Project, while the two other stations were located approximately 100 km from the Project. These three stations were selected for assessment due to their locations and because they are all currently operating and have at least five years' worth of data. None of the stations monitor for SPM or PM_{10}, which is consistent throughout Québec.

The Trois-Rivières station is the closest operational station to the Project, but it does not include monitoring for NO_2 or CO. It is located approximately 15 km from the Project and is bordered by the Saint-Maurice River and the St. Lawrence River.

The next station selected is located in the George-Maranda Park in Lévis and includes all indicator compounds with the exception of CO, PM_{10}, and SPM. The Lévis station is located approximately 102 km from the Project and was selected as the best representative station for the Project location that monitored NO_2.

The final station selected, Québec, is located approximately 99 km away from the Project and is situated south of the St. Lawrence River. This station was selected as it is the closest station to the Project that monitored CO. The Québec station also monitors for NO_2, but since it is located in a more heavily populated area than the Lévis station, the Lévis station was chosen for NO_2.

Ideally, an air quality monitoring station would be within close proximity of the Project with a similar geographical siting and similar influences; however, the NAPS program focuses on areas that are affected by local sources and there are no stations that satisfy these conditions. Therefore, for the Project, the Trois-Rivières station is considered to be the most representative station for the assessment due to proximity.

The relative locations of the three air monitoring stations selected to describe the background air quality within the assessment boundary (i.e., Trois-Rivières, Lévis, and Québec) are provided in Table 26 and the station locations are shown on Figure 1. For this assessment, data from 2017 to 2021 was used, which is the most recent five-year period at the time of this assessment for which all data are available and quality assured by ECCC.

Table 26: Location of Air Monitoring Stations in Close Proximity to the Project

City	NAPS Station ID	Location	Latitude and Longitude	Distance to the Project[(a)] (km)	Direction
Trois-Rivières	050803	Outside the Assessment Boundary	46.3572, -72.5462	15	West
Lévis	055702	Outside the Assessment Boundary	46.8060, -71.1675	102	Northeast
Québec	050308	Outside the Assessment Boundary	46.8212, -71.2205	99	Northeast

Notes:

(a) Approximate distance from G1WF.

NAPS = National Air Pollution Surveillance

Table 27 provides a summary of the monitoring data available from each of the three selected stations. At the time of this assessment, complete datasets were available up until 2021.

Table 27: Availability of Ambient Air Quality Data (Years)

Compound	Trois Rivières – École Mees	Lévis – Parc Georges Maranda	Québec – Vieux-Limoilou
SPM	—	—	—
PM_{10}	—	—	—
$PM_{2.5}$	2014-2021	2016-2021	1989-2021
NO_2	—	2016-2021	1989-2021
SO_2	2014-2021	2016-2021	1989-2021
CO	—	—	1989-2021
O_3	2014-2021	2016-2021	1989-2021

Note:

SPM = suspended particulate matter; PM_{10} = particles nominally smaller than 10 µm in diameter; $PM_{2.5}$ = particles nominally smaller than 2.5 µm in diameter; CO = carbon monoxide; NO_2 = nitrogen dioxide; NO = nitrogen oxide; O_3 = ozone; SO_2 = sulphur dioxide; — = data for the parameter were not available at that station.

3.3 Assessment of Background Air Quality

The continuous monitoring stations listed in Table 1 were used to reflect the existing conditions within the assessment boundary. The existing air quality levels based on background air concentrations from available monitoring stations are summarized in the following sections. The available air monitoring data represents the combined effect of emissions from sources near to each of the monitoring stations, as well as the effect of the emissions transported into the region.

Although gaseous monitoring equipment records concentrations in units of parts per million parts (ppm) or parts per billion parts (ppb), regulatory criteria are established on the basis of micrograms per cubic metre (µg/m³). In this section, monitoring results for gaseous compounds are presented in the units of µg/m³, to facilitate the comparison of monitoring to criteria. The conversion from ppm to µg/m³ is unique to each compound, based on the molecular weight of the compound and standard atmospheric conditions (1 atmosphere of pressure and 25°C). In contrast, particulate monitoring equipment records concentrations in units of µg/m³, allowing for direct comparison to the regulatory criteria.

3.3.1 Comparison of Monitored Data by Indicator Compound

The graphs in the following sections present simplified box-and-whisker plots showing the available concentration data. The box on the figures represents the bounds of the middle 50% of the data points. The top of the box represents the 75th percentile concentration, while the bottom of the box represented the 25th percentile concentration. The line through the middle of the box represents the median, or 50th percentile concentration. The orange diamond represents the average concentration, and the green circle represents the 90th percentile. On these figures, the whiskers extend up to the maximum and down to the minimum concentration.

The 90th percentile of the 1-hour, 8-hour and 24-hour measurements are typically used to represent the background air quality value when conducting an effects assessment as this value is exceeded only 10% of the time. The annual average concentration is used for annual background levels [9] and based on the measurement data. The average concentration for the shorter time periods provides an indication of what air quality would typically be at the location. The 75th percentile provides an indication of the concentration below which most of the existing air quality readings occurred. Significant differences between the average and 75th percentile readings provide an indication that the background air quality is dominated by infrequent, increases in measured concentration.

There are no monitoring data available for SPM and PM_{10}, however, an estimate of the SPM and PM_{10} concentrations can be calculated from the available $PM_{2.5}$ monitoring data. The mean levels of $PM_{2.5}$ in Canadian locations are found to be about 54% of the PM_{10} concentrations and about 30% of the SPM concentrations [10]. By applying this ratio, it was possible to estimate the SPM and PM_{10} concentrations for the monitoring stations.

Fine Particulate Matter ($PM_{2.5}$)

Particulate emissions occur due to anthropogenic activities (e.g., industrial, transportation and residential sources), as well as natural sources. Suspended particulate matter is classified based on its aerodynamic particle size, primarily due to the different health effects that can be associated with the particles of different diameters.

In Québec, fine particulate matter ($PM_{2.5}$) emissions have declined since 1990 [11]. While the maximum 24-hour value of $PM_{2.5}$ at Trois-Rivières and Lévis may be above the QAQSC, the 90th percentiles were calculated as 12.5 µg/m³ and 12.2 µg/m³, for the Trois-Rivières and Lévis stations, and are both below the QAQSC limit of 30 µg/m³ (Figure 4).

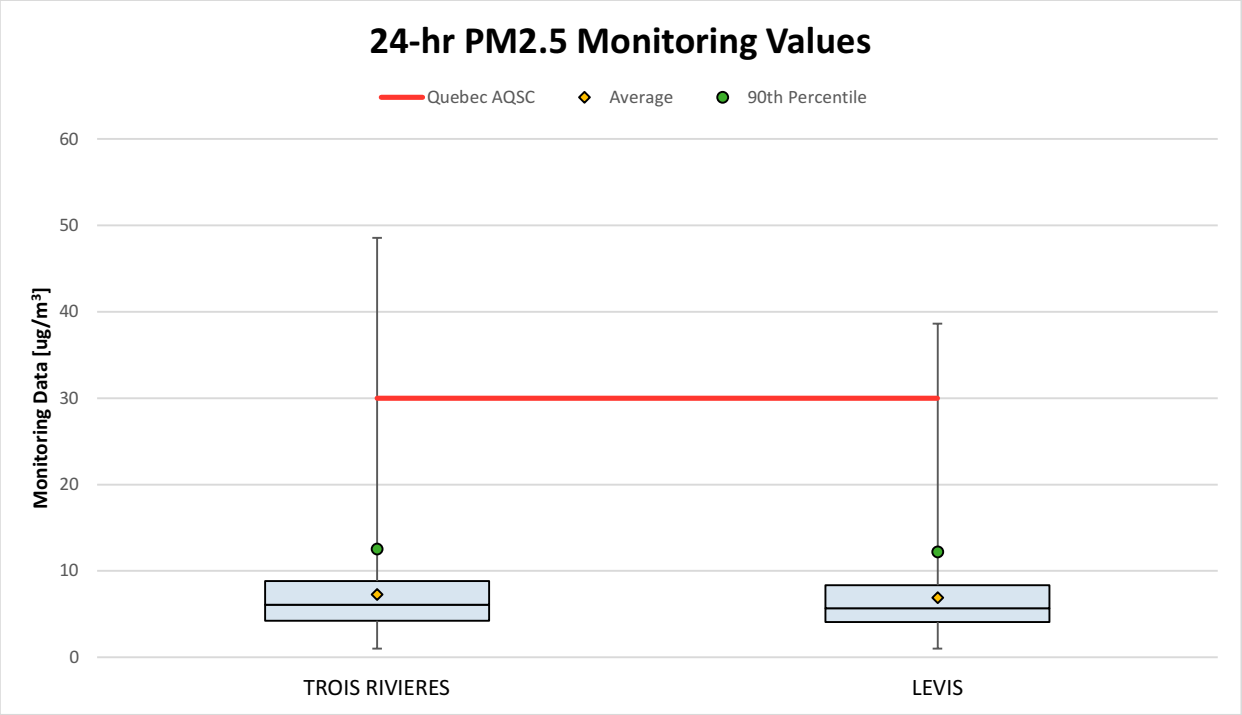

Figure 4: $PM_{2.5}$ Monitoring Data for 2017-2021

Nitrogen Oxides and Nitrogen Dioxide (NO_x and NO_2)

The oxides of nitrogen (NO_X) are emitted in two primary forms: nitric oxide (NO) and nitrogen dioxide (NO_2). The NO reacts with ozone in the atmosphere to create NO_2. The air quality assessment was complete for NO_2, which has a Quebec AQSC. The primary source of NO_X and NO_2 in the region is the combustion of fossil fuels. Emissions of NO_X and NO_2 result from the operation of stationary sources such as, boilers and generators, as well as the operation of mobile sources such as vehicles, haul trucks and other equipment.

The annual mean concentrations of NO_2 in Québec have been decreasing since 1990 [11]. The Trois-Rivières monitoring station did not have any NO_2 monitoring data available, and so only the Lévis monitoring station was used, as it is the second closest station to the site. As shown in Figure 5, the maximum values at the Lévis station reach 92.2 µg/m³ and 44.8 µg/m³ for the 1-hr and 24-hr monitoring values, respectively, which are greatly below the QAQSC limits of 414 µg/m³ and 207 µg/m³, respectively.

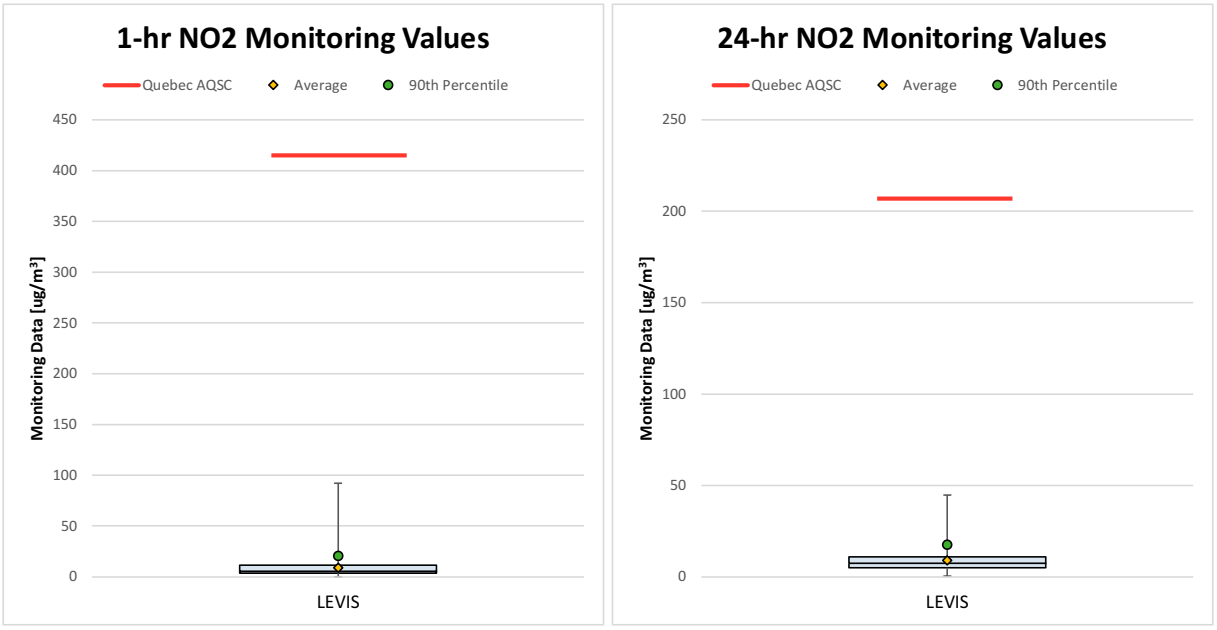

Figure 5: NO_2 Monitoring Data for 2017-2021

Sulphur Dioxide (SO_2)

The primary source of sulphur dioxide (SO_2) is the combustion of fossil fuels in a variety of sectors such as the electricity and smelter sectors. In Québec, emissions have decreased steadily since 1990 [11].

A summary of the monitored SO_2 concentrations for 4-min and 24-hour is presented in Figure 6. The 4-min values were obtained by multiplying the 1-hour values by the conversion factor of 1.9 [12]. As shown in Figure 6, there were no values above the 4-min or 24-hour QAQSC limits of 1050 µg/m³ and 288 µg/m³, respectively.

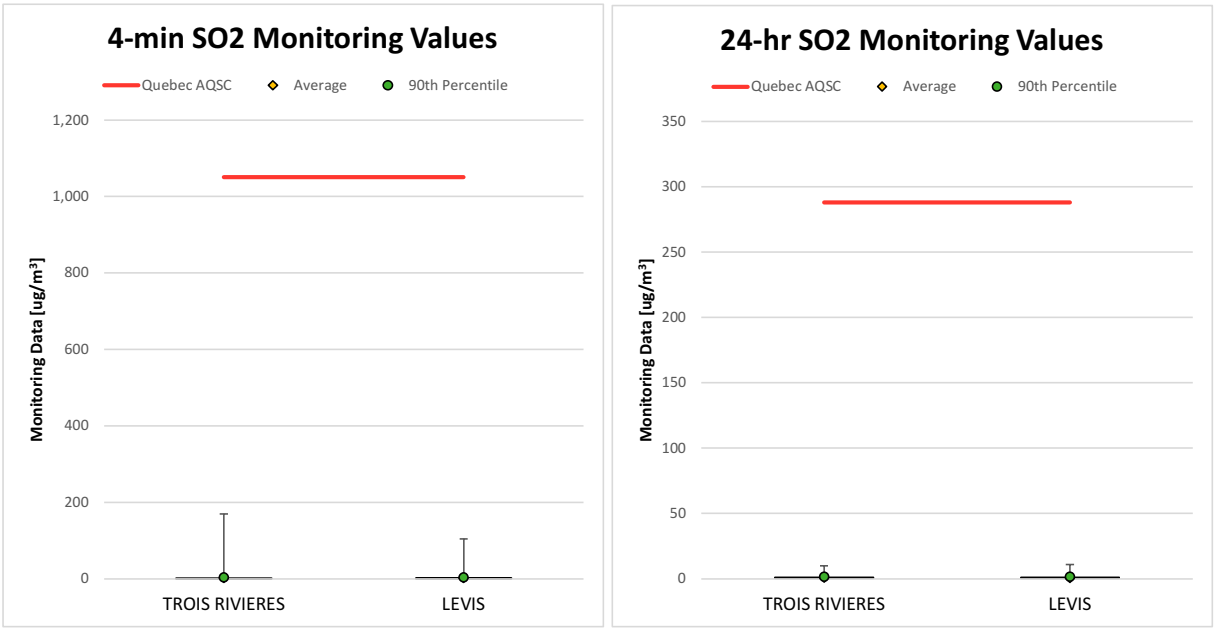

Figure 6: SO_2 Monitoring Data for 2017-2021

Carbon Monoxide (CO)

Carbon monoxide (CO) is a colourless, odourless, and tasteless gas which is toxic at high concentrations, toxic gas. It is produced primarily from the incomplete combustion of fossil fuels, as well as natural sources. Emissions of CO have been decreasing since 1990, mainly due to transportation emission reductions [11].

The Trois-Rivières and Levis stations both did not have any CO monitoring data available, and so a third station in Québec city was used. As demonstrated in Figure 7, there were no values above the 1-hour or 8-hour QAQSC limits of 34,000 µg/m³ and 12,700 µg/m³, respectively.

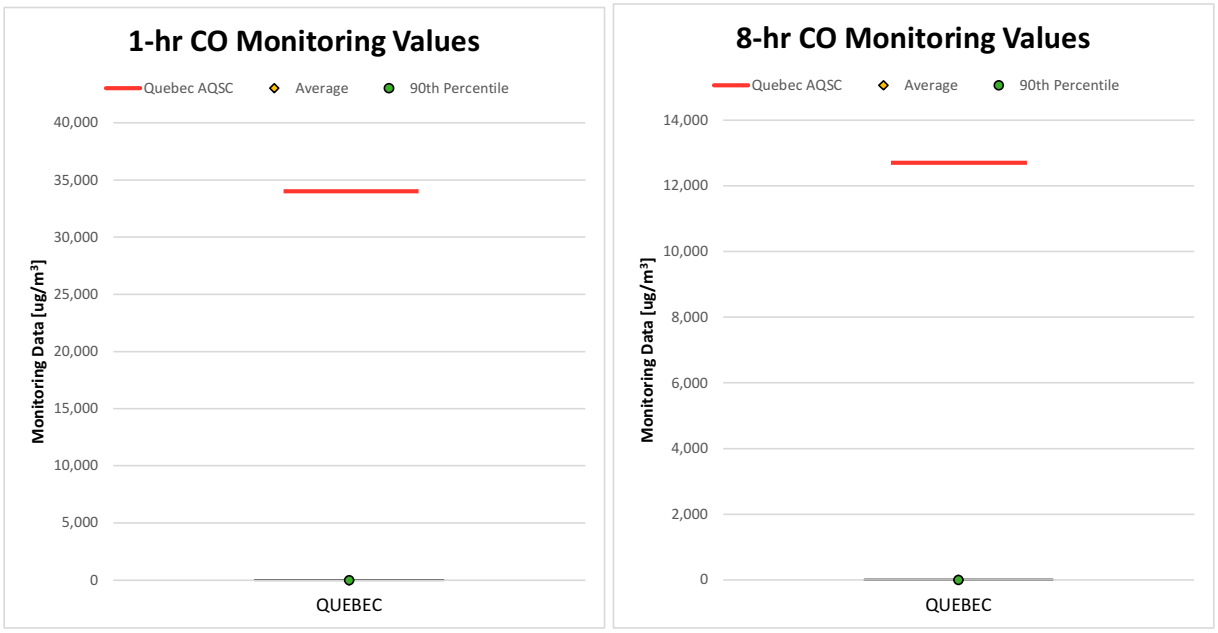

Figure 7: CO Monitoring Data for 2017-2021

Ozone (O_3)

Ground-level ozone (O_3) is formed when NO_X and VOCs react in the presence of sunlight. A summary of the monitored O_3 concentrations is provided on Figure 8. As shown, all the 1-hour O_3 values for the Trois-Rivières and Lévis station fall below the QAQSC limit of 160 µg/m³, however, the Trois-Rivières station reaches a maximum value of 159.0 µg/m³.

Although the maximum 8-hour concentrations of O_3 were above the Québec AQSC limit of 125 µg/m³ for both the stations, the average and 90th percentile concentrations were below this QAQSC. Overall, O_3 values above the 8-hour Québec AQSC were measured at the Trois-Rivières station and Lévis station 0.08% and 0.02% of the time (equivalent to 26 and 6 measurements in 5 years), respectively, throughout the period of 2017 to 2021.

Although the maximum 8-hour O_3 monitored data were above the Québec QAQSC at both stations, as these stations are located 15 km and 102 km from the GL site in urban settings with higher NO_X and VOCs; consequently, and therefore this results in higher O_3 data. These stations will provide conservative background ozone concentration estimates for the Project located in a more rural setting and with a lower population density.

Figure 8: O_3 Monitoring Data for 2017-2021

3.4 Summary of Monitored Data by Station

For each of the stations, monitoring data for the years 2017 through 2021 were summarized by indicator compound for the averaging period relevant to the QAQSC. As discussed above, to provide an understanding of the variability of the monitoring data, the average, 75th percentile, 90th percentile and maximum values for the three stations are summarized in Table 28, Table 29, and Table 30.

Table 28: Summary of Background Air Quality at the Trois-Rivières Station (2017 – 2021)

CAC	Averaging Period	Average (µg/m³)[(a)]	75th (µg/m³)[(a)]	90th (µg/m³)[(a)]	Max (µg/m³)[(a)]
SPM[(b)]	24-hour	24.14	29.44	41.81	161.94
PM_{10}[(b)]	24-hour	13.41	16.36	23.23	89.97
$PM_{2.5}$	24-hour	7.24	8.83	12.54	48.58
NO_2	1-Hour	—	—	—	—
	24-Hour	—	—	—	—
	Annual	—	—	—	—
SO_2	4-min©	1.39	1.00	2.99	169.21
	1-Hour	0.73	0.52	1.57	89.06
	24-Hour	0.73	0.86	1.60	9.96
	Annual	0.75	—	—	0.92
CO	1-Hour	—	—	—	—
	8-Hour	—	—	—	—
O_3	1-Hour	52.24	68.69	80.46	158.96
	8-Hour	60.10	77.03	87.33	134.43

Notes:

(a) Data measured in parts per billion (ppb) or parts per million (ppm), were converted to µg/m³ assuming standard temperature and pressure (25°C and one atmosphere of pressure).

(b) SPM and PM_{10} concentrations were calculated using $PM_{2.5}$ concentrations and conversion ratios [10].

(c) 4-min SO_2 values were obtained from 1-hour values using a conversion factor of 1.9 [12].

CAC = criteria air contaminant; µg/m³ = microgram per cubic metre; SPM = suspended particulate matter; PM_{10} = particles nominally smaller than 10 µm in diameter; $PM_{2.5}$ = particles nominally smaller than 2.5 µm in diameter; NO_2 = nitrogen dioxide; SO_2 = sulphur dioxide; CO = carbon monoxide; O_3 = ozone.

Table 29: Summary of Background Air Quality at the Lévis Station (2017 – 2021)

Indicator	Averaging Period	Average[a] (µg/m³)	75th[a] (µg/m³)	90th[a] (µg/m³)	Max[a] (µg/m³)
SPM[b]	24-hour	22.92	27.78	40.71	128.75
PM_{10}[b]	24-hour	12.73	15.43	22.62	71.53
$PM_{2.5}$	24-hour	6.88	8.33	12.21	38.63
NO_2	1-Hour	8.96	11.29	20.69	92.17
	24-Hour	8.96	10.82	17.48	44.75
	Annual	8.94	—	—	9.96
SO_2	4-min	1.28	1.49	2.99	104.02
	1-Hour	0.68	0.79	1.57	54.74
	24-Hour	0.68	0.86	1.57	10.74
	Annual	0.68	—	—	1.04
CO	1-Hour	—	—	—	—
	8-Hour	—	—	—	—
O_3	1-Hour	53.76	68.69	78.50	149.15
	8-Hour	64.29	76.29	85.61	133.20

Notes:

(a) Data measured in parts per billion (ppb) or parts per million (ppm), were converted to µg/m³ assuming standard temperature and pressure (25°C and one atmosphere of pressure).

(b) SPM and PM_{10} concentrations were calculated using $PM_{2.5}$ concentrations and conversion ratios [10].

(c) 4-min SO_2 values were obtained from 1-hour values using a conversion factor of 1.9 [12] .

µg/m³ = microgram per cubic metre; SPM = suspended particulate matter; PM_{10} = particles nominally smaller than 10 µm in diameter; $PM_{2.5}$ = particles nominally smaller than 2.5 µm in diameter; NO_2 = nitrogen dioxide; SO_2 = sulphur dioxide; CO = carbon monoxide; O_3 = ozone.

Table 30: Summary of Background Air Quality at the Québec Station (2017 – 2021)

Indicator	Averaging Period	Average[a] (µg/m³)	75th[a] (µg/m³)	90th[a] (µg/m³)	Max[a] (µg/m³)
$PM_{2.5}$	24-hour	—[b]	—[b]	—[b]	—[b]
	Annual	—[b]	—[b]	—[b]	—[b]
NO_2	1-Hour	—[b]	—[b]	—[b]	—[b]
	24-Hour	—[b]	—[b]	—[b]	—[b]
	Annual	—[b]	—[b]	—[b]	—[b]
SO_2	1-Hour	—[b]	—[b]	—[b]	—[b]
	24-Hour	—[b]	—[b]	—[b]	—[b]
	Annual	—[b]	—[b]	—[b]	—[b]
CO	1-Hour	0.23	0.25	0.36	2.49
	8-Hour	0.29	0.32	0.44	1.70
O_3	1-Hour	—[b]	—[b]	—[b]	—[b]
	8-Hour	—[b]	—[b]	—[b]	—[b]

Notes:

(a) Data measured in parts per billion (ppb) or parts per million (ppm), were converted to µg/m³ assuming standard temperature and pressure (25°C and one atmosphere of pressure).

(b) Monitoring data was available for these contaminants but was not included in the study.

µg/m³ = microgram per cubic metre; SPM = suspended particulate matter; PM_{10} = particles nominally smaller than 10 µm in diameter; $PM_{2.5}$ = particles nominally smaller than 2.5 µm in diameter; NO_2 = nitrogen dioxide; SO_2 = sulphur dioxide; CO = carbon monoxide; O_3 = ozone.

3.5 Summary of Background Air Quality

This section summarizes the existing air quality within the assessment boundary, which is considered as background air quality. The Trois-Rivières, Lévis, and Québec air quality monitoring station are all approximately located within 100 km of the Project. As discussed above, due to proximity to the Project, the Trois-Rivières station is considered to be the most representative station for the assessment. The background air quality values retained for the assessment are presented below in Table 31 and are based on the three stations assessed. The background concentrations were selected from the maximum values of each station, to represent the worst-case scenario for the background concentrations. The existing concentrations are below the respective provincial and federal criteria for each indicator compound, suggesting that the region has generally good air quality.

Table 31: Background Air Quality Values (90th Percentile, Average for Annual Only)[a]

Indicator	Averaging Period	Trois-Rivières (15 km W)	Lévis (102 km NE)	Québec (99 km NE)	Background
SPM[b]	24-hour	**41.8**	40.7	—	**41.8**
PM_{10}[b]	24-hour	**23.2**	22.6	—	**23.2**
$PM_{2.5}$	24-hour	**12.5**	12.2	—[d]	**12.5**
NO_2	1-Hour	—	**20.7**	—[d]	**20.7**
	24-Hour	—	**17.5**	—[d]	**17.5**
	Annual	—	**8.94**	—[d]	**8.94**
SO_2	4-min[c]	**2.99**	**2.99**	—[d]	**2.99**
	1-Hour	**1.57**	**1.57**	—[d]	**1.57**
	24-Hour	**1.60**	1.57	—[d]	**1.60**
	Annual	**0.753**	0.676	—[d]	**0.753**
CO	1-Hour	—	—	**0.355**	**0.355**
	8-Hour	—	—	**0.444**	**0.444**
O_3[c]	1-Hour	**80.5**	78.5	—[d]	**80.5**
	8-Hour	**87.3**	85.6	—[d]	**87.3**

Notes:

(a) Data measured in parts per billion (ppb) or parts per million (ppm), were converted to µg/m³ assuming standard temperature and pressure (25°C and one atmosphere of pressure).

(b) SPM and PM_{10} concentrations were calculated using $PM_{2.5}$ concentrations and conversion ratios [10] .

(c) 4-min SO_2 values were obtained from 1-hour values using a conversion factor of 1.9 [12] .

(d) Monitoring data was available for these contaminants but was not included in the study.

Bolded values represent the background air quality.

µg/m³ = microgram per cubic metre; SPM = suspended particulate matter; PM_{10} = particles nominally smaller than 10 µm in diameter; $PM_{2.5}$ = particles nominally smaller than 2.5 µm in diameter; NO_2 = nitrogen dioxide; SO_2 = sulphur dioxide; CO = carbon monoxide; O_3 = ozone.

4. REFERENCES

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APPENDIX 2

Emission Estimates

1. INTRODUCTION

This Appendix was prepared to support the EPMR for the CNL's Phase 3 Decommissioning of G1WF (Project) at the Gentilly Nuclear Complex Site. The following sections summarize the emission calculation methods followed to quantify the air quality emissions for use in the non-radiological dispersion modelling for indicator compounds as well as greenhouse gas (GHG) emissions. The emission estimation methods described within this Appendix follow accepted practices for conducting Environmental Assessments and, where appropriate, guidance in Appendix C of REGDOC-2.9.1, *Environmental Principles, Assessments and Protection Measures* [1]. Scientifically accepted by the MELCCFP and well-documented emission factors, such as AP-42 from the United States Environmental Protection Agency (US EPA) and *"Règlement sur la déclaration obligatoire de certaines émissions de contaminants dans l'atmosphère (RDOCECA)"* [2] were used to estimate maximum and average emission rates.

2. ASSESSMENT OF COMPOUNDS AND ACTIVITIES

The assessment of air quality focused on predicting changes in the concentrations of selected indicator compounds, all of which are non-radiological. The GHG assessment focused on predicting the emissions of GHGs and comparing them to provincial and federal emissions.

2.1 AIR QUALITY ASSESSMENT

2.1.1 AIR QUALITY – INDICATOR COMPOUNDS

The selected indicator compounds fall into two categories:

- **particulate matter**: suspended particulate matter (SPM), particles nominally smaller than 10 micrometres (µm) in diameter (PM_{10}) and particles nominally smaller than 2.5 µm in diameter ($PM_{2.5}$); and
- **combustion gases**: nitrogen oxides (NO_X) represented by nitrogen dioxide (NO_2), sulphur dioxide (SO_2) and carbon monoxide (CO).

These compounds are associated with various Project activities. Particulate matter is typically associated with airborne dust from demolition and decommissioning activities including non-road equipment (such as construction vehicles) and vehicles travelling over on-site paved roads, as well as material handling activities. Products of combustion (NO_X, SO_2 and CO) are associated with the exhaust from on-site vehicles. Ozone was assessed as part of baseline conditions, for use in the estimation of NO_2 concentrations resulting from the Project. Emissions of ozone are not quantified for the Project's activities as it is not directly emitted into the atmosphere from the Project.

Emissions were assessed for the Project activities during the various stages of the Planning Envelope. Scientifically accepted and well-documented emission factors, such as AP-42 from the United States Environmental Protection Agency [3] were used to estimate maximum and average emission rates. Compounds that will be emitted from the Project in negligible amounts and/or activities that discharge a compound in a negligible amount were excluded from further analysis. The rationale for these exclusions is provided in Section 2.2.2. Table 1 provides a summary of the activities for which emissions were calculated in the air quality assessment, as well as a summary of the compounds expected to be released from the Project. The air quality assessment includes Planning Envelope A (PE-A) and Planning Envelope B (PE-B), and therefore, the emissions and associated effects during these stages of the Project represent the bounding cases.

Table 1: Activities and Non-Radiological Indicator Compounds Released/Expected During the Planning Envelop

Planning Envelope	Duration	Project Component	Air Quality Assessment? [Y/N]	Emission Source Type	Non-Radiological Indicator Compounds					
					SPM	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO
Planning Envelope A	2026-2030	Decommissioning of Southern portion of the Turbine Building including the tunnel to the Reactor Building and SFCA	Y	Non-road Equipment Exhaust	X	X	X	X	X	X
	2026-2030	Decommissioning of Basement portion of the Service Building including spent resin storage area		Demolition and Material Handling	X	X	X	—	—	—
				Road Exhausts	X	X	X	X	X	X
Planning Envelope B	2027-2034	Reactor Building clear-out including calandria and bioshield and decommissioning of dome and containment structure		Paved Roads	X	X	X	—	—	—

Notes:

SPM = suspended particulate matter; PM_{10} = particles nominally smaller than 10 µm in diameter; $PM_{2.5}$ = particles nominally smaller than 2.5 µm in diameter; NO_2 = nitrogen dioxide; SO_2 = sulphur dioxide; CO = carbon monoxide; Y = yes; N = No.

2.1.2 ACTIVITIES NOT CONSIDERED IN THE AIR QUALITY ASSESSMENT

There are many activities associated with the Project that produce emissions; however, not all activities produce emissions for any or all compounds that are relevant to the overall emissions assessment. All activities that potentially produce emissions were evaluated to assess their relevance; however, only activities that were considered to be relevant were included in the assessment. The following lists rationale as to why certain activities and/or emissions of certain compounds can be excluded from the assessment:

- the emission rates of certain compounds are very small relative to the overall emissions at the Project;
- the emissions from certain sources are not relevant to the assessment of emissions from the Project due to their nature and/or frequency; and
- the location of the source relative to the rest of the sources on-site (i.e., the source is located far away from any potential receptors).

Table 2 lists the activities that were not assessed and the accompanying rationale.

Table 2: Emissions Not Included in the Air Quality Assessment

Activity/Compound	Rationale for Excluding from the Air Quality Assessment
Snow removal equipment	Emissions from this equipment occur seasonally and are infrequent (i.e., only during the winter following a snowfall), and therefore, are not included in the representative scenario.
Operations support activities, such as maintenance activities	Emissions from these sources are infrequent, small and do not occur at all times compared to the other activities that are occurring regularly and/or continuously. For example, these activities may include minor vehicles maintenance.
Non-road nuisance dust	Potential sources of dust not already included in the assessment will be managed through the *Management and Monitoring of Emissions* [4].
Non-dust fugitive emissions	Materials such as insulating material and asbestos are managed through existing strict procedures outlined in the Management Control Procedure, Controlling Asbestos Hazards [5] and are therefore not included in the assessment.

Notes:

NO_2 = nitrogen dioxide; SO_2 = sulphur dioxide; CO = carbon monoxide; PHT = primary heat transport; hPa = hectopascal pressure unit

3. ASSUMPTIONS

Table 3 documents the assumptions made as part of the estimation of indicator compounds and GHG emission rates.

Table 3: Air Quality and Greenhouse Gas Emissions Assessment Assumptions List

Activity	Data Sources / Assumptions			
	Parameter	Value	Unit	Source / Assumption
General				
Operating Schedule	Weekly Schedule	4	days/week	CNL
	Annual Schedule	50	weeks/year	CNL
	Monthly Schedule	12	months/year	CNL
	General Daily Schedule	10	hr/day (maximum)	CNL
		7.5	hr/day (average)	CNL
Project Stages				Project Stages: PE-A — Decommissioning of Southern portion of the Turbine Building including the tunnel to the Reactor Building and SFCA. Decommissioning of Basement portion of the Service Building including spent resin storage area. (Duration: 2026-2030; # of Years: 5); PE-B — Reactor Building clear-out including calandria and bioshield and decommissioning of dome and containment structure. (Duration: 2027-2034; # of Years: 8)
Demolition				
Volumes for Removal	Concrete Waste	70,363	Mg	CNL
		28,145	m³	
	Masonry Waste	563	Mg	
		225	m³	
	Miscellaneous Construction Waste	560	Mg	
		1,099	m³	
	Excavated Materials	36,966	Mg	
		24,644	m³	
	Structural Steel and Miscellaneous Metals	3,239	Mg	
		–	m³	
	Rebar	3,601	Mg	
		–	m³	
	Mechanical & Electrical Waste	2,564	Mg	
		–	m³	
	Total	117,855	Mg	
		60,012	m³	
Duration	Assume total removed in	12	years	Duration of Planning Envelopes combined.
Material	Daily Material Movement	66	tonne/day	Estimated based on CNL data from other decommissioning projects.
	Material Moisture Content	0.25	%	US EPA AP-42 Section 13.2.4, minimum moisture content used in study to develop emission factors.

Table 3: Air Quality and Greenhouse Gas Emissions Assessment Assumptions List

<table>
<tr><th rowspan="2">Activity</th><th colspan="4">Data Sources / Assumptions</th></tr>
<tr><th>Parameter</th><th>Value</th><th>Unit</th><th>Source / Assumption</th></tr>
<tr><td colspan="5">Roads</td></tr>
<tr><td rowspan="3">Parameters</td><td>Silt Loading</td><td>0.6</td><td>g/m²</td><td>US EPA AP-42 Section 13.2.1 – Ubiquitous Baseline ADT < 500.</td></tr>
<tr><td>Maximum Speed</td><td>50</td><td>km/hr</td><td>CNL Speed Limit.</td></tr>
<tr><td>Vehicle Width</td><td>3</td><td>m</td><td>Haul Road Workgroup Final Report.</td></tr>
<tr><td>Road Segments</td><td></td><td></td><td></td><td>Quantity transported was based on information provided by CNL.
Distance travelled was estimated using Google Earth, assumed 2 passes per road.

<table>
<tr><th>Project Component</th><th>Activity</th><th>Description</th><th colspan="2">Quantity Transported</th><th>Distance Travelled (One-Way) [km]</th></tr>
<tr><td rowspan="2">Planning Envelope A & B</td><td rowspan="2">Raw Material Movement</td><td rowspan="2">Raw material from demolition site to property boundary</td><td>129.41</td><td>m³/day (max)</td><td>1.82</td></tr>
<tr><td>49.02</td><td>m³/day (average)</td><td>1.82</td></tr>
</table></td></tr>
<tr><td rowspan="4">Equipment</td><td>Truck Capacity</td><td>9.2</td><td>m³/truck</td><td>Tandem Axle Dump Truck
http://www.donmann.com/equipment.php?subPage=trucks&equip=tandem</td></tr>
<tr><td rowspan="2">Truck Weight</td><td>35600</td><td>kg</td><td rowspan="2">Tandem Steer/Tridem Drive Straight Truck, Maximum Gross Vehicle Weight Limits RTAC)
https://www.gov.mb.ca/mit/mcd/mce/pdf/mb_vehicle_weights_and_dimensions_guide.pdf</td></tr>
<tr><td>35.6</td><td>tonne</td></tr>
<tr><td>Horsepower</td><td>365 – 475</td><td>hp</td><td>Cat® CT13 Engine
http://www.cat.com/en_US/products/new/equipment/on-highway-trucks/on-highway-trucks/18463770.html</td></tr>
<tr><td>Truck Load Factor</td><td>0.9</td><td></td><td>Conservative assumption, assumed operating 90% of time.</td></tr>
<tr><td colspan="5">Non-road Equipment</td></tr>
<tr><td>Equipment</td><td>Vehicle Tier</td><td>Tier 4</td><td></td><td>CNL</td></tr>
<tr><td></td><td></td><td></td><td></td><td>Load factors were obtained from US EPA [6]. Table F4 was used to obtain load factors for common cycle types and Table F6 was used to obtain the representative cycle types if not available in Table F4. The highest potential load factor was used for equipment that did not explicitly have a load factor defined in the Crank case document.
[6]. Exhaust and Crankcase Emission Factors for Nonroad Compression-Ignition Engines in MOVES2014b.
https://cfpub.epa.gov/si/si_public_file_download.cfm?p_download_id=541846&Lab=OTAQ

<table>
<tr><th>Project Component</th><th>Equipment</th><th>Number of Units per Day</th><th>Horsepower Range [hp]</th><th>Load Factor</th><th>Basis for Equipment Type Load Factor</th></tr>
<tr><td>1.1</td><td>Tractor (Site Prep)</td><td>2</td><td>300 – 600</td><td>0.21</td><td>Backhoe/Loader</td></tr>
<tr><td>3.1</td><td>Crane</td><td>1</td><td>300 – 600</td><td>1.00</td><td>None (Crane)</td></tr>
<tr><td>3.1</td><td>Excavator – Large</td><td>5</td><td>300 – 600</td><td>0.53</td><td>Excavator</td></tr>
<tr><td>3.1</td><td>Material Handler (Wheel)</td><td>4</td><td>175 – 300</td><td>0.21</td><td>Backhoe/Loader</td></tr>
<tr><td>3.1</td><td>Wheel Loader – Small</td><td>2</td><td>175 – 300</td><td>0.21</td><td>Backhoe/Loader</td></tr>
<tr><td>3.1</td><td>Wheel Loader – Large</td><td>2</td><td>300 – 600</td><td>0.21</td><td>Backhoe/Loader</td></tr>
<tr><td>3.1</td><td>Wheel Dozer</td><td>2</td><td>300 – 600</td><td>0.58</td><td>Crawler Dozer</td></tr>
</table></td></tr>
<tr><td colspan="5">Miscellaneous</td></tr>
<tr><td colspan="2">Wind Speed</td><td>2.52</td><td>m/s</td><td>This is the average daily wind speed between 2005 and 2009, based on the hourly wind data obtained from the Bécancour Meteorological Station.</td></tr>
</table>

hr = hour; m³ = cubic metre; kg = kilogram; Btu = British thermal units; gr/100 ft³ = grains per 100 feet; yr = year; Mg = megragram; g/m² = grams per square metre; km/hr = kilometres per hour; m = metre; kW = kilowatt; m/s = metres per second; hp = horsepower.

4. CALCULATIONS

The emission calculations expected during the Planning Envelope were estimated as per REGDOC-2.9.1 [1], including average and maximum emission rates from the planned sources associated with the Project. Sample calculations are provided to demonstrate how the emission estimates were developed.

The emission rates for the indicator compounds are expressed in units of grams per seconds (g/s), which are required for the dispersion models. The dispersion model assumes the emission rate is constant over an hourly period, which is the smallest time-step within the models used for predictions. Non-radiological indicator compounds were assessed against their respective criteria and averaging periods (e.g., NO_2 has criteria with 1-hour, 24-hour and annual averaging periods).

Prior to air dispersion modelling, 1-hour (hourly) emission rates were calculated for NO_X, SO_2 and CO and 24-hour (daily) emission rates were calculated for SPM, PM_{10}, $PM_{2.5}$, NO_X, SO_2 and CO. Hourly emission rates represent emissions averaged over a period of one hour while daily emission rates represent emissions averaged over a day, based on the activities operating schedule as described in Table 3. The 8-hour CO emission rate was conservatively assumed to equal its 1-hour emission rate. Hourly emission rates were used for NO_X, SO_2 and CO for all averaging periods while daily emission rates were used for the particulates for all averaging periods.

The emission rates for GHG emissions are expressed in tonnes of carbon dioxide equivalent (CO_2e) per year, as required under the assessment frameworks discussed in ERR Section 6.2.2.4.1 Methods.

4.1 Indicator Compounds – Emission Calculations

Indicator compound emissions for particulates (SPM, PM_{10}, $PM_{2.5}$), NO_X, SO_2 and CO were calculated for activities described in the Project description (Section 3.0) for the Planning Envelope. These included the following:

- fugitive emissions from material handling activities related to demolition;
- vehicles exhaust from non-road equipment and on-road vehicles; and
- fugitive dust from paved roads.

The assessment follows scientifically accepted and well-documented calculation methods and emission factors, such as AP-42 from the US EPA.

4.1.1 Material Handling

Material handling activities associated with the demolition activities are expected to occur. These are characterized during the Project by the potential of fugitive dust by the movement of material during demolition.

4.1.1.1 Demolition

The demolition activities will involve the removal of the following components: Service Building, Turbine Building, and Reactor Building. All of the removed components will be hauled away for disposal. Demolition activities, as well as material removal, will be completed using non-road equipment. Emissions released from demolition activities are estimated based on the area of the proposed demolition and conservatively include the footprint of all three buildings.

Predictive emissions for particulate emissions were estimated using the demolition emission factors for PM_{10} obtained from the WRAP Air document titled WRAP Fugitive Dust Handbook, Chapter 3 – Construction and Demolition [7]. The following equation was used to calculate particulate emissions from demolition:

$$\text{Emission Rate } \left[\frac{\text{g}}{\text{s}}\right] = \text{Emission Factor } \left[\frac{\text{ton}}{\text{acre} - \text{month}}\right] \text{x Area Demolished [acre]x Activity Period [month]x Conversion Factors}$$

The following is a sample calculation for the daily PM_{10} emission rate from the demolition activities under the maximum scenario:

$$\text{Emission Rate} = 0.42 \frac{\text{ton}}{\text{acre} - \text{month}} \text{ x } 907{,}185 \frac{\text{g}}{\text{ton}} \text{x } \frac{1 \text{ acre}}{0.004 \text{ km}^2} \text{ x } 0.0066 \text{ km}^2 \text{x } \frac{1 \text{ month}}{16 \text{ days}} \text{ x } \frac{1 \text{ day}}{24 \text{ hr}} \text{ x } \frac{1 \text{ hr}}{3{,}600 \text{ s}}$$

$$\text{Emission Rate} = 0.45 \frac{\text{g}}{\text{s}}$$

As the available emission factor is for PM_{10}, the emission factors for SPM and $PM_{2.5}$ were calculated using analysis conducted by MRI on behalf of WRAP, where the $PM_{2.5}/PM_{10}$ ratio for fugitive dust from construction and demolition activities is 0.1. It is assumed that the SPM emission factors equals the PM_{10} emission factor.

4.1.2 Non-Road Vehicles – Exhaust Emissions

Exhaust and Crankcase Emission Factors for Nonroad Compression-Ignition Engines in MOVES2014b [6] ; (Crank case document) were used to calculate the exhaust (tailpipe) emissions from on-site vehicles. A load factor of 1.0 was assumed for equipment that did not have an explicitly defined a load factor or a representative load factor to use in the pieces of equipment identified in the Crank case document. It was assumed that all on-site vehicles comply with Tier 4 emission standards.

The following predictive emissions equation was used to calculate the daily emission rates for on-site vehicles:

$$\text{Daily Emission Rate} = \text{Emission Factor } \left[\frac{\text{g}}{\text{hp} - \text{hr}}\right] \times \text{Engine Horsepower Rating[hp]} \times \text{Load Factor} \times \text{Numberof Units per Day} \times \text{Daily Operating Hours} \times \text{Conversion Factors}$$

The following is a sample calculation for the daily PM_{10} emissions for the tractors to be used for the Project:

$$\text{Daily Emission Rate} = 0.01 \frac{\text{g}}{\text{hp} - \text{hr}} \times 600 \text{ hp} \times 0.21 \times 2 \text{ Tractors} \times \frac{10 \text{ operating hr/day}}{24 \text{ hr/day}} \times \frac{1 \text{ hr}}{3{,}600 \text{ s}}$$

$$\text{Daily Emission Rate} = 2.92\text{E} - 04 \text{ g/s}$$

The emissions rates for PM_{10}, NO_X and CO were calculated using the same equation. The emission rate for SPM was assumed to equal the emission rate of PM_{10}. The emission rate for $PM_{2.5}$ was calculated by multiplying the PM_{10} emission rate by 97%, as per the guidance document [6]. The emission rate calculation for SO_2 included a conversion calculation for the emission factor prior to using the above equation. The emission rates for non-road equipment were calculated for all equipment associated with the Project based on the type and number of equipment present (e.g., dozers, excavators). Emission calculations for non-road equipment assume all equipment is operating at the same time and all are located at the Project.

Table 4: MOVES Inputs

Run Specifications	Input
Description	CNL Gentilly Year: 2024 Vehicles: Medium trucks (Single unit short haul) Contaminants: All
Scale	Model: On-road
	Domain/Scale: County
	Calculation Type: Emission Rates
Time Spans	Year: 2024
	Months: January and July
	Days: Weekdays
	Hours: All (00:00 to 23:59)
Nearby Representative County	Somerset County, Maine
On-road Vehicles	Single Unit Short Haul (Medium Duty)
Road Type	Urban unrestricted
Pollutants	Carbon Monoxide
	Sulfur Dioxide
	Nitrogen Dioxide
	Particulate Matter < 10 µm (PM_{10})
	Particulate Matter < 2.5 µm ($PM_{2.5}$)
Temperature	Average hourly temperature from the ECCC Trois-Rivieres Station
Humidity	Average hourly temperature from the ECCC Trois-Rivieres Station
Fuel Options	
RVP (PSI)	12.7 psi for January, 7.6 psi for July
Gasoline sulphur content	12 ppm
Vehicle Fleet Characteristics	
Vehicle Age Distribution	default
Average Speed Distribution	default
Vehicle VMT	Estimated based on amount of material demolished per day
Hourly Miles Travelled (VMT) Distribution	default
Annual Average Daily Traffic	Estimated based on amount of material demolished per day

The emission factors developed for the trucks are provided in Table 5. The emission factors were converted from grams per VMT to grams per second to estimate emissions from on-road vehicles idling and driving in both the construction and operations phases.

Table 5: Emission Factors for Fleet Trucks Calculated Using MOVES

Compound	Emission Factor (g/s)
Carbon Monoxide	4.49E-04
Sulfur Dioxide	1.17E-06
Nitrogen Dioxide	1.16E-04
PM_{10}	7.49E-05
$PM_{2.5}$	2.66E-05

Notes:

PM_{10} = particles nominally smaller than 10 µm in diameter; $PM_{2.5}$ = particles nominally smaller than 2.5 µm in diameter.

The following equation was used to calculate the vehicle kilometres travelled per day (VKT/day) with the assumption that 15 trucks will make 2 passes on the road segment:

$$\text{Daily Vehicle Kilometers Travelled } \left[\frac{\text{VKT}}{\text{day}}\right] = \frac{\text{\# of Trucks}}{\text{day}} \times \text{Number of Passes per Road} \times \text{Road Length Travelled [km]}$$

The length of the road segment was estimated based on the site imagery. The following predictive emissions equation was used to calculate the vehicles exhaust emission rates for on-site vehicles travelling on a paved road:

$$\text{Emission Rate } \left[\frac{\text{g}}{\text{s}}\right] = \text{Emission Factor } \left[\frac{\text{g}}{\text{VKT}}\right] \times \text{Daily Vehicle Kilometers Travelled} \frac{\text{VKT}}{\text{day}} \times ConversionFactors$$

4.1.3 On-Road Vehicles – Paved Road Dust

The US EPA AP-42 emission factors from Chapter 13.2.1 – Paved Roads (January 2011) were used to calculate the fugitive dust emissions from paved roadways. The following predictive emissions equation was used to calculate the fugitive dust emission factor for paved roads:

$$\text{Emission Factor } [\frac{\text{g}}{\text{VKT}}] = (\text{k}(\text{sL})^{0.91} \times (\text{W})^{1.02})$$

Where: k = particle size multiplier for particle size range and units of interest (Table 6)

sL = road surface silt loading (grams per square metre [g/m2]) assumed to be 0.6 (as per US EPA AP-42 Section 13.2.1-3, ubiquitous baseline DT <500)

W = average weight (tons) of the vehicles travelling the road

Table 6: Particle Size Assumptions for Paved Road Dust

Size Range	SPM	PM_{10}	$PM_{2.5}$
k(g/VKT)	3.23	0.62	0.15

Notes:

SPM = suspended particulate matter; PM_{10} = particles nominally smaller than 10 µm in diameter; $PM_{2.5}$ = particles nominally smaller than 2.5 µm in diameter; k(g/VKT) = the constant for the particle size multipliers used on the Road Dust emission calculations, in units of g/VKT (or grams per vehicle kilometre travelled).

The following is a sample calculation for SPM for the predictive emission factor for vehicles that will travel along paved segment 1 (P1) from the demolition site to the property boundary. It was estimated that the fleet vehicles will have an average weight of 45.7 tons.

$$\text{Emission Factor} = (3.23 \times (0.6)^{0.91} \times (50.3)^{1.02})$$

$$\text{Emission Factor} = 110.5 \frac{\text{g}}{\text{VKT}}$$

The emission rate of particulates was calculated according to the following equation.

$$\text{Daily Emission Rate } \left[\frac{\text{g}}{\text{s}}\right] = \text{ Emission Factor } \left[\frac{\text{g}}{\text{VKT}}\right] \times \text{Daily Vehicle Kilometers Travelled } \left[\frac{\text{VKT}}{\text{day}}\right] \times \text{Conversion Factors}$$

The following is a sample calculation for the SPM emission rate for vehicles travelling along the same paved road segment:

$$\text{Emission Rate} = 110.5 \frac{\text{g}}{\text{VKT}} \times 54.6 \frac{\text{VKT}}{\text{day}} \times \frac{1 \text{ day}}{24 \text{ hr}} \times \frac{1 \text{ hr}}{3600 \text{ s}}$$

$$\text{Emission Rate} = 6.98\text{E} - 02 \text{ g/s}$$

The emission rates of PM_{10} and $PM_{2.5}$ were calculated as presented above.

4.1.3.1 Raw Material Handling

Material handling activities associated with the demolition are expected to occur during the Project. These are characterized during the Project by the potential of fugitive dust during the movement of material during demolition. The daily amount of raw material handled was estimated based on the daily amount of demolished material.

Predictive emission factors for particulate emissions were developed using equations from US EPA Section 13.2.4 – Aggregate Handling and Storage Piles [9]. The following predictive emissions equation was used in determining the emission factors for material handling:

$$\text{Emission Factor } [\frac{\text{kg}}{\text{Mg}}] = \text{k} \times 0.0016 \times \frac{\left(\frac{\text{U}}{2.2}\right)^{1.3}}{\left(\frac{\text{M}}{2}\right)^{1.4}}$$

Where: k = particle size multiplier for particle size range (Table 7)

U = mean wind speed (metres per second [m/s])

M = moisture content of material (percent [%])

Table 7: Particle Size Multiplier for Particle Size Range Used for Material Transfer Assumptions

SPM	PM_{10}	$PM_{2.5}$
0.74	0.35	0.053

Notes:

SPM = suspended particulate matter; PM_{10} = particles nominally smaller than 10 µm in diameter; $PM_{2.5}$ = particles nominally smaller than 2.5 µm in diameter.

The following is a sample equation for the emission factor and emission rate of SPM from the material handling of demolished material under the maximum scenario. A mean wind speed of 2.52 m/s calculated using the hourly wind speed data obtained from the Bécancour meteorological dataset (2005 to 2009) provided by the MELCCFP was used for the calculation. This wind speed is the average daily mean wind speed. The moisture content for the raw material was based on the minimum moisture content used in the study to develop emission factors per US EPA AP-42 Chapter 13.2.4 [9].

$$\text{Emission Factor} = 0.74 \times 0.0016 \times \frac{\left(\frac{2.5}{2.2}\right)^{1.3}}{\left(\frac{0.25}{2}\right)^{1.4}}$$

$$\text{Emission Factor} = 2.60\text{E}-02 \frac{\text{kg}}{\text{Mg}}$$

$$\text{Emission Rate} = 2.60\text{E}-02 \frac{\text{kg}}{\text{Mg}} \times 66 \frac{\text{Mg}}{\text{day}} \times \frac{1 \text{ day}}{24 \text{ hr}} \times \frac{1 \text{ hr}}{3{,}600 \text{ s}} \times \frac{1{,}000 \text{ g}}{1 \text{ kg}}$$

$$\text{ER} = 1.98\text{E}-02 \frac{\text{g}}{\text{s}}$$

4.2 Greenhouse Gas – Emission Calculations

The GHG emissions, including CO_2, CH_4 and N_2O, were calculated for on-road and non-road equipment (mobile equipment). Emissions for the Project were calculated using the equipment/vehicle information available for the Planning envelope. The assessment followed the calculation methods in the Quebec RDOCECA and ECCC GHGRP, as well as other guidance was used as deemed appropriate.

4.2.1 On-Road And Non-Road Equipment (Mobile Equipment)

The GHG emissions from mobile equipment from the Project were calculated based on fuel consumption and fuel-specific emission factors as presented in Table A6.1-14 in Part 2 of ECCC's National Inventory Report 1990-2021 for calculating CO_2, CH_4 and N_2O emissions [10]. The emission factors found in the ECCC's National Inventory Report also align with the emission factors of Quebec's RDOCECA. The method to calculate GHG emissions from mobile equipment is based on equipment rating, load factor and the default fuel specific emission factor (grams per litre [g/L]).

The equations below present the methods for calculating CO_2, CH_4 and N_2O emissions from mobile equipment:

$$\text{Emissions}\left[\frac{\text{tonnes}}{\text{yr}}\right] = \text{BSFC}_{\text{i,k}}\left[\frac{\text{lb}}{\text{hp}-\text{hr}}\right] \times \text{h}_{\text{pi,k}}\,[\text{hp}] \times \text{h}_{\text{i,k}}\left[\frac{\text{hr}}{\text{yr}}\right] \times \text{LF}_{\text{i,k}} \times \text{Daily \# of Units} \div \text{Diesel Density}\left[\frac{\text{kg}}{\text{L}}\right] \times \text{EF}_{\text{i,CO2}}\left[\frac{\text{g}}{\text{L}}\right] \times \text{Conversion Factors}$$

Where: hi,k = total annual hours of operation for the mobile equipment sources

hpi,k = rated equipment horsepower for mobile equipment

LFi,k = load factor for mobile equipment, between 0 and 1

BSFCi,k = brake-specific fuel consumption for mobile equipment

EF = fuel-specific default emission factor

It was assumed that all mobile equipment is fueled by diesel. The annual fuel consumption for each vehicle type was calculated based on an assumed vehicle horsepower, brake specific fuel consumption and load factors from the Crank case document [6].

The following is a sample calculation for the emission rate of CO_2 from the non-road tractors:

$$\text{Emissions}_{CO2} = 0.367\frac{\text{lb}}{\text{hp} - \text{hr}} \times 600\ \text{hp} \times 10\frac{\text{hr}}{\text{day}} \times 200\frac{\text{days}}{\text{yr}} \times 0.21 \times 2\ \text{units} \times \frac{1\ \text{L}}{0.840\ \text{kg}} \times 2681\frac{\text{g}}{\text{L}} \times \frac{0.454\ \text{kg}}{1\ \text{lb}} \times \frac{1\ \text{tonne}}{1{,}000{,}000\ \text{g}}$$

$$\text{Emissions}_{CO2} = 268\frac{\text{tonne}}{\text{yr}}$$

4.2.2 Global Warming Potentials

Emissions from CO_2, CH_4 and N_2O were converted to CO_2e. The GHG emissions are expressed as tonnes of equivalent CO_2, by multiplying the annual emissions of each GHG by its 100-year global warming potential (GWP). The GWP of each gas represents the gas's ability to trap heat in the atmosphere in comparison to CO_2. The Quebec Provincial GWPs and the ECCC federal GWPs that are used to calculate the GHG emissions from the Project are listed in Table 8 [11].

Table 8: Global Warming Potentials

GHG Compound	Federal and Quebec GWP
CO_2	1
CH_4	25
N_2O	298

Note:

GHG = greenhouse gas; CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; GHGRP = Greenhouse Gas Reporting Program
GWP = Global Warming Potential.

5. EMISSION RATES

This section outlines the emission rates to be used in the Air Quality Assessment (in g/s) and GHG Assessment (in tonne CO_2e/year), which were calculated for the Project as described in Section 4.0.

5.1 Air Quality Assessment

Table 9 and Table 10 summarize the maximum and average scenario daily emission rates, respectively, for each activity at the Project. Tables 11 and 12 summarize the maximum and average scenario percentages, respectively, that each source contributes to the overall emissions from the Project activities based on the daily emission rates.

Table 9: Maximum Scenario Summary of Daily Emissions Rates

Planning Envelope	Duration	Project Component[(c)]	Emission Source Type	Maximum Emission Rates [g/s]					
				SPM[a]	PM_{10}[a]	$PM_{2.5}$[a]	NO_X[b]	SO_2[b]	CO[b]
Planning Envelope A	2026-2030	Decommissioning of Southern portion of the Turbine Building including the tunnel to the Reactor Building and SFCA	Non-road Equipment Exhaust	4.36E-03	4.36E-03	4.23E-03	3.14E-01	5.22E-03	2.72E+00
	2026-2030	Decommissioning of Basement portion of the Service Building including spent resin storage area	Demolition and Material Handling	4.66E-01	4.56E-01	4.61E-02	—	—	—
			Road Exhausts	7.49E-05	7.49E-05	2.66E-05	2.79E-04	2.80E-06	1.08E-03
Planning Envelope B	2027-2034	Reactor Building clear-out including calandria and bioshield and decommissioning of dome and containment structure	Paved Roads	6.98E-02	1.34E-02	3.24E-03	—	—	—

Notes:

(a) Daily Emission Rates [g/s]

(b) Hourly Emission Rates [g/s]

(c) Each emission source type is applicable to each Project component

SPM = suspended particulate matter; PM10 = particles nominally smaller than 10 µm in diameter; PM2.5 = particles nominally smaller than 2.5 µm in diameter; NO_X = oxides of nitrogen; SO2 = sulphur dioxide; CO = carbon monoxide; g/s = grams per second

Table 10: Average Scenario Summary of Emissions Rates

Planning Envelope	Duration	Project Component[(c)]	Emission Source Type	Average Emission Rates [g/s]					
				SPM[a]	PM_{10}[a]	$PM_{2.5}$[a]	NO_X[b]	SO_2[b]	CO[b]
Planning Envelope A	2026-2030	Decommissioning of Southern portion of the Turbine Building including the tunnel to the Reactor Building and SFCA	Non-road Equipment Exhaust	3.27E-03	3.27E-03	3.17E-03	3.14E-01	5.22E-03	2.72E+00
	2026-2030	Decommissioning of Basement portion of the Service Building including spent resin storage area	Demolition and Material Handling	1.24E-01	1.20E-01	1.22E-02	—	—	—
			Road Exhaust	3.00E-05	3.00E-05	1.06E-05	2.79E-04	2.80E-06	1.08E-03
Planning Envelope B	2027-2034	Reactor Building clear-out including calandria and bioshield and decommissioning of dome and containment structure	Paved Roads	2.79E-02	5.36E-03	1.30E-03	—	—	—

Notes:

(a) Daily Emission Rates [g/s]

(b) Hourly Emission Rates [g/s]

(c) Each emission source type is applicable to each Project component

SPM = suspended particulate matter; PM10 = particles nominally smaller than 10 µm in diameter; PM2.5 = particles nominally smaller than 2.5 µm in diameter; NO_X = oxides of nitrogen; SO2 = sulphur dioxide; CO = carbon monoxide; g/s = grams per second

Table 11: Maximum Scenario Summary of Percentage Contributions of Emissions Rates

Planning Envelope	Duration	Project Component[(a)]	Emission Source Type	Compound Percent of Overall Compound Emissions					
				SPM	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO
Planning Envelope A	2026-2030	Decommissioning of Southern portion of the Turbine Building including the tunnel to the Reactor Building and SFCA	Non-road Equipment Exhaust	<1%	<1%	8%	99.9%	99.9%	99.96%
	2026-2030	Decommissioning of Basement portion of the Service Building including spent resin storage area	Demolition and Material Handling	86%	96%	86%	—	—	—
			Road Exhaust	<1%	<1%	<1%	<1%	<1%	<1%
Planning Envelope B	2027-2034	Reactor Building clear-out including calandria and bioshield and decommissioning of dome and containment structure	Paved Roads	13%	3%	6%	—	—	—

Notes:

(a) Each emission source type is applicable to each Project component

SPM = suspended particulate matter; PM_{10} = particles nominally smaller than 10 µm in diameter; $PM_{2.5}$ = particles nominally smaller than 2.5 µm in diameter; NO_X = oxides of nitrogen;
SO_2 = sulphur dioxide; CO = carbon monoxide; < = less than; % = percent; — = not applicable.

Table 12: Average Scenario Summary of Percentage Contributions of Emissions Rates

Planning Envelope	Duration	Project Component[(a)]	Emission Source Type	Compound Percent of Overall Compound Emissions					
				SPM	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO
Planning Envelope A	2026-2030	Decommissioning of Southern portion of the Turbine Building including the tunnel to the Reactor Building and SFCA	Non-road Equipment Exhaust	2%	3%	19%	99.9%	99.9%	99.96%
	2026-2030	Decommissioning of Basement portion of the Service Building including spent resin storage area	Demolition and Material Handling	80%	93%	73%	—	—	—
			Road Exhaust	<1%	<1%	<1%	<1%	<1%	<1%
Planning Envelope B	2027-2034	Reactor Building clear-out including calandria and bioshield and decommissioning of dome and containment structure	Paved Roads	18%	4%	8%	—	—	—

Notes:

(a) Each emission source type is applicable to each Project component

SPM = suspended particulate matter; PM_{10} = particles nominally smaller than 10 µm in diameter; $PM_{2.5}$ = particles nominally smaller than 2.5 µm in diameter; NO_X = oxides of nitrogen;
SO_2 = sulphur dioxide; CO = carbon monoxide; < = less than; % = percent; — = not applicable.

5.2 Greenhouse Gas Assessment

The GHG emissions were estimated for the project phases including emissions from mobile fuel combustion sources. Table 13 presents the Project's predicted annual emissions where Tonnes of CO_2e were calculated using the aligned Federal and Quebec GWPs.

Table 13: Summary of GHG Emission Rates

Source	Annual Emissions (tonnes CO_2e)			Total Annual Emissions (tonnes CO_2e)
	CO_2	CH_4	N_2O	
	124-38-9	74-82-8	10024-97-2	
Mobile Equipment (Road & Non-Road)	4,865	3.93	108	4,977
Total	**4,865**	**3.93**	**108**	**4,977**

Notes:

CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalent.

6. CONSERVATISM IN EMISSION CALCULATIONS

Table 14 outlines the areas where conservatism was assumed in the emission rate calculations for air quality and GHG emissions, which results in an assessment that is not likely to under-predict the emissions associated with the Project.

Table 14: Areas of Conservatism in the Emission Rate Calculations

Project Activity	Conservatism
Non-road Equipment	It is conservatively assumed that all non-road equipment is operating simultaneously during the daily operating hours for the Project and for the entire duration. In reality, it is unlikely that all equipment would operate simultaneously and that the same type of equipment will operate simultaneously for different components of the Project.
Fugitive Dust from Paved Roads	Roadway segments at the Project were assessed based on the type of roadway and anticipated traffic. Emission estimation equations from Chapters 13.2.1 of the AP-42 Emission Factor [12] were used for fugitive road dust from paved roads. These emission estimates are conservative and will overestimate emissions from facility roadways for the following reasons. ▪ The US EPA AP-42 equations were developed from measured emissions from public roadways and as a result will tend to over-estimate low speed vehicle traffic from construction and industrial sites. ▪ All roadways at the Project were modelled assuming simultaneous and continuous use; however, it is unlikely that this situation will occur in reality. ▪ As the dust best management practices are revised through continuous improvements, the emissions from the on-site roadways are likely to decrease. ▪ Seasonal variability for fugitive dust emissions was not considered in the assessment.

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APPENDIX 3

Dispersion Modelling

1. INTRODUCTION

This Appendix was prepared to support the EPMR for the CNL's Phase 3 Decommissioning of the G1WF (Project) at the Gentilly Nuclear Complex Site. This Appendix describes the dispersion model and modelling approach used to conduct the non-radiological air dispersion modelling as part of the effects assessment. More specifically, this Appendix documents the methods, inputs and assumptions that were used to prepare and complete the dispersion modelling to predict ground-level concentrations of non-radiological indicator compounds resulting from the Project.

The modelling approach described within this Appendix follows generally accepted practices for conducting environmental assessments and modelling guidance. The MELCCFP dispersion modelling guidance included in the *Guide de la Modélisation de la Dispersion Atmosphérique* [1] (the Guidelines) was used in the assessment and was supported with the following guidance documents, as appropriate: the Ontario Ministry of the Environment, Conservation and Parks (MECP) document titled *Air Dispersion Modelling Guideline for Ontario* [2], and in the National Stone, Sand and Gravel Association (NSSGA) document titled *Modeling Fugitive Dust Sources* [3]. The air dispersion modelling for the Project entailed the use of AERMOD dispersion modelling to assess predicted concentrations from all emissions sources and paved roads.

2. AIR DISPERSION MODELLING

2.1 Dispersion Modelling

The likely environmental effects for the air quality indicators were evaluated with the aid of the AERMOD dispersion model (version 22112) developed by the United States Environmental Protection Agency (U.S. EPA).

The selection of the AERMOD model was based on the following capabilities:

- has a technical basis that is scientifically sound and is in keeping with the current understanding of dispersion in the atmosphere;
- applies formulations that are clearly delineated and are subjected to rigorous independent scrutiny;
- makes predictions that are consistent with observations;
- is recognized by federal and provincial regulators, including Québec, as a regulatory default model;
- evaluates the source configurations and indicator compounds associated with the Project;
- the terrain surrounding the Project is relatively simple and can be addressed by the terrain features of the model;
- allows for the use of localised meteorological data;
- incorporates building downwash effects; and
- long-range transport of compounds is not anticipated.

More specifically, AERMOD is recognized by federal regulators as one of the regulatory default dispersion models and is suitable to model construction activities, waste disposal operations, and fugitives.

AERMOD consists of the model and two pre-processors; the AERMET meteorological pre-processor and the AERMAP terrain pre-processor (Figure 1). The following approved dispersion model and pre-processors were used in the assessment:

- AERMOD dispersion model (v. 22112); and
- AERMAP surface pre-processor (v. 18081).

AERMET was used by the MELCCFP to prepare a 5-year meteorological dataset (2005-2009) for Bécancour which is representative of the Project site.

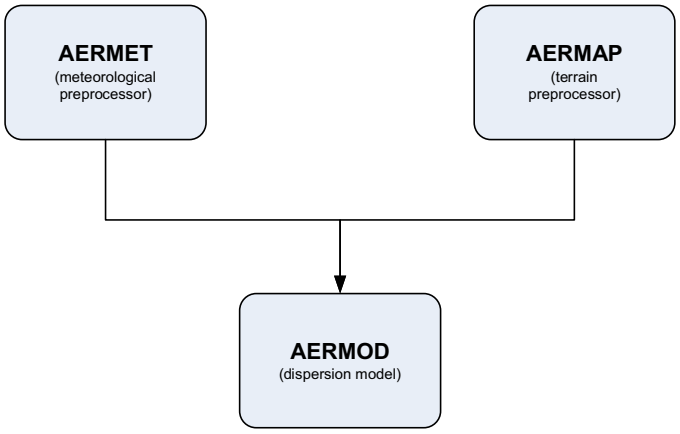


Figure 1: AERMOD Model System

2.1.1 Model Development

The AERMOD dispersion modelling system was developed by the U.S. EPA as a replacement to the long-standing Industrial Source Complex model, as the model recommended by the U.S. EPA for regulatory applications in the United States. The model is generally based on Gaussian plume dispersion theory [4], but also incorporates a series of specific algorithms to reflect current understanding of dispersion theory [4]. The selected model is recommended by Québec (the Guidelines); therefore, the AERMOD model is considered a suitable model for the Project.

2.1.2 Model Calibration and Validation

Regulatory dispersion models do not readily lend themselves to modification to incorporate site-specific characteristics in the equations themselves. However, the model does require site-specific meteorological data to operate. Digital terrain data for the site and surrounding area are also required inputs to the AERMAP pre-processor and used to characterize how the local topography could affect the dispersion of air contaminants. Part of the rigorous process used by the U.S. EPA prior to adopting AERMOD as a regulatory model [4] was a significant peer review process to confirm that the model could accurately predict ground-level concentrations when compared to monitoring data [4].

2.1.3 Model Uncertainty and Sensitivity

Dispersion models employ assumptions that simplify the random processes associated with atmospheric motions and turbulence. While this simplification limits the model's ability to replicate individual events, the strength of the model lies in the ability to predict overall values for a given set of meteorological conditions. The process undertaken by the U.S. EPA ensured that the model predictions can be relied on as reasonable estimate of the likely concentrations. AERMOD is based on known theory and proven to reliably produce repeatable results. To limit the uncertainty associated with emissions input to the model, conservative assumptions were made where practical. Finally, five years of meteorological data are used as an input to the model to ensure the full range of possible meteorological conditions is evaluated.

2.2 Dispersion Modelling Inputs

To predict ambient air concentrations with the aid of AERMOD, a series of inputs are required that parameterize the sources of emissions as well as their transport. These inputs can be grouped into categories:

- Dispersion meteorological data;
- Terrain and receptors;
- Building downwash; and
- Emissions and source configurations.

2.2.1 Dispersion Meteorological Data

The MELCCFP, as well as other agencies, recommends that five years of hourly data be used in the model to cover a wide range of potential meteorological conditions (the Guidelines). The meteorological data files were obtained from the MELCCFP for the region of Bécancour, which covers the period of January 2005 to December 2009.

The meteorological input files used by the AERMOD dispersion model are generated using the AERMET pre-processor, which is designed to be run in three stages:

1) Extracts the data and assesses data quality;
2) Merges the available data for 24-hour periods and writes these data to an intermediate file; and
3) Reads the merged data file and develops the necessary boundary layer parameters for dispersion calculations by AERMOD.

The AERMET pre-processor produces two meteorological data files. The first file contains boundary layer scaling parameters (e.g., surface friction velocity, mixing height, and Monin-Obukhov length) as well as wind speeds, wind directions and temperature at a reference-height (i.e., 10 m). The second file contains one or more levels (a profile) of winds, temperature, and the standard deviation of the fluctuating components of the wind. These files are used as inputs to AERMOD.

2.2.2 Terrain and Modelling Receptors

Terrain elevations have the potential to influence air quality and odour concentrations at individual receptors, therefore surrounding terrain data is required when using regulatory dispersion models in both simple and complex terrain situations [4]. Digital terrain data is used in the AERMAP pre-processor to determine the base elevations of receptors, sources, and buildings. AERMAP then searches the terrain height and location that has the greatest influence on dispersion for each receptor [4]. This is referred to as the hill height scale. The base elevation and hill height scale produced by AERMAP are directly inserted into the AERMOD input file.

2.2.2.1 Digital Terrain Data

The terrain information required by the AERMOD dispersion model was generated by the AERMAP pre-processor. An AERMAP file was developed based on Canadian Digital Elevation Data (CDED) for the assessment boundary obtained from WebGIS in AERMOD. The terrain in the assessment boundary is open with flat topography; elevations range from approximately 0 to 50 metres above sea level. The Canadian Digital Elevation Data file used in the modelling for the Project is as follows:

- 031i08_0200_demw.dem

2.2.2.2 Modelling Domain

The modelling domain was set to be 24 km by 24 km in size to encompass the assessment boundary for the Project (Figure 2). This domain is large enough to capture the potential air quality effects of the Project on the surrounding area.

2.2.2.3 Model Receptors

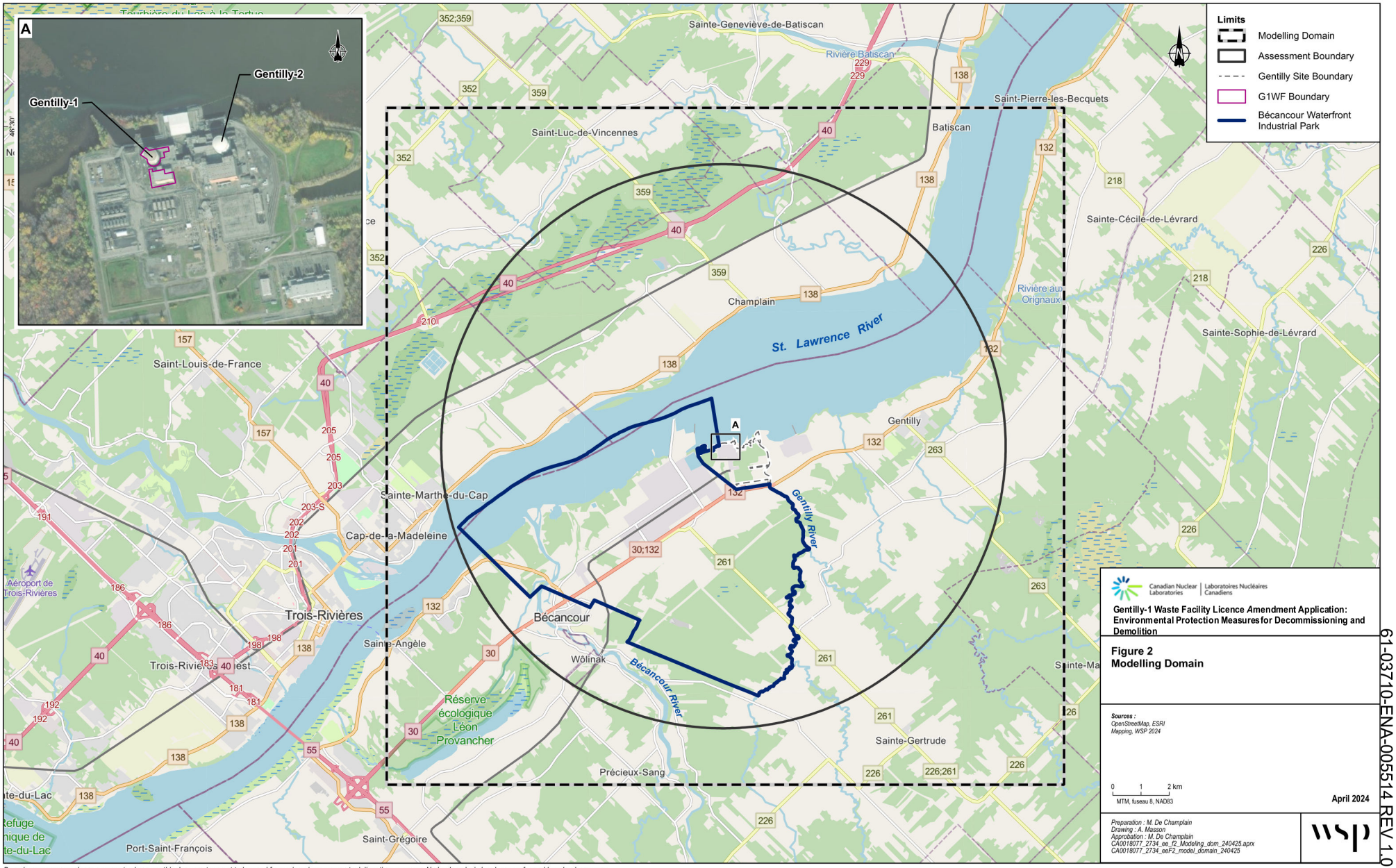
Air quality concentrations were predicted at selected groups of receptors which include Hydro-Québec property boundary and the Becancour Waterfront Industrial Park and a grid of receptors covering a m10 km radius around the . Receptor locations are specified in terms of X, Y and Z coordinates. A total of 1,887 receptors were placed along at intervals of 25 m within the Gentilly site boundary and a uniform polar grid of receptors was used that produced 180 receptors in five rings at 2,000 m intervals, extending out to a total radius of 10 km centered on the Gentilly site (i.e., the assessment boundary). All receptors are assumed to be ground-level receptors (i.e., Z = 0 m). This positioning allows for more receptors closer to the emission sources. The air quality receptor grid is illustrated on Figure 3.

2.2.3 Building Downwash

For this assessment, the effects of building downwash were not included given the low-level fugitive nature of the sources, they are not expected to be subject to downwash effects from nearby buildings.

2.2.4 Emissions and Source Configurations

Air emission rates were estimated for the Project sources for which a measurable change from existing conditions is anticipated and may occur. These emission rates were then used as inputs for the dispersion modelling that provided estimates of maximum ground-level concentrations resulting from the Project emissions. Appendix 2 provides a detailed description of the methods, inputs, and assumptions used to estimate emission rates.



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Gentilly-1 Waste Facility Licence Amendment Application: Environmental Protection Measures for Decommissioning and Demolition

Figure 2
Modelling Domain

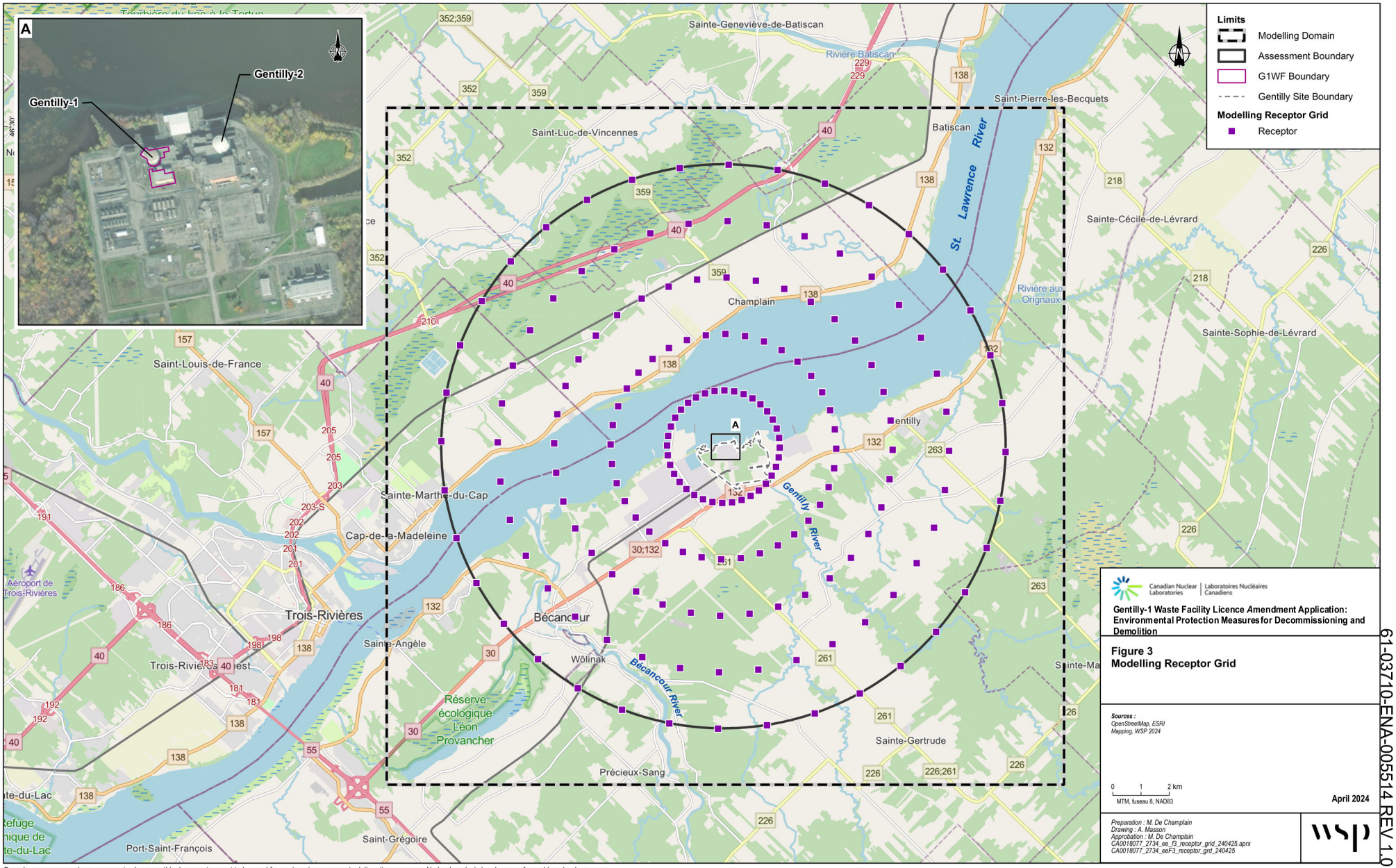
Sources :
OpenStreetMap, ESRI Mapping, WSP 2024

April 2024

Preparation : M. De Champlain
Drawing : A. Masson
Approbation : M. De Champlain
CA0018077_2734_ee_f2_Modeling_dom_240425.aprx
CA0018077_2734_eeF2_model_domain_240425

wsp

Boundary accuracy and measurements shown on this document are not to be used for engineering or property delineation purposes. No land analysis has been performed by a land surveyor.



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2.2.4.1 Volume and Line-Volume Sources

The model source types used in this assessment were volume and line-volume sources. Figure 4 – Site Layout and Dispersion Modelling Plan illustrates the model source locations used in this assessment for the Project. Volume sources are used to model releases from a variety of industrial sources that cannot be classified as a point or area source and line-volume sources are used to model release from roads.

Volume sources are square and are determined by calculating the shortest side length of the area which the source's dimensions result in. The volume source parameters developed for the dispersion model were based on the source dimensions and the calculation of the shortest side length, following guidance in *Modelling Fugitive Dust Sources* [3]. The volume source parameters are summarized in Table 1.

The Québec MELCCFP does not specify a source type to use for modelling paved roads, however, the Ontario MECP has suggested that roads should be modelled as a series of individual volume sources creating a line that follows the road [2]. The roads in the assessment were modelled using this volume source approach. The roads were divided into contiguous volume sources with a release height of 2.55 m which is calculated from the assumed height of the haul truck of 3 m [5]. The Single Lane option for line-volume sources in AERMOD was used as the Two Lanes options is for cases with heavy two-way traffic where the combined plume needs to be approximated [5]. In this case, an assumed vehicle width of 3 m was used [5]. The emission rate for the entire road segment was divided amongst the total volume sources for the entire segment. There is only one paved road segment considered in the assessment, accounting for the activities requiring truck hauling. The line-volume source parameters for the road are summarized in Table 2.

Table 1: Volume Source Summary

Source Description (ID)	Volume Height [m]	Release Height [m]	Length of Side [m]	Initial Lateral Dimension [m]	Initial Vertical Dimension [m]	Source Coordinate X [m]	Source Coordinate Y [m]	Contaminant	CAS No.	Maximum Hourly Emission Rate [g/s]	Maximum Daily Emission Rate [g/s]
Non-Road Vehicles - Exhaust Emissions (NONROAD)	1.5	1.5	115	26.7	0.35	703121	5141343	SPM	N/A-1	—	4.36E-03
								PM_{10}	N/A-2	—	4.36E-03
								$PM_{2.5}$	N/A-3	—	4.23E-03
								NO_X	10102-44-0	3.14E-01	1.31E-01
								CO	630-08-0	5.22E-03	2.18E-03
								SO_2	7446-09-5	2.72E+00	1.13E+00
Demolition and Material Handling (DEMO_MH)	24.9	12.45	47	10.93	11.58	703143	5141378	SPM	N/A-1	—	4.66E-01
								PM_{10}	N/A-2	—	4.56E-01
								$PM_{2.5}$	N/A-3	—	4.61E-02

Table 2: Line-Volume Source Summary

Source Description (ID)	Vehicle Height [m]	Vehicle Width [m]	Plume Height [m]	Release Height [m]	Plume Width [m]	Initial Lateral Dimension [m]	Initial Vertical Dimension [m]	Number of Volume Sources Comprising Segment	Cont.	CAS No.	Max Hourly Emission Rate [g/s]	Max Daily Emission Rate [g/s]	Max Daily Emission Rate per Volume Source [g/s]	Max Daily Emission Rate per Volume Source [g/s]
Paved Road (P1)	3	3	5.1	2.55	9	4.19	2.37	202	SPM	N/A-1	—	6.99E-02	—	3.46E-04
									PM_{10}	N/A-2	—	1.35E-02	—	6.67E-05
									$PM_{2.5}$	N/A-3	—	3.27E-03	—	1.62E-05
									NO_X	10102-44-0	2.79E-04	1.16E-04	1.38E-06	5.75E-07
									CO	630-08-0	2.80E-06	1.17E-06	1.39E-08	5.78E-09
									SO_2	7446-09-5	1.08E-03	4.49E-04	5.34E-06	2.23E-06

Dispersion Modelling Plan

- Paved Road Segment

Volume Sources

- Demolition and Material Handling
- Offroad Equipment

Infrastructures

- Flood protection dike
- Fence
- Transmission lines
- Substation

Road network

- National or Regional Road
- Local Road
- Railroad

Hydrography

- Permanent stream
- Intermittent stream
- Waterbody

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Gentilly-1 Waste Facility Licence Amendment Application: Environmental Protection Measures for Decommissioning and Demolition

Figure 4
Site Layout and Dispersion Modelling Plan

Sources :
OpenStreetMap, ESRI
Mapping, WSP 2024

0 80 160 m
MTM, fuseau 8, NAD83

April 2024

Preparation : M. De Champlain
Drawing : A. Masson
Approbation : M. De Champlain
CA0018077_2734_ee_f4_site_layout_240425.aprx
CA0018077_2734_eeF4_Site_layout_240425

wsp

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2.2.4.2 Model Options

Table 3 presents the modelling parameters used in the dispersion modelling assessment.

Table 3: Options Used in the AERMOD Model

Modelling Parameter	Description	Used in the Assessment?
DFAULT	Specifies that regulatory default options will be used.	Yes
CONC	Specifies that concentration values will be calculated.	Yes
AVERTIME	Time averaging periods calculated.	1-hr, 8-hr, 24-hr, Annual
DEPOS	Total deposition flux values will be calculated	No, deposition was not considered for this assessment
DDEP	Specifies that dry deposition will be used	No, deposition was not considered for this assessment
WDEP	Specifies that wet deposition will be used	No, deposition was not considered for this assessment

2.3 POST-PROCESSING

Most air quality concentration results are output directly from the model; however, there are certain parameters, including averaging periods less than 1 hour and conversion of NO_2 using existing regional ozone concentrations that require post-processing. These post-processing methods are described in the following sections.

2.3.1 TIME AVERAGE CONVERSIONS

The smallest time scale that AERMOD predicts is a 1-hour average value. There are instances when criteria are based on different averaging times, and in these cases the following conversion factor, recommended by the MELCCFP for conversion from a 1-hour averaging period to the applicable averaging period less than 1-hour could be used (the Guidelines). An example is given below for converting from a 1-hour averaging period to a 4-minute averaging period:

$$C(T) = C_{1\,hour} \times 0.97T^{-0.25}$$

$$C_{4\,min} = C_{1\,hour} \times 0.97\left(\frac{4}{60}\right)^{-0.25}$$

$$\frac{C_{4\,min}}{C_{1\,hour}} = 1.91$$

Where: C1 hour = the concentration at a 1-hour averaging period,

C(T) = the concentration for desired averaging period T, and

T = the time period of desired averaging period under 1 hour, measured in hours.

For averaging periods greater than 1-hour, the AERMOD output was used directly.

2.3.2 Conversions of NO_X TO NO_2

Emissions of oxides of nitrogen (NO_X) were used as inputs to the AERMOD model. Ambient predictions of nitrogen dioxide (NO_2), one of the criteria air contaminants, can be calculated from modelled NO_X values using the Ozone Limiting Method (OLM). The OLM consists of comparing the maximum modelled NO_X concentration to the background ozone (O_3) concentration to assess the limiting factor to NO_2 [6]. The following equations present the method:

If background $[O_3] > 0.90\ [NO_X]$, total conversion: $[NO_2] = [NO_X]$

If background $[O_3] < 0.90\ [NO_X]$, NO_2 is limited by O_3: $[NO_2] = [O_3] + 0.10\ [NO_X]$

For the air quality assessment, the 1-hour, 24-hour and annual NO_2 concentrations were calculated assuming total conversion of NO_X since background ozone values at these averaging periods were above $0.90\ [NO_X]$.

Table 4 provides a summary of the NO_2 calculation for the three averaging periods under the Maximum Scenario. The maximum O_3 background concentration from the five assessed stations was conservatively used for comparison.

Additional information on the background air quality assessment is presented in Appendix 1.

Table 4: Summary of Maximum Scenario NOx Conversion to NO_2

Averaging Period	O3 Background Concentration (µg/m³)	NOx Estimated Concentration (µg/m³)	0.9 (NOx)	Required Approach	NO2 Estimated Concentration (µg/m³)
1-hour	78.50	91.1	82.0	OLM	87.6
24-hour	73.02	7.88	7.09	Full Conversion	7.88
Annual	52.62	0.629	0.566	Full Conversion	0.629

Notes:

O_3 = ozone; NO_X = nitrogen oxides; NO_2 = nitrogen dioxide.

2.4 Conservatism in Modelling and Post-Processing Approaches

Table 5 outlines the areas where conservatism was assumed in the modelling approach, which results in an assessment that is not likely to under-predict the air quality associated with the Project.

Table 5: Areas of Conservatism in the Modelling Approach

Area	Conservatism
All operations for the G1WF were assumed to occur simultaneously	The modelling assessment includes all operations occurring simultaneously and continuous over the entire modelling period.
Fugitive Dust Modelling	The parameters that were required for fugitive dust modelling from paved roads include the locations of the roadway segments, base elevations, effective heights of the emissions, and the initial plume size in the lateral and vertical directions. It is recognized that this modelling approach will result in higher predicted concentrations close to the roadways than actual values for the following reason: When the roads are wet or snow-covered, the emissions will be reduced or eliminated. AERMOD has the capacity to have a variable emission rate that could account for actual meteorological emissions; however variable emission rates were not used in this assessment for conservatism. Despite the limitations of the emission rate estimates and dispersion modelling, these are the best estimates available.

It is assumed that the conservative emission rates, when combined with the conservative operating conditions and conservative dispersion modelling assumptions and post-processing assumptions description herein, are not likely to under predict the modelled concentrations at each of the identified receptors.

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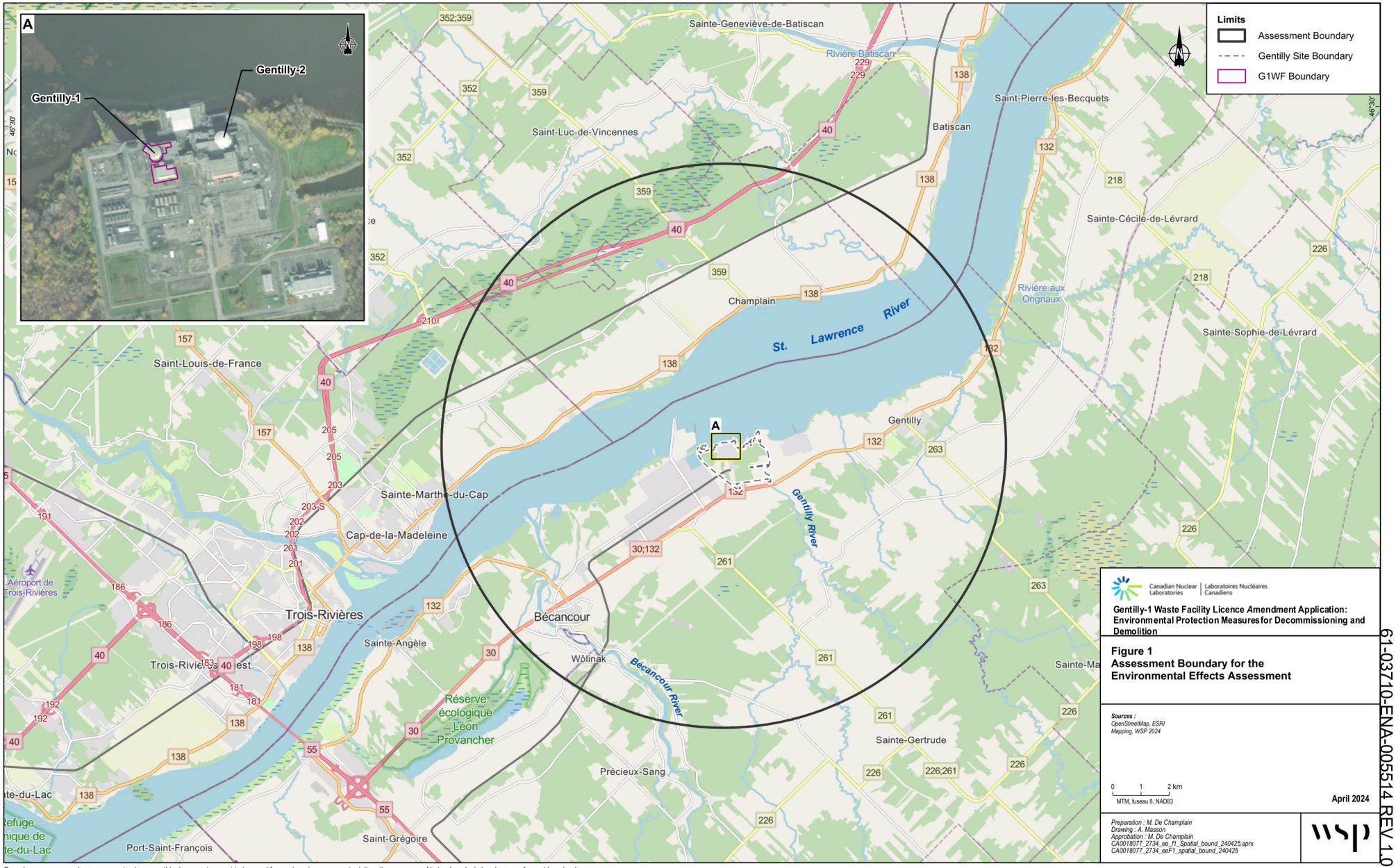
APPENDIX 4

Description of the Terrestrial Environment

1. INTRODUCTION

This Appendix was prepared to support the EPMR for the proposed CNL's Phase 3 Decommissioning of G1WF (Project) at the Gentilly Nuclear Complex Site (Gentilly site). This Appendix presents a description of the existing environment, specific to the Valued Components (VCs) selected for the assessment. A screening of the species at risk was completed to determine the VCs to be included in the assessment (Attachment A; [42]).

The Assessment Boundary was selected to provide description of existing conditions in sufficient detail to enable potential Project interactions with species at risk to be identified, understood and assessed. The Assessment Boundary for the environmental effects assessment is equivalent to approximately a 10 km radius circle centered on the Gentilly site (Figure 1).



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2. DESCRIPTION OF EXISTING ENVIRONMENT FOR VALUED COMPONENTS

The following information sources were used to describe exiting conditions for the species at risk selected for the assessment of effects to wildlife:

- species at risk file data file, assumed to be compiled through a spatial query by Québec Natural Heritage Data Center [Centre de données du patrimoine naturel du Québec (CDPNQ)] [1];
- previous environmental assessments conducted for the Gentilly site [2];
- Québec breeding birds Atlas [Atlas des oiseaux nicheurs du Québec [3]];
- eBird web-based bird observation database hosted by the Cornell Lab of Ornithology and National Audubon Society [4];
- Québec amphibian and reptile atlas [Atlas des amphibiens et reptiles du Québec [5];
- Landcover and buildings data; and
- Wetland.

A description of the existing conditions is provided for each species at risk and migratory bird selected for the assessment in the following sections. For each species, landcover and wetlands spatial data were used to provide descriptions of habitat availability and distribution under existing conditions, representing an estimate of suitable habitat available as a result of past and present development and activities. A review of habitat requirements and species ecology was completed for each wildlife species at risk and migratory bird to identify habitat that is most likely to be limiting for the species in the Assessment Boundary and the loss of which would be most likely to result in change to its abundance in the vicinity of the Gentilly site. The limiting habitat was selected as the focus of the wildlife assessment.

2.1 Barn Swallow and Cliff Swallow

The breeding range of barn swallow and cliff swallow overlap the Assessment Boundary. Breeding habitat for barn swallow typically includes three components: a vertical or horizontal substrate (often enclosed) for the nest site itself, open habitat (e.g., fields, meadows) for foraging and a body of water that provides mud for nest building [6]. Cliff Swallows prefer open or semi-open landscapes such as grasslands, agricultural fields, and riparian zones. These environments support their aerial insectivorous diet, which consists primarily of flying insects.

Both barn swallow and cliff swallow nests are typically found inside or outside of buildings, under bridges and in road culverts. These structures offer vertical surfaces with overhangs, which protect nests from rain and predators. Common foraging habitat for these species includes open riparian areas, road rights of way, urban and residential areas and clearings in wooded areas [6].

Barn swallow is listed as Threatened under SARA but does not yet have legally defined critical habitat described in a recovery strategy. It has also been recently downgraded by COSEWIC to Special Concern [7]. No nesting pair has been observed at the Gentilly site. Cliff swallow is not a species at risk; however, it is protected by the MBCA. There is confirmed nesting activity on infrastructure such as the Reactor Building at the G1WF, where Cliff Swallows continue to nest without interfering with operations.

For the purposes of the wildlife assessment, a conservative approach has been taken and all mapped buildings at the Gentilly site were considered suitable nesting habitat for barn swallow and cliff swallow. Open wetlands, agricultural fields and waterbodies were also considered suitable habitat for feeding. A total of 8,347.02 ha (46.18%) and 3.62 ha (22.62%) of suitable nesting habitat for barn swallow and cliff swallow is estimated to be present in the Assessment Boundary and Gentilly site, respectively (Table 1).

There is also likely additional nesting habitat located in the culverts at any watercourse crossings, particularly at the three watercourse crossings at Bécancour river, west of the Gentilly site (Figure 2). Although not quantified, the other habitat components for both species are most likely met within the Assessment Boundary: the aerated pound and large rivers (Bécancour, Gentilly, de la Ferme and du Moulin) represent likely locations of potential mud sources for nest building.

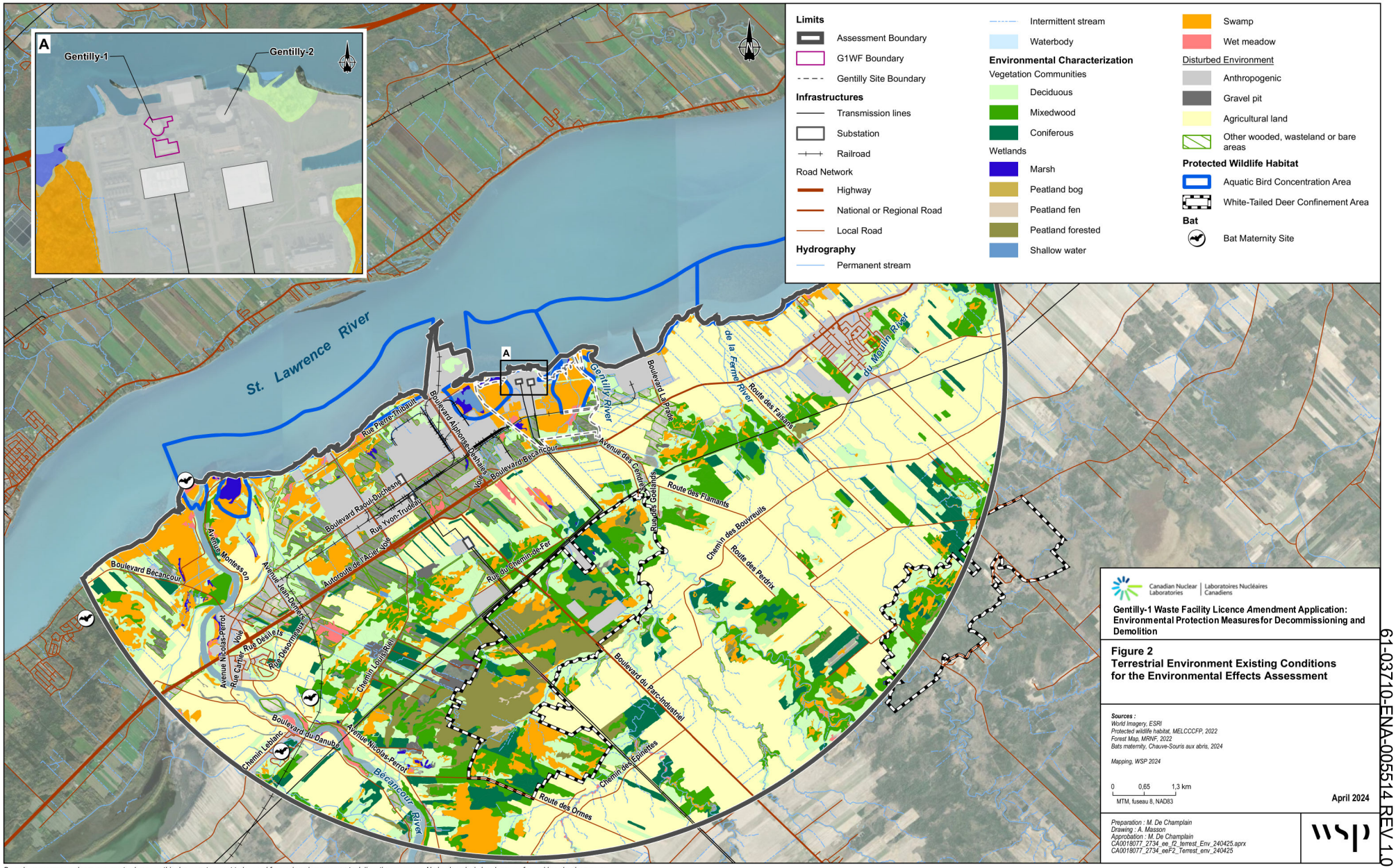
Table 1: Nesting Habitat Availability for Barn Swallow and Cliff Swallow

Percent (%)	Assessment Boundary		Gentilly Site	
	Area (ha)	Percent (%)	Area (ha)	Percent (%)
Suitable	7,162.38	46.18	3.62	22.62
Unsuitable	8,347.02	53.82	12.40	77.38
Total	15,509.40	100.00	16.02	100.00

Disturbances can have both positive and negative effects on barn swallow and cliff swallow breeding habitat availability. Past and present anthropogenic development has most likely increased the amount of nesting habitat at the Gentilly site for barn swallow and cliff swallow by providing suitable substrate for nest building (e.g., buildings). Vegetation clearing can also improve breeding habitat by creating open areas for foraging [6]. Utility and road corridors and the open turfgrass lawn areas of the Gentilly site provide suitable foraging habitat for barn swallow and cliff swallow.

Suitable barn swallow and cliff swallow nesting habitat (i.e., buildings and culverts) is distributed throughout the Assessment Boundary and at the Gentilly site (Figure 3). Habitat may be a limiting factor for barn swallow and cliff swallow because they rely heavily on buildings for nest sites; however, both species are highly mobile and can establish territories in new areas.

Narrow linear disturbances, such as road corridors at the Gentilly site and in the Assessment Boundary, generally do not represent barriers to bird movement [8]. Existing disturbances in the Assessment Boundary do not likely function as dispersal barriers for both species. Habitat fragmentation is not a limiting factor for barn swallow [9] or cliff swallow, likely because of their high mobility and use of open areas for foraging.



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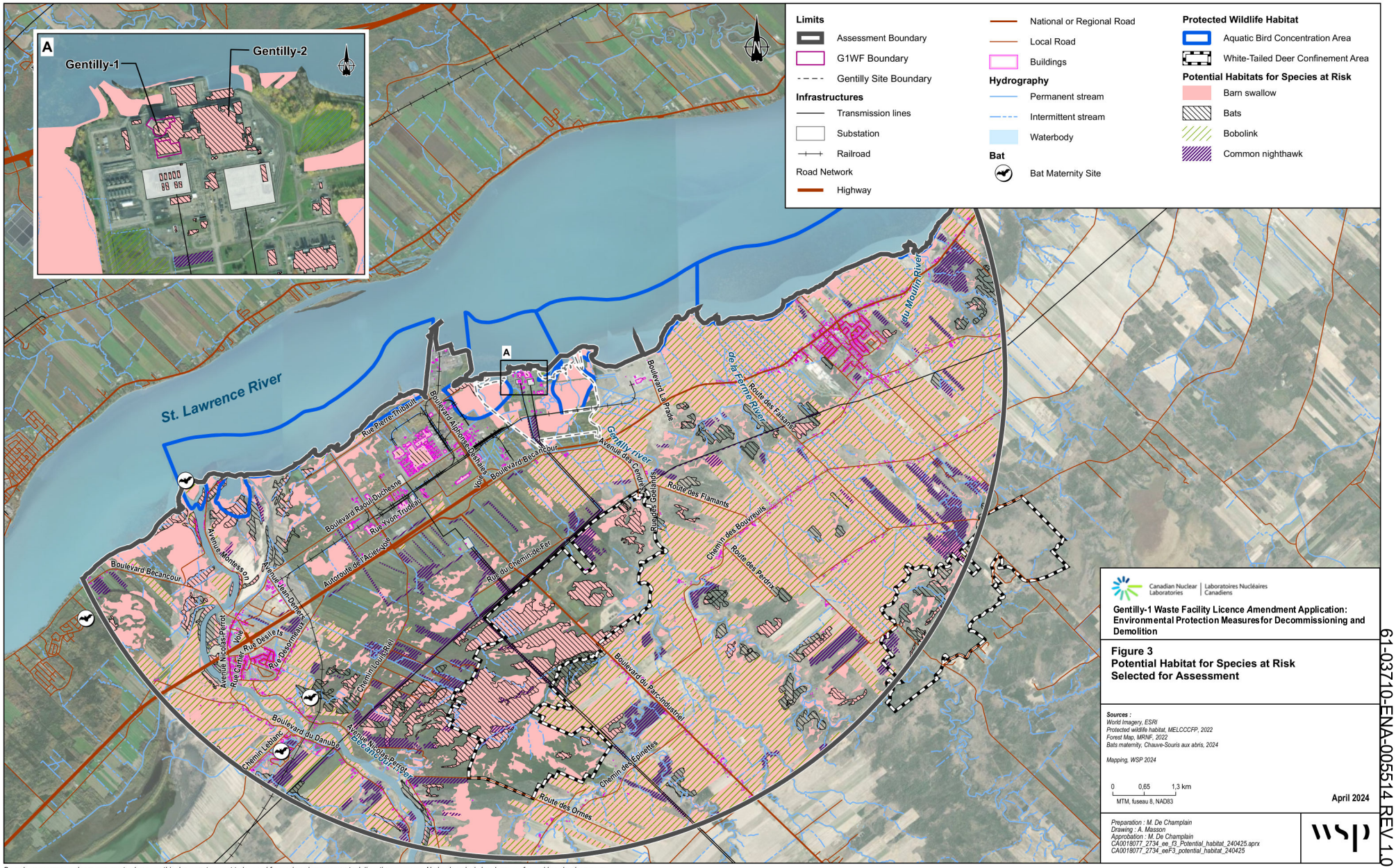

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2.4 Bats

All bat species in Canada have four primary habitat requirements: overwintering sites (hibernacula), swarming sites, roosts and foraging areas. Maternity roost sites and, especially, hibernacula are considered to be the main limiting habitat features for little brown myotis and northern myotis within their ranges [18]. Critical habitat for these SARA-listed bat species has only been “partially identified” for a portion of their over-all critical habitat requirements (i.e., hibernacula). It is acknowledged that protection of hibernacula alone is insufficient to meet the population and distribution objectives for the three endangered bat species [19]. Critical habitat requirements for maternity roosts and summering habitat for roosting and foraging have not yet been formally identified and are the focus of future research effort [19].

Within the Assessment Boundary, the potential for hibernacula in exposed bedrock that typically forms caves (i.e., karst topography with limestone, dolomite and gypsum-containing minerals) was coarsely assessed at an overview-level. Based on data available, which describes regional geology in the Assessment Boundary, the potential for bat hibernacula is low but possible across the Assessment Boundary, because some of those mineral types are presents. There have been no surveys to-date that would confirm the presence or absence of hibernacula or potential hibernacula features within the Assessment Boundary; however, the potential for hibernacula to be present is considered to be possible based on geological conditions. Although little brown myotis occasionally hibernate in anthropogenic structures (like houses), it is unlikely that this is occurring within the G1WF buildings, as there are likely few gaps between the outer walls and below-grade floors that would permit entry, as there was significant shielding and barrier installation of the below-grade floors to limit the release of radioactivity during the time when the reactor was functional. As a final confirmation to ensure their absence, pre-demolition visual surveys will be conducted in all below-grade floors of the G1WF buildings. Foraging habitat requirements are varied between the two species representing this VC and not likely limiting in the local environment. As a result, the focus of this assessment is on potential maternity roost habitat.

Based on research conducted to-date on maternity roosting behaviour in natural habitats, older forests are generally preferred by bats, including the species represented by this VC, likely because of higher snag availability (COSEWIC 2013). Snags contain cavities and loose bark required for sheltering roosting females and pups (Environment Canada 2015). Little brown myotis and northern myotis show a preference for large-diameter (i.e., older) trees and little brown myotis females show evidence of philopatry in roost selection (the tendency to return to the same home area following hibernation; COSEWIC 2013; Environment Canada 2015). There is considerable variation in preferred roost tree species. Lacki et al. (2007) determined that little brown myotis most often roost in large trembling aspen, but also in white spruce and red spruce. Olson and Barclay (2013) found the majority of roosts located in trembling aspen or balsam poplar. Poplar-leading deciduous and mixed forest stands are common in forest stands located within the Assessment Boundary. However, preferred roost tree species may vary by region and availability in the forest community.

Information on the roosts used by the hoary bat is scarce (Tremblay and Jutras, 2010). During the summer, it takes refuge in the treetops (MFFP, 2019), where females generally raise their young solitarily in the foliage (Koehler, 1991; Shump and Shump, 1982).

The silver bat is closely associated with tree structures (Tremblay and Jutras, 2010). During the day, it shelters in a tree, hanging upside down from a branch or hiding in a crack in the bark (MFFP, 2021). Very few studies have been carried out on the roosts used by silver bats (Tremblay and Jutras, 2010). It is thought to use tree cavities as maternity roosts and cracks in or under the bark as daytime roosting sites (Barclay *et al.*, 1988; Mattson *et al.*, 1996). In eastern North America, only one study, in Ontario (Parsons *et al.*, 1986), reports the use of an old woodpecker cavity as a maternity roost (Tremblay and Jutras, 2010). Mattson *et al.* (1996) also report that silver bats are particularly frequent in areas where snag densities exceed twenty per hectare.

The available landcover and wetlands spatial data were used to determine a conservative, coarse-scale estimation of the availability of forests or swamp wetland types representing maternity roost habitat preferences for little brown myotis and northern myotis as follows:

- forest stands (all types); and
- treed wetlands (swamps).

Anthropogenic structures such as buildings, bridges and bat boxes are used for maternity roosts by little brown myotis and less commonly by northern myotis (Whitaker et al. 2006). For the purposes of this assessment, as part of a conservative approach, all mapped buildings in the Assessment Boundary and at the Gentilly site were considered potential suitable maternity roost habitat for little brown myotis. There were 2,813 buildings of various sizes in the Assessment Boundary and 20 buildings at the Gentilly site.

A total of 1,274.99 ha and 3.61 ha of suitable natural maternity roost habitat and artificial (buildings) for little brown myotis and northern myotis is estimated to occur in the Assessment Boundary and Gentilly site, respectively, comprising 8.22% of total land cover in the Assessment Boundary and 22.53% of total land cover at the Gentilly site (Table 2).

Table 2: Maternity Roosting Habitat Availability for Bats

Habitat Suitability	Assessment Boundary	Gentilly Site	Assessment Boundary	Gentilly Site
	Area (ha)	Percent (%)	Area (ha)	Percent (%)
Suitable	1,274.99	8.22	3.61	22.53
Unsuitable	14,234.41	91.78	12.41	77.47
Total	15,509.40	100.00	16.02	100.00

A bat inventory was conducted in 2012 on the territory of the société du parc industriel et portuaire de Bécancour [31], [32]. The presence of the big brown bat, silver bat, hoary bat and *myotis* sp. Has been confirmed. In the agroforestry plateau sector, located in the Assessment Boundary, the same species and genus were detected, in addition to the red bat. Moreover, in the Assessment Boundary, bats have been observed in residential habitations along the Bécancour and St. Lawrence Rivers (Neighbourhood Bat Watch 2024).

The Assessment Boundary contains areas of potential maternity roosting habitat for bats. Suitable foraging habitat in the form of wetlands and riparian areas around the Bécancour River is also abundant in close proximity to potential roosting habitats.

The clearing, building construction and maintenance of large turfgrass covered lawns within the Gentilly site, and the presence of roads and associated infrastructure have likely reduced natural maternity roosting habitat availability at the Gentilly site. However, as described above, these changes do not represent a complete reduction of potential roosting habitat availability for one of the two bat species. Little brown myotis are well adapted to human disturbance and use buildings, bat houses and bridges for maternity roosts. Considering the natural and anthropogenic roosting habitat within the Assessment Boundary, the availability of maternity roosting habitat is not likely a limiting factor for bats.

Potential maternity roost habitat for little brown myotis and northern myotis is common and well-distributed across the Assessment Boundary in the form of tree covered habitat (Figure 3). Required foraging habitat features (wetlands, open water features such as the sewage lagoons and east bank of the Bécancour and St. Lawrence Rivers) are also well distributed and commonly intersperse the potential maternity roosting habitat of the Assessment Boundary. Throughout the Assessment Boundary, linear features in the form of roads, the hydroelectric corridor and other gaps in forest cover create gaps and potential commuting corridors, if they are not too wide. Both species avoid large clearcuts in forested areas, as well as open areas (COSEWIC 2013; Environment Canada 2015).

The effects of edges and corridors around mature forest stands on little brown myotis and northern myotis are not well known and there are inter-specific differences among them. Studies suggest that some degree of forest fragmentation may be beneficial for little brown myotis (Broders and Forbes 2004; Broders *et al.* 2006; Ethier and Fahrig 2011; Jantzen and Fenton 2013; Segers and Broders 2014). Other studies have found that little brown myotis prefer closed and cluttered canopy areas and avoid edges (Kalcounis and Brigham 1995; Jung *et al*. 1999; Morris *et al*. 2010). The forest structure preferred by northern myotis is not well characterized; however, edge habitat around the outer limits of mature forest stands, riparian and cleared corridors (from roads and hydroelectric lines) represent potential foraging and commuting corridors [18]. Consequently, not only are maternity roost and foraging habitats common in the Assessment Boundary, but they are also well connected.

Within the Gentilly site, it does not appear to represent an area with a high likelihood of containing significant maternity roost numbers (Figure 3).

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APPENDIX 5

Engagement

Summary of Engagement Activities

The tables below highlight engagement CNL has conducted to date with respect to the G1WF, noting that most engagement has focused on ensuring awareness of CNL/AECL, the G1WF itself as well as the Project and licensing decision, and the overall decommissioning approach, in order to seek feedback from the public and Indigenous Nations, communities and organizations. Engagement activities noted may include items related to the Gentilly site and previous activities which are not within the scope of the Project or the proposed amendment to the licence.

Feedback has included an interest in procurement and economic development opportunities from local Indigenous Nations. From the general public, CNL has heard an interest in further regulatory oversight with the IAA, an interest in interim management for the resulting waste and concerns around transportation of high-level waste, an activity that was safely completed in 2025 June in accordance with all applicable regulations and laws. Feedback received also relates to matters that are not within the scope of the Project or the licencing decision to be made by the CNSC, but all items have been noted for completeness where related to the G1WF or an aspect of it.

Feedback from engagement activities with the public, industry and local elected officials is detailed in *the Gentilly-1 Waste Facility Decommissioning Public Communications Supplementary Report (2023 January-2026 February)*.

Table 1: W8banaki Nations

Date	Activity	Description	Relevant comments/feedback
2023 May 04	Meeting with W8banaki Nation including Deputy Director of the Bureau du Ndakina and an Archaeologist with the Bureau du Ndakina	Shared overview of G1WF and introduction of CNL/AECL	———
2024 April	Public and Indigenous mail out	Mailed out ~10,000 pamphlets describing the G1WF decommissioning and CNL/AECL. This included contact information for CNL, encouraging recipients to share comments and questions.	———
2024 June 18	Meeting with W8bananki Nation	Continued exploration of whether the Nation was interested in engaging on the G1WF.	———
2024 December 19	Season's greetings email/mailout to all stakeholders and W8banaki Nation and Wendat Nation	Sent a holiday greeting electronically and by post to ~10,000 addresses in Indigenous and non-Indigenous communities around the G1WF, indicating CNL's interest and availability to discuss operations in the region.	———
2025 May 5	Mail out: invitation to Public Information Session	Posted ~10,000 invitations to Public Information Session to citizens and Abenaki communities of Odanak and Wolinak	———

Table 1: W8banaki Nations

Date	Activity	Description	Relevant comments/feedback
2025 May 27	Communication: Gentilly-1 Decommissioning Project – Notice of Hearing in Writing and capacity available through the CNSC Participant Funding Program	Emailed CNSC Notice of Hearing in Writing to all stakeholders and rightsholders: Wendat Nation and W8banaki Nation.	_____
2025 August 12	Communication: Results of the Independent Environmental Monitoring Program (IEMP) at the Gentilly site.	Emailed results of CNSC IEMP to all stakeholders and rightsholders: Wendat Nation and W8banaki Nation.	_____
2025 December 03	Email	Email providing information on the upcoming Notice of Intent for the Decommissioning of Gentilly-1 under Section 82 of the IAA and the G1WF.	_____
2025 December 15	Email	Email from CNL sharing that the Notice of Intent for the proposed decommissioning of the G1WF is now available on the Registry.	_____
2025 December 19	Email	Confirmation that the Notice of Intent for the proposed G1WF Project would be available for comment until 2026 February 05.	_____
2026 February 02	Email	Invitation to all engaged Indigenous Nations, communities and organizations provided an invitation to CNL's Environmental Remediation Management Webinars on 2026 February 10. Webinar topics include Gentilly-1 Decommissioning Project: Decommissioning and Licensing, CNL's Transportation of Dangerous Goods Program, and Whiteshell's Underground Research Laboratories Final Experiment.	_____

Table 2: Wendat Nation

Date	Activity	Description	Relevant comments/feedback
2023 October 03	Meeting with representatives from the Wendat Nation	Shared overview of G1WF and introduction of CNL/AECL	———
2024 April	Public and Indigenous mail out	Mailed out ~10,000 pamphlets describing the G1WF and CNL/AECL. This included contact information for CNL, encouraging recipients to share comments and questions.	———
2024 December 19	Season's greetings email/mailout to elected officials, members of the public, W8banaki Nation, Wendat Nation, and other interested parties.	Sent a holiday greeting electronically and by post to ~10,000 addresses in Indigenous and non-Indigenous communities around the G1WF, indicating CNL's interest and availability to discuss operations in the region.	———
2025 March 13	Meeting with Wendat Nation	Continued exploration of whether the Nation was interested in engaging on the G1WF.	Representatives indicated interest in economic development and procurement opportunities.
2025 May 5	Mail out: invitation to Public Information Session	Posted ~10,000 invitations to Public Information Session to citizens and Abenaki communities of Odanak and Wolinak	———
2025 May 27	Communication: Gentilly-1 Decommissioning Project – Notice of Hearing in Writing and capacity available through the CNSC Participant Funding Program	Emailed CNSC Notice of Hearing in Writing to all stakeholders and rightsholders: Wendat Nation and W8banaki Nation.	———
2025 June 10	Meeting with Wendat Nation – Presentation on CNL Indigenous Procurement	Followed up on 2025 March meeting to further discuss the Wendat Nation's interest in procurement. Attended by representatives from CNL's Indigenous Relations team and Supply Chain team.	———
2025 August 12	Communication: Results of the Independent Environmental Monitoring Program (IEMP) at the Gentilly site.	Emailed results of CNSC IEMP to all stakeholders and rightsholders: Wendat Nation and W8banaki Nation.	———
2025 December 03	Email	Email providing information on the upcoming Notice of Intent for the Decommissioning of Gentilly-1 under Section 82 of the IAA and the G1WF.	———

Table 2: Wendat Nation

Date	Activity	Description	Relevant comments/feedback
2025 December 15	Email	Email from CNL sharing that the Notice of Intent for the proposed decommissioning of the G1WF is now available on the Registry.	_____
2025 December 19	Email	Confirmation that the Notice of Intent for the proposed G1WF Project would be available for comment until 2026 February 05.	_____
2026 February 02	Email	Invitation to all engaged Indigenous Nations, groups and organizations provided an invitation to CNL's Environmental Remediation Management Webinars on 2026 February 10. Webinar topics include Gentilly-1 Decommissioning Project: Decommissioning and Licensing, CNL's Transportation of Dangerous Goods Program, and Whiteshell's Underground Research Laboratories Final Experiment.	_____

Table 3: Algonquins of Pikwàkanagàn First Nation

Date	Activity	Description	Relevant comments/feedback
2024 April 03	Email	Invitation to the public webinar on the G1WF decommissioning.	_____
2025 July 03	Email	Email shared information update on Gentilly-1 used fuel transfers.	_____
2025 July 08	Meeting	This bi-weekly meeting between Algonquins of Pikwàkanagàn First Nation (AOPFN), CNL and AECL included a discussion on Gentilly-1 fuel transfer updates.	_____
2025 August 05	Meeting	This bi-weekly communications meeting between AOPFN, CNL and AECL included a discussion on Gentilly-1 fuel transfer updates.	_____
2025 August 19	Meeting	This bi-weekly communications meeting between AOPFN, CNL and AECL included a discussion on Gentilly-1 fuel transfer updates.	_____
2025 September 04	Meeting	This radioactive waste working group between AOPFN, CNL, and AECL included a discussion on G1WF waste.	_____
2025 September 16	Meeting	This bi-weekly communications meeting between AOPFN, CNL and AECL included a discussion on G1WF waste.	_____
2025 December 03	Email	Email providing information on the upcoming Notice of Intent for the Decommissioning of Gentilly-1 under Section 82 of the IAA and the G1WF.	_____
2025 December 09	Meeting	This bi-weekly communications meeting between AOPFN, CNL and AECL included a discussion on the G1WF Notice of Intent.	_____
2025 December 09	Email	Email to CNL from AOPFN inquiring on timeline for upcoming shipments of waste from the G1WF. CNL responded, provided additional information regarding Gentilly-1, radioactive waste shipments and licence requirements, as well as the regulatory process.	_____

Table 3: Algonquins of Pikwàkanagàn First Nation

Date	Activity	Description	Relevant comments/feedback
2025 December 15	Email	Email sharing with AOPFN that the Notice of Intent for the proposed decommissioning of the G1WF is now available on the Registry.	_____
2025 December 19	Email	Confirmation that the Notice of Intent for the proposed G1WF Project would be available for comment until 2026 February 05.	_____
2025 January 14	Meeting	This meeting was dedicated to the radioactive waste strategy between AOPFN and CNL; at this meeting CNL extended and invitation for AOPFN to visit the G1WF.	____
2026 January 15	Meeting	This bi-monthly radioactive waste sub working group meeting between AOPFN, CNL and AECL included a discussion on waste transfers related to the G1WF.	_____
2026 February 02	Email	Invitation to all engaged Indigenous Nations, communities and organizations provided an invitation to CNL's Environmental Remediation Management Webinars on 2026 February 10. Webinar topics include Gentilly-1 Decommissioning Project: Decommissioning and Licensing, CNL's Transportation of Dangerous Goods Program, and Whiteshell's Underground Research Laboratories Final Experiment.	_____
2026 February 04	Email	Email from CNL to AOPFN enclosing letter regarding AOPFN comments on the G1WF Project.	See Section 3.1.2.3 of the EPMR for discussion.
2026 February 10	Email	Email from CNL to AOPFN providing materials from the Environmental Remediation Management Webinars on 2026 February 10, specifically regarding G1WF.	_____
2026 February 27	Meeting	This meeting between AOPFN, CNL and AECL discussed AOPFN's letter submitted during the public comment period under the IAA.	_____

Table 4: Kebaowek First Nation

Date	Activity	Description	Relevant comments/feedback
2024 April 03	Email	Email invitation to CNL's April webinars on CNL's Gentilly-1 Decommissioning Project and Whiteshell Laboratories Restoration Project.	_____
2025 July 17	Meeting	This tripartite bi-weekly meeting between Kebaowek First Nation (KFN), CNSC, and CNL included a discussion on Gentilly-1 fuel transfers.	_____
2025 August 07	Meeting	This meeting between KFN and CNL included a presentation and discussion on CNL's Integrated Waste Strategy (IWS) describing anticipated waste (G1WF).	_____
2025 December 03	Email	Email from CNL to KFN providing information regarding an upcoming Notice of Intent for the Decommissioning of Gentilly-1 under Section 82 of the IAA.	_____
2025 December 11	Meeting	This monthly meeting between KFN, CNL and AECL included a discussion on the Notice of Intent for the G1WF Project.	_____
2025 December 11	Email	Email from CNL to KFN included a series of questions posed by KFN at the 2025 December 11 KFN-CNL-AECL monthly meeting, and requested KFN to confirm that the questions were captured correctly.	KFN confirmed receipt and added an additional question.
2025 December 15	Email	Email from CNL to KFN sharing that the Notice of Intent for the proposed decommissioning of the G1WF is now available on the Registry. Provided a link and additional information for KFN review and input.	_____
2025 December 18	Email	Email from KFN to CNL asserting that the Notice of Intent posted on the Registry does not provide sufficient information for KFN to conduct the project screening under section 10 of the KFN Rights and Responsibilities Assessment Law (R&R Law). KFN noted that CNL and AECL are to send KFN a project description prior to written comments in accordance with the R&R Law.	_____

Table 4: Kebaowek First Nation

Date	Activity	Description	Relevant comments/feedback
2025 December 19	Email	Email from KFN to CNL posing further questions about the G1WF.	_____
2026 January 14	Email	Email from CNL to KFN providing further information in response to questions on the G1WF.	_____
2026 January 27	Email	Email from KFN to CNL requesting several documents related to the G1WF.	_____
2026 February 02	Email	Email invitation from CNL to all engaged Indigenous Nations, to CNL's Environmental Remediation Management Webinars on 2026 February 10. Webinar topics include Gentilly-1 Decommissioning Project: Decommissioning and Licensing, CNL's Transportation of Dangerous Goods Program, and Whiteshell's Underground Research Laboratories Final Experiment.	_____
2026 February 05	Email	Letter from KFN to CNL outlining KFN's comments on the section 82 assessment for the proposed G1WF Project.	See Section 3.1.2.4 of the EPMR for discussion.

Table 5: Public, Industry and Local Elected Officials

Date	Activity	Description
2023 January 05-10	Public Attitudes Survey	Through a third party research organization, CNL commissioned a survey to assess attitudes and familiarity with the project and CNL in the Trois-Rivières region around the G1WF site. Results from 501 respondents indicated high familiarity with the site, low awareness of CNL, and an interest in hearing more about the clean up and decommissioning for the G1WF.
2023 May 01	Meeting with constituency office staff: Nicolet-Bécancour riding and Trois-Rivières	Shared overview of G1WF and introduction of CNL/AECL
2023 May 04	Participated in meeting of the joint municipality-industry committee: Comité mixte municipal industriel (CMMI) de Bécancour	Shared overview of G1WF and introduction of CNL/AECL
2023 May 04	Meeting with regional offices of federal Bloc Québécois Members of Parliament	Shared overview of G1WF and introduction of CNL/AECL
2023 June 06	Meeting with local municipal officials from Bécancour, Trois-Rivières, Champlain, MRC Bécancour	Shared overview of G1WF and introduction of CNL/AECL
2023 June 06	Meeting with staff from the Conseil régional en environnement du Centre-du-Québec	Shared overview of G1WF and introduction of CNL/AECL
2023 June 06	Meeting with Mayor and staff from the City of Bécancour	Shared overview of G1WF and introduction of CNL/AECL
2023 June 13	Meeting with representatives from environmental groups, including the Rally Against Radioactive Pollution, Regroupement national des Conseils régionaux en environnement du Québec (RNCREQ), Action Environnement Basses Laurentides, Representative, Coalition Vigilance Oléoducs (CoVO)	Shared overview of G1WF and introduction of CNL/AECL
2023 June 22	CRL Environmental Stewardship Committee (ESC)meeting	Presentation on CNL's operations and activities included overview information on the G1WF.
2023 October 12	CRL ESC meeting	Presentation addressed the following actions from the June 2023 meeting: CNL to provide the ESC members with the timeline for the G1WF decommissioning and licensing process and for CNL to provide more information on the waste characterization and the waste transported from several CNL-managed sites, including G1WF.
2024 February 26	Meeting with staff from the Québec Ministry of the Environment, the Fight Against Climate Change, Wildlife and Parks	Shared overview of G1WF and introduction of CNL/AECL.
2024 March 21	CRL ESC meeting	Presentation on CNL's operations and activities included information on the G1WF.
2024 April	Public and Indigenous mail out	Mailed out ~10,000 pamphlets describing the G1WF decommissioning and CNL/AECL. This included contact information for CNL, encouraging recipients to share comments and questions.

Table 5: Public, Industry and Local Elected Officials

Date	Activity	Description
2024 April 09	Public Information Session	Hosted in person information session in Bécancour where members of the public could learn about the Project and overall decommissioning approach and engage in discussions with available representatives.[2]
2024 April 09	Public Webinar	Hosted public webinar on Zoom in French (English interpretation was available), which was advertised widely throughout the surrounding region and in the vicinity of CRL. This event had more than 100 unique viewers and the recording was posted on YouTube.[3]
2024 April 09	CBC Radio Canada produced video journal and article	CBC Radio Canada produced a video journal discussing the Gentilly-1 decommissioning approach and what is to come, as well as an article following the updates of the webinar and public information session. The CBC interviewed CNL for the article.
2024 April 10	Meeting with the industrial commissioner for the city of Bécancour	Shared overview of G1WF and introduction of CNL/AECL
2024 October 31	CRL ESC meeting	Presentation on CNL's operations and activities included information on the G1WF.
2024 December 19	Season's greetings email/mailout to all stakeholders and W8banaki Nation and Wendat Nation	Sent a holiday greeting electronically and by post to ~10,000 addresses in Indigenous and non-Indigenous communities around the facility, indicating CNL's interest and availability to discuss operations in the region.
2025 March 17	The Park in 30 Minutes – interview on Gentilly-1 Decommissioning Project	Discussed the Project and decommissioning approach on local radio.[4]
2025 March 25	CRL ESC meeting	Presentation on CNL's operations and activities included information on the G1WF.
2025 May 5	Mail out: invitation to Public Information Session	Posted ~10,000 invitations to Public Information Session to citizens and Abenaki communities of Odanak and Wolinak
2025 May 14	Public information session on the decommissioning of the Gentilly-1 and Gentilly-2 facilities	Co-hosted well-advertised public information session in Bécancour with project information and subject matter experts. More than 50 people attended.[5] Responded to several media outlets around the same time.

[2] See CNL's media release for details on this Public Information Session: Transparency & Action: The latest in CNL's public engagement for the Gentilly-1 Decommissioning Project - Canadian Nuclear Laboratories.

[3] See CNL's YouTube recording of this webinar in French https://youtu.be/dspKGjahpTU?si=xmP8v-mAvqaKOuZc and English https://youtu.be/nf-msOj4J7Y?si=W7k5EoSDtsveMDCf.

[4] See this link to listen to the interview: https://www.via905.fm/au-moins-500-pour-demanteler-de-gentilly-1.

[5] See this link to view CNL media release on the event: Public Information Session on Gentilly-1 and Gentilly-2 Decommissioning draws strong community engagement - Canadian Nuclear Laboratories.

Table 5: Public, Industry and Local Elected Officials

Date	Activity	Description
2025 May 27	Communication: Gentilly-1 Decommissioning Project – Notice of Hearing in Writing and capacity available through the CNSC Participant Funding Program	Emailed CNSC Notice of Hearing in Writing to all stakeholders and rightsholders: Wendat Nation and W8banaki Nation.
2025 August 5	Visit to CRL by representatives of the Quebec Ministry of Economy, Innovation, and Energy (MEIE)	Hosted the Assistant Deputy Minister, Director of Renewable Energy Development, Policy Advisor for a tour and information sharing visit at CRL, discussed the G1WF.
2025 August 12	Communication: Results of the Independent Environmental Monitoring Program (IEMP) at the Gentilly site.	Emailed results of CNSC IEMP to all stakeholders and rightsholders: Wendat Nation and W8banaki Nation.
2025 October 23	CRL ESC meeting	Presentation on CNL's operations and activities included information on the G1WF. The update noted that CNL successfully completed the transfer of all used nuclear fuel from G1WF to CRL utilizing the OPTIMUS-H package. The update also noted the project was completed safely and ahead of schedule.
2025 October 27	Interview and site visit with Radio-Canada	Toured journalists from Radio-Canada around the G1WF to ensure transparency. Resulted in radio and online article.[6]
2026 February 10	Public Webinar: G1WF	Hosted public webinar on Zoom in French (English interpretation was available), which was distributed widely to contacts in the surrounding region and promoted via social media. The webinar was also advertised in the vicinity of CNL's CRL Whiteshell sites. The event had a 147 unique viewers, and the recording was posted on YouTube.[7]
2026 February 10	Public Webinar: Transportation of Dangerous Goods	Hosted public webinar on Zoom in English (French interpretation was available), which was distributed widely to contacts in the surrounding G1WF region and promoted via social media. The webinar was also advertised in the vicinity of CNL's CRL and Whiteshell sites. The event had a 108 unique viewers, and the recording was posted on YouTube.[8]

[6] See link for resulting article: Une visite de ce qu'il reste de la centrale nucléaire Gentilly-1 | Radio-Canada.

[7] See CNL's YouTube recordings of this webinar in French https://youtu.be/16OllpRXJ3E?si=1lHd2HEdAPJN1jsZ and English https://youtu.be/laFezbrmdUg?si=OgF5C-HGpBvFKtQW.

[8] See CNL's YouTube recording of this webinar in French https://youtu.be/l9lcrZV51co?si=Kki-RqY1kTYJfe-4 and English https://youtu.be/dTzr76EMSQE?si=pG3W3Xr3d_utERE5.

ATTACHMENT A

Species at Risk Screening Table

Scientific Name	Common Name	Confirmed at the Gentilly Site	Included in the Assessment?	Justification for Inclusion/Exclusion	COSEWIC[a]	SARA[b]	Quebec [c]	G-Rank[d]	S-Rank[d]
Mammals									
Urocyon cinereoargenteus	Gray fox	No	No	Species not detected at the Gentilly site and no potential habitat found that could be affected by the project.	THR	THR	NAR	G5	NAR
Canis sp. cf. lycaon	Eastern wolf	No	No	Species not detected at the Gentilly site and no potential habitat found that could be affected by the project.	THR	THR	NAR	NAR	NAR
Myotis lucifugus	Little-brown myotis	No	Yes	Species detected near the Gentilly site that could be affected by the project (if building are used).	END	END	THR	G3G4	S1
Myotis septentrionalis	Northern myotis	No	Yes	Species detected near the Gentilly site that could be affected by the project (if building are used).	END	END	THR	G2G3	S1
Lasionycteris noctivagans	Silver-haired bat	No	No	Species detected near the Gentilly site but are unlikely to be affected by the project.	END	NAR	LDTV	G3G4	S3B
Lasiurus cinereus	Hoary bat	No	No	Species detected near the Gentilly site but are unlikely to be affected by the project.	END	NAR	LDTV	G3G4	S3B
Perimyotis subflavus	Tri-colored bat	No	No	Species detected near the Gentilly site but are unlikely to be affected by the project.	END	END	THR	G2G3	S1
Lasiurus borealis	Eastern red bat	No	No	Species detected in the Assessment Boundary but are unlikely to be affected by the project.	END	NAR	VUL	G3G4	S1S2B
Reptiles									
Glyptemys insculpta	Wood turtle	No	No	Species not detected at the Gentilly site and no potential habitat found that could be affected by the project.	THR	THR	VUL	G2	S3
Chrysemys picta	Painted turtle	No	No	Species not detected at the Gentilly site and no potential habitat found that could be affected by the project.	SC	SC	LDTV	G5	S4
Chelydra serpentina	Common snapping turtle	No	No	Species not detected at the Gentilly site and no potential habitat found that could be affected by the project.	SC	SC	LDTV	G5	S4
Graptemys geographica	Northern map turtle	No	No	Species not detected at the Gentilly site and no potential habitat found that could be affected by the project.	SC	SC	VUL	G5	S3
Pseudacris triseriata	Western chorus frog	No	No	Species not detected at the Gentilly site and no potential habitat found that could be affected by the project.	NAR	THR	VUL	G5	S2
Lampropeltis triangulum	Eastern milksnake	No	No	Species not detected at the Gentilly site and no potential habitat found that could be affected by the project.	SC	SC	NAR	G5	S3

Scientific Name	Common Name	Confirmed at the Gentilly Site	Included in the Assessment?	Justification for Inclusion/Exclusion	COSEWIC[a]	SARA[b]	Quebec [c]	G-Rank[d]	S-Rank[d]
Apalone spinifera	Spiny softshell turtle	No	No	Species not detected at the Gentilly site and no potential habitat found that could be affected by the project.	THR	THR	THR	G5	S1
Emydoidea blandingii	Blanding's turtle	No	No	Species not detected at the Gentilly site and no potential habitat found that could be affected by the project.	THR	THR	END	G4	S2
Sternotherus odoratus	Eastern musk turtle	No	No	Species not detected at the Gentilly site and no potential habitat found that could be affected by the project.	THR	SC	THR	G5	S2
Chelydra serpentina	Snapping turtle	No	No	Species not detected at the Gentilly site and no potential habitat found that could be affected by the project.	SC	SC	NAR	G5	S4
Clemmys guttata	Spotted turtle	No	No	Species not detected at the Gentilly site and no potential habitat found that could be affected by the project.	END	END	LDTV	G5	SNA
Amphibian									
Lithobates palustris	Pickerel frog	No	No	Species not detected at the Gentilly site and no potential habitat found that could be affected by the project.	NAR	NAR	LDTV	G5	S4
Desmognathus fuscus	Northern Dusky salamander	No	No	Species not detected at the Gentilly site and no potential habitat found that could be affected by the project.	NAR	NAR	LDTV	G5	S4
Hemidactylium scutatum	Four-toad salamander	No	No	Species not detected at the Gentilly site and no potential habitat found that could be affected by the project.	NAR	NAR	LDTV	G5	S3
Birds									
Falco peregrinus	Peregrine falcon	No	No	Species not detected at the Gentilly site and no potential habitat found that could be affected by the project.	NAR	NAR	VUL	G4	SNA
Hylocichla mustelina	Wood thrush	No	No	Species not detected at the Gentilly site and no potential habitat found that could be affected by the project.	THR	THR	-	G4	S3B
Riparia Riparia	Sand martin	No	No	Species not detected at the Gentilly site and no potential habitat found that could be affected by the project.	THR	THR	-	G5	S2S3B
Hirundo rustica	Barn swallow	No	Yes	Species detected near the Gentilly site and habitat within the Gentilly site could be affected by the project.	SC	THR	NAR	G5	S3B
Chaetura pelagica	Chimney swift	No	No	Species not detected at the Gentilly site and no potential habitat found that could be affected by the project.	THR	THR	THR	G4G5	S2B

Scientific Name	Common Name	Confirmed at the Gentilly Site	Included in the Assessment?	Justification for Inclusion/Exclusion	COSEWIC[a]	SARA[b]	Quebec [c]	G-Rank[d]	S-Rank[d]
Cardellina canadensis	Canada warbler	No	No	Species not detected at the Gentilly site and no potential habitat found that could be affected by the project.	SC	THR	LDTV	G5	S4S5B
Haliaeetus leucocephalus	Bald eagle	No	No	Species not detected at the Gentilly site and no potential habitat found that could be affected by the project.	NAR	NAR	VUL	G5	S4
Sturnella magna	Eastern meadowlark	No	No	Species not detected at the Gentilly site and no potential habitat found that could be affected by the project.	THR	THR	NAR	G5	S3B
Dolichonyx oryzivorus	Bobolink	No	Yes	Species detected near the Gentilly site that could be affected by the project.	SC	THR	VUL	G5	S3B
Chordeiles minor	Common nighthawk	No	Yes	Species detected near the Gentilly site that could be affected by the project.	SC	SC	LDTV	G5	S3S4B
Antrostomus vociferus	Eastern whip-poor-will	No	No	Species not detected at the Gentilly site and no potential habitat found that could be affected by the project.	SC	THR	VUL	G5	S3B
Asio flammeus	Short-eared owl	No	No	Species not detected at the Gentilly site and no potential habitat found that could be affected by the project.	THR	SC	LDTV	G5	S3B
Euphagus carolinus	Rusty blackbird	No	No	Species not detected at the Gentilly site and no potential habitat found that could be affected by the project.	SC	SC	LDTV	G4	S3S4B
Contopus virens	Eastern woodpewee	No	No	Species not detected at the Gentilly site and no potential habitat found that could be affected by the project.	SC	SC	NAR	G5	S3B
Coccothraustes vespertinus	Evening grosbeak	No	No	Species not detected at the Gentilly site and no potential habitat found that could be affected by the project.	SC	SC	NAR	G5	S3B
Ammodramus savannarum pratensis	Grasshoper sparrow	No	No	Species not detected at the Gentilly site and no potential habitat found within the Gentilly site.	SC	SC	LDTV	G5T5	S1B
Contopus cooperi	Olive-sided flycatcher	No	No	Species not detected at the Gentilly site and no potential habitat found that could be affected by the project.	SC	SC	NAR	G4	S3B
Melanerpes erythrocephalus	Red-headed woodpecker	No	No	Species not detected at the Gentilly site and no potential habitat found that could be affected by the project.	THR	THR	LDTV	G5	S1B
Ixobrychus exilis	Least bittern	No	No	Species not detected at the Gentilly site and no potential habitat found that could be affected by the project.	THR	THR	VUL	G4G5	S2B

Scientific Name	Common Name	Confirmed at the Gentilly Site	Included in the Assessment?	Justification for Inclusion/Exclusion	COSEWIC[a]	SARA[b]	Quebec [c]	G-Rank[d]	S-Rank[d]
Ardea herodias	Great blue heron	No	No	Species not detected at the Gentilly site and no potential habitat found that could be affected by the project.					
Invertebrates									
Danaus plexippus	Monarch	No	No	Species not detected at the Gentilly site and no potential habitat found that could be affected by the project.	END	END	NAR	G4T3	SNR

Notes:

(a) COSEWIC END = Endangered; THR = Threatened; SC = Special Concern; NAR = Not at Risk.

(b) Federal Species at Risk Act (SARA), 2002. Schedule 1 (Last amended 8 December 2023); Part 1 (Extirpated - EXP), Part 2 (Endangered - END), Part 3 (Threatened – THR), Part 4 (Special Concern – SC).

(c) Act respecting threatened or vulnerable species in Quebec (1989) (chapter E-12.01 Current as of Decembre 31, 2023); END = Endangered; THR = Threatened; VUL = Vulnerable; LDTV = Likely to be designated as threatened or vulnerable; NAR = Not at Risk.

(d) Global Ranks (G-Rank) and Provincial Ranks (S-Rank) are rarity or conservation status ranks assigned to species or ecological communities by NatureServe and Quebec Conservation Data Centre, respectively. These ranks are not legal designations. Rank definitions: G1 or S1 (Critically Imperiled); G2 or S2. (Imperilled); G3 or S3 (Vulnerable); G4 or S4 (Apparently Secure); G5 or S5 (Secure); G#G# or S#S# (Range Rank); GNR or SNR (Not Ranked); GU or SU (Unrankable – Data Deficient); GX or SX (Presumed Extinct or Extirpated); GH or SH (Possibly Extinct or Extirpated – Historical); SNA (Not Applicable).
Qualifiers: B = Breeding; N = Non-breeding; M = Migrant; ? = Inexact or uncertain numeric rank.

EIS = Environmental Impact Statement; VC = Valued Component; - = not listed/no status; COSEWIC = Committee on the Status of Endangered Wildlife in Canada.

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