Annual Compliance Report
2013/2014

Name of Facility: Shield Source Incorporated

Name of Licensee: Shield Source Incorporated
Reporting Period: January 1, 2013 to March 31, 2014
Licence Number: NSPFOL-12.00/2013, NSPFOL-12.00/2014

Operators Business Address:
925-211C Airport Road
Cavan Monaghan, ON K9J 0E7

Submitted to: Canadian Nuclear Safety Commission, Nadia Petseva
Submitted: March 31, 2014

Approved/ Issued by:

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1.0 Introduction

1.1 General Introduction

In 2013, SSI operated a Class 1B Nuclear Facility under Nuclear Substance Processing Facility Operating Licence NSPFOL-12.00/2013 issued by the Canadian Nuclear Safety Commission. This licence, which expired on December 31, 2013, was replaced with Nuclear Substance Processing Facility Operating Licence NSPFOL-12.00/2014 which extended the licence period through March 31, 2014 to allow time for SSI to complete its site clean-up and for the CNSC to review documentation regarding the closure of SSI. Both licenses contained the condition; 2.1 (a) The licensee shall not process tritium gas for the purpose of producing gaseous tritium light sources without the prior approval of the Commission.

2012 was a difficult year for SSI. In March 2012, as a result of independent third party emission monitoring installed to help determine the potential cause of rising tritium oxide emissions, SSI discovered a significant discrepancy in reported tritium gas emissions. As soon as this discrepancy was discovered, SSI immediately and voluntarily suspended tritium processing operations and notified the CNSC. With regulatory approval, SSI conducted a tritium processing test in April 2012 to validate the new emission findings. The test confirmed that SSI’s emission monitoring equipment was not properly recording emissions. This information was immediately shared with the CNSC, the tritium fill machines were made inoperable, and SSI confirmed that it would not process additional tritium without written approval of the CNSC.

An independent third party expert conducted a root cause investigation of the emission monitoring discrepancy and subsequently prepared a detailed report Root Cause Investigation – Tritium Stack Emissions Reporting Discrepancies which was provided to the CNSC and made available to the public via the SSI website.

SSI did not exceed any Action Levels or Release Limits during the year. Through established programs and a commitment to the principle of ALARA, SSI limited radiation exposure to our employees and the public to levels significantly below allowable dose limits.

SSI retained its certification to the ISO AS9100 Quality Management System with a successful audit by an ANSI-ASQ National Accreditation Board accredited organization.

On March 4, 2013, SSI notified the CNSC of its decision not to apply for the renewal of its operating license.
1.2 Facility Operation

The nuclear facility is located in Cavan Monaghan, Ontario at 211C-925 Airport Road. (The physical location did not change but the mailing address was changed on November 19, 2012). The site is located at the Peterborough Municipal Airport and is part of the industrial area of the airport. The building is a two storey structure containing more than one tenant. The remaining part of the building is utilized for aircraft support industry and services. SSI occupies 300 m² of licensed area at the northwest corner of the building encompassing production, warehousing and office space. An aerial shot of the facility is shown in Figure FACR1301.

![SSI Manufacturing Facility](image)

Figure FACR1301: SSI Manufacturing Facility

All equipment including the liquid scintillation counter, tritium-in-air monitors, velocity probes, and calipers used in our production process that required calibration were calibrated in 2013 to assure accuracy.

SSI continued to strive for operational excellence with programs that encouraged quality and education through continuous improvement while ensuring the safety of the employees, the public and the environment. Processes and procedures, including those for Radiation Safety, Waste Management, Environmental Monitoring, Purchasing, Maintenance and Quality are outlined in both our Quality Management Program (QMP) and AS9100 Quality Management System documents.
The General Manager is accountable for the programs related to safety, training and customer service, and oversees the implementation of processes and procedures for operating and maintaining the facility. The Radiation Safety Officer (RSO) is responsible for all elements of the Radiation Safety Program with support from the General Manager.

With input and guidance from the President and Chief Financial Officer (CFO), the Management Team is responsible for all operations within our facilities.

As is expected when a company is closing down, some of our employees left the company to pursue other opportunities throughout the year. Throughout the process, SSI management ensured that all critical operations and responsibilities were managed and performed by trained and competent employees. There were 18 on-site employees in January 2013 and 8 on-site employees at the end of December 2013 which included the General Manager and Radiation Safety Officer.

1.3 Production or Utilization

Due to emissions measurement discrepancies in 2012, the manufacture of GTLS ceased when the tritium fill machines were shut down and locked out on April 4, 2012. There was no bulk tritium processing in 2013 or 2014.

To remain a viable business entity, thereby making it possible for SSI to continue to fulfill its regulatory obligations and continue to fulfill customer requirements, SSI purchased GTLS from other licensed manufacturers. These outsourced GTLS were incorporated into the manufacture of our safety devices. SSI suspended the manufacturing process (with purchased GTLS) in October 2013 to focus on the clean-up of the facility in preparation of closure.

The maximum possession quantity of tritium under our Operating Licence is 18,500 TBq. This total includes both raw tritium gas and tritium gas in sealed sources and devices. SSI did not exceed this limit during 2013 or 2014.

All production employees at our Class 1B licensed facility were considered Nuclear Energy Workers (NEW’s). In 2013, SSI analyzed 656 samples from 18 different NEW workers and 26 samples from 5 different Non-NEW individuals for tritium in bioassay samples. In addition, there were 83 samples analyzed for 14 different contractors throughout 2013. Therefore, a total of 765 samples were analyzed in 2013. There was no dose received by employees or contractors in 2014. The results of this sampling activity are provided later in this document. All doses were submitted to the National Dose Registry.

SSI operated a second facility in which non-nuclear processing occurred. The second facility held a Nuclear Substances and Radiation Devices Licence number 08765-7-17.0 that allowed the facility to possess, transfer, use, store and conduct licensed activities in
the location specified in the Appendix of the licence. Employees of this facility were considered non-NEW employees and thus were not required to submit regular bioassays for sampling.

In 2013, the CNSC conducted one Type II Compliance Inspection in June. This included a review of our general record keeping, review of previous action items, observations of work practices, and discussions of operations and plans for closure. In August 2013, the CNSC performed an environmental inspection in which split samples were taken of various environmental sampling locations around the facility by the CNSC and SSI. The CNSC took their samples to their laboratory for analysis and SSI sent their samples to their third party laboratory.

In addition, we commissioned third party reviews of our stack monitoring systems, air flow within the facility, tritium in air monitors, and security system.

1.4 Facility Modification

Throughout the licensing period, SSI performed facility modifications related to the clean-up and decontamination of the facility as listed in Table TACR1301.

<table>
<thead>
<tr>
<th>Date</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>September 2012</td>
<td>Installation of a new tritium bubbler system that is capable of measuring tritium gas and tritium oxide emissions. A third party tritium oxide monitoring system was installed to allow for analysis comparison to verify the new system.</td>
</tr>
<tr>
<td>January 2013</td>
<td>Use of Tritium Bubbler system to measure air emissions. Third party was still in place to verify results, when needed.</td>
</tr>
<tr>
<td>March 2013</td>
<td>Announced that SSI would not submit a licence application to renew the current operating licence when it expired in December 2013.</td>
</tr>
<tr>
<td>April 2013</td>
<td>Removal of bulk tritium from tritium fill machine (TFM)#1.</td>
</tr>
<tr>
<td>April – May 2013</td>
<td>Removal of bulk tritium from TFM #2.</td>
</tr>
<tr>
<td>September 23, 2013</td>
<td>Third party collected preliminary concrete core samples in tritium fill room (TFR).</td>
</tr>
<tr>
<td>Oct 23 – Nov 1, 2013</td>
<td>Third party removal of the TFMs and TFR components.</td>
</tr>
<tr>
<td>November 26 - 27, 2013</td>
<td>Third party collection of concrete core floor samples and wall samples in TFR.</td>
</tr>
<tr>
<td>January 28-29, 2014</td>
<td>Installation of insulation and vapour barrier on the exterior wall within the TFR.</td>
</tr>
<tr>
<td>February 24 – 27, 2014</td>
<td>Removal of stack and ventilation system</td>
</tr>
<tr>
<td>March 12-28, 2014</td>
<td>Facility renovations: new drywall in the TFR, filling ventilation holes and other related markings, and painting.</td>
</tr>
</tbody>
</table>
2.0 Safety and Control Areas

2.1 Management

2.1.1 Management System

SSI continued to strive for operational excellence through programs that encouraged safety, quality, and education. Processes and procedures, including those for Radiation Safety, Waste Management, Environmental Monitoring, Purchasing, Maintenance and Quality are outlined in both our Quality Management Program (QMP) and AS9100 Quality Management System documents.

In 2013, SSI conducted Management Self-Assessment Meetings with the Management Team, Production Meetings with all Employees; and Health & Safety Meetings with members of the Workplace Health and Safety Committee.

As mentioned earlier, it is expected when a company is closing, some of our employees will leave the company to pursue other opportunities. Throughout the process, SSI management has ensured that all critical operations and responsibilities were managed and performed by trained and competent employees.

2.1.2 Human Performance Management

In 2013, SSI made the decision to close the facility. This presented some human resource challenges to ensure that sufficient staff remained on site while the facility concluded operations and worked on preparing the site for closure. In order to ensure sufficient staff limited lay-offs were made initially and as expected several employees found new job opportunities and left on their own accord. In the end as the final closure of the facility occurred, three key employees remained which included a manager, a RSO and a shipper/receiver.

At least one of the three employees had up to date training in Standard First Aid with CPR; TDG Training; IATA Air Dangerous Goods Training; Basic Certification Part 1 & Part 2 Training; Lift Truck Certification; Radiation Safety Officer Training; and Accident Investigation Training. All three employees had received SSI’s initial, job specific and refresher training which included Radiation Protection Training, Emergency Preparedness Training, Security Awareness, WHMIS, AODA, Workplace Harassment Policy, Vehicle Safety Policy, and Workplace Occupational Health & Safety Policy.

SSI’s training program was designed to enable each employee to acquire and maintain the knowledge, skills, and attitudes required to perform their specific job and understand how their actions impact our corporate performance and regulatory responsibilities. This
was accomplished by dividing the training programs into stages in order to monitor the employee’s progress. Key topics for both the initial and subsequent job-specific training are the same, however, the depth of detail varies depending on the stage of the training and the specific job requirements. Training topics were related to practical on-the-job situations and conditions.

The first stage of training for all new employees included Radiation Protection Training, Emergency Preparedness Training, Security Awareness and Workplace Hazardous Materials Information System Training, all of which took place at the start of their employment. This training was completed before an employee could begin their job specific training, with refresher training conducted every two years with all SSI employees.

After the successful completion of the initial stage of training outlined above, employees began their second stage of training which incorporated basic training for specific job responsibilities and site specific work areas. For our production staff, this training was provided by the Operations Manager in conjunction with those employees who were doing or have done the specific job for which the employee was being trained. Each employee was required to read their Departmental Handbook before commencing any actual work. The duration and oversight by management of training varied by position. Highly technical production positions required more training and oversight by management than other production positions.

Our Quality Management System Training required each employee to read the QMP1 and QMP2 documents, along with all applicable procedures and work instructions. Additional quality management training was provided on the ISO AS9100 Quality System, with the content of training determined based on the employee’s responsibilities within the organization.

SSI had a Contractor Management Program that was developed to provide approved contractors with safe operating and handling procedures to complete their required process. The program included the procedures for the selection and management of contractors when completing work at our facility or on our behalf. Training was conducted to unsupervised contractors who were working in areas that present a possible dose risk within our facility.

SSI had an audit program that regularly reviews various aspects of the Site Training Program. Corrective/Preventative Actions were created to address any issues identified during these audits and the Management Team discussed the training needs in their semi-annual meetings.

All employees were required to provide a valid Security Check to be granted a Facility Access Security Clearance to work at our facility. These were maintained throughout

Throughout the year, SSI continued to support and provide tools for collecting and communicating employee feedback, including regular production meetings, information boards and department meetings. These meetings were held to discuss Health & Safety, Production, Regulatory Requirements, Radiation Safety and employee topics/concerns. Communication with the management and the employees is was essential for reinforcing the safety culture, especially after the closure announcement, and implementing new programs to support the efforts to maintain a safe and productive work environment for all employees.

2.1.3 Operating Performance

The purpose of the facility was to manufacture safety devices. Since the shutdown of our tritium fill machines at the end of March 2012, SSI sourced sealed GTLS from other suppliers to be used to assemble safety signs and devices.

SSI operated during regular business hours, but was capable of modifying the production schedules as dictated by customer demands. Our stack ventilation system was continuously running and emissions are sampled constantly until February 2014 when the stack was removed from the facility.

At the end of 2013 there were eight employees working at our Class 1B licensed facility. Company policy required a minimum of two workers and one manager to be present at any time for production to operate. One of these workers must be a RSO or back-up RSO. By the end of March 2014, only three employees remained but they included a manager, RSO and shipper/receiver.

2.2 Facility and Equipment

2.2.1 Safety Analysis

In the past, SSI had commissioned third party reviews of our Safety Programs that included: Safety Analysis Report; Air Balance Report; and a Fire Hazard Analysis.

The Fire Hazard Analysis was completed after the installation of a two hour fire wall separating SSI from the other attached building in January 2009. Fire Hazard Analysis were scheduled to be conducted every 5 years, therefore, based on our licensing plans, the 2009 Analysis was the last. Due to the decision to close, a Fire Inspection was not conducted in December 2013.
To ensure the protection of our employees and the public, all equipment or process changes as well as identified problems were documented in applicable processes such as Change Control, Corrective/Preventative Action and Document Development and Control. The Change Control Procedures were updated to require three signatures for all changes. If a change was to critical operational systems and processes, the signatures must be provided by the President, the RSO and the General Manager or the Operations Manager. For all other changes, at least one of the three signatures must be provided by a Management Team Member.

2.2.2 Physical Design

The physical design and the functionality of the facility have been designed to minimize the effects of our manufacturing operation on the employees, public, and the environment by following the principles of ALARA. This was done by ensuring that all of the building features and equipment within the facility meet all applicable regulatory guidelines and provide a safe work environment.

As SSI moved into the planning process for the clean-up and decontamination, SSI worked closely with third party consultants that were experienced in radioactive clean-up projects to design an effective plan. The physical design of the facility changed several times throughout the year with the removal of the tritium fill machines and related components in October 2013, removal of the walls and ceiling from the tritium fill room in November 2013, removal of the stack and ventilation in February 2014 and the facility renovations in March 2014 to return the facility to the original state. All major activities are summarized in Table TACR1301 and further outlined in Appendix B of this report.

2.2.3 Fitness for Service

SSI had a detailed preventative maintenance program that included scheduled maintenance for machinery, programs and systems within the facility. Periodic maintenance for unexpected issues was documented and performed as necessary.

SSI also had a detailed calibration and verification schedule for all relevant equipment and systems to ensure that all systems were operating at peak performance and were calibrated as per the required schedules.

SSI had performed preventative maintenance, equipment inspections and verifications as per our schedules. All schedules can be found in the maintenance logs and forms related to each piece of equipment or system within our operations. In 2013 and 2014, SSI performed a clean-up and decontamination of the facility to allow unrestricted commercial use of the space. Further details can be found in Appendix B of this report.
2.3 Core Control Processes

2.3.1 Radiation Protection

SSI had a comprehensive Radiation Protection Program (RPP) to meet the requirements of the Nuclear and Safety Control Act and the Radiation Protection Regulations. The RPP was outlined in our QMP documents and supported by the Environmental Monitoring Program. The RPP program was designed to provide the necessary procedures to ensure a safe and clean work environment that protects employee and public health. Consistent with the principals of ALARA our program includes the following:

- Bioassay analysis (urine sampling)
- Environmental Sampling including: Stack Emissions (air released from our stack); Liquid Effluent (water discharged to sewer); Ambient Air & Water; Monitoring Well Water; and Vegetation.
- Respiratory Protection Program
- Tritium-in-air monitors
- Surface contamination monitoring

SSI had established CNSC approved Action and Administrative Levels for various radiation protection parameters. These levels were set to provide an early warning of the need for an internal investigation and/or reporting to the CNSC.

2.3.1.1 Limit and Level Exceedances

In 2013, SSI did not exceed any Administrative or Action Levels for HT or HTO.

SSI had separate Action Levels for Tritium Oxide (HTO) and Tritium Gas (HT). Table TACR1302 shows the Release Limits, Action and Administrative Levels for Emission from SSI.

**Table TACR1302: Release Limits, Action and Administrative Levels for Tritium Emissions**

<table>
<thead>
<tr>
<th></th>
<th>Tritium Oxide (HTO)</th>
<th>Tritium Gas (HT)</th>
<th>Total Tritium (HTO and HT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Release Limits</td>
<td>70 TBq/Year</td>
<td>500 TBq/year</td>
<td></td>
</tr>
<tr>
<td>Action Levels</td>
<td>5 TBq/Week</td>
<td>17 TBq/Week</td>
<td></td>
</tr>
<tr>
<td></td>
<td>50 TBq/Year</td>
<td>170 TBq/Year</td>
<td></td>
</tr>
<tr>
<td>Administrative Levels</td>
<td>1 TBq/Week</td>
<td>3.4 TBq/Week</td>
<td></td>
</tr>
<tr>
<td></td>
<td>35 TBq/Year</td>
<td>119 TBq/Year</td>
<td></td>
</tr>
</tbody>
</table>

In addition, SSI had a Release Limit and an Action Level for liquid effluents. The Release Limit and Action Level are outlined in Table TACR1303 below. SSI did not exceed any limits for liquid effluent in 2013 or 2014.
Table TACR1303: Release Limit and Action Level for Tritium Liquid Effluents

<table>
<thead>
<tr>
<th></th>
<th>Liquid Effluent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Release Limit</td>
<td>100 GBq/year</td>
</tr>
<tr>
<td>Action Level</td>
<td>10 GBq/year</td>
</tr>
</tbody>
</table>

2.3.1.2 Bioassay Analysis

SSI operated a licensed dosimetry program which included weekly bioassay (urine) sampling for all employees at our facility. We also collected a sample before any maintenance related to the tritium processing procedures, as well as 4 and 24 hours after the completion of maintenance or other event that may cause a dose. In addition, as part of the Contractor Management Program, we provided a bioassay program for contractors who may receive a dose while performing work within our facility. In 2013, there was a maximum dose of 0.02 mSv received by contractors while dismantling the tritium fill machines for radioactive waste disposal while working at our facility.

Through weekly bioassay sampling, we monitored the tritium dose received by our employees. Table TACR1304 shows the average, minimum, maximum and collective effective dose received in each year during the last 5 years. Average dose values can be deceiving if you are not evaluating the information based on working hours. Table TACR1305 shows working hours and the number of months an employee was with a company. The number of months an employee was with a company affects minimum dose values as the less time they are in the company, the less dose they will receive.

In April 2012, processing on the tritium fill machines was voluntarily suspended pending a review of the cause of increased emissions. While assembly of self-luminous devices and dismantling procedures were still being performed, the workforce was reduced with fewer products manufactured for the remainder of the year. This change in operations caused the maximum and average dose of employees to remain lower than in previous years.
Table TACR1304: Employee Dose Statistics (2009-2013)

<table>
<thead>
<tr>
<th>Dose Statistics</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>Regulatory Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Persons Monitored</td>
<td>26</td>
<td>25</td>
<td>27</td>
<td>26</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>Average Effective Dose (mSv/year)</td>
<td>0.31</td>
<td>0.36</td>
<td>0.32</td>
<td>0.12</td>
<td>0.04</td>
<td></td>
</tr>
<tr>
<td>Minimum Dose (mSv)</td>
<td>0.008</td>
<td>0.002</td>
<td>0.038</td>
<td>0.001</td>
<td>0.002</td>
<td>50 mSv/year, 100 mSv/5 years</td>
</tr>
<tr>
<td>Maximum Individual Effective Dose (mSv/year)</td>
<td>1.55</td>
<td>1.99</td>
<td>1.75</td>
<td>0.62</td>
<td>0.17</td>
<td></td>
</tr>
<tr>
<td>Collective Annual Dose (mSv)</td>
<td>8.124</td>
<td>8.967</td>
<td>8.745</td>
<td>3.090</td>
<td>0.686</td>
<td></td>
</tr>
</tbody>
</table>

Table TACR1305: Total Working Months (2009-2013)

<table>
<thead>
<tr>
<th>Length of Employment</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Year (12 months)</td>
<td>18</td>
<td>20</td>
<td>18</td>
<td>13</td>
<td>8</td>
</tr>
<tr>
<td>11 months</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>10 months</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>9 months</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>8 months</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>7 months</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>0</td>
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<tr>
<td>6 months</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>5 months</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>4 months</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>3 months</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>2 months</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1 month</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Total Employees</td>
<td>26</td>
<td>25</td>
<td>27</td>
<td>26</td>
<td>18</td>
</tr>
<tr>
<td>Total Working Months</td>
<td>260</td>
<td>261</td>
<td>278</td>
<td>225</td>
<td>143</td>
</tr>
</tbody>
</table>

There were no incidents in which the Administrative Level of 100 Bq/mL or Action Level of 500 Bq/mL were exceeded in 2013.

A distribution of the annual effective dose for SSI employees for 2009 to 2013 is included in Table TACR1306. In 2013, all eighteen employees had an effective dose of <0.5 mSv. All annual effective doses reported were below the Administrative Level of 3 mSv/year and the Action Level of 5 mSv/year in 2013.
Table TACR1306: 2013 Distribution of Annual Effective Dose (Number of Employees)

<table>
<thead>
<tr>
<th>Annual Effective Dose</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;0.5 mSv</td>
<td>21</td>
<td>20</td>
<td>23</td>
<td>24</td>
<td>18</td>
</tr>
<tr>
<td>0.5 – 1.0 mSv</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>1.0 – 2.0 mSv</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2.0 – 3.0 mSv</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

2.3.1.3 Contamination Control

In 2013, 7,635 surface swabs were performed including routine and non-routine swabs monitoring for tritium contamination. Routine surface swabs were taken from gaseous tritium light sources (GTLS), devices, packaging, site location work areas, and returned devices. Non-routine surface swabs were taken if there was reason to believe contamination had occurred, such as a GTLS breakage.

Surface swabs for 2013 are summarized in Table TACR1307.

Table TACR1307: 2013 Surface Swab Results

<table>
<thead>
<tr>
<th></th>
<th># Swabs</th>
<th># Pass</th>
<th>% Pass</th>
</tr>
</thead>
<tbody>
<tr>
<td>GTLS</td>
<td>550</td>
<td>95</td>
<td>82.7%</td>
</tr>
<tr>
<td>Devices</td>
<td>2286</td>
<td>2254</td>
<td>98.6%</td>
</tr>
<tr>
<td>Packaging</td>
<td>1333</td>
<td>1313</td>
<td>98.7%</td>
</tr>
<tr>
<td>Returned/Incoming Devices</td>
<td>811</td>
<td>784</td>
<td>96.7%</td>
</tr>
<tr>
<td>Plant Transfer</td>
<td>282</td>
<td>282</td>
<td>100%</td>
</tr>
<tr>
<td>Site Location (normal operations)</td>
<td>856</td>
<td>765</td>
<td>89.4%</td>
</tr>
<tr>
<td>Non-Routine</td>
<td>1517</td>
<td>1172</td>
<td>77.3%</td>
</tr>
</tbody>
</table>

There were 6,118 routine surface swabs performed in 2013 with an average success rate of 89.8%, meaning that 5,493 swabs were found to be of acceptable levels. All surfaces determined to be higher than acceptable levels are thoroughly washed and re-tested until a pass is achieved.

There were 1,517 non-routine swabs performed in 2013 with an average success rate of 77.3%. These non-routine swabs were comprised of waste material, receivables and returns, surface swabs and miscellaneous material.

Non-routine swabs are expected to have a lower success rate because they are only performed if there is reason to believe that the material may be contaminated. This may include surface swabs that are testing for contamination after a GTLS breakage, a leaking device is found or a maintenance procedure has occurred. In addition, waste that is
tested to be above allowable limits is packaged and sent to a licensed waste facility for disposal.

All surface contamination swabs were analyzed by using the Liquid Scintillation Counter (LSC).

2.3.1.4 ALARA

SSI is committed to the ALARA principle by implementing programs, procedures and processes to keep the dose to the employees and the public and the effect on the environment to As Low As Reasonably Achievable.

2.3.2 Conventional Health & Safety

The health and safety of our employees is our first priority. Our processes and procedures have been designed specifically to ensure that all employees are protected when working at our facility. In doing so, we comply with Part II of the Canada Labour Code.

SSI had a Workplace Health and Safety Committee (WHSC), comprised of four employees from management and production, that was responsible; for being current with new regulations and requirements regarding workplace health and safety; to review health and safety concerns brought forth by employees, and; to make recommendations for the improvement of the health and safety of the employees within the facility. This was accomplished by completing inspections of the facility through regular tours in which workplace activities were observed and being available to employees to hear their concerns or questions. In 2013, the WHSC held meetings in which the review of previous items, new items and facility tours were conducted. In addition, several informal meetings were held to review the plans for the safe clean-up and decontamination of the facility in preparation for the closure. All formal meetings had minutes taken, compiled and a printout placed on the Workplace Health and Safety Board. All the Workplace Health and Safety Meetings were documented and given to the Management Team for review.

SSI had a range of programs in place to ensure the safety of the employees and the public and to monitor employees to determine if they are fit for duty.

In addition, a maintenance schedule existed to verify and monitor all security, fire and emergency exits throughout the facility. All procedures and schedules for facility maintenance were managed and maintained by our Operations Manager.
2.3.3 Environmental Protection

SSI created an Environmental Monitoring Program (EMP) to monitor levels of tritium emitted from SSI to the environment. The EMP was implemented not only to satisfy SSI’s licence conditions within the Nuclear Safety and Control Act and its regulations, but to ensure protection to SSI’s employees, the public and the environment.

Sampling was done to obtain a comprehensive picture of SSI’s footprint on the surrounding environment. Our EMP included monitoring liquid effluent (water released to the sewer) and stack emissions (air releases from our stack) from SSI’s facility on a daily basis. In addition, SSI collected samples from all possible pathways of contamination. The current SSI EMP was updated in April 2013.

The 2013 sampling program consisted of the collection of six types of samples - stack emissions, liquid effluent, ambient air samples, ambient water samples, monitoring well samples and vegetation samples.

Stack emissions and liquid effluent are measured continuously from the SSI facility. Ambient air, ambient water samples and the monitoring well samples are collected monthly from sample locations located within a 16 km radius of the SSI ventilation stack. Vegetation samples are collected during harvest time, which was between June and September.

The Environmental Monitoring Data is provided in Appendix A: Environmental Monitoring Annual Compliance Report 2013/2014.

2.3.4 Emergency Management and Response

SSI submitted a Fire Protection Plan to the CNSC in December 2011 which included our Pre-Fire Safety Plan and Fire Safety Plan. As part of our Fire Safety Plan, SSI conducted our annual fire drill in September 2012.

A Fire Hazard Analysis was completed in 2009 after the installation of the 2 hour fire wall separating SSI from the other building occupants.

Until March 2012, SSI used tritium fill machines to transfer tritium gas from bulk shipping containers to GTLS. The tritium fill machines have been completely shut down since April 4, 2012. After deciding not to request a renewal of the current operating licence in March 2013, SSI transferred all bulk tritium off of the tritium fill machines in April/May 2013 and sent the gas to a licensed facility. The machines were dismantled and all components within the tritium fill room were packaged for disposal to a licensed radioactive waste facility in October 2013.
Both stationary and portable tritium-in-air monitors were used throughout the facility to detect any release of tritium which would trigger an audible alarm notifying staff of a release. When an alarm sounds, all systems were secured to ensure that the release of tritium is contained and employees were evacuated until the source of the alarm could be found. The air monitors were calibrated annually by an accredited facility.

The fire alarm system was designed to alert employees at the facility that a fire emergency exists and that the Fire Safety Plan must be implemented. The fire alarm system was designed as a single stage system consisting of smoke detectors that were connected and monitored by a 24 hour monitoring company. The alarm system control panel was equipped with battery backup and was maintained through regular in-house and annual third party inspections.

As a condition of our Licence, we arranged for an annual third party review of compliance with the National Building Code of Canada, 2005, the National Fire Code of Canada, 2005, and National Fire Protection Association NFPA-801, Standard for Facilities Handling Radioactive Materials, 2008 edition. Our Fire Inspection was performed by a third party consultant in December 2012. All corrective actions were closed in July 2013. Due to the closure, a Fire Inspection was not scheduled in 2013.

As part of our Training Program, all employees were trained on Emergency Preparedness during their initial training with refresher training conducted every 2 years.

SSI updated the Emergency Plan in 2009 to include information from the Cavan Monaghan Township Fire Department that due to our proximity to the Peterborough Airport, the Peterborough Fire Department was responsible for responding in the event of a fire. We invited all relevant Emergency Responders to visit our facility.

### 2.3.5 Waste and By-product Management

During the manufacture of self-luminous signs and devices, tritium contaminated waste could be generated through liquid effluents, general low level contaminated solid material and high level contaminated solid material.

Additional tritium contaminated waste resulted from dismantling expired safety devices returned from customers. In Canada, we had developed a Product Recall Program that involved quarterly contact with our customers when the useful life of purchased products has or will be ending. The customer was asked to send their devices to SSI for appropriate disposal. In conjunction with our largest US customer, we initiated a similar return and replacement program for expired or unwanted self-luminous signs several years ago. As a result of this program, end users of our safety devices in the United States were contacted 3 months prior to the expiration of their signs effective life and reminded of their disposal obligations as a General Licensee of the US Nuclear Regulatory Commission or their Agreement State and are provided with replacement options. This
program represented a proactive effort to help insure that self-luminous signs were disposed of in a responsible manner consistent with US and Canadian Regulations. The sign dismantling process was stopped in April 2013 in preparation of the closure of the facility. After April 2013, all returned signs and devices were sent to another licensed facility for dismantling and disposal.

Liquid effluents contaminated with tritium resulted from the decontamination of the GTLS and parts, water from laundering of personnel protective equipment, air conditioning condensation and the general cleaning of the tritium fill room and decontamination room. These effluents were captured in holding tanks and tested prior to being released.

Low level tritium contaminated solid waste material was generated in the sign assembly operations and cleaning of the facility. This may have included but not be limited to disposable material from cleaning, disposable personnel protective equipment, glass waste from light source generation and expired device waste.

High level tritium contaminated waste was generated from broken or damaged tritium light sources and/or signs and contaminated machine parts.

SSI utilized hazardous materials. All remaining hazardous waste that was left behind after the closure of the facility were taken to a proper hazardous waste facility.

Tritium contaminated waste (both low level and high level) were packaged and sent to a licensed radioactive waste disposal facility. Table TACR1308 shows the amount of waste that was sent for disposal since 2011.

<table>
<thead>
<tr>
<th>Year</th>
<th>Amount of Waste (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>9.46</td>
</tr>
<tr>
<td>2012</td>
<td>11.38</td>
</tr>
<tr>
<td>2013</td>
<td>4.73</td>
</tr>
<tr>
<td>2013: clean-up</td>
<td>12.28</td>
</tr>
<tr>
<td>2014: clean-up</td>
<td>5.71</td>
</tr>
</tbody>
</table>

Our return and replacement program was the largest source of solid contaminated waste. Returned safety devices were disassembled and the GTLS were removed. The GTLS were shipped to a licensed nuclear waste management facility. There was a direct correlation between our increase in solid waste and the number of returned signs dismantled. Table TACR1309 shows the number of returned signs for the years 2009 through 2013. As mentioned above, the sign dismantling process was stopped in April 2013.
From January 2013 through March 2014, there were four shipments of tritium contaminated waste sent to a licensed waste disposal facility. These shipments consisted of eight types of waste:

- Boxes of compacted waste containing tritium contaminated gloves and paper products which were packaged as Radioactive Material, Excepted Packages, Limited Quantity of Material, UN2910, boxes containing tritium contaminated waste;
- Boxes containing Cesium source from the Liquid Scintillation Counter packaged as Radioactive Material, Excepted Packages, Limited Quantity of Material, UN2910;
- B-25 crates containing components from the tritium fill room, stack and ventilation that did not have contamination levels greater than 8.76E+06 Bq which were packaged as Radioactive Material, Excepted Packages, Limited Quantity of Material, UN2910;
- Crate containing the old stack fan and motor assembly packaged as Radioactive Material, Excepted Packages, Limited Quantity of Material, UN2910;
- B-25 crate containing tritium contaminated parts from the tritium fill machines which were packaged as Radioactive Material, Type A Package, UN2915, Class 7;
- GTLS, oils and liquids in absorbent material, and/or spent tritiated parts from machinery which were packaged as Radioactive Material, Type A Package, UN2915, Class 7; and
- Signs that were packaged as Radioactive Material, Type A Package, UN2915, Class 7.
- Uranium getter beds removed from the tritium fill machines that were packaged as Radioactive Material, Type A Package, UN2915, Class 7. There was a total of 2,300g of depleted uranium in the shipment.

Table TACR1309: Number of Returned Safety Devices Dismantled

<table>
<thead>
<tr>
<th>Year</th>
<th>Returned Safety Devices Dismantled</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>11749</td>
</tr>
<tr>
<td>2010</td>
<td>20697</td>
</tr>
<tr>
<td>2011</td>
<td>23106</td>
</tr>
<tr>
<td>2012</td>
<td>21250</td>
</tr>
<tr>
<td>2013</td>
<td>4376</td>
</tr>
</tbody>
</table>
The following table is a summary of the 2013 and 2014 waste shipments:

<table>
<thead>
<tr>
<th>Exempted Packages, UN2910</th>
<th>Type A Packages, UN2915</th>
</tr>
</thead>
<tbody>
<tr>
<td># of Packages</td>
<td>Total Volume (m³)</td>
</tr>
<tr>
<td>1</td>
<td>18</td>
</tr>
<tr>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>3</td>
<td>--</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
</tr>
</tbody>
</table>

All shipments were packaged, stored and shipped in accordance with the Transport of Dangerous Goods Regulations, Packaging and Transport of Nuclear Substances Regulations and the IAEA Safety Standards Series TS-R-1, Regulations for the Safe Transport of Radioactive Material.

2.3.6 Nuclear Security

SSI had a Security Plan that provided details regarding the security of the facility and outlined the processes and programs in place to meet the security plan requirements. This document is considered prescribed information and is subject to the requirements of the Nuclear Safety and Control Regulations.

In January 2012, a CNSC security inspection was conducted. SSI has addressed all of the findings that were outlined in this inspection.

Due to its confidential nature, additional information is included as a separate document, Appendix C.

2.3.7 Safeguards and Non-proliferation

This Safety and Control Area is not applicable.

2.3.8 Packaging and Transport of Nuclear Substances

SSI has operated in full compliance with the requirements of the Packaging and Transport of Nuclear Substance Regulations, Transportation of Dangerous Goods (TDG) Regulations and International Air Transport Association (IATA) Regulations.

SSI’s packages have contained safety devices containing GTLS, bulk tritium or waste contaminated with tritium. All employees who shipped packages have received TDG training and the shipper/receiver has completed IATA training.
SSI followed the *Nuclear Non-proliferation Import and Export Control Regulations* by maintaining CNSC issued import and export licenses for the shipping and receiving of safety devices and GTLS. All reports and documentation were prepared for the CNSC regularly as specified in the licenses.

Safety devices and waste were transported by ground and air to customers around the world utilizing couriers, transport companies and company owned vehicles. Bulk tritium was transported by ground utilizing transport companies and company owned vehicles.
3.0 Other Matters of Regulatory Interest

3.1 Public Information Program

As per the Public Information Program, SSI has maintained open communications with the public by proactively providing information and responding to their telephone calls or inquiries.

Updates about the progress of the clean-up and closure have been provided on the SSI website throughout the year.

In addition, SSI will host an information session for the public, interested elected officials, interested Airport employees and media. This meeting will occur following the submission of this document and approval from the CNSC. The event will be communicated through local media and an email will be sent to all members of the public on our mailing list.

3.2 Financial Guarantee

In March 2013, SSI announced that we would not apply to renew our current operating licence. Upon commencement of the clean-up in September 2013, the escrow account contained $640,748.42. Based on estimations, SSI and the CNSC agreed that there were sufficient funds to cover all activities associated with the clean-up of the facility.

As per the Escrow Agreement, SSI has received joint approval to withdraw funds from the Escrow account to cover costs associated with the clean-up over the last five months. As SSI carried on the clean-up activities, the Escrow Account has been utilized to pay for all related expenses. As of March 31, 2014, all clean-up activities have been completed or scheduled with all expenses covered by the current funds available in the Escrow Account. There will be no additional expenditures or financial liability for the CNSC or surrounding communities to cover any clean-up costs.