Canadian Nuclear Safety Commission Independent Environmental Monitoring Program

SRB Technologies (Canada) Inc. nuclear processing facility (2014)

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Executive summary

Under the *Nuclear Safety and Control Act* (NSCA), licensees of nuclear facilities are required to implement an environmental monitoring program to demonstrate that the public and the environment are protected from emissions related to the facility's nuclear activities. The results of these monitoring programs are submitted to the Canadian Nuclear Safety Commission (CNSC) to ensure compliance with applicable guidelines and limits, as set out in regulations that oversee Canada's nuclear industry.

SRB Technologies (Canada) Inc. (SRB) is licensed by the CNSC to operate the SRB Technologies Inc. nuclear processing facility (SRB facility), located in Pembroke, Ontario. SRB uses tritium, a nuclear substance, to make self-luminous emergency exit signs, military applications such as landmine markers, and other safety products not requiring batteries or other external sources of power. SRB implements and maintains a comprehensive environmental protection program to monitor and control nuclear and hazardous substances released from the SRB facility, to determine concentrations of contaminants in the environment, and to assess exposure to the public.

To complement ongoing compliance activities, the CNSC launched its Independent Environmental Monitoring Program (IEMP) to independently verify that the public and the environment around licensed nuclear facilities are safe. The IEMP involves taking samples from public areas around the facilities, and measuring and analyzing the amount of radiological (nuclear) and hazardous substances in those samples. CNSC staff collect the samples and send them to the CNSC's state-of-the-art laboratory for testing and analysis.

The 2014 IEMP sampling plan for the SRB facility site focused on radiological contaminants. A site-specific sampling plan was developed based on SRB's approved environmental monitoring program, CSA Group standards and the CNSC's regulatory experience with the site. In 2014, samples were collected in publicly accessible areas outside the SRB facility site perimeter and included water, soil, air, vegetation, and foodstuffs such as milk, wine, fruits and vegetables from local farms.

The radioactivity measured in the samples was below available guidelines and CNSC reference levels. CNSC reference levels are based on conservative assumptions about the exposure that would result in a dose of 0.1 mSv/year, which represents one-tenth of the CNSC's public dose limit of 1 mSv/year. No health impacts are expected at this dose level.

The IEMP results confirm that the public and the environment around the SRB facility site are safe and that there are no health impacts as a result of the facility operations. The IEMP results are consistent with the results submitted by SRB, confirming that the licensee's environmental protection program protects the health and safety of people and the environment.

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1. Introduction

The Canadian Nuclear Safety Commission (CNSC) regulates the use of nuclear energy and materials to protect health, safety, security and the environment and to implement Canada's international commitments on the peaceful use of nuclear energy; and to disseminate objective scientific, technical and regulatory information to the public. SRB Technologies (Canada) Inc. (SRB) uses tritium, a nuclear substance, to make self-luminous emergency exit signs, military applications such as landmine markers, and other safety products not requiring batteries or other external sources of power, at its nuclear processing facility (SRB facility).

As a condition of its licence, SRB implements and maintains a comprehensive environmental protection program (EPP) to monitor and control radiological substances released from the SRB facility. The CNSC conducts activities to verify compliance of licensees' programs. These activities include desktop reviews of licensees' results, which are submitted to the CNSC annually, as well as site inspections. CNSC staff review the licensees' monitoring results to ensure that:

- the licensee is demonstrating adequate operational control of its facility
- environmental releases are below applicable limits
- principles of pollution prevention and ALARA (as low as reasonably achievable, social and economic factors being taken into account) are being applied
- humans and the environment are protected

The CNSC launched the Independent Environmental Monitoring Program (IEMP) to align with other Canadian and international regulatory bodies. The IEMP complements the CNSC's staff reviews and approval of licensees' environmental monitoring programs during licensing, as well as compliance activities to ensure that licensees are adhering to the regulatory requirements, licence conditions, and approved programs throughout the operation of nuclear facilities.

The IEMP is performed by CNSC staff in public areas and consists of sampling environmental media and analyzing radiological and non-radiological substances released from facilities in all areas of the nuclear fuel cycle: uranium mines and mills, processing facilities, power plants and research reactors, as well as waste management facilities. Summaries of the results are made available on the CNSC website.

2. Background

2.1 SRB site and facility

Located in Pembroke, Ontario approximately 300 metres west of the Muskrat River, 150 kilometres northwest of Ottawa, the SRB facility processes tritium gas to produce light sources and manufactures radiation devices for containing the sources.

SRB leases a space in an industrial building similar to a strip mall. The closest residence is located approximately 255 metres northwest of the facility.

There are two stacks at the SRB facility that release tritium. The principal stack, known as the rig stack, is related to tritium processing. The other, known as the bulk stack, primarily handles the bulk transfer of tritium from the main tritium container to smaller pyrophoric units.

SRB also releases liquid effluent in batches to the municipal sewer system. These are sampled prior to discharge, to ensure that all applicable standards and guidelines are met.

The CNSC regulates SRB's activities at the SRB facility site under the Class IB nuclear substance processing facility operating licence, NSPFOL-13.00/2022.

2.2 SRB's environmental protection program

The EPP comprises two sub-programs: the effluent and emission monitoring program and the environmental monitoring program. The effluent and emission monitoring program ensures that releases to the environment from the facility are controlled and monitored. The environmental monitoring program is established to determine the level of contaminants in the environment as a result of the releases, and assesses any environmental impacts.

2.2.1 SRB's effluent and emission monitoring program

As part of the SRB facility's EPP, SRB has controls in place to minimize the releases of radiological substances into the environment. Such controls incorporate the principles of pollution prevention and ALARA to ensure that releases are below prescribed limits. SRB implements a comprehensive air emission and liquid effluent monitoring program that regularly monitors radiological releases from the SRB facility.

Releases result from the processing of tritium gas taking place at the SRB facility. The nuclear substances released from the SRB facility operations in atmospheric emissions are elemental tritium and tritium and in liquid effluent releases is tritium.

As per CNSC requirements, environmental action levels and release limits for airborne and waterborne radiological releases from the SRB facility are prescribed in SRB's operating licence, NSPFOL-13.00/2022, and the corresponding licence conditions handbook issued by the CNSC. These are in place to establish a framework to ensure that releases are controlled and to ensure the protection of the health and safety of the public and of the environment. The results from the SRB facility effluent and emissions monitoring program for radiological parameters are, in general, below the limits and guidelines. SRB's effluent and emission monitoring results are provided in SRB's 2014 annual compliance and performance report. [1]

2.2.2 SRB's environmental monitoring program

SRB maintains a comprehensive environmental monitoring program (EMP) for the SRB facility, which consists of radiological components.

The radiological component of the EMP is conducted through the routine collection and analysis of environmental samples from numerous locations within the SRB facility and in the surrounding area. Monitored media include ambient air; foodstuffs such as milk, red wine, and fruits and vegetables; and groundwater, Muskrat River water and other surface waters onsite and offsite. Groundwater monitoring is also conducted within the SRB facility and focuses on groundwater quality approximately 150 metres from the stacks. The results from the EMP show that of the 34 monitoring wells, samples from 2 wells exceeded the levels in Ontario Regulation 169/03, *Ontario Drinking-Water Quality Standards* [2], of 7,000 Bq/L. These 2 wells, both of which are not drinking water wells, are located within 50 metres of the stack and showed either decreasing or steady concentrations in 2014. The SRB monitoring and assessment results are also provided in SRB's 2014 annual compliance and performance report. [1]

3. Independent Environmental Monitoring Program

3.1 Objective

The objective of the IEMP is to independently verify that the public and the environment around the facilities are safe and protected from the releases from the facilities; it helps to confirm the CNSC's regulatory position and support decision making. The intent of the IEMP is not to be a mechanism to validate or make modifications to the facility's EMP, as this is achieved through the CNSC's licensing and compliance activities. The results are independent of the facility's EMP.

The IEMP objective can be achieved by:

- directly measuring contaminant concentrations in the surrounding environment that are associated with nuclear activities
- comparing contaminant concentrations with available background values, environmental quality criteria and other available benchmarks
- assessing risk to the public and the environment associated with releases and concentrations of nuclear and hazardous substances in the environment

3.2 Program design

The IEMP for the SRB facility has been designed using CSA Standard N288.4-10, *Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills*. [3] The site-specific sampling plan also took into consideration SRB's approved EMP and the CNSC's regulatory experience with the SRB facility.

4. Sampling and analytical methods

4.1 Sampling criteria

Sampling by CNSC staff for the IEMP is conducted based on the following criteria:

- Contaminants of interest: Contaminants are identified based on the operation of the site, releases to the environment, and other factors identified in the facility environmental risk assessment.

- Environmental samples: Environmental samples are obtained from various media (e.g., water, soil, air, vegetation), biota and foodstuffs (e.g., meat, fish, milk, produce), reflecting the exposure pathways linking releases from operation of the facility with human receptors (i.e., environmental transfer).
- Location: Locations are publicly accessible areas that are representative of areas of potential exposure based on exposure pathways, as well as reference locations for which there is no potential for exposure from the operations of the nuclear facility. Location selection will often consider distance from the operation, as well as meteorological data such as prominent wind direction and precipitation for atmospheric releases and water current for effluent discharges. In addition, sampling in areas not related to nuclear sites is also considered to determine reference or background values that are not always available.

4.2 Sample collection

The sampling locations were chosen taking into account possible dispersion of operational releases from the SRB facility. Most locations are close to or at the SRB offsite sampling locations in the SRB's 2014 annual compliance and performance report. [1] The samples were collected on public lands at locations that were accessible by road, of the SRB facility. Tables 1, 2, 3, 4 and 5 describe the sampling locations. Figure A-1 in appendix A provides a map of these locations. A total of 9 samples of water, soil, air and vegetation plus 5 samples of foodstuffs (14 samples total) were collected at 9 locations. Sample collection techniques were grab shearing, tubing, shovelling, nabbing, air bubbling, and purchasing of locally produced milk, wine, fruit and vegetables at a local farm, winery and grocery store.

Table 1: Description of water samples

Sample ID	Sampling location in Pembroke, ON	Sample description
SR10-W03	650 metres northeast of the SRB facility at the Muskrat River, underneath the bridge	River water (surface)
SR11-W04	2,250 metres north of the SRB facility at the Ottawa River, at the marina	River water (surface)

Table 2: Description of soil samples

Sample ID	Sampling location in Pembroke, ON	Sample description
SR02-S01	300 metres southeast of the SRB facility, along Upper Valley Drive	Surface
SR03-S02	75 metres southwest of SRB facility, along Upper Valley Drive	Surface
SR05-S03	275 metres northwest of SRB facility, corner of International Drive and Upper Valley Drive	Surface

Table 3: Description of air samples

Sample ID	Sampling location in Pembroke, ON
SR03-A01	70 metres northwest of the SRB facility

Table 4: Description of grass and wild vegetation samples

Sample ID	Sampling location in Pembroke, ON	Sample description
SR02-V01	300 metres southeast of the SRB facility, along Upper Valley Drive	Grass
SR03-V02	75 metres southwest of the SRB facility, along Upper Valley Drive	Grass
SR05-V03	275 metres northwest of the SRB facility, corner of International Drive and Upper Valley Drive	Grass

Table 5: Description of foodstuff samples

Sample ID	Sampling location in Pembroke, ON	Sample description
SR01-F01	1,750 metres southeast of the SRB facility, Bouden's Garden Farm, 495 Drive In Road, R.R. #3	Local kale
SR01-F02	1,750 metres southeast of the SRB facility, Bouden's Garden Farm, 495 Drive In Road, R.R. #3	Local tomatoes
SR01-F03	1,750 metres southeast of the SRB facility, Bouden's Garden Farm, 495 Drive In Road, R.R. #3	Local potatoes
SR04-F04	Brewer's Edge Wine, 330 Boundary Road	Local red wine
SR12-F05	Muncion Grocery Store northeast of the SRB facility, 425 Pembroke E, Brum's Dairy Farm	Local milk

4.3 Analytical techniques

The following sections discuss the analytical techniques used to analyze the samples collected around the SRB facility.

4.3.1 Radiological analyses

4.3.1.1 Water samples

Water samples were analyzed for tritiated water (HTO).The water samples were purified using distillation and analyzed for HTO using a low background PerkinElmer liquid scintillation counter (LSC).

4.3.1.2 Soil samples

Soil samples were analyzed for HTO. For HTO analysis, water was extracted from these samples using the freeze-drying method under a vacuum setup. The extracted water samples were analyzed for tritium using a low background PerkinElmer LSC.

4.3.1.3 Air samples

Air samples were analyzed for HTO and tritiated hydrogen (HT). For air samples, the HTO and HT concentration was calculated using the volume of air (m^3) bubbled during the sample collection period.

4.3.1.4 Foodstuff and vegetation samples

The foodstuff and vegetation samples were analyzed for HTO. For HTO analysis, water was extracted from food samples using the freeze-drying method under a vacuum setup. The extracted water samples were analyzed for HTO using a low background PerkinElmer LSC.

4.3.2 Quality assurance and quality control

The principal objective of the laboratory analysis is to produce high-quality data. This is achieved through the use of analytical methods and procedures that are accurate and reliable.

Standard reference material obtained from the U.S. National Institute of Standards and Technology (NIST), written methods and standard operating procedures are used. In addition, the CNSC laboratory participates in proficiency testing (PT) offered by national organizations, such as the National Research Council Canada; the Quebec Ministère du Développement durable, de l’Environnement et de la Lutte contre les changements climatiques; Canadian Nuclear Laboratories; and international laboratories such as the International Atomic Energy Agency’s Analytical Laboratories for the Measurement of Environmental Radioactivity and the Safeguards Analytical Laboratory.

The following sections provide an overview of the quality control elements that ensure the quality of the IEMP data.

4.3.2.1 Field protocol

IEMP sampling procedures were developed based on recognized and validated sampling methods. Sample preservation is conducted following best practices for applicable analytical methods, and field duplicates are routinely used. Samples are shipped to the CNSC laboratory using predetermined protocols for packaging and chain-of-custody (cooler for sample preservation and courier service). For the SRB facility sampling, the samples were transported to the laboratory by the field sampling crew, using coolers filled with ice to keep the samples cold to maintain sample integrity.

4.3.2.2 Radiological analyses

Selected standard reference materials traceable to NIST were used to calibrate the parameters of the counting instruments. For tritium analysis, a NIST 4926e standard as well as a calibration standard provided by the counter manufacturer (PerkinElmer) were used for calibration and for instrument performance checks. The pass criteria for instrument performance checks are set at ±3sigma (standard deviation) of the mean value measured using the calibration set from PerkinElmer. In addition, all radiological sample batches included a blank sample for background detection. The laboratory also participates in proficiency testing (PT) exercises offered by external programs and has achieved passing results on analysis of HTO and organically bound tritium (OBT).

4.3.2.3 Minimum detection concentration

As explained in the *Multi-Agency Radiation Survey and Site Investigation Manual* [4], a minimum detection concentration (MDC) is the *a priori* net activity level above the critical level that an instrument can be expected to detect 95 percent of the time. In addition, MDC is calculated from measured values of input quantities and will change slightly from sample to sample depending on test portion size and background level. For samples for which detectable activity was not found, we have reported the calculated MDC with the symbol <, as shown in appendix B.

5. Results and discussion

5.1 Interpretation criteria

Various sources are used to interpret the results, including comparisons with applicable background values and appropriate national and/or provincial environmental quality criteria. For the SRB facility, the following criteria were used to interpret the results.

National environmental quality criteria used included the Canadian Council of Ministers of the Environment (CCME) *Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health* [5], *Canadian Water Quality Guidelines for the Protection of Aquatic Life* [6] and *Canadian Sediment Quality Guidelines for the Protection of Aquatic Life* [7], as well as Health Canada's *Guidelines for Canadian Drinking Water Quality*. [8] [9]

Provincial criteria used included Ontario Regulation 153/04, *Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act* [10], Ontario Regulation 169/03, *Ontario Drinking-Water Quality Standards* [2], and the provincial water quality objectives and guidelines.

For radiological parameters where no criteria existed, CNSC reference levels were established based on conservative assumptions and using the methodology found in CSA Standard N288.1-14, *Guidelines for calculating derived release limits for radioactive material in airborne* *and liquid effluents for normal operation of nuclear facilities*. [11] The reference level for a particular radionuclide in a particular medium represents the activity concentration in that medium that would result in a whole-body effective dose of 0.1 mSv/year to a member of the public, based on the dominant exposure pathways (e.g., inhalation, ingestion or external immersion). The dose of 0.1 mSv/year was chosen to align with the approach used by the World Health Organization and Health Canada for drinking water standards. [8] [9] [12] It represents one-tenth of the CNSC's public dose limit of 1 mSv/year.

The licensees' data is also considered when the IEMP results are assessed, to verify that the licensee's data is within the range of what was measured in the IEMP. Accordingly, if an IEMP sample result is above the range reported by the licensee and has a potential for risk, an investigation would be launched and necessary actions to protect public health and the environment would be taken.

5.2 Radiological analyses

5.2.1 Water samples

Radionuclide activity concentrations in water samples collected around the SRB facility are provided in table B-1 of appendix B and were compared with Ontario Regulation 169/03, *Ontario Drinking-Water Quality Standards* [2] as well as Health Canada's *Guidelines for Canadian Drinking Water Quality*. [8] [9]

Levels of HTO were below the minimum detection concentration (MDC), indicating that radionuclide concentrations in the Muskrat River and Ottawa River water are at safe levels to drink.

5.2.2 Soil samples

Radionuclide activity concentrations in soil samples collected around the SRB facility are provided in table B-2 of appendix B. These were compared with CNSC reference levels that consider both accidental soil ingestion and ground shine (i.e., external immersion) pathways. All samples with detectable radionuclide concentrations were more than 1,000,000 times lower than the reference levels, indicating safe levels of exposure.

The measured radioactivity in soil samples was below CNSC reference levels. No health impacts are expected at this dose level.

5.2.3 Air samples

Radionuclide activity concentrations in air samples collected around the SRB facility are provided in table B-3 of appendix B. Sample results for HTO and HT were compared with CNSC reference levels. In the air samples, the HTO and HT activity concentrations were more than 141 and 1,300,000 times lower than the reference inhalation and immersion levels, respectively. No health impacts are expected at this dose level.

5.2.4 Vegetation samples

Radionuclide activity concentrations in vegetation (grass) samples collected around the SRB facility are provided in table B-4 of appendix B. Sample results for HTO were compared with CNSC reference levels. In the grass samples, the HTO activity concentrations were more than 83 times lower than the reference levels. No health impacts are expected at this dose level.

5.2.5 Foodstuff samples

Radionuclide activity concentrations in wine, milk, fruit and vegetable samples collected around the SRB facility are provided in tables B-5, B-6, B-7, and B-8, respectively, in appendix B. All of the results indicate levels safe for consumption: In wine samples, the HTO activity concentrations were more than 3,000 times lower than the reference levels. In milk samples, the HTO activity concentrations were below the MDC. Similarly, the measured levels of HTO in fruit samples were more than 2,800 times lower than the reference levels, while the measured levels of HTO in vegetable samples were more than 575 times lower than the reference levels. No health impacts are expected at this dose level.

6. Conclusion

The radiological analyses of samples collected around the SRB facility were performed using appropriate and validated analytical methods.

The measured radioactivity in water is below the MDC, indicating that the Muskrat River and the Ottawa River are at safe levels to drink.

The measured radioactivity in soil and vegetation samples, as well as samples of milk, red wine, and fruits and vegetables were below CNSC reference levels and are within available background levels. CNSC reference levels are based on conservative assumptions about the exposure that would result in a dose of 0.1 mSv/year, which represents one-tenth of the CNSC's public dose limit of 1 mSv/year. No health impacts are expected at this dose level.

The IEMP results confirm that the public and the environment around the SRB facility are safe and that there are no health impacts as a result of facility operations. These results are consistent with the results submitted by SRB, confirming that the licensee's environmental protection program protects the health and safety of people and the environment.

Acronyms

ALARA	as low as reasonably achievable
Bq	becquerel
CNSC	Canadian Nuclear Safety Commission
EMP	environmental monitoring program
HT	tritiated hydrogen
HTO	tritiated water
IEMP	Independent Environmental Monitoring Program
LSC	liquid scintillation counter
MDC	minimum detection concentration
NIST	National Institute of Standards and Technology
PT	proficiency testing
SRB	SRB Technologies (Canada) Incorporated

References

1. *SRB Technologies (Canada) Inc. 2014 Annual Compliance and Performance Report*.

2. Ontario Ministry of the Environment, *Ontario Regulation 169/03 – Ontario Drinking Water Quality Standards,* 2003, available at e-laws.gov.on.ca/html/regs/english/elaws_regs_030169_e.htm

3. CSA Group, *N288.4-10: Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills*, 2010.

4. U.S. Nuclear Regulatory Commission, Multi-Agency Radiation Survey and Site Investigation Manual, NUREG-1575, Revision 1, 2000, available at: http://www.epa.gov/radiation/marssim/obtain.html

5. Canadian Council of Ministers of the Environment, *Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health,* 1999, available at ceqg-rcqe.ccme.ca/en/index.html

6. Canadian Council of Ministers of the Environment*, Canadian Water Quality Guidelines for the Protection of Aquatic Life,* 1999, available at ceqg-rcqe.ccme.ca/en/index.html

7. Canadian Council of Ministers of the Environment*, Canadian Sediment Quality Guidelines for the Protection of Aquatic Life,* 2001, available at ceqg-rcqe.ccme.ca/en/index.html

8. Health Canada, Federal-Provincial-Territorial Committee on Drinking Water of the Federal-Provincial-Territorial Committee on Health and the Environment, *Guidelines for Canadian Drinking Water Quality – Summary Table*, August 2012.

9. Health Canada, *Guidelines for Canadian Drinking Water Quality: Guideline Technical Document – Radiological Parameters,* 2009.

10. Ontario Ministry of the Environment, *Ontario Regulation 153/04 – Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act*, April 15, 2011, available at ene.gov.on.ca/environment/en/resources/STDPROD_086517.html

11. CSA Group, *N288.1-14: Guidelines for calculating derived release limits for radioactive material in airborne and liquid effluents for normal operation of nuclear facilities,* 2014.

12. World Health Organization (WHO), Guidelines for Drinking-water Quality, Third Edition, 2008, available at www.who.int/**water**_sanitation_**health**/dwq/fulltext.pdf

13. National Alcohol Strategy Advisory Committee, Canada's Low-Risk Alcohol Drinking Guidelines, available at http://www.ccsa.ca/Eng/topics/alcohol/drinking-guidelines/Pages/default.aspx

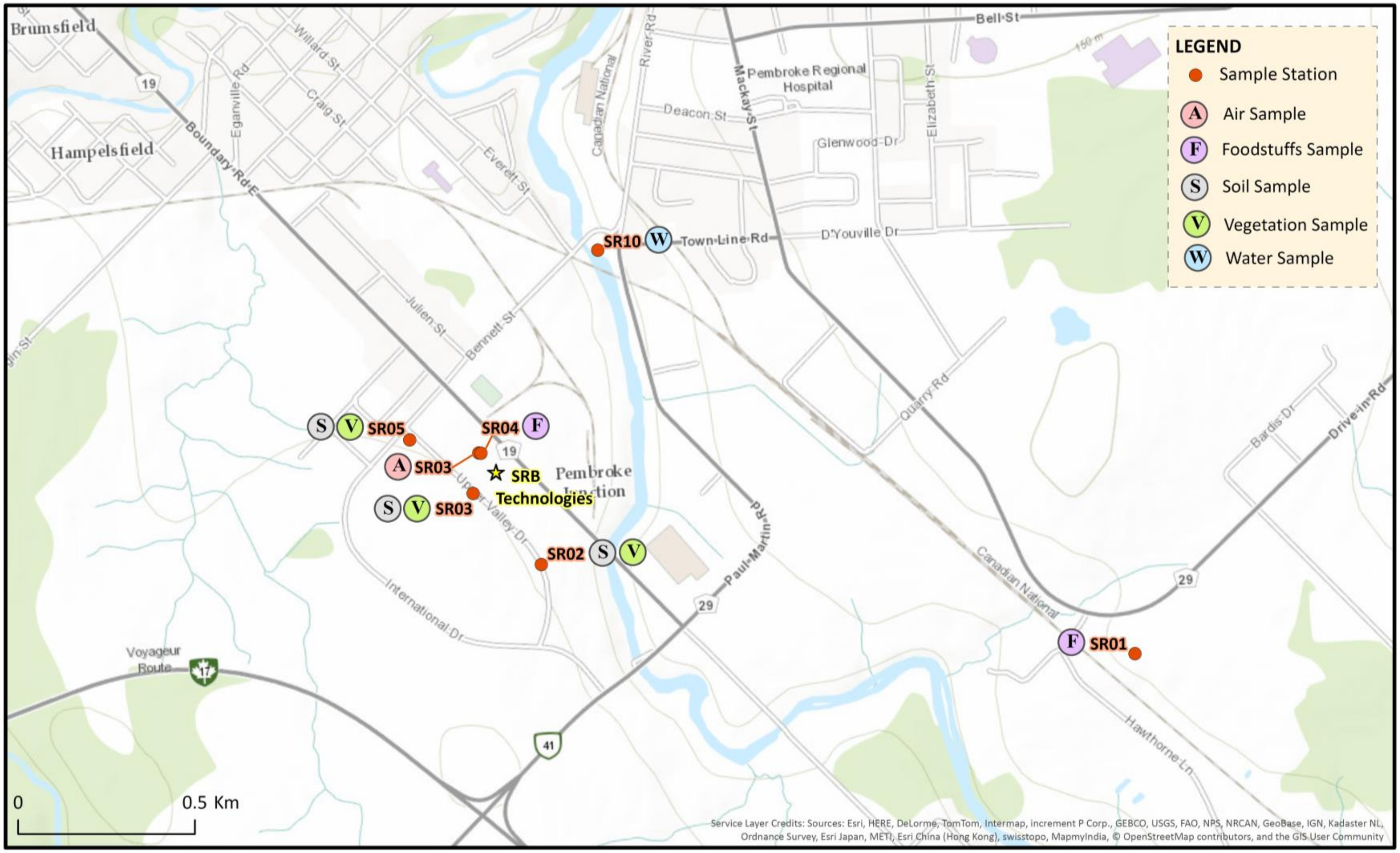
Appendix A: Maps

For location descriptions for all maps, consult tables 1–5, as applicable in the main report.

Figure A-1: Locations of the SRB facility and the 2014 samples

Figure A-2: Locations of the SRB facility and the 2014 samples north of the facility

Figure A-3: Locations of the SRB facility and the 2014 samples



Appendix B: Independent Environmental Monitoring Program sample analysis results

Table B-1: Results of tritium concentration in water samples

Sample ID	Tritiated water (HTO) (Bq/L)
Drinking water guidelines[1]	**7,000**
Background level	**0.12-45**
SR10-W03	<5[2]
SR11-W04	<5

1. Health Canada *Guidelines for Canadian Drinking Water Quality*. [7] [8]
2. The < symbol indicates that a result is below the provided detection limit for laboratory analysis.

Table B-2: Results of tritium concentration in soil samples

Sample ID	Tritiated water (HTO) (Bq/kg fresh weight)
Reference level[1]	**68,500,000**
SR02-S01	12.7
SR03-S02	13.7
SR05-S03	57.2

1. The concentration required for a hypothetical representative person (most-exposed member of a critical group) to receive an effective whole-body dose of 0.1 mSv/year due to exposure to the given radionuclide from accidental soil ingestion and ground shine. Reference levels calculated based on conservative assumptions using CSA Standard N288.1-14. [11]

Table B-3: Results of tritium concentration in air samples

Sample ID	Tritiated water (HTO)[1] (Bq/m^3)	Tritiated hydrogen (HT) (Bq/m^3)
Reference level[1]	**340**	**5,100,000**
SR03-A01	2.4	3.7

1. The concentration required for a hypothetical person (most-exposed member of a critical group) to receive an effective whole-body dose of 0.1 mSv/year due to exposure to the given radionuclide from air inhalation and immersion. Reference levels calculated based on conservative assumptions using CSA Standard N288.1-14. [11]

Table B-4: Results of tritium concentration in grass samples

Sample ID	Tritiated water (HTO) (Bq/kg fresh weight)
Reference level[1]	**10,900**
SR02-V01	34.3
SR03-V02	48.5
SR05-V03	130

1. The concentration required for a hypothetical representative person (most-exposed member of a critical group) to receive an effective whole-body dose of 0.1 mSv/year due to exposure to the given radionuclide from ingestion of grasses and wild vegetation via meat consumption. Reference levels calculated based on conservative assumptions using CSA Standard N288.1-14. [11]

Table B-5: Results of tritium concentration in wine samples

Sample ID	Tritiated water (HTO) (Bq/L)
Reference level[1]	**45,100**
SR04-F04	14.6

1. The concentration required for a hypothetical representative person (most-exposed member of a critical group) to receive an effective whole-body dose of 0.1 mSv/year due to exposure to the given radionuclide from red wine ingestion. Reference levels calculated based on conservative assumptions using CSA Standard N288.1-14. [10] The consumption rate is based on *Canada's Low-Risk Alcohol Drinking Guidelines.* [13]

Table B-6: Results of tritium concentration in milk samples

Sample ID	Tritiated water (HTO) (Bq/kg fresh weight)
Reference level[1]	5,560
SR12-F05	<1.5[2]

1. The concentration required for a hypothetical representative person (most-exposed member of a critical group) to receive an effective whole-body dose of 0.1 mSv/year due to exposure to the given radionuclide from milk ingestion. Reference levels calculated based on conservative assumptions using CSA Standard N288.1-14. [11]
2. The < symbol indicates that a result is below the provided laboratory analytical detection limit.

Table B-7: Results of tritium concentration in fruits

Sample ID	Tritiated water (HTO) (Bq/kg fresh weight)
Reference level[1]	**123,000**
SR01-F02 (tomatoes)	43.2

1. The concentration required for a hypothetical representative person (most-exposed member of a critical group) to receive an effective whole-body dose of 0.1 mSv/year due to exposure to the given radionuclide from fruit ingestion. Reference levels calculated based on conservative assumptions using CSA Standard N288.1-14. [11]

Table B-8: Results of tritium concentration in vegetables

Sample ID	Tritiated water (HTO) (Bq/kg fresh weight)
Reference level[1]	**104,000**
SR01-F01 (kale)	180
Reference level[1]	**279,000**
SR01-F03 (potatoes)	37

1. The concentration required for a hypothetical representative person (most-exposed member of a critical group) to receive an effective whole-body dose of 0.1 mSv/year due to exposure to the given radionuclide from vegetable ingestion. Reference levels calculated based on conservative assumptions using CSA Standard N288.1-14. [11]