SRB Technologies (Canada) Inc.

320-140 Boundary Road
Pembroke, ON, K8A 6W5

2015 Annual Compliance and Performance Report

Reporting Period:	January 1 – December 31, 2015
Licence Numbers:	NSPFOL-13.00/2015 (2015-01-01 to 2015-06-30)
	NSPFOL-13.00/2022 (2015-07-01 to 2015-12-31)
Licence Conditions:	NSPFOL-13.00/2015 Condition 2.4
	NSPFOL-13.00/2022 Condition 4.2

SRB Technologies (Canada) Inc.

2015 Annual Compliance and Performance Report

Submission date: March 31, 2016

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Executive Summary

SRBT is pleased to provide this compliance and performance report to the Canadian Nuclear Safety Commission as part of our licensed activities.

Overall, 2015 was a highly successful year for SRBT, which included a renewal of our operating licence for a period of seven years. This renewed licence term represents the longest term licence in the twenty-five year history of our facility.

We continue to process tritium safely, responsibly and efficiently. The ratio of the amount of tritium released to atmosphere versus the amount of tritium that we process has continued to decrease in 2015, where we achieved a new low value of 0.20%, meaning that for every 100 units of tritium that goes into our product, only 0.20 units is released as gaseous effluent. In fact, SRBT released approximately the same amount of tritium to atmosphere in 2015 as was released in 2011; however, four times the amount of tritium processing occurred in 2015 vs. 2011.

In 2015, a total of 27,989,832 GBq of tritium was processed. We expect that in 2016, the ratio of tritium released to atmosphere to processed will continue to trend down, falling below our target of 0.20%. We also expect that tritium released to atmosphere per week will be less than 2015, and achieve our target of equal to or less than 1,000 GBq per week, on average.

The modifications to our processing strategies and several emission-reduction initiatives continue to pay dividends with respect to worker dose, public dose, and the environmental impact of our facility. The collective dose to our staff reached an all-time low for a full processing year at less than 4 mSv, and no staff member exceeded 1 mSv for the year – a value that represents the dose limit to the public. This is a testament to the continued diligence of the Health Physics Team in maintaining radiation exposures ALARA.

The calculated public dose remains much less than 1% of the prescribed limit of 1 mSv, as derived from direct sampling and monitoring of the local environment. Groundwater concentrations continue to respond favorably as they recover from historical processing practices. For the first time, the highest average tritium concentration in a monitored residential well averaged less than 200 Bq/L.

Our facility continues to be subjected to several independent assessments during the year, and we have in place an expanded internal compliance program to complement these audits. In 2015 CNSC Staff performed several inspections of all aspects of our operations of the facility, and SRBT has either addressed or is in the process of addressing all findings.

We have continued to operate the facility in an open and transparent manner. As 2015 represented a licensing year, the amount of public interest in our operations increased substantially from outside of the local community. SRBT made every effort to address all comments and inquiries during the year, and particularly during licence renewal.

SRBT provided presentations to Pembroke City Council, and conducted facility tours for local community groups and interested residents. Several requests for information were put forth by the public in 2015, all of which were fulfilled in an expeditious manner.

SRBT also performed a significant amount of outreach, including the mailing of renewed pamphlets and brochures to the entire city population, as well as door-to-door visitation of nearby households. We implemented frequent web site updates, including the latest environmental monitoring results, reports pertaining to the emergency exercise, action level exceedances, and our licence renewal documentation. SRBT also created a corporate Facebook page as an additional mode of communication.

The ways in which we manage our facility continue to evolve and change in response to new requirements. In 2015, SRBT provided CNSC Staff revisions of several key documents associated with our licensing basis, including the Waste Management Program, Public Information Program, Emergency Plan, and Fire Protection Program. SRBT also worked towards a revision to the facility Safety Analysis Report, and conducted a comprehensive gap analysis between our environmental protection programs and processes and the requirements of the applicable N288-series of CSA standards.

Site specific requirements for payments to the decommissioning escrow account have continued to be met, after Commission acceptance of the revised Preliminary Decommissioning Plan and Financial Guarantee. This represents a completely self-funded vehicle that does not rely on insurance, letters of credit or third party resources in order to ensure funding availability for decommissioning.

Overall, 2015 represents one of the most successful years of operation for SRBT; however, improvements in compliance and safety will never cease, and we will continue to strive to reduce doses to our workers, the public, and our impact on the environment.

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Acronyms and Abbreviations

ACR	Annual Compliance Report
ALARA	As Low As Reasonably Achievable
Bq	Becquerel
BSI	British Standards Institute
CAN/ULC	Canadian Standard - Underwriters Laboratories Canada
CCRC	Concerned Citizens Of Renfrew County
CLC	Canada Labour Code
CLW	Clearance Level Waste
CNL	Canadian Nuclear Laboratories
CNSC	Canadian Nuclear Safety Commission
CSA	Canadian Standards Association
CVC	Compliance Verification Criteria
DU	Depleted Uranium
ECR	Engineering Change Request
EL	Export Licence
EMP	Environmental Monitoring Program
ESDC	Employment And Social Development Canada
FASC	Facility Access Security Clearance
FHA	Fire Hazards Analysis
FPP	Fire Protection Program
GHS	Globally Harmonized System Of Classification And Labelling Of Chemicals
GNSCR	General Nuclear Safety And Control Regulations
GTLS	Gaseous Tritium Light Source
GWMP	Groundwater Monitoring Program
HRSDC	Human Resources And Skills Development Canada
HT	Elemental Tritium

Acronyms and Abbreviations (cont'd)

HTO	Tritium Oxide
HVAC	Heating, Ventilation, Air Conditioning
IAEA	International Atomic Energy Agency
IATA	International Air Transportation Agency
IEMP	Independent Environmental Monitoring Program
ISO	International Organization For Standardization
LCH	Licence Conditions Handbook
LLW	Low-Level Waste
LSC	Liquid Scintillation Counters
MDA	Minimum Detectable Activity
NCR	Non-Conformance Report
NDR	National Dose Registry
NFCC	National Fire Code Of Canada
NFPA	National Fire Protection Agency
NIST	National Institute Of Standards And Technology
NPFD	Nuclear Processing Facilities Division
NSCA	Nuclear Safety And Control Act
NSPFOL	Nuclear Substance Processing Facility Operating Licence
OBT	Organically Bound Tritium
OFI	Opportunity For Improvement
OLC	Operating Limits And Conditions
OPG	Ontario Power Generation
PAS	Passive Air Sampler
PDP	Preliminary Decommissioning Plan
PFD	Pembroke Fire Department
PIP	Public Information Program

Acronyms and Abbreviations (cont'd)

PLC	Professional Loss Control
PUTT	Pyrophoric Uranium Tritium Trap
QA	Quality Assurance
QC	Quality Control
RD/GD	Regulatory Document / Guidance Document
RDU	Remote Display Unit
REGDOC	Regulatory Document
SAR	Safety Analysis Report
SAT	Systematic Approach To Training
SCA	Safety And Control Area
SSC	Structure, System, And Component
SSI	Shield Source Incorporated
SSR	Specific Safety Requirements
Sv	Sievert
TDG	Transportation Of Dangerous Goods
TR	Technical Report
TSSA	Technical Standards And Safety Authority
UL	Underwriter Laboratories
VLLW	Very Low-Level Waste
WHMIS	Workplace Hazardous Materials Information System
WMP	Waste Management Program
WSIB	Workplace Safety And Insurance Board

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1. Introduction

1.1 General Introduction

For the period of January 1 - June 30, 2015, SRB Technologies (Canada) Inc. (SRBT) operated a tritium processing facility in Pembroke, Ontario, under Canadian Nuclear Safety Commission (CNSC) Nuclear Substance Processing Facility Operating Licence NSPFOL-13.00/2015[1]. On June 29, 2015 upon conclusion of the licence renewal process, NSPFOL-13.00/2022[2] was approved by the Commission[3], and came into effect upon expiry of the previous licence.

The facility was operated in compliance with the regulatory requirements of the Nuclear Safety and Control Act (NSCA), our operating licences, and all other applicable federal and provincial regulations throughout the review period. Compliance was ensured by the continued implementation of our Management System and associated programs and procedures, coupled with a high level of independent internal and external oversight through audit and inspection activities.

One action level exceedance occurred in 2015 relating to weekly atmospheric tritium releases for the period of May 26 – June 2. The exceedance was caused by the failure of a valve on tritium processing equipment during operations, and corrective actions were taken to prevent recurrence.

One additional reportable event occurred on September 25 where a false fire alarm caused by maintenance activities resulted in the activation of a contingency plan, where the Pembroke Fire Department was dispatched to the facility. A review was conducted of this event and measures were taken to ensure the cause of the event was addressed.

Additional details on both of these events are presented in this report under section 1.2.

Both of the applicable operating licences include conditions that require SRBT to prepare and submit an annual compliance report (ACR). This requirement is currently defined as part of the compliance verification criteria (CVC) in the Licence Conditions Handbook (LCH)[4] relating to condition 4.2 of NSPFOL-13.00/2022, which states:

> *The licensee shall submit an annual compliance report by March 31 of each year, covering the operation for the 12-month period from January 1 to December 31 of the previous year that includes at a minimum:*
>
> a) *Operational review including equipment and facility performance and changes, significant events/highlights that occurred during the year.*
> b) *Information on production including verification that limits specified in the licence was complied with.*

c) *Modifications including changes in organization, administration and/or procedures that may affect licensed activities.*
d) *Health physics information including operating staff radiation exposures including distributions, maxima and collective doses; review of action level or regulatory exceedance(s), if any, historical trending where appropriate.*
e) *Environmental and radiological compliance including results from environmental and radiological monitoring, assessment of compliance with licence limits, historical trending where appropriate, and quality assurance/quality control results for the monitoring.*
f) *Facility effluents including gaseous and liquid effluent releases of nuclear substances from the facility, including unplanned releases of radioactive materials and any releases of hazardous substances.*
g) *Waste management including types, volumes and activities of solid wastes produced, and the handling and storage or disposal of those wastes.*
h) *Updates regarding activities pertaining to safety, fire protection, security, quality assurance, emergency preparedness, research and development, waste management, tritium mitigation and training (as applicable).*
i) *Compliance with other federal and/or provincial Regulations.*
j) *A summary of non-radiological health and safety activities, including information on minor incidents and lost time incidents.*
k) *A summary of stakeholder engagement activities, public opinion and information products, as committed to in the Public Information Program.*
l) *Forecast for coming year(s).*

The purpose of this report is therefore to report the required information in order to meet the requirements of conditions 4.2 of Licence NSPFOL-13.00/2022, and the CVC in the associated LCH.

The information is reported in a format similar to that outlined in CNSC document *Annual Compliance Monitoring and Operational Performance Reporting Requirements for Class 1B Nuclear Facilities* (CNSC e-Doc 3471152)[5], and in consideration of regulatory feedback and comments regarding ACRs submitted over the previous licence term.

Where possible, information is presented in the most appropriate section / safety and control area, in such a way as to avoid duplication in other sections.

1.2 Facility Operation – Compliance Highlights and Significant Events

SRBT conducted its licenced activities in a safe and compliant manner throughout 2015.

1.2.1 Tritium Processing

In 2015, SRBT conducted 5,209 tritium processing operations (light source filling), with a total of 27,989,832 GBq of tritium being processed into gaseous tritium light sources (GTLS).

As a comparison, in 2014, SRBT conducted 5,104 tritium processing operations (light source filling), with a total of 28,714,119 GBq of tritium being processed.

Please refer to section 1.4, ‘Production or Utilization’ for additional details on tritium processing in 2015.

1.2.2 Production and Distribution of Self-luminous Safety Products

1,150 shipments of our self-luminous safety products were made to customers in 16 different countries, including Canada.

Please refer to section 4.8, ‘SCA – Packaging and Transport of Nuclear Substances’ for additional details on the production and shipment of our products in 2015.

1.2.3 Acceptance of Expired Products for Light Source Reuse or Disposal

A total of 20,200 expired (or otherwise removed from service) self-luminous safety ‘EXIT’ type signs were accepted by SRBT from Canadian and American sources in 2015, representing a total of 4,218 TBq of tritium. These signs were disassembled safely and the light sources removed, packaged and shipped to a licenced radioactive waste management service provider. A very small number of these signs were evaluated as having light sources that could be reused in other self-luminous devices.

As well, an additional 497 TBq of tritium was accepted from international origins (i.e. other than Canada and the United States) in the form of expired tritium illuminated devices, such as expired aircraft signs, dials, gauges and other smaller equipment. These were also processed for shipment to a licenced waste management facility.

Please refer to section 4.5, ‘SCA – Waste Management’ and section 4.8, ‘SCA – Packaging and Transport of Nuclear Substances’ for additional details on the acceptance of expired self-luminous safety signs in 2015.

1.2.4 External Oversight

During the year, there were a total of 11 major inspections or audits conducted by stakeholders and external parties on our operations.

CNSC staff conducted compliance inspections or promotional visits on three occasions, focused on several aspects of our operations, including (but not limited to) Emergency Management, Fire Protection, Human Performance Management, Import and Export, Security and Waste Management.

SRBT has fully addressed, or is in the process of addressing all compliance actions associated with these activities in close consultation with CNSC staff.

Ontario Power Generation (OPG) conducted a comprehensive audit over the course of four days in September as part of contractual obligations.

The audit did not result in any significant safety-related findings, problem development sheets or station condition records, and concluded that the controls and processes in place with respect to monitoring, handling and usage of tritium are generally effective.

BSI Management Systems, on behalf of the International Organization for Standardization (ISO), conducted audits on two occasions (January and December).

In both cases, BSI concluded that SRBT continues to effectively manage our operations in a fashion that ensures the elements of the scope of our certification with ISO 9001 are effectively addressed.

A major customer of SRBT products also conducted a focused audit of our operations in July 2015, while Underwriter's Laboratories completed four quarterly audits as planned.

Details on the above noted external oversight of SRBT operations can be found in section 2.1, 'SCA – Management System'.

In addition, two focused facility inspections were conducted relating to fire protection. The Pembroke Fire Department inspected the facility on May 19, 2015, while PLC Fire Safety Solutions conducted a N393-13 compliant site condition inspection and program audit over a period in October 2015. Details on these inspections can be found in section 4.4, 'SCA – Emergency Management and Fire Protection'.

1.2.5 Internal Oversight

Internally, there were 15 internal compliance audits conducted through the year, focused on all aspects of our operations and our organization.

A total of 15 non-conformance reports (NCR) and 42 opportunities for improvement (OFI) were identified as a result of these activities, all of which having been addressed (or are in the process of being addressed) by the responsible managers.

Additional details on internal oversight of SRBT operations can be found in section 2.1, 'SCA – Management System'.

1.2.6 Action Level Exceedance

During the course of the year, SRBT operations resulted in the exceedance of an environmental action level on one occasion.

During the week of May 26 – June 2, 2015, the action level for combined tritium releases to atmosphere (oxide + elemental) was exceeded. A comprehensive investigation revealed that the cause of the exceedance was the failure of a valve seal on a tritium processing components during operations.

The seal failure permitted elemental tritium to leak from the processing system and into the active ventilation system. Technicians diagnosed the leak and reduced the consequences of the valve seal failure effectively; however, the operation of the failed valve also partially contributed to the event.

The amount of tritium that escaped resulted in the action level exceedance. A total of 16,946.80 GBq of combined tritium oxide (HTO) and elemental tritium (HT) was released during the week, with the majority being a direct result of the noted event. The action level for this parameter (HTO+HT) is set at 7,753 GBq week.

Several actions were taken in order to prevent recurrence of this type of event in the future, including additional coaching to staff on the operation of this type of valve, and the reduction in the number of cycles the valve may be used before being removed from service.

In addition, the lessons learned from this event were fed into the training being developed under the SRBT Training Program Manual, using the systematic approach to training (SAT) processes.

Finally, research was conducted on determining if there were potential options available to improve the type of valve used as part of these processes, in order to minimize the potential for leakage. Work on this initiative continues as of the end of 2015, as part of SRBT's emissions reduction initiatives.

A final written report was filed with CNSC staff as required[6], with the report being accepted by CNSC staff on August 17, 2015[7].

1.2.7 Reported Events

SRBT reported one event to CNSC staff in 2015 pursuant to the General Nuclear Safety and Control Regulations (GNSCR).

The report[8] described a false fire alarm that occurred at the facility on September 25, 2015, which resulted in the deployment of the Pembroke Fire Department (PFD) to the facility. During maintenance activities on the compressor, a hose disconnected from the unit resulting in the dispersion of finely-divided oil droplets in the vicinity of a smoke detector.

The smoke detector signalled detection, and the facility fire alarm activated immediately, resulting in the evacuation of all personnel from the facility. The central alarm monitoring contractor relayed the alarm to the PFD and a fire truck was deployed to the facility within minutes.

Upon arriving on site, the false nature of the alarm was diagnosed, and after confirming the safety of the facility with the PFD, normal operations resumed. Maintenance personnel were debriefed on the cause of the alarm, and the alarm system was reset and confirmed fully operational.

The deployment of the Fire Department to the facility was determined to be in line with the definition of 'activation of a contingency plan', as described in Clause 29 (2) of the GNSCR, and both a preliminary and full report on the event was submitted as required.

CNSC staff accepted the full report on November 18, 2015[9].

1.2.8 Licence Renewal

SRBT applied for renewal of our nuclear substance processing facility operating licence on September 8, 2014[10].

A public hearing was conducted by the CNSC in Pembroke on May 14, 2015, where the licence application was considered by the Commission, as well as interventions by stakeholders and members of the public.

On June 29, 2015, SRBT was informed that the Commission had renewed our NSPFOL for a period of seven years[11]. Licence NSPFOL-13.00/2022[2] is now the applicable licence permitting SRBT's licenced activities. This licence expires on June 30, 2022.

1.2.9 Summary of Significant Modifications

In 2015 there were no major modifications made to the facility structure, systems or components outside of the licensing basis.

Work towards constructing, connecting and occupying the facility expansion continued in 2015. At no time was the expansion used in any way for licenced activities by SRBT, nor were common physical systems integrated during the calendar year.

The projected connection and occupancy of the expansion to the current facility footprint should take place in the first half of 2016.

Please refer to sections 1.5, 'Changes in Facility Structure, Systems and Components' and 3.2, 'SCA – Physical Design', for more information regarding facility modifications carried out in 2015.

1.2.10 Summary of Organizational Structure and Key Personnel

In general, the organizational structure of SRBT remained the same as in 2014, with only minor changes and additions.

One organizational position was added in our engineering department, while the Health and Safety Specialist position underwent a change in title to more accurately reflect the responsibilities of the job; the position title is now the Manager – Safety and Security.

Staffing levels remained stable at 43 employees.

Please refer to section 2.1, 'SCA – Management System' for details regarding SRBT's organizational structure in 2015.

1.3 Summary of Compliance with Licence and OLCs

Throughout 2015, SRBT complied with the conditions of our operating licence, and possessed, transferred, used, processed, managed and stored all nuclear substances related to the operation of the facility in compliance with both the previous and renewed licence.

Specifically:

- All required programs have been implemented and maintained,
- The CNSC was notified as required of changes to the programs, processes and documents referenced in the management system / licensing basis,
- All required records have been established and maintained pursuant to the operating licence, the Nuclear Safety and Control Act and its regulations,
- All pertinent notifications were made, and written reports filed, within prescribed periods,
- A decommissioning strategy was accepted and maintained for future use,
- A financial guarantee was maintained for decommissioning, and payments made in accordance with the relevant schedules,
- Cost recovery fees were paid on time and in full, and
- Limits on releases of tritium to the atmosphere and sewer, and radiation dose limits to the public and SRBT nuclear energy workers were not exceeded.

SRBT also remained in compliance with requirements of all other federal and provincial regulations as pertaining to the operation of the facility, including the Canada Labour Code and associated regulations, as well as provincial regulations with respect to the emission of gaseous hazardous substances.

In 2015, SRBT developed the latest revision of the Safety Analysis Report (SAR) for the facility; the latest revision was submitted to CNSC staff on January 15, 2016[12].

Included within the latest SAR is a set of Operating Limits and Conditions (OLCs) that SRBT complies with as part of the overall safe operation of the facility.

As of the date of submission of this ACR, Revision 3 of the SAR continues to be undergoing regulatory assessment; however, SRBT is pleased to provide the following summary report respecting SRBT compliance with these proposed OLCs throughout the course of 2015.

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

1.3.1 Tritium Possession Limit

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

SRBT possessed less than 6,000 TBq of tritium at all times during 2015.

Please refer to section 2.3, 'SCA – Operating Performance' for more details.

1.3.2 Tritium Processing – Permitted Hours of Operation

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

All tritium processing operations were conducted between the hours of 0700h and 1900h during 2015. No processing occurred outside of this time period.

1.3.3 Tritium Processing – Precipitation

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

Tritium processing operations were only conducted during periods of zero precipitation during 2015.

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

1.3.4 Tritium Releases to Atmosphere – Tritium Oxide

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

The total amount of tritium oxide released to atmosphere in 2015 was equal to 1.16E+13 Bq (11,554 GBq), representing 17.2% of this licenced limit.

Please refer to section 4.3 'SCA – Environmental Protection' for more details.

1.3.5 Tritium Releases to Atmosphere – Tritium Oxide + Elemental

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

The total amount of combined tritium oxide and elemental tritium released to atmosphere in 2015 was equal to 5.62E+13 Bq (56,237 GBq), representing 12.6% of this licenced limit.

Please refer to section 4.3 'SCA – Environmental Protection' for more details.

1.3.6 Minimum Effective Stack Height for Processing

Tritium processing operations shall not occur unless the minimum effective stack height of 27.8 metres is being achieved on the applicable stack unit.

The minimum effective stack height of 27.8 metres was met during all periods of tritium processing operations, as demonstrated by daily pre-operational checks.

1.3.7 Tritium Releases to Sewer – Water-soluble Tritium

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

The total amount of water soluble tritium released to the municipal sewer in 2015 was equal to 6.54E+9 Bq, representing 3.3% of this licenced limit.

Please refer to section 4.3 'SCA – Environmental Protection' for more details.

1.3.8 PUTT Filling Cycles

Any pyrophoric uranium tritium trap (PUTT) base is limited to 13 complete bulk splitter filling cycles, after which it is no longer permitted to be used for further tritium processing.

All tritium processing in 2015 was conducted using PUTTs that had been cycled 13 times or less on the bulk splitter.

A total of 10 PUTTs were decommissioned in 2015; seven of these were removed from service once reaching the 13 cycle limit, while three others were removed from service due to mechanical problems.

1.3.9 PUTT / Bulk Container Tritium Loading Limit

> PUTTs are limited to less than 111,000 GBq of tritium loading at any time. Bulk containers are limited to less than 925,000 GBq of tritium loading at any time.

In 2015, no PUTT was loaded with more than 111,000 GBq of tritium. No bulk container was used in the facility in excess of the 925,000 GBq loading limit.

1.3.10 Bulk Container Heating Limit

> Bulk tritium containers are limited to a heating temperature of approximately 550 °C, as measured by the thermocouple placed between the heating band and the container surface. Brief and small exceedances of this value are tolerable so long as they are not sustained, and the temperature is returned below this value as soon as possible.

Bulk tritium container heating operations were conducted in strict compliance with this limit throughout 2015.

1.3.11 On-site Depleted Uranium Inventory

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

The on-site inventory of depleted uranium (DU) did not exceed 10 kg in 2015.

Please refer to section 2.3, ‘SCA – Operating Performance’, and section 4.5 ‘Waste Management’ for more details on inventory controls of DU in 2015.

1.3.12 Facility Action Levels and Administrative Limits

There were no exceedances of radiation protection action levels in 2015.

There was one instance where a worker exceeded the administrative limit of 100 Bq/ml for tritium concentration in urine in Zone 2. An internal investigation was conducted as required using the SRBT non-conformance process.

Please refer to section 4.1 ‘SCA – Radiation Protection’ for more details.

There was one instance of an exceedance of an Environmental Protection Action Level in 2015.

For the period of May 26 – June 2, 2015, the action level for total tritium released to atmosphere (tritium oxide + tritium gas) was exceeded.

Please refer to section 4.3 ‘SCA – Environmental Protection’ for more details.

1.4 Production or Utilization

1.4.1 Tritium Processing

In 2015, at total of 27,989,832 GBq of tritium was processed. This represents a very slight decrease of -2.52% from the 2014 value of 28,714,119.

The following table is presented to illustrate the five-year history of tritium processing at SRBT.

TABLE 1: TRITIUM PROCESSED – FIVE-YEAR HISTORY

Calendar Year	2011	2012	2013	2014	2015
Tritium Processed (GBq)	7,342,449	10,224,590	30,544,759	28,714,119	27,989,832

Since 2013, a generally stable trend of processing has been established.

1.4.2 Tritium Possession

SRBT is restricted by licence to possess no more than 6,000 TBq of tritium in any form at the facility at any time.

Throughout 2015 this possession limit was not exceeded. The maximum tritium activity possessed at any time during 2015 was 5,064 TBq in May.

At all times, unsealed source material was stored on tritium traps or in the handling volumes of tritium processing equipment.

The monthly data of tritium activity on site during calendar year 2015 can be found in **Appendix A** of this report.

***NOTE: Based upon CNSC staff comments on SRBT's 2014 ACR, the information pertaining to compliance verification for other limits relating to Environmental Protection have been included in section 4.3 'SCA – Environmental Protection).*

1.5 Changes in Facility Structure, Systems and Components

During 2015, there were no significant changes made to the facility structure.

Progress towards construction of a facility addition on the west side of the building in which SRBT is housed was steady through most of the year. As of December 31, 2015, the addition had yet to be physically connected to the existing facility structure, and does not interface in any way with the SRBT facility.

The addition is expected to be ready for integration with the existing facility structure in the first half of 2016, upon receiving CNSC acceptance of the completed third-party review as required by clause 4.6 of Canadian Standards Association (CSA) Standard N393-13, *Fire protection for facilities that process, handle, or store nuclear substances.*

In 2015, there were three changes implemented relating to facility safety-related systems.

The tritium processing equipment purge gas system was changed from nitrogen to argon gas use, in support of tritium emission reduction initiatives.

This change was fully controlled using SRBT Engineering Change processes. After an initial safety assessment which recommended that the change be made, an initial test phase was conducted to confirm safety and effectiveness of the conversion.

Completion of the change control process was achieved on September 8, 2015, and argon gas has been used to effectively purge processing systems ever since.

The fire detection and alarm system was upgraded with a new integrated system in 2015, using SRBT Engineering Change processes. The system was independently tested and reviewed for compliance with applicable requirements by qualified third party service providers prior to full implementation, and procedures and inspection and testing practices were modified to reflect the upgrade.

Finally, a change was initiated through to the testing phase for a new type of manual valve on SRBT's tritium traps. This change is expected to reduce leakage and by extension, emissions of tritium to the gaseous effluent stream.

Please refer to section 3.2, 'SCA – Physical Design' for more details on the physical changes described above.

1.6 Changes in Documentation

In 2015, several key management system programs and plans were revised, including the Security Program, the Preliminary Decommissioning Plan, the Fire Protection Program, the Waste Management Program, the Public Information Program, and the Emergency Plan.

As well, procedural revision and improvement was a major focus throughout the year. In total, 91 Engineering Change Requests (ECRs) were generated to control the revision and review of procedures in 2015.

Specific details on the changes in documentation can be found in section 2.1, 'SCA – Management System'.

2. Management SCAs

2.1 SCA – Management System

The quality management system implemented continues to ensure that results of various assessments are raised in a corrective or preventive action and subjected to a root cause analysis controlled by the Quality Department.

In 2015, a total of 68 non-conformances and 52 opportunities for improvement were raised in different areas of the company operations. By the end of 2015, 49 of these non-conformances had been addressed in full. The remaining 19 are expected to be addressed before the end of 2016.

SRBT promotes a healthy safety culture, and ensures that all staff members participate and contribute in identifying areas that may need improvement or corrective action. Examples of this include:

- Over six sessions conducted between June 23-25, 2015, all SRBT staff participated in training on safety culture and the new revision of the company's vision, mission, goals, values and policy (approved June 29/15), which was revised to include the obligation and commitment of all employees to adhere to the Quality Management System. These sessions were conducted as small and diverse focus groups to encourage open discussion and interaction between staff from all areas, and all levels of the organization.
- On December 10, 2015, during the annual all-staff training day, the Quality Manager formally presented the corrective action process to all staff. The importance of this process in ensuring safety and overall product quality was specifically highlighted, and it was noted that any staff member can initiate and participate in the process of corrective action.

Between January 7 and 23, 2015 the Organizational Management reviews were conducted with the Quality Manager to review the Benchmarking and Self-assessment activities that were performed by all the Organizational Managers for 2014.

A Senior Management Meeting took place on April 28, 2015 to report and discuss the results of the Benchmarking and Self-assessment activities performed in the previous calendar year, and to define areas where improvements can be made in the various company safety programs.

The 2015 Organizational Management reviews are scheduled to take place in early 2016 for the Quality Manager to review the Benchmarking and Self-assessment activities that were performed by all the Organizational Managers for 2015.

On April 27, 2015 a Management Meeting took place for which all managers and senior management were present. The quality management system was reviewed to ensure it remains suitable and effective at meeting the requirements of the NSCA, Regulations, conditions of the licence and ISO 9001: 2008.

Although SRBT is in the process of transitioning their management system to be in line with the CSA standard N286-12, as required by the CNSC, the review and effectiveness of the Quality Management System was found to be effective overall at meeting the current requirements of the NSCA, Regulations and conditions of the licence as well as ISO 9001:2008 and customer requirements.

SRBT regularly performs various assessments to measure the performance and effectiveness of the Quality Management System to ensure it remains effective and review if any improvements are needed and corrective actions addressed as required. These reviews are performed through several methods for example; review of internal audits, benchmarking, routine and non-routine self-assessments and management reviews, regulatory audits and other third party audit results such as ISO 9001: 2008 and customers.

2.1.1 Staffing and Organization

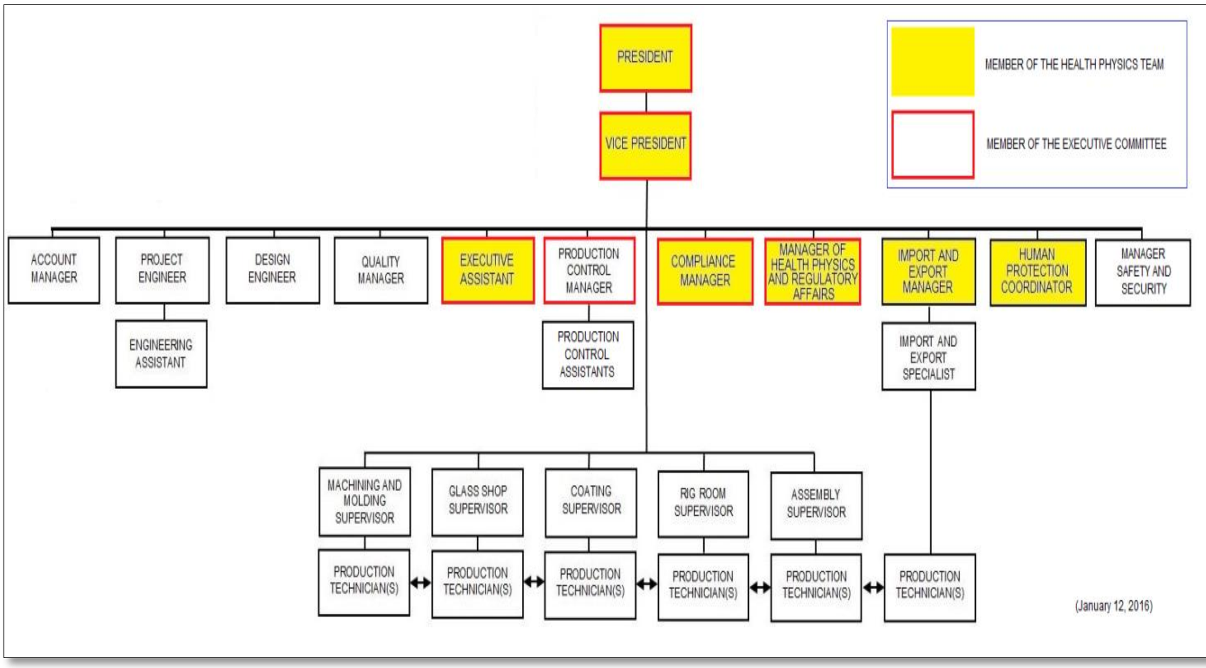
At the beginning of 2015, SRBT total staff complement stood at 43 employees, with a stable trend of employment being maintained through the year. As of the end of 2015, the total staff complement remains at 43 employees.

The following additions or alterations to the organization were implemented in 2015:

- In April, the position of **Design Engineer** was added to the organization and staffed. This individual is responsible for several key manufacturing processes, developing component specifications, performing inspections of incoming materials against requirements, and various other technical engineering duties.
- The title of the Health and Safety Specialist was changed. This individual now holds the title of **Manager – Safety and Security** in order to more accurately describe and account for their level of responsibility within the organization.

The following organizational chart represents the structure of the company, as of the end of 2015, that ensures SRBT meets the Nuclear Safety and Control Act, regulations and conditions of our operating licence:

FIGURE 1: ORGANIZATIONAL CHART



A total of 43 employees work at the company including 16 administrative employees and 27 production employees.

The 16 administrative employees include:

Two members of Senior Management,

- President has the overall responsibility for the facility and ensures that all licensing requirements are met.
- Vice President assumes the full duties of the President in his absence or otherwise assists the President's in his duties.

Ten individuals at the Management level,

- Quality Manager is mainly responsible for the company Quality Assurance Program.
- Import and Export Manager is mainly responsible for the transport and receipt of radioactive materials.
- Executive Assistant is mainly responsible for providing administrative support to the President, and for ensuring meeting minutes are recorded.
- Production Control Manager is mainly responsible for all company purchasing and production planning activities.
- Project Engineer is mainly responsible for all company research and development activities and the company maintenance program.

- Design Engineer is mainly responsible for certain key manufacturing processes, quality assurance of goods received, and developing specifications for components and material purchases.
- Account Manager is mainly responsible for all company accounting activities.
- Manager – Safety and Security is mainly responsible for ensuring staff health and safety and ensuring compliance with the Occupational Health and Safety Regulations.
- Compliance Manager is mainly responsible for performing independent internal audits and further ensuring compliance.
- Manager of Health Physics and Regulatory Affairs is mainly responsible for oversight of all company Health Physics activities as well as communicating with CNSC staff to ensure deadlines are met.

SRBT also employs a full-time nuclear industry consultant who is mainly responsible for supporting Fire Protection and Emission Reduction initiatives.

Three employees that assist individuals at the Management level,

- Import and Export Specialist assists the Import and Export Manager in their duties.
- Production Control Assistant assists the Production Control Manager in their duties.
- Engineering Assistant assists the Project Engineer in their duties.

The 27 production employees include:

Five Production Supervisors,

- Glass Shop Supervisor is responsible for all the activities within the Glass Shop Department.
- Coating Supervisor is responsible for all the activities within the Coating Department.
- Rig Room Supervisor is responsible for all the activities within the Rig Room Department.
- Assembly Supervisor is responsible for all the activities within the Assembly Department.
- Machining and Molding Supervisor is responsible for all the activities within the Machining and Molding Department.

These supervisors oversee the work of 22 Production Technicians,

- Production Technicians who are responsible for performing production activities to company procedures.

2.1.2 Committees

In 2015, committees have continued to be instrumental in the development and refinement of company programs and procedures, identifying new safety initiatives and ensuring continuing effective communication at all organizational levels.

Committees use meeting results as an opportunity for improvement and make recommendations accordingly. In 2015 a total of 100 committee meetings took place at the company compared to 91 in 2014, an increase of 10%.

TABLE 2: COMMITTEE MEETINGS

COMMITTEE	NUMBER OF MEETINGS
OTHER COMMITTEE / STAFF MEETINGS	49
WORKPLACE HEALTH AND SAFETY COMMITTEE	12
HEALTH PHYSICS COMMITTEE	10
FIRE PROTECTION COMMITTEE	7
PUBLIC INFORMATION COMMITTEE	6
TRAINING COMMITTEE	5
WASTE MANAGEMENT COMMITTEE	4
MITIGATION COMMITTEE	4
EXECUTIVE COMMITTEE	2
PRODUCTION COMMITTEE	1
TOTAL	**100**

In 2015, SRBT Senior Management expanded the membership of the Executive Committee to include an additional four staff members. The new committee members are all senior and experienced members of the SRBT organization with excellent leadership qualities, and who possess a set of diverse backgrounds within the company.

The expansion of the Executive Committee was driven by a desire to ensure that a variety of objective viewpoints and opinions are brought to the table when making key business decisions, as well as to support the President and Vice-President is organizing and managing SRBT as it develops and grows over time.

The Executive Committee plans on formally instituting a new committee in 2016. The Maintenance Committee will be responsible for ensuring effective implementation of the SRBT Maintenance Program, and will begin formally meeting in early 2016.

The Health Physics Committee met 15 times less in 2015 than in 2014 mainly due to the increase in “Other Staff” meetings which include 20 meetings discussing the ongoing implementation of the action plan for compliance with CSA N286-12, *Management system requirements for nuclear facilitie*s, as well as 9 meetings discussing the Emergency Training Exercise which took place on February 9, 2015.

During the Health Physics Committee meetings several significant improvements were discussed such as new health physics equipment, procedural updates, inventory control, stack monitoring verification and the introduction of a new member to the Committee who has been trained to perform daily health physics tasks.

Other notable improvements made by the Committees in 2015 include the launch of new website, installation of new fire panel, many revised programs and procedures, team meetings to address individual actions in to the N286-12 plan, and maintenance improvements.

It is fully expected that Committee Meetings will continue to be the main force to improve Nuclear Safety in the future and new Committees will continue to be instituted as deemed appropriate.

2.1.3 Review of Quality Assurance and Management System Activities

In 2014, SRBT conducted a comprehensive gap analysis between our management system and the requirements of CSA Standard N286-12, *Management system requirements for nuclear facilities.* An implementation plan[13] was provided to CNSC staff on September 8, 2014, detailing the path forward to close all significant gaps.

As part of the accepted implementation plan, throughout 2015 SRBT continued to build a management system framework that will ultimately be compliant with CSA Standard N286-12, in line with the timeframes indicated.

Several new processes were formally documented and adopted as part of the implementation plan, including processes aimed at ensuring effective communication throughout the organization, a healthy safety culture, and augmented control of change in the facility.

CNSC staff were kept updated on the project status on a routine basis, with updates being furnished on July 31[14] and November 27, 2015[15].

Progress towards the next revision of the SRBT Quality Manual (the top-tier management system governing document) continues to be made, and the project remains on track to complete all required actions.

It continues to be fully expected that the next revision of the SRBT Quality Manual will be submitted for review and acceptance to the CNSC before the end of calendar year 2016.

In 2015 the Quality Manual[16] remained unchanged. The current Quality Manual (Revision H) was issued September 12, 2014 and submitted to CNSC staff[17], and found acceptable by CNSC Staff in a letter dated December 12, 2014[18].

As SRBT is certified to ISO 9001:2008 Standard, for which recently there has been a change in version; ISO 9001:2015, and with the intent to maintain ISO certification with the International Organization for Standardization (ISO), in the coming year the Quality Manager will review the requirements for the transition to the newest version of ISO 9001:2015 through gap analysis.

Any changes that may be required for this transition is intended to be included in a drafted revision of the next Quality Manual and submitted to CNSC Staff for approval.

As an addition to the Quality Management System that was driven by the Implementation Plan was the development of the document titled 'Document & Process Structure'. This is a descriptive document developed to provide further understanding of SRBT's documentation structure and processes.

SRBT's Vision, Mission, Goals, Values and Policy was revised to further include a Policy statement with an obligation for all employees throughout the company to comply and adhere to the requirements of the Quality Management System. Employees are encouraged to contribute to the continual improvement and upgrading of the company's Quality Management System. The revised policy went into effect as of June 29, 2015.

2.1.4 Review of Quality Assurance and Management System Effectiveness

The SRBT management system is subject to both focused periodic review, as well as continuous review and improvement.

Based upon the following factors and the information presented in this report, it is concluded that the SRBT management system has been effective throughout the year:

- No lost-time injuries or incidents,
- Highest worker dose for 2015 is <2% of regulatory limit,
- Maximum calculated public dose remains <1% of regulatory limit,
- Continued decrease in ratio of tritium released vs. processed,
- All conditions of operating licence(s) met throughout the year,
- Issuance of a seven-year renewal of operating licence (longest licence term achieved by SRBT to date)

2.1.5 Audit Summary – Internal

The year 2015 marked the first complete calendar year where SRBT had in place a dedicated Compliance Manager, whose main responsibility was to provide comprehensive internal oversight of our operations and compliance with our licenced activities.

The goal of SRBT's internal auditing process is to ensure that all licensed activities and company safety programs and procedures are being adhered to. Internal audits were specifically focused on the safety and control areas established by the CNSC.

The Compliance Manager implemented an audit schedule for 2015 that touched on all aspects of our operations. A total of 15 internal audits were completed focused in the following areas of our operations:

- Tritium Laboratory
- Waste Management
- Environmental Protection
- Dosimetry Service
- Glass Shop, Coating Room, Milling and Molding
- Materials / Production Control
- Emergency Management and Fire Protection
- Quality Assurance
- Engineering
- Radiation Protection
- Training
- Rig Room and Assembly
- Public Information Program and Financial Guarantee
- Shipping and Import / Export
- Conventional Health and Safety

The audits performed resulted in 15 non-conformances (NCR) and 42 opportunities for improvement (OFI) being identified. Corrective actions have been or are being taken in each case in order to drive compliance and continuous improvement.

2.1.6 Audit Summary – External

During the year, there were a total of 11 major inspections or audits conducted by stakeholders and external parties on our operations.

2.1.6.1 CNSC Inspections (3)

CNSC staff conducted compliance inspections on three occasions, focused on several aspects of our operations.

In March, compliance inspection NPFD-SRB-2015-03-13 was conducted by CNSC staff, and included inspection focus areas of Fitness for Service, Radiation Protection, Packaging and Transport, Security, Fire Protection and Conventional Health and Safety. CNSC staff concluded that SRBT was in overall compliance with the CNSC regulatory requirements. Under the main report[19], one Directive, four Action Notices and three Recommendations were assigned which have all been addressed to the satisfaction of the inspection team.

The findings and compliance actions relating to Security were provided to SRBT under the cover of a separate report, and were also all addressed satisfactorily.

In October, compliance inspection NPFD-SRB-2015-10-06 was conducted by CNSC staff, and included inspection focus areas of Human Performance Management (Personnel Training), Emergency Management and Fire Protection, and Waste Management. CNSC staff concluded that SRBT was in overall compliance with the CNSC regulatory requirements. Two Directives, five Action Notices and one Recommendation were assigned[20] which have all been addressed by SRBT, and are pending closure or additional communication by CNSC staff at the conclusion of 2015.

In December, CNSC staff conducted a compliance inspection solely focused on the import and export of controlled substances such as tritium. The inspection report[21] was provided in January 2016, with CNSC staff concluding that, apart from findings relating to specifically identified export licences, SRBT was generally compliant with export and import licensing requirements. The report included four Directives and two Recommendations that are in the process of being addressed by SRBT in close consultation with CNSC staff.

2.1.6.2 Ontario Power Generation Audit (1)

Ontario Power Generation (OPG) conducted a comprehensive audit over the course of four days in September as part of SRBT contractual obligations as a purchaser of tritium.

The audit scope was broad in nature, and included aspects relating to tritium usage and inventory controls, security, environmental monitoring, personnel dose, fire protection, and instrumentation.

The audit did not result in any significant safety-related findings, problem development sheets or station condition records, and concluded that the controls and processes in place with respect to monitoring, handling and usage of tritium are generally effective. The report specifically noted that there were no problems identified, and that one management action request was generated as a result of the audit.

Several areas of strength were detailed, including that there exists a very collaborative and cooperative culture with the SRBT organization, and that there is comprehensive program documentation to ensure that operating practices fall within the mandate of the operating licence.

2.1.6.3 ISO Certification Audits (2)

On behalf of the International Organization for Standardization (ISO), BSI Management Systems conducted audits on two occasions (January for calendar year 2014, and December for calendar year 2015) as part of the maintenance of SRBT's ISO 9001 certification.

The January audit resulted in 3 opportunities for improvement being identified, while the December audit resulted in 6 opportunities for improvement, as well as successful continuation of SRBT certification.

In the case of both audits, BSI concluded that SRBT continues to effectively manage our operations in a fashion that ensures the elements of the scope of our certification with ISO 9001 are effectively addressed.

2.1.6.4 Customer-Led Audits (1)

Isolite Inc. (a customer of SRBT products) also conducted a focused audit of our operations over two days in July 2015.

The audit concluded that SRBT is following our Quality Management System and regulatory requirements, and that the guidelines of ISO 9001 are being met.

2.1.6.5 Underwriters Laboratories (4)

Underwriters Laboratories (UL) provides safety-related certification, validation, testing, inspection, auditing, advising and training services to a wide range of clients, including manufacturers.

UL performs quarterly visits of our facility. These visits are unannounced and are to ensure compliance that the products we produce which are listed with UL are manufactured using the materials, procedures and testing parameters required under the specific UL listing.

In 2015, UL performed inspections on March 3, 2015, May 21, 2015, July 15, 2015 and on October 21, 2015 with no issues identified during any visit.

2.1.6.6 SRBT Audits of Suppliers, Manufacturers or Service Providers

SRBT did not perform any audits of suppliers, manufacturers or service providers in 2015. One audit follow-up was completed with respect to an external audit performed in a previous year on a key supplier. The Quality Manager completed the review of supporting documentation received from a supplier to finalizing the report from a previous inspection at supplier's facility in support of the production of bases for the PUTTs used to dispense tritium into light sources. The audit report on this supplier is on file.

Based upon the audits performed in 2015, it is concluded that in general SRBT's management system continues to be effective in ensuring safety, compliance and the achievement of our operational goals.

2.1.7 Benchmarking and Self-Assessments

In 2015, individuals responsible for specific programs and procedures at SRBT regularly looked at process problems, corrective actions as well as trending and used this information to benchmark elsewhere in or out of the organization in order to improve the effectiveness of these programs and procedures and to help define where improvements could be made.

Benchmarking against other CNSC Licensees was encouraged. The documents of other CNSC Licensees were continuously reviewed:

- Commission Member Documents
- Proceedings, Including Reasons for Decision
- Documents from other licensees

Self-assessments are also performed by Organizational Managers to identify, correct and prevent problems that hinder the achievement of the company's vision, mission, goals, values and policy and to assess the adequacy and effectiveness of the Quality Management System.

Self-assessments were performed by review of:

- Analysis and trending of performance data against historical data
- Input from stakeholders (public, contractors, regulators, etc.)
- Workspace inspections or observations
- Routine communications with staff to determine whether expectations are understood
- Training and coaching results
- Corrective and preventive actions raised throughout the organization
- Internal audit results

Meetings with the Quality Manager and Senior Management are scheduled to take place in 2016 as required, to discuss the results of the 2015 benchmarking and self-assessment activities and to define areas of improvement.

2.1.8 Programs and Procedures

2.1.8.1 Programs

In 2015, several key management system programs and plans were revised in line with SRBT's mission of continuous improvement.

In January, the first version of the **SRBT Training Program Manual** was developed and implemented. The manual describes all training processes that are in place at SRBT in order to ensure full compliance with REGDOC 2.2.2, *Personnel Training.* CNSC staff reviewed the Training Program Manual and accepted it as part of the licensing basis of the facility upon licence renewal[22].

In March, the **Security Program** underwent revision in advance of a focused CNSC inspection. The changes were submitted to CNSC staff[23] and were accepted shortly thereafter.

In late 2014, a revision to the **Preliminary Decommissioning Plan** (PDP) was finalized, and submitted to CNSC as part of the basis for the licence renewal[24]. The Commission accepted the plan[25] as part of the renewed licence upon rendering their decision on SRBT's application on June 29, 2015.

On August 11, 2015, SRBT submitted a revision to the **Fire Protection Program** (FPP) to CNSC staff[26] as part of the action plan[27] for compliance with CSA Standard N393-13, *Fire protection for facilities that process, handle, or store nuclear substances.* CNSC staff notified SRBT of the acceptance of this revision of the program on November 19, 2015[28].

The **Waste Management Program** (WMP) underwent two revisions in 2015. On September 11, 2015, revision D was submitted to CNSC staff[29]. This revision was performed in order to move specific detailed information from the program document into WMP-procedure level documents, to address an OFI from an internal audit, and also to implement minor corrections. This revision was accepted by CNSC staff on November 19, 2015[30]. Revision E of the WMP was developed in order to capture the implementation of new conditional clearance levels (CCLs) for clearance-level waste management at the facility. Technical report SRBT-2015-TR-03 was documented in support of the CCLs being incorporated into the WMP. The report was generated in line with international guidance on the subject, and demonstrated that there was no additional risk anticipated to members of the public should the CCLs be applied at SRBT. Revision E of the WMP was submitted to CNSC staff for review and incorporation into the SRBT licensing basis on December 7, 2015[31], and was accepted by CNSC staff in the first quarter of 2016[32].

On September 25, 2015, SRBT submitted revision 9 of the **Public Information Program** (PIP) to CNSC staff[33]. The revision was made in order to address an OFI from an internal audit. The latest revision of the PIP demonstrates SRBT's commitment to openness and transparency by being vastly improved by more broadly reaching stakeholders using more methods of providing information. CNSC staff accepted the PIP on October 26, 2015[34].

The SRBT **Emergency Plan** was revised and submitted to CNSC staff on September 30, 2015[35]. The revision was made to address gaps between the plan and the latest regulatory guidance contained in REGDOC 2.10.1, *Nuclear Emergency Preparedness and Response.* In addition, lessons learned from Emergency Exercise One were integrated into the plan. CNSC staff indicated that the revised Emergency Plan was acceptable and met the intent of REGDOC 2.10.1 on October 2, 2015[36].

2.1.8.2 Procedures

In 2015, a total of 91 Engineering Change requests (ECR) were filed relating to procedural changes in the SRBT management system (compared to 47 in 2014). The breakdown of ECRs filed was as follows (note that an ECR may encompass more than one procedural improvement):

TABLE 3: PROCEDURAL ECR SUMMARY

PROGRAM	NUMBER OF ECRs
RADIATION SAFETY PROGRAM	19
PRODUCTION	19
ENGINEERING	15
FIRE PROTECTION	9
QUALITY	7
LIQUID SCINTILLATION COUNTING LAB	5
WASTE MANAGEMENT	3
MAINTENANCE	3
SHIPPING AND RECEIVING	2
HEALTH AND SAFETY	2
ENVIRONMENTAL PROTECTION	1
OTHER	6
TOTAL	**91**

Procedural changes were implemented for a variety of purposes. Many improvements have been incorporated as a result of the continuing, expanded oversight provided by SRBT's internal audit processes, as directed and implemented by the Compliance Manager (a position incorporated into the organization in 2014).

As well, several new procedures and processes have been incorporated into the management system as a result of continuous improvement projects, including the Implementation Plan[13] for compliance with CSA Standard N286-12, *Management system requirements for nuclear facilities.*

New procedures include:

- A separate set of three Waste Management procedures to accompany the revised program (implemented in January)
- The Training Program Manual includes the set of SAT-based processes that govern how training is managed (implemented in January)
- ENG-021, *Turnover Process*, as part of the N286-12 plan (implemented in June)
- RSO-038, *PUTT Management* (implemented in July)
- ENG-022, *Safety Analysis Review,* as part of the N286-12 plan (implemented in September)
- QAS-025, *Graded Approach,* as part of the N286-12 plan (implemented in September)
- ENG-023, *Information Management,* as part of the N286-12 plan (implemented in October)
- ENG-024, *Communication Process,* as part of the N286-12 plan (implemented in November)
- RSO-039, *Planning for Unusual Situations* (implemented in December)
- QAS-026, *Safety Culture Monitoring Process,* as part of the N286-12 plan (implemented in December)

2.2 SCA – Human Performance Management

Throughout the course of 2015, SRBT ensured that at all times a sufficient number of qualified workers were available to carry out licenced activities in a safe manner, and in accordance with the NSCA and associated regulations.

In 2015 our staff remained stable; by the end of the year, SRBT employed a total of 43 staff members, which is the same value as was in place at the end of 2014.

The average experience of our workforce stands just under 9 years, with an average age of just under 42 years old. The Health Physics Team possesses a combined 114 years of work experience with the company, while production supervisors average 18 years of experience with SRBT.

Careful consideration continues to be taken when appointing new staff to ensure continued Nuclear Safety.

The activities of five work areas (marked in yellow in Table 4) do not involve tasks that affect Nuclear Safety. Generally employees hired as Production Technicians are first appointed to one of these five work areas. These positions do not in any way impact the company's ability to ensure that the requirements of the Nuclear Safety and Control Act, Regulations and conditions of the licence[1,2] are met.

TABLE 4: NUCLEAR SAFETY TASKS PERFORMED PER WORK AREA

WORK AREA	AVERAGE EXPERIENCE (IN YEARS)	RESPONSIBLE FOR PROGRAMS AND PROCEDURES THAT AFFECT NUCLEAR SAFETY	PROCESS TRITIUM	HANDLE SEALED TRITIUM SOURCES
ADMINISTRATION	**12.86**	✓	-	-
RIG ROOM	**8.91**	-	✓	✓
GLASS SHOP	**8.76**	-	-	-
ASSEMBLY	**4.91**	-	-	✓
MACHINING AND MOLDING	**6.77**	-	-	-
COATING	**5.85**	-	-	-
SHIPPING	**2.10**	-	-	-
CLEANING	**1.21**	-	-	-

The Rig Room is the department where tritium processing takes place, and has the highest average work experience with the company of any production department. The average work experience of the staff within this department is just over 8 years.

The Supervisor and another employee in this department have over 24 years of experience and perform or oversee all activities that involve tritium processing or handling of tritium sources.

The Assembly Department is where tritium sources are handled by staff for assembly into products or for packaging. The tritium is contained in the source at this stage and the possibility of tritium exposure is low. The Supervisor in this department has over 16 years of experience and performs or oversees all activities of four other staff members.

2.2.1 Training

2.2.1.1 Annual All-Staff Training Session

Once per calendar year, SRBT shuts down all manufacturing operations in order to conduct an all-day, all-staff training session.

The agenda for this training traditionally incorporates a wide variety of aspects of our operations. The majority of the day is dedicated to a refresher course in radiation protection, specifically oriented at the unique type of hazard present at SRBT.

This training was conducted on December 10, 2015, and included information with respect to natural radiation exposure, anticipated health effects from radiation exposure, tritium, proper handling of tritium throughout the facility, as well as a practical contamination control exercise.

As well, training is provided to all staff on fire safety, security, and the SRBT non-conformance process.

Specific information on the radiation safety training provided by SRBT can be found in section 4.1, ‘SCA - Radiation Protection’.

2.2.1.2 Management System and Safety Culture Training Session

In June 2015, as part of the N286-12 Implementation Plan[13], SRBT conducted focused sessions with all staff members on the concepts of the new management system being implemented, and fostering a healthy safety culture in the facility. These sessions were noted to be very successful, with small groups of no more than eight participants from a cross-section of the workforce having an open forum to discuss what a healthy safety culture looks like, and how SRBT is striving to continually improve our management system and safety culture every day.

2.2.1.3 Fire Extinguisher Training

Annual fire extinguisher training was conducted with the support of the Pembroke Fire Department on September 25, 2015. The training was conducted using a new electronic simulator, eliminating the risks associated with the controlled, repeated burning and extinguishing of liquid hydrocarbons as an environmentally-friendly measure.

2.2.1.4 Fire Responder Training

SRBT and the Pembroke Fire Chief evaluate if and when familiarization training for responders is required. The decision is based on if changes have occurred at SRBT's facility, if the training has not been performed for a number of years or if there are a number of new firefighters and/or volunteers that have not yet taken the training.

There was no training of fire responders in 2015; however, several members of the fire department participated in the full-scale emergency exercise in February. The training of fire responders was last performed in 2011 and included a tour of the facility and information with respect to the hazardous materials found on the site. Responders were also instructed on the various properties and precautions with respect to tritium.

2.2.1.5 Health and Safety Training

The Manager – Safety and Security attended a Health & Safety Conference in Ottawa in October 2015, and took part in training seminars that included:

- WHMIS 2015 & GHS – What You Need To Know
- Sitting Disease: Why You Need To Change The Way You Work
- Health & Safety Compliance – Making Managers and Supervisors Part of the Solution
- Unpaid Workers – Are You Taking Due Care?

2.2.1.6 TDG Training

In March 2015, all staff who perform shipping and receiving activities underwent training on the shipment of dangerous goods. This training was provided by a qualified third party provider.

2.2.2 Systematic Approach to Training Program

In January 2015, CNSC staff accepted the inaugural version of the SRBT Training Program Manual as part of the licensing basis of the facility[22].

This manual was the key deliverable relating to the work performed to bring SRBT into compliance with REGDOC 2.2.2, *Personnel Training.* This document is the main Human Performance Management compliance verification criteria applied to SRBT under the renewed licence, as part of the LCH.

Throughout 2015, SRBT has made significant efforts to advance the development and implementation of the training activities that were analyzed as requiring the application of a fully systematic approach.

These seven activities include:

- SAT-HP-01, *Advanced Health Physics Instrumentation*
- SAT-HP-02, *Liquid Effluent Management and Control*
- SAT-HP-03, *Weekly Stack Monitoring*
- SAT-HP-04, *Bioassay and Dosimetry*
- SAT-OP-01, *Tritium Processing – Filling and Sealing Light Sources*
- SAT-OP-02, *Bulk Splitter Operation*
- SAT-OP-03, *Handling PUTTs*

At the conclusion of 2015, three of seven activities had either entered into full implementation, with one of those having been fully implemented and evaluated. The remaining four activities continue to be developed for implementation in a risk-informed fashion, and are on track to be implemented in the first half of 2016.

The Training Committee continues to ensure that the processes described in the Training Program Manual are managed effectively and improved.

CNSC staff performed a compliance inspection in October of 2015 that included a focused assessment of SRBT's implementation of the Training Program Manual. Generally, SRBT was found to be in compliance with regulatory requirements, while several positive improvement opportunities were identified[20].

SRBT has made progress in implementing changes and improvements, and has started to revise key training processes in line with the inspection feedback. Revision B of the Training Program Manual is on track for submission to CNSC staff in the first half of 2016.

2.3 SCA – Operating Performance

SRBT has continued to operate the facility safely and in compliance with our operating licenses throughout 2015.

Our programs and processes have continued to evolve to meet or exceed regulatory requirements and expectations, with safety as an overriding priority in all aspects of our licensed activities.

Please refer to section 2.1 'SCA – Management System' for details on the set of internal and external audits conducted at SRBT.

2.3.1 Ratio of Tritium Released to Processed

In 2015 our team continued to strive to minimize the amount of tritium released to the environment for every unit of tritium processed – we refer to this as the 'released to processed' ratio. This ratio is an excellent indicator of the overall effectiveness of our emission-reducing initiatives.

The following table illustrates how this ratio has trended since 2010.

TABLE 5: TRITIUM RELEASED TO PROCESSED RATIO (2010-2015)

DESCRIPTION	2010	2011	2012	2013	2014	2015
TOTAL TRITIUM RELEASED TO ATMOSPHERE (GBQ/YEAR)	36,426	55,584	29,905	78,875	66,161	56,237
TRITIUM PROCESSED (GBQ/YEAR)	6,643,732	7,342,449	10,224,590	30,544,759	28,714,119	27,989,832
RELEASED TO PROCESSED (%)	0.55	0.76	0.29	0.26	0.23	0.20
CHANGE IN RATIO INCREASE (+) / REDUCTION (-)	-31%	+38%	-62%	-10%	-12%	-13%

2.3.2 Objectives and Targets

SRBT performance against key objectives and targets for 2015 is tabled here, as well as the targets set for 2016:

TABLE 6: 2015 OBJECTIVES AND TARGETS

DESCRIPTION	2015 TARGET	2015	2016 TARGET
RATIO OF TRITIUM EMISSIONS VS. PROCESSED	< 0.22%	0.20%	0.19%
WEEKLY AVERAGE TRITIUM RELEASES TO ATMOSPHERE	1,272 GBq	1,081 GBq	1,000 GBq
MAXIMUM DOSE TO NUCLEAR ENERGY WORKER	< 1.29 mSv	0.87 mSv	0.83 mSv
AVERAGE DOSE TO NUCLEAR ENERGY WORKER	< 0.10 mSv	0.07 mSv	0.065 mSv
LOST TIME INJURIES	0	0	0

2.3.3 Action Level Exceedance

In 2015, a single action level exceedance was reported relating to tritium releases to atmosphere. This exceedance occurred during the period of May 26 – June 2, 2015 due to the leakage of a process valve during filling operations.

SRBT conducted an investigation and identified contributing causes, root causes and corrective actions. SRBT submitted a corrective action plan to minimize the probability of recurrence[6].

Additional details on this event can be found in section 4.3, 'SCA – Environmental Protection'.

2.3.4 Inventory Control Measures

2.3.4.1 Tritium

SRBT has continuously possessed, transferred, used, processed, managed and stored all nuclear substances related to the operation of our facility in compliance with the requirements of our licence.

A number of Inventory Control Measures are in place to ensure that tritium on site does not exceed the possession limit prescribed by our operating licence.

The maximum amount of tritium possessed by SRBT at any one time during 2015 was 5,064 TBq, or approximately 84% of our possession limit. Tritium on site is found in:

- Bulk containers, U-beds and tritium traps
- New light sources
- The exit signs for our facility
- New product that contain light sources
- Work in progress
- Waste
- Expired light sources taken out of product
- Products that contain expired light sources
- Non-conforming product

SRBT also possesses other nuclear substances as part of our licenced activities.

2.3.4.2 Depleted Uranium

SRBT possessed 7.27 kg of depleted uranium in metallic form at the beginning of 2015. This material is used for tritium traps as part of the production of gaseous tritium light sources, with a trap being limited to 13 cycles of tritium filling on the bulk splitting rig. Once the cycle limit is reached, the trap is taken out of service.

A comprehensive physical inventory of depleted uranium was performed in April 2015 as part of an internal audit of depleted uranium inventory processes. It was determined that the inventory of material on site at that time was approximately 7.56 kg, with the discrepancy being attributed primarily to rounding of weight measurements made over time when traps were built and commissioned.

In May 2015 SRBT made a shipment of expired tritium trap bases to a licenced waste management facility, thus reducing the inventory of depleted uranium on site by 1.65 kg.

At the conclusion of 2015, SRBT possesses 5.91 kg of depleted uranium. A limit of 10 kg of this material in inventory is applied as part of the operating limits and conditions in the SAR.

TABLE 7: DEPLETED URANIUM INVENTORY BREAKDOWN AT THE END OF 2015

QTY	DESCRIPTION	DEPLETED URANIUM IN EACH (GRAMS)	TOTAL DEPLETED URANIUM (GRAMS)
1	LOOSE FORM	NA	3,167
9	ACTIVE P.U.T.T.	30 +/- 1 GRAM	270
7	NON-ACTIVE P.U.T.T.	30 +/- 1 GRAM	211
4	AMERSHAM CONTAINERS THAT WE OWN (0666AY)	405	1,620
2	AMERSHAM CONTAINERS THAT WE OWN (3605D)	320	640
		TOTAL	**5,908**

2.3.4.3 Liquid Scintillation Counter External Sources

At the beginning of 2015, SRBT possessed a total of six external standard sources used in liquid scintillation counters (LSC).

Four of these sources were removed from the facility during the year.

The following two sources were routed to a licenced waste management facility as they no longer served any use or purpose:

- One Radium-226 370 kBq source that was part of a Wallac 1215 LSC which had been removed from service several years ago.
- One Barium-133 14.8 kBq source that was removed from another LSC which had been removed from service several years ago.

In addition, SRBT donated two obsolete LSCs to a local college for use as teaching tools in support of the college's Radiation Safety program. These units both house Europium-152 sources with original activities of 740 kBq. Both of these sources fall below the exemption quantity for Eu-152.

At the conclusion of 2015, the facility retains two LSC that use Ba-133 external sources exhibiting original activities of 696 kBq. These sources also fall below the exemption quantity for Ba-133.

2.3.4.4 Check Source

An exempt Cs-137 disc check source, with an original activity of 28 kBq is stored in the LSC lab for health physics-related testing.

2.3.5 Results of LSC-QA Program

2.3.5.1 Routine Performance Testing

Routine Performance Testing are performed on both LSCs as required in section 4.2.3 of CNSC Regulatory Standard S-106 titled “Technical and Quality Assurance Requirements for Dosimetry Services”, Revision 1.

Routine Performance Testing is performed to specifically demonstrate that the dosimetry service is operated in a predictable and consistent way.

Routine Performance Testing was carried out every 3 months as required throughout 2015 on each of the two ‘TriCarb 2910’ units, with no failure reported.

2.3.5.2 Weekly LSC Performance Check

The LSC-QA program requires weekly instrument performance checks using National Institute of Standards and Technology (NIST) traceable standards of a blank, H-3 and C-14 standards.

All tests have been performed on both TriCarb 2910 LSC units, and included an assessment of the instrument efficiency for tritium measurement, the figure of merit, the tritium background measurement, and a chi-square test. In all cases, both instruments passed the acceptability criteria on a weekly basis.

2.3.5.3 Batch Validity Tests

NIST traceable standards, certified to have an estimated accuracy of ± 1.2%, are prepared in-house, analyzed and checked against acceptability criteria with every batch of samples being analyzed. All tests were performed with every batch in order to ensure quality control of laboratory processes.

3. Facility and Equipment SCAs

3.1 SCA – Safety Analysis

Our operating practices and processes in 2015 have continued to be conducted in full alignment with the latest version of SRBT's Safety Analysis Report (SAR) [37], and the document titled Review of Hypothetical Incident Scenarios, dated February 22, 2008[38].

The overall safety case remained valid and effective throughout 2015. No modification or change performed in 2015 has affected the validity of the safety case.

There were no modifications or changes made to the facility which affected the safety analysis, and all preventative measures and strategies in place to ensure hazards are effectively identified and mitigated remained effective.

With the incorporation of the new CSA standard N286-12, *Management system requirements for nuclear facilities* as part of the regulatory expectations relating to our facility, SRBT conducted a gap analysis[39] in 2014 to determine areas that require action to bring our management system into compliance with the standard. As part of the N286-12 Implementation Plan[13], SRBT developed and implemented a new process to govern the management of our facility safety case.

On September 28, 2015, ENG-022, "Safety Analysis Review Process" was issued for use. This process was executed in full for the first time in December 2015, and resulted in the identification of several areas of the document that required improvement and revision. None of the identified discrepancies were outside of the bounds of the safe operating envelope of the facility.

After the review, SRBT elected to renew and revise the SAR in order ensure the current facility state and operational processes were accurately captured.

The revision was implemented in line with available international guidance on format and content of safety analysis reports for nuclear power plants. SRBT does not operate a nuclear power plant; however, the guidance in IAEA GS-G-4.1, *Format and Content of the Safety Analysis Report for Nuclear Power Plants* was applied in a risk-informed fashion, as appropriate for a facility such as SRBT.

On January 15, 2016, revision 3 of the SRBT Safety Analysis Report was submitted to CNSC staff for review and acceptance[12]. This revision incorporates all the current information on SRBT, and also establishes a formalized set of Operating Limits and Conditions that shall be complied with in order to maintain safe operations.

SRBT's Review of Hypothetical Incident Scenarios[38] has also been integrated into the SAR as an Appendix in order to ensure that the entire technical safety case is now included as part of the main licensing document.

Going forth, ENG-022 will drive a formal review on an annual basis in order to ensure that the SRBT SAR undergoes continuous improvement and assessment, and that SRBT remains within the bounds of the safety case.

As always, SRBT will continue to respond to events in the nuclear industry and beyond that could influence or otherwise affect our safety analysis. It is not expected that our licensed activities and processes will change over the coming years. However, should emissions-reducing initiatives identify any technical and engineered systems that could increase the level of safety if incorporated, these emissions-reducing initiatives will be thoroughly analyzed with respect to safety, in consultation with CNSC staff and the Commission if required, prior to implementation.

3.2 SCA – Physical Design

As a manufacturing company, SRBT owns and operates several pieces of equipment, several of which constitute structures, systems and components (SSCs) which have a bearing on safety and our licensed activities.

Such equipment includes the active ventilation systems and associated emissions monitoring equipment, fire detection and suppression systems, tritium processing rigs, tritium-in-air monitors, and liquid scintillation counters.

The overall facility design is also a key aspect of our operations, and must be managed and controlled safely. The SRBT Engineering Change process helps to ensure that any modifications are controlled, reviewed and accepted.

The Engineering Change process underwent a major update and revision in 2015, in alignment with the N286-12 action plan. The revised process incorporated elements for more clearly identifying why a change is required, design control aspects, an assessment of how the change may intersect with the Safety and Control Areas (SCAs), as well as follow up and closure details.

Three significant changes in physical design of important facility systems took place (or began to take place) in 2015, and a change to the overall facility footprint was also worked towards, but without yet having changed the physical design of the current facility.

All changes have been controlled using SRBT change control processes, and in no case did any change result in a negative impact on the ability of the facility and structures, systems and components (SSC) to meet and maintain their design bases.

The following physical design changes were implemented or developed in 2015, none of which were deemed to be outside of the design or licensing basis of the facility:

3.2.1 Fire Detection and Alarm System

The fire detection and alarm system was improved with the addition of a new fire alarm panel, along with associated upgrades to smoke detection, heat detection, pull stations and audible / visual fire alarms throughout the facility.

The system was commissioned and put into service in January with the issuance of a fire alarm verification report by an independent third party service provider. The fire detection and suppression systems were again independently reviewed as part of a site condition inspection and program audit conducted in late 2015, with no major safety concerns being raised and one opportunity for improvement being identified by the independent third party fire protection experts.

3.2.2 Manual Valve on PUTTs

After investigating the cause of the action level exceedance during the week of May 26 – June 2, one of the key actions taken was to investigate improvements to the valve design used as part of our pyrophoric uranium tritium traps (PUTTs).

An assessment concluded that the use of a bellows-type valve with a different stem tip would likely reduce the probability of chronic leakage of tritium from our traps, as well as the likelihood of failure such as that which caused the exceedance. An Engineering Change Request was generated with a comprehensive change control package being documented in order to ensure that the safety of the change was fully assessed.

Work towards designing, procuring and commissioning new weld-sealed bellows type valves was initiated shortly after the investigation concluded. This work was undertaken as part of the SRBT Emissions Reduction Initiative.

As of the end of 2015, custom valves had been manufactured, tested and put through an active commissioning plan to confirm the safety and reliability of the new PUTT valve design. Familiarization and turnover was conducted with all qualified personnel who process tritium.

Initial results on the overall effect of this potential design change have been positive, and it is expected that once the change is fully approved, the use of these new valves will significantly contribute to the reduction of tritium emissions associated with routine processing.

3.2.3 Conversion from Nitrogen to Argon for Purge Processes

As part of the SRBT Emissions Reduction Initiative, an assessment of the purging gas used at the conclusion of processing runs was initiated. The assessment concluded that there may be tangible benefits to the use of argon gas instead of the nitrogen gas being applied.

An Engineering Change Request was generated with an associated technical report being documented in order to ensure that no new or unexpected hazards were introduced upon implementation of this change. A comprehensive plan was developed to control the testing phase of the change, and qualified personnel who conduct purging were familiarized with the changes prior to implementation.

A bottle of argon gas was first installed on the purging system on August 19; tritium emissions and gas consumption rates were monitored to determine if there were any notable changes in system behaviour or emissions. On September 8, the use of argon was determined to be at least as effective and safe as the use of nitrogen, and the change was made permanent. Since the use of argon was implemented, tritium emissions have remained low, with data suggesting that emissions have been decreasing on the average since.

3.2.4 Future Expansion

As was reported in our licence renewal application[10], in early 2016, SRBT is expected to take residence of a building expansion being built by the site landlord. This 180 m^2 extension to the physical footprint of the facility is for the main purpose of adding space for enhanced molding and milling activities, offices and storage. No radiological materials or processes are expected to be routinely handled or conducted in this new space.

Throughout 2015, SRBT has worked in close consultation with the site landlord and the CNSC to ensure that all expectations and requirements are addressed prior to any physical interface with the current facility being made. As of the end of 2015, work continues towards meeting the goal of occupancy in the first half of 2016.

The addition is expected to be ready for integration with the existing facility structure within the target timeframe, upon receiving CNSC acceptance of the completed third-party review as required by clause 4.6 of Canadian Standards Association (CSA) Standard N393-13, *Fire protection for facilities that process, handle, or store nuclear substances*.

3.3 SCA – Fitness for Service

All equipment, including all safety-related equipment, is kept in a condition that is fit for service. The facility and equipment associated with the facility were maintained and operated within all manufacturers requirements. In 2015 there were no significant equipment failures that presented a safety concern, demonstrating the effectiveness of the Maintenance Program implemented by SRBT.

The program was guided by, and developed in accordance with the applicable sections of CNSC Regulatory Document RD/GD- 210, *Maintenance Programs for Nuclear Power Plants*, which defines the requirements of the CNSC with regards to maintenance programs for nuclear power plants. SRBT does not operate a nuclear power plant; however, using appropriate elements of RD/GD-210 demonstrates a proactive approach to compliance with the standards of maintenance activities in the nuclear industry.

SRBT has implemented a graded approach within its Maintenance Program in order to ensure the appropriate procedures, maintenance intervals, and preventative maintenance activities are in place or have been identified for development. This process also identifies the requirements for critical spare parts and calibrations. Equipment within all departments at SRBT were reviewed under the graded approach.

Documented maintenance meetings were initiated and held under the Maintenance Program in 2015, while additional procedures were developed under the Maintenance Program in 2015, increasing the scope of controlled and documented activities.

SRBT developed and follows a central maintenance activity schedule for all preventative maintenance activities scheduled for increased visibility on all activities being performed within the facility.

Preventative maintenance was scheduled and performed in 2015 on equipment as per **Appendix B** of this report. Maintenance records are kept on file including completed work orders of preventative maintenance activities. A maintenance schedule captures all SRBT facility planned preventative maintenance activities whether performed by SRBT personnel or an approved contractor, and includes maintenance inspections as required by the Fire Protection Program.

The fitness for service of key individual structures, systems and components are summarized below:

3.3.1 Ventilation

The ventilation of the facility is such that the air from the facility flows to the area with greatest negative pressure in Zone 3 which has the highest potential for tritium contamination where all tritium processing takes place. This area and part of Zone 2 are kept at high negative pressure with the use of two air handling units which combined provide airflow of approximately 10,000 cubic feet per minute.

The air handling units are connected to a series of galvanized and stainless steel ducts. In addition to providing ventilation for the facility these air handling units also provide local ventilation to a number of fume hoods which are used to perform activities that have a potential for tritium contamination and exposure.

These air handling units are maintained through contract maintenance and service program with local contract providers in conjunction whereby preventive maintenance is performed by qualified staff. All records of the maintenance are kept on file. Ventilation equipment maintained in calendar year 2015 can be found in **Appendix C** of this report.

All ventilation systems were maintained in fully operational condition with no major system failures during 2015 to the requirements of our Maintenance Program and operational procedures. Equipment is maintained on a quarterly or semi-annually basis. Equipment maintenance was performed under contract with a fully licensed maintenance and TSSA certified local HVAC contract provider. All records of the maintenance are kept on file.

3.3.2 Stack Flow Performance

Stack maintenance is performed by a third party, in order to ensure effective performance of the ventilation system and minimize airflow reductions from the beginning to the end of the maintenance cycle to ensure accuracy of results.

Pitot tubes that were installed in the stacks are maintained by a third party to ensure stack airflow are at design requirements. This essentially allows for daily stack flow verification in addition to more detailed annual stack flow verification performed by a third party.

Stack flow performance verification was performed on September 18, 2015 by a third party. The inspection confirmed that the stacks were performing to design requirements and that the airflow on both air handling units have remained approximately the same in 2015 from what they were in 2014. The stack height and the airflow in the fume hoods continue to be checked on a regular basis.

We will continue to monitor and trend the results of the yearly Stack Performance Verification. No further action is required at this time other than continuing to perform the daily readings of the stack height and the monthly airflow checks of fume hoods. All records are kept on file.

3.3.3 Liquid Scintillation Counters

The two TriCarb 2910 liquid scintillation counters were subjected to an annual preventive maintenance procedure on November 24, 2015, approximately one year after the initial installation and commissioning of the units had been performed. No significant concerns or issues were identified during the maintenance activity.

Both systems will continue to be maintained and calibrated on an annual basis by a qualified service representative from the manufacturer of the equipment, to ensure their functionality, accuracy and reliability.

3.3.4 Portable Tritium-in-Air Monitors

Portable tritium-in-air monitors are maintained in Zones 2 and 3. The portable units are used to determine the source of tritium that might cause an alarm threshold to be breached.

In 2015, the number of available portable tritium-in-air monitors was increased to eight units.

Four monitors are available in Zone 3, two are available in Zone 2, and one is available in Zone 1 in the shipping and receiving area. There is also one unit stored off-site at the Pembroke Fire Hall as part of an emergency preparedness kit.

As required by our Radiation Safety Program, all tritium-in-air monitors were calibrated and maintained at least once during 2015. All records of the maintenance are kept on file.

3.3.5 Stationary Tritium-in-Air Monitors

The ambient air in selected key areas of the facility is continuously monitored using stationary tritium-in-air monitors.

There are five stationary tritium-in-air monitors available for airborne tritium monitoring at the facility, with an additional unit available on standby as a spare.

Three monitors are strategically located in Zone 3; one in the Rig Room where gaseous tritium light sources are filled and sealed, one in the Laser Room where a laser is used to cut and seal small gaseous tritium light sources and inspected, and one in the Tritium Laboratory where tritium is transferred from bulk supply containers to filling containers.

One stationary tritium-in-air monitor is located in Zone 2 in the Assembly Area, where gaseous tritium light sources are pre-packed in preparation for shipping or installed into device housings.

A stationary tritium-in-air monitor is located in the shipping area in order to provide an early warning signal of a problem should a light or device be damaged during packaging activities.

As required by our Radiation Safety Program all tritium-in-air monitors were calibrated and maintained at least once during 2015. All records of the maintenance are kept on file.

3.3.6 Stack Monitoring Equipment

Stack monitoring equipment is incorporated for each of two main air-handling units. For each air-handling unit, the monitoring equipment includes:

- A tritium-in-air monitor connected to a real-time recording device.
- A bubbler system for discriminately collecting HTO and HT.
- A flow measurement device with elapsed time, flow rate and volume.

Each tritium-in-air monitor connected to real-time recording devices (chart recorders) and was calibrated and maintained at least once in 2015. Both of the chart recorders (analog and digital) underwent calibration verification on a quarterly basis. All records of the maintenance are kept on file.

Bubbler systems (and spare systems) were also maintained throughout the year, with a bi-monthly maintenance cycle being implemented on all stack monitoring equipment. Filters for the bubbler system and for both tritium-in-air monitors connected to the chart recorder are checked regularly and changed if required, with records are kept on file.

As the calibration of a flow measurement device is only valid for one year, each device is replaced with a calibrated unit on an annual basis. Four new calibrated units were brought into service in June 2015, and the four units with expiring calibration validity were removed from service, and scheduled to be sent for calibration in March 2016.

3.3.7 Stack Monitoring Verification Activities

The annual verification activity for the bubbler systems was performed over two weeks in February 2015, where independent third party measurements provided validation that SRBT bubblers continue to effectively measure weekly gaseous tritium emissions (both HTO and HT).

All results measured and derived by the third party were within the acceptance criteria of +/- 30% of SRBT measurements for both tritium forms, from both active ventilation trains.

3.3.8 Weather Station

Maintenance of the weather station is performed as per the manufacturer's recommendation, every two years.

Maintenance of the weather station was not performed in 2015. It was last performed on October 31, 2014, and is scheduled to be performed next in 2016. All records of the maintenance are kept on file.

4. Core Control Processes SCAs

4.1 SCA – Radiation Protection

4.1.1 Dosimetry Services

During 2015, SRBT maintained a Dosimetry Service License[40], for the purpose of providing in-house dosimetry services for the staff of SRBT and contract workers performing services for SRBT where there existed potential exposure for uptake of tritium.

All dosimetry results were submitted on a quarterly basis to Health Canada in a timely fashion for input to the National Dose Registry. A final annual report was also submitted as required. A total of 47 individual staff members were included in National Dose Registry (NDR) reports at some point in 2015.

SRBT participated in the annual Tritium Urinalysis Performance Test sponsored by the National Calibration Reference Centre for Bioassay, Radiation Surveillance and Health Assessment Division, Radiation Protection Bureau of Health Canada. The participation is a regulatory requirement for Dosimetry Service Providers.

SRBT received the Certificate of Achievement for successful participation in the Tritium Urinalysis Performance Test from the National Calibration Reference Centre for Bioassay and In Vivo Monitoring for the year 2015[41].

SRBT also submitted to the CNSC an Annual Compliance Report for the Dosimetry Service License[42].

4.1.2 Staff Radiation Exposures and Trends

Through the Dosimetry Service License 11341-3-18.1, SRBT assesses the radiation dose to its employees and to contract workers who may have exposure to tritium.

All SRBT staff members are classified as Nuclear Energy Workers and participate in the dosimetry program.

Persons who work in Zones 1 and 2 provide bioassay samples for tritium concentration assessment on a bi-weekly frequency due to the very low probability of uptake of tritium. Persons assigned to work in Zone 3 provide bioassay samples on a weekly frequency due to the higher probability of chronic uptake of tritium.

There were no occurrences of any personnel contamination events in 2015.

The assessment of dose to personnel, due to tritium uptake, is performed in accordance with the Health Canada Guidelines for Tritium Bioassay and CNSC Regulatory Standard S-106, *Technical and Quality Assurance Requirements for Dosimetry Services*, revision 1.

The maximum annual dose received by any person employed by SRBT is well within the regulatory limit for a nuclear energy worker of 50.0 mSv per calendar year.

The maximum annual staff dose was 0.87 mSv with an average for all staff of 0.07 mSv. Collective dose was also low at 3.22 mSv.

The tables found in **Appendix D** of this report provide the radiological dose data for workers at SRBT for 2015, as well as a comparison of dosimetry results for the years 1997 to 2015.

Please note that direct comparison of the dose in 2007 and 2008 to other years may not be informative or appropriate as the facility only processed tritium until January 31, 2007, and only resumed processing tritium in July of 2008.

4.1.3 Action Levels for Dose and Bioassay Level

Dose and bioassay tritium concentration action levels are defined in SRBT's 'Licence Limits, Action Levels and Administrative Limits document[43]. They are as follows:

TABLE 8: ACTION LEVELS FOR RADIATION PROTECTION

PERSON	PERIOD	ACTION LEVEL
NUCLEAR ENERGY WORKER	CALENDAR QUARTER	1.0 mSv
	1 YEAR	3.0 mSv
	5 YEAR	15.0 mSv
PREGNANT NUCLEAR ENERGY WORKER	BALANCE OF THE PREGNANCY	2.0 mSv

PARAMETER	ACTION LEVEL
BIOASSAY RESULT	1,000 Bq / ml FOR ANY PERIOD

In 2015 there were no exceedances of an action level for dose or bioassay tritium concentration at SRBT.

4.1.4 Administrative Limits for Dose and Bioassay Level

Dose and bioassay tritium concentration administrative limits are defined in SRBT's 'Licence Limits, Action Levels and Administrative Limits document[43]. They are as follows:

TABLE 9: ADMINISTRATIVE LIMITS FOR RADIATION PROTECTION

PERSON	PERIOD	ADMINISTRATIVE LIMIT
NUCLEAR ENERGY WORKER	CALENDAR QUARTER	0.75 mSv
	1 YEAR	2.25 mSv

PARAMETER	ADMINISTRATIVE LIMIT
BIOASSAY RESULT	500 Bq / ml FOR ANY PERIOD IN ZONE 3 100 Bq / ml FOR ANY PERIOD IN ZONE 1 OR 2.

In 2015 there was one exceedances of an administrative limit relating to the bioassay tritium concentration measured in a staff member working in Zone 2.

A worker who had been handling a light source that broke while being manipulated exhibited a tritium concentration of 106 Bq / ml of urine, just slightly in excess of the administrative limit.

An investigation was conducted to determine cause, as well to assess if there were corrective or preventative measures that could prevent recurrence of the event. The worker was restricted from handling light sources until their concentration in urine fell to less than half of the administrative limit.

4.1.5 Discussion of Significance of Dose Control Data

4.1.5.1 Maximum Dose

The maximum dose to any staff member in 2015 was 0.87 mSv. This individual works in Zone 3 and performs tritium processing operations in Zone 3 as their primary duty. In 2014 the maximum dose to a staff member was 1.29 mSv – thus 2015 represents a drop of nearly 33% for maximum dose.

This dose value is highly significant, as it represents the achievement of the 2015 objective of less than 1.29 mSv, and thus supports the conclusion that the Radiation Safety Program and the Health Physics Team are achieving a high level of performance, and that workers are properly and adequately trained in safely conducting activities that may pose a radiation hazard.

The continued reduction in maximum dose is attributable to several ongoing initiatives, including: ensuring that no one worker exclusively performs dose-intensive activities; increased use of portable tritium in air monitors during routine operations; changes in the way PUTT valves are manipulated during operations; changes in the design of the PUTT valve (as described in section 3.2, 'SCA – Physical Design'), as well as the continuous oversight of the Health Physics Team during key activities on the shop floor.

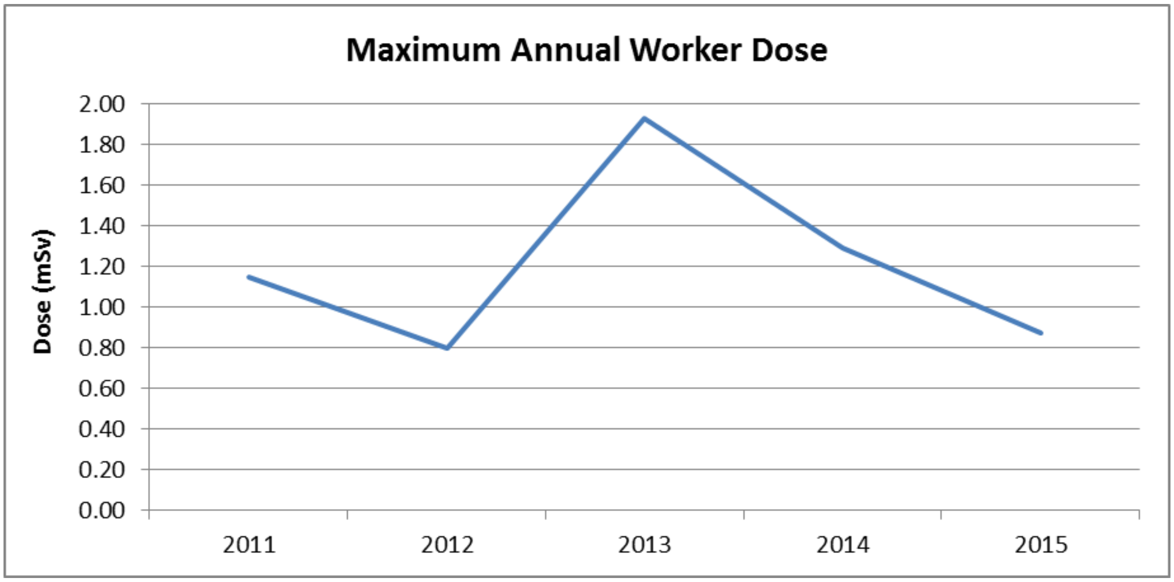
In 2015, the maximum dose to an employee working primarily in Zone 2 was 0.13 mSv and is 0.04 mSv higher than the maximum dose to an employee working primarily in Zone 2 in 2014. This increase is not viewed as a significant change year over year for the type of operations conducted in Zone 2.

The maximum dose to an employee working primarily in Zone 1 was 0.02 mSv and is 0.01 mSv more than the maximum dose to an employee working primarily in Zone 1 in 2014. This is not viewed as a significant change year over year based upon the magnitude of the actual dose being extremely low as expected.

In 2015, the maximum dose to an employee working primarily in administration was 0.08 mSv, a value which is 0.04 mSv higher than 2014. The majority of the radiation dose to this particular administrative employee in 2015 was likely due to several waste management improvement initiatives that required increased residency time in Zone 3 areas.

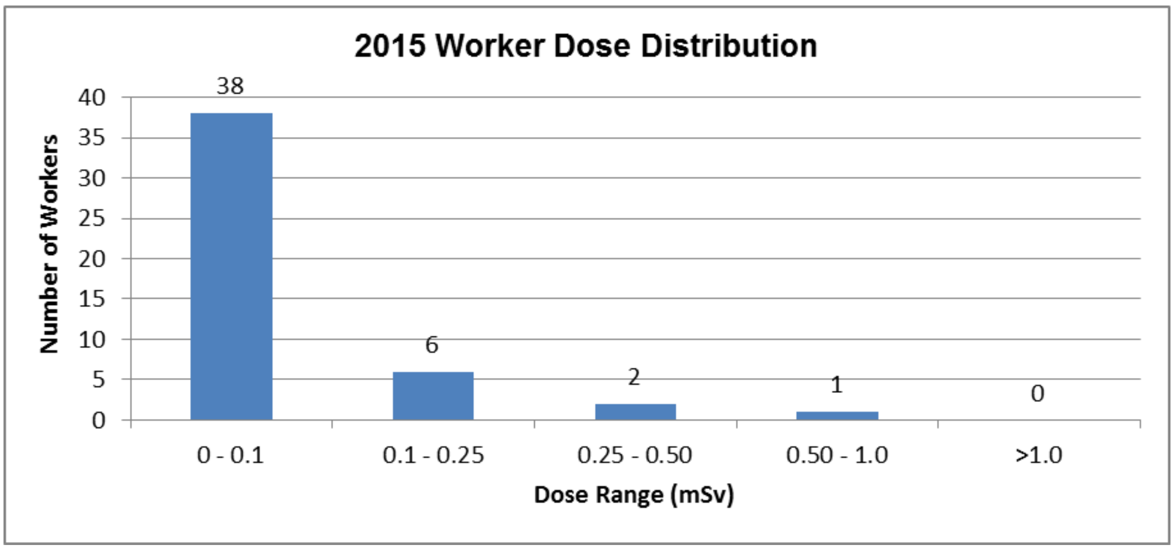
The maximum dose to any worker at SRBT over the past five years is trended below for comparison:

FIGURE 2: MAXIMUM ANNUAL WORKER DOSE TREND



A distribution of maximum worker doses in 2015 is provided here:

FIGURE 3: WORKER DOSE DISTRIBUTION



4.1.5.2 Average Dose

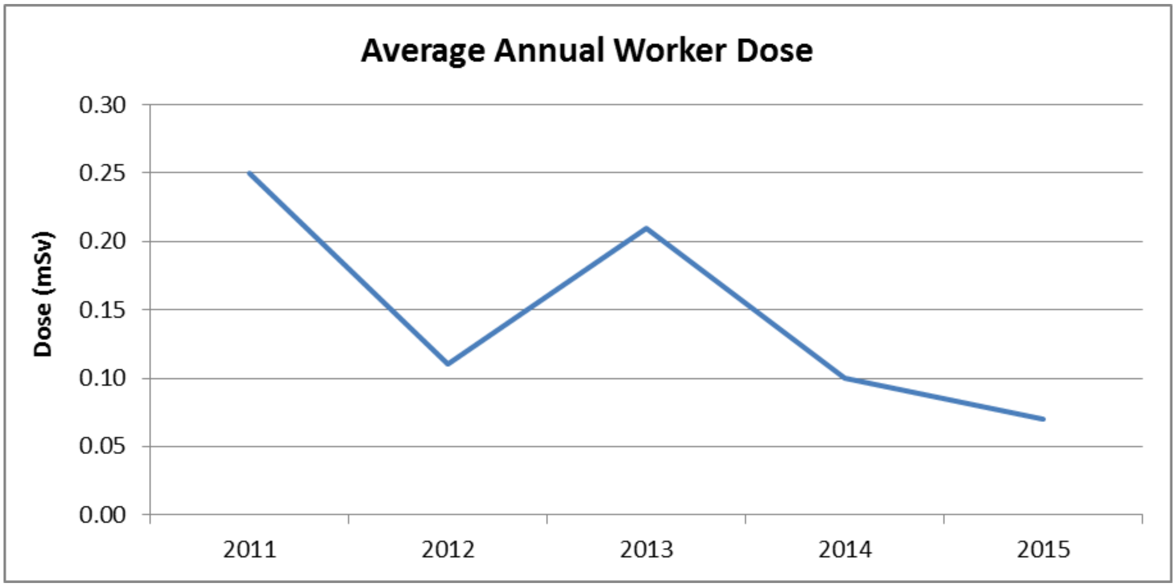
The average dose to workers at SRBT in 2015 was 0.07 mSv. In 2014, the average was 0.10 mSv, thus 2015 represents approximately a 30% reduction in the average dose to staff.

This dose value is somewhat significant, as it is reliant not only on the radiation doses of individuals, but also the number of individuals working at SRBT.

A general trend can be taken over the past two years of data, as the total number of employees having worked or are working as NEWs during this time has been relatively stable, allowing for a direct comparison.

The average dose to workers at SRBT over the past five years is trended below for comparison:

FIGURE 4: AVERAGE ANNUAL WORKER DOSE TREND



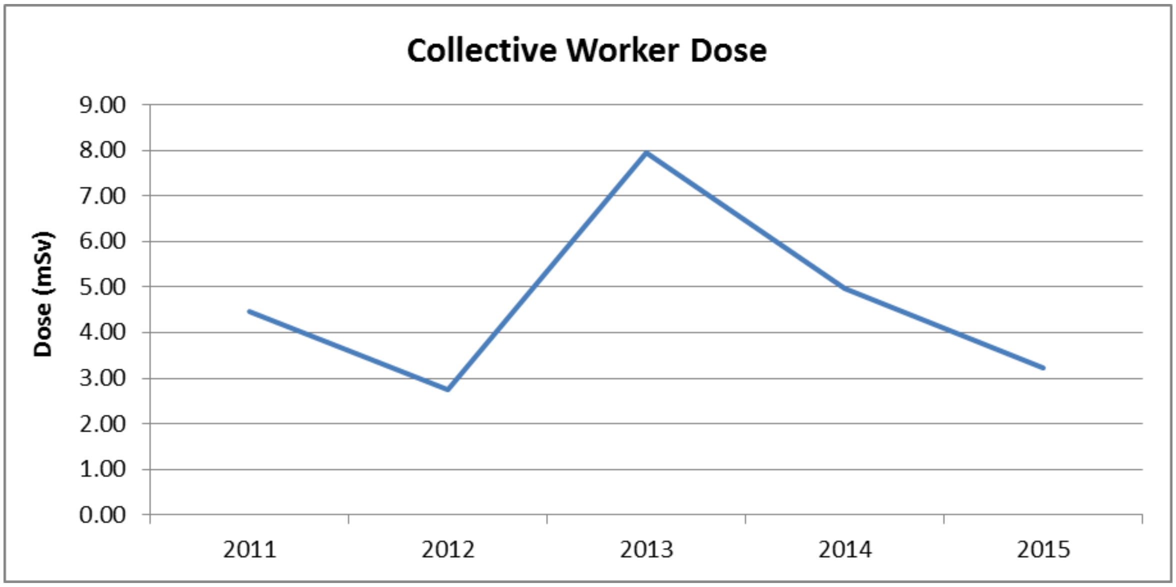
4.1.5.3 Collective Dose

The collective dose to workers at SRBT in 2015 was 3.22 mSv. In 2014, the collective dose was 4.98 mSv; the 2015 collective dose is thus approximately 35% less than the year previous.

As both the number of employees that were exposed to radiation hazards and the amount of tritium processed was relatively consistent between 2014 and 2015, the drop in collective dose is viewed as another significant data point that demonstrates the continued effectiveness of the Radiation Safety Program to protect workers and maintain radiation doses as low as reasonably achievable.

The collective dose to workers at SRBT over the past five years is trended below for comparison:

FIGURE 5: COLLECTIVE DOSE TREND



The averaged quarterly collective dose to employees working primarily in Zone 3 in 2015 was 0.65 mSv, a value which is 0.49 mSv lower than in 2014.

The averaged quarterly collective dose to employees working primarily in Zone 2 in 2015 was 0.08 mSv, a value that is 0.01 mSv higher than in 2014.

The averaged quarterly collective dose to employees working primarily in Zone 1 in 2015 was 0.03 mSv, a value that is 0.02 mSv higher than in 2014.

The averaged quarterly collective dose to employees working primarily in administration in 2015 was 0.06 mSv, a value that is 0.03 mSv higher than in 2014.

4.1.6 Contamination Control and Facility Radiological Conditions

Tritium contamination control is maintained by assessment of non-fixed tritium contamination levels throughout the facility by means of swipe method and liquid scintillation counting of the swipe material.

SRBT has in place the following administrative surface contamination limits:

TABLE 10: ADMINISTRATIVE LIMITS FOR SURFACE CONTAMINATION

ZONE	SURFACES	ADMINISTRATIVE SURFACE CONTAMINATION LIMITS
1	ALL SURFACES	4.0 Bq/cm^2
2	ALL SURFACES	4.0 Bq/cm^2
3	ALL SURFACES	40.0 Bq/cm^2

An overview of swipe monitoring results for 2015 has been tabulated and is included in **Appendix E** of this report. A total of 8,011 swipes were performed in various work areas in 2015.

The data collected shows that 416 swipes were taken in Zone 1 resulting in a pass rate of 96.9% below the administrative level of 4 Bq/cm^2.

The data collected shows that 1,716 swipes were taken in Zone 2 resulting in a pass rate of 96.6% below the administrative level of 4 Bq/cm^2.

The data collected shows that 5,879 swipes were taken in Zone 3 resulting in a pass rate of 93.4% below the administrative level of 40 Bq/cm^2.

All swipe results are reported to the area supervisors. The area supervisor and the Health Physics Team reviews the results to determine where extra cleaning effort is necessary. A comparison of the data for 2014 and 2015 was made:

TABLE 11: PASS RATE FOR CONTAMINATION ASSESSMENTS

ZONE	2014 PASS RATE	2015 PASS RATE
1	97.8%	96.9%
2	93.5%	96.6%
3	93.7%	93.4%

Overall, routine contamination measurements conducted throughout the facility in 2015 fell below the administrative limits 94.3% of the time. This represents a relatively stable trend over the past several years.

4.1.7 Discussion on the Effectiveness of Radiation Protection Program

Based upon the following factors and the overall evidence presented in this report, it is concluded that the SRBT radiation protection program has been effective throughout the year:

- Highest worker dose for 2015 is <2% of regulatory limit, and was less than the regulatory limit for a member of the general public (0.87 mSv),
- Collective dose and average dose continue to trend positively (i.e. a decrease compared to the previous year).
- Contamination control data demonstrates a high level of control and an intolerance for contamination in excess of administrative limits,
- Radiation protection equipment issues are virtually non-existent, with an excellent track record of maintenance and fitness for service,
- Radiation protection training results demonstrate that staff has a good appreciation and knowledge of how to protect themselves from hazards

4.1.8 Summary of Radiation Protection Program Improvements

In 2015, the following improvements were implemented with respect to the Radiation Safety Program at SRBT:

- The new liquid scintillation counters were fully commissioned and put into service for all assay types in 2015, with excellent performance,
- A dedicated technician provided continuous on-the-floor support in all aspects of radiation protection and health physics,
- Three spare portable tritium-in-air monitors were fully refurbished, calibrated and subsequently returned to use,
- A co-op student from the Algonquin College Radiation Safety Program was hired and worked several months over the summer as a dedicated radiation protection resource,
- The annual radiation safety training was enhanced to include a practical contamination control demonstration, including the use and proper removal of protective clothing.

Continuous improvement remains a driving principle behind the implementation of the Radiation Safety Program, and the effort to reduce occupational exposure to radiation in line with the ALARA principle.

4.1.9 Occupational Dose Targets

As described in the 2014 annual compliance report, the occupational dose targets for 2015 were set as 1.29 mSv (maximum dose to staff member) and 0.10 mSv (average dose to all staff).

Both of these targets were achieved, as described above. The maximum dose to any worker was 0.87 mSv, while the average dose to all workers was 0.07 mSv.

SRBT believes that in 2016 both the maximum and average dose to workers can potentially be lowered even further. As a result, the occupational dose targets are set for 2016 as follows:

- Maximum dose: 0.83 mSv, and
- Average dose: 0.065 mSv

4.1.10 Summary of Radiation Protection Training and Effectiveness

All new staff members receive introductory training in radiation safety, even if they were not expected to handle nuclear substances as part of their responsibilities.

In 2015, four employees were hired and were provided with this initial indoctrination training that is required for declaration as a nuclear energy worker. Personnel performed well on the associated test, with no instances of remedial testing required.

On December 10, 2015, SRBT held its annual all-staff training session, which includes a comprehensive training presentation specifically regarding radiation protection concepts and requirements, specifically tailored to the type of hazard at SRBT.

The training session was augmented with a practical demonstration of several concepts relating to contamination control practices, including the use of rubber barriers, protective clothing, the removal of protective clothing, and good work practices in contaminated environments.

Open dialogue was encouraged with a question and answer session, and a closed-book written test was provided to all participants.

A test is administered at the conclusion of the course; in 2015, all participants successfully challenged the test. Results averaged 94.9% with no marks below the pass criterion of 70%. Any wrong answer on the test was also discussed in detail with all employees individually to ensure full understanding.

4.1.11 Summary of Radiation Device and Instrument Performance

All equipment associated with radiation protection at SRBT performed acceptably in 2015, and all maintenance activities (including instrument calibration) was performed as required. This includes:

- Liquid scintillation counters
- Portable tritium in air monitors
- Stationary tritium in air monitors
- Portable radiation detectors (‘RadEye’ type alpha/beta and gamma detectors)

SRBT continues to ensure that all equipment relating to the protection of workers from the hazards associated with tritium are kept fit for service, as required by the Maintenance Program.

4.1.12 Summary of Inventory Control Measures

A summary of inventory control measures can be found in section 2.3, ‘SCA – Operating Performance’.

4.2 SCA – Conventional Health and Safety

4.2.1 Jurisdiction

SRBT is subject to Federal Jurisdiction thus, the Canada Labour Code Part II (CLC Part II) and the Canada Occupational Health and Safety regulations.

4.2.2 Industrial Health and Safety Program

Being under federal jurisdiction in 2015, the Industrial Health and Safety Program for the SRBT facility was compliant with the requirements of the CLC Part II & Canada Occupational Health and Safety regulations.

4.2.3 Responsible Manager Title Change

In 2015, the Health and Safety Specialist position title was changed to more accurately reflect the responsibilities of the person occupying this position in the SRBT organization.

The new title of this manager is the Manager – Safety and Security. Responsibilities with respect to the SCA of Conventional Health and Safety remain the same.

4.2.4 Workplace Health and Safety Committee

In accordance with Section 135(1) of the CLC Part II, SRBT maintains a Workplace Health and Safety Committee.

The Committee is comprised of four representatives. Under section 135(10) of the CLC Part II the Committee is required to meet no less than 9 times per year. The Committee met 12 times in 2015, with all meeting minutes kept on file.

4.2.5 Minor Incidents

There were only two minor incidents where the employee required medical care at the local hospital.

In one incident a worker had a small piece of broken glass enter his eye even though safety glasses were being worn while performing work, as required.

In the second incident, a worker was sent for medical assessment and attention as a preventative measure due possible skin contact with corrosive liquids during the unpacking of a shipment of materials.

In both cases, the required documents were sent to Workplace Safety and Insurance Board (WSIB) with complete reports being kept on file.

Neither of these incidents were defined as a lost-time injury, and both affected employees returned to work either the same or next day as the day the incident occurred.

Both incidents were investigated and examined, and new protective measures or equipment have been implemented in order to prevent recurrences.

4.2.6 Lost Time Incidents

There were no major conventional health and safety related incidents to report in 2015, and no lost-time injuries occurred.

4.2.7 Visits from Employment and Social Development Canada

In 2015, there were no facility visits conducted by representatives of Employment and Social Development Canada.

4.2.8 Reporting

In accordance with Section 15.10 (1) of Part XV of the Canada Occupational Health and Safety Regulations the Employer's Annual Hazardous Occurrence Report was submitted to Human Resources and Skills Development Canada (HRSDC) as required.

In accordance with Section 10 of the Safety and Health Committees and Representatives Regulations, the Work Place Committee Report was submitted to the Regional Safety Officer at Canada Labour prior to March 1, 2015, as required.

4.2.9 Health and Safety Training

The Health and Safety Specialist (now the Manager – Safety and Security) had attended a Health & Safety Conference in Ottawa on October 2015 and took part in training seminars that included:

- WHMIS 2015 & GHS – What You Need To Know
- Sitting Disease: Why You Need To Change The Way You Work
- Health & Safety Compliance – Making Managers and Supervisors Part of the Solution
- Unpaid Workers – Are You Taking Due Care?

4.3 SCA – Environmental Protection

This section of the report will provide environmental and radiological compliance including results from environmental, effluent and groundwater monitoring, an assessment of compliance with any licence limits, historical trending where appropriate, and quality assurance/quality control results for the monitoring.

As part of the January 2016 action plan associated with the gap analysis of several N288-series of standards[44], SRBT has committed to ensuring that the information required by each applicable in-force standard to be reported annually pertaining to the environmental monitoring, effluent monitoring and groundwater monitoring programs is included with this annual compliance report, and all subsequent reports.

A summary of the requirements of each of the applicable standards is provided here.

N288.4-10: Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills: Section 11.2.2 – "The report shall include":

TABLE 12: REPORTING REQUIREMENTS (N288.4-10)

	REQUIREMENT	REPORT SECTION
a	The results of the EMP, including measurements of the monitored hazardous and/or nuclear substances, physical stressors, and physical and biological parameters, including their statistical analyses (i.e. assessment of changes through space and time).	4.3.1 **Appendices F through N**
	Radiation doses calculated as doses to receptors where this is required.	4.3.5 **Appendix S**
	An assessment of the EMP results compared with the previous performance indicator targets.	4.3 Reference is made to previous years for performance indication.
	Documentation and justification of any deviations from field sampling, and analytical and data management procedures.	4.3.1.9 4.3.1.10
b	A summary and assessment of the field and laboratory QA/QC results including any non-conformances.	4.3.1.11
c	A summary of the audit and review results and subsequent corrective actions.	4.3.7
d	A summary of any proposed modifications to the EMP.	4.3.8
e	Documentation, assessment and review of any supplementary studies that have been initiated, completed, or both.	4.3.1.12

N288.5-11: Effluent monitoring programs at Class I nuclear facilities and uranium mines and mills: Section 11.2.2 – "The report shall include the results of the effluent monitoring program, including at least":

TABLE 13: REPORTING REQUIREMENTS (N288.5-11)

	REQUIREMENT	REPORT SECTION
a	The amount or concentration of radioactive nuclear substances and hazardous substances released, as required to demonstrate compliance with regulatory limits and performance with respect to any other release target (e.g., action levels).	4.3.2 **Appendices O and P**
b	The characteristics of the effluents.	4.3.2
c	The results of any toxicity testing conducted (if required).	Not applicable
d	A summary and assessment of the field and laboratory QA/QC results, including any non-conformance.	4.3.2.4
e	A statement of uncertainties inherent in the monitoring results and any dose estimates derived from them.	4.3.2.5 Dose estimates are derived using EMP data
f	A summary of the audit and review results and subsequent corrective actions.	4.3.7
g	A summary of any proposed modifications to the effluent monitoring program.	4.3.8
h	Documentation, assessment, and review of any supplementary studies that have been initiated or completed, or both.	4.3.2.6

N288.7-15: Groundwater protection programs at Class I nuclear facilities and uranium mines and mills: Section 11.1 – "A facility should prepare annual monitoring reports documenting the GWMP, which include the following":

TABLE 14: REPORTING REQUIREMENTS (N288.7-15)

	REQUIREMENT	REPORT SECTION
a	The results of the GWMP including i) completeness of monitoring activities (identify if all planned activities were accomplished); ii) measurements of the monitored substances, biological, and hydrogeological parameters based on program objectives; and iii) data analysis and interpretations.	4.3.3 **Appendix Q**
b	Relevant groundwater and hydrogeological characteristics.	4.3.3 **Appendix R**
c	Doses calculated for the identified receptors (if doses have been calculated to aid in interpreting GWMP results).	4.3.5 **Appendix S**
d	A summary and assessment of the field and laboratory QA results, including any non-conformances.	4.3.3.3
e	A statement of uncertainties inherent in the monitoring results and any dose estimates derived from them (where applicable).	4.3.3.4 4.3.5
f	Documentation of any supplementary studies that have been initiated, completed, or both (with references to the original studies).	4.3.3.5
g	An overall statement of data quality and discussion of results in terms of data performance and acceptance criteria.	4.3.3.6
h	Discussion of monitoring results in terms of program objectives and the conceptual site model.	4.3.3.7
Note 1	A summary of any audits performed, their results, and any corrective actions taken as a result of the audit's findings may also be included in the reporting.	4.3.7

4.3.1 Environmental Monitoring

SRB Technologies (Canada) Inc. implements a comprehensive Environmental Monitoring Program (EMP)[45] that provides data for site-specific determination of tritium concentrations along the various pathways for exposure probabilities to the public due to the activities of the operations. Most samples are analyzed and collected by a third party contracted by SRBT.

4.3.1.1 Passive Air Monitoring

A total of 40 passive air samplers (PAS) are located throughout a two kilometer radius from the SRBT facility, in eight sectors, ranging in distance at 250, 500, 1,000, and 2,000 meters.

The samples were collected on a monthly basis by a third party laboratory for tritium concentration assessment by the third party laboratory.

Several duplicate samplers are included for quality assurance purposes. Several samplers are also located specifically to provide data for assessment of the defined critical group members. PAS results for 2015 can be found in the table in **Appendix F** of this report.

The table shows the HTO concentrations for the samplers located in each of the eight compass sectors. The correlation for the results of the samplers as they increase in distance from the facility is quite evident. The patterns of the lines are very similar in most cases. Tritium oxide in air concentrations for each month of 2015 are graphically represented for each of eight compass sectors and for each of the distances from the facility and are found in **Appendix G** of this report.

The PAS`s represent the tritium exposure pathways for inhalation and skin absorption; results are used in the calculations for critical group annual estimated dose for 2015.

The sum of the average concentration for all 40 PAS`s in 2015 was 54.74 Bq/m^3 a value that trends well with the value observed in 2014 (49.74 Bq/m^3).

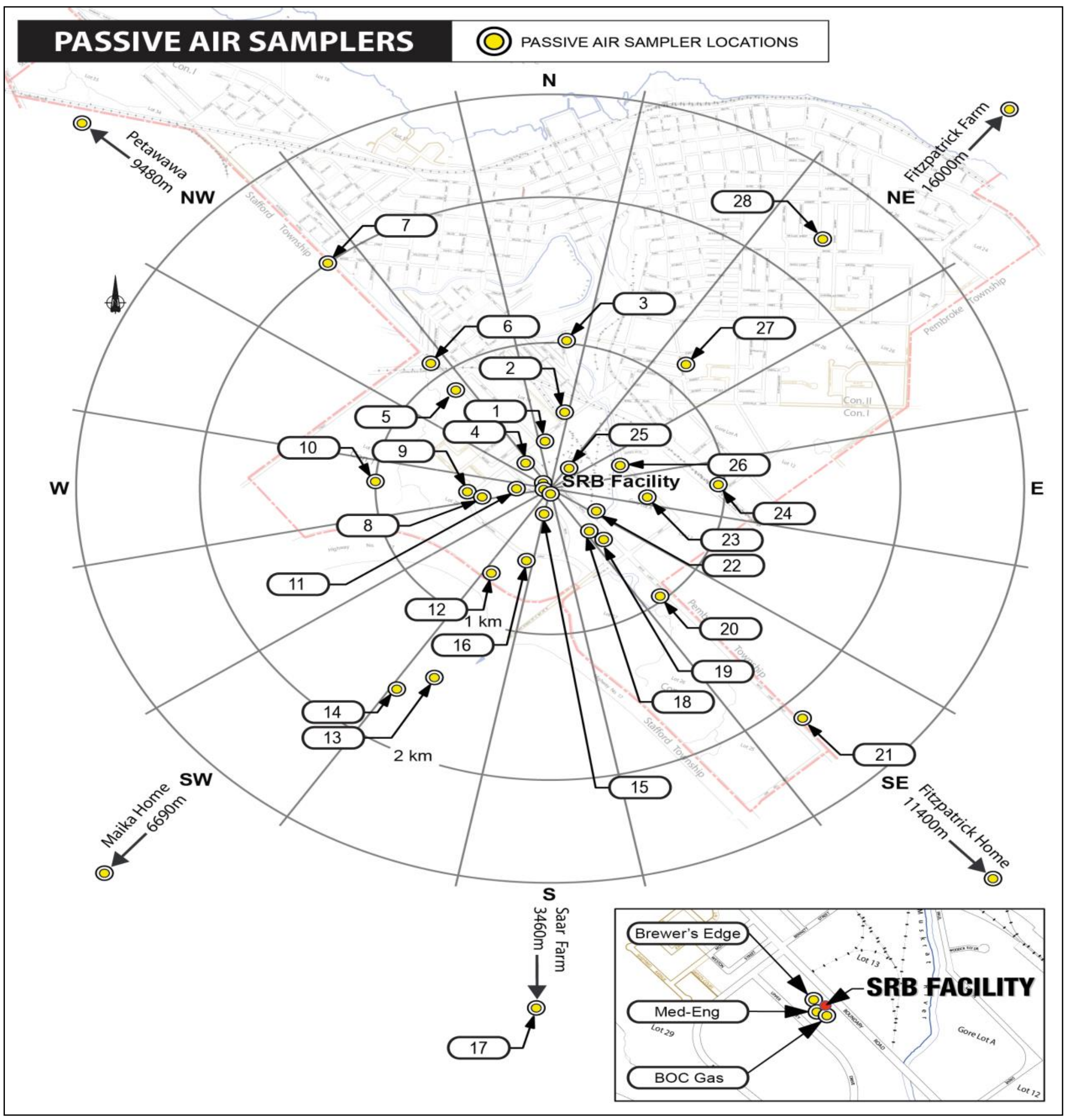
Total tritium emissions in 2015 were 56,237 GBq, 85% of the emissions in 2014 (66,161 GBq). The reduction in total emissions is very much dominated by a decrease in the amount of elemental tritium being released each processing run. This in turn is due to several continuing initiatives that are discussed later in this section, as well as the continued use of higher resolution real-time emission data using the digital data recorder (allowing staff to take actions to reduce emissions at even lower levels).

Facility emissions of tritium oxide (HTO) were slightly elevated in 2015 (11,554 GBq) versus 2014 (10,712 GBq). The percentage increase of HTO emissions (+7.9%) correlates very well with the increase in cumulative average of all PAS data (+10.1%), suggesting excellent correlation between these two parameters. The increase in HTO emissions is likely due to environmental effects such as humidity.

The data relating to PAS in 2015 continues to demonstrate that the environmental monitoring program collects data that consistently reflects the emissions from the facility.

The relative positioning of the PAS array used as part of the EMP is provided here:

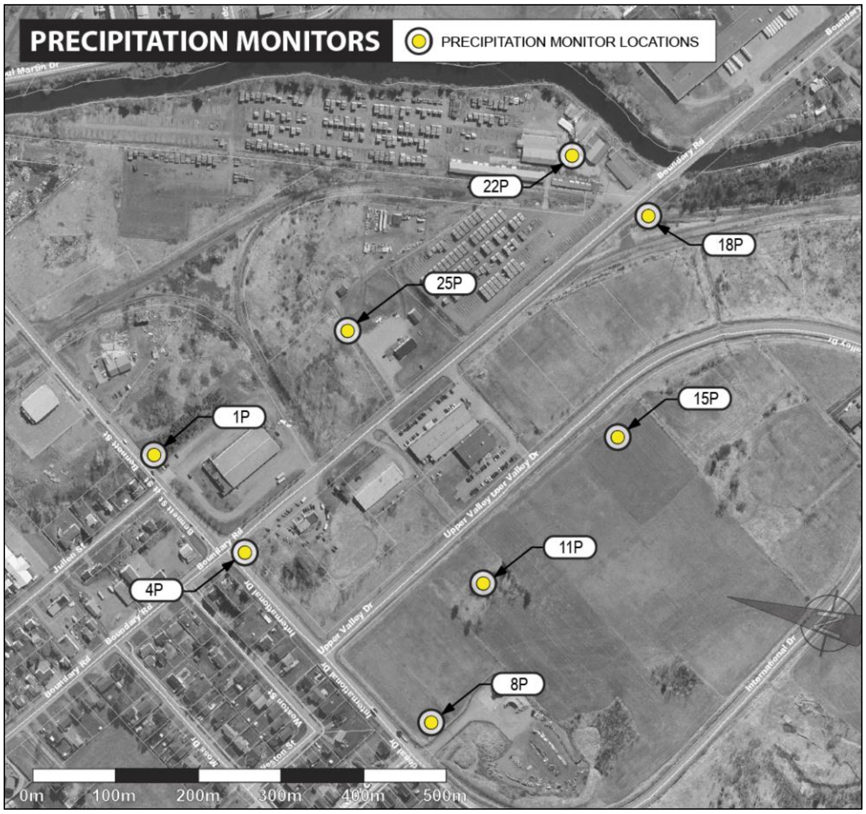
FIGURE 6: LOCATION OF PASSIVE AIR SAMPLERS



4.3.1.2 Precipitation Monitoring

Eight precipitation monitors are installed near existing air monitoring stations that are located approximately 250 m from the facility.

FIGURE 7: LOCATION OF PRECIPITATION MONITORS



The samples were collected on a monthly basis by SRBT and a third party laboratory for tritium concentration assessment by the third party laboratory. Average results in 2015 ranged between 19 Bq/L (sampler 11P) and 201 Bq/L (sampler 4P).

The average tritium concentration for all eight precipitation monitors in 2015 was 70 Bq/L, an increase compared to the 2014 average of 42 Bq/L.

One sample taken during the November sampling period was measured at 1,621 Bq/L; this value significantly affects the averages for both sampler 4P as well as the overall value. Removing this value results in sampler 4P having an average of 72 Bq/L, with the overall average of 53 Bq/L – very much comparable with the 2014 data.

The high precipitation concentration at 4P during this period coincides with elevated results from PAS sampling stations in the northwest sector during the same period. The PAS result from the station at 250 m to the northwest (where precipitation monitor 4P is also located) was also significantly elevated (24.4 Bq/m^3).

Emissions for the period in question were not abnormally elevated, and there were no instances of a large, single release occurring of concern.

SRBT analyzed the weather data for the period in question in order to determine the likely cause of such elevated results, and concluded that the most likely cause was an abrupt and sudden change in the local weather on November 6, 2015.

Tritium processing was being performed during the morning while the wind was blowing south; however, a significant storm arrived around 1100h, resulting in a dramatic shift of the wind direction towards the northwest sector, coupled with a downpour of rain over a very short time period.

Processing was stopped as soon as precipitation was detected, as required. It is likely that the processing operations performed just prior to the weather shift, coupled with the downdraft and heavy precipitation experienced in a short time period, entrained a significant amount of tritium, resulting in the abnormally high values observed in the PAS and precipitation monitor.

Precipitation monitoring results for 2015 and comparisons can be found in **Appendix H** of this report.

4.3.1.3 Receiving Waters Monitoring

Samples of receiving waters downstream from SRBT in the Muskrat River were collected regularly. Samples were collected by SRBT and a third party laboratory for tritium concentration assessment by the third party laboratory.

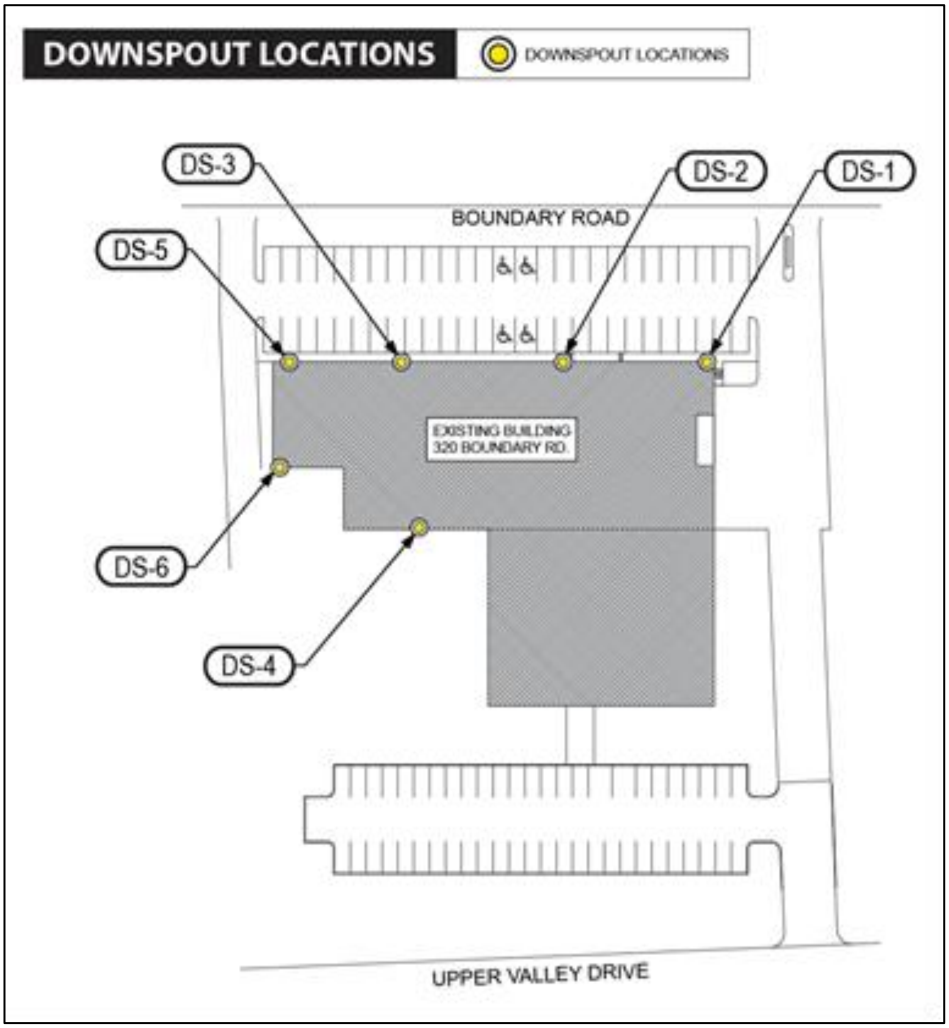
All obtained samples of receiving waters in 2015 fell below the minimum detectable activity for tritium concentration, (between 5-6 Bq/L), with one exception where a duplicate sample was measured at 7 Bq/L (+/- 2 Bq/L) in September.

Receiving waters monitoring results for can be found in **Appendix I** of this report

4.3.1.4 Downspout Runoff Monitoring

Tritium concentrations are measured in all facility downspouts. The samples were collected periodically by SRBT for tritium concentration assessment.

FIGURE 8: LOCATION OF FACILITY DOWNSPOUTS



Runoff from downspouts was collected during four precipitation events throughout 2015, with no measurement greater than 100 Bq/L (a value noted as the minimum detectable activity for the assay). The average tritium concentration for downspouts in 2014 was 267 Bq/L.

Runoff monitoring results can be found in **Appendix J** of this report.

4.3.1.5 Produce Monitoring

Produce from a local market and from two local gardens were sampled in 2015. The number of gardens tended by members of the public that were volunteered for sampling decreased from previous years; several previous participants did not elect to have SRBT obtain samples, or could not be contacted despite numerous attempts.

The samples were collected and assessed by a third party laboratory to establish free-water tritium concentration. In addition, a second independent laboratory participated in the sampling of produce in order to provide an additional measure of confidence and comparison of results.

The official results were derived from the traditionally used third party, and reported to the members of the public and posted on the web site. This data is also used in the calculations for critical group annual estimated dose for 2015.

The average free water tritium concentration in produce offered by local residents in 2015 was 113 Bq/L, a value that is on par with the measured tritium concentration in produce for 2014 of 118 Bq/L.

The average free water tritium concentration in produce offered by the local market was 7.6 Bq/L, a significant decrease from the 177 Bq/L average observed in 2014.

Results between the two independent laboratories were very comparable for the same sample type, as illustrated below:

TABLE 15: PRODUCE SAMPLE ANALYSIS INTERCOMPARISON

SAMPLE	UNITS	LAB 1	LAB 2
408 BOUNDARY ONION	Bq/L	179	136
408 BOUNDARY CUCUMBER	Bq/L	129	126
408 BOUNDARY TOMATO	Bq/L	153	135
413 SWEEZY CUCUMBER	Bq/L	83	74
413 SWEEZY BEET	Bq/L	60	49
BOUDENS TOMATO	Bq/L	10	10
BOUDENS CUCUMBER	Bq/L	6	10
BOUDENS ZUCCHINI	Bq/L	10	7
BOUDENS ONION	Bq/L	6	7
BOUDENS POTATO	Bq/L	6	9

Produce monitoring results and locations for calendar year 2015 can be found in **Appendix K** of this report with graphs comparing 2006 to 2015 results.

4.3.1.6 Milk Monitoring

Milk from a local producer and from a local distributor is sampled every four months. The samples were collected by SRBT and a third party laboratory for tritium concentration assessment by the third party laboratory. This data is also used in the calculations for critical group annual estimated dose for 2015.

Milk monitoring results and locations for 2015 can be found in **Appendix L** of this report. Tritium concentrations in milk for 2015 remained very low, with a maximum detected concentration at 4 Bq/L, just above the minimum detectable activity (MDA) of 3 Bq/L.

4.3.1.7 Wine Monitoring

Wine from a local producer is sampled once a year. The sample was collected by a third party laboratory for tritium concentration assessment by the third party laboratory.

Wine monitoring results for 2015 remain low at 14 Bq/L; annual data can be found in **Appendix M** of this report with a graph comparing results from 2006 to 2015.

4.3.1.8 Weather Data

A weather station near the facility collects data on a continuous basis. See weather data for 2015 in **Appendix N**.

4.3.1.9 Deviations from Field Sampling Procedures

In 2015, there were no noted deviations from field sampling procedures and protocols by our third party independent laboratory conducting all field work.

4.3.1.10 Deviations from Analytical and Data Management Procedures

In 2015, there were no noted deviations from EMP analytical and data management procedures.

4.3.1.11 Field and Laboratory QA/QC Results and Non-conformances

Field and laboratory operations conducted by the independent third party laboratory include several quality assurance and quality control activities.

Field QA/QC activities include duplicate sampling of five passive air sampler stations, duplicate sampling of the Muskrat River, and the use of trip / method blanks for each type of sample obtained in the field.

Laboratory QA/QC activities include tritium spiking of certain collected samples and blanks, as well as laboratory reference standards for low and high activity concentrations. Sample QC is tested using spike recovery and relative percent difference tests.

In 2015 there were no reported non-conformances relating to EMP field and laboratory QA/QC activities, and none were raised by SRBT after further assessment of raw data from the independent laboratory.

4.3.1.12 Supplementary Studies – 2015

There were no supplementary studies initiated or completed relating to the SRBT EMP in 2015.

4.3.2 Effluent Monitoring

SRBT monitors two main effluent streams from the facility for tritium.

Tritium releases via the gaseous effluent pathway (active ventilation) are monitored in real time, with integrated measurements being conducted weekly to determine total emissions and verify compliance with licence limits and action levels.

Liquid effluent is retained in batches and analyzed for tritium concentration prior to being released to sewer.

4.3.2.1 Gaseous Effluent

In 2015, SRBT operated well within release limits to atmosphere that are prescribed as part of the operating licence of the facility. The renewed licence (NSPFOL-13.00/2022)[2] references release limits defined in Appendix E of the Licence Conditions Handbook[4].

A summary of the releases of tritium oxide and total tritium in 2015 is tabulated below:

TABLE 16: GASEOUS EFFLUENT DATA (2015)

NUCLEAR SUBSTANCE AND FORM	LIMIT (GBq/YEAR)	RELEASED (GBq/YEAR)	RELEASED (GBq/WEEK)	% OF LIMIT
TRITIUM AS TRITIUM OXIDE (HTO)	67,200	11,554	222	17.19%
TOTAL TRITIUM AS TRITIUM OXIDE (HTO) AND TRITIUM GAS (HT)	448,000	56,237	1,081	12.55%

Please refer to **Appendix O** for a complete data set on tritium releases to atmosphere in 2015.

For comparison, in 2014 HTO emissions were 15.94% of the licence limit, while total tritium emissions were 14.77% of the licence limit.

Total air emissions in 2015 decreased by 15% of what they were in 2014, while tritium processed decreased by just 2.5%. This is indicative of continued success in reducing process-based emissions as part of SRBT’s Emissions Reduction Initiative.

Details on the past five years of gaseous effluent data are provided below for ease of trend analysis:

TABLE 17: GASEOUS EFFLUENT DATA (2011-2015)

NUCLEAR SUBSTANCE AND FORM	RELEASED 2011 (GBq)	RELEASED 2012 (GBq)	RELEASED 2013 (GBq)	RELEASED 2014 (GBq)	RELEASED 2015 (GBq)
TRITIUM AS TRITIUM OXIDE (HTO)	12,504	8,356	17,824	10,712	11,554
TOTAL TRITIUM AS TRITIUM OXIDE (HTO) AND TRITIUM GAS (HT)	55,684	29,905	78,875	66,161	56,237

When analyzing the operation's performance at reducing emissions it is important to analyze the releases to atmosphere against the tritium processed. This provides an indication at how effective emission reduction initiatives have been successful in reducing emissions.

The following table defines the ratio of tritium released to atmosphere against tritium processed from 2008:

TABLE 18: TRITIUM RELEASED TO ATMOSPHERE vs PROCESSED (2008-2015)

YEAR	TRITIUM RELEASED TO ATMOSPHERE (GBq/YEAR)	TRITIUM PROCESSED (GBq/YEAR)	% RELEASED TO PROCESSED	% INCREASE (+) REDUCTION (-)
2008	40,100	2,356,979	1.70	N/A
2009	40,547	5,045,720	0.80	- 53%
2010	36,426	6,643,732	0.55	- 31%
2011	55,584	7,342,449	0.76	+ 38%
2012	29,905	10,224,590	0.29	- 62%
2013	78,875	30,544,759	0.26	- 10%
2014	66,161	28,714,119	0.23	-12%
2015	56,237	27,989,832	0.20	-13%

SRBT was once again able to achieve an overall reduction in the amount of tritium emitted from the facility for every unit of tritium processed. Since 2008, this key performance ratio has decreased by a factor of more than eight. Put another way, SRBT released approximately the same amount of tritium to the gaseous effluent pathway in 2015 as was released in 2011; however, the amount of tritium processed in 2015 was nearly four times greater than in 2011.

4.3.2.2 Air Emission Target

SRBT set a total tritium emission target at the beginning of 2015 of 1,271 GBq / week, and was successful in meeting this target (1,081 GBq / week).

For calendar year 2016, SRBT has set a total tritium emission target of **1,000 GBq / week or less,** on average. This would represent a 7.5% reduction compared to the weekly average achieved in 2015.

4.3.2.3 Action Level Exceedance

In 2015, a single action level exceedance was reported relating to tritium releases to atmosphere.

This exceedance occurred during the period of May 26 – June 2, 2015, where 16,946.80 GBq of total tritium was released compared to a weekly action level of 7,753 GBq, representing 219% of the action level for the week.

This release constituted 3.78% of the annual release limit for total tritium.

SRBT conducted an investigation and identified contributing causes, root causes and corrective actions. SRBT's investigation concluded that the higher tritium emissions were related to two root causes – service-related degradation of the packing on a process valve, and operation of the valve during processing at an inappropriate point in the process.

Since the event occurred, SRBT has taken several actions to reduce the probability of recurrence, including investigating new types of valves that would reduce the probability of leakage over time, coaching all qualified technicians on the event and its causes, and incorporating the lessons learned from the event into the SAT-based training on tritium processing operations.

SRBT submitted the report and corrective action plan[6] which was accepted by CNSC staff[7]. Both the initial[46] and final detailed report[6] on this event were posted to our public website, in accordance with our Public Information Program[33].

4.3.2.4 Liquid Effluent

In 2015, SRBT operated well within release limits to sewer that are prescribed as part of the operating licence of the facility. The renewed operating licence (NSPFOL-13.00/2022) references release limits defined in Appendix E of the Licence Conditions Handbook.

TABLE 19: LIQUID EFFLUENT DATA (2015)

NUCLEAR SUBSTANCE AND FORM	LIMIT (GBq/YEAR)	RELEASED (GBq/YEAR)	% OF LIMIT
TRITIUM – WATER SOLUBLE	200	6.5	3.27%

Total liquid effluent releases in 2015 decreased significantly when compared to 2014 values (6.5 GBq in 2015 vs. 12.5 GBq in 2014) due to several factors, including a continued reduction in the amount of failed leak tests of manufactured light sources, and process improvements leading to a lower tritium in air concentration during the summer, thus reducing the concentration of tritium in air conditioner and dehumidifier drain water.

Details on the past five years of liquid effluent data are provided below for ease of trend analysis:

TABLE 20: LIQUID EFFLUENT DATA (2011-2015)

NUCLEAR SUBSTANCE AND FORM	RELEASED 2011 (GBq)	RELEASED 2012 (GBq)	RELEASED 2013 (GBq)	RELEASED 2014 (GBq)	RELEASED 2015 (GBq)
TRITIUM – WATER SOLUBLE	7.8	12.0	9.1	12.5	6.5

Please refer to **Appendix P** for a complete data set of releases to sewer in calendar year 2015.

4.3.2.5 Summary of Field and Laboratory QA/QC

Effluent monitoring activities include several procedural steps that ensure acceptable quality assurance and control, including duplicate / triplicate sample acquisition and measurement, the use of process blanks, and the measurement of known reference standards as part of the assay of activity in collected sample media. All QA/QC results obtained in 2015 were acceptable; no non-conformances were identified.

4.3.2.6 Statement of Uncertainties Inherent in Monitoring Results

Uncertainties associated with effluent monitoring at SRBT may be present at several points in the process.

For gaseous effluent, such uncertainties include: sampling representativeness, total airflow collected, catalytic efficiency of HT to HTO conversion, capture efficiency of sample media, standard measurement errors associated with liquid scintillation counting, sample acquisition errors such as volume of drawn sample for analysis, and errors in stack flow rate and differential pressure measurement.

For liquid effluent, such uncertainties include: sample volume, liquid effluent volume, standard measurement errors associated with liquid scintillation counting, and sample acquisition errors such as volume of drawn sample for analysis.

In order to ensure that the uncertainties inherent in monitoring results are kept acceptably low, SRBT ensures that a third party laboratory conducts independent verification procedures on the gaseous effluent monitoring system on an annual basis. Allowable deviation between the assessed measurement of gaseous emissions is +/- 30%; in 2015, results were well within this acceptance criteria.

The QA/QC processes associated with gaseous effluent monitoring contribute to the confidence in the results. This includes independent verification of the assessment of gaseous releases at several levels. As well, the data gathered from the EMP is assessed against the data from the gaseous effluent monitoring process on a frequent basis to verify that results are relatively consistent with each other.

For liquid effluent, uncertainties inherent in monitoring results are addressed by QA/QC processes associated with liquid effluent monitoring, as well as independent verification of the assessment of releases.

The inherent uncertainties associated with effluent monitoring are well within acceptable bounds when contrasted against the measured releases, and the licenced limits for releases by each pathway.

4.3.2.7 Supplementary Studies

In 2015, no supplementary studies were conducted relating to effluent monitoring at SRBT.

4.3.2.8 Hazardous Substance Releases to Air

In 2015 SRBT continued to make releases of hazardous substances to the air under a Certificate of Approval (Air), number 5310-4NJQE2[47], issued by the Ontario Ministry of the Environment in accordance with section 9 of the Ontario Environmental Protection Act.

4.3.3 Groundwater Monitoring

Based on our groundwater studies[48] and ensuing reports, SRBT maintains a comprehensive groundwater monitoring program as part of our overall Environmental Monitoring Program.

Groundwater data is reported to CNSC staff on a monthly basis, within 30 days of sampling, as required by Licence Conditions Handbook section 4.2, clause 2.

Dedicated, engineered sampling wells are used to establish tritium concentrations in the groundwater each month at various depths and in differing geologic strata. Variations are trended over time to measure the response of historical contamination of the local aquifer.

Since the program was established, groundwater measurements have been in very good agreement with established hydrogeological modelling predictions.

While most of the released tritium in the air is dispersed, some of it will reach the soil through dry and wet deposition. Infiltrated precipitation water brings tritium into the groundwater below it. The deposition of tritium on and around the facility from air emissions and resulting soil moisture and standing water are the sole direct contributor to tritium found in groundwater.

Groundwater is affected by the percolation of soil moisture and standing water from the surface. Current concentrations in the wells are expected to gradually decrease once all historical emissions have flushed through the system and/or decayed with some influence of higher concentrations in nearby wells from lateral underground water flow.

This will be confirmed by continuous monitoring of the existing network of wells. The rate at which this decrease will occur is dependent on the level and speed of recharge of the groundwater on and around the SRBT facility.

In 2015, 384 samples of groundwater were obtained and analyzed, with all planned groundwater monitoring activities being accomplished, except for the following:

- MW07-21 was not monitored for the first seven months of the year as the well cap had heaved over the winter, resulting in the need for repair in order to begin acquiring samples again. Repair could not be effected until the summer due to ground conditions near the well. The repair was completed in July, and the well sampling resumed with the August set of samples. NCR-468 was raised to capture the corrective measures taken to repair the well.

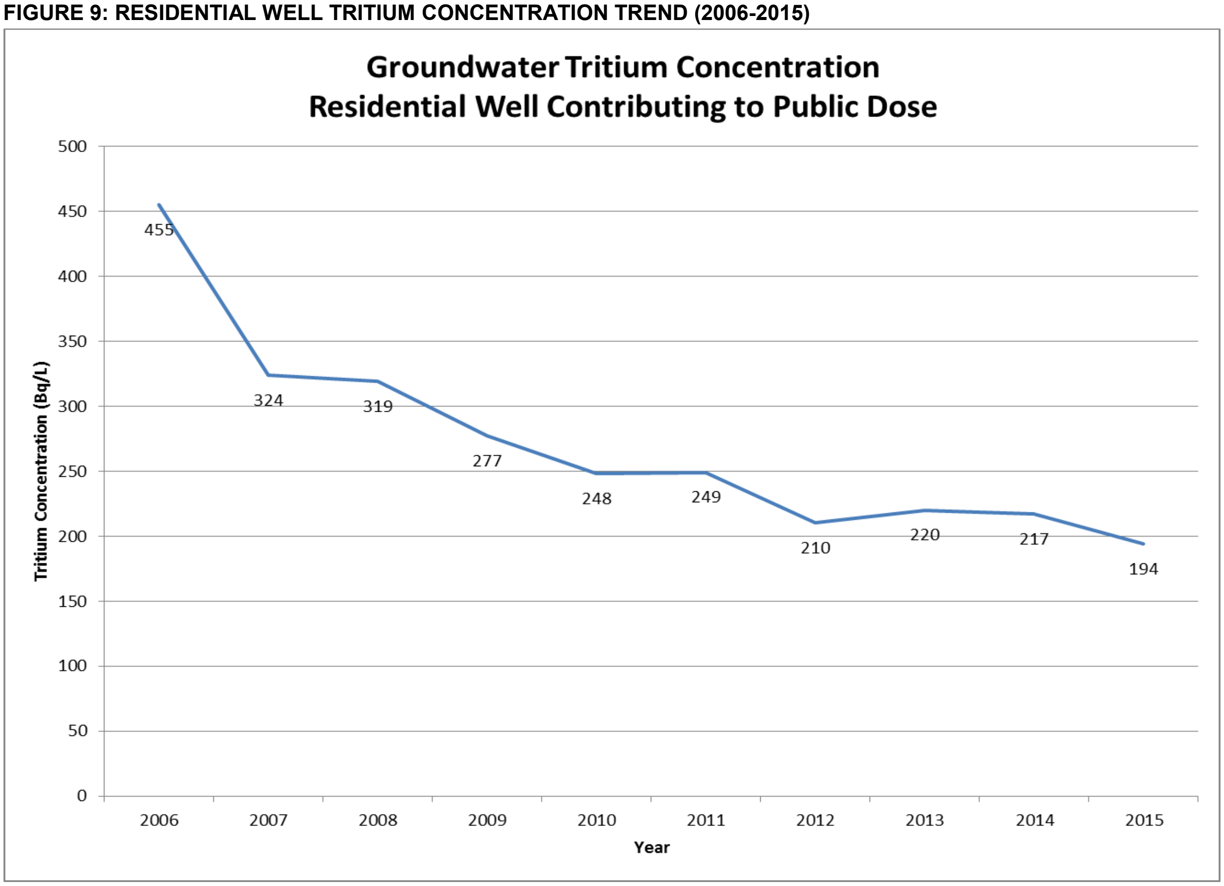
- Several samples in March were not acquired due to the well being dry or being inaccessible. This is not an uncommon occurrence depending on the conditions experienced in the fall and winter months. For those wells that were not sampled in March, samples were successfully acquired in April.
- In total, throughout 2015 there were 19 instances where a monitoring well sample could not be obtained at the time of sampling. As a comparison, in 2014 this occurred 21 times.

4.3.3.1 Groundwater Tritium Concentration

In 2015 SRBT has continued to provide a compilation of the entire set of groundwater monitoring data to CNSC staff on a monthly basis. Well monitoring results can be found in **Appendix Q** of this report.

Several local residences permit SRBT to acquire samples three times annually, to provide additional data for our program. In 2015, the highest average residential well tritium concentration value was RW-08, measured at 194 Bq/L, a value that continues trend downward, and remains far below the Ontario Drinking Water Quality Standard of 7,000 Bq/L.

FIGURE 9: RESIDENTIAL WELL TRITIUM CONCENTRATION TREND (2006-2015)

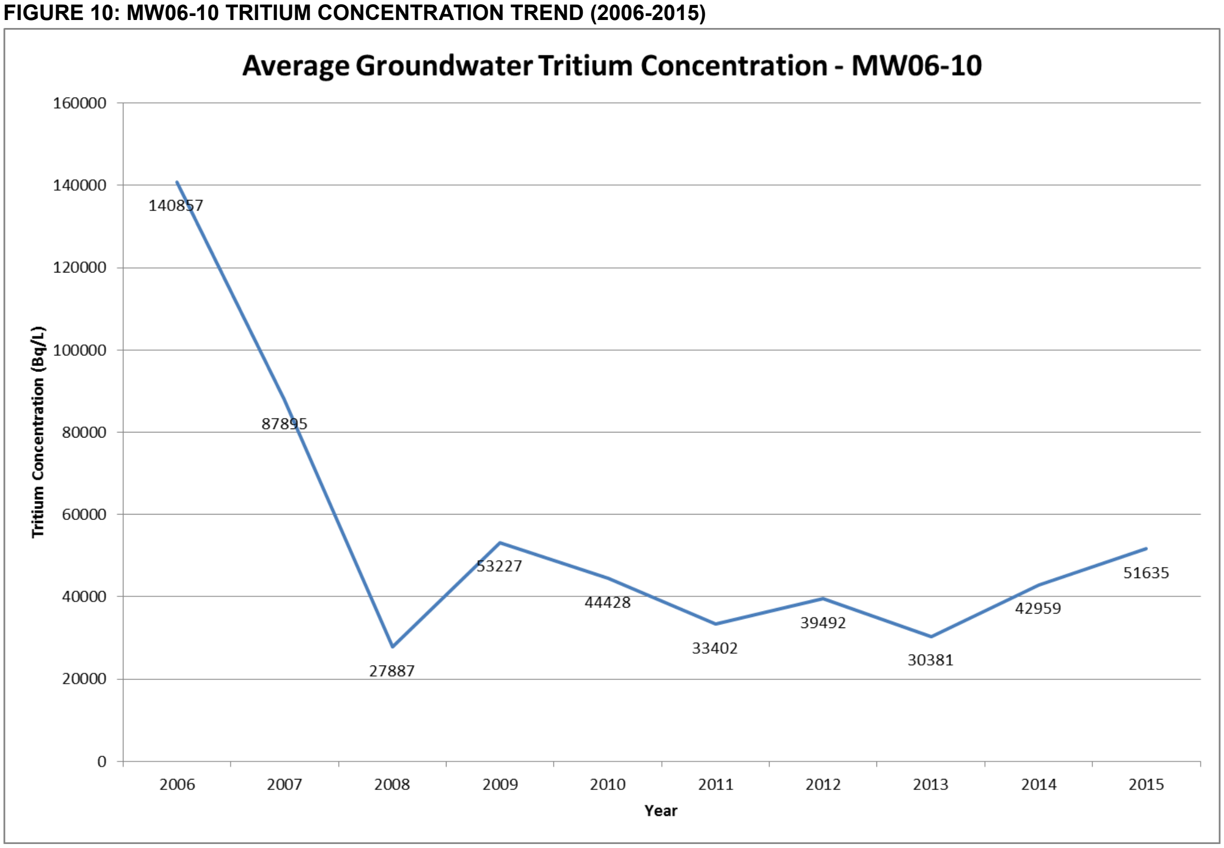


More importantly, public dose values attributed to groundwater consumption have decreased significantly over the past several years as a direct result of our efforts to minimize our environmental impact.

Of the now 34 dedicated, engineered monitoring wells that surround the SRBT facility, the concentrations of only two wells exceed the Ontario Drinking Water Guideline of 7,000 Bq/L. These two wells (MW06-10 and MW07-13) are located on the SRBT site within 50 meters of the stacks. In 2007, the concentration of 8 wells exceeded 7,000 Bq/L.

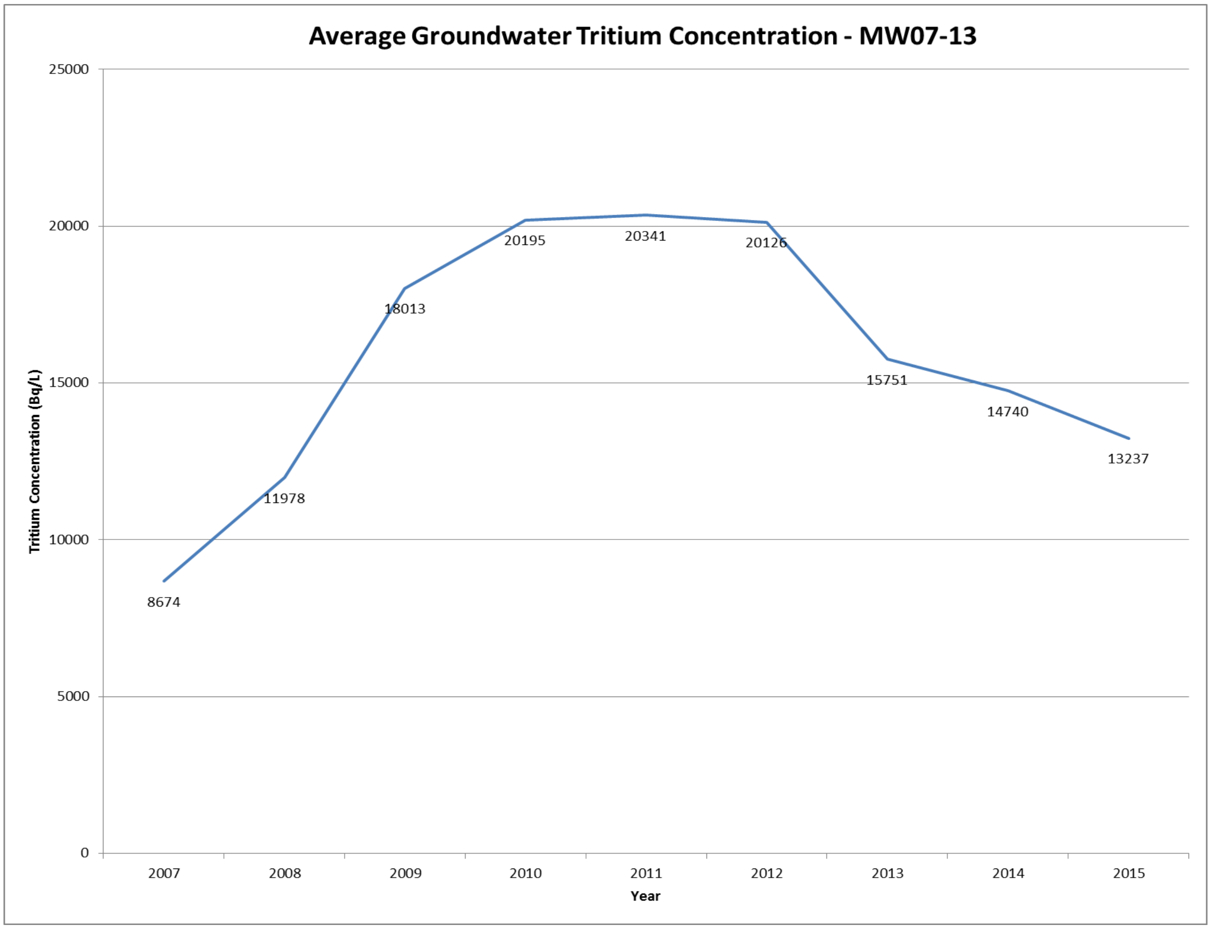
The highest average tritium concentration in any well remains in monitoring well MW06-10 which is located directly beneath the area where the stacks are located. The average concentration of tritium measured in MW06-10 rose to 51,635 Bq/L, an increase compared to the 2014 value of 42,959.

FIGURE 10: MW06-10 TRITIUM CONCENTRATION TREND (2006-2015)



The average concentration of MW07-13 in 2015 was 13,237 Bq/L, a decrease compared to the 2014 value of 14,740 Bq/L.

FIGURE 11: MW07-13 TRITIUM CONCENTRATION TREND (2007-2015)



The average concentrations in the majority of the monitoring wells continue to decrease since being drilled, a trend that is expected to continue over time.

4.3.3.2 Groundwater Level Measurements

The water levels are measured in monitoring wells on a monthly basis prior to purge and sampling. Analysis of this data shows consistent trends from year to year when comparing season to season.

A compilation of groundwater level measurements for 2015 can be found in **Appendix R** of this report.

4.3.3.3 Summary of Field and Laboratory QA/QC

Field and laboratory operations pertaining to groundwater monitoring conducted by the independent third party laboratory include several quality assurance and quality control activities.

Field QA/QC activities include duplicate sampling of certain wells, and the use of trip / method blanks for each type of sample obtained in the field.

Laboratory QA/QC activities include tritium spiking of certain collected samples and blanks, as well as laboratory reference standards for low and high activity concentrations. Sample QC is tested using spike recovery and relative percent difference tests.

In 2015 there were no reported non-conformances relating to groundwater monitoring field and laboratory QA/QC activities, and none were raised by SRBT after further assessment of raw data from the independent laboratory.

4.3.3.4 Statement of Uncertainties Inherent in Monitoring Results

Uncertainties associated with SRBT groundwater monitoring may be present at certain points in the process.

The main uncertainties relate to standard measurement errors associated with liquid scintillation counting, and sample acquisition errors such as volume of drawn sample for analysis.

In order to ensure that the uncertainties inherent in groundwater monitoring results are kept acceptably low, SRBT ensures that the third party laboratory includes all QA/QC data associated with the monitoring as part of the final reports provided.

In addition, in 2015 SRBT contracted an additional independent laboratory to perform samples of groundwater in duplicate, beginning in September. Results between the two laboratories are quite similar, and well within expectations considering the uncertainties that may impact the final result.

The inherent uncertainties associated with groundwater monitoring are well within acceptable bounds when contrasted against the tritium concentrations that may present an unacceptable risk to the public.

4.3.3.5 Supplementary Studies

In 2015, no supplementary studies were conducted relating to groundwater monitoring at SRBT, other than the use of an additional independent laboratory to compare and confirm tritium measurements in groundwater. This additional laboratory continues to provide groundwater monitoring services to SRBT at the time of the issuance of this report.

4.3.3.6 Data Quality, Performance and Acceptance Criteria

Overall, the quality of data gathered as part or SRBT groundwater monitoring activities is successful in ensuring a high level of performance in monitoring, and in demonstrating that acceptance criteria (such as the limits on dose to the public) continue to be met.

4.3.3.7 Program Objectives and Conceptual Site Model

The overall objective of the continued groundwater monitoring activities conducted by SRBT is to assess and evaluate the effects of SRBT operations on the local groundwater resources, and ultimately to determine if the risk to the environment and the public from SRBT operations remains acceptably low.

Only two wells monitored on a regular basis exceed the Ontario Drinking Water Guideline value of 7,000 Bq/L. Both of these wells are dedicated, engineered groundwater monitoring wells and are not used as a source of water consumption.

The highest average concentration in a residential well continues to show a trend downward over time. This year for the first time the value of tritium in the highest average residential well fell below 200 Bq/L.

SRBT concludes that the comprehensive array of groundwater monitoring activities conducted continue to meet objectives and expectations.

4.3.4 Other Monitoring

On occasion SRBT conducts monitoring of other environmental media in order to provide continued assurance of the safety of our operations.

4.3.4.1 Soil Monitoring

Soil sampling is not a formal part of SRBT's Environmental Monitoring Program. Soil samples were obtained during 2015 as a proactive confirmatory measure during paving activities directly beside the facility, within 50 metres of the stack area. Two samples were obtained on November 20, 2015, with both measuring less than the Ontario Drinking Water Guideline value of 7,000 Bq/L (3,428 and 2,979 Bq/L).

4.3.4.2 Sludge Monitoring

In April 2015 and September 2015, SRBT collected samples of sludge cake from the Pembroke Pollution Control Centre. Liquid sludge was also collected from the Petawawa Pollution Control Plant in February 2015.

All samples were collected and analyzed by an independent laboratory, with the September sample set being analyzed in duplicate by another independent laboratory for confirmation purposes.

The results obtained are tabled below:

TABLE 21: SLUDGE MONITORING

LAB	SAMPLE TYPE	APRIL 2015	SEPTEMBER 2015
1	Bq/L - FREE-WATER TRITIUM	19	21
1	Bq/kg - OBT FRESH WEIGHT	116	49
2	Bq/L - FREE-WATER TRITIUM	-	20
2	Bq/kg - OBT FRESH WEIGHT	-	215

Liquid sludge was also collected from the Petawawa Pollution Control Plant in February 2015, with measured values of 8 Bq/L free-water tritium and 14 Bq/kg OBT fresh weight.

The sludge data does not enter into calculation of public dose; however, given the interest in the subject demonstrated by some stakeholders during the licence renewal process, SRBT is continuing to gather data on sludge tritium concentrations on at least a biannual basis.

4.3.5 Public Dose

The calculation method used to determine the dose to the 'Critical Group' as defined in the SRBT Environment Monitoring Program (EMP) is described in the EMP document. All data and tables relating to the calculation of the dose to the public can be found in **Appendix S**.

For 2015, the dose has been calculated using the effective dose coefficients found in CSA Guideline N288.1-14[49].

TABLE 22: CSA GUIDELINE N288.1-14 EFFECTIVE DOSE COEFFICIENTS FOR H-3

AGE GROUP	EFFECTIVE DOSE COEFFICIENT – INHALATION (HTO) (μSv/Bq)	EFFECTIVE DOSE COEFFICIENT – INGESTION (HTO) (μSv/Bq)	EFFECTIVE DOSE COEFFICIENT – INGESTION (OBT) (μSv/Bq)
INFANT	8.0E-5	5.3E-5	1.3E-4
CHILD	3.8E-5	2.5E-5	6.3E-5
ADULT	3.0E-5	2.0E-5	4.6E-5

The dose assessed for the Critical Group is a summation of:

- Tritium uptake from inhalation and absorption through skin at the place of residence and/or the place of work, ($P_{(i)19}$ and $P_{(e)19}$), and
- Tritium uptake due to consumption of well water (P_{29}), and
- Tritium uptake due to consumption of produce (P_{49}), and
- Tritium uptake due to consumption of dairy products (P_{59}).

<u>Dose due to inhalation</u>

The closest residence to SRBT is located by Passive Air Sampler NW250 approximately 240 meters from the point of release. The 2015 average concentration of tritium oxide in air at Passive Air Sampler NW250 has been determined to be **4.15 Bq/m^3**.

Three passive air samplers are located close to the SRBT facility and represent the tritium oxide in air ($P_{(i)19}$ and $P_{(e)19}$) concentrations for the critical group member (adult worker) at samplers 1, 2, and 13. The sampler indicating the highest tritium oxide in air concentration is used to calculate the P19 dose values while at work. The highest average result for 2015 for PAS # 1, PAS # 2, and PAS # 13 is **4.71 Bq/m^3** at PAS # 1.

Using the following inhalation rates coefficients found in CSA Guideline N288.1-14[50] and assuming 2,080 hours (23.744%) of work per year with 6,680 hours (76.256%) at home for a total of 8,760 hours per week:

TABLE 23: CSA GUIDELINE N288.1-14 INHALATION RATES

AGE GROUP	INHALATION RATE (m^3/a)
INFANT	2,740
CHILD	7,850
ADULT	8,400

$P_{(i)19}$: Adult worker dose due to HTO inhaled at residence

The average value for tritium oxide in air for the sampler taken as representing the place of residence for the defined critical group equals 4.33 Bq/m^3.

$P_{(i)19r}$ = [$H\text{-}3_{air}$] (Bq/m^3) Breathing Rate (m^3/a) x DCF_{H3} (µSv/Bq)
= 4.15 Bq/m^3 x 8,400 m^3/a (76.256%) x 3.0E-05 µSv/Bq
= 0.797 µSv/a

$P_{(i)19}$: Adult worker dose due to HTO inhaled at work

Taking the highest concentration between Passive Air Samplers #1, #2, and #13 is Passive Air Samplers #13 at 4.71 Bq/m^3.

$P_{(i)19w}$ = [$H\text{-}3_{air}$] (Bq/m^3) Breathing Rate (m^3/a) x DCF_{H3} (µSv/Bq)
= 4.71 Bq/m^3 x 8,400 m^3/a (23.744%) x 3.0E-05 µSv/Bq
= 0.282 µSv/a.

$P_{(i)19}$: Adult resident dose due to HTO inhaled at residence

The average value for tritium oxide in air for the sampler representing the place of residence for the defined critical group equals 4.33 Bq/m^3:

$P_{(i)19}$ = [$H\text{-}3_{air}$] (Bq/m^3) Breathing Rate (m^3/a) x DCF_{H3} (µSv/Bq)
= 4.15 Bq/m^3 x 8,400 m^3/a x 3.0E-05 µSv/Bq
= 1.046 µSv/a

$P_{(i)19}$: Infant resident dose due to HTO inhaled at residence

The average value for tritium oxide in air for the sampler representing the place of residence for the defined critical group equals 4.33 Bq/m^3:

$P_{(i)19}$ = [$H\text{-}3_{air}$] (Bq/m^3) Breathing Rate (m^3/a) x DCF_{H3} (µSv/Bq)
= 4.15 Bq/m^3 x 2,740 m^3/a x 8.0E-05 µSv/Bq
= 0.910 µSv/a

$P_{(i)19}$: Child resident dose due to HTO inhaled at residence

The average value for tritium oxide in air for the sampler representing the place of residence for the defined critical group equals 4.33 Bq/m^3:

$P_{(i)19}$ = [H-3$_{air}$] (Bq/m^3) Breathing Rate (m^3/a) x DCF$_{H3}$ (µSv/Bq)
= 4.15 Bq/m^3 x 7,850 m^3/a x 3.8E-05 µSv/Bq
= 1.238 µSv/a

<u>Dose due to skin absorption</u>

$P_{(e)19}$: Adult worker dose due to skin absorption of HTO at residence

The dose due to skin absorption is taken as equal to the dose due to inhalation.

$P_{(e)19r}$ = 0.797 µSv/a

$P_{(e)19}$: Adult worker dose due to skin absorption of HTO at work

The dose due to skin absorption is taken as equal to the dose due to inhalation.

$P_{(e)19w}$ = 0.282 µSv/a

$P_{(e)19}$: Adult resident dose due to skin absorption of HTO at residence

The dose due to skin absorption is taken as equal to the dose due to inhalation.

$P_{(e)19}$ = 1.046 µSv/a

$P_{(e)19}$: Infant resident dose due to skin absorption of HTO at residence

The dose due to skin absorption is taken as equal to the dose due to inhalation.

$P_{(e)19}$ = 0.910 µSv/a

$P_{(e)19}$: Child resident dose due to skin absorption of HTO at residence

The dose due to skin absorption is taken as equal to the dose due to inhalation.

$P_{(e)19}$ = 1.238 µSv/a

Dose due to consumption of well water

The tritium uptake due to consumption of well water is calculated by taking the average tritium concentration of the water sampled.

Using the following annual consumption rates (at the 95th percentile) found in CSA Guideline N288.1-14[51]:

TABLE 24: CSA GUIDELINE N288.1-14 WATER CONSUMPTION RATES

AGE GROUP	WELL WATER CONSUMPTION RATE (L/a)
INFANT	305.7
CHILD	482.1
ADULT	1,081.1

The highest concentration in a residential well used as the sole source of the drinking water is found in RW-8 at **194 Bq/L** and will therefore be used in the calculation of the public dose.

P_{29}: Adult dose due to consumption of well water

P_{29} = $[H\text{-}3]_{well}$ x M x 2.0E-05 μSv/Bq;
= [194 Bq/L] x 1,081.1 L/a x 2.0E-05 μSv/Bq
= 4.195 μSv/a

P_{29}: Infant dose due to consumption of well water

P_{29} = $[H\text{-}3]_{well}$ x M x 5.3E-05 μSv/Bq;
= [194 Bq/L] x 305.7 L/a x 5.3E-05 μSv/Bq
= 3.143 μSv/a

P_{29}: Child dose due to consumption of well water

P_{29} = $[H\text{-}3]_{well}$ x M x 5.3E-05 μSv/Bq;
= [194 Bq/L] x 482.1 L/a x 2.5E-05 μSv/Bq
= 2.338 μSv/a

Dose due to consumption of produce

The tritium uptake due to consumption of produce, both locally purchased and home grown is calculated by taking the average tritium concentration of produce purchased from the local market and consuming 70% of the annual total and by taking the average tritium concentration from local gardens and consuming 30% of the annual total.

Using the following annual consumption rates for produce found in CSA Guideline N288.1-14[52]:

TABLE 25: CSA GUIDELINE N288.1-14 PRODUCE CONSUMPTION RATES

AGE GROUP	FRUIT CONSUMPTION RATE (Kg/a)	ABOVE-GROUND VEGETABLES CONSUMPTION RATE (Kg/a)	ROOT VEGETABLES CONSUMPTION RATE (Kg/a)	TOTAL CONSUMPTION RATE (Kg/a)
INFANT	76.6	36.1	12.1	124.8
CHILD	124.4	97.6	43.2	265.2
ADULT	149.2	192.3	71.8	413.3

The average tritium concentration in produce purchased from the sampled market in 2015 was **7.6 Bq/L**, while the average concentration in produce from a local garden in 2015 was **154 Bq/L** at 408 Boundary Road.

Historically the average concentration of all produce in all gardens was used but it was determined that using the garden with the highest average concentrations would be more conservative.

P_{49}: Adult dose due to consumption of produce (HTO)

$$\begin{aligned} \mathbf{P_{49HTO}} &= [[\mathbf{H}_{\mathbf{prod,market}}] + [\mathbf{H}_{\mathbf{prod,res}}]] \times 2.0\text{E-}05\ \mu Sv/Bq \\ &= [[H\text{-}3_{veg}]\ (Bq/kg) \times (kg) \times 0.7] + [H\text{-}3_{veg}]\ (Bq/kg) \times (kg) \times 0.3]] \times 2.0\text{E-}5\ \mu Sv/Bq \\ &= [[7.6\ Bq/kg \times 413.3\ kg/a \times 0.7] + [154\ Bq/kg \times 413.3\ kg/a \times 0.3]] \times 2.0\text{E-}05\ \mu Sv/Bq \\ &= [[2{,}199\ Bq/a] + [19{,}094\ Bq/a]] \times 2.0\text{E-}05\ \mu Sv/Bq \\ &= 0.426\ \mu Sv/a \end{aligned}$$

P_{49}: Infant dose due to consumption of produce (HTO)

$$\begin{aligned} \mathbf{P_{49HTO}} &= [[\mathbf{H}_{\mathbf{prod,market}}] + [\mathbf{H}_{\mathbf{prod,res}}]] \times 5.3\text{E-}05\ \mu Sv/Bq \\ &= [[H\text{-}3_{veg}]\ (Bq/kg) \times (kg) \times 0.7] + [H\text{-}3_{veg}]\ (Bq/kg) \times (kg) \times 0.3]] \times 5.3\text{E-}5\ \mu Sv/Bq \\ &= [[7.6\ Bq/kg \times 124.8\ kg/a \times 0.7] + [154\ Bq/kg \times 124.8\ kg/a \times 0.3]] \times 5.3\text{E-}05\ \mu Sv/Bq \\ &= [[664\ Bq/a] + [5{,}766\ Bq/a]] \times 5.3\text{E-}05\ \mu Sv/Bq \\ &= 0.341\ \mu Sv/a \end{aligned}$$

P_{49}: Child dose due to consumption of produce (HTO)

P_{49HTO} = [[$H_{prod,market}$] + [$H_{prod,res}$]] x 2.5E-05 µSv/Bq
= [[H-3_{veg}] (Bq/kg) x (kg) x 0.7] + [H-3_{veg}] (Bq/kg) x (kg) x 0.3]] x 2.5E-5 µSv/Bq
= [[7.6 Bq/kg x 265.2 kg/a x 0.7] + [154 Bq/kg x 265.2 kg/a x 0.3]] x 2.5E-05 µSv/Bq
= [[1,411 Bq/a] + [12,252 Bq/a]] x 2.5E-05 µSv/Bq
= 0.342 µSv/a

For organically bound tritium (OBT), the same equations are applied, using the same ingestion rates and fractions. Since measures of OBT are not available, the measured HTO amount can be used to estimate the OBT. The transfer parameter from HTO in air to HTO in the plant (on a fresh weight basis) is given by:

$$P_{14HTO} = RF_p \cdot [1 - DW_p] / H_a$$

The transfer parameter from HTO in air to OBT in a plant (fresh weight basis) is:

$$P_{14HTO\text{-}OBT} = RF_p \cdot DW_p \cdot ID_p \cdot WE_p / H_a$$

Where: RF_p = Reduction factor – default is 0.68

DW_p = Dry weight of plant – default value of 0.1 for generic fruit and vegetables

ID_p = Isotopic discrimination factor for plant metabolism (unitless) - default is 0.8

WE_p = Water equivalent of the plant dry matter (L water • kg^{-1} dry plant) – default value for all plants is 0.56

H_a = Atmospheric absolute humidity - a generic default value of 0.011 L/m^3 can be used.

In using the default values and combining the equations, the amount of OBT in a plant (fresh weight basis) can be determined by multiplying the HTO measure for plants for the same location by 0.05.

If we assume the average concentration in produce purchased from a market to be 7.6 Bq/L and if we assume the average concentration in produce from the local gardens with the highest average concentration of 154 Bq/L at 408 Boundary Road, then the values for OBT will be **0.38 Bq/L** produce purchased from a market and **7.7 Bq/L** in produce from local gardens:

P_{49}: Adult dose due to consumption of produce (OBT)

P_{49OBT} = [[$H_{prod,market}$] + [$H_{prod,res}$]] x 4.6E-05 µSv/Bq
= [[H-3_{veg}] (Bq/kg) x (kg) x 0.7] + [H-3_{veg}] (Bq/kg) x (kg) x 0.3]] x 4.6E-5 µSv/Bq
= [[0.38 Bq/kg x 413.3 kg/a x 0.7] + [7.7 Bq/kg x 413.3 kg/a x 0.3]] x 4.6E-05 µSv/Bq
= [[109.9 Bq/a] + [954.7 Bq/a]] x 4.6E-05 µSv/Bq
= 0.049 µSv/a

P_{49}: Infant dose due to consumption of produce (OBT)

P_{49OBT} = [[$H_{prod,market}$] + [$H_{prod,res}$]] x 1.3E-4 µSv/Bq
= [[H-3_{veg}] (Bq/kg) x (kg) x 0.7] + [H-3_{veg}] (Bq/kg) x (kg) x 0.3]] x 1.3E-4 µSv/Bq
= [[0.38 Bq/kg x 124.8 kg/a x 0.7] + [7.7 Bq/kg x 124.8 kg/a x 0.3]] x 1.3E-4 µSv/Bq
= [[33.2 Bq/a] + [288.3 Bq/a]] x 1.3E-4 µSv/Bq
= 0.042 µSv/a

P_{49}: Child dose due to consumption of produce (OBT)

P_{49OBT} = [[$H_{prod,market}$] + [$H_{prod,res}$]] x 6.3E-5 µSv/Bq
= [[H-3_{veg}] (Bq/kg) x (kg) x 0.7] + [H-3_{veg}] (Bq/kg) x (kg) x 0.3]] x 6.3E-5 µSv/Bq
= [[0.38 Bq/kg x 265.2 kg/a x 0.7] + [7.7 Bq/kg x 265.2 kg/a x 0.3]] x 6.3E-5 µSv/Bq
= [[70.5 Bq/a] + [612.6 Bq/a]] x 6.3E-5 µSv/Bq
= 0.043 µSv/a

P_{49}: Adult dose due to consumption of produce (HTO + OBT)

P_{49} = P_{49HTO} + P_{49OBT}
= 0.426 µSv/a + 0.049 µSv/a
= 0.475 µSv/a

P_{49}: Infant dose due to consumption of produce (HTO + OBT)

P_{49} = P_{49HTO} + P_{49OBT}
= 0.341 µSv/a + 0.042 µSv/a
= 0.383 µSv/a

P_{49}: Child dose due to consumption of produce (HTO + OBT)

P_{49} = P_{49HTO} + P_{49OBT}
= 0.342 µSv/a + 0.043 µSv/a
= 0.385 µSv/a

Dose due to consumption of local milk

The tritium uptake due to consumption of milk, from a local producer and distributor is calculated by taking the average tritium concentration of the milk sampled.

Using the following annual milk consumption rates found in CSA Guideline N288.1-14[52]:

TABLE 26: CSA GUIDELINE N288.1-14 MILK CONSUMPTION RATES

AGE GROUP	MILK CONSUMPTION RATE (kg/a)
INFANT	339.9
CHILD	319.6
ADULT	188.5

The average concentration in milk being 3.233 Bq/L but adjusting for the density of milk 3.233 Bq/L x 0.97 L/kg = **3.136 Bq/kg**.

P_{59}: Adult dose due to consumption of milk

P_{59} = $[H\text{-}3]_{dairy}$ x M x 2.0E-05 μSv/Bq;
= [3.136 Bq/kg] x 188.5 kg/a x 2.0E-05 μSv/Bq
= 0.012 μSv/a

P_{59}: Infant dose due to consumption of milk

P_{59} = $[H\text{-}3]_{dairy}$ x M x 5.3E-05 μSv/Bq;
= [3.136 Bq/kg] x 339.9 kg/a x 5.3E-05 μSv/Bq
= 0.056 μSv/a

P_{59}: Child dose due to consumption of milk

P_{59} = $[H\text{-}3]_{dairy}$ x M x 5.3E-05 μSv/Bq;
= [3.136 Bq/kg] x 319.6 kg/a x 2.5E-05 μSv/Bq
= 0.025 μSv/a

Critical group annual dose due to tritium uptake based on EMP

Based on the EMP results and the coefficients and parameters taken from N288.1-14[49,50,51,52], the annual dose (P_{total}) due to tritium uptake from inhalation and skin absorption, consumption of local produce, local milk and well water equates to a conservatively calculated maximum of **6.840 µSv** for an adult worker of the critical group in 2015 compared to 6.738 µSv in 2014 (which relied upon N288.1-08 parameters and coefficients).

TABLE 27: 2015 CRITICAL GROUP ANNUAL DOSE BASED ON EMP

DOSE CONTRIBUTOR		ADULT WORKER ANNUAL DOSE (µSv/A)	ADULT RESIDENT ANNUAL DOSE (µSv/A)	INFANT RESIDENT ANNUAL DOSE (µSv/A)	CHILD RESIDENT ANNUAL DOSE (µSv/A)
DOSE DUE TO INHALATION AT WORK	$P_{(I)19}$	0.282	N/A	N/A	N/A
DOSE DUE TO SKIN ABSORPTION AT WORK	$P_{(E)19}$	0.282	N/A	N/A	N/A
DOSE DUE TO INHALATION AT RESIDENCE	$P_{(I)19}$	0.797	1.046	0.910	1.238
DOSE DUE TO SKIN ABSORPTION AT RESIDENCE	$P_{(E)19}$	0.797	1.046	0.910	1.238
DOSE DUE TO CONSUMPTION OF WELL WATER	P_{29}	4.195	4.195	3.143	2.338
DOSE DUE TO CONSUMPTION OF PRODUCE	P_{49}	0.475	0.475	0.383	0.385
DOSE DUE TO CONSUMPTION OF MILK	P_{59}	0.012	0.012	0.056	0.025
2015 PUBLIC DOSE	P_{TOTAL}	**6.840**	6.774	5.402	5.224

Statement of Uncertainties in Calculation of Public Dose:

All parameters taken from N288.1-14 are at the 95th percentile where available. Actual ingestion and inhalation rates are likely to be lower for most of the population. Calculated doses are likely to be significantly higher than actual doses to critical group members as a result.

4.3.6 Program Effectiveness

SRBT environmental protection programs have continued to be effective in measuring tritium in the environment and at ensuring the prevention of unreasonable risk to the environment.

A total of 40 passive air samplers (PAS) are located throughout a two kilometer radius from the SRBT facility, in eight sectors, ranging in distance at 250, 500, 1,000, and 2,000 meters. Our passive air sampler system is effective and provides the full extent of tritium concentrations in air resulting from the emissions from the facility and in turn effective at providing real data to accurately estimate the dose to a member of the critical group resulting from the emissions from the facility.

The percentage increase of HTO emissions (+7.9%) observed in 2015 correlates very well with the increase in cumulative average of all PAS data (+10.1%), suggesting excellent correlation between these two parameters.

Total tritium emissions in 2015 (56,237 GBq) decreased to 85% of those experienced in 2014 (66,161 GBq). This is primarily due to continued emissions-reduction initiatives, and the availability of higher resolution real-time emission data using the digital data recorder (allowing staff to take actions to reduce emissions at even lower levels).

Our groundwater monitoring system is effective at providing the full extent of tritium concentrations in groundwater resulting from the emissions from the facility and in turn effective at providing real data to accurately estimate the dose to a member of the critical group resulting from the emissions from the facility.

Our precipitation monitoring system is effective at monitoring soil moisture concentrations resulting from the emissions from the facility and in turn effective at providing real data to accurately estimate the future groundwater conditions resulting from the emissions from the facility.

Tritium concentrations in both milk and produce that are consumed by residents living near the facility are measured. This data is effective at providing the full extent of tritium concentrations in human food resulting from the emissions from the facility and in turn effective at providing real data to accurately estimate the dose to a member of the critical group resulting from the emissions from the facility.

4.3.7 Program Review and Audit Summary

In 2015, programs and processes relating to Environmental Protection were subjected to a comprehensive internal audit conducted in May, focused predominantly on SRBT's EMP, effluent monitoring, and groundwater monitoring activities.

The audit resulted in six non-conformances being raised, as well several opportunities for improvement being identified. Each NCR raised is described below, along with corrective actions taken to address each item:

TABLE 28: ENVIRONMENTAL PROTECTION NON-CONFORMANCE REPORTS

IDENTIFIER	FINDING	ACTION TAKEN
NCR-458	PROGRAM – Effluent Monitoring The operator stated a background sample was prepared the previous week (to coincide with the sampling period) and this background is taken into Zone 2 along with the other prepared samples. The procedure does not include this step or indicate how the background is prepared (water-glycol mixture). This step is being performed based on work experience / training not as per the written procedure.	LSC-006 'Assessment of Gaseous Emissions from Stacks' was revised on August 21, 2015 to accurately reflect the preparation of the background sample during weekly stack monitoring procedures.
NCR-459	PROGRAM – Effluent Monitoring Section 4 of RSO-013 'Liquid Effluent Assessment' states that the EMS target is 0.15 GBq/day of liquid effluent releases. Verified that this release limit is now considered an action level. The administrative limit is 0.07 GBq/day as per the document Licence Limits, Action Levels and Administrative Limits. The procedure should reflect the correct release limit or make reference to the document that includes the current release limit.	RSO-013 was revised on August 18, 2015 to incorporate a reference to 'Licence Limits, Action Levels and Administrative Limits' document.
NCR-460	PROGRAM – Groundwater Monitoring Section 3 of RSO-026 'Water Level Measurements' states that the measurement is noted along with the time at which it was measured. Upon reviewing the records it was noted that the 'time' was not being recorded.	RSO-026 was revised on August 18 to remove the requirement to record the time the level measurement was obtained, as it is not a data point that is used for any subsequent analysis.

TABLE 28 (cont'd): ENVIRONMENTAL PROTECTION NON-CONFORMANCE REPORTS

NCR-461	PROGRAM – EMP Section 7 of RSO-032 'Tritium Concentration in Runoff' states that the time and other relevant conditions (i.e. heavy rain, melting snow etc.) of sampling is recorded and included with or attached to the LSC report. This information is not being recorded as per the procedure and therefor there is no record of this information.	The requirement to record weather conditions during downspout sampling was reinforced with staff who are qualified to collect these samples. The procedure and associated form were revised in December to further highlight the requirement to record conditions.
NCR-462	PROGRAM – EMP Section 3 of RSO-033 'Weather Station' states that measurements of all weather conditions are to be performed at least every minute. Review of the data shows that measurements are being taken every 5 minutes.	RSO-033 was revised on December 2 to reflect the fact that data is collected on a five minute basis, an interval that is acceptable for the purposes of SRBT EMP.
NCR-463	PROGRAM – Effluent Monitoring Section 3 of RSO-034 'Well Purging' states that the water from the liquid effluent collection barrel is sampled by a third party to determine the activity. Confirmed with the Health Physics Team that this water is sampled in-house.	RSO-034 was revised on August 18 to remove the statement that a third party conducts the assessment of tritium activity in the collected purge water.

4.3.8 Program Improvements

4.3.8.1 CSA N288-series Gap Analysis

In 2015, SRBT undertook a gap analysis of the entire set of management system documentation associated with Environmental Protection against the available suite of CSA standards related to the subject. These standards included:

- CSA N288.4-10 – *Environmental monitoring at Class I nuclear facilities and uranium mines and mills*
- CSA N288.5-11 – *Effluent monitoring programs at Class I nuclear facilities and uranium mines and mills*
- CSA N288.6-12 – *Environmental risk assessments at Class I nuclear facilities and uranium mines and mills*
- CSA N288.7-15 – *Groundwater protection programs at Class I nuclear facilities and uranium mines and mills*

The final gap analysis document was submitted to CNSC staff on January 15, 2016[44], with an associated action plan designed as a multi-year project of improvement and assessment of all aspects of environmental protection associated with our operations.

One of the first deliverables related to this initiative is a review of the contents of the annual compliance report to ensure that all required information is included within the report, as defined by the above set of standards.

A summary of how the requirements have been met is included in tabular form in section 4.3 of this report.

4.3.8.2 Additional Independent Laboratory Analysis

Beginning with the sampling and analysis of locally-grown produce in September 2015, SRBT has contracted the services of an additional third-party laboratory to conduct environmental monitoring on behalf of SRBT.

This third party was contracted to provide additional duplicate sampling and analysis of produce, sludge cake, and groundwater, in order to provide SRBT with assurance that the main contractor continues to provide high-quality, accurate data.

Data between the two independent laboratories has been trended and compared, with excellent agreement being observed in all measurements.

4.3.9 Emission Reduction Initiatives

SRBT has committed to investing a significant percentage of annualized profits into researching, developing and implementing initiatives aimed at reducing the emission of tritium to the environment associated with our licenced activities.

In 2015, SRBT allocated resources into several areas in order to adhere to this commitment and reduce emissions. A description of these initiatives is provided here.

4.3.9.1 Industry Outreach

SRBT reached out to groups or businesses which specialize in tritium, tritium handling and tritium chemistry, including:

- Canadian Nuclear Laboratories (CNL),
- Kinectrics Inc.,
- The University of Rochester, and
- Torion Plasma Inc.

Technical visits were arranged and conducted at SRBT, as well as at the facilities at CNL and Kinectrics Inc., in order to better understand the aspects of our operations that could potentially be improved and the services the other party could offer. Several recommendations have been or are being formulated which will be considered by SRBT over the coming months and years in order to reduce tritium emissions.

Work towards this initiative continues in 2016.

4.3.9.2 Purge Gas Conversion

In 2015, SRBT implemented a conversion from nitrogen-based purging of our equipment to argon gas, in order to ensure a completely inert gas is used within all processing equipment when purging.

Argon-based purging is viewed as the industry standard for closed, vacuum based systems such as the processing equipment used by SRBT; conversion eliminates any possible chemical reactions with the internal surfaces of our systems and our tritium traps.

This change was analyzed, reviewed and conducted according to SRBT engineering change control processes.

4.3.9.3 Remote Display and Alarm Units

Over the past several years, SRBT has greatly strengthened the real-time emissions monitoring data that is available to our staff during routine processing, as well as abnormal situations.

This initiative has continued with the design and purchase of remote display units (RDU) for the real-time tritium in air monitors that are part of the emissions monitoring system.

The RDUs are designed to provide both audible and visual information on the concentration of tritium in the gaseous effluent streams associated with tritium processing. The units will be mounted in Zone 3, in an area that will be easily viewable by processing staff.

Emissions will ultimately be reduced as abnormal situations will result in an alarm, permitting faster diagnosis and resolution of any problem with tritium processing leaks.

The RDUs are in the process of final testing and are expected to be delivered in early 2016. This change was analyzed, reviewed and is being conducted according to SRBT engineering change control processes.

4.3.9.4 PUTT Valve Improvements

As part of the action plan associated with the exceedance of an action level in late May, SRBT conducted a review of the type of valves used on tritium traps, in consultation with the manufacturer of the current valve type, in order to determine if there were other valve types that could be used that would effectively reduce or eliminate leakage through the valve stem over time. The review determined that emissions could be effectively reduced by two measures.

First, changing the way the current valve was operated by ensuring the valve was opened ‘full-stroke’ resulted in the isolation of the valve packing from the process gas, ultimately reducing the amount of leakage into the PUTT through any packing imperfections.

Second, a new, welded bellows-type valve was designed by the manufacturer in consultation with SRBT that was expected to offer a significantly greater degree of leak-tightness and performance over time. A set of prototype valves were manufactured, procured and tested, with excellent initial results.

The final testing and commissioning of the new type of valve is expected to be completed in the first quarter of 2016; it is expected that the Mitigation Committee will accept the new design of valve for full implementation at that time.

This change was analyzed, reviewed and is being conducted according to SRBT engineering change control processes.

4.4 SCA – Emergency Management and Fire Protection

As most potential hazards associated with the facility would result from fire, Emergency Management and Response for the facility are addressed by an extensive Fire Protection Program supported by an Emergency Plan.

4.4.1 Fire Protection

Various measures were taken at the facility in 2015 to improve fire safety. These activities included but were not limited to the following:

- Update and revision of Fire Hazard Analysis for the facility;
- Update and revision of Fire Protection Program;
- New third party contractor completed an audit of Fire Protection Program as well as conducted a Site Condition Inspection at the facility (detailed reports were completed for both);
- New fire alarm panel and associated components installed;
- Provided employee fire safety training session;
- Enhanced training for two fire committee members;
- Conducted on-site emergency exercise involving a fire at the facility; and
- Upgrades made to enhance fire protection and life safety in the facility.

4.4.1.1 Fire Protection Committee

In 2015, seven formal Fire Protection Committee meetings were held which resulted in the implementation of several improvements for fire protection and life safety at the facility. All Fire Protection Committee meeting minutes are kept on file.

One new member was added to the Fire Protection Committee in 2015. This new member is also a volunteer firefighter for the Pembroke Fire Department and receives ongoing fire protection training from the Pembroke Fire Department.

Two Fire Protection Committee members are enrolled in a Fire Protection Program course provided at a local community college. The course content covers chemistry and physics of fires, building design for life safety, as well as other aspects of fire protection and up to date information on applicable building and fire codes.

4.4.1.2 Fire Protection Program and Procedures

The SRBT Fire Protection Program document was updated in 2015 to meet the requirements of the SRBT operating licence, licence condition handbook and relevant codes and standards[53].

The following is a listing of the operating licence, and specific codes and standards that have been incorporated into the Fire Protection Program:

- Nuclear Substance Processing Facility Operating Licence (NSPFOL-13.00/2022),
- The new Licence Conditions Handbook (LCH) associated with NSPFOL-13.00/2022,
- National Building Code of Canada, 2010,
- National Fire Code of Canada, 2010, and
- CSA Standard N393-13, *Fire Protection for Facilities That Process, Handle and Store Nuclear Substances*.

Numerous upgrades and minor revisions were also made to internal procedures to enhance fire protection and life safety at the facility, in line with our policy of continuous improvement.

4.4.1.3 Fire Hazards Analysis

On April 2, 2015, SRBT submitted a revised Fire Hazards Analysis (FHA) document to CNSC staff[54] as part of the action plan associated with compliance with N393-13. The revision was conducted by an independent, qualified third party, and did not identify any new safety-related concerns with respect to fire protection in the facility.

4.4.1.4 Maintenance of the Sprinkler System

In 2015 quarterly maintenance was performed on the fire sprinkler system by a third party, in addition a weekly check of various valves and line pressures were performed by trained SRBT staff. All records are kept on file.

4.4.1.5 Fire Protection Equipment Inspections

In 2015 inspections of the emergency lighting and fire extinguishers have been performed monthly in-house by trained staff.

An inspection of the emergency lighting and fire extinguishers was also performed by a qualified third party on March 31, 2015. All records are kept on file.

4.4.1.6 Fire Extinguisher Training

Annual fire extinguisher training was provided to SRBT staff by the Pembroke Fire Department on September 25, 2015. Training records are maintained on file.

The training was conducted using a new electronic simulator, eliminating the risks associated with the controlled, repeated burning and extinguishing of liquid hydrocarbons as an environmentally-friendly measure.

4.4.1.7 Fire Protection Committee Member Training

The Fire Protection Committee now includes two members that are volunteer firefighters for local fire departments.

They are provided with ongoing fire protection training from their departments and are also enrolled in a fire protection course at a local college.

4.4.1.8 Fire Responder Training

SRBT and the Pembroke Fire Chief evaluate if and when familiarization training for responders is required. The decision is based on if changes have occurred at SRBT's facility, if the training has not been performed for a number of years or if there are a number of new firefighters and/or volunteers that have not yet taken the training.

There was no training of fire responders in 2015; however, several members of the fire department participated in the full-scale emergency exercise in February, with an acceptable level of performance. The training of fire responders was last performed in 2011 and included a tour of the facility and information with respect to the hazardous materials found on the site. Responders were also instructed on the various properties and precautions with respect to tritium.

4.4.1.9 Fire Alarm Drills

A total of seven in-house Fire Alarm Drills were conducted in 2015.

Following each fire drill, supervisory staff and other key personnel complete a Fire Alarm Drill Report. Each report is reviewed by the Fire Protection Committee and actions are taken as required to enhance fire and life safety at the facility.

4.4.1.10 Fire Protection Consultant Inspection

In 2015 a qualified third party (PLC Fire Safety Solutions) was contracted to conduct an audit of the Fire Protection Program, in order to meet the operating licence requirements, including the requirements of CSA standard N393-13, *Fire protection for facilities that process, handle, or store nuclear substances*.

The scope of the audit was to evaluate the fire protection program for compliance with the applicable inspection, testing and maintenance requirements of our operating licence.

The following codes and standards were reviewed for applicability to the specific systems at SRBT:

- NFCC-2010, *National Fire Code of Canada*
- CSA standard N393-13, *Fire protection for facilities that process, handle, or store nuclear substances*.
- NFPA 10-2007, *Standard for Portable Fire Extinguishers*
- NFPA 13-2007, *Standard for the Installation of Sprinkler Systems*
- NFPA 25-2008, *Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems*
- CAN/ULC S536-04, *Standard for the Inspection and Testing of Fire Alarm Systems;* and
- CAN/ULC S561-03, *Standard for Installation and Services for Fire Signal Receiving Centres and Systems.*

The Fire Protection Program Audit concluded that SRBT's Fire Protection Program is thorough, comprehensive and generally compliant with the requirements of the above noted codes and standards[55].

One area identified as non-compliant was insufficient documentation available to evaluate the inspection, testing and maintenance program relating to the fire alarm system at the facility.

Actions have been taken to ensure that items identified as non-compliant in the Fire Protection Program Audit have been appropriately addressed and are being rectified in a timely manner. Both the Fire Protection Program Audit Report and Site Condition Inspection Report were submitted to CNSC staff as required[56].

4.4.1.11 Pembroke Fire Department Inspection

The Pembroke Fire Department conducted a facility inspection on May 19, 2015. Two minor items of non-compliance were identified and were corrected within a 30 day period. The Pembroke Fire Department followed up by again visiting the facility and confirming the remediation actions taken were correct.

4.4.2 Emergency Preparedness

Various measures were taken at the facility in 2015 to further improve emergency preparedness and emergency response measures.

4.4.2.1 Emergency Plan

SRBT has continued to maintain a comprehensive Emergency Plan[57] to control and manage emergency situations should they arise.

In January, SRBT completed a gap analysis[58] between our Emergency Plan and the requirements outlined in REGDOC 2.10.1, *Nuclear Emergency Preparedness and Response.* The analysis was submitted to CNSC staff on January 26, 2015[59], and included a comprehensive plan to address all identified gaps.

On September 30, 2015, SRBT submitted revision 5 of the Emergency Plan for review and acceptance by CNSC staff[35]. Confirmation of acceptance of the new plan was received on October 2, 2015[36].

4.4.2.2 Emergency Exercise – February 9, 2015

SRBT conducted a full-scale emergency exercise on February 9, 2015.

This exercise included participation of several members of the Pembroke Fire Department, who also provided feedback during the exercise hot wash at the conclusion of the day.

The scenario for the exercise consisted of a response to a simulated smoldering fire in Zone 2 of the facility. SRBT personnel responded according to their training, as did the fire department. The scenario also included the simulated breakage of several gaseous tritium light sources, thus necessitating response by SRBT Health Physics Team members to ensure contamination control, dose assessment and post-emergency recovery activities.

CNSC staff observed the exercise from all areas, including within the facility, at the muster point, and in the emergency waiting area.

Overall, the exercise was successfully executed, and provided a large amount of feedback and data that was used to further drive improvements in the Emergency Plan. A final report[60] was submitted to CNSC staff for review.

The emergency exercise demonstrated that SRBT met the following requirements:

- CNSC regulatory document RD-353, *Testing the Implementation of Emergency Measures,*
- SRBT Emergency Plan, and
- SRBT Fire Protection Program.

One key component of the emergency exercise was that two evaluators were used to assess the entire exercise. One evaluator was the City of Pembroke Community Emergency Management Coordinator and the other was the SRBT Compliance Manager.

The evaluators used pre-established checklists which covered specific regulatory requirements that had to be met based on the above noted CNSC document and SRBT programs. The evaluations concluded that all specific requirements were met.

Following the completion of the emergency exercise two de-briefing sessions were held. During each de-briefing session comments and feedback was received and documented. Several stakeholder groups were involved in these de-briefings, including:

- CNSC staff,
- Members of the Pembroke Fire Department (including the Fire Chief);
- Emergency exercise evaluators;
- SRBT management; and
- SRBT staff.

Based on the information received during the emergency exercise de-briefing sessions, SRBT management identified 38 items/areas where improvements and corrective actions could be made. In accordance with the SRBT Quality Manual Corrective Actions Process, a Non-Conformance Report was raised to encompass all items/areas where corrective actions and improvements are being addressed.

It is noted that the items/areas where corrective actions were specified were not non-compliances with in-force regulatory requirements, but were improvements that were implemented to enhance the SRBT Emergency Plan and future emergency exercises.

The operating experience gained during the exercise was included as part of the revision process of the Emergency Plan that was submitted in September.

4.5 SCA – Waste Management

SRBT implements a Waste Management Program (WMP) that is aligned with the applicable requirements and guidelines in the following CSA Standards:

- CSA N292.0-14, *General principles for the management of radioactive waste and irradiated fuel*
- CSA N292.3-14, *Management of low- and intermediate-level radioactive waste*
- CSA N292.5-11, *Guideline for the exemption or clearance from regulatory control of materials that contain, or potentially contain, nuclear substances*

As part of SRBT's mission of continuous improvement, this program underwent revision twice in 2015.

In September, the program was revised to make general improvements and corrections, and to eliminate information that was not programmatic in nature (i.e. was better captured in procedural level documentation). Revision D of the WMP was accepted by CNSC staff on November 19, 2015[30].

In December, the program was revised to incorporate new conditional clearance levels for clearance-level waste materials generated by SRBT. CNSC staff accepted the technical basis of the new CCLs as well as Revision E of the program document on February 19, 2016[32].

4.5.1 Radioactive Consignments – Waste

Six shipments of "Low Level Waste" (LLW) were made in 2015.

Of the six shipments, four included expired gaseous tritium light sources (April 21, June 23, August 25 and November 3). A total of 217 Type A packages of expired gaseous tritium light sources were generated in 2015.

Three of the six shipments included waste materials generated by other processes, including used protective clothing, used equipment components, crushed glass, filters, broken lights and cleaning material. In addition, SRBT routed two packages of expired tritium traps containing depleted uranium to a licenced waste management facility.

The following table is provided as a summary of the low-level waste material that was generated and routed to a licenced waste management facility in 2015.

TABLE 29: RADIOACTIVE WASTE CONSIGNMENTS (2015)

DATE	CONSIGNOR	WASTE DESCRIPTION	QTY AND PACKAGE DESCRIPTION	TOTAL WEIGHT (Kg)	TOTAL ACTIVITY (TBq)
Apr. 21, 2015	CNL	LLW	56 x Type A Pkgs	220	1,215.19
May 5, 2015	CNL	DU	2 x Type A Pkgs	8	24.00
		LLW	3 x 200 L Drums	210	0.12
Jun. 23, 2015	CNL	LLW	48 x Type A Pkgs	192	695.96
			3 x 200 L Drums	210	0.16
July 28, 2015	CNL	LLW	6 x 200 L Drums	420	0.34
Aug. 25, 2015	CNL	LLW	57 x Type A Pkgs	228	1,335.84
Nov. 3, 2015	CNL	LLW	56 x Type A Pkgs	224	1,026.39

4.5.2 Storage of Radioactive Waste

Radioactive waste was stored on-site and inventory records of the waste were maintained. All packaged wastes were inspected monthly for potential off-gassing and container integrity.

4.5.2.1 Low-level Waste Interim Storage

Low-level waste (LLW) is any waste assessed as possessing activity levels that exceeds conditional clearance limits (for tritium), or in excess of the exemption quantities established in the Nuclear Substances and Radiation Devices Regulations (for all other radionuclides). Typical examples of such wastes are tritium-contaminated equipment or components, crushed glass, filters, broken lights, clean-up material, pumps, pump oil, etc.

LLW was collected in various sealed receptacles, assessed, and ultimately placed into approved containers in the Waste Storage Room within Zone 3. Once sufficient material was collected, it was prepared for transfer to a licensed waste handling facility, using approved processes.

TABLE 30: INTERIM STORAGE OF LOW-LEVEL WASTE

AMOUNT IN STORAGE AT YEAR END 2014	AMOUNT GENERATED THROUGHOUT 2015	TRANSFERRED OFF SITE 2015	AMOUNT IN STORAGE AT YEAR END 2015
9 x 200 L drums	+ 4 x 200 L drums	- 12 x 200 L drums	1 x 200 L drums
0.29 TBq	+ 0.79 TBq	- 0.62 TBq	0.46 TBq

4.5.2.2 Clearance-level Waste Interim Storage

Waste that is only minimally contaminated and is likely to meet accepted clearance criteria is classified as "Very Low-Level Waste" (VLLW). This classification is temporary, as ultimately VLLW is assessed and routed through one of two accepted disposal pathways – either as LLW or as clearance-level waste (CLW).

Examples of such materials are typically paper towels, gloves, disposable lab coats, shoe covers, etc. and was collected in various receptacles in the active areas of the facility, assessed, and ultimately placed into storage awaiting transfer or disposal.

Throughout 2015, the WMP clearance criteria applied to VLLW was 1 MBq/g, up to a maximum of 1 tonne of cleared material per pathway. Any VLLW that was assessed as being less than this criteria was routed through accepted CLW pathways, such as landfill or recycling.

The amount of CLW generated and stored in 2015 is tabulated below.

TABLE 31: INTERIM STORAGE OF CLEARANCE-LEVEL WASTE (LANDFILL)

AMOUNT IN STORAGE AT YEAR END 2014	AMOUNT GENERATED THROUGHOUT 2015	TRANSFERRED OFF SITE 2015	AMOUNT IN STORAGE AT YEAR END 2015
0 Kg	+1,000.00 Kg	-1,000.00 Kg	0 Kg
0 GBq	+40.88 GBq	-40.88 GBq	0 GBq

TABLE 32: INTERIM STORAGE OF CLEARANCE-LEVEL WASTE (PLASTIC RECYCLE)

AMOUNT IN STORAGE AT YEAR END 2014	AMOUNT GENERATED THROUGHOUT 2015	TRANSFERRED OFF SITE 2015	AMOUNT IN STORAGE AT YEAR END 2015
51.80 kg	+1,538.20 kg	-971.50 kg	618.50 kg
5.48 GBq	+128.67 GBq	-80.65 GBq	53.51 GBq

A number of drums are also stored on site that contain excavated soil from well drilling activities that took place between 2006 and 2007.

TABLE 33: INTERIM STORAGE OF CLEARANCE-LEVEL WASTE (SOIL)

AMOUNT IN STORAGE AT YEAR END 2014	AMOUNT GENERATED THROUGHOUT 2015	TRANSFERRED OFF SITE 2015	AMOUNT IN STORAGE AT YEAR END 2015
12 x 200 L drums	0	0	12 x 200 L drums
0.09 GBq	0	0	0.09 GBq

4.5.2.3 Hazardous Material Collection and Storage

There were no hazardous wastes collected or stored in 2015.

4.5.2.4 Waste Minimization

SRBT continues to minimize the generation of radioactive waste materials as part of our overall approach to waste management.

The Waste Management committee met four times through the year to review and discuss initiatives that could ultimately minimize the amount of radioactive waste routed to licenced waste management facilities.

Continued segregation of material prior to bringing items into active zones remains effective at reducing waste materials that require management.

In addition, in late 2015 SRBT began the process of seeking regulatory acceptance of the application of new conditional clearance levels (CCLs) to be applied to certain types of waste.

SRBT sought to reduce the acceptable activity per unit weight value of CLW from 1 MBq / gram down to 0.25 MBq / gram, while increasing the acceptable total annual mass of CLW that could be disposed of through conventional means.

Acceptance of these new CCLs would ultimately reduce the maximum possible activity that could be routed via conventional pathways to 75% of previously accepted values.

A technical assessment was provided to CNSC staff along with Revision E of the WMP[31]. Acceptance of the new CCLs was received in early 2016[32], and thus was not applied in 2015; however, going forth these values will assist in ensuring effective management of this waste material, and further minimizing the amount of LLW generated as well.

4.5.2.5 Key Waste Process Improvements

During 2015, SRBT staff continued to divert uncontaminated materials from becoming unnecessarily contaminated by reducing the material transferred to the active areas.

On January 20, 2015, the first version of a new procedure set was implemented under Revision C of the WMP.

Included within this procedure set are:

- WMP-001, *Waste Segregation, Classification and Characterization*
- WMP-002, *Waste Handling and Minimization*
- WMP-003, *Interim Preparation and Storage of Waste*

The implementation of these procedures, coupled with the revised WMP have introduced a significant overall improvement to the already robust waste management practices at SRBT.

4.5.2.6 Expired Product Management

SRBT continues to offer return and disposal services to customers who possess expired tritium-illuminated devices, such as ‘EXIT’ signs.

In 2015, a total of 20,200 expired (or otherwise removed from service) self-luminous safety ‘EXIT’ type signs were accepted by SRBT from Canadian and American sources, representing a total activity of 4,218 TBq of tritium.

Expired signs are disassembled safely and the light sources removed, in order to ensure that the volume of low-level radioactive waste that is generated is minimized. The expired lights are then packaged and shipped to a licenced radioactive waste management service provider.

As well, an additional 497 TBq of tritium was accepted from international origins (i.e. other than Canada and the United States) in the form of expired tritium illuminated devices, such as aircraft signs, dials, gauges and other smaller equipment.

A small number of these signs were evaluated as being fit for service in other applications, or having light sources that could be reused in other self-luminous devices. This practice is the only re-use of the lights and the tritium associated with these lights; SRBT no longer ‘reclaims’ tritium gas from expired or non-conforming light sources, and has not done so since 2005.

4.5.2.7 Improvement Initiatives for Expired Product Management

In 2015, SRBT began discussions with industry partners to investigate improved methods in treating this low-level waste material so as to reduce volume and future risks.

A review of the storage and disposal methods used by the licenced waste management facility determined that there may be safer, more responsible and more economical ways to store expired tritium light sources for the medium- to long-term.

SRBT provided Canadian Nuclear Laboratories with an initial safety assessment of the prospect of ceasing the storage of these expired light sources in below-grade engineered 'bunkers', and routing them instead to controlled, modular above-ground storage buildings that are already authorized and used to store waste materials containing a wide variety of radionuclides, over the course of several decades.

SRBT and CNL continue to work towards assessing the feasibility of this option, and finalizing the steps required to determine whether or not this alternative storage mode would be acceptable and an improvement.

SRBT believes that, in consideration of the currently approved methods of managing this waste material, the storage of these items in such a fashion would ultimately reduce the risk to the environment and future persons who will have to manage this material.

As well, SRBT has also began discussions with industry partners to determine if there exists effective and efficient ways to reclaim the tritium that remains in expired light sources and / or non-conforming new light sources, for ultimate reuse in new self-luminous safety devices.

Although the project is in the early stages, it is hoped that a viable management alternative to long-term storage of these materials can be found, in partnership with other entities in the tritium and nuclear technology field.

4.6 SCA – Security

SRBT did not experience any security-related events in 2015, nor during the entire licensing period of operating licence NSPFOL-13.00/2015.

SRB Technologies (Canada) Inc. has implemented an accepted Security Program for the facility, in accordance with CNSC regulatory requirements and expectations.

In 2015, CNSC conducted one inspection activity focused on Security. The findings of the inspection were generally positive, with some improvement initiatives being implemented as a result of the regulatory feedback. CNSC staff accepted all actions taken in response to the inspection report shortly after implementation.

New staff members are required to qualify for a Facility Access Security Clearance (FASC), even if they are not expected to handle nuclear substances as part of their responsibilities. Individuals and contractors that visit the facility are required to also have an FASC or be escorted at all times by a staff member with a valid FASC.

Maintenance of the physical security system is performed by an independent third party at least every 6 months.

4.7 SCA – Safeguards and Non-Proliferation

SRBT possesses, uses, stores and manages an extremely small quantity of depleted uranium, which is a controlled nuclear substance. Our inventory of depleted uranium inventory did not increase in 2015.

This material is used as storage media for tritium gas on our processing equipment, a well-understood and widely-used strategy for manipulating and storing tritium in its gaseous, elemental state. By using depleted uranium in this fashion, we can ensure that the quantity of gaseous tritium being used during any given processing operation is restricted. This helps to ensure that the consequences of any unplanned event are minimized with respect to radiation and environmental protection, by ensuring that any release of tritium is limited.

During 2015, the International Atomic Energy Agency (IAEA) did not conduct verification activities of our inventory of this material, nor requested any information on this matter. As a licensee, and pursuant to the General Nuclear Safety and Control Regulations, SRBT is fully committed to ensure that we meet all applicable regulatory requirements relating to Canada's obligations relating to nuclear non-proliferation and safeguards.

Should a safeguards verification activity be requested or conducted, or a request for information made by the IAEA, SRBT will provide all accommodation to the agency and CNSC Staff in order to satisfy our responsibilities in this safety and control area.

In December 2015, CNSC staff conducted an inspection focused on SRBT processes that control and manage the import and export of tritium from the facility. The final inspection report was issued in January 2016[21], to which SRBT replied[61] within the requested date.

4.8 SCA – Packaging and Transport of Nuclear Substances

SRBT prepared, packaged and shipped all manufactured products containing nuclear substances in accordance with the *Packaging and Transport of Nuclear Substances Regulations.*

No transport incidents or dangerous occurrences associated with packaging and transport of SRBT products to or from the facility were reported in 2015.

For the purpose of packaging and offering for transport, shipments of product designated as dangerous goods, SRBT must comply with the requirements of:

- CNSC
- IAEA
- International Air Transport Association (IATA)
- Transport Canada

The procedures used at SRBT are based on regulations and practices found in the following publications:

- Packaging and Transport of Nuclear Substances Regulations
- IAEA Safety Standards Series - No. SSR-6
- Dangerous Goods Regulations (IATA)
- The TDG Compliance Manual: Clear Language Edition (Carswell)

Staff members involved with the packaging, offering for transport and receipt of dangerous goods are given Transportation of Dangerous Goods (TDG) training in accordance with the applicable regulations and are issued certificates by the employer.

4.8.1 Outgoing Shipments

In total, 1,150 consignments were safely shipped to various customers located in 16 countries around the world, including Canada.

A table is provided comparing the amount of shipments of our products have been made over the past five years.

TABLE 34: OUTGOING SHIPMENTS OF PRODUCT (2011-2015)

Year	2011	2012	2013	2014	2015
Number of Shipments*	239	367	744	1,122	1,150
Number of Countries	13	17	13	19	16

*Note – SRBT often ships single palletized shipments of safety signs to the US which subsequently get broken down into multiple sub-consignments. These types of shipments are counted as a single consignment for the purposes of this table.

All outgoing shipments were conducted in compliance with all regulatory requirements pertaining to the transport of dangerous goods and / or nuclear substances. All packages were assessed for surface contamination prior to being offered for transport as required by SRBT procedures.

Information pertaining to the number of monthly outgoing shipments containing radioactive material for 2015 can be found in **Appendix T** of this report.

4.8.2 Incoming Shipments

In total, 598 consignments of returned, expired self-luminous devices were received from various customers located in 6 countries around the world, including Canada. These returns held a total activity of 4,715 TBq of tritium.

The vast majority of the returned, expired devices were in the form of expired ‘EXIT’ signs that were destined to have the expired light sources removed and sent for storage at a licenced waste management facility.

A table is provided comparing the amount of shipments of our products have been made over the past five years.

TABLE 35: INCOMING SHIPMENTS OF EXPIRED PRODUCT (2011-2015)

Year	2011	2012	2013	2014	2015
Number of Shipments	16	25	204	467	598
Number of Countries	4	6	6	10	9

All incoming shipments were received safely and in acceptable condition. Incoming packages containing nuclear substances are assessed for tritium leakage upon receipt.

Information pertaining to the number of monthly received shipments containing radioactive material for 2015 can be found in **Appendix U** of this report.

5. Other Matters of Regulatory Interest

5.1 Public Information and Disclosure

This section of the report will provide public information initiatives taken in 2015.

5.1.1 Direct Interaction with the Public

Historically almost all public inquiries occur during re-licensing. Following SRBT's application for a ten year licence there were several public inquiries for request for information. These inquiries had been made solely by two members from two local interest groups, the First Six Years and the Concerned Citizens of Renfrew County (CCRC). On average it took 3.6 days to reply to each inquiry with the most days being nine days due to the request that required the review of records that dated back to 2000.

In 2015, as part of the current licence we have sampled water from a number of wells belonging to the public every four months for tritium concentration. On a yearly basis we also sample produce from gardens belonging to members of the public for tritium concentration. We promptly provide each member of the public with a report of the sample results along with the anticipated radioactive exposure due to tritium from consuming either the water or produce. We provide members of the public a comparison of this exposure against the CNSC limit and against radioactive exposure from other known sources, such as cosmic radiation, x-rays, etc.

Plant tours have proven to be a useful tool for SRBT to reach the public. In 2015 we have provided plant tours to 51 members of the general public (compared with 28 in 2014) who had expressed interest in our facility.

In 2015 we have also provided plant tours to local representatives of:

- the Renfrew County Community Futures Development Corporation,
- the Business Development Bank of Canada,
- The City of Pembroke,
- the Pembroke Fire Department,
- the Ontario Provincial Police,
- students of the Algonquin College Radiation Safety Program, and
- the Renfrew County and District Health Unit.

In 2015 as part of conducting our business in Pembroke we have also provided plant tours to local employee representatives of our existing and prospective suppliers of goods and/or services, including:

- Dean and Sinclair,
- Canadian Nuclear Laboratories,
- Perkin Elmer,
- PLC Fire Safety Solutions,
- Sabic,
- Engel, and
- Kinectrics Inc.

In 2015 we also provided plant tours to existing and prospective customers including:

- Isolite,
- SP2,
- Betalight BV, and
- Cammenga.

TABLE 36: PLANT TOURS (2015)

	2015
GENERAL PUBLIC	51
LOCAL INSTITUTIONS	6
LOCAL SUPPLIERS	7
CUSTOMERS	4
TOTAL	**68**

On March 16, 2015 SRBT staff met with representatives from two local interest groups, the First Six years and the Concerned Citizens of Renfrew County.

A meeting was held at a neutral location at their request. Four SRBT employees attended the meeting, including President Stephane Levesque, Vice-President Ross Fitzpatrick, Manager of Health Physics and Regulatory Affairs Jamie MacDonald and Executive Assistant Katie Levesque. Doug McNab, a consultant from D&J Consulting was also present.

Several topics were discussed, including but not limited to:

- Jamie MacDonald and Doug McNab's past work experience with the CNSC,
- SRBT's Emergency Training Exercise which took place on February 9, 2015,
- Action level exceedance which occurred during the week of October 28 to November 4, 2014,
- Calculation of SRBT's public dose,
- If garden sampling is still done, confirmed it is and if CNSC staff take duplicate samples as well,
- New import/export manager,
- SRBT's products, operations, staff increase and production increase,
- Filling rigs including the quantity of filling cycles each month,
- Pyrophoric Uranium Tritium Traps (PUTT's),
- Decommissioning of Shield Source Inc. (SSI), and
- SRBT's ventilation system.

A tour of the SRBT facility was also provided immediately following the meeting which lasted approximately 1.5 hours. The tour encompassed all aspects of SRBT's production areas which includes the glass shop, the coating room, the rig room, the assembly room, the milling area and the shipping area. Also shown during the tour are the office areas and the liquid scintillation counting lab.

The following are the keys points that were addressed during the tour:

- A safety briefing was provided, including the actions to take in the event of a fire alarm or tritium-in-air alarm,
- Viewed various light shapes and types, including spheres,
- Discussed several pieces of equipment including the chart recorder, the digital data recorder, the bubbler systems and the real-time stack monitoring system, the new liquid scintillation counting units, and tritium-in-air monitors throughout the facility,
- When entering the Rig Room and Assembly areas, an explanation was given on the procedure for entering and exiting properly, and what safety equipment is required.
- While in the Rig Room, discussed the bulk splitting process, the reclaim rig (including demonstration that it has been electrically and mechanically disconnected), fume hoods, filling rigs (with additional discussions on the 2014 action level exceedance), PUTTs, laser cutting processes, and showing the contents and arrangement of the Waste Room.

- Discussed the training of production technicians in the Rig Room, including improvements towards implementing a SAT-based program.
- Explained how SRBT products are used in safety applications where lighting is essential and the use of power, such as batteries or electricity, is prohibitive or not available.
- Explained SRBT's Dosimetry Service Licence and how we continue to successfully pass annual Health Canada performance testing.
- SRBT was asked to confirm that environmental sampling is being done; it was explained that a contracted, independent third party performs the sampling of wells, passive air samplers, precipitation monitors, produce, milk, wine, and surface waters.
- During the tour it was pointed out that SRBT installed an additional tritium-in-air monitor in 2014, dedicated to the shipping area in order to provide immediate feedback in the case of light breakage during packing activities.

On March 18 and 19, 2015, two SRBT representatives campaigned door-to-door to 215 local residences and businesses around the SRBT facility, within approximately 500 meters of the facility. Each resident or business was given an updated SRBT information pamphlet.

SRBT was successful in conducting a one on one discussion with 57 individuals. The following is a summary of the outcome of the discussions with those 57 individuals:

- The majority of individuals noted that they were familiar with the SRBT facility.
- Four individuals inquired on the operations that take place at SRBT, and this information was provided.
- No concerns or issues were raised regarding SRBT's licence renewal application for a period of 10 years.
- A tour of the facility was offered to all 57 individuals contacted, with only one expressing interest.
- On March 27, 2015, a tour was provided to the individual who had expressed interest in a tour; the neighbour of this person also partook in the facility tour, with the outcome of the tour being highly positive.
- One of the individuals who toured the facility on March 27 submitted a written intervention in favor of SRBT's application for renewal.

- It was noted by several individuals that they had been solicited via telephone from an ‘unknown individual’ stating that they should be concerned with the upcoming licence renewal of SRBT. This ‘unknown individual’ state that residents should also be concerned with consuming vegetation grown at their residence.
- Residents who had been contacted by this unknown solicitor indicated that they did not have concerns with the SRBT licence application or the facility in general.
- One individual informed SRBT staff that he had been specifically told that he could not grow a garden in his backyard due to the proximity of his residence to the SRBT facility. SRBT representatives informed the individual that it was safe to have a garden.

Following the municipal elections SRBT wanted to provide the new Pembroke City Council members the opportunity to learn about the operations of SRBT and also to answer any questions or concerns.

On April 5, 2015, SRBT made a presentation to the new council members and provided information on product, licence application, inspections by CNSC and third parties, training, “Lessons Learned” from Shield Source Inc. (SSI), public and worker dose, air and liquid emissions, environmental monitoring results, emergency exercise, public interactions, SRBT’s website, Financial Guarantee and SRBT’s future outlook.

Two minor questions were asked regarding Waste Management and Environmental sampling both of which were addressed. The presentation was covered by media and televised on Cogeco Cable. A copy of the presentation is also posted on our web site.

During the week of April 7, 2015 a mass mailing of 10,000 of SRBT’s updated information pamphlets were sent by Canada Post to all residences of the City of Pembroke and Laurentian Valley. Following this mailing, SRBT received one e-mail on April 19, 2015 from an individual who had expressed concerns in the past.

This individual thanked SRBT for sending the pamphlet and requested information on emissions, tritium, dose and monitoring wells. On April 21, 2015, SRBT responded by e-mail thanking this individual for their feedback, stating a response was being prepared and in the meantime offered to provide a tour of the facility.

On April 28, 2015, two SRBT representatives campaigned a second door to door to 154 residences in three different residential areas all within approximately four kilometers of the facility.

From the mass mailing conducted throughout the week of April 7, 2015 all 154 residences already received an updated pamphlet but each given an additional pamphlet. SRBT was successful in conducting a one on one discussion with 19 individuals.

The following is the outcome of the discussions with those 19 individuals:

- No concerns or issues were raised regarding SRBT's licence renewal application for a period of 10 years.
- One individual inquired on the operations that take place at SRBT, and this information was provided.
- A tour of the facility was offered to all 19 contacted individuals, with no interest expressed.

In conclusion, a total of 369 residences and businesses throughout the City of Pembroke were solicited door to door with a total of 76 individuals being spoken to directly.

SRBT was successful in conducting a one-on-one discussion with 20.5% of residences and businesses solicited, with the majority of the feedback being positive.

5.1.2 Program Revision

On September 25, 2015, SRBT submitted revision 9 of the Public Information Program (PIP) to CNSC staff[33]. The revision was made in order to address an OFI from an internal audit.

The latest revision of the PIP demonstrates SRBT's commitment to openness and transparency by being vastly improved by more broadly reaching stakeholders using more methods of providing information. CNSC staff accepted the PIP on October 26, 2015[34].

5.1.3 Public Information Committee

The Public Information Committee held six formal meetings in 2015, mostly consisting of discussing a new revision of the Public Information Program, new revisions of our groundwater brochure updated on April 13, 2015 and the general information brochure and pamphlet updated on March 25, 2015, which all reflect the data from the 2014 Annual Compliance Report and were posted on our website.

The committee also discussed the launch of our new website, meeting with members of local special interest groups, completion of actions committed to the CNSC, and our new Facebook account.

A member of the local interest groups showed interest in becoming a member of the Public Information Committee when asked and therefore will be contacted in 2016 to discuss further.

The former mayor of Pembroke Ed Jacyno, who served Pembroke for 18 years, including 3 terms as Mayor and 2 terms as Deputy Mayor, is now employed by SRBT and is scheduled to become a member of the Public Information Committee in 2016.

5.1.4 Website

On February 25, 2015 our new and improved website was launched at www.srbt.com.

The new website continues to provide current environmental monitoring data and content on tritium but now also includes content on emergency preparedness, the safe transport of tritium to the facility and products from the facility, how to safely dispose of products, as well as the Licence and Licence Condition Handbook. It's also designed so that content is more accessible, easier to find, and in plain language. All previous company web sites and domain names are also all directed to this site.

The main page provides a number of possible information sources for the public on tritium and radiation exposure. Several "Public Notifications" were posted on the website in 2015, including details on the Emergency Exercise, the Notice of Public Hearing, SRBT's written submissions for licence renewal, the Independent Environmental Monitoring Program (IEMP) results, SRBT's presentation at the licence renewal hearing, notice of SRBT's licence renewal for a period of seven years, and the annual staff fire extinguisher training.

5.1.5 Community Support

SRBT has supported the local community by providing support to various organizations and causes.

SRBT is a member of the Algonquin College Radiation Safety Program Advisory Committee and during the summer of 2015, SRBT employed a summer student who graduated the Radiation Safety Program at Algonquin College.

SRBT has supported the Main Street Community Services who provides research based programs for children with special needs.

SRBT has supported causes such as Canadian Breast Cancer Foundation, Community Living Upper Ottawa Valley and Bernadette McCann House for Women.

SRBT also supports Festival Hall the local community theater, a memorial hockey tournament and Daddy’s Little Princess Ball which raises money for the Children’s Hospital of Eastern Ontario. We also sponsor several sports teams and groups, including a local hockey team, fishing team, and a youth basketball skills development program.

5.2 Preliminary Decommissioning Plan and Financial Guarantee

The SRBT Preliminary Decommissioning Plan (PDP) underwent a significant revision in 2014-15 prior to licence renewal.

In 2014, SRBT partnered with industry consultants to revise the PDP to address both CNSC staff comments and make changes and improvements to the PDP based on operating experience and knowledge of decommissioning other CNSC licensed facilities. The consultants who assisted SRBT were directly involved in the full decommissioning of Shield Source Inc. which had been a CNSC licensed facility with operations very similar to that of SRBT.

In late 2014, SRBT provided CNSC staff with a final revised Preliminary Decommissioning Plan[24], Cost Estimate and Financial Guarantee[62]; the revised Cost Estimate reflected inflationary increases since the plan was last approved by the Commission in 2008. These documents were also revised using guidelines found in CNSC regulatory guides G-219, *Decommissioning Planning for Licensed Activities*, and G-206, *Financial Guarantees for the Decommissioning of Licensed Activities,* as well as CSA Standard N294-09, *Decommissioning of facilities containing nuclear substances.*

SRBT further investigated methods for establishing a Financial Guarantee as outlined in Regulatory Guide G-206. This review concluded that the method currently used to fund the Financial Guarantee which was approved by the Commission for this facility in June 26, 2008 continues to be the only available method of funding for SRBT. This method is appropriate to our individual situation as allowed in Regulatory Guide G-206.

As part of the PDP, SRBT proposed to fund the increase of $102,012.00 by making six equal installments of $17,002.00, in October and April of each year, over a three-year period, to the Escrow Account.

Contingent on the approval of the Commission, SRBT proposed that the first payment towards the revised Financial Guarantee begin in October 2015 with the renewal of the licence effective July 1, 2015. As well, historical annual inflationary indexes are typically below the annual accrued interest rate of the Escrow Account; as such, SRBT proposed that all accrued interest in the existing Escrow Account remain in that account and be used to address inflationary indexing.

With the renewal of our operating licence for a period of seven years, on June 29, 2015 the Commission concluded that the decommissioning strategy and related financial guarantee are acceptable for the purpose of the 2014-15 application for licence renewal[25]. As required, the first installment for the expanded financial guarantee was made in October 2015[63].

6. Improvement Plans and Forecast

6.1 Continued Management System Improvement Initiatives

Since 2014, SRBT has been working toward completing a comprehensive action plan[13] for transitioning to a management system that meets the requirements of CSA Standard N286-12, *Management system requirements for nuclear facilities.*

Throughout 2015, progress has been steady and has met expectations and target dates. Frequent project meetings were held in order to drive forward with the project deliverables, and to address any issues or problems in achieving the ultimate goal of the plan.

In July[14] and November[15], SRBT furnished comprehensive updates to CNSC staff on the status of the project. No significant comments or concerns were received regarding either of the submissions.

SRBT has instituted several new processes aimed at addressing the specific gaps that were identified. Going forth, the majority of the project will be completed in calendar year 2016, and a final new revision of the SRBT Quality Manual will have been created and submitted to CNSC staff for review and acceptance.

Concurrently to this project, ISO has released the 2015 revision to their 9001 standard. SRBT maintains ISO 9001 certification as part of our manufacturing operations; as a result, in 2016 a review of the revised standard will be performed to identify any significant gaps between SRBT's N286-12 compliant management system and the ISO 9001:2015 standard, in order to take action to address any issues.

6.2 Emission Reduction Initiatives

In 2016 and beyond, SRBT will continue to explore multiple avenues toward reducing tritium emissions from the facility, as per our stated commitment to ensuring investment in this area[64].

SRBT has engaged with expert third parties on tritium abatement technologies, including Kinectrics and Torion Plasma, to investigate and implement possible technological solutions and improvement relating to emission reduction and waste management activities.

In the first half of 2016, a comprehensive set of recommendations are anticipated to be put forth to SRBT by an expert third party on potential ways of driving emissions lower.

SRBT is also sending a representative to the 11th International Conference on Tritium Science and Technology (TRITIUM 2016), in Charleston, South Carolina. The conference is being hosted by the American Nuclear Society, and will present an excellent networking and learning opportunity.

Process improvements will also continue to be sought out, including the completion of the transition to bellows-sealed valves on the PUTTs. As well, the installation of RDUs will ensure the fastest operator response to any potential upset conditions that may arise during tritium processing, thus ensuring the minimization of releases.

SRBT has made the commitment to invest no less than 5% of the company annualized net profit back into emission reduction initiatives (based upon fiscal year profit figures, October 1 through September 30 each year).

On September 30, 2016, the first full fiscal year will have elapsed permitting the evaluation of net profits, and by extension the financial resources that will be made available as part of this commitment; however, significant investment has already been made in this area.

6.3 Safety Performance Objectives for 2016

For the coming year, SRBT Senior Management has established an expanded set of performance objectives which will be tracked and reported on as part of the 2016 ACR.

The following table documents the safety performance objectives for SRBT in 2016:

TABLE 37: SRBT SAFETY AND PERFORMANCE OBJECTIVES FOR 2016

PARAMETER	OBJECTIVE
Maximum Worker Dose	0.83 mSv
Average Worker Dose	0.065 mSv
Calculated Dose to Member of the Public	0.007 mSv
Total Tritium Emissions to Atmosphere (per week average)	1,000 GBq / week
Ratio – Tritium Emissions vs. Processed	0.19
Total Tritium Emissions – Liquid Effluent Pathway	7 GBq
Action Level Exceedances – Environmental	2
Action Level Exceedances – Radiation Protection	2
Contamination Control – Facility-wide Pass / Fail Rate	95%
Lost Time Injuries	0
Minor Injuries Reportable to EDHRC	3

6.4 Planned Modifications and Foreseen Changes

In 2016, several improvements are expected to be realized with respect to our operations and licenced activities.

The following key management system programs or documents are scheduled to be revised, submitted in 2016, and subsequently reviewed and accepted by CNSC staff:

- SRBT Safety Analysis Report (Revision 3)
- Training Program Manual
- Emergency Plan
- Derived Release Limits
- Environmental Monitoring Program
- Environmental Management System

As well, SRBT is scheduled to create an Effluent Monitoring Program document by the end of 2016, in order to align all effluent monitoring activities within one management system program, in line with the requirements of the N288-series of CSA standards, and the action plan developed by SRBT[44].

Also, the following processes or procedures will be created as part of the N286-12 Implementation Plan[13]:

- Decommissioning process
- Commissioning process
- Independent Assessment process
- Business Planning process
- Research and Development process
- Site Selection process

The facility expansion will be completed and integrated with the current facility structure in 2016. There will not be any physical interface between the expansion and the current footprint prior to review and acceptance by CNSC staff, including from the perspective of fire protection.

SRBT will have procured, received and installed remote display units (RDUs) for the real-time stack monitoring system in the coming year. The RDUs will be mounted in the Rig Room and Tritium Laboratory, and display the current tritium concentration in the Rig and Bulk stack effluent stream in an easily viewable spot for production technicians to get instantaneous information on gaseous emissions from processing.

Each unit will have programmable audible and visual alarm capability, which will ensure that any upset condition associated with tritium processing is brought to the immediate attention of staff in the area, thus allowing for the most rapid diagnosis and remediation of the situation, and the minimization of releases.

As well, SRBT will continue to pursue and explore opportunities to reduce emissions in all forms, as part of our 2015 commitment to allocate 5% of our annualized net profit towards this end.

7. Concluding Remarks

Throughout 2015, the management and staff of SRBT complied with all regulatory and licensing requirements of our operating licences.

Our management system continues to change as we work toward providing a N286-12 compliant Management System Quality Manual to CNSC staff by the end of 2016.

The implementation of the Training Program Manual continues, enabling a systematic approach to how we train our staff to perform safety-critical work.

Our facility remains within its designed safety basis, and continues to be fit for service; key systems have continued to be maintained diligently and effectively throughout 2015. Our maintenance program continues to ensure that all key components and systems remain reliable and in service.

Exposures to ionizing radiation to both workers and members of the public continue to remain low, and are far less than the regulatory limits prescribed. The local environment has remained protected, and continues to recover from historical practices, as we continue to implement best practices each and every day. Licence limits for our nuclear substance effluent streams continue to be respected with significant margin.

There were no instances of any conventional injury that resulted in lost time to our workers. Security of the facility and all nuclear substances was maintained at all times. There were no instances of safety-related events with respect to the packaging and transport of our packages.

We continue to be well protected from fire hazards, and have maintained an accepted plan should an emergency condition arise. The emergency exercise was a resounding success, and offered several learning opportunities that have been internalized by our team, and injected into our plan.

Our public information program fully satisfies the requirements of the CNSC, and we continue to look for new ways to reach out into our local community in a positive and constructive fashion. The amount of public information initiatives in 2015 increased significantly due to the licence renewal process; however, the program continuously ensured that information was disseminated to interested parties in an expeditious fashion.

Our decommissioning responsibilities are fully documented and resourced, with additional funds being added in the next three years to meet the revised plans. Although we plan on operating the facility for at least the next two decades if not longer, having a complete, self-funded guarantee of financial resource availability is an additional testament to our commitment of being a good community partner.

We continue to effectively manage all forms of waste generated by our operations, and incessantly look to minimize the amount of waste that must be managed and controlled. The implementation of new conditional clearance levels will permit the most rational and safe management of waste materials, while reducing the maximum amount of activity that could theoretically be routed through conventional pathways.

We are committed to continue our investments into effluent reducing initiatives and technologies in the coming years. SRBT has begun to make key inroads with other industry experts and partners in order to explore all avenues towards reduction of our environmental impact.

Safety and excellence in operations shall always remain as the number one overall priority in everything we do, and 2015 was a direct reflection of the success at achieving these goals.

8. References

[1] Nuclear Substance Processing Facility Operating Licence NSPFOL-13.00/2015, valid from July 1, 2010 to June 30, 2015; signed June 30, 2010.

[2] Nuclear Substance Processing Facility Operating Licence NSPFOL-13.00/2022, valid from July 1, 2015 to June 30, 2022; signed June 29, 2015.

[3] CNSC Record of Proceedings, Including Reasons for Decision, June 29, 2015 (e-Doc 4790778).

[4] Licence Condition Handbook – SRB Technologies (Canada) Inc. Nuclear Substance Processing Facility Operating Licence NSPFOL-13.00/2022 (e-Doc 4624621 (Rev. 0) and 4899130 (Rev.1)).

[5] Annual Compliance Monitoring and Operational Performance Reporting Requirements for Class 1B Nuclear Facilities (CNSC e-Doc 3471152); provided via email to J. MacDonald (SRBT) by J. Campbell (CNSC), February 17, 2016.

[6] SRBT Final Written Report: Action Level Exceedance – May 26 – June 2, 2015, submitted as attachment to email from J. MacDonald (SRBT) to J. Campbell (CNSC), *Final Written Report – June 2, 2015 Action Level Exceedance,* July 2, 2015.

[7] Letter from J. Campbell (CNSC) to S. Levesque (SRBT), *CNSC Response to SRB Final Report on the June 2, 2015 Action Level Exceedance,* dated August 17, 2015. (e-Doc 4815447)

[8] SRBT Full Report: Activation of Contingency Plan – September 25, 2015, submitted as attachment to email from J. MacDonald (SRBT) to J. Campbell (CNSC), *Full Report – SRBT Contingency Plan Activation September 25, 2015,* dated October 9, 2015.

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9. Appendices

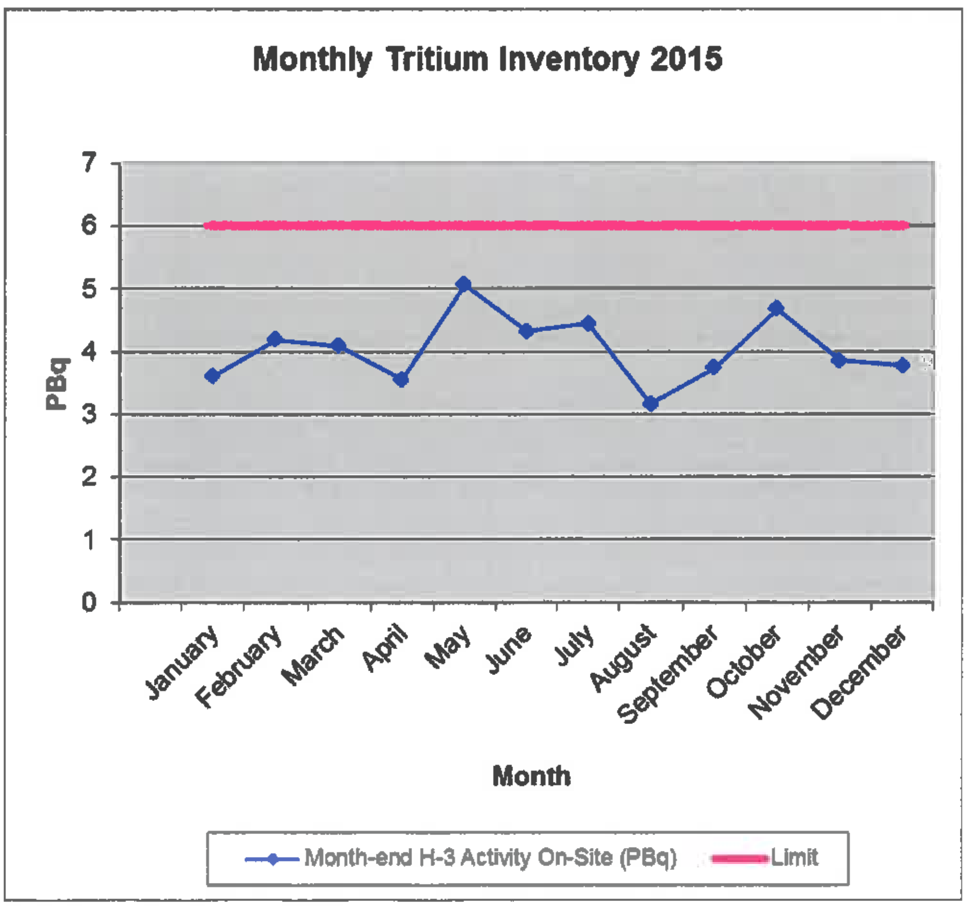
APPENDIX A

Tritium Activity on Site During 2015

TRITIUM ACTIVITY ON SITE DURING 2015

Month / 2015	Month-end H-3 Activity On-Site (PBq)	Percent of Licence Limit (%)
January	3.60	60.00
February	4.19	69.83
March	4.09	68.17
April	3.55	59.17
May	5.06	84.33
June	4.32	72.00
July	4.44	74.00
August	3.16	52.67
September	3.74	62.33
October	4.68	78.00
November	3.85	64.17
December	3.77	62.83
2015 Monthly Average	***4.04***	***67.29***

Note: Possession limit is 6.00 PBq.



APPENDIX B

Equipment Maintenance Information for 2015

2015 Scheduled Maintenance Activities Performed

Semi-Annual maintenance on HVAC equipment: **Contract** J.W HVAC Services Ltd	July 20, 2015 Nov 19, 2015
Quarterly maintenance on Rig & Bulk stack units: **Contract:** J.W HVAC Services Ltd	March 17, 2015 July 20, 2015 Sept 17, 2015 Feb 8, 2016
Annual stack verification by a third party on Rig & Bulk stack units: **Contract:** Tab Inspection	September 18, 2015
Sprinkler System quarterly maintenance by a third party: **Contract:** Drapeau Automatic Sprinkler Corp	March 16, 2015 June 29, 2015 Sept 30, 2015 Dec 29, 2015
Emergency Lighting & Fire Extinguisher annual inspection by a third party: **Contract:** Layman Fire and Safety	March 31, 2015
Sprinkler System inspection by SRBT:	Weekly
Fire Alarm Components inspection by SRBT:	Weekly
Fire Separation doors inspection by SRBT:	Monthly
Fire Extinguisher inspection by SRBT:	Monthly
Emergency Lights inspection by SRBT:	Monthly
Quarterly maintenance carried out on the compressor: **Contract:** Valley Compressor	January 27, 2015 April 13, 2015 July 6, 2015 Sept 25, 2015
Fumehood Inspections by SRBT:	Monthly
Tritium-in-Air Sample Collector Bubblers maintenance:	Bi-monthly
Tritium-in-Air Sample Collector Bubblers third party annual verification: **Contract:** Canadian Nuclear Laboratories	February 10-24, 2015
Liquid Scintillation Counters third party annual maintenance: **Contract:** PerkinElmer	November 24, 2015
Real-time Stack Monitoring system verification by SRBT:	March 23/24, 2015 June 10, 2015 September 2, 2015 December 1/4, 2015
Report of any weakening or possible major failure of any components:	None

All ventilation systems were maintained in fully operational condition with no major system failures during 2015. One non-conformance was identified and raised on a past due maintenance activity. SRBT's non-conformance process was followed and the item was corrected within 30 days.

Ventilation equipment maintenance was performed under contract with a fully licensed maintenance and TSSA certified local HVAC contract provider.

All process equipment is serviced and maintained by qualified staff and through contract with companies that specialize in process control systems. All process equipment has been maintained in fully operational condition with no major equipment failures during 2015.

Corrective maintenance was performed on equipment as required as a result of as found conditions during inspections and is recorded.

APPENDIX C

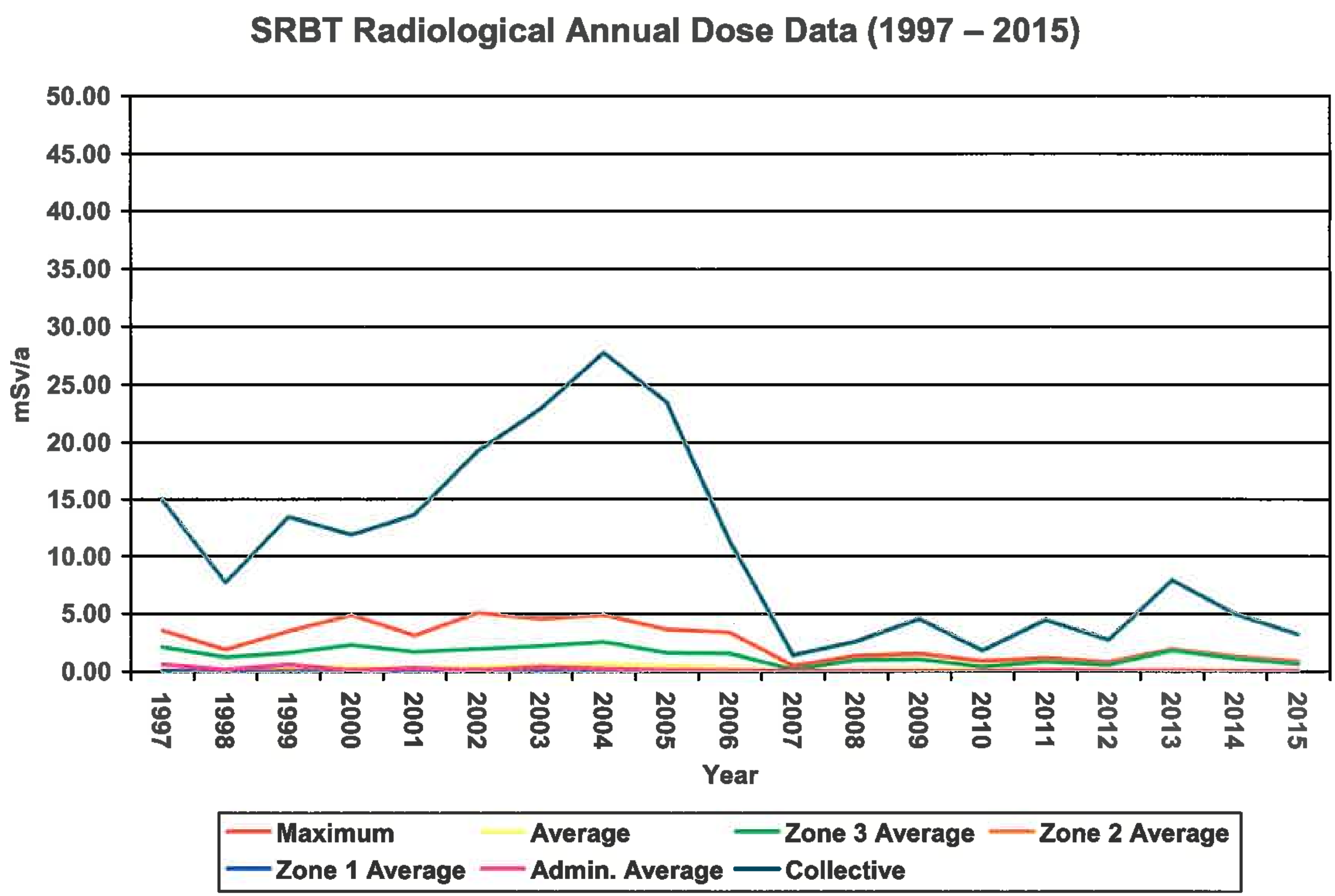
Ventilation Equipment Maintained in 2015

VENTILATION EQUIPMENT MAINTAINED IN 2015

	TYPE	ZONE	LOCATION
1	Heat Recovery unit	1	Mold area/Office
5	Unit heaters	1 & 3	Rig room, Glass shop, Molding area, Front Office, Records Room Hallway
2	A/C wall units	1	Coating room, Glass shop
2	Makeup air units	1 & 2	Coating room, Assembly room
4	Exhaust fans	1 & 2	Coating, Assembly, Glass room, Paint Booth
1	HRV with reheat	2	Assembly room
2	Fan coils	1	Office, Mold area/Office
2	Condenser	1	Mold area/Office
1	Mid efficient gas furnace & central air	1	Stores
1	Mid efficient gas furnace	1	Receiving
1	Bulk stack air handling unit	1	Compound
1	Rig stack air handling unit	1	Compound
2	Rig and Bulk stack air handling units pitot tubes	1	Compound

APPENDIX D

Radiological Occupational Annual Dose Data for 2015


SRBT Radiological Annual Dose Data (1997 – 2015)
mSv/a
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
Year
Maximum
Average
Zone 3 Average
Zone 2 Average
Zone 1 Average
Admin. Average
Collective

SRB RADIOLOGICAL ANNUAL DOSE DATA (1997 – 2015)

ANNUAL DOSE (mSv/year)	1997	1998	1999	2000	2001	2002	2003	2004	2005	*2006	**2007	***2008	2009	2010	2011	2012	2013	2014	2015	AVERAGE
Maximum Dose	3.55	1.91	3.48	4.89	3.11	5.08	4.54	4.90	3.61	3.35	0.48	1.34	1.50	0.88	1.15	0.80	1.93	1.29	0.87	2.56
Average	0.52	0.24	0.46	0.38	0.29	0.40	0.55	0.67	0.50	0.30	0.04	0.16	0.25	0.11	0.25	0.11	0.21	0.10	0.07	0.30
Average Zone 3	2.12	1.26	1.62	2.30	1.70	1.94	2.22	2.58	1.61	1.57	0.17	1.00	1.06	0.42	0.87	0.58	1.82	1.14	0.65	1.40
Average Zone 2	0.07	0.12	0.11	0.15	0.08	0.18	0.16	0.18	0.12	0.07	0.07	0.02	0.01	0.01	0.11	0.03	0.08	0.07	0.08	0.09
Average Zone 1	0.08	<0.01	<0.01	<0.01	0.01	0.01	0.01	0.02	<0.01	<0.01	0.00	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.03	0.02
Average Administration	0.61	0.17	0.60	0.12	0.31	0.11	0.39	0.24	0.12	0.09	<0.01	0.05	0.05	0.02	0.13	0.06	0.08	0.03	0.06	0.17
Collective Dose	15.01	7.72	13.47	11.91	13.65	19.21	22.91	27.75	23.50	11.34	1.40	2.62	4.57	1.82	4.47	2.75	7.94	4.98	3.22	10.54

DOSIMETRY RANGE (mSv/year)	1997	1998	1999	2000	2001	2002	2003	2004	2005	*2006	**2007	***2008	2009	2010	2011	2012	2013	2014	2015	AVERAGE
0.00 – 0.99	23	29	28	33	43	43	39	30	39	34	32	15	15	17	16	24	34	47	47	30.95
1.00 – 1.99	4	3	4	1	4	2	0	5	3	3	0	1	3	0	2	0	4	1	0	2.11
2.00 – 2.99	1	0	0	1	1	2	3	2	3	0	0	0	0	0	0	0	0	0	0	0.68
3.00 – 3.99	1	0	2	1	1	0	2	2	2	1	0	0	0	0	0	0	0	0	0	0.63
4.00 – 4.99	0	0	0	1	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0.21
> 5.00	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0.05
> 50.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Staff Members	29	32	34	37	49	48	45	41	47	38	32	16	18	17	18	24	38	48	47	34.63

*** Operated 48 weeks**
**** Operated 5 weeks**
***** Operated 26 weeks**

APPENDIX E

Swipe Monitoring Results for 2015

2015 Routine Contamination Assessment Summary - Zone 3

Zone 3 Swipe Areas	No. of Swipes	Amount > Admin Limit	Pass Rate
Rig 7 Floor	245	41	83.3
Rig 7	245	9	96.3
Rig 1 Floor	245	26	89.4
Rig 1	245	9	96.3
Flr @ Rig 6	245	33	86.5
Rig 6	245	2	99.2
Floor @ Rig 8	245	39	84.1
Rig 8	245	10	95.9
Flr @ Barrier	245	25	89.8
Muffle F/H	245	18	92.7
Laser rm flr random	245	15	93.9
EIP Area	245	3	98.8
Laser Rm F/H	245	13	94.7
Trit Lab Flr random	245	32	86.9
Diss. F. hood	245	16	93.5
Floor @ Rig 5	240	44	81.7
Rig 5	240	3	98.8
Bulk Splitter Sash	180	12	93.3
Reclaim Fume Hood	180	1	99.4
Toolbox	128	7	94.5
Storage Rm Floor	128	12	90.6
Storage Rm Shelves	118	1	99.2
Waste Rm Floor	68	4	94.1
Bulk f. hood	65	2	96.9
Rig Room Phone	64	1	98.4
Waste Rm Door	64	0	100.0
Laser Rm Phone	64	0	100.0
Trit Lab Phone	64	1	98.4
Storage Rm Door	64	0	100.0
Laser Rm Counter	63	0	100.0
Cleaning Cabinet	62	1	98.4
Shelf @ Barrier	60	1	98.3
Waste Rm Walls	60	1	98.3
Lid of Effl Barrel	60	1	98.3
Scint Table	53	0	100.0
Paperwork Rack	53	0	100.0
Waste Room Shelving	53	0	100.0
Trit Lab Table	53	3	94.3
Computer Area	5	1	80.0
Glove Holder - Rig Room	5	0	100.0
Glove Holder - Laser Room	5	0	100.0
Glove Holder - Trit Lab	5	0	100.0
TOTAL	5879	387	93.4

APPENDIX E

2015 Routine Contamination Assessment Summary – Zone 2

Zone 2 Swipe Areas	No. of Swipes	Amount > Admin Limit	Pass Rate
Floor at Barrier	143	6	95.8
WIP Shelving	143	3	97.9
QA Shelving	143	5	96.5
Work Counters	143	1	99.3
InspectionPrep counter	143	6	95.8
Reflector Shelving	112	2	98.2
Bubbler Fume hood	112	5	95.5
Counter @ Barrier	109	12	89.0
Storage Room Floor	106	4	96.2
Photometer Room Floor	104	2	98.1
Silkscreening Floor	73	2	97.3
Inspection Prep Cabinet	70	5	92.9
Sonic Welding Area	69	2	97.1
Zone 2 Phone	40	0	100.0
Storage Room Random	36	0	100.0
Shelves by Windows	34	0	100.0
Table at Barrier	34	0	100.0
Aircraft WIP Cabinets	34	0	100.0
Stock Sign Cabinets	31	2	93.5
Fridge	31	2	93.5
Safety Glasses Area	3	0	100.0
Random Chairs	3	0	100.0
TOTAL	1716	59	96.6

2015 Routine Contamination Assessment Summary – Zone 1

Zone 1 Swipe Areas	No. of Swipes	Amount > Admin Limit	Pass Rate
Lunch Room	52	0	100.0
LSC Room	52	0	100.0
RR Ante Rm	52	1	98.1
RR Barrier	52	7	86.5
Assy Barrier	52	3	94.2
Shipping Floor	25	2	92.0
Random Utility Carts	14	0	100.0
Hallway - Assy/RR	14	0	100.0
Z1 Effluent Barrel	14	0	100.0
Hallway Racks	13	0	100.0
Cleaning Cart	13	0	100.0
Assy Door	13	0	100.0
RR Ante Rm Door	13	0	100.0
RR Barrier Door	13	0	100.0
Wire Rack Outside Assy	11	0	100.0
Stores	11	0	100.0
Table @ Assy Barrier	1	0	100.0
Sink by Milling	1	0	100.0
TOTAL	416	13	96.9

2015 Routine Contamination Assessment Summary

Overall Facility Summary

Zone	No. of Swipes	Amount > Admin Limit	Pass Rate
Zone 3	5879	387	93.4
Zone 2	1716	59	96.6
Zone 1	416	13	96.9
ALL ZONES	8011	459	94.3

APPENDIX F

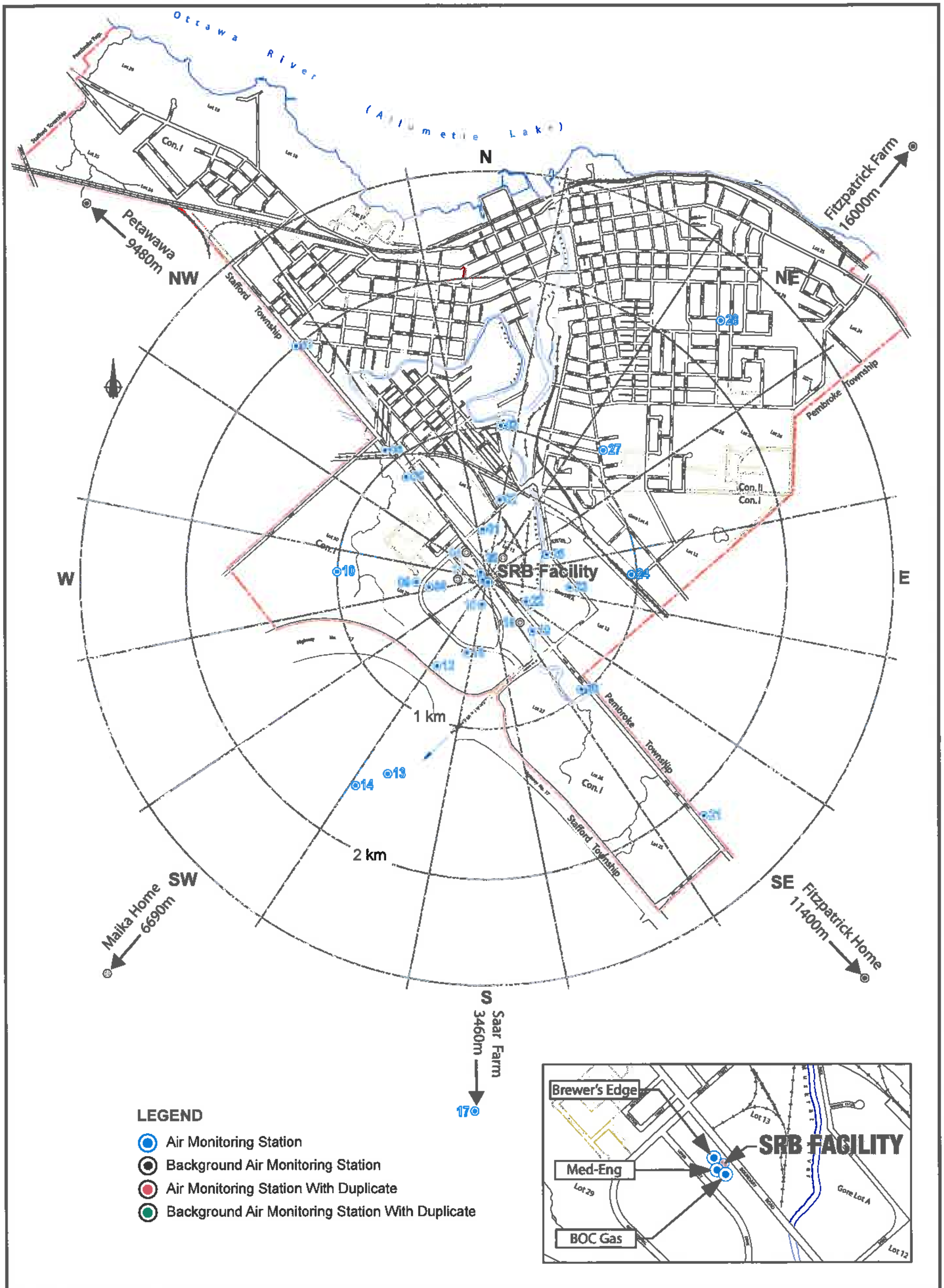
Passive Air Sampler Results for 2015

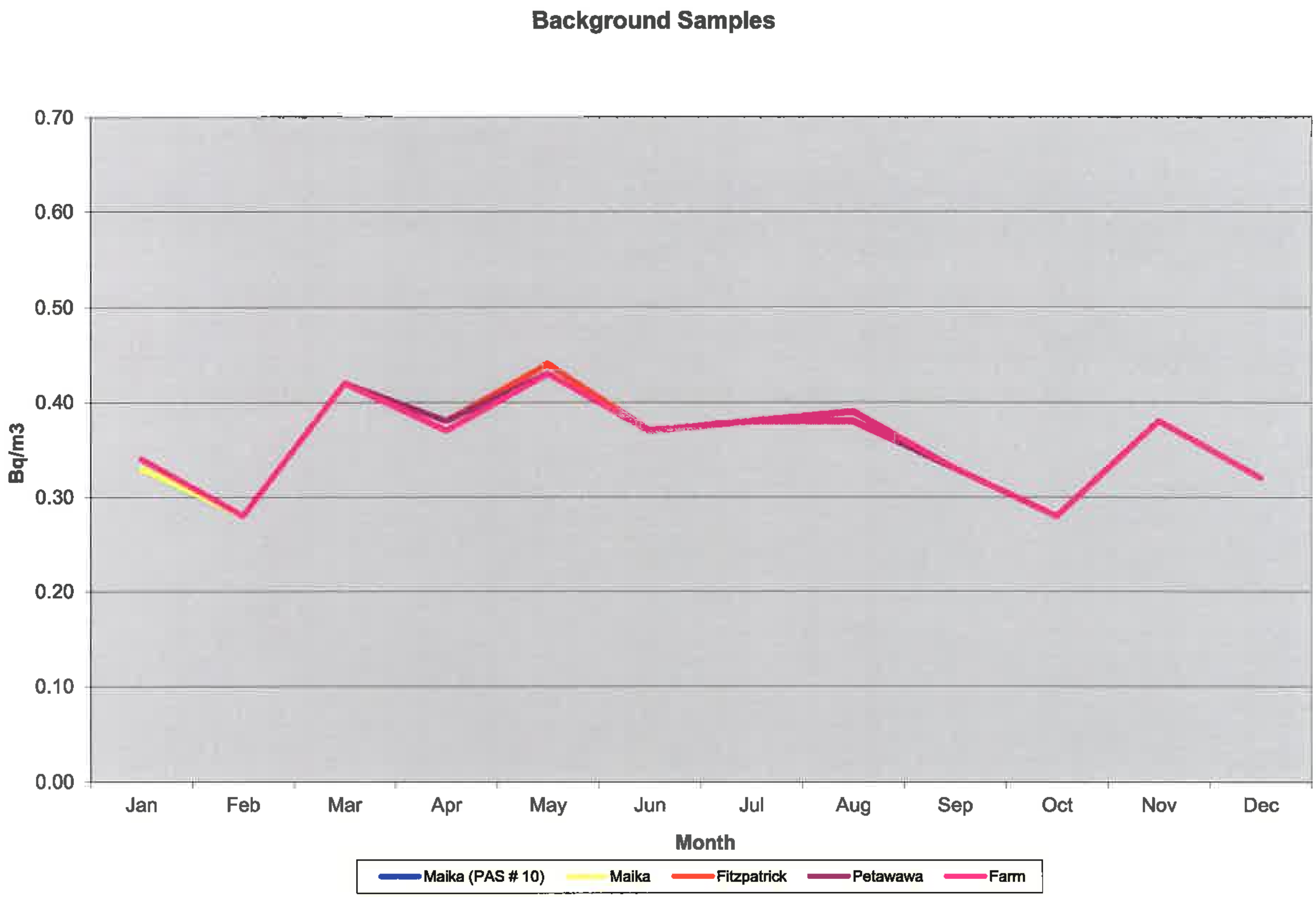
2015 Environment Monitoring Program
Passive Air Sampling System

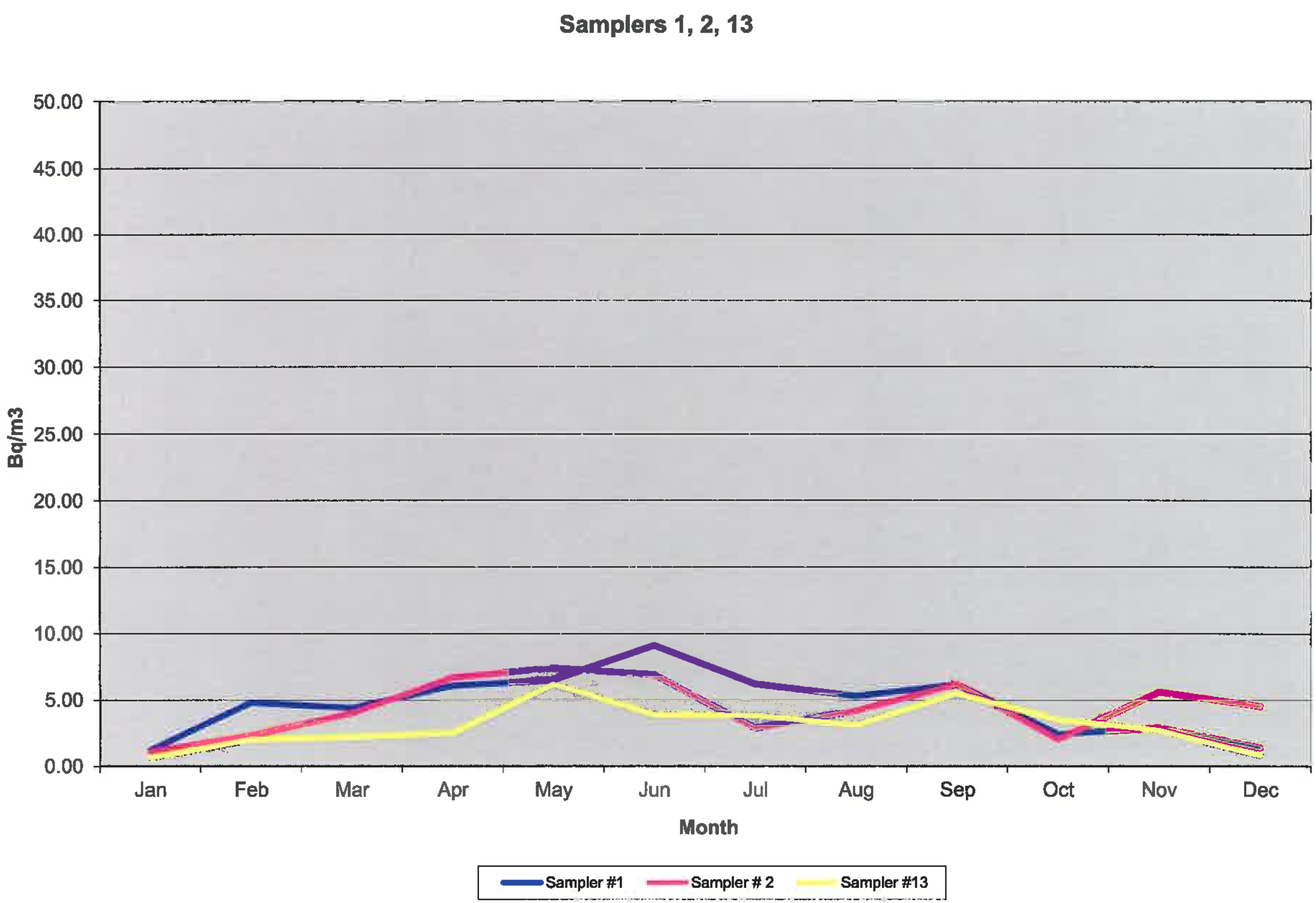
Sampler No.	Sampler ID	Location	Dist. to SRBT	Jan (Jan9-Feb3)	Feb (Feb3-Mar4)	Mar (Mar4-Apr2)	Apr (Apr2-May5)	May (May5-June2)	Jun (June2-July2)	Jul (July2-Aug5)	Aug (Aug5-Sep 1)	Sep (Sept1-Oct2)	Oct (Oct2-Nov3)	Nov (Nov3-Dec2)	Dec (Dec2-Jan6)	Average (Bq/m3)
				(Bq/m3)												
1	N250	N 45° 48.486' W 077° 07.092' Elev. 137m	322m	1.00	2.30	1.30	1.40	1.70	2.50	2.74	2.30	0.72	0.36	1.10	0.90	1.53
2	N500	N 45° 48.572' W 077° 07.008' Elev. 134m	493m	0.59	0.30	0.87	0.75	1.10	0.67	0.38	1.00	0.84	0.29	1.10	0.49	0.70
3	N1000	N 45° 48.869' W 077° 06.997' Elev. 135m	1040m	0.33	0.28	0.41	0.38	0.44	0.38	0.37	0.40	0.47	0.74	0.43	0.32	0.41
4 (PAS #4)	NW250	N 45° 48.412' W 077° 07.189' Elev. 137m	222m	0.68	0.86	1.30	1.60	3.20	4.70	1.48	3.60	3.40	1.00	24.40	3.60	4.15
5	NW500	N 45° 48.577' W 077° 07.382' Elev. 134m	615m	0.38	0.28	0.47	0.38	0.86	0.68	0.42	1.40	1.40	0.77	5.40	1.10	1.13
6 (PAS # 8)	NW1000	N 45° 48.754' W 077° 07.599' Elev. 130m	1050m	0.33	0.31	0.42	0.37	0.44	0.40	0.38	0.70	0.57	0.32	3.30	0.39	0.66
7	NW2000	N 45° 49.141' W 077° 08.090' Elev. 139m	2000m	0.33	0.28	0.42	0.46	0.87	1.60	1.78	1.50	1.60	0.30	1.70	0.32	0.93
8	W250	N 45° 48.300' W 077° 07.323' Elev. 138m	297m	0.84	0.86	1.70	1.10	1.70	0.85	0.38	1.10	0.73	0.28	1.40	0.50	0.95
9	W500	N 45° 48.288' W 077° 07.393' Elev. 137m	389m	0.47	0.28	0.66	0.62	0.93	0.48	0.42	0.46	0.57	0.29	0.65	0.46	0.52
10	W1000	N 45° 48.306' W 077° 07.630' Elev. 134m	691m	0.47	0.59	0.62	0.37	0.43	0.37	0.38	0.38	0.35	0.28	0.52	0.31	0.42
11	SW250	N 45° 48.247' W 077° 07.206' Elev. 140m	183m	0.33	0.43	0.79	0.63	1.40	0.86	0.38	0.86	1.20	0.68	0.76	0.35	0.72
12	SW500	N 45° 47.896' W 077° 07.307' Elev. 148m	839m	0.33	0.44	0.41	0.37	0.44	0.37	0.38	0.39	0.34	0.28	0.49	0.32	0.38
13	SW1000	N 45° 47.599' W 077° 07.543' Elev. 149m	1470m	0.33	0.35	0.42	0.38	0.44	0.37	0.38	0.39	0.35	0.28	0.37	0.32	0.37
14	SW2000	N 45° 47.408' W 077° 07.866' Elev. 155m	2110m	0.34	0.28	0.42	0.38	0.45	0.40	0.39	0.40	0.35	0.30	0.41	0.33	0.37
15	S250	N 45° 48.129' W 077° 07.014' Elev. 131m	356m	1.00	0.90	1.50	1.80	1.50	1.80	0.83	1.00	0.62	0.67	1.10	1.20	1.16
16	S500	N 45° 48.029' W 077° 07.110' Elev. 143m	532m	0.39	0.71	0.42	0.38	0.44	0.37	0.40	0.39	0.55	0.28	0.68	0.32	0.44
17 (PAS # 12)	S1000	N 45° 46.466' W 077° 07.441' Elev. 158m	1450m	0.33	0.28	0.42	0.37	0.43	0.37	0.38	0.38	0.33	0.28	0.38	0.32	0.36
18	SE250	N 45° 48.189' W 077° 06.874' Elev. 132m	365m	4.30	3.50	6.70	4.20	6.30	3.30	2.45	3.40	2.20	1.40	1.60	2.50	3.49
19	SE500	N 45° 48.108' W 077° 06.783' Elev. 123m	554m	2.00	1.60	4.00	2.00	3.00	1.30	0.55	1.20	0.66	0.53	0.87	1.40	1.59
20	SE1000	N 45° 47.894' W 077° 06.501' Elev. 120m	1090m	0.50	0.40	1.04	0.76	0.80	0.37	0.38	0.39	0.35	0.28	0.38	0.33	0.50
21	SE2000	N 45° 47.505' W 077° 05.978' Elev. 137m	2080m	0.40	0.28	0.42	0.38	0.44	0.37	0.38	0.39	0.34	0.30	0.38	0.32	0.37
22	E250	N 45° 48.234' W 077° 06.807' Elev. 131m	401m	2.20	1.80	3.90	1.90	2.60	1.80	1.42	1.90	0.70	1.50	1.40	1.30	1.87
23	E500	N 45° 48.333' W 077° 06.693' Elev. 132m	520m	0.34	0.28	1.10	1.10	0.94	0.70	0.95	0.54	0.50	0.63	0.42	0.82	0.69
24	E1000	N 45° 48.303' W 077° 06.260' Elev. 143m	1080m	0.34	0.28	0.42	0.38	0.44	0.37	0.38	0.39	0.35	0.28	0.37	0.31	0.36
25	NE250	N 45° 48.371' W 077° 06.964' Elev. 124m	198m	0.94	0.67	3.10	5.20	11.00	7.80	4.76	7.70	3.90	2.90	2.30	1.70	4.33
26	NE500	N 45° 48.421' W 077° 06.732' Elev. 131m	508m	0.32	0.28	1.60	1.10	1.70	0.82	0.74	0.79	0.59	0.50	0.40	0.69	0.79
27	NE1000	N 45° 48.683' W 077° 06.441' Elev. 148m	1100m	0.33	0.28	0.42	0.38	0.62	0.37	0.38	0.39	0.34	0.29	0.38	0.35	0.38
28	NE2000	N 45° 49.116' W 077° 05.843' Elev. 156m	2200m	0.33	0.28	0.42	0.38	0.44	0.37	0.38	0.38	0.34	0.29	0.37	0.31	0.36
Pre-Sample Points																
(PAS #1)		N 45° 48.287' W 077° 07.123' Elev. 129m	94.1m	1.20	4.80	4.40	6.10	6.50	9.10	6.22	5.30	6.20	2.40	2.90	1.40	4.71
(PAS #2)		N 45° 48.325' W 077° 07.132' Elev. 132m	52.8m	1.10	2.30	4.00	6.70	7.40	6.90	2.85	4.20	6.20	2.00	5.60	4.50	4.48
(PAS #13)		N 45° 48.262' W 077° 07.093' Elev. 132m	61.5m	0.63	2.00	2.20	2.50	6.20	3.90	3.82	3.10	5.50	3.50	2.70	0.80	3.07
Replicates																
4-2	NW250	N 45° 48.412' W 077° 07.189' Elev. 137m	222m	0.56	0.50	1.30	1.60	3.00	4.30	0.82	3.50	3.20	0.93	20.80	3.00	3.63
11-2	SW250	N 45° 48.247' W 077° 07.206' Elev. 140m	183m	0.33	0.41	0.42	0.49	1.10	0.76	0.38	0.81	1.10	0.59	0.72	0.32	0.62
18-2	SE250	N 45° 48.189' W 077° 06.874' Elev. 132m	365m	4.10	2.90	6.60	4.10	5.60	2.90	1.26	2.20	1.00	1.20	1.00	1.80	2.89
25-2	NE250	N 45° 48.371' W 077° 06.964' Elev. 124m	198m	0.69	0.52	3.00	3.80	10.60	4.50	4.69	5.80	3.80	2.20	2.20	1.70	3.63
Background Samples																
Maika (PAS # 10)	SW	N 45° 46.367' W 077° 11.447' Elev. 149m	6690m	0.33	0.28	0.42	0.38	0.44	0.37	0.38	0.39	0.33	0.28	0.38	0.32	0.36
Maika	Duplicate	Same as above	6690m	0.33	0.28	0.42	0.38	0.44	0.37	0.38	0.39	0.33	0.28	0.38	0.32	0.36
Fitzpatrick	SE	N 45° 44.818' W 076° 59.822' Elev. 159m	11400m	0.34	0.28	0.42	0.38	0.44	0.37	0.38	0.39	0.33	0.28	0.38	0.32	0.36
Petawawa	NW	N 45° 51.497' W 077° 12.828' Elev. 149m	9480m	0.34	0.28	0.42	0.38	0.43	0.37	0.38	0.38	0.33	0.28	0.38	0.32	0.36
Farm	NE	N 45° 53.071' W 076° 56.768' Elev. 142m	16000m	0.34	0.28	0.42	0.37	0.43	0.37	0.38	0.39	0.33	0.28	0.38	0.32	0.36
			Sum	30.76	34.21	59.69	56.70	87.63	68.95	46.58	60.97	53.31	30.52	90.88	36.70	54.74

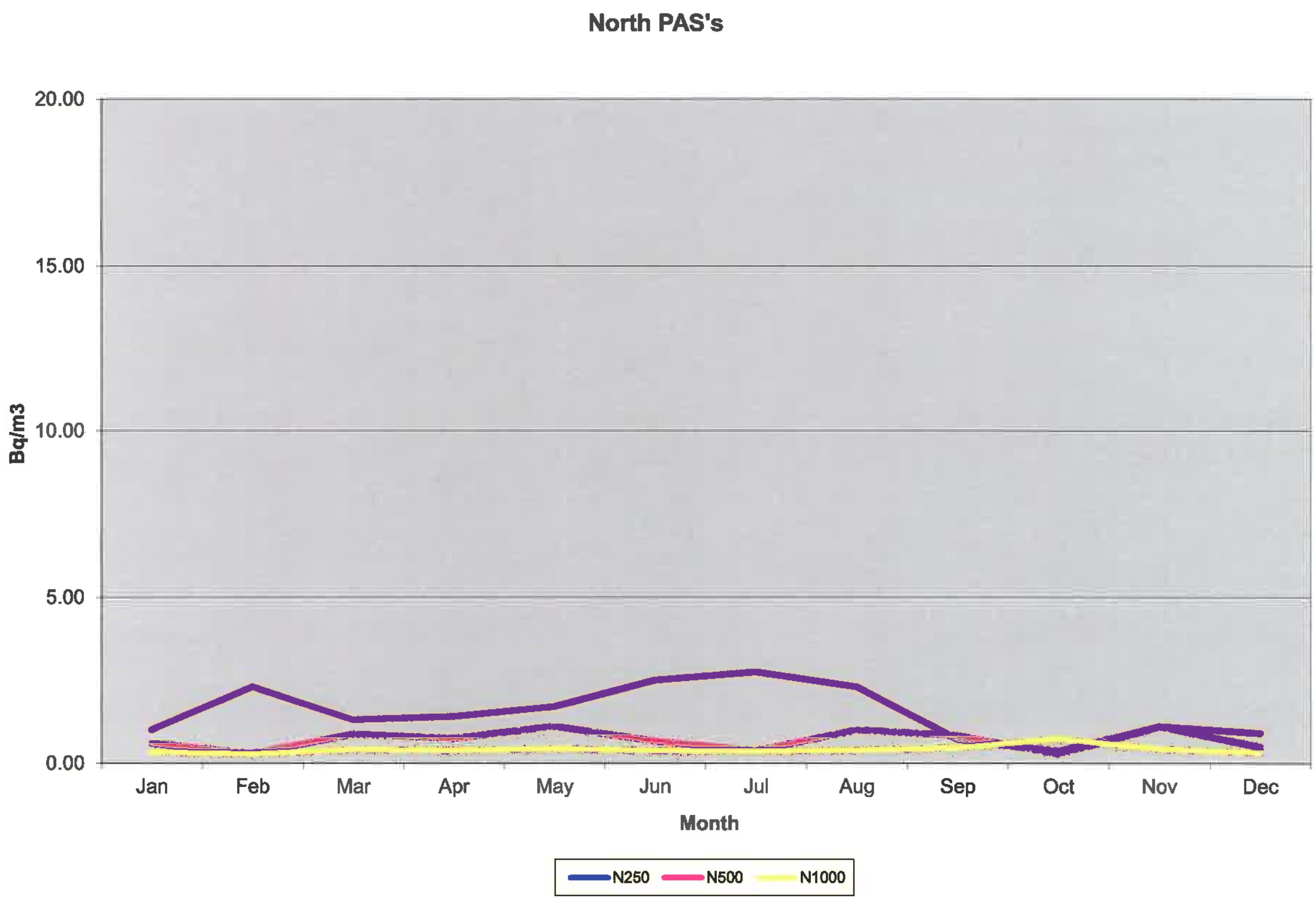
* No Sample Available

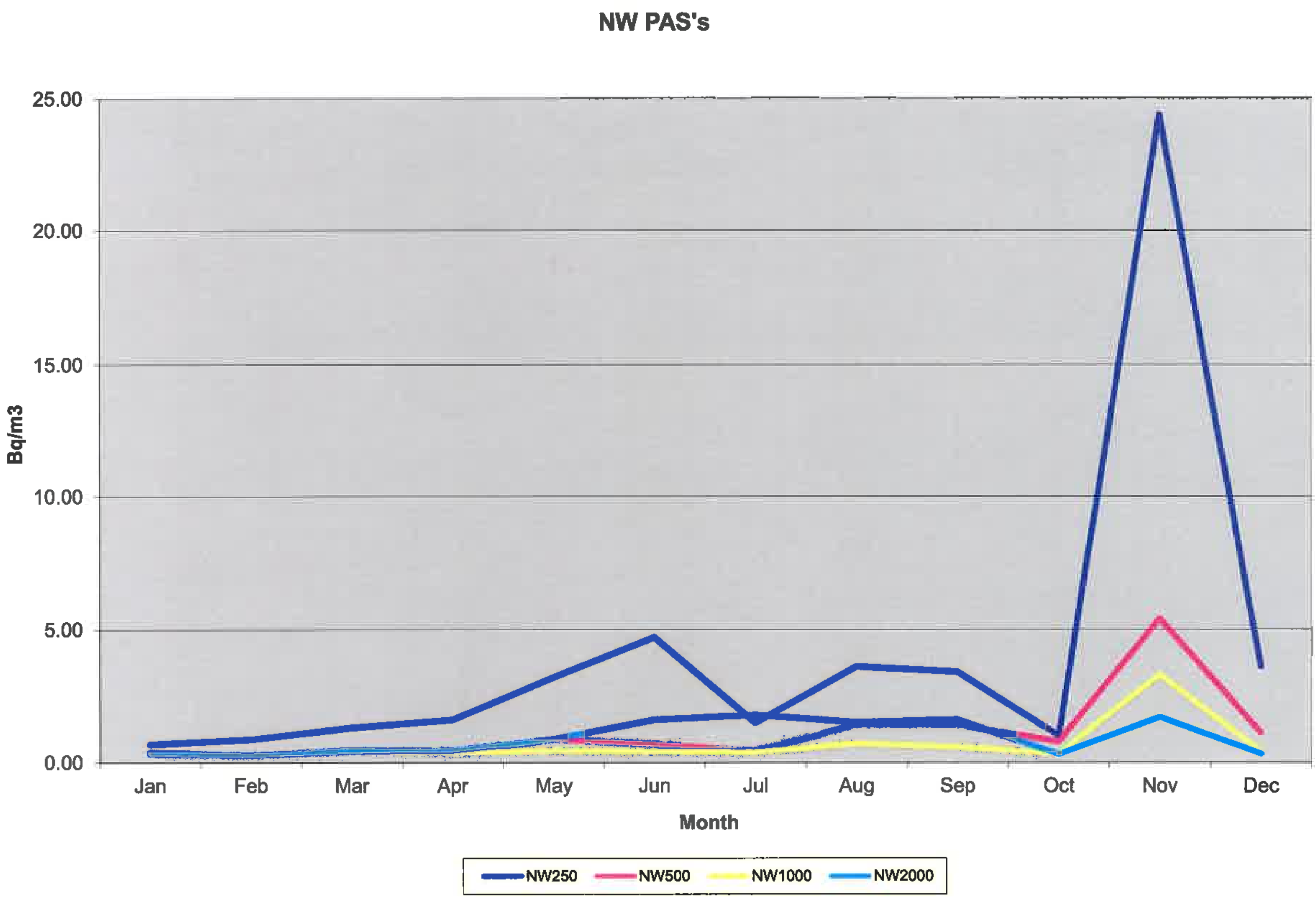
LOCATION OF SRB PASSIVE AIR SAMPLERS

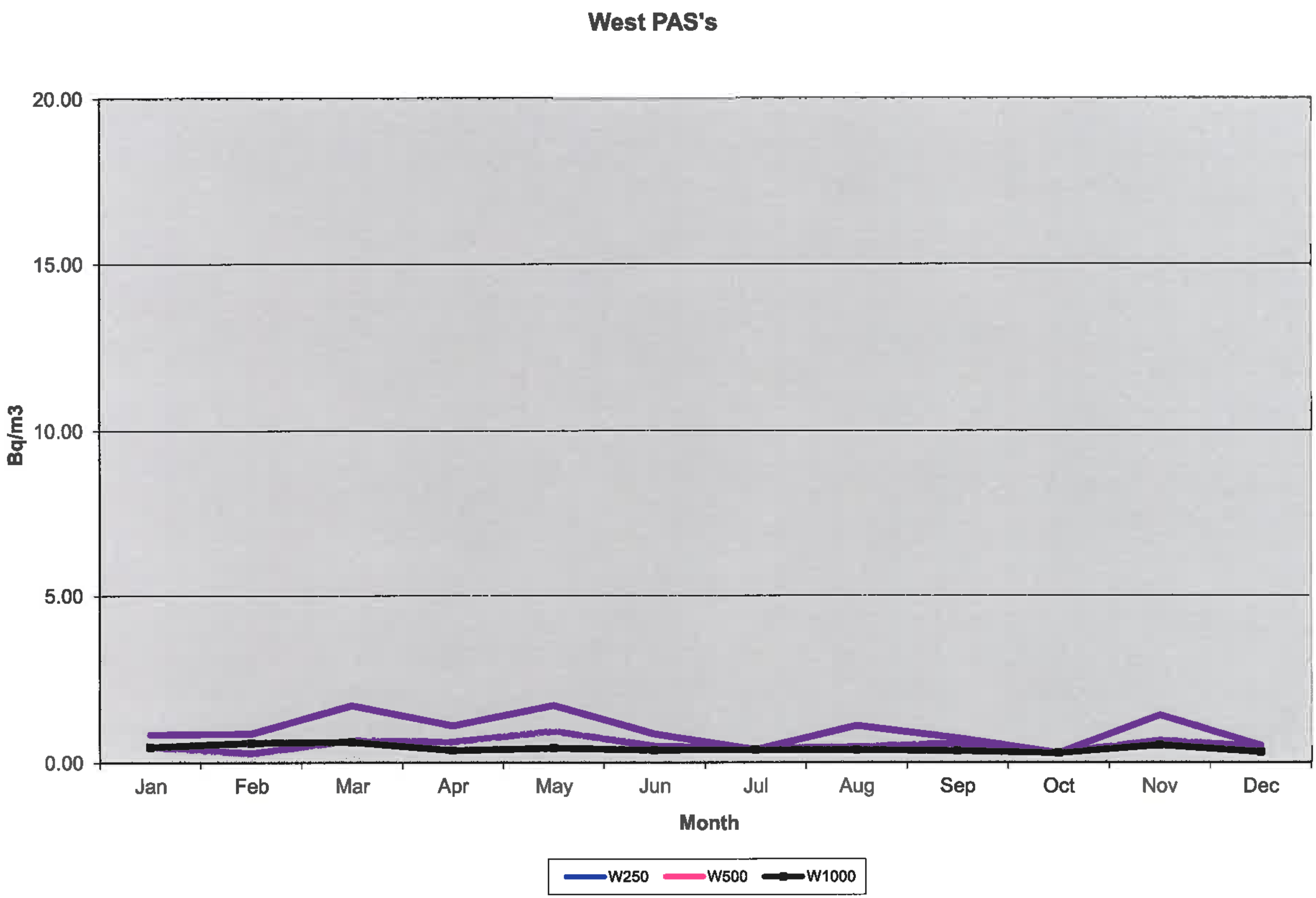


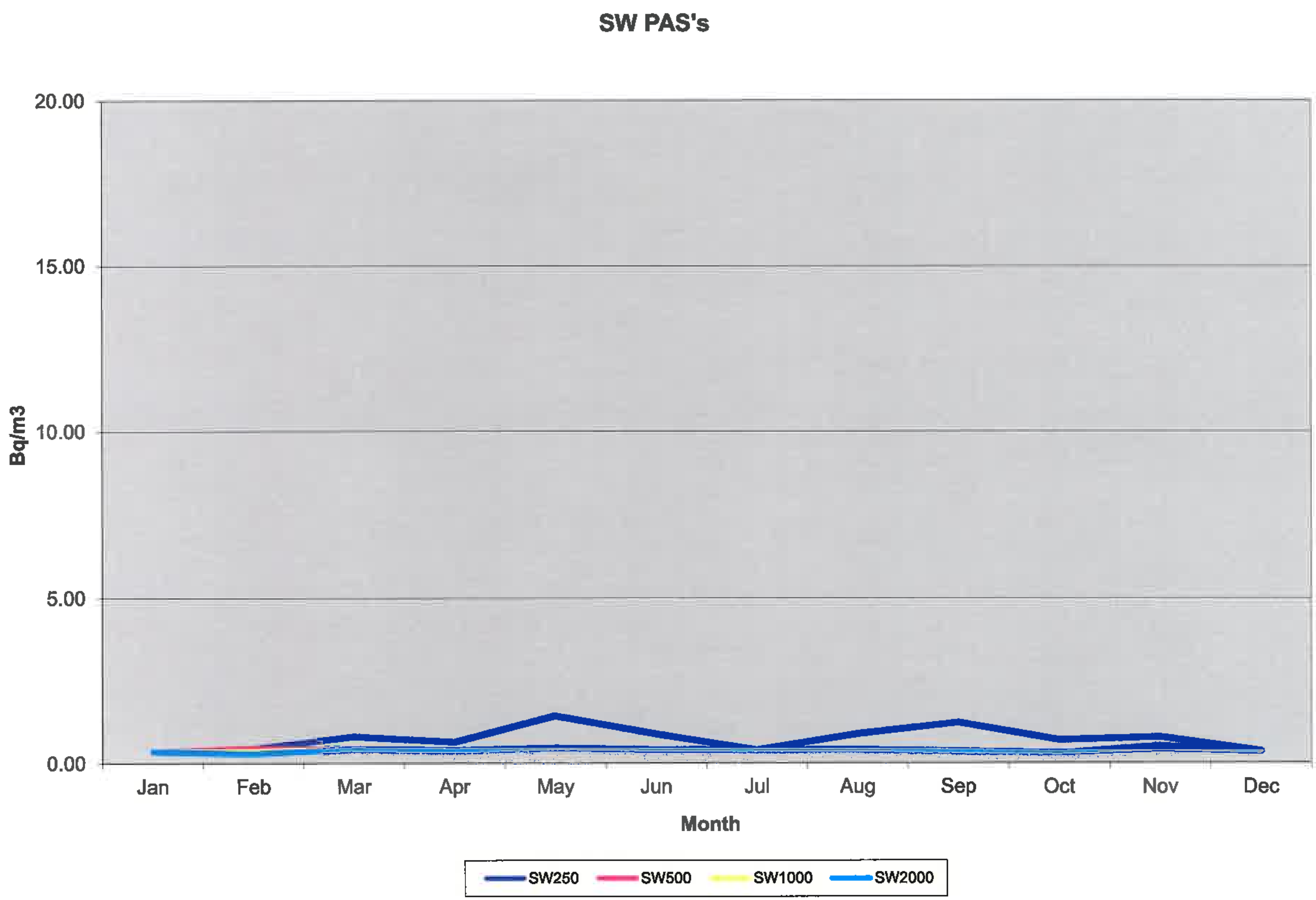

Background Samples
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
Bq/m3
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Maika (PAS # 10)
Maika
Fitzpatrick
Petawawa
Farm

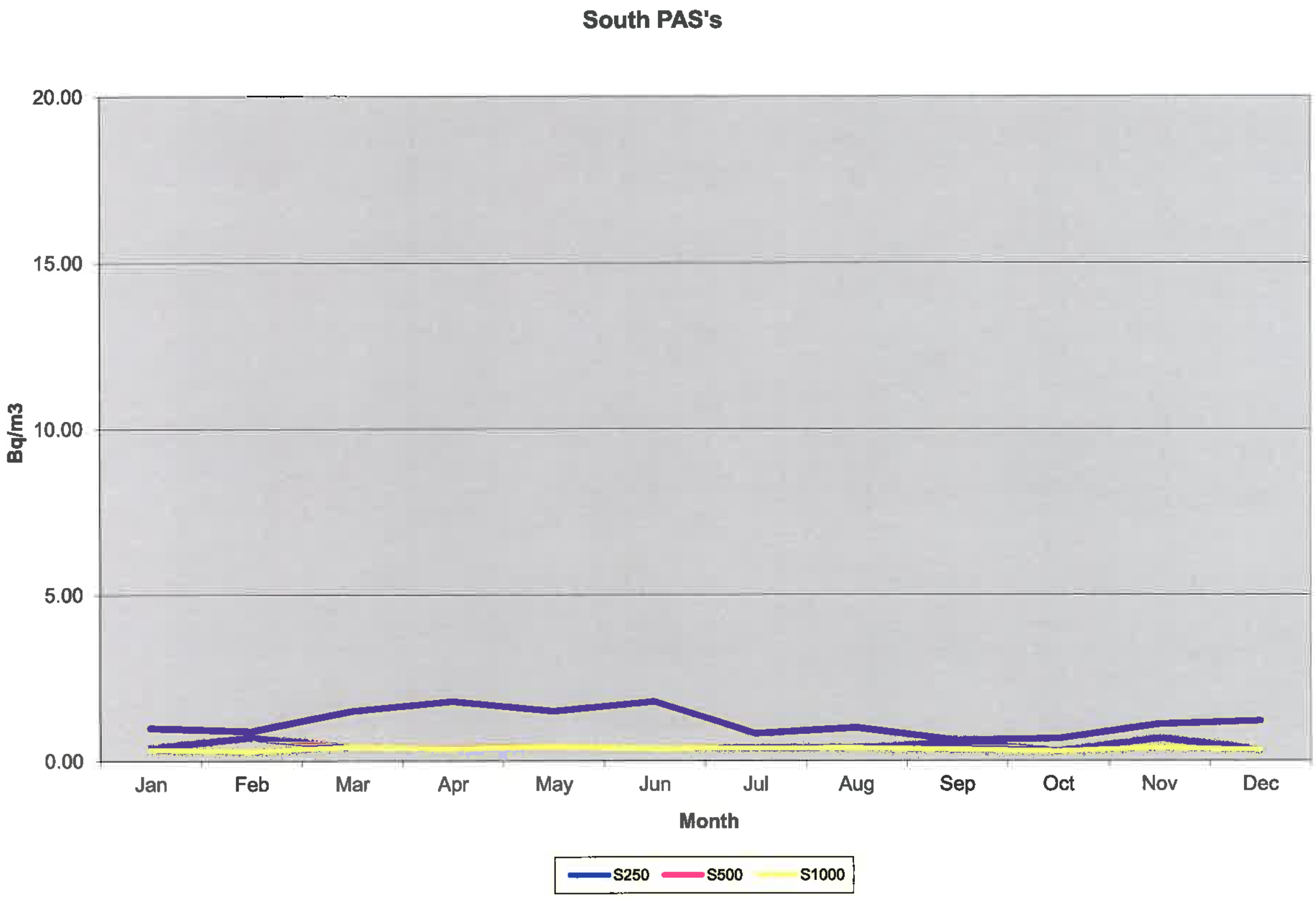

Samplers 1, 2, 13
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
Bq/m3
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Sampler #1
Sampler # 2
Sampler #13

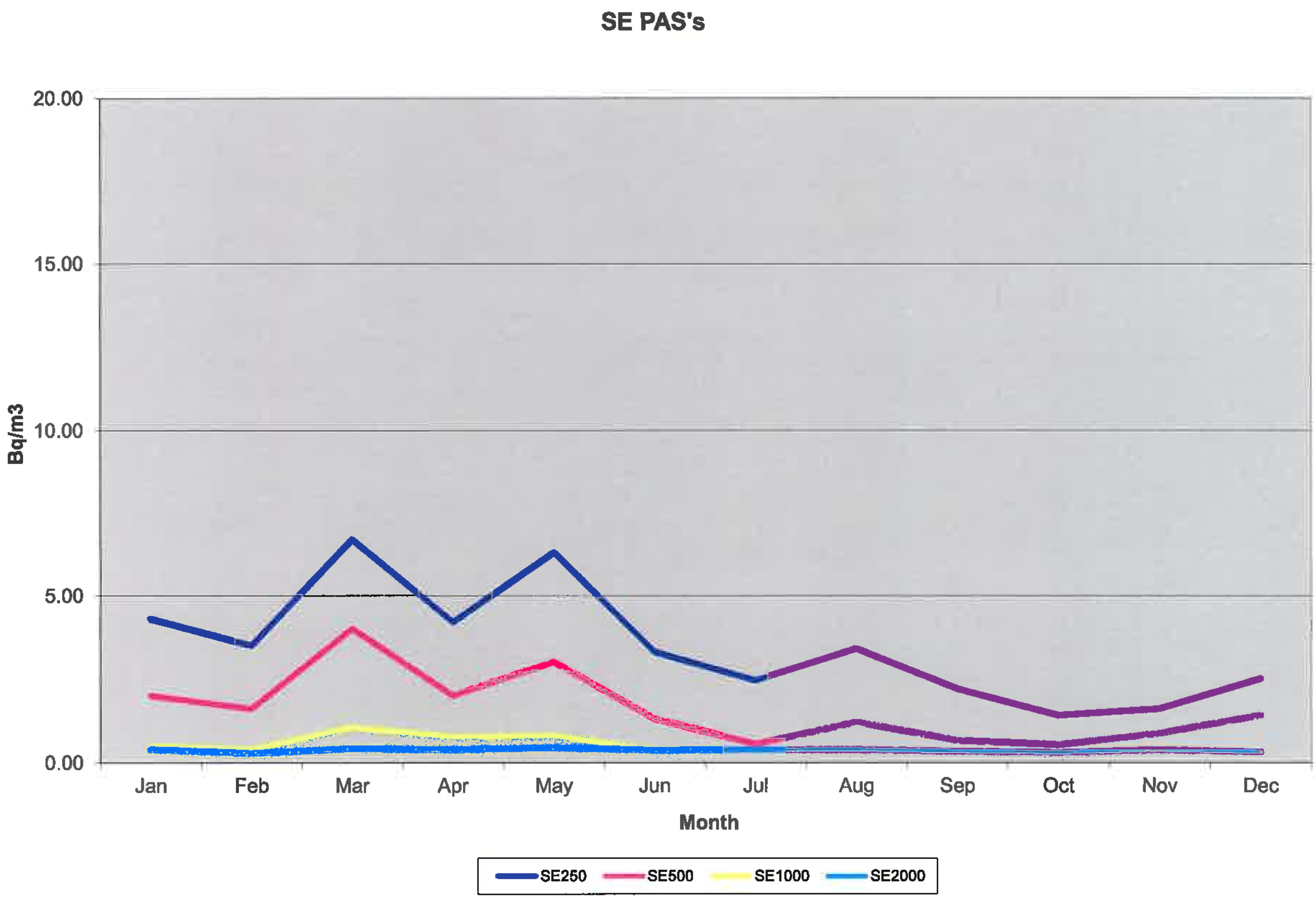

North PAS's
20.00
15.00
10.00
5.00
0.00
Bq/m3
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
N250
N500
N1000


NW PAS's
25.00
20.00
15.00
10.00
5.00
0.00
Bq/m3
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
NW250
NW500
NW1000
NW2000


West PAS's
20.00
15.00
10.00
5.00
0.00
Bq/m3
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
W250
W500
W1000

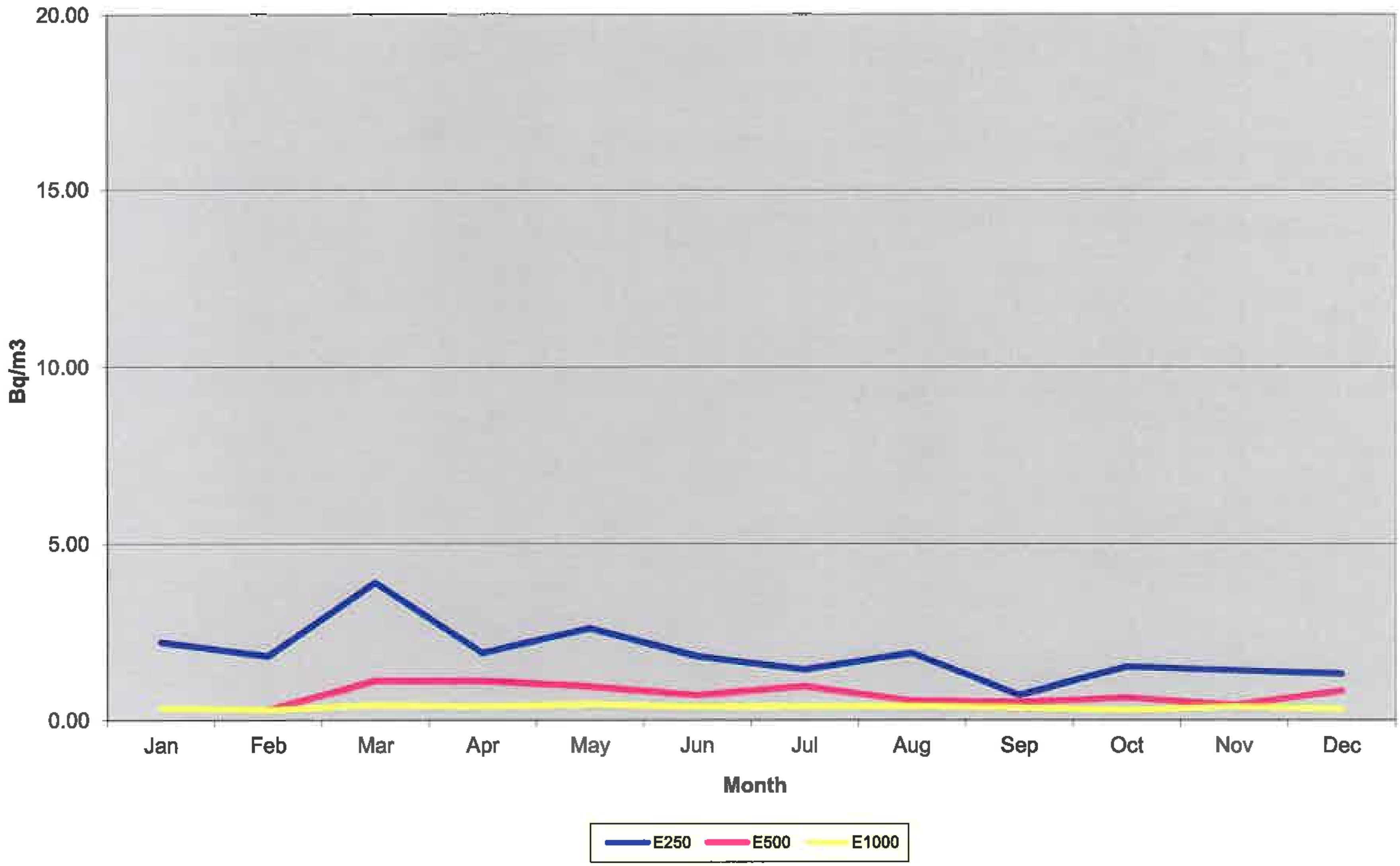

SW PAS's
20.00
15.00
10.00
5.00
0.00
Bq/m3
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
SW250
SW500
SW1000
SW2000

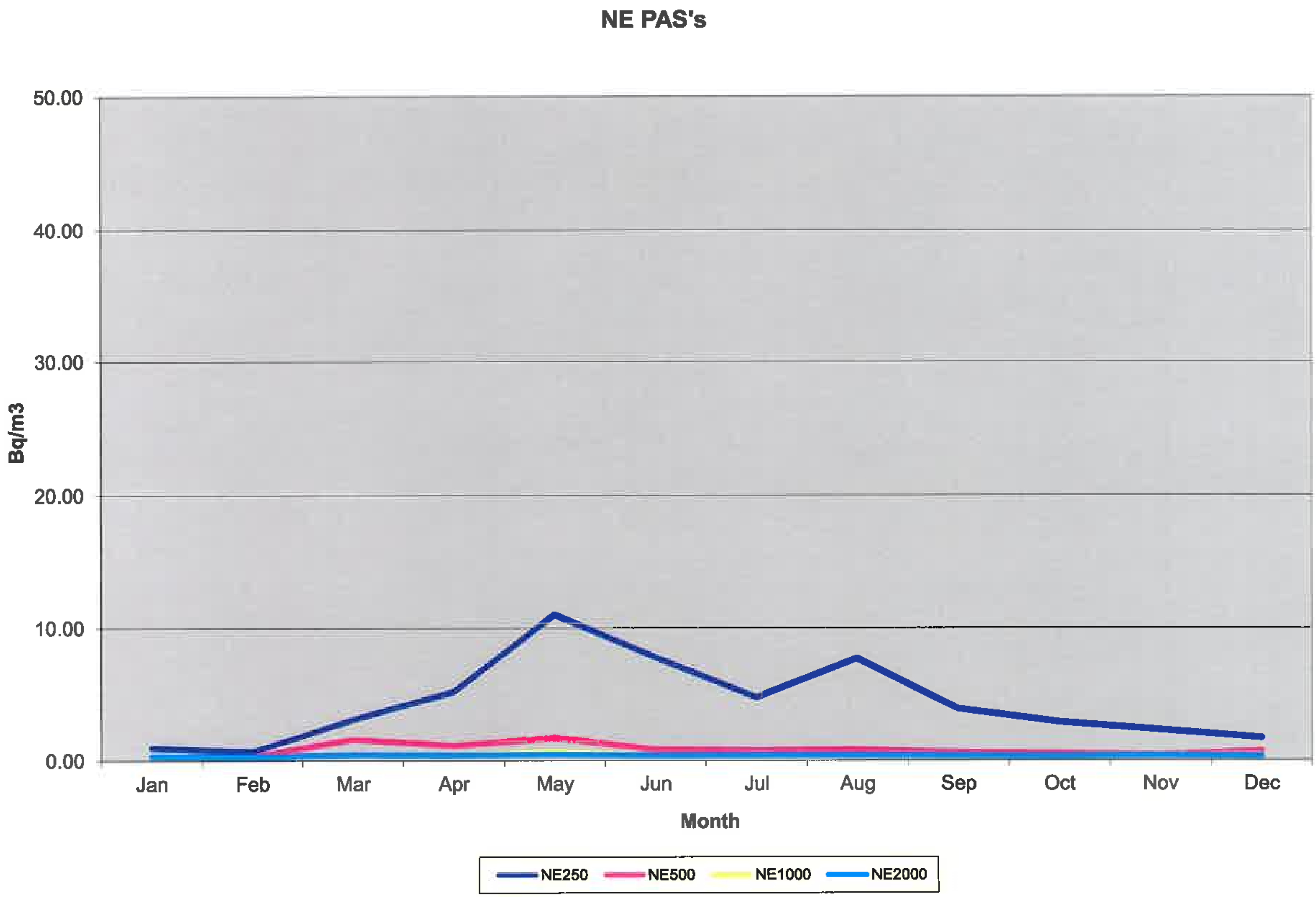

South PAS's
20.00
15.00
10.00
5.00
0.00
Bq/m3
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
S250
S500
S1000



SE PAS's
20.00
15.00
10.00
5.00
0.00
Bq/m3
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
SE250
SE500
SE1000
SE2000

East PAS's


20.00
15.00
10.00
5.00
0.00
Bq/m3
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
E250
E500
E1000


NE PAS's
50.00
40.00
30.00
20.00
10.00
0.00
Bq/m3
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
NE250
NE500
NE1000
NE2000

APPENDIX G

Wind Direction Graphs for 2015

Passive Air Sampling Data (Results in Bq/m3)

1st Quarter

Direction	January 250 M	January 500 M	January 1000 M	January 2000 M	February 250 M	February 500 M	February 1000 M	February 2000 M	March 250 M	March 500 M	March 1000 M	March 2000 M
North	1 00	0 59	0 33		2.30	0.30	0.28		1 30	0 87	0 41	
North West	0 68	0 38	0 33	0 33	0.86	0.28	0.31	0.28	1 30	0 47	0 42	0 42
West	0 84	0 47	0 47		0.86	0.28	0.59		1 70	0 66	0 62	
Southwest	0 33	0 33	0 33	0.34	0.43	0.44	0.35	0.28	0 79	0 41	0 42	0 42
South	1 00	0 39	0 33		0.90	0.71	0.28		1 50	0 42	0 42	
South East	4 30	2 00	0.50	0 40	3.50	1.60	0.40	0.28	6 70	4 00	1 04	0 42
East	2 20	0 34	0.34		1.80	0.28	0.28		3 90	1 10	0.42	
North East	0 94	0 32	0 33	0 33	0.67	0.28	0.28	0.28	3 10	1 60	0 42	0 42

2nd Quarter

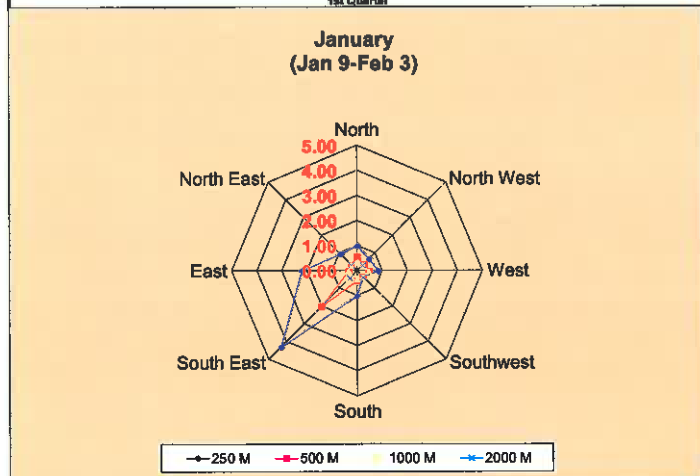
Direction	April 250 M	April 500 M	April 1000 M	April 2000 M	May 250 M	May 500 M	May 1000 M	May 2000 M	June 250 M	June 500 M	June 1000 M	June 2000 M
North	1.40	0 75	0.38		1.70	1 10	0.44		2.50	0.97	0.38	
North West	1 60	0 38	0.37	0 46	3 20	0 86	0 44	0 87	4 70	0 68	0 40	1 60
West	1 10	0.62	0.37		1 70	0 93	0 43		0 85	0.48	0.37	
Southwest	0 63	0 37	0 38	0 38	1 40	0.44	0.44	0.45	0.86	0.37	0 37	0 40
South	1 80	0 38	0 37		1 50	1 50	0 43		1 80	0 37	0 37	
South East	4 20	2 00	0 76	0 38	6.30	3 00	0.80	0.44	3.30	1 30	0 37	0.37
East	1 90	1 10	0 38		2.60	0.94	0.44		1.80	0.70	0.37	
North East	5 20	1 10	0.38	0 38	11.00	1 70	0.62	0.44	7 80	0.82	0.37	[illegible]

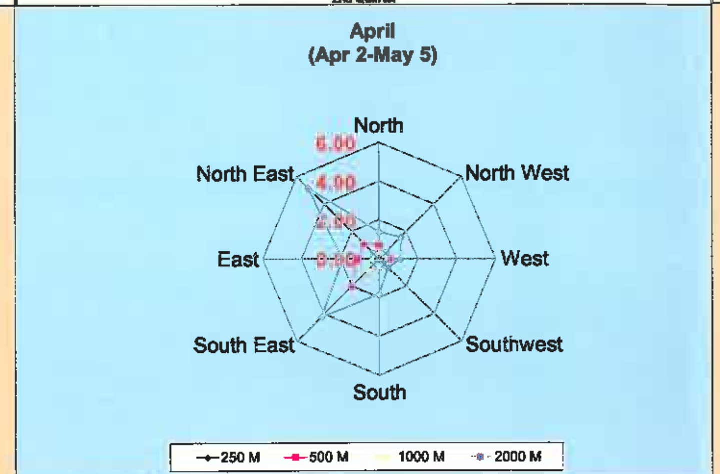
3rd Quarter

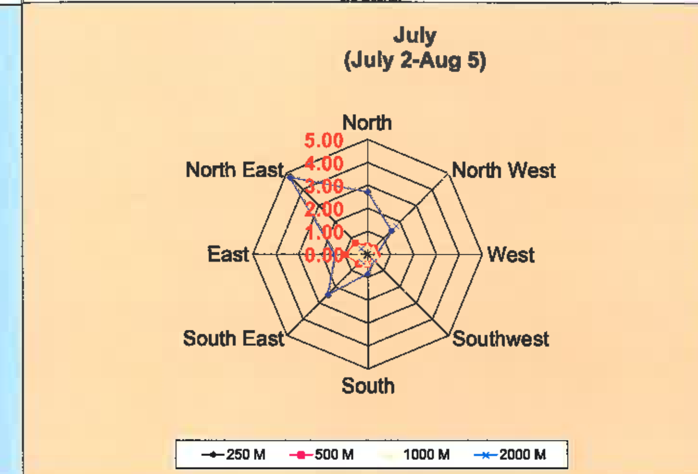
Direction	July 250 M	July 500 M	July 1000 M	July 2000 M	August 250 M	August 500 M	August 1000 M	August 2000 M	September 250 M	September 500 M	September 1000 M	September 2000 M
North	2 74	0 38	0 37		2.30	1.00	0.40		0 72	0.84	0 47	
North West	1 48	0 42	0 38	1 78	3.60	1.40	0.70	1.50	3 40	1 40	0 57	1 60
West	0 38	0 42	0 38		1.10	0.46	0.38		0 73	0 57	0 35	
Southwest	0 38	0 38	0 38	0.39	0.86	0.39	0.39	0.40	1 20	0 34	0 35	0 35
South	0.83	0 40	0 38		1.00	0.39	0.38		0 62	0.55	0 33	
South East	2 45	0 55	0 38	0 38	3.40	1.20	0.39	0.39	2 20	0 66	0.35	0 34
East	1 42	0 95	0 38		1.90	0.54	0.39		0.70	0 50	0.35	
North East	4 76	0 74	0 38	0.38	7.70	0.79	0.39	0.38	3.90	0.59	0 34	0,34

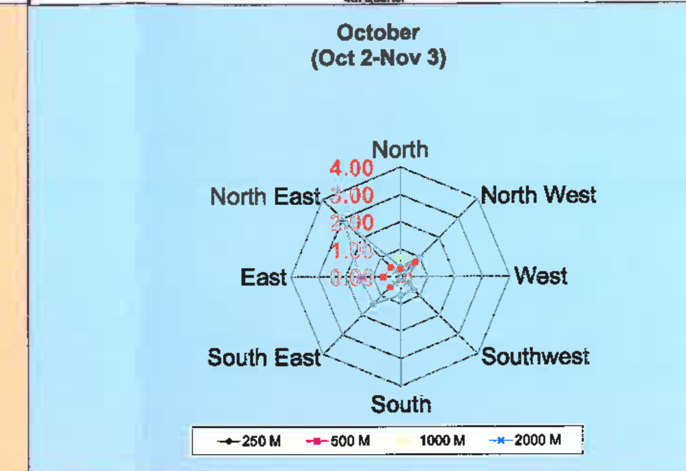
4th Quarter

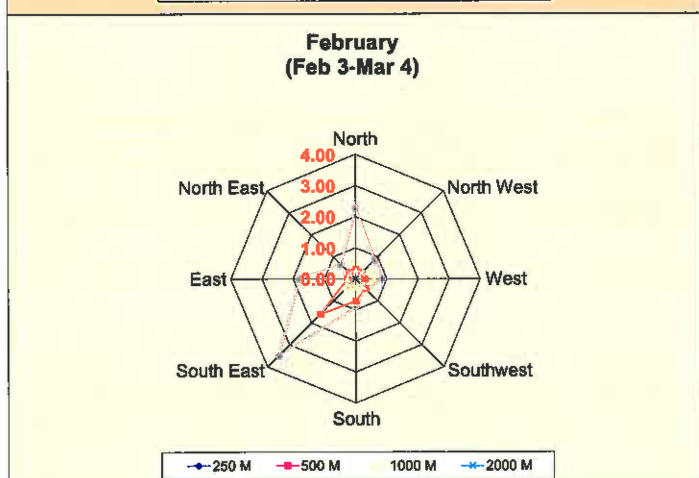
Direction	October 250 M	October 500 M	October 1000 M	October 2000 M	November 250 M	November 500 M	November 1000 M	November 2000 M	December 250 M	December 500 M	December 1000 M	December 2000 M
North	0.36	0 29	0 74		1 10	1.10	0 43		0 90	0 49	0.32	
North West	1.00	0 77	0.32	0 30	24 40	5 40	3 30	1 70	3 60	1 10	0 39	0 32
West	0.28	0.29	0.28		1.40	0.65	0 52		0 50	0.46	0.31	
Southwest	0 68	0.28	0 28	0.30	0.76	0.49	0.37	0.41	0.36	0.32	0.32	0.33
South	0 67	0 28	0 28		1 10	0.68	0.38		1 20	0 32	0 32	
South East	1 40	0 53	0 28	0 30	1.60	0.87	0.38	0 38	2 50	1 40	0 33	0 32
East	1.50	0 63	0.28		1.40	0.42	0.37		1.30	0.82	0 31	
North East	2.90	0 50	0 29	0.29	2.30	0.40	0 38	0.37	1 70	0.69	0.35	0.31

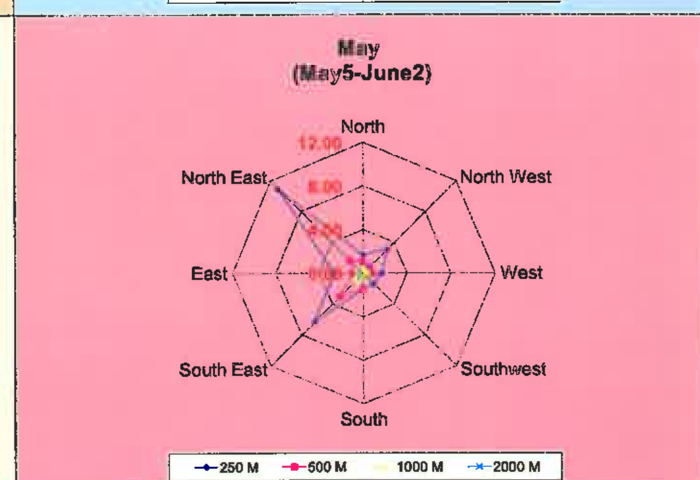


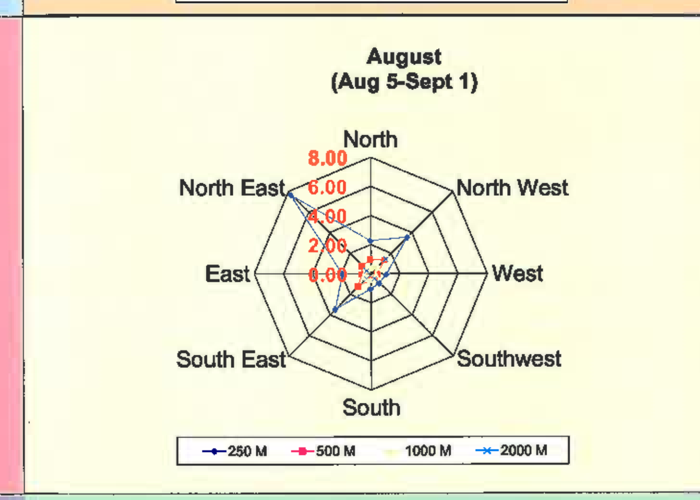


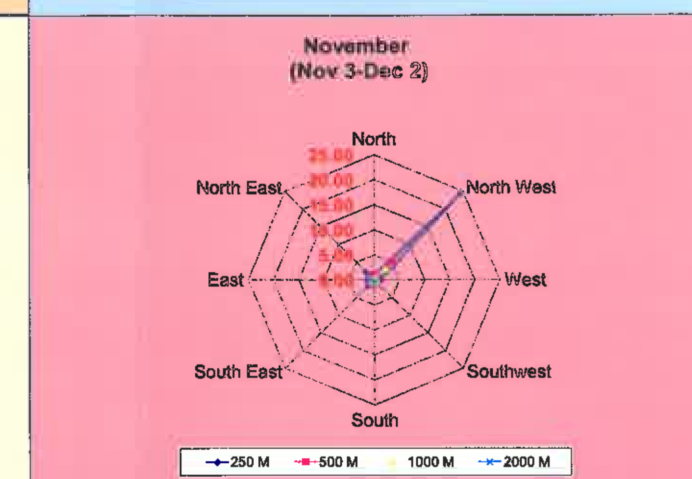


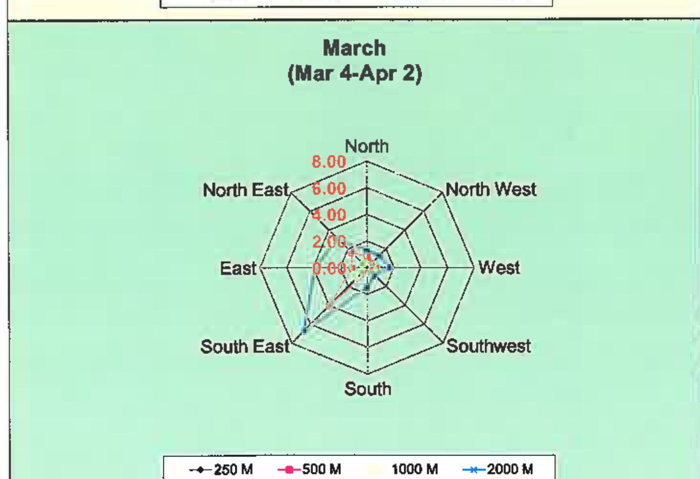


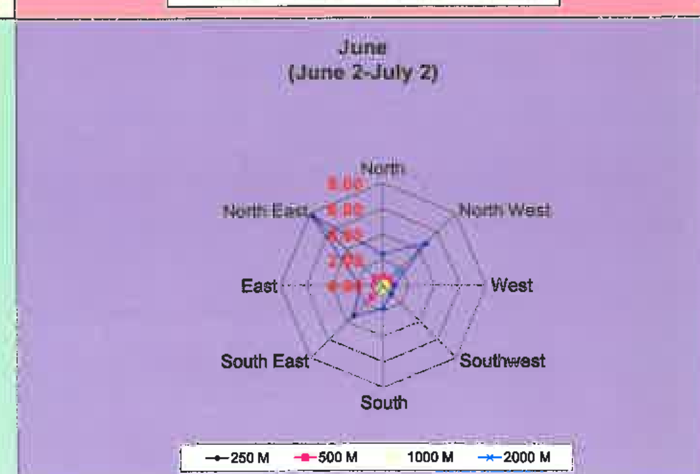


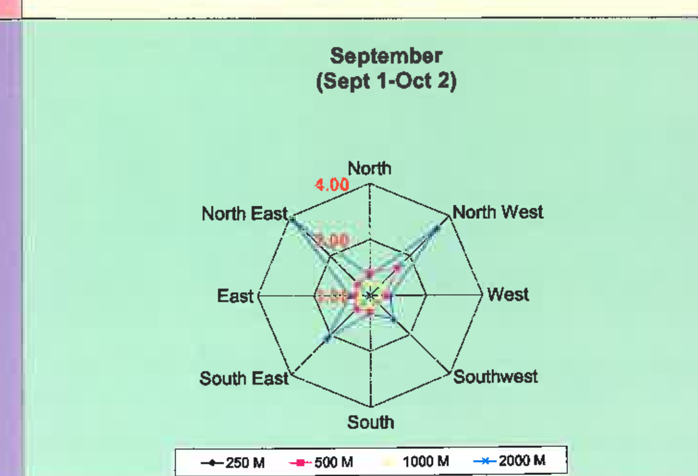


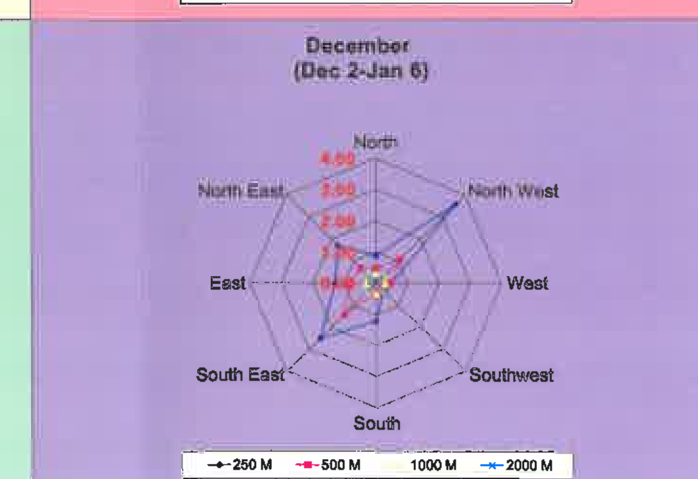












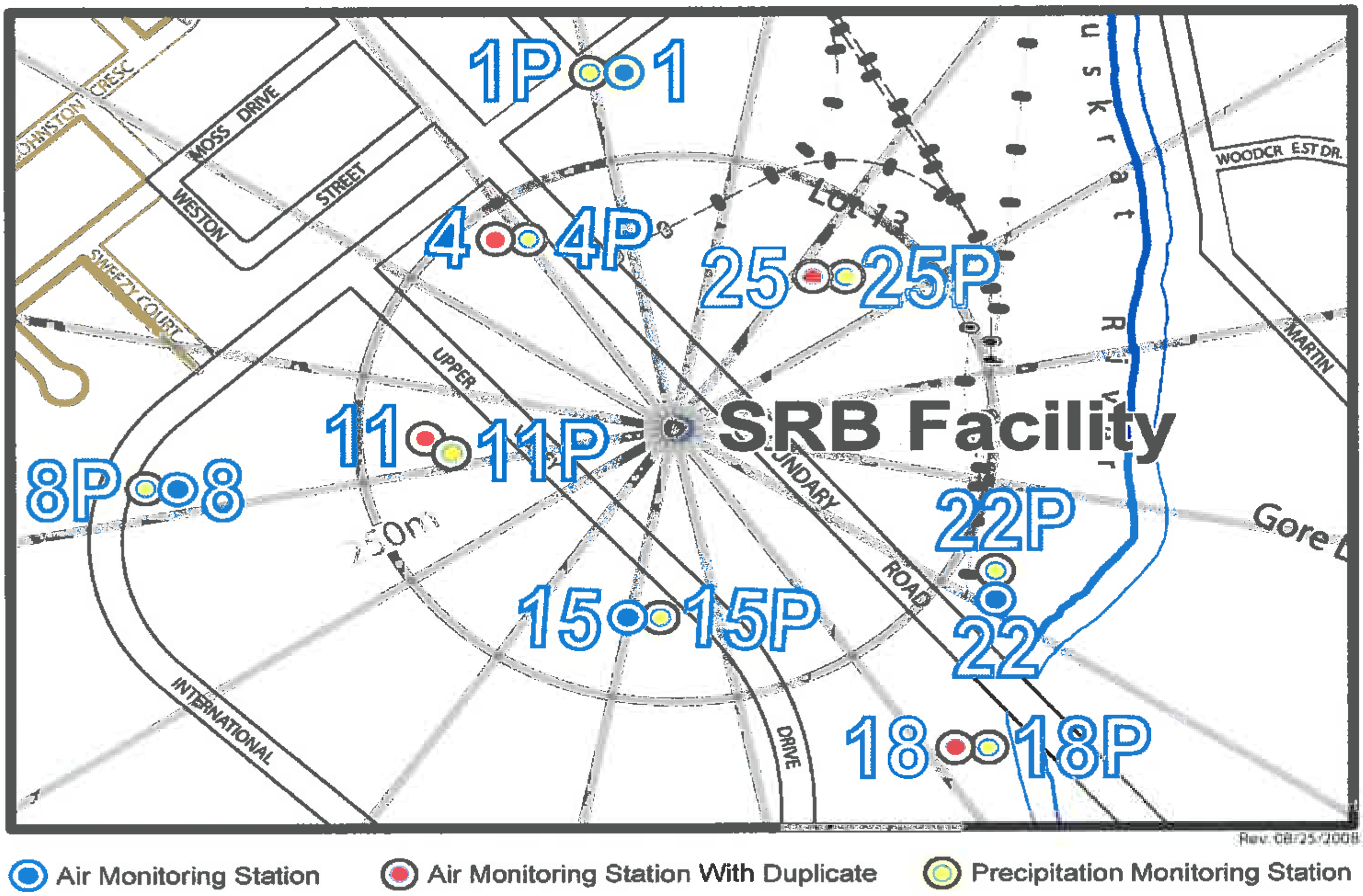
APPENDIX H

Precipitation Monitoring Results for 2015

Precipitation Monitoring Results for 2015

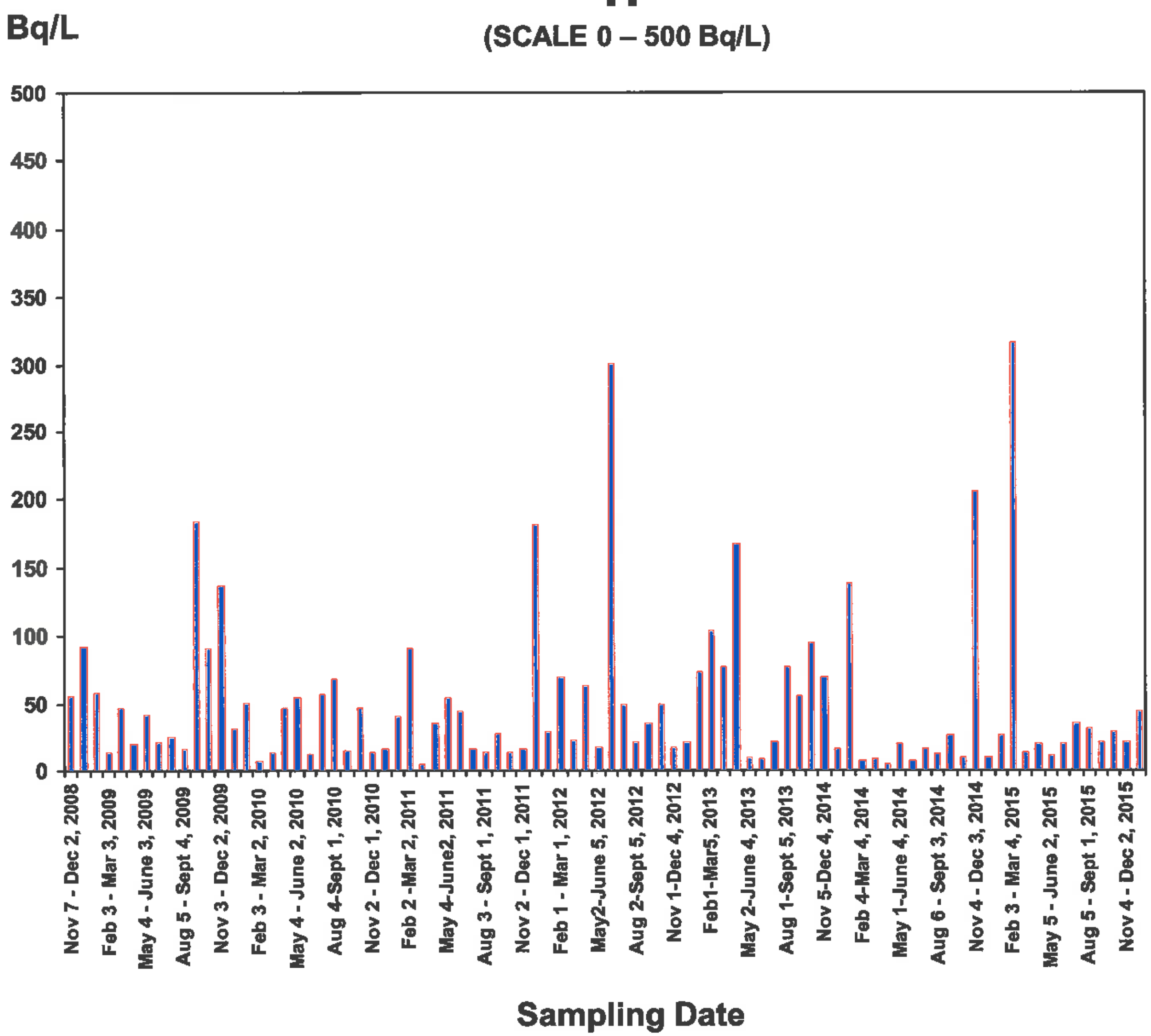
PRECIPITATION SAMPLERS								
	1P	4P	8P	11P	15P	18P	22P	25P
	Bq/L							
January 9, 2015 - February 3, 2015	27	53	14	12	23	212	63	8
February 3, 2015 - March 4, 2015	316	122	189	53	106	875	475	73
March 4, 2015 - April 2, 2015	14	207	31	14	69	99	102	18
April 2 - May 5, 2015	20	96	5	5	9	50	6	36
May 5 - June 2, 2015	11	37	67	58	24	22	11	16
June 2 - July 2, 2015	20	22	19	32	36	43	15	63
July 2 - August 5, 2015	35	23	No sample	5	9	12	9	34
August 5 - September 1, 2015	32	38	6.3	6.2	25	22	16	32
September 1 - October 2, 2015	22	35	8	7	15	27	15	34
October 2 - November 4, 2015	29	44	10	10	10	24	14	16
November 4 - December 2, 2015	21	1,621	17	18	12	48	36	18
December 2, 2015 - January 6, 2016	44	114	14	11	147	14	15	19
Average	**49**	**201**	**35**	**19**	**40**	**121**	**65**	**31**
Average all results	70							

Map of Air and Precipitation Monitoring Stations



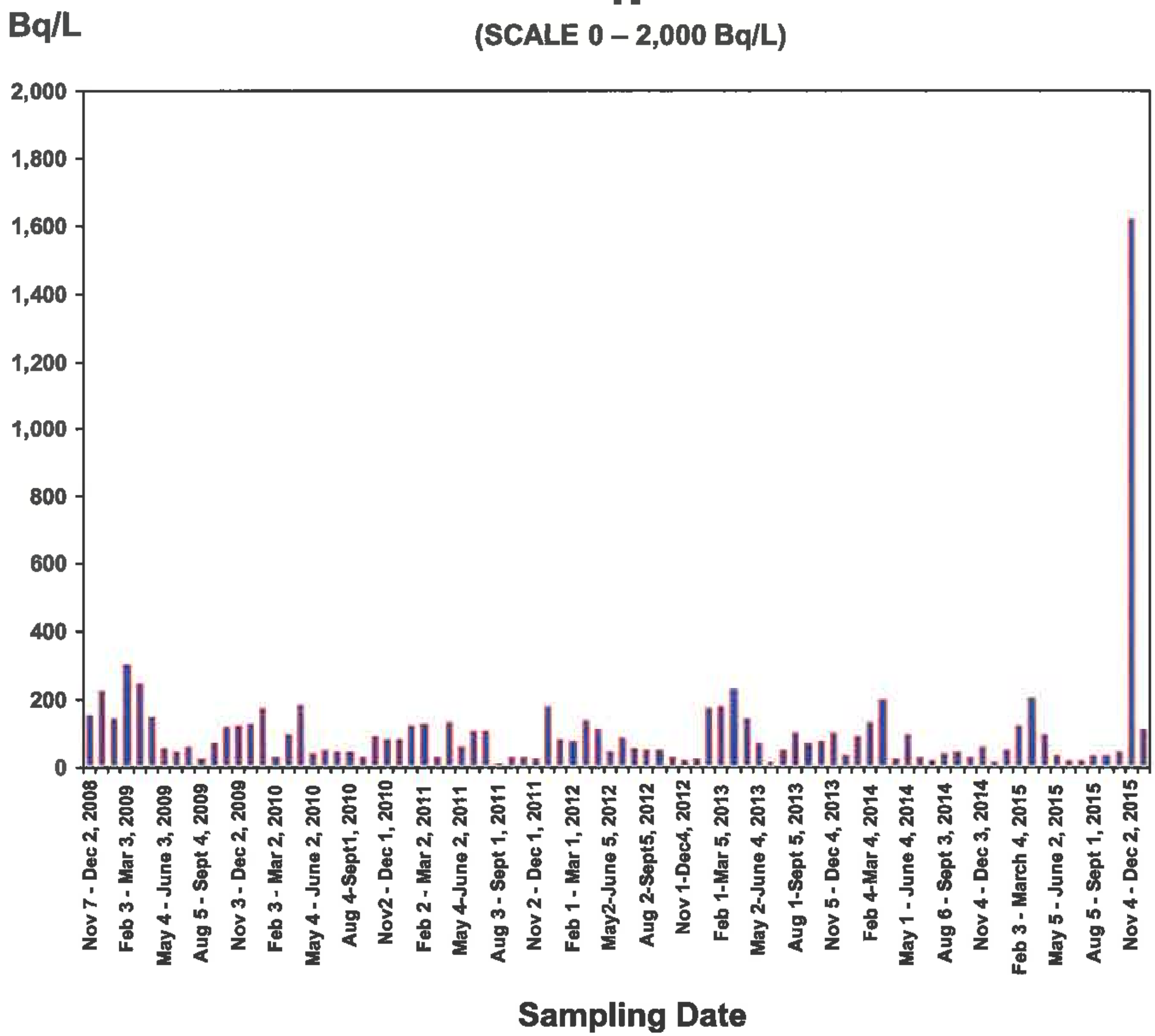
PRECIPITATION RESULTS
1P

(SCALE 0 – 500 Bq/L)

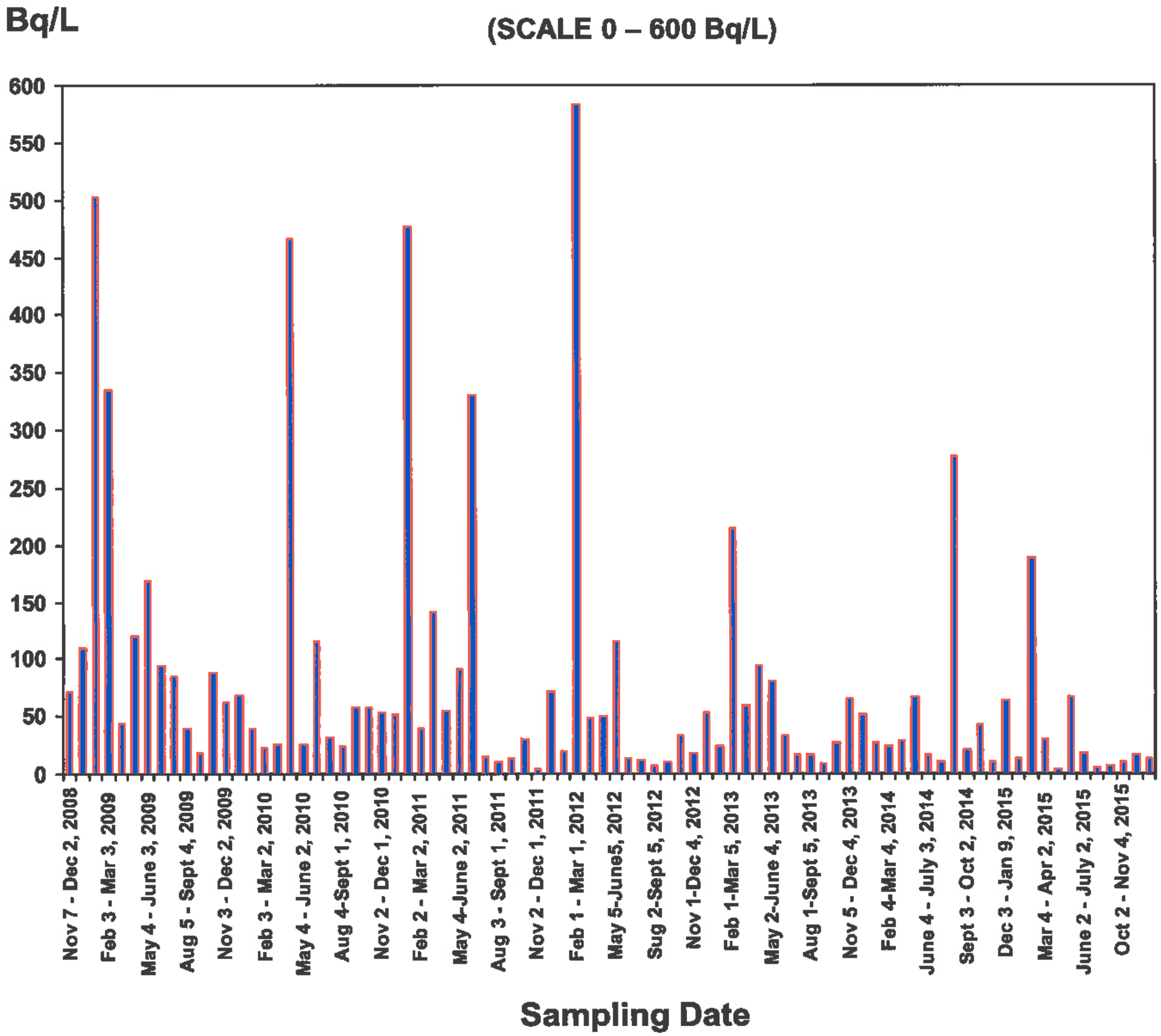


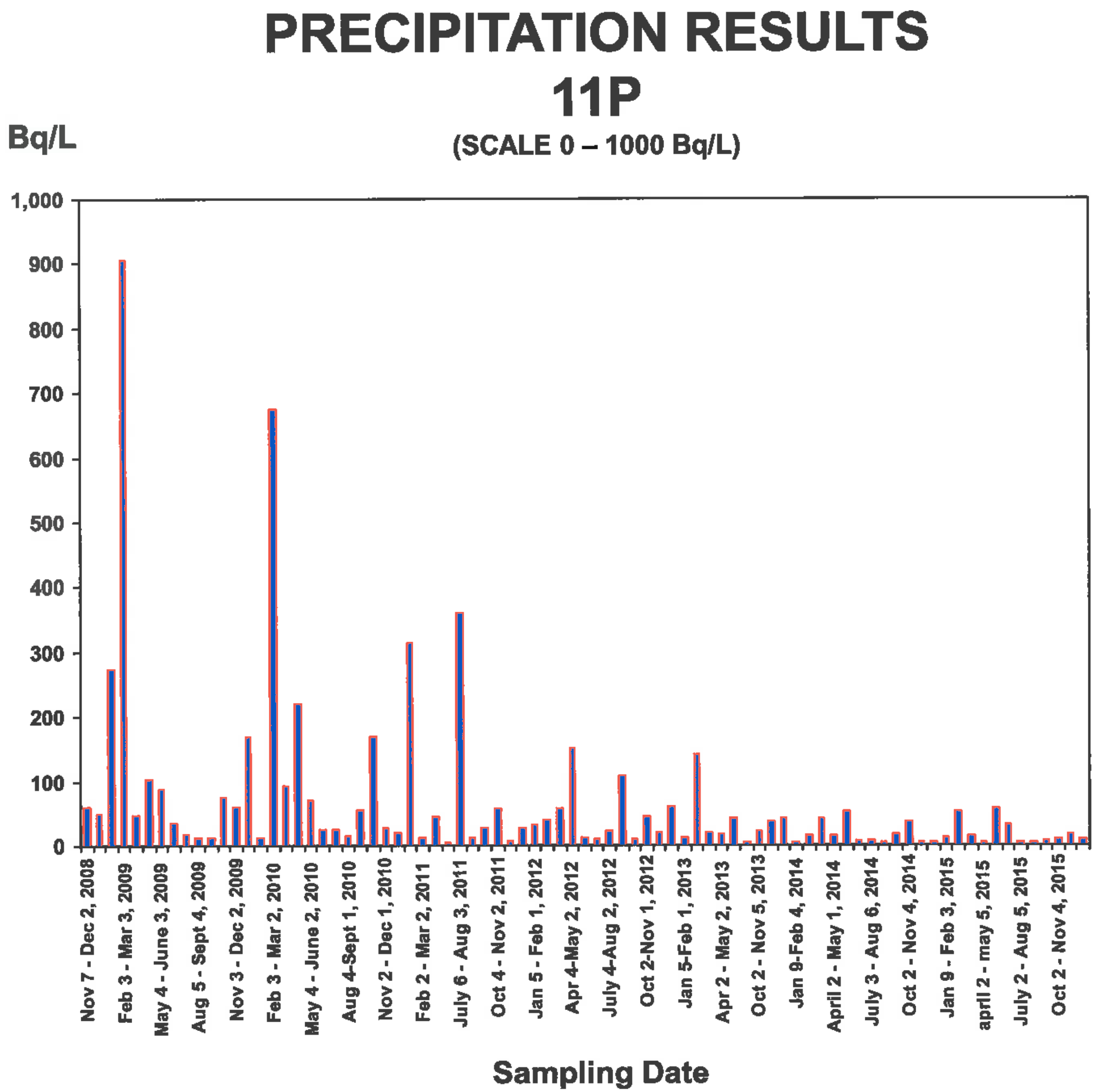
PRECIPITATION RESULTS
4P

(SCALE 0 – 2,000 Bq/L)



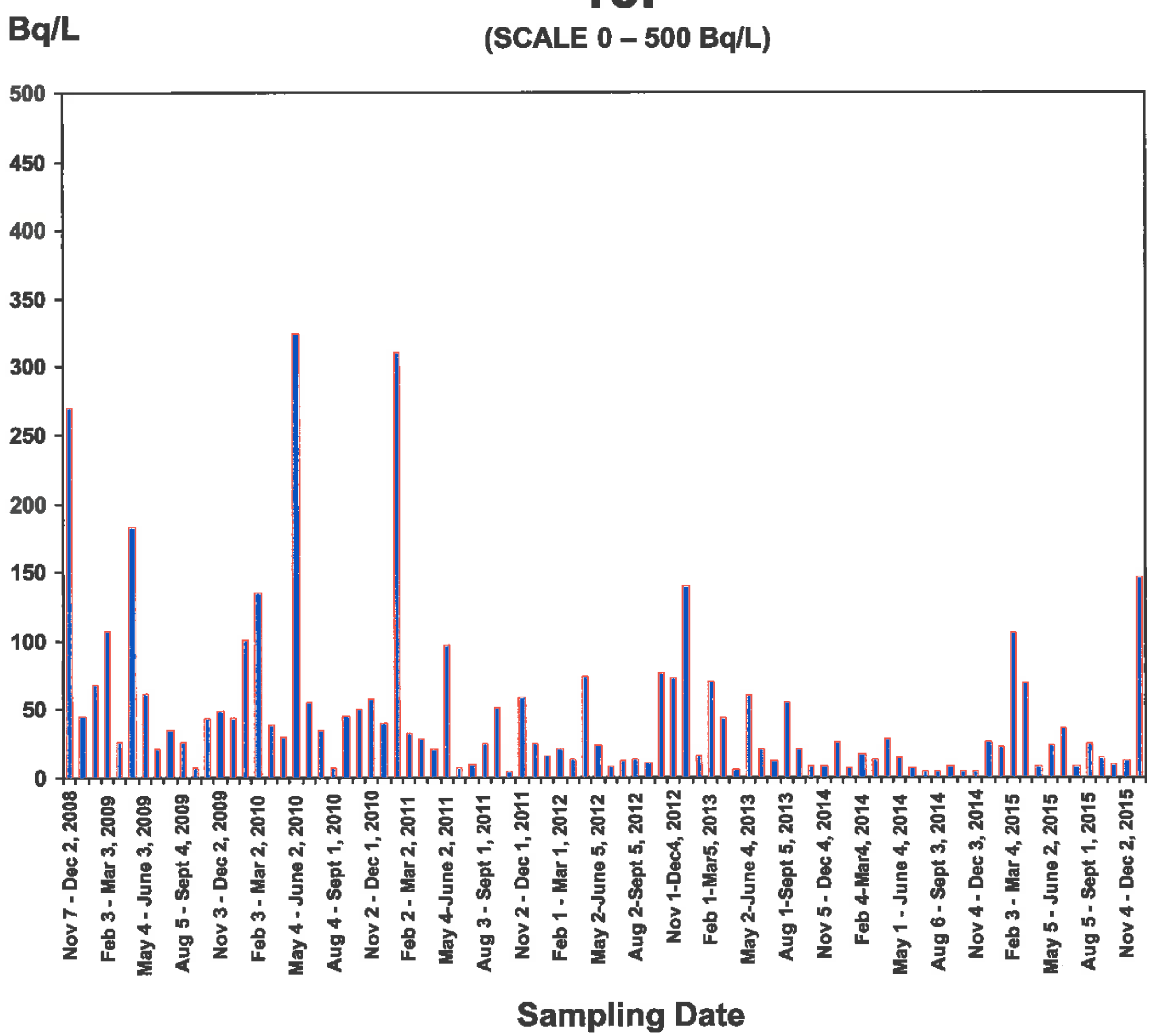
PRECIPITATION RESULTS
8P





PRECIPITATION RESULTS
11P
(SCALE 0 – 1000 Bq/L)
Bq/L
1,000
900
800
700
600
500
400
300
200
100
0
Nov 7 - Dec 2, 2008
Feb 3 - Mar 3, 2009
May 4 - June 3, 2009
Aug 5 - Sept 4, 2009
Nov 3 - Dec 2, 2009
Feb 3 - Mar 2, 2010
May 4 - June 2, 2010
Aug 4-Sept 1, 2010
Nov 2 - Dec 1, 2010
Feb 2 - Mar 2, 2011
July 6 - Aug 3, 2011
Oct 4 - Nov 2, 2011
Jan 5 - Feb 1, 2012
Apr 4-May 2, 2012
July 4-Aug 2, 2012
Oct 2-Nov 1, 2012
Jan 5-Feb 1, 2013
Apr 2 - May 2, 2013
Oct 2 - Nov 5, 2013
Jan 9-Feb 4, 2014
April 2 - May 1, 2014
July 3 - Aug 6, 2014
Oct 2 - Nov 4, 2014
Jan 9 - Feb 3, 2015
april 2 - may 5, 2015
July 2 - Aug 5, 2015
Oct 2 - Nov 4, 2015
Sampling Date

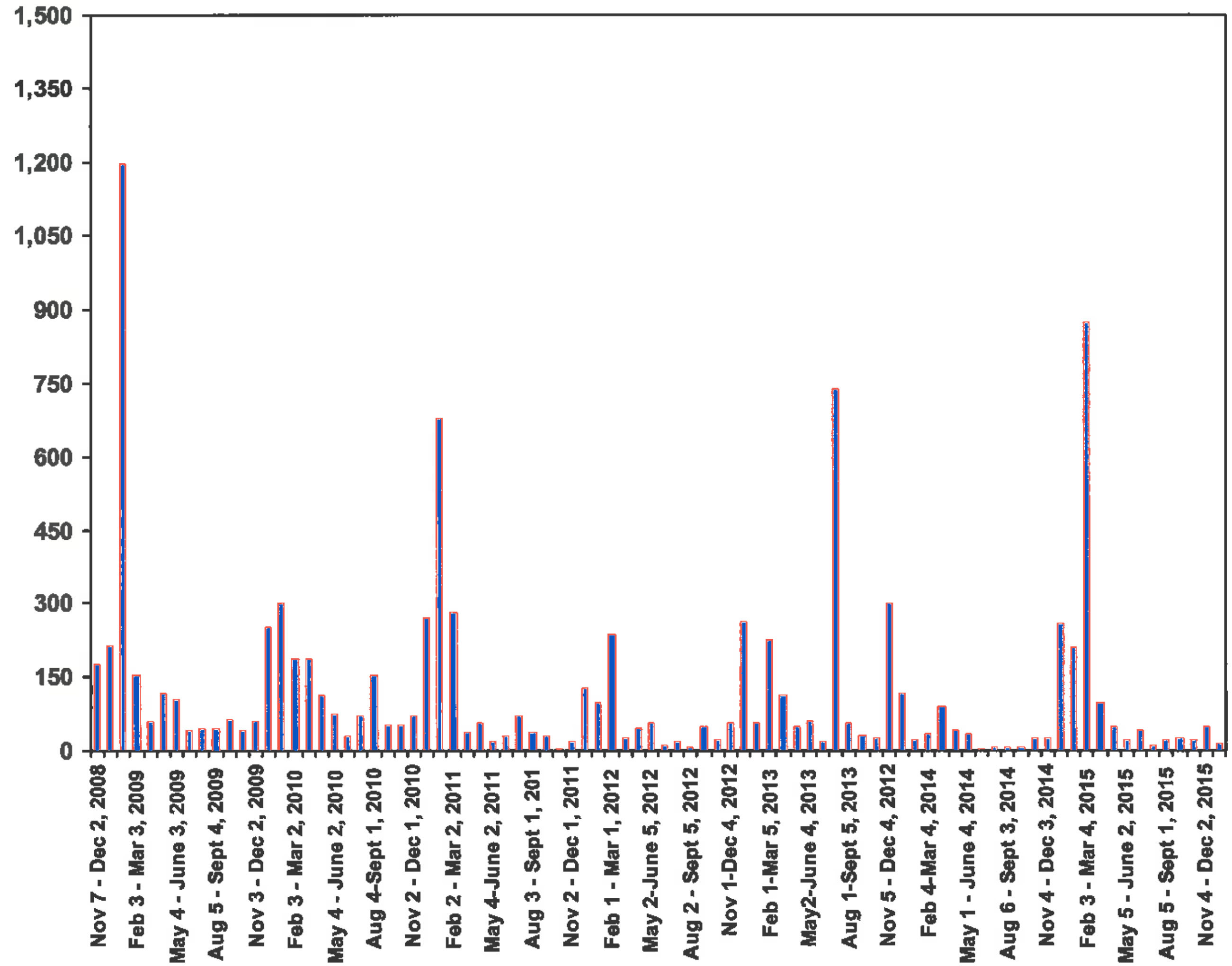
PRECIPITATION RESULTS
15P



PRECIPITATION RESULTS
18P

Bq/L

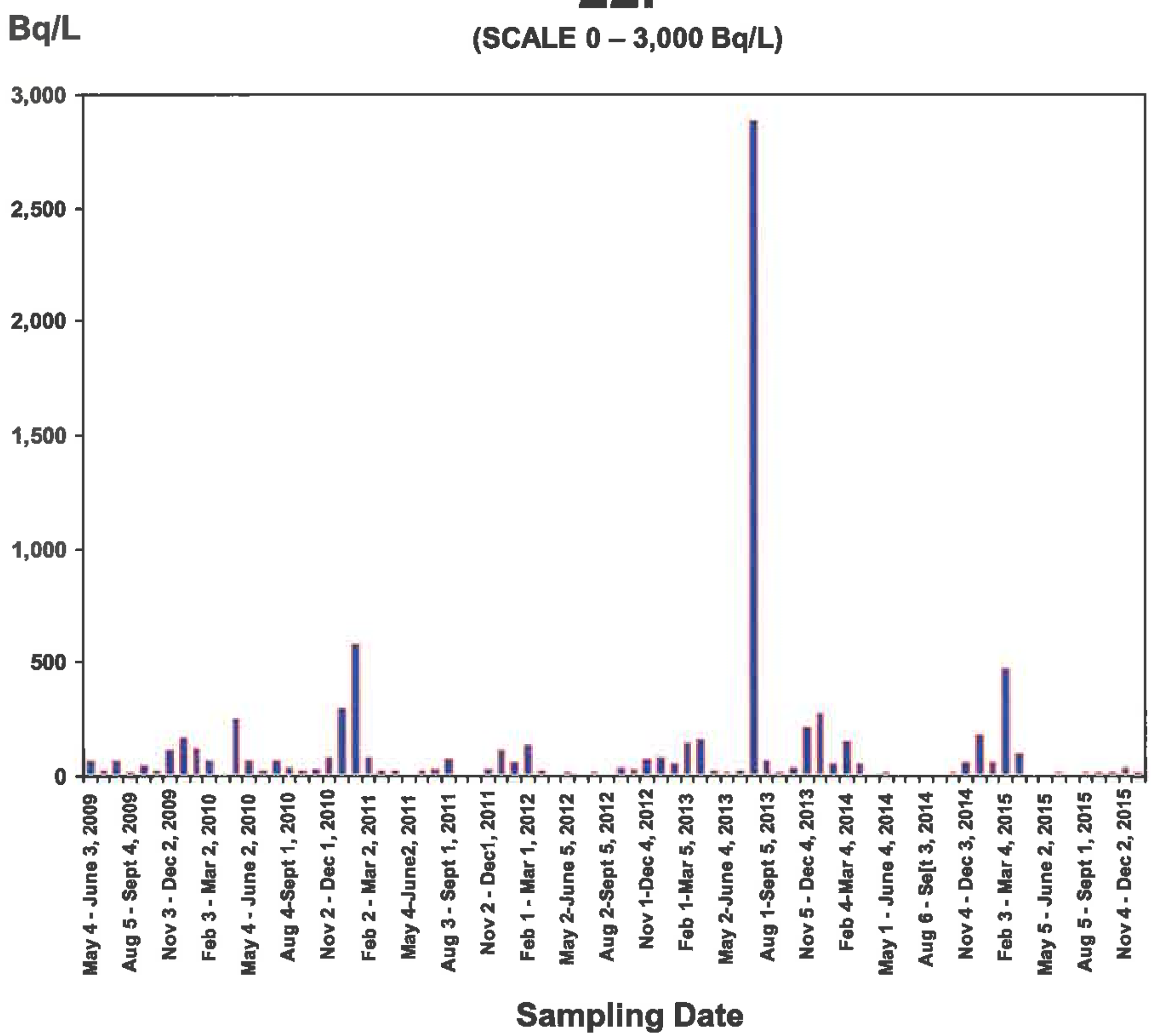
(SCALE 0 – 1500 Bq/L)



Sampling Date

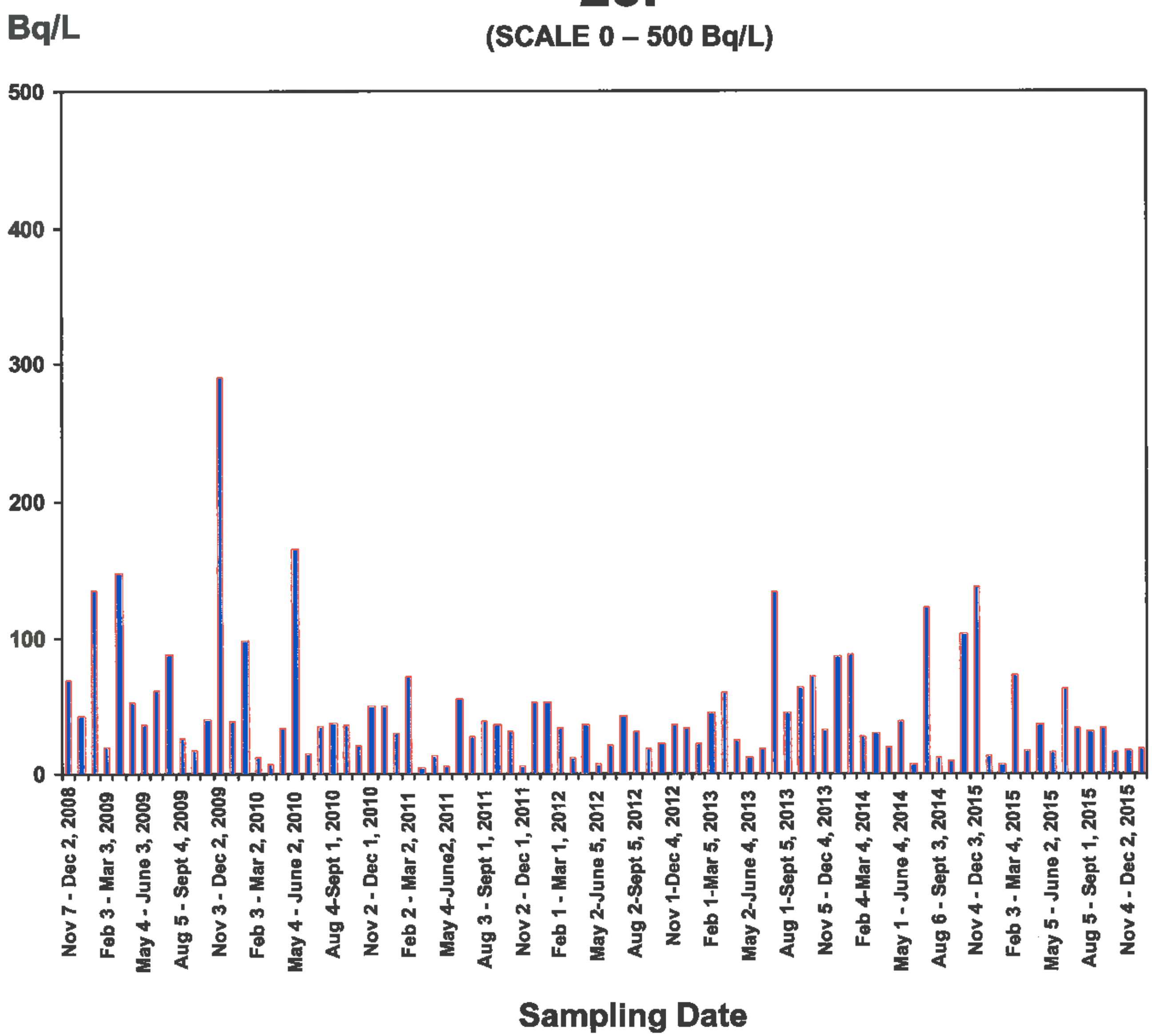
APPENDIX H

PRECIPITATION RESULTS
22P
(SCALE 0 – 3,000 Bq/L)



PRECIPITATION RESULTS
25P

(SCALE 0 – 500 Bq/L)



APPENDIX I

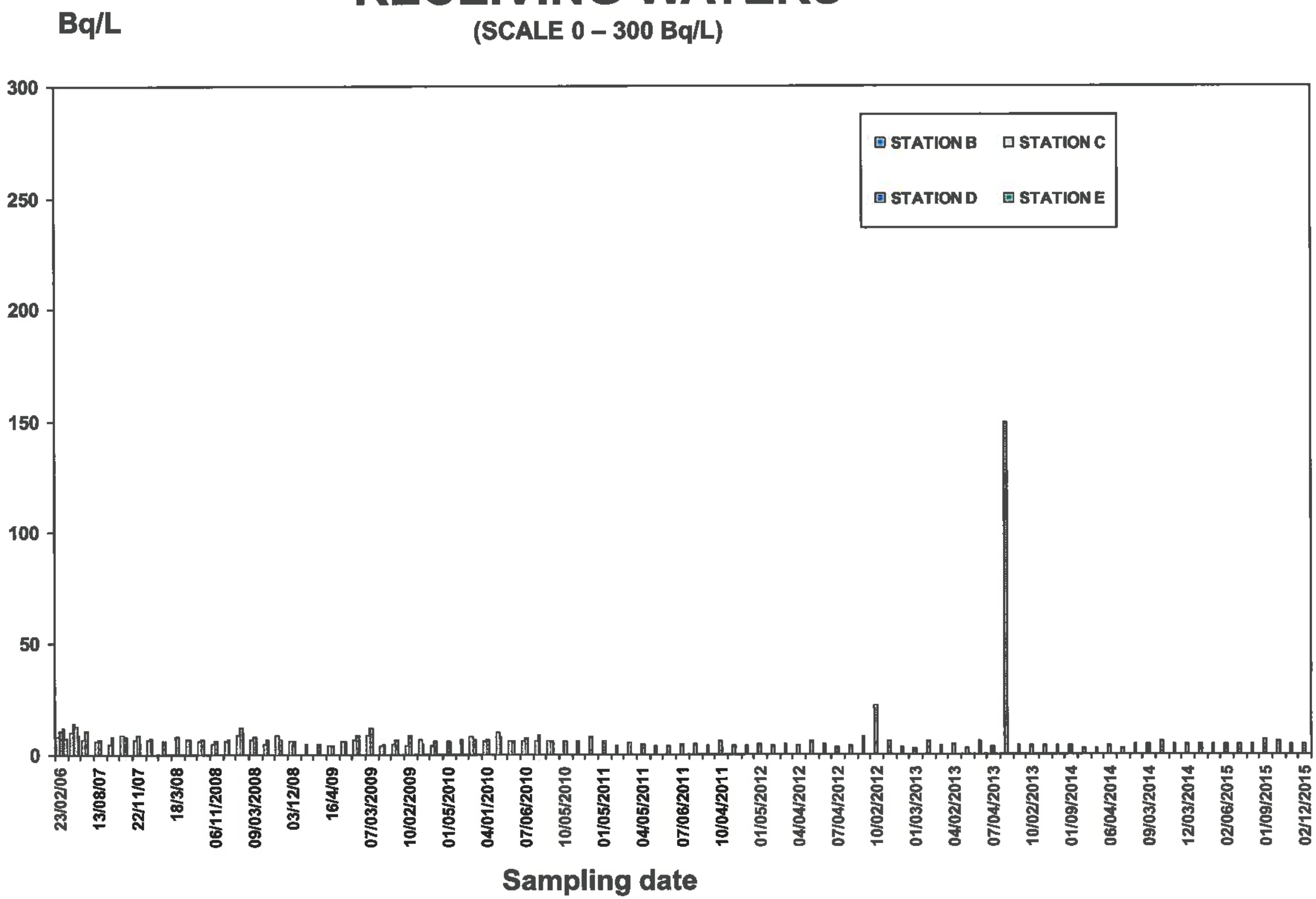
Receiving Waters Monitoring Results for 2015

RECEIVING WATERS MONITORING LOCATIONS

Basemap Source: City of Pembroke (www.pembrokeontario.com)

MONITORING RESULTS RECEIVING WATERS

(SCALE 0 – 300 Bq/L)



APPENDIX J

Runoff Monitoring Results for 2015

Runoff Monitoring Results for 2015

DOWNSPOUTS							
Date	Time	DS-1	DS-2	DS-3	DS-4	DS-5	DS-6
20-Apr-15	2:30 PM	No sample	100	100	100	100	100
20-Aug-15	2:40 PM	No sample	100	100	100	100	100
2-Sep-15	1:00 PM	No sample	100	100	No sample	100	No sample
28-Oct-15	12:30 PM	No sample	100	100	100	100	100
Average		**No sample**	**100**	**100**	**100**	**100**	**100**
Average all results		**100**					

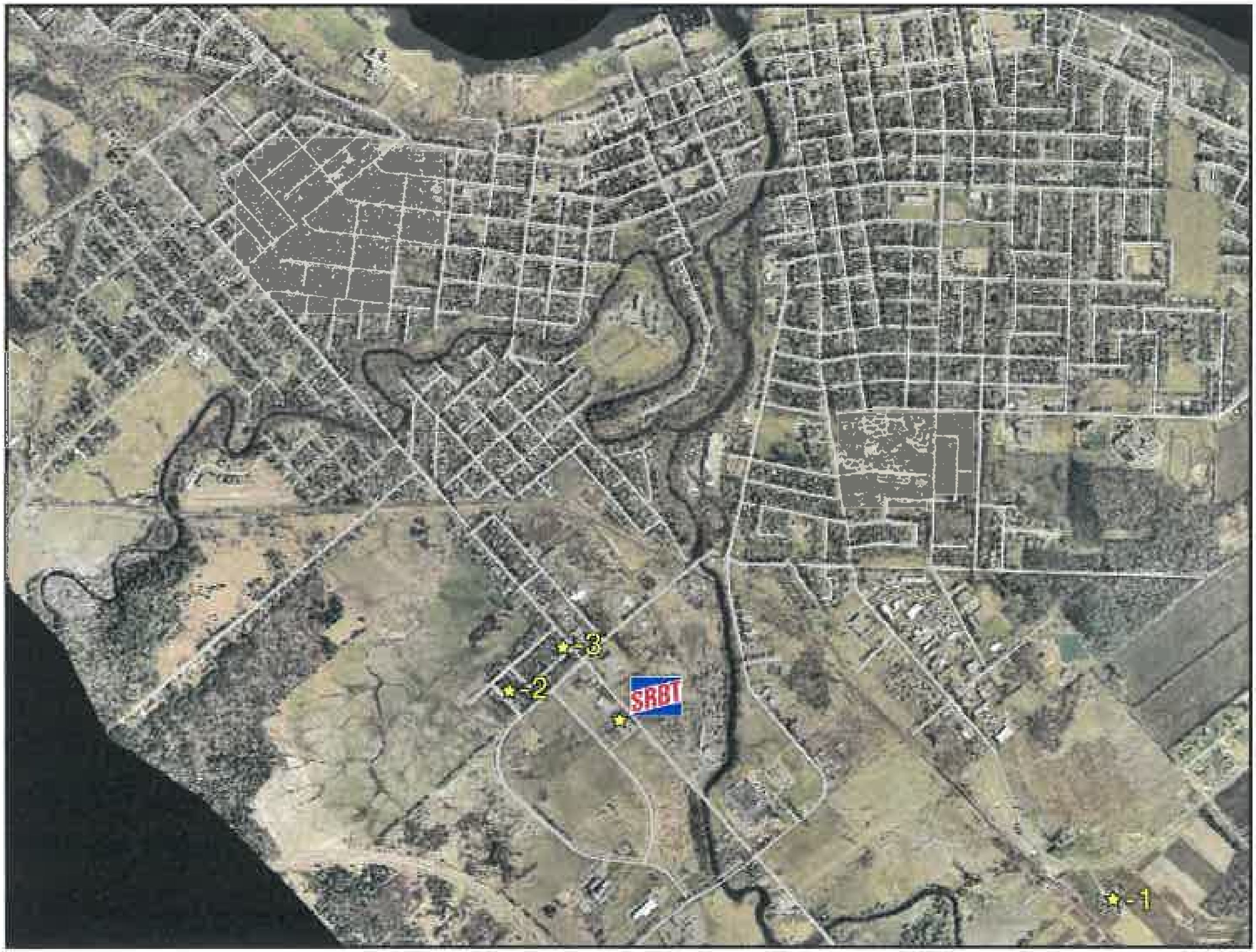
Values are in Bq / L.
Lower Limit of Detection – 100 Bq / L

☐ LOCATION OF DOWNSPOUTS

APPENDIX K

Produce Monitoring Results for 2015

SRB PRODUCE SAMPLING - 2015



Rev. 11/12/2015

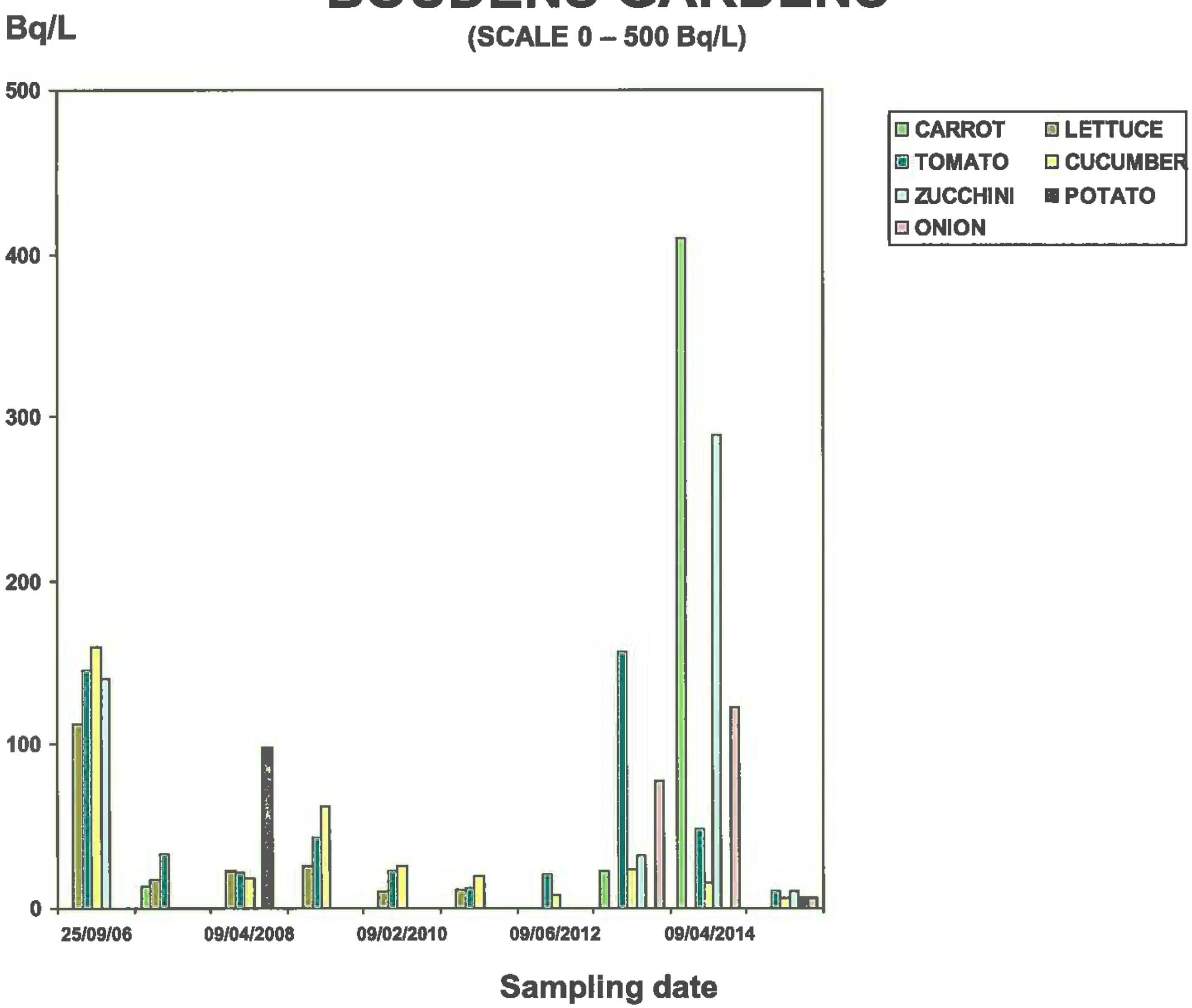
Sample Locations

1- Local Market ~ 1.75 KM
2- 413 Sweezey Crt. ~ 0.4 KM
3- 408 Boundary Rd. ~ 0.35 KM

DESCRIPTION	DISTANCEE FROM STACKS	TOMATO	CUCUMBER	BEET	ONION	AVG
413 SWEEZEY CRT	400		83	60		71.5
408 BOUNDARY RD	400	153	129		179	154
					AVG	113

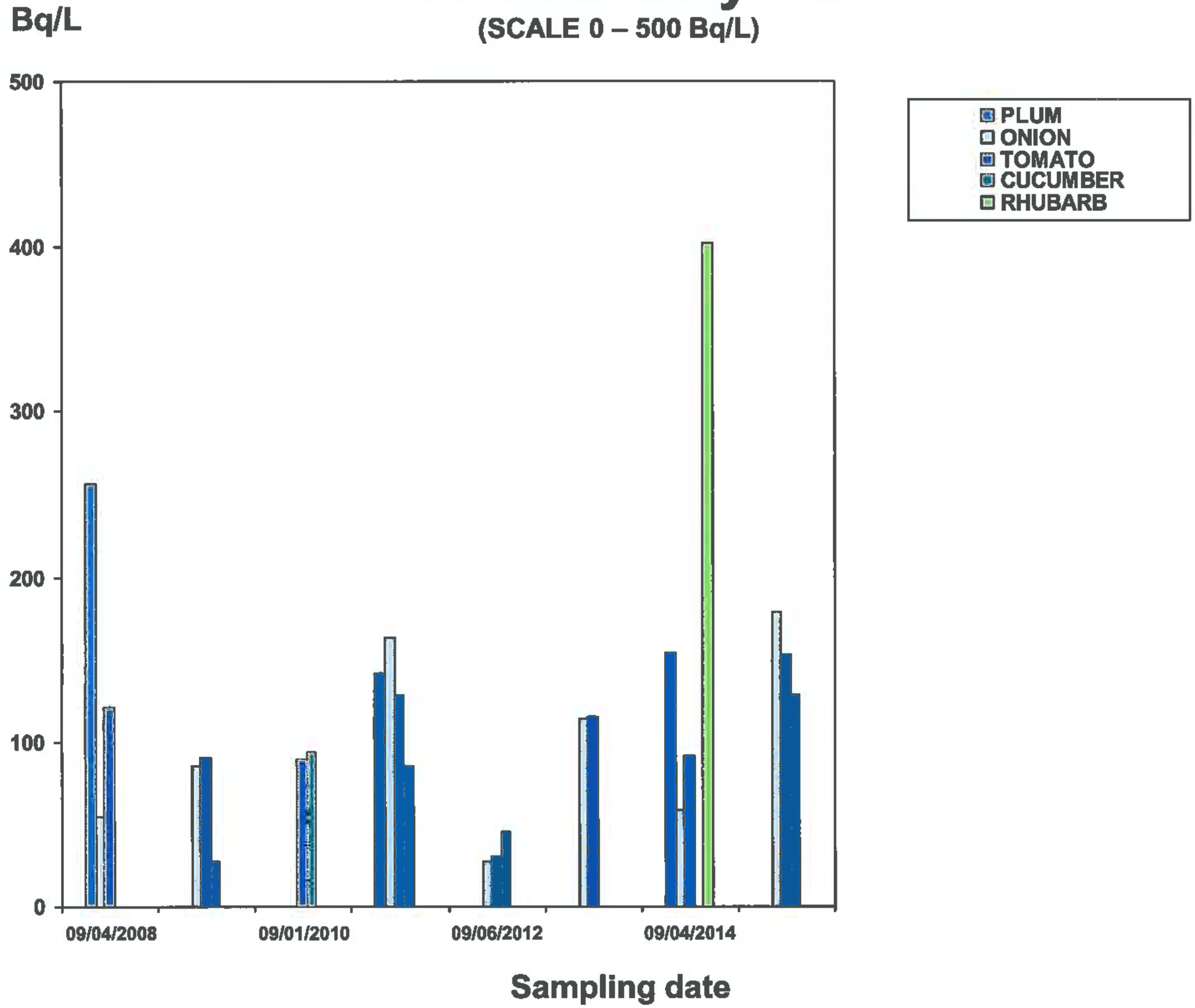
DESCRIPTION	DISTANCE FROM STACKS	TOMATO	CUCUMBER	POTATO	ZUCCHINI	ONION	AVG
LOCAL MARKET	1,750	10	6	6	10	6	7.6
						AVG	7.6

PRODUCE MONITORING RESULTS
BOUDENS GARDENS

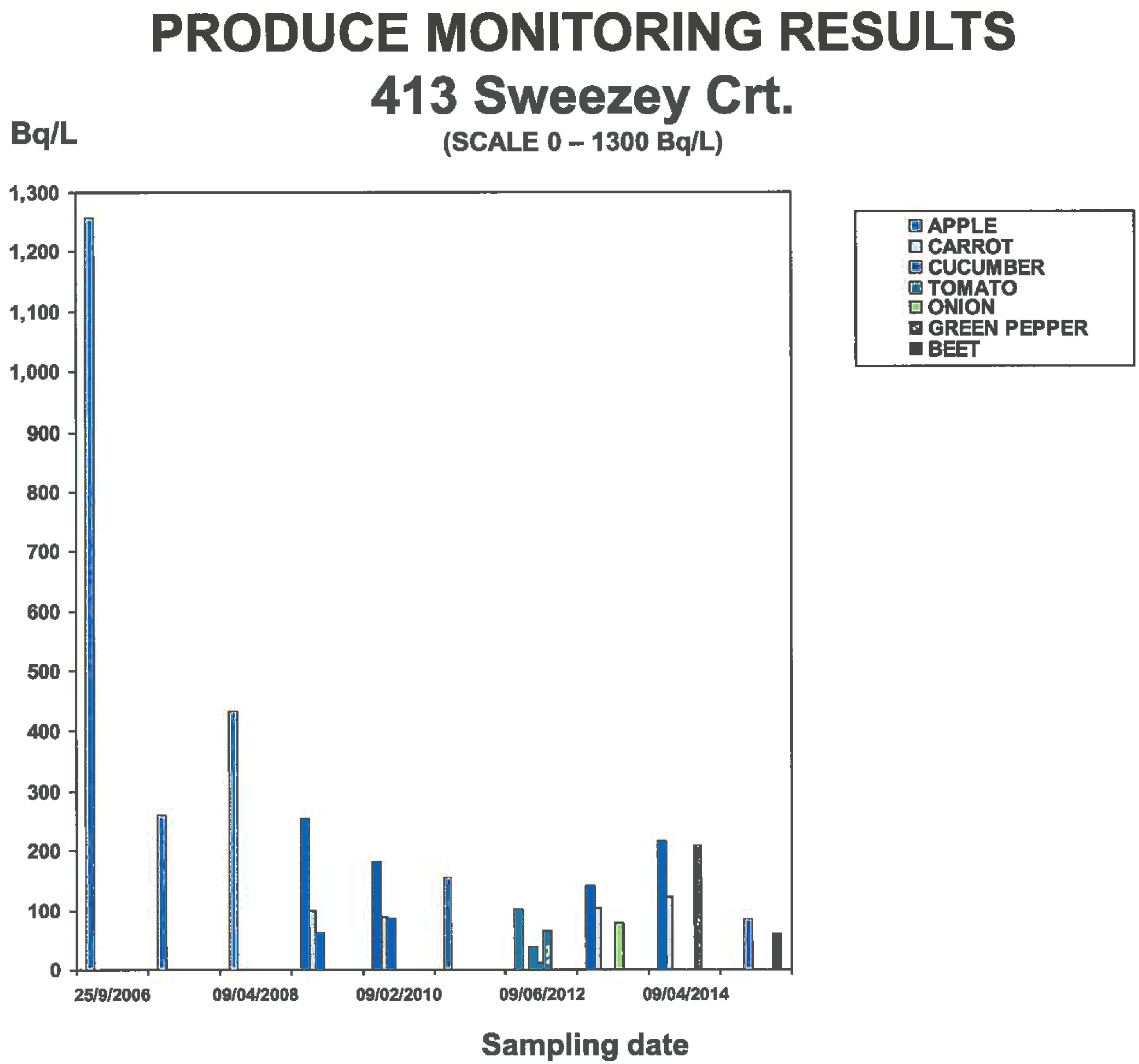


APPENDIX K

PRODUCE MONITORING RESULTS
408 Boundary Rd.



APPENDIX K


PRODUCE MONITORING RESULTS
413 Sweezey Crt.
(SCALE 0 – 1300 Bq/L)
Bq/L
1,300
1,200
1,100
1,000
900
800
700
600
500
400
300
200
100
0
25/9/2006
09/04/2008
09/02/2010
09/06/2012
09/04/2014
Sampling date
APPLE
CARROT
CUCUMBER
TOMATO
ONION
GREEN PEPPER
BEET

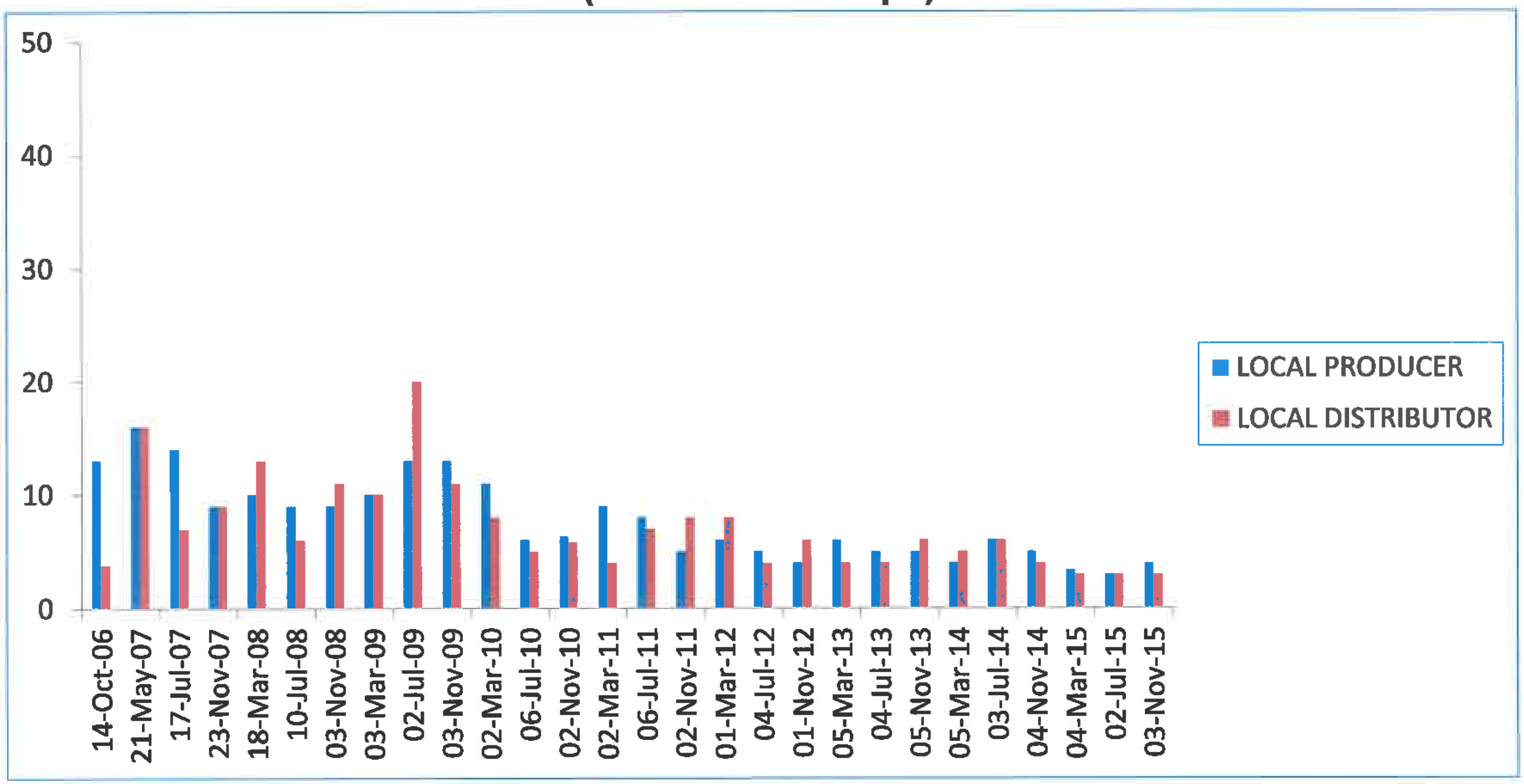
APPENDIX K

APPENDIX L

Milk Monitoring Results for 2015

MILK		
	LOCAL MILK PRODUCER	LOCAL MILK DISTRIBUTOR
	Bq/L	Bq/L
14-Oct-06	13	3.8
21-Mar-07	16	16
17-Jul-07	14	7
23-Nov-07	9	9
18-Mar-08	10	13
10-Jul-08	9	6
03-Nov-08	9	11
03-Mar-09	10	10
02-Jul-09	13	20
03-Nov-09	13	11
02-Mar-10	11	8
06-Jul-10	6	5
02-Nov-10	6.3	5.8
02-Mar-11	9	4
06-Jul-11	8	7
02-Nov-11	5	8
01-Mar-12	6	8
04-Jul-12	5	4
01-Nov-12	4	6
05-Mar-13	6	4
04-Jul-13	5	4
05-Nov-13	5	6
05-Mar-14	4	5
03-Jul-14	6	6
04-Nov-14	5	4
04-Mar-15	3.4	3
02-Jul-15	3	3
03-Nov-15	4	3

MONITORING RESULTS
MILK
(SCALE 0 – 50Bq/L)



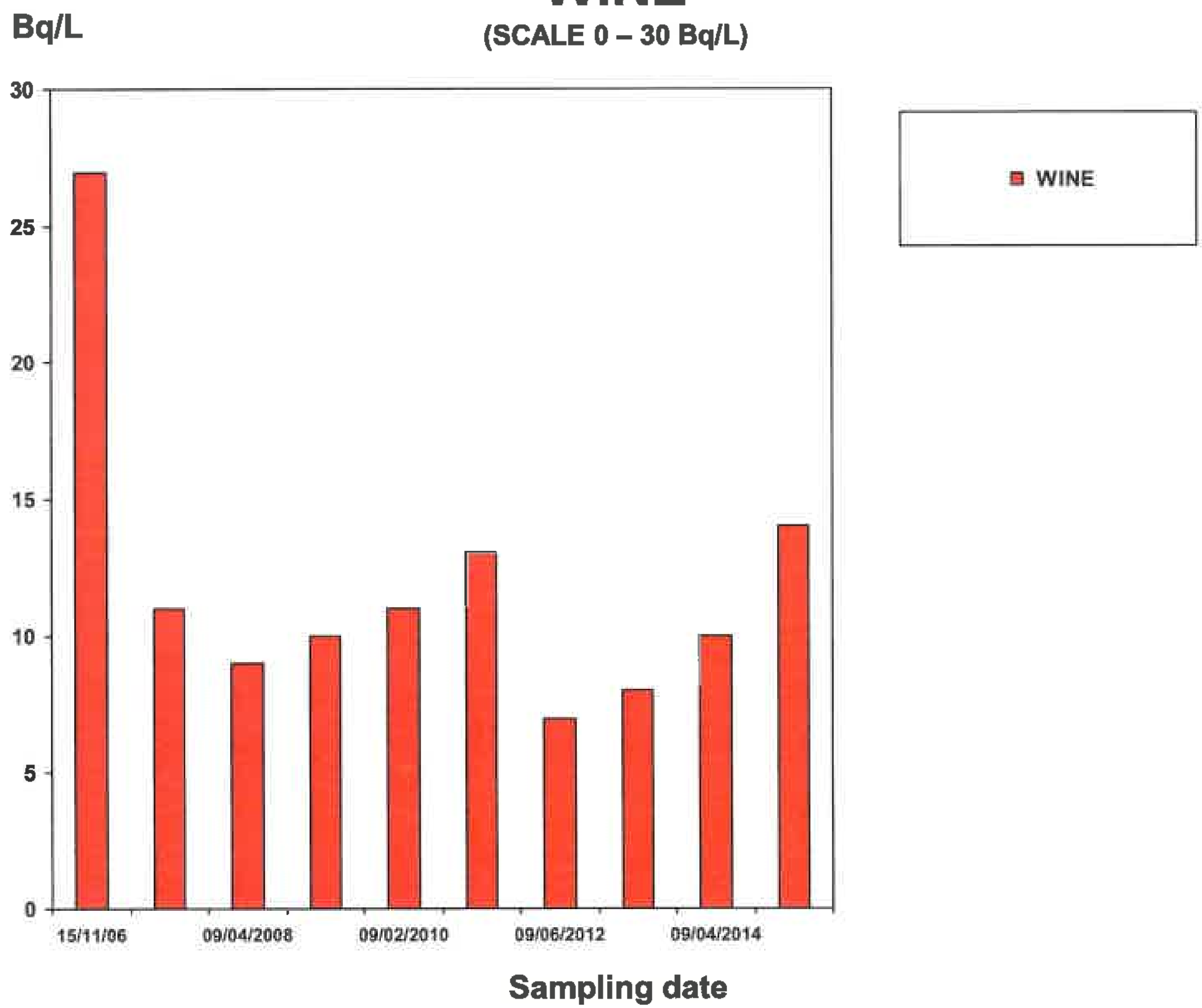
SAMPLING DATE

APPENDIX L

APPENDIX M

Wine Monitoring Results for 2015

MONITORING RESULTS
WINE
(SCALE 0 – 30 Bq/L)



APPENDIX M

APPENDIX N

Weather Data for 2015

WEATHER DATA SUMMARY

Month	Pressure, mbar (AVG)	Counts, # (TOTAL)	Wind Speed, m/s (AVG)	Gust Speed, m/s (AVG)	Wind Direction, o (AVG)	Temp, °C (AVG)	RH, % (AVG)	DewPt, °C (AVG)	[illegible]	[illegible]
Jun-09	993.27	434	2.1	3.14	193.5	17.839	72.3	12.1	SSW	[illegible]
Jul-09	994.44	429	2.44	3.64	187.9	18.375	77.6	14.1	SSW	85.8
Aug-09	998.83	351	2.25	3.37	216.5	18.725	76.81	14.2	SW	70.2
Sep-09	1000.93	274	2.38	3.56	204.3	13.225	79.5	9.4	SSW	54.8
Oct-09	999.08	311	2.68	3.94	184.37	5.94	80.39	2.6	SSW	62.2
Nov-09	1001.38	223	2.38	3.37	181.22	3.09	84.08	0.48	SSW	44.6
Dec-09	999.04	205	3.06	4.28	212.67	-7.98	84.17	-10.20	SW	41
Jan-10	998.29	130	2.92	4.14	207.47	-8.00	82.83	-10.45	SSW	26
Feb-10	992.66	98	3.80	5.35	263.34	-4.77	78.74	-8.05	WSW	19.6
Mar-10	998.25	66	2.62	3.78	207.51	3.20	55.32	-5.74	SSW	13.20
Apr-10	994.48	241	3.32	4.87	225.19	9.76	59.56	1.11	SW	48.20
May-10	998.87	143	2.76	4.09	209.71	15.21	62.06	6.99	SSW	28.6
Jun-10	995.55	541	2.47	3.75	223.24	18.09	71.9	12.35	SW	108.2
Jul-10	994.76	456	2.22	3.37	205.34	21.58	74.64	16.40	SSW	91.20
Aug-10	996.89	212	2.3	3.52	182.9	19.79	74.62	14.6	SSW	42.4
Sep-10	996.26	582	2.71	4.01	215.29	12.94	83	9.88	SW	116.4
Oct-10	994.46	336	3.09	4.55	229.58	6.46	76.58	2.25	SW	67.2
Nov-10	999.17	488	2.8	4.04	181.89	1.41	80.28	-1.82	SSW	97.6
Dec-10	994.92	42	2.84	4.3	236.18	-6.11	83.63	-8.48	SW	8.4
Jan-11	999.37	36	2.32	3.35	218.96	-13.55	80.55	-16.23	SW	7.2
Feb-11	997.25	64	2.95	4.39	210.46	-7.9	72.02	-12.31	SSW	12.8
Mar-11	999.25	243	2.91	4.31	221.81	-2.22	68.57	-7.78	SW	48.6
Apr-11	997.34	625	3.07	4.71	198.53	5.98	66.85	-0.59	SSW	125
May-11	996.97	313	2.75	4.3	172.74	14.48	70.04	8.29	SSE	62.6
Jun-11	994.13	499	2.2	3.47	209.21	19.15	71.63	13.24	SSW	99.8
Jul-11	994.13	508	2.17	3.32	213.95	21.25	73.51	15.81	SW	101.6
Aug-11	993.87	297	2.18	3.34	205.71	19.43	75.64	14.65	SSW	59.4
Sep-11	998.81	345	2.29	3.51	207.55	14.94	79.58	11.12	SSW	69
Oct-11	997.30	263	2.52	3.80	195.43	8.90	76.23	4.57	SSW	52.6
Nov-11	997.58	334	2.74	4.01	191.12	3.78	76.18	-0.31	SSW	66.8
Dec-11	1000.63	135	2.86	4.11	194.41	-3.94	84.07	-6.29	SSW	27
Jan-12	995.69	79	3.12	4.43	174.91	-8.8	82.65	-11.27	SSE	15.8
Feb-12	997.46	42	2.63	3.78	236.99	-5.22	76.11	-8.93	SW	8.4
Mar-12	999.83	143	2.98	4.47	184.54	2.98	73.12	-1.91	SSW	28.6
Apr-12	996.49	253	3.81	5.69	231.16	6.1	64.08	-1.11	SW	50.6
May-12	996.92	283	2.76	4.13	193.14	15.36	65.55	7.99	SSW	56.6
Jun-12	995.55	151	2.74	4.21	202.49	20.54	67.96	13.74	SSW	30.2
Jul-12	996.63	83	2.15	3.41	203.08	21.97	60.98	13.2	SSW	16.6
Aug-12	996.84	376	2.3	3.56	184.35	19.77	75.06	14.75	SSW	75.2
Sep-12	997.24	288	2.58	3.83	171.98	13.05	77.68	8.85	SSE	57.6
Oct-12	995.32	698	3.01	4.46	154.9	8.17	82.73	5.2	SSE	139.6
Nov-12	1003.94	107	2.62	3.79	149.02	-0.27	79.5	-3.54	SE	21.4
Dec-12	997.63	227	2.64	3.79	175.86	-7.37	86.66	-9.26	SSE	45.4
Jan-13	999.52	238	2.88	4.07	158.51	-9.37	81.02	-12.09	SSE	47.6
Feb-13	997.83	120	3.11	4.44	172.1	-7.85	80.56	-10.7	SSE	24
Mar-13	996.32	56	3.11	4.42	184.89	-0.78	68.28	-6.26	SSW	11.2
Apr-13	1001.26	393	3.4	4.96	180.57	5.45	67.35	-0.66	S	78.6
May-13	998.69	444	2.86	439	157.65	13.73	65.62	6.31	SSE	88.8
Jun-13	996.99	575	2	3.13	143.94	17.04	76.44	12.37	SE	115
Jul-13	998.2	616	1.96	3.17	204.94	20.78	75	15.76	SSW	123.2
Aug-13	997.43	189	1.99	3.23	194.8	18.57	75.66	13.78	SSW	37.8
Sep-13	999.39	329	2.17	3.43	179.28	13.51	79.07	9.55	SSE	65.8
Oct-13	998.88	485	2.48	3.78	185.72	7.62	78.89	3.94	SSW	97
Nov-13	1000.61	181	3.53	5.19	165.64	-1.68	80.95	-4.64	SSE	36.2
Dec-13	1001.31	54	2.61	3.78	157.56	-12.58	80.82	-15.27	SSE	10.8
Jan-14	994.49	126	3.06	4.38	179.86	-10.23	77.48	-13.51	SSE	25.2
Feb-14	998.97	36	3.03	4.39	163.35	-10.63	70.07	-15.21	SSE	7.2
Mar-14	998.78	63	3.3	4.8	146.1	-5.36	66.6	-10.93	SE	12.6
Apr-14	998.09	469	3.34	4.94	145.93	4.86	68.9	-1.08	SE	93.8
May-14	997.89	327	2.63	4.01	193.05	14.28	67.14	7.45	SSW	65.4
Jun-14	997.38	675	2.31	3.58	209.92	19.1	71.34	13.14	SSW	135
Jul-14	996.69	609	2.09	3.33	251.26	18.84	75.42	14.01	WSW	121.8
Aug-14	997.63	417	2.26	3.43	232.01	18.25	81.17	14.64	SW	83.4
Sep-14	1001.59	371	2.21	3.42	185.84	13.75	82.62	10.63	SSW	74.2
Oct-14	995.26	477	2.79	4.28	164.52	8.38	82.8	5.47	SSE	95.4
Nov-14	996.57	123	2.95	4.69	212.65	-1.17	79.57	-4.33	SW	24.6
Dec-14	1001.49	178	2.74	4.17	209.51	-7.37	82	-10	SSW	35.6
Jan-15	1001.76	19	2.58	3.82	228.14	-14.19	75.42	-17.69	SW	3.8
Feb-15	1001.62	20	2.79	4.12	220.51	-15.24	70.86	-19.58	SW	4.0
Mar-15	1000.23	88	2.71	4.21	204.21	-3.66	64.74	-9.92	SSW	17.6
Apr-15	997.66	179	3.23	4.98	227.05	7.29	61.43	-0.69	SW	35.8
May-15	1001.25	453	2.81	4.35	199.42	15.05	66.37	7.92	SSW	90.6
Jun-15	996.33	549	2.4	3.68	212.55	17.35	73.68	12.08	SW	109.8
Jul-15	993.51	313	2.1	3.33	163.86	20.55	74.6	15.44	SSE	62.6
Aug-15	997.94	357	1.88	2.95	145.95	19.3	80.6	15.59	SE	71.4
Sep-15	1002.2	163	2.06	3.32	203.53	16.82	77.45	12.52	SSW	32.6
Oct-15	999.74	372	2.81	4.26	188.52	6.96	78.15	3.19	SSW	74.4
Nov-15	1002.09	197	2.59	3.87	160.57	2.97	82.73	0.16	SSE	39.4
Dec-15	1000.02	240	2.83	4.22	177.37	-0.78	84.3	-3.19	SSE	48

Site-Specific Absolute Humidity Values

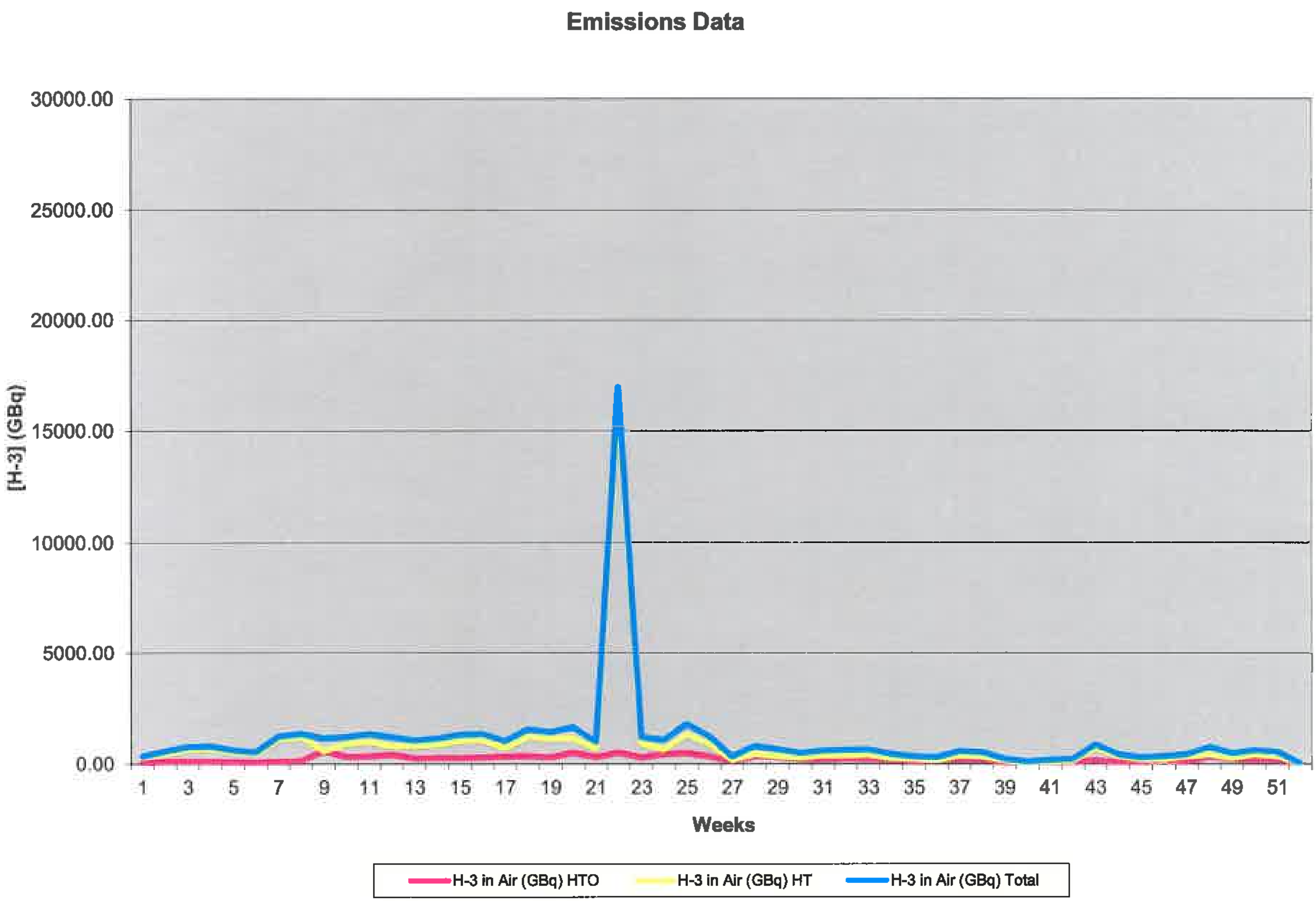
year	Endpoint	Monthly Readings												Average		
		J	F	M	A	M	J	J	A	S	O	N	D	Annual	Snow-free Period	Growing Season
2000	Temp (C)	-11.8	-8.2	0.5	4.4	12.4	15.6	18.4	17.7	12.8	7.9	1.0	-11.3	4.9	11.3	16.1
	Dew Point (C)	-16.5	-12.8	-5.7	-3.6	7.0	10.9	13.8	13.8	8.7	2.7	-2.4	-14.8	0.1	6.3	11.8
	RH (%)	68.9	71.7	65.9	61.7	72.7	76.1	77.2	79.9	78.2	72.4	79.4	76.1	73.4	74.7	77.9
	Ha (g/m^3)	1.4	1.9	3.2	3.6	7.6	9.8	11.7	11.7	8.5	5.7	4.0	1.6	5.9	7.8	10.4
2001	Temp (C)	-10.2	-9.9	-3.4	5.8	13.2	18.5	18.9	20.6	14.4	8.3	3.7	-1.2	6.6	12.9	18.1
	Dew Point (C)	-13.4	-14.4	-9.7	-2.8	6.3	12.0	12.4	13.8	10.5	4.6	-0.7	-4.0	1.2	7.0	12.2
	RH (%)	78.0	70.7	63.6	58.5	67.8	68.9	68.8	69.0	79.8	78.6	75.3	82.9	71.8	70.8	71.6
	Ha (g/m^3)	1.8	1.7	2.3	3.9	7.2	10.4	10.7	11.7	9.6	6.5	4.6	3.6	6.2	8.1	10.6
2002	Temp (C)	-5.4	-7.0	-4.0	5.2	9.7	16.5	21.0	19.5	16.6	5.3	-0.7	-6.6	5.8	11.6	18.4
	Dew Point (C)	-8.5	-11.4	-9.2	-1.4	3.2	11.7	15.2	14.3	12.0	1.8	-3.8	-10.0	1.2	6.6	13.3
	RH (%)	80.0	72.0	69.4	65.8	67.2	76.4	72.5	74.9	76.7	79.4	80.7	77.5	74.4	74.2	75.1
	Ha (g/m^3)	2.6	2.1	2.4	4.3	5.9	10.3	12.7	12.0	10.5	5.4	3.7	2.3	6.2	8.1	11.4
2003	Temp (C)	-14.2	-14.0	-4.5	2.8	11.6	17.3	19.3	19.7	15.1	6.4	1.5	-5.7	4.6	11.7	17.9
	Dew Point (C)	-18.8	-19.5	-10.2	-5.5	5.4	10.9	14.4	15.0	11.4	3.2	-1.6	-8.3	-0.3	6.6	12.9
	RH (%)	69.1	64.5	66.4	58.2	70.5	70.3	76.4	76.8	81.1	81.5	81.6	82.4	73.2	74.5	76.2
	Ha (g/m^3)	1.2	1.1	2.3	3.2	6.8	9.7	12.1	12.6	10.2	5.9	4.3	2.6	6.0	8.1	11.1
2004	Temp (C)	-16.6	-8.5	-1.2	4.6	11.3	15.8	19.1	17.3	15.5	8.0	0.8	-9.7	4.7	11.6	16.9
	Dew Point (C)	-21.4	-13.1	-6.1	-2.8	5.2	9.6	15.0	13.0	11.1	3.8	-3.1	-12.9	-0.1	6.5	12.1
	RH (%)	67.4	71.3	71.8	62.6	70.7	70.1	79.0	77.7	76.9	76.6	76.8	78.2	73.2	73.8	75.9
	Ha (g/m^3)	0.9	1.8	3.1	3.9	6.8	9.0	12.6	11.1	9.9	6.2	3.9	1.9	5.9	7.9	10.6
5-yr Avg	*Temp (C)*	*-11.7*	*-9.5*	*-2.5*	*4.6*	*11.6*	*16.8*	*19.3*	*19.0*	*14.9*	*7.2*	*1.2*	*-6.9*	***5.3***	***11.8***	***17.5***
	Dew Point (C)	*-15.7*	*-14.2*	*-8.2*	*-3.2*	*5.4*	*11.0*	*14.2*	*14.0*	*10.7*	*3.2*	*-2.3*	*-10.0*	***0.4***	***6.6***	***12.5***
	RH (%)	*72.7*	*70.0*	*67.4*	*61.4*	*69.8*	*72.4*	*74.8*	*75.7*	*78.6*	*77.7*	*78.8*	*79.4*	***73.2***	***73.6***	***75.3***
	Ha (g/m^3)	*1.6*	*1.7*	*2.7*	*3.8*	*6.9*	*9.8*	*12.0*	*11.8*	*9.7*	*5.9*	*4.1*	*2.4*	***6.0***	***8.0***	***10.8***
Factor to convert		***190***	***176***	***113***	***80***	***44***	***31***	***25***	***25***	***31***	***50***	***73***	***124***	***50***	***37***	***28***

Monthly data derived from hourly readings at Environment Canada's Petawawa A Station
Average Annual values calculated using monthly means
Snow-free period is April to November, inclusive
Growing season is June to September, inclusive

APPENDIX O

Gaseous Effluent Data for 2015

Week	Date Initial	Date Final	H-3 in Air (GBq) HTO	H-3 in Air (GBq) HT	H-3 in Air (GBq) Total	(GBq) ∑(HTO)	(GBq) ∑(HTO + HT)	Action Levels HTO (840 GBq)	Action Levels HTO+HT (7,753 GBq)	1996 SRBT DEL %DEL Adult Resident	1996 SRBT DEL %DEL Infant Resident	1996 SRBT DEL %DEL Adult Worker	Weekly Release Limit %WRL HTO	Weekly Release Limit %WRL HT	2006 SRBT DRL % DRL Adult Resident	2006 SRBT DRL % DRL Infant Resident	2006 SRBT DRL % DRL Nursing Infant	2006 SRBT DRL % DRL Nursing Mother	2006 SRBT DRL % DRL Adult Worker
1	30/12/2014	06/01/2015	44.82	291.20	336.02	44.82	336.02	5%	4%	0.01	0.01	0.01	0.03	0.06	0.03	0.03	0.05	0.03	0.03
2	06/01/2015	13/01/2015	106.38	449.31	555.69	151.20	891.71	13%	7%	0.02	0.01	0.02	0.08	0.11	0.07	0.06	0.12	0.07	0.07
3	13/01/2015	20/01/2015	124.82	632.70	757.52	276.02	1649.23	15%	10%	0.03	0.02	0.03	0.09	0.15	0.09	0.07	0.14	0.09	0.09
4	20/01/2015	27/01/2015	105.27	676.81	782.08	381.29	2431.31	13%	10%	0.02	0.01	0.02	0.08	0.15	0.08	0.06	0.13	0.08	0.08
5	27/01/2015	03/02/2015	82.98	525.08	608.06	464.27	3039.37	10%	8%	0.02	0.01	0.02	0.06	0.12	0.06	0.05	0.10	0.06	0.06
6	03/02/2015	10/02/2015	65.01	459.10	524.11	529.28	3563.48	8%	7%	0.01	0.01	0.02	0.05	0.10	0.05	0.04	0.08	0.05	0.05
7	10/02/2015	17/02/2015	120.79	1105.99	1226.78	650.07	4790.26	14%	16%	0.03	0.02	0.03	0.09	0.24	0.10	0.08	0.16	0.10	0.10
8	17/02/2015	24/02/2015	142.96	1203.16	1346.12	793.03	6136.38	17%	17%	0.03	0.02	0.03	0.11	0.26	0.11	0.09	0.19	0.12	0.11
9	24/02/2015	03/03/2015	566.50	570.64	1137.14	1359.53	7273.52	67%	15%	0.11	0.06	0.13	0.42	0.22	0.34	0.26	0.54	0.35	0.33
10	03/03/2015	10/03/2015	310.09	898.52	1208.61	1669.62	8482.13	37%	16%	0.06	0.04	0.07	0.23	0.23	0.20	0.15	0.33	0.21	0.20
11	10/03/2015	17/03/2015	337.88	992.15	1330.03	2007.50	9812.16	40%	17%	0.07	0.04	0.08	0.25	0.26	0.22	0.17	0.36	0.23	0.22
12	17/03/2015	24/03/2015	407.12	788.02	1195.14	2414.62	11007.30	48%	15%	0.08	0.05	0.09	0.30	0.23	0.25	0.19	0.41	0.26	0.25
13	24/03/2015	31/03/2015	245.98	793.76	1039.74	2660.60	12047.04	29%	13%	0.05	0.03	0.06	0.18	0.20	0.16	0.12	0.26	0.17	0.16
14	31/03/2015	07/04/2015	274.14	852.90	1127.04	2934.74	13174.08	33%	15%	0.06	0.03	0.06	0.20	0.22	0.18	0.14	0.29	0.18	0.18
15	07/04/2015	14/04/2015	265.35	1038.25	1303.60	3200.09	14477.68	32%	17%	0.05	0.03	0.06	0.20	0.25	0.18	0.14	0.29	0.18	0.18
16	14/04/2015	21/04/2015	293.54	1045.78	1339.32	3493.63	15817.00	35%	17%	0.06	0.04	0.07	0.22	0.26	0.20	0.15	0.32	0.20	0.19
17	21/04/2015	28/04/2015	327.35	697.75	1025.10	3820.98	16842.10	39%	13%	0.07	0.04	0.08	0.24	0.20	0.21	0.16	0.33	0.21	0.20
18	28/04/2015	05/05/2015	339.40	1202.31	1541.71	4160.38	18383.81	40%	20%	0.07	0.04	0.08	0.25	0.30	0.23	0.17	0.37	0.23	0.22
19	05/05/2015	12/05/2015	291.46	1131.59	1423.05	4451.84	19806.86	35%	18%	0.06	0.04	0.07	0.22	0.27	0.20	0.15	0.32	0.20	0.19
20	12/05/2015	19/05/2015	498.41	1138.70	1637.11	4950.25	21443.97	59%	21%	0.10	0.06	0.12	0.37	0.31	0.32	0.24	0.51	0.32	0.31
21	19/05/2015	26/05/2015	302.51	680.12	982.63	5252.76	22426.60	36%	13%	0.06	0.03	0.07	0.22	0.19	0.19	0.14	0.31	0.20	0.19
22	26/05/2015	02/06/2015	502.75	16444.05	16946.80	5755.51	39373.40	60%	219%	0.13	0.11	0.14	0.37	3.25	0.70	0.58	1.25	0.73	0.69
23	02/06/2015	09/06/2015	284.91	905.28	1190.19	6040.42	40563.59	34%	15%	0.06	0.03	0.07	0.21	0.23	0.19	0.14	0.30	0.19	0.18
24	09/06/2015	16/06/2015	429.66	640.40	1070.06	6470.08	41633.65	51%	14%	0.09	0.05	0.10	0.32	0.21	0.26	0.20	0.42	0.27	0.26
25	16/06/2015	23/06/2015	481.50	1297.34	1778.84	6951.58	43412.49	57%	23%	0.10	0.06	0.11	0.36	0.34	0.31	0.24	0.50	0.32	0.30
26	23/06/2015	30/06/2015	322.38	888.51	1210.89	7273.96	44623.38	38%	16%	0.07	0.04	0.07	0.24	0.23	0.21	0.16	0.34	0.21	0.20
27	30/06/2015	07/07/2015	134.77	187.76	322.53	7408.73	44945.91	16%	4%	0.03	0.02	0.03	0.10	0.06	0.08	0.06	0.13	0.08	0.08
28	07/07/2015	14/07/2015	340.31	440.54	780.85	7749.04	45726.76	41%	10%	0.07	0.04	0.08	0.25	0.15	0.21	0.16	0.33	0.21	0.20
29	14/07/2015	21/07/2015	307.65	340.98	648.63	8056.69	46375.39	37%	8%	0.06	0.03	0.07	0.23	0.12	0.19	0.14	0.30	0.19	0.18
30	21/07/2015	28/07/2015	215.66	271.20	486.86	8272.35	46862.25	26%	6%	0.04	0.02	0.05	0.16	0.09	0.13	0.10	0.21	0.13	0.13
31	28/07/2015	04/08/2015	203.08	379.97	583.05	8475.43	47445.30	24%	8%	0.04	0.02	0.05	0.15	0.11	0.13	0.10	0.20	0.13	0.12
32	04/08/2015	11/08/2015	235.18	380.90	616.08	8710.61	48061.38	28%	8%	0.05	0.03	0.05	0.17	0.12	0.15	0.11	0.23	0.15	0.14
33	11/08/2015	18/08/2015	224.98	412.82	637.80	8935.59	48699.18	27%	8%	0.05	0.03	0.05	0.17	0.12	0.14	0.11	0.22	0.14	0.14
34	18/08/2015	25/08/2015	197.36	243.11	440.47	9132.95	49139.65	23%	6%	0.04	0.02	0.05	0.15	0.08	0.12	0.09	0.19	0.12	0.12
35	25/08/2015	01/09/2015	109.74	215.39	325.13	9242.69	49464.78	13%	4%	0.02	0.01	0.03	0.08	0.06	0.07	0.05	0.11	0.07	0.07
36	01/09/2015	08/09/2015	138.81	148.59	287.40	9381.50	49752.18	17%	4%	0.03	0.02	0.03	0.10	0.06	0.08	0.06	0.13	0.09	0.08
37	08/09/2015	15/09/2015	191.74	371.26	563.00	9573.24	50315.18	23%	7%	0.04	0.02	0.04	0.14	0.11	0.12	0.09	0.19	0.12	0.12
38	15/09/2015	22/09/2015	194.67	322.09	516.76	9767.91	50831.94	23%	7%	0.04	0.02	0.04	0.14	0.10	0.12	0.09	0.19	0.12	0.12
39	22/09/2015	29/09/2015	66.66	151.72	218.38	9834.57	51050.32	8%	3%	0.01	0.01	0.02	0.05	0.04	0.04	0.03	0.07	0.04	0.04
40	29/09/2015	06/10/2015	49.97	54.50	104.47	9884.54	51154.79	6%	1%	0.01	0.01	0.01	0.04	0.02	0.03	0.02	0.05	0.03	0.03
41	06/10/2015	13/10/2015	71.09	98.03	169.12	9955.63	51323.91	8%	2%	0.01	0.01	0.02	0.05	0.03	0.04	0.03	0.07	0.04	0.04
42	13/10/2015	20/10/2015	88.45	130.75	219.20	10044.08	51543.11	11%	3%	0.02	0.01	0.02	0.07	0.04	0.05	0.04	0.09	0.06	0.05
43	20/10/2015	27/10/2015	162.57	697.55	860.12	10206.65	52403.23	19%	11%	0.03	0.02	0.04	0.12	0.17	0.11	0.09	0.18	0.11	0.11
44	27/10/2015	03/11/2015	90.55	331.74	422.29	10297.20	52825.52	11%	5%	0.02	0.01	0.02	0.07	0.08	0.06	0.05	0.10	0.06	0.06
45	03/11/2015	10/11/2015	92.45	191.73	284.18	10389.65	53109.70	11%	4%	0.02	0.01	0.02	0.07	0.05	0.06	0.04	0.09	0.06	0.06
46	10/11/2015	17/11/2015	133.72	200.68	334.40	10523.37	53444.10	16%	4%	0.03	0.01	0.03	0.10	0.06	0.08	0.06	0.13	0.08	0.08
47	17/11/2015	24/11/2015	97.88	324.94	422.82	10621.25	53866.92	12%	5%	0.02	0.01	0.02	0.07	0.08	0.06	0.05	0.10	0.07	0.06
48	24/11/2015	01/12/2015	325.50	417.85	743.35	10946.75	54610.27	39%	10%	0.07	0.04	0.07	0.24	0.14	0.20	0.15	0.32	0.20	0.19
49	01/12/2015	08/12/2015	221.76	256.28	478.04	11168.51	55088.31	26%	6%	0.04	0.02	0.05	0.16	0.09	0.13	0.10	0.21	0.14	0.13
50	08/12/2015	15/12/2015	175.32	424.66	599.98	11343.83	55688.29	21%	8%	0.04	0.02	0.04	0.13	0.12	0.11	0.08	0.18	0.11	0.11
51	15/12/2015	22/12/2015	194.59	334.76	529.35	11538.42	56217.64	23%	7%	0.04	0.02	0.04	0.14	0.10	0.12	0.09	0.19	0.12	0.12
52	22/12/2015	29/12/2015	15.80	3.24	19.04	11554.22	56236.68	2%	0%	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.01	0.01	0.01
	Annual	Total	11554.22	44682.46	56236.68					Average % DEL			Average % WRL		Average % DRL				
	Weekly	Average	222.20	859.28	1081.47					0.05	0.03	0.05	0.16	0.21	0.15	0.11	0.24	0.15	0.15
% Annual Release Limit:				(Bq/a)	% Release Limit					Projected Dose (uSv/a)					Projected Dose (uSv/a)				
		HTO	6.72E+13		17.19					0.46	0.27	0.52			1.50	1.14	2.44	1.54	1.47
		HTO + HT	4.48E+14		12.55					Adult Resident	Infant Resident	Adult Worker	HTO	HT	Adult Resident	Infant Resident	Nursing Infant	Nursing Mother	Adult Worker
Derived Weekly HTO Release/Emission Limit (GBq/week)										5.00E+05	9.40E+05	4.40E+05	2.90E+04	NA	1.73E+05	2.33E+05	1.10E+05	1.69E+05	1.77E+05
Derived Weekly HT Release/ Emission Limit (GBq/week)										6.60E+07	2.70E+07	6.40E+07	NA	1.80E+06	4.02E+06	4.52E+06	2.07E+06	3.80E+06	4.07E+06


Emissions Data
30000.00
25000.00
20000.00
15000.00
10000.00
5000.00
0.00
[H-3] (GBq)
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49 51
Weeks
H-3 in Air (GBq) HTO
H-3 in Air (GBq) HT
H-3 in Air (GBq) Total

APPENDIX P

Liquid Effluent Data for 2015

ANNUAL LIQUID EFFLUENT TRACKING TABLE			
Year = 2015			
WEEK ENDING	WEEKLY RELEASE (Bq)	WEEK	ANNUAL LICENCE LIMIT
			200,000,000,000
11-Jan-15	320,665,908	1	199,679,334,092
18-Jan-15	324,817,442	2	199,354,516,650
25-Jan-15	333,120,510	3	199,021,396,140
1-Feb-15	444,160,680	4	198,577,235,460
8-Feb-15	240,118,697	5	198,337,116,763
15-Feb-15	124,539,660	6	198,212,577,103
22-Feb-15	0	7	198,212,577,103
1-Mar-15	5,356,267	8	198,207,220,836
8-Mar-15	0	9	198,207,220,836
15-Mar-15	0	10	198,207,220,836
22-Mar-15	18,708,200	11	198,188,512,636
29-Mar-15	0	12	198,188,512,636
5-Apr-15	0	13	198,188,512,636
12-Apr-15	127,387,200	14	198,061,125,436
19-Apr-15	97,709,000	15	197,963,416,436
26-Apr-15	0	16	197,963,416,436
3-May-15	5,621,867	17	197,957,794,569
10-May-15	580,500	18	197,957,214,069
17-May-15	59,458,833	19	197,897,755,236
24-May-15	9,462,000	20	197,888,293,236
31-May-15	125,039,467	21	197,763,253,769
7-Jun-15	59,793,934	22	197,703,459,835
14-Jun-15	69,610,667	23	197,633,849,168
21-Jun-15	83,341,624	24	197,550,507,544
28-Jun-15	115,915,982	25	197,434,591,562
5-Jul-15	72,021,400	26	197,362,570,162
12-Jul-15	111,175,650	27	197,251,394,512
19-Jul-15	296,990,558	28	196,954,403,954
26-Jul-15	344,383,200	29	196,610,020,754
2-Aug-15	301,793,467	30	196,308,227,287
9-Aug-15	257,837,466	31	196,050,389,821
16-Aug-15	208,997,400	32	195,841,392,421
23-Aug-15	206,515,949	33	195,634,876,472
30-Aug-15	46,544,667	34	195,588,331,805
6-Sep-15	42,919,800	35	195,545,412,005
13-Sep-15	236,050,717	36	195,309,361,288
20-Sep-15	128,684,563	37	195,180,676,725
27-Sep-15	39,844,733	38	195,140,831,992
4-Oct-15	123,855,666	39	195,016,976,326
11-Oct-15	0	40	195,016,976,326
18-Oct-15	4,448,800	41	195,012,527,526
25-Oct-15	69,115,455	42	194,943,412,071
1-Nov-15	322,538,790	43	194,620,873,281
8-Nov-15	322,538,790	44	194,298,334,491
15-Nov-15	398,002,078	45	193,900,332,413
22-Nov-15	386,953,012	46	193,513,379,401
29-Nov-15	4,188,733	47	193,509,190,668
6-Dec-15	0	48	193,509,190,668
13-Dec-15	50,755,500	49	193,458,435,168
20-Dec-15	3,203,800	50	193,455,231,368
27-Dec-15	0	51	193,455,231,368
3-Jan-16	0	52	193,455,231,368
		53	193,455,231,368
Annual Total (Bq)	6,544,768,632		
Annual Total (GBq)	7		
Limit (GBq)	200		
% of limit	**3.27**		

Generated: January 5, 2016

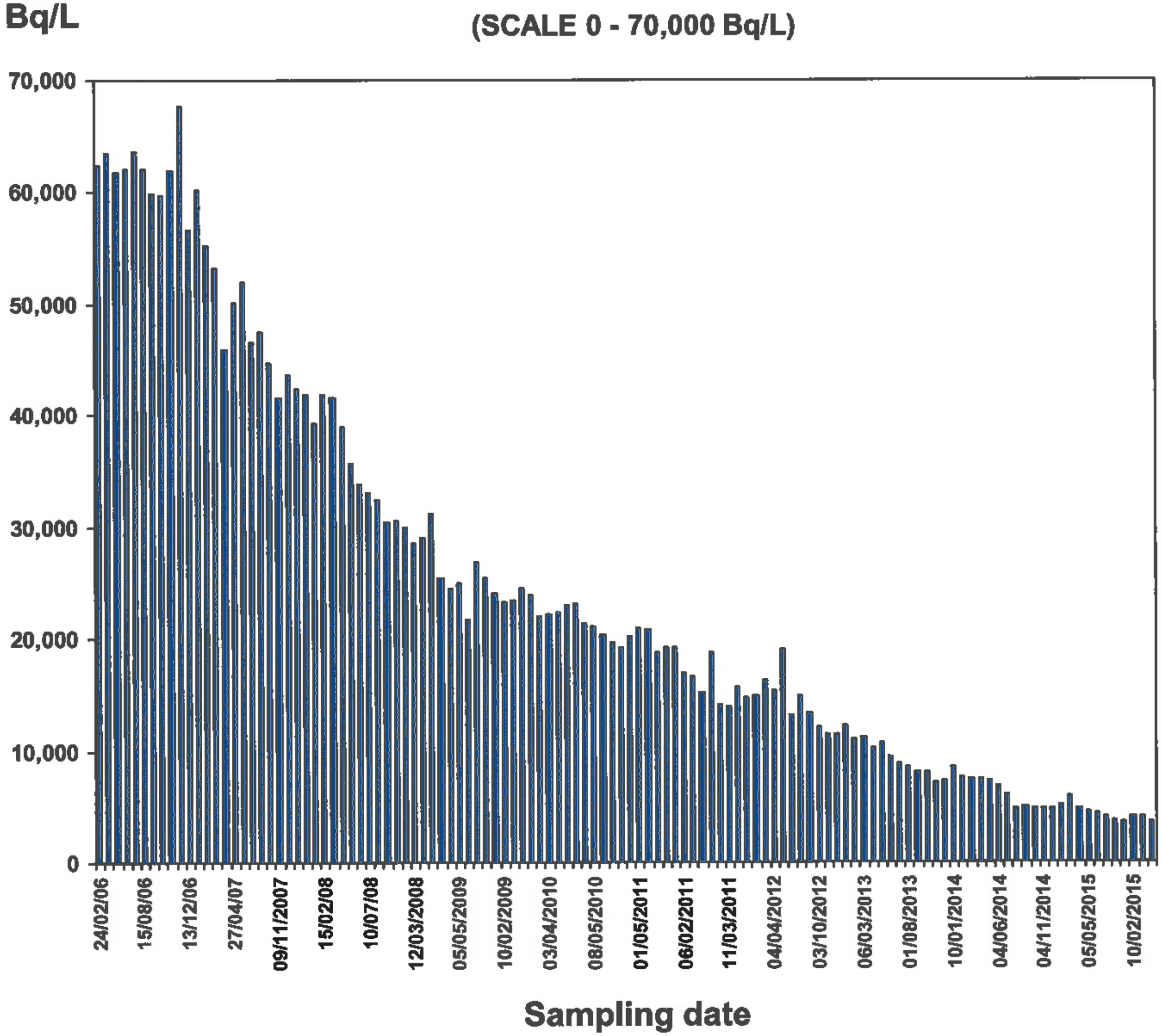
Compiled by:
Jamie MacDonald, Manager HP

APPENDIX Q

Well Monitoring Results for 2015

WELL I.D.	DESCRIPTION		DISTANCE FROM STACKS (m)	Jan. 9, 2015	Feb. 3, 2015	Mar. 4, 2015	Apr. 2, 2015	May 5, 2015	Jun. 2, 2015	Jul. 3, 2015	Aug. 5, 2015	Sep. 1, 2015	Oct. 2, 2015	Nov. 4, 2015	Dec. 2, 2015	WELL I.D.
MW06-1	SRB SITE	IN SOIL	50	5,194	5,831	No Sample	4,781	4,424	4,349	4,068	3,775	3,619	4,109	4,015	3,556	MW06-1
MW06-2	SRB SITE	IN SOIL	75	1,984	1,911	1,966	2,035	1,917	1,995	2,008	1,964	1,993	1,905	1,955	1,942	MW06-2
MW06-3	SRB SITE	IN SOIL	50	1,196	1,280	No Sample	Dry	1,203	1,281	1,270	1,202	1,207	Dry	Dry	1,104	MW06-3
MW06-8	SRB SITE	IN SOIL	55	942	935	861	810	970	982	951	923	878	895	845	854	MW06-8
MW06-9	SRB SITE	IN SOIL	25	2,763	2,780	No Sample	2,696	2,828	2,808	2,794	2,700	2,679	2,740	2,631	2,614	MW06-9
MW06-10	SRB SITE	SURFACE OF BEDROCK	0	45,781	52,123	62,948	56,732	39,421	24,762	35,300	62,253	59,058	61,402	65,265	54,580	MW06-10
MW07-11	SRB SITE	SURFACE OF BEDROCK	75	1,496	1,514	1,587	1,535	1,726	1,551	1,417	1,451	1,493	1,511	1,557	1,415	MW07-11
MW07-12	SRB SITE	SURFACE OF BEDROCK	55	449	380	355	443	514	520	548	521	508	448	434	439	MW07-12
MW07-13	SRB SITE	SURFACE OF BEDROCK	50	14,479	14,531	14,390	13,847	11,960	13,553	13,049	12,785	12,817	12,736	12,555	12,146	MW07-13
MW07-15	SRB SITE	SURFACE OF BEDROCK	25	1,890	1,579	1,660	1,588	1,699	1,810	1,814	1,657	1,633	1,618	1,599	1,610	MW07-15
MW07-16	SRB SITE	SURFACE OF BEDROCK	15	2,293	2,109	2,351	2,144	2,354	2,341	2,289	2,127	2,140	2,024	2,068	2,011	MW07-16
MW07-17	SRB SITE	DEEPER BEDROCK	15	716	648	715	728	866	868	805	755	777	809	890	779	MW07-17
MW07-18	SRB SITE	SURFACE OF BEDROCK	10	5,543	6,327	6,943	7,037	4,569	4,842	5,243	5,075	5,347	5.524	4,790	4,649	MW07-18
MW07-19	SRB SITE	SURFACE OF BEDROCK	20	2,388	4,272	2,984	3,693	2,664	3,182	3,152	3,261	3,570	3,845	2,916	2,740	MW07-19
MW07-20	SUPERIOR PROPANE PROPERTY	SURFACE OF BEDROCK	90	841	797	816	793	823	838	776	796	705	707	696	709	MW07-20
MW07-21	SUPERIOR PROPANE PROPERTY	SURFACE OF BEDROCK	110	No Sample	No Sample	No Sample	No Sample	No Sample	No Sample	No Sample	1,012	1,170	1,228	1,073	1,122	MW07-21
MW07-22	SRB SITE	SURFACE OF BEDROCK	70	1,152	1,092	1,313	1,123	1,118	1,201	1,200	1,125	1,185	1,270	1,154	1,116	MW07-22
MW07-23	SRB SITE	SURFACE OF BEDROCK	90	2,358	2,243	2,254	2,268	2,206	2,202	2,266	2,171	2,229	2,118	2,143	2,018	MW07-23
MW07-24	HARRINGTON PROPERTY	SURFACE OF BEDROCK	115	2,272	2,235	2,333	2,350	2,385	2,355	2,367	2,279	2,320	2,278	2,304	2,287	MW07-24
MW07-26	SRB SITE	SURFACE OF BEDROCK	50	2,168	2,140	2,203	1,494	2,043	2,124	2,062	2,122	1,936	1,939	1,504	1,553	MW07-26
MW07-27	CITY PROPERTY	SURFACE OF BEDROCK	55	DRY	4,855	No Sample	5,014	4,917	4,866	4,825	4,786	4,961	4,951	4,848	4,671	MW07-27
MW07-28	CITY PROPERTY	DEEPER BEDROCK	55	1,700	1,434	1,231	1,371	1,599	1,318	1,668	1,436	1,499	1,299	1,391	1,405	MW07-28
MW07-29	SRB SITE	DEEPER BEDROCK	10	3,133	3,014	4,377	4,300	2,793	3,365	4,348	4,195	4.314	4,731	4,495	4,330	MW07-29
MW07-31	SRB SITE	DEEPER BEDROCK	70	513	579	No Sample	585	830	799	803	735	825	898	874	879	MW07-31
MW07-32	HARRINGTON PROPERTY	DEEPER BEDROCK	115	<82	<85	95	<83	83	104	124	158	137	142	106	201	MW07-32
MW07-34	SRB SITE	SHALLOW BEDROCK	10	3,318	3,033	2,241	4,005	3,391	3,391	3,416	3,245	3,375	3,191	3,654	3,483	MW07-34
MW07-35	CITY PROPERTY	SHALLOW BEDROCK	55	4,060	3,971	4,203	3,952	3,879	3,788	3,962	3,832	3,938	3,786	4,212	3,751	MW07-35
MW07-36	CITY PROPERTY	SHALLOW BEDROCK	80	2,844	2,997	No Sample	2,959	2,254	2,268	2,827	2,963	3,416	3,268	3,078	2,943	MW07-36
MW07-37	SRB SITE	SHALLOW BEDROCK	60	1,023	1,092	1,179	1,011	810	893	906	925	989	1,107	1,104	1,070	MW07-37
CN-1S	CN PROPERTY		125			No Sample	523			877				Dry		CN-1S
CN-1D	CN PROPERTY		130			No Sample	621			964				Dry		CN-1D
CN-2	CN PROPERTY		150			851				721				Dry		CN-2
CN-3S	CN PROPERTY		165			No Sample	228			266				268		CN-3S
CN-3D	CN PROPERTY		160			No Sample	446			579				Dry		CN-3D
RW-1	413 BOUNDARY ROAD		465			N/A				N/A				N/A		RW-1
RW-2	185 MUD LAKE ROAD		1,100			97				79				72		RW-2
RW-3	183 MUD LAKE ROAD		1,100			77				71				98		RW-3
RW-4	711 BRUHAM AVENUE		2,200			N/A				N/A				N/A		RW-4
RW-5	171 SAWMILL ROAD		2,300			9				9				11		RW-5
RW-6	40987 HWY 41		1,400			14				14				14		RW-6
RW-7	40925 HWY 41		1,600			<5				5				<4		RW-7
RW-8	204 BOUNDARY ROAD		700			190				159				232		RW-8
RW-9	206 BOUNDARY ROAD		650			54				49				41		RW-9
RW-10	208 BOUNDARY ROAD		625			<5				<5				<4		RW-10
RW-11	200 MUD LAKE ROAD		794			N/A				N/A				N/A		RW-11
RW-12	202 MUD LAKE ROAD		753			5.1				<4				6		RW-12
B-1	SUPERIOR PROPANE OFFICE		160			809				1,102				950		B-1
B-2	SUPERIOR PROPANE TRUCK WASH		250			1,272				1,174				1,077		B-2
B-3	INTERNATIONAL LUMBER OFFICE		385			<5				<4				<4		B-3

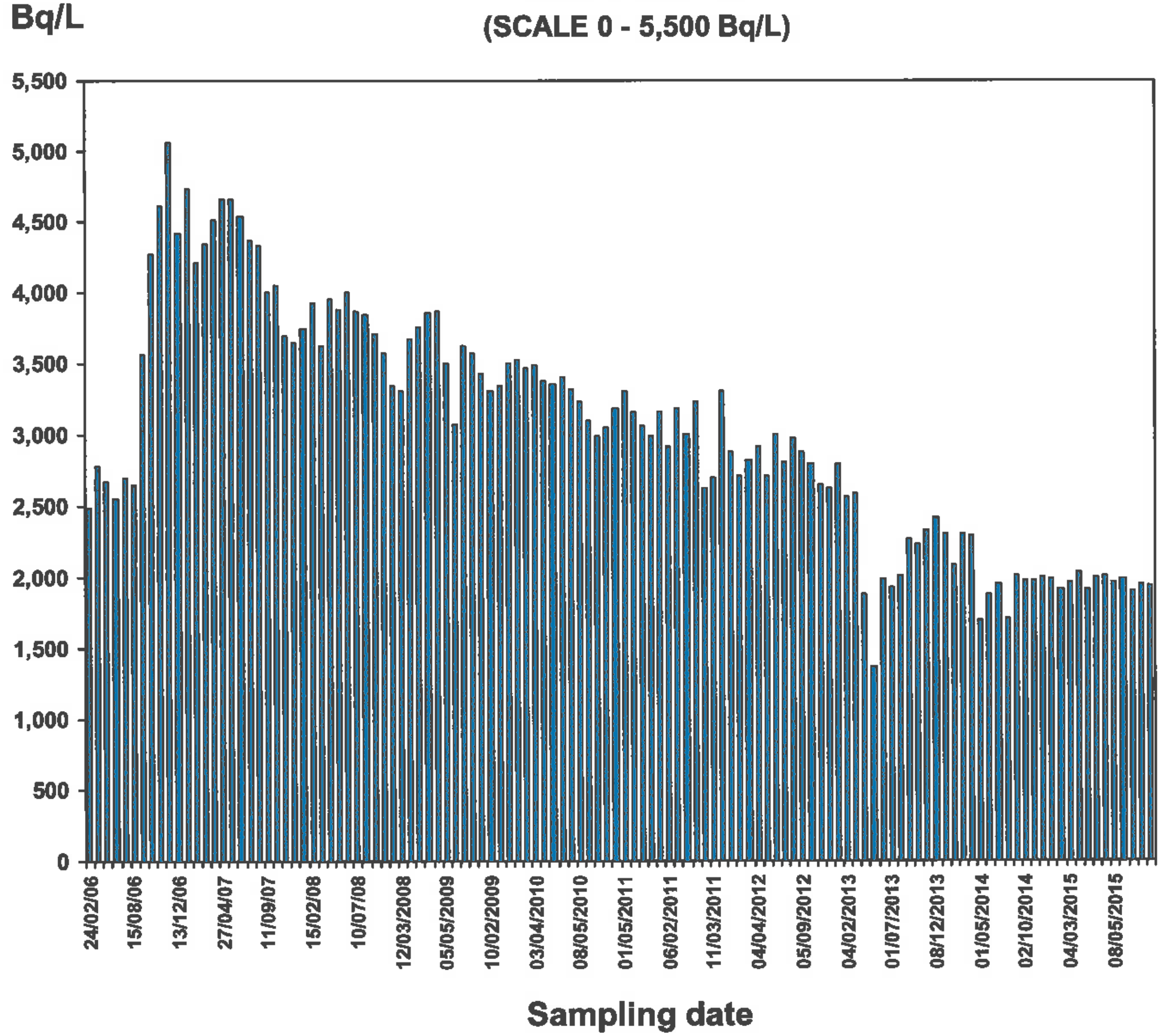
MONITORING RESULTS
MW06-1



APPENDIX Q

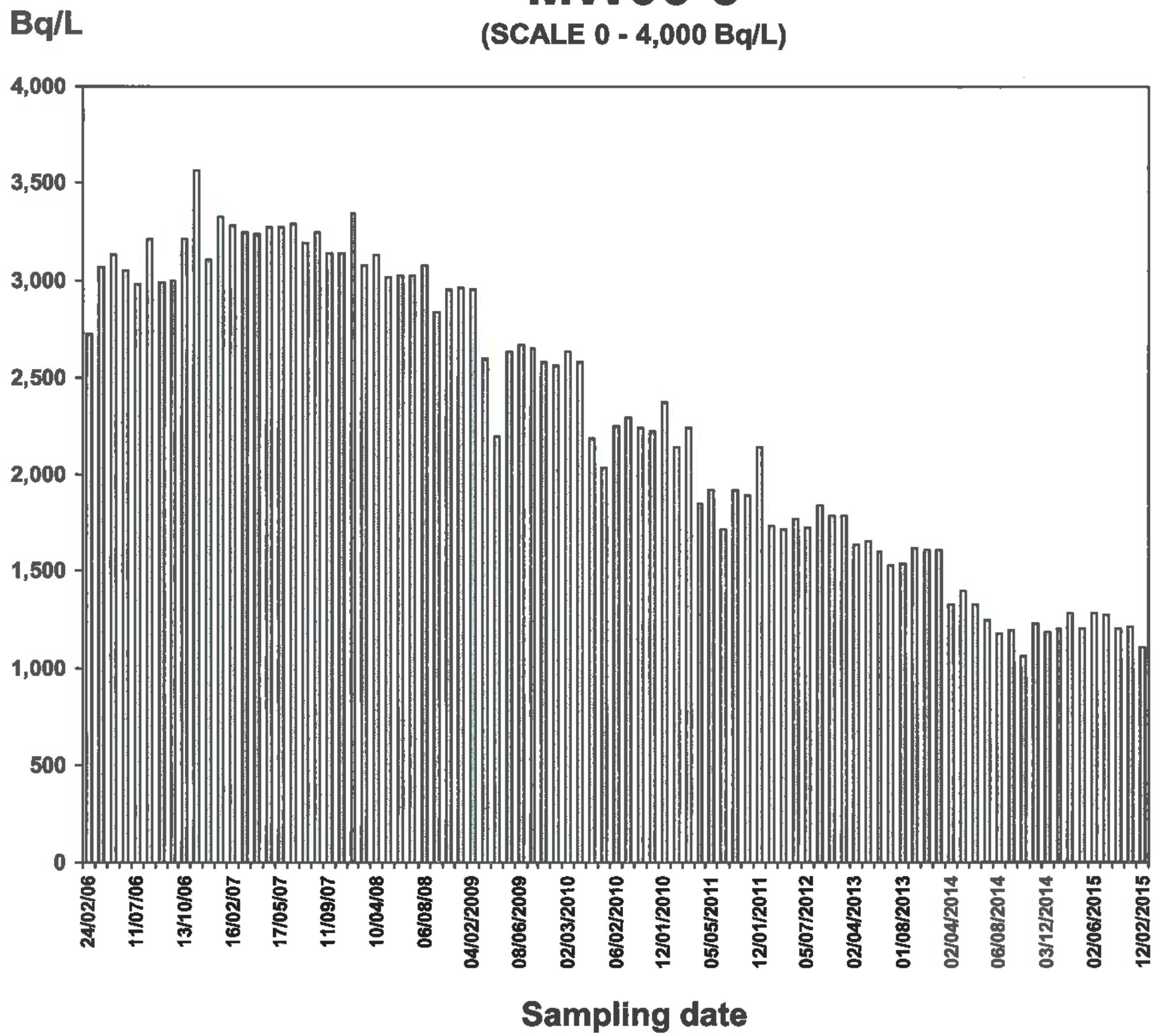
MONITORING RESULTS
MW06-2

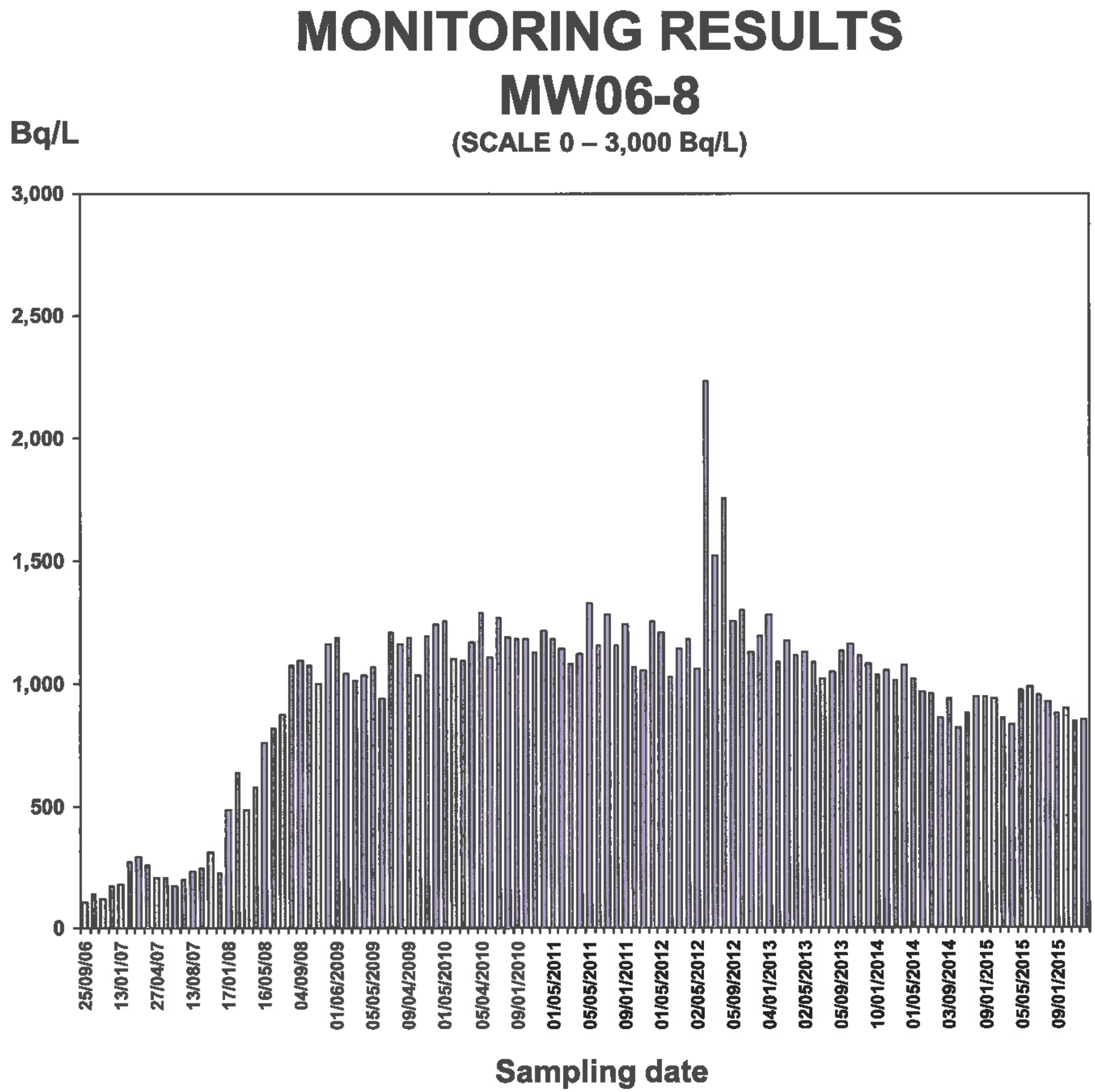
(SCALE 0 - 5,500 Bq/L)

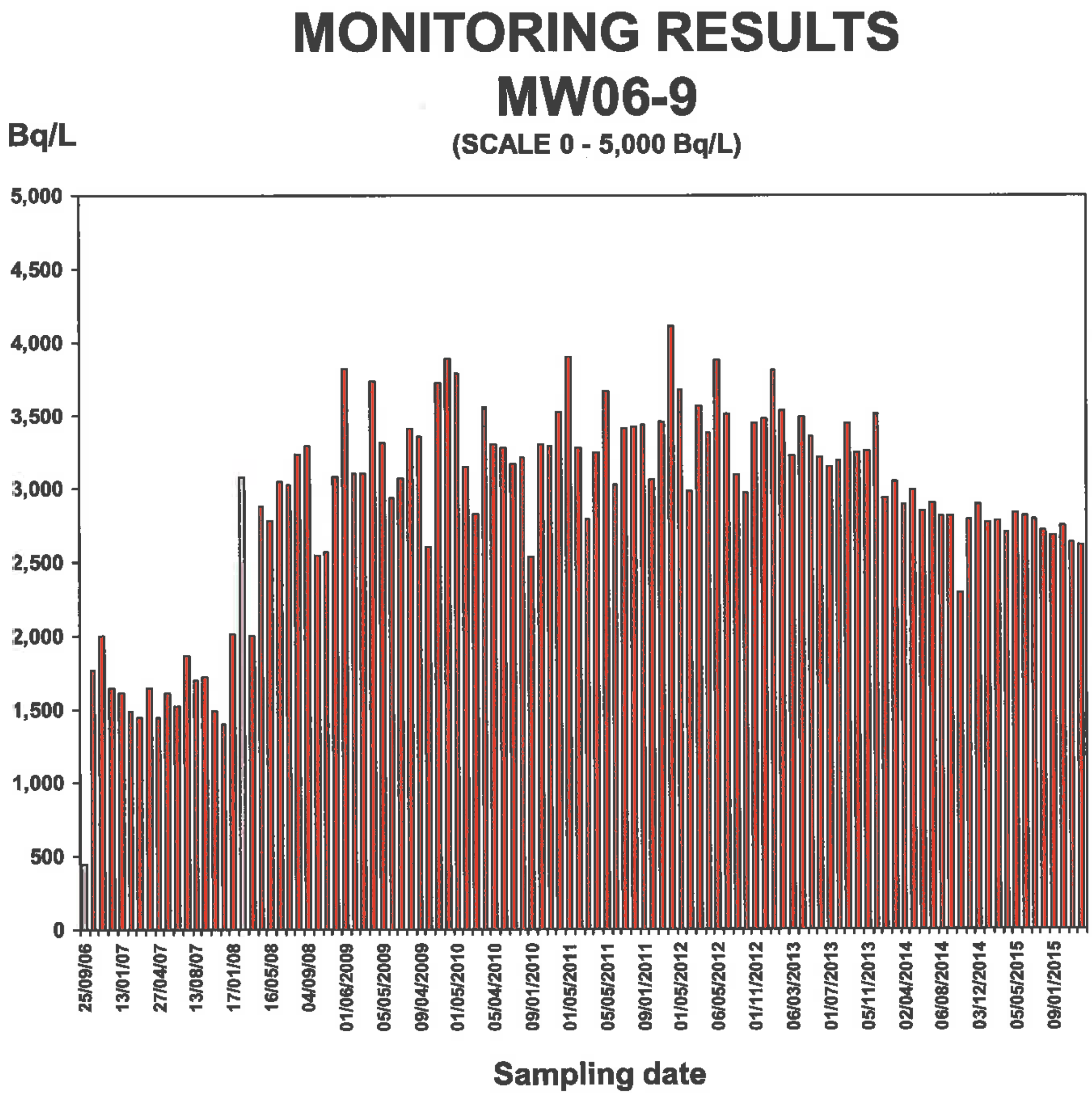


APPENDIX Q

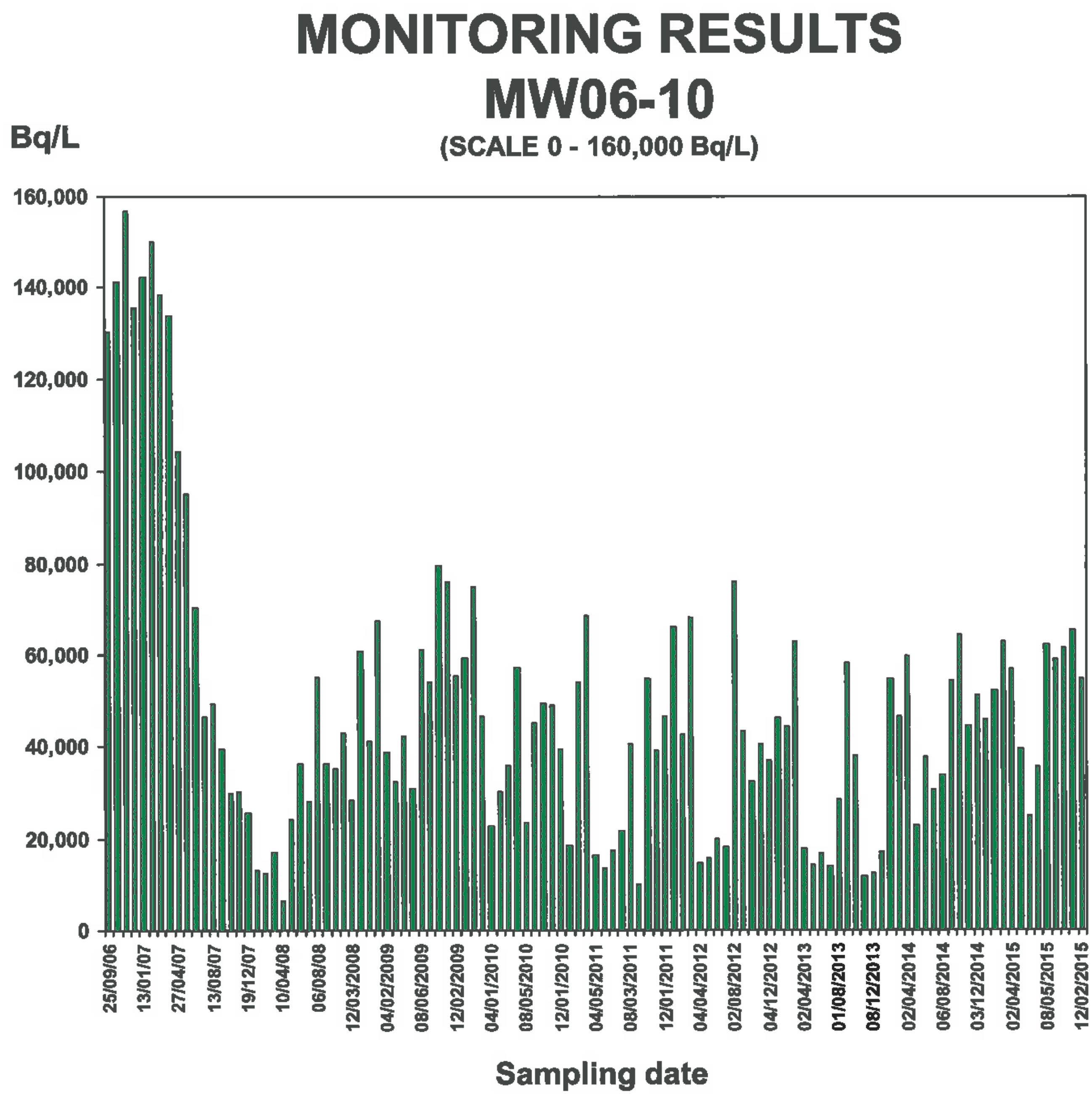
MONITORING RESULTS
MW06-3
(SCALE 0 - 4,000 Bq/L)




MONITORING RESULTS
MW06-8
Bq/L
(SCALE 0 – 3,000 Bq/L)
3,000
2,500
2,000
1,500
1,000
500
0
25/09/06
13/01/07
27/04/07
13/08/07
17/01/08
16/05/08
04/09/08
01/06/2009
05/05/2009
09/04/2009
01/05/2010
05/04/2010
09/01/2010
01/05/2011
05/05/2011
09/01/2011
01/05/2012
02/05/2012
05/09/2012
04/01/2013
02/05/2013
05/09/2013
10/01/2014
01/05/2014
03/09/2014
09/01/2015
05/05/2015
09/01/2015
Sampling date


MONITORING RESULTS
MW06-9
(SCALE 0 - 5,000 Bq/L)
Bq/L
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
25/09/06
13/01/07
27/04/07
13/08/07
17/01/08
16/05/08
04/09/08
01/06/2009
05/05/2009
09/04/2009
01/05/2010
05/04/2010
09/01/2010
01/05/2011
05/05/2011
09/01/2011
01/05/2012
06/05/2012
01/11/2012
06/03/2013
01/07/2013
05/11/2013
02/04/2014
06/08/2014
03/12/2014
05/05/2015
09/01/2015
Sampling date

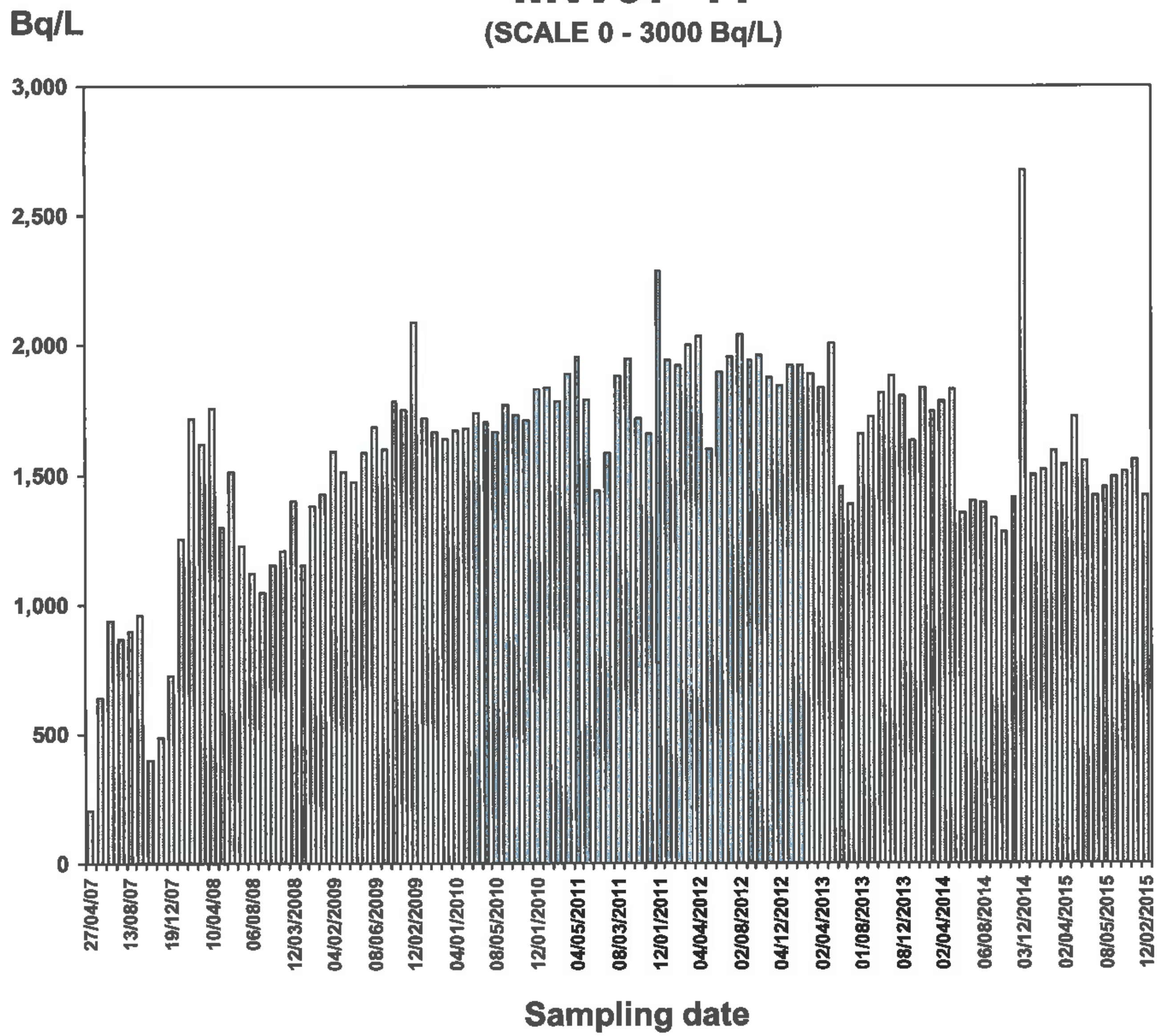
APPENDIX Q



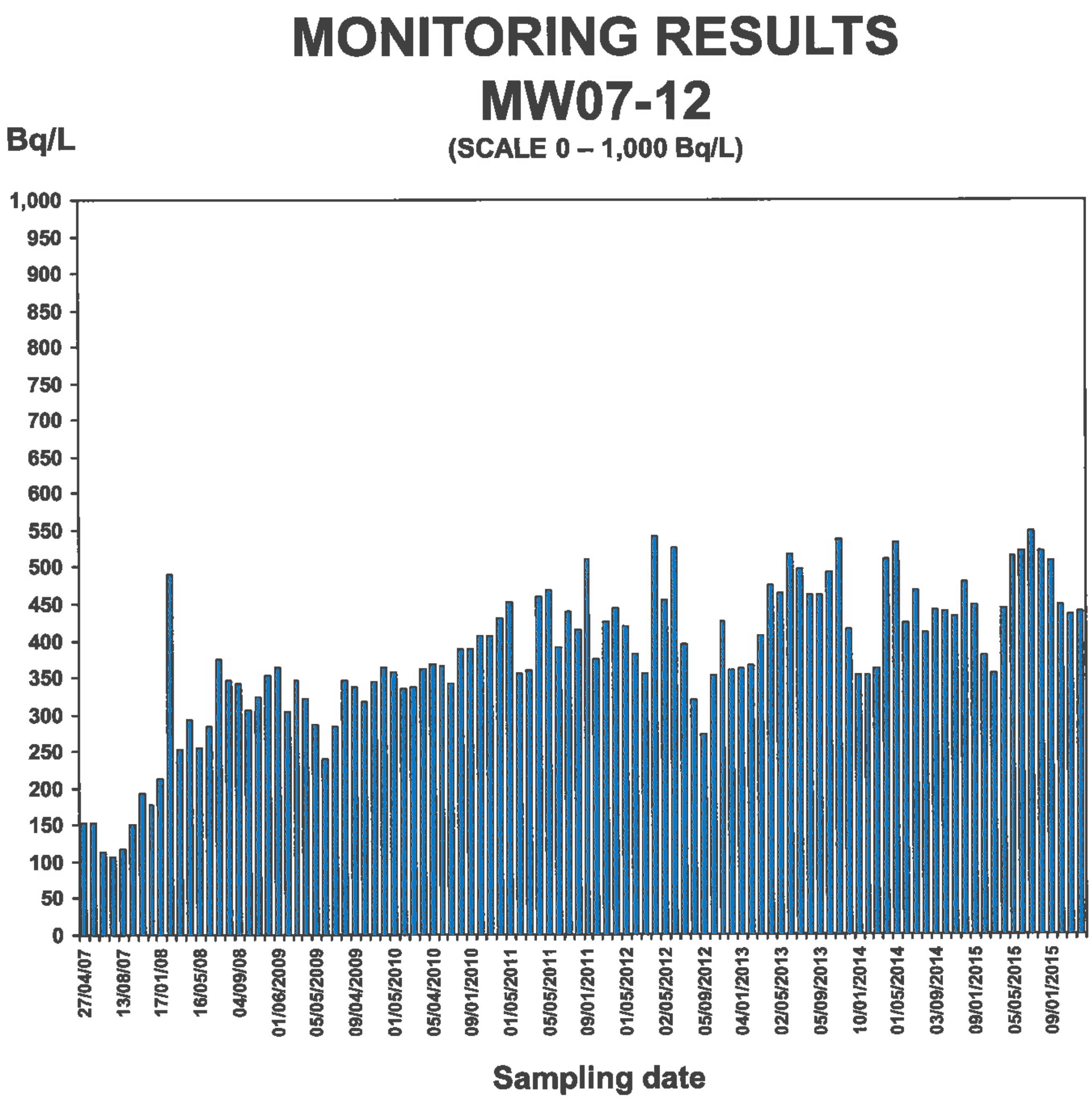
MONITORING RESULTS
MW06-10
(SCALE 0 - 160,000 Bq/L)
Bq/L
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
25/09/06
13/01/07
27/04/07
13/08/07
19/12/07
10/04/08
06/08/08
12/03/2008
04/02/2009
08/06/2009
12/02/2009
04/01/2010
08/05/2010
12/01/2010
04/05/2011
08/03/2011
12/01/2011
04/04/2012
02/08/2012
04/12/2012
02/04/2013
01/08/2013
08/12/2013
02/04/2014
06/08/2014
03/12/2014
02/04/2015
08/05/2015
12/02/2015
Sampling date

APPENDIX Q

MONITORING RESULTS
MW07-11
(SCALE 0 - 3000 Bq/L)

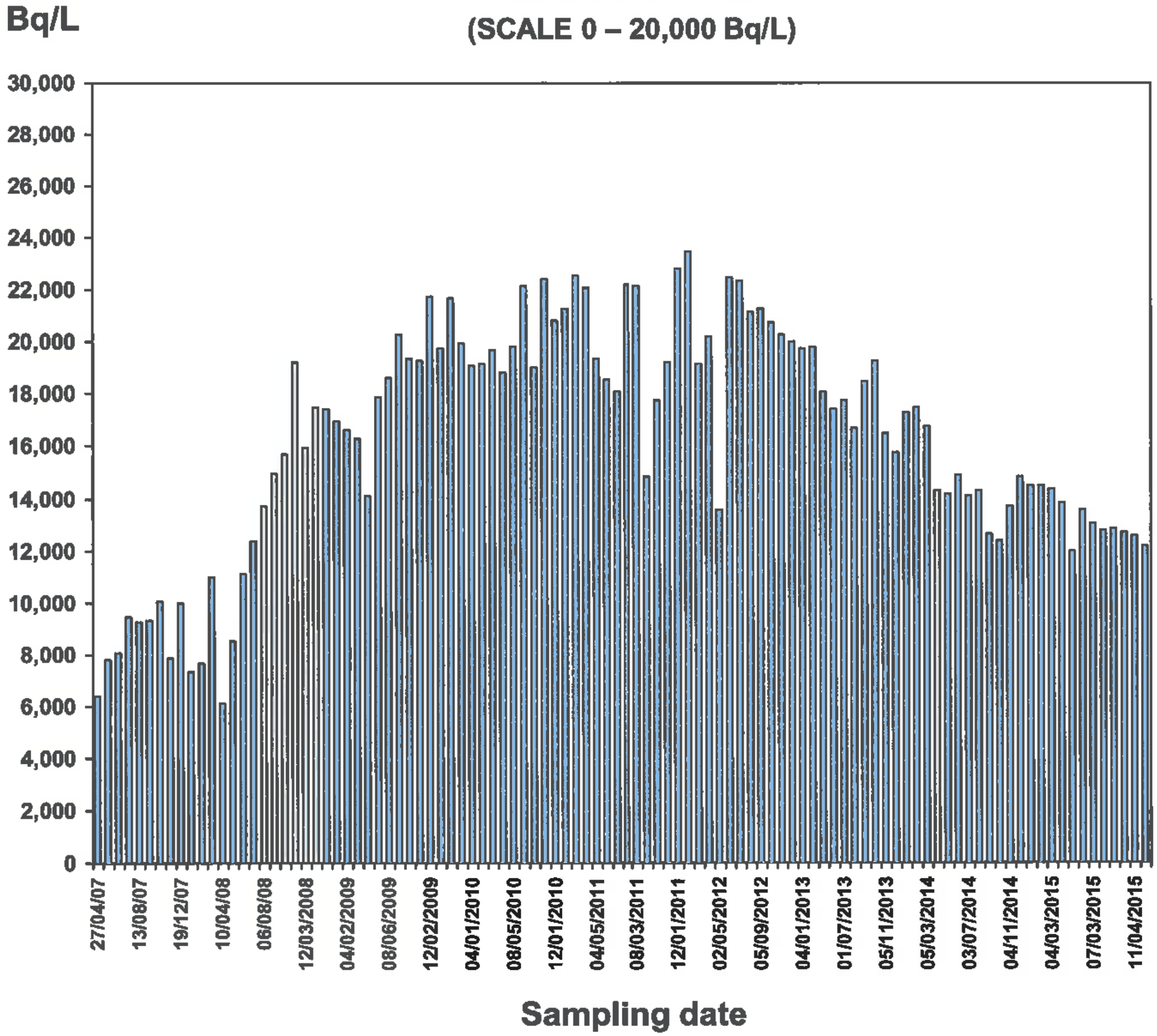


APPENDIX Q


MONITORING RESULTS
MW07-12
Bq/L
(SCALE 0 – 1,000 Bq/L)
1,000
950
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
27/04/07
13/08/07
17/01/08
16/05/08
04/09/08
01/06/2009
05/05/2009
09/04/2009
01/05/2010
05/04/2010
09/01/2010
01/05/2011
05/05/2011
09/01/2011
01/05/2012
02/05/2012
05/09/2012
04/01/2013
02/05/2013
05/09/2013
10/01/2014
01/05/2014
03/09/2014
09/01/2015
05/05/2015
09/01/2015
Sampling date

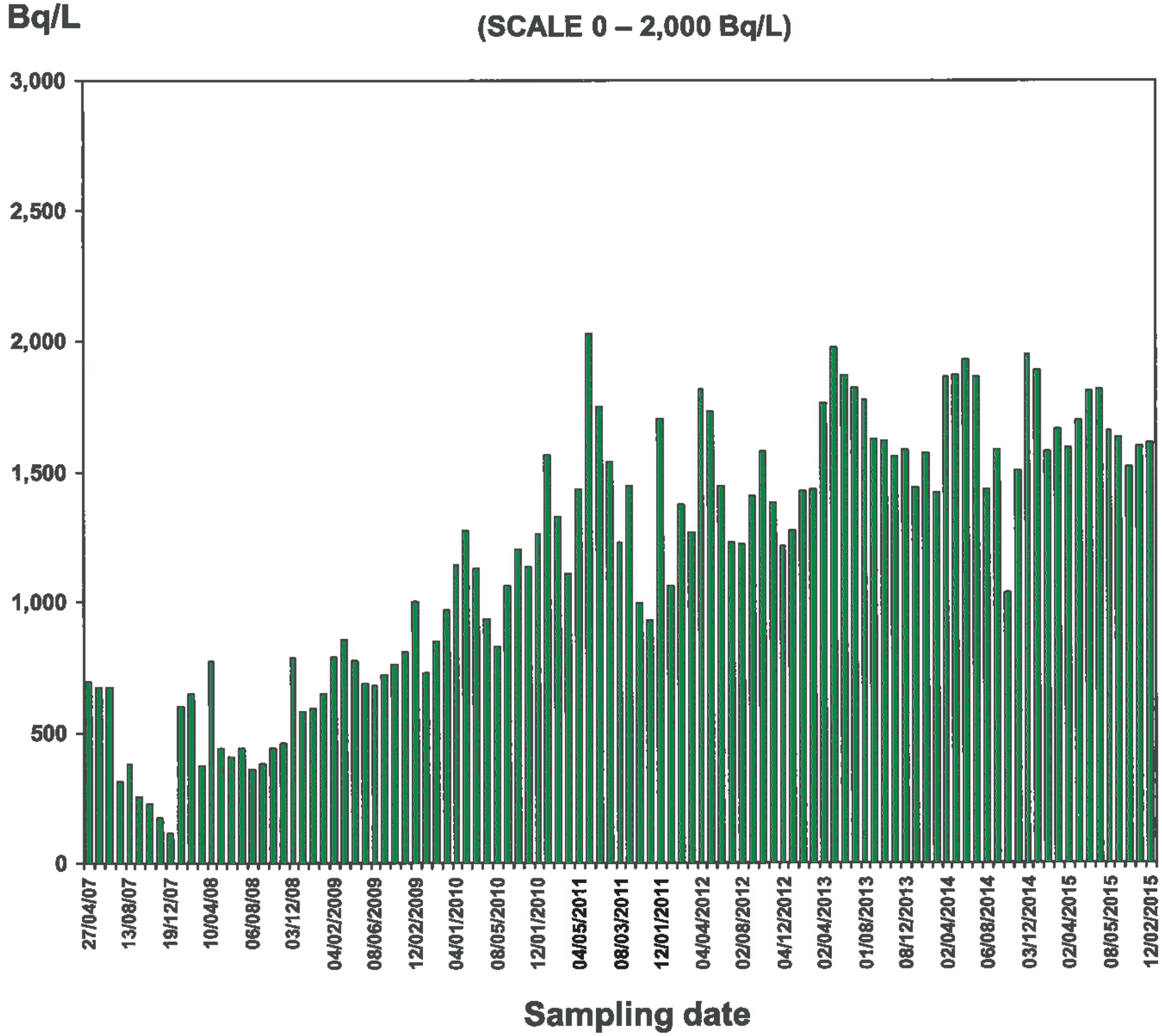
APPENDIX Q

MONITORING RESULTS
MW07-13
(SCALE 0 – 20,000 Bq/L)

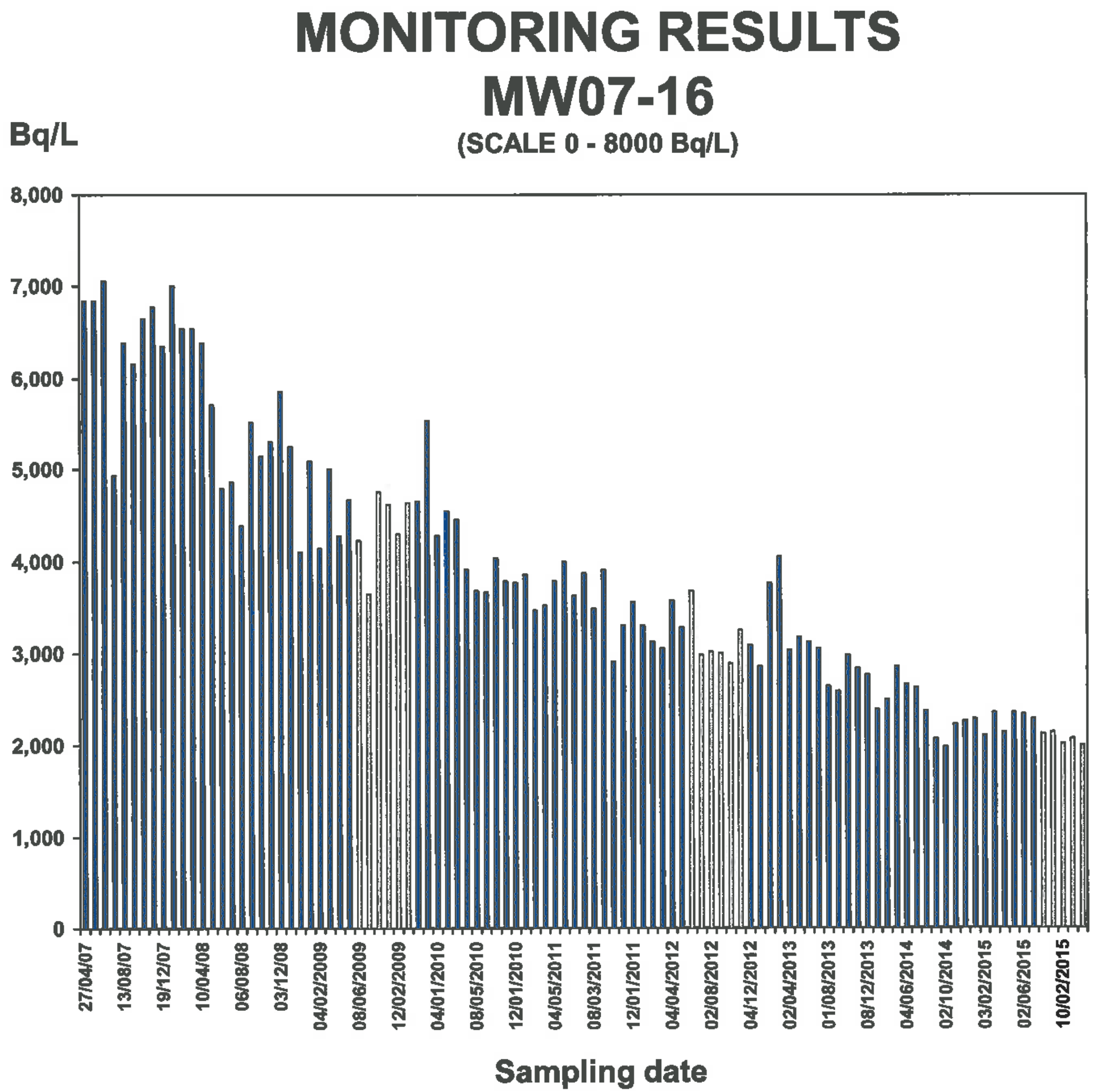


APPENDIX Q

MONITORING RESULTS
MW07-15

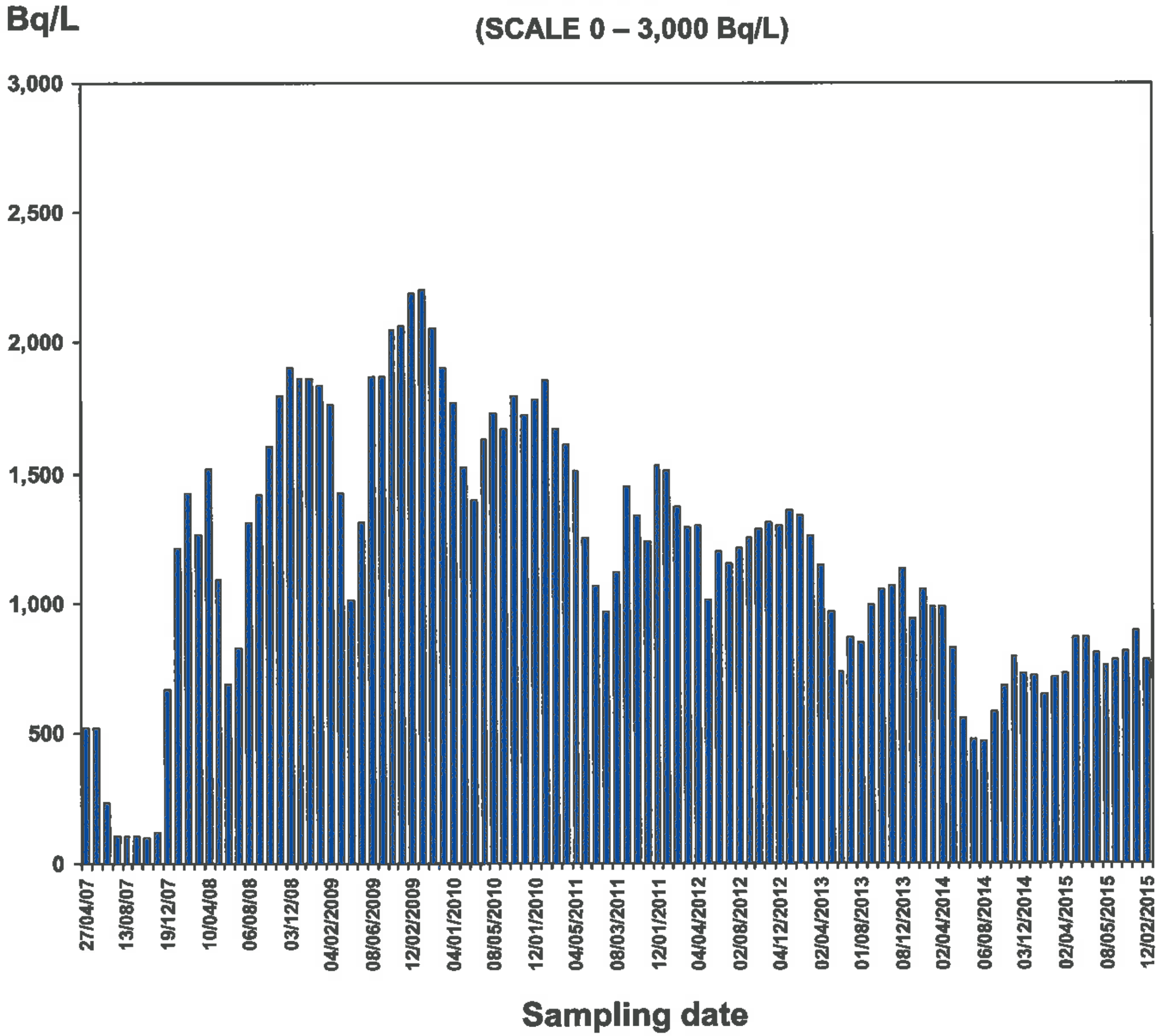


APPENDIX Q


MONITORING RESULTS
MW07-16
(SCALE 0 - 8000 Bq/L)
Bq/L
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
27/04/07
13/08/07
19/12/07
10/04/08
06/08/08
03/12/08
04/02/2009
08/06/2009
12/02/2009
04/01/2010
08/05/2010
12/01/2010
04/05/2011
08/03/2011
12/01/2011
04/04/2012
02/08/2012
04/12/2012
02/04/2013
01/08/2013
08/12/2013
04/06/2014
02/10/2014
03/02/2015
02/06/2015
10/02/2015
Sampling date

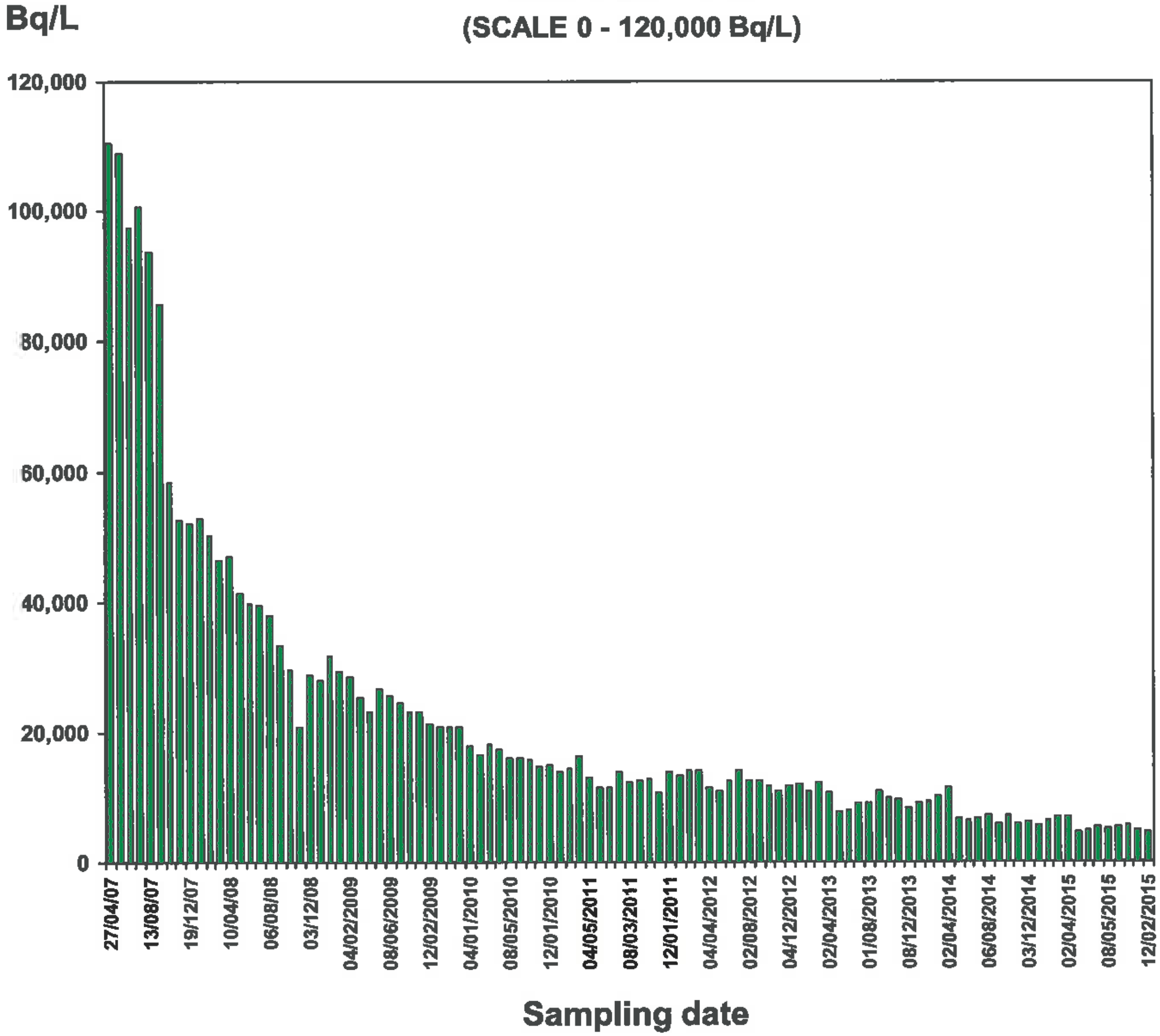
APPENDIX Q

MONITORING RESULTS
MW07-17
(SCALE 0 – 3,000 Bq/L)



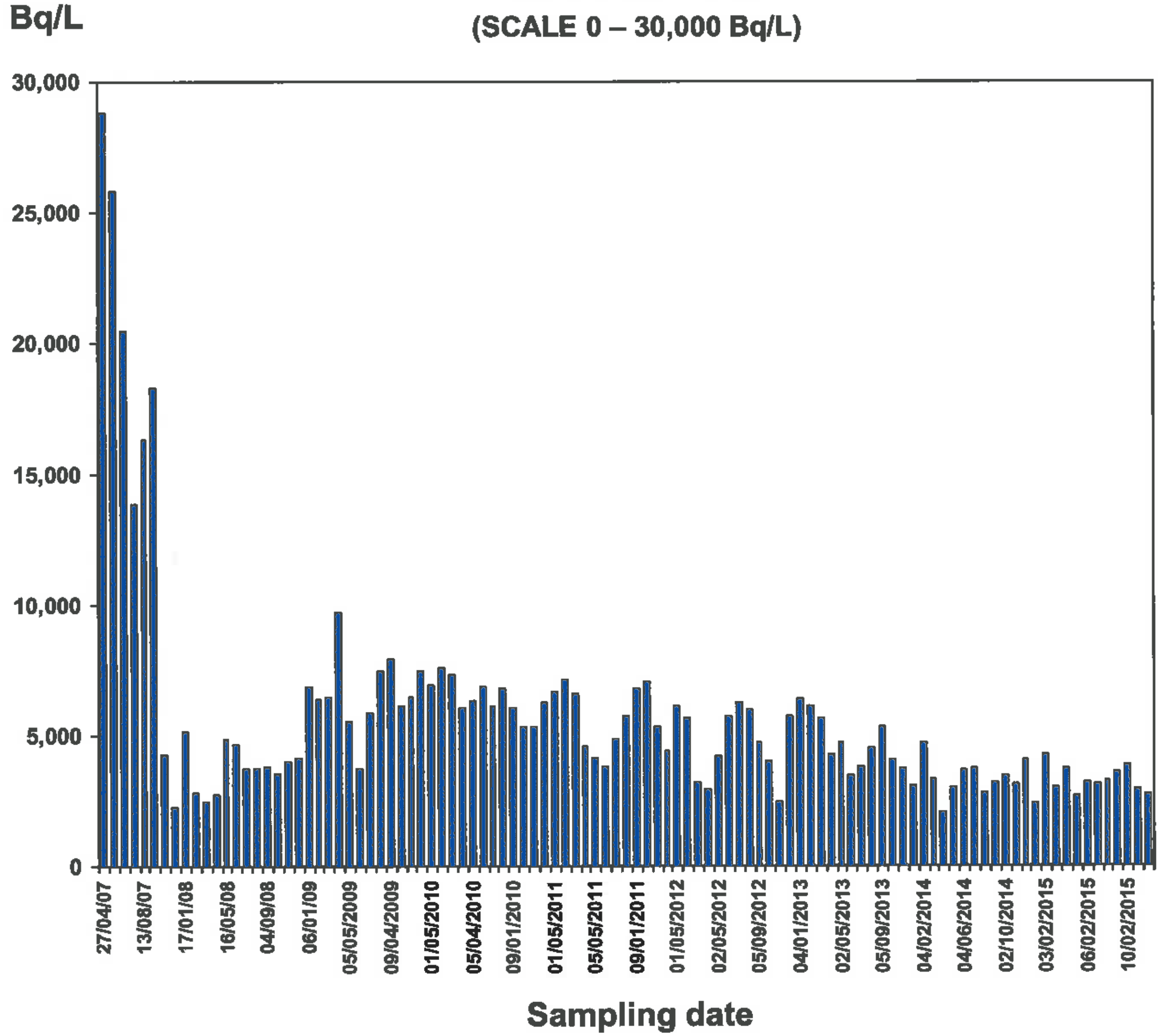
APPENDIX Q

MONITORING RESULTS
MW07-18



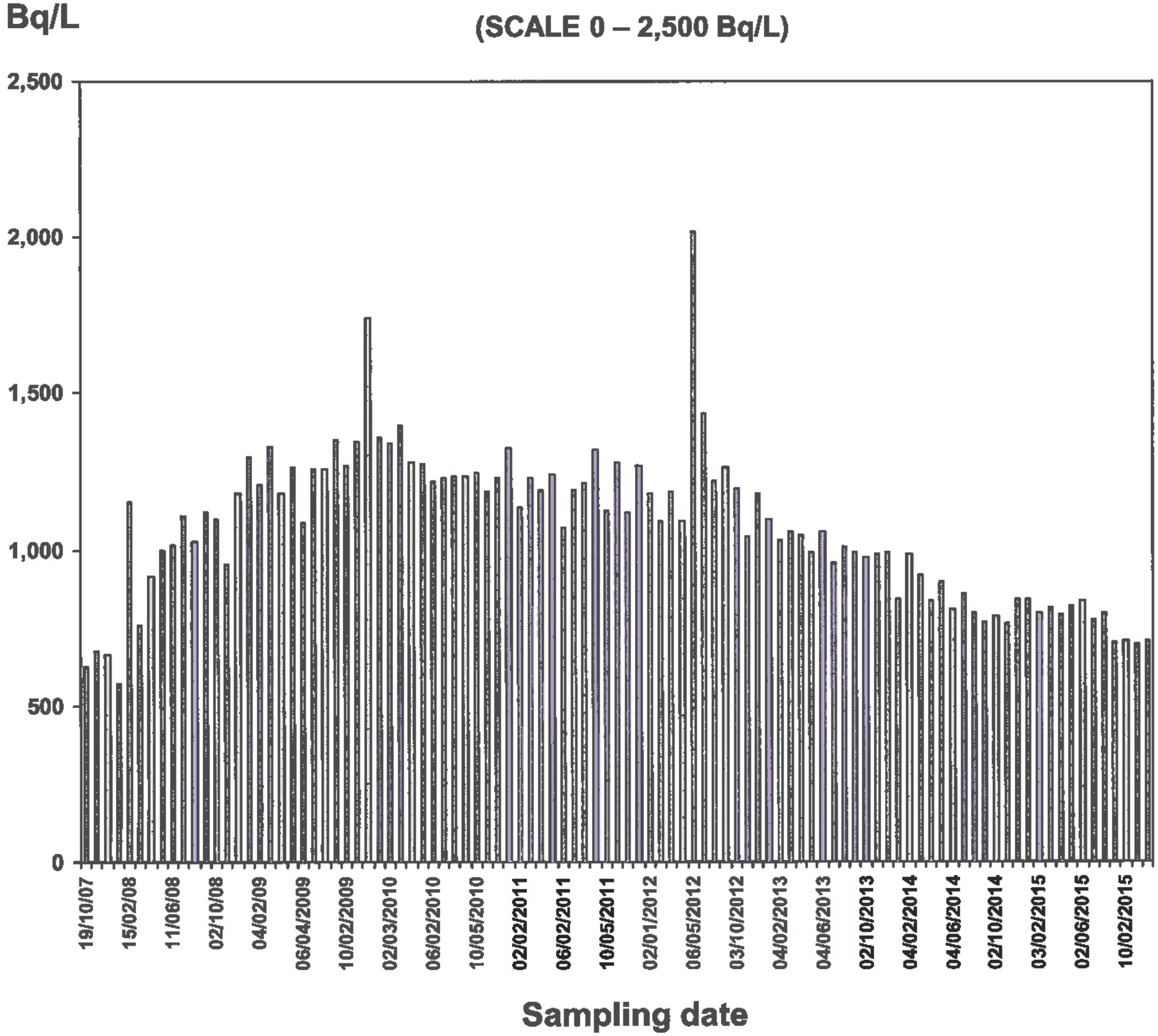
APPENDIX Q

MONITORING RESULTS
MW07-19
(SCALE 0 – 30,000 Bq/L)



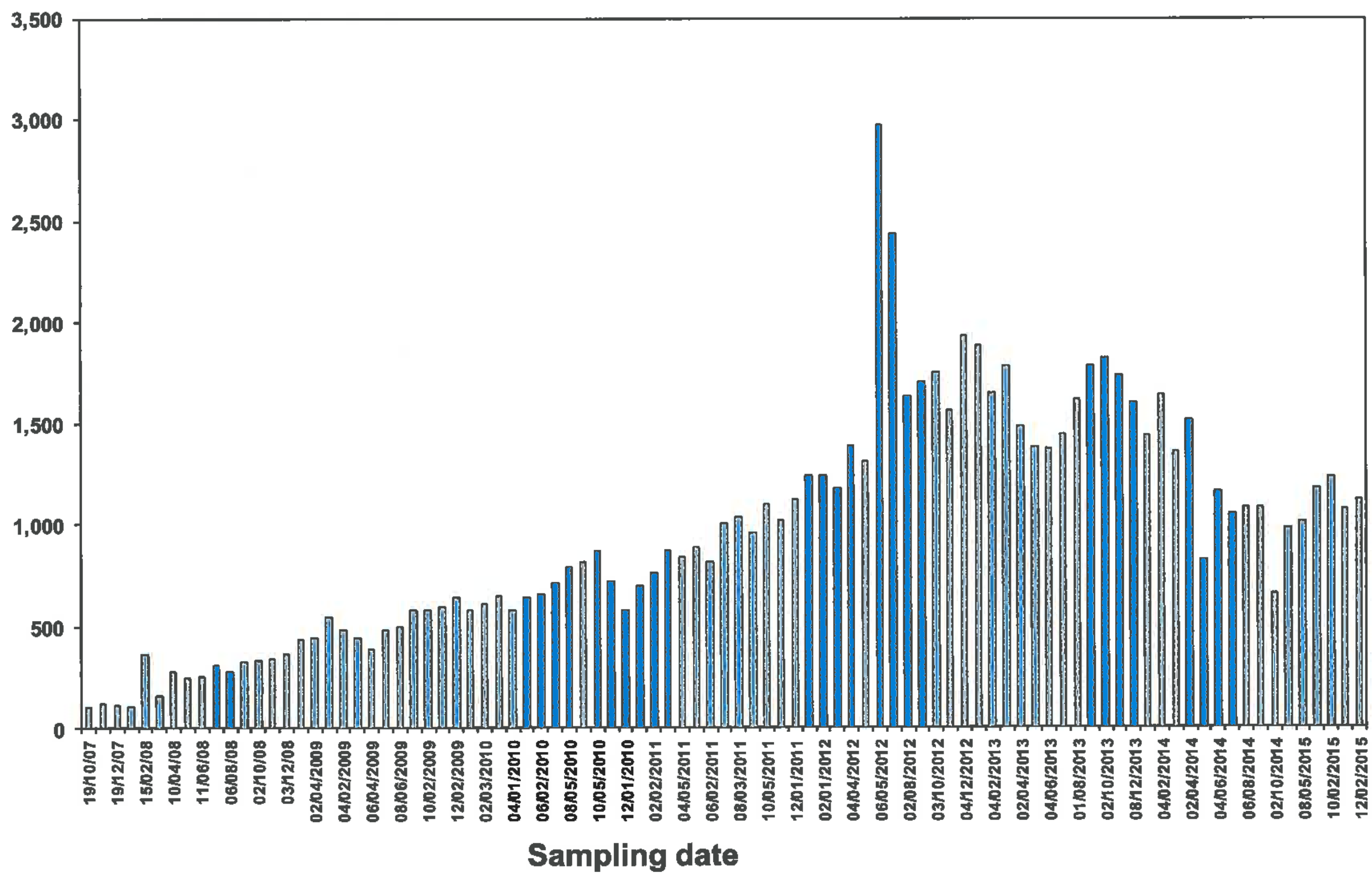
APPENDIX Q

MONITORING RESULTS
MW07-20
(SCALE 0 – 2,500 Bq/L)

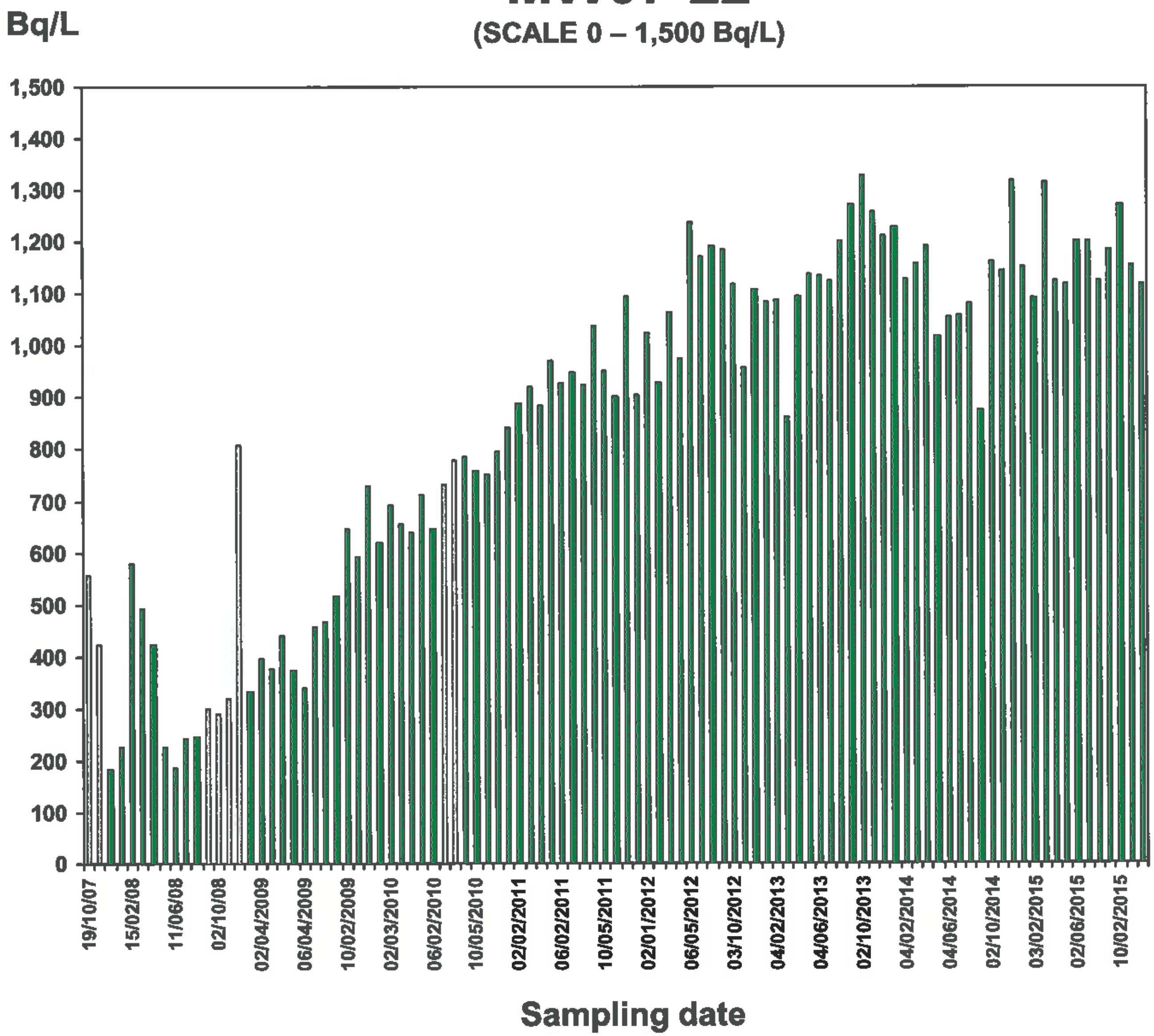


MONITORING RESULTS
MW07-21
(SCALE 0 - 3500 Bq/L)

Bq/L



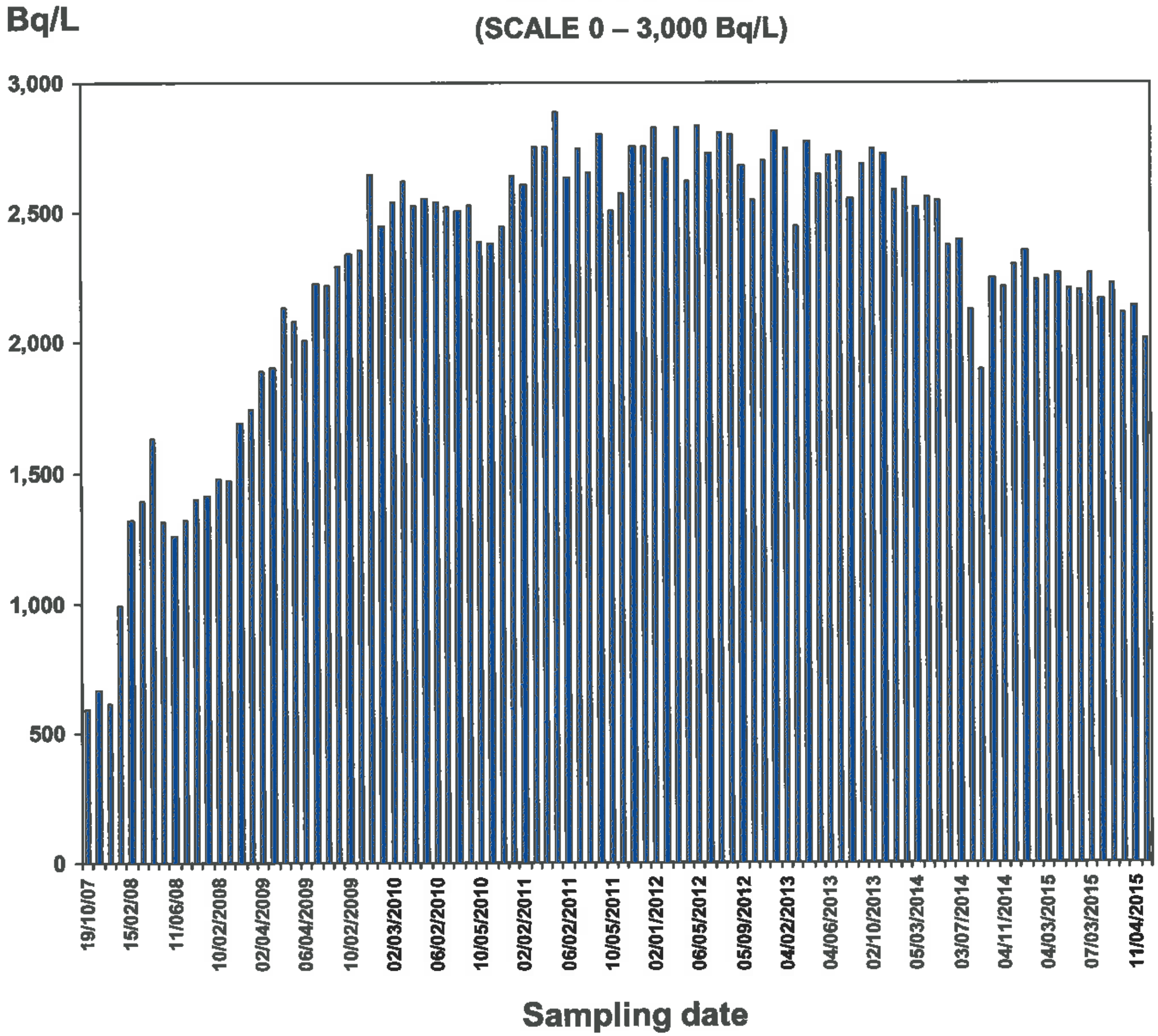
MONITORING RESULTS
MW07-22
(SCALE 0 – 1,500 Bq/L)



APPENDIX Q

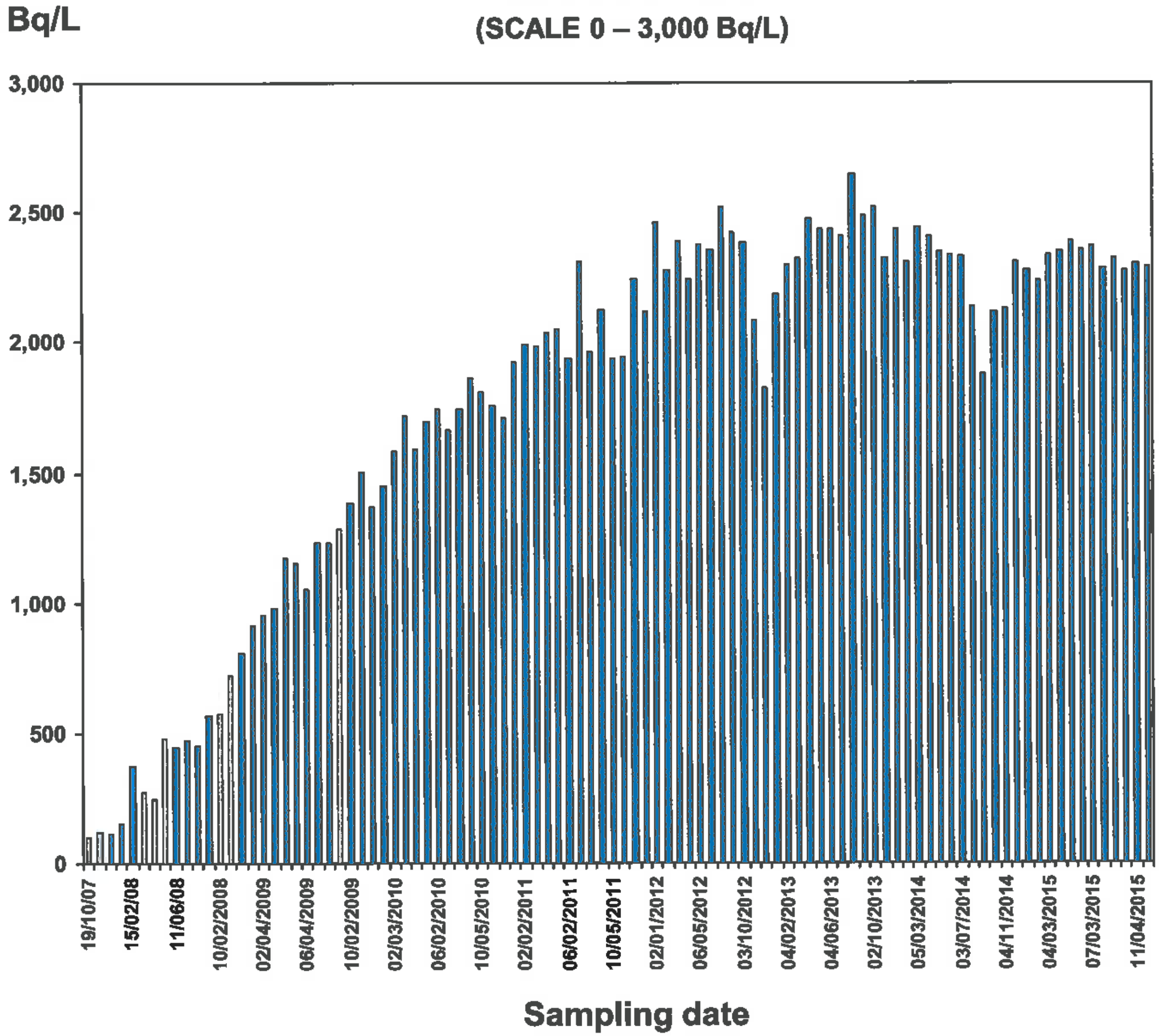
MONITORING RESULTS
MW07-23

(SCALE 0 – 3,000 Bq/L)

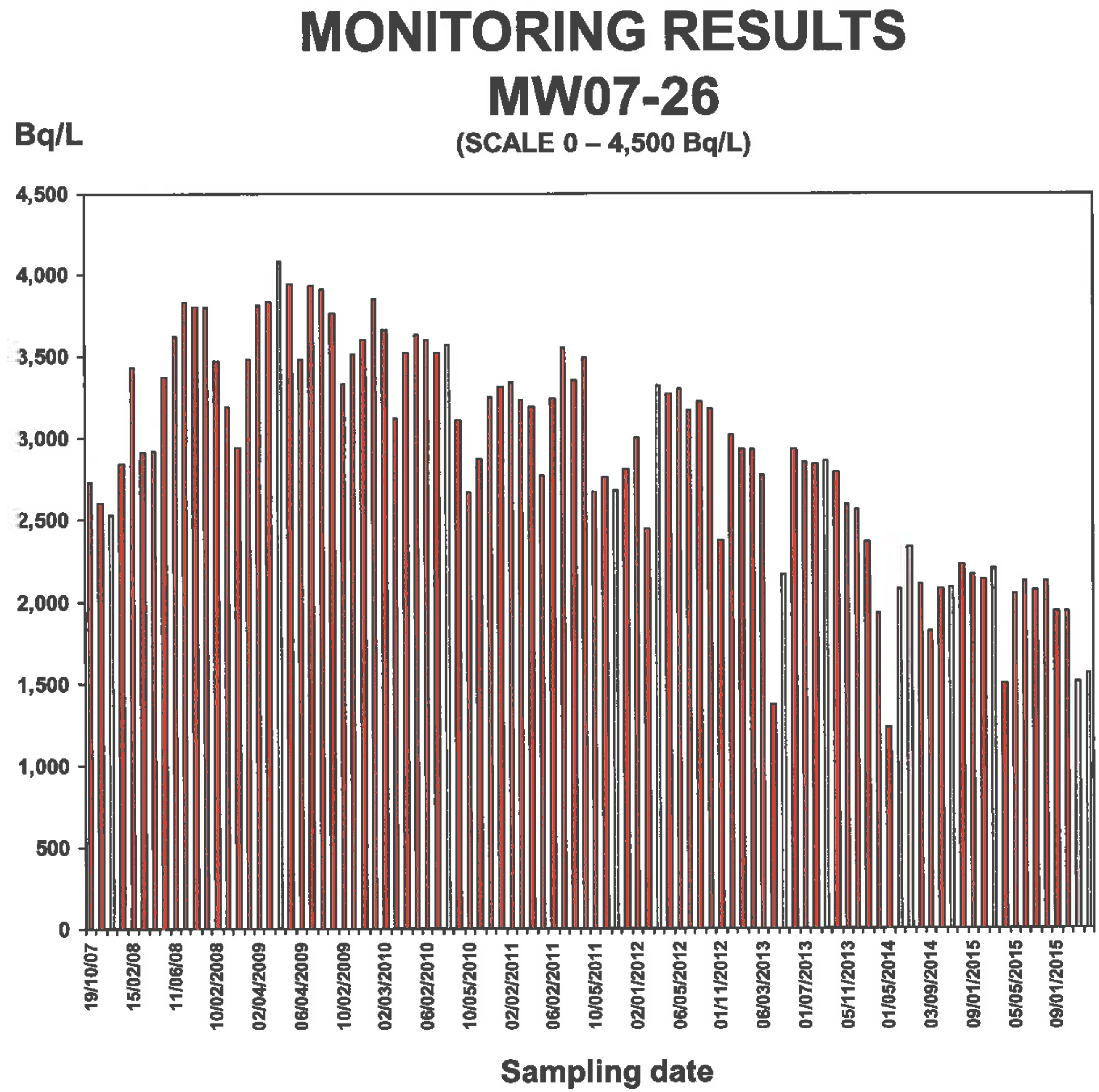


APPENDIX Q

MONITORING RESULTS
MW07-24
(SCALE 0 – 3,000 Bq/L)

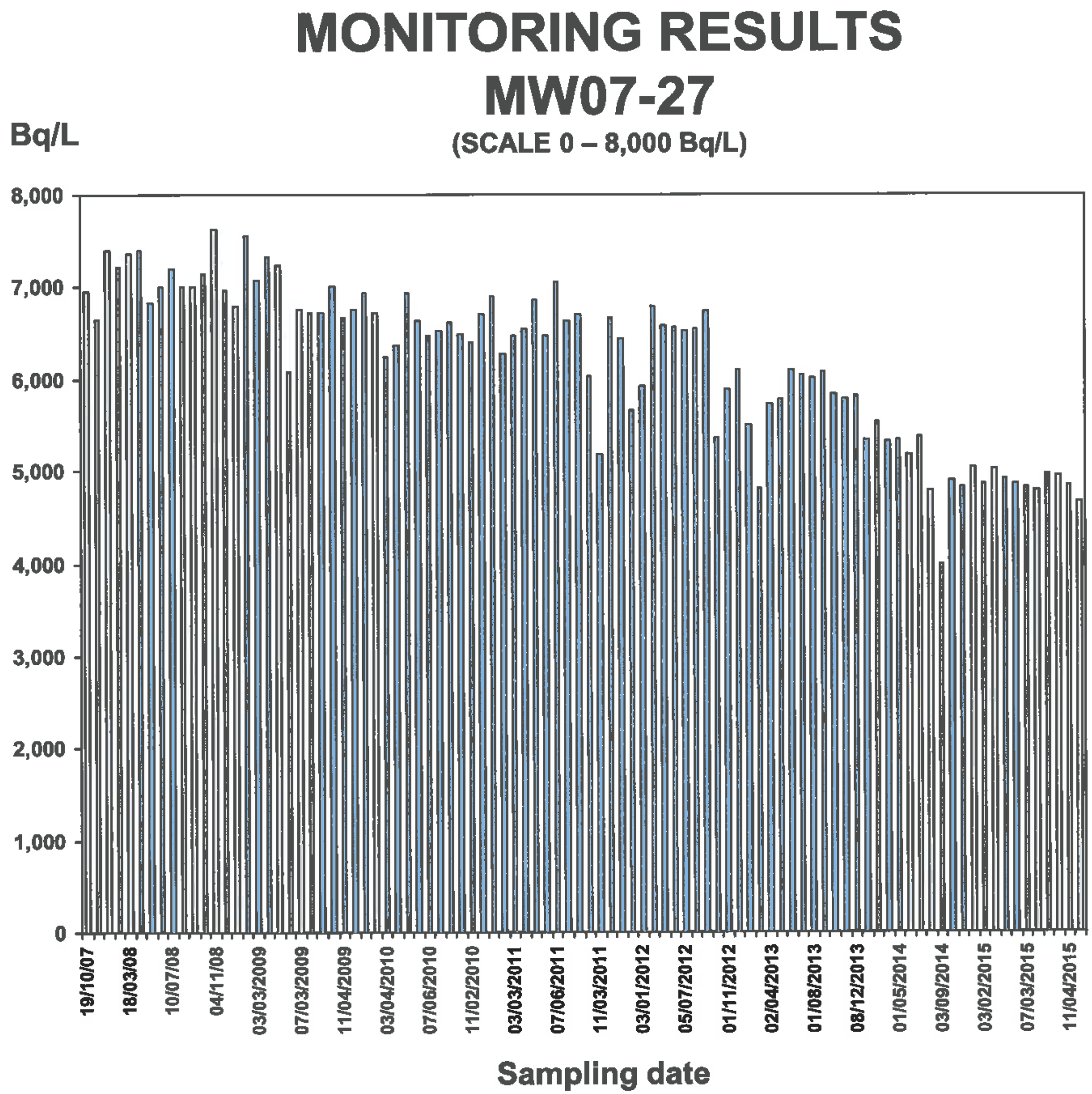


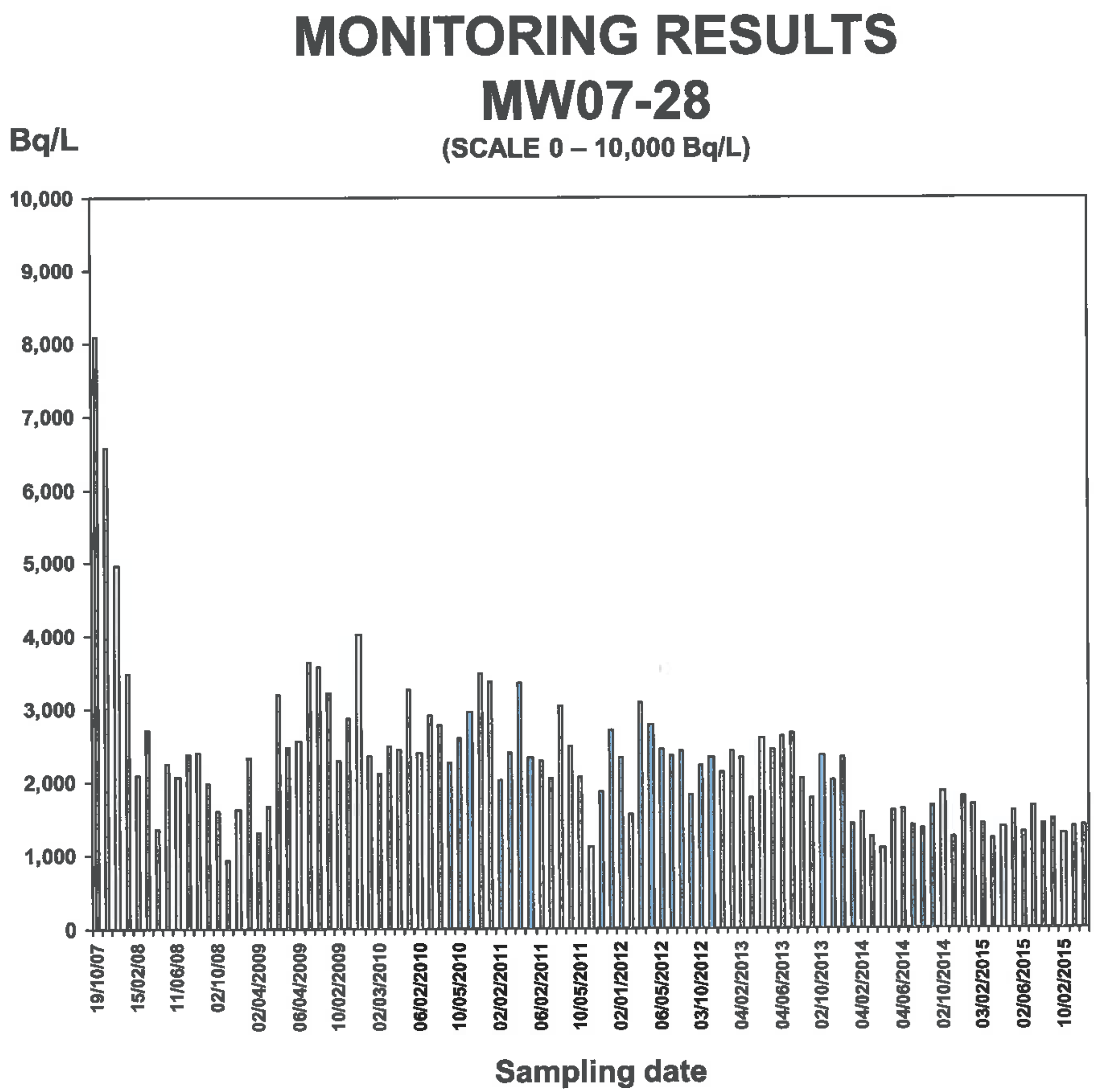
APPENDIX Q



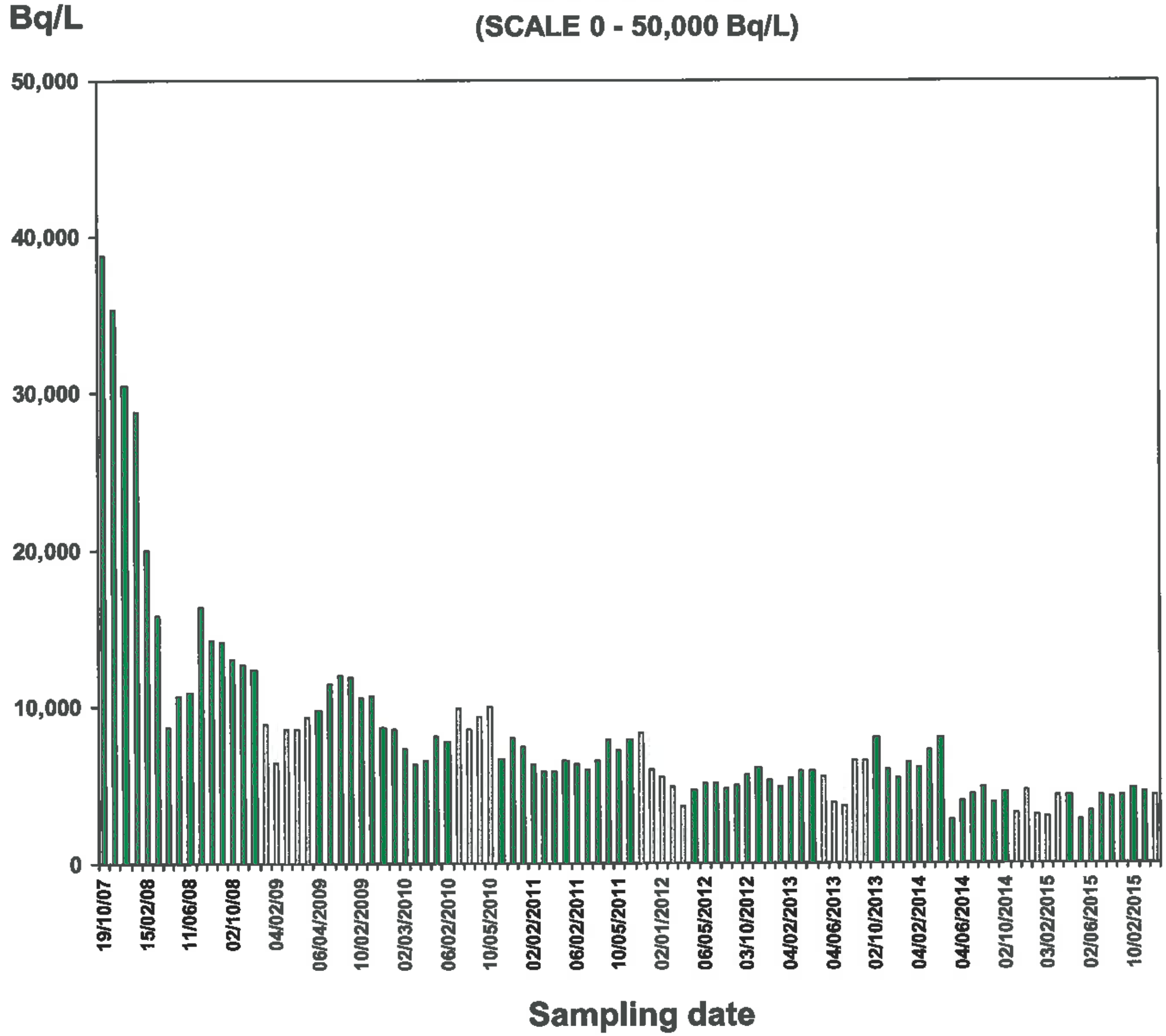
MONITORING RESULTS
MW07-26
(SCALE 0 – 4,500 Bq/L)
Bq/L
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
19/10/07
15/02/08
11/06/08
10/02/2008
02/04/2009
06/04/2009
10/02/2009
02/03/2010
06/02/2010
10/05/2010
02/02/2011
06/02/2011
10/05/2011
02/01/2012
06/05/2012
01/11/2012
06/03/2013
01/07/2013
05/11/2013
01/05/2014
03/09/2014
09/01/2015
05/05/2015
09/01/2015
Sampling date

APPENDIX Q


MONITORING RESULTS
MW07-27
(SCALE 0 – 8,000 Bq/L)
Bq/L
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
19/10/07
18/03/08
10/07/08
04/11/08
03/03/2009
07/03/2009
11/04/2009
03/04/2010
07/06/2010
11/02/2010
03/03/2011
07/06/2011
11/03/2011
03/01/2012
05/07/2012
01/11/2012
02/04/2013
01/08/2013
08/12/2013
01/05/2014
03/09/2014
03/02/2015
07/03/2015
11/04/2015
Sampling date

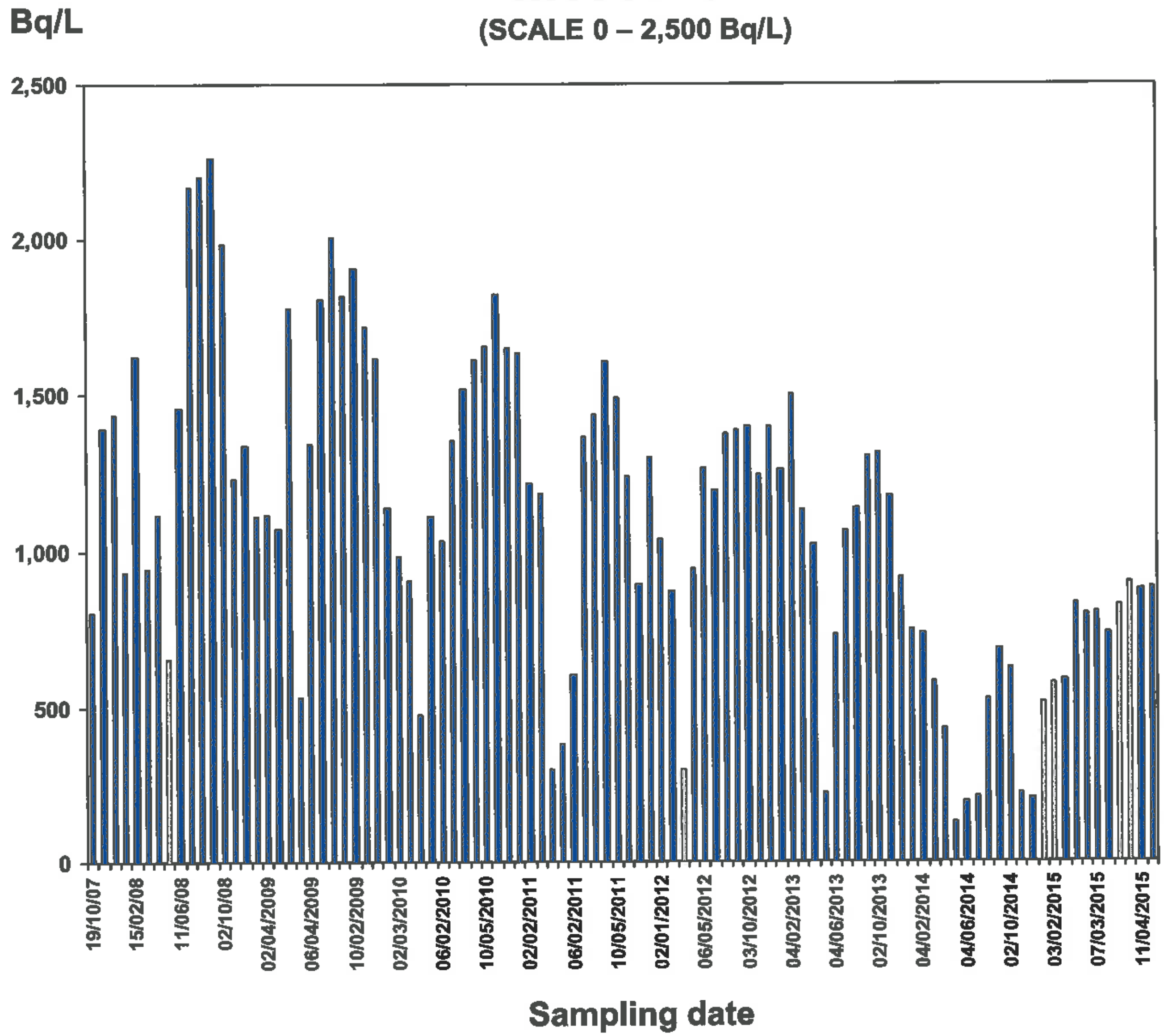

MONITORING RESULTS
MW07-28
Bq/L
(SCALE 0 – 10,000 Bq/L)
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
19/10/07
15/02/08
11/06/08
02/10/08
02/04/2009
06/04/2009
10/02/2009
02/03/2010
06/02/2010
10/05/2010
02/02/2011
06/02/2011
10/05/2011
02/01/2012
06/05/2012
03/10/2012
04/02/2013
04/06/2013
02/10/2013
04/02/2014
04/06/2014
02/10/2014
03/02/2015
02/06/2015
10/02/2015
Sampling date

MONITORING RESULTS
MW07-29
(SCALE 0 - 50,000 Bq/L)

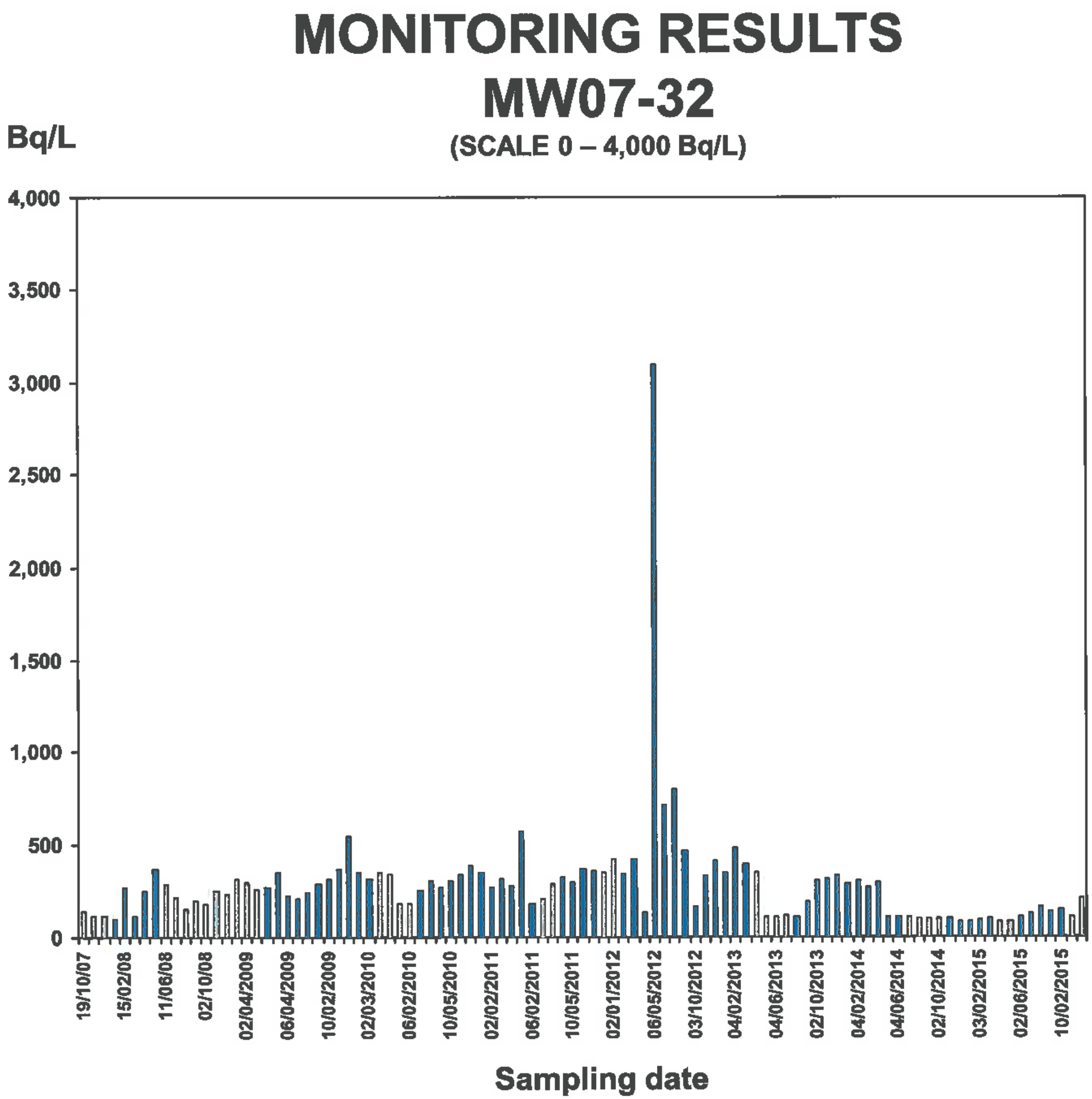


APPENDIX Q

MONITORING RESULTS
MW07-31



APPENDIX Q

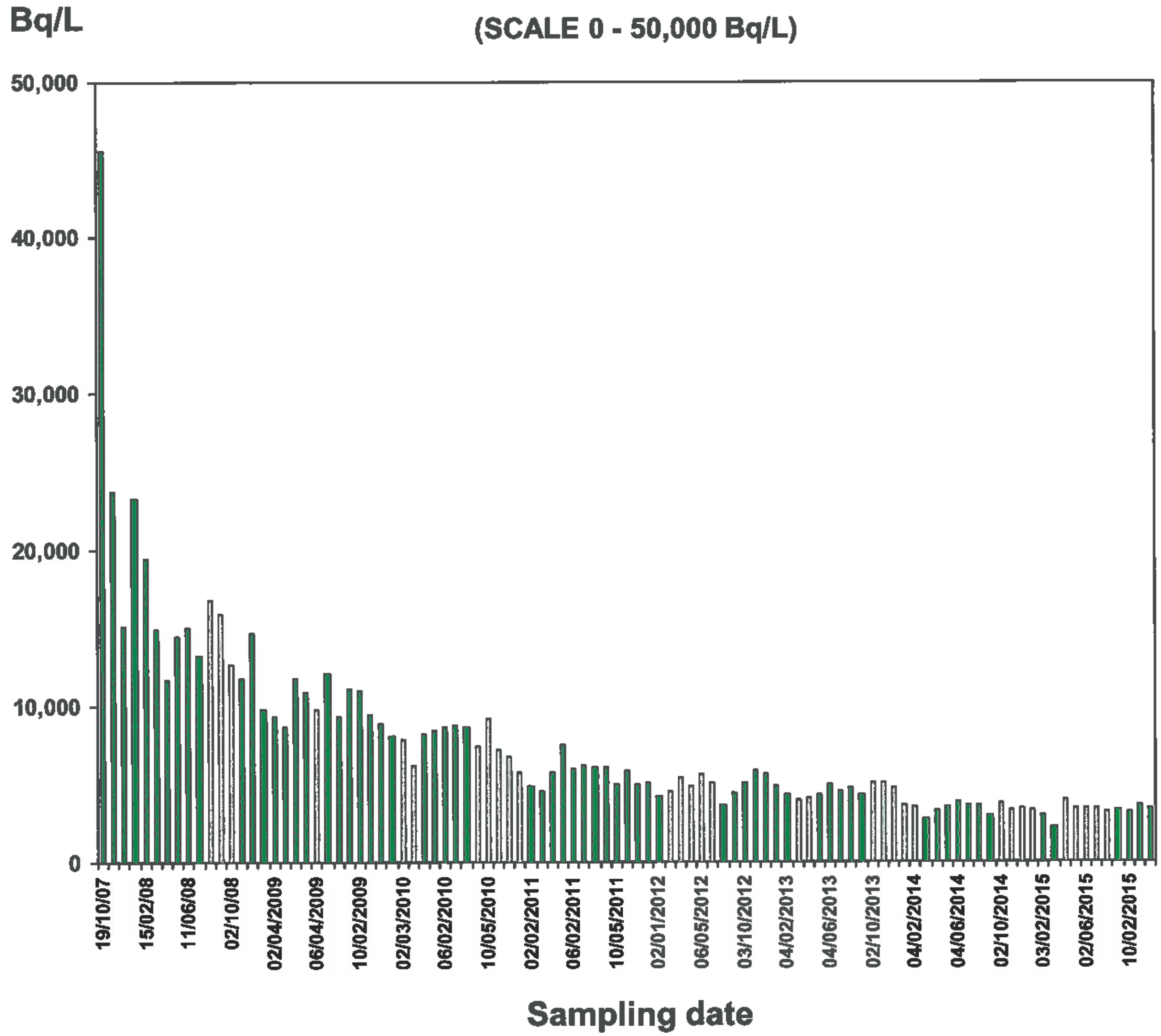


MONITORING RESULTS
MW07-32
(SCALE 0 – 4,000 Bq/L)
Bq/L
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
19/10/07
15/02/08
11/06/08
02/10/08
02/04/2009
06/04/2009
10/02/2009
02/03/2010
06/02/2010
10/05/2010
02/02/2011
06/02/2011
10/05/2011
02/01/2012
06/05/2012
03/10/2012
04/02/2013
04/06/2013
02/10/2013
04/02/2014
04/06/2014
02/10/2014
03/02/2015
02/06/2015
10/02/2015
Sampling date

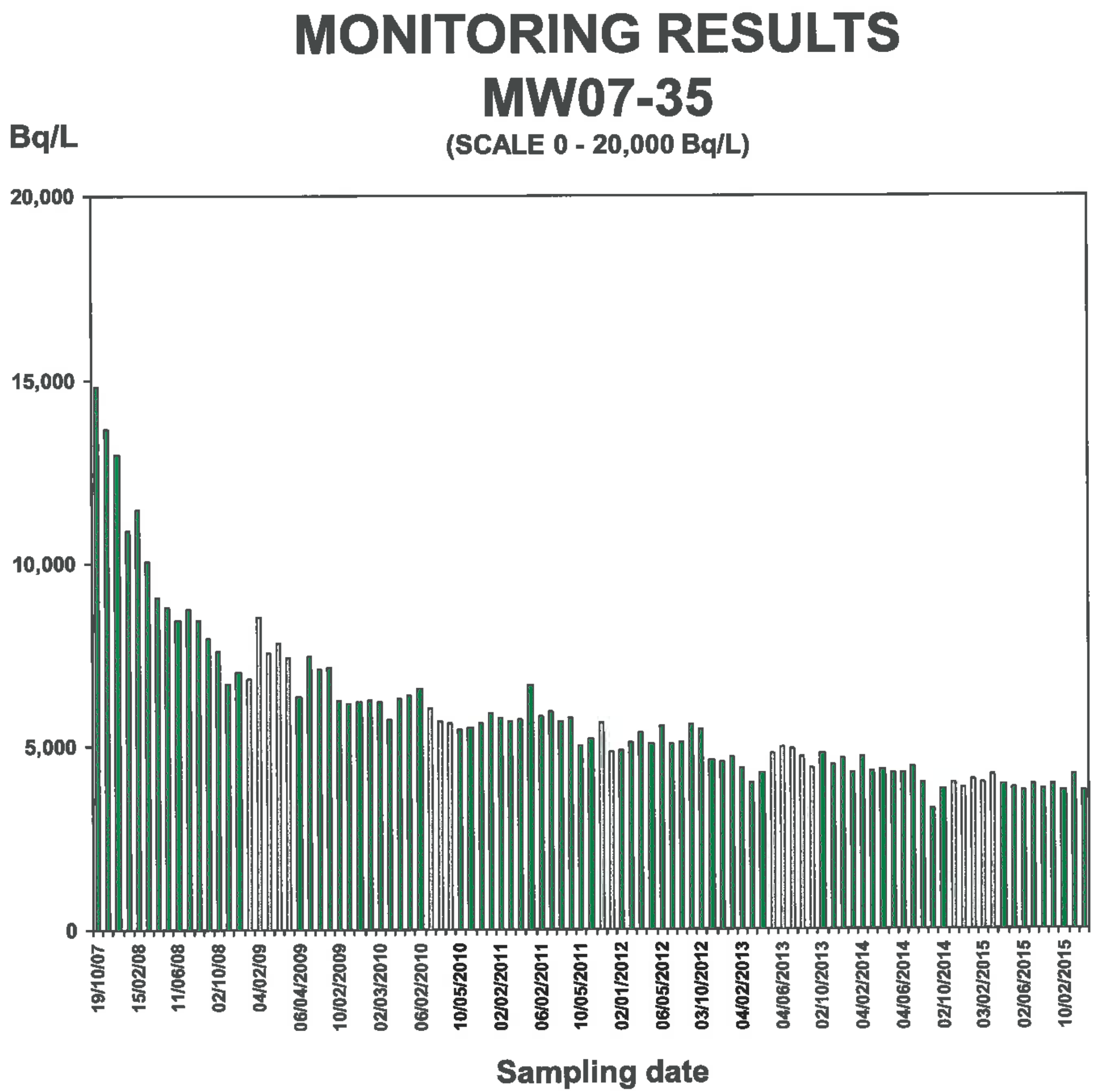
APPENDIX Q

MONITORING RESULTS
MW07-34

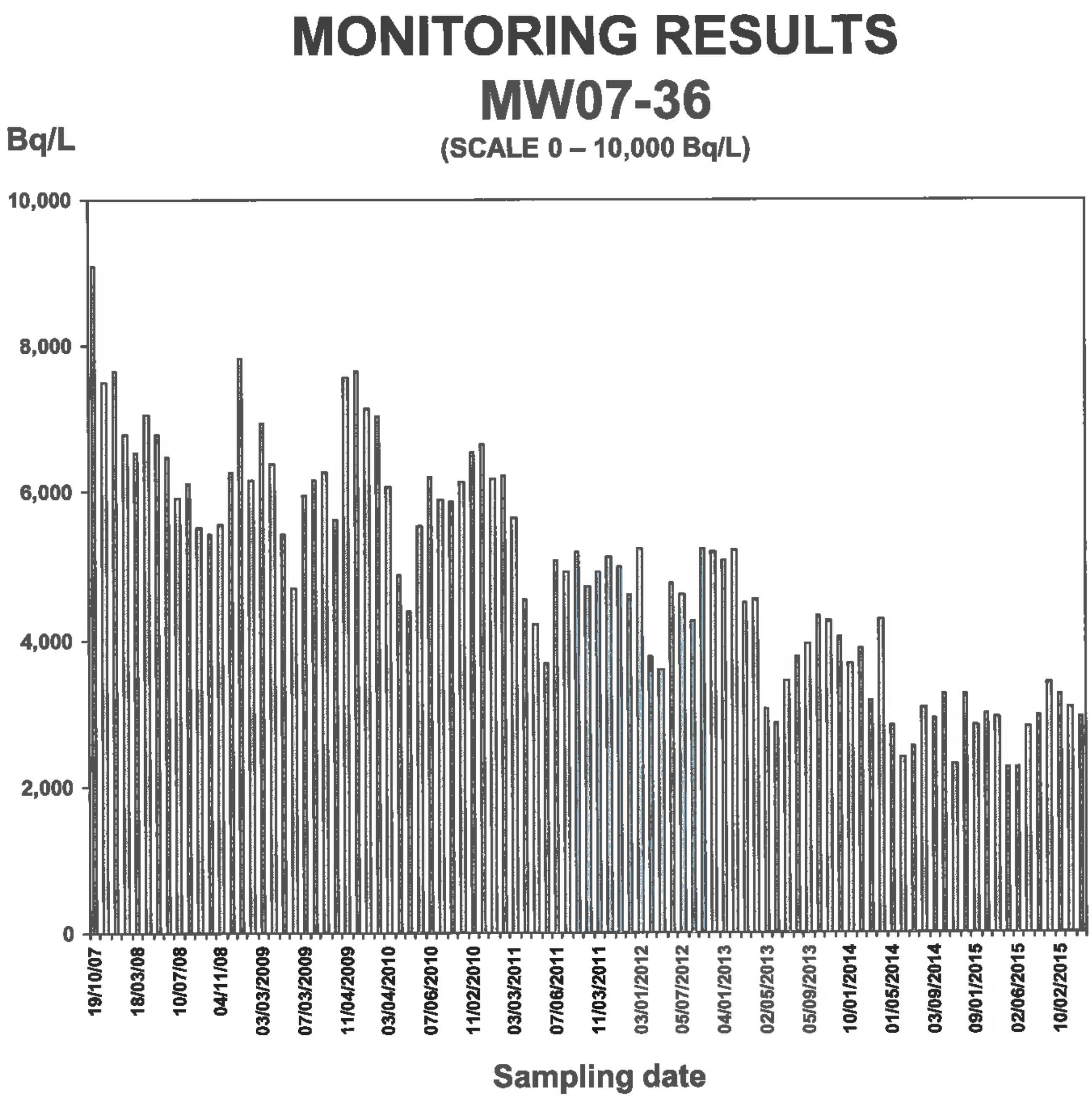
(SCALE 0 - 50,000 Bq/L)



APPENDIX Q

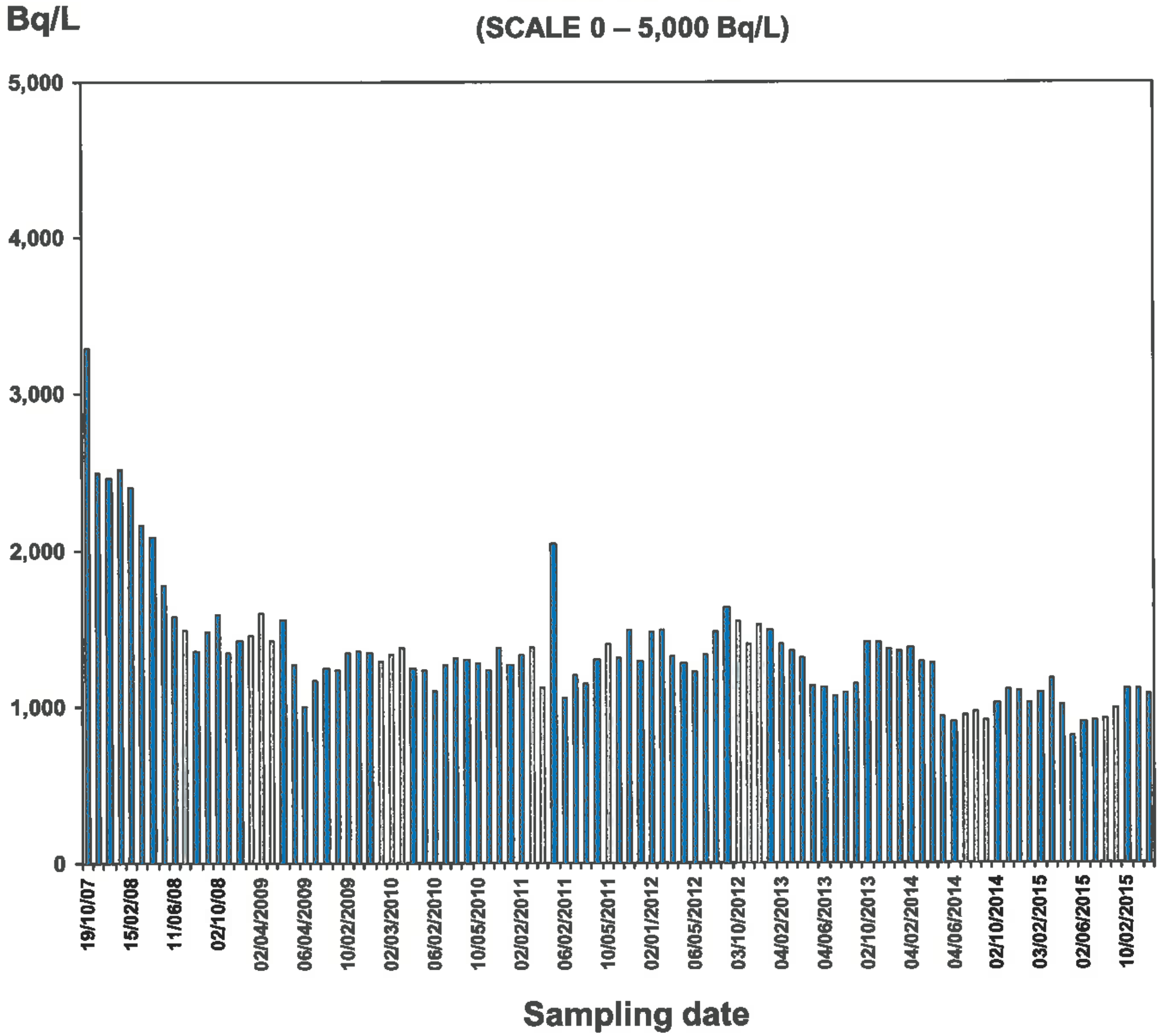

MONITORING RESULTS
MW07-35
(SCALE 0 - 20,000 Bq/L)
Bq/L
20,000
15,000
10,000
5,000
0
19/10/07
15/02/08
11/06/08
02/10/08
04/02/09
06/04/2009
10/02/2009
02/03/2010
06/02/2010
10/05/2010
02/02/2011
06/02/2011
10/05/2011
02/01/2012
06/05/2012
03/10/2012
04/02/2013
04/06/2013
02/10/2013
04/02/2014
04/06/2014
02/10/2014
03/02/2015
02/06/2015
10/02/2015
Sampling date

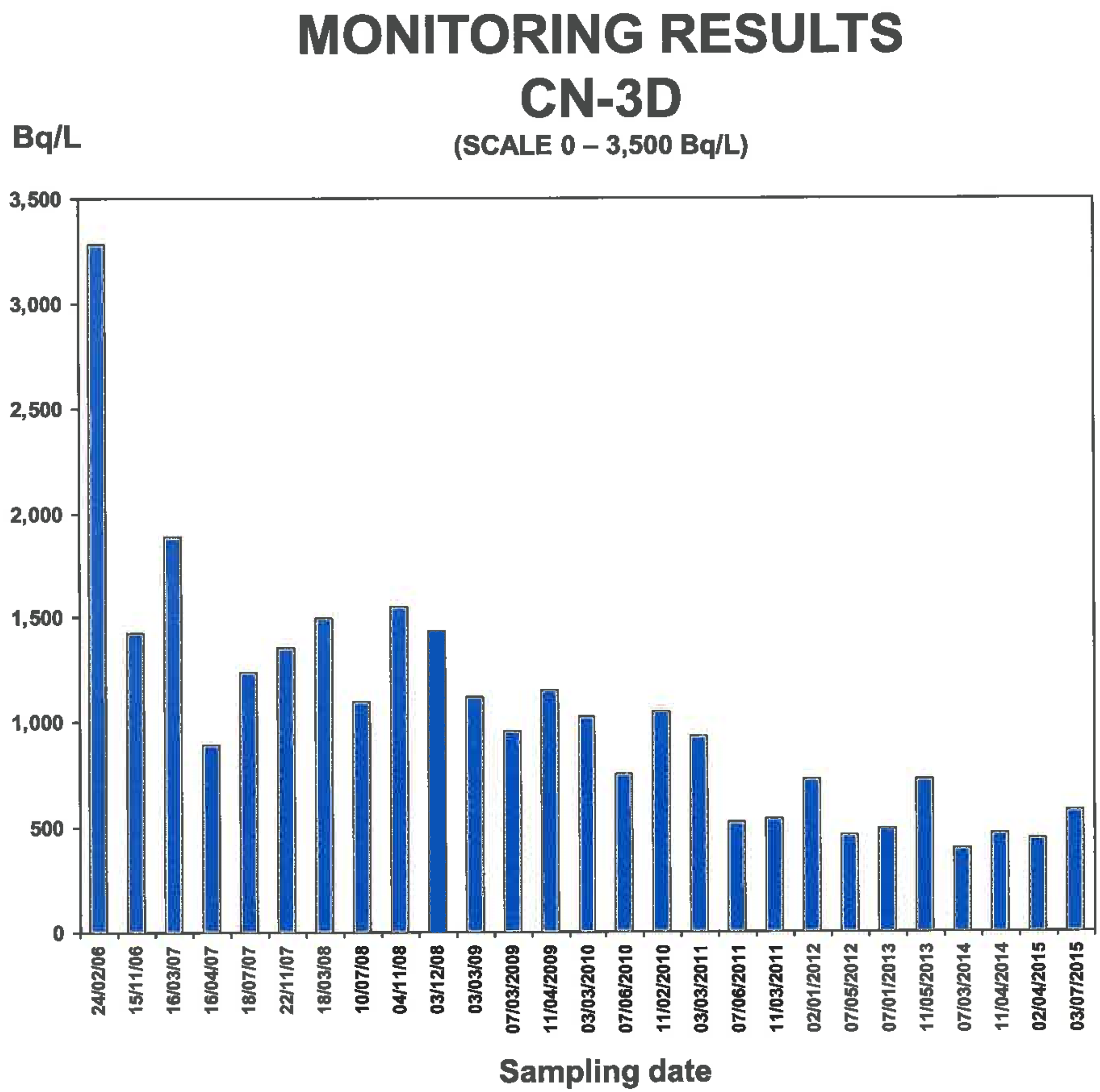
APPENDIX Q


MONITORING RESULTS
MW07-36
(SCALE 0 – 10,000 Bq/L)
Bq/L
10,000
8,000
6,000
4,000
2,000
0
19/10/07
18/03/08
10/07/08
04/11/08
03/03/2009
07/03/2009
11/04/2009
03/04/2010
07/06/2010
11/02/2010
03/03/2011
07/06/2011
11/03/2011
03/01/2012
05/07/2012
04/01/2013
02/05/2013
05/09/2013
10/01/2014
01/05/2014
03/09/2014
09/01/2015
02/06/2015
10/02/2015
Sampling date

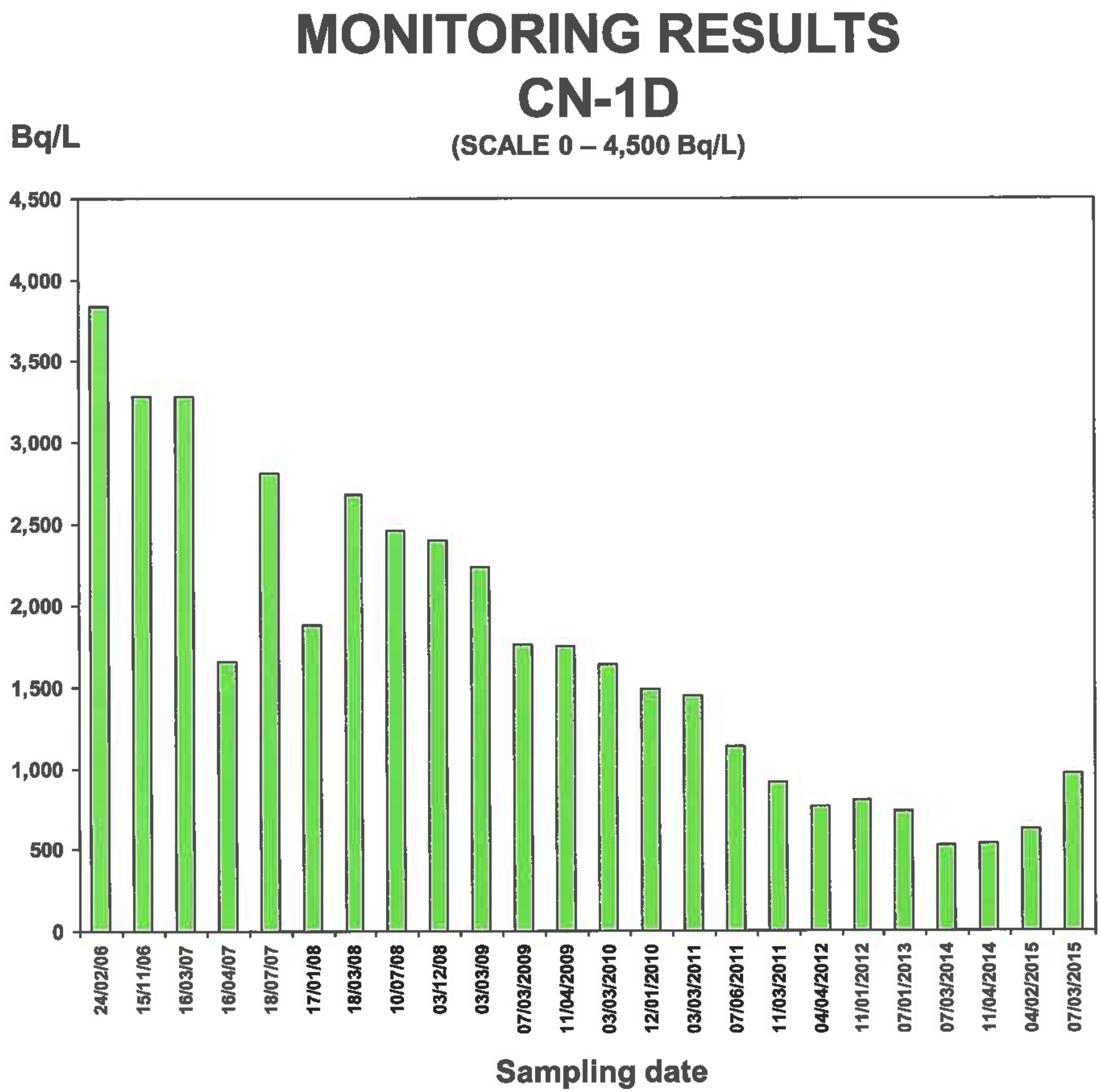
APPENDIX Q

MONITORING RESULTS
MW07-37

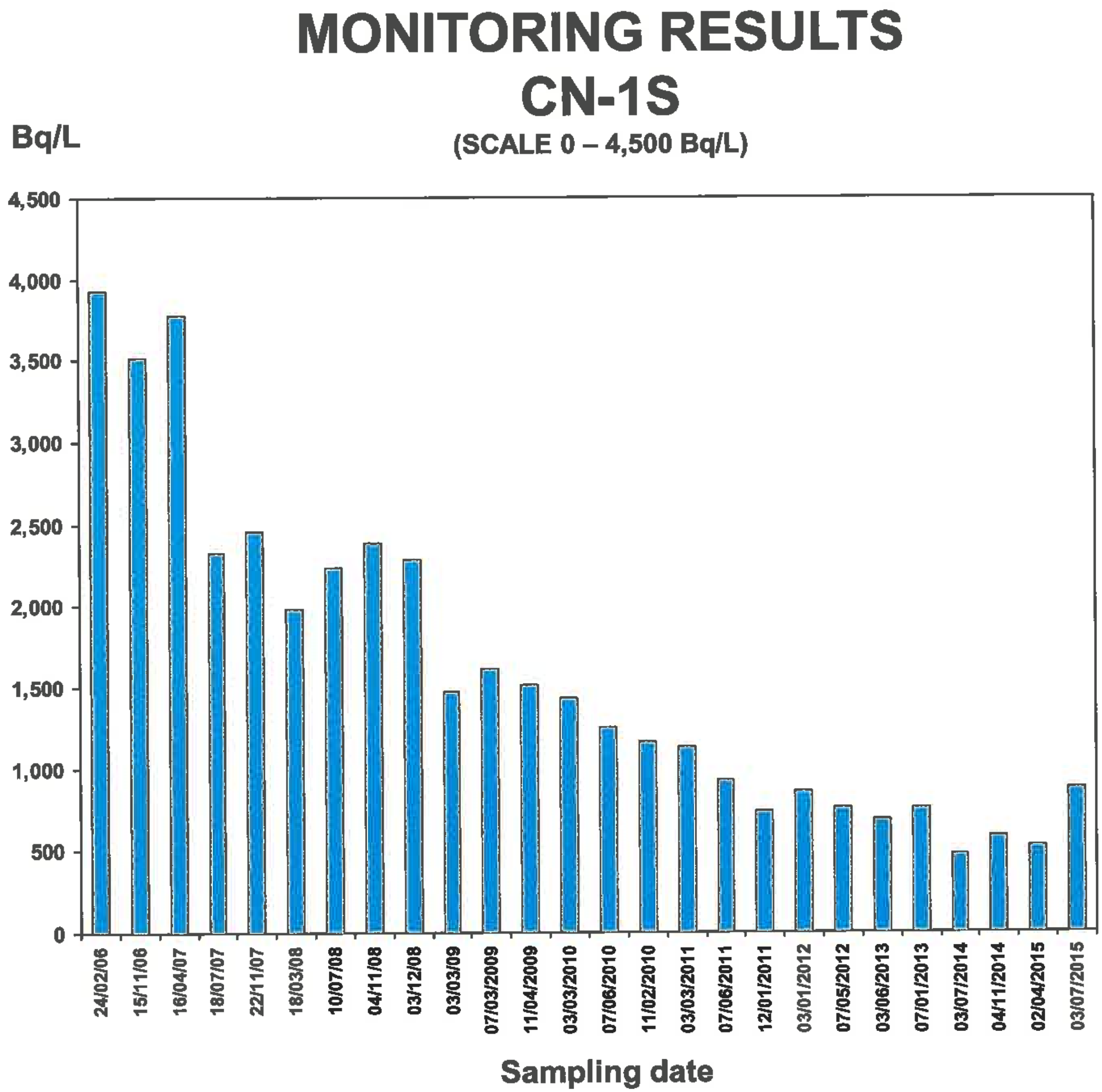



MONITORING RESULTS
CN-3D
Bq/L
(SCALE 0 – 3,500 Bq/L)
3,500
3,000
2,500
2,000
1,500
1,000
500
0
24/02/06
15/11/06
16/03/07
16/04/07
18/07/07
22/11/07
18/03/08
10/07/08
04/11/08
03/12/08
03/03/09
07/03/2009
11/04/2009
03/03/2010
07/06/2010
11/02/2010
03/03/2011
07/06/2011
11/03/2011
02/01/2012
07/05/2012
07/01/2013
11/05/2013
07/03/2014
11/04/2014
02/04/2015
03/07/2015
Sampling date

APPENDIX Q


MONITORING RESULTS
CN-1D
(SCALE 0 – 4,500 Bq/L)
Bq/L
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
24/02/06
15/11/06
16/03/07
16/04/07
18/07/07
17/01/08
18/03/08
10/07/08
03/12/08
03/03/09
07/03/2009
11/04/2009
03/03/2010
12/01/2010
03/03/2011
07/06/2011
11/03/2011
04/04/2012
11/01/2012
07/01/2013
07/03/2014
11/04/2014
04/02/2015
07/03/2015
Sampling date

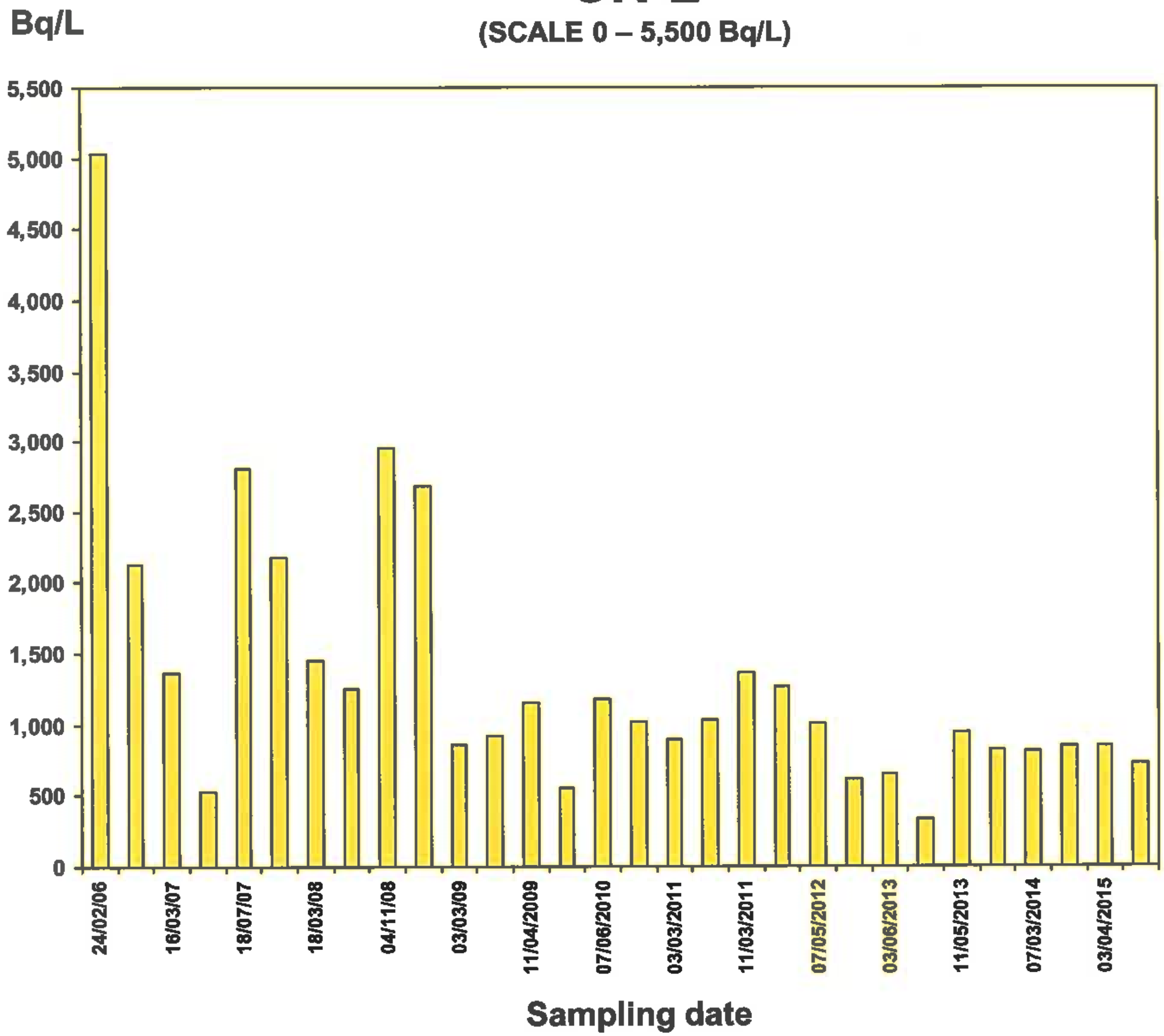
APPENDIX Q

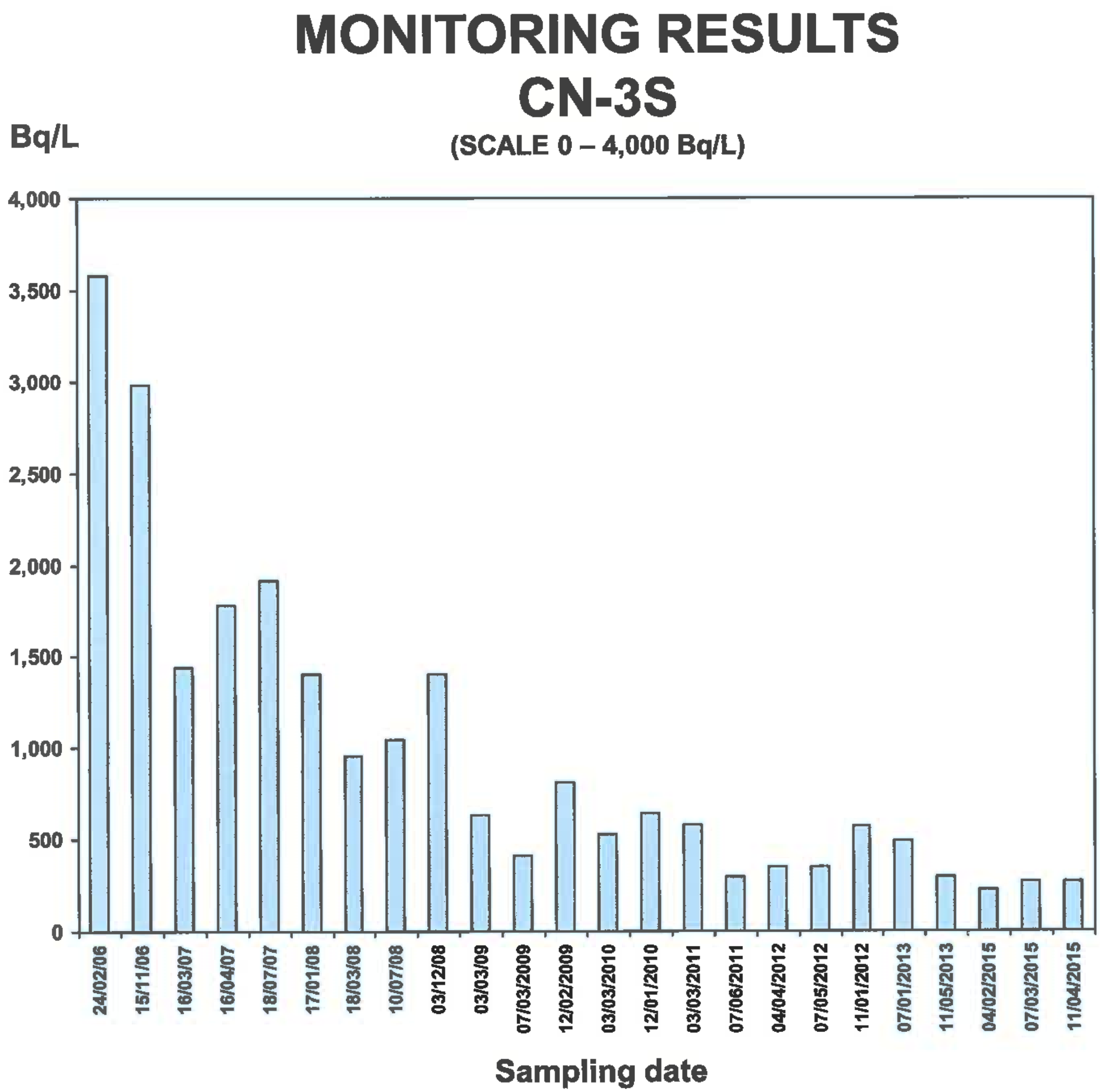


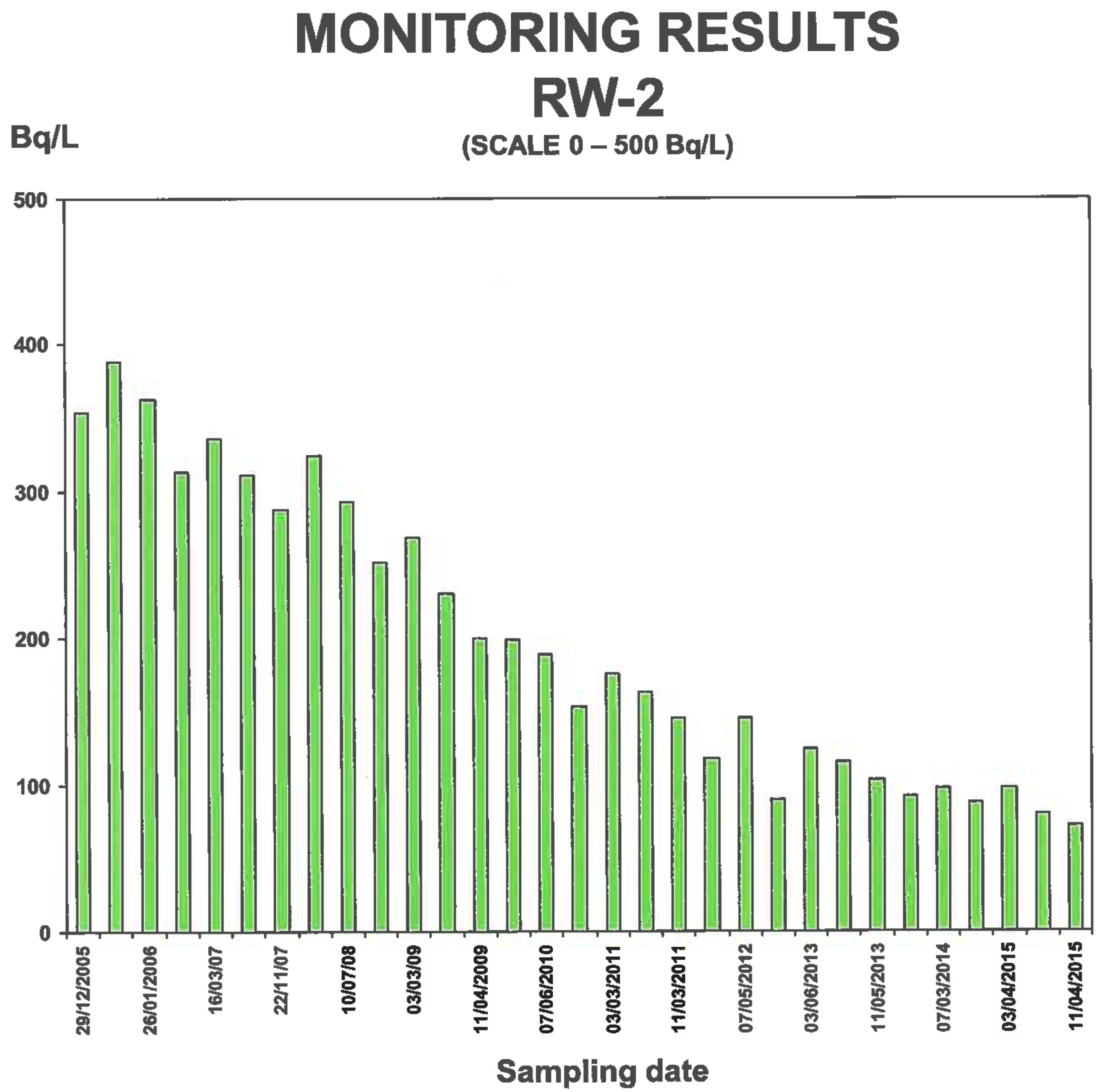
MONITORING RESULTS
CN-1S
Bq/L
(SCALE 0 – 4,500 Bq/L)
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
24/02/06
15/11/06
16/04/07
18/07/07
22/11/07
18/03/08
10/07/08
04/11/08
03/12/08
03/03/09
07/03/2009
11/04/2009
03/03/2010
07/06/2010
11/02/2010
03/03/2011
07/06/2011
12/01/2011
03/01/2012
07/05/2012
03/06/2013
07/01/2013
03/07/2014
04/11/2014
02/04/2015
03/07/2015
Sampling date

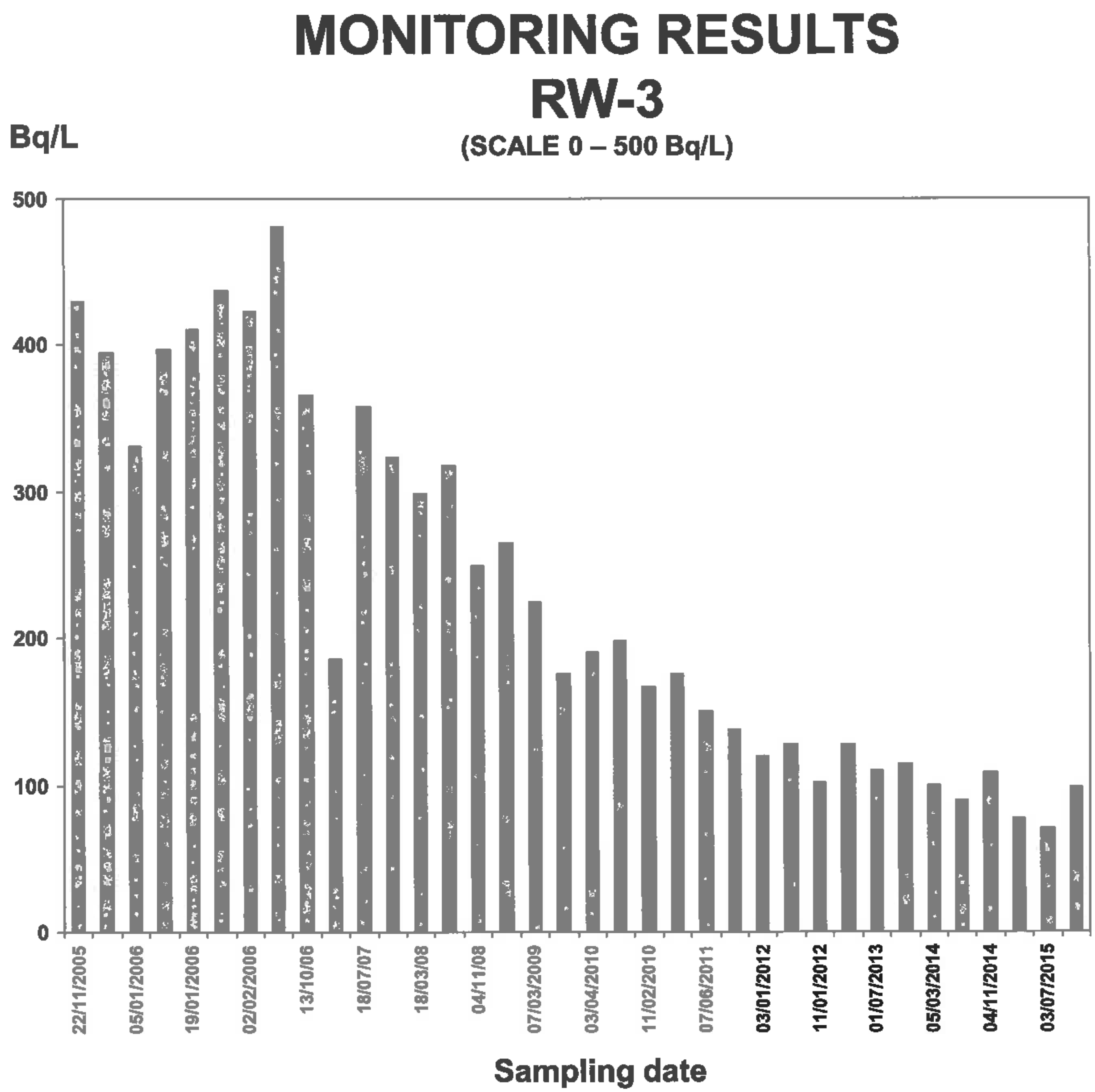
APPENDIX Q

MONITORING RESULTS
CN-2
(SCALE 0 – 5,500 Bq/L)



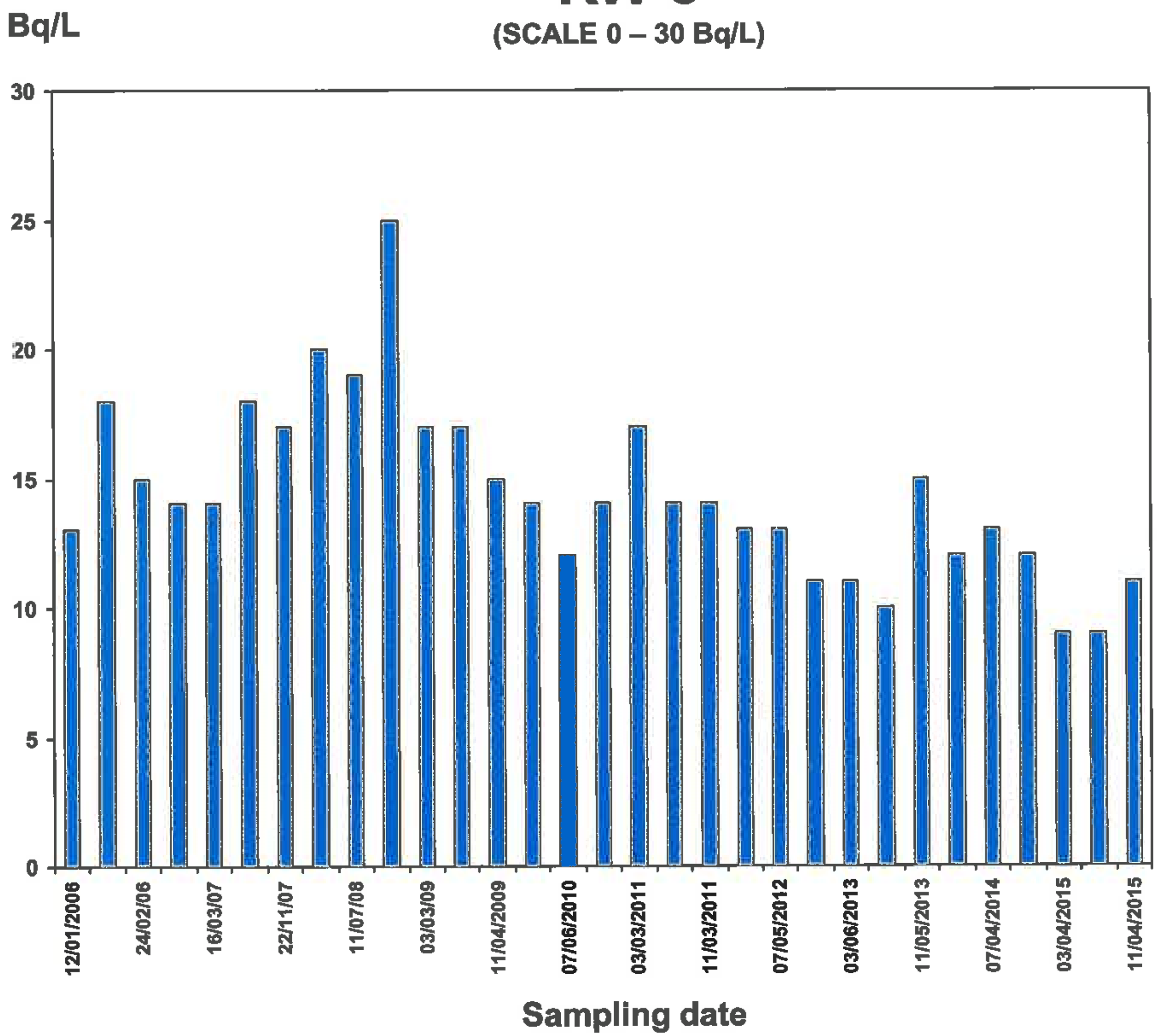

MONITORING RESULTS
CN-3S
Bq/L
(SCALE 0 – 4,000 Bq/L)
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
24/02/06
15/11/06
16/03/07
16/04/07
18/07/07
17/01/08
18/03/08
10/07/08
03/12/08
03/03/09
07/03/2009
12/02/2009
03/03/2010
12/01/2010
03/03/2011
07/06/2011
04/04/2012
07/05/2012
11/01/2012
07/01/2013
11/05/2013
04/02/2015
07/03/2015
11/04/2015
Sampling date


MONITORING RESULTS
RW-2
(SCALE 0 – 500 Bq/L)
Bq/L
500
400
300
200
100
0
29/12/2005
26/01/2006
16/03/07
22/11/07
10/07/08
03/03/09
11/04/2009
07/06/2010
03/03/2011
11/03/2011
07/05/2012
03/06/2013
11/05/2013
07/03/2014
03/04/2015
11/04/2015
Sampling date


MONITORING RESULTS
RW-3
(SCALE 0 – 500 Bq/L)
Bq/L
500
400
300
200
100
0
22/11/2005
05/01/2006
19/01/2006
02/02/2006
13/10/06
18/07/07
18/03/08
04/11/08
07/03/2009
03/04/2010
11/02/2010
07/06/2011
03/01/2012
11/01/2012
01/07/2013
05/03/2014
04/11/2014
03/07/2015
Sampling date

APPENDIX Q

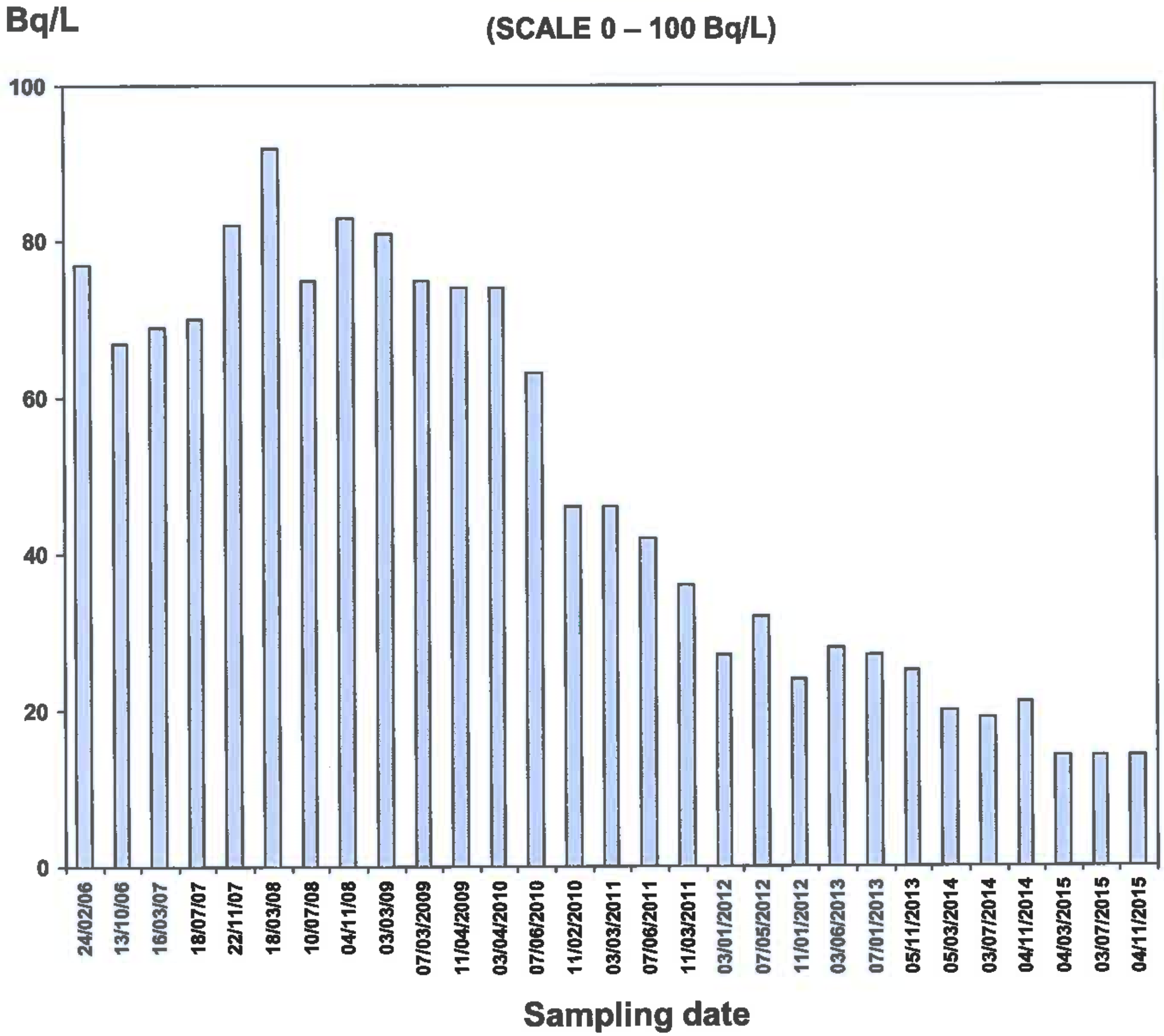
MONITORING RESULTS
RW-5
(SCALE 0 – 30 Bq/L)



APPENDIX Q

MONITORING RESULTS
RW-6

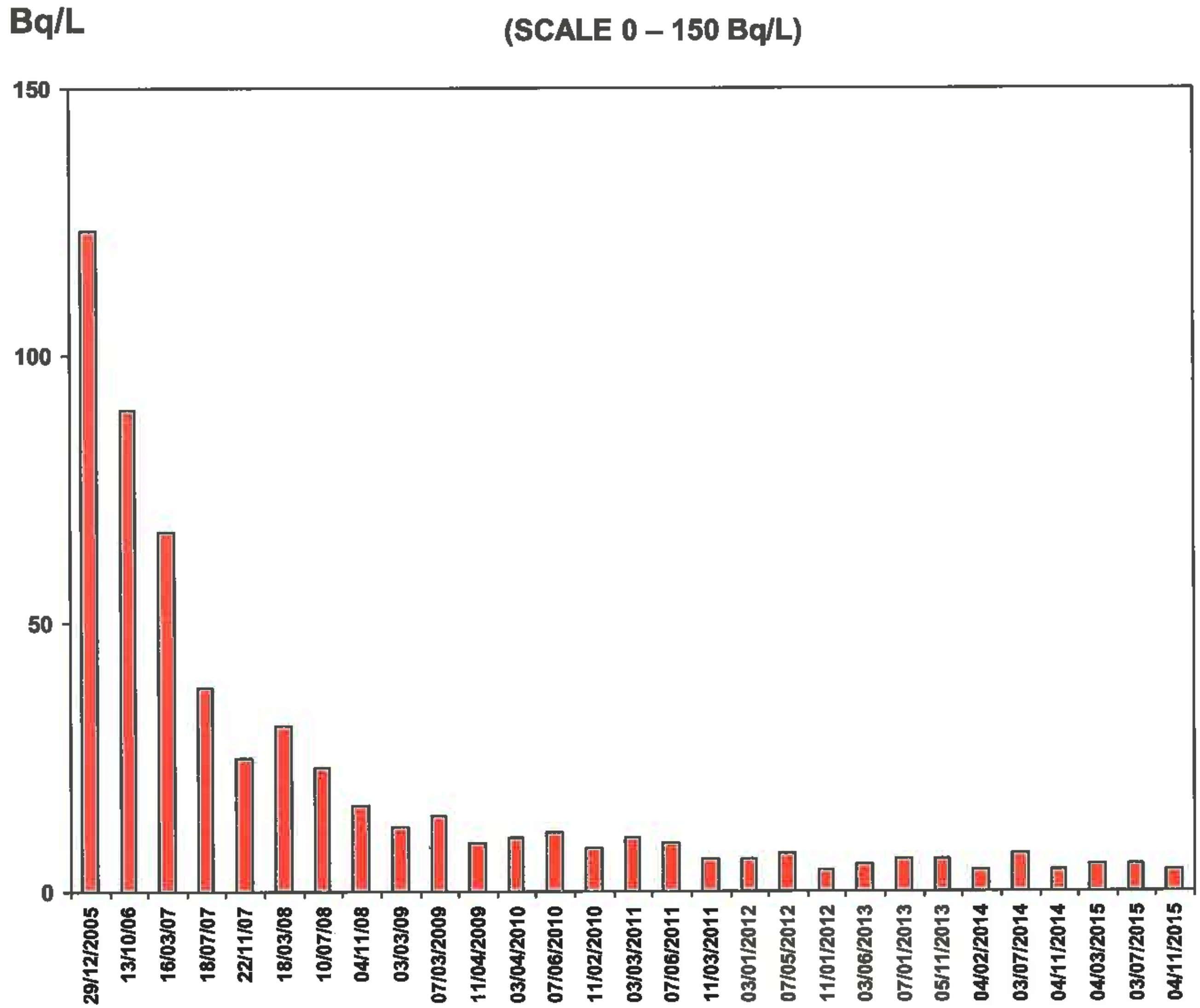
(SCALE 0 – 100 Bq/L)



APPENDIX Q

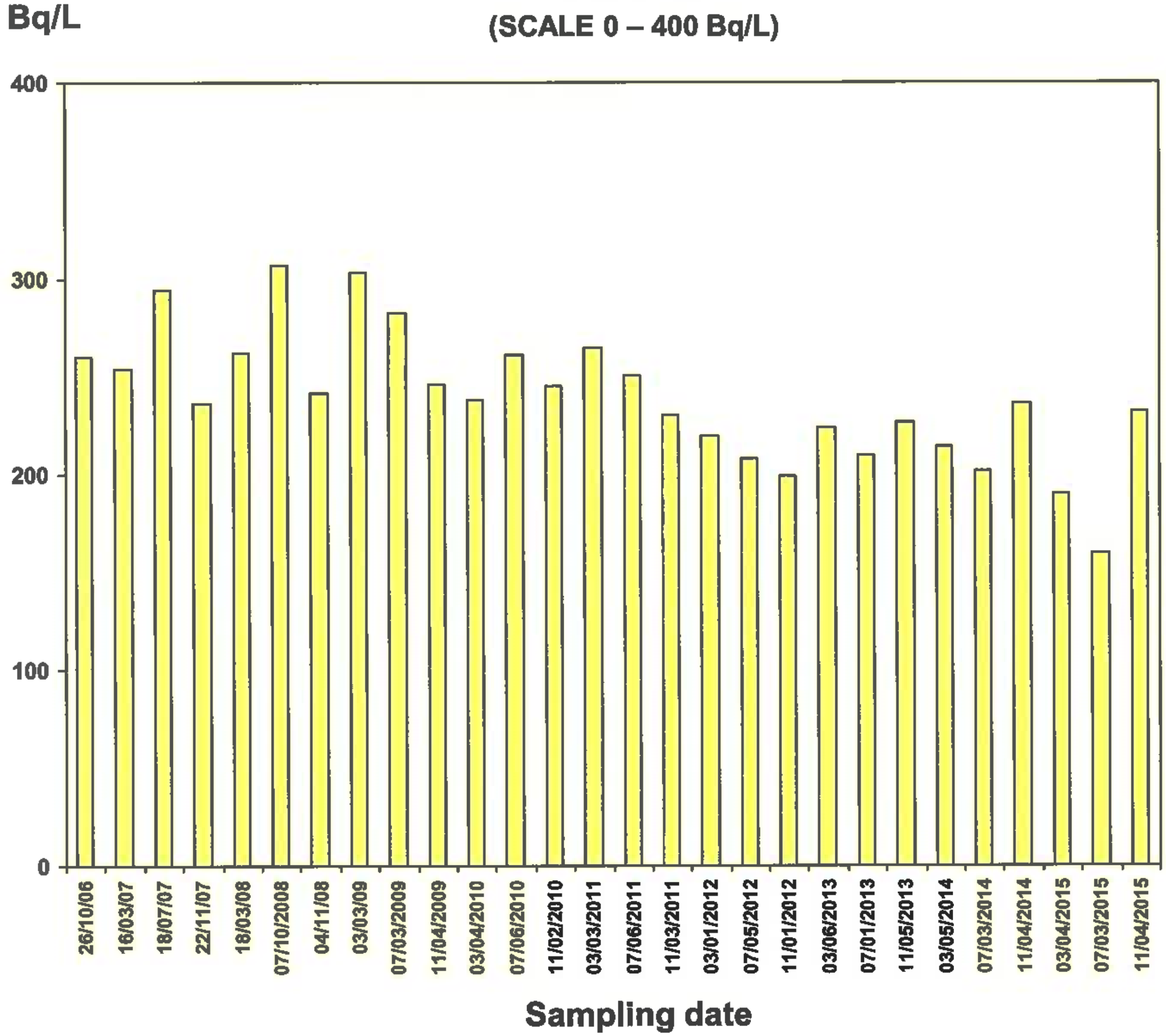
MONITORING RESULTS
RW-7

(SCALE 0 – 150 Bq/L)



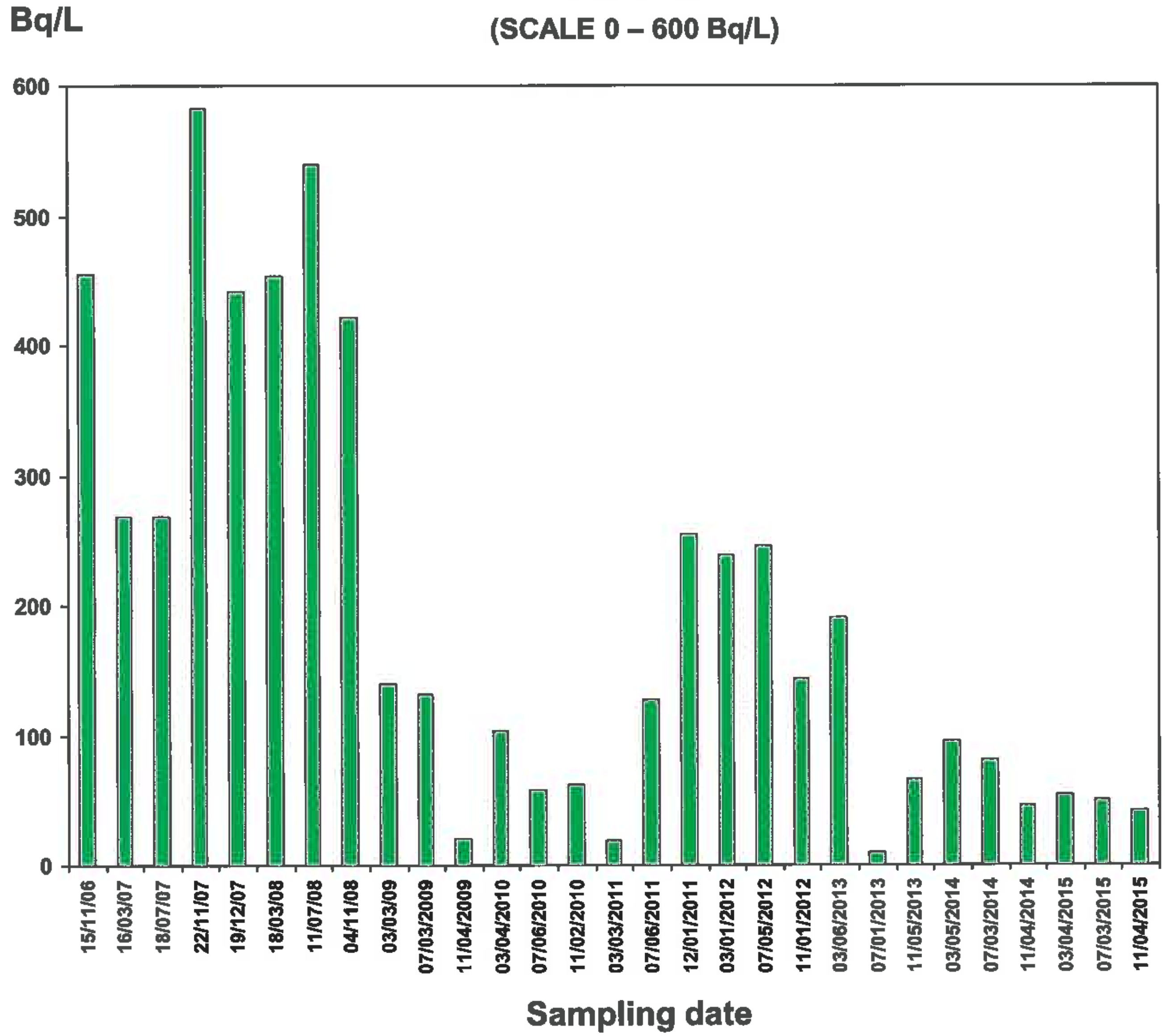
MONITORING RESULTS
RW-8

(SCALE 0 – 400 Bq/L)



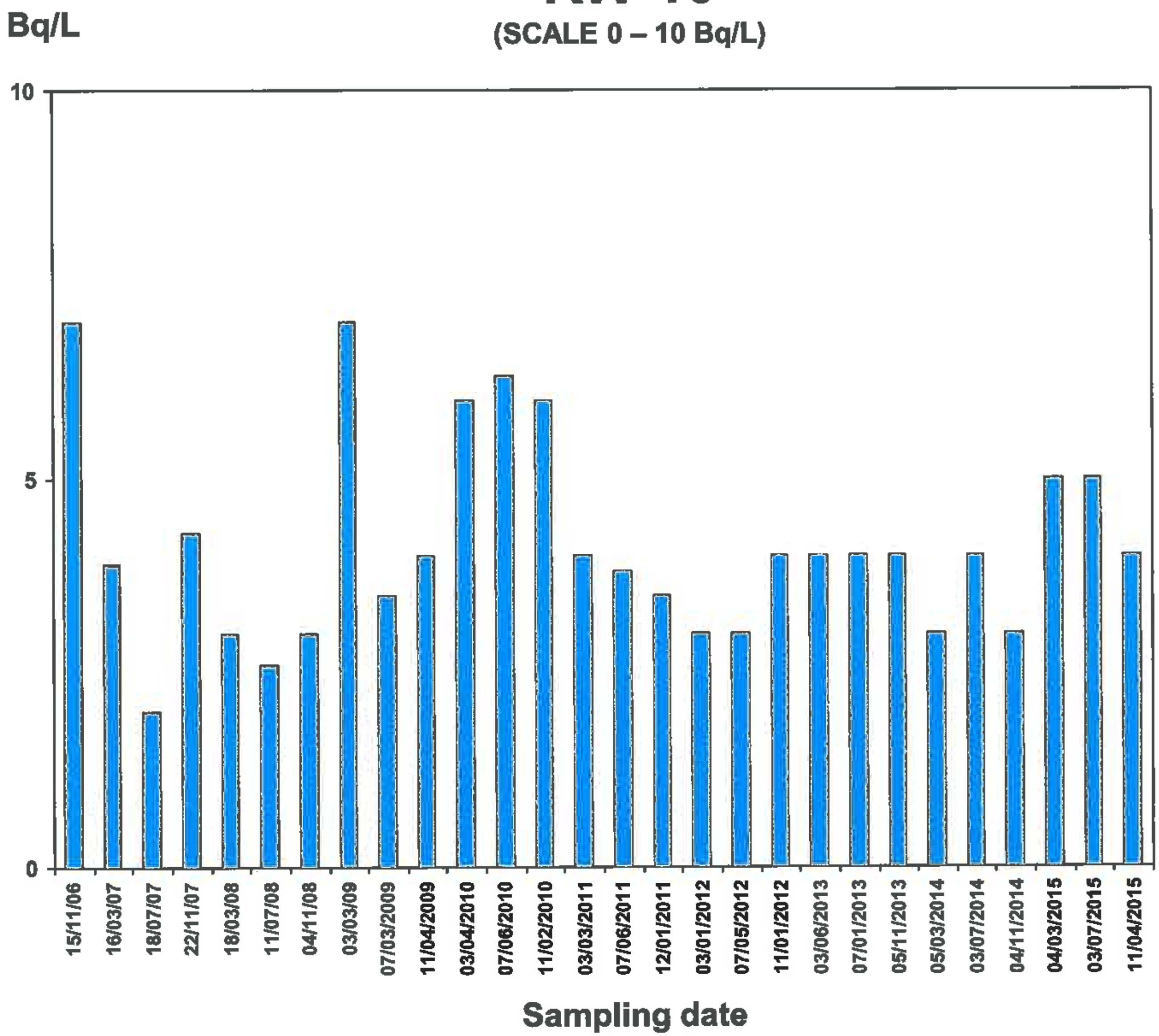
APPENDIX Q

MONITORING RESULTS
RW-9
(SCALE 0 – 600 Bq/L)

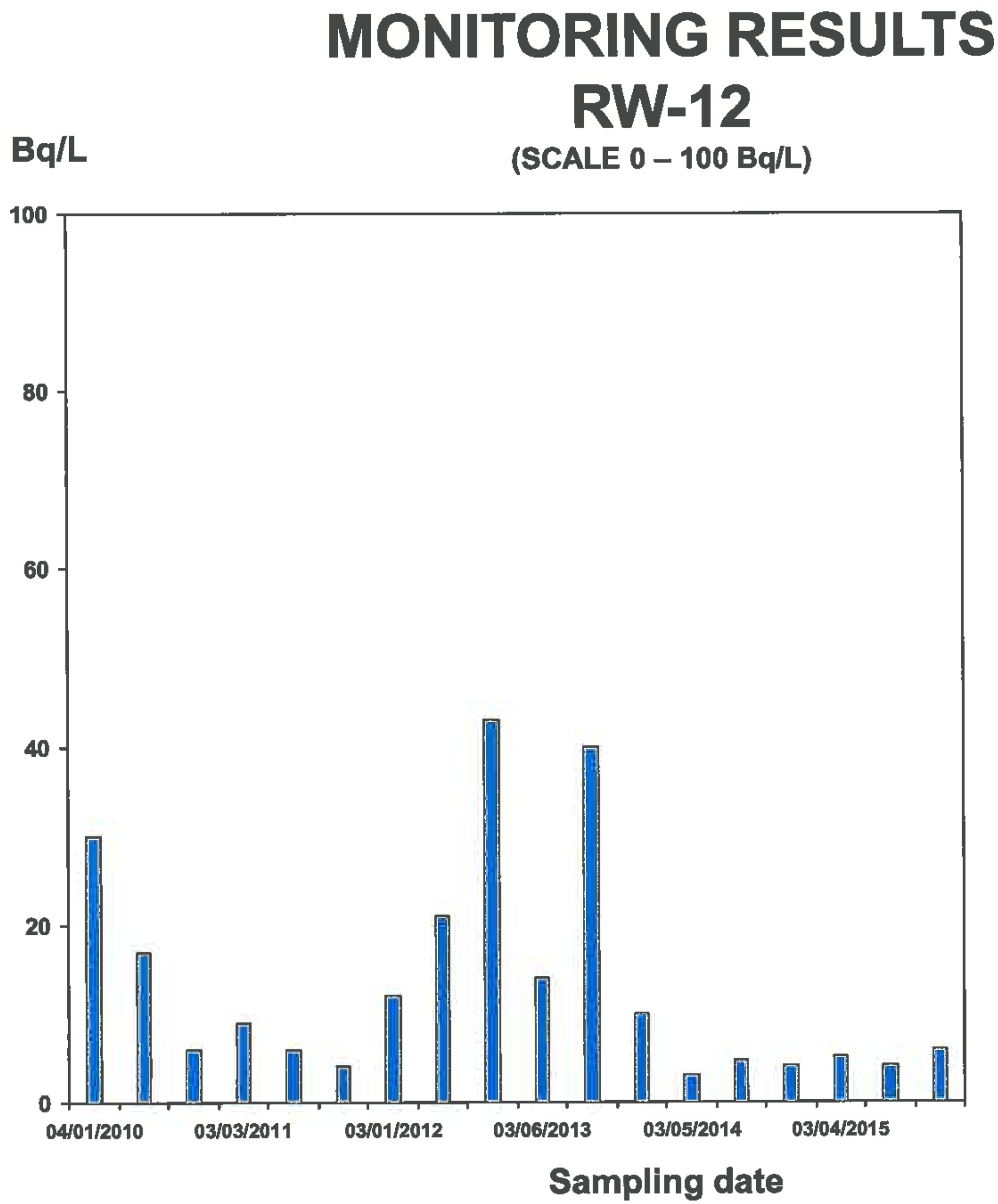


APPENDIX Q

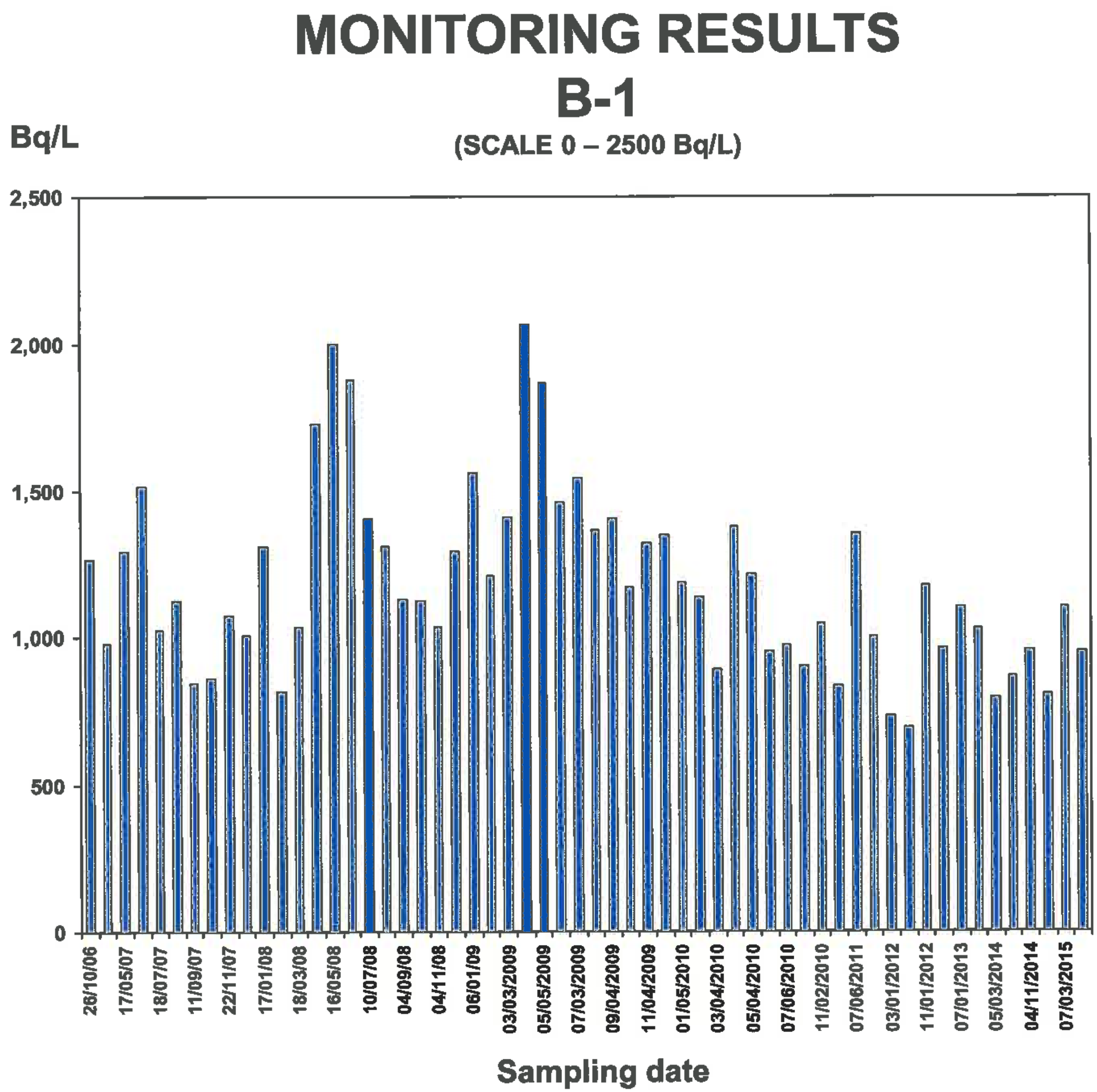
MONITORING RESULTS
RW-10
(SCALE 0 – 10 Bq/L)



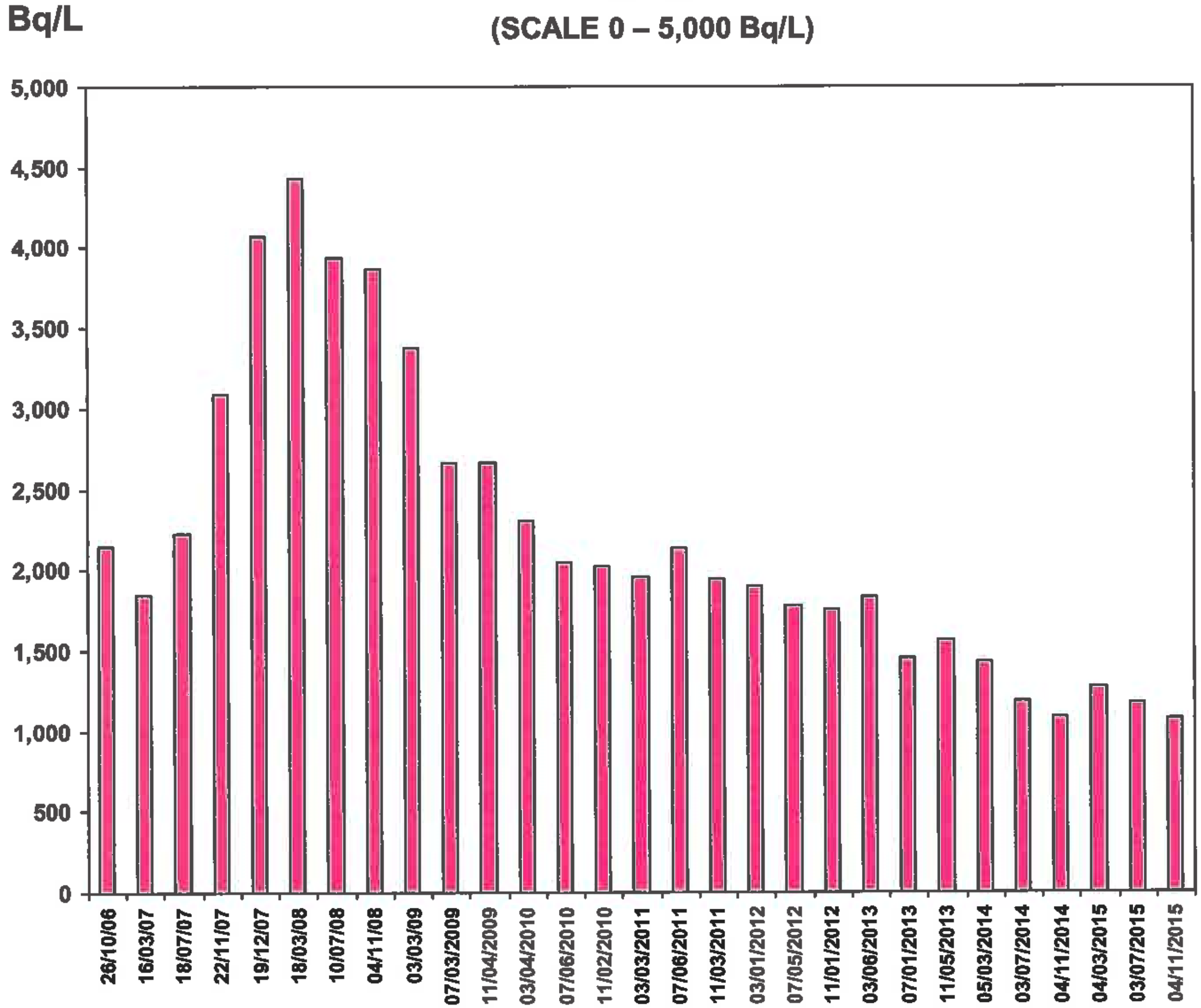
APPENDIX Q

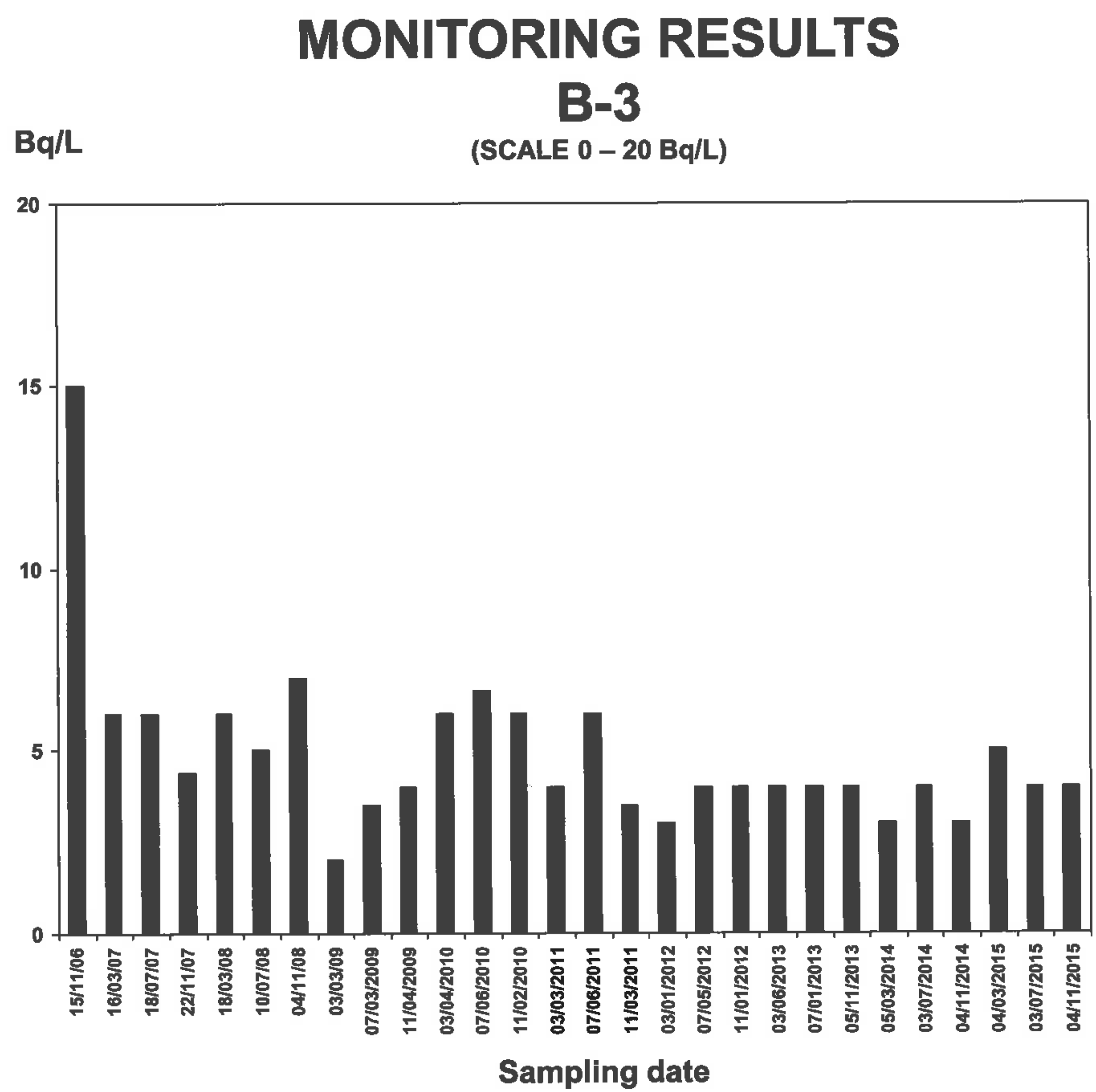

MONITORING RESULTS
RW-12
Bq/L
(SCALE 0 – 100 Bq/L)
100
80
60
40
20
0
04/01/2010
03/03/2011
03/01/2012
03/06/2013
03/05/2014
03/04/2015
Sampling date

APPENDIX Q


MONITORING RESULTS
B-1
(SCALE 0 – 2500 Bq/L)
Bq/L
2,500
2,000
1,500
1,000
500
0
26/10/06
17/05/07
18/07/07
11/09/07
22/11/07
17/01/08
18/03/08
16/05/08
10/07/08
04/09/08
04/11/08
06/01/09
03/03/2009
05/05/2009
07/03/2009
09/04/2009
11/04/2009
01/05/2010
03/04/2010
05/04/2010
07/06/2010
11/02/2010
07/06/2011
03/01/2012
11/01/2012
07/01/2013
05/03/2014
04/11/2014
07/03/2015
Sampling date

MONITORING RESULTS
B-2
(SCALE 0 – 5,000 Bq/L)




MONITORING RESULTS
B-3
(SCALE 0 – 20 Bq/L)
Bq/L
20
15
10
5
0
15/11/06
16/03/07
18/07/07
22/11/07
18/03/08
10/07/08
04/11/08
03/03/09
07/03/2009
11/04/2009
03/04/2010
07/06/2010
11/02/2010
03/03/2011
07/06/2011
11/03/2011
03/01/2012
07/05/2012
11/01/2012
03/06/2013
07/01/2013
05/11/2013
05/03/2014
03/07/2014
04/11/2014
04/03/2015
03/07/2015
04/11/2015
Sampling date

APPENDIX Q

APPENDIX R

Compilation of Water Level Measurements for 2015

	MW06-1	MW06-2	MW06-3	MW06-8	MW06-9	MW06-10	MW07-11	MW07-12
Easting	335449	335478	335363	335464	335401	335408	335478	335465
Northing	5074615	5074578	5074535	5074590	5074605	5074506	5074576	5074588
TOP Elevation (m)	130.99	130.03	133.09	130.30	131.15	131.32	130.06	130.41
GS Elevation (m)	130.17	129.24	132.32	129.58	129.86	130.24	129.15	129.58
Well Diameter (m)	0.051	0.051	0.051	0.032	0.032	0.032	0.032	0.032
Well Depth (m)	5.165	5.330	6.130	6.700	5.930	7.770	7.215	7.450
Stick-up (m)	0.820	0.788	0.767	0.720	1.290	1.077	0.905	0.835
08-Jan-15	128.11	127.36	128.17	126.69	128.13	127.63	126.72	126.67
02-Feb-15	126.25	126.71	127.03	124.93	126.15	125.69	125.13	124.90
03-Mar-15	125.81	125.45	127.01	124.13	125.60	124.91	124.36	124.29
01-Apr-15	127.98	126.09	127.01	125.70	127.44	126.69	125.54	125.72
04-May-15	128.84	127.85	129.00	127.14	129.14	128.55	127.24	127.15
01-Jun-15	128.82	127.80	129.07	127.49	129.08	128.53	127.44	127.46
02-Jul-15	128.68	127.61	128.44	126.86	128.51	127.89	127.07	126.92
04-Aug-15	128.21	127.20	127.39	126.42	127.88	127.05	126.46	126.38
31-Aug-15	128.17	127.05	127.27	126.36	127.75	126.95	126.40	126.32
01-Oct-15	127.12	126.51	127.06	125.63	126.64	125.94	125.72	125.59
03-Nov-15	128.40	126.83	127.31	126.31	127.81	127.02	126.39	126.28
01-Dec-15	128.43	127.51	127.55	126.60	128.04	127.25	126.65	126.55

	MW07-13	MW07-15	MW07-16	MW07-17	MW07-18	MW07-19	MW07-20	MW07-21	MW07-22	MW07-23
Easting	335448	335403	335393	335392	335387	335378	335296	335522	335472	335492
Northing	5074616	5074605	5074599	5074599	5074595	5074587	5074616	5074584	5074584	5074560
TOP Elevation (m)	130.92	130.84	130.98	131.08	131.23	131.61	130.70	129.51	130.25	130.04
GS Elevation (m)	130.03	129.93	130.16	130.16	130.37	130.79	129.85	128.78	129.05	129.29
Well Diameter (m)	0.032	0.032	0.032	0.051	0.032	0.032	0.032	0.032	0.032	0.032
Well Depth (m)	6.615	7.230	7.050	14.610	7.250	7.400	7.820	7.580	7.465	5.905
Stick-up (m)	0.893	0.910	0.822	0.915	0.868	0.815	0.850	0.730	1.200	0.750
08-Jan-15	126.75	127.59	127.57	122.98	127.48	127.45	125.69	no data	126.58	127.30
02-Feb-15	124.48	125.24	125.22	121.67	125.50	125.51	123.74	no data	124.94	125.91
03-Mar-15	123.71	124.53	124.58	120.83	124.68	129.82	123.02	no data	124.13	124.97
01-Apr-15	125.98	126.55	126.65	121.20	126.57	126.96	124.18	no data	125.62	126.04
04-May-15	127.19	128.43	128.41	123.54	128.49	128.55	126.50	no data	127.29	127.76
01-Jun-15	127.38	128.54	128.50	123.66	128.52	128.62	126.53	no data	127.37	127.94
02-Jul-15	126.86	127.95	127.87	122.63	127.81	127.89	125.87	no data	126.87	127.66
04-Aug-15	126.26	127.10	127.01	121.94	126.90	127.00	126.07	126.78	126.29	127.05
31-Aug-15	126.29	126.99	126.90	121.68	126.85	126.89	125.57	124.53	126.23	127.05
01-Oct-15	125.18	125.79	125.73	121.01	125.80	125.86	124.51	123.69	125.51	126.36
03-Nov-15	126.28	127.15	127.04	121.00	126.90	126.92	125.27	124.37	126.20	127.05
01-Dec-15	126.48	127.30	127.23	121.38	127.38	127.18	125.82	125.18	126.47	127.40

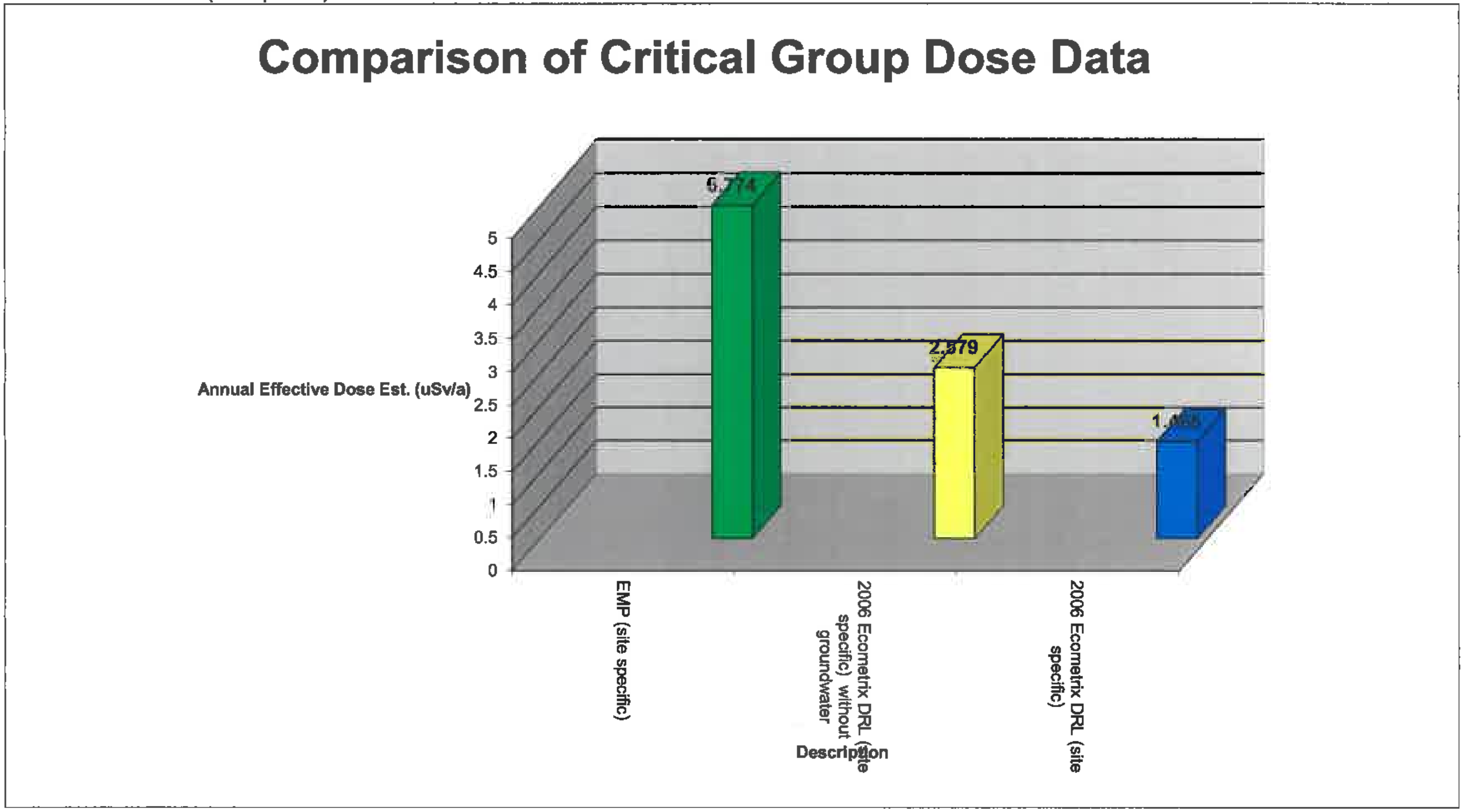
	MW07-24	MW07-26	MW07-27	MW07-28	MW07-29	MW07-31	MW07-32	MW07-34	MW07-35	MW07-36	MW07-37
Easting	335519	335357	335354	335352	335384	335471	335517	335393	335354	335338	335468
Northing	5074530	5074567	5074611	5074612	5074592	5074583	5074530	5074591	5074613	5074629	5074589
TOP Elevation (m)	129.03	132.42	132.89	132.71	131.09	130.16	128.86	131.12	132.89	133.10	130.06
GS Elevation (m)	128.22	131.85	132.02	132.04	130.57	129.38	128.23	130.71	132.16	132.31	129.47
Well Diameter (m)	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032
Well Depth (m)	6.525	7.310	8.330	14.400	13.000	13.240	13.090	9.110	9.390	9.330	8.590
Stick-up (m)	0.810	0.570	0.870	0.670	0.520	0.780	0.630	0.410	0.730	0.790	0.590
08-Jan-15	126.47	128.06	127.18	123.07	123.03	122.05	122.05	126.85	126.92	125.90	126.74
02-Feb-15	125.89	125.98	125.16	121.68	121.63	120.90	120.91	124.64	124.83	124.49	125.13
03-Mar-15	124.42	125.35	124.47	120.93	120.94	120.16	120.20	124.12	124.29	124.03	124.33
01-Apr-15	125.39	126.50	126.32	121.20	121.22	120.28	120.29	125.69	125.59	125.18	125.85
04-May-15	126.65	128.88	128.33	123.65	123.66	122.23	122.23	127.71	127.81	127.17	127.48
01-Jun-15	127.05	128.92	128.35	123.73	123.72	122.61	122.64	127.78	127.92	127.04	127.54
02-Jul-15	126.80	127.82	127.34	122.65	122.67	121.79	121.84	126.99	126.84	125.72	127.05
04-Aug-15	126.16	126.77	126.41	122.24	121.98	120.92	120.90	126.30	126.84	125.16	126.46
31-Aug-15	126.17	126.57	126.24	121.79	121.81	120.46	120.46	126.14	125.84	125.09	126.40
01-Oct-15	125.59	125.89	125.27	121.08	121.10	119.95	119.94	125.21	124.98	124.56	125.68
03-Nov-15	126.24	126.47	126.08	121.10	121.11	119.88	119.88	126.04	125.69	125.07	126.37
01-Dec-15	126.47	126.93	126.39	121.51	121.53	120.29	120.29	126.30	125.98	125.25	126.95

APPENDIX S

Data and Calculations for Public Dose in 2015

ADULT RESIDENT

EMP (site specific)	6.774
2006 Ecometrix DRL (site specific) without groundwater	2.579
2006 Ecometrix DRL (site specific)	1.465



DRL's and EMP Data to Annual Dose **ADULT RESIDENT**

DRL's (1996 Canatom DRL and 2006 Ecometrix DRL)

Stack Emissions

	2006 SRBT DRL		2006 SRBT DRL	
	ADULT WORKER		NURSING INFANT	
Date	% weekly DRL	(uSv)	% weekly DRL	(uSv)
30/12/2015	0.03	0.01	0.06	0.01
06/01/2015	0.07	0.01	0.12	0.02
13/01/2015	0.09	0.02	0.14	0.03
20/01/2015	0.08	0.01	0.13	0.02
27/01/2015	0.06	0.01	0.10	0.02
03/02/2015	0.05	0.01	0.08	0.02
10/02/2015	0.10	0.02	0.16	0.03
17/02/2015	0.11	0.02	0.19	0.04
24/02/2015	0.33	0.06	0.54	0.10
03/03/2015	0.20	0.04	0.33	0.06
10/03/2015	0.22	0.04	0.36	0.07
17/03/2015	0.25	0.05	0.41	0.08
24/03/2015	0.16	0.03	0.26	0.05
31/03/2015	0.18	0.03	0.29	0.06
07/04/2015	0.18	0.03	0.29	0.06
14/04/2015	0.19	0.04	0.32	0.06
21/04/2015	0.20	0.04	0.33	0.06
28/04/2015	0.22	0.04	0.37	0.07
05/05/2015	0.19	0.04	0.32	0.06
12/05/2015	0.31	0.06	0.51	0.10
19/05/2015	0.19	0.04	0.31	0.06
26/05/2015	0.69	0.13	1.25	0.24
02/06/2015	0.18	0.04	0.30	0.06
09/06/2015	0.26	0.05	0.42	0.08
16/06/2015	0.30	0.06	0.50	0.10
23/06/2015	0.20	0.04	0.34	0.06
30/06/2015	0.08	0.02	0.13	0.03
07/07/2015	0.20	0.04	0.33	0.06
14/07/2015	0.18	0.04	0.30	0.06
21/07/2015	0.13	0.02	0.21	0.04
28/07/2015	0.12	0.02	0.20	0.04
04/08/2015	0.14	0.03	0.23	0.04
11/08/2015	0.14	0.03	0.22	0.04
18/08/2015	0.12	0.02	0.19	0.04
25/08/2015	0.07	0.01	0.11	0.02
01/09/2015	0.08	0.02	0.13	0.03
08/09/2015	0.12	0.02	0.19	0.04
15/09/2015	0.12	0.02	0.19	0.04
22/09/2015	0.04	0.01	0.07	0.01
29/09/2015	0.03	0.01	0.05	0.01
06/10/2015	0.04	0.01	0.07	0.01
13/10/2015	0.05	0.01	0.09	0.02
20/10/2015	0.11	0.02	0.18	0.03
27/10/2015	0.06	0.01	0.10	0.02
03/11/2015	0.06	0.01	0.09	0.02
10/11/2015	0.08	0.02	0.13	0.03
17/11/2015	0.06	0.01	0.11	0.02
24/11/2015	0.19	0.04	0.32	0.06
01/12/2015	0.13	0.03	0.21	0.04
08/12/2015	0.11	0.02	0.18	0.03
15/12/2015	0.12	0.02	0.19	0.04
22/12/2015	0.01	0.00	0.02	0.00
Sum (uSv)		1.47		2.43
Ave. (%DRL)	0.15		0.24	
Annual Dose Est.	1.47 uSv/a		2.43 uSv/a	
	Adult Worker		Nursing Infant	

EMP Data using CAN/CSA N-288

		(uSv/a)
Atmospheric HTO immersion	P(e)19	1.046
Atmospheric HTO inhalation	P(i)19	1.046
Surface HTO ingestion	P(i)29	4.195
Surface HTO immersion	P(e)29	0.000
External soil exposure	P39	0.000
Forage & crop ingestion	P49	0.475
Animal produce ingestion	P59	0.012
Aquatic animal ingestion	P69	0.000
Aquatic plant ingestion	P79	0.000
External sediment exposure	P89	0.000
Summation	(uSv)	6.774

ADULT RESIDENT
EMP Factors for Dose

Pathways Analysis of Dose to the Public		
		per annum
Atmospheric HTO immersion	P(e)19	1.046
Atmospheric HTO inhalation	P(i)19	1.046
Surface HTO ingestion	P(i)29	4.195
Surface HTO immersion	P(e)29	0.000
External soil exposure	P39	0.000
Forage & crop ingestion	P49	0.475
Animal produce ingestion	P59	0.012
Aquatic animal ingestion	P69	0.000
Aquatic plant ingestion	P79	0.000
External sediment exposure	P89	0.000
Total (uSv)		**6.774 uSv/a**
Total without P_{29} (uSv)		**2.579 uSv/a**

ADULT RESIDENT
EMP Factors for Dose P19

P19 is the transfer pathway of exposure to HTO from compartment 1 (Atmosphere) to 9 (dose)
P(i)19 is the pathway of exposure due to inahalation of HTO
P(e)19 is the pathway of exposure due to immersion in a cloud of HTO

Formula:
P(i)19 (uSv) = [HTO]air (Bq/m3) x Inhalation (m3) x DCF (uSv/Bq)

Calculation:

PAS # (#)	P(i)19 (uSv)	[HTO]air (Bq/m3)	Time (hr/a)	DCF (uSv/Bq)	Sum1,4 (uSv/a)	Sum 2,4 (uSv/a)	Sum 13,4 (uSv/a)	Maximum (uSv/a)
1	0.000			3.000E-05	0.000			
2	0.000			3.000E-05		0.000		
3	0.000			3.000E-05				
4	1.046	4.150	8400.000	3.000E-05	1.046	1.046	1.046	
5	0.000			3.000E-05				
6	0.000			3.000E-05				
7	0.000			3.000E-05				
8	0.000			3.000E-05				
9	0.000			3.000E-05				
10	0.000			3.000E-05				
11	0.000			3.000E-05				
12	0.000			3.000E-05				
13	0.000			3.000E-05			0.000	
			P(i)19	Sum	1.046	1.046	1.046	1.046 uSv/a

Formula:

P(e)19 (uSv) = P(i)19 (uSv) (CAN/CSA-N288.1-14)

Therefore P(e)19 = 1.046 uSv/a | P(i)19 = 1.046 uSv/a

P19 Values as per CAN/CSA-N288.1-14							
P19 =	P(i)19	+	P(e)19	=	(uSv/a)
P19 =	1.046	+	1.046	=	2.092

CAN/CSA-N288.1-14		
P(i)19	1.046	uSv/a
P(e)19	1.046	uSv/a
P19	2.092	uSv/a

ADULT RESIDENT
EMP Factors for Dose P29

P29 is the transfer pathway of exposure to HTO from compartment 2 (Surface Water) to 9 (Dose)
P(i)29 is the pathway of exposure due to ingestion of HTO
P(e)29 is the pathway of exposure due to immersion in HTO

Formula:
P(i)29 = [HTO] (Bq/L) x Ingestion (L) x DCF (uSv/Bq)

Well	P(i)29 (uSv/a)	[HTO]well (Bq/L)	Ingestion (L/a)	DCF (uSv/Bq)
1	0.000	0	1081.1	2.00E-05
2	1.773	82	1081.1	2.00E-05
3	1.787	83	1081.1	2.00E-05
4	0.101	5	1081.1	2.00E-05
5	0.209	10	1081.1	2.00E-05
6	0.000	0	1081.1	2.00E-05
7	0.303	14	1081.1	2.00E-05
8	4.195	194	1081.1	2.00E-05
9	1.038	48	1081.1	2.00E-05
10	0.101	5	1081.1	2.00E-05
11	20.620	954	1081.1	2.00E-05
12	0.094	4	1081.1	2.00E-05
Avg P(i)29	2.518	uSv/annum		

Date	Well 1 (Bq/L)	Well 2 (Bq/L)	Well 3 (Bq/L)	Well 4 (Bq/L)	Well 5 (Bq/L)	Well 6 (Bq/L)	Well 7 (Bq/L)	Well 8 (Bq/L)	Well 9 (Bq/L)	Well 10 (Bq/L)	Well 11 (Bq/L)	Well 12 (Bq/L)
09/01/15												
03/02/15												
04/03/15		77.0	97.0	5.0	9.0		14.0	190.0	54	5	809	5
02/04/15												
05/05/15												
02/06/15												
03/07/15		71.0	79.0	5.0	9.0		14.0	159	49	5	1,102	4
05/08/15												
01/09/15												
02/10/15												
04/11/15		98.0	72.0	4.0	11.0		14.0	232	41	4	950	4
02/12/15												
Average		82	83	5	10		14	194	48	5	954	4

Well 1, RW-1	413 Boundary Road
Well 2, RW-3	183 Mud Lake Road
Well 3, RW-2	185 Mud Lake Road
Well 4, RW-7	40925 Highway 41
Well 5, RW-5	171 Sawmill Road
Well 6, RW-4	711 Bruham Avenue
Well 7, RW-6	40987 Highway 41
Well 8, RW-8	204 Boundary Rd.
Well 9, RW-9	206 Boundary Rd
Well 10, RW-10	208 Boudary Rd
Well 11, B-1	Superior Office
Well 12, B-3	Intern. Lumber Office

P(e)29 is the pathway of exposure to HTO due to immersion in surface water.
P(e)29 is not considered in the DRL calculations of 1996.

P(e)29 =	0.000	uSv/mo

RW-8			
	P(i)29	4.195	uSv/mo
	P(e)29	0.000	uSv/mo
	P29	4.195	uSv/mo

ADULT RESIDENT
EMP Factors for Dose P49

P49 is the pathway for exposure to HTO due to ingestion of forage and crops.

Produce Sample Results (Bq/L)																			
Source	Market							Home											
Type	Cucumber	Potato	Zucchini	Tomato	Onion	Average	LOCATION	Beet	Green Pepper	Rhubarb Leaf	Carrot	Apple	Tomato	Potato	Cucumber	Swiss Chard	Onion	Zucchini	Average
H-3	6.00	6.00	10.00	10.00	6.00	8	413 SWEEZEY COURT	60.00							83.00				72
							408 BOUNDARY ROAD						153.00		129.00		179.00		154
																			#DIV/0!
																			#DIV/0!
Average	6.00	6.00	10.00	10.00	6.00	8		60.00	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	153.00	#DIV/0!	106.00	#DIV/0!	179.00	#DIV/0!	113

Produce Consumption							
100%=	413.300	kg/a	[HTO] (Bq/kg)	(Bq/a)	[OBT] (Bq/kg)	(Bq/a)
70%	289.310	kg/a	8	2198.76	0.38	109.94
30%	123.990	kg/a	154	19094.46	7.70	954.72

P49 = [HTO or OBT]produce (Bq/kg) x Produce Ingested (kg/mo) x DCF (uSv/Bq)

P49 (uSv/a)	[HTO] pro (Bq/a)	DCF (uSv/Bq)	[OBT] pro (Bq/a)	DCF (uSv/Bq)
0.475	21293.22	2.00E-05	1064.66	4.60E-05

P49	0.475	uSv/mo

APPENDIX S

ADULT RESIDENT
EMP Factors for Dose P59

P59 is the exposure to HTO due to ingestion of animal produce.

2014 Sample Results

Local Producer	
	(Bq/L)
1	3.40
2	3.00
3	4.00
Average	3.47

Local Distributor	
	(Bq/L)
1	3.00
2	3.00
3	3.00
Average	3.00

TOTAL AVERAGE	3.23	Bq/L

Milk Density Adjustment Milk Average (Bq/L) x Milk density (L/kg)		
Bq/L	L/kg	Bq/kg
3.23	0.97	3.136

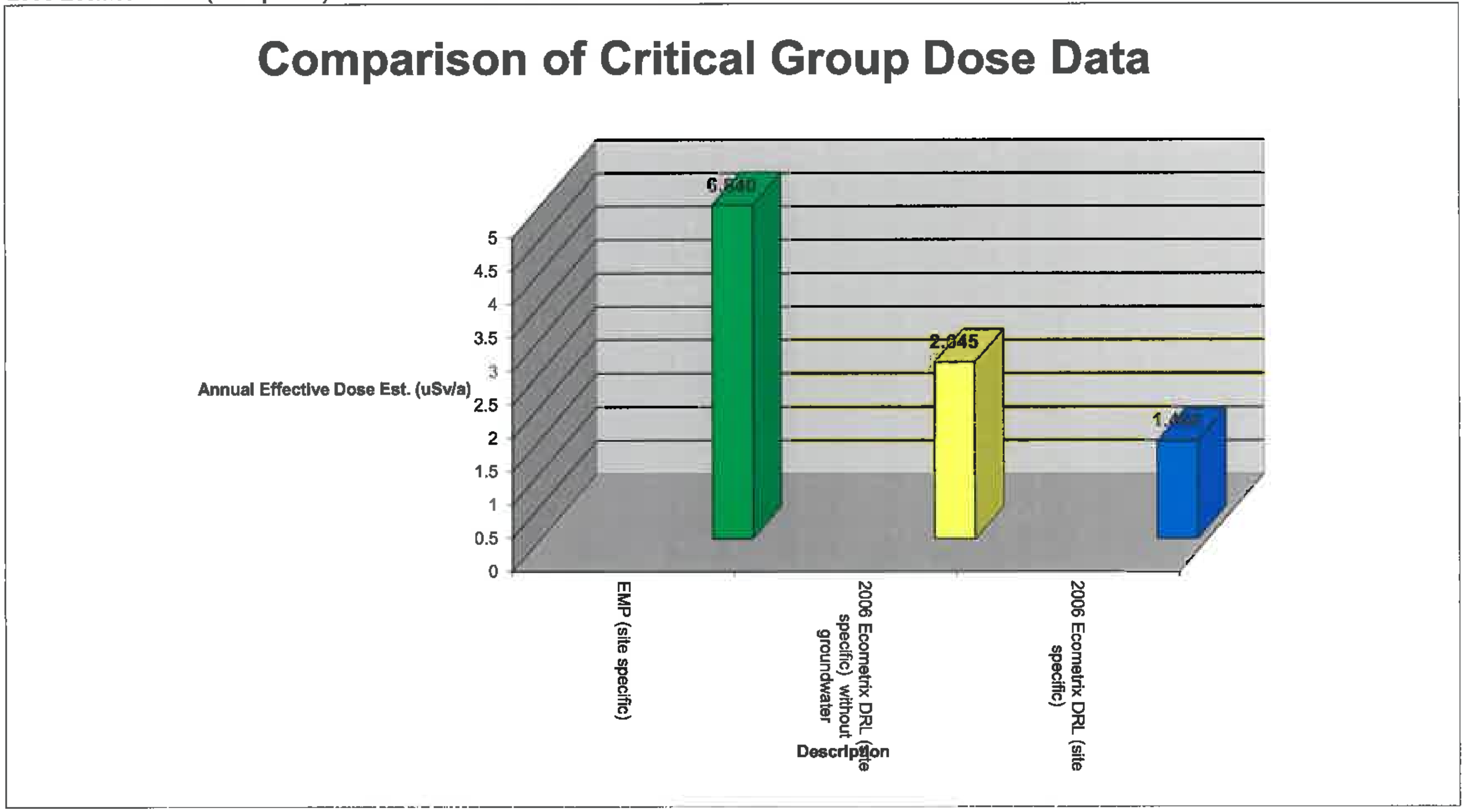
Consumption kg/da x da/a = kg/a		
kg/da)	(da/a)	(kg/a)
0.516	365.25	188.5

P59 = [HTO]animal produce (Bq/kg) x Ingestion (kg) x DCF				
P59	[HTO]	Ingested	DCF	
(uSv/a)	(Bq/kg)	(kg/a)	(uSv/Bq)	
0.012	3.14	188	2.00E-05	

P59	0.012	uSv/a

ADULT WORKER

EMP (site specific)	6.840
2006 Ecometrix DRL (site specific) without groundwater	2.645
2006 Ecometrix DRL (site specific)	1.465



DRL's and EMP Data to Annual Dose **ADULT WORKER**

DRL's (1996 Canatom DRL and 2006 Ecometrix DRL)

Stack Emissions

	2006 SRBT DRL		2006 SRBT DRL	
	ADULT WORKER		NURSING INFANT	
Date	% weekly DRL	(uSv)	% weekly DRL	(uSv)
30/12/2015	0.03	0.01	0.06	0.01
06/01/2015	0.07	0.01	0.12	0.02
13/01/2015	0.09	0.02	0.14	0.03
20/01/2015	0.08	0.01	0.13	0.02
27/01/2015	0.06	0.01	0.10	0.02
03/02/2015	0.05	0.01	0.08	0.02
10/02/2015	0.10	0.02	0.16	0.03
17/02/2015	0.11	0.02	0.19	0.04
24/02/2015	0.33	0.06	0.54	0.10
03/03/2015	0.20	0.04	0.33	0.06
10/03/2015	0.22	0.04	0.36	0.07
17/03/2015	0.25	0.05	0.41	0.08
24/03/2015	0.16	0.03	0.26	0.05
31/03/2015	0.18	0.03	0.29	0.06
07/04/2015	0.18	0.03	0.29	0.06
14/04/2015	0.19	0.04	0.32	0.06
21/04/2015	0.20	0.04	0.33	0.06
28/04/2015	0.22	0.04	0.37	0.07
05/05/2015	0.19	0.04	0.32	0.06
12/05/2015	0.31	0.06	0.51	0.10
19/05/2015	0.19	0.04	0.31	0.06
26/05/2015	0.69	0.13	1.25	0.24
02/06/2015	0.18	0.04	0.30	0.06
09/06/2015	0.26	0.05	0.42	0.08
16/06/2015	0.30	0.06	0.50	0.10
23/06/2015	0.20	0.04	0.34	0.06
30/06/2015	0.08	0.02	0.13	0.03
07/07/2015	0.20	0.04	0.33	0.06
14/07/2015	0.18	0.04	0.30	0.06
21/07/2015	0.13	0.02	0.21	0.04
28/07/2015	0.12	0.02	0.20	0.04
04/08/2015	0.14	0.03	0.23	0.04
11/08/2015	0.14	0.03	0.22	0.04
18/08/2015	0.12	0.02	0.19	0.04
25/08/2015	0.07	0.01	0.11	0.02
01/09/2015	0.08	0.02	0.13	0.03
08/09/2015	0.12	0.02	0.19	0.04
15/09/2015	0.12	0.02	0.19	0.04
22/09/2015	0.04	0.01	0.07	0.01
29/09/2015	0.03	0.01	0.05	0.01
06/10/2015	0.04	0.01	0.07	0.01
13/10/2015	0.05	0.01	0.09	0.02
20/10/2015	0.11	0.02	0.18	0.03
27/10/2015	0.06	0.01	0.10	0.02
03/11/2015	0.06	0.01	0.09	0.02
10/11/2015	0.08	0.02	0.13	0.03
17/11/2015	0.06	0.01	0.11	0.02
24/11/2015	0.19	0.04	0.32	0.06
01/12/2015	0.13	0.03	0.21	0.04
08/12/2015	0.11	0.02	0.18	0.03
15/12/2015	0.12	0.02	0.19	0.04
22/12/2015	0.01	0.00	0.02	0.00
Sum (uSv)		1.47		2.43
Ave. (%DRL)	0.15		0.24	
Annual Dose Est.	1.47 uSv/a		2.43 uSv/a	
	Adult Worker		Nursing Infant	

EMP Data using CAN/CSA N-288

		(uSv/a)
Atmospheric HTO immersion	P(e)19	1.079
Atmospheric HTO inhalation	P(i)19	1.079
Surface HTO ingestion	P(i)29	4.195
Surface HTO immersion	P(e)29	0.000
External soil exposure	P39	0.000
Forage & crop ingestion	P49	0.475
Animal produce ingestion	P59	0.012
Aquatic animal ingestion	P69	0.000
Aquatic plant ingestion	P79	0.000
External sediment exposure	P89	0.000
Summation	(uSv)	6.840

ADULT WORKER
EMP Factors for Dose

Pathways Analysis of Dose to the Public		
		per annum
Atmospheric HTO immersion	P(e)19	1.079
Atmospheric HTO inhalation	P(i)19	1.079
Surface HTO ingestion	P(i)29	4.195
Surface HTO immersion	P(e)29	0.000
External soil exposure	P39	0.000
Forage & crop ingestion	P49	0.475
Animal produce ingestion	P59	0.012
Aquatic animal ingestion	P69	0.000
Aquatic plant ingestion	P79	0.000
External sediment exposure	P89	0.000
Total (uSv)		**6.840 uSv/a**
Total without P_{29} (uSv)		**2.645 uSv/a**

ADULT WORKER
EMP Factors for Dose P19

P19 is the transfer pathway of exposure to HTO from compartment 1 (Atmosphere) to 9 (dose)
P(i)19 is the pathway of exposure due to inhalation of HTO
P(e)19 is the pathway of exposure due to immersion in a cloud of HTO

Formula:
P(i)19 (uSv) = [HTO]air (Bq/m3) x Inhalation (m3) x DCF (uSv/Bq)

Calculation:

PAS # (#)	P(i)19 (uSv)	[HTO]air (Bq/m3)	Time (hr/a)	DCF (uSv/Bq)	Sum1,4 (uSv/a)	Sum 2,4 (uSv/a)	Sum 13,4 (uSv/a)	Maximum (uSv/a)
1	0.282	4.710	1994.496	3.000E-05	0.282			
2	0.268	4.480	1994.496	3.000E-05		0.268		
3	0.000			3.000E-05				
4	0.797	4.150	6405.504	3.000E-05	0.797	0.797	0.797	
5	0.000			3.000E-05				
6	0.000			3.000E-05				
7	0.000			3.000E-05				
8	0.000			3.000E-05				
9	0.000			3.000E-05				
10	0.000			3.000E-05				
11	0.000			3.000E-05				
12	0.000			3.000E-05				
13	0.184	3.070	1994.496	3.000E-05			0.184	
			P(i)19	Sum	1.079	1.066	0.981	1.079 uSv/a

Formula:

P(e)19 (uSv) = P(i)19 (uSv)	(CAN/CSA-N288.1-14)					
Therefore P(e)19 =	1.079	uSv/a	P(i)19 =	1.079	uSv/a	

P19 Values as per CAN/CSA-N288.1-14					
P19 =	P(i)19	+	P(e)19	=	(uSv/a)
P19 =	1.079	+	1.079	=	2.159

CAN/CSA-N288.1-14		
P(i)19	1.079	uSv/a
P(e)19	1.079	uSv/a
P19	2.159	uSv/a

ADULT WORKER
EMP Factors for Dose P29

P29 is the transfer pathway of exposure to HTO from compartment 2 (Surface Water) to 9 (Dose)
P(i)29 is the pathway of exposure due to ingestion of HTO
P(e)29 is the pathway of exposure due to immersion in HTO

Formula:
P(i)29 = [HTO] (Bq/L) x Ingestion (L) x DCF (uSv/Bq)

Well	P(i)29 (uSv/a)	[HTO]well (Bq/L)	Ingestion (L/a)	DCF (uSv/Bq)
1	0.000	0	1081.1	2.00E-05
2	1.773	82	1081.1	2.00E-05
3	1.787	83	1081.1	2.00E-05
4	0.101	5	1081.1	2.00E-05
5	0.209	10	1081.1	2.00E-05
6	0.000	0	1081.1	2.00E-05
7	0.303	14	1081.1	2.00E-05
8	4.195	194	1081.1	2.00E-05
9	1.038	48	1081.1	2.00E-05
10	0.101	5	1081.1	2.00E-05
11	20.620	954	1081.1	2.00E-05
12	0.094	4	1081.1	2.00E-05
Avg P(i)29	2.518	uSv/annum		

Date	Well 1 (Bq/L)	Well 2 (Bq/L)	Well 3 (Bq/L)	Well 4 (Bq/L)	Well 5 (Bq/L)	Well 6 (Bq/L)	Well 7 (Bq/L)	Well 8 (Bq/L)	Well 9 (Bq/L)	Well 10 (Bq/L)	Well 11 (Bq/L)	Well 12 (Bq/L)
09/01/15												
03/02/15												
04/03/15		77.0	97.0	5.0	9.0		14.0	190.0	54	5	809	5
02/04/15												
05/05/15												
02/06/15												
03/07/15		71.0	79.0	5.0	9.0		14.0	159	49	5	1,102	4
05/08/15												
01/09/15												
02/10/15												
04/11/15		98.0	72.0	4.0	11.0		14.0	232	41	4	950	4
02/12/15												
Average		82	83	5	10		14	194	48	5	954	4

Well 1, RW-1	413 Boundary Road
Well 2, RW-3	183 Mud Lake Road
Well 3, RW-2	185 Mud Lake Road
Well 4, RW-7	40925 Highway 41
Well 5, RW-5	171 Sawmill Road
Well 6, RW-4	711 Bruham Avenue
Well 7, RW-6	40987 Highway 41
Well 8, RW-8	204 Boundary Rd.
Well 9, RW-9	206 Boundary Rd
Well 10, RW-10	208 Boudary Rd
Well 11, B-1	Superior Office
Well 12, B-3	Intern. Lumber Office

P(e)29 is the pathway of exposure to HTO due to immersion in surface water.
P(e)29 is not considered in the DRL calculations of 1996.

P(e)29 =	0.000	uSv/mo

RW 8			
	P(i)29	4.195	uSv/mo
	P(e)29	0.000	uSv/mo
	P29	4.195	uSv/mo

ADULT WORKER
EMP Factors for Dose P49

P49 is the pathway for exposure to HTO due to ingestion of forage and crops.

Produce Sample Results (Bq/L)																			
Source	Market						Home												
Type	Cucumber	Potato	Zucchini	Tomato	Onion	Average	LOCATION	Beet	Green Pepper	Rhubarb Leaf	Carrot	Apple	Tomato	Potato	Cucumber	Swiss Chard	Onion	Zucchini	Average
H-3	6.00	6.00	10.00	10.00	6.00	8	413 SWEEZEY COURT	60.00							83.00				72
							408 BOUNDARY ROAD						153.00		129.00		179.00		154
																			#DIV/0!
																			#DIV/0!
Average	6.00	6.00	10.00	10.00	6.00	8		60.00	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	153.00	#DIV/0!	106.00	#DIV/0!	179.00	#DIV/0!	113

Produce Consumption						
100%=	413.300 kg/a	[HTO] (Bq/kg)	(Bq/a)	[OBT] (Bq/kg)	(Bq/a)	
70%	289.310 kg/a	8	2198.76	0.38	109.94	
30%	123.990 kg/a	154	19094.46	7.70	954.72	

P49 = [HTO or OBT]produce (Bq/kg) x Produce Ingested (kg/mo) x DCF (uSv/Bq)

P49 (uSv/a)	[HTO] pro (Bq/a)	DCF (uSv/Bq)	[OBT] pro (Bq/a)	DCF (uSv/Bq)
0.475	21293.22	2.00E-05	1064.66	4.60E-05

P49	0.475	uSv/mo

ADULT WORKER
EMP Factors for Dose P59

P59 is the exposure to HTO due to ingestion of animal produce.

2014 Sample Results

Local Producer	
	(Bq/L)
1	3.40
2	3.00
3	4.00
Average	3.47

Local Distributor	
	(Bq/L)
1	3.00
2	3.00
3	3.00
Average	3.00

TOTAL AVERAGE	3.23	Bq/L

Milk Density Adjustment		
Milk Average (Bq/L) x Milk density (L/kg)		
Bq/L	L/kg	Bq/kg
3.23	0.97	3.136

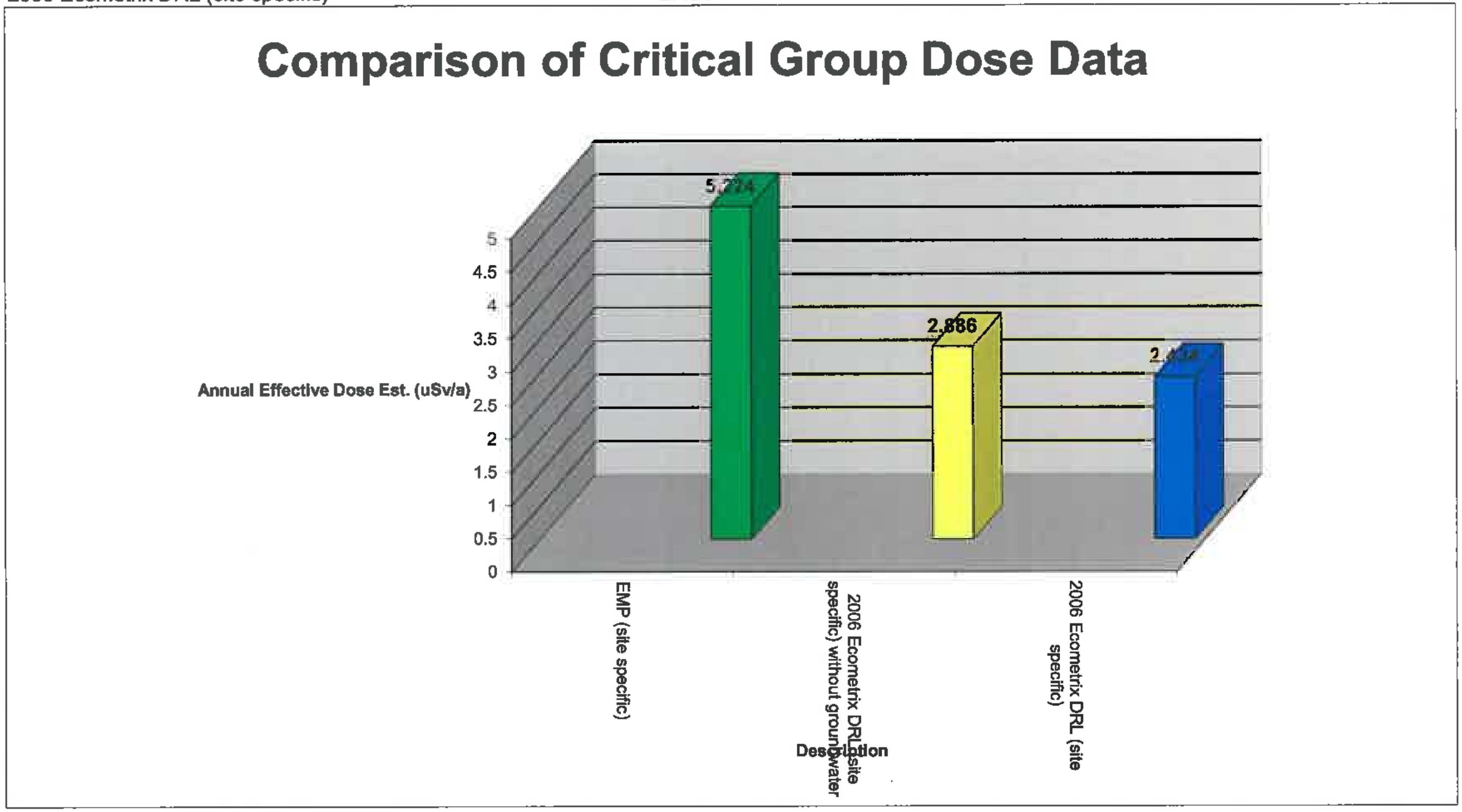
Consumption		
kg/da x da/a = kg/a		
kg/da)	(da/a)	(kg/a)
0.516	365.25	188.5

P59 = [HTO]animal produce (Bq/kg) x Ingestion (kg) x DCF				
P59	[HTO]	Ingested	DCF	
(uSv/a)	(Bq/kg)	(kg/a)	(uSv/Bq)	
0.012	3.14	188	2.00E-05	

P59	0.012	uSv/a

CHILD RESIDENT

EMP (site specific)	5.224
2006 Ecometrix DRL (site specific) without groundwater	2.886
2006 Ecometrix DRL (site specific)	2.434



DRL's and EMP Data to Annual Dose

CHILD RESIDENT

DRL's (1996 Canatom DRL and 2006 Ecometrix DRL)

Stack Emissions

	2006 SRBT DRL		2006 SRBT DRL	
	ADULT WORKER		NURSING INFANT	
Date	% weekly DRL	(uSv)	% weekly DRL	(uSv)
30/12/2015	0.03	0.01	0.06	0.01
06/01/2015	0.07	0.01	0.12	0.02
13/01/2015	0.09	0.02	0.14	0.03
20/01/2015	0.08	0.01	0.13	0.02
27/01/2015	0.06	0.01	0.10	0.02
03/02/2015	0.05	0.01	0.08	0.02
10/02/2015	0.10	0.02	0.16	0.03
17/02/2015	0.11	0.02	0.19	0.04
24/02/2015	0.33	0.06	0.54	0.10
03/03/2015	0.20	0.04	0.33	0.06
10/03/2015	0.22	0.04	0.36	0.07
17/03/2015	0.25	0.05	0.41	0.08
24/03/2015	0.16	0.03	0.26	0.05
31/03/2015	0.18	0.03	0.29	0.06
07/04/2015	0.18	0.03	0.29	0.06
14/04/2015	0.19	0.04	0.32	0.06
21/04/2015	0.20	0.04	0.33	0.06
28/04/2015	0.22	0.04	0.37	0.07
05/05/2015	0.19	0.04	0.32	0.06
12/05/2015	0.31	0.06	0.51	0.10
19/05/2015	0.19	0.04	0.31	0.06
26/05/2015	0.69	0.13	1.25	0.24
02/06/2015	0.18	0.04	0.30	0.06
09/06/2015	0.26	0.05	0.42	0.08
16/06/2015	0.30	0.06	0.50	0.10
23/06/2015	0.20	0.04	0.34	0.06
30/06/2015	0.08	0.02	0.13	0.03
07/07/2015	0.20	0.04	0.33	0.06
14/07/2015	0.18	0.04	0.30	0.06
21/07/2015	0.13	0.02	0.21	0.04
28/07/2015	0.12	0.02	0.20	0.04
04/08/2015	0.14	0.03	0.23	0.04
11/08/2015	0.14	0.03	0.22	0.04
18/08/2015	0.12	0.02	0.19	0.04
25/08/2015	0.07	0.01	0.11	0.02
01/09/2015	0.08	0.02	0.13	0.03
08/09/2015	0.12	0.02	0.19	0.04
15/09/2015	0.12	0.02	0.19	0.04
22/09/2015	0.04	0.01	0.07	0.01
29/09/2015	0.03	0.01	0.05	0.01
06/10/2015	0.04	0.01	0.07	0.01
13/10/2015	0.05	0.01	0.09	0.02
20/10/2015	0.11	0.02	0.18	0.03
27/10/2015	0.06	0.01	0.10	0.02
03/11/2015	0.06	0.01	0.09	0.02
10/11/2015	0.08	0.02	0.13	0.03
17/11/2015	0.06	0.01	0.11	0.02
24/11/2015	0.19	0.04	0.32	0.06
01/12/2015	0.13	0.03	0.21	0.04
08/12/2015	0.11	0.02	0.18	0.03
15/12/2015	0.12	0.02	0.19	0.04
22/12/2015	0.01	0.00	0.02	0.00
Sum (uSv)		1.47		2.43
Ave. (%DRL)	0.15		0.24	
Annual Dose Est.	1.47 uSv/a		2.43 uSv/a	
	Adult Worker		Nursing Infant	

EMP Data using CAN/CSA N-288

		(uSv/a)
Atmospheric HTO immersion	P(e)19	1.238
Atmospheric HTO inhalation	P(i)19	1.238
Surface HTO ingestion	P(i)29	2.338
Surface HTO immersion	P(e)29	0.000
External soil exposure	P39	0.000
Forage & crop ingestion	P49	0.385
Animal produce ingestion	P59	0.025
Aquatic animal ingestion	P69	0.000
Aquatic plant ingestion	P79	0.000
External sediment exposure	P89	0.000
Summation	(uSv)	5.224

CHILD RESIDENT
EMP Factors for Dose

Pathways Analysis of Dose to the Public		
		per annum
Atmospheric HTO immersion	P(e)19	1.238
Atmospheric HTO inhalation	P(i)19	1.238
Surface HTO ingestion	P(i)29	2.338
Surface HTO immersion	P(e)29	0.000
External soil exposure	P39	0.000
Forage & crop ingestion	P49	0.385
Animal produce ingestion	P59	0.025
Aquatic animal ingestion	P69	0.000
Aquatic plant ingestion	P79	0.000
External sediment exposure	P89	0.000
Total (uSv)		5.224 uSv/a
Total without P_{29} (uSv)		2.886 uSv/a

CHILD RESIDENT
EMP Factors for Dose P19

P19 is the transfer pathway of exposure to HTO from compartment 1 (Atmosphere) to 9 (dose)
P(i)19 is the pathway of exposure due to inahalation of HTO
P(e)19 is the pathway of exposure due to immersion in a cloud of HTO

Formula:
P(i)19 (uSv) = [HTO]air (Bq/m3) x Inhalation (m3) x DCF (uSv/Bq)

Calculation:

PAS # (#)	P(i)19 (uSv)	[HTO]air (Bq/m3)	Inhalation (m3/a)	DCF (uSv/Bq)	Sum1,4 (uSv/a)	Sum 2,4 (uSv/a)	Sum 13,4 (uSv/a)	Maximum (uSv/a)
1	0.000		7,850	3.800E-05				
2	0.000		7,850	3.800E-05				
3	0.000		7,850	3.800E-05				
4	1.238	4.150	7,850	3.800E-05	1.238	1.238	1.238	
5	0.000		7,850	3.800E-05				
6	0.000		7,850	3.800E-05				
7	0.000		7,850	3.800E-05				
8	0.000		7,850	3.800E-05				
9	0.000		7,850	3.800E-05				
10	0.000		7,850	3.800E-05				
11	0.000		7,850	3.800E-05				
12	0.000		7,850	3.800E-05				
13	0.000		7,850	3.800E-05				
			P(i)19 Sum		**1.238**	**1.238**	**1.238**	**1.238** uSv/a

Formula:

P(e)19 (uSv) = P(i)19 (uSv)	(CAN/CSA-N288.1-14)				
Therefore P(e)19 =	**1.238**	**uSv/a**	**P(i)19 =**	**1.238**	**uSv/a**

P19 Values as per CAN/CSA-N288.1-14						
P19 =	**P(i)19**	**+**	**P(e)19**	**=**	**(uSv/a)**
P19 =	**1.238**	**+**	**1.238**	**=**	**2.476**

CAN/CSA-N288.1-14		
P(i)19	**1.238**	**uSv/a**
P(e)19	**1.238**	**uSv/a**
P19	**2.476**	**uSv/a**

CHILD RESIDENT
EMP Factors for Dose P29

P29 is the transfer pathway of exposure to HTO from compartment 2 (Surface Water) to 9 (Dose)
P(i)29 is the pathway of exposure due to ingestion of HTO
P(e)29 is the pathway of exposure due to immersion in HTO

Formula:
P(i)29 = [HTO] (Bq/L) x Ingestion (L) x DCF (uSv/Bq)

Well	P(i)29 (uSv/a)	[HTO]well (Bq/L)	Ingestion (L/a)	DCF (uSv/Bq)	Date	Well 1 (Bq/L)	Well 2 (Bq/L)	Well 3 (Bq/L)	Well 4 (Bq/L)	Well 5 (Bq/L)	Well 6 (Bq/L)	Well 7 (Bq/L)	Well 8 (Bq/L)	Well 9 (Bq/L)	Well 10 (Bq/L)	Well 11 (Bq/L)	Well 12 (Bq/L)
1	0.000	0	482.1	2.50E-05	09/01/15												
2	0.988	82	482.1	2.50E-05	03/02/15												
3	0.996	83	482.1	2.50E-05	04/03/15		77.0	97.0	5.0	9.0		14.0	190.0	54	5	809	5
4	0.056	5	482.1	2.50E-05	02/04/15												
5	0.117	10	482.1	2.50E-05	05/05/15												
6	0.000	0	482.1	2.50E-05	02/06/15												
7	0.169	14	482.1	2.50E-05	03/07/15		71.0	79.0	5.0	9.0		14.0	159	49	5	1,102	4
8	2.338	194	482.1	2.50E-05	05/08/15												
9	0.579	48	482.1	2.50E-05	01/09/15												
10	0.056	5	482.1	2.50E-05	02/10/15												
11	11.494	954	482.1	2.50E-05	04/11/15		98.0	72.0	4.0	11.0		14.0	232	41	4	950	4
12	0.052	4	482.1	2.50E-05	02/12/15												
Avg P(i)29	1.404	uSv/annum															
					Average		82	83	5	10		14	194	48	5	954	4

Well 1, RW-1	413 Boundary Road
Well 2, RW-3	183 Mud Lake Road
Well 3, RW-2	185 Mud Lake Road
Well 4, RW-7	40925 Highway 41
Well 5, RW-5	171 Sawmill Road
Well 6, RW-4	711 Bruham Avenue
Well 7, RW-6	40987 Highway 41
Well 8, RW-8	204 Boundary Rd
Well 9, RW-9	206 Boundary Rd
Well 10, RW-10	208 Boudary Rd
Well 11, B-1	Superior Office
Well 12, B-3	Intern. Lumber Office

P(e)29 is the pathway of exposure to HTO due to immersion in surface water.
P(e)29 is not considered in the DRL calculations of 1996.

P(e)29 = 0.000 uSv/mo

RW-9			
	P(i)29	2.338	uSv/mo
	P(e)29	0.000	uSv/mo
	P29	2.338	uSv/mo

CHILD RESIDENT
EMP Factors for Dose P49

P49 is the pathway for exposure to HTO due to ingestion of forage and crops.

Produce Sample Results (Bq/L)																			
Source	Market						Home												
Type	Cucumber	Potato	Zucchini	Tomato	Onion	Average	LOCATION	Beet	Green Pepper	Rhubarb Leaf	Carrot	Apple	Tomato	Potato	Cucumber	Swiss Chard	Onion	Zucchini	Average
H-3	6.00	6.00	10.00	10.00	6.00	8	413 SWEEZEY COURT	60.00							83.00				72
							408 BOUNDARY ROAD						153.00		129.00		179.00		154
																			#DIV/0!
																			#DIV/0!
Average	6.00	6.00	10.00	10.00	6.00	8		60.00	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	153.00	#DIV/0!	106.00	#DIV/0!	179.00	#DIV/0!	113

Produce Consumption						
100%=	265.200	kg/a	[HTO] (Bq/kg)	(Bq/a)	[OBT] (Bq/kg)	(Bq/a)
70%	185.640	kg/a	8	1411	0.38	71
30%	79.560	kg/a	154	12252	7.70	613

P49 = [HTO or OBT]produce (Bq/kg) x Produce Ingested (kg/mo) x DCF (uSv/Bq)

P49 (uSv/a)	[HTO] pro (Bq/a)	DCF (uSv/Bq)	[OBT] pro (Bq/a)	DCF (uSv/Bq)
0.385	13663	2.50E-05	683	6.30E-05

P49	0.385	uSv/mo

CHILD RESIDENT
EMP Factors for Dose P59

P59 is the exposure to HTO due to ingestion of animal produce.

2014 Sample Results

Local Producer	
	(Bq/L)
1	3.40
2	3.00
3	4.00
Average	3.47

Local Distributor	
	(Bq/L)
1	3.00
2	3.00
3	3.00
Average	3.00

TOTAL AVERAGE	3.23	Bq/L

Milk Density Adjustment Milk Average (Bq/L) x Milk density (L/kg)		
Bq/L	L/kg	Bq/kg
3.23	0.97	3.14

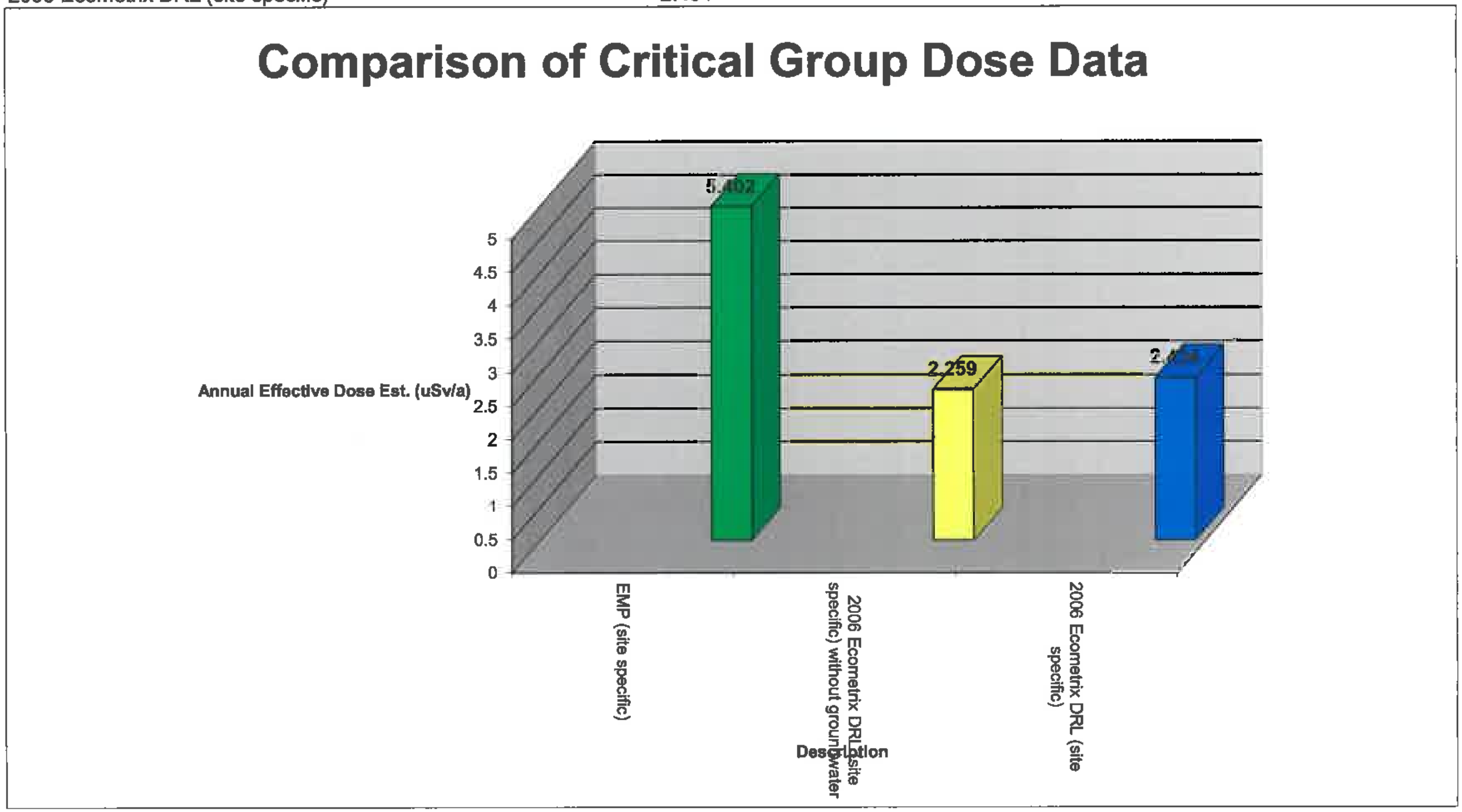
Consumption kg/da x da/a = kg/a		
kg/da)	(da/a)	(kg/a)
0.875	365.25	319.6

P59 = [HTO]animal produce (Bq/kg) x Ingestion (kg) x DCF				
P59	[HTO]	Ingested	DCF	
(uSv/a)	(Bq/kg)	(kg/a)	(uSv/Bq)	
0.025	3.14	319.59	2.50E-05	

P59	0.025	uSv/a

INFANT RESIDENT

EMP (site specific)	5.402
2006 Ecometrix DRL (site specific) without groundwater	2.259
2006 Ecometrix DRL (site specific)	2.434



DRL's and EMP Data to Annual Dose

INFANT RESIDENT

DRL's (1996 Canatom DRL and 2006 Ecometrix DRL)

Stack Emissions

	2006 SRBT DRL		2006 SRBT DRL	
	ADULT WORKER		NURSING INFANT	
Date	% weekly DRL	(uSv)	% weekly DRL	(uSv)
30/12/2015	0.03	0.01	0.06	0.01
06/01/2015	0.07	0.01	0.12	0.02
13/01/2015	0.09	0.02	0.14	0.03
20/01/2015	0.08	0.01	0.13	0.02
27/01/2015	0.06	0.01	0.10	0.02
03/02/2015	0.05	0.01	0.08	0.02
10/02/2015	0.10	0.02	0.16	0.03
17/02/2015	0.11	0.02	0.19	0.04
24/02/2015	0.33	0.06	0.54	0.10
03/03/2015	0.20	0.04	0.33	0.06
10/03/2015	0.22	0.04	0.36	0.07
17/03/2015	0.25	0.05	0.41	0.08
24/03/2015	0.16	0.03	0.26	0.05
31/03/2015	0.18	0.03	0.29	0.06
07/04/2015	0.18	0.03	0.29	0.06
14/04/2015	0.19	0.04	0.32	0.06
21/04/2015	0.20	0.04	0.33	0.06
28/04/2015	0.22	0.04	0.37	0.07
05/05/2015	0.19	0.04	0.32	0.06
12/05/2015	0.31	0.06	0.51	0.10
19/05/2015	0.19	0.04	0.31	0.06
26/05/2015	0.69	0.13	1.25	0.24
02/06/2015	0.18	0.04	0.30	0.06
09/06/2015	0.26	0.05	0.42	0.08
16/06/2015	0.30	0.06	0.50	0.10
23/06/2015	0.20	0.04	0.34	0.06
30/06/2015	0.08	0.02	0.13	0.03
07/07/2015	0.20	0.04	0.33	0.06
14/07/2015	0.18	0.04	0.30	0.06
21/07/2015	0.13	0.02	0.21	0.04
28/07/2015	0.12	0.02	0.20	0.04
04/08/2015	0.14	0.03	0.23	0.04
11/08/2015	0.14	0.03	0.22	0.04
18/08/2015	0.12	0.02	0.19	0.04
25/08/2015	0.07	0.01	0.11	0.02
01/09/2015	0.08	0.02	0.13	0.03
08/09/2015	0.12	0.02	0.19	0.04
15/09/2015	0.12	0.02	0.19	0.04
22/09/2015	0.04	0.01	0.07	0.01
29/09/2015	0.03	0.01	0.05	0.01
06/10/2015	0.04	0.01	0.07	0.01
13/10/2015	0.05	0.01	0.09	0.02
20/10/2015	0.11	0.02	0.18	0.03
27/10/2015	0.06	0.01	0.10	0.02
03/11/2015	0.06	0.01	0.09	0.02
10/11/2015	0.08	0.02	0.13	0.03
17/11/2015	0.06	0.01	0.11	0.02
24/11/2015	0.19	0.04	0.32	0.06
01/12/2015	0.13	0.03	0.21	0.04
08/12/2015	0.11	0.02	0.18	0.03
15/12/2015	0.12	0.02	0.19	0.04
22/12/2015	0.01	0.00	0.02	0.00
Sum (uSv)		1.47		2.43
Ave. (%DRL)	0.15		0.24	
Annual Dose Est.	1.47 uSv/a		2.43 uSv/a	
	Adult Worker		Nursing Infant	

EMP Data using CAN/CSA N-288

		(uSv/a)
Atmospheric HTO immersion	P(e)19	0.910
Atmospheric HTO inhalation	P(i)19	0.910
Surface HTO ingestion	P(i)29	3.143
Surface HTO immersion	P(e)29	0.000
External soil exposure	P39	0.000
Forage & crop ingestion	P49	0.383
Animal produce ingestion	P59	0.056
Aquatic animal ingestion	P69	0.000
Aquatic plant ingestion	P79	0.000
External sediment exposure	P89	0.000
Summation	(uSv)	5.402

INFANT RESIDENT
EMP Factors for Dose

Pathways Analysis of Dose to the Public		
		per annum
Atmospheric HTO immersion	P(e)19	0.910
Atmospheric HTO inhalation	P(i)19	0.910
Surface HTO ingestion	P(i)29	3.143
Surface HTO immersion	P(e)29	0.000
External soil exposure	P39	0.000
Forage & crop ingestion	P49	0.383
Animal produce ingestion	P59	0.056
Aquatic animal ingestion	P69	0.000
Aquatic plant ingestion	P79	0.000
External sediment exposure	P89	0.000
Total (uSv)		5.402 uSv/a
Total without P_{29} (uSv)		2.259 uSv/a

INFANT RESIDENT
EMP Factors for Dose P19

P19 is the transfer pathway of exposure to HTO from compartment 1 (Atmosphere) to 9 (dose)
P(i)19 is the pathway of exposure due to inahalation of HTO
P(e)19 is the pathway of exposure due to immersion in a cloud of HTO

Formula:
P(i)19 (uSv) = [HTO]air (Bq/m3) x Inhalation (m3) x DCF (uSv/Bq)

Calculation:

PAS # (#)	P(i)19 (uSv)	[HTO]air (Bq/m3)	Inhalation (m3/a)	DCF (uSv/Bq)	Sum1,4 (uSv/a)	Sum 2,4 (uSv/a)	Sum 13,4 (uSv/a)	Maximum (uSv/a)	
1	0.000		2,740	8.000E-05					
2	0.000		2,740	8.000E-05					
3	0.000		2,740	8.000E-05					
4	0.910	4.150	2,740	8.000E-05	0.910	0.910	0.910		
5	0.000		2,740	8.000E-05					
6	0.000		2,740	8.000E-05					
7	0.000		2,740	8.000E-05					
8	0.000		2,740	8.000E-05					
9	0.000		2,740	8.000E-05					
10	0.000		2,740	8.000E-05					
11	0.000		2,740	8.000E-05					
12	0.000		2,740	8.000E-05					
13	0.000		2,740	8.000E-05					
			P(i)19 Sum		**0.910**	**0.910**	**0.910**	**0.910**	**uSv/a**

Formula:

P(e)19 (uSv) = P(i)19 (uSv)		(CAN/CSA-N288.1-14)				
Therefore	**P(e)19 =**	**0.910**	**uSv/a**	**P(i)19 =**	**0.910**	**uSv/a**

P19 Values as per CAN/CSA-N288.1-14					
P19 =	**P(i)19**	**+**	**P(e)19**	**=**	**(uSv/a)**
P19 =	**0.910**	**+**	**0.910**	**=**	**1.819**

CAN/CSA-N288.1-14		
P(i)19	**0.910**	**uSv/a**
P(e)19	**0.910**	**uSv/a**
P19	**1.820**	**uSv/a**

INFANT RESIDENT
EMP Factors for Dose P29

P29 is the transfer pathway of exposure to HTO from compartment 2 (Surface Water) to 9 (Dose)
P(i)29 is the pathway of exposure due to ingestion of HTO
P(e)29 is the pathway of exposure due to immersion in HTO

Formula:
P(i)29 = [HTO] (Bq/L) x Ingestion (L) x DCF (uSv/Bq)

Well	P(i)29 (uSv/a)	[HTO]well (Bq/L)	Ingestion (L/a)	DCF (uSv/Bq)
1	0.000	0	305.7	5.30E-05
2	1.329	82	305.7	5.30E-05
3	1.339	83	305.7	5.30E-05
4	0.076	5	305.7	5.30E-05
5	0.157	10	305.7	5.30E-05
6	0.000	0	305.7	5.30E-05
7	0.227	14	305.7	5.30E-05
8	3.143	194	305.7	5.30E-05
9	0.778	48	305.7	5.30E-05
10	0.076	5	305.7	5.30E-05
11	15.451	954	305.7	5.30E-05
12	0.070	4	305.7	5.30E-05
Avg P(i)29	[illegible]	uSv/annum		

Date	Well 1 (Bq/L)	Well 2 (Bq/L)	Well 3 (Bq/L)	Well 4 (Bq/L)	Well 5 (Bq/L)	Well 6 (Bq/L)	Well 7 (Bq/L)	Well 8 (Bq/L)	Well 9 (Bq/L)	Well 10 (Bq/L)	Well 11 (Bq/L)	Well 12 (Bq/L)
09/01/15												
03/02/15												
04/03/15		77.0	97.0	5.0	9.0		14.0	100.0	54	5	809	5
02/04/15												
05/05/15												
02/06/15												
03/07/15		71.0	79.0	5.0	9.0		14.0	159	49	5	1,102	4
05/08/15												
01/09/15												
02/10/15												
04/11/15		98.0	72.0	4.0	11.0		14.0	232	41	4	950	4
02/12/15												
Average		82	83	5	10		14	194	48	5	954	4

Well 1, RW-1	413 Boundary Road
Well 2, RW-3	183 Mud Lake Road
Well 3, RW-2	185 Mud Lake Road
Well 4, RW-7	40925 Highway 41
Well 5, RW-5	171 Sawmill Road
Well 6, RW-4	711 Bruham Avenue
Well 7, RW-6	40987 Highway 41
Well 8, RW-8	204 Boundary Rd
Well 9, RW-9	206 Boundary Rd
Well 10, RW-10	208 Boudary Rd
Well 11, B-1	Superior Office
Well 12, B-3	Intern. Lumber Office

P(e)29 is the pathway of exposure to HTO due to immersion in surface water.
P(e)29 is not considered in the DRL calculations of 1996.

P(e)29 =	0.000	uSv/mo

RW-9

P(i)29	3.143	uSv/mo
P(e)29	0.000	uSv/mo
P29	3.143	uSv/mo

INFANT RESIDENT
EMP Factors for Dose P49

P49 is the pathway for exposure to HTO due to ingestion of forage and crops.

Produce Sample Results (Bq/L)																			
Source	Market						Home												
Type	Cucumber	Potato	Zucchini	Tomato	Onion	Average	LOCATION	Beet	Green Pepper	Rhubarb Leaf	Carrot	Apple	Tomato	Potato	Cucumber	Swiss Chard	Onion	Zucchini	Average
H-3	6.00	6.00	10.00	10.00	6.00	8	413 SWEEZEY COURT	60.00							83.00				72
							408 BOUNDARY ROAD						153.00		129.00		179.00		154
																			#DIV/0!
																			#DIV/0!
Average	6.00	6.00	10.00	10.00	6.00	8		60.00	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	153.00	#DIV/0!	106.00	#DIV/0!	179.00	#DIV/0!	113

Produce Consumption						
100%=	124.800	kg/a	[HTO] (Bq/kg)	(Bq/a)	[OBT] (Bq/kg)	(Bq/a)
70%	87.360	kg/a	8	664	0.38	33.20
30%	37.440	kg/a	154	5766	7.70	288.29

P49 = [HTO or OBT]produce (Bq/kg) x Produce Ingested (kg/mo) x DCF (uSv/Bq)

P49 (uSv/a)	[HTO] pro (Bq/a)	DCF (uSv/Bq)	[OBT] pro (Bq/a)	DCF (uSv/Bq)
0.383	6429.70	5.30E-05	321.48	1.30E-04

P49	0.383	uSv/mo

APPENDIX S

INFANT RESIDENT
EMP Factors for Dose P59

P59 is the exposure to HTO due to ingestion of animal produce.

2014 Sample Results

Local Producer	
	(Bq/L)
1	3.40
2	3.00
3	4.00
Average	3.47

Local Distributor	
	(Bq/L)
1	3.00
2	3.00
3	3.00
Average	3.00

TOTAL AVERAGE	3.23	Bq/L

Milk Density Adjustment Milk Average (Bq/L) x Milk density (L/kg)		
Bq/L	L/kg	Bq/kg
3.23	0.97	3.14

Consumption kg/da x da/a = kg/a		
kg/da)	(da/a)	(kg/a)
0.930595	365.25	339.90

P59 = [HTO]animal produce (Bq/kg) x Ingestion (kg) x DCF				
P59	[HTO]	Ingested	DCF	
(uSv/a)	(Bq/kg)	(kg/a)	(uSv/Bq)	
0.0560	3.14	339.90	5.30E-05	

P59	0.056	uSv/a

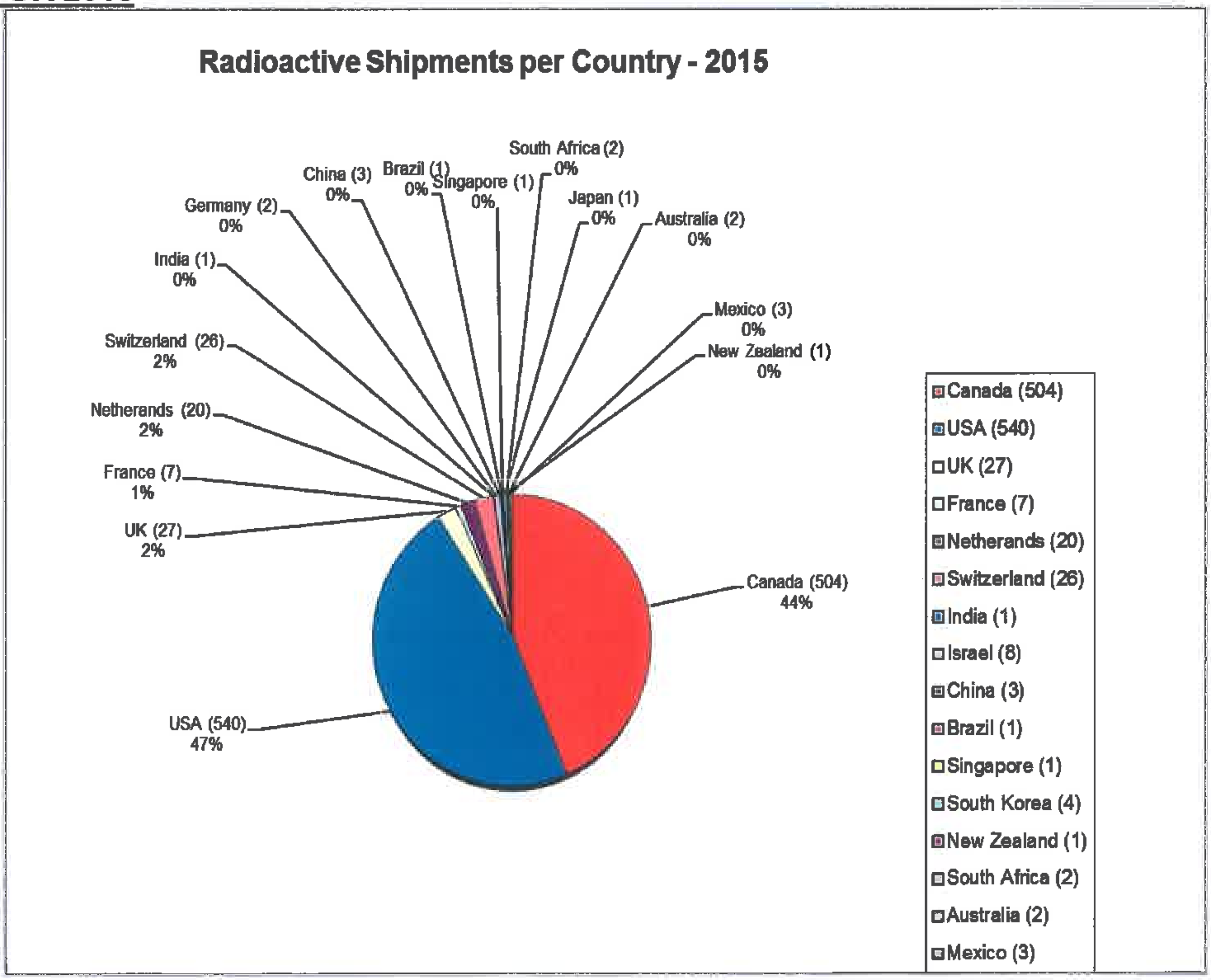
APPENDIX T

Outgoing Shipments Containing Radioactive Material for 2015

SHIPMENTS CONTAINING RADIOACTIVE MATERIAL FOR 2015

Month / 2015	Number of Shipments
January	103
February	96
March	108
April	118
May	86
June	105
July	99
August	85
September	73
October	110
November	99
December	68
Total Shipments	1150
2015 Monthly Average:	***176.92***

DISTRIBUTION OF SHIPMENTS CONTAINING RADIOACTIVE MATERIAL FOR 2015



APPENDIX U

Incoming Shipments Containing Radioactive Material for 2015

INCOMING SHIPMENTS CONTAINING RADIOACTIVE MATERIAL FOR 2015

Month / 2015	Number of Shipments
January	52
February	58
March	37
April	29
May	42
June	46
July	73
August	55
September	53
October	71
November	48
December	34
Total Shipments	*598*
2015 Monthly Average:	*8.17*

ORIGIN OF INCOMING SHIPMENTS FOR 2015