Preliminary Decommissioning Plan

November 2019

EXECUTIVE SUMMARY

SRB Technologies (Canada) Inc. (SRBT) is the world's leading producer of gaseous tritium light sources (GTLS) – flame-sealed borosilicate glass capsules which are internally coated with a phosphorescent powder, and vacuum back-filled with high-purity tritium gas.

The low-energy beta particles emitted during the decay of the tritium gas interact with the phosphorescent powder and produce visible light. These light sources are then installed into various devices that require a reliable light source without electrical power or other extraneous power source.

As prescribed by the *Class I Nuclear Facilities Regulations*, and as required by licence condition 12.2 of operating licence NSPFOL-13.00/2022, SRBT is required to document and maintain a Preliminary Decommissioning Plan (PDP).

The PDP represents an important component of the licensing basis of the SRBT Class I nuclear facility. It has been developed in accordance with Canadian Nuclear Safety Commission (CNSC) Regulatory Guide G-219, *Decommissioning Planning for Licensed Activities*.

The plan has also been developed in line with the requirements of Canadian Standards Association (CSA) standard N294-09 (R2019), *Decommissioning of facilities containing nuclear substances,* as required by the SRBT Licence Conditions Handbook (LCH).

Within the PDP, feasible decommissioning envelopes for the entire facility are established and documented which can be accomplished with low risk to the health and safety of the decommissioning personnel, the public, and the environment.

The PDP must also describe the expected costs associated with completing facility decommissioning. Once accepted by the CNSC, these costs establish the magnitude of the financial guarantee for decommissioning that must be put in place, in accordance with condition 1.3 of NSPFOL-13.00/2022, and CNSC Regulatory Guide G-206, *Financial Guarantees for the Decommissioning of Licensed Activities*.

The PDP helps to ensure that the SRBT facility is able to adequately prepare for the future costs of decommissioning, and to help identify potential issues well in advance so that solutions can be pursued proactively.

SRBT Preliminary Decommissioning Plan

November 2019

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NOV 29/2019
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Revision History

Release Date	Reviewed By	Revision Notes
March 14, 2006	S. Levesque S. MacDougall	
January 30, 2007	S. Levesque	Document revised to address comments in CNSC staff letter dated July 5, 2006. Changes outlined in SRBT letter dated January 30, 2007 tilted “CNSC Review of the Preliminary Decommissioning Plan and the Associated Cost Estimate plus Financial Guarantee”.
June 15, 2007	S. Levesque	Document revised to address comments in CNSC staff letter dated February 23, 2007. Changes outlined in SRBT letter dated June 15, 2007 titled “CNSC Review of the Preliminary Decommissioning Plan and the Associated Cost Estimate plus Financial Guarantee”.
March 20, 2008	S. Levesque	Document revised to reflect acceptance of the Financial Guarantee for the Safe State of closure by hearing dated September 12, 2007. Document now also includes final “Escrow Agreement” and “Financial Security And Access Agreement” signed by CNSC President on January 14, 2008.
June 11, 2008	R. Fitzpatrick S. Levesque	Document revised to reflect submission of SRBT letter dated June 11, 2008 tilted “Financial Guarantee for the Full Cost of the Decommissioning and Cost Recovery Fee Arrears”.
March 31, 2009	R. Fitzpatrick S. Levesque	Document revised to reflect acceptance of the Financial Guarantee by hearing dated April 3, 2008 and June 12, 2008. Document also includes latest final “Escrow Agreement” and “Financial Security And Access Agreement” signed by CNSC President on February 20, 2009.

Revision History (continued)

Release Date	Reviewed By	Revision Notes
June 23, 2013	K. Belec R. Fitzpatrick S. Levesque	Document revised to meet requirement for review every five years.
June 20, 2014	S. Levesque D. McNab T. Donahue	Document revised to address comments in CNSC staff letters dated September 17, 2013 and January 14, 2014.
November 13, 2014	S. Levesque D. McNab T. Donahue	Document revised to address comments in CNSC staff letters dated August 22, 2014 and November 7, 2014
November 29, 2019	R. Fitzpatrick K. Levesque S. Levesque J. MacDonald	Plan revised in accordance with compliance verification criterion (CVC) 3 under section 12.2 of Part II of the SRBT Licence Conditions Handbook, which states that “The decommissioning plan shall be revised at a minimum of every five years, unless otherwise specified by the Commission”.

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Acronyms and Abbreviations

CCL	Conditional Clearance Level
CLW	Clearance-level Waste
CMD	Commission Member Document
CNSC	Canadian Nuclear Safety Commission
CSA	Canadian Standards Association
CVC	Compliance Verification Criterion
DCGL	Derived Concentration Guideline Level
DDP	Detailed Decommissioning Plan
DSL	Dosimetry Service Licence
DU	Depleted Uranium
EMS	Environmental Management System
FG	Financial Guarantee
GTLS	Gaseous Tritium Light Source
HTO	Tritium Oxide
LCH	Licence Conditions Handbook
LLW	Low-level Waste
LSC	Liquid Scintillation Counting
MARSSIM	Multi-Agency Radiation Site Survey Investigation Manual
NEW	Nuclear Energy Worker
NSPFOL	Nuclear Substance Processing Facility Operating Licence
OBT	Organically-bound Tritium
OPP	Ontario Provincial Police
PDP	Preliminary Decommissioning Plan
PFD	Pembroke Fire Department
PPE	Personal Protective Equipment
REGDOC	Regulatory Document
SRBT	SRB Technologies (Canada) Inc.
SSP	Safe Shutdown Phase
WMP	Waste Management Program

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1. Background

On March 14, 2006 SRB Technologies (Canada) Inc. (SRBT) submitted to the Canadian Nuclear Safety Commission (CNSC) staff a Preliminary Decommissioning Plan[1] (PDP).

In a letter[2] dated July 6, 2006 CNSC staff provided SRBT comments on the submitted PDP. SRBT addressed these comments in a letter[3] dated January 30, 2007.

In a letter[4] dated February 23, 2007, CNSC staff provided SRBT additional comments specifically on the cost estimate included in the PDP. SRBT addressed these comments in a letter[5] to CNSC staff dated June 15, 2007.

As reported in CNSC staff CMD 07-H145[6] released on July 27, 2007, CNSC staff subsequently reviewed and accepted the revised cost estimate and a hearing was held by the Commission on September 12, 2007, to approve the Financial Guarantee (FG) for the Safe State of Closure of the facility.

In a Record of Proceedings, Including Reasons for Decision[7] released by CNSC on October 23, 2007 after the hearing, the Commission accepted the FG provided by SRBT for the safe state of closure of its facility.

In a letter[8] dated June 11, 2008, SRBT provided CNSC staff a proposal for funding of the full value of the FG. CNSC staff subsequently reviewed SRBT's proposal and recommended[9] at a licence hearing on June 12, 2008 that the Commission accept the proposed funding schedule for the full value of the FG.

In a Record of Proceedings, Including Reasons for Decision[10] released by CNSC on June 26, 2008 after the hearing, the Commission accepted the FG provided by SRBT for the full value.

On June 23, 2013, SRBT submitted to the CNSC staff a revised Preliminary Decommissioning Plan[11]. In a letter[12] dated September 17, 2013, CNSC staff provided SRBT comments on the revised PDP. SRBT addressed these comments in a letter[13] dated November 19, 2013.

In a letter[14] dated January 15, 2014, CNSC staff provided SRBT with additional comments specific to an overview of the radiological, chemical and physical conditions predicted to exist at end of operations and FG requirements.

SRBT then hired consultants Doug McNab of D&J Consulting, and Terry Donahue of RadSafe Canada Ltd., to revise SRBT's PDP to address both CNSC staff comments and make changes and improvements to the PDP based on their knowledge of decommissioning other CNSC licensed facilities.

Mr. Donahue and Mr. McNab were directly involved in the full decommissioning of Shield Source Inc., in Peterborough, Ontario, which had been a CNSC licensed facility with operations very similar to that of SRBT.

On June 20, 2014, SRBT submitted to CNSC staff a newly revised PDP[15] which addressed CNSC staff comments from two letters dated September 17, 2013[12], and January 15, 2014[14]. On August 22, 2014[16] CNSC staff provided comments on the review of SRBT's revised PDP and FG.

In a response[17] dated September 21, 2014, SRBT provided CNSC staff a response to the comments from the CNSC staff letter[16] dated August 22, 2014.

In an e-mail[18] dated October 27, 2014, CNSC staff responded and indicated SRBT had addressed all comments; however, not enough justification was given for decreasing the contingency factor from 25% to 15%.

In a letter[19] dated October 30, 2014, SRBT proposed to CNSC staff that a contingency factor of 10% shall be applied in the FG only for those definitive projected operational costs which are strictly included in the 'running costs', as such costs are based on known expenditures. These include known, fixed costs such as electricity costs, heating, rent and similar costs. A contingency factor of 25% was to be applied to all other FG costs projected within the PDP.

In a letter[20], dated November 7, 2014, CNSC staff provided SRBT a response accepting the proposal to use a 10% contingency for running costs and 25% contingency factor added to all other listed phase items, as this has been accepted previously.

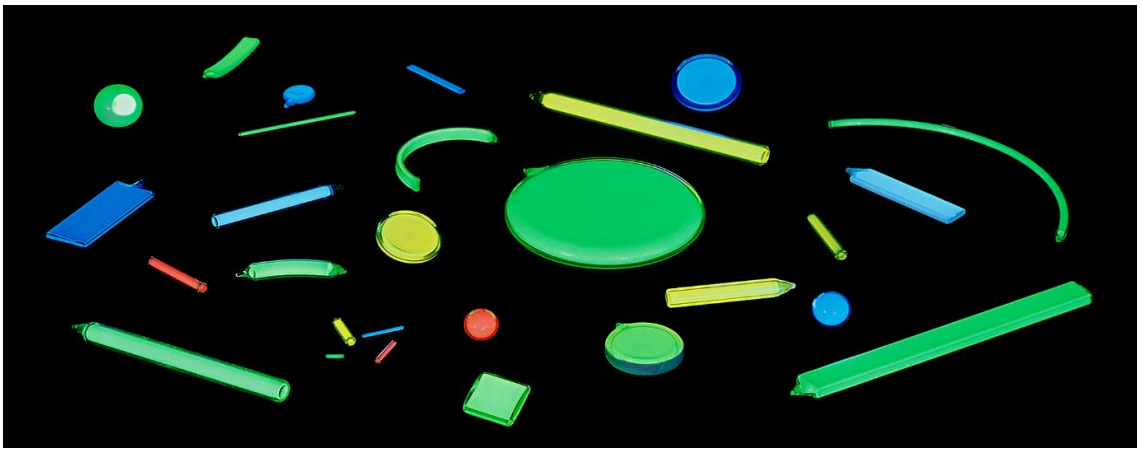
CNSC staff accepted the 2014 version of the PDP on November 24, 2014[21], noting that previous comments had been addressed.

This revision of the PDP and associated FG has been initiated as part of the five-year cycle of review and revision of this key licensing basis document, in accordance with compliance verification criterion (CVC) 3, under section 12.2 of Part II of the in-force Licence Conditions Handbook (LCH).

2. Introduction

SRB Technologies (Canada) Inc. is a small company that has been in Pembroke since 1990 manufacturing gaseous tritium light sources. SRBT is the original developer of the gaseous tritium light source which is a glass capsule internally coated with luminescent powder and filled with tritium. The interaction between the particles emitted by the tritium and the luminescent coating produces light on a continuous basis.

Figure 1: VARIOUS TYPES OF TRITIUM LIGHT SOURCES PRODUCED BY SRBT



The products that SRBT manufactures which use these light sources are crucial to ensure the safety and security of people all over the world, including peace keeping forces. Other lighting technologies require wiring, power or batteries which result in a lack of reliability, portability and in some cases safety. Our lighting products do not use electricity thereby reducing energy consumption and aid the environment against Global Warming.

Figure 2: VARIOUS TYPES OF PRODUCTS PRODUCED BY SRBT

SRBT is licensed by the Canadian Nuclear Safety Commission under Nuclear Substance Processing Facility Operating Licence number NSPFOL-13.00/2022 for the purpose of manufacturing gaseous tritium light sources.

The requirements for such a license are described in the *General Nuclear Safety and Control Regulations* and the *Class 1 Nuclear Facility Regulations*. In particular, Section 3(k) of the *Class 1 Nuclear Facilities Regulations* requires that every application for a license in respect to a Class 1 nuclear facility, other than a license to abandon, shall contain the proposed plan for the decommissioning of the nuclear facility.

SRBT's PDP has been prepared in accordance with the requirements of the *Nuclear Safety and Control Act* and CNSC Regulatory Guide G-219, *Decommissioning Planning for Licensed Activities*.

The goal of the PDP is to establish feasible decommissioning envelopes that can be accomplished with low risk to the health and safety of the decommissioning personnel, the public, and the environment. In addition, the PDP must propose financial guarantees in accordance with the CNSC Regulatory Guide G-206, *Financial Guarantees for the Decommissioning of Licensed Activities*.

In accordance with section 6.1.2 of G-219, this PDP includes the following:

1. a brief description of, and diagram showing, the various areas, components and structures to be decommissioned;
2. an overview of the principal radiological, chemical and physical conditions predicted to exist at the end of operations;
3. a discussion of the general types of hazards, associated with the above conditions, that could be encountered during decommissioning;
4. identification of any features of the surrounding natural and social environment that could be significantly affected by the decommissioning process;
5. a statement of, and rationale for, the preferred strategic approach to decommissioning within each planning envelope;
6. a statement of the final end-state objectives in each planning envelope;
7. a description of the main decommissioning work packages envisioned in each planning envelope; including for each work package:
    a. the general technical approach;

b. any principal hazards anticipated;

c. the general strategies for ensuring the protection of decommissioning workers, the public and the environment; and

d. the approximate type, quantity and disposition of wastes arising.

8. a conceptual schedule showing the approximate duration and sequencing of work packages;

9. reasonably conservative cost estimates (based on the work packages) for labour, materials, equipment, waste management, environmental assessment, monitoring, and administration (e.g., training, safety, licensing, project management, government and public liaison);

10. the proposed financial guarantee arrangements; and

11. a description of the facility operational records that will be maintained for the purpose of both periodically updating the preliminary plan, and preparing the detailed decommissioning plan.

As required by the SRBT LCH, the development of this PDP also takes into consideration the guidance provided in Canadian Standards Association (CSA) document N294-09 (R2019), *Decommissioning of facilities containing nuclear substances*.

3. Scope

This document describes the preliminary plan for the decommissioning of the SRBT facility located at 320-140 Boundary Road, Pembroke, Ontario. It describes those actions that will be taken between the time that:

- A decision is made to permanently shutdown the facility, and
- The CNSC grants a License to Abandon, and the facility and possession of the leased premises are returned to the owner.

This document describes the preliminary plans for the decommissioning of the facility, as they exist on the date of this plan. The PDP will be reviewed:

- Every five years, and
- Following any substantive remodeling of the facility or modification of the operations carried out within the facility, and revised as necessary.

This PDP is intended for the purposes described in the introduction only, and will be used as the basis for developing the Detailed Decommissioning Plan (DDP), once a decision has been made to shutdown the facility.

The DDP will be prepared prior to the permanent shutdown of the facility, and will be submitted to the CNSC (and any other appropriate regulatory agency) in support of an application for a License to Decommission.

4. Geographic Description

4.1 Site Location – Area Under Control of Licensee

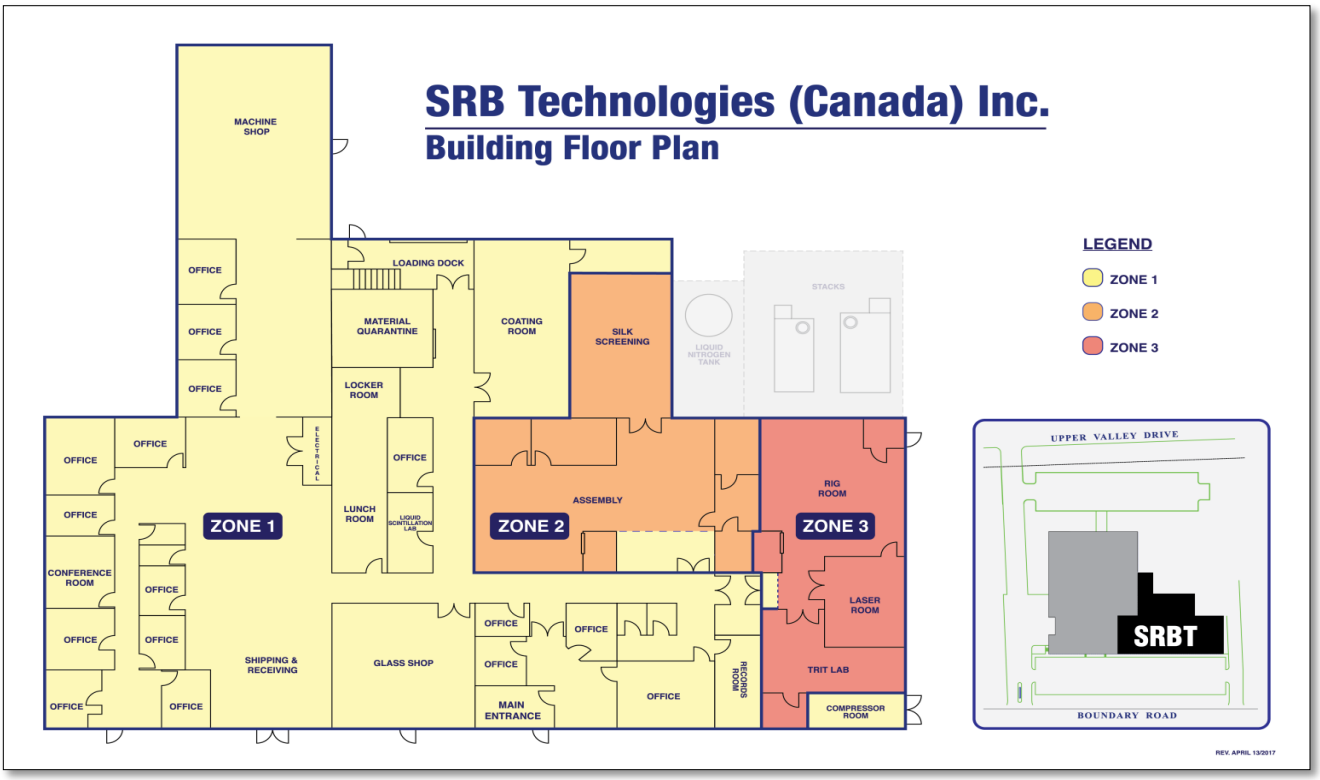
The SRBT facility is located at 320 Boundary Road in Pembroke, Ontario. Pembroke is located approximately 150 km northwest of Ottawa on the south shore of the Ottawa River at the mouth of the Muskrat River. The Muskrat River runs from south to north past Boundary Road approximately 500 meters to the east of SRBT and eventually discharges in the Ottawa River.

The building which houses the facility is situated on parts of lots 28 and 29 of Concession 1, and was constructed in 1990 with a slab-on-grade floor. The current zoning of the facility is M3 (Industrial Park Zone) as designated under municipal by-law 88-17. This zoning excludes residential use.

SRBT fully controls approximately 1,400 square metres of the interior floor space of the building, as well as the immediate surrounding grounds outside of the facility. A fenced compound is maintained on the northwest corner of the facility, housing the primary active ventilation system components (fans, motors, stacks).

The floor plan diagram below illustrates the area of the building and property that are under the direct control of SRBT.

Figure 3: SRBT FACILITY BUILDING FLOOR PLAN



4.2 Site Location – Surrounding Area

The SRBT facility resides within an area known as TransCanada Corporate Park – an industrial park within the boundary of the City of Pembroke.

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 application as bomb disposal and military special operations. A third tenant provides various industrial process gas and equipment to local customers.

Directly across the road from SRBT is a commercial pool and spa services vendor, as well as a small local propane distribution facility.

Next door to the facility are several businesses, including engineering services, disaster restoration services, and a do-it-yourself brewery.

Land allocated for agricultural purposes lies generally to the west of the facility, extending out approximately 300-500 metres. As well, the new headquarters of the Pembroke Fire Department (PFD) is located due west of the facility.

The local detachment of the Ontario Provincial Police (OPP) lies to the southwest, along with the Renfrew County District Health Unit. To the south there are two major-chain hotels as well as a local distillery and a truck stop.

To the north of the property is the Pembroke and Area Community Centre, which houses a full-size skating rink. Several other businesses are located within 500 metres to the north and north east.

A commercial building lies to the southeast of the facility, while a lumber yard is located due east.

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. The population of Pembroke was most recently assessed by Statistics Canada[22] to number 13,882 persons.

Figure 4: SRBT FACILITY LOCATION – SATELLITE IMAGE

Figure 5: AERIAL PHOTOGRAPH LOOKING SOUTHWEST OF SRBT FACILITY

Figure 6: AERIAL PHOTOGRAPH LOOKING NORTHWEST OF FACILITY

Figure 7: AERIAL PHOTOGRAPH LOOKING NORTHEAST OF FACILITY

4.3 Site Location – Surrounding Environment

SRBT is situated between the Muskrat River, the Indian River, and the Ottawa River.

The most common fish found in the Ottawa River is walleye, followed by channel catfish and lake sturgeon. Walleye, pike, smallmouth bass, and rock bass yellow perch are some of the fish found in the Indian River. The Muskrat River is home to walleye, sturgeon, small and large mount bass, pike, etc.

The Mud Lake Wetland is located about 9 km south-east of SRBT and covers about 783 hectares. Many species breed at the Wetland including river otter, marsh wren, northern harrier, northern pintail, and osprey. In terms of fauna, there are many deer in the area; however, the closest significant deer habitat is located approximately 9 km away from the SRBT facility.

Grasses, shrubs, and individual trees typical in urban, commercial and residential land development make up the vegetation of Pembroke. Most of the agricultural crops in the area consist of pasture, corn, and some market garden vegetables. Several dairy farms are located across the Trans-Canada Highway.

Consult the SRBT *Safety Analysis Report*, as well as the documents that comprise the SRBT Environmental Management System for more information regarding the environmental characteristics surrounding the facility.

5. Facility Description

5.1 General

SRBT's facility is located at 320 Boundary Road, Pembroke, Ontario. Pembroke is located approximately 150 km northwest of Ottawa on the south shore of the Ottawa River at the mouth of the Muskrat River.

The facility is located in an industrial park in the southern part of the city of Pembroke, and is housed in a three-unit Butler Building complex owned by 898702 Ontario Inc. The complex is comprised of a steel frame with a metal and block exterior.

The facility is divided into four main parts that are separated by cinderblock firewalls, which are located:

- Between Zone 3 and the rest of the facility.
- Between the original main facility and the first expansion (what is now the shipping area and south offices).
- Between the first expansion and the latest expansion in 2016.

The wall between the SRBT facility and the sole neighbouring building tenant is a fire separation with a fire resistance rating of one hour. SRBT occupies the end unit at the northern end of the building (Unit 140).

5.2 Nuclear Substance Processing

SRBT uses vacuum-based processing equipment in order to process tritium gas (T2) for the purposes of manufacturing GTLS. A GTLS consists of a hermetically sealed borosilicate glass capsule, internally coated with a phosphorescent powder and filled with tritium gas.

The low-energy beta radiation emitted by the tritium gas upon decay interacts with the powder and causes it to emit visible light. These 'Betalights'® are then installed into various devices which provide a reliable, uninterrupted source of light when conventional power sources are unfeasible or suboptimal. SRBT operates several 'processing rigs' in order to create these GTLS. These rigs are vacuum-based systems of valves, pumps and tubing, and are designed to have a tritium trap attached in order to fill light sources.

A tritium trap is a specialized vacuum device that contains approximately 30 grams of uranium (typically depleted uranium (DU)). Uranium is used as an adsorbent material for the tritium gas under vacuum conditions. At typical room temperatures, tritium gas will adsorb onto the DU and be retained as a hydride. This property of DU allows for the safe and secure storage of significant quantities of tritium gas over time. When the DU is heated to around 400 degrees C, tritium gas will begin to be released from the DU hydride matrix. When these processes are performed at vacuum pressures in the absence of air or other gaseous contaminants, tritium gas can effectively be processed and used to fill light sources. This is the principal technical characteristic of the processing facility with respect to tritium.

Tritium processing equipment is located in Zone 3 of the facility, denoting the radiological zone with the greatest potential for exposure to hazards posed by the use of tritium gas. Processing takes place in an area known as the Rig Room. Within the Rig Room, four double-sided ventilated cabinets house the main filling stations where light sources are filled with tritium. A total of eight processing rigs may be installed and in service depending on operational requirements.

A second area within Zone 3 is known as the Laser Room. In this area, laser cutting equipment is used to process long, thin GTLS known as 'laser sticks. These sticks are cut to specification using specialized lasers. Up to three laser systems may be employed at any point in time depending on operational requirements.

Finally, within Zone 3 is the Tritium Laboratory, which houses equipment known as the Bulk Splitter. This system is used to take bulk amounts of tritium purchased by SRBT on specialized containers and subdivide it onto containers that will interface with the processing rigs. The principles of operation of the bulk splitter are the same as those used on the processing rigs.

5.3 Facility Layout

A general floor plan of the portion of the building occupied by SRBT is shown previously in Figure 3. With the latest facility expansion taking place in 2016, the SRBT facility has a footprint of approximately 1,400 m^2 .

The interior areas of the facility are divided into three separate radiological zones. The zones are defined in SRBT's *Radiation Safety Program*, and are briefly described here.

- Zone 1

Zone 1 consists of offices, hallways, lunchroom, glass shop, coating room, shipping area, a moulding / machining area, and the storage area. Zone 1 is the largest zoned area in the facility with an area of 1,092 m2. The ground floor area of this zone is approximately 864 m^2. The remaining area is that of the second-floor mezzanine.

Tritium contamination potential in Zone 1 is considered to be very low. As per the Radiation Safety Program, the administrative control limit for tritium contamination in Zone 1 is 4 Bq/cm^2, averaged over an area of 100 cm^2. Routine swipe samples are taken in Zone 1 on a weekly basis, and results are trended and recorded.

- Zone 2

Zone 2 consists of the assembly room and silk-screening room. The floor area of this zone is approximately 180 m^2. All Zone 2 areas are approximately 3 metres in height, and have plasterboard ceilings.

Staff access to Zone 2 areas is controlled. Minimum personal protective equipment (PPE) for entry into Zone 2 includes a lab coat, shoe covers and safety glasses.

The potential for tritium contamination is considered to be low but possible, due to the potential for breakage when technicians handle filled GTLS. The administrative control limit for tritium contamination in Zone 2 is 4 Bq/cm^2, averaged over an area of 100 cm^2 (the same value applied in Zone 1). Routine swipe samples are taken in Zone 2 every other day, and results are trended and recorded. Tritium in air concentrations are continuously monitored and recorded.

- Zone 3

Zone 3 consists of the Rig Room, Laser Room, Tritium Lab (which includes the fume hoods, Bulk Splitter and a secure storage room. The floor area of Zone 3 is approximately 128 m^2.

Staff access to Zone 3 areas is controlled. Minimum PPE for entry into Zone 3 includes a lab coat, shoe covers, safety glasses and gloves.

The potential for tritium contamination and/or tritium exposures are greatest in Zone 3 due to the nature of the work being conducted in this area. The administrative control limit for tritium contamination in accessible areas of Zone 3 is 40 Bq/cm^2 averaged over an area of 100 cm^2. Routine swipe samples are taken in Zone 3 every weekday of operations, and results are trended and recorded. Tritium in air concentrations are continuously monitored and recorded.

Typical contamination assessment results over the recent five-year period (2014-2018) for each radiological Zone of the facility are provided in Appendix A.

5.4 Facility Equipment

A list of relevant equipment located in Zones 1, 2 and 3 is detailed in Appendix B.

5.5 Radioactive Materials

The following radioactive materials / nuclear substances are used or stored within the SRBT facility:

- Tritium

Tritium gas is used to fill light sources. The facility operating licence issued by the CNSC authorizes SRBT to possess a maximum of 6,000 TBq of tritium at any time.

During routine operations, the tritium inventory typically varies between 3,000 and 6,000 TBq at any given time; for example, during the period between 2014-2018, an average monthly inventory of 3,983 TBq has been maintained. This quantity of tritium generally represents the typical amount on site at any one time; however, it may fluctuate within the bounds of the limit.

The tritium in the facility is generally contained in GTLS, in tritium traps, and in Type 'B' shipping containers (routinely GE Healthcare 3605D)

- Depleted Uranium

Depleted uranium (DU) is used in getter beds, otherwise known as tritium traps, that are used during the manufacturing process.

The inventory of depleted uranium on site is limited to 10 kg, with between 2 to 4 kg typically held in getter beds / traps, and the remaining 'virgin' DU kept in secure storage for use in tritium traps that will be manufactured at a later date.

- Check sources

Sealed sources are used as internal reference standards in the two liquid scintillation counters (LSC) operated on site. These counters are located in the LSC lab.

Each of the TriCarb 2910 LSC includes a 740 kBq Ba-133 sealed source; this activity falls below the exemption quantity of 1,000 kBq for this nuclear substance, as defined in the *Nuclear Substances and Radiation Devices Regulations*.

Check / calibration sources (sealed vials containing less than 5 kBq of tritium and carbon-14 activities) are also stored in the LSC lab, and are used to calibrate the liquid scintillation counters on a routine basis, and as reference standards as part of laboratory quality control processes. These standards also fall well below the exemption quantities for these nuclear substances.

5.6 Hazardous Materials

Limited amounts of hazardous materials are used in various procedures within the SRBT facility; hazardous materials used in significant quantities are listed below:

Table 1: Hazardous Materials Typically Used at SRBT

Product	Routine Quantity Used	Disposal
Acetone	40 L	Hazardous Waste Facility
Argon	100 L	Empty container returned to supplier
Chloroform	4 L	Hazardous Waste Facility
Diethyl Ether	4 L	Hazardous Waste Facility
Epoxy Paint	4 L	Hazardous Waste Facility
Epoxy Thinner / Primer	7 L	Hazardous Waste Facility
Ethanediol	4 L	Hazardous Waste Facility
Ethylene glycol	1 L	Hazardous Waste Facility
Hydrofluoric Acid	4 L	Hazardous Waste Facility
Liquid Nitrogen	500 L	Empty container returned to supplier
LSC Cocktail	10 L	Hazardous Waste Facility
Methyl Hydrate	8 L	Hazardous Waste Facility
Orthophosphoric Acid	1 L	Hazardous Waste Facility
Oxygen	75 lbs.	Empty container returned to supplier
Phosphoric Acid	2 L	Hazardous Waste Facility
Poly Stripper and Thinner	25 L	Hazardous Waste Facility
Poly Thinner	20 L	Hazardous Waste Facility
Propane	10 L	Empty container returned to supplier
Screen Printing Inks	50 L	Hazardous Waste Facility
Tensol-70	10 L	Hazardous Waste Facility
Trichloroethylene	4 L	Hazardous Waste Facility

There are no processing systems that are expected to contain hazardous substances in the facility. In virtually every case, these substances are handled manually in very small quantities, and only when required during light source / device manufacturing.

6. Decommissioning Strategy

6.1 End State Objective

The objective of decommissioning is to permanently retire the SRBT facility from service in a manner that protects the health, safety and security of workers, the public and the environment.

Upon completion of facility decommissioning, the building will be in a condition that will permit the release of the facility from any further regulatory control by the CNSC. Possession of the leased premises will be returned to the owner for future commercial or industrial use, or for redevelopment.

6.2 Strategy for Decommissioning

A ‘Prompt Removal’ strategy will be adopted for the decommissioning of the nuclear material at SRBT.

In this approach, decommissioning begins immediately after the shutdown of the facility and continues, without interruption, until the decommissioning is complete.

Neither ‘Deferred Removal’ nor ‘In-situ Confinement’ is a practical decommissioning strategy for this facility:

- There is little advantage to be gained from deferring the decommissioning of the facility given that the only radioactive material likely to remain in the facility at the time of decommissioning is tritium, which has a half-life of 12.3 years. Any decay that might occur during any reasonable period of deferral will be negligible.
- In-situ confinement is not practical since the facility is housed in a leased building that is expected to be returned to the owner in a condition that permits the re-use or redevelopment of the property.

6.3 Planning Assumptions

Decommissioning of the SRBT facility is based on the following assumptions:

- The facility will continue to operate at its current capacity until a decision is made to cease operations;
- The decision to cease operations will be based on normal business considerations and will be made at least one year in advance of shutdown;
- Inventories of radioactive, hazardous and other materials will be reduced in the three-month period preceding shutdown, and any remaining inventory of these materials will be dispositioned in the first month following shutdown;
- The decommissioning work will only commence following the issuance of a Licence to Decommission by the CNSC;
- This PDP has been prepared and costed under the assumption that all activities completed under the safe shutdown and decommissioning phases are completed by third party contractors working under CNSC oversight;
- Decommissioning will continue until the site is in a condition that will permit its release from any further regulatory control by the CNSC;
- At the conclusion of the decommissioning process, the CNSC will issue a Licence to Abandon the facility; and
- Possession of the leased premises will be returned to the owner for future commercial or industrial use or redevelopment.

7. Planning for Decommissioning

7.1 Decision to Decommission

SRBT's decision to decommission will be based on an intentional business choice. It is anticipated that SRBT will decide to decommission one year prior to the shutdown of the facility.

After the decision to decommission is made, SRBT will notify CNSC of their intent to cease operations and proceed with decommissioning of the facility. For planning purposes, it is assumed that the facility will be decommissioned within six months from initiation of the Safe Shutdown Phase (SSP).

The process steps to be followed as a result of the decision to shutdown the facility are outlined in Table 2, and consist of twenty-seven activities conducted in four main phases:

- Operating / Decommissioning Planning Phase;
- Safe Shutdown Phase;
- Decommissioning Phase; and
- End State Phase

The decommissioning planning schedule described in Table 2 is based upon the assumption that the decision to shut down is not due to unexpected circumstances, and can be supported by the current SRBT management team; however, the activities as listed in the Safe Shutdown, Decommissioning and End State Phases could be implemented by either the SRBT management team, a qualified third party, or a combination therein.

The decommissioning cost estimate provided in this document is conservative, and based upon a worst-case scenario, where the termination of activities is due to unexpected events. All activities listed from line items 4-27 in Table 2 assume completion by a qualified third party. The funds allocated in the FG are also based on this worst-case scenario.

Table 2: Decommissioning Planning Schedule

	DESCRIPTION	OPERATING PHASE												SHUTDOWN					
		MONTHS																	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	OPERATING/DECOMMISSIONING PLANNING PHASE																		
1.	Decision to decommission by SRBT.	√																	
2.	Notify CNSC.	√																	
3.	Tritium processing/sign production ceases.												√						
	SAFE SHUTDOWN PHASE													√	√	√			
4.	Notification to Customers: cessation of returned products (old signs).													√					
5.	Final shipment of all remaining product to customers (filled signs).													√					
6.	Remove radioactive and hazardous waste and ship to approved facility.													√					
7.	Initial scoping surveys: contamination assessments, core sampling.													√					
8.	Sample analysis (in house and 3rd party analysis).													√	√				
9.	Revision of Public Involvement Program.													√					
10.	Review of Radiation Protection Program as part of DDP development.													√					
11.	Develop and submit Detailed Decommissioning Plan to CNSC.													√					
12.	Prepare/submit Decommissioning Licence Application.													√					
13.	CNSC Impact Assessment decision. (**1 day estimated**)														√				
14.	CNSC Review of Decommissioning Licence Application and associated program review (including any required Impact Assessment). **(40 days estimated)**													√	√				
15.	CNSC licence assessment and decisions process. **(20 days estimated)**															√			
16.	Mobilization: set up and preparation for decommissioning phase														√				
17.	Decommissioning Licence approved.															√			
	DECOMMISSIONING PHASE																		
18.	Decontamination and dismantling (all zones, rig room equipment and fume hoods).																√		
19.	Decommissioning of outside wells, air handling units																√		
20.	Soil assessment (analysis by 3rd party)																√		
21.	Packaging and transport of radioactive waste																√		
22.	Final surveys (MARSSIM)																	√	
23.	Complete and submit decommissioning Final Report																	√	
	END STATE PHASE																		
24.	Apply for Licence to Abandon																		√
25.	CNSC Review of decommissioning Final Report **(5 days estimated)**																		√
26.	CNSC review of abandonment licence application & CMD development **(4 days estimated)**																		√
27.	Licence to abandon approved																		√

7.2 Operating and Decommissioning Planning Phase (Activities 1 – 3)

7.2.1 SRBT commits to the provision of a minimum notice of 12 months when it has been decided to cease production activities and to prepare to decommission the SRBT facility.

7.2.2 Once that decision has been made by SRBT management, CNSC will be informed of that decision and this notification will be in at least 12 months in advance of any planned decommissioning activities.

7.2.3 At the end of the Operating Phase tritium processing and sign production activities have ended.

The activities listed below are operational activities that would be the first to be implemented following SRB's decision to cease production and prepare for decommissioning.

It is SRBT's intent to provide at least 12 months notice to CNSC in advance of ceasing operations, and these listed activities would be completed in that 12-month period.

These activities do not require a 12-month window for completion and could be completed in a much shorter period of time in the event of an unexpected termination of operations.

7.3 Safe Shutdown Phase (Activities 4 – 17)

7.3.1 SRBT has a long-standing practice of accepting the return of expired signs from customers. These customers will be given sufficient notice of the planned closure of the facility to allow them to return expired signs and to arrange alternate disposal avenues for the future.

7.3.2 All filled signs will be shipped to customers in order to bring to zero the inventory of tritium gas filled products.

7.3.3 The inventory of existing radioactive waste and hazardous waste will be packaged and shipped for disposal at approved/licensed facilities. Tritium traps will be removed from the production equipment and returned to the supplier or another facility licensed to accept the material for reuse or disposal. Any hazardous materials remaining on the site that will not be required for use during the decommissioning will be packaged for disposal in accordance with the Regulations applicable at the time.

7.3.4 Initial scoping surveys will be initiated to collect data to assist in the development of the detailed decommissioning plan. These surveys will include extensive contamination assessments following a Multi-Agency Radiation Site Survey Investigation Manual (MARSSIM)[23] approach to numbers and locations. These scoping surveys will also include a review of the operating records and results of previous radiation surveys. A review will be completed of any hazardous materials used within the facility. Environmental monitoring results will also be reviewed.

7.3.5 Contamination survey sample analysis can be completed in house; however, the cost estimates assume 3rd party analysis of the samples.

7.3.6 The Public Involvement Program will be based on the advice provided in the Canadian Nuclear Safety Commission Regulatory Document REGDOC 3.2.1, *Public Information and Disclosure.* The purpose of this program is to allow the target audience to participate and be informed regarding decisions related to the decommissioning of SRBT. The target audience for SRBT includes, but is not limited to, the general public of the surrounding community, interested stakeholders, and local media.

The Public Involvement Program will include both information and consultation opportunities. In accordance with the *Class I Nuclear Facilities Regulations*, the surrounding community will be informed of the probable effects on the environment and health and safety of the people

as a result of the decommissioning of the facility. The Public Involvement Program will be designed to involve a broad cross-section of the target audience using methods that will meet the needs of the participants and the objectives of SRBT.

The program will identify issues and concerns; provide opportunities for public involvement; ensure all input was considered in decommissioning planning and/or in the environmental assessment; and, include proper documentation of the process and results.

7.3.7 The SRBT *Radiation Safety Program* will be reviewed to ensure alignment of program requirements and the activities proposed in the Detailed Decommissioning Plan (DDP).

7.3.8 A DDP will be developed, supported by the results of the initial scoping survey. The information obtained during the initial scoping survey will be used to identify those structures, systems and components that may be contaminated with radioactive materials; determine the procedures and tools that will be required during the decommissioning; and identify any potential hazards to workers, the public or the environment. It will also identify what decommissioning work, if any, may be required in the area around the facility.

The Detailed Decommissioning Plan will describe the actions that will be taken to permanently retire the facility from operation in a manner that ensures the health, safety, and security of workers, the public, and the environment. The Detailed Decommissioning Plan will contain the elements outlined in the Regulatory Guide G-219 titled "*Decommissioning Planning for Licensed Activities*".

7.3.9 In parallel to the development of the DDP an application for a Decommissioning Licence will be completed and submitted to CNSC with the DDP. This application for a License to Decommission will be prepared in accordance with the regulations outlined in sections 3 and 7 of the *Class I Nuclear Facilities Regulations*. Any other required permits and licenses from federal, provincial, and municipal agencies will be obtained before any decommissioning work begins.

7.3.10 CNSC has estimated 1 person-day of effort is required for a regulatory review of the Environmental Assessment.

7.3.11 CNSC has estimated 40 person-days of effort are required to fully review and assess the DDP and Decommissioning licence application.

7.3.12 CNSC has estimated 20 person-days of effort are required to complete the licensing assessment and the licence approval decisions process.

7.3.13 Mobilization allows time for the procurement of decommissioning supplies and additional PPE if required. The work performed during this phase of the decommissioning is intended to prepare the facility for subsequent 'Decontamination and Dismantling' work. Mobilization may include, but is not limited to:

- Delivering to the site any special equipment or tools that will be required during the decontamination and dismantling work;
- Ensuring that the site services that will be required during the decontamination and dismantling work are available and disconnecting any services that will not be required; and
- Preparing temporary storage areas for wastes, recyclable materials and re-usable equipment.

7.3.14 SRBT will remain in the Safe Shutdown Phase until CNSC has approved the application for decommissioning of the facility and a Decommissioning Licence has been granted.

7.4 Decommissioning Phase (Activities 18 – 23)

The Decommissioning Phase describes the steps and activities to be taken to permanently retire the SRBT facility from service in a manner that protects the health, safety and security of workers, the public and the environment.

Upon completion of this phase, the facility will be in a condition that will permit the release of it from any further regulatory control by the CNSC.

7.4.1 Decontamination and dismantling activities describe the removal of all equipment used in the tritium gas fill process. Decontamination processes will be carried out on all equipment that can be easily decontaminated to approved clearance levels. Equipment that cannot be decontaminated to meet regulatory limits will be dismantled, packaged and shipped to a licensed waste management facility. These activities will be carried out in Zones 2 and 3.

7.4.2 Decommissioning of the outside wells involves the removal of the well casings by a qualified third-party contractor. Air handling units will be decommissioned only once all facility work packages have been completed.

7.4.3 Soil assessments will be conducted as part of the final clearance survey. See typical results obtained in the past in Appendix C, and note that all results are below the Unconditional Clearance Level of 100 Bq/g.

7.4.4 Radioactive waste shall be packaged and prepared for transport in accordance with applicable regulations. All radioactive waste will be shipped to a licensed waste management facility.

7.4.5 Final clearance surveys shall be completed to verify that clearance levels proposed in the DDP have been satisfied. The Multi-Agency Radiation Site Survey and Investigation Manual (MARSSIM)[23] methodology will be implemented for facility final clearance surveys.

7.4.6 Complete and submit the Decommissioning Final Report, documenting all activities, radiological conditions, waste volumes and final status for submission to CNSC.

Labour costing estimates during the Decommissioning Phase are as follows:

Table 3: Planned Labour Costs

Type of Labour	$ / person-day
Work already typically performed by in-house resources, including packaging and shipment of non-decommissioning LLW, and other general physical labour of a non-technical nature:	220
Public relations activities and communications:	870
Non-routine radiological measurements, including those performed by third parties:	1,300
Work of an advanced / complex / technical nature, including physical decommissioning activities throughout the facility:	1,300
Licensing, DDP preparation, other regulatory / administrative / reporting work of a technical nature:	1,740

NOTE: Planned labour costing rates are based 2014 PDP values, multiplied by 1.0826 (estimated Canadian rate of inflation between 2014-2019 – see https://www.bankofcanada.ca/rates/related/inflation-calculator/, value obtained July 18, 2019), and rounded upward to the nearest ten dollars.

7.5 End State Phase (Activities 24 – 27)

In the End State Phase all of the decommissioning activities have been completed and the Decommissioning Final Report has been submitted to CNSC for review and approval.

7.5.1 An application for a Licence to Abandon will be submitted.

7.5.2 CNSC has estimated 5 person-days of effort are required to review the Decommissioning Final Report.

7.5.3 CNSC has estimated 4 person-days of effort are required to review the Abandonment Licence Application and prepare the Commission Member Document (CMD).

7.5.4 Licence to Abandon is approved.

8. Decommissioning Planning Envelopes and Work Packages

8.1 Overview

In order to adequately facilitate the SRBT facility decommissioning requirements, and as described in CSA N294, decommissioning planning envelopes have been developed and defined work packages have been structured for each envelope.

The decommissioning process identifies one planning envelope for the Safe Shutdown Phase and six planning envelopes for the Decommissioning Phase.

Third party contractors, experienced in the decommissioning of a similar Class 1B facility, assisted SRBT in 2014 in the development of the original planning envelopes, and the work packages within each envelope. The 2019 revision of the PDP advances this work, updates the facility condition, and modernizes the expected resourcing and costing figures for each discrete work activity.

Before decommissioning begins there are a number of activities identified in the Safe Shutdown Phase that must be completed. These activities can all be completed in one planning envelope. This planning envelope does not require the same level of detail as the decommissioning envelopes, but will describe the scope of work, the duration of the activity and the associated cost.

8.2 Technical Approach

The decommissioning planning envelopes and work packages are structured such that the work activities will proceed from radiological areas with greatest potential for tritium contamination to those radiological areas of lowest contamination potential.

Classification of areas follows MARSSIM[23] guidelines. In these guidelines, classification is defined as “the process by which an area or survey unit is described according to radiological characteristics.” Areas with some potential for residual contamination are described in these guidelines as ‘impacted areas.

Impacted areas are further divided into one of three classifications: Class 1, 2 and 3.

8.2.1 Class 1 Areas

Areas that have, or had prior to remediation, a potential for radioactive contamination (based on site operating history) or known contamination (based on previous radiation surveys) above the Derived Concentration Guideline Level (DCGL).

Examples of Class 1 areas include:

- site areas previously subjected to remedial actions;
- locations where leaks or spills are known to have occurred;
- former burial or disposal sites;
- waste storage sites; and
- areas with contaminants in discrete solid pieces of material and high specific activity.

8.2.2 Class 2 Areas

Areas that have, or had prior to remediation, a potential for radioactive contamination or known contamination, but are not expected to exceed the DCGL.

Examples of Class 2 areas include:

- locations where radioactive materials were present in an unsealed form;
- potentially contaminated transport routes;
- areas downwind from stack release points;

- upper walls and ceilings of buildings or rooms subjected to airborne radioactivity;
- areas handling low concentrations of radioactive materials; and
- areas on the perimeter of former contamination control areas.

8.2.3 Class 3 Areas

Any impacted areas that are not expected to contain any residual radioactivity, or are expected to contain levels of residual radioactivity at a small fraction of the DCGL, based on site operating history and previous radiation surveys.

Examples of areas that might be classified as Class 3 include:

- buffer zones around Class 1 or Class 2 areas, and
- areas with very low potential for residual contamination but insufficient information to justify a non-impacted classification.

These classification guidelines will be considered for each planning envelope, and the various work packages in those envelopes, to assist in determining the degree of survey effort in the Detailed Decommissioning Plan.

For Class 1 survey units (separate locations within the planning envelopes), MARSSIM[23] suggests that survey unit sizes do not exceed 100 m^2 floor area for structures and 2,000 m^2 for land areas. Similarly, Class 2 survey units are limited to 1,000 m^2 and 10,000 m^2, respectively. Class 3 survey units are not limited in size.

Based on SRBT's knowledge of the operations, the facility has been grouped into one Safe Shutdown Phase planning envelope and six Decommissioning Phase planning envelopes.

Safe Shutdown Planning Envelope

- Planning Envelope 1 – Safe Shutdown activities

Decommissioning Phase Planning Envelopes

- Planning Envelope 2 – Zone 3 Areas
- Planning Envelope 3 – Zone 2 Areas
- Planning Envelope 4 – Zone 1 Areas
- Planning Envelope 5 – Zone 3 Ventilation System (ductwork)

- Planning Envelope 6 – Air Handling Units and Stacks
- Planning Envelope 7 – Decommissioning of the Outside Sampling Wells

The ventilation system, air handling units and stacks (planning envelopes 5 & 6) will be totally dismantled and disposed of as active waste. Consequently, Planning Envelope 5 and 6 will not be evaluated by the surveys discussed in this PDP.

Since the remaining planning envelopes represent areas with similar use, construction, and contamination potential, the areas will be categorized as follows:

Table 4: Safe Shutdown Phase Planning Envelope

Planning Envelope	Work Package	Details
1	1. Notification to customers	9.1
1	2. Final shipment of all remaining product to customers	9.2
1	3. Removal of current inventory of nuclear waste	9.3
1	4. Removal of current inventory of hazardous materials	9.4
1	5. Complete facility scoping surveys	9.5
1	6. Sample analysis and environmental monitoring	9.6
1	7. Update Public Involvement Program	9.7
1	8. Prepare Detailed Decommissioning Plan	9.8
1	9. Mobilization	9.9

Table 5: Decommissioning Phase Planning Envelopes

Planning Envelope	Work Package	Details
2	1. Tritium Lab	10.1
2	2. Laser Room	10.2
2	3. Rig Room	10.3
3	1. Assembly Room	11.1
3	2. Silk Screening Room	11.2
4	1. Entire Zone 1 Area	12.1
5	1. Zone 3 Ventilation Systems (Interior)	13.1
6	1. Air Handling Units and Stacks (Exterior)	14.1
7	1. Decommissioning of Outside Test Wells (31)	15.1

8.3 Radiological Clearance Levels

As part of routine facility operations, SRBT's *Licence Limits, Action Levels and Administrative Limits* document specifies the administrative limits for non-fixed surface contamination limits as separate values, depending on the radiological zone.

For the purpose of this PDP, the most restrictive operational administrative limit will be adopted as the Radiological Clearance Level during decommissioning activities, for the purpose of free release (i.e. reuse of items, equipment, and building surfaces). Contamination assessments by swipe sample will be averaged over 100 cm^2.

For items or equipment designated as waste, SRBT's *Waste Management Program* includes a conditional clearance level (CCL) that ensures effective waste management strategies are applied, and in accordance with the principle of keeping radiological exposures as low as reasonably achievable.

The current CCL is defined in terms of a specific activity value limit of 0.15 MBq / gram, up to a maximum of 5,000 kg of waste material per disposal pathway. This limit applies to any waste items physically within Zone 2 or Zone 3 of the facility.

Table 6: Radiological Clearance Levels

Zone	Surface	Operational Administrative Limit
1	All surfaces	4.0 Bq/cm^2
2	All surfaces	4.0 Bq/cm^2
3	All surfaces	40.0 Bq/cm^2

Zone	Surface	Decommissioning Radiological Clearance Level ***Free Release***
All zones	All surfaces	4.0 Bq/cm^2

Zone	Surface	Decommissioning Radiological Clearance Level ***Waste Management***
2 and 3	All surfaces	0.15 MBq / g (maximum of 5,000 kg for any disposal pathway)

8.4 Principal Hazards Anticipated

Tritium represents the only radiological hazard anticipated during decommissioning activities at the SRBT facility.

As well, conventional, chemical, electrical, fire and security hazards will also be assessed in the development of each individual work package.

8.5 Radiological Safety

All workers involved in decommissioning activities will protected from radiological hazards, and be monitored for exposure to ionizing radiation, in accordance with SRBT's *Radiation Safety Program* requirements.

SRBT will continue to maintain a Dosimetry Service License (DSL) in order to perform bioassay measurements and dose assessments for decommissioning workers, until the decommissioning of the facility is complete.

In support of the DSL, SRBT's Dosimetry Service Program (DSP) will also continue to be implemented, including all management system provisions for quality assurance and control elements, throughout the decommissioning of the facility. All personnel involved with the physical decommissioning of the facility will be designated as Nuclear Energy Workers (NEW).

In addition, radiation protection action levels used during operations shall remain in place in order to ensure control of decommissioning work, and the protection of workers. These action levels are as follows:

Table 7: Radiation Protection Action Levels

Parameter	Action Level
NEW – Quarter of a year	1.0 mSv
NEW – Calendar year	3.0 mSv
NEW – Five-year period	10.0 mSv
Pregnant NEW – Balance of Pregnancy	0.5 mSv
Bioassay result – tritium concentration in urine	1,000 Bq / ml

8.6 Conventional Health and Safety

Work will be performed in accordance with the requirements of the Canada Occupational Health and Safety Regulations, and the decommissioning licence issued by the CNSC.

The SRBT Health and Safety Policy, associated safety procedures, and the Hazard Prevention Program govern the health and safety provisions and requirements for all workers at SRBT. These management system elements will remain in place, and will provide effective safety controls during decommissioning activities, ensuring that all work is performed safely.

Safety is the number one priority in all aspects of our work, and engineering controls, safe work procedures and personal protective equipment will be used to effectively protect workers from any occupational safety hazards throughout decommissioning.

8.7 Security

During decommissioning, SRBT expects to continue to maintain the security of the facility in accordance with the existing SRBT *Security Program*.

The existing security arrangement will remain effective in ensuring an appropriate level of security at the facility throughout decommissioning work. Any modification to the security provisions in place will be controlled and approved by CNSC staff prior to implementation.

8.8 Environmental Protection

As part of the facility operating licence, SRBT maintains and implements a comprehensive Environmental Management System (EMS), which includes the following key management system programs / processes:

- Environmental Protection Program – compliant with CNSC REGDOC 2.9.1
- Groundwater Protection Program – compliant with CSA N288.7
- Environmental Risk Assessment Process – compliant with CSA N288.6
- Environmental Monitoring Program – compliant with CSA N288.4
- Effluent Monitoring Program – compliant with CSA N288.5
- Groundwater Monitoring Program – compliant with CSA N288.7

In addition, environmental action levels used during operations shall remain in place in order to ensure control of decommissioning work, and the protection of the public and the environment. These action levels are as follows:

Table 8: Environmental Protection Action Levels

Parameter	Action Level
Weekly gaseous effluent – tritium oxide	840 GBq
Weekly gaseous effluent – tritium oxide + elemental tritium	7,753 GBq
Gaseous effluent - concentration of tritium	≥ 0.74 GBq/m^3 (for a duration of ten minutes)
Daily liquid effluent – water soluble tritium	0.15 GBq

Throughout decommissioning, the EMS will continue to be implemented as required until such time that all nuclear substances have been removed from the premises, the building meets free release criteria, and the final decommissioning report has been accepted by CNSC staff.

Two exceptions to this will be the cessation of the Groundwater Monitoring Program and the gaseous effluent elements of the Effluent Monitoring Program, as the monitoring wells and active ventilation systems will be decommissioned in advance of the final report being issued.

Once the final report is accepted, all remaining EMS programs will be terminated, and any monitoring equipment in the area surrounding the facility will be removed.

8.9 Waste Management

As a key element of the operating licence, SRBT implements and maintains a comprehensive Waste Management Program (WMP), which includes processes and controls for both radioactive and hazardous waste.

This program meets the requirements of the applicable N292-series of CSA standards, including N292.0, N292.3 and N292.5, and has proven effective at ensuring safe management of waste materials throughout all aspects of operation of the facility. For the purposes of decommissioning, the WMP will continue to be maintained and implemented. Any changes to this program will be controlled and submitted to CNSC staff for review and regulatory acceptance prior to implementation.

All waste materials will be prepared for shipment, packaged, labeled and surveyed for external contamination as required. Waste material that meets regulatory or conditional clearance levels will be handled and packaged appropriately, and sent to a recycling facility or municipal landfill. Waste that exceeds clearance levels will be designated as low-level waste, and properly packaged and shipped to a licensed radioactive waste handling facility.

All reasonable effort will be made to recover as much material as possible for reuse or recycling, to minimize the volume of waste that is generated, and to avoid generating mixed wastes (containing both radioactive and hazardous materials).

8.9.1 Radioactive Waste

Radioactive wastes will include any materials that exceed clearance levels and cannot reasonably be decontaminated and cleared for release.

Conditional clearance levels will be those specified in the detailed decommissioning plan / WMP as accepted by the CNSC, while unconditional clearance levels are those prescribed in the *Nuclear Substances and Radiation Devices Regulations*.

Radioactive wastes will be packaged for transport and disposal in accordance with the requirements of the regulations applicable at the time of the decommissioning.

All radioactive wastes will be removed from the site for storage or disposal at a licensed radioactive waste management facility prior to the beginning of the final survey.

Low-level waste (LLW) is costed in line with the latest prices on a per-unit volume basis, for drums of waste materials, by Canadian Nuclear Laboratories.

8.9.2 Hazardous Waste

Hazardous wastes will include any materials defined as hazardous by applicable regulations. Hazardous wastes will be prepared for transport and disposal in accordance with the requirements of the regulations applicable at the time of the decommissioning.

All hazardous wastes will be removed for disposal to a hazardous waste management facility prior to the beginning of the decommissioning activities.

No hazardous materials are expected to be used during decommissioning activities; therefore, no hazardous waste will be generated by these activities.

8.9.3 Reusable and Recyclable Materials

Office equipment and furniture that meet the clearance levels will be sold for reuse where possible. Similarly, some production equipment, such as the milling machine, injection molding machine, and painting equipment will be sold for reuse where possible.

Metals and other recyclable materials that meet clearance levels will be segregated from any other wastes during the course of the work. These materials will be sent to an authorized facility for recycling.

8.9.4 Demolition Waste

Any material that is neither hazardous nor radioactive and that is not suitable for either reuse or recycling will be sent for disposal at a local waste management site that is authorized to accept these wastes.

8.10 Planning Envelope / Work Package Details

Decommissioning work activities will be conducted by a qualified third-party contractor. The contractor will be required to follow the Detailed Decommissioning Plan, following its approval by the CNSC.

Each planning envelope and work package will address applicable conditions identified in the Regulatory Guide G-219, as identified below:

- A brief description of, and diagram showing, the areas and components to be decommissioned;
- An overview of the principal radiological, chemical and physical conditions during decommissioning;
- An overview of the principal radiological, chemical and physical conditions predicted to exist following decommissioning activities;
- A statement describing the strategic approach (prompt removal);
- A statement describing the final end-state objective in each planning envelope;
- A description of the main work package details, including:
    - the general technical approach,
    - principal hazards,
    - general strategy for the protection of workers, the public and the environment,
    - type, quantity and disposition of wastes generated,
    - duration, and
    - cost.

9. Planning Envelope 1: Safe Shutdown State

9.1 Work Package 1: Notification to Customers

Following the decision to decommission the facility, SRBT customers will be notified of this decision.

The current process allows customers to return expired signs to SRBT for dismantling and disposal. The purpose of the customer notification is to give the customers sufficient time to return any expired signs to SRBT before decommissioning commences, and to allow the customer to find alternate routes for accepting expired signs.

9.1.1 Duration

Twenty person-days (1 calendar month) of effort have been determined to be sufficient to complete this work package.

9.1.2 Cost

Table 9: Cost Summary Planning Envelope 1, Work Package 1

Activity	Quantity	Unit Cost ($)	Total
Notification to customers (person-day effort)	20	220	$4,400
WORK PACKAGE COST			**$4,400**

9.2 Work Package 2: Final Shipment of Remaining Product

Following the decision to decommission the facility SRBT will have an inventory of signs ready for shipment to customers.

This inventory of new signs will be shipped to customers before decommissioning commences. Policy requires the customer to cover the cost of shipping; therefore, these costs are not included in the PDP.

9.2.1 Duration

Forty person-days of effort are estimated for completion of this work package. This estimate is based on current inventory and operational experience.

9.2.2 Cost

Table 10: Cost Summary Planning Envelope 1, Work Package 2

Activity	Quantity	Unit Cost ($)	Total
Prepare and ship inventory (person-day effort)	40	220	$8,800
WORK PACKAGE COST			**$8,800**

9.3 Work Package 3: Removal of Radioactive Waste

SRBT implements a comprehensive Waste Management Program that ensures routine shipments of low-level radioactive waste are conducted on a frequent basis. By policy, the volume of LLW retained in storage over time is kept to a minimum.

This material consists of contaminated conventional trash / waste, crushed glass stubs from processing operations, expired light sources, and tritium traps removed from service.

A review of SRBT's recent waste inventory trends shows that a reasonably conservative maximum volume of LLW stored on site is not expected to exceed 2 m^3 upon cessation of operations.

Once final products have been shipped to customers, and production operations have completed ceased, all LLW on site will be properly packaged, labelled and shipped to a licenced waste management facility for storage and disposal prior to beginning decommissioning activities.

9.3.1 Duration

Based on current operating experience this work package can be completed with 10 person-days of effort.

9.3.2 Cost

Table 11: Cost Summary Planning Envelope 1, Work Package 3

Activity	Quantity	Unit Cost ($)	Total
Radioactive waste (volume)	2 m^3	28,000	$48,000
Prepare and ship waste (person-day effort)	10	220	$2,200
WORK PACKAGE COST			**$50,200**

9.4 Work Package 4: Removal of Inventory of Hazardous Waste

Hazardous materials can either be returned to supplier (gas cylinders) or disposed of at a local waste management hazardous waste facility. Decommissioning activities will not generate hazardous waste. All hazardous waste will be removed prior to decommissioning.

9.4.1 Duration

It is estimated that 10 person-days of effort is required to collect, package and transport the hazardous waste to a hazardous waste handling facility.

9.4.2 Cost

Table 12: Cost Summary Planning Envelope 1, Work Package 4

Activity	Quantity	Unit Cost ($)	Total
Hazardous Waste	Current inventory	500	$500
Prepare and ship waste (person-day effort)	10	220	$2,200
WORK PACKAGE COST			**$2,700**

9.5 Work Package 5: Scoping Surveys

Scoping surveys will be completed to collect data to assist in the development of the Detailed Decommissioning Plan. These surveys will include extensive contamination assessments following a MARSSIM[23] approach to location and number of samples collected, including core samples of materials as deemed required.

9.5.1 Duration

Five person-days of effort have been estimated to complete the scoping survey activities, not including the analysis of the samples. Core sampling cost estimates are based upon recent services provided to SRBT by an independent laboratory for similar project types.

9.5.2 Cost

Table 13: Cost Summary Planning Envelope 1, Work Package 5

Activity	Quantity	Unit Cost ($)	Total
Scoping Surveys (person-day effort)	5	1,300	$6,500
Core sampling, analysis, shipment and report	16	350	$5,600
		Total	**$12,100**

9.6 Work Package 6: Sample Analysis & Environmental Monitoring

Sample analysis describes the time allocated to analyze the contamination samples collected during the scoping surveys. This work package also allocates time and costs to ongoing environmental monitoring during the Safe Shutdown and Decommissioning Phases.

9.6.1 Duration

Two person-days of effort have been estimated to complete the swipe sample analysis. One person-day per month (for 5 months) has been estimated to complete the environmental monitoring activities. These activities include collection of the passive air samples and well samples and the analysis of these samples. The environmental monitoring activities are planned over the 5-month period covering the Safe Shutdown and Decommissioning Phases.

9.6.2 Cost

Table 14: Cost Summary Planning Envelope 1, Work Package 6

Activity	Quantity	Unit Cost ($)	Total
Sample Analysis (person-day effort)	2	1,300	$2,600
Environmental Monitoring (person-day effort)	5	1,300	$6,500
		Total	**$9,100**

9.7 Work Package 7: Update Public Involvement Program

SRBT has an established Public Involvement Program. The target audience for this program includes, but is not limited to, the general public of the surrounding community, interested stakeholders, and local media.

The Public Involvement Program will be updated prior to the commencement of decommissioning activities, ensuring that the target audience is fully informed of the planned decommissioning activities and has the opportunity for input. The program will allow for timely updates on the progress and status of the decommissioning activities.

9.7.1 Duration

Two person-days of effort are anticipated for the initial review and revision to the current program. Five person-days of effort are estimated for monthly updates during the decommissioning process (5 months) and one person-day of effort for a final update.

9.7.2 Cost

Table 15: Cost Summary Planning Envelope 1, Work Package 7

Activity	Quantity	Unit Cost ($)	Total
Public Involvement Program (person-day effort)	8	870	$6,960
		Total	**$6,960**

9.8 Work Package 8: Prepare Detailed Decommissioning Plan

A detailed decommissioning plan is defined in CNSC Regulatory Guide G-219, *Decommissioning Planning for Licensed Activities* as “a plan setting out the detailed work program, safety and environmental protection procedures, and management systems will be followed in the decommissioning of a licensed activity/facility. Detailed decommissioning plans should evolve from the preliminary decommissioning plan.”

The detailed decommissioning plan will describe the actions that will be taken to permanently retire the facility from operation in a manner that ensures the health, safety, and security of workers, the public and the environment. The detailed decommissioning plan will contain the elements outlined in guide G-219.

9.8.1 Duration

Eight person-days of professional effort are estimated to develop the detailed decommissioning plan. This amount of effort is based on previous third-party experience in writing a similar work plan for a Class 1B licensed facility. The information provided in the preliminary decommissioning plan shall be the foundation for development of the detailed decommissioning plan.

9.8.2 Cost

Table 16: Cost Summary Planning Envelope 1, Work Package 8

Activity	Quantity	Unit Cost ($)	Total
Prepare Detailed Decommissioning Plan	8	1,740	$13,920
		Total	**$13,920**

9.9 Work Package 9: Mobilization

Mobilization describes the preliminary coordination and procurement of equipment and services necessary to support the decommissioning activities. Mobilization may include, but is not limited to:

- Obtaining and delivering to the site any special equipment or tooling required,
- Ordering of PPE,
- Ensuring that necessary site services are available,
- Arranging for disconnection and/or isolation of site services that are not required to support decommissioning activities,
- Preparing temporary storage areas for wastes, recyclable materials and re-useable equipment, and
- Ordering approved shipping containers for radioactive waste.

9.9.1 Duration

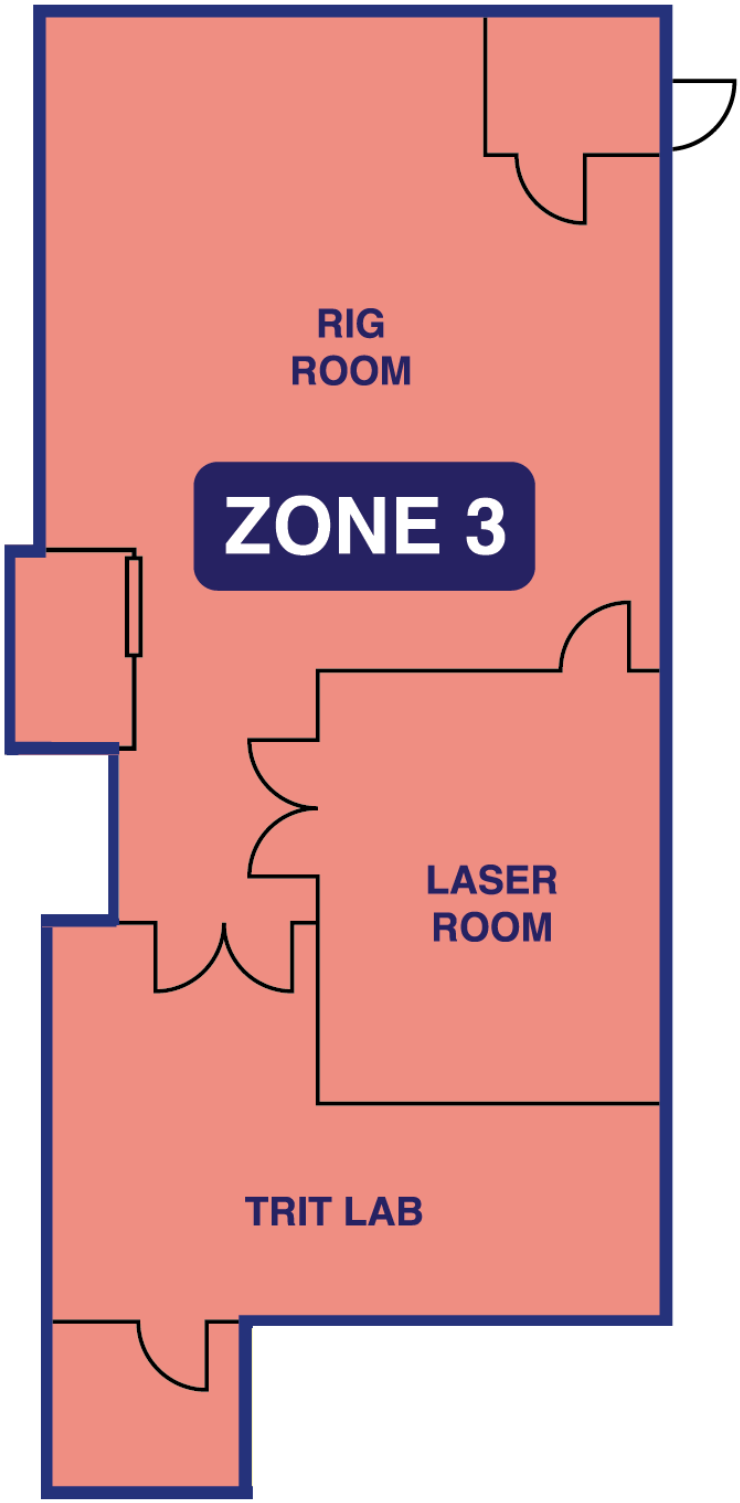
Three person-days of effort are estimated to complete this work package.

9.9.2 Cost

Table 17: Cost Summary Planning Envelope 1, Work Package 9

Activity	Quantity	Unit Cost ($)	Total
Mobilization (person-day effort)	3	1,300	$3,900
		Total	**$3,900**

10. Planning Envelope 2: Zone 3 Work Area



10.1 Work Package 1: Tritium Lab

10.1.1 Description of Areas and Components to be Decommissioned

Planning Envelope	Zone	Work Package		Floor Area (m^2)	MARSSIM Classification
2	3	1	Tritium Lab	28	Class 1

The Tritium Lab is a separate room within the Zone 3 area and consists of the following key decommissioning components:

- Bulk Splitting Rig and Fume Hood
- Secondary Fume Hood
- Items not associated with processing (furniture, shelving, cabinets etc.)

10.1.2 Principal Radiological, Chemical and Physical Conditions During Decommissioning

10.1.2.1 Bulk Splitting Rig

- Tritium is the only radiological hazard present in the Bulk Splitting Rig. Tritium gas will be drawn down from the volumetric cylinders to the tritium traps. Residual tritium contamination may be present in the internal components.
- There are no chemical hazards associated with this unit.
- Electrical power supply will be disconnected.
- There are no other physical or industrial hazards associated with the Bulk Splitting Rig.

10.1.2.2 Secondary Fume Hood

- Low levels of residual tritium contamination may be present on the interior of the fume hood structure.
- There are no chemical hazards associated with this unit.
- Electrical power supply will be disconnected.
- There are no other physical or industrial hazards associated with this fume hood.

10.1.2.3 Other items

- Very low levels of removable tritium contamination may be present on the surfaces of furniture, cabinetry, shelving, and any other items in this area.
- Operating experience strongly suggests that any items exhibiting surface contamination can be readily decontaminated to meet clearance levels, either as clearance-level waste or for unconditional clearance.
- There are no physical, industrial or chemical hazards associated with these items.

10.1.3 Principal Radiological, Chemical and Physical Conditions After Decommissioning

10.1.3.1 Bulk Splitting Rig

- Processing components of the bulk splitting rig will have been properly dismantled, packaged and shipped to a licenced waste management facility for disposal.
- Structural components will have been decontaminated and assessed as either CLW, or volume-reduced and packaged and shipped as LLW.
- No radiological, chemical, physical or industrial hazards will exist after decommissioning.

10.1.3.2 Secondary Fume Hood

- Structural components will have been decontaminated and assessed as either CLW, or volume-reduced and packaged and shipped as LLW.
- No radiological, chemical, physical or industrial hazards will exist after decommissioning.

10.1.3.3 Other items

- All other items in this area will have been decontaminated and assessed as CLW.
- No radiological, chemical, physical or industrial hazards will exist after decommissioning.

10.1.4 Strategic Approach to Decommissioning

A ‘Prompt Removal’ strategy will be adopted for the decommissioning of this work package. For detailed rationale see Section 6.2.

10.1.5 End State Objective

Upon completion of the decommissioning activities in this work package, the Tritium Lab will be in a condition that will permit the release of the room from any further regulatory control by the CNSC once Planning Envelope 5 work has been completed.

10.1.6 Technical Approach to Decommissioning

The Bulk Splitting Rig will be dismantled. Based on operating experience, the scroll pumps, stainless steel tubing, fittings and valves from the Bulk Splitter and Reclaim Rig are likely to be contaminated to such an extent that decontamination is not practical and these components will be packaged for radioactive waste disposal.

The other components will be decontaminated and surveyed to confirm that they meet regulatory clearance levels.

A contingency factor of 20% of the volume of a drum of LLW is allocated in this planning envelope for items that cannot be decontaminated below clearance levels.

As appropriate, contamination surveys will include indirect measurements (swipe) and direct measurements of fixed and removable tritium activity by laboratory analysis or survey instrument.

10.1.7 Strategy for Protection of Workers, Public and the Environment

All personnel performing decommissioning activities shall be designated Nuclear Energy Workers. A bioassay program shall be established for the decommissioning contractor personnel.

Continuous tritium-in-air monitors shall be employed in the work areas.

Ongoing contamination assessments shall be carried out in the work areas.

Normal Zone 3 Personal Protective Equipment (PPE) shall be the minimum requirement and upgraded should monitored conditions require enhanced levels of protection.

Active ventilation shall continue to operate during dismantling and disassembly activities in this work area. Real-time stack monitoring shall continue to operate.

Action levels for decommissioning activities shall be established.

10.1.8 Type, Quantity and Disposition of Wastes Generated

Table 18: Waste Summary – LLW (Planning Envelope 2, Work Package 1)

Component / Item	Volume (m^3)	Disposition
Bulk splitting rig header, tubing, cylinders	0.030	Licenced LLW facility
Bulk splitting rig scroll pump	0.030	
LLW Contingency (20% drum volume)	0.048	
Total Volume LLW	**0.108**	

Table 19: Waste Summary – CLW (Planning Envelope 2, Work Package 1)

Component / Item	Mass (kg)	Disposition
Bulk splitting rig fume hood structure	150	Landfill / Metal Recycler
Secondary fume hood structure	150	
Other furniture and items	100	
Total Mass CLW	**400**	

10.1.9 Duration

Five (5) person-days of effort are estimated for this work package. This effort includes radiological assessments, dismantling, decontamination and packaging activities.

10.1.10 Estimated Cost

Table 20: Cost Summary Planning Envelope 2, Work Package 1

Activity	Quantity	Unit Cost ($)	Total
Radioactive Waste Disposal	0.108 m^3	28,000	$3,024
Labour	5 person days	1,300	$6,500
WORK PACKAGE COST			**$9,524**

10.2 Work Package 2: Laser Room

10.2.1 Description of Areas and Components to be Decommissioned

Planning Envelope	Zone	Work Package		Floor Area (m^2)	MARSSIM Classification
2	3	2	Laser Room	24	Class 1

The Laser Room contains two (2) laser cutting units, only one of which is in operation. These systems are used to cut miniature tritium light sources. The units are contained within ventilated cabinets connected to the active ventilation systems.

As well there is a stainless-steel work station and a steel storage cabinet, both of which are connected to the active ventilation systems as well. There are other items not associated with processing, including furniture and cabinetry.

10.2.2 Principal Radiological, Chemical and Physical Conditions During Decommissioning

- Tritium is the only radiological hazard present in the Laser Room.
- Laser cutting chambers are likely to be contaminated to an extent that decontamination will not be practical. All other items and components are expected to be contaminated to a much lesser extent, and able to be decontaminated to below clearance levels.
- There are no chemical hazards associated with this area.
- Electrical power supply will be disconnected from all equipment.
- There are no other physical or industrial hazards associated with the Laser Room.

10.2.3 Principal Radiological, Chemical and Physical Conditions After Decommissioning

- Laser cutting equipment will have been dismantled. Cutting chambers will have been packaged and disposed of as LLW, while all other items and components have been decontaminated and processed as clearance-level waste.
- No radiological, chemical, physical or industrial hazards will exist after decommissioning.

10.2.4 Strategic Approach to Decommissioning

A ‘Prompt Removal’ strategy will be adopted for the decommissioning of this work package. For detailed rationale see Section 6.2.

10.2.5 End State Objective

Upon completion of the decommissioning activities in this work package, the Laser Room will be in a condition that will permit the release of the room from any further regulatory control by the CNSC once Planning Envelope 5 work has been completed.

10.2.6 Technical Approach to Decommissioning

The laser cutters will be dismantled. Based on operating experience, the cutting chambers are likely to be contaminated to such an extent that decontamination is not practical and these components will be packaged for radioactive waste disposal.

All other components will be decontaminated and surveyed to confirm that they meet regulatory clearance levels. A contingency factor of 20% of the volume of a drum of LLW is allocated in this planning envelope for items that cannot be decontaminated below clearance levels.

As appropriate, contamination surveys will include indirect measurements (swipe) and direct measurements of fixed and removable tritium activity by laboratory analysis or survey instrument.

10.2.7 Strategy for Protection of Workers, Public and the Environment

All personnel performing decommissioning activities shall be designated Nuclear Energy Workers. A bioassay program shall be established for the decommissioning contractor personnel.

Continuous tritium-in-air monitors shall be employed in the work areas. Ongoing contamination assessments shall be carried out in the work areas.

Normal Zone 3 Personal Protective Equipment (PPE) shall be the minimum requirement and upgraded should monitored conditions require enhanced levels of protection.

Active ventilation shall continue to operate during dismantling and disassembly activities in this work area. Real-time stack monitoring shall continue to operate.

Action levels for decommissioning activities shall be established.

10.2.8 Type, Quantity and Disposition of Wastes Generated

Table 21: Waste Summary – LLW (Planning Envelope 2, Work Package 2)

Component / Item	Volume (m^3)	Disposition
Laser cutting chambers (2)	0.048	Licenced LLW facility
LLW Contingency (20% drum volume)	0.048	
Total Volume LLW	**0.096**	

Table 22: Waste Summary – CLW (Planning Envelope 2, Work Package 2)

Component / Item	Mass (kg)	Disposition
Stainless Steel Workstation	50	Landfill / Metal Recycler
Ventilated laser cabinets	75	
Metal storage cabinet	50	
Other furniture and items	25	
Total Mass CLW	**200**	

10.2.9 Duration

Two (2) person-days of effort are estimated for this work package. This effort includes radiological assessments, dismantling, decontamination and packaging activities.

10.2.10 Estimated Cost

Table 23: Cost Summary Planning Envelope 2, Work Package 2

Activity	Quantity	Unit Cost ($)	Total
Radioactive Waste Disposal	0.096 m^3	28,000	$2,688
Labour	2 person days	1,300	$2,600
WORK PACKAGE COST			**$5,288**

10.3 Work Package 3: Rig Room

10.3.1 Description of Areas and Components to be Decommissioned

Planning Envelope	Zone	Work Package		Floor Area (m^2)	MARSSIM Classification
2	3	3	Rig Room	60	Class 1

The Rig Room is a separate room within the Zone 3 area consisting of the following key decommissioning components:

- Up to eight (8) separate tritium processing fill stations (‘Rigs’) installed in four (4) separate ventilated cabinets, including scroll pumps.
- One (1) glass stub crusher.
- One (1) ‘muffle’ oven.
- A bank of stainless steel fume hoods and associated cabinetry, including three (3) separate work stations for muffle, crushing and wash processes.
- Other items not associated with tritium processing, including two drying ovens (non-active use only), a computer workstation, and other furniture and cabinetry.

10.3.2 Principal Radiological, Chemical and Physical Conditions During Decommissioning

10.3.2.1 Tritium Fill Stations / Rigs

- Tritium is the only radiological hazard present in the processing rigs. Tritium traps will have been removed and processed as part of earlier work (see Planning Envelope 1, Work Package 3). Residual tritium contamination will be present in the internal rig components, such as tubing, valves and pumps.
- An auxiliary system delivering liquid nitrogen to certain processing rigs will have been disconnected and emptied.
- Electrical power supply will be disconnected.
- There are no other potential chemical, physical or industrial hazards associated with the Rigs.

10.3.2.2 Glass Stub Crusher

- Residual tritium contamination may be present on the interior of the stub crusher.
- Electrical power supply will be disconnected.
- There are no other potential chemical, physical or industrial hazards associated with the stub crusher.

10.3.2.3 Muffle Oven

- Residual tritium contamination may be present on the interior of the muffle oven.
- Electrical power supply will be disconnected.
- There are no other potential chemical, physical or industrial hazards associated with the muffle oven.

10.3.2.4 Fume Hood Bank

- Low levels of residual tritium contamination may be present on the interior of the fume hood structure.
- Electrical power supply will be disconnected.
- There are no other potential chemical, physical or industrial hazards associated with these fume hoods.

10.3.2.5 Other items

- Operating experience strongly suggests that any items exhibiting surface contamination can be readily decontaminated to meet clearance levels, either as clearance-level waste or for unconditional clearance.
- There are no physical, industrial or chemical hazards associated with these items.

10.3.3 Principal Radiological, Chemical and Physical Conditions After Decommissioning

10.3.3.1 Tritium Fill Stations / Rigs

- All tritium gas filling heads will have been properly disconnected and capped, and packaged and shipped as LLW. Scroll pumps will have been disconnected, and all tritium-exposed components of the pumps will be processed as LLW as well. Ventilated cabinetry and rig electronics will be dismantled, decontaminated and processed as either LLW or CLW.
- No radiological, chemical, physical or industrial hazards will exist after decommissioning.

10.3.3.2 Glass Stub Crusher

- The stub crusher will have been dismantled, packaged and shipped as LLW.
- No radiological, chemical, physical or industrial hazards will exist after decommissioning.

10.3.3.3 Muffle Oven

- The muffle oven will have been dismantled, and interior components packaged and shipped as LLW. Outer components will be decontaminated and processed as either LLW or CLW.
- No radiological, chemical, physical or industrial hazards will exist after decommissioning.

10.3.3.4 Fume Hood Bank

- Operating experience strongly suggests that the fume hoods will be readily decontaminated, and will be either processed as CLW or repurposed.
- There are no other potential chemical, physical or industrial hazards associated with these fume hoods.

10.3.3.5 Other items

- Operating experience strongly suggests that any items exhibiting surface contamination can be readily decontaminated to meet clearance levels, either as CLW or for unconditional clearance.
- There are no physical, industrial or chemical hazards associated with these items.

10.3.4 Strategic Approach to Decommissioning

A ‘Prompt Removal’ strategy will be adopted for the decommissioning of this work package. For detailed rationale see Section 6.2.

10.3.5 End State Objective

Upon completion of the decommissioning activities in this work package, the Rig Room will be in a condition that will permit the release of the room from any further regulatory control by the CNSC once Planning Envelope 5 work has been completed.

10.3.6 Technical Approach to Decommissioning

The tritium filling rigs, glass stub crusher and muffle fume hood will be dismantled. Based on operating experience, the all ‘wetted’ tubing associated with the processing rigs, including exposed scroll pump components, are likely to be contaminated to such an extent that decontamination is not practical. These components will be packaged for radioactive waste disposal.

All other components will be decontaminated and surveyed to confirm that they meet regulatory clearance levels.

A contingency factor of 100% of the volume of a drum of LLW is allocated in this planning envelope for items that cannot be decontaminated below clearance levels.

As appropriate, contamination surveys will include indirect measurements (swipe) and direct measurements of fixed and removable tritium activity by laboratory analysis or survey instrument.

10.3.7 Strategy for Protection of Workers, Public and the Environment

All personnel performing decommissioning activities shall be designated Nuclear Energy Workers. A bioassay program shall be established for the decommissioning contractor personnel.

Continuous tritium-in-air monitors shall be employed in the work areas. Ongoing contamination assessments shall be carried out in the work areas.

Normal Zone 3 Personal Protective Equipment (PPE) shall be the minimum requirement and upgraded should monitored conditions require enhanced levels of protection.

Active ventilation shall continue to operate during dismantling and disassembly activities in this work area. Real-time stack monitoring shall continue to operate. Action levels for decommissioning activities shall be established.

10.3.8 Type, Quantity and Disposition of Wastes Generated

Table 24: Waste Summary – LLW (Planning Envelope 2, Work Package 3)

Component / Item	Volume (m^3)	Disposition
Filling heads, scroll pumps (8)	0.50	Licenced LLW facility
Glass stub crusher	0.10	
Muffle oven – interior components	0.05	
LLW Contingency (100% drum volume)	0.24	
Total Volume LLW	**0.89**	

Table 25: Waste Summary – CLW (Planning Envelope 2, Work Package 3)

Component / Item	Mass (kg)	Disposition
Ventilated cabinetry for rigs	200	Landfill / Metal Recycler
Fume hood bank	400	
Muffle oven – exterior components	20	
Scroll pumps – non-wetted components	80	
Drying ovens	200	
Other furniture and items	200	
Total Mass CLW	**1,100**	

10.3.9 Duration

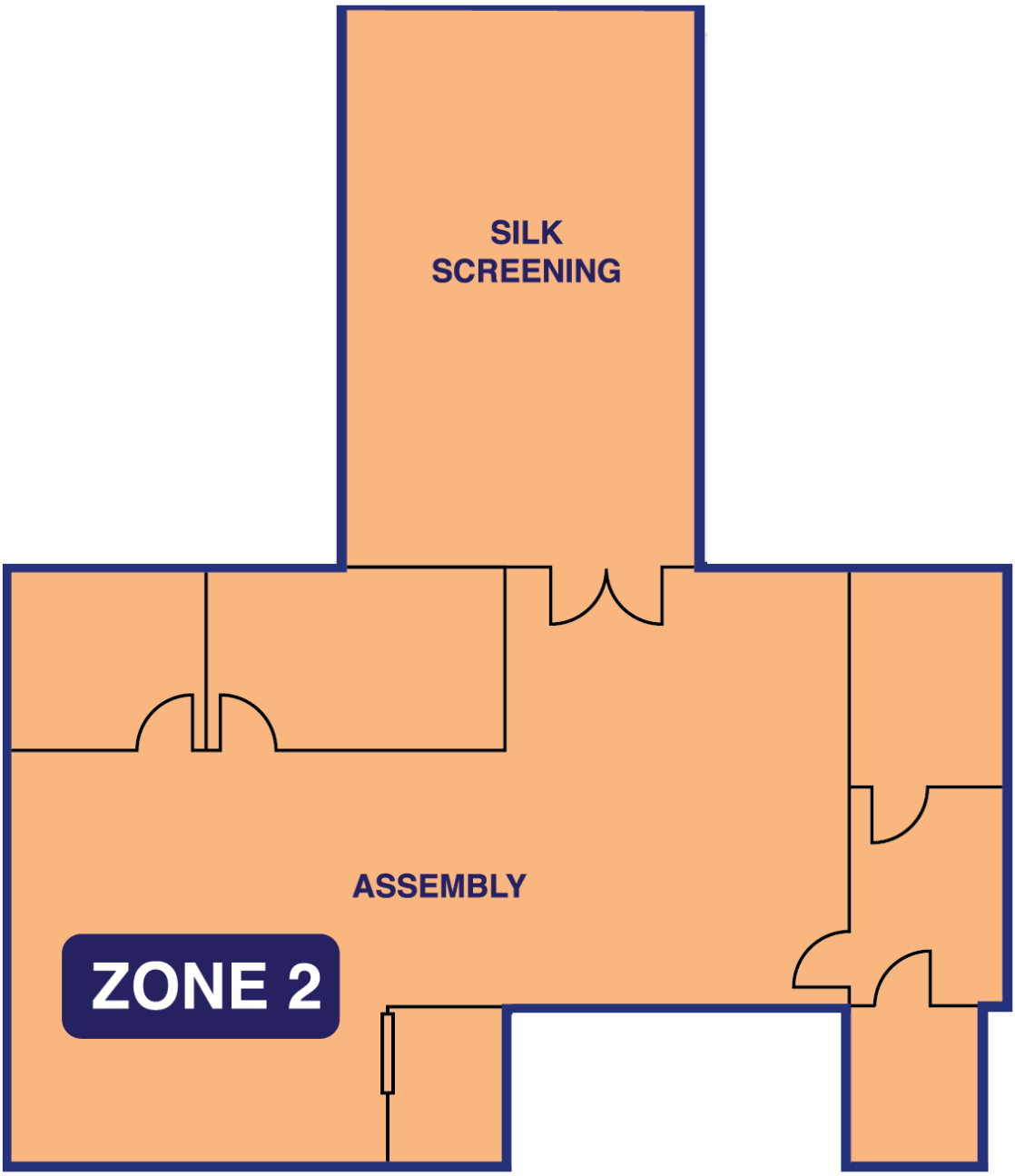
Eighteen (18) person-days of effort are estimated for this work package. This effort includes radiological assessments, dismantling, decontamination and packaging activities.

10.3.10 Estimated Cost

Table 26: Cost Summary Planning Envelope 2, Work Package 3

Activity	Quantity	Unit Cost ($)	Total
Radioactive Waste Disposal	0.89 m^3	28,000	$24,920
Labour	18 person days	1,300	$23,400
WORK PACKAGE COST			**$48,320**

11. Planning Envelope 3: Zone 2 Work Area



11.1 Work Package 1: Assembly Room

11.1.1 Description of Areas and Components to be Decommissioned

Planning Envelope	Zone	Work Package		Floor Area (m^2)	MARSSIM Classification
3	2	1	Assembly Area	114	Class 2

The Assembly Area consists of the work stations associated with the brightness testing and installation of GTLS tubes into various sign frames. These tubes have all been leak tested in Zone 3 before being transferred to the Zone 2 Assembly Area.

The extent of decommissioning activities in this area will consist of radiological clearance surveys of all work stations and equipment, walls and floor areas.

The tritium-in-air stack monitors are located in the Assembly Area and will be decommissioned after the Zone 3 ventilation and facility stacks have been decommissioned.

11.1.2 Principal Radiological, Chemical and Physical Conditions During Decommissioning

- There exists low potential for tritium contamination in this area. All GTLS tubes will have been removed from this area prior to decommissioning.
- Residual tritium contamination may be present in the tubing and components of the tritium-in-air stack monitoring system.
- Any chemical/hazardous materials will have been transferred to a Hazardous Waste Facility, if required.
- There are no electrical or pressurized systems in this area that require disconnecting or depressurizing to facilitate decommissioning activities.

11.1.3 Principal Radiological, Chemical and Physical Conditions After Decommissioning

- There will be no radiological or chemical hazards remaining in this area after decommissioning.
- The area will be cleared of all work stations, furniture, shelving and other associated components.
- The room will be vacant after decommissioning.

11.1.4 Strategic Approach to Decommissioning

A ‘Prompt Removal’ strategy will be adopted for the decommissioning of this work package. For detailed rationale see Section 6.2.

11.1.5 End State Objective

Upon completion of the decommissioning activities in this work package, the Assembly Area will be in a condition that will permit the release of the room from any further regulatory control by the CNSC.

11.1.6 Technical Approach to Decommissioning

Detailed tritium contamination surveys will be conducted on all furniture, equipment, shelving, work stations and all other removable components to ensure that clearance levels are met. Surveys will include indirect measurements (swipe) and direct measurements for fixed and removable tritium activity using a portable survey instrument that works on any flat, conducting surface.

All furniture and cabinetry is expected to be either processed as CLW, or repurposed for other use. Cabinets and equipment are expected to be able to be reused by other businesses after undergoing clearance assessments.

Once the area is cleared of equipment and furniture a MARSSIM[23] based radiological clearance survey will be completed of the walls and floors to ensure that clearance levels are met.

A final detailed physical inspection will be conducted in all areas of the Assembly Area after the removal of all equipment to confirm the absence of any GTLS tubes.

11.1.7 Strategy for Protection of Workers, Public and the Environment

All personnel performing decommissioning activities shall be designated Nuclear Energy Workers. A bioassay program shall be established for the decommissioning contractor personnel.

Continuous tritium-in-air monitors shall be employed in the work areas. Ongoing contamination assessments shall be carried out in the work areas.

Normal Zone 2 Personal Protective Equipment (PPE) shall be the minimum requirement and upgraded should monitored conditions require enhanced levels of protection.

Real-time stack monitoring shall continue to operate. Note that the real-time stack monitoring equipment shall remain operational until Planning Envelope 5 has been completed; only then may the equipment be shut down and decommissioned.

Action levels for decommissioning activities shall be established.

11.1.8 Type, Quantity and Disposition of Wastes Generated

Table 27: Waste Summary – LLW (Planning Envelope 3, Work Package 1)

Component / Item	Volume (m^3)	Disposition
Stack monitoring piping / tubing	0.03	Licenced LLW facility
Total Volume LLW	**0.03**	

Table 28: Waste Summary – CLW (Planning Envelope 3, Work Package 1)

Component / Item	Mass (kg)	Disposition
Shelving, work tables, equipment, chairs and cabinetry that cannot be repurposed	300	Landfill / Metal Recycler
Total Mass CLW	**300**	

11.1.9 Duration

Four (4) person-days of effort are estimated for this work package. This effort includes radiological assessments, dismantling, decontamination and physical removal of all waste and repurposed items.

11.1.10 Estimated Cost

Table 29: Cost Summary Planning Envelope 3, Work Package 1

Activity	Quantity	Unit Cost ($)	Total
Radioactive Waste Disposal	0.03 m^3	28,000	$840
Labour	4 person days	1,300	$5,200
WORK PACKAGE COST			**$6,040**

11.2 Work Package 2: Silk Screening Room

11.2.1 Description of Areas and Components to be Decommissioned

Planning Envelope	Zone	Work Package		Floor Area (m^2)	MARSSIM Classification
3	2	2	Silk Screening Room	43	Class 2

The Silk Screening Room is an area where speciality light frames are built and painted before the installation of GTLS tubes. No radioactive materials are routinely handled in this room. The room does contain numerous metal drying racks and work tables that will require clearance surveys and dismantling.

11.2.2 Principal Radiological, Chemical and Physical Conditions During Decommissioning

- There exists very limited potential for tritium contamination in this area. No radioactive materials are routinely handled or stored in this area.
- Any chemical/hazardous materials, including paint products, will have been transferred to a Hazardous Waste Facility, if required.
- There are no electrical or pressurized systems in this area that require disconnecting or depressurizing to facilitate decommissioning activities.

11.2.3 Principal Radiological, Chemical and Physical Conditions After Decommissioning

- There will be no radiological or chemical hazards remaining in this area after decommissioning.
- The area will be cleared of all work stations, furniture, shelving and other associated components.
- The room will be vacant after decommissioning.

11.2.4 Strategic Approach to Decommissioning

A ‘Prompt Removal’ strategy will be adopted for the decommissioning of this work package. For detailed rationale see Section 6.2.

11.2.5 End State Objective

Upon completion of the decommissioning activities in this work package, the Silk Screening Room will be in a condition that will permit the release of the room from any further regulatory control by the CNSC.

11.2.6 Technical Approach to Decommissioning

Detailed tritium contamination surveys will be conducted on all furniture, equipment, shelving, work stations and all other removable components to ensure that clearance levels are met. Surveys will include indirect measurements (swipe) and direct measurements for fixed and removable tritium activity using a portable survey instrument that works on any flat, conducting surface.

All furniture and cabinetry is expected to be either processed as CLW, or repurposed for other use. Cabinets and equipment are expected to be able to be reused by other businesses after undergoing clearance assessments.

Once the area is cleared of equipment and furniture a MARSSIM[23] based radiological clearance survey will be completed of the walls and floors to ensure that clearance levels are met.

A final detailed physical inspection will be conducted in all areas of the Assembly Area after the removal of all equipment to confirm the absence of any GTLS tubes.

11.2.7 Strategy for Protection of Workers, Public and the Environment

All personnel performing decommissioning activities shall be designated Nuclear Energy Workers. A bioassay program shall be established for the decommissioning contractor personnel.

Ongoing contamination assessments shall be carried out in the work areas.

Normal Zone 2 Personal Protective Equipment (PPE) shall be the minimum requirement and upgraded should monitored conditions require enhanced levels of protection.

Real-time stack monitoring shall continue to operate.

Action levels for decommissioning activities shall be established.

11.2.8 Type, Quantity and Disposition of Wastes Generated

Table 30: Waste Summary – LLW (Planning Envelope 3, Work Package 2)

Component / Item	Volume (m^3)	Disposition
None	-	Licenced LLW facility
Total Volume LLW	**0**	

Table 31: Waste Summary – CLW (Planning Envelope 3, Work Package 2)

Component / Item	Mass (kg)	Disposition
Shelving, work tables, equipment, chairs and cabinetry that cannot be repurposed	200	Landfill / Metal Recycler
Total Mass CLW	**200**	

11.2.9 Duration

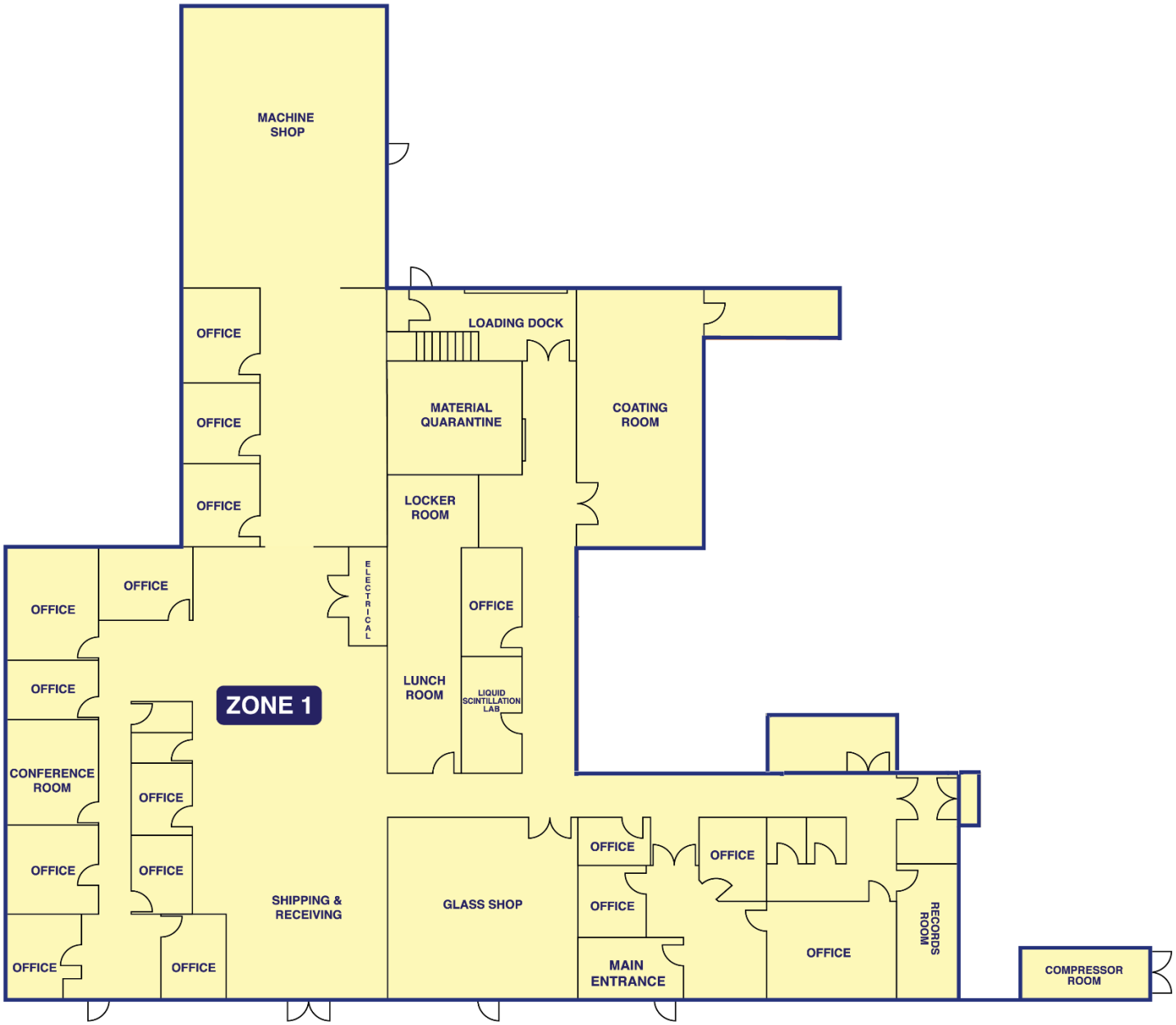
Two (2) person-days of effort are estimated for this work package. This effort includes radiological assessments, dismantling, decontamination and physical removal of all waste and repurposed items.

11.2.10 Estimated Cost

Table 32: Cost Summary Planning Envelope 3, Work Package 2

Activity	Quantity	Unit Cost ($)	Total
Radioactive Waste Disposal	0 m^3	28,000	$0
Labour	2 person days	1,300	$2,600
WORK PACKAGE COST			**$2,600**

12. Planning Envelope 4: Zone 1 Work Area



12.1 Work Package 1: Entire Zone 1 Area

12.1.1 Description of Areas and Components to be Decommissioned

Planning Envelope	Zone	Work Package		Floor Area (m^2)	MARSSIM Classification
4	1	1	All Zone 1 Areas	1,092	Class 2

The extent of decommissioning activities in this area will consist of radiological clearance surveys of all work stations, furniture, equipment, walls and floor areas.

12.1.2 Principal Radiological, Chemical and Physical Conditions During Decommissioning

- The potential for tritium contamination in this Zone is extremely low. Any radioactive materials handled in this area are all packaged items ready for shipment.
- Any chemical/hazardous materials, including paint products, will have been transferred to a Hazardous Waste Facility, if required.
- There are no electrical or pressurized systems in this area that require disconnecting or depressurizing to facilitate final clearance surveys.

12.1.3 Principal Radiological, Chemical and Physical Conditions After Decommissioning

- There will be no radiological or chemical hazards remaining in this area after decommissioning.
- The area will be cleared of all work stations, furniture, shelving and other associated components.
- The area will be vacant after decommissioning.

12.1.4 Strategic Approach to Decommissioning

A ‘Prompt Removal’ strategy will be adopted for the decommissioning of this work package. For detailed rationale see Section 6.2.

12.1.5 End State Objective

Upon completion of the decommissioning activities in this work package, the Zone 1 Area will be in a condition that will permit the release of the room from any further regulatory control by the CNSC.

12.1.6 Technical Approach to Decommissioning

Detailed tritium contamination surveys will be conducted on all furniture, equipment, shelving, work stations and all other removable components to ensure that clearance levels are met.

All furniture and cabinetry is expected to be repurposed for other use. Cabinets and equipment are expected to be able to be reused by other businesses after undergoing final clearance surveys.

Once the area is cleared of equipment and furniture a MARSSIM[23] based radiological clearance survey will be completed of the walls and floors to ensure that clearance levels are met.

12.1.7 Strategy for Protection of Workers, Public and the Environment

All personnel performing decommissioning activities shall be designated Nuclear Energy Workers. A bioassay program shall be established for the decommissioning contractor personnel.

Ongoing contamination assessments shall be carried out in the work areas.

Action levels for decommissioning activities shall be established.

12.1.8 Type, Quantity and Disposition of Wastes Generated

Table 33: Waste Summary – LLW (Planning Envelope 4, Work Package 1)

Component / Item	Volume (m^3)	Disposition
None	-	Licenced LLW facility
Total Volume LLW	**0**	

Table 34: Waste Summary – CLW (Planning Envelope 4, Work Package 1)

Component / Item	Mass (kg)	Disposition
None	-	Landfill / Metal Recycler
Total Mass CLW	**0**	

Note that the absence of CLW in the planning envelope does not mean that there will be no waste or recyclable materials generated during decommissioning activities in Zone 1. Rather, any waste materials are not required to be accounted for as 'clearance-level waste' in accordance with the SRBT Waste Management Program.

The mass of waste and recyclables from Zone 1 is not limited by administrative restrictions in the way that waste is managed in Zone 2 and 3.

12.1.9 Duration

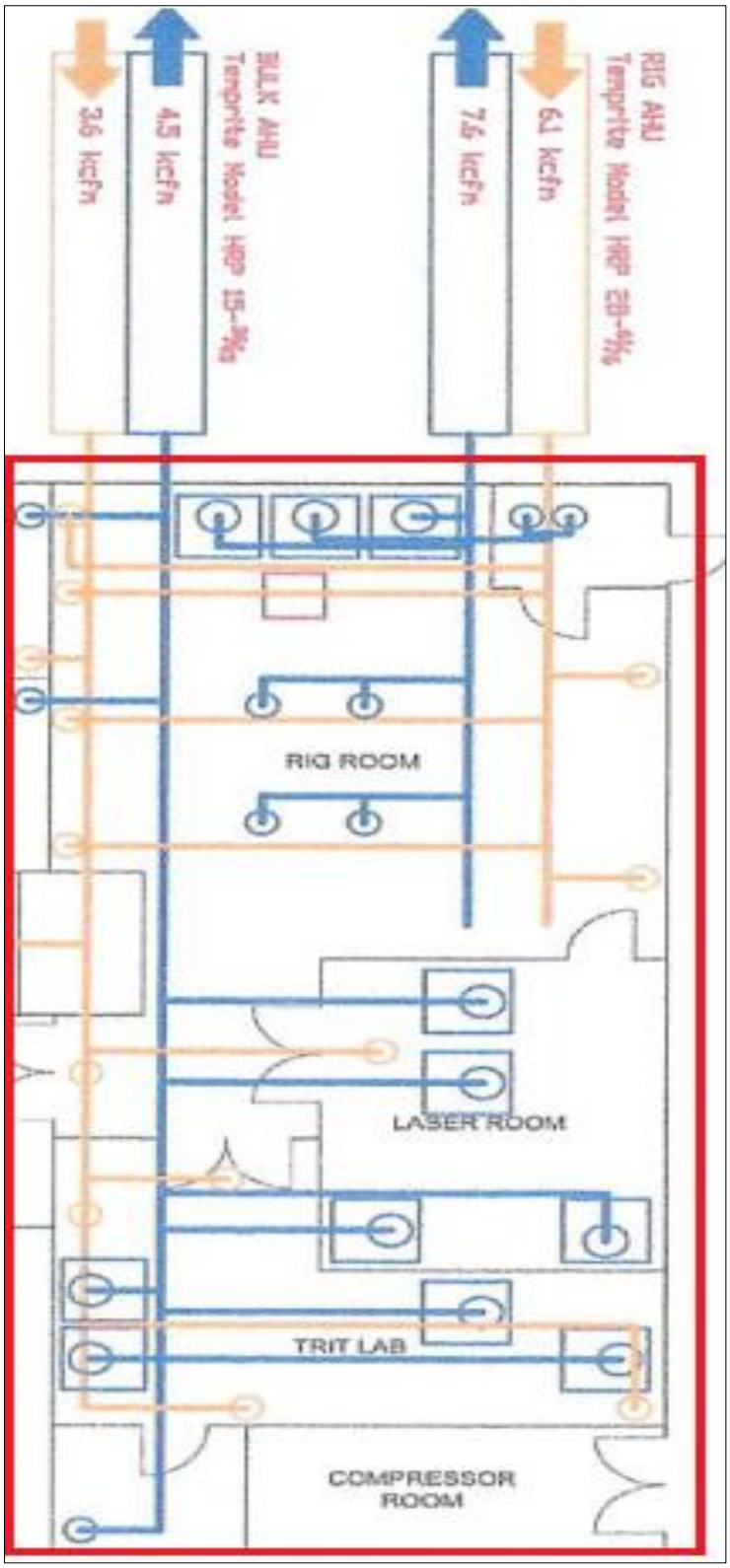
Ten (10) person-days of effort are estimated for this work package. This effort includes radiological assessments, dismantling, and physical removal of all equipment and furniture.

12.1.10 Estimated Cost

Table 35: Cost Summary Planning Envelope 4, Work Package 1

Activity	Quantity	Unit Cost ($)	Total
Radioactive Waste Disposal	0 m^3	28,000	$0
Labour	10 person days	1,300	$13,000
WORK PACKAGE COST			**$13,000**

13. Planning Envelope 5: Zone 3 Ventilation Systems



13.1 Work Package 1: Zone 3 Ventilation Systems

13.1.1 Description of Areas and Components to be Decommissioned

Planning Envelope	Zone	Work Package		Floor Area (m^2)	MARSSIM Classification
5	3	1	Zone 3 Ventilation	N/A	Class 1

The Zone 3 Ventilation Systems consist of two separate series of ductwork. The ductwork is a combination of round, flexible metal ductwork and rectangular sheet metal ductwork. All ductwork is located above a false ceiling, which will be removed to facilitate access and removal.

Removal of Zone 3 ductwork will only commence after the completion of the work described in Planning Envelopes 2 and 3.

13.1.2 Principal Radiological, Chemical and Physical Conditions During Decommissioning

- Residual tritium contamination will be present on the interior surfaces of the ductwork.
- Any chemical/hazardous materials will have been transferred to a Hazardous Waste Facility, if required.
- There are no electrical or pressurized systems in this area that require disconnecting or depressurizing to facilitate final clearance surveys.
- Working at height safety practices will be considered for this activity.

13.1.3 Principal Radiological, Chemical and Physical Conditions After Decommissioning

- There will be no radiological or chemical hazards remaining in this area after decommissioning.
- Following removal of the ductwork, the Zone 3 final clearance surveys can be completed.

13.1.4 Strategic Approach to Decommissioning

A ‘Prompt Removal’ strategy will be adopted for the decommissioning of this work package. For detailed rationale see Section 6.2.

13.1.5 End State Objective

Upon completion of the decommissioning activities in this work package, the Zone 3 Area will be in a condition that will permit the release of the room from any further regulatory control by the CNSC.

13.1.6 Technical Approach to Decommissioning

Detailed tritium contamination surveys will not be required because there will be no attempt to clear these materials for release or recycling.

Characterization surveys will be completed to determine the information required for waste acceptance at a licensed radioactive waste facility. Surveys will include indirect measurements (swipe) and direct measurements for fixed and removable tritium activity using survey instruments as appropriate.

Once the area is cleared of all ductwork a MARSSIM[23] based radiological clearance survey will be completed of the walls and floors to ensure that clearance levels are met.

13.1.7 Strategy for Protection of Workers, Public and the Environment

All personnel performing decommissioning activities shall be designated Nuclear Energy Workers. A bioassay program shall be established for the decommissioning contractor personnel.

Ongoing contamination assessments shall be carried out in the work areas.

Continuous tritium-in-air monitoring shall be carried out during the removal activities.

In addition to normal Zone 3 Personal Protective Equipment (PPE), enhanced levels of protection may be considered depending on radiological conditions measured at the time of removal. This may include respiratory protection measures.

Real-time stack monitoring shall continue to operate. Once this work package has been completed, this system may then be decommissioned in accordance with Planning Envelope 3.

Action levels for decommissioning activities shall be established.

13.1.8 Type, Quantity and Disposition of Wastes Generated

The ventilation ductwork is made of light gauge sheet metal. The exhaust headers and associated runs are rectangular in cross-section, and can readily be volume-minimized by sectioning into flat sheets.

The total duct work to be processed runs over a length of about 8,100 cm, and is expected to be able to be placed in a certified 'B-12' Type A package (total volume = 1.25 m^3) after volume reduction; however, a contingency equivalent to the volume of a Type 'A' drum (0.24 m^3) is included in the planning envelope to ensure conservatism.

Table 36: Waste Summary – LLW (Planning Envelope 5, Work Package 1)

Component / Item	Volume (m^3)	Disposition
Volume-minimized ventilation ductwork	1.49	Licenced LLW facility
Total Volume LLW	**1.49**	

Table 37: Waste Summary – CLW (Planning Envelope 5, Work Package 1)

Component / Item	Mass (kg)	Disposition
None	-	Landfill / Metal Recycler
Total Mass CLW	**0**	

13.1.9 Duration

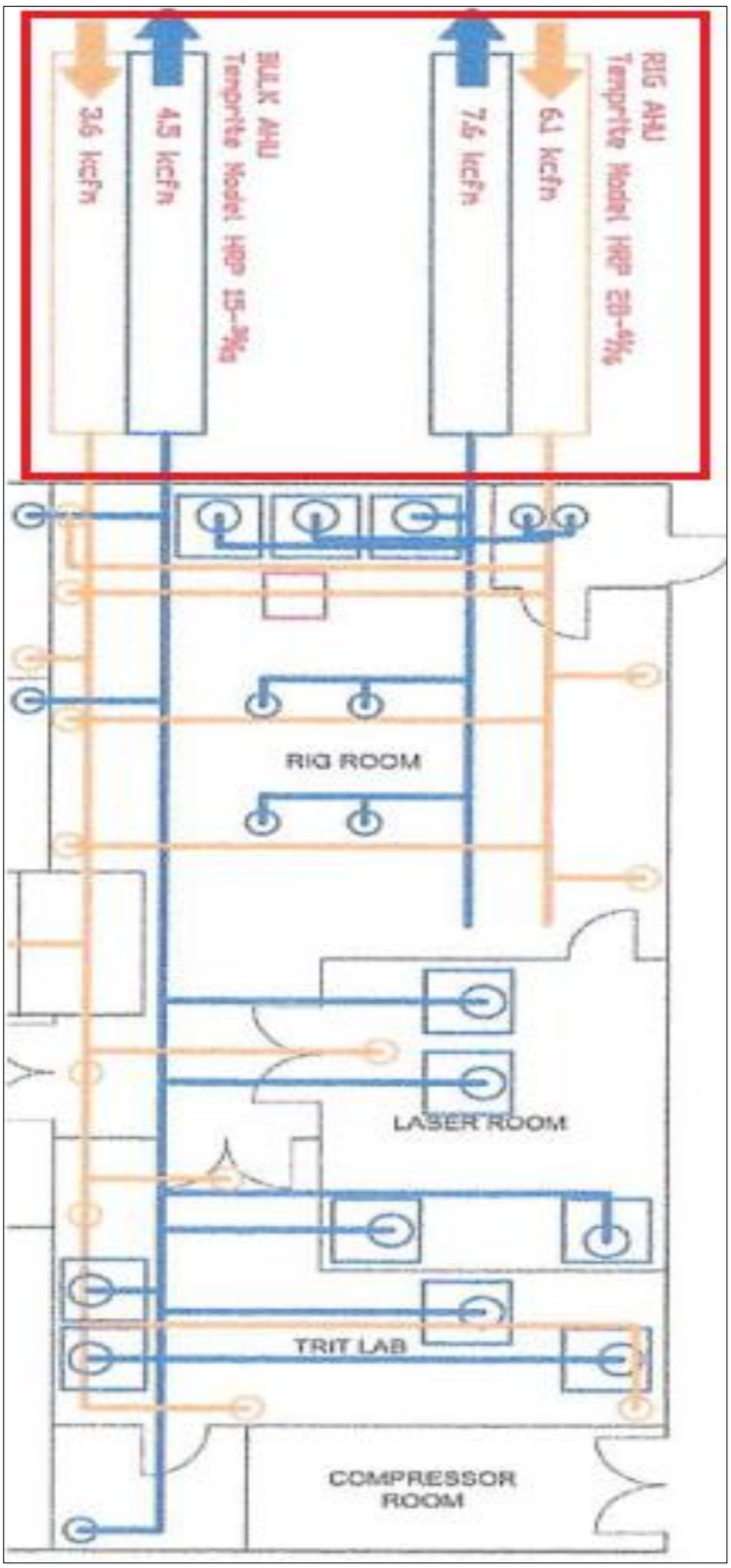
Ten (10) person-days of effort are estimated for this work package. This effort includes radiological assessments, dismantling, volume reduction and packaging of all ductwork.

13.1.10 Estimated Cost

Table 38: Cost Summary Planning Envelope 5, Work Package 1

Activity	Quantity	Unit Cost ($)	Total
Radioactive Waste Disposal	1.49 m^3	28,000	$41,720
Labour	10 person days	1,300	$13,000
WORK PACKAGE COST			**$54,720**

14. Planning Envelope 6: Air Handling Units and Stacks



14.1 Work Package 1: Air Handling Units and Stacks

14.1.1 Description of Areas and Components to be Decommissioned

Planning Envelope	Zone	Work Package		Floor Area (m^2)	MARSSIM Classification
6	N/A	1	Air Handling Units	N/A	Class 1

The Bulk Air Handling Unit supplies and exhausts the Tritium Lab, Laser Room, Storage Room and two rooms in Zone 2, while the Rig Air Handling Unit supplies and exhausts the tritium filling rigs in the Rig Room.

These are located outside of the building in the secure fenced-in compound.

14.1.2 Principal Radiological, Chemical and Physical Conditions During Decommissioning

- Residual tritium contamination will be present on the interior surfaces of the ductwork.
- Any chemical/hazardous materials will have been transferred to a Hazardous Waste Facility, if required.
- The electrical power supply to the units will be disconnected prior to decommissioning activities.
- Working at height safety practices will be considered for this activity, including training and qualifications for operating the hoisting equipment.

14.1.3 Principal Radiological, Chemical and Physical Conditions After Decommissioning

- There will be no radiological or chemical hazards remaining in this area after decommissioning.
- Following removal of the air handling units and stacks, final clearance surveys can be completed.

14.1.4 Strategic Approach to Decommissioning

A ‘Prompt Removal’ strategy will be adopted for the decommissioning of this work package. For detailed rationale see Section 6.2.

14.1.5 End State Objective

Upon completion of the decommissioning activities in this work package, the area will be in a condition that will permit the release of the room from any further regulatory control by the CNSC.

14.1.6 Technical Approach to Decommissioning

Detailed tritium contamination surveys will not be required because there will be no attempt to clear these materials for release or recycling.

Characterization surveys will be completed to determine the information required for waste acceptance at a licensed radioactive waste facility. Surveys will include indirect measurements (swipe) and direct measurements for fixed and removable tritium activity using survey instruments as appropriate.

Volume reduction practices including cutting and compaction will be employed where practicable.

14.1.7 Strategy for Protection of Workers, Public and the Environment

All personnel performing decommissioning activities shall be designated Nuclear Energy Workers. A bioassay program shall be established for the decommissioning contractor personnel.

Ongoing contamination assessments shall be carried out in the work areas, and contamination control practices will be employed during work. Protective equipment and clothing shall be selected based upon hazard assessments during work.

Fire protection practices will be employed during any cutting activities involving spark or open flame / torches.

Hoisting, rigging and cutting work, and any heavy equipment operations will be performed by qualified personnel only.

14.1.8 Type, Quantity and Disposition of Wastes Generated

The two stacks are light gauge sheet metal, each being approximately 6 m in height and 20 cm in diameter.

The Bulk Air Handling Unit has an estimated mass of 2,200 kg, while the Rig Air Handling unit is estimated at 3,000 kg. The units are approximately 4.2 m in length, 1.5 m in width and 2.5 m in height. Engineering lifting lugs are attached to each unit.

The composition of these units, along with the estimated total radiological activity facilitates the disposition of these units at a licensed metal melt facility operated by EnergySolutions. This facility has accepted and processed millions of pounds of radioactive waste generated at licensed facilities in Canada. Discussions with this service provider have confirmed that the air handling units satisfy waste acceptance criteria, and can be accommodated and disposed of via this pathway.

Table 39: Waste Summary – LLW (Planning Envelope 6, Work Package 1)

Component / Item	Mass (kg)	Disposition
Bulk air handling unit	2,200	EnergySolutions Metal Melt
Rig air handling unit	3,000	
Stacks	230	
Total Mass	**5,430**	

Table 40: Waste Summary – CLW (Planning Envelope 6, Work Package 1)

Component / Item	Mass (kg)	Disposition
None	-	Landfill / Metal Recycler
Total Mass CLW	**0**	

14.1.9 Duration

Four (4) person-days of effort are estimated for this work package. This effort includes radiological assessments, dismantling, volume reduction and packaging activities.

14.1.10 Estimated Cost

Table 41: Cost Summary Planning Envelope 6, Work Package 1

Activity	Quantity	Unit Cost ($)	Total
Radioactive Waste Disposal	5,430	10	$54,300
Labour	4 person days	1,300	$5,200
Crane rental	1	1,000	$1,000
Articulated boom lift rental	1	550	$550
Transportation costs	1	$8,000	$8,000
WORK PACKAGE COST			**$80,050**

15. Planning Envelope 7: Groundwater Monitoring Wells

15.1 Work Package 1: Removal of 29 Groundwater Monitoring Wells

15.1.1 Description of Areas and Components to be Decommissioned

Planning Envelope	Zone	Work Package		Floor Area (m^2)	MARSSIM Classification
7	N/A	1	Groundwater Monitoring Wells	N/A	N/A

There are 29 groundwater monitoring wells located on the grounds surrounding the facility. These wells are used as part of SRBT's Groundwater Monitoring and Protection programs.

These wells will be decommissioned by a qualified third party contractor.

15.1.2 Principal Radiological, Chemical and Physical Conditions During Decommissioning

There are no radioactive, chemical, electrical or other physical hazard associated with the decommissioning of these wells.

15.1.3 Principal Radiological, Chemical and Physical Conditions After Decommissioning

There will be no radiological, chemical or physical hazards in these areas once the wells are decommissioned and removed.

15.1.4 Strategic Approach to Decommissioning

A 'Prompt Removal' strategy will be adopted for the decommissioning of this work package. For detailed rationale see Section 6.2.

15.1.5 End State Objective

Upon completion of the decommissioning activities in this work package, the area will be in a condition that will permit the release of the room from any further regulatory control by the CNSC.

15.1.6 Technical Approach to Decommissioning

The work package will be completed by a qualified well drilling contractor who has experience and equipment to perform this work. Wells have previously been decommissioned (last in 2014) by qualified contractors.

15.1.7 Strategy for Protection of Workers, Public and the Environment

Hoisting, cutting and other equipment used in this work package will be operated by qualified personnel only. Normal industrial safety practices will be followed.

15.1.8 Type, Quantity and Disposition of Wastes Generated

All waste associated with this work package is not expected to be radioactively contaminated. Any wastes generated will be disposed of or recycled after assessment.

15.1.9 Duration

Similar work has been performed previously by a qualified contractor on a per-unit removal basis of approximately $500 per well. The time to complete the work is not defined, but it is not expected to take any more than a few days at most.

15.1.10 Estimated Cost

Table 42: Cost Summary Planning Envelope 7, Work Package 1

Activity	Quantity	Unit Cost ($)	Total
Groundwater monitoring well removal	29	500	$14,400
WORK PACKAGE COST			**$14,500**

16. Final Survey

The purpose of the Final Survey is to demonstrate that the decommissioning work is complete; specifically, that the premises and their surroundings are in the desired end state.

The Final Survey will be performed after all decontamination, dismantling and waste management work is complete. The final radiological survey will apply MARSSIM[23] methodology in procedures that will be described in the DDP.

These procedures will meet the requirements of the applicable regulations, standards and guidelines in force at the time at the time of the decommissioning. The results of the Final Survey will be presented in the Decommissioning Report.

17. End State

The SRBT facility will have been retired from service and left in a state where the health and safety of the workers, the public and the environment will not be impacted.

Upon completion of the decommissioning, the facility will be in a condition that will permit the release of the facility from any further regulatory control by the CNSC. Possession of the leased premises will be returned to the owner for future commercial or industrial use or development.

18. Decommissioning Report

A Decommissioning Report will be prepared following completion of the decommissioning work.

The Decommissioning Report will include detailed summaries of:

- All decommissioning work that was completed under the Detailed Decommissioning Plan and the outcome of that work,
- The radioactive, hazardous and demolition wastes that were generated and the disposition of those wastes,
- Any incidents, releases or unexpected events that occurred during the course of the decommissioning work; and
- The results of the final survey that was performed and the interpretation of the results.

Any additional information required by the Regulations in force at the time of the decommissioning will also be included in the Decommissioning Report. This report will form part of the submission to the CNSC for a Licence to Abandon

19. Abandonment

An application for a Licence to Abandon will be completed and submitted to CNSC for review and approval. This application will be supported by the Final Decommissioning Report.

After decommissioning of the facility is complete and a License to Abandon has been granted, the premises will be returned to the owner of the building for reuse or redevelopment.

20. Impact Assessment

20.1 Environment

It is expected that there will be no significant impact on the surrounding natural environment due to the decommissioning of the facility.

This is based on previous regulatory environmental assessments which have noted that the environmental effects arising from future decommissioning are not expected to be significant, and on the fact that facility operations have remained unchanged (or improved) since the assessment was completed.

20.2 Socioeconomic

There is expected to be a significant impact on the social and economic environment.

The main elements that will be affected are the local economy through direct loss of employment for individuals in the area, the local and surrounding area's economy through loss of spin-off jobs, and indirect loss of employment due to the loss of operations and employment at the facility.

20.3 Waste

Currently, SRBT facility disposes of non-hazardous waste at the local municipal landfill. The waste disposed of at that site may include such items as cardboard, paper, gloves, cleaning material, and plastic components. No significant impacts are expected to occur from the non-hazardous waste associated with decommissioning.

It is planned that all hazardous wastes will be removed prior to decommissioning. SRBT will dispose of hazardous and radioactive waste at licensed waste management facilities; therefore, no adverse environmental impacts are expected.

21. Documentation

SRBT will maintain the following documents for use in the development of the detailed decommissioning plan:

- Design descriptions of the custom built tritium processing equipment, including filling rigs, laser cutting systems, and bulk splitting rig,
- Results of routine contamination surveys and environmental monitoring programs, and
- Details of any spills of hazardous materials, or releases of radioactive materials which may have occurred over the operating life of the facility.

22. Decommissioning Cost Estimate

The facility and the equipment used in the facility have remained generally unchanged in comparison to what was described in the previous version of the PDP which was issued in 2014, with five notable exceptions.

SRBT procured and commissioned an injection molder, and began producing sign parts in house since the last review of the PDP. The facility footprint was also expanded by approximately 214 m^2 in order to house and operate this equipment.

The injection molder operates in Zone 1 of the facility, and does not interface with any nuclear substances. It is expected that this equipment will be sold once facility shutdown takes place.

SRBT also procured and commissioned an industrial 3D printer, and began working towards producing prototype device components and temporary injection molds. This printer is also expected to be sold once facility shutdown takes place.

The following equipment was successfully dismantled and removed from the Zone 3 area of facility, after SRBT developed and executed internal change control and individual dismantlement and disposal projects:

- ‘LMI’ laser cutting workstation
- Reclaim rig
- Rig room fume hoods

The removed rig room fume hoods were original equipment installed when the facility was opened in 1990, and were comprised of wood / particle board. They were replaced with similar fume hoods constructed of stainless steel.

Due to the robustness of their construction, and the materials used, the replacement hoods are expected to be fully decontaminated and either sold / repurposed, or recycled when decommissioning takes place.

This revision of the PDP incorporates the above changes into all applicable planning envelopes and work packages, as well as the evolution of SRBT’s safety programs and management system over the past several years. This revision also updates costing figures as required.

Table 34 below summarizes the projected cost to achieve the defined end-state.

Note that running costs and anticipated regulatory fees have been adjusted from previous values by applying an inflation factor of 1.0826 (estimated Canadian rate of inflation between 2014-2019 – see https://www.bankofcanada.ca/rates/related/inflation-calculator/, value obtained July 18, 2019), and rounded upward to the nearest ten dollars before applying the corresponding contingency factor.

Table 43: Cost to Achieve End State

SAFE SHUTDOWN PHASE			
DESCRIPTION OR ACTIVITY	**SUBTOTAL**	**CONTINGENCY**	**TOTAL**
Cessation of accepting old signs: notification	$4,400	25%	$5,500
Final shipment of remaining signs to customers	$8,800	25%	$11,000
Removal of Nuclear Substances	$50,200	25%	$62,750
Removal of Hazardous Substances	$2,700	25%	$3,375
Scoping Surveys	$12,100	25%	$15,125
Sample Analysis & Environmental Monitoring	$9,100	25%	$11,375
Public Involvement Program	$6,960	25%	$8,700
Detailed Decommissioning Plan	$13,920	25%	$17,400
Mobilization	$3,900	25%	$4,875
Running Costs (3 months)	$49,880	10%	$54,868
SAFE SHUTDOWN PHASE COSTS	**$161,960**		**$194,968**
DECOMMISSIONING PHASE			
DESCRIPTION OR ACTIVITY	**SUBTOTAL**	**CONTINGENCY**	**TOTAL**
Planning Envelope 2, Work Package 1	$9,524	25%	$11,905
Planning Envelope 2, Work Package 2	$5,288	25%	$6,610
Planning Envelope 2, Work Package 3	$48,320	25%	$60,400
Planning Envelope 3, Work Package 1	$6,040	25%	$7,550
Planning Envelope 3, Work Package 2	$2,600	25%	$3,250
Planning Envelope 4, Work Package 1	$13,000	25%	$16,250
Planning Envelope 5, Work Package 1	$54,720	25%	$68,400
Planning Envelope 6, Work Package 1	$80,050	25%	$100,063
Planning Envelope 7, Work Package 1	$14,500	25%	$18,125
Soil sampling	$3,000	25%	$3,750
Running Costs (3 months)	$49,880	10%	$54,868
TOTAL COSTS DECOMMISSIONING PHASE	**$286,922**		**$351,171**
CNSC REVIEW AND ASSESSMENT FEES			
DESCRIPTION OR ACTIVITY	**SUBTOTAL**	**CONTINGENCY**	**TOTAL**
CNSC Impact Assessment Determination (1 day)	$2,070	25%	$2,588
Review of Decommissioning Licence Application & associated program review (40 days)	$82,820	25%	$103,525
Licensing assessment and decision (20 days)	$41,410	25%	$51,763
Review of Decommissioning Final Report (5 days)	$10,360	25%	$12,950
CNSC review of Abandonment Licence Application and CMD development (4 days)	$8,290	25%	$10,363
TOTAL: CNSC FEES	**$144,950**		**$181,188**
TOTAL COST TO ACHIEVE END STATE	**$727,327.00**		

23. Funding

CNSC Regulatory Guide G-206, *Financial Guarantees for the Decommissioning of Licensed Activities* provides guidance regarding the establishment and maintenance of measures to fund the decommissioning of activities licensed by the CNSC.

To be acceptable to the CNSC, a funding measure must provide assurance that adequate resources will be available to fund decommissioning activities based on information provided to the CNSC. The FG must be at arm's length from the licensee and the CNSC must be assured that it or its agents can, upon demand, access or direct adequate funds if a licensee is not available to fulfil its obligations for decommissioning.

23.1 Current Funding

SRBT's latest FG was approved[24] by the CNSC upon renewal of the operating licence on June 30, 2015, based upon the 2014 revision of the Preliminary Decommissioning Plan.

The difference between the previously existing FG of $550,476.00 and the newly costed plan estimate of $652,488.00 was funded by installments made to an escrow account in October and April of each year, with the last installment made in April 2018.

An Escrow Agreement[25] and a Financial Security and Access Agreement[26] have been approved by CNSC staff providing access to these funds should the need arise.

As of October 31, 2019, the escrow account balance stands at $699,187.65, which represented just over 107% of the required guarantee based on the previous PDP.

For the updated 2019 version of the PDP and updated cost estimate, a minor deficit of $28,139.35 remains with respect to complete funding.

23.2 Proposed Funding

Upon acceptance of the 2019 revision of the PDP, SRBT will update the Escrow Agreement in close consultation with CNSC staff in order to ensure full funding of the FG within a fiscally reasonable time frame.

A schedule of routine deposits to the escrow account will be drawn up, and followed until the FG reaches 100% full funding level for the eventual decommissioning of the facility.

23.3 Escalation Factor per Annum

Historical annual inflationary indices are typically below the annual accrued interest rate of the escrow account.

SRBT continues to propose that all accrued interest in the existing escrow account remains in that account, to be used to address inflationary indexing.

24. References

[1] SRB Technologies (Canada) Inc., “Preliminary Decommissioning Plan”, March 14, 2006.

[2] CNSC Staff letter, Ann Erdman to Stephane Levesque, “CNSC Review of the Preliminary Decommissioning Plan and the Associated Cost Estimate plus Financial Guarantee”, July 6, 2006.

[3] SRB Technologies (Canada) Inc. letter, Stephane Levesque to Ann Erdman, “CNSC Review of the Preliminary Decommissioning Plan and the Associated Cost Estimate plus Financial Guarantee”, January 30, 2007.

[4] CNSC Staff letter, Ann Erdman to Stephane Levesque, “SRB Technologies (Canada) Inc. Revised Preliminary Decommissioning Plan Cost Estimate”, February 23, 2007.

[5] SRB Technologies (Canada) Inc. letter, Stephane Levesque to Ann Erdman, “SRB Technologies (Canada) Inc. Revised Preliminary Decommissioning Plan Cost Estimate plus Financial Guarantee”, June 15, 2007.

[6] CNSC Staff, “Information and Recommendations from Canadian Nuclear Safety Commission Staff”, CMD 07-H145, July 27, 2007.

[7] Canadian Nuclear Safety Commission, “Records of Proceedings, Including Reasons for Decision, Financial Guarantee for the Safe State of Closure for the Class IB Facility Located in Pembroke, Ontario”, October 23, 2007.

[8] SRB Technologies (Canada) Inc. letter, Stephane Levesque to Henry Rabski, “Financial Guarantee for the Full Cost of the Decommissioning and Cost Recovery Fee Arrears”, June 11, 2008.

[9] Canadian Nuclear Safety Commission, “Transcript for Hearing of June 12, 2008”, Page 12 lines 5 to 8, June 26, 2008.

[10] Canadian Nuclear Safety Commission, “Records of Proceedings, Including Reasons for Decision, Application to Resume the Processing and Use of Tritium at the Gaseous Tritium Light Source Facility in Pembroke, Ontario”, June 26, 2008.

[11] SRB Technologies (Canada) Inc., “Preliminary Decommissioning Plan”, June 23, 2013.

[12] CNSC Staff letter, Nadia Petseva to Stephane Levesque, “CNSC Staff’s Review of SRB Technologies (Canada) Inc. Preliminary Decommissioning Plan and Associated Cost Estimate”, September 17, 2013.

[13] SRB Technologies (Canada) Inc. letter, Stephane Levesque to Nadia Petseva, “CNSC Staff’s Review of SRB Technologies (Canada) Inc. Preliminary Decommissioning Plan and Associated Cost Estimate”, November 19, 2013.

[14] CNSC Staff letter, Nadia Petseva to Stephane Levesque, “Review of SRB Technologies (Canada) Inc. (SRB)’s Response to CNSC Comments on Preliminary Decommissioning Plan and Financial Guarantee for SRB Technologies (Canada) Inc.”, January 15, 2014.

[15] SRB Technologies (Canada) Inc., “Preliminary Decommissioning Plan”, June 20, 2014.

[16] CNSC Staff letter, Nadia Petseva to Stephane Levesque, “Review of SRB’s revised Preliminary Decommissioning Plan and Financial Guarantee”, August 22, 2014.

[17] SRB Technologies (Canada) Inc. letter, table, appendices A, B and C and attachments 1, 2 and 3, Stephane Levesque to Robert Buhr, “CNSC Staff’s Review of SRB’s Preliminary Decommissioning Plan and Financial Guarantee, dated June 2014”, September 21, 2014.

[18] CNSC Staff e-mail, Ann Erdman to Stephane Levesque, “CNSC Staff’s review of the SRB PDP and cost estimate comments provided Sept. 21, 2014”, October 27, 2014.

[19] SRB Technologies (Canada) Inc. letter, Stephane Levesque to Mike Rinker, “Contingency Factor for Revised SRBT Financial Guarantee”, October 30, 2014.

[20] CNSC Staff letter, Ann Erdman to Stephane Levesque, “CNSC Response to SRB’s comments regarding the Preliminary Decommission Plan including the Cost Estimate”, November 7, 2014.

[21] CNSC Staff letter, Jennifer Campbell to Stephane Levesque, “Review of SRB’s revised Preliminary Decommissioning Plan and Financial Guarantee”, November 24, 2014.

[22] Census information from Statistics Canada website at http://www12.statcan.gc.ca.

[23] The Multi-Agency Radiation and Site Survey Investigation Manual, “MARSSIM”, NUREG 1575, Rev 1, August 2000.

[24] Record of Proceedings, Including Reasons for Decision; SRB Technologies (Canada) Inc. Application to Renew the Class IB Nuclear Substance Operating Licence for the Gaseous Tritium Light Source Facility in Pembroke, Ontario – Public Hearing Date: May 14, 2015; paragraph 9 (e-Doc 4790778)

[25] SRB Technologies (Canada) Inc. “Escrow Agreement’, Revision 1, February 16, 2015.

[26] SRB Technologies (Canada) Inc. “Financial Security and Access Agreement’, Revision 1 February 16, 2015.

25. Appendices

List of Appendices:

A. Routine Contamination Assessment Data: 2018

B. Facility Equipment

C. Historical Soil Sample Results

Appendix A

Routine Contamination Assessment Data: 2018

The following tables present data pertaining to the average contamination level found on surfaces throughout the SRBT facility during the fourth quarter of 2018. This information is divided by Zone, and all areas routinely assessed are listed. It is representative of typical levels of contamination assessed as part of the Radiation Safety Program.

Zone 1 – Q4 2018

Zone 1 Swipe Areas	No. of swipes	Average Value	Amount pass	Amount Fail	Average Pass
Lunch Room	12	0.03	12	0	100.00%
LSC Room	12	0.20	12	0	100.00%
RR Ante Rm	12	0.57	12	0	100.00%
RR Barrier	12	6.03	11	1	91.67%
Assy Barrier	12	1.22	10	2	83.33%
Disassembly Table	11	9.23	8	3	72.73%
Disassembly Wire Racks	12	0.32	12	0	100.00%
Shipping Area	12	0.06	12	0	100.00%
Mold Storage	11	0.10	11	0	100.00%
RMA Storage Area	11	3.52	10	1	90.91%
Doorknobs	1	0.06	1	0	100.00%
Punchcard Area	1	0.11	1	0	100.00%
LSC Garbage Cans	1	0.06	1	0	100.00%
	120	1.65	113	7	94.17%

Zone 2 – Q4 2018

Zone 2 Swipe Areas	No. of swipes	Average Value	Amount pass	Amount Fail	Average Pass
Floor at Barrier	34	2.75	30	4	88.24%
Work Area Floors	34	2.64	30	4	88.24%
Work Counters	34	0.38	34	0	100.00%
WIP Cabinet	34	1.44	30	4	88.24%
Shoe Covers	34	2.52	31	3	91.18%
Laser Light Trays	34	1.41	32	2	94.12%
Floor Beside Disassambly	34	2.62	27	7	79.41%
Disassembly Bins	33	2.61	27	6	81.82%
Paint Booth	33	0.41	33	0	100.00%
Photometer Room Floor	34	1.45	32	2	94.12%
Inspection Prep Floor	34	2.35	29	5	85.29%
Insp. Prep. Counter	34	1.10	31	3	91.18%
WIP Rack	1	0.04	1	0	100.00%
Microscope	1	0.15	1	0	100.00%
Insp. Dark Room Counter	1	0.02	1	0	100.00%
	409	1.46	369	40	90.22%

Zone 3 – Q4 2018

Zone 3 Swipe Areas	No. of swipes	Average Value	Amount pass	Amount Fail	Average Pass
Rig 7 Floor	58	28.16	47	11	81.03%
Rig 7	58	14.95	53	5	91.38%
Rig 1 Floor	58	23.59	50	8	86.21%
Rig 1	58	3.66	58	0	100.00%
Flr @ Rig 6	58	75.04	48	10	82.76%
Rig 6	58	20.87	55	3	94.83%
Floor @ Rig 8	58	16.64	55	3	94.83%
Rig 8	58	3.41	58	0	100.00%
Floor @ Rig 5	58	40.54	32	26	55.17%
Rig 5	58	96.55	55	3	94.83%
Muffle F/H	58	23.61	54	4	93.10%
Waste Room Shelving	56	16.19	51	5	91.07%
Liquid Nitrogen Tank	56	8.62	56	0	100.00%
Oven	56	11.84	52	4	92.86%
Flr @ Barrier	58	27.47	46	12	79.31%
Laser rm flr random	58	22.04	52	6	89.66%
EIP Area	58	8.34	56	2	96.55%
Laser Rm F/H	58	25.97	55	3	94.83%
Shoe Covers	58	30.03	46	12	79.31%
Trit Lab Flr random	58	18.16	54	4	93.10%
Bulk Fume Hood	56	26.62	55	1	98.21%
Disass. Fume Hood	58	5.99	58	0	100.00%
Variac	58	6.89	56	2	96.55%
Reclaim Sash	56	9.57	54	2	96.43%
Metal Rig Table	2	4.53	2	0	100.00%
Waste Room Door	2	2.40	2	0	100.00%
Cabinets Beneath Disassy	2	37.28	1	1	50.00%
Reclaim F/H	2	6.32	2	0	100.00%
Lower B/S Cabinet	2	32.71	2	0	100.00%
	1392	22.34	1265	127	90.88%

The following tables represent typical contamination assessment data within the SRBT facility for calendar year 2018. This data is obtained in line with Radiation Safety Program requirements, and is representative of the magnitude of expected removable tritium contamination on surfaces in each zone during operations.

2018 Routine Contamination Assessment Summary - Zone 3

Zone 3 Swipe Area	No. of Assessments	Amount > Admin. Level (40 Bq/cm^2)	Pass Rate
Rig 7 Floor	241	13	94.6
Rig 7	241	8	96.7
Rig 1 Floor	241	11	95.4
Rig 1	241	2	99.2
Flr @ Rig 6	241	14	94.2
Rig 6	241	3	98.8
Floor @ Rig 8	241	8	96.7
Rig 8	241	0	100.0
Floor @ Rig 5	241	34	85.9
Rig 5	241	4	98.3
Flr @ Barrier	241	18	92.5
Laser rm flr random	241	22	90.9
EIP Area	241	19	92.1
Laser Rm F/H	241	26	89.2
Trit Lab Flr random	241	12	95.0
Shoe Covers	241	27	88.8
Muffle F/H	241	18	92.5
Disass. Fume Hood	239	14	94.1
Scint Table	123	1	99.2
Reclaim F/H	122	0	100.0
Bulk Splitter Fume Hood	119	2	98.3
Variac	116	7	94.0
Lower Reclaim Cabinets	63	0	100.0
Waste Room Racks	62	3	95.2
Waste Room Floor	62	2	96.8
Shoe Cover Bins	62	2	96.8
Trit Lab Desk	62	2	96.8
Bulk Splitter Sash	62	2	96.8
Laser Stock Cabinet	61	1	98.4
Laser Room Microscope	61	2	96.7
Waste Room Door	60	0	100.0
Cabinets Beneath Disassy	60	3	95.0
Lower B/S Cabinet	60	0	100.0
Metal Rig Table	60	3	95.0
Waste Room Shelving	56	5	91.1
Liquid Nitrogen Tank	56	0	100.0
Oven	56	4	92.9
Reclaim Sash	56	2	96.4
Port-Hole	2	0	100.0
Waste Room Walls	2	0	100.0
Cleaning Cabinet	2	0	100.0
Operations Logbook	2	0	100.0
Torch Handles	2	0	100.0
TOTAL ZONE 3	**5785**	**294**	**94.9**

2018 Routine Contamination Assessment Summary - Zone 2

Zone 2 Swipe Area	No. of Assessments	Amount > Admin. Level (4 Bq/cm^2)	Pass Rate
Floor at Barrier	144	13	91.0
Work Area Floors	144	11	92.4
Work Counters	144	3	97.9
Shoe Covers	144	13	91.0
Insp. Prep. Counter	144	6	95.8
Microscope	110	6	94.5
Photometer Room Floor	107	6	94.4
Inspection Prep Floor	107	12	88.8
Floor Beside Disassambly	107	14	86.9
Silk Screening Room	75	5	93.3
WIP Cabinets	73	6	91.8
Laser Light Trays	69	6	91.3
Wire Rack at Barrier	44	2	95.5
Racks in Spray Room	37	0	100.0
Stock Cabinets	36	1	97.2
UV Printing Room	36	2	94.4
Sign Light Stock Cabinet	36	3	91.7
WIP Rack	36	0	100.0
Insp. Dark Room Counter	36	0	100.0
Disassembly Bins	33	6	81.8
Paint Booth	33	0	100.0
Counter at Barrier	30	2	93.3
Welding Area	1	0	100.0
Exposing Unit	1	0	100.0
UV Printing Room	1	0	100.0
TOTAL ZONE 2	**1728**	**117**	**93.2**

2018 Routine Contamination Assessment Summary - Zone 1

Zone 1 Swipe Area	No. of Assessments	Amount > Admin. Level (4 Bq/cm^2)	Pass Rate
Lunch Room	50	1	98.0
LSC Room	50	1	98.0
RR Ante Rm	50	2	96.0
RR Barrier	50	3	94.0
Assy Barrier	50	3	94.0
Disassembly Wire Racks	50	1	98.0
Shipping Area	50	0	100.0
Shipping Computer Area	13	0	100.0
Shipping Office	13	0	100.0
Accountant Office	13	0	100.0
Wire Cart	13	0	100.0
Shipping Shelving	13	0	100.0
Floor in Machine Shop	13	0	100.0
Doorknobs	13	0	100.0
Punch card Area	13	0	100.0
LSC Garbage Cans	13	0	100.0
Disassembly Table	11	3	72.7
Mold Storage	11	0	100.0
RMA Storage Area	11	1	90.9
TOTAL ZONE 1	**500**	**15**	**97.0**

Overall Facility Summary – 2018

Facility Zone	No. of Assessments	Amount > Admin. Level	Pass Rate
ZONE 3	5,785	294	94.9
ZONE 2	1,728	117	93.2
ZONE 1	500	15	97.0
TOTAL ZONE 1	**8,013**	**426**	**94.7**

Appendix B

Facility Equipment

ZONE 1 EQUIPMENT

The following systems and components are located within Zone 1 areas:

Front Offices

1- Konica Minolta Bizhub C554e fax/copy/printer

6- Panasonic Digital KX DT343 telephones

6- Executive Workstations

5- Lenovo Computer

1- Apple MacBook Pro

Records Room

1-Lenovo Server and Monitor

1-Panasonic KXTDE100 Phone System

1-Panasonic KXTVM50 Voice System

Glass Shop

1- Weightronix Model PC220 balance

1- Heathway 532 EV glass lathe

2- Cress Model C122012 DW/942 HLC electric furnaces

1- PSH stress relief kiln

1- Lowinger Glasbearbeitingsmaschinenbau glass roller

1- Herbert Arnold KF30 glass cutter

1- Pay Lamp Machinery type FD glass extruder

1- Lenovo Computer

Coating Room

5- SLEE Type 6NFH Ventilated Work Stations

1- Uline model H-1649 balance

1- Corrosive storage cabinet

2- Dehumidifiers

1- Fisher Scientific Isotemp Drying Oven

1- Baxter Tempcon Drying Oven

1- Lenovo Computer

Shipping

1- Pelouze weight scale model 4010

1- Lenovo Computer

1- Overhoff Model 357 tritium in air monitor

1- Overhoff Model 200SB portable tritium in air monitor

Back Offices

8- Lenovo Thinkpad Computers

2- Apple Computers

1- Epson model 1640XL scanner

1- Konica Minolta Bizhub C554e fax/copy/printer

1- Konica Minolta Bizhub C227 copy/printer

1- Laser Jet Pro CM1415FNW Color MFP

10- Panasonic Digital KX-DT343 telephones

1- 1-DAHLE BS5498 Paper cutter

1- Fellowes 225CI Shredder

Liquid Scintillation Lab

2- TriCarb 2910 Liquid Scintillation Counters

4- Omega flowmeter/totalizer (spares)

2- Overhoff model 357 tritium in air monitors (spares)

1- Powervar uninterrupted power supply system w/conditioner

1- Monarch 2000 Electronic Chart Recorder (spare)

1- Tyne Surface Activity Monitor

2- Redeye Portable Radiation Survey Meters (PRD and B20)

Various radioisotope laboratory equipment (pipettors, dispensers, etc.)

Lunchroom

1- Sony Bravia TV

1- Pyramid Time Trax EZ

2- Microwaves

1- Newco Coffee Maker

2- Danby Designer Refrigerator

Building Ventilation

2- Make-up Air Supply Units

2- Area Heating and Air-conditioning Units

2- Area Air-conditioning Units

4- Area Heating and Circulation Unit

2- Air/Heat Exchange Units

4- Wall-type Air-conditioner Units

Machining Area

1- First Model LC-1 ½ TM Milling Machine

1- Nissei FNX280II Injection Molding Machine

1- Thoreson McCosh TD-90 Pellet Dryer

1- Hyster W30ZR Lift Truck

1- BJ3500 Forkcrane

1- Objet500 Connex3 3d Printer

1- Lenovo Computer

Assortment of Shop Tools (power tools, hand tools, benchtop machines)

Rig Room Ante Room Area

1- Linear Chart Recorder

1- Monarch 2000 Electronic Chart Recorder

Compressor Room

1- Compressor Unit and Accessories

ZONE 2 EQUIPMENT

The following systems and components are located within Zone 2 areas:

Assembly

1- Branson Ultrasonic Welder

1- 4’ x 4’ Spray paint hood

1- Mimaki UJF-series UV printer

1- UV Curing Oven

2- Photo Assessment Instruments (Photometer)

2- National Equipment XP500 Exposure unit

1- Overhoff model 357 tritium in air monitor

2- Overhoff Model 200SB portable tritium in air monitors

1- Lenovo Computer

1- Kyocera FS1370DN Printer

Silk Screening

1- American Silk-Screening Device (semi-automated)

1- American Silk-Screening Device (manual)

1- Custom Walk-In Screen washing hood

1- 5’ Constant Velocity Class I safety cabinet

Stack monitoring equipment

2- Overhoff model 357 tritium in air monitor

4- Overhoff tritium air sample collectors (bubblers)

4- Omega flowmeter/totalizer

2- APC uninterrupted power supply systems

ZONE 3 EQUIPMENT

The following systems and components are located within Zone 3 areas:

Rig Room

8- Filling Rigs (including oil-free scroll pumps and stainless-steel tubing and valves)

2- Vacuum thermal drying ovens

3- Constant velocity stainless steel safety cabinets / fume hoods

1- Overhoff model 357 tritium in air monitor

1- Overhoff Model 200SB portable tritium in air monitor

1- Overhoff Remote Display Unit

1- Lenovo Computer

Laser Room

1- Operational laser cutting systems (‘EIP’ laser system)

1- 6’ x 3’ stainless steel fume hood

1- Overhoff model 357 tritium in air monitor

1- Overhoff Model 200SB portable tritium in air monitor

1- Ventilated steel cabinet

Tritium Lab

1- Custom Bulk Splitting rig (including an oil-free scroll pump and stainless-steel tubing and valves)

2- 4’ Constant velocity Class I safety cabinets (manufactured from particle board)

1- Overhoff model 357 tritium in air monitor

1- Overhoff Model 200SB portable tritium in air monitor

1- Overhoff Remote Display Unit

Store Room

1- 3’ x 5’ Fire proof Vault

Ventilation Systems

The ventilation systems include the ducts, plenums and Air Handling Units.

Appendix C

Historical Soil Sample Results

SOIL SAMPLE LOCATIONS

Sample	HTO Free Water Tritium Concentration (Bq/L)	OBT/HTO Ratio[i]	Total Tritium (HTO + OBT) Bulk Specific Activity (Bq/g)	
			Highest	Lowest
1	662	10	1.4	0.5
2	2303	10	4.7	1.6
3	2343	10	4.8	1.6
4	356	10	0.7	0.2
5	736	10	1.5	0.5
6	471	10	1.0	0.3
7	384	10	0.8	0.3
8	842	10	1.7	0.6
9	1410	10	2.9	1.0
10	10977	10	22.6	7.6
11	518	10	1.1	0.4
12	28	10	0.1	0.0

Note: samples 9-11 (shaded) were collected within the fenced compound enclosure

[i] Organically Bound Tritium is not reported but is significant with respect to the release criteria

- Previous soil measurements at SRB have shown a ratio of OBT to HTO of 3.5 to 9.9
- OBT/HTO ratio of 10 is used as a conservative estimate