Canadian Nuclear Safety Commission | Commission canadienne de sûreté nucléaire

CMD 22-H8.1

File / dossier : 6.01.07
Date: 2022-01-14
Edocs: 6718184

Written submission from SRB Technologies (Canada) Inc.

Mémoire de SRB Technologies (Canada) Inc.

In the Matter of the

SRB Technologies (Canada) Inc.

Application for the renewal of the licence for SRBT Facility

Commission Public Hearing

April 13 and 14, 2022

À l'égard de

SRB Technologies (Canada) Inc.

Demande de renouvellement de permis pour l'installation de SRBT

Audience publique de la Commission

13 et 14 avril 2022

Canada

Table of Contents

Executive Summary

SRB Technologies (Canada) Inc. (SRBT) is the worldwide leader in the manufacture and distribution of self-luminous safety signs and devices. Our tritium processing facility is located on the outskirts of Pembroke, Ontario. We have been in operation since 1990, processing tritium gas into light sources under several licenses issued by the Canadian Nuclear Safety Commission (CNSC) and its predecessor, the Atomic Energy Control Board.

On June 30, 2022, SRBT's current Nuclear Substance Processing Facility Operating Licence (NSPFOL) (number NSPFOL-13.00/2022) shall expire. This licence was issued by the CNSC in 2015, for a period of seven years. An application for renewal of this licence was submitted to the CNSC on June 30, 2021, including a request that the licence be renewed for a fifteen-year term.

Throughout the duration of the current operating licence, SRBT facility operations have been extremely safe and successful. Our safety and compliance performance has been excellent. Safety is the paramount consideration in all that we do, and continuous improvement in all facets of our operations and safety management remains our core mission.

Several major projects have been implemented to improve and modernize elements of the SRBT Management System, bringing it into full compliance with the requirements of CSA Standard N286-12, *Management system requirements for nuclear facilities*. Our training program has continuously improved and matured, in alignment with the requirements of CNSC Regulatory Document (REGDOC)-2.2.2, *Personnel Training*.

We are proud to note that since the current NSPFOL went into effect on July 1, 2015, **no action levels have been exceeded** relating to environmental or radiation protection aspects of SRBT operations, demonstrating an excellent level of control and safety management.

Our Environmental Management System has been brought into full alignment with relevant CSA standards, and we have effectively minimized the rate of significant workplace incidents and injuries, as well as achieved very low effective doses to both nuclear energy workers and the public.

In 2020, SRBT completed the first full Environmental Risk Assessment (ERA) in accordance with CSA Standard N288.6-12, *Environmental risk assessments for Class I nuclear facilities and uranium mines and mills*. The report has been published on our website, and the recommendations stemming from the assessment have been incorporated into our EMS going into the next five-year cycle of the process.

Our Safety Analysis Report (SAR) was updated and modernized in 2017, and is openly available to the public on our website. The facility has been operated in full compliance with all Operating Limits and Conditions contained within the SAR throughout the current licence term, and has been continuously maintained fit-for-service in line with our Maintenance Program.

SRBT continues to implement a Fire Protection Program, with several layers of defence-in-depth that provides excellent assurance of protection and control of this hazard. In addition, our Emergency Plan has been maintained, and both fire drills and emergency exercises conducted to ensure operational readiness at all time.

The small volume of radioactive waste generated during operations continues to be managed in accordance with licence requirements, including applicable CSA standards in the N292-series.

Thousands of shipments containing radioactive material have been safely shipped and received during the current licence period. Facility security has been continuously maintained, with no security-related incidents or issues throughout the licence term.

Our Preliminary Decommissioning Plan (PDP) was updated in November 2019, including a revised estimate of the cost of decommissioning. The SRBT Financial Guarantee for decommissioning remains fully funded and held in escrow; as of December 31, 2021, the FG is funded to $747,760.51, or 102.8% of the required guarantee of $727,327.00.

We have continued to fine-tune our Public Information Program, including our target audience to ensure a greater level of meaningful and transparent engagement with stakeholders. We continue to work hard to cultivate and expand open and fruitful relationships with members of the public, as well as key Indigenous communities in our area. Our Public Information Program includes a wide variety of social media platforms which are used to provide up-to-date information to the public.

We also continue to maintain a comprehensive website, which includes a number of easily-accessible and openly-available documents and reports relating to our operations, including (but not limited to) our facility Safety Analysis Report, Environmental Risk Assessment, our Annual Compliance and Performance Reports, CNSC inspection reports, event reports, our Preliminary Decommissioning Plan, the Public Information Program, and a wide range of environmental monitoring data.

To summarize, SRBT has operated safely throughout the term of our current licence, and remains wholly committed to ensure continuous improvement into the future in all aspects of our operations, safety management, and our relationship with stakeholders.

The activities conducted under the current licence have not changed since the licence was renewed in 2015, and no changes to our licenced activities are requested as part of this application for renewal.

We firmly believe that the information submitted to the Commission as part of the licence application process, combined with our operational and safety performance, clearly demonstrates that SRBT is qualified to continue to carry on licenced activities, and that we will continue to make adequate provision for the protection of the environment, the health and safety of persons and the maintenance of national security and measures required to implement international obligations to which Canada has agreed.

Justification of Requested Licence Term

There are numerous technical and administrative justifications for a renewed licence term of fifteen years.

The **stable and unchanging nature of our nuclear substance processing operations** itself warrants consideration of a long-term licence.

SRBT manufactures tritium-powered self-luminous safety lights and devices, and has done so using fundamentally static methods for decades. Incremental improvements have been made over time, and will continue to be made in order to reduce our impact on persons and the environment, but the general process of what we do will not differ in the next fifteen years.

Our facility does not include components that need to undergo refurbishment for long-term performance, such as with nuclear reactor facilities. SRBT does not perform unique nuclear research or complex, nuclear-related operations. The physical licenced activities conducted under the current licence have not changed significantly through the term of the licence, and no significant changes are foreseen in the period requested.

Our **comprehensive and mature management system** provides an excellent level of safety assurance. SRBT was one of the first Class I nuclear facilities to achieve alignment and compliance with the requirements of CSA Standard N286-12, and we have continued to improve the management system over time, in line with our organizational philosophy. We have continuously revised elements of our management system with each new or revised regulatory document that is incorporated as part of our licensing basis over time.

The **quality and comprehensiveness of the safety analyses** that support our licenced activities have remained high while being continually improved with each iteration. The latest versions of the facility Safety Analysis Report, the Fire Hazard Assessment, and the more recently-completed Environmental Risk Assessment have been deemed to meet CNSC staff expectations.

The set of risk assessments conducted demonstrate that the expected impact upon persons and the environment, during both routine / normal operations and emergency situations, is very low, especially among Class I nuclear facilities.

Emergency and accident scenarios have been modelled, showing that **even in the most limiting emergency scenario, the anticipated effective dose imparted to any person is expected to be well below regulatory limits for routine operations** (i.e. less than 1 mSv for persons who are not nuclear energy workers, and less than 50 mSv for nuclear energy workers – refer to Appendix A of the Safety Analysis Report for more information).

CNSC staff have continually rated our performance as satisfactory or fully satisfactory across all Safety and Control Areas throughout the current licence term.

SRBT has ensured that representatives attend all annual meetings of the Commission where CNSC staff have presented Regulatory Oversight Reports on our facility, and have readily been available to answer questions at each meeting – a practice that will continue into the next licence term. Frequent meetings where SRBT's performance is discussed openly, in a public setting, provide additional rationale for why a longer licence term is also justifiable.

Our **regulatory compliance history** for the last decade and beyond has been excellent. CNSC inspection activities continue to occur frequently, with the number and significance of compliance actions being issued trending lower and remaining so over time. SRBT prides itself on ensuring a high level of regulatory compliance in all Safety and Control Areas.

As well, over the current licence term SRBT has been able to achieve and maintain a **very low rate of reportable events**. For those events that have occurred, the nuclear safety-related risk to persons and the environment has ranged from very low to virtually non-existent.

We implement a comprehensive **Environmental Management System** that includes several key protection and monitoring programs that comply and align with the CSA N288-suite of standards. Both Environmental and Groundwater Monitoring Program data has consistently demonstrated that the impact of our operations on the environment has remained exceedingly low over time.

With respect to groundwater protection in particular, **tritium concentrations in monitoring wells across the entire array of sampling wells have continuously been decreasing for several years**, as the operational changes that were implemented in the mid- to late-2000s take full effect. Of the 29 monitoring wells routinely sampled, only a single well located in an access-restricted fenced area very near the stacks exhibits a tritium concentration in excess of the Ontario Drinking Water Guideline value of 7,000 Bq/L. Tritium concentrations in wells used for some drinking water exhibit concentrations that are less than 14% of the Guideline value, and continue to decrease.

SRBT openly and promptly shares a wide variety of information with the public by way of our website, including environmental and groundwater monitoring data, reportable events, inspection reports, annual compliance reports, and more. We have meaningfully engaged with local stakeholders and Indigenous groups as part of our Public Information Program, and will continue to improve these processes as we move into the future.

Our business provides an important service to end users of tritium self-luminous safety signs, where we will take in expired or otherwise disused signs for safe processing. A long-term licence provides consumer assurance that there will continue to be a safe and effective option for ensuring best disposal practices for these items in the future.

As well, a fifteen-year licence term would provide several key benefits to our organization, and would substantially help SRBT to continue to grow and maintain the current business in a sustainable fashion, and ensure a continued high level of focus on operating the facility safely and compliantly.

A fifteen-year licence term allows resources that would otherwise need to be allocated toward licence renewal-related cost recovery fees to be diverted into facility improvements, effective safety management, and the exploration and research of ways to minimize SRBT's impact on the environment.

Our workforce is very experienced, with very little turnover over time. Having an operating licence in place for a long-term period is also an important factor in **attracting and retaining key qualified staff.**

The stability offered by a fifteen-year licence would also further ensure SRBT's ability to **secure long term contracts with customers and suppliers**. Experience has demonstrated that customers and suppliers are not willing to sign contracts beyond a licence term.

Experience has also shown that it is easier to **secure financing** from financial and banking institutions with longer-term operating licences in place, as this provides for a signal of assurance that the business is stable and secure.

A fifteen-year licence term would also instill additional confidence with stakeholders that SRBT's operation is recognized by the Commission as presenting little risk to the community.

CNSC staff, the Commission and all stakeholders can be assured that the current vision for the operation of the facility over a fifteen-year licence term would not deviate in strategy from the operations that have occurred during the current licence period.

To conclude, based upon our performance, our continued commitment to operating the facility safely, and improving our operations continuously, SRBT believes that a licence term of fifteen years would be reasonable, beneficial, appropriate and justified.

1.0 Introduction

1.1 Background

LOCATION

Located in Pembroke, Ontario, SRB Technologies (Canada) Inc. (SRBT) operates a nuclear substance processing facility focused on production and distribution of self-luminous safety signs and devices that use tritium-powered light sources for illumination.

Figure 1: SRB Technologies (Canada) Inc. in Pembroke, Ontario.

The facility is situated in TransCanada Corporate Park, which is near the southern city limits. Within the same building as the SRBT facility are two other commercial / industrial businesses. The adjacent business is a company that specializes in the manufacture of personal protective equipment and clothing intended for such applications as body cooling in high-temperature conditions, and for military special operations. A third tenant provides various industrial process gas and equipment to local customers.

Various other commercial businesses and municipal services are located in the surrounding area, including two major-chain hotels, a hockey arena / community centre, and both the Pembroke Fire Department and the Pembroke detachment of the Ontario Provincial Police.

Figure 2: South view from the SRBT facility, with Pembroke Fire Department and Ontario Provincial Police stations shown.

The nearest zoned residential area is called Johnson's Meadows, which was originally developed in the 1970s but has expanded since. From the location of the active ventilation system stacks, the nearest residential area is approximately 250 metres to the northwest. In addition, a narrow band of land along Boundary Road to the southeast is zoned residential. The main portion of the City of Pembroke lies north of the facility.

Figure 3: West view from the SRBT facility with Pembroke Fire Department shown.

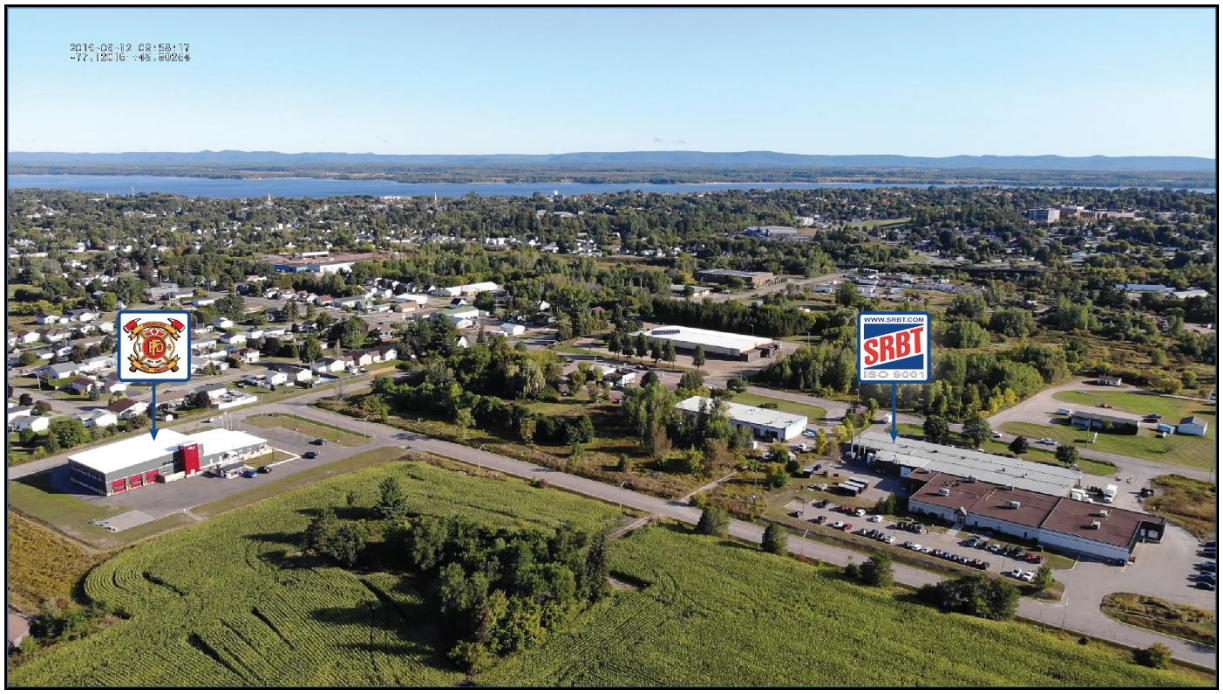


Figure 4: Northeast view from the SRBT facility with Pembroke Fire Department shown.

PRODUCTS

Tritium light source technology was originally developed several decades ago in the United Kingdom by the precursor of our company. Operation of the current facility in Pembroke began in 1990 under a licence issued by the Atomic Energy Control Board.

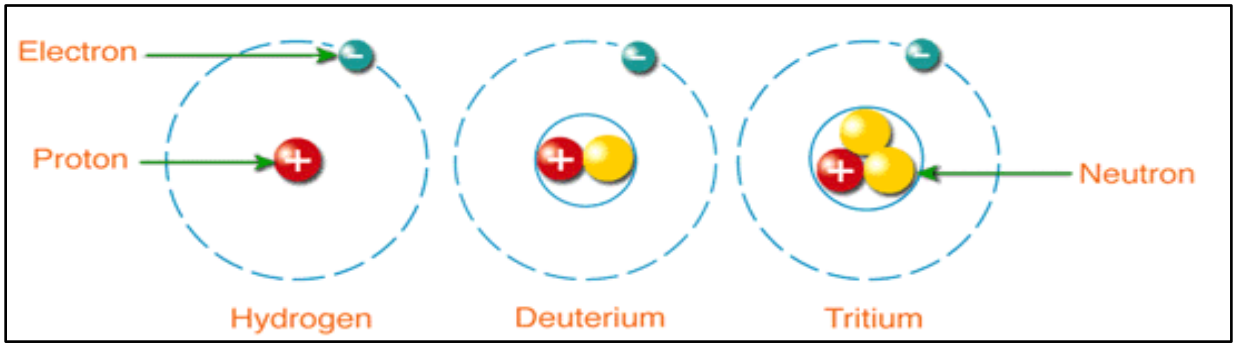


Figure 5: Hydrogen isotopes, including normal hydrogen, deuterium and tritium.

Tritium is a radioactive isotope of hydrogen that occurs naturally in the environment, mainly due to nuclear reactions induced by high-energy cosmic rays in the upper atmosphere. This isotope exhibits a half-life of approximately 12.3 years, and upon decay emits a beta particle of very low energy as it transmutates to stable Helium-3.

Tritium is also produced artificially as a by-product in nuclear reactors and nuclear power generation. During operation, tritiated water accumulates in reactor process fluid systems at Canadian nuclear power-generating stations.

It is removed and converted into diatomic molecular tritium gas by Ontario Power Generation at the Tritium Removal Facility in Darlington, Ontario. The tritium gas is immobilized and stored as a metal tritide, and made commercially available to customers such as SRBT.

Gaseous tritium light sources (GTLS) are comprised of borosilicate glass capsules that have been internally coated with a thin layer of phosphorescent zinc-sulfide powder. When excited by electrons, certain formulations of this powder emit characteristic wavelengths of light that can be detected by human eyes.

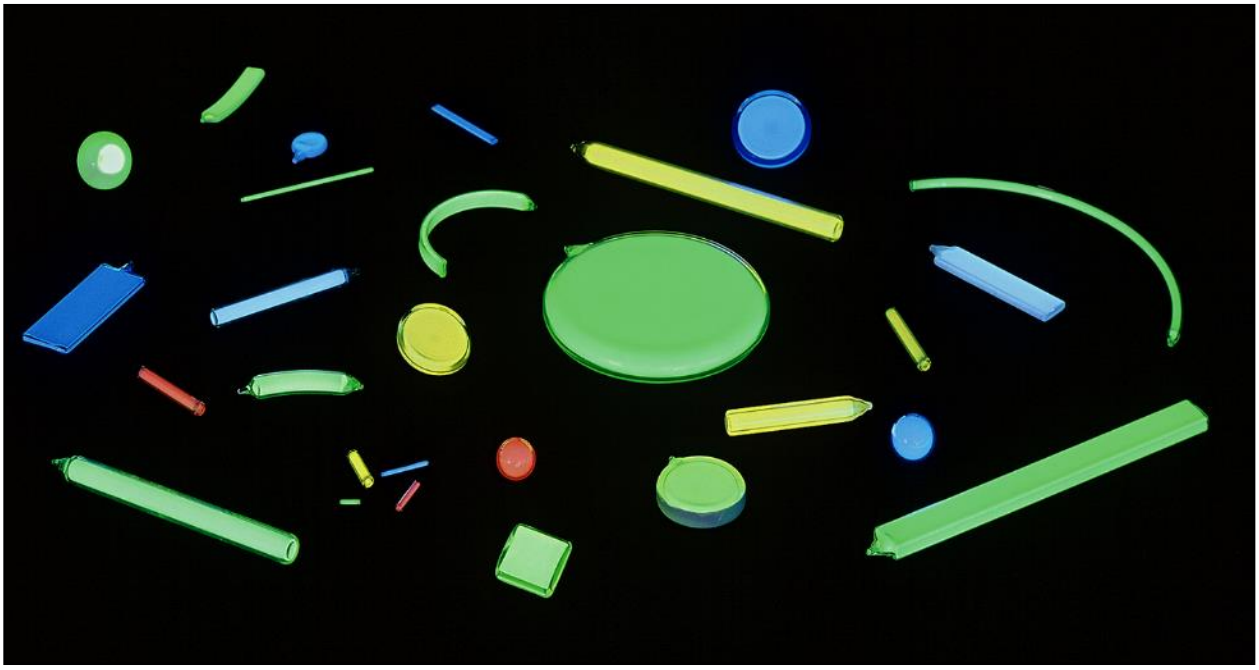


Figure 6: Examples of various gaseous tritium light sources manufactured by SRBT.

Using our facility processes and incorporating tritium gas into the coated glass capsules, the phosphorescent powder becomes excited by the beta particles emitted by the tritium as it decays. This results in a continuously illuminated light source that requires no energy input in order to remain lit.

The initial brightness of a GTLS is directly correlated to the amount of tritium gas inside the light. Over time, the light source will become dimmer at a characteristic rate as the tritium gas decays, thus necessitating replacement if a minimum brightness is required for a specific application.

Typically, safety devices that use GTLS have usable life spans ranging up to 20 years, depending on the model of the device. As part of our closed-loop product cycle, SRBT offers a service to take back expired safety signs and devices containing GTLS, in order to safely process and either repurpose or safely dispose of the light sources.

Figure 7: Aerospace safety signs represent a key product line manufactured by SRBT.

Figure 8: SRBT manufactures a wide range of self-luminous safety products.

In response to the onset of the global COVID-19 pandemic, SRBT shifted part of our plastics molding capability towards designing and manufacturing a Canadian-made face shield for use as personal protective equipment. These face shields were manufactured and distributed pursuant to a Medical Device Establishment Licence issued by Health Canada.

Figure 9: SRBT face shield production.

The SRBT facility has safely processed tritium over the thirty-plus years since it was first authorized for operations. In 2012, SRBT became 100% Canadian-owned and operated, and has made it a corporate mission to continuously improve our operations, and to reduce or eliminate impacts to our environment and stakeholders in our community.

Our company currently employs 40 hard-working local residents of Pembroke and area who are dedicated to ensuring the protection of our local environment, our fellow employees, and the public at all times. We are committed to being transparent, visible and open with stakeholders, and to sharing information with members of the public.

Figure 10: President Stephane Levesque and Vice President Ross Fitzpatrick accept the 2017 Ontario Export Award – Consumer Products and Technology Category.

Figure 11: SRBT employees showing their support for the Humboldt Broncos hockey team in 2018.

Figure 12: The employees of SRBT accepting the 2014 Members' Choice Award from the Ontario Association of Community Futures Development Corporations, along with the local Member of Federal Parliament.

Figure 13: Completing the loading of the first pallet of face shields for delivery to a local hospital in 2020.

1.2 Highlights

On June 30, 2022, SRBT's current Nuclear Substance Processing Facility Operating Licence, NSPFOL-13.00/2022, shall expire. This licence was issued by the CNSC in 2015, for a period of seven years, and has not been amended since issuance.

An application for renewal of this licence was submitted to the CNSC on June 30, 2021, including a request that the licence be renewed for a fifteen-year term.

The activity requested to be licenced is identical to the activity of that described in section IV of the current licence NSPFOL-13.00/2022. Specifically, it has been requested that a licence be issued that authorizes SRBT to carry on the following activities:

(a) operate a Class IB Facility, comprising of a tritium processing facility, at the location referred to in Section II of this licence (hereinafter "the facility") for the purposes of manufacturing radiation devices;

(b) produce, possess, transfer, service and use, radiation devices arising from the activities described in (a);

(c) possess, transfer, use, process, manage, store and dispose of nuclear substances that are required for, associated with, or arise from the activities described in (a);

(d) the possession of tritium up to a limit of 6,000 terabecquerels of tritium in any form;

(e) possess, and use prescribed information that is required for, associated with, or arise from the activities described in (a).

Throughout the duration of the current operating licence, SRBT facility operations have been extremely safe and successful. Our safety and compliance performance has been excellent; however, continuous improvement in all facets of our operations and safety management remains our core mission.

Several major projects have been implemented to improve and modernize elements of the SRBT Management System, bringing it into full compliance with the requirements of CSA Standard N286-12, Management system requirements for nuclear facilities.

The key management system principles outlined in this standard have been integrated with all SRBT safety-related processes and programs, and comprehensive management review exercises ensures continued high levels of compliance, performance and improvement.

Our training program has continuously improved and matured, in alignment with the requirements of CNSC Regulatory Document (REGDOC)-2.2.2, Personnel Training. A systematic approach to training has been implemented for nuclear facility operations and safety-related processes, resulting in very few significant human-performance related events.

Since the current NSPFOL went into effect on July 1, 2015, no environmental or radiation protection-related action levels have been exceeded at the SRBT facility.

Our Environmental Management System has been brought into full alignment with relevant CSA standards, including our Environmental, Effluent and Groundwater Monitoring Programs. Annual independent third-party comparison exercises within EMS monitoring programs consistently demonstrate high precision and accuracy of measurements, and excellent program performance.

Data obtained via the Groundwater Monitoring Program has clearly demonstrated a continued downward trend in the concentration of tritium in groundwater near the facility. For the period between 2015-2021, water from 100% of the SRBT monitoring wells has exhibited a significant drop in average annual concentration, ranging from a decrease of 6% at MW07-12 to a decrease of 85% at MW06-1. This data clearly demonstrates the positive effect of the operational changes put in place over the last fifteen years.

The monitoring well that features the highest concentration of tritium is well MW06-10. This is the sole monitoring well that exhibits a tritium concentration which exceeds the Ontario Drinking Water Quality Standard O. Reg 169/03 (7,000 Bq/L).

It is important to specifically note that this well is not a source of drinking water – MW06-10 is an engineered sampling well, drilled specifically for that purpose in September 2006, and has been routinely sampled since. The well is situated directly between the two air handling units for the active ventilation systems on the westerly side of the facility, within a locked, fenced-in compound that prevents unauthorized access.

Based purely upon its location, this well is expected to exhibit the most elevated concentration of tritium among the array of groundwater monitoring wells drilled by SRBT as part of our Groundwater Protection and Monitoring Programs. The concentration of tritium in water sampled from this well has decreased by 42% since 2015 and by 79% since 2006.

SRBT has worked tirelessly to achieve a very low frequency of significant workplace incidents and injuries, as well as very low effective doses to both nuclear energy workers and the public. Workers and the public are well-protected and safe, and the radiological impacts of our operations have been demonstrated to be extremely low, and well within acceptable limits.

In 2020, SRBT completed the first full Environmental Risk Assessment (ERA) in accordance with CSA Standard N288.6-12, Environmental risk assessments for Class I nuclear facilities and uranium mines and mills. The report has been published on our website, and the recommendations stemming from the assessment have been incorporated into our EMS going into the next five-year cycle of the process.

Our Safety Analysis Report (SAR) has been maintained and updated to reflect facility changes through the current licence term. The SAR underwent a significant revision in 2017, and was accepted by CNSC staff in 2018. The facility has been operated in full compliance with the Operating Limits and Conditions contained within the SAR throughout the current licence term.

The facility has been continuously maintained in line with our Maintenance Program, ensuring that all safety-related equipment is kept in a high state of fitness for service at all times.

SRBT has maintained a comprehensive Fire Protection Program, with several layers of defence-in-depth that provides excellent assurance of protection and control of this hazard. In addition, our Emergency Plan has been maintained, and both fire drills and emergency exercises conducted to ensure operational readiness at all time. A successful, full-scale emergency exercise was most recently conducted in October 2021, in conjunction with the Pembroke Fire Department, the City of Pembroke, and local paramedics.

Waste continues to be managed in accordance with licence requirements, including applicable CSA standards in the N292-series. Through the application of a continuous principle of waste minimization, and the implementation of effective and conservative processes for characterizing and categorizing waste materials, SRBT ensures that the burden on the environment and on future generations of Canadians is minimized.

Thousands of shipments containing radioactive material have been shipped and received during the current licence period, in compliance with regulatory requirements pertaining to packaging, transport, and import/export controls, with very few reportable incidents, all of which were of low risk-significance, and addressed to the satisfaction of CNSC staff. As well, facility security has been continuously maintained, with no security-related incidents or issues throughout the licence term.

Our Preliminary Decommissioning Plan (PDP) was updated in November 2019, including a revised estimate of the cost of decommissioning. In turn, the value of the Financial Guarantee was increased to a level equal to this cost estimate in 2020, with the funds held in escrow for the sole purpose of financing the decommissioning of the facility.

The SRBT Financial Guarantee is a cash fund held in escrow, and does not rely on any letters of credit, bonds, insurance or other expressed commitments. Interest accrued on the funds deposited remain held in escrow over time; as a result, as of December 31, 2021, the FG is funded to $747,760.51, or 102.8% of the required guarantee of $727,327.00.

With respect to Public Information and Disclosure, we have continued to fine-tune our target audience and messaging to ensure a greater level of meaningful and transparent engagement with stakeholders. We continue to work hard to cultivate open and fruitful relationships with members of the public and key Indigenous communities in our area.

Our compliance performance has continued to be exemplary, with few compliance actions being put to SRBT as a result of CNSC compliance inspection activities. Those compliance actions that have been issued have generally been low in risk significance, and addressed quickly and effectively to the satisfaction of the CNSC.

To summarize, SRBT has operated safely throughout our current licence, and remains wholly committed to ensure continuous improvement into the future in all aspects of our operations, safety management, and our relationship with stakeholders.

2.0 Business Plan

SRBT business plans for the next fifteen years are, in essence, ‘status-quo’, meaning that there are currently no major changes anticipated in the way that the organization will operate the facility, and no planned major nuclear substance processing facility modification projects on the horizon.

SRBT fully expects to continue to strive to sustainably manufacture self-luminous safety devices and tritium light sources for our customers, with the fundamental business goals of increasing market share, and finding new safety-related applications for the products and technologies that are offered by our company.

Our unique product line will continue to be focused on ensuring life-safety in challenging environments, without the need for electrical power. Tritium light sources, and devices that use them, deliver a variety of significant benefits to users, such as being inherently reliable, maintenance-free, and easy to install.

Our safety signs are designed to be safe for installation in harsh or dangerous environments, such as mines, sewers, petrochemical facilities, or other areas where the risks associated with electrical discharge must be accounted for.

Tens of thousands of aircraft worldwide are fitted with our self-luminous safety signs, ensuring that even in the event of a complete loss of power, paths of egress are clearly illuminated for escape. As well, our self-luminous devices are used by many NATO peacekeeping forces, providing reliable light without an associated heat signature.

We will continue to assess our performance, and to explore opportunities for improvement in both the safety-related aspects of our operations, and in the quality of our products.

Facility structures, systems and components (SSC) will continue to be maintained and, where required, renewed and refurbished, in order to ensure that they remain fit to serve their purpose.

We will continue to closely monitor the impacts of the operation of our facility, and ensure that any associated risks to workers, the public and the environment are continuously assessed and minimized.

Currently, there is no planned end-date for the operation of the SRBT facility. Assuming that this application is successful and a long-term licence is issued by the Commission, current projections suggest that operations will remain the same, in line with the considerations made above.

There is no set future time frame where it is expected that nuclear substance processing at the facility is to cease, or for the decommissioning phase of the facility life cycle to commence.

3.0 Safety and Control Areas

In this section of the CMD, each of the fourteen (14) SCAs established by the CNSC are discussed in detail.

The discussion includes information on the relevance and management of each SCA, on our performance over the current licence term, and on our future plans in each area.

As well, any current or future challenges are considered where applicable, and specific requests in each area are tabled for consideration.

3.1 Management System

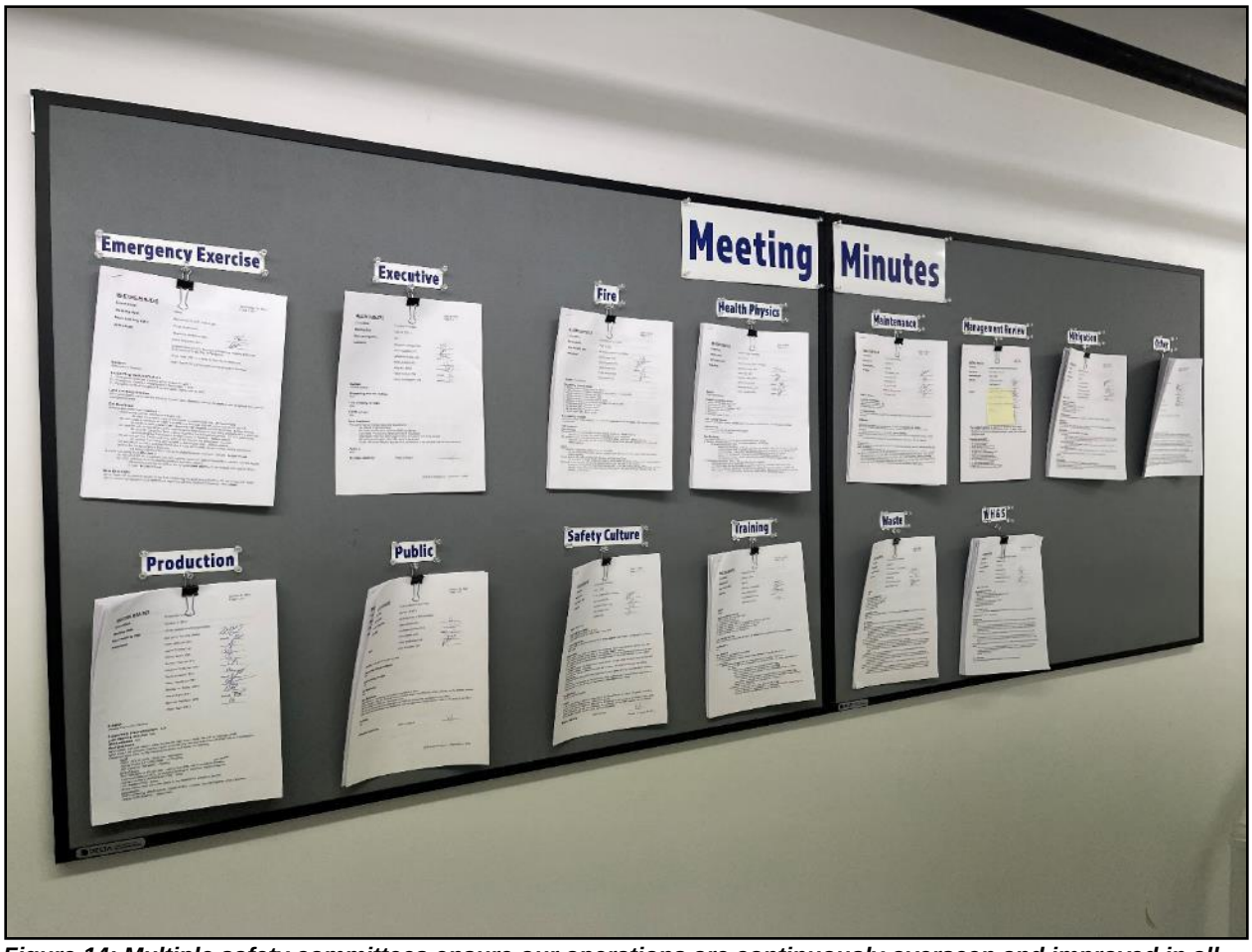


Figure 14: Multiple safety committees ensure our operations are continuously overseen and improved in all areas; the minutes of committee meetings are posted in a central location, for all staff to access.

The Management System SCA covers the framework that establishes the processes and programs required to ensure an organization achieves its safety objectives, continuously monitors its performance against these objectives, and fosters a healthy safety culture.

3.1.1 Relevance and management

Governing Management System Document

The management system aspects of our operations, both with respect to safety and product quality, are described in the SRBT *Quality Manual*, which represents the top-tier governing document in the system. All other management system documents are subordinate to the Quality Manual, and must conform to its requirements.

The Quality Manual is designed in a way that fully aligns and complies with the requirements of CSA Standard N286-12, *Management system requirements for Class I nuclear facilities and uranium mines and mills*, as well as ISO 9001. All N286-12 management system principles are discussed in this manual, along with high-level descriptions of the processes that have been implemented to ensure that these principles are consistently incorporated into our operations and the maintenance of nuclear safety.

The manual includes SRBT's Quality Policy statement, which codifies the key vision and mission statements for the entire organization, outlines key safety goals, and ensures that our values are well understood and internalized within all levels of the organization. The Quality Policy is included for reference as Figure 15.

Adherence to the Quality Manual and a faithfulness to the components of the Quality Policy are obligations of all employees and management at SRBT. As well, the concept of continually improving the management system at all levels, by all workers, is actively encouraged in the Quality Policy.

SRBT's Executive Committee is responsible for ensuring the design of the Quality Manual meets requirements, that it is continually improved, and that all facility operations are conducted in accordance with its requirements.

Organization and Organizational Structure

Insofar as it may bear on SRBT's compliance with the Nuclear Safety and Control Act (NSCA) and the regulations made under the NSCA, the organization, organizational structure, reporting lines and responsibilities for all members of SRBT's workforce are fully described in the administrative descriptive document *Organizational Structure and Responsibilities*, which is directly subordinate to the SRBT Quality Manual.

SRBT management are responsible and accountable for compliance with the NSCA, associated regulations, and the requirements of any CNSC licence at all times, with the ultimate accountability being held by the President.

The current SRBT organizational structure is provided as Figure 16.

Our Vision

Strive to maintain or exceed the standing required to allow our company to process tritium and manufacture life safety devices to fulfill the needs of our customers.

Our Mission

Continuously improve company programs in order to meet or exceed the requirements of the Nuclear Safety and Control Act, Regulations and conditions of the licence in order to strive to achieve higher grades in all safety areas.

Our Goals

1. To promote a strong safety culture throughout the organization by having all employees continuously assess and analyze any impact the operations may have on the public and the environment.
2. To reduce any risk to the public and the environment due to the operations to ensure that requirements of the Nuclear Safety and Control Act, Regulations, conditions of the licence and ISO 9001 requirements are met or exceeded.
3. To be transparent, visible and open with our community, our regulators, and our staff.
4. To ensure that the products are supplied to customer requirements and specifications and to the requirements of the Nuclear Safety and Control Act, Regulations, conditions of the licence and ISO 9001 requirements.
5. To continue to lower emissions and improve the effectiveness of our programs and processes.

Our Values

We will achieve our goals by acting with integrity with the regulators, the members of the public and our employees, and by respecting their input and contribution by making improvements based on this input.

Our Policy

It is the policy of the company and its employees to learn from our operational experience and research, to consider the input of all stakeholders and be conservative in our decision making to ensure the protection of the public and the environment to achieve the goals that we have set to meet our ultimate vision.
Compliance to the Quality Management System is an obligation throughout the company for all employees; all workers are committed to adhere with all requirements of the Quality Management System, and are encouraged to contribute to the continual improvement and upgrading of the company's Quality Management System.

Figure 15: SRBT Quality Policy.

SRBT Organizational Structure

This chart depicts the relationships of our people.

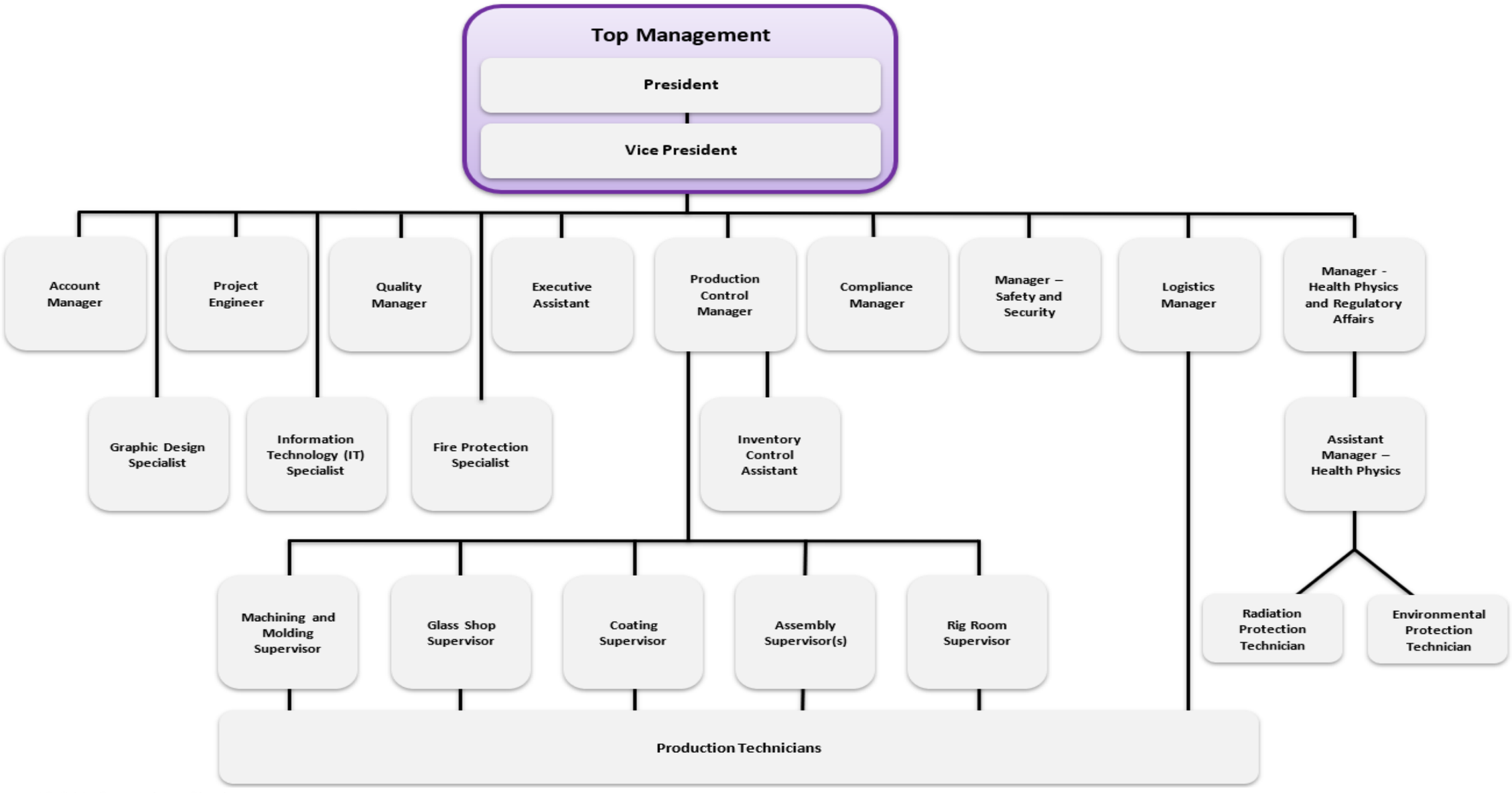


Figure 16: SRBT Organizational Structure.

Safety Committees

Our organization includes several committees, in order to ensure a collaborative approach is taken to directing improvements and change, as well as in the implementation and maintenance of programs, processes and procedures.

Committees represent an integral part of the overall management system in place at SRBT, supporting several key concepts outlined in both CSA standard N286-12*, Management system requirements for nuclear facilities*, and ISO 9001, *Quality management system – Requirements*.

Each committee collaboratively works toward achieving defined objectives in their area of responsibility and oversight. Committees are typically chaired by managers that are responsible for various safety programs or processes, and often include members of all levels of the workforce, from workers in our manufacturing departments, up to Top Management.

Between 2015-2021, a total of 588 committee meetings were held at SRBT. Addendum A1 provides a summary of the number of safety committee meetings that have taken place, broken down by calendar year of the current licence term.

Key Management System Documents

The general hierarchy of the structure of the documented Management System is provided graphically here as Figure 17:

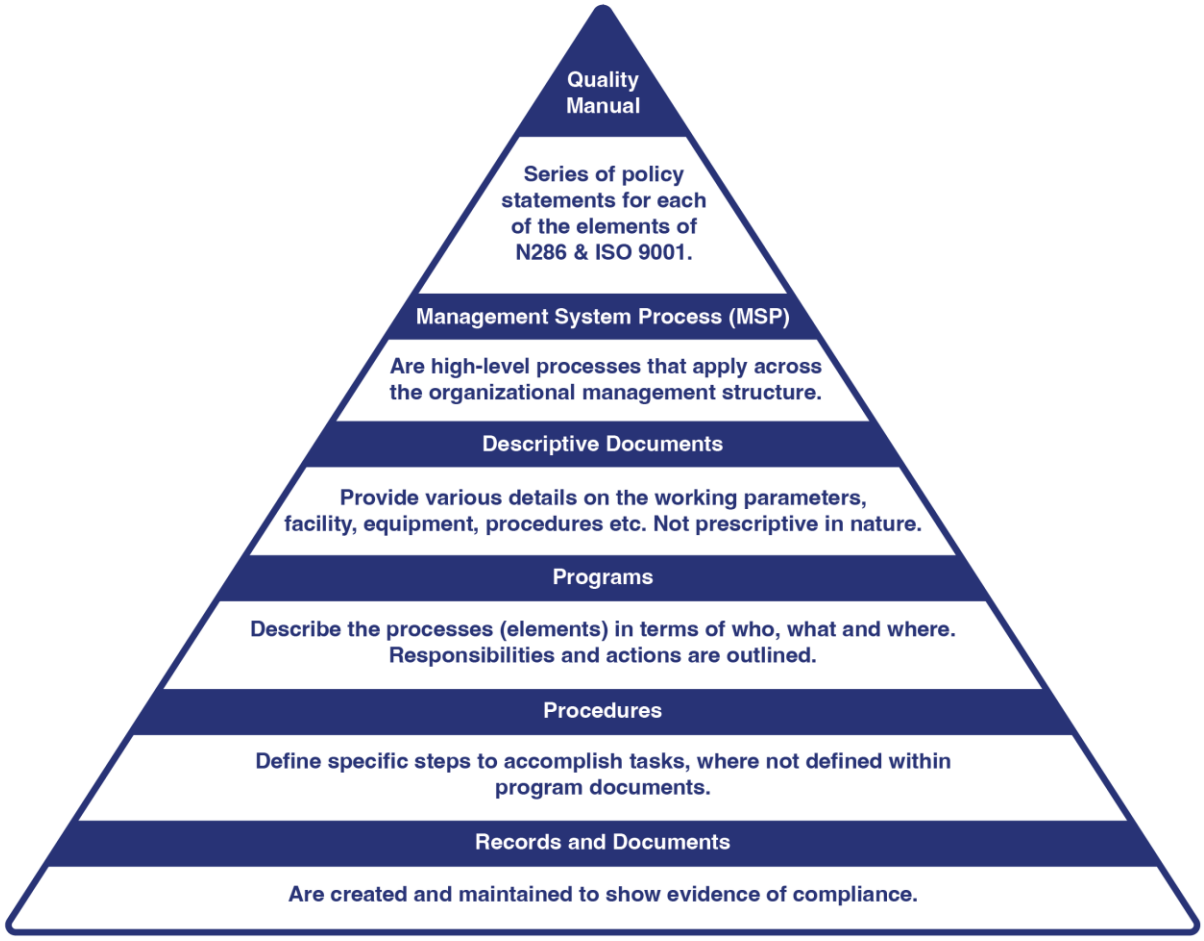


Figure 17: SRBT Management System structural hierarchy.

SRBT implements several safety programs which specifically govern the management of each individual SCA. Details on each of these programs and their procedures are provided in the corresponding section of this CMD focusing on particular SCAs – for example, the Environmental Monitoring Program is discussed in Section 3.9 – Environmental Protection.

Figure 18 represents the management system document structure implemented by SRBT, and includes all safety-related programs and processes, as well as all technical and administrative descriptive documents that support effective and safe operations.

SRBT Management System Document Structure

This chart depicts the relationships of our key descriptive documents, programs, processes and procedures

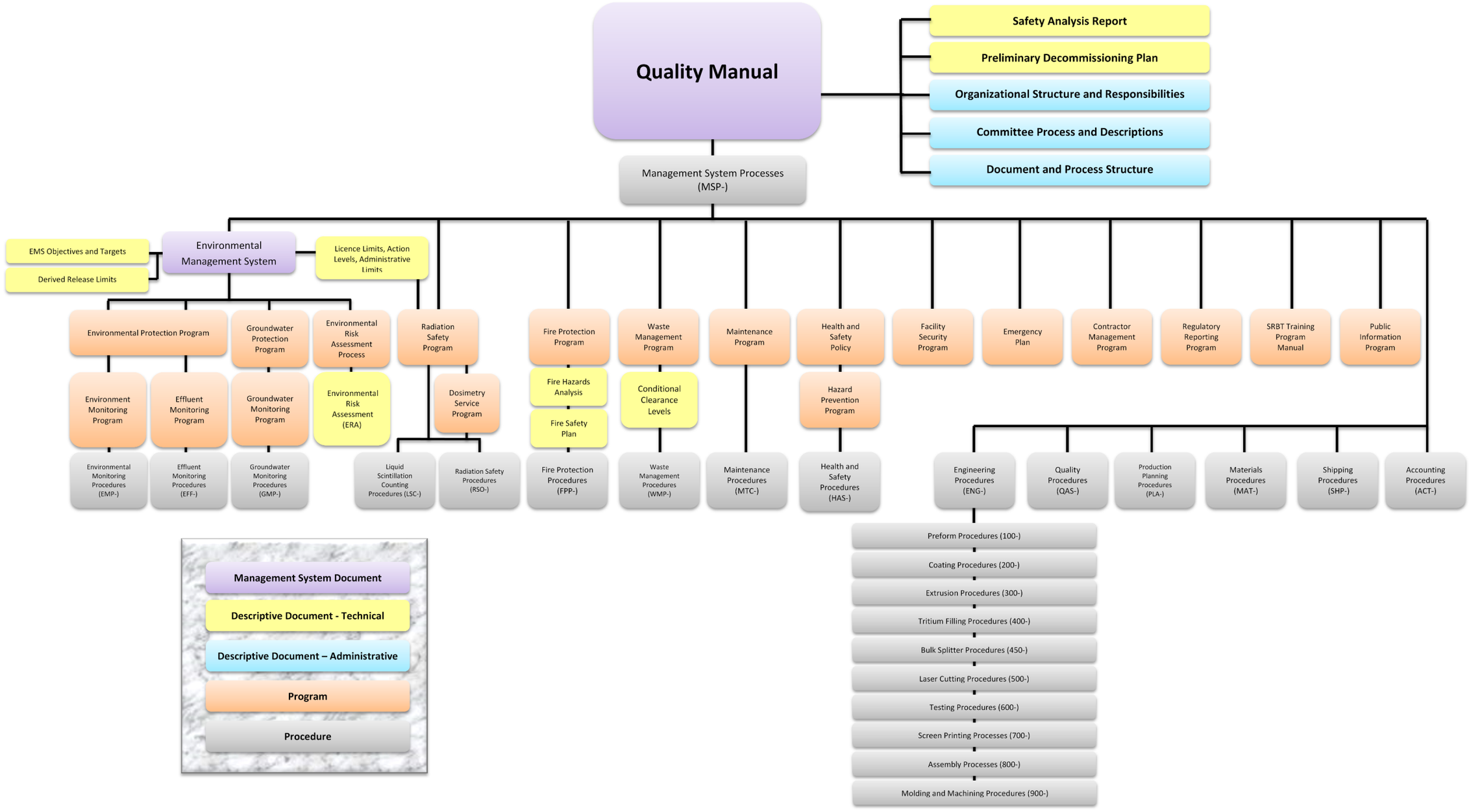


Figure 18: Management System Document Structure.

Safety Culture Management

The Safety Culture Committee is responsible for the monitoring and promotion of a healthy safety culture at the facility, and the maintenance and implementation of the associated management system processes.

At all levels, a positive safety culture is promoted by the implementation of our management system, and the active involvement of Committees in managing our safety programs. In addition, all staff are frequently trained and encouraged to identify safety-related or quality-related issues as part of their engagement with our management system.

During annual all-staff training exercises, as well as when new workers are hired, they are informed that all staff are expected to raise issues when they are identified as a condition of their employment. It is emphasized that all employees can raise non-conformance reports and opportunities for improvements through our MSPs, and participate in the actions that are taken to address issues or incorporate improvements.

The Safety Culture Committee conducts anonymous surveys of staff, focused on understanding how they perceive the organizational safety culture at SRBT, and providing the opportunity to give feedback. The survey is designed in a quantifiable fashion, allowing for trending of scores for each particular question over time.

The survey has consistently identified that our workforce understands that safety is paramount at the facility, and that the safety culture has trended in a positive fashion over time. The latest survey indicates a unanimous understanding amongst all staff that “safety is a very important factor at the facility”. An increased emphasis on encouraging employees to bring forward safety concerns to supervision and management has also been a product of analysis of the results of the survey over time.

The Quality Policy defined in our *Quality Manual* specifically identifies a strong safety culture as one of the overarching goals of the organization:

“To promote a strong safety culture throughout the organization by having all employees continuously assess and analyze any impact the operations may have on the public and the environment.”

By actively promoting and encouraging all of our employees to participate in these processes, the goal of pursuing and maintaining a positive safety culture at the facility is continuously supported at all times.

3.1.2 Past performance

In 2014, SRBT embarked on a comprehensive gap analysis project, focused on assessing gaps between CSA Standard N286-12, *Management system requirements for nuclear facilities*, and what was at that time called our Quality Assurance Program.

In September 2014, the gap analysis report was submitted to CNSC staff, along with an action plan to address all significant gaps over the following three years. CNSC staff accepted this action plan in November 2014, and SRBT provided scheduled updates on our progress in implementing the plan over time.

Over the course of the implementation of the action plan, several management system documents were revised, new hierarchical relationships between the document set were established, and new processes and procedures developed in order to ensure all gaps were addressed effectively, and in a controlled fashion.

A final status update was provided on December 1, 2016, where it was noted that all improvement actions had been completed, bringing our management system into compliance with the requirements of N286-12.

CNSC staff conducted a compliance inspection focused on the SCA – Management System in March 2017. One action notice and two recommendations were issued, both of which were addressed to the satisfaction of CNSC staff by August 2017.

The three-year project to align our management system with the requirements of N286-12 was highly successful, and has helped SRBT to improve our operations and safety performance throughout the term of our licence. Since that time, the Quality Manual has been revised on three occasions, with each revision being accepted by CNSC staff.

In August 2021, CNSC staff again conducted a compliance inspection focused on the Management System SCA. The inspection took place over the course of five days, and resulted in a single notice of non-compliance action of low safety significance concerning the conduct of audits to confirm the initial and continuing acceptability of supplier’s management systems.

Throughout the term of the current licence, SRBT has updated safety programs and processes in the spirit of continuous improvement, and in response to developments in regulatory requirements and events.

In all cases, the programs and processes that are associated with our licensing basis have been submitted to CNSC staff for review and acceptance, in order to ensure that the CNSC remains informed of the changes within our documented management system, as well as to provide assurance that the facility remains within the licensing basis at all times.

These changes were implemented in compliance with condition 1.2 of our NSPFOL, as well as in line with the described compliance verification criteria in SRBT’s LCH.

Over the course of the current licence term, we consider our performance in the SCA of Management System to meet our internal expectations, and to be very good in general, with a stable trend over time and projected into the future.

This assessment is based on the following key points:

- SRBT conducted a comprehensive overhaul of our management system, bringing it into compliance with CSA N286-12 in a controlled manner over the course of several years.
- SRBT has continued to maintain management system documents throughout the course of the current licence term, and has sought out and implemented improvements at every step.
- A comprehensive management review process has continued to be effectively performed annually, resulting in proactive maintenance of our overall system, and integration of key organizational positions into decision-making and risk-management processes.
- A robust process of internal audit, and the active management of non-conformances, opportunities for improvement, and associated action plans drives high performance.
- CNSC staff has consistently rated SRBT's performance in this area as 'Satisfactory' each year as part of their Annual Compliance and Performance Report.
- The most recent focused CNSC inspection of the Management System SCA, conducted in August 2021 over the course of five days, resulted in only a single notice of non-compliance of very low risk significance, demonstrating clearly SRBT's commitment to excellence in this area.

3.1.3 Future plans

Going forth, we fully expect to continue to improve our management system through the application of effective assessment, including management review.

We will continue to monitor changes in regulatory requirements in this area, as well as industry best-practices as a learning organization.

We will be committed to promoting a strong safety culture among our entire organization, and to tracking our safety performance using appropriate objectives and targets.

The documents comprising our management system will be revised as needed, and in accordance with the requirements of our Licence Conditions Handbook (LCH). Our management system will also be updated in line with any future versions of the CSA N286 and ISO 9001 standards.

3.1.4 Challenges

We do not anticipate experiencing any challenges relating to the Management System SCA.

3.1.5 Requests

We do not wish to put forth any specific requests pertaining to the Management System SCA.

3.2 Human Performance Management

Figure 19: SRBT staff at the facility-wide safety training session in 2021.

The Human Performance Management SCA covers the activities that enable effective human performance through the development and implementation of processes that ensure a sufficient number of licensee personnel are in all relevant job areas and have the necessary knowledge, skills, procedures and tools in place to safely carry out their duties.

3.2.1 Relevance and management

In order to ensure that an excellent level of human performance is achieved in all operational areas that impact safe operations, SRBT implements a documented program that fully describes the processes implemented with respect to training and human performance management.

This program is titled the SRBT Training Program Manual; the manual and its processes have been implemented since 2014 when SRBT undertook to align our training processes with the newly published CNSC REGDOC-2.2.2, *Personnel Training*.

The Manager – Health Physics and Regulatory Affairs is responsible for ensuring the design of SRBT's training program meets requirements, and that the program is implemented in accordance with the manual. The Training Committee provides support and oversight on all aspects of training of staff.

Over the course of the licence term, the manual has been revised on four separate occasions in response to action items and recommendations stemming from CNSC inspections, as well as from internal audits and management review exercises. In each case, the manual has been submitted to CNSC staff for review and acceptance prior to implementation, in accordance with condition 1.2 of the current NSPFOL.

The manual is designed to describe and govern how training is managed and applied during the course of facility operations. The manual defines the processes used to determine who requires training, what tasks require training, individual qualifications, how training is delivered, and how often training is renewed.

The implementation and improvement of a training program that complies with the requirements of REGDOC-2.2.2 during the course of the current licence term has been very successful in ensuring safe and compliant operations of the facility, and excellent human performance in the execution of safety-related activities.

The training program is reviewed annually to establish the results achieved in implementing the program for recruiting, training and qualifying workers. Overall, to date the results have been consistently satisfactory, and combined with improvements over time, have significantly enhanced human performance in key safety areas.

Training considerations are included as a component part of our change control and event reporting processes, as well as management review including self-assessments.

3.2.2 Past performance

Over the course of the current licence term, we consider our performance in the SCA of Human Performance Management to meet our internal expectations, and to be very good in general, with a stable trend over time and projected into the future.

This assessment is based on the following key points:

- SRBT first implemented a Training Program that complied with REGDOC-2.2.2 just prior to the licence renewal in 2015; since that time the program has been revised several times in order to drive improvements.
- SRBT has experienced very few safety-significant events that had a root cause in human performance throughout the current licence term.
- Trainee performance has been excellent, with few instances of remedial training being required over time.
- Feedback on training is routinely solicited as part of the program. The majority of feedback from trainees is that they have found the applied training to provide them with information that was understandable, that has helped them to have a better understanding of the subject matter, and could be applied to their job at SRBT.

- CNSC inspections in this area have identified the effective implementation of programmatic requirements and good operating practices. The last inspection in this area took place in 2020, with three compliance actions and two recommendations being put forth, all of which were effectively addressed to the satisfaction of CNSC staff.

- CNSC staff has consistently rated SRBT's performance in this area as 'Satisfactory' each year as part of their Annual Compliance and Performance Report.

3.2.3 Future plans

Going forth, we fully expect to continue to consistently implement and improve our training program, and for it to remain an integrated component of our overall management system. Staff will continue to be trained systematically, in accordance with our program, and qualifications will continue to be maintained through refresher training activities as required.

Through diligent application of our program, we will ensure that our workforce maintains an exemplary level of human performance in all safety-related activities undertaken.

3.2.4 Challenges

We do not anticipate experiencing any challenges relating to the Human Performance Management SCA.

3.2.5 Requests

We do not wish to put forth any specific requests pertaining to the Human Performance Management SCA.

3.3 Operating Performance

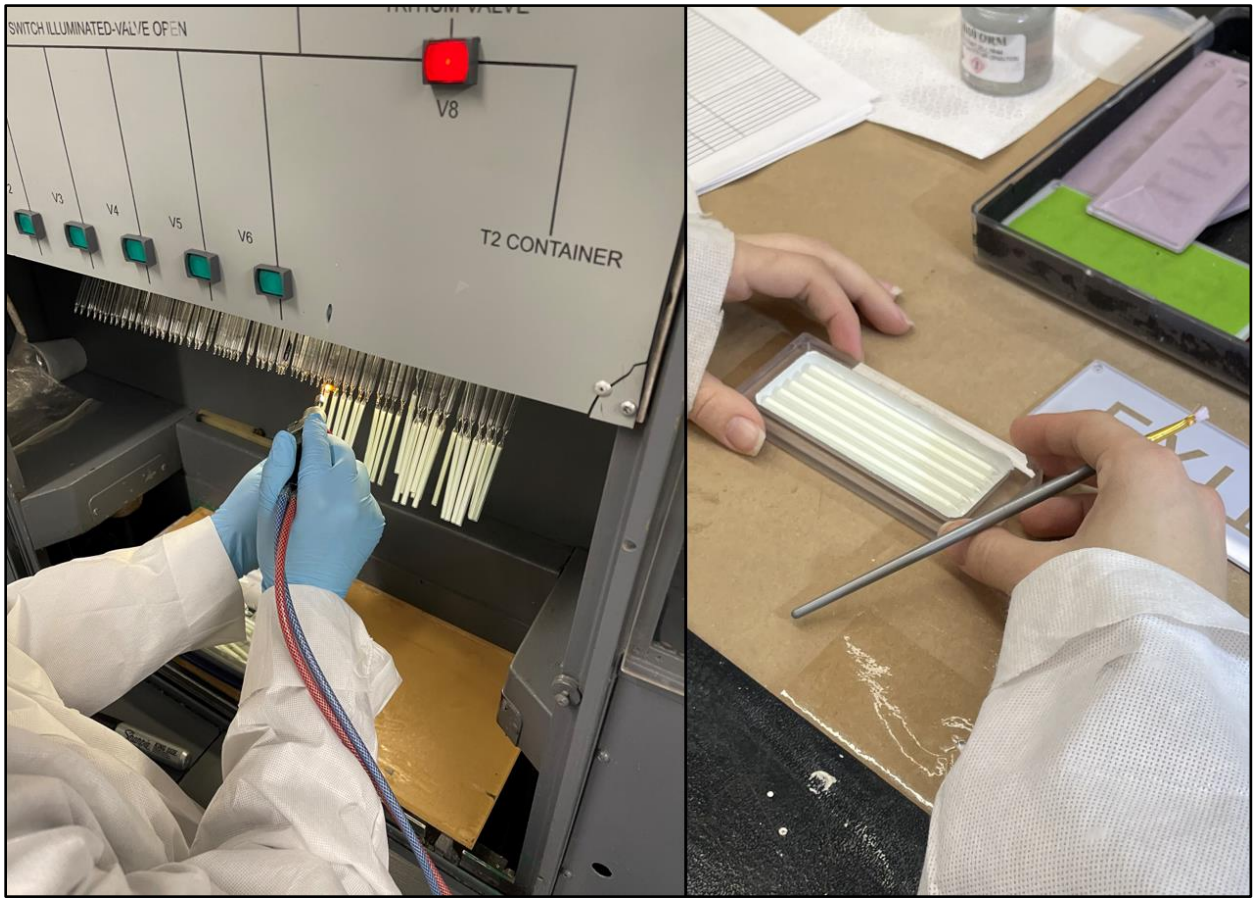


Figure 20: A qualified production technician end-seals gaseous tritium light sources (left); the assembly of a self-luminous aircraft safety sign (right).

The Operating Performance SCA includes a review of the conduct of the licensed activities and the activities that enable effective performance.

3.3.1 Relevance and management

Under licence NSPFOL-13.00/2022, the following activities are authorized, and are safely executed in accordance with the *Nuclear Safety and Control Act* and pursuant regulations:

- operate a Class IB Facility, comprising of a tritium processing facility, at the location referred to in Section II of this licence (hereinafter “the facility”) for the purposes of manufacturing radiation devices;
- produce, possess, transfer, service and use, radiation devices arising from the activities described in (a);
- possess, transfer, use, process, manage, store and dispose of nuclear substances that are required for, associated with, or arise from the activities described in (a);

- the possession of tritium up to a limit of 6,000 terabecquerels of tritium in any form;
- possess, and use prescribed information that is required for, associated with, or arise from the activities described in (a).

All of these activities are conducted in accordance with the SRBT management system, and its documented and controlled processes and procedures.

Throughout the term of the current licence, the SRBT facility achieved an acceptable level of safe operating performance across all SCAs, and continued to effectively develop and improve all aspects of our operations.

A high level of operating performance is promoted at all times, through effective and independent oversight, the adherence to procedures, and by implementing several management-level processes, including routine and periodic management review, safety committee oversight, benchmarking and self-assessments.

3.3.2 Past performance

Compliance with Operating Limits and Conditions

SRBT operates the nuclear facility in compliance with a set of Operating Limits and Conditions (OLCs) that are detailed in the facility *Safety Analysis Report* (SAR). A complete list of OLCs are listed in section 10 of the SAR, which is also available to the public on our website.

Application of these OLCs ensure that SRBT's nuclear processing facility operations remain safe and controlled at all times, with conservative safety margins, both with respect to workers, other persons and the environment.

Throughout the current licence term, SRBT has continued to operate the nuclear facility within the bounds of these OLCs at all times. Each year, a summary of compliance with each individual OLC has been included in SRBT's Annual Compliance Report (ACR), with no noted non-compliances over the course of the licence term.

This includes limits on the amount of tritium possessed by SRBT at any time, as well as limits on the quantity of tritium released to the environment, in any form, through both the gaseous and liquid effluent pathways.

Addendum A2 summarizes data associated with quantitative OLCs over the course of the current licence term (seven years of data), including minima and maxima. As well, statements of compliance with each applicable OLC are included.

Action Level Exceedances

An action level is an indicator of a potential loss of control of part of a program or control measure. Exceeding an action level signals a potential reduction in the effectiveness of the program or control measure, and may indicate a deviation from normal operation.

SRBT implements action levels for radiation protection and environmental protection purposes. These are set to be much lower than licence limits and OLCs, in order to ensure adequate margin for safety in case of an exceedance.

Since the current NSPFOL went into effect on July 1, 2015, there have been no instances where an action level has been exceeded at the SRBT facility.

Current action levels are defined in SRBT's administrative technical document *Licence Limits, Action Levels and Administrative Limits*. The action levels defined within this document were proactively developed in line with the requirements and guidance contained in CSA Standard N288.8-17, *Establishing and implementing action levels for releases to the environment from nuclear facilities*. This document was most recently reviewed and accepted by CNSC staff on August 21, 2019.

Reportable Events

Over the course of the current licence term, SRBT has experienced a small number of events that met the criteria for reporting to CNSC staff. The requirements for reporting events to the Commission and/or CNSC staff are defined in the NSCA, and the criteria for reporting defined in the regulations made pursuant to the NSCA.

SRBT developed and implemented a new program in March 2016, focused on ensuring reports of events were controlled and consistently met compliance requirements. The in-force revision of the *Regulatory Reporting Program* is included with this licence renewal application.

In January 2018, the Commission published REGDOC-3.1.2*, Reporting Requirements, Volume 1: Non-Power Reactor Class I Nuclear Facilities and Uranium Mines and Mills*. This document describes the applicable event reporting requirements for such facilities. SRBT's Regulatory Reporting Program was revised shortly after its publication to ensure compliance with this new REGDOC.

Addendum A3 provides a complete summary of reportable events experienced by the facility, spanning from July 1, 2015 to December 31, 2021.

Event reports made to CNSC staff (except for security-related events) are shared with the public in a dedicated section of our website.

Compliance Inspection Performance

Since the issuance of the current NSPFOL, CNSC staff have performed thirteen compliance inspections focused on several SCAs. No significant nuclear safety-related compliance items were identified during any compliance inspection activity, and all action items have been promptly resolved to the satisfaction of CNSC staff. CNSC inspection reports (except those dealing with security) are shared with the public in a dedicated section of our website.

A summary of the NSPFOL-related inspection activities conducted since issuance of the current licence is provided in Addendum A4. The number of compliance actions issued, and the number of days between the issuance of the inspection report and the closure of the last associated action item is also highlighted.

Annual Compliance and Performance Report Ratings

Throughout the current licence term, CNSC staff has rated SRBT's performance in all applicable SCAs as 'Satisfactory'.

Addendum A5 includes a table illustrating the annual ratings of SRBT's performance by CNSC staff since the licence was renewed in 2015.

Both the SRBT Annual Compliance and Performance Report and CNSC staff's Regulatory Oversight Report are shared with the public, and posted to our website each year once available.

Internal Audits

Throughout the course of the current licence term, SRBT has implemented a comprehensive program of internal audits on all aspects of our processing operations and safety programs.

The position of Compliance Manager has been included as part of our overall organization since 2015. This individual's main responsibility is to perform independent internal audits, and formally report directly to SRBT Senior Management.

Over the last seven calendar years between 2015-2021, a total of 83 internal audits have been completed by the Compliance Manager, or an average of one internal audit every month.

Non-conformance reports (NCR) and opportunities for improvements (OFI) stemming from these audits require managers to develop risk-informed action plans to either address the non-conformances and findings, or to implement the improvement.

As part of the NCR and OFI management system processes, actions are reviewed for effectiveness at an appropriate point in time after implementation, in order to ensure that the cause of any problem or issue has been adequately and successfully addressed.

Management Review

Top Management is responsible to ensure that a comprehensive Management Review exercise is conducted at least annually, in accordance with documented procedures. This review encompasses all aspects of our operations, with a particular focus on the maintenance of safety at all levels of the organization.

SRBT organizational managers conduct benchmarking exercises, in support of the annual Management Review.

Key inputs to the Management Review include, as a minimum:

- A review of the status of actions from previous Management Reviews;
- A review of the Quality Policy for adequacy;
- A review of changes in issues that are relevant to the SRBT management system, both internal and external to the organization;
- A review of the performance and effectiveness of all aspects of the SRBT management system;
- A review of the adequacy of resources;
- A review of the effectiveness of actions taken to manage risks and opportunities; and
- A review of the performance of SRBT Committees.

From this important exercise, decisions and actions are made related to opportunities for performance improvement, changes to the management system, and resourcing, in order to drive continuous improvement at the upper-most level of the organization.

Summary of Annual Production / Utilization Data

Addendum A6 includes data pertaining to the total amount of tritium processed at the SRBT facility in the seven calendar years spanning 2015-2021, as well as data on the ratio between the amount of tritium released to atmosphere as gaseous effluent vs. the amount of tritium processed by the facility. This metric in particular is an excellent indicator of the operating performance of the facility with respect to SRBT's impact on persons and the environment.

Over the course of the current licence term, we consider our performance in the SCA of Operating Performance to meet our internal expectations, and to be very good in general, with a stable trend over time and projected into the future.

This assessment is based on the following key points:

- No instances of operations outside of the bounds of the safety case, as defined by the OLCs.
- Consistent, low levels of tritium emissions throughout the course of the current licence term, and no action level exceedances experienced.
- SRBT has experienced very few safety-significant or reportable events throughout the current licence term, and no reported events resulted in an impact on safety to persons or the environment.

- CNSC inspection activities have consistently identified few non-compliances, and action items have been addressed rapidly and effectively, in accordance with a risk-based approach where appropriate.

- The independent internal audit process has been effective at continually improving all aspects of the organization and operations throughout the course of the current licence term.

- CNSC staff has consistently rated SRBT's performance in this area as 'Satisfactory' each year as part of their Annual Compliance and Performance Report.

3.3.3 Future Plans

Over the next fifteen years, SRBT expects to see either a stable or increasing trend in the amount of tritium processed each year, depending directly on the amount of sales of our self-luminous safety-related product lines. Nonetheless, we also intend to ensure that the ratio of tritium released to atmosphere compared to that processed to remain either stable, or decrease over time.

Throughout the term of any renewed licence, we will ensure that our operating performance is continuously assessed and improved through the application of our management system and adherence to the conditions of our operating licence, our safety programs and the OLCs described in the facility safety analyses.

We will continue to strive to ensure that the frequency and magnitude of any safety-related events are minimized, including reportable events and action level exceedances. We will also continue to work hard toward maintaining our excellent rate of compliance with requirements, as evidenced through both internal and external audits and inspections, including those performed by CNSC staff.

3.3.4 Challenges

We do not anticipate experiencing any challenges relating to the Operating Performance SCA.

3.3.5 Requests

We do not wish to put forth any specific requests pertaining to the Operating Performance SCA.

3.4 Safety Analysis

The Safety Analysis SCA covers maintenance of the analysis that supports the overall safety case for the facility. Safety analysis is a systematic evaluation of the potential hazards associated with the conduct of a proposed activity or facility and considers the effectiveness of preventative measures and strategies in reducing the effects of such hazards.

3.4.1 Relevance and management

The SRBT facility has been in operation since 1990, with various iterations of a facility safety analysis having been developed and documented since operations first began.

The current governing facility-level analysis focused on nuclear safety is captured in the SRBT *Safety Analysis Report* (SAR). The in-force version of the SAR is Revision 4, dated November 2017, representing the primary safety case for the operation of the nuclear processing facility.

The SAR is reviewed and accepted by CNSC staff. It is shared with the public, and made openly available on our website.

In the SAR, several limiting scenarios of accident / emergency are postulated, and the associated dose impacts to members of the public are modelled along with CSA-published dose coefficients for certain categories of persons.

The SAR includes detailed descriptions of:

- The nuclear facility itself, including the location, perimeter, areas, and structures of the nuclear facility, as well as the design and design operating condition of said structures;
- SRBT's approach to safety, and the management of safety in general, including the operational management philosophy, the methods applied to the monitoring and management of safety-related aspects of facility operations, and the promotion of a strong, positive and health safety culture;
- The characteristics of the site, both with respect to the area under the control of SRBT, and the surrounding area;
- The general safety-related design aspects of the facility, including but not limited to:
    - an established safety objective for both normal operations and during worst-case credible accidents or emergencies, where the established non-emergency regulatory limits for worker (50 mSv) and public (1 mSv) radiation doses are not expected to be exceeded;
    - general design principles for ensuring nuclear and radiation safety of the facility; and
    - application of the safety principle of defence-in-depth;

- The equipment and systems that are used for carrying out licensed activities, such as nuclear substance processing, and for the assurance of nuclear and radiological safety, as well as the design and design operating condition of said equipment and systems;

- The complete set of safety analyses for worst-case scenarios / postulated initiating events / hypothetical incident scenarios, including the derivation of the source term released and the associated modelled worst-case doses at several distances away from the facility.

As tabulated below, the SAR concludes that even under the most limiting hypothetical worst-case incident, workers and members of the public are not expected to exceed the effective dose limits prescribed by Section 13 of the *Radiation Protection Regulations* (i.e. non-emergency limits).

HYPOTHETICAL SCENARIO		MAXIMUM DOSE (mSv)	RECEPTOR	DISTANCE FROM SRBT (m)
A	Release of the entire contents of a tritium trap ('pyrophoric unit')	0.0337	Member of the public	99
B	Release of the entire contents of a bulk container	0.304	Member of the public	99
C	Release from a tornado	0.140	Member of the public	100
D	Release from impact of a large rogue vehicle	0.180	Member of the public	99
E	Smoldering fire within the controlled area of the facility	9.28	Staff	
F	Release from breakage during handling	3.95	Staff	
G	Release from breakage during packing	3.02	Staff	

Table 1: Maximum calculated effective doses in worst-case scenarios in SRBT Safety Analysis Report.

3.4.2 Past performance

Over the course of the current licence term, we consider our performance in the SCA of Safety Analysis to meet our internal expectations, and to be very good in general, with a stable trend over time and projected into the future.

We have continued to update and maintain the facility safety analysis in accordance with the conditions of our operating licence and LCH. The SAR underwent a major revision in both format and content in 2017, with significant improvements in the level of descriptive detail of the facility and the safety case itself, as well as enhanced application of modelling in worst-case accident scenarios.

The set of OLCs described in the SAR have been applied and effectively adhered to through the term of the current licence, ensuring both safe operations and the minimization of any impact to both workers and members of the general public at all times.

The SAR represents the primary overall safety case for the operation of the SRBT nuclear substance processing facility; however, there are several other supporting safety analyses that have been developed with respect to specific aspects of the facility, in line with regulatory requirements and expectations in other SCAs.

These supporting safety analyses include:

- Derived Release Limits (SCA – Environmental Protection)
- Environmental Risk Assessment (SCA – Environmental Protection)
- Comprehensive Report – Groundwater Studies (SCA – Environmental Protection)
- Fire Hazard Assessment (SCA – Fire Protection and Emergency Management)
- Conditional Clearance Levels (SCA – Waste Management)

Each of these analyses are addressed in the appropriate section of this CMD.

A Safety Analysis Review Process is incorporated as part of the overall SRBT management system, and the consideration of the impact on SRBT safety analysis is integrated as a component part of our overall change control processes

CNSC staff has consistently rated SRBT's performance in this area as 'Satisfactory' each year as part of their Annual Compliance and Performance Report.

3.4.3 Future plans

In accordance with our current LCH, the SAR is due to be reviewed and revised by the end of 2022. This review will be done against the requirements of IAEA document SSR-4, *Safety of Nuclear Fuel Cycle Facilities,* as well as CNSC Regulatory Document (REGDOC)-2.4.4, *Safety Analysis for Class IB Facilities.* As of the end of 2021, this REGDOC has not yet been published; however, it is expected that it will be published in 2022.

The revised SAR will be submitted to CNSC staff in advance of implementation, as per the change control processes described in any in-force operating licence and LCH at that time.

As well, all supporting safety analyses will be reviewed and revised in accordance with regulatory requirements or expectations, or as warranted by any changes in the conditions upon which these analyses were based.

3.4.4 Challenges

We do not anticipate experiencing any challenges relating to the Safety Analysis SCA.

3.4.5 Requests

We do not wish to put forth any specific requests pertaining to the Safety Analysis SCA.

3.5 Physical Design

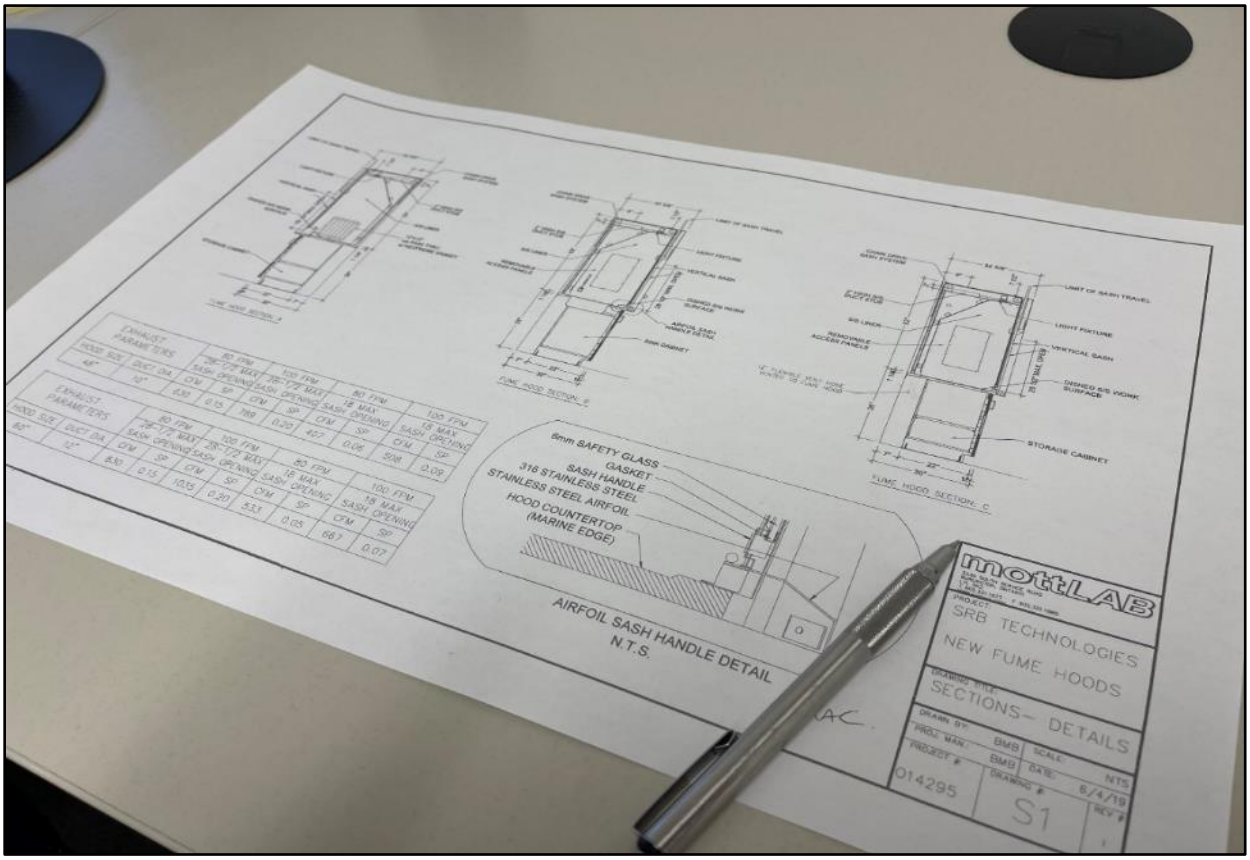


Figure 21: Drawings of replacement ventilated cabinets being reviewed before procurement as part of SRBT Design Control processes. Key vented cabinetry was replaced in the facility in 2019.

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

3.5.1 Relevance and management

SRBT implements a suite of processes aimed at ensuring the control of all physical design aspects of the structures, systems and components (SSC) associated with licensed activities.

Procedures are maintained and implemented which describe requirements associated with design planning, design inputs, design control, design outputs, and changes to designs.

Change control procedures require design control considerations to be evaluated for each instance of physical change to both SSCs and product specifications.

As well, stand-alone engineering procedures are defined, focused on ensuring adequate controls at each life-cycle stage for SSCs, including research and development, commissioning, turnover, and decommissioning.

3.5.2 Past performance

Over the course of the current licence term, we consider our performance in the SCA of Physical Design to meet our internal expectations, and to be very good in general, with a stable trend over time and projected into the future.

This assessment is based on the following key points:

- The SSCs that comprise the SRBT nuclear processing facility are well characterized and designed for purpose and safe facility operations. The design basis of all nuclear safety-related equipment is well understood and maintained by the organization effectively.
- Our change control process has continuously been implemented effectively throughout the course of the current licence term, and all physical design changes and new SSCs have undergone comprehensive review in accordance with this process, as well as the supporting set of engineering processes where appropriate.
- The consideration of the physical design impact of any change is integrated as a component part of our overall change control processes.
- CNSC staff has consistently rated SRBT's performance in this area as 'Satisfactory' each year as part of their Annual Compliance and Performance Report.

3.5.3 Future plans

Going forth, we expect to continue to ensure integrated control over the physical design of all safety-related SSCs at the facility through the application of our design control processes, as part of the continued implementation of our overall management system.

We do not currently have any plans for expansion of the nuclear-related footprint of the facility; however, we will continue to assess potential improvements to all SSCs over time, in accordance with the principle of continual improvement.

3.5.4 Challenges

We do not anticipate experiencing any challenges relating to the Physical Design SCA.

3.5.5 Requests

We do not wish to put forth any specific requests pertaining to the Physical Design SCA.

3.6 Fitness for Service

The Fitness for Service SCA covers activities that impact the physical condition of structures, systems and components to ensure that they remain effective over time. This area includes programs that ensure all equipment is available to perform its intended design function when called upon to do so.

3.6.1 Relevance and management

Maintenance Program

As described in the SAR, the SRBT nuclear substance processing facility consists of a number of structures, systems and components that are designed to process tritium, manufacture gaseous tritium light sources, and ensure safety of workers, members of the public and the environment.

In order to ensure that important SSCs are kept fit for service, SRBT implements a comprehensive *Maintenance Program*, including procedures focused on the control and effective execution of all maintenance activities on site. The scope of the program includes all safety-related SSCs, as well as critical equipment which supports the continuity of key business processes. The program was last revised and accepted by CNSC staff in 2019.

The program describes how corrective maintenance, preventive maintenance, and SSC monitoring are performed. Requirements for the conduct of work assessment, planning, scheduling and execution of the maintenance activities are defined, as well as for post-maintenance testing and verification.

The program has been designed in consideration of the guidance contained in CNSC REGDOC-2.6.2, *Maintenance Programs for Nuclear Power Plants*, with many concepts and elements having been incorporated into the program using a graded approach.

Processes are in place for the management of a master equipment list and critical spare parts, which are both typical elements of maintenance programs implemented by Class 1A nuclear facilities, that SRBT has chosen to integrate into its program as a best practice.

Maintenance Committee

A committee focused solely on the management and execution of maintenance activities at the facility continues to actively oversee and improve all aspects of the program. The meets frequently throughout the year to ensure maintenance-related issues are resolved, and the program is implemented effectively.

As with many other committees, the Maintenance Committee includes staff at all levels of the organization, helping to facilitate a better understanding of any issues at hand, as well as promoting a positive safety culture with respect to maintenance at the facility.

Management of Maintenance Contractors

Maintenance is performed both in-house by qualified and authorized members of the internal organization, and by qualified contracted third parties where necessary. Where contractors are used for on-site maintenance activities, controls are implemented to ensure their safety with respect to radiological and conventional hazards.

SRBT does not routinely deploy contract staff for dose-intensive work, as is typical at nuclear power stations. During the current licence term, no contract worker has incurred a significant effective dose from exposure to ionizing radiation while working at the facility.

Contract workers who may be exposed to a radiological hazard undergo screening bioassay testing, and there have been no instances of a recordable effective dose during the current licence term.

Where warranted, contractors that frequently service facility SSCs obtain elevated security clearances, as per the SRBT Security Program. These contractors can then be authorized to work more independently in the facility where appropriate, subject to oversight and control from their assigned contact / project manager.

3.6.2 Past performance

Over the course of the current licence term, we consider our performance in the SCA of Fitness for Service to meet our internal expectations, and to be very good in general, with a stable trend over time and projected into the future.

This assessment is based on the following key points:

- All safety-related SSCs have functioned well throughout the current licence term, and there have been no significant failures of equipment directly related to the inadequate application of our Maintenance Program.
- We have no backlog of preventive maintenance activities. These activities have been performed routinely and on-time throughout the duration of the current licence term, with very few instances of deferral.
- The Maintenance Program incorporates aspects of programs used by nuclear power plants, such as keeping a master equipment list and an inventory of critical spare parts.
- Contractors continue to be used where needed, and the work controls put in place for these members of the public have effectively protected them from all hazards while working in the facility.
- CNSC staff has consistently rated SRBT's performance in this area as 'Satisfactory' or 'Fully Satisfactory' each year as part of their Annual Compliance and Performance Report.

3.6.3 Future plans

Going forth, we fully expect to continue to consistently implement and improve the Maintenance Program, and for it to remain an integrated component of our overall management system.

Through diligent application of our program, we will ensure the continued effectiveness of all facility SSCs during all phases of operations.

The program will be updated as new requirements and guidance are developed and published, and in accordance with applicable industry best practices.

3.6.4 Challenges

We do not anticipate experiencing any challenges relating to the Fitness for Service SCA.

3.6.5 Requests

We do not wish to put forth any specific requests pertaining to the Fitness for Service SCA.

3.7 Radiation Protection

Figure 22: A member of the SRBT Health Physics Team conducts a removable contamination assessment of packages being readied for transport.

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

3.7.1 Relevance and management

Radiation Protection Program

All aspects of operational radiation protection are described in and controlled by our Radiation Safety Program.

This management system safety program defines the composition of the internal organization responsible for ensuring the program is implemented (the Health Physics Team), how the ALARA principle is applied at the facility, how dose due to ionizing radiation is quantified and controlled, and how radiation hazards such as contamination are monitored, limited and managed.

The Manager – Health Physics and Regulatory Affairs leads the Health Physics Team, and is responsible for ensuring that the design of the Radiation Safety Program meets requirements, and that the program is implemented in accordance with associated procedures.

The Health Physics Team acts to ensure all procedures are executed, and effective doses to workers are maintained ALARA.

Action Levels for Radiation Protection

As part of the Radiation Safety Program, SRBT has put in place several radiation protection-related action levels.

Action levels are defined in terms of both effective doses and the internal concentration of tritium in workers, as a multi-layered control measure. Action levels are subdivided into specific work areas where appropriate, and consideration is made for pregnant nuclear energy workers.

These action levels were last reviewed and revised in 2019 as part of the five-year review cycle outlined in our LCH. They were revised in line with the guidance outlined in CSA standard N288.8-17, *Establishing and implementing action levels for releases to the environment from nuclear facilities,* as well as what was at the time a draft REGDOC-2.7.1, *Radiation Protection*.

Over the term of the current operating licence, no radiation protection-related action level has been exceeded, indicating an acceptable level of control over the hazard associated with the nuclear substances and activities authorized by our operating licence.

Radiation Dose Control

Effective doses of ionizing radiation are routinely incurred by workers at SRBT, primarily via intake of tritium oxide.

Over the course of the current licence period, the effective doses to SRBT workers have remained very low compared to regulatory limits.

Effective doses to workers are calculated using data obtained by monitoring tritium concentrations using bioassay testing (urinalysis). These activities are performed in line with SRBT's Dosimetry Services Licence 11341-3-28.4, issued by CNSC staff, as well as our Dosimetry Service Program.

Addendum A7 includes key statistical data pertaining to the effective dose incurred by SRBT nuclear energy workers (NEW) in the past seven calendar years, since the current licence term began.

It is worthwhile to note that during the current licence term, no SRBT NEW has incurred an effective dose that exceeded 1 mSv in any calendar year, a value which represents the limit for any person who is not a NEW, as defined in Section 13 of the *Radiation Protection Regulations*. This is a notable achievement for a Class I nuclear facility.

Radiation Detection Instrumentation

As part of the Radiation Safety Program, SRBT deploys several instruments for the routine detection of radiation and radiological contamination, including liquid scintillation, stationary and portable tritium-in-air monitors, and special-purpose, portable alpha/beta- and gamma-detecting instruments. Tritium-in-air monitors are located in strategically selected areas of the facility in order to ensure proper hazard control, and to keep exposures ALARA.

Figure 23: A tritium-in-air monitor (left) continuously samples air in the Shipping and Receiving Area, in order to alert staff in case of an upset condition. Beneath the monitor, a passive air sampler is mounted, to determine the lower-level, chronic concentration of tritium in the working environment over time. Portable tritium-in-air monitors (right) are also available for use throughout the facility.

Both stationary and portable tritium-detecting instruments are only used by trained and qualified workers, and the instruments are calibrated and maintained in accordance with applicable regulatory requirements and dedicated procedures. During the current licence term, SRBT has invested over $500,000 in equipment for the detection and quantification of tritium.

Contamination and Hazard Control

In order to limit the spread of radioactive contamination within and from the site of licensed activity, SRBT implements a comprehensive program of contamination assessment as part of the Radiation Safety Program.

Using a defense-in-depth approach, a high degree of contamination control is routinely achieved. The SRBT facility is divided into three radiological safety zones, based upon the level of radiological hazards associated with the work in each area, and upon the contamination controls in place. Each individual zone has specific controls in place for the protection of personnel from the hazards associated with radiation.

The requirements for the wearing of personal protective equipment and clothing are defined in accordance with the particular zone in which the work is to be performed. Persons moving from a higher ‘active’ zone (Zone 2 or 3) into Zone 1 must follow a specific procedure for removing articles of protective clothing, traversing a physical ‘barrier’ which acts as a buffer zone, and proceeding to thoroughly wash their hands.

In the areas where nuclear substances are processed, controlled and monitored air handling systems provides negative-pressure ventilation, in order to ensure any fugitive tritium gas is removed from the area, minimizing the hazard to workers.

Finally, routine contamination monitoring is conducted by the Health Physics Team, in order to characterize the amount of contamination that is present at any given time, and to drive ALARA-focused decontamination efforts where necessary.

Items that are removed from ‘active’ zones are assessed for contamination prior to being released to the ‘inactive’ areas of the facility. As well, all shipments of goods containing nuclear substances are assessed for contamination prior to offering for shipment and transport, in accordance with the *Packaging and Transport of Nuclear Substances Regulations*.

Measurements of tritium in various samples, including contamination swipes, are performed using liquid scintillation counters.

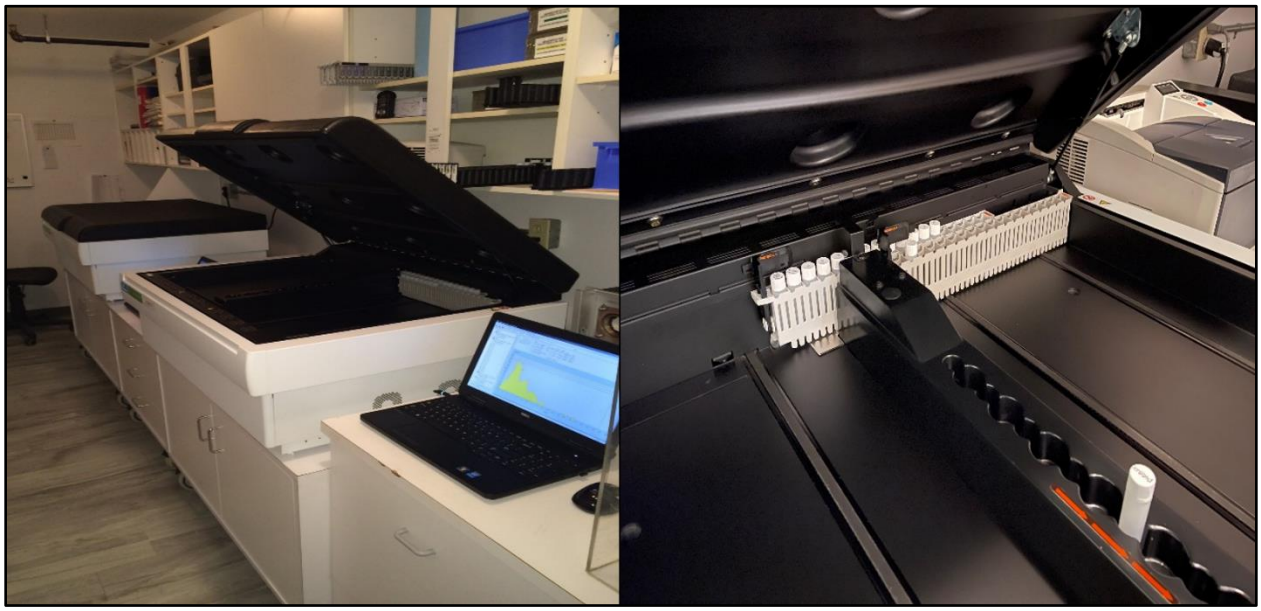


Figure 24: Liquid scintillation counters are used extensively to routinely quantify tritium in various sample types, in support of multiple safety programs.

Two liquid scintillation counters are in use at the facility, and are used by the Health Physics Team in support of various processes under the Radiation Safety Program, the Dosimetry Services Program, the Environmental Monitoring Program, Effluent Monitoring Program, Groundwater Monitoring Program, and the Waste Management Program.

3.7.2 Past performance

Over the course of the current licence term, SRBT considers its performance in the SCA of Radiation Protection to meet our internal expectations, and to be very good in general, with a stable trend over time and projected into the future.

This assessment is based on the following key points:

- Radiation doses to employees have been maintained exceptionally low for a Class I nuclear facility, with no instance of an employee exceeding 1 mSv in any calendar year throughout the term of the current licence.

- Radiation hazards have consistently been well controlled, with very good performance in both monitoring the hazards, and ensuring that they are reduced or eliminated in line with the ALARA principle.

- The Radiation Safety Program and associated procedures have been continuously improved and maintained over the course of the current licence term.

- CNSC inspection activities have consistently identified few non-compliances in the area of Radiation Protection, and action items have been addressed rapidly and effectively, in accordance with a risk-based approach where appropriate.

- The latest CNSC inspection focused on the area of Radiation Protection at SRBT (in October 2020) did not identify any areas of non-compliance nor put forth any recommendations. The inspection team concluded that they "… found the licensee to be in compliance with the inspection criteria, and therefore no compliance actions or recommendations were raised as part of this inspection".

- CNSC staff has consistently rated SRBT's performance in this area as 'Satisfactory' each year as part of their Annual Compliance and Performance Report.

3.7.3 Future plans

Going forth, we fully expect to continue to consistently implement and improve our Radiation Safety Program, and for it to remain an integrated component of our overall management system.

We will continue to strive to maintain effective doses to our workers ALARA, and to ensure continued control over the hazard at all times. The continued adherence to the requirements of our Radiation Safety Program, our Dosimetry Services Licence and the associated program and processes, will ensure that effective dose data is accurate and precise, providing confidence in our overall approach to radiation protection at the facility.

The program will be updated as new requirements and guidance are developed and published, and in accordance with applicable industry best practices. Comprehensive self-assessments, benchmarking exercises and internal audits will drive continual improvement, in accordance with the requirements of the *Radiation Protection Regulations* and the principles described in CSA standard N286-12.

3.7.4 Challenges

We do not anticipate experiencing any challenges relating to the Radiation Protection SCA.

3.7.5 Requests

We do not wish to put forth any specific requests pertaining to the Radiation Protection SCA.

3.8 Conventional Health and Safety

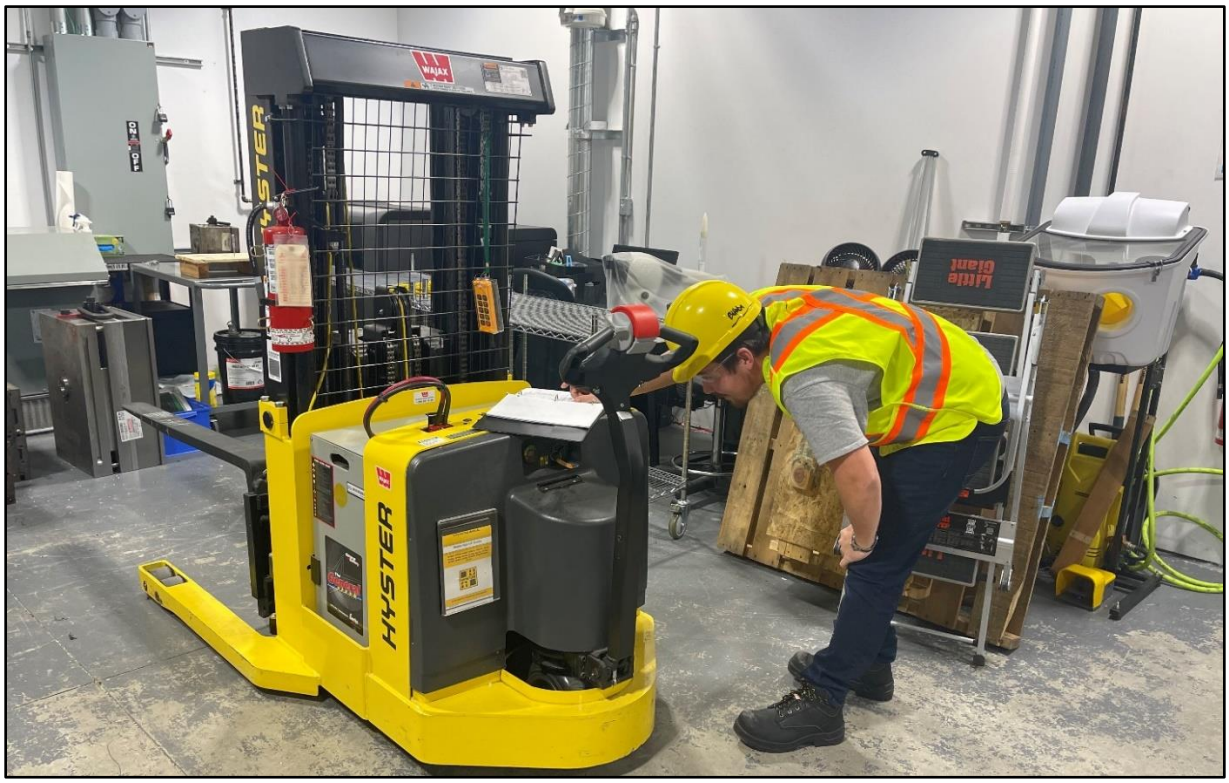


Figure 25: A qualified operator conducts and records pre-job checks of an electric forklift used in support of SRBT's plastics molding processes.

The Conventional Health and Safety SCA covers the implementation of a program to manage workplace safety hazards and to protect personnel and equipment.

3.8.1 Relevance and management

SRBT is subject to the conventional health and safety provisions of the *Canada Labour Code* (CLC) and the *Canada Occupational Health and Safety Regulations*.

In order to ensure a safe and compliant workplace is maintained at all times, and during all activities, SRBT implements a conventional health and safety program that includes the Health and Safety Policy, the Hazard Prevention Program, and several Health and Safety procedures.

The implementation and maintenance of these programs are the responsibility of the Manager – Safety and Security. The Health and Safety Policy and Hazard Prevention Program represent the top tier of SRBT's worker health and safety policies and procedures.

In accordance with Section 135 of the CLC, Part II, SRBT has established a Workplace Health and Safety Committee. This Committee consists of both management and employee representatives, who work to ensure that all aspects of the program are carried out effectively and that requirements of the CLC, the regulations pursuant to the CLC, and the conventional health and safety aspects of the NSPFOL are identified, understood and complied with by the organization.

3.8.2 Past performance

SRBT has effectively maintained a very low rate of workplace injuries and lost-time incidents throughout the term of our current licence.

A workplace injury is defined as an injury which required first aid treatment on-site, at a minimum. Examples of such injuries may include a minor cut which required application of a self-adhesive bandage, a minor burn to the skin of the hand, or a muscle strain relating to a work activity. A lost-time incident is an injury which resulted in the worker missing scheduled work.

Key statistical data pertaining to these conventional health and safety metrics over the course of the current licence term can be found in Addendum A8.

Over the course of the current licence term, we consider our performance in the SCA of Conventional Health and Safety to meet our internal expectations, and to be very good in general, with a stable trend over time and projected into the future.

This assessment is based on the following key points:

- The rate of workplace injuries and lost-time incidents has been maintained very low, and there have been no incidents of significant or disabling injury to workers at SRBT throughout the current licence term.

- The Workplace Health and Safety Committee has continued to monitor and improve the program of conventional health and safety assurance, and all reports to the applicable federal regulatory body having jurisdiction (i.e. Employment and Social Development Canada (ESDC)) have been made with no identified issues.

- CNSC inspection activities have consistently identified few non-compliances in the area of Conventional Health and Safety, and action items have been addressed rapidly and effectively, in accordance with a risk-based approach where appropriate.

- Officers with the ESDC conducted an unannounced inspection of the SRBT facility in 2017, and assessed the documentation comprising the required health and safety program, and the conduct of the Workplace Health and Safety Committee. The inspection activity did not identify any findings or concerns, and several positive findings and best practices were noted at the exit meeting.

- CNSC staff has consistently rated SRBT’s performance in this area as either ‘Fully Satisfactory’ or ‘Satisfactory’ each year as part of their Annual Compliance and Performance Report.

3.8.3 Future plans

We fully expect to continue to ensure an excellent level of conventional health and safety for all workers through the consistent implementation of our program, policies and procedures in this area.

The frequency and severity of workplace incidents and injuries will remain minimized, and a continual focus on proactively identifying potential hazards, and improving our protection measures will remain in place.

Our conventional health and safety programs will be updated as new requirements and guidance are developed and published, and in accordance with applicable industry best practices. Comprehensive self-assessments, benchmarking exercises and internal audits will drive continual improvement, in accordance with the principles described in CSA standard N286-12.

3.8.4 Challenges

We do not anticipate experiencing any challenges relating to the Conventional Health and Safety SCA.

3.8.5 Requests

We do not wish to put forth any specific requests pertaining to the Conventional Health and Safety SCA.

3.9 Environmental Protection

Figure 26: SRBT Health Physics Team member sampling aquatic vegetation from the Muskrat River near the facility (left); samples acquired from areas within the Indigenous community of Pikwakanagan in 2020 (right).

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

3.9.1 Relevance and management

As a major sub-component of the overall facility management system, SRBT implements a comprehensive Environmental Management System (EMS) that encompasses all aspects of the protection of the environment from the impact of routine facility operations.

The EMS is comprised of several levels of management system documents and technical assessments, all of which are based upon CSA standards in the N288-series. The governing document in the system is the Environmental Management System; the documented structure of the complete SRBT EMS is pictographically represented in Figure 27.

The Manager – Health Physics and Regulatory Affairs is responsible for ensuring that the design of the EMS, and all subordinate components, meet regulatory requirements, and that the system and programs are implemented accurately. Qualified members of the Health Physics Team act to ensure all procedural activities are executed.

The implementation of the EMS and its associated protection and monitoring programs ensures that SRBT is continuously making adequate provision for the protection of the environment and the health and safety of persons.

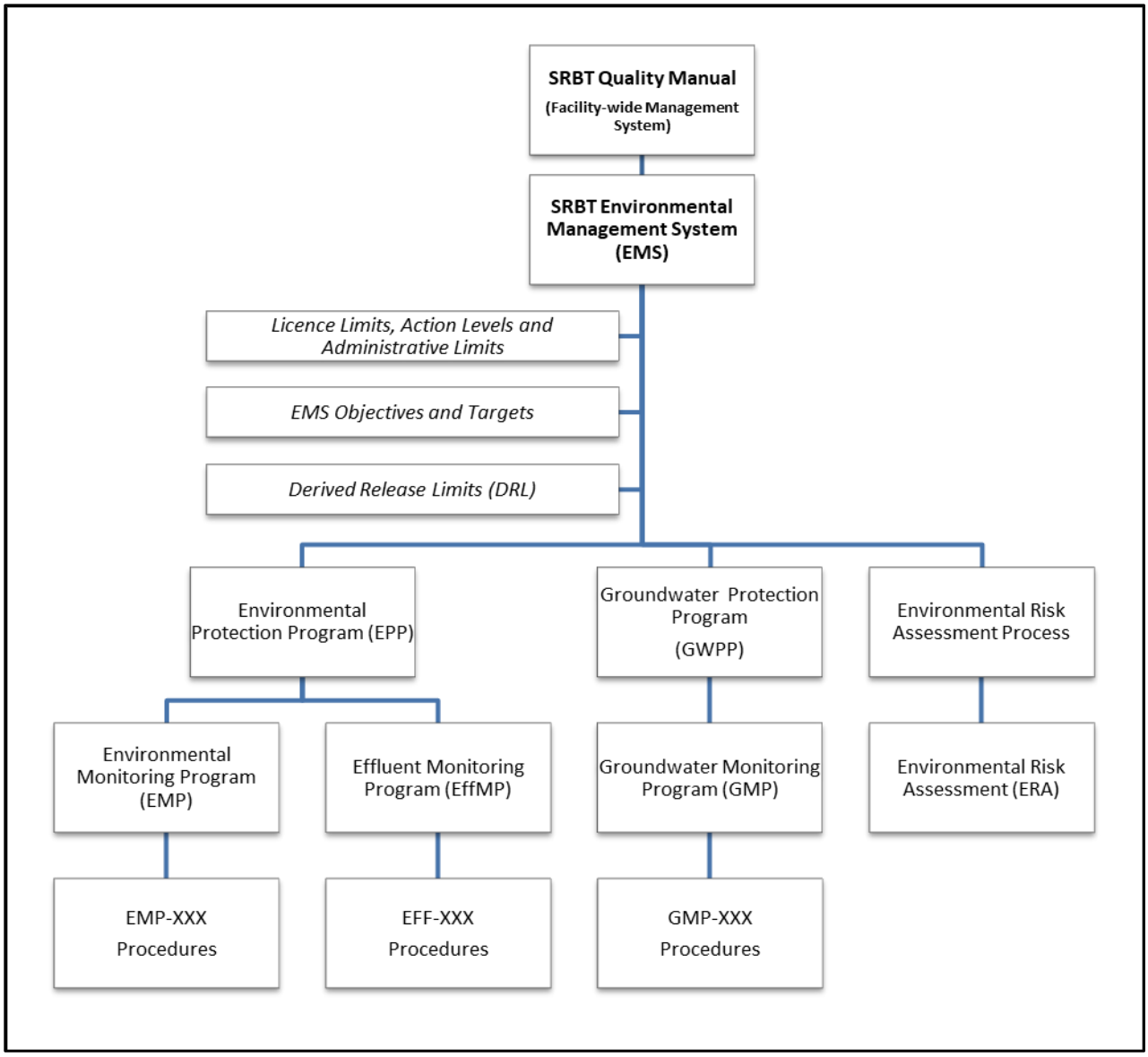


Figure 27: SRBT Environmental Management System document hierarchy.

Environmental Risk Assessment

In December 2020, SRBT completed and submitted the first Environmental Risk Assessment (ERA), in line with the requirements and guidance of CSA N288.6-12, *Environmental risk assessments at Class I nuclear facilities and uranium mines and mills*. After receiving and addressing comments from CNSC staff, the ERA was formally accepted in April 2021, and has been published on SRBT's website for public access.

The ERA systematically identifies stressors and contaminants of potential concern that may be introduced in significant amounts through the routine operation of the facility. The associated risks to both humans and ecological components are derived for significant contaminants and stressors.

In 2020, members of the Indigenous community of Pikwakanagan assisted our team with vegetation and environmental sampling activities in their community, in support of the ERA. We have continued to collaborate with the Pikwakanagan community as we have implemented the recommendations from the initial ERA report, which included the conduct of confirmatory sampling in the area.

The risks are contrasted against established benchmark values to determine significance, and various recommendations and conclusions are put forth to effectively manage these risks, and improve upon the understanding of the environmental aspects of the facility.

The ERA and its conclusions and recommendations form a key input in the design of the EMS monitoring and protection programs, as part of a continuous cycle of improvement and refinement. The entire set of EMS-related programs were updated to reflect the completion of the ERA in July 2021.

The ERA concluded that our facility has operated, and continues to operate, in a fashion that is fully protective of human and ecological receptors in the surrounding area. The conservatively-derived levels of risk are acceptably low to both human and ecological receptors, and are projected to remain acceptably low with continued routine operations.

Derived Release Limits (DRL)

The sole significant radionuclide released into the environment during routine facility operations is tritium, in the form of both tritium oxide and elemental / molecular tritium gas.

Gaseous tritium oxide and elemental tritium are released via the active ventilation systems that service the processing areas of the facility. These systems are monitored, and the amount of tritium released in both forms is quantified weekly, and reported to CNSC staff annually.

The amount of tritium that, if released in any given calendar year, could result in an effective dose exceeding the regulatory limit of 1 mSv for any person who is not a NEW (i.e. a member of the public) is derived using standard methods, and compiled in a report titled *Derived Release Limits for the SRB Pembroke Facility*. The latest version of this report was submitted to CNSC staff in November 2021.

Licence Limit for Atmospheric Releases

It is important to note that the limits applied to SRBT atmospheric tritium releases are NOT directly linked to the calculated DRL.

Instead, the current licence limits for atmospheric tritium releases have been set to be orders of magnitude lower than the DRL, in line with the goal of protection of the environment - most specifically groundwater. SRBT proposes no change to these limits for any renewed operating licence.

For comparison, the following table juxtaposes the most recent DRL for tritium oxide from SRBT, against the current licenced release limit, expressed as a percentage:

NUCLEAR SUBSTANCE	LICENCE LIMIT (Bq/year)	DERIVED RELEASE LIMIT (Bq/year)	LICENCE LIMIT / DERIVED RELEASE LIMIT
Tritium Oxide	6.72E+13	5.62E+15	1.2 %

Table 2: Comparison of Licenced Atmospheric Release Limit and Derived Release Limit for tritium oxide.

Licence Limit on Releases of Tritium to Sewer

Releases of water-soluble tritium to the municipal sewer via liquid effluent pathways are limited to the amounts described in the operating licence and its associated LCH.

The current limit for these releases is 200 GBq per year, and SRBT proposes no change to this limit for any renewed operating licence. The technical basis of the licence limit is that it is set to be one-fifth (20%) of the recommended limit in Table IV of IAEA-TECDOC-1000, *Clearance of materials resulting from the use of radionuclides in medicine, industry and research* - a value that is designed to limit the dose to a hypothetical worker at the sewage treatment plant to 2 µSv or less in a year.

As part of the process of conducting the ERA, the conservatively-calculated effective dose to the maximally-exposed worker at the Pembroke Pollution Control Centre is less than 0.1 µSv per year. This dose is based both on modelling conducted as part of the ERA, as well as on recent direct measurements of radiological conditions at that facility.

Action Levels for Environmental Protection

As part of the EMS, SRBT has put in place several environmental protection-related action levels. These action levels were last reviewed and revised in 2019 as part of the five-year review cycle outlined in our LCH. They were revised in line with the guidance outlined in CSA standard N288.8-17*, Establishing and implementing action levels for releases to the environment from nuclear facilities*.

Action levels are defined in terms of the amount of tritium released in gaseous form per week, the amount of tritium released to sewer per day, and an upper bound for the concentration of gaseous tritium in the active ventilation system over any given period of ten minutes.

Over the term of the current operating licence, no environmental protection-related action level has been exceeded, indicating an acceptable level of control over the release of nuclear substances associated with the activities authorized by our operating licence.

EMS Protection and Monitoring Programs

SRBT implements a series of protection and monitoring programs as component parts of the EMS, all of which are aimed at ensuring the protection of all environmental components around the facility, and the management and minimization of any associated risks.

The Environmental Protection Program (EPP) ensures the protection of the environment by establishing the framework upon which releases of tritium are controlled, minimized, monitored at the source, and monitored in the environment.

Subordinate to the EPP are two monitoring programs that ensure quality data is gathered routinely on releases of tritium from the facility, in order to demonstrate compliance and support risk management activities.

The Effluent Monitoring Program (EffMP) describes how releases are monitored at the point of release, and establishes a series of programmatic objectives. The program is designed in compliance with the requirements of CSA standard N288.5-11, *Effluent monitoring programs at Class I nuclear facilities and uranium mines and mills*.

Figure 28: Equipment used to continuously monitor and measure gaseous releases of tritium through the active ventilation systems.

The Environmental Monitoring Program (EMP) describes how the behaviour of tritium is monitored in the surrounding environment, and establishes a series of programmatic objectives. The program is designed in compliance with the requirements of CSA standard N288.4-10, *Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills*.

The Groundwater Protection Program (GWPP) ensures the protection of the quality of groundwater resources near the facility, by establishing the framework for minimizing the interaction of tritium with aquifers, and ensuring the groundwater conditions are continuously monitored and assessed over time.

Subordinate to the GWPP is the Groundwater Monitoring Program (GMP), which describes the processes by which groundwater resources are monitored for tritium concentration, and establishes a series of programmatic objectives. Both the GWPP and the GMP are designed in compliance with the requirements of CSA standard N288.7-15, *Groundwater protection programs at Class I nuclear facilities and uranium mines and mills*.

The responsibility for the implementation of all of the above programs rests with the Manager – Health Physics and Regulatory Affairs. The Health Physics Team supports the implementation of the detailed procedures subordinate to the EffMP, EMP and GMP, ensuring that the objectives of the programs, and the ultimate protection of the environment, are assured during routine facility operations.

Data generated by these monitoring programs is subject to review, assessment and independent verification at several points. The data is reviewed for quality, accuracy, and for any adverse or noteworthy trends before being accepted in-house.

In the case of gaseous effluent monitoring, the report is assessed by multiple members of the organization each week, including the Health Physics Team, department supervisors who oversee tritium processing, and Top Management.

In addition, annual independent third-party comparison exercises within all three EMS monitoring programs consistently demonstrate high precision and accuracy of measurements, and excellent program performance.

The Mitigation Committee meets frequently to review effluent and environmental data, contrast the data against in-house objectives and targets, and consider any operational aspects that could be changed or improved in order to achieve organizational goals of minimizing the effect of operations on the environment.

Finally, a comprehensive report is furnished to CNSC staff as part of the Annual Compliance Reporting cycle, where the requirements described in applicable CSA N288-series standards are met each year, and an assessment of the effective dose to members of the public is completed.

Shift from Third-Party to In-House Monitoring

Over the course of the current licence, we have increased our capacity to accurately and precisely conduct environmental and groundwater monitoring activities. At the beginning of the licence term, the majority of monitoring and analysis was conducted on behalf of SRBT by qualified third-party contract laboratories.

In 2017, we conducted an intercomparison exercise to establish our capacity to perform groundwater sample analyses with an acceptable level of quality, accuracy and precision. Water was sampled from wells, and then analysed by SRBT and the qualified third-party. Results were very comparable and well within acceptance criteria.

As such, the GMP and associated procedures were revised to incorporate in-house monitoring and analysis of groundwater as part of routine activities. Since September 2017, SRBT has performed all routine groundwater monitoring, with results that meet stringent standards for quality control.

An annual intercomparison exercise between SRBT and a qualified, independent third-party laboratory continues to be conducted, adding further confidence in the groundwater results generated by the program.

In the second quarter of 2020 with the onset of the global COVID-19 pandemic, the independent third-party laboratory notified us that there would be an interruption to certain environmental monitoring services that they routinely provided to our facility.

As a result, our team pivoted and worked to develop and implement procedures for the conduct of monitoring air concentrations, precipitation and river water near the facility. New laboratory protocols were designed to ensure that an adequate minimum detectable activity could be achieved for all media sampled as part of this program.

The project was successful, and the decision was made to permanently shift these monitoring activities in-house in May 2020. The procedures and protocols have been continuously improved as more experience has been gained, allowing faster turnaround time and more control over the processes.

All results are subject to quality control checks at each stage, ensuring confidence in the data. As with the groundwater monitoring program, an intercomparison exercise between SRBT and a qualified, independent third-party laboratory is conducted each year, adding further confidence in the environmental monitoring results generated by the program.

Qualified independent third-party laboratories continue to analyse residential and business well water, as well as non-aqueous sample materials, including milk, produce, and sludge cake from the Pembroke Pollution Control Centre. SRBT has limited in-house capacity to perform quantitative analysis of non-aqueous sample types where very low minimum detectable activities are called for.

Looking forward into the next few years, the Health Physics department has begun to research and plan for expansion of SRBT liquid scintillation counting laboratory processes, in order to provide the capacity and ability to analyse all environmental sample types for tritium and organically-bound tritium, including those sample analyses currently provided by third-parties.

3.9.2 Past performance

Our performance in the area of Environmental Protection has been excellent throughout the term of the current licence. As discussed below, all environmental metrics are trending positively over time, and our programs, processes and risk assessments have been continuously improved and expanded.

CNSC staff has consistently rated SRBT's performance in this area as 'Satisfactory' each year as part of their Annual Compliance and Performance Report. The last focused and comprehensive compliance inspection conducted by CNSC staff in this safety and control area resulted in zero compliance actions or recommendations, confirming a very high level of performance.

Environmental Protection, Effluent Monitoring and Public Dose

The key environmental metrics for the 2015-2021 time period include:

- Annual releases to atmosphere (including % of limit),
- Ratio of atmospheric tritium releases and amount of tritium processed in a calendar year,
- Annual releases to sewer (including % of limit), and
- Annual dose to the public (calculated using both % DRL and EMP data)

Key highlights in this area include:

- The maximum annual release of tritium oxide to atmosphere during the course of the current licence term represented only 17.6% of the licence limit, and 0.21% of the derived release limit.
- The maximum annual release of molecular / elemental tritium to atmosphere during the course of the current licence term represented only 0.02% of the derived release limit.
- The maximum annual release of total tritium to atmosphere during the course of the current licence term represented only 12.6% of the licence limit.
- The maximum annual release of water-soluble tritium to sewer during the course of the current licence term represented only 6.9% of the licence limit.
- The maximum effective dose to a person who is not a nuclear energy worker (i.e. a member of the public) during the course of the licence term represented only 0.7% of the regulatory limit of 1 mSv. This figure is based on environmental monitoring data, coupled with very conservative assumptions of the conditions of exposure, such as 95th percentile breathing rates, and rates of consumption of produce and groundwater. The true effective dose is very likely to be significantly lower than this derived value.

Data associated with annual effective dose to persons who are not nuclear energy workers (dose to members of the public) can be found in Addendum A9.

Data pertaining to SRBT effluent monitoring can be found in Addendum A10.

Environmental Monitoring

Figure 29: Two passive air sampler cages and a precipitation collector are attached to a utility pole in the Indigenous community of Pikwakanagan, in support of the SRBT Environmental Risk Assessment in 2020.

A compilation of key environmental monitoring data is provided in Addendum A11, including details on tritium concentrations in air, precipitation, surface waters, produce, and other media.

In all cases, results are contrasted against benchmark values to determine if there are any results that warrant follow up or enhanced analysis.

As well, a significant amount of environmental monitoring data contributed to the development of the Environmental Risk Assessment (ERA) report, and the conclusions from this report drove additional monitoring in the area surrounding the facility, as well as in nearby Indigenous communities.

A detailed description of our collaborative engagement with the Algonquins of Pikwakanagan can be found in Section 4.2 of this CMD.

Groundwater Protection and Monitoring

Figure 30: An example of a sampling well at SRBT (left); workers conduct groundwater monitoring at the facility (right). Groundwater monitoring has been continuously performed by SRBT since 2006.

Several operational changes were implemented beginning in 2006, aimed at reducing the impact operations had on groundwater resources.

SRBT conducted studies of the conditions of the groundwater aquifer at that time, focused on establishing the baseline conditions (including the concentration of tritium in the groundwater), and planning ways to lessen the impact of facility operations.

The studies led SRBT to improve upon both the design of processing equipment as well as the operating procedures used by staff. As well, SRBT enacted restrictions on the time of day that tritium processing may take place, and prohibited the processing of tritium during periods of precipitation in order to reduce the deposition of entrained tritium in rain and snow on the ground near the facility, resulting in elevated groundwater contamination over time.

Since those changes were implemented, and a comprehensive groundwater monitoring program was put in place and continually improved, the data has continuously demonstrated that the conditions of the groundwater resource surrounding the facility has improved drastically over time.

Over the course of the current seven-year licence term, the concentration of tritium in groundwater monitoring wells has continuously declined. A comparison of the average annual tritium concentration in the twenty-nine monitoring wells routinely sampled by SRBT for calendar years 2015 and 2021 is provided in Addendum A12.

The improving status of the groundwater near the facility can be effectively summarized in three key data points:

- Since 2015 when the current licence was issued, all twenty-nine monitoring wells have shown a significant decrease in the average annual tritium concentration measured as part of the GMP. These results are tabulated in Addendum A12.

- As of the end of calendar year 2021, the average percentage decrease of tritium concentration across all monitoring wells since the start of 2015 is 56%. Individual monitoring wells have all exhibited drops in average annual concentration, ranging from a decrease of 6% at MW07-12 to a decrease of 85% at MW06-1.

- When the monitoring program was first implemented in the 2006-2007 timeframe, a total of 11 monitoring wells exhibited concentrations in excess of the Ontario Drinking Water Quality Standard for tritium (7,000 Bq/L). As of the end of 2021, only a single well exhibits a concentration in excess of this value – MW06-10, which is a well drilled directly between the two active ventilation system stack units in the secured, fenced compound on the west side of the facility.

It is important to specifically note that MW06-10 is not a source of drinking water – it is an engineered sampling well, drilled specifically for that purpose in September 2006, and has been routinely sampled since.

Based purely upon its location, this well is expected to exhibit the most elevated concentration of tritium among the array of groundwater monitoring wells drilled by SRBT as part of our Groundwater Protection and Monitoring Programs. The concentration of tritium in water sampled from this well has decreased by 42% since 2015 and by 79% since 2006.

3.9.3 Future plans

With our successful implementation of expanded in-house analysis capabilities for certain types of environmental monitoring samples, we are beginning to lay the groundwork for the development of a dedicated laboratory specifically designed for low-level environmental sample counting.

Although formal project planning has yet to commence, having the capacity to prepare and analyze these types of samples would bring about many benefits, including expanding our contribution to the scientific knowledge base on the behaviour of tritium in the environment. Such capability would also possibly allow our business to introduce commercial analytical services to the scientific community and the public in general.

One of the direct and tangible benefits of a 15-year licence term is that it would allow us to allocate additional financial resources to such a project that may otherwise be earmarked for increased future cost-recovery fees associated with shorter-term licence renewals.

3.9.4 Challenges

We do not anticipate experiencing any challenges relating to the Environmental Protection SCA.

3.9.5 Requests

We do not wish to put forth any specific requests pertaining to the Environmental Protection SCA.

3.10 Emergency Management and Fire Protection

Figure 31: The SRBT facility includes a comprehensive suite of fire and life safety systems and components, such as the central fire alarm control panel (left). Members of the Pembroke Fire Department train SRBT employees on the use of fire extinguishers annually. A part of the training is shown from 2018 (right).

The Emergency Management and Fire Protection SCA covers emergency plans and emergency preparedness programs that exist for emergencies and for non-routine conditions. This area also includes any results of participation in exercises. As well, all aspects of Fire Protection of the facility are captured in this SCA.

3.10.1 Relevance and management

Emergency Management

In the event of an emergency at the nuclear substance processing facility, SRBT has documented, maintained and practiced the execution of a comprehensive Emergency Plan.

The Emergency Plan (EP) describes all phases of emergency management at SRBT, including planning and preparation for emergencies, how the organization will respond in the event of an emergency situation developing, and the methods and strategies to be implemented for the recovery phase after the emergency is resolved.

The EP includes four main components: planning basis, emergency response plan and procedures, preparedness, and program management. The design of the plan is intended to comply with CNSC REGDOC-2.10.1, *Nuclear Emergency Preparedness and Response,* with the President having the overall responsibility for the oversight and management of the EP for the SRBT facility.

The declaration of an emergency at the facility triggers the activation of an Emergency Response Organization (ERO), which includes a number of key technical and administrative members of the SRBT organization. Upon activation, these individuals take on specific responsibilities aimed at managing the emergency through coordination and communication with stakeholders and emergency responders, with the aim of resolving it effectively while minimizing its impact on persons and the environment, and ensuring that the recovery phase is implemented.

In order to ensure prepared, continuous emergency response capacity, SRBT maintains a collaborative relationship with the City of Pembroke and the Pembroke Fire Department (PFD), which includes training components for responders, and independent oversight of safety-related systems and components aimed at reducing or eliminating hazards which could result in an emergency situation developing.

Fire Protection

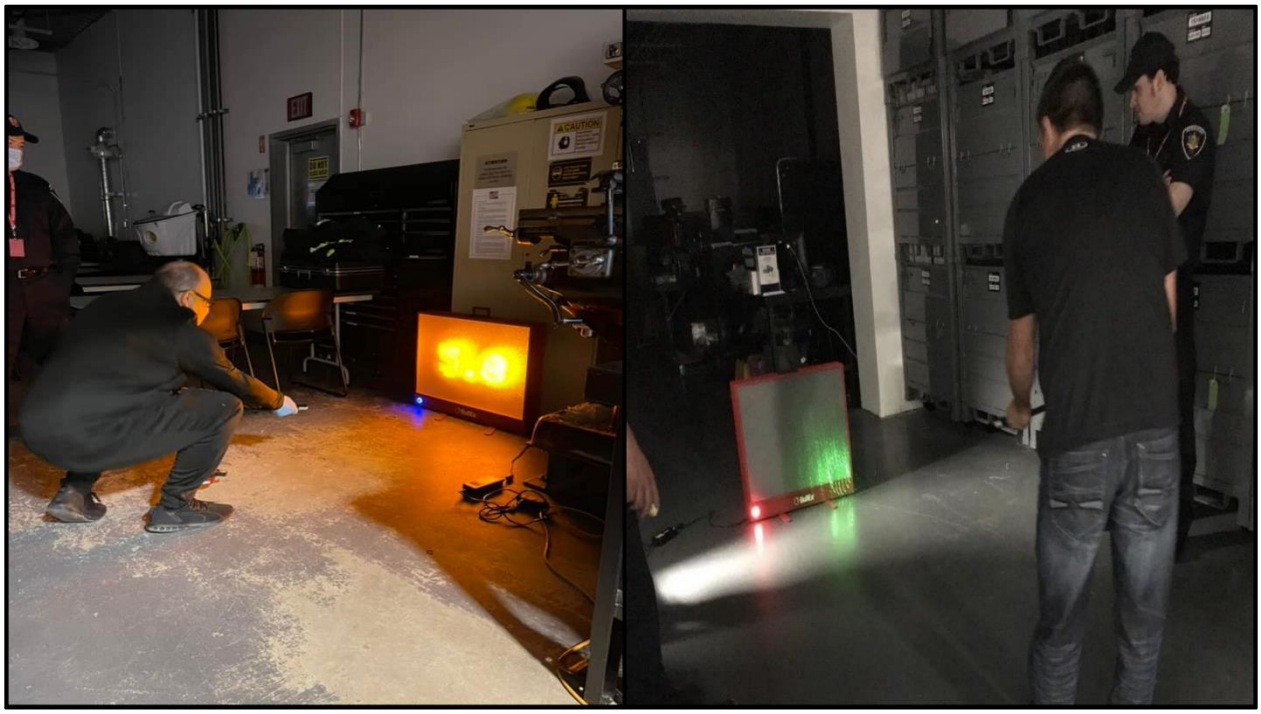


Figure 32: SRBT conducts annual training for all employees on the use of fire extinguishers. The training includes a practical component with a simulated fire scenario and extinguisher.

Several of the emergency scenarios that could develop at the facility are based upon the occurrence of a significant fire which impacts nuclear substances on site. As such, SRBT implements a set of management system programs, procedures and plans which ensure effective control of fire as a potential hazard.

The SRBT Fire Protection Program (FPP) is designed to fully meet the requirements of CSA standard N393-13, *Fire protection for facilities that process, handle, or store nuclear substances*. This program is routinely reviewed by several organizations independent of SRBT, including the Pembroke Fire Department and a qualified third-party contractor in fire protection

of nuclear facilities, in order to ensure compliance with requirements, and a high level of defence-in-depth.

The FPP covers both the procedures in place, as well as the physical SSCs that are designed to reduce the likelihood and impact of fires. The program is designed to help in preventing fires from starting, detecting fires early, controlling and extinguishing fires that occur, and providing a level of fire protection for structures, systems and components, so that any damage will not prevent essential facility functions from being performed.

Supporting the FPP are two technical descriptive documents which establish and quantify the fire hazard at the facility, and define the expected response by all workers at the facility.

The SRBT Fire Hazard Assessment (FHA) is compiled and documented by an independent and qualified third-party, with the objectives of identifying the fire hazards at the facility, evaluating the impact of fires involving these hazards on the safety objectives at the facility, and assessing the adequacy of the fire protection measures in place to mitigate these hazards. The current FHA was updated in 2020. The FHA forms a key input into the continuing improvement of the FPP and associated procedure set, as well as the physical fire safety provisions installed and maintained at the facility.

The SRBT Fire Safety Plan (FSP) is a requirement of the National Fire Code of Canada, as well as the FPP, and covers the pre-incident plan, emergency and evacuation procedures, the fire safety systems and equipment on site, fire drills, and staff training.

All SRBT staff are responsible to be knowledgeable of the FSP and their associated responsibilities. Copies of the plan are available throughout all areas of the facility. The plan is reviewed and approved by the PFD, who provide training to staff and conduct facility fire safety inspections on an annual basis in line with the requirements in the plan.

Emergency Exercise – 2021

A full-scale Emergency Exercise was conducted in October 2021, in conjunction with the PFD, the City of Pembroke, and local paramedics.

The exercise was assessed by CNSC staff as part of a compliance inspection, who provided many positive comments on its execution and the achievement of objectives.

Overall, the exercise proved to be a success, with a challenging, multi-faceted scenario being presented for all participants. Personnel response was found to be in line with the expectations and requirements of the Emergency Plan, and all exercise objectives were met.

Several observations on ways that the response could be improved in the future were tabled by all participants during collaborative post-exercise debriefings and meetings. Actions being taken to continuously improve the Emergency Plan were described within a final report furnished to CNSC staff on December 23, 2021, and are being tracked as required by our improvement process.

All recommendations have been, or are in the process of being incorporated into the Emergency Plan as a result of the operating experience gained from the exercise.

A selection of images from the 2021 Emergency Exercise are provided below:

Figure 33: SRBT staff, the Pembroke Fire Department, the City of Pembroke, and local paramedics participated in a full-scale Emergency Exercise in October 2021.

Figure 34: First responders collaborate with members of the SRBT Emergency Response Organization during the 2021 Emergency Exercise (left); fire fighters are assessed for tritium contamination during the recovery phases of the emergency exercise (right).

3.10.2 Past performance

Over the course of the current licence term, SRBT considers its performance in the SCA of Emergency Management and Fire Protection to meet our internal expectations, and to be very good in general, with a stable trend over time and projected into the future.

This assessment is based on the following key points:

- There have been no emergencies or fires at the facility during the current licence term.
- Associated safety programs have continued to be improved in line with new regulatory requirements and guidance, including the 2015 versions of the National Building Code and National Fire Code, as well as CSA standard N393-13 and REGDOC-2.10.1.
- The FPP, FHA and FSP have all been reviewed and revised as required, in close consultation with stakeholders such as the PFD, and independently qualified third-parties in fire safety of nuclear facilities.
- CNSC inspection activities have consistently identified few non-compliances in the area of Emergency Management and Fire Protection, and action items have been addressed rapidly and effectively, in accordance with a risk-based approach where appropriate.
- Yearly third-party inspections by both the Pembroke Fire Department and qualified third-party contractors, focused on fire protection measures implemented at the facility, have consistently found very few items of concern or non-conformance.
- All required equipment checks and inspections were successful through the term of the licence, ensuring readiness of all fire protection-related systems and components.
- Fire drills have been conducted at the required frequencies, with few issues identified and excellent organization response observed each time.
- CNSC staff has consistently rated SRBT’s performance in this area as ‘Satisfactory’ each year as part of their Annual Compliance and Performance Report.

3.10.3 Future plans

Going forth, we fully expect to continue to consistently implement and improve our Fire Protection Program, our Fire Hazard Assessment and Fire Safety Plan. These key documents will remain integrated components of our overall management system.

Our Emergency Plan will also continue to be improved as we incorporate learning from exercises, as well as industry operating experience and regulatory feedback. The Emergency Plan will also be revised as our facility-wide Safety Analysis Report is maintained, as these documents are closely linked.

Full-scale emergency exercises will be planned and executed at least once every five years, in accordance with our program requirements. Comprehensive reports on these exercises will be documented and distributed, and will help drive improvements in our preparedness.

3.10.4 Challenges

We do not anticipate experiencing any challenges relating to the Emergency Management and Fire Protection SCA.

3.10.5 Requests

We do not wish to put forth any specific requests pertaining to the Emergency Management and Fire Protection SCA.

3.11 Waste Management

Figure 35: Non-reusable gaseous tritium light sources from expired self-luminous safety signs are placed in Type 'A' shipping containers and sent to a licensed radioactive waste management facility.

The Waste Management SCA covers internal waste-related programs that form part of the facility's operations up to the point where the waste is removed from the facility to a separate waste management facility. This area also covers the planning for decommissioning.

3.11.1 Relevance and management

Waste Management

The routine processing of tritium for the purposes of manufacturing gaseous tritium light sources and devices results in the generation of small quantities of tritium-contaminated waste materials. In order to effectively and safely manage these materials, SRBT implements a *Waste Management Program* (WMP) as part of our overall management system.

The program includes a comprehensive set of subordinate procedures, all of which are aimed at ensuring that waste is minimized, appropriately classified and segregated, characterized for hazards, stored and processed safely, and cleared or disposed of in accordance with all requirements.

The WMP is designed in consideration of several standards, regulatory guides and requirements, including CSA N292.0-19, *General principles for the management of radioactive waste and irradiated fuel,* CSA N292.3-14, *Management of low- and intermediate-level radioactive waste,* and CSA N292.5-11, *Guideline for the exemption or clearance from regulatory control of materials that contain, or potentially contain, nuclear substances.*

A dedicated Waste Management Committee ensures that the program is continuously monitored, and improvement opportunities identified over time. Tritium-contaminated waste materials are characterized by qualified members of the Health Physics Team, and are routinely directed through the most appropriate waste stream.

Waste materials that are characterized as being contaminated to levels that exceed conditional clearance levels are disposed of through licenced radioactive waste management service providers.

Decommissioning Planning

SRBT has developed and maintained a Preliminary Decommissioning Plan (PDP), which describes the planned, high-level strategies that will be implemented should the decision be made to decommission the nuclear substance processing facility.

The goal of the PDP is to establish feasible decommissioning envelopes that can be accomplished with low risk to the health and safety of decommissioning personnel, the public, and the environment. As well, the PDP helps to establish the anticipated cost of executing decommissioning of the facility, with adequate conservative margins to account for any uncertainties.

The SRBT PDP underwent a significant revision in 2019. The revised and updated plan was submitted to CNSC staff on November 29, 2019, and CNSC staff accepted the revised PDP on February 3, 2020, with a revised cost estimate.

As the cost estimate rose with the revision of the PDP, an update to the required Financial Guarantee associated with the PDP was necessary. The Record of Decision on the acceptance of the revised Financial Guarantee was issued by the Commission on December 8, 2020, noting the acceptance of our revised guarantee, in the amount of $727,327.00. Additional details on the Financial Guarantee can be found in Section 4.3 of this CMD.

3.11.2 Past performance

Over the course of the current licence term, we consider our performance in the SCA of Waste Management to meet our internal expectations, and to be very good in general, with a stable trend over time and projected into the future.

This assessment is based on the following key points:

- No waste management-related safety issues or significant events have occurred during the term of the current licence.
- The WMP was reviewed and revised several times throughout the current licence term, and was continuously improved with each change.
- The application of conditional clearance levels was initiated in 2015, resulting in the implementation of a safe, reasonable waste management strategy for very mildly-contaminated materials from low-level waste streams.

- The SRBT FG was recently updated and fully-funded to the new cost estimate of $727,327.00, and was accepted by the Commission in December of 2020.
- The PDP was reviewed and comprehensively revised for both content and format in 2019, considering several facility changes that were implemented during the current licence term, including the addition of a facility extension, and the safe removal of obsolete equipment and equipment that had reached the end of its serviceable life.
- Specifically, three contaminated systems in the tritium processing area (Zone 3) were safely dismantled and removed in 2019-20, in accordance with detailed and controlled work plans, with all contaminated components exceeding clearance levels being disposed of as low-level radioactive waste:
    - Ventilated wooden cabinets (fume hoods) were replaced with modern stainless-steel units in the Rig Room;
    - A laser-cutting system (last used in the mid-2000s) was removed from the Laser Room; and
    - The reclaim rig was thoroughly and safely decontaminated, dismantled and removed from the facility. The equipment had been in a continuously shut-down state for a number of years.
- CNSC inspection activities have consistently identified few non-compliances in the area of Waste Management, and action items have been addressed rapidly and effectively, in accordance with a risk-based approach where appropriate.
- CNSC staff has consistently rated SRBT's performance in this area as 'Satisfactory' each year as part of their Annual Compliance and Performance Report.

3.11.3 Future plans

We fully expect to continue to consistently implement and improve our Waste Management Program, and for it to remain an integrated component of our overall management system.

Sustainable waste management principles will continue to be applied in all aspects of our program, and we will strive to continue to reduce the amount of radioactive waste generated as part of our licenced activities.

3.11.4 Challenges

We do not anticipate experiencing any challenges relating to the Waste Management SCA.

3.11.5 Requests

We do not wish to put forth any specific requests pertaining to the Waste Management SCA.

3.12 Security

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

3.12.1 Relevance and management

As a licensee that is listed in Schedule 2 of the *Nuclear Security Regulations*, SRBT must comply with the requirements of Part 2 of those regulations. The provisions of Part 1 of those regulations do not apply, as SRBT is not licensed in respect to Category I, II or III nuclear material, and the facility is not a nuclear power plant. In order to ensure compliance with Part 2 of the Nuclear Security Regulations, SRBT implements and maintains a Facility Security Program.

The in-force version of the SRBT Facility Security Program document represents the proposed measures to ensure compliance with the *Nuclear Security Regulations*, and to prevent acts of sabotage or attempted sabotage at the nuclear facility, including measures to alert the licensee of such acts.

The Security Program was most recently revised in 2021, and was deemed acceptable by CNSC staff on October 12, 2021.

3.12.2 Past performance

Over the course of the current licence term, SRBT considers its performance in the SCA of Security to meet our internal expectations, and to be very good in general, with a stable trend over time and projected into the future. The facility has not experienced any security-related events or issues through the current licence term.

CNSC staff has consistently rated SRBT's performance in this area as 'Satisfactory' each year as part of their Annual Compliance and Performance Report.

3.12.3 Future plans

The Security Program will continue to be maintained in accordance with the conditions of our operating licence, in line with the principle of continual improvement.

3.12.4 Challenges

We do not anticipate experiencing any challenges relating to the Security SCA.

3.12.5 Requests

We do not wish to put forth any specific requests pertaining to the Security SCA.

3.13 Safeguards and Non-proliferation

The Safeguards and Non-proliferation SCA covers the programs and activities required for the successful implementation of the obligations arising from the Canada/International Atomic Energy Agency (IAEA) safeguards agreements, as well as all other measures arising from the *Treaty on the Non-Proliferation of Nuclear Weapons*.

3.13.1 Relevance and management

The current operating licence does not include any conditions associated with the Safeguards and Non-proliferation SCA. Notwithstanding, there are two relevant aspects of our operations that intersect with this area.

Depleted Uranium

SRBT possesses and uses a very limited quantity of depleted uranium as a processing storage media for molecular tritium gas.

The maximum amount of depleted uranium possessed by SRBT is defined in the Safety Analysis Report as an Operating Limit and Condition.

This limit is set at 10 kg, an amount which corresponds to the general exemption quantity of this type of material, as defined in section 5 (1) (f) of the *Nuclear Substances and Radiation Devices Regulations*.

As well, an exemption is on file with International Atomic Energy Agency (IAEA) and the International Safeguards Division of the CNSC for the material possessed. Exemption tracking identifier EU\01\CN-2\D\ZZ00211 was granted on December 27, 2018, and SRBT ensures that the associated guidelines are followed with respect to this exemption.

SRBT is continuously prepared to ensure that all necessary measures are taken to facilitate Canada's compliance with applicable international nuclear safeguards agreements. Any IAEA inspector, or person acting on the behalf of the IAEA shall be provided with such reasonable services and assistance as are required to enable the IAEA to carry out its duties and functions pursuant to safeguards agreements.

Import and Export of Tritium

Exported and imported products containing tritium gas are controlled under the *Nuclear Non-proliferation Import and Export Control Regulations*, as tritium is a controlled substance that is listed in the schedule of these regulations.

As such, each time SRBT intends to export or import products containing tritium, an application for a licence is made to CNSC staff in compliance with those requirements.

3.13.2 Past performance

CNSC staff does not evaluate SRBT's performance in this safety and control area as part of routine regulatory oversight. During the current licence term, a reported SCA rating of 'N/A' has been listed in each Regulatory Oversight Report presented to the Commission.

Notwithstanding, over the course of the current licence term, SRBT considers its performance in the SCA of Safeguards and Non-proliferation to meet our internal expectations, with a stable trend over time and projected into the future.

3.13.3 Future plans

SRBT will continue to ensure that the total mass of depleted uranium possessed remains below the limit defined in the Safety Analysis Report. We will also ensure that we adhere to the guidelines upon which exemption EU\01\CN-2\D\ZZ00211 was granted. Otherwise, there are no significant future plans in this area.

3.13.4 Challenges

We do not anticipate experiencing any challenges relating to the Safeguards and Non-proliferation SCA.

3.13.5 Requests

We do not wish to put forth any specific requests pertaining to the Safeguards and Non-proliferation SCA.

3.14 Packaging and Transport

Figure 36: Type 'A' packages of light sources are prepared for shipment, in accordance with the Packaging and Transport of Nuclear Substances Regulations (2015).

The Packaging and Transport SCA covers programs for the safe packaging and transport of nuclear substances to and from the licensed facility.

3.14.1 Relevance and management

As a manufacturer of self-luminous safety devices which contain tritium gas, and are sold to customers both domestically in Canada and internationally, SRBT implements a comprehensive suite of procedures that ensure compliance with the *Packaging and Transport of Nuclear Substances Regulations, 2015* (PTNSR).

Organizationally, the responsibility for ensuring the safe and compliant shipping of packages containing radioactive materials is held by the Logistics Manager, who is supported by several trained and qualified production technicians in the conduct of all shipping, and import and export activities.

These individuals are trained and certified in the packaging and handling of Class 7 dangerous goods. These staff members undergo refresher training every two years, led by an independent, qualified service provider, in order to ensure that they remain qualified to perform these activities safely and in compliance with all regulatory requirements.

Shipping activities are governed by a specific set of controlled procedures, and the Logistics Manager is responsible for ensuring that procedures are maintained and implemented at all times.

3.14.2 Past performance

Over the course of the current licence term, SRBT considers its performance in the SCA of Packaging and Transport to meet our internal expectations, and to be very good in general, with a stable trend over time and projected into the future.

This assessment is based on the following key points:

- For a total of 8,878 shipments of radioactive materials, only five reportable events relating to Packaging and Transport ('dangerous occurrences', as defined in the PTNSR) were experienced during the current licence term. None of these events resulted in a safety impact to any person or the environment and all events were reported to CNSC staff in line with regulatory requirements.

- In four of the five cases of such an event, the cause of these occurrences was not primarily attributed to SRBT, but was caused instead by outside agencies (carriers, customers). None of these events resulted in significant safety risk to persons or the environment, and were all reported to CNSC as required. See Addendum A3 for details on all reportable events during the current licence term.

- Staff assigned to the Shipping Department have remained certified to handle and ship Class 7 goods, through biannual training from an independent, qualified service provider, ensuring that workers are kept abreast of changes in requirements throughout the term of the current licence.

- The procedures that control shipping and receiving activities have been maintained and frequently updated by the Logistics Manager to ensure accuracy.

- CNSC inspection activities have consistently identified few non-compliances in the area of Packaging and Transport, and action items have been addressed rapidly and effectively, in accordance with a risk-based approach where appropriate.

- CNSC staff have consistently rated SRBT's performance in this area as 'Satisfactory' each year as part of their Annual Compliance and Performance Report.

3.14.3 Future plans

We fully expect to continue to ensure safe packaging and transport of SRBT products worldwide through the application of our dedicated procedures and continuing training.

Our packaging and transport processes will be updated as new requirements and guidance are developed and published, and in accordance with applicable industry best practices. Comprehensive self-assessments, benchmarking exercises and internal audits will drive continual improvement, in accordance with the principles described in CSA standard N286-12.

3.14.4 Challenges

We do not anticipate experiencing any challenges relating to the Packaging and Transport SCA.

3.14.5 Requests

We do not wish to put forth any specific requests pertaining to the Packaging and Transport SCA.

4.0 Other Matters of Regulatory Interest

Other matters of regulatory interest include relevant topics to SRBT, and to the decision of the Commission on the renewal of NSPFOL, but that are not covered by the SCAs.

4.1 Public Information Program

Figure 37: The homepage for SRBT public website (www.srbt.com).

SRBT implements and maintains a Public Information Program (PIP), which is designed to meet the requirements of REGDOC-3.2.1, *Public Information and Disclosure*. In this program, which is available on our website, processes are described which are designed to inform persons living in the vicinity of the site of the general nature and characteristics of our facility and the operations undertaken.

In addition, information is provided in order to illustrate the anticipated effects on the environment and the health and safety of persons that may arise from licensed activities.

Several strategies are used to communicate with the public and interested stakeholders, including pamphlet distribution, public presentations, and the maintenance of a publicly-accessible website. We also manage a suite of social media profiles, including Facebook, Instagram, Twitter, LinkedIn, TikTok and Reddit accounts, all of which are frequently updated.

SRBT's Public Disclosure Protocol outlines our goal to be transparent, visible and open with our community, our regulators, and our staff. The Public Information Committee is led by Senior Management, and is committed to achieving this goal by having suitable mechanisms in place to provide specific information in a timely, clear and concise manner about operations to the target audience.

SRBT is also committed to the continuous review of the effectiveness of these mechanisms and to make modifications to adapt to perceived changes in public perception.

The facility operates within the City of Pembroke. The effects of the operations, although minimal, are by far the greatest on Pembroke and its residents.

For these reasons, the PIP has been developed to reach the population of Pembroke and the immediate surrounding area, specifically including:

- The critical group defined as individuals living within 500 meters of the facility;
- Residents with wells or gardens that are being monitored by SRBT;
- Local and adjacent businesses;
- Local media, television, print and radio;
- Local special interest groups;
- Local Indigenous groups; and
- Local elected officials at the Municipal, Provincial and Federal level

The activities outlined in the PIP demonstrate that SRBT is committed to maintaining two-way communication channels to address the questions and concerns of people within our target audience in a timely and clear manner.

The licence application and hearing process has been actively promoted as a key component of our PIP. Our licence renewal package was posted on our website shortly after submission, and was directly distributed to several identified key stakeholders within days of issuance.

Any inquiry or request for additional information has been acknowledged and resolved within a week of receipt. This includes specific requests the Concerned Citizens of Renfrew County, the Algonquins of Ontario, and from one local resident. In all cases, all non-protected documents pertaining to our application have been provided in full, and without redaction.

On August 10, 2021, SRBT Senior Management participated in a public meeting of Council for the City of Pembroke, where a presentation on our facility and operations, and the process of applying for renewal of our operating licence, was made. City council members posed several questions, and expressed their continuing support for our continued safe operations.

As always, presentations, meetings and plant tours will be conducted as necessary to members of Pembroke council, local stakeholders, interested parties and members of indigenous communities, in order to ensure that the objectives of our Public Information Program continue to be achieved.

Our performance in the area of Public Information and Disclosure has met our expectations, and feedback from CNSC staff has been generally positive over the course of our current licence. Stakeholders have consistently expressed their appreciation for our policy of openly sharing data and information, both routinely and upon specific request.

As well, a greater level of focus has been applied to engaging with Indigenous communities in our region. For details on this initiative, please see the following section of this CMD.

With respect to licence renewal, SRBT directly provided copies of our renewal application document to interested parties identified as stakeholders in the surrounding area, including,

- City of Pembroke officials,
- Local Member of Federal Parliament,
- Local Member of Provincial Parliament,
- The Concerned Citizens of Renfrew County and Area,
- Indigenous communities identified either as stakeholders, or as interested parties in the surrounding area (**see Section 4.2**),
- Residents with wells or gardens being monitored by SRBT as part of our EMP, and
- Local media outlets.

Going forward, we fully intend to continue to review and improve our Public Information Program over time, in response to stakeholder feedback, self-assessments, benchmarking, and any future regulatory changes in this important area. The Public Information Program was most recently revised in 2021, and was deemed acceptable by CNSC staff on October 29, 2021.

4.2 Indigenous Engagement

Figure 38: SRBT employees showing their support for 'Every Child Matters' in September of 2021.

Over the past several years, SRBT has conducted outreach with local Indigenous communities on multiple occasions, with the goal of introducing these communities to our company, and providing them with any information that may help to foster sustainable and meaningful long-term relationships.

These outreach activities included collaboration with the Algonquins of Pikwakanagan First Nation (APFN), an Indigenous community near Golden Lake, Ontario, during the execution of the SRBT Environmental Risk Assessment (ERA) project.

In 2020, members of the community assisted our team with vegetation and environmental sampling activities in support of the ERA. We have continued to collaborate with the Pikwakanagan community as we have implemented the recommendations from the initial ERA report, which included the conduct of confirmatory sampling in the area.

SRBT is a proud member of the Canadian Council for Aboriginal Business. As well, our team undertook a day of reflection as the facility observed Canada's first National Day for Truth and Reconciliation on September 30, 2021.

All members of SRBT's Executive Committee participated in Indigenous Awareness training, led by the First Peoples Group, on October 14, 2021. This unique training opportunity was coordinated through the Canadian Nuclear Association, and helped to provide new perspectives and understanding on this important topic.

With respect to licence renewal, SRBT directly provided both physical and electronic copies of our renewal application document to Indigenous communities identified either as stakeholders, or as interested parties in the surrounding area, including:

- Algonquins of Pikwakanagan First Nation,
- Algonquins of Ontario,
- Métis Nation of Ontario,
- Kebaowek First Nation, and
- Algonquin Anishinabeg Nation

Going forward, SRBT fully intends to continue to build relationships with Indigenous communities in our vicinity, and to use these relationships to help inform how we can improve our operations, reduce our environmental impact, and ensure the continued safety and health of the people that live in these communities and in the surrounding area.

4.3 Financial Guarantee

As described previously, SRBT maintains a Preliminary Decommissioning Plan (PDP) that describes the planned, high-level strategies that will be implemented should the decision be made to decommission the nuclear substance processing facility.

The PDP establishes the anticipated cost of executing decommissioning of the facility, with adequate conservative margins to account for any uncertainties. This cost estimate is backed by a Financial Guarantee (FG) that is allocated solely for the purposes of facility decommissioning in the future.

A revised and updated PDP was submitted to CNSC staff on November 29, 2019, who accepted the revised PDP on February 3, 2020. The revised PDP included an updated cost estimate of $727,327.00, a value which represented an increase from the 2014 estimate of $652,488.00, thus necessitating an update to the FG.

On February 4, 2020, SRBT submitted the revised financial documentation, as well as a proposal to fully fund the FG to $727,327.00 by the end of April 2020. On April 24, 2020, SRBT provided evidence to CNSC staff that the FG was fully funded to the updated value, in advance of consideration by the Commission during a hearing focused on the acceptability of the FG.

On September 8, 2020, the CNSC announced that a hearing in writing would be conducted to consider our revised PDP and updated FG. Intervenors were requested to file any submissions before October 9, 2020. One intervention was received from the public on this matter.

The Record of Decision on the matter was issued by the Commission on December 8, 2020, noting that the Commission accepted SRBT's revised financial guarantee amount of $727,327.00.

The SRBT Financial Guarantee is a cash fund held in escrow, and does not rely on any letters of credit, bonds, insurance or other expressed commitments. Interest accrued on the funds deposited remain held in escrow over time.

As of December 31, 2021, the FG is funded to $747,760.51, or 102.8% of the required guarantee of $727,327.00.

4.4 Cost Recovery

Throughout the current licence term, SRBT has maintained good standing with respect to the payment of all CNSC cost recovery fees, as required by subsection 24(2) of the *Nuclear Safety and Control Act,* and Part 2 of the *CNSC Cost Recovery Fees Regulations.* SRBT will continue to ensure that these obligations are fully met under any renewed operating licence.

5.0 Conclusions

Throughout the nearly seven-year term of the current operating licence, the management and staff of SRBT have complied with all regulatory requirements and licence conditions.

Our management system underwent a significant, controlled change early on in the licence term, becoming fully compliant with the requirements of CSA N286-12 standard. The management system has been effective at helping the organization to achieve operational and safety-related goals, and in ensuring continuous and safe control of our operations.

Over time, we have adjusted and improved our processes in support of the safe and effective operation of our facility, and we seek out and apply operating experience to continuously improve the system.

We have improved all elements of human performance through the application of a systematic approach to training, and through the promotion and maintenance of a diligent nuclear safety culture at all levels of the organization.

Our facility has remained within its designed safety basis, and continues to be maintained fit for service. Key structures, systems and components have continued to be maintained diligently and effectively through the implementation of our Maintenance Program.

Exposures to ionizing radiation to both workers and members of the public continue to remain low, and are far less than the regulatory limits prescribed.

The local environment has remained protected, and the already low level of impact of our operations continues to be reduced over time, as we continue to implement best practices each and every day. Licence limits for our nuclear substance effluent streams continue to be respected with significant margin. Groundwater tritium concentrations have continuously declined throughout the term of our current licence.

A comprehensive Environmental Risk Assessment has been completed in line with the applicable standards, showing that the level of risk to humans and the environment due to SRBT operations is exceedingly low, with respect to radiological, non-radiological and physical stressors.

Our conventional health and safety program has continued to ensure our workers are safe, and the security of the facility and all nuclear substances was maintained at all times. A very low level of lost-time injuries continues to be maintained each year, and the significance of all recorded injuries at the facility is consistently very low.

SRBT remains well protected from fire hazards, and have maintained an accepted plan should an emergency condition arise. A full-scale emergency exercise was conducted in 2021, in order to practice our response as described in our Emergency Plan, should an emergency arise at our facility. The results of that exercise have been compiled, and are being used to drive improvement in facility and personnel preparedness.

The facility has remained secure throughout the course of the current licence term, with zero security-related events being experienced. SRBT also promotes a diligent facility security culture through continuous training of our staff.

We continue to effectively manage all forms of waste generated by our operations, and continue to look to minimize the amount of waste that must be managed and controlled.

Our decommissioning responsibilities are documented and accepted in our Preliminary Decommissioning Plan, and the associated financial guarantee is fully funded after having been updated and approved by the Commission in 2020.

Our Public Information Program fully satisfies all regulatory requirements, and we continue to look for new ways to reach out into our local community in a positive and constructive fashion.

Indigenous Engagement activities have become a focal point of the program over the last few years, and we fully intend to continue to build upon these new relationships over the course of any renewed licence term.

Safety and excellence in operations shall always remain as the number one overall priority in everything we do, and we feel that our performance over the course of the last licence is a direct reflection of the success at achieving these goals.

Notwithstanding, we are never satisfied – under any renewed operating licence, we will continue to tirelessly improve our operations, and minimize our impact on people and the environment as our company continues to sustainably grow over the coming years.

Addenda: Supporting Details and Data

A1 Safety Committee Meetings

COMMITTEE	2015	2016	2017	2018	2019	2020	2021	TOTAL
PRODUCTION COMMITTEE	1	2	8	31	31	36	45	154
WORKPLACE HEALTH AND SAFTY COMMITTEE	12	9	12	9	16	9	14	81
HEALTH PHYSICS COMMITTEE	10	8	8	8	8	6	5	53
MITIGATION COMMITTEE	4	5	6	3	5	3	4	30
FIRE PROTECTION COMMITTEE	7	8	4	4	3	2	2	30
MAINTENANCE COMMITTEE	-	6	4	6	5	4	4	29
PUBLIC INFORMATION COMMITTEE	6	5	4	4	2	3	2	26
EXECUTIVE COMMITTEE	2	5	5	2	4	4	3	25
TRAINING COMMITTEE	5	4	3	3	3	3	4	25
WASTE MANAGEMENT COMMITTEE	4	3	2	1	3	3	2	18
SAFETY CULTURE COMMITTEE	-	2	2	3	1	1	1	10
OTHER COMMITTEE/STAFF MEETINGS	49	22	16	3	1	3	13	107
TOTAL	**100**	**79**	**74**	**77**	**82**	**77**	**99**	**588**

A2 Compliance with Operating Limits and Conditions

The following summary report is provided respecting SRBT compliance with the Operating Limits and Conditions (OLC) established within our Safety Analysis Report (SAR) throughout the term of the current operating licence.

Each applicable OLC is repeated below, with a statement of compliance.

- **Tritium Possession Limit**

SRBT is authorized by licence to possess up to 6,000 TBq of tritium in any form.

SRBT possessed less than 6,000 TBq of tritium at all times during the term of the current licence.

- **Tritium Processing – Permitted Hours of Operation**

Tritium processing operations consist of filling and sealing of gaseous tritium light sources (GTLS) on processing rigs, laser cutting of GTLS, or bulk splitting operations. *Tritium processing operations are restricted to 0700h – 1900h, seven days a week, unless specifically approved by senior management.*

All tritium processing operations were conducted between the hours of 0700h and 1900h during the term of the current licence. No processing occurred outside of this time period.

- **Tritium Processing – Precipitation**

Tritium processing shall not occur during measurable periods of precipitation, as detected by the precipitation detection system or equivalent.

Tritium processing operations were only conducted during periods where measurable precipitation was not occurring during the term of the current licence.

Processing operations were ceased and equipment placed into a safe state when precipitation events occurred during operating hours.

- **Tritium Releases to Atmosphere – Tritium Oxide**

SRBT shall not release in excess of 6.72E+13 Bq of tritium oxide to atmosphere in any year.

The total amount of tritium oxide (HTO) released in any year to atmosphere during the term of the current operating licence did not exceed this limit.

The maximum release of tritium oxide for any year occurred in 2019, and was equal to 1.19E+13 Bq (11,858 GBq), representing 17.6% of this licence limit.

➢ **Tritium Releases to Atmosphere – Tritium Oxide + Elemental**

SRBT shall not release in excess of 4.48E+14 Bq of total tritium as tritium oxide and tritium gas to atmosphere in any year.

The total amount of combined HTO and elemental tritium (HT) released in any year to atmosphere during the term of the current operating licence did not exceed this limit.

The maximum release of combined HTO and HT for any year occurred in 2015, and was equal to 5.62E+13 Bq (56,237 GBq), representing 12.6% of this licence limit.

➢ **Minimum Differential Pressure Measurements for Tritium Processing**

Tritium processing operations shall not occur unless the following differential pressures are achieved, as measured by the gauges on each of the active ventilation system stacks:

- *Rig Stack: 0.27 inches of water column*
- *Bulk Stack: 0.38 inches of water column*

These measurements correspond to an average effective stack height of 27.8 metres, assuming a wind speed of 2.2 m/s.

At no time did tritium processing occur during the term of the current licence when the noted differential pressures in the stacks were not being achieved, as measured daily prior to operations commencing.

➢ **Tritium Releases to Sewer – Water-soluble Tritium**

SRBT shall not release in excess of 2.00E+11 Bq of water-soluble tritium to the municipal sewer system in any year.

The total amount of water-soluble tritium released in any year to the municipal sewer system during the term of the current operating licence did not exceed this limit.

The maximum release of water-soluble tritium for any year occurred in 2019, and was equal to 1.37E+10 Bq (13.67 GBq), representing 6.8% of this licence limit.

➢ **PUTT Filling Cycles**

Any pyrophoric uranium tritium trap (PUTT) base is limited to 30 complete bulk splitter filling cycles, after which it is no longer permitted to be used for further tritium processing.

All tritium processing during the term of the current licence was conducted using tritium traps that had been cycled 30 times or less on the bulk splitter.

➢ PUTT / Bulk Container Tritium Loading Limit

PUTTs are limited to less than 111,000 GBq of tritium loading at any time.

Bulk containers are limited as follows:

- *SRBT shall request no more than 925,000 GBq per bulk container when submitting a purchase order to an approved supplier of tritium gas.*
- *No bulk container shall exceed 1,000,000 GBq of tritium loading at any time.*

No PUTT was loaded with more than 111,000 GBq of tritium during the term of the current licence, and no bulk container was used in the facility in excess of the 1,000,000 GBq loading limit during the term of the current licence.

➢ Bulk Container Heating Limit

Bulk tritium containers are limited to a heating temperature of approximately 550°C, as measured by the thermocouple placed between the heating band and the container surface.

Brief and small exceedances of this value are tolerable so long as they are not sustained, and the temperature is returned below this value as soon as possible.

Bulk tritium container heating operations were conducted in compliance with this limit at all times throughout the term of the current licence.

➢ On-site Depleted Uranium Inventory

The on-site physical inventory of depleted uranium (virgin, in use and decommissioned bases) is limited to 10 kg.

The on-site inventory of depleted uranium (DU) did not exceed 10 kg during the term of the current licence. The maximum inventory at the facility at any point in time since July 1, 2015 was 9.678 kg.

A3 Reportable Events

Over the course of the current licence term, SRBT has experienced a small number of events that met the criteria for reporting to CNSC staff.

The requirements for reporting events to the Commission and/or CNSC staff are defined in the NSCA, and the criteria for reporting defined in the regulations made pursuant to the NSCA.

SRBT developed and implemented a new *Regulatory Reporting Program* in March 2016, focused on ensuring reports of events were controlled and consistently met compliance requirements.

In January 2018, the Commission published REGDOC-3.1.2, *Reporting Requirements, Volume 1: Non-Power Reactor Class I Nuclear Facilities and Uranium Mines and Mills*. This document describes the applicable event reporting requirements for such facilities. SRBT's *Regulatory Reporting Program* was revised to ensure compliance with this new REGDOC.

The following table forms a complete summary of reportable events experienced by the facility, spanning from July 1, 2015 to December 31, 2021.

REPORTABLE EVENTS AT SRBT – JULY 1, 2015 – DECEMBER 31, 2021		
EVENT DATE	**EVENT DESCRIPTION**	**FINAL REPORT ACCEPTANCE DATE**
September 25, 2015	During maintenance work on the air compressor, an oil hose became disconnected from a pressurized section of the compressor, ejecting a fine mist of oil into the room, and activating the smoke detector and setting off the facility fire alarm. The Pembroke Fire Department responded to the false alarm within minutes. There was no hazard to workers, the facility or the environment.	November 18, 2015
June 1, 2016	At 1150h, the facility fire alarm sounded, and all personnel evacuated and responded accordingly. It was determined that the smoke had been detected in the compressor room, caused by friction associated with the entanglement of a failed drive belt on the unit. There was no hazard to workers, the facility or the environment. SRBT increased the frequency of drive belt maintenance from annual to semi-annual as a result of this event.	June 15, 2016
November 28, 2016	Information provided to SRBT indicated that a trailer containing four pallets of expired tritium exit signs had been stolen while in transport to our facility in Pembroke. The trailer was stolen while parked in the yard of Sera Global Logistics in Mississauga, Ontario while awaiting further transport. The trailer was reported as being found on December 15, 2016. The carrier and Peel Regional Police inspected the trailer in close consultation with SRBT, where it was determined that the packages had not been tampered with, and remained in good condition for transport. Once the shipment arrived in Pembroke, members of the SRBT Health Physics Team performed a radiological assessment of the trailer and its contents, finding no evidence of any hazard. An inventory check confirmed that there were no missing exit signs.	February 7, 2017
June 6, 2017	A package was returned to SRBT with clear evidence of damage in transport. The package was categorized as UN2910, Excepted Package, Limited Quantity of Material, and was destined for a customer located in Bulgaria when it was refused loading for export by aircraft due to the apparent damage to the outside of the package. The package was assessed upon receipt, and although the physical damage was visually evident, an assessment found no radiological hazard associated with the package (i.e. no evidence of contamination, products contained within were still in excellent condition). There was no hazard to workers, the facility or the environment.	June 20, 2017
November 21, 2017	A contracted freight carrier notified SRBT that they had declared a package containing 26 tritium-powered self-luminous aircraft safety signs lost. The package was intended for a customer in Germany, and was categorized as UN2911, Excepted Package, Articles. On December 6, 2017, the carrier informed SRBT that the package had been located in Munich, and delivery to the customer was completed on December 12, 2017.	January 22, 2018

REPORTABLE EVENTS AT SRBT – JULY 1, 2015 – DECEMBER 31, 2021		
DATE	**EVENT DESCRIPTION**	**FINAL REPORT ACCEPTANCE DATE**
February 28, 2018	On February 5, 2018, a spent bulk tritium container was transported and delivered to a consignee as a Type 'A' package, but was later determined to have contained a Type 'B' quantity of tritium. The consignee notified SRBT of this finding after conditioning the tritium container in preparation for filling. As a result, SRBT altered internal packaging procedures to categorize all spent bulk tritium containers as UN2916 Type 'B' in the future. There was no hazard to workers, the facility or the environment.	March 16, 2018
January 2, 2019	At a lumber yard approximately 500 metres south of the facility, a major fire took place which resulted in a loss of power to a significant part of the City of Pembroke, including the SRBT facility. Power was restored the next morning, and there was never any threat to the SRBT facility from the fire at any time. A member of SRBT's organization was on site at all times once alerted of the loss of power. There was no hazard to workers, the facility or the environment.	January 16, 2019
January 16, 2019	SRBT erroneously accepted three tritium-powered aircraft safety signs from a customer in the European Union. The signs had recently been sold and exported by SRBT in accordance with an export licence. The signs were received by the customer, but after inspection the signs were rejected as they were found to not meet the design requirements for their purpose. The customer sent the three signs back without authorization from SRBT, and the shipment was mistakenly accepted upon arrival, without having the required import licence. There was no hazard to workers, the facility or the environment.	January 24, 2019
February 19, 2021	A fire alarm occurred at the facility at approximately 0745h. A malfunction of the compressor generated a small quantity of smoke just prior to the unit automatically shutting down. The Pembroke Fire Department responded to the event within minutes of the alarm, noted no further hazard, and gave the all clear after assessing the facility. The compressor malfunction was likely due to a very brief power fluctuation on the municipal grid just prior to the false alarm. A momentary 'brownout' caused a voltage drop on the motor under load conditions, likely leading to the generation of smoke from overheating as the motor recovered under load, and eventually an automatic safety trip on the compressor. There was no hazard to workers, the facility or the environment.	March 16, 2021
August 16, 2021	A hand-held oxy-acetylene torch malfunctioned during operation, causing a brief excess flame which was detected immediately by staff, and by the facility fire protection systems, resulting in the fire alarm sounding. Staff shut of the gas to the torch, eliminating the hazard. PFD fire fighters arrived shortly thereafter, and the all-clear was given after checking the area and equipment. There was no hazard to workers, the facility or the environment.	September 20, 2021

A4 CNSC Compliance Inspection Activities

Since the issuance of the current NSPFOL, CNSC staff have performed thirteen compliance inspections focused on several SCAs. No significant nuclear safety-related compliance items were identified during any compliance inspection activity.

A summary of the NSPFOL-related inspection activities conducted since issuance of the current licence is provided below.

The number of compliance actions issued, and the number of days between the issuance of the inspection report and the closure of the last associated action item is also highlighted.

CNSC COMPLIANCE INSPECTIONS

DATE	SCA(s) / FOCUS AREA	IDENTIFIED COMPLIANCE ACTIONS	BUSINESS DAYS TO CLOSURE OF ALL ACTIONS
October 5-6, 2015	Human Performance Management	7	132
October 4-5, 2016	Environmental Protection	1	33
February 16, 2017	Radiation Protection	2	46
March 20, 2017	Management System	1	64
February 8, 2018	Security	0	0
March 13, 2018	Conventional H&S Fitness for Service Packaging and Transport	1	58
February 26-28, 2019	Conventional H&S Environmental Protection Fitness for Service Operating Performance Radiation Protection Waste Management	6	34
August 28-29, 2019	Environmental Protection	0	0
January 27-28, 2020	Human Performance Management	3	35
October 27-28, 2020	Radiation Protection	0	0
August 9-13, 2021	Management System	1	TBD
October 26, 2021	Emergency Management	TBD	TBD
November 30 – December 2, 2021	Fire Protection	TBD	TBD

A5 CNSC Staff Ratings

Throughout the current licence term, CNSC staff has rated SRBT performance in all applicable SCAs as either 'Satisfactory' (SA) or 'Fully Satisfactory' (FS).

CNSC PERFORMANCE RATINGS FOR SRBT (2015-2020)

SAFETY AND CONTROL AREA	2015	2016	2017	2018	2019	2020
Management System	SA	SA	SA	SA	SA	SA
Human Performance Management	SA	SA	SA	SA	SA	SA
Operating Performance	SA	SA	SA	SA	SA	SA
Safety Analysis	SA	SA	SA	SA	SA	SA
Physical Design	SA	SA	SA	SA	SA	SA
Fitness for Service	FS	FS	FS	FS	SA	SA
Radiation Protection	SA	SA	SA	SA	SA	SA
Conventional Health and Safety	FS	FS	FS	FS	SA	SA
Environmental Protection	SA	SA	SA	SA	SA	SA
Emergency Management and Fire Protection	SA	SA	SA	SA	SA	SA
Waste Management	SA	SA	SA	SA	SA	SA
Security	SA	SA	SA	SA	SA	SA
Packaging and Transport	SA	SA	SA	SA	SA	SA

Note that the use of 'Fully Satisfactory' as a performance rating was eliminated by CNSC as a policy decision when tabling the 2019 Annual Compliance and Performance Report.

As such, CNSC staff has noted that the ratings of 'Satisfactory' in the areas of Fitness for Service and Conventional Health and Safety since 2019 are not intended to represent a downgrade in performance for subsequent years.

A6 Annual Tritium Processing Data

This addendum includes data pertaining to the total amount of tritium processed at the SRBT facility in the seven calendar years spanning 2015-2021.

As well, the percentage ratio between the amount of tritium released to atmosphere as gaseous effluent vs. the amount of tritium processed is tabulated, as this metric is an excellent indicator of the operating performance of the facility with respect to SRBT's impact on persons and the environment.

ANNUAL TRITIUM PROCESSING DATA (2015-2021)

CALENDAR YEAR	TRITIUM PROCESSED (GBq)	TRITIUM RELEASED TO ATMOSPHERE (GBq)	RELEASED / PROCESSED (%)
2015	27,989,832	56,237	0.20
2016	28,122,678	28,945	0.10
2017	32,968,695	24,822	0.08
2018	31,251,329	33,180	0.11
2019	30,327,048	31,769	0.10
2020	27,887,498	25,186	0.09
2021	29,392,257	28,729	0.10
AVERAGE	**29,705,620**	**32,695**	**0.11**

A7 Effective Dose Data for SRBT Nuclear Energy Workers

Effective doses of ionizing radiation are routinely incurred by workers at SRBT, via intake of tritium oxide. Over the course of the current licence period, the effective doses to SRBT workers have remained very low compared to regulatory limits.

The effective dose to persons is calculated using data obtained by monitoring tritium concentration in persons using bioassay testing (urinalysis). These activities are performed in line with SRBT's Dosimetry Services Licence 11341-3-28.4, issued by CNSC staff, as well as SRBT's *Dosimetry Service Program*.

The following table describes key statistical data pertaining to the effective dose incurred by NEWs at SRBT in the past seven calendar years, since the current licence term began.

EFFECTIVE DOSES TO SRBT NEW (2015-2021)

CALENDAR YEAR	MAXIMUM EFFECTIVE DOSE (mSv)	AVERAGE EFFECTVE DOSE (mSv)	COLLECTIVE DOSE (p·mSv)
2015	0.87	0.070	3.22
2016	0.34	0.049	2.21
2017	0.46	0.045	1.96
2018	0.48	0.044	2.06
2019	0.57	0.065	2.95
2020	0.43	0.077	3.30
2021	0.36	0.056	2.35
AVERAGE	**0.50**	**0.058**	**2.58**

It is worthwhile to note that during the current licence term, **no SRBT NEW has incurred an effective dose that exceeded 1 mSv** in any calendar year, which represents the limit for any person who is not a NEW, as defined by the *Radiation Protection Regulations*.

A8 Workplace Injuries and Significance

Throughout the course of the current licence term, SRBT has effectively maintained a very low rate of workplace injuries and lost-time incidents.

This addendum describes key statistical data pertaining to these conventional health and safety metrics over the course of the past seven calendar years, since the current licence term began.

A workplace injury is defined as an injury which required first aid treatment on-site, at a minimum. Examples of such injuries may include a minor cut which required application of a self-adhesive bandage, a minor burn to the skin of the hand, or a muscle strain relating to a work activity. As glass blowing and forming are a key activity in our manufacturing processes, minor cuts and burns are not unexpected.

A lost-time incident is an injury which resulted in the worker missing scheduled work.

MINOR INJURIES AND LOST-TIME INCIDENTS (2015-2021)

CALENDAR YEAR	WORKPLACE INJURIES	LOST-TIME INCIDENTS
2015*	2*	0
2016*	3*	0
2017	21	3
2018	15	0
2019	22	0
2020	16	0
2021	7	0
AVERAGE	**12.3**	**0.4**

*NOTE: beginning in 2017, the definition for a recordable workplace injury was changed to include any and all incidents requiring basic first aid, no matter how minor. Prior to 2017, workplace injuries were only tracked if they were deemed significant and/or required off-site medical attention.

A9 Effective Dose Data for Persons who are Not Nuclear Energy Workers

Data on the conservatively-calculated effective dose to persons who are not NEWs (i.e. members of the public) attributed to SRBT licensed activities is summarized below, for the term of the current licence.

The limit for this dose is 1 mSv in any calendar year, as defined in the *Radiation Protection Regulations*.

Note that doses calculated using the DRL do not incorporate any groundwater consumption, while the EMP-calculated value includes this input as a conservative measure.

KEY ENVIRONMENTAL METRICS – PUBLIC DOSE (2015-2021)

YEAR	MAXIMUM EFFECTIVE DOSE (mSv): PERCENTAGE OF DRL	% of LIMIT	MAXIMUM EFFECTIVE DOSE (mSv): CALCULATED VIA EMP	% of LIMIT
2015	0.0024	0.2%	0.0068	0.7%
2016	0.0008	0.1%	0.0046	0.5%
2017	0.0009	0.1%	0.0034	0.3%
2018	0.0013	0.1%	0.0038	0.4%
2019	0.0014	0.1%	0.0022	0.2%
2020	0.0012	0.1%	0.0024	0.2%
2021	0.0016	0.2%	0.0020	0.2%
AVG.	**0.0013**	**0.1%**	**0.0036**	**0.4%**

**NOTES:*

1. *2015 DRL dose calculated using 2006 DRL values.*
2. *2016-2020 DRL dose calculated using 2016 DRL values.*
3. *2021 DRL dose calculated using 2021 DRL values.*

A10 Effluent Monitoring Data

SRBT releases tritium to the environment in a controlled and monitored fashion. There are two environmental pathways – gaseous releases to atmosphere, and liquid releases to municipal sewer.

The amount of tritium that may be released through both pathways is limited to amounts described in the SRBT Licence Conditions Handbook.

For gaseous releases to atmosphere, limits are described in terms of both the amount of tritium oxide (HTO), and total tritium (both HTO and elemental/HT) that may be released per calendar year.

As well, SRBT tracks the ratio between the amount of tritium released via the gaseous pathway, and the amount of tritium that is processed as part of licensed facility operation. This ratio is a good indicator of overall performance over time; lower ratios indicate better operating and environmental protection performance, while a higher ratio could be an indicator of a problem or an opportunity to improve.

Data on atmospheric releases of gaseous tritium through the term of the current licence are tabulated below.

ATMOSPHERIC RELEASE DATA (2015-2021)

YEAR	TRITIUM OXIDE RELEASED TO ATMOSPHERE (GBq)	% of LIMIT	TOTAL TRITUM RELEASED TO ATMOSPHERE (GBq)	% of LIMIT	RELEASED TO PROCESSING RATIO (%)
2015	11,554	17.2%	56,237	12.6%	0.20%
2016	6,293	9.4%	28,945	6.5%	0.10%
2017	7,198	10.7%	24,822	5.5%	0.08%
2018	10,741	16.0%	33,180	7.4%	0.11%
2019	11,858	17.6%	31,769	7.1%	0.10%
2020	9,755	14.5%	25,186	5.6%	0.09%
2021	8,387	12.5%	28,729	6.4%	0.10%
AVG.	**9,398**	**13.9%**	**32,695**	**7.3%**	**0.11%**

For liquid releases, the limit is described in terms of the total amount of water-soluble tritium that may be released to the municipal sewer in a calendar year.

Data on liquid releases of water-soluble tritium to the municipal sewer through the term of the current licence are tabulated below:

MUNICIPAL SEWER RELEASE DATA (2015-2021)

YEAR	TRITIUM – WATER SOLUBLE RELEASED TO SEWER (GBq)	% of LIMIT
2015	6.50	3.3%
2016	5.18	2.6%
2017	6.85	3.4%
2018	10.02	5.0%
2019	13.67	6.9%
2020	5.56	2.8%
2021	3.07	1.5%
AVG.	**7.26**	**3.6%**

A11 Environmental Monitoring Data and Maps

SRBT conducts a wide variety of environmental monitoring, with the data being used to calculate the effective dose to the public, and to trend performance over time. Environmental data also provides the primary source of information for SRBT's Environmental Risk Assessment (ERA).

In all cases, a high degree of conservatism is applied when modelling the interactions of humans and ecological receptors with tritium in the surrounding environment.

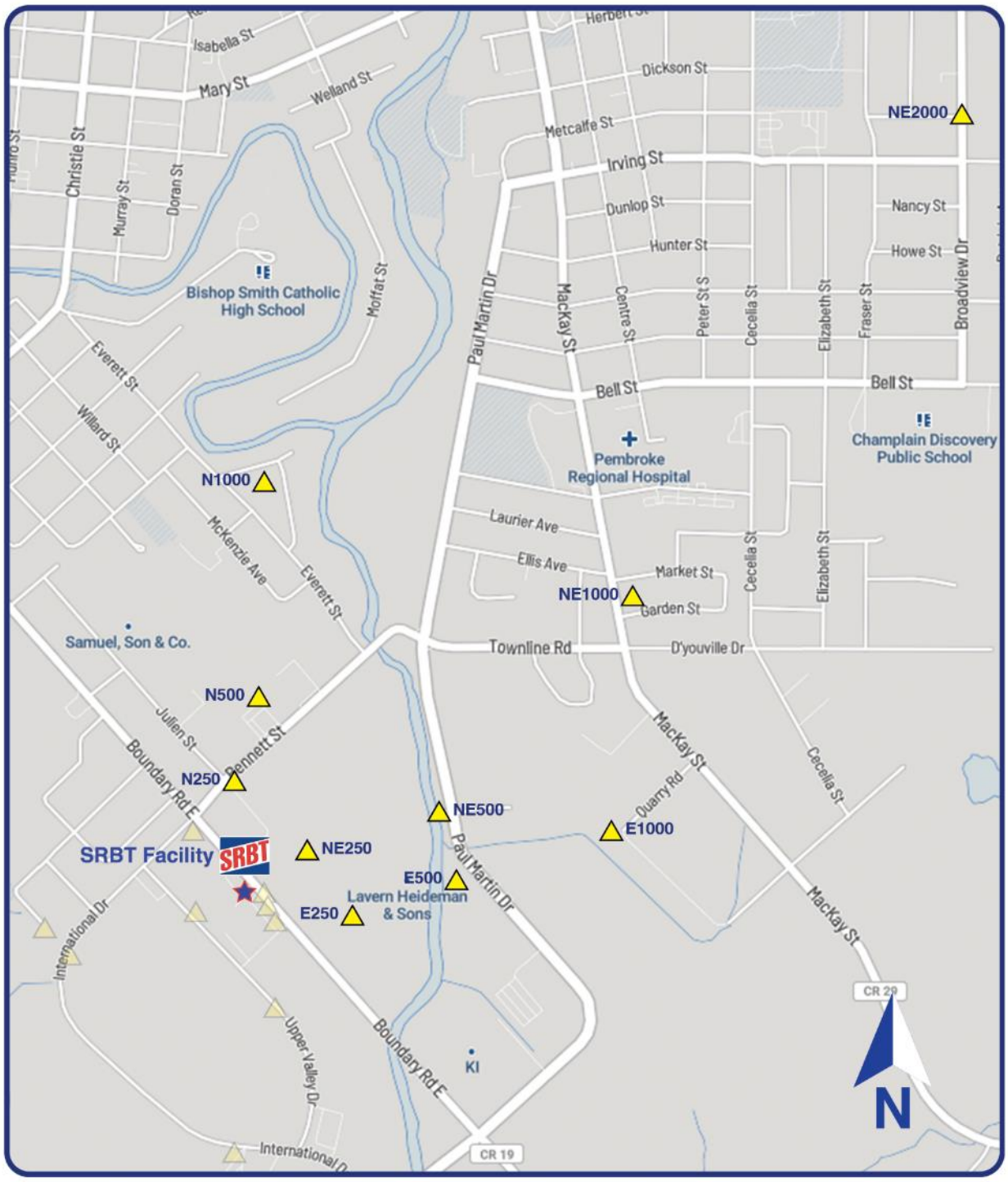
The maximum measurement obtained during the current licence term for several important types of environmental media is provided below, including measures of tritium oxide (HTO) and organically-bound tritium (OBT) in certain sample types. Averages are provided as well for additional context.

Benchmark values, at which investigation is triggered and action is recommended to be taken, are also listed. Concentrations of tritium in environmental media reaching the benchmark values are not likely to pose a significant impact to persons or the environment; however, they may be an indicator that the principle of 'as low as reasonably achievable' is not being met.

ENVIRONMENTAL SAMPLE TYPE	UNITS	MAXIMUM MEASUREMENT (2015-2021)	AVERAGE MEASUREMENT (2015-2021)	BENCHMARK VALUE	MAXIMUM vs. BENCHMARK
Air concentration, residential (HTO)	Bq/m^3	24.40	1.34	340	7.1 %
Precipitation	Bq/L	1,621	40	7,000	23.2 %
Drinking water (HTO)	Bq/L	232	41	7,000	3.3 %
Muskrat river (HTO)	Bq/L	14	7	7,000	0.2 %
Residential produce (HTO)	Bq/kg	210	58	100,000	0.2 %
Residential produce (OBT)	Bq/kg	13	4	45,200	0.0 %
Commercial produce (HTO)	Bq/kg	12	6	100,000	0.0 %
Commercial produce (OBT)	Bq/kg	4	3	45,200	0.0 %
Animal produce – milk (HTO)	Bq/kg	5	4	5,560	0.1 %

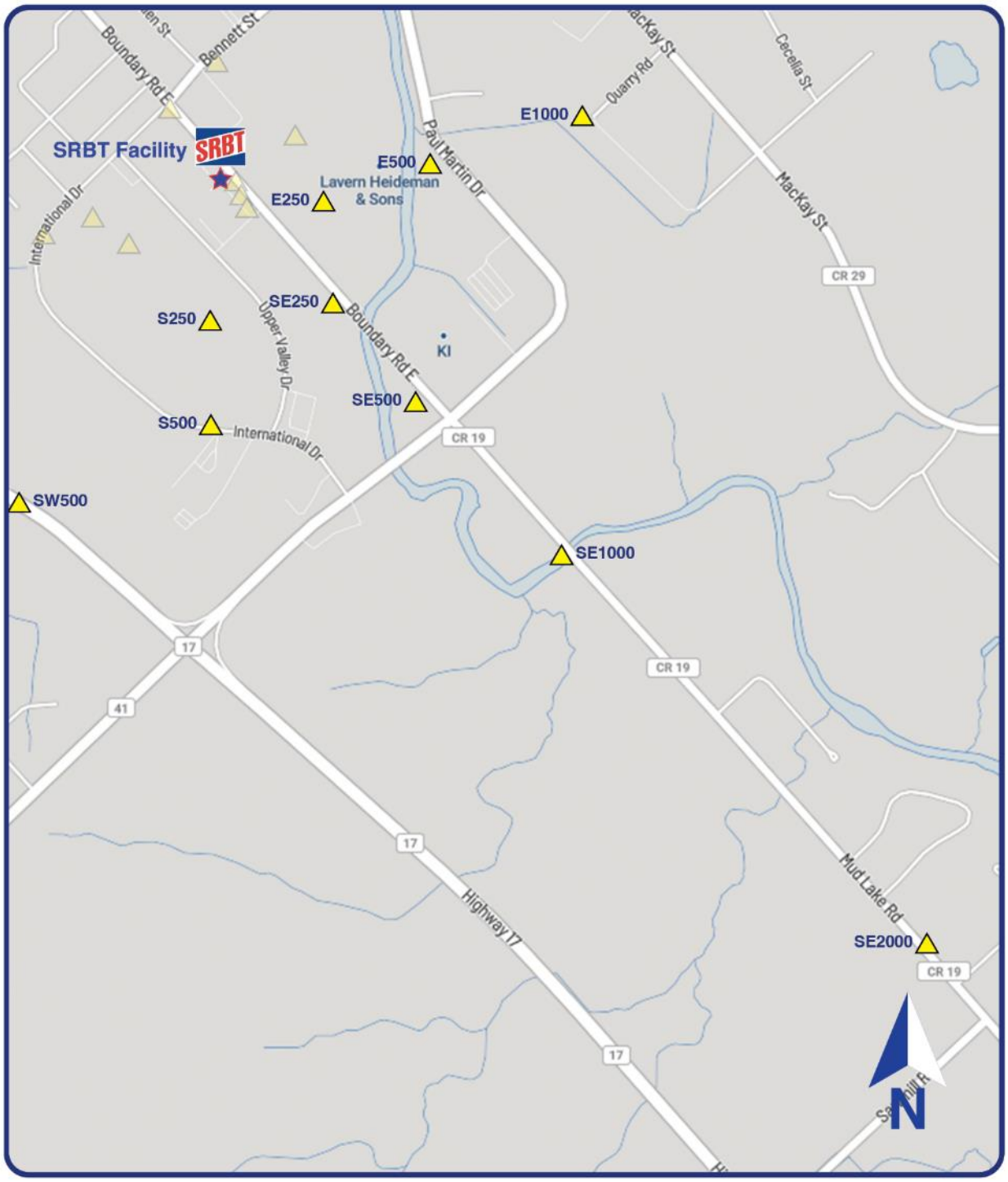
Maps depicting the routine sample points for the environmental media used as input to public dose calculations, along with other key sample types, are provided for information purposes:

PASSIVE AIR SAMPLERS – NE QUADRANT



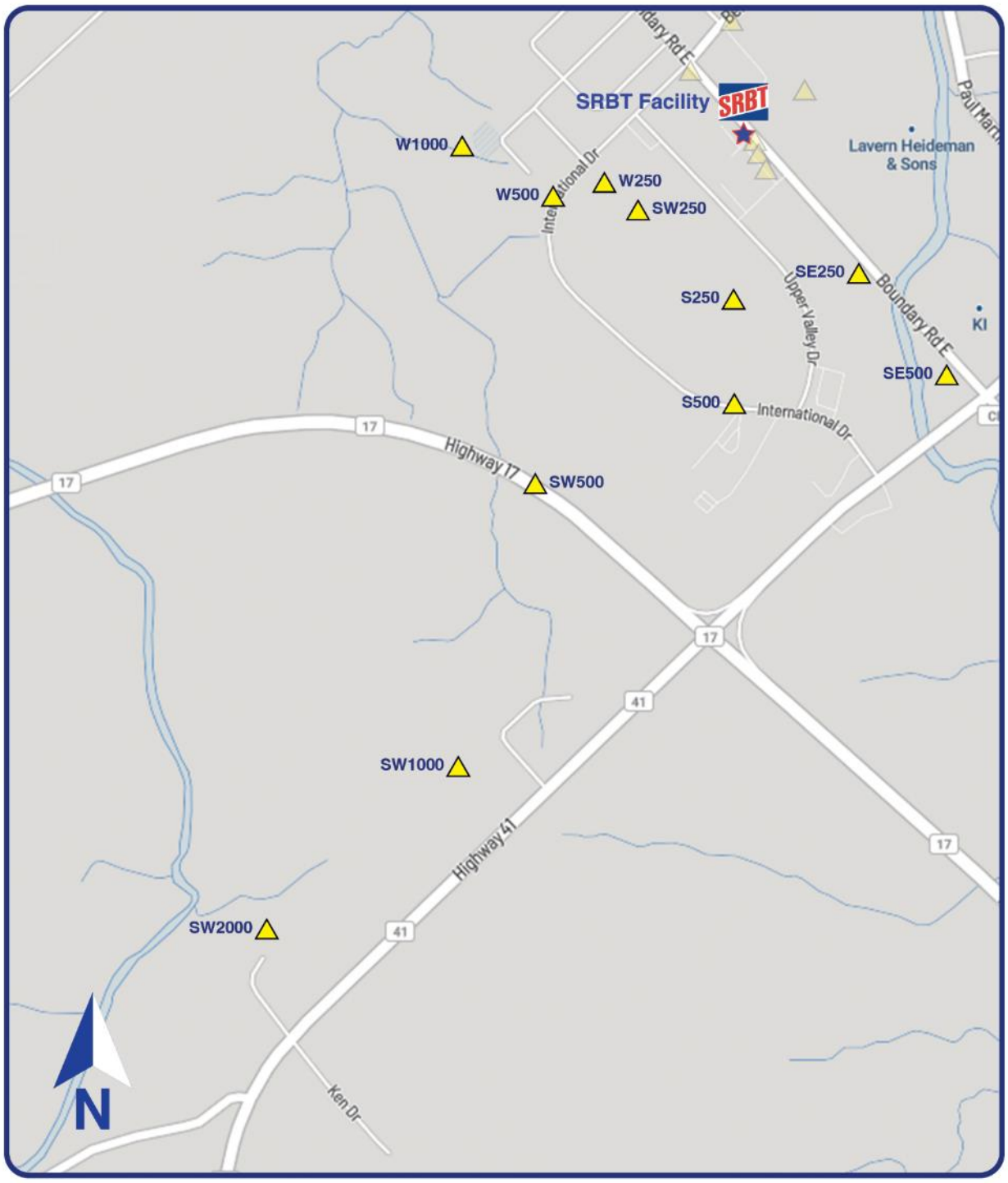
PAS Stations N / NE / E △

PASSIVE AIR SAMPLERS – SE QUADRANT

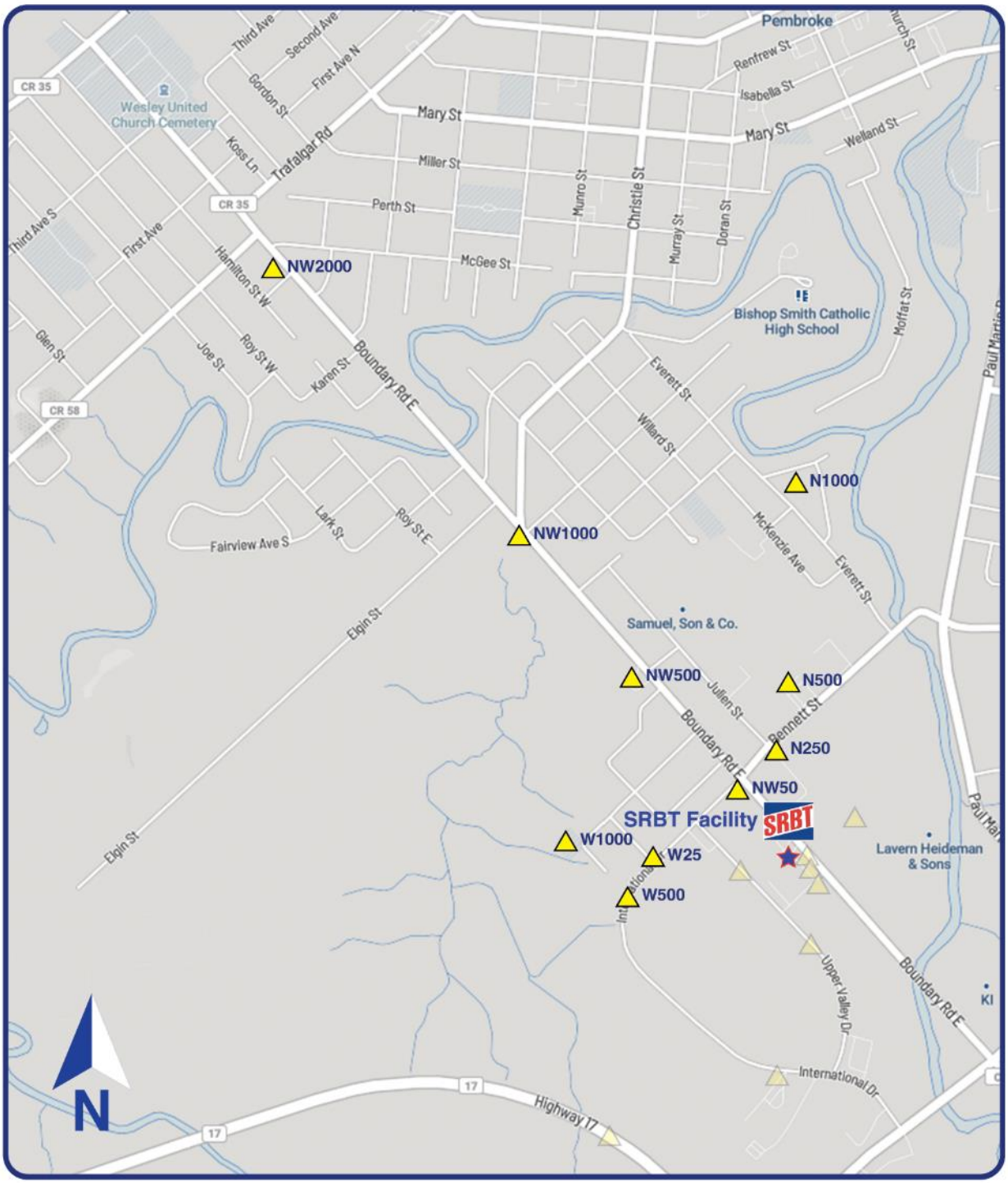


PAS Stations S / SE / E △

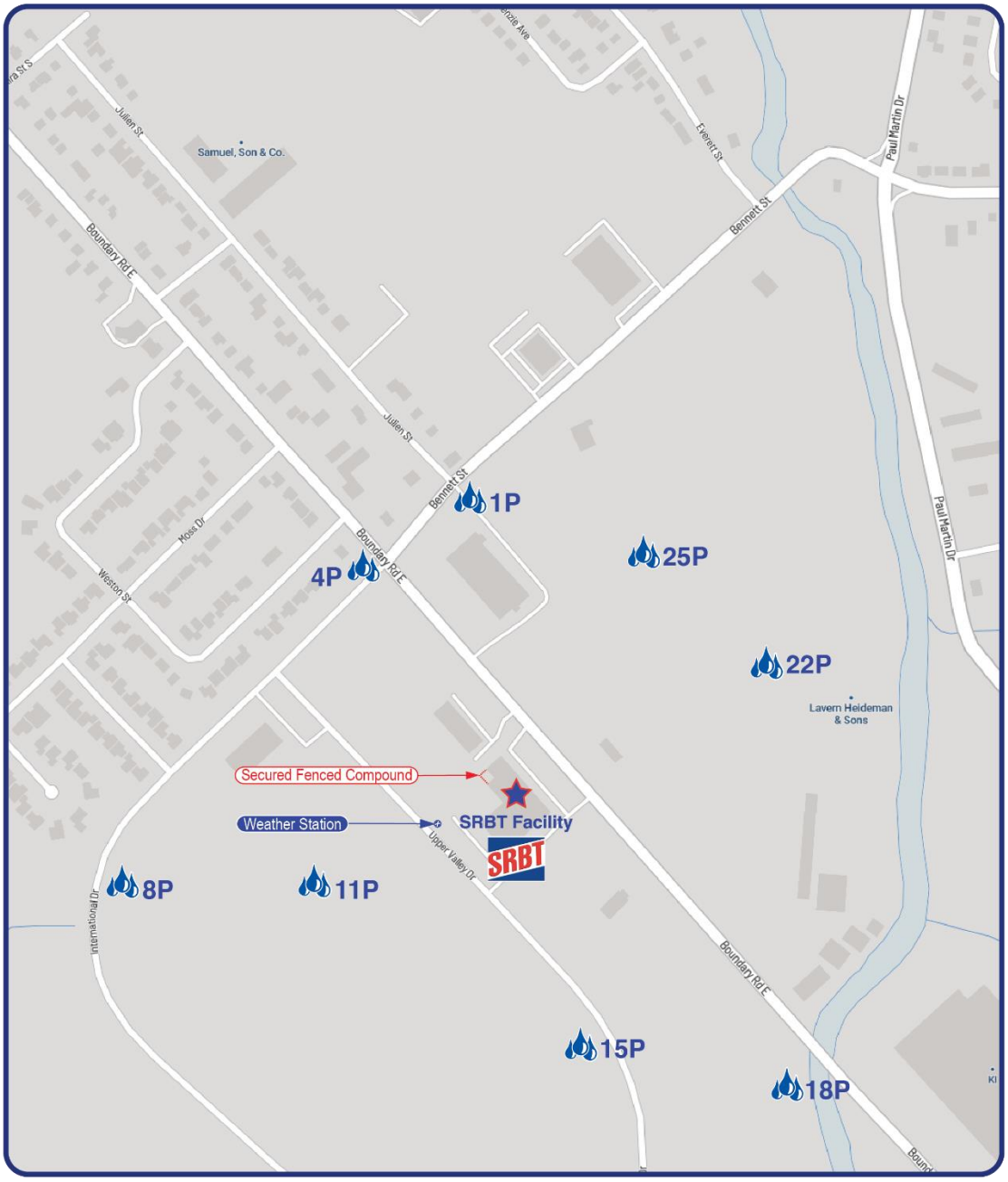
PASSIVE AIR SAMPLERS – SW QUADRANT



PASSIVE AIR SAMPLERS – NW QUADRANT

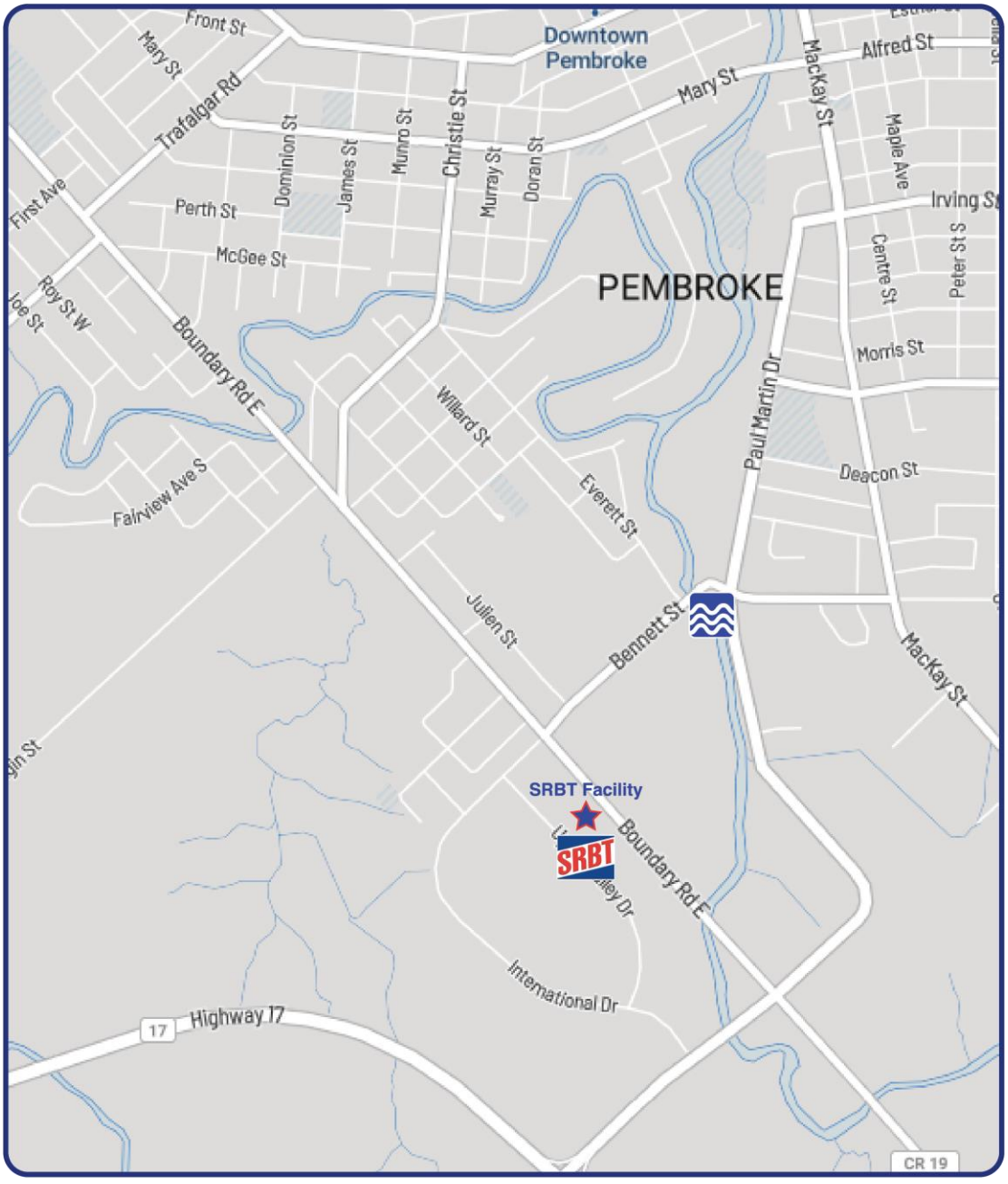


PRECIPITATION SAMPLERS



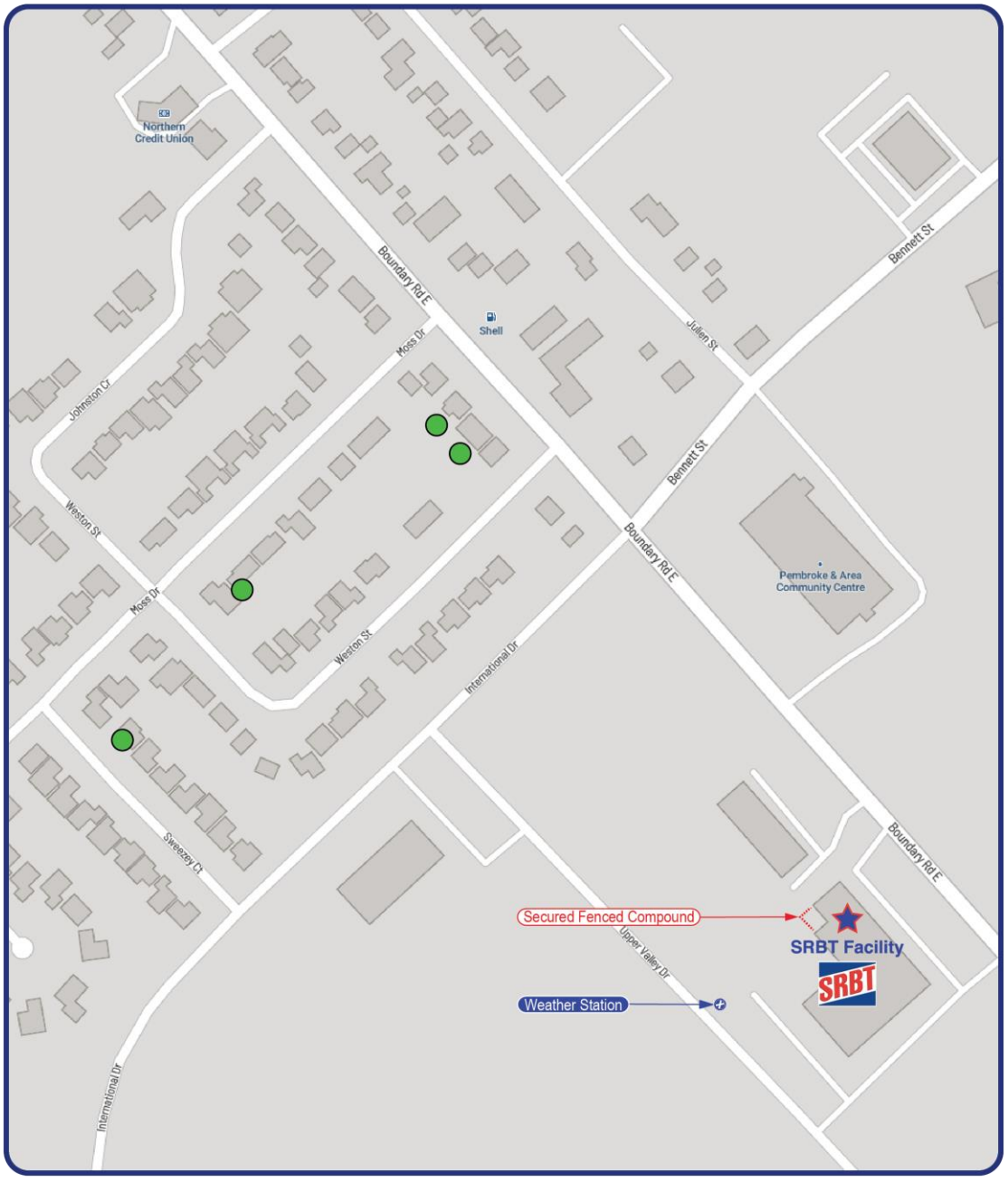
Precipitation Sampling Stations

MUSKRAT RIVER – ROUTINE SAMPLE LOCATION



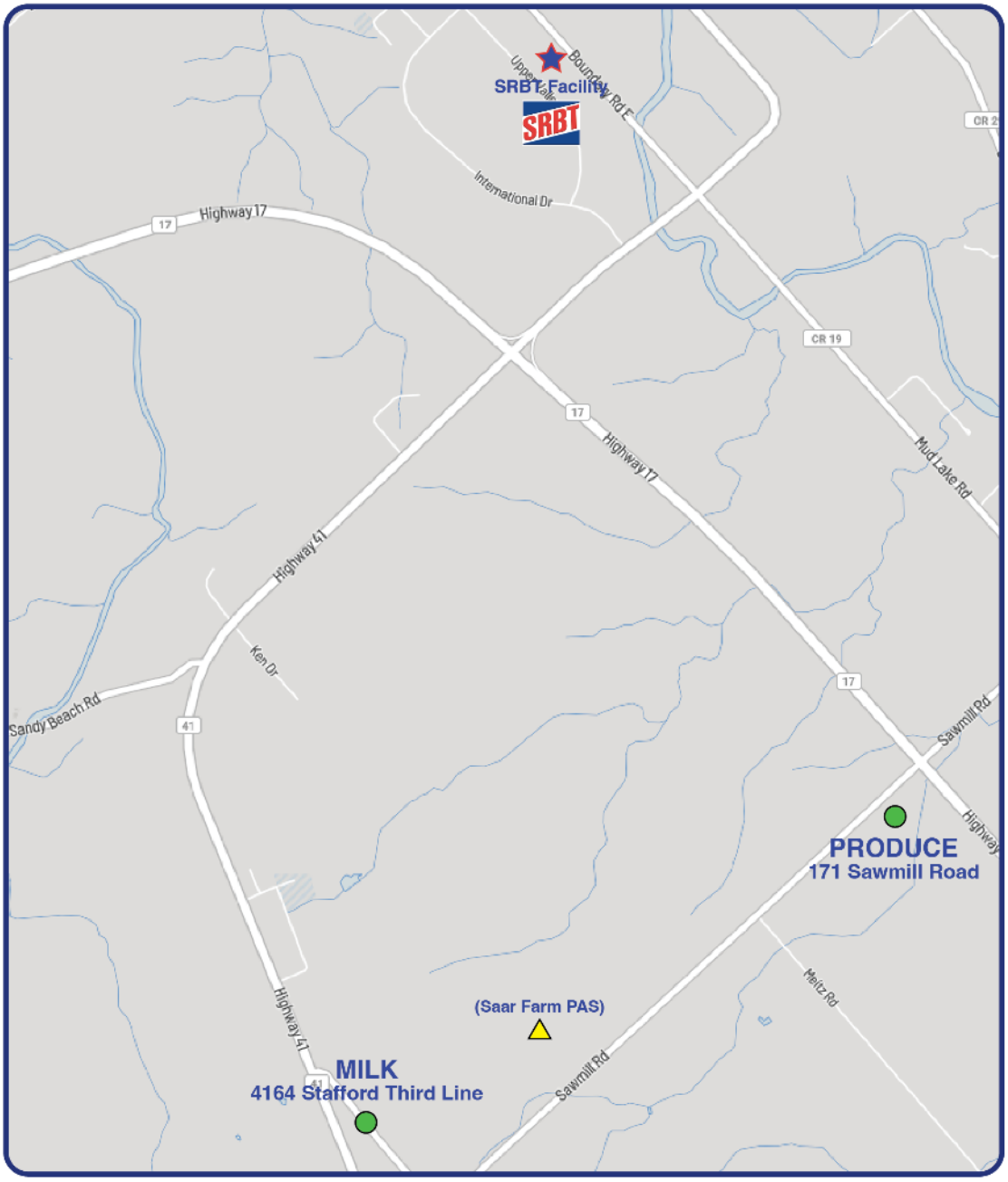
River Water Sampling Point

PRODUCE SAMPLING (< 1 km from facility)



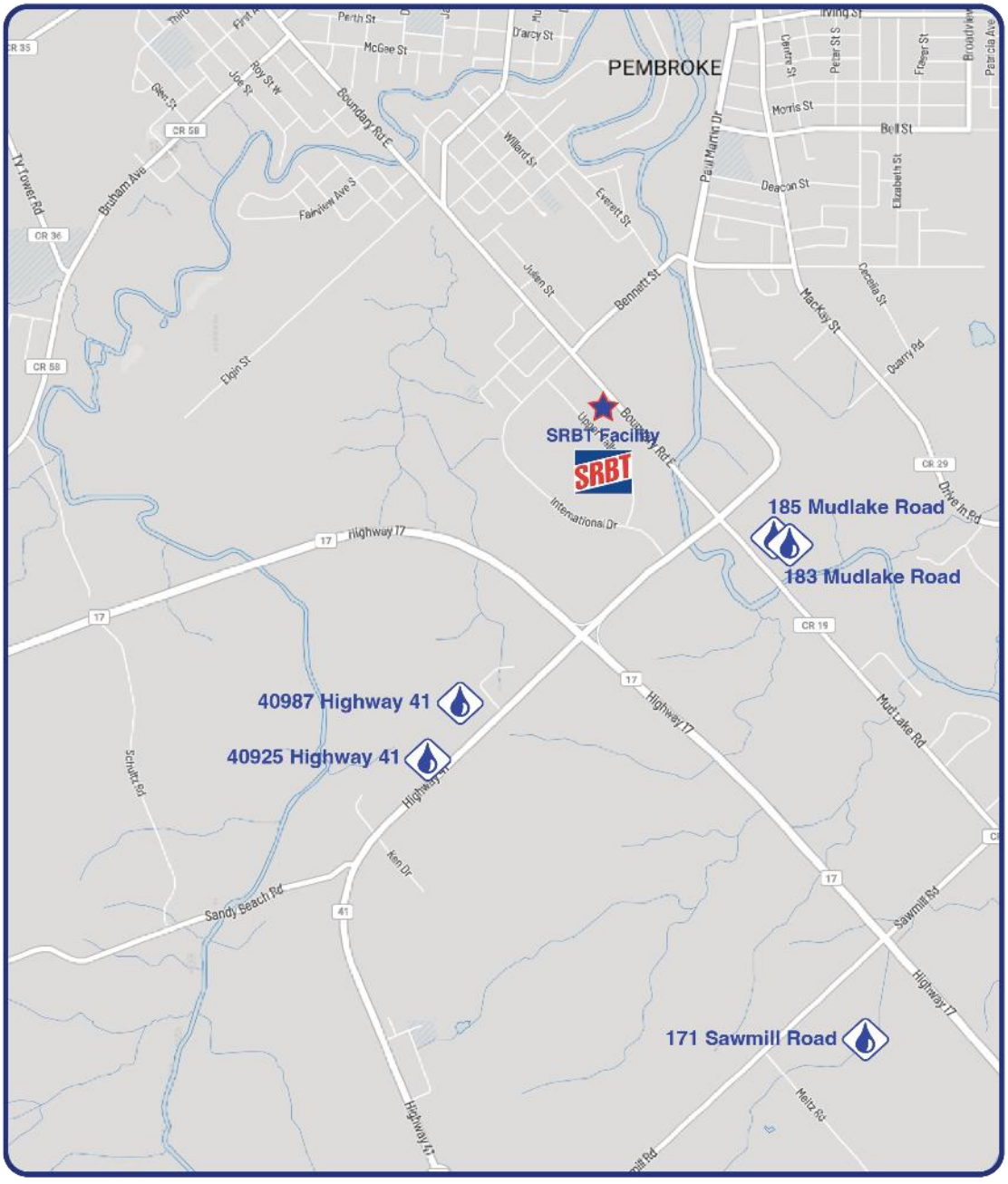
Produce Monitoring Sample Points ●

PRODUCE (> 1 km from facility) AND MILK SAMPLING



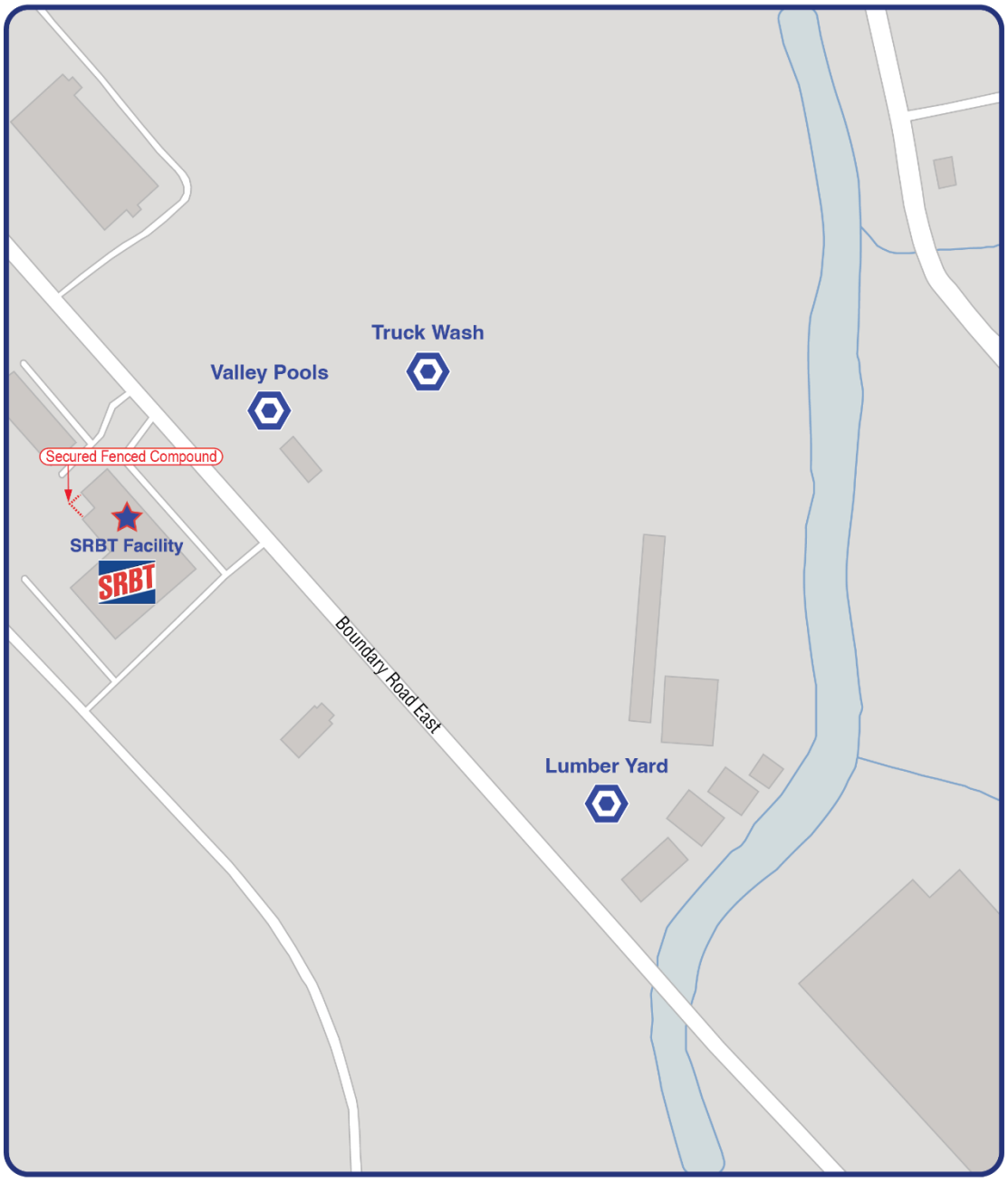
Produce / Milk Monitoring Sample Points ●

RESIDENTIAL WELL SAMPLING



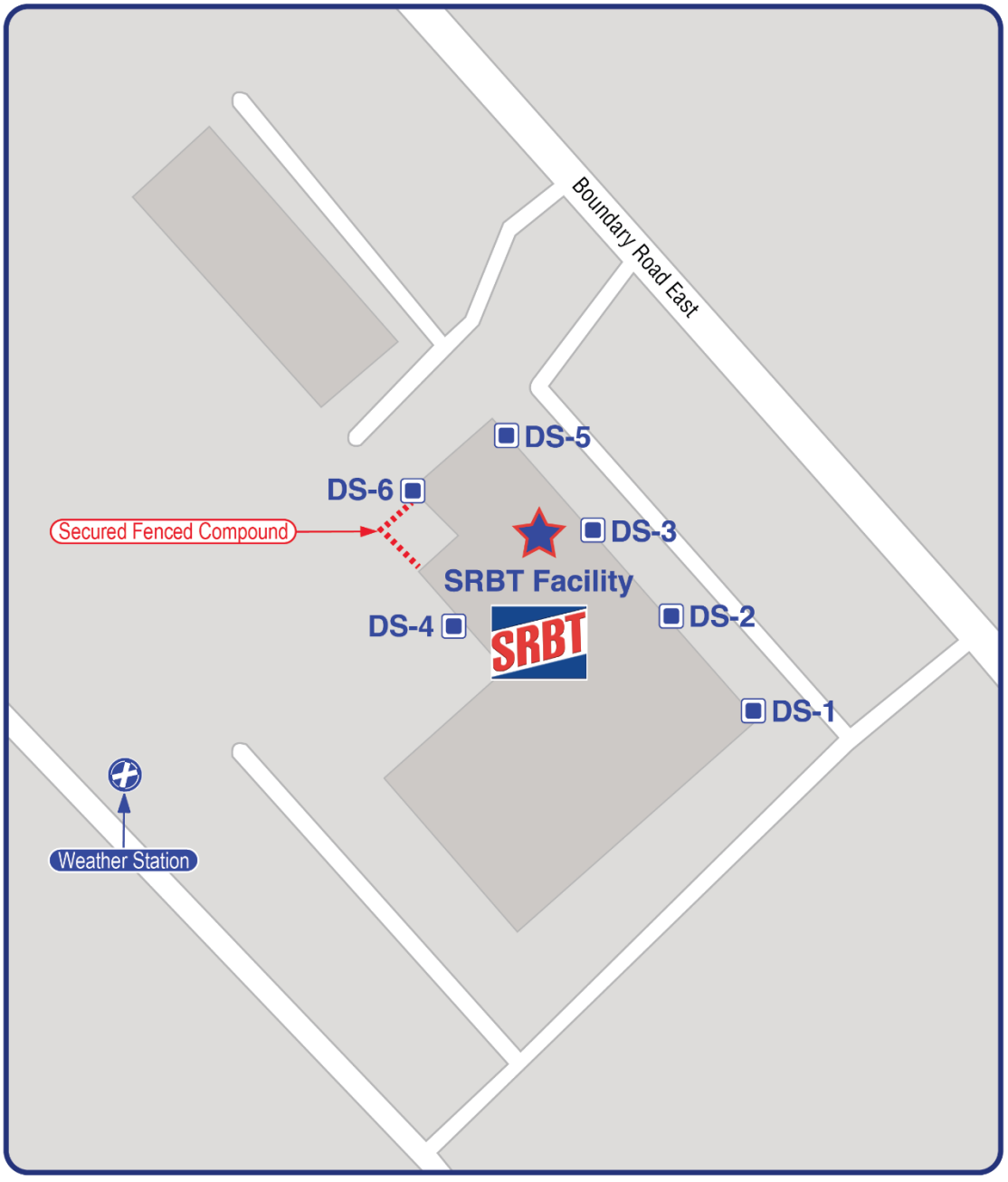
Drinking Water Monitoring Sample Points

BUSINESS WELL SAMPLING



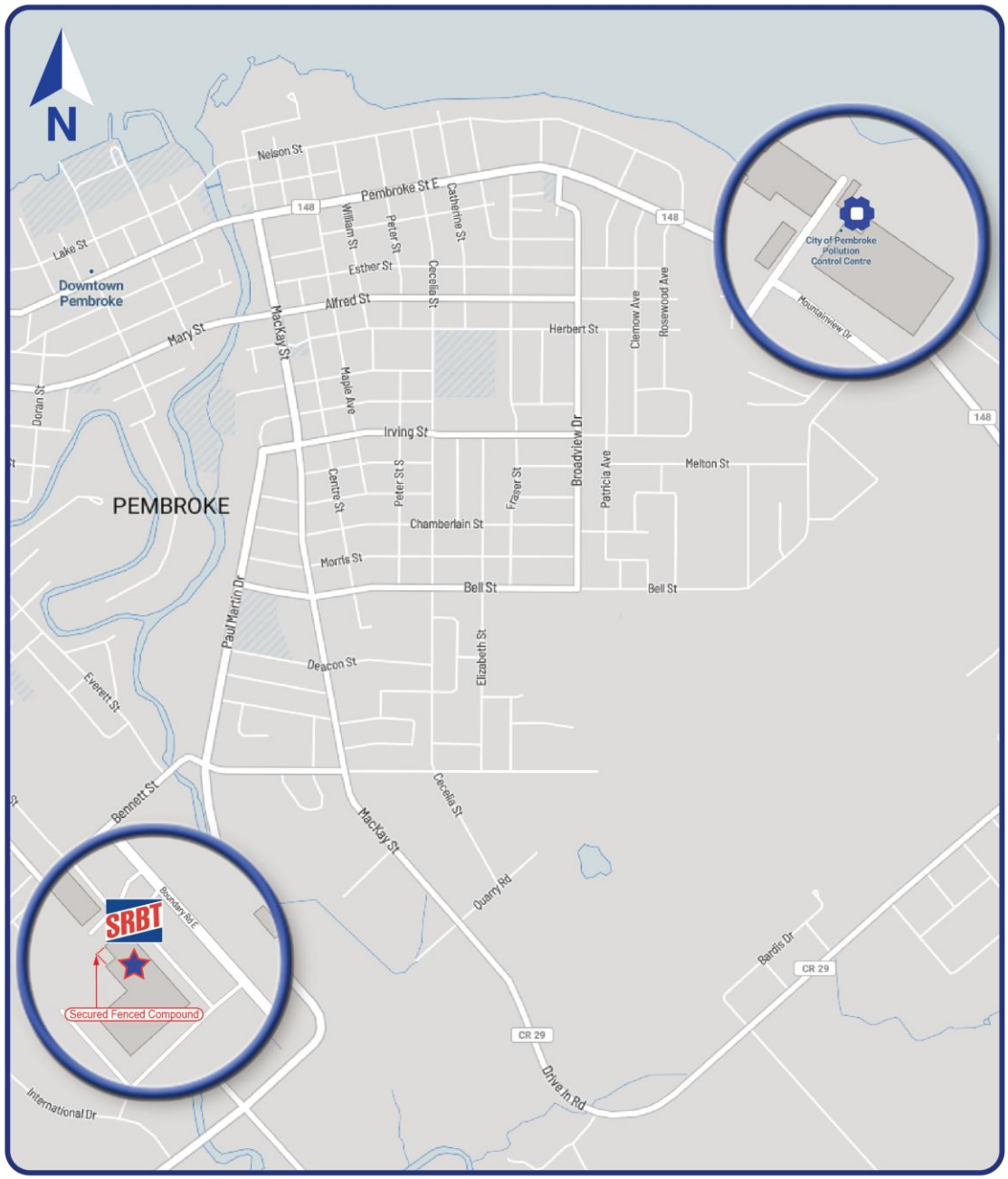
Business Well Monitoring Sample Points

FACILITY DOWNSPOUT RUNOFF SAMPLING



Facility Downspout Runoff Sampling Points ■

SEWAGE SLUDGE CAKE SAMPLING



Sludge Cake Monitoring Sample Points

A12 Groundwater Monitoring Data and Map

Over the course of the licence term, the concentration of tritium in groundwater monitoring wells has continuously declined. The average annual tritium concentration in the twenty-nine monitoring wells routinely sampled by SRBT is provided in below for calendar years 2015 and 2021, along with the percentage change in average concentration over that time span.

ANNUAL AVERAGE TRITIUM CONCENTRATION IN SRBT WELLS (2015 vs. 2021)

WELL ID	ANNUAL AVERAGE – 2015 (Bq/L)	ANNUAL AVERAGE – 2021 (Bq/L)	% CHANGE
MW06-1	4,338	651	**- 85.0**
MW06-2	1,965	736	**- 62.5**
MW06-3	1,218	199	**- 83.7**
MW06-8	906	550	**- 39.3**
MW06-9	2,731	1,366	**- 50.0**
MW06-10	51,635	30,153	**- 41.6**
MW07-11	1,521	858	**- 43.6**
MW07-12	463	435	**- 6.0**
MW07-13	13,237	3,527	**- 73.4**
MW07-15	1,680	1,076	**- 36.0**
MW07-16	2,188	897	**- 59.0**
MW07-17	780	296	**- 62.1**
MW07-18	5,491	1,102	**- 79.9**
MW07-19	3,222	959	**- 70.2**
MW07-20	775	296	**- 61.8**
MW07-21	1,121	363	**- 67.6**
MW07-22	1,171	729	**- 37.7**
MW07-23	2,206	1,147	**- 48.0**
MW07-24	2,314	1,511	**- 34.7**
MW07-26	1,941	421	**- 78.3**
MW07-27	4,869	1,696	**- 65.2**
MW07-28	1,446	670	**- 53.7**
MW07-29	3,950	1,075	**- 72.8**
MW07-31	756	325	**- 57.0**
MW07-32	128	60	**- 53.1**
MW07-34	3,312	1,153	**- 65.2**
MW07-35	3,945	1,550	**- 60.7**
MW07-36	2,892	1,154	**- 60.1**
MW07-37	1,009	717	**- 28.9**
AVERAGE	**4,249**	**1,920**	**- 56.5**

SRBT expects the trend of declining tritium concentration in groundwater to continue into the near future, and will continue to work towards minimizing the impact of operations on groundwater resources in the area around the facility.

A map depicting the array of groundwater monitoring wells is provided for information purposes: