SRB Technologies (Canada) Inc.

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2020 Annual Compliance and Performance Report

Reporting Period:	January 1 – December 31, 2020
Licence Number:	NSPFOL-13.00/2022
Licence Condition:	4.2

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SRB Technologies (Canada) Inc.

2020 Annual Compliance and Performance Report

Submission date: March 31, 2021

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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.

Our facility continues to process tritium safely, responsibly and efficiently, and we are proud of the level of performance and improvements achieved during 2020.

This year of operations was unique given the inherent challenges introduced by the onset of the COVID-19 pandemic. Despite these challenges, no nuclear safety-related events or significant safety-related issues occurred, and the safety of workers, the public and the environment was maintained at all times. As well, no SRBT employee was diagnosed as having been infected with the SARS-CoV-2 virus throughout the year, signifying effective implementation of the suite of infection-control measures at the facility.

The ratio of the amount of tritium released to atmosphere versus the amount of tritium that we processed in 2020 decreased when compared to the previous year. For every 1,000 units of tritium that went into our products this year, 0.9 units of tritium was eventually released as gaseous effluent. This ratio (0.09%) met our annual internal target of 0.12%, and represented a decrease in the ratio achieved in 2019 (0.10%).

In 2020, SRBT processed 27,887,498 GBq of tritium into self-luminous light sources and safety devices; in comparison, in 2019, a total of 30,327,048 GBq of tritium was processed.

The total amount of tritium released to the environment through the gaseous effluent pathway decreased (25,186 GBq) compared with the previous year (31,769 GBq). The annualized gaseous tritium releases met our target for 2020; on the average, 484 GBq of tritium was released weekly, versus our target of 650 GBq per week.

The collective dose to workers at SRBT totalled 3.30 person·mSv, and no staff member exceeded 1 mSv for the year – a value that represents the dose limit to the public. As well, no action levels were exceeded with respect to radiation doses. This is a testament to the continued diligence of our workers in maintaining radiation exposures as low as reasonably achievable (ALARA).

The calculated public dose remains far less than 1% of the prescribed limit of 1 mSv, as derived from direct sampling and monitoring of the local environment. Groundwater tritium concentrations continue to respond favorably to modified and optimized processing practices.

In 2020, CNSC staff performed two inspections at the facility; all identified compliance and improvement items have since been fully addressed to the satisfaction of CNSC staff.

Throughout the year, SRBT provided CNSC staff revisions of several key documents associated with our licensing basis, including (but not limited to) SRBT’s Regulatory Reporting Program, Training Program, Groundwater Monitoring Program and Fire Hazard Assessment.

With CNSC staff providing a recommendation of the acceptance of our revised Preliminary Decommissioning Plan (PDP) in early 2020, deposits were made to our Financial Guarantee (FG) in April, increasing the funding to the account up to $727,327. This amount aligns with the updated projected cost of future decommissioning. As before, the SRBT FG does not rely on insurance, letters of credit or third-party resources in order to ensure funding availability for future decommissioning of the facility; the funds are held in escrow for access via a Financial Agreement with the Commission.

The Commission held a hearing-in-writing in the fourth quarter of 2020, in order to review and render a final decision on the acceptability of the PDP and the associated FG. On December 8, 2020, it was determined that these important aspects of our licensing basis had been accepted by the Commission. The FG has continued to accrue investment interest over time, which will be reinvested, leaving a balance which exceeds the required amount.

In summary, 2020 represents a highly successful and safe year of operation for SRBT. Continual improvements in compliance and safety is an ongoing mission, and we will always strive to reduce our operational impact on the environment, and to optimize safety and the effective doses to our workers and the public.

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Acronyms and Abbreviations

ACR	Annual Compliance Report / Annual Compliance and Performance Report
ALARA	As Low As Reasonably Achievable
APFN	Algonquins of Pikwakanagan First Nation
Bq	Becquerel
BSI	British Standards Institute
CFAST	Consolidated Fire and Smoke Transfer (model)
CLC	Canada Labour Code
CLW	Clearance Level Waste
CNL	Canadian Nuclear Laboratories
CNSC	Canadian Nuclear Safety Commission
COVID-19	Coronavirus Disease (2019)
CSA	Canadian Standards Association
CSM	Conceptual Site Model
CVC	Compliance Verification Criteria
dp	Differential Pressure
DS	Downspout
DSL	Dosimetry Service Licence
DU	Depleted Uranium
ECR	Engineering Change Request
EffMP	Effluent Monitoring Program
EMP	Environmental Monitoring Program
EMS	Environmental Management System
ERA	Environmental Risk Assessment
ESDC	Employment and Social Development Canada
FASC	Facility Access Security Clearance
FG	Financial Guarantee
FHA	Fire Hazard Assessment
GMP / GWMP	Groundwater Monitoring Program

Acronyms and Abbreviations

GTLS	Gaseous Tritium Light Source
HT	Elemental Tritium
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
IT	Information Technology
LCH	Licence Conditions Handbook
LLW	Low-Level Waste
LSC	Liquid Scintillation Counters / Counting
LTI	Lost Time Incident
MDA	Minimum Detectable Activity
MW	Monitoring Well
NBCC	National Building Code of Canada
NCR	Non-Conformance Report
NDR	National Dose Registry
NEW	Nuclear Energy Worker
NFCC	National Fire Code of Canada
NIST	National Institute of Standards and Technology
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
PAS	Passive Air Sampler
PDP	Preliminary Decommissioning Plan

Acronyms and Abbreviations

PFD	Pembroke Fire Department
PIP	Public Information Program
PLC	Professional Loss Control
PTNSR	Packaging and Transport of Nuclear Substances Regulations
PUTT	Pyrophoric Uranium Tritium Trap
QA	Quality Assurance
QC	Quality Control
RDU	Remote Display Unit
REGDOC	Regulatory Document
RPD	Relative Percent Difference
RPT	Routine Performance Test
RW	Residential Well
SAR	Safety Analysis Report
SAT	Systematic Approach to Training
SCA	Safety and Control Area
SN	Serial Number
SRBT	SRB Technologies (Canada) Incorporated
SSC	Structure, System, and/or Component
SSR	Specific Safety Requirements
Sv	Sievert
T2	Molecular Tritium Gas
TDG	Transportation of Dangerous Goods
TNA	Training Needs Analysis
TSSA	Technical Standards and Safety Authority
TUPT	Tritium Urinalysis Performance Test
UL	Underwriters' Laboratories
VLLW	Very Low-Level Waste
wc	Water Column
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 – December 31, 2020, 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-13.00/2022[1].

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, provincial and municipal regulations throughout the review period. As well, no new CNSC-licensed activities were implemented since the previous compliance monitoring report.

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.

During this period, there were no exceedances of environmental or radiation protection action levels, nor licence / regulatory limits associated with our operating licence. Two events occurred during the year which were deemed to meet criteria for reporting to CNSC staff, neither of which impacted nuclear safety.

The SRBT operating licence includes 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)[2] 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 to provide 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 which meets the requirements of CNSC Regulatory Document 3.1.2, *Reporting Requirements, Volume I: Non-Power Reactor Class I Nuclear Facilities and Uranium Mines and Mills,* SRBT's Regulatory Reporting Program, and in consideration of regulatory feedback and comments regarding previous ACRs submitted in the past.

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 safely and compliantly throughout 2020.

1.2.1 Tritium Processing

In 2020, SRBT conducted 4,002 tritium processing operations (light source filling), with a total of 27,887,498 GBq of tritium being processed into gaseous tritium light sources (GTLS). Both of these values represent decreases over 2019 processing statistics (4,521 operations, 30,327,048 GBq processed).

Please refer to section 1.4, 'Production or Utilization' for additional details on tritium processing in 2020.

1.2.2 Production and Distribution of Self-luminous Safety Products

In 2020, 827 shipments of our self-luminous safety products were made to customers in 19 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 2020.

1.2.3 Acceptance of Expired Products

In 2020, a total of 34,081 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 5,360.02 TBq of tritium. In 2019, 28,073 signs were processed representing 5,144.93 TBq of tritium.

These signs were disassembled safely and the light sources removed. A very small number of these signs were evaluated as having light sources that could be reused in other self-luminous devices. Lights that could not be repurposed were packaged and shipped to a licenced radioactive waste management service provider.

As well, an additional 179.69 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. 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 2020.

1.2.4 External Oversight

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

CNSC staff conducted compliance inspections on two occasions in 2020.

In January, CNSC staff conducted a general compliance inspection (SRBT-2020-01), with a scope focused on the Human Performance Management Safety and Control Area (SCA), while in October, CNSC staff conducted a compliance inspection (SRBT-2020-02) focused on the Radiation Protection SCA.

Three compliance actions were raised by CNSC staff as a result of these inspections, as well as two recommendations. All compliance actions associated with these activities were addressed to the full satisfaction of CNSC staff.

BSI Management Systems, on behalf of the International Organization for Standardization (ISO), conducted a major audit of SRBT operations in September 2020. The audit verified our implementation of a quality management system aligned with the 2015 version of the ISO 9001 standard. No findings were identified during this audit.

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, and confirmed our certification to the 2015 version of ISO 9001.

One major customer of SRBT products conducted an independent audit of our operations in October 2020, while Underwriters' Laboratories (UL) completed four quarterly audits as planned.

Additional 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. Both the Pembroke Fire Department (PFD) and Professional Loss Control (PLC) inspected the facility in October. Details on these inspections can be found in section 4.4, 'SCA – Emergency Management and Fire Protection'.

All external audits and inspections were conducted remotely due to the COVID-19 pandemic, with the exception of the CNSC inspection in January, the first UL inspection in February, and the inspections relating to Fire Protection. In-person inspections were performed in line with SRBT's COVID-related protocols.

1.2.5 Internal Oversight

Nine internal compliance audits were conducted through the year, focused on all aspects of our operations and our organization. A total of 10 non-conformance reports (NCR) and 13 opportunities for improvement (OFI) were identified as a result of these activities, all of which have 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 Reported Events

SRBT did not experience any event that met the regulatory criteria for unplanned event reporting in 2020. Event reporting is governed by the SRBT Regulatory Reporting Program.

1.2.7 Operational Challenges

This year of operations was unique given the inherent challenges introduced by the onset of the COVID-19 pandemic.

As the virus began to spread into the Province of Ontario in February and March, SRBT Senior Management carefully monitored the developments on a daily basis.

Beginning in March, restrictions were enacted on visitor access to the facility, and specific directions were given to all staff on the expectations on not attending work if they experienced symptoms of COVID-19. Augmented facility disinfection protocols were enacted, and have continued since the onset of the pandemic.

The maximum size of any group of individuals in the facility was restricted to align with the guidance from the provincial government, and 'work-from-home' strategies were implemented for all administrative employees who could feasibly do so without negatively impacting safety.

Plexiglas barriers and an augmented air circulation and filtration system were installed in the lunchroom

Over the summer months, work schedules were adjusted in order to promote augmented physical distancing of staff, and all essential outside visitors were mandated to wear non-medical face coverings while in the facility.

In October, concurrent with an amendment to Ontario Regulation 364/20, face masks were mandated throughout the facility for all persons.

Despite these challenges, no nuclear safety-related events or significant safety-related issues occurred, and the safety of workers, the public and the environment was maintained at all times.

As well, to date, no SRBT employee has been diagnosed as having been infected with the SARS-CoV-2 virus throughout the year, signifying effective implementation of the suite of infection-control measures at the facility.

CNSC staff was kept informed of all pandemic-related developments at the facility throughout the year, and a number of press releases and social media posts were also made for the awareness of the general public.

1.2.8 Summary of Significant Modifications

No significant modifications were implemented in the facility which pertain to our licensed activities in 2020, and there were no changes to the self-luminous safety light production capacity of the facility.

All minor and non-safety significant modifications to structures, systems and components were conducted in accordance with our change control processes.

Please refer to section 3.2, 'SCA – Physical Design', for more information regarding notable facility modifications carried out in 2020.

1.2.9 Summary of Organizational Structure and Key Personnel

At the conclusion of 2020, SRBT employs 38 employees and managers. No significant structural changes to the organization were implemented in 2020.

Please refer to section 2.1, 'SCA – Management System' for details regarding SRBT's organizational structure in 2020.

1.3 Summary of Compliance with Licence and OLCs

Throughout 2020, 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 regulatory requirements.

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,
- An accepted decommissioning strategy continues to be maintained for future use,
- An accepted financial guarantee continues to be maintained for future decommissioning.
- 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 management of hazardous materials and waste.

The following summary report is provided respecting SRBT compliance with the Operating Limits and Conditions (OLC) established within our Safety Analysis Report (SAR) throughout the course of 2020.

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 2020.

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 2020. 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 where measureable precipitation was not occurring during 2020.

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 (HTO) released to atmosphere in 2020 was equal to 9.76E+12 Bq (9,755 GBq), representing 14.5% 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 HTO and elemental tritium (HT) released to atmosphere in 2020 was equal to 2.52E+13 Bq (25,186 GBq), representing 5.6% of this licenced limit.

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

1.3.6 Minimum Differential Pressure Measurements for Tritium Processing

Tritium processing operations shall not occur unless the following differential pressures are achieved, as measured by the gauges on each of the active ventilation system stacks: • Rig Stack: 0.27 inches of water column (wc) • Bulk Stack: 0.38 inches of water column These measurements correspond to an average effective stack height of 27.8 metres, assuming a wind speed of 2.2 m/s.

At no time did tritium processing occur during 2020 when the noted differential pressures (dp) were not being achieved, as measured daily prior to operations commencing.

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 2020 was equal to 5.56E+09 Bq, representing 2.78% 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 30 complete bulk splitter filling cycles, after which it is no longer permitted to be used for further tritium processing.

All tritium processing in 2020 was conducted using PUTTs that had been cycled 30 times or less on the bulk splitter.

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 as follows:

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

In 2020, no PUTT was loaded with more than 111,000 GBq of tritium.

No bulk container was used in the facility in excess of the 1,000,000 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 compliance with this limit throughout 2020.

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 2020.

Please refer to section 2.3, 'SCA – Operating Performance' for more details on inventory controls of DU in 2020.

1.3.12 Exceedances of Facility Action Levels

There were no exceedances of radiation protection or environmental protection action levels in 2020.

Please refer to section 2.1.7 for details on this initiative.

1.4 Production or Utilization

1.4.1 Tritium Processing

In 2020, at total of 27,887,498 GBq of tritium was processed. This represents a decrease of about 8% from the 2019 value of 30,327,048 GBq.

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

TABLE 1: TRITIUM PROCESSED – FIVE-YEAR TREND

YEAR	2016	2017	2018	2019	2020
TRITIUM PROCESSED (GBq)	28,122,678	32,968,695	31,251,329	30,327,048	27,887,498

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 2020 this possession limit was not exceeded. The maximum tritium activity possessed at any time during 2020 was 4,707 TBq, in December. The monthly average inventory of tritium in the facility was 3,405 TBq.

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 2020 can be found in **Appendix A** of this report.

1.5 Changes in Management System Documentation

On February 6, 2020, CNSC staff issued the third revision of SRBT's Licence Conditions Handbook. This revision included several updates, including the incorporation of more restrictive action levels, and the removal of the requirement to routinely sample certain groundwater wells on other property.

In 2020, SRBT revised several key program-level management system documents associated with our licensing basis, following the change control provisions of our Licence Conditions Handbook.

Examples of revised programs and procedures include:

- Regulatory Reporting Program
- Training Program Manual
- Fire Hazard Assessment
- Groundwater Monitoring Program
- RSO-009, *Tritium Inventory Management*
- RSO-029, *Nuclear Substances Inventory Management*
- SHP-001, *Packing and Shipping – General Requirements*
- SHP-005, *Document – Dangerous Goods Document*

In line with our mission and policy of continual improvement, process and procedural revisions continued to be a managerial focus throughout the year.

In total, 100 Engineering Change Requests (ECRs) were generated to control the revision and review of programs, procedures or forms in 2020.

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

Throughout 2020, the SRBT management system was effectively and thoroughly implemented, ensuring that our nuclear substance processing facility operations continued to meet the requirements detailed in our LCH, including key elements such as organization and responsibilities, capability of personnel, use of experience, work planning and control, process and change control, independent verification, non-conformance and corrective action.

A total of 43 non-conformances (NCR) and 52 opportunities for improvement (OFI) were raised in different areas of the company operations.

As of the end of 2020, 32 out of the 43 NCRs raised in 2020 had been addressed, reviewed for effectiveness and closed. The remaining 11 NCRs are still in progress due to the fact that they were raised in the later part of the year, or due to relative longer timeframes for the actions that are to be taken to resolve the issues identified.

For opportunities for improvement (OFIs), 35 out of the 52 raised in 2020 have been addressed, reviewed for effectiveness and closed. The remaining 17 OFIs were either raised later in the year, and/or were assigned target completion due dates that have not yet been reached, and will be reviewed as per normal processes as they are addressed.

SRBT affirms that corrective actions and opportunities for improvement have been effective at resolving problems and promoting the concept of continual improvement within our management system in 2020.

Organizational Management Reviews were conducted in early 2020 by all program owners and responsible managers, including benchmarking and self-assessment activities. These reviews were focused on the 2019 calendar year. Reports were submitted to the Executive Assistant in preparation for the annual Management Review.

Between August 28 – September 1, the annual Management Review was conducted by way of a series of one-on-one meetings between key members of the Executive Committee and each of the individual program owners and responsible managers. Smaller meetings were held in order to ensure compliance with facility COVID-19 protocols limiting the number of people gathering together.

The results of the benchmarking and self-assessment activities performed for the previous calendar year were reviewed and discussed, and areas where improvements could be made in the various company safety programs were highlighted.

The management system was found to be effective at meeting the current requirements of the NSCA, associated regulations and the conditions of the operating licence, as well as ISO 9001:2015, and customer requirements.

The 2020 Organizational Management Reviews are scheduled to take place in early 2021, followed by Executive Committee meetings to discuss the outputs of the reviews with responsible managers, and the identification any opportunities for improvements, actions required to mitigate risks, and compliance or performance issues.

2.1.1 Staffing and Organization

At the beginning of 2020, SRBT total staff complement stood at 42 employees.

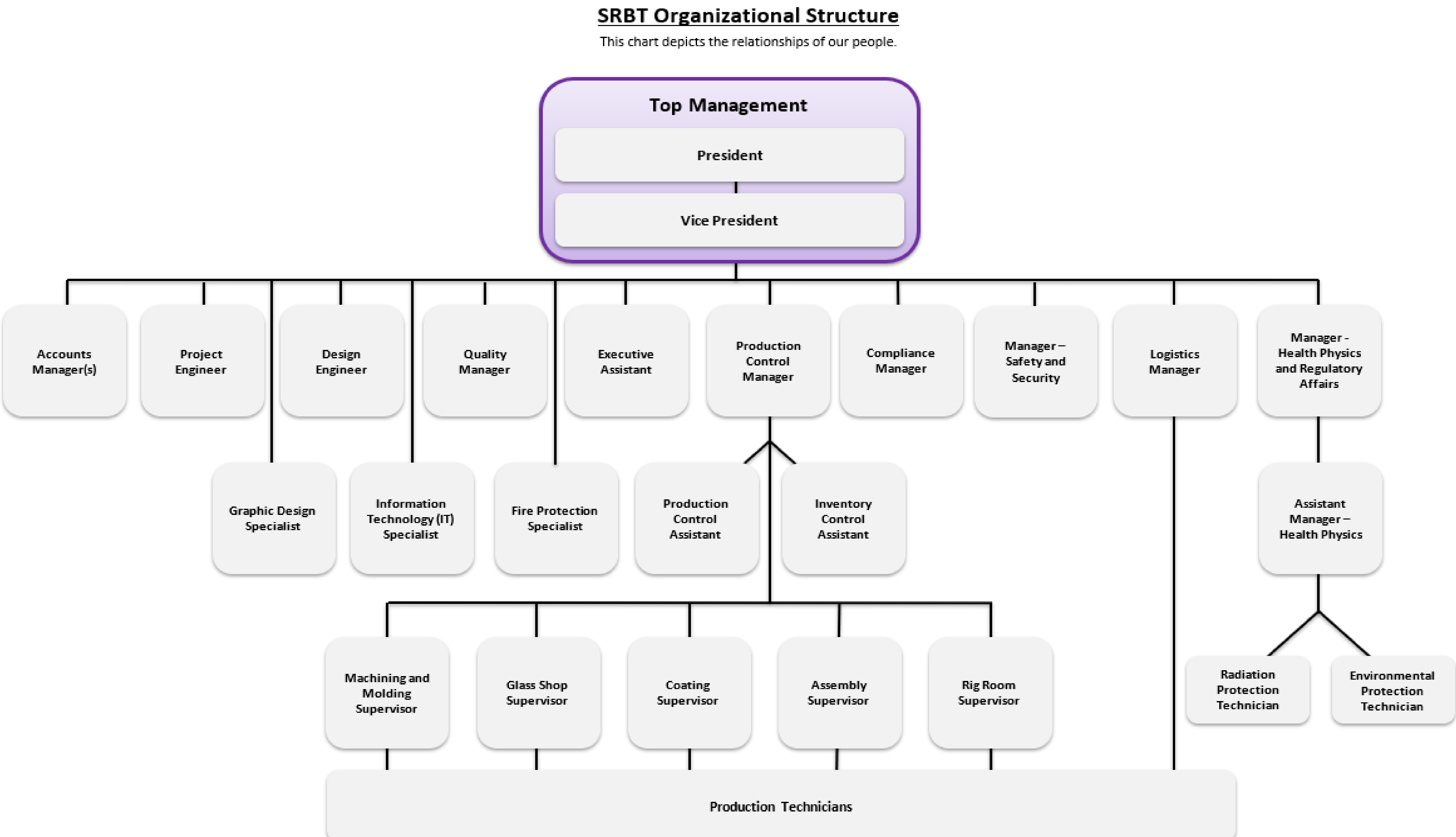
One new seasonal employee was hired during the year, while four employees are no longer employed by the company. Of the four employees who left SRBT, one of these individuals elected to vacate their position in consideration of the COVID-19 pandemic, while another was laid off as their position in the organization was no longer required.

In addition to these changes, one employee began a period of parental leave in 2020, which has continued through the end of the year.

As such, as of the end of 2020, the total working staff complement stands at 38 employees, with and additional employee on parental leave.

The organizational chart on Figure 1 represents the structure of the company, as of the end of 2020, that ensures SRBT meets the Nuclear Safety and Control Act, regulations and conditions of our operating licence.

FIGURE 1: ORGANIZATIONAL CHART



As of the end of 2020, a total of 38 employees worked at the company, including 17 administrative employees and 21 production / technician-level employees.

Administrative employees include the two members of Top 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.

At the conclusion of 2020, the administrative employees also include ten individuals at the Organizational Management level:

- Quality Manager is mainly responsible for ensuring the quality of products, the satisfaction of customers, and adherence to the requirements of the Underwriters Laboratories (UL). They also provide input ensuring that our management system meets the requirements of the ISO 9001 standard.
- Logistics Manager is mainly responsible for the shipment, receipt and inventory control of radioactive materials, as well as import and export activities.
- 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 developing and maintaining product specifications and manufacturing procedures.
- Design Engineer is mainly responsible for product research and development, plastics molding and printing, and oversight of the change control process (NOTE: not currently staffed; responsibilities managed by Project Engineer).
- Account Managers (2) are 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 Canada Occupational Health and Safety Regulations, and support for the Security Program.

- Compliance Manager is mainly responsible for performing independent internal audits and further ensuring facility compliance with external and internal requirements.
- 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 on regulatory matters.

Five employees provide program oversight and/or directly assist individuals at the management support level,

- Graphic Design Specialist is responsible for coordinating changes to the company website, and for the design and development of public information products and sales literature.
- IT Specialist manages and maintains the facility computer network and provides a wide range of technical and engineering support.
- Fire Protection Specialist ensures that facility fire safety procedures are implemented, and for coordinating with the Pembroke Fire Department for drills, inspection and training. This individual is also responsible for the day-to-day management of maintenance activities in the facility.
- Production Control Assistant is responsible for processing sales orders, maintaining the order book and distributing work packages (NOTE: not currently staffed; responsibilities managed by the Production Control Manager).
- Inventory Control Assistant oversees the receipt of all materials, including quality evaluation where applicable, and for general stores and materials.
- Assistant Manager – Health Physics is responsible for the day-to-day implementation of company Health Physics-related programs and processes, including coordinating the activities of technician-level resources assigned to the department.

At the technician level, within the Health Physics department, two individuals are assigned:

- Radiation Protection Technician performs duties relating primarily to radiation protection.
- Environmental Protection Technician is primarily responsible for performing duties relating to environmental protection and monitoring.

Nineteen production-focused 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 fourteen Production Technicians,

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

2.1.2 Committees

In 2020, 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 2020, a total of 77 committee meetings took place at the company compared to 82 in 2019, and 77 in 2018.

TABLE 2: COMMITTEE MEETINGS

COMMITTEE	NUMBER OF MEETINGS
PRODUCTION COMMITTEE	36
WORKPLACE HEALTH AND SAFETY COMMITTEE	9
HEALTH PHYSICS COMMITTEE	6
MAINTENANCE COMMITTEE	4
EXECUTIVE COMMITTEE	4
MITIGATION COMMITTEE	3
TRAINING COMMITTEE	3
WASTE MANAGEMENT COMMITTEE	3
PUBLIC INFORMATION COMMITTEE	3
OTHER COMMITTEE / STAFF MEETINGS	3
FIRE PROTECTION COMMITTEE	2
SAFETY CULTURE COMMITTEE	1
TOTAL	**77**

Committee meetings continue to be a key force to improve all aspects of our operations, and safety in general.

2.1.3 Review of Quality Assurance and Management System Effectiveness

The SRBT management system is subject to both focused periodic reviews, 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:

- A very low frequency of lost-time injuries or incidents occurring in 2020,
- All workplace injuries were relatively minor in nature,
- Highest worker dose for 2020 is less than 1% of the regulatory limit,
- Maximum calculated public dose remains less than 1% of the regulatory limit for persons who are not nuclear energy workers,
- Continued low ratio of tritium released vs. processed,
- Gaseous tritium oxide releases were less than 15% of authorized limits, while combined oxide and elemental tritium releases were less than 6% of authorized limits,
- Tritium releases via liquid effluent were less than 3% of authorized limits,
- All conditions of our facility operating licence met throughout the year,
- No open CNSC compliance actions as of the end of 2020,
- Continued improvement of several key programs and processes, and
- Continuous registered certification to the latest revision of the ISO 9001 standard.

2.1.4 Audit Summary – Internal

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 are often specifically focused on the safety and control areas established by the CNSC.

The Compliance Manager implemented an audit schedule for 2020 that touched on several aspects of our operations.

A total of nine internal audits were completed, focused in the following areas of our operations:

- Environmental Risk Assessment Process
- Management System
- Engineering Department
- Radiation Safety and Dosimetry Service
- Quality Department
- Environmental Protection (EMP)
- Shipping and Inventory Control
- Health and Safety
- Production Departments

Internal audits resulted in 10 non-conformances (NCR) and 13 opportunities for improvement (OFI) being identified in 2020. Actions have been established and tracked in each case in order to drive compliance and continuous improvement.

2.1.5 Audit Summary – External

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

2.1.5.1 CNSC Inspections (2)

CNSC staff conducted compliance inspections on two occasions in 2020.

In January, CNSC staff conducted an inspection focused on the Human Performance Management SCA (SRBT-2020-01).

As a result of the inspection, three compliance actions and two recommendations were issued [3], which were satisfactorily addressed by SRBT.

In October, CNSC staff conducted a compliance inspection (SRBT-2020-02) focused on the Radiation Protection SCA. This inspection was performed remotely by CNSC staff due to the continued challenges of the COVID-19 pandemic.

No compliance actions or recommendations were issued as a result of this inspection[4].

At the conclusion of 2020, there are no outstanding compliance actions associated with the SRBT operating licence.

2.1.5.2 ISO Certification Audits (1)

On behalf of the International Organization for Standardization (ISO), BSI Management Systems conducted an audit of SRBT operations related to the quality management system on September 10-11, 2020, as part of the maintenance of SRBT's ISO 9001 certification.

No findings were identified through this audit, which was conducted remotely due to the continued challenges of the COVID-19 pandemic.

2.1.5.3 Customer-Led Audits (1)

In October 2020, an external audit was executed by a major customer of our commercial safety signs. The audit was a product-focused quality audit of our facility.

No findings were identified through this audit, which was conducted remotely due to the continued challenges of the COVID-19 pandemic.

2.1.5.4 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 2020, UL performed inspections on February 13 in-person, and on April 1, July 6 and October 13 remotely, with no variation notices being raised through the year.

Out of these four inspections, the last three were conducted remotely due to the continued challenges of the COVID-19 pandemic.

2.1.5.5 Fire Protection Inspections (2)

Two focused facility inspections were conducted relating to fire protection.

The Pembroke Fire Department inspected the facility in October, with no violations being identified.

Professional Loss Control (PLC) Fire Safety Solutions conducted a N393-13 compliant site condition inspection in October. The inspection report showed no new non-conformances and concluded the findings from the previous inspection had been rectified.

Both of these inspections were performed in-person, with all COVID-19 precautions and protocols followed by participants for the duration of the activity.

Details on these inspections can be found in section 4.4, ‘SCA – Emergency Management and Fire Protection’.

2.1.5.6 SRBT Audits of Suppliers, Manufacturers or Service Providers

In 2020, SRBT did not perform an audit of any supplier, manufacturer or service provider.

Two external audits of suppliers located in the United States of America had been scheduled; however, these audits were deferred due to travel restrictions associated with the COVID-19 pandemic.

2.1.6 Benchmarking and Self-assessments

In 2020, 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 similar CNSC licensees is encouraged. Documents describing the performance of similar CNSC licensees are made available for review, including:

- Commission Member Documents
- Proceedings, Including Reasons for Decision
- Documents from other licensees, including annual compliance reports

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.)
- Workplace 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

Both Benchmarking and Self-assessment reports formed key inputs into the annual Management Review meetings conducted over the course of three days between August 28 – September 1, 2020.

The scope of these meetings was to fully and critically review our operations for calendar year 2019, to develop actions to address identified issues and risks, and to take advantage of opportunities for improvement.

The 2020 Management Review cycle is scheduled to be completed in the first calendar quarter of 2021.

2.1.7 Programs and Procedures

2.1.7.1 Programs and Major Licensing Documents

In 2020, several key management system programs and plans were revised in line with SRBT's mission of continuous improvement.

CNSC staff accepted the latest revisions of SRBT's **Fire Protection Program** and **Fire Safety Plan** on January 29, 2020[5]. These documents had been submitted for regulatory review in November 2019.

On February 3, 2020, CNSC staff accepted SRBT's revised **Preliminary Decommissioning Plan** and the associated cost estimate[6]. In response, SRBT proactively increased the funding in our **Financial Guarantee** to match the cost estimate in April.

A decision on the final regulatory acceptance of these changes was rendered by the Commission after the conduct of a public hearing in writing in the fourth calendar quarter. The decision accepting the revised Financial Guarantee amount was published by the Commission on December 8, 2020[7].

On February 27, 2020, SRBT submitted Revision C of the **Regulatory Reporting Program** to CNSC staff[8]. Changes included the removal of the requirement to report the results of the Groundwater Monitoring Program within 30 days of sampling, as well as administrative updates and corrections. The program was accepted by CNSC staff on March 27, 2020[9].

On March 4, 2020, SRBT submitted revised versions of two LCH-listed procedures that had been implemented[10]. **SHP-001,** ***Packing and Shipping – General Requirements,*** and **SHP-005,** ***Document – Dangerous Good Document*** were revised to include minor administrative improvements.

SRBT submitted a revision of our **Groundwater Monitoring Program** to CNSC staff on March 12, 2020[11]. This revision formalized the removal of the requirement to routinely sample the groundwater monitoring wells located on an adjacent property. CNSC staff accepted the revised program document on April 1, 2020[12].

On May 11, 2020, in response to findings stemming from an inspection focused on Human Performance Management, SRBT submitted a revised **Training Program Manual** and **Regulatory Reporting Program** to CNSC staff[13].

These programs were revised to address a gap in our training processes, where an effective Training Needs Analysis tool for assessing skill and knowledge gaps created by changes was needed. This tool was developed and incorporated into several management system processes, including both of these programs.

CNSC staff accepted these program revisions on May 15, 2020 when notifying SRBT of the closure of all compliance action items associated with the inspection[14].

On August 19, 2020, SRBT submitted revised versions of two LCH-listed procedures that had undergone revision[15]. **RSO-009, *Tritium Inventory Management,*** and **RSO-029, *Nuclear Substances Inventory Management*** were revised to incorporate opportunities for improvement identified during an internal audit. The procedures were confirmed as acceptable by CNSC staff on September 14, 2020[16].

SRBT submitted a new **Fire Hazard Assessment** report to CNSC staff on December 11, 2020[17]. This assessment must be conducted and documented at least every five years, as per clause 6.2.3 of CSA Standard N393-13, *Fire protection for facilities that process, handle or store nuclear substances*. The assessment was last performed in 2015.

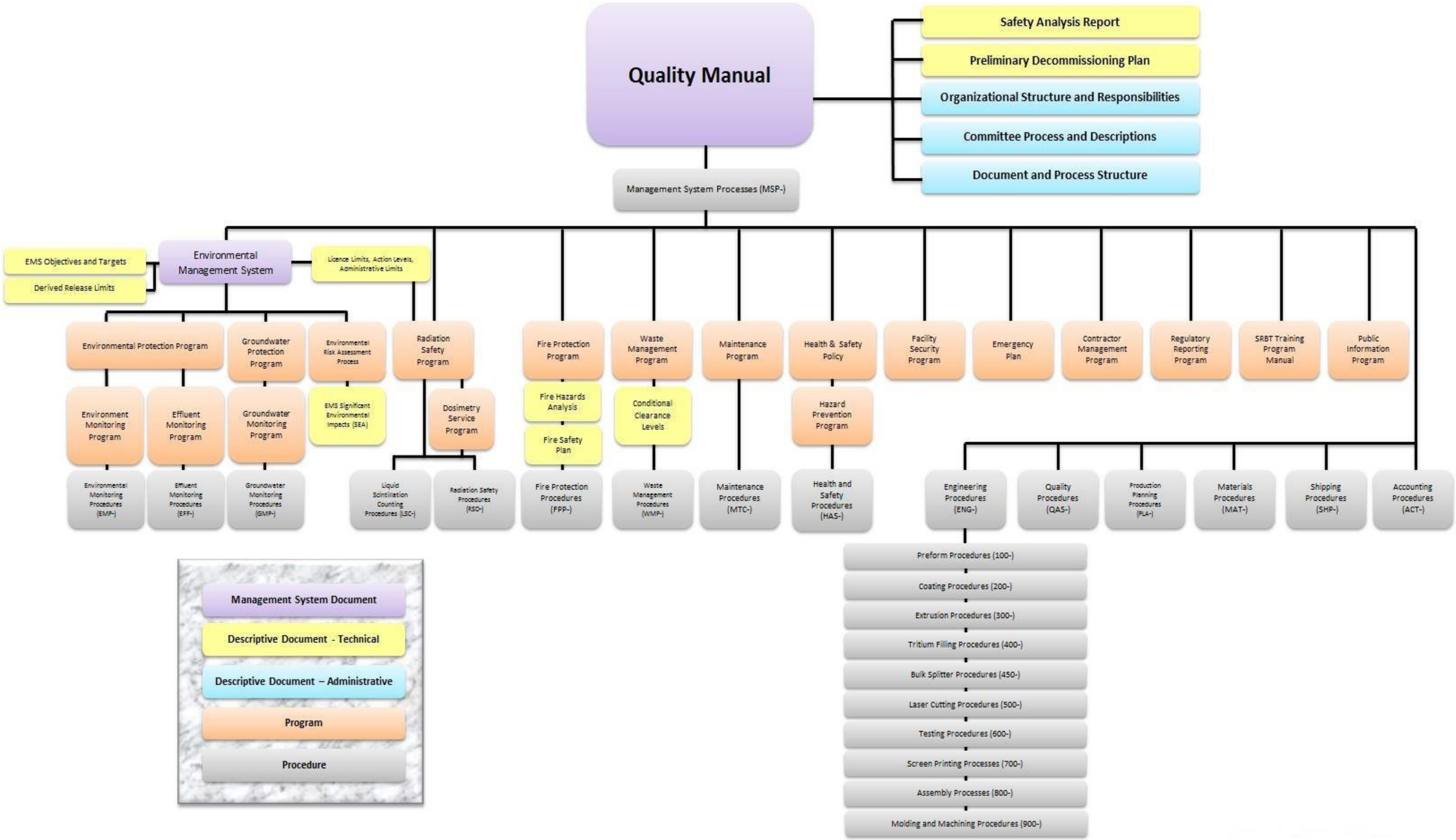
On December 23, 2020, SRBT submitted the first version of our **Environmental Risk Assessment** (ERA) for regulatory review[18]. The ERA was developed in compliance with the requirements of CSA Standard N288.6-12, *Environmental risk assessments for Class I nuclear facilities and uranium mines and mills*.

The development and publication of the ERA was the culmination of a five-year project to fully align SRBT's Environmental Management System with the suite of applicable CSA N288-series standards.

2.1.7.2 SRBT Management System Document Hierarchy

Figure 2 illustrates the Management System document hierarchy in place as of the end of 2020.

FIGURE 2: MANAGEMENT SYSTEM DOCUMENTS



2.1.7.3 Management System Changes

In 2020, a total of 100 Engineering Change requests (ECR) were filed relating to procedural changes in the SRBT management system (compared to 105 in 2019, and 60 in 2018). The breakdown of ECRs filed was as follows:

TABLE 3: PROCEDURAL ECR SUMMARY

PROGRAM / AREA	NUMBER OF ECRs
ENGINEERING	25
CONVENTIONAL HEALTH AND SAFETY	15
PRODUCTION	9
LIQUID SCINTILLATION COUNTING LAB	8
RADIATION SAFETY	8
ENVIRONMENTAL MONITORING AND PROTECTION	7
QUALITY	5
MANAGEMENT SYSTEM	4
WORK PLANNING	4
SHIPPING AND RECEIVING	4
MAINTENANCE	3
FIRE PROTECTION	3
EFFLUENT MONITORING	1
WASTE MANAGEMENT	1
OTHER	3
TOTAL	**100**

Note that where appropriate, one ECR may encompass more than one procedural improvement.

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 well as a dedicated managerial focus on improvement initiatives in each area.

2.2 SCA – Human Performance Management

Throughout the course of 2020, SRBT ensured the programs that manage human performance were implemented effectively, and the interfaces between these programs and other aspects of our management system were maintained and executed. At all times a sufficient number of qualified workers were available to carry out licenced activities in a safe manner, and in accordance regulatory requirements and SRBT safety programs.

In 2020 our staff complement decreased marginally; at the end of the year, SRBT employed a total of 38 staff members, including one seasonal employee. One employee is on parental leave as of the end of 2020. For reference, SRBT employed 42 staff members at the conclusion of 2019.

The average experience of our workforce stands just under 12.5 years, with an average age of just over 42 years old.

The Health Physics Team possesses a combined 123 years of work experience with the company, while production supervisors average just over 21 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.

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	**18.11**	✓	-	-
MACHINING AND MOLDING	**15.50**	-	-	-
GLASS SHOP	**14.25**	-	-	-
RIG ROOM	**10.69**	-	✓	✓
ASSEMBLY	**10.16**	-	-	✓
COATING	**7.17**	-	-	-
SHIPPING	**5.85**	-	-	-
CLEANING	**0.00**	-	-	-

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] and LCH [2] are met.

The Rig Room is the work area where tritium gas is processed into GTLS. The average work experience of the staff within this department is just under 11 years. The Supervisor in this department has over 29 years of experience and performs or oversees 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 29 years of experience and performs or oversees all activities of other staff members.

As a result of COVID 19 restrictions, Senior Management instituted a night shift in order to reduce the amount of staff at the facility which includes the appointment of a second Supervisor in the Assembly Department who has over 21 years of experience.

Of the four employees who left SRBT, one of these individuals elected to vacate their position in consideration of the COVID-19 pandemic, while another was laid off as their position in the organization was no longer required. Due to the implemented COVID-19 protocols, there is no longer a dedicated staff member responsible for cleaning the facility. Instead, all staff are directly responsible for cleaning their areas and offices, and common areas are cleaned by dividing the workload among all staff by assigned work areas.

During an Executive Committee meeting date December 11, 2020, Senior Management noted that starting in 2021, the Compliance Manager will no longer be on the Health Physics Team since the Radiation Protection Technician and the Environmental Protection Technician are now fully trained in their areas.

Fundamentally, the Compliance Manager should be as independent from the rest of the organization as feasible. With the organizational changes implemented to the Health Physics Team in 2019, the need for the Compliance Manager to continue to act as a member of this committee has diminished. Progressively, it is planned that a second member (the Executive Assistant) will also be removed from the Health Physics Team for similar reasons.

The overall performance of the human performance program implemented by SRBT was satisfactory throughout 2020, and several improvements made will serve to continually increase its effectiveness.

2.2.1 Training

2.2.1.1 Annual All-Staff Training Session

Traditionally, 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 typically 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.

The COVID-19 pandemic posed challenges to the way that this training usually is conducted; as a result, in lieu of gathering in a single large group for a full day of training, the decision was made to instead conduct several focused training sessions with limited participants, all of which followed required pandemic safety directions, including the wearing of masks, frequent sanitizing of surfaces, and maintaining adequate distance from others.

This training was conducted in eight small groups of trainees over the course of three days in December, and was focused information with respect to natural radiation exposure, anticipated health effects from radiation exposure, tritium, proper handling of tritium throughout the facility, and equipment for personal radiation protection purposes.

The recent changes to the *Radiation Protection Regulations* were also discussed, and a revised version of SRBT's 'Nuclear Energy Worker (NEW) Declaration' form was signed by all employees to demonstrate that the required new information had been provided to all SRBT NEWs.

All trainees successfully challenged the associated written test for this training. Thirty-five participants averaged a score of 98% on the ten-question multiple choice test, against a performance benchmark of 75%.

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

2.2.1.2 Fire Extinguisher Training

As a consequence of the COVID-19 pandemic, it was decided that the annual fire extinguisher training for all SRBT employees would not be conducted in 2020.

This training typically involves individuals from the Pembroke Fire Department (PFD) coming into the facility and interacting in close contact with SRBT employees, along with the shared use of training aids such as electronic fire extinguishers.

Throughout the pandemic, the PFD has been ensuring that their operational readiness to respond to emergency situations in their area of service remains uncompromised, by limiting their community activities to those deemed essential or safety-critical.

As such, considering the frequency of training that has been in place for several years, and the fact that there are no new SRBT employees currently working full-time in the facility that did not receive this training in 2019, it was determined that based on the balance of risk, cancelling this training for calendar year 2020 was a reasonable and prudent decision.

Considering the positive outlook on the future of the pandemic towards the second half of 2021, it is anticipated that this training will be resumed in the coming year as usual.

2.2.1.3 Fire Protection Specialist Training

The Fire Protection Specialist continues to serve as a volunteer firefighter for a local fire department, and receives fire protection training from this department.

2.2.1.4 TDG Training

Transportation of Dangerous Goods (TDG) training for shipping department staff is scheduled every two years. The training is conducted by an outside agency with expertise in the transport of dangerous goods.

A session was last conducted on February 25, 2019. Seven employees successfully underwent this training at that time, and were TDG-certified. The next training session is slated to be conducted on February 18, 2021.

2.2.1.5 Health and Safety Training

Due to the COVID-19 pandemic, all training conferences that were normally attended yearly were cancelled in 2020.

Online training took place in the areas of both the Canada Labour Code and Health and Safety Committees and Representatives for a committee member.

2.2.2 Systematic Approach to Training Program

SRBT continues to implement a systematic approach to training (SAT) as part of our overall training program, and the Training Committee actively ensures that the processes described in the Training Program Manual are managed effectively and improved on an ongoing basis.

Two meetings of the Training Committee were held in 2020, with the annual program evaluation being held in May, and the annual review of the qualification of SAT-based trainers being conducted in November.

There were eight instances where new or modified activities or equipment were brought to the Training Committee for a categorization decision during the year. Six of these were determined to be eligible for management as Category 1 training activities (non-SAT based), and were assigned to the responsible manager to ensure that training is performed as needed.

Two others were assigned Category 2, resulting in them being included in the scope of the SAT program:

- The tasks of assembly and disassembly/retirement of tritium traps was re-analysed, as part of the inaugural program analysis review in May. It was determined that the original analysis of these activities did not completely consider the potential consequences of a human performance error, and as such, a re-categorization was performed by the Committee. It was determined that these tasks more reasonably fall under Category 2 (SAT-based) training; as such, the SAT process will be applied, and the outputs incorporated into SAT-OP-03, *Handling PUTTs* upon the next revision of those materials.

- A new process subordinate to the Radiation Safety Program was reviewed and declared Category 2 training in December after a preliminary determination was rendered through the application of a Training Needs Analysis (TNA). The new activity involves formalizing the routine daily checks of all tritium-in-air monitors throughout the facility. Initial training on the new procedure was provided to responsible members of the Health Physics Team, and the information is to be incorporated into SAT-HP-01, *Advanced Health Physics Instrumentation* upon the next revision of those materials.

Qualification management processes continue to ensure that SAT-qualified staff members maintain their skills through frequency of performance requirements, and that the qualification of SAT-based trainers continues to be evaluated periodically.

A total of eleven individual workers (spanning all organizational levels) are either fully qualified in their area of responsibility, or are in the process of qualification, in at least one of the eight SAT-based activities developed and implemented.

The following table compiles information on the number of qualified workers assigned tasks that are trained in accordance with a SAT-based method at the end of 2020.

TABLE 5: WORKER QUALIFICATION IN SAT-BASED ACTIVITIES

SAT WORK ACTIVITY	FULLY QUALIFIED WORKERS	WORKERS PROGRESSING TOWARD FULL QUALIFICATION
SAT-HP-01: ADVANCED HEALTH PHYSICS INSTRUMENTATION	3	0
SAT-HP-02: LIQUID EFFLUENT MANAGEMENT AND CONTROL	4	0
SAT-HP-03: WEEKLY STACK MONITORING	4	0
SAT-HP-04: BIOASSAY AND DOSIMETRY	4	0
SAT-OP-01: TRITIUM PROCESSING – FILLING AND SEALING LIGHT SOURCES	5	1
SAT-OP-02: BULK SPLITTER OPERATIONS	4	0
SAT-OP-03: HANDLING PUTTS	4	0
SAT-SHP-01: IMPORT AND EXPORT PROCESSES	4	0

Five SAT-based training exams were administered in 2020 for three work activities, after trainees had been provided with the systematically-developed training modules. Trainees achieved exam scores averaging 96% (vs. a performance benchmark of 75%).

Based on feedback from the CNSC inspection of the Training Program in 2020, there were several improvements implemented as they pertain to the SAT program at SRBT.

The description of the positions that the SRBT SAT program applies to was refined in a new revision to the SRBT Training Program Manual, in order to eliminate confusion as to the scope of the program, and to whom the program applies.

A revamped process for developing and implementing an improved level of refresher training for certain tasks that are infrequent, abnormal or related to an emergency situation was commenced in 2020. Work continues to progress into the first quarter of 2021 as these routine refresher training sessions are implemented where required.

A periodic review of the analysis-phase information for all SAT-based training activities was incorporated into the program, based on a recommendation from CNSC staff.

This global review first took place in 2020, and will be conducted annually going forth, in order to ensure that the information remains correct and valid, and any significant changes in processes or tasks are considered in the context of their impact on the developed training materials.

Finally, a facility-appropriate TNA tool was created and implemented for SRBT management and staff to use, as a complementary component of our overall management system processes.

The tool was used eight times in 2020 since its implementation in mid-June, and has been applied to a varied number of safety and production areas of the facility.

The frequent use of this documented TNA process has been very helpful at ensuring a level of appropriate training is provided to SRBT staff whenever new or modified processes or equipment are considered, or in response to certain safety-related issues or events.

2.3 SCA – Operating Performance

SRBT has continued to operate the facility safely and in compliance with our operating licence throughout 2020.

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.

A summary of compliance with operational limits and conditions can be found under section 1.3 of this report, while a summary of annual production / utilization data can be found in section 1.4 of this report.

A description of the internal and external audits conducted relating to licensed activities can be found under sections 2.1.4 and 2.1.5 of this report.

2.3.1 Ratio of Tritium Released to Processed

In 2020 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 reduction initiatives.

The following table illustrates how this ratio has trended over the past five years.

TABLE 6: TRITIUM RELEASED TO PROCESSED RATIO FIVE-YEAR TREND (2016-2020)

DESCRIPTION	2016	2017	2018	2019	2020
TOTAL TRITIUM RELEASED TO ATMOSPHERE (GBq/YEAR)	28,945	24,822	33,180	31,769	25,186
TRITIUM PROCESSED (GBq/YEAR)	28,122,678	32,968,695	31,251,329	30,327,048	27,887,498
RELEASED / PROCESSED (%)	**0.10**	**0.08**	**0.11**	**0.10**	**0.09**
CHANGE IN RATIO INCREASE (+) / REDUCTION (-)	-50%	-20%	+38%	-9%	-10%

A slight decrease in the ratio of tritium released to processed was observed for the second straight year in 2020.

2.3.2 Objectives and Targets

SRBT performance against key objectives and targets for 2020 is tabled below.

TABLE 7: 2020 PERFORMANCE TARGETS

DESCRIPTION	2020 TARGET	2020 PERFORMANCE
MAXIMUM DOSE TO NUCLEAR ENERGY WORKER	≤ 0.70 mSv	0.43 mSv
AVERAGE DOSE TO NUCLEAR ENERGY WORKER	≤ 0.060 mSv	0.077 mSv
CALCULATED DOSE TO MEMBER OF THE PUBLIC	≤ 0.0040 mSv	0.0024 mSv
WEEKLY AVERAGE TRITIUM RELEASES TO ATMOSPHERE	≤ 650 GBq / week	484 GBq
RATIO OF TRITIUM EMISSIONS VS. PROCESSED	≤ 0.12	0.09%
TOTAL TRITIUM EMISSIONS LIQUID EFFLUENT PATHWAY	≤ 12 GBq	5.56 GBq
ACTION LEVEL EXCEEDANCES ENVIRONMENTAL	≤ 1	0
ACTION LEVEL EXCEEDANCES RADIATION PROTECTION	≤ 1	0
CONTAMINATION CONTROL FACILITY-WIDE PASS RATE	≥ 95%	96.2%
LOST TIME INJURIES	0	0
MINOR INJURIES REPORTABLE TO WSIB	≤ 5	1
MINOR INCIDENTS / FIRST AID INJURIES (NON-REPORTABLE)	≤ 15	16

Targets values are set at the outset of each calendar year by committee. Data is tracked and trended throughout the year in order to ensure that appropriate measures can be taken where appropriate, in an effort to ensure a high level of safety performance.

Where targets are missed, specific actions are documented and tracked to improve performance where feasible; however, in some cases production considerations can result in effects that were not anticipated when the annual targets were set.

The target for average dose to SRBT nuclear energy workers was missed. Review of the data throughout the year ascribed the missed target to the influence associated with an increased rate of processing of expired signs in Zone 1 during the late-2019 to early 2020 timeframe.

The batches of signs that were being processed routinely at that time contained a relatively higher rate of slightly damaged / leaking signs, which ultimately caused a higher than usual level of chronic airborne tritium contamination in the facility, leading to relatively elevated (but still very low) doses to workers. This issue had previously been identified in the 2019 ACR.

Once the problem was fully diagnosed and understood, SRBT put in place corrective measures in the first quarter of 2020, aimed at reducing the associated hazard. These corrective actions proved successful in driving down chronic low doses in workers for the remainder of the year. More details on this issue can be found in the Radiation Protection section of this report.

The target for minor incidents / first aid injuries (non-reportable) was missed by a single incident. The Workplace Health and Safety Committee has left the target at 15 incidents or less for 2021, and are committed to working with staff to achieve this target.

2.3.3 Reportable Events

SRBT did not experience any reportable unplanned events in 2020.

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 2020 was 4,707 TBq, which represents 78.5% of the facility possession limit. The average monthly inventory on site was 3,405 TBq.

Tritium on site is found in:

- Bulk containers 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, and
- Non-conforming product

Refer to **Appendix A** for additional details on tritium inventory in 2020.

2.3.4.2 Depleted Uranium

SRBT possessed a reported 9.523 kg of depleted uranium in metallic form at the beginning of 2020. This material is used for tritium traps as part of the production of gaseous tritium light sources.

As a result of the annual detailed mass assessment in July, the total inventory was adjusted downward by 155 grams.

An analysis of the variation in the mass of material measured by weigh scale versus the inventory values suggests three potential factors influencing the discrepancy:

- Rig Room staff have continued to remove non-uranium when building traps using the material in Container 1.
- Previous measurements performed on Container 2 were done in several smaller batches, which may have increased the uncertainty of the overall measurement. Only two divided measurements of the material in Container 2 were performed this year. The weigh scale limit is 3,000 grams, thus necessitating multiple measurements for this container.
- The scale was calibrated in February 2020, and it was noticed at that time that the unit was not properly levelled. This was condition was corrected.

At the conclusion of 2020, the total mass of depleted uranium on site is listed as 9.368 kg. A limit of 10 kg of this material in inventory is applied as part of the operating limits and conditions in the SAR.

The breakdown of this inventory is as follows:

TABLE 8: DEPLETED URANIUM INVENTORY BREAKDOWN AT THE END OF 2020

QTY	DESCRIPTION	DEPLETED URANIUM IN EACH (GRAMS)	TOTAL DEPLETED URANIUM (GRAMS)
1	LOOSE FORM – CONTAINER 1	N/A	1,660
1	LOOSE FORM – CONTAINER 2	N/A	4,821
9	ACTIVE P.U.T.T.	30 +/- 5 grams	278
23	NON-ACTIVE P.U.T.T.	30 +/- 5 grams	689
6	AMERSHAM CONTAINERS	320	1,920
		TOTAL	**9,368**

2.3.5 Liquid Scintillation Quality Assurance and Control

2.3.5.1 Routine Performance Testing

As a component of SRBT's Dosimetry Services Licence (DSL), Routine Performance Testing (RPT) is performed on both liquid scintillation counters on a quarterly basis, as required in section 4.2.3 of CNSC Regulatory Standard S-106, *Technical and Quality Assurance Requirements for Dosimetry Services* (Rev. 1).

These quality assurance tests are performed to demonstrate that liquid scintillation counting assays in support of the dosimetry service are operated in a predictable and consistent way.

With one exception, this testing was carried out every 3 months as required throughout 2020 on each of the two 'TriCarb 2910' units, with no failures reported.

The scheduled RPT test for the third calendar quarter was inadvertently missed. NCR-815 was raised to document that the test was missed, establish the cause of the event, and ensure that actions are taken to prevent recurrence.

The missed RPT test was discovered when preparing to start the Q4 RPT. A discussion was held by the Health Physics Team to understand why the test was not performed.

The RPT has an associated recurring call-up in the 'Tasks' function of the Manager of Health Physics and Regulatory Affairs' Outlook application. The RPT task for Q3 (which should have been done at the start of July) was inadvertently closed when the annual Tritium Urinalysis Performance Test (TUPT) was completed. The TUPT is usually performed in May, but had been delayed to early July due to the pandemic.

It was established that the responsible manager closed the RPT task by mistake when the TUPT was completed, and therefore the RPT for Q3 was missed.

The event was discussed in detail with the Health Physics Team. This was the first missed RPT test in many years, and the event came about due to highly unusual circumstances.

The Q4 test was completed as scheduled with no issues. This issue was reported in detail to CNSC staff in the 2020 Annual Compliance Report for Dosimetry Services Licence 11341-3-28.2[19].

2.3.5.2 Weekly LSC Performance Check

SRBT quality assurance requirements for liquid scintillation counting include 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. An instrument must meet acceptability criteria on a weekly basis, or the unit is removed from service pending corrective maintenance or actions.

2.3.5.3 Assay Quality Control Tests

NIST-traceable reference standards are prepared in-house, and are analyzed and checked against quality control acceptance criteria with every batch of liquid scintillation counting samples being analyzed.

All tests were performed as required with every assay throughout 2020, in order to ensure quality control of LSC laboratory processes.

3. Facility and Equipment SCAs

3.1 SCA – Safety Analysis

Our operating practices and processes in 2020 have continued to be conducted in full alignment with the latest version of SRBT's Safety Analysis Report (SAR).

There were no changes to the facility or our operations that had any direct bearing on the safety analysis in 2020.

Please refer to section 1.3 of the report for a complete assessment of SRBT compliance against the Operating Limits and Conditions in the SAR.

In summary, the overall safety case for SRBT continues to be effectively validated and maintained by the effective implementation of our management system. Preventive measures and strategies for potential hazards are built in to our programs and processes. Key safety processes include independent verification, frequent internal audit and oversight, and management by designated committees.

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 facility, our licensed activities or our processes will change significantly over the coming years; however, SRBT will continue to manage and improve the SAR in line with our management system processes.

As per the Licence Conditions Handbook (LCH), condition 5.1, compliance verification criterion 2, the SAR is next due for scheduled periodic review in 2022.

3.2 SCA – Physical Design

As a manufacturing company, SRBT owns and operates several pieces of equipment, many of which constitute structures, systems and components (SSC) 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 change control process helps to ensure that modifications are controlled, reviewed, accepted, and recorded using an Engineering Change Request (ECR).

Modifications to structures, systems and components associated with our licensed activities are conducted in accordance with these change control processes and overall management system.

No significant changes in physical design of production- or safety-related facility systems or components took place in 2020. There were no changes to the self-luminous safety light production capacity of the facility.

All minor and non-safety significant modifications to structures, systems and components were conducted in accordance with our change control processes.

Although unrelated to our CNSC-licensed activities or the maintenance of nuclear safety, with the onset of the COVID-19 pandemic, SRBT researched, designed and developed a model of injection-molded face shield for personal protective use.

SRBT was issued Medical Device Establishment Licence 12643 by Health Canada on May 11, 2020[20], authorizing SRBT to market our face shields to persons and organizations who require them.

The manufacture of these items leveraged pre-existing injection molding capacity, and did not require any change to conventional or nuclear safety-significant SSCs.

3.3 SCA – Fitness for Service

All equipment, including all safety-related equipment, is kept in a condition that is fit for service through the implementation of the Maintenance Program. The facility and equipment associated with the facility were effectively maintained and operated within all manufacturer requirements.

Note that, although the Maintenance Program incorporates several program elements associated with nuclear power plants as best practice (such as critical spares, master equipment lists, etc.), aging management is not an element that is formally included as a specific strategy.

In 2020 there were no significant equipment failures that presented a safety concern, demonstrating the effectiveness of the Maintenance Program implemented by SRBT.

Documented maintenance meetings were initiated and held by the Maintenance Committee throughout 2020. As part of management review processes, an annual review of 2020 activities will be conducted in the first quarter of 2021, including data pertaining to equipment failures, maintenance activity success rates, non-conformances, procedural revisions, and audit findings.

Maintenance records are kept on file including completed work orders of preventative maintenance activities. A maintenance schedule is created and managed by the Fire Protection Specialist, which effectively captures all safety-significant planned preventative maintenance activities, whether performed by SRBT personnel or an approved contractor, and includes maintenance inspections as required by the Fire Protection Program.

As well, corrective maintenance was tracked, trended and reviewed to assess the performance of equipment, and to identify any preventative activities which may improve performance.

Preventative maintenance was scheduled and performed in 2020 on key facility equipment as per **Appendix B** of this report.

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 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.

All ventilation systems were maintained fit for service throughout 2020. Corrective and preventative maintenance was identified and performed according to the requirements of the Maintenance Program and operational procedures. Key equipment is maintained either on a quarterly or semi-annually basis, with most equipment maintenance being performed under contract with a fully licensed maintenance and TSSA-certified local heating, ventilation and air conditioning (HVAC) contract provider.

A listing of the ventilation equipment maintained in 2020 can be found in **Appendix C** of this report.

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.

The annual stack flow performance verification was performed on September 23, 2020 by a third party. The inspection confirmed that the stacks continue to perform to design requirements. SRBT continues to monitor and trend the results of the annual stack performance verification.

3.3.3 Liquid Scintillation Counters

The two TriCarb 2910 liquid scintillation counters (LSC) were subjected to an annual preventive maintenance procedure on October 1, 2020. No significant concerns or issues were identified during the maintenance activity.

There were no instances where corrective maintenance was required on either LSC in 2020.

Both systems will continue to be preventively 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 and made available throughout the facility. The portable units are used to investigate potential sources of tritium leakage, and for personnel protection.

In late 2020, a new unit was procured and put into service in order to increase the number of monitors available for use in the facility. As of the end of 2020, SRBT now owns a total of eight portable monitors, as well as an additional unit that is used by our sister company in North Carolina.

Six of these monitors are used at the facility (one in Zone 1, two in Zone 2 and three in Zone 3), a seventh is kept on emergency standby at the Pembroke Fire Hall as part of an emergency preparedness kit, and the eighth unit is kept as a ready spare in the LSC laboratory.

As required by our Radiation Safety Program, all in-service tritium-in-air monitors were calibrated and maintained at least once during 2020, with all records of the maintenance kept on file.

Corrective maintenance of portable monitors was initiated in three cases in 2020:

- SN 4197 was sent to the manufacturer in October to undergo a refurbishment, including pump replacement, as the unit was no longer providing a sufficiently stable air flow when operating.
- SN 4197 and 4870 were sent to the manufacturer in November for repairs, after they were damaged by the use of an incorrect adapter on the shop floor. OFI-507 was raised to document the occurrence and put in place improvement measures to prevent this issue from recurring in the future.

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 continues to be five stationary tritium-in-air monitors deployed for continuous airborne tritium monitoring at the facility, with two spare units available if needed.

The in-service monitors operate 24 hours a day to ensure that any upset conditions are identified and addressed quickly.

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 light sources are 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 preventively maintained at least once during 2020. All facility monitors functioned effectively and continuously throughout the year, with all records of maintenance retained on file.

In 2020, three stationary monitors were returned to the manufacturer for refurbishment. The refurbishment included pump replacement, main circuit board and power supply modernization, and installation of advanced filter housing components.

These corrective maintenance activities marked the conclusion of a successful multi-year project to fully refurbish and upgrade all five SN 2600-series stationary monitors (used at the facility since the 2006-07 timeframe). This project represents a key investment in the reliability and longevity of these important safety-related components.

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,
- An alarming remote display unit (RDU) in Zone 3,
- A bubbler system for discriminately collecting HTO and HT in the sampled stream of effluent,
- A flow measurement device with elapsed time, flow rate and volume of the sampled stream of effluent, and
- A dedicated back-up power supply servicing the monitors, bubbler systems and flow meters, capable of providing several hours of uninterrupted power to the equipment during a power failure.

Each tritium-in-air monitor is connected to real-time recording devices (chart recorders), and was calibrated and preventively maintained as required in 2020.

The chart recorders (analog and digital), tritium monitors and RDUs are included in calibration verification activities on a quarterly basis.

Bubbler systems (and spare systems) were also maintained throughout the year, with a bi-monthly maintenance cycle being implemented on all in-service stack monitoring equipment.

No corrective maintenance was required on any of the components that comprise the stack monitoring equipment.

3.3.7 Stack Monitoring Verification Activities

The annual verification activity for the bubbler systems was performed in February 2020, where independent third-party measurements provided validation that SRBT bubblers continue to effectively measure weekly gaseous tritium emissions (both HTO and HT).

The acceptance criterion for deviation between the assessed measurements of gaseous emissions is +/- 30%. In 2020, all results were well within this acceptance criteria, with SRBT measurements ranging between 97.8% and 122.0% of those obtained by the independent third party.

The next annual inter-comparison test is scheduled for February 2021.

3.3.8 Weather Station

Maintenance of the weather station is performed as per the manufacturer's recommendation, every two years, with batteries being replaced every four years.

Maintenance of the weather station was performed in June 2020. The batteries are scheduled to be replaced in 2021.

Upon downloading weather station data in July, it became apparent that the weather station sensors that determine wind speed and direction had ceased functioning properly.

The SRBT Maintenance Committee has been tasked with diagnosing the problem and performing corrective maintenance, or if need be, instrument replacement.

The weather station is not a safety-related system or component. The data collected is used for modelling the derived release limits, and for analysis of EMP data as required.

Key sensors unrelated to wind speed and direction continue to function as expected. It is expected that the weather station will be returned to full service sometime in 2021.

3.3.9 Air Compressor

Process tasks at SRBT require the use of a compressed air system.

The air compressor is subject to quarterly preventative maintenance activities, and semi-annual belt changes, all of which were carried out throughout 2020. During periods of high usage rates, additional maintenance is performed on the compressor as an extra precaution to ensure ideal performance.

4. Core Control Processes SCAs

4.1 SCA – Radiation Protection

4.1.1 Dosimetry Services

During 2020, SRBT maintained a Dosimetry Service Licence (DSL), 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. SRBT implements a dedicated Dosimetry Service Program in support of compliance with the requirements of this licence.

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 43 individual staff members were included in National Dose Registry (NDR) reports at some point in 2020.

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 2020[21].

SRBT also submitted the 2020 Annual Compliance Report to CNSC Dosimetry Services Specialists for the Dosimetry Service Licence[19].

4.1.2 Staff Radiation Exposures and Trends

In compliance with Dosimetry Service Licence 11341-3-28.1 (replaced by 11341-3-28.2 on July 3, 2020[22]), 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.

Those 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. Those 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 2020.

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* (Rev. 1).

The maximum effective dose received by any person employed by SRBT in 2020 was 0.43 mSv, a value which is well within the regulatory limit for a nuclear energy worker of 50.0 mSv per calendar year.

The average effective dose for all staff was calculated to be 0.077 mSv, while the collective dose for all workers was measured as 3.30 person·mSv (for 43 persons total).

The tables found in **Appendix D** of this report provide the radiological dose data for workers at SRBT for 2020, as well as a comparison of dosimetry results for the preceding five years.

Calendar year 2020 also marked the final year of the latest complete five-year dosimetry period, as defined in the *Radiation Protection Regulations*. The effective dose limit for nuclear energy workers (NEW) during a five-year dosimetry period is 100 mSv.

During the five-year dosimetry period spanning 2016-2020, no SRBT nuclear energy worker exceeded this limit; the highest effective dose for any SRBT NEW during this period was 2.20 mSv.

One SRBT NEW provided written notification of pregnancy on December 10, 2019, and continued working until beginning maternity leave in July. This individual’s effective dose for the balance of her pregnancy was 0.03 mSv, which is well below the regulatory limit of 4 mSv.

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.

Radiation protection-related action levels were last reviewed and revised in 2019, in line with the requirements of the LCH.

The current radiation protection-related action levels are as follows:

TABLE 9: ACTION LEVELS FOR RADIATION PROTECTION

PERSON	PERIOD	ACTION LEVEL
NUCLEAR ENERGY WORKER	CALENDAR QUARTER	1.0 mSv
	1 YEAR	3.0 mSv
	5 YEAR	10.0 mSv
PREGNANT NUCLEAR ENERGY WORKER	BALANCE OF THE PREGNANCY	0.5 mSv

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

In 2020 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 also defined in SRBT's *Licence Limits, Action Levels and Administrative Limits document*.

Radiation protection-related administrative limits are as follows:

TABLE 10: ADMINISTRATIVE LIMITS FOR RADIATION PROTECTION

PERSON	PERIOD	ADMINISTRATIVE LIMIT
NUCLEAR ENERGY WORKER	CALENDAR QUARTER	0.67 mSv
	1 YEAR	2.00 mSv
	5 YEAR	8.50 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 2020 there were no exceedances of an administrative limit for dose or bioassay tritium concentration at SRBT.

4.1.5 Contractor Dose

In 2020, SRBT did not employ contract staff to perform work that presented a significant radiological hazard.

Nine screening bioassay samples were obtained and measured from contracted tradespersons who provided maintenance support in areas other than Zone 1.

None of these samples exceeded our internal screening criteria requiring the calculation of effective dose.

To summarize, no contractor received a recordable dose due to activities performed at our facility in 2020.

4.1.6 Discussion of Significance of Dose Control Data

A tabular summary of effective dose metrics for 2020 is provided in **Appendix D.**

4.1.6.1 Maximum Dose

The maximum effective dose to any staff member in 2020 was 0.43 mSv. This individual works in Zone 3 and performs tritium processing operations in Zone 3 as their primary duty.

In 2019, the maximum dose to a staff member was 0.57 mSv; the 2020 value represents a 25% decrease in the maximum dose to a worker from 2019.

The variance in maximum dose is within expected operational variance given the activities conducted during the year.

A maximum dose of 0.43 mSv represents the achievement of our internal target for 2020 of less than 0.70 mSv. This 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.

This also marks the sixth consecutive year where no SRBT worker received an effective dose in excess of 1 mSv, despite a consistently high rate of production throughput.

The maximum individual dose for the current five-year dosimetry period (January 1, 2016 – December 31, 2020) is 2.20 mSv.

SRBT continuously strives to lower the maximum dose to workers by using several strategies, including training, ensuring that no one worker exclusively performs dose-intensive activities, frequent and routine use of portable tritium in air monitors during processing operations, and the continuous oversight of the Health Physics Team during key activities on the shop floor.

In 2020, the maximum dose to an employee working primarily in Zone 2 was 0.14 mSv (a decrease versus the 2019 value of 0.27 mSv), while for Zone 1 staff the maximum dose was 0.10 mSv (versus 0.09 mSv in 2019).

The maximum worker dose over the past ten years is trended in Figure 3 for comparison, as well as a distribution chart in Figure 4 for worker doses in 2020:

FIGURE 3: MAXIMUM ANNUAL WORKER DOSE TREND

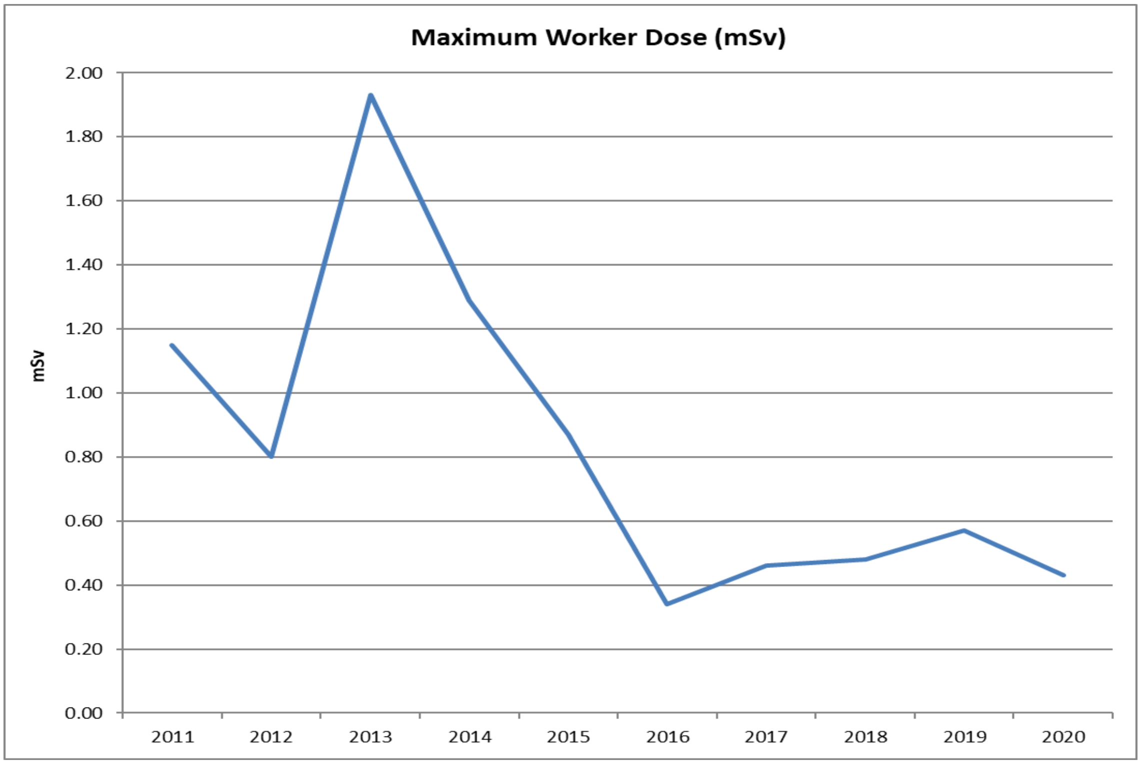
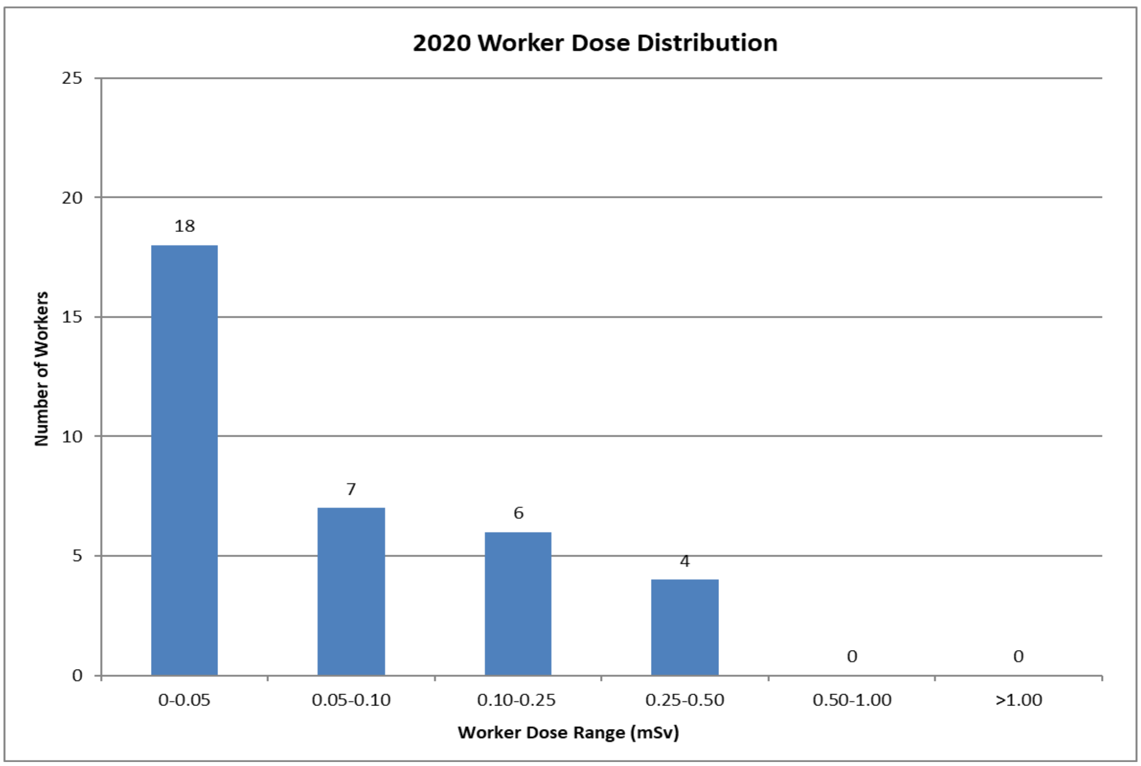


FIGURE 4: WORKER DOSE DISTRIBUTION



4.1.6.2 Average Dose

The average dose to workers at SRBT in 2020, including those workers whose dose value was zero, was 0.077 mSv.

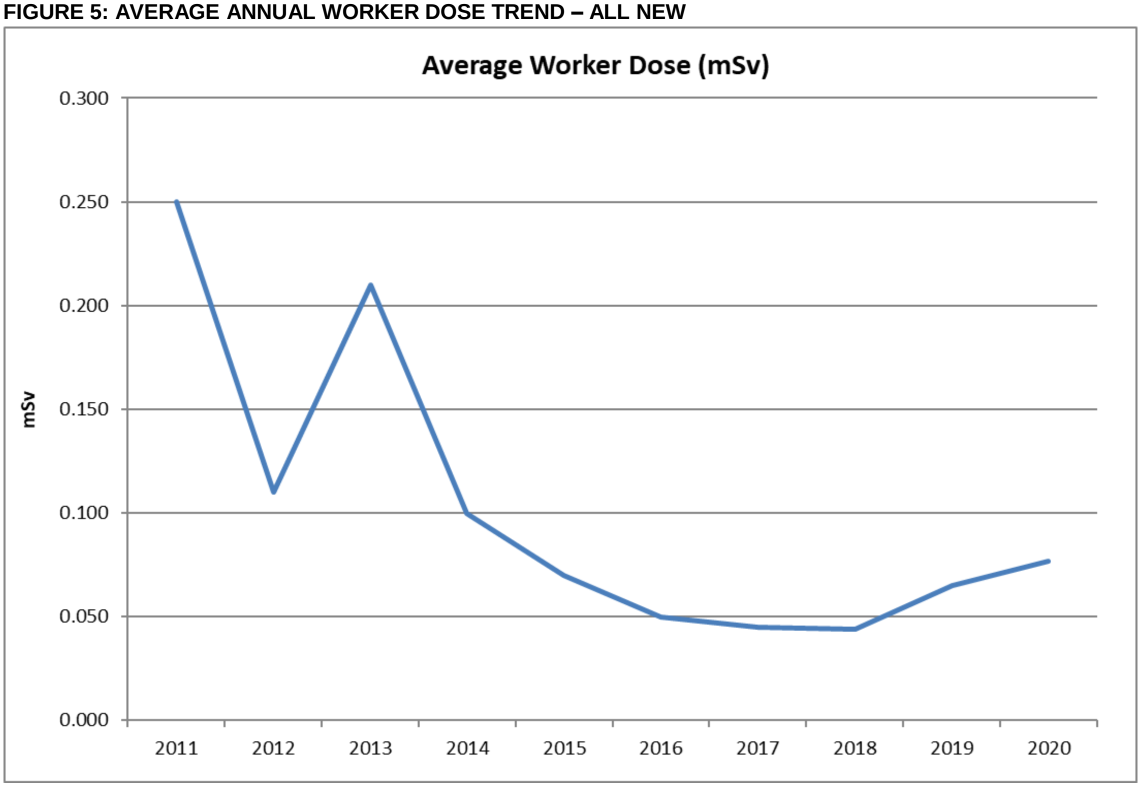
In 2019, this average was 0.065 mSv, thus the 2020 data represents an increase in the average dose to staff, for the second year in succession.

One key factor significantly influenced the average dose increase in 2019 and 2020. SRBT experienced an increase in the rate of expired sign processing beginning in September 2019, and running over the course of several months and into 2020.

Improvement actions were taken to lower chronic exposures associated with this work through Q1 2020, with good success.

The average dose to all workers at SRBT over the past ten years is trended in Figure 5 for comparison:

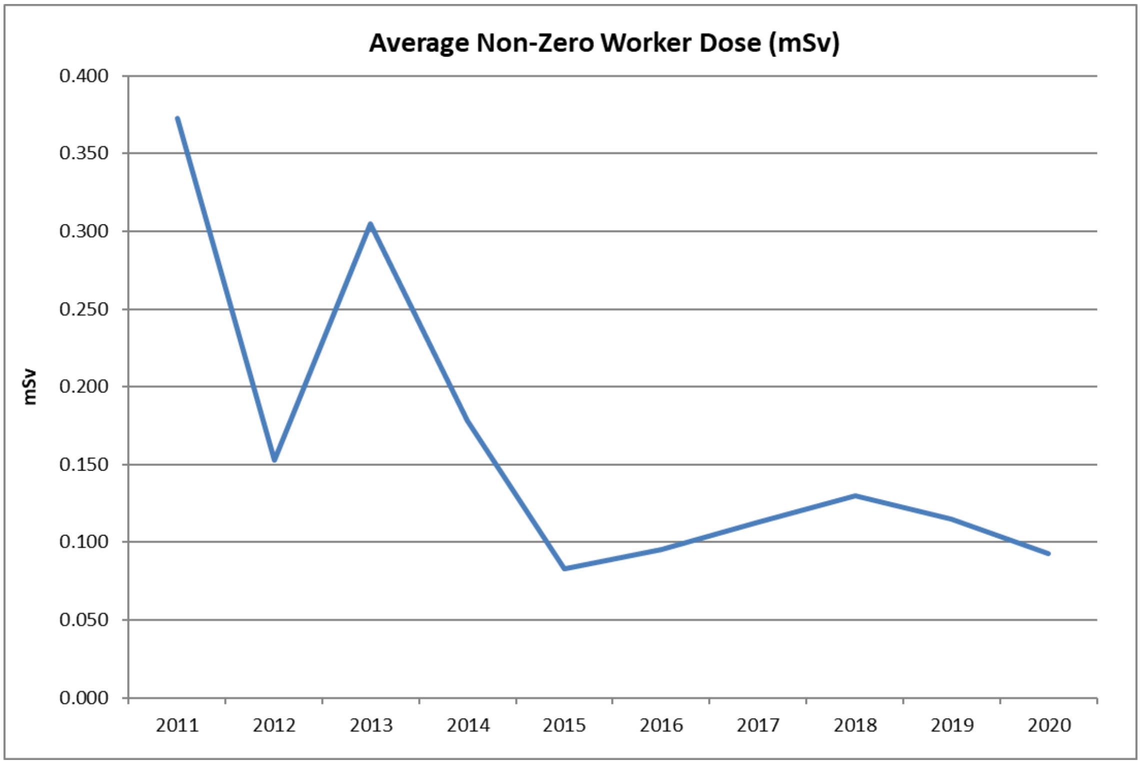
FIGURE 5: AVERAGE ANNUAL WORKER DOSE TREND – ALL NEW



Excluding the eight NEWs that incurred effective doses of less than 0.01 mSv (i.e., only taking into consideration 'non-zero' doses), the average effective dose was 0.093 mSv in 2020.

The average dose to all workers at SRBT incurring 'non-zero' doses over the past ten years is trended in Figure 6 for comparison:

FIGURE 6: AVERAGE ANNUAL WORKER DOSE TREND – NON-ZERO DOSES



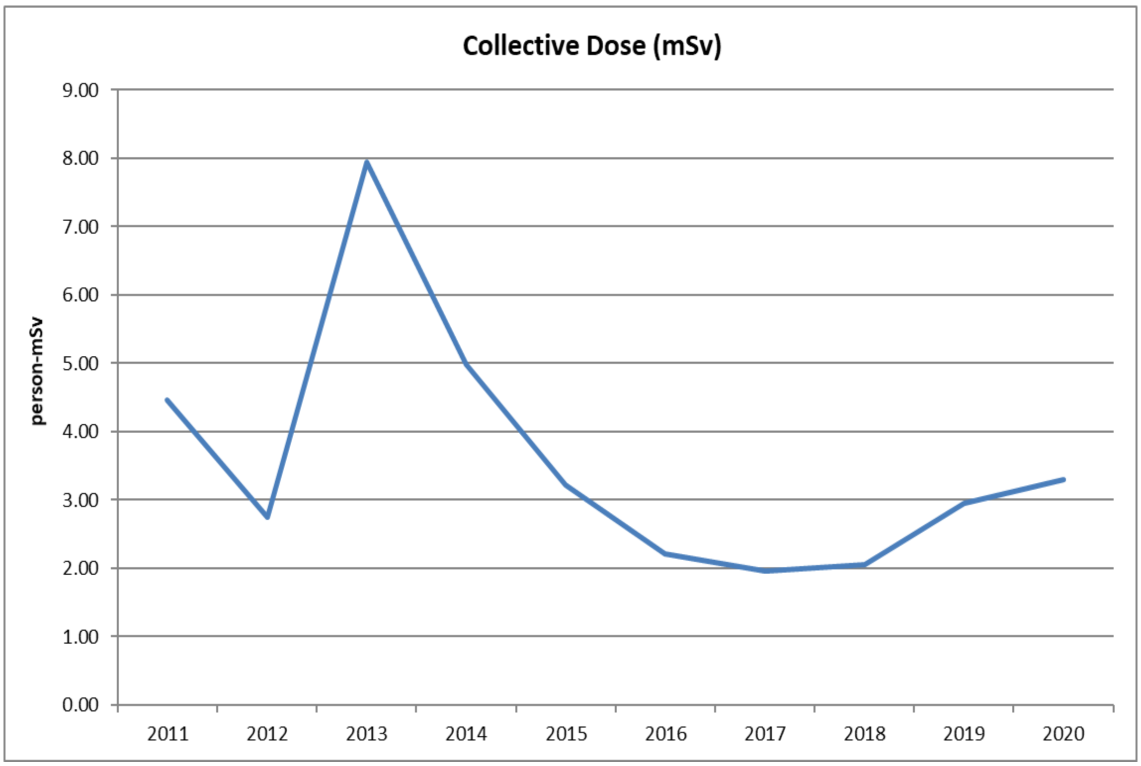
4.1.6.3 Collective Dose

The collective dose to all workers at SRBT in 2020 was 3.30 person·mSv. In 2019, the collective dose was 2.95 person·mSv. The annual collective dose for SRBT workers increased by about 12%.

One key factor significantly influenced the collective dose increase in 2020. An increase in the rate of expired sign processing began in September 2019, and continued into the first quarter of 2020. Actions were taken to reduce the radiological impact of this condition; the subsequent improvement actions taken to lower chronic exposures associated with this work were effective through the rest of 2020.

The collective dose to all workers at SRBT over the past ten years is trended in Figure 7 for comparison:

FIGURE 7: COLLECTIVE DOSE TREND



4.1.6.4 Dose to Members of the Public

The effective dose to members of the public is discussed extensively in section 4.3.5 of this report.

4.1.7 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 11: 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 contamination monitoring results for 2020 has been tabulated and is included in **Appendix E** of this report. A total of 8,256 assessments were performed in various work areas in 2020.

A total of 612 swipes were taken in Zone 1 resulting in a pass rate of 96.41% of assessments being measured below the administrative level of 4 Bq/cm^2.

A total of 1,764 swipes were taken in Zone 2 resulting in a pass rate of 96.71% of assessments being measured below the administrative level of 4 Bq/cm^2.

A total of 5,880 swipes were taken in Zone 3 resulting in a pass rate of 96.05% of assessments being measured 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 the last five years is presented:

TABLE 12: PASS RATE FOR CONTAMINATION ASSESSMENTS

ZONE	2016	2017	2018	2019	2020
1	98.4%	98.7%	97.0%	96.5%	96.4%
2	94.7%	97.1%	93.2%	93.1%	96.7%
3	91.3%	95.2%	94.9%	93.5%	96.1%

Overall, routine contamination measurements conducted throughout the facility in 2020 fell below the administrative limits 96.22% of the time, achieving the internal target of ≥ 95% by a margin of 1.22%.

This marks the first year since 2017 where the surface contamination target of >95% pass rate has been achieved. A dedicated focus was promoted across the organization in 2020 by the Health Physics Team, in order to drive improvements in the levels of removable surface contamination throughout the facility.

The Health Physics Team continues to track and trend all facility contamination control data throughout the year, with a focused quarterly review to identify areas for improvement.

With respect to the monitoring of airborne tritium contamination throughout the facility, SRBT's Radiation Safety Program includes several processes that measure and control airborne tritium hazards in our facility:

- Stationary tritium-in-air monitors are strategically located throughout the facility, with audible alarms triggered at conservative tritium concentrations.
- All staff are trained in the use of portable tritium-in-air monitors for self-protection purposes; these are also strategically located in the facility for quick use when needed.
- A series of passive air samplers are distributed throughout the facility, allowing for weekly averaging of tritium concentrations in key areas.
- The Health Physics Team logs all stationary tritium-in-air monitor alarm events, in order to track and trend frequency of occurrence, to facilitate radiological assessments and/or investigations, and to drive improvements in process safety.

Zone alarm cause / frequency and passive air sampling data is routinely assessed by the Health Physics Team in order to identify any areas of concerns or trends.

The frequency of zone alarms decreased slightly in 2020 when compared with 2019. A total of 118 recorded alarm conditions for stationary tritium-in-air alarms occurred in 2020; a total of 135 such occurrences took place in 2019.

This decrease is partially attributed to a successful campaign of refurbishment of all stationary tritium in air monitors in the 2000-serial number range. Most of these units have been owned and operated by SRBT since 2006-07. Each of these five instruments were sent to the manufacturer to undergo a process of refurbishment of older components, beginning in 2019. The result has been a significant reduction in false alarms since refurbishment.

As was noted in the 2019 annual compliance report, the average level of chronic, low-level airborne tritium in the facility increased in the second half of 2019, a phenomenon which correlates with the increase in the average and collective dose of workers at SRBT during the year.

The handling of certain light sources which present manufacturing challenges, coupled with a higher volume of expired sign returns beginning in September 2019 resulted in a measured impact on the magnitude of low-level, chronic airborne contamination levels in the facility.

The concentration of airborne tritium contamination is so low as to not effectively be measured by stationary monitors; however, the contamination is effectively detected over time by the facility passive air samplers. The data from the samplers is not instantaneous – the data is retroactive, and is available only after the sample has been analysed.

This condition persisted into the first few weeks of 2020; however, the Health Physics Team assessed the situation during the December 2019 – January 2020 timeframe, and implemented several improvement measures to lessen the amount of chronic, low-level airborne tritium concentration throughout the facility.

As a result, although the average worker dose in Q1 2020 remained significantly higher than recent norms, once the improvement initiatives were fully implemented, the doses for the remaining part of the year fell back down to historical norms.

Table 13 demonstrates the average quarterly tritium concentration in several key areas of the facility over the past two years, as measured by the passive air sampler at that location.

TABLE 13: AVERAGE WEEKLY PAS CONCENTRATIONS

AREA DESCRIPTION	AVERAGE WEEKLY CONCENTRATION - TRITIUM IN AIR (Bq/m^3)							
	2019				2020			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Disassembly Area	626	1163	1188	3964	3422	953	3023	1447
Hallway at Assembly Door	717	361	452	509	2359	686	989	585
Expired Sign Storage Area	549	666	1108	1474	5145	611	285	276
Area Near Receiving Counter	167	140	823	826	2902	322	441	392

This phenomenon is also illustrated in the following table of average quarterly effective doses to SRBT NEWs for the past two years.

TABLE 14: AVERAGE SRBT NEW QUARTERLY EFFECTIVE DOSES (μSv)

QUARTER	2019-Q1	2019-Q2	2019-Q3	2019-Q4	2020-Q1	2020-Q2	2020-Q3	2020-Q4
AVG (μSv)	11.3	13.9	19.3	25.6	33.7	15.2	17.2	17.2

Going forward, the expectation is that the average effective dose to SRBT NEWs, and by extension, the collective dose, should trend downward in calendar year 2021.

4.1.8 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.

Key points:

- Highest worker dose for 2020 of 0.43 mSv, or 0.86% of the regulatory limit of 50 mSv, and was for the sixth consecutive year where all NEWs incurred less than 1 mSv (representing the regulatory limit for a person who is not a nuclear energy worker).
- Collective dose and average dose remain low in relation to production levels, although both of these data points were slightly elevated compared to the previous year. The cause of these increases is understood, and improvement measures have been effective at helping to reverse this trend.
- Contamination control data demonstrates a high level of control and a low rate of contamination in excess of administrative limits. The internal target of a pass-rate of 95% or greater was achieved for the first time since 2017.
- There were no personnel contamination events at the facility in 2020.
- Radiation protection equipment issues are minimal, with a continuing investment in new equipment leading to 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.

4.1.9 Occupational Dose Targets

As described in the 2019 annual compliance report, the occupational dose targets for 2020 were set as 0.70 mSv (maximum dose to staff member) and 0.060 mSv (average dose to all staff).

The maximum dose to any worker was 0.43 mSv (target met), while the average dose to all workers was 0.077 mSv (target missed). There were no action level exceedances.

The causes of the trends observed in 2019-20 have been investigated and are understood, and actions have been taken to improve performance in this area; however, it is important to acknowledge that the radiation protection-related dose metrics for the SRBT facility remain exceedingly low for a facility of our class.

SRBT projects that in 2021, the maximum dose to a worker should remain low and relatively stable, while the average dose to workers is expected to decrease with the implementation of improvement actions in 2020. Trends already suggest that these improvements have been effective.

With these considerations, the targets for calendar year 2021 have been set as follows:

- Maximum dose: ≤ 0.60 mSv (decrease of 0.10 mSv)
- Average dose: ≤ 0.060 mSv (no change)
- Action level exceedances: No more than 1 instance (no change)

4.1.10 Summary of Radiation Protection Training and Effectiveness

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

In 2020, one new employee was hired and was provided with this initial training that is required for declaration as a nuclear energy worker. This individual passed the associated test and was assigned to perform tasks primarily in Zone 2 in 2020.

Over the course of three days in December, 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. Open dialogue is always encouraged with a question-and-answer session, and a closed-book written test is provided to all participants.

This year, due to the ongoing COVID-19 pandemic, the annual training was conducted in several smaller groups, limited to no more than five individuals maintaining physical distance, and wearing masks in a sanitized environment. A total of eight such sessions were conducted over the course of three days.

A test is administered at the conclusion of the course; in 2020, all thirty-five participants successfully challenged the test, averaging a score of 98% on the ten-question multiple choice test, against a performance benchmark of 75%. Any incorrect answer on the test was discussed in detail with each employee individually to ensure full understanding following the completion of the training.

As well, this year's training included a summary discussion of the pertinent amendments made to the *Radiation Protection Regulations* in 2020, including (but not limited to) the considerations pertaining to breastfeeding NEWs, and the specific requirements for all employees during the declaration of an emergency.

Each SRBT employee completed an updated declaration form for their status as a NEW, and were provided with a copy of that declaration signed by both the individual and a management-level member of the Health Physics Team.

4.1.11 Summary of Radiation Protection Equipment Performance

In 2020, all equipment associated with radiation protection at SRBT performed acceptably, and all key maintenance activities, such as instrument calibration, were performed as required.

Radiation protection equipment includes liquid scintillation counters, portable tritium in air monitors, stationary tritium in air monitors and portable radiation detectors (‘RadEye’ type alpha/beta/gamma detectors).

There were no instances of corrective maintenance required for the liquid scintillation counters. There were several instances where stationary and portable tritium-in-air monitors were sent to the manufacturer either for refurbishment or for corrective maintenance.

The rate of the need for corrective maintenance on all radiation protection equipment remains acceptable, and SRBT owns and maintains spare instruments that remain ready to be put into service should the need arise.

4.1.12 Summary of Radiation Protection Improvements

In 2020, the following improvements were implemented with respect to the Radiation Safety Program at SRBT:

- An improved process of receiving and assessing pallets of expired tritium safety signs from customers was implemented in early 2020. These improved survey methods were aimed at reducing the level of chronic airborne contamination in the facility over time. The data through the year clearly shows that these improvement initiatives have been effective at achieving this goal.
- Six procedures (including associated forms) in the RSO- procedure set were reviewed and revised in 2020, in order to incorporate improvement opportunities or to address audit findings:
    - **RSO-009, *Tritium Inventory Management***, and **RSO-029, *Nuclear Substances Inventory Management*** were both revised to incorporate administrative improvements, and submitted to CNSC staff for review and acceptance on August 18, 2020, as these documents are listed in the SRBT LCH as requiring written notification when changes are implemented. As well, form RSO-029-F-03 was revised in February to incorporate a table itemizing the amount of depleted uranium in each active tritium trap being used for tritium processing.
    - **RSO-011, *Instrument Calibration*** was revised in December, to amend the names of certain forms associated with this procedure. The forms were also revised to improve their function and layout. Other minor improvements and corrections were also made.
    - **RSO-020, *Betalight Leak Testing*** was revised in February in order to formally incorporate the use of a 'quick screen' test for certain types of light sources. The aim of this improvement is to reduce the amount of tritium-contaminated water generated by the process of leak-testing over time.
    - **RSO-030, *Inventory Control of Time Expired Product*** was revised in August, to incorporate administrative improvements as a result of an internal audit.
    - **RSO-040, *Facility Passive Air Sampling*** was revised in December after an internal audit, to include a description of the use of a certain form that is associated with this procedure, but was not previously referenced in the procedure formally.

- A new procedure was implemented to formalize routine, daily instrument checks throughout the facility. RSO-042, *Routine Tritium-in-air Monitor Checks* sets out the requirements and methods for daily checks of these instruments, and the conduct of these checks is recorded on an associated form. This procedure was implemented in October.
- Advanced, supplemental training on the effective use of portable tritium-in-air monitors was provided to a subset of employees who most often use these instruments. The training was well received by all who participated. As well, information posters on the use of these instruments were posted in areas where the monitors are frequently used, as an aide-memoire for all staff.
- Three more stationary tritium-in-air monitors (model 357RM) were refurbished by the original manufacturer in 2020. This included the installation of new main circuit boards, transformers, pumps, filter assemblies and cables. At the conclusion of 2020, all five 357RM instruments of this vintage have been refurbished and returned to service. The refurbishment work will significantly extend the life and reliability of each unit, and improve monitoring throughout the facility.

Overall, SRBT's Radiation Safety Program continues to provide an effective level of radiological protection to our workers, and continues to be improved over time.

Looking forward, in 2021, the Health Physics Team composition is planned to be adjusted, with the removal of the Compliance Manager from its membership.

Fundamentally, the organizational position of Compliance Manager should be as independent from the rest of the organization as feasible.

With the organizational changes implemented to the Health Physics Team in 2019, the need for the Compliance Manager to continue to act as a member of this committee has diminished.

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 Conventional Health and Safety Program

Being under federal jurisdiction in 2020, the Health and Safety Policy for the SRBT facility was compliant with the requirements of the CLC Part II, and the Canada Occupational Health and Safety Regulations.

4.2.3 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 9 times in 2020, with all meeting minutes kept on file.

4.2.4 Minor Incidents

There were 16 minor incidents reported in 2020 where an employee required first aid treatment; of these, one incident resulted in medical care being sought at the local hospital as a precautionary measure. This is a marked decrease from the 22 minor incidents reported in 2019.

A breakdown of the type of minor injuries occurring in 2020 is provided:

- Minor Cuts – 12
- Burns (flame) – 1
- Slip / Fall – 1
- Back injury - 1
- Pinched finger - 1

One injury requiring a hospital visit was reported to the Workplace Safety Insurance Board as required. An individual incurred a laceration injury to one of their hands which required medical attention, and was back at work for their next scheduled shift.

4.2.5 Lost Time Incidents

In 2020, no lost time incidents (LTI) occurred. The following table summarizes the frequency of occurrence of LTIs over the past five years:

TABLE 15: LOST TIME INCIDENTS FIVE-YEAR TREND (2016-2020)

DESCRIPTION	2016	2017	2018	2019	2020
LOST TIME INCIDENTS	0	3	0	0	0

SRBT's continuing goal is to have zero LTIs each year; the fact that this goal was achieved in 2020 speaks to the effectiveness of our conventional safety program.

4.2.6 Health and Safety Performance Targets

SRBT sets programmatic targets that are tracked by responsible safety committees throughout the year. Actions are taken that are intended to help the organization reach safety goals / objectives / targets, as well as when they may be missed.

In 2020, SRBT set the following targets for the area of Conventional Health and Safety:

- Zero lost time incidents (experienced zero – goal achieved)
- Less than or equal to 5 minor injuries reportable to Workplace Safety and Insurance Board (WSIB) (experienced one – goal achieved)
- No more than 15 minor incidents (16 were recorded – goal missed)

These three conventional health and safety targets remain unchanged for 2021.

4.2.7 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 Employment and Social Development Canada (ESDC) prior to March 1, 2020, as required.

In accordance with Section 9 of the Policy Committees, Work Place Committees and Health and Safety Representatives Regulations, the Work Place Committee Report was submitted to the Regional Safety Officer at Canada Labour prior to March 1, 2020, as required.

4.2.8 Health and Safety Training

Due to the COVID-19 pandemic, all training conferences that were normally attended yearly were cancelled in 2020.

Online training took place in the areas of both the Canada Labour Code and Health and Safety Committees and Representatives for a committee member.

4.2.9 Health and Safety Initiatives and Improvements

In 2020, several health and safety initiatives were implemented, and numerous improvements were put in place. Significant initiatives and improvements include:

- Four new health and safety procedures were created. One is in review pending final approval.
- The SRBT Hazard Prevention Program was fully reviewed and updated in 2020. Final approval is pending.
- The SRBT Health and Wellness Policy was revised to include COVID-19 safety practices.
- The SRBT Harassment Policy was revised, and is now titled the SRBT Workplace Harassment and Violence Prevention Policy, to ensure compliance with the *Workplace Harassment and Violence Prevention Regulations.*

4.3 SCA – Environmental Protection

This section of the report will provide environmental protection compliance information, 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 SRBT's overall Environmental Protection Program, and as an input into the design of the environmental, effluent and groundwater monitoring programs, a conceptual site model (CSM) can provide a valuable representation of the factors and elements that are considered for monitoring within the boundaries of the program.

SRBT has been in operation since 1990, and has performed extensive monitoring of effluent, the environment and groundwater over the course of operations since then. In 2007, a comprehensive analysis was performed of the operations of the facility (including historical practices) in order to identify the sources of tritium that could affect the environment and the groundwater.

As well, in 2008 the significant environmental aspects of facility operation were initially established, and have been reviewed periodically since then in order to identify if there are other processes or operations that have been introduced that could lead to an impact on the environment.

These analyses, coupled with decades of operational experience, leads to the establishment of a simplified CSM that shows the significant pathways and environmental interactions pertaining to the release of the sole radiological contaminant of potential concern – tritium.

A pictographic representation of these source – receptor pathways is provided below in Figure 8, and should be consulted when considering the information provided in the next three subsections of this report.

On December 23, 2020, SRBT submitted the first version of our Environmental Risk Assessment (ERA) for regulatory review[18]. The ERA was developed in compliance with the requirements of CSA Standard N288.6-12, *Environmental risk assessments for Class I nuclear facilities and uranium mines and mills*. The development and publication of the ERA was the culmination of a five-year project to fully align SRBT's Environmental Management System with the suite of applicable CSA N288-series standards.

Human and ecological conceptual models of tritium interactions with the environment near the site are described within the ERA, and are included in Figures 9, 10, 11 and 12. Species included are conservatively representative of the local flora and fauna.

FIGURE 8: CONCEPTUAL SITE MODEL

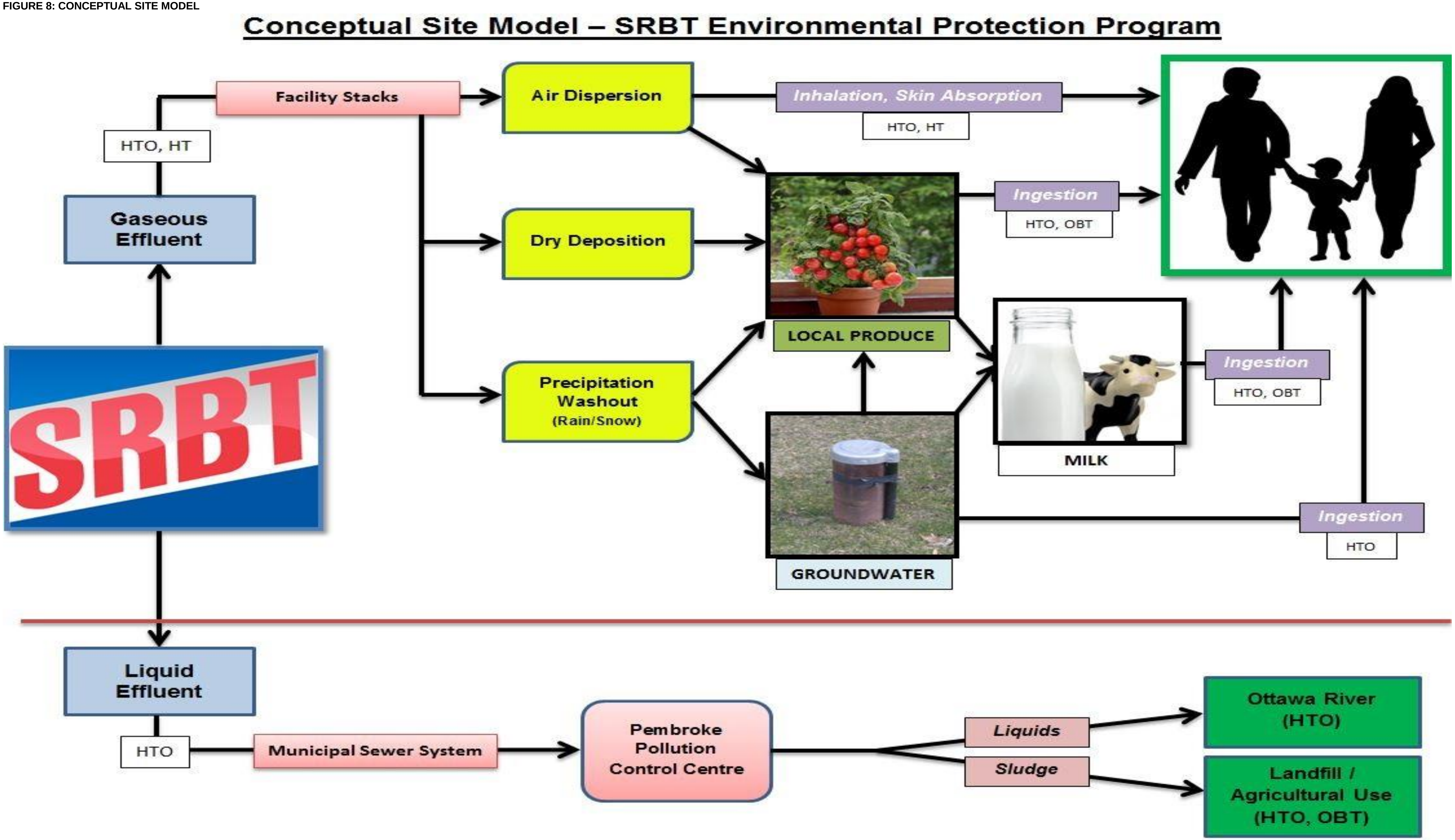


FIGURE 9: HUMAN EXPOSURE PATHWAYS (HTO/T2, GASEOUS SOURCES)

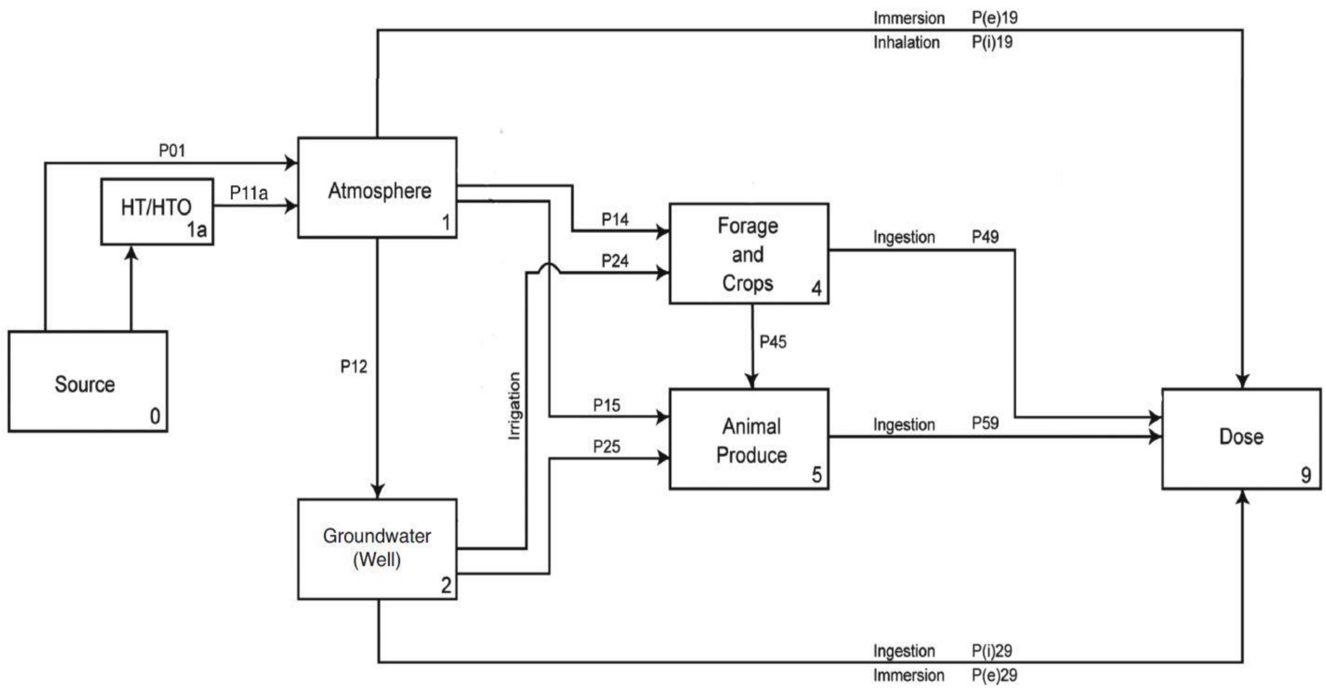


FIGURE 10: HUMAN EXPOSURE PATHWAYS (HTO/T2, LIQUID SOURCES)

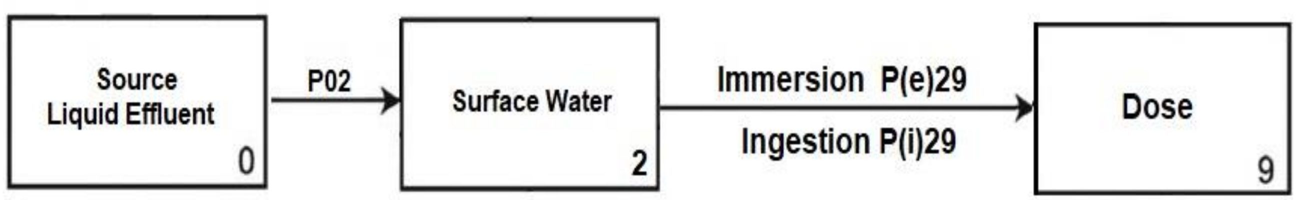


FIGURE 11: CONCEPTUAL ECOLOGICAL MODEL - TERRESTRIAL

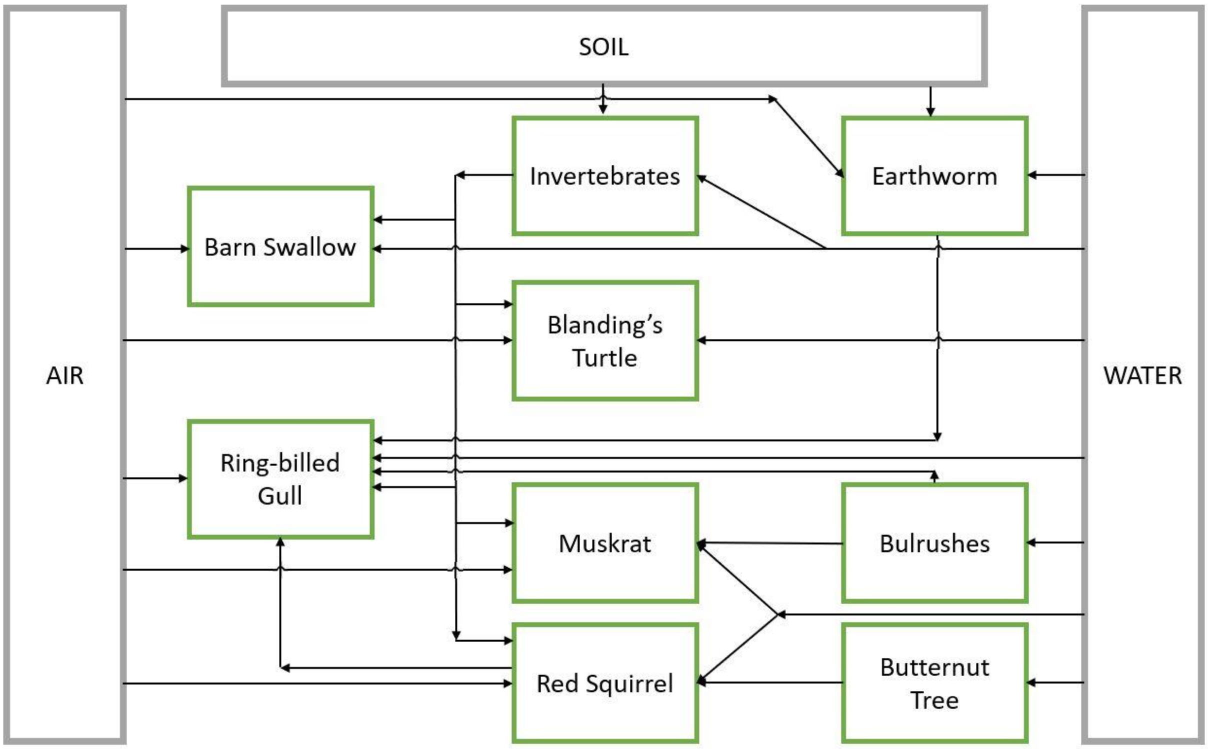
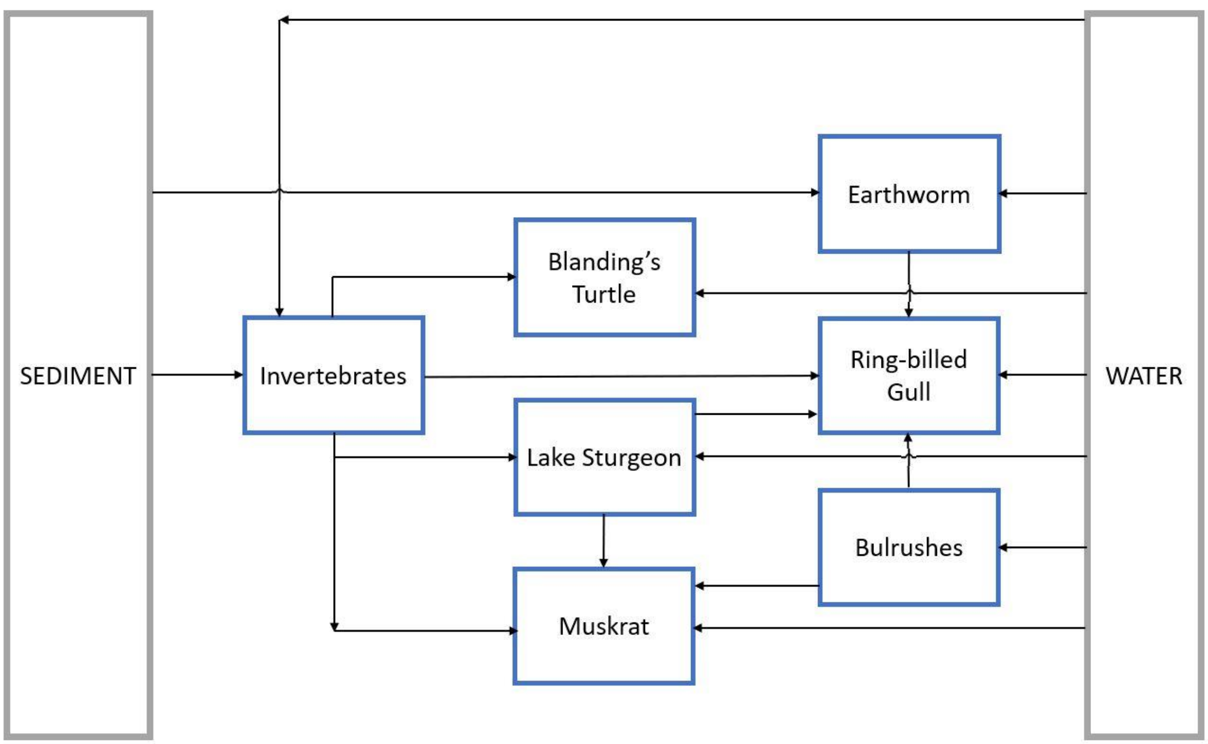


FIGURE 12: CONCEPTUAL ECOLOGICAL MODEL – AQUATIC / RIPARIAN



As part of ensuring compliance with the reporting requirements of several N288-series of standards, 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 our annual compliance report.

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 16: 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.	4.3.1.10 4.3.1.11
b	A summary and assessment of the field and laboratory QA/QC results including any non-conformances.	4.3.1.12
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.	4.3.1.13

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 17: 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 Action levels and other targets: 4.3.2.2, 4.3.2.4 and 4.3.2.5 **Appendices P and Q**
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.	4.3.2.6
e	A statement of uncertainties inherent in the monitoring results and any dose estimates derived from them.	4.3.2.7 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.	4.3.2.8

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 18: 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 O**
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).	Not applicable: GMP data does not contribute to dose calculations (residential wells fall within scope of EMP)
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) that provides data for site-specific determination of tritium concentrations along the various pathways of exposure to the public due to the activities of the operations.

4.3.1.1 Passive Air Monitoring

A total of 40 passive air samplers (PAS) are deployed in the environment near the SRBT facility. Thirty-five of these a located within a two-kilometer radius from the SRBT facility, in eight sectors, ranging in stepped distance of 250, 500, 1,000, and (in four sectors) 2,000 meters. The remaining five samplers are much further distant, and are intended to assess areas not expected to be impacted by routine SRBT processing operations.

Historically, the samples have been collected and analyzed on a monthly basis by a qualified third party laboratory, with a reported minimum detectable activity (MDA) ranging between 0.28 - 0.35 Bq/m^3.

Beginning with the March 2020 sample set, SRBT began performing all EMP PAS sampling and analysis in-house. This was required as the third party was not readily able to provide this service due to the onset of the COVID-19 pandemic. Since then, SRBT has continued to perform this activity with acceptable quality control and performance.

Typically, SRBT's analysis of these samples results in an MDA of between 0.68 – 0.84 Bq/m^3, a value which both acceptably identifies any significant air concentrations over time in the environment, and provides the resolution needed to determine the level of risk to the public and the environment in comparison to regulatory requirements.

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.

EMP PAS results for 2020 can be found in the table in **Appendix F** of this report. The table shows the average tritium oxide (HTO) concentrations for the samplers located in each of the eight compass sectors for the given sampling period.

Average tritium oxide in air concentrations for each month of 2020 are graphically represented for each of eight compass sectors, and for each sampled distance from the facility, in **Appendix G** of this report.

The PAS array represents the tritium exposure pathways for inhalation and skin absorption; results are used in the calculations for critical group annual estimated dose for 2020.

The sum of the average concentration for the passive air samplers in 2020 was 85.15 Bq/m^3, a value that is clearly elevated when compared with the value observed in 2019 (48.42 Bq/m^3). The cause of this increase is understood and expected.

Beginning with the March sample set, the monthly sum total of all PAS results has been significantly higher due to the way that samples that are less than the MDA have historically been accounted for in the calculation of this statistic.

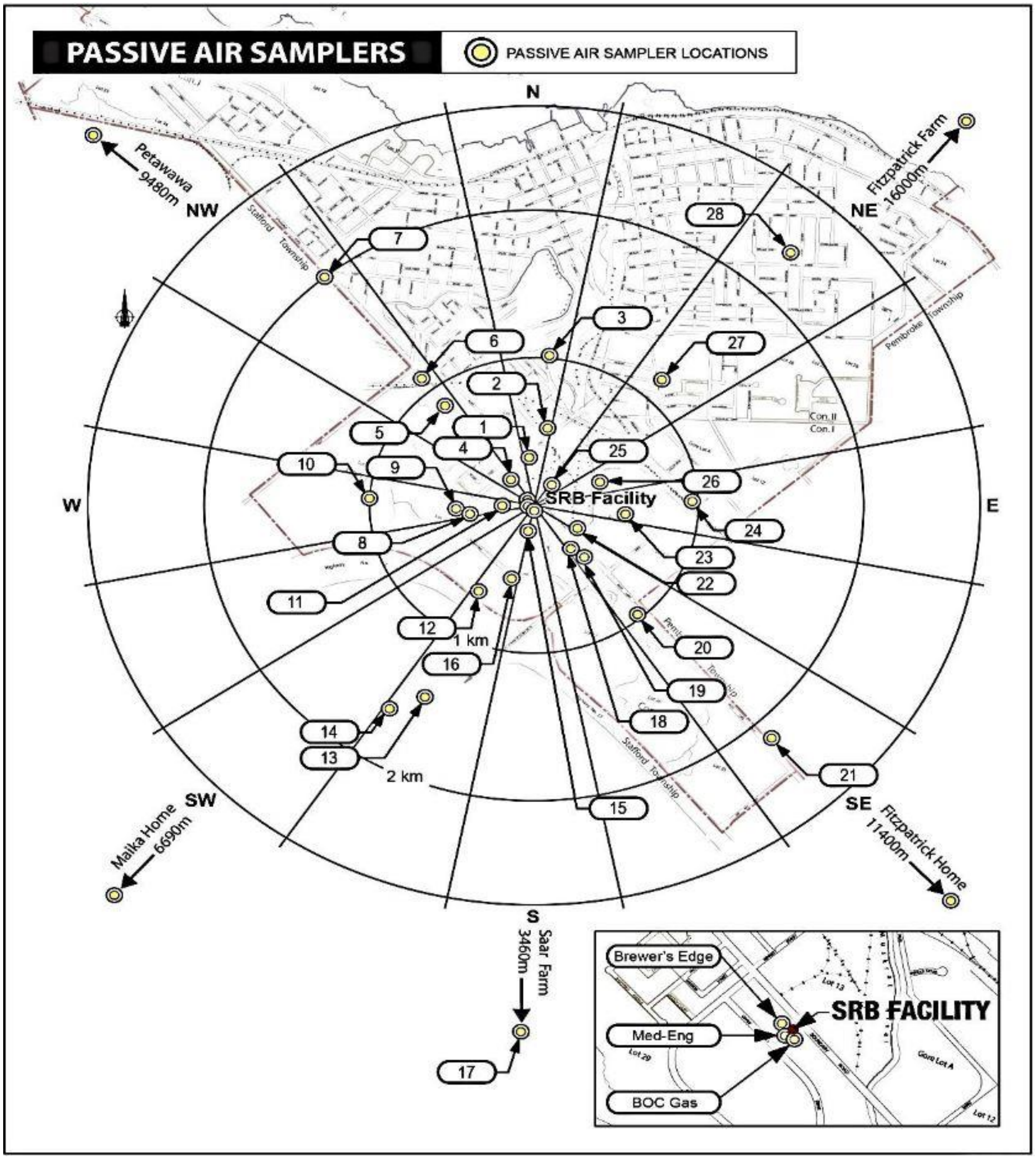
Samples that are lower than the MDA have traditionally been ascribed the value of the MDA for the purposes of cumulative totals. Since the MDA has increased since March, the cumulative total for monthly PAS has been artificially increased versus what historically have been calculated.

As a result, the elevated MDA means that the traditional comparison of the collective EMP PAS data for 2020 against the PAS data for previous years is not useful.

Total gaseous tritium emissions in 2020 were measured as 25,186 GBq, a significant decrease of approximately 20% compared to emissions in 2019 (31,769 GBq). The oxide component of tritium emission also decreased in 2020, with 9,755 GBq being released, compared with 11,858 GBq of HTO being released in 2019.

The relative positioning of the PAS array used as part of the EMP is provided in Figure 13.

FIGURE 13: 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, as shown in Figure 14.

FIGURE 14: LOCATION OF PRECIPITATION MONITORS

Historically, precipitation samples have been collected and analyzed on a monthly basis by a qualified third party laboratory, with a reported minimum detectable activity (MDA) of around 5 Bq/L.

Beginning with the March sample period, SRBT began performing all precipitation sampling and analysis in-house. This was required as the third party was not readily able to provide this service due to the onset of the COVID-19 pandemic. Since then, SRBT has continued to perform this activity with acceptable quality control and performance.

Typically, SRBT's analysis of precipitation samples results in an MDA of between 21 - 23 Bq/L, a value which can identify significant concentrations of tritium in precipitation, and provides the resolution needed to determine the level of risk to the public and the environment.

Average results in 2020 ranged between 11 Bq/L (sampler 1P) and 84 Bq/L (sampler 18P); the average tritium concentration for all eight precipitation monitors in 2020 was 34 Bq/L, which compares very well with the average of 33 Bq/L in 2019 and 34 Bq/L in 2018.

The geographic distribution of the sample collectors, coupled with any given meteorological conditions during and shortly after tritium processing, is expected to yield some variations in the data year-to-year.

Precipitation monitoring results for 2020, along with five-year trends at each sampling location, can be found in **Appendix H** of this report.

4.3.1.3 Muskrat River Monitoring

Samples of the Muskrat River downstream from SRBT were collected and analyzed monthly by a third party laboratory for the first two months of 2020.

Beginning with the April spot sample, SRBT began performing all Muskrat River sampling and analysis in-house. This was required as the third party was not readily able to provide this service due to the onset of the COVID-19 pandemic. Since then, SRBT has continued to perform this activity with acceptable quality control and performance.

Typically, SRBT's analysis of Muskrat River samples results in an MDA of around 10 - 14 Bq/L, a value which can identify significant concentrations of tritium in the river, and provides the resolution needed to determine the level of risk to the public and the environment. Previously, the qualified third party analysis resulted in an MDA of between 5-6 Bq/L.

All obtained samples of receiving waters in 2020 fell below the MDA for tritium concentration (between 5 - 6 Bq/L for January – February, and then between 10 – 14 Bq/L for the remainder of the year), with the exception of the May spot sample, when one of the two duplicate samples was analyzed by SRBT as exhibiting a concentration of 11.7 Bq/L (MDA = 10.3 Bq/L for the May analysis).

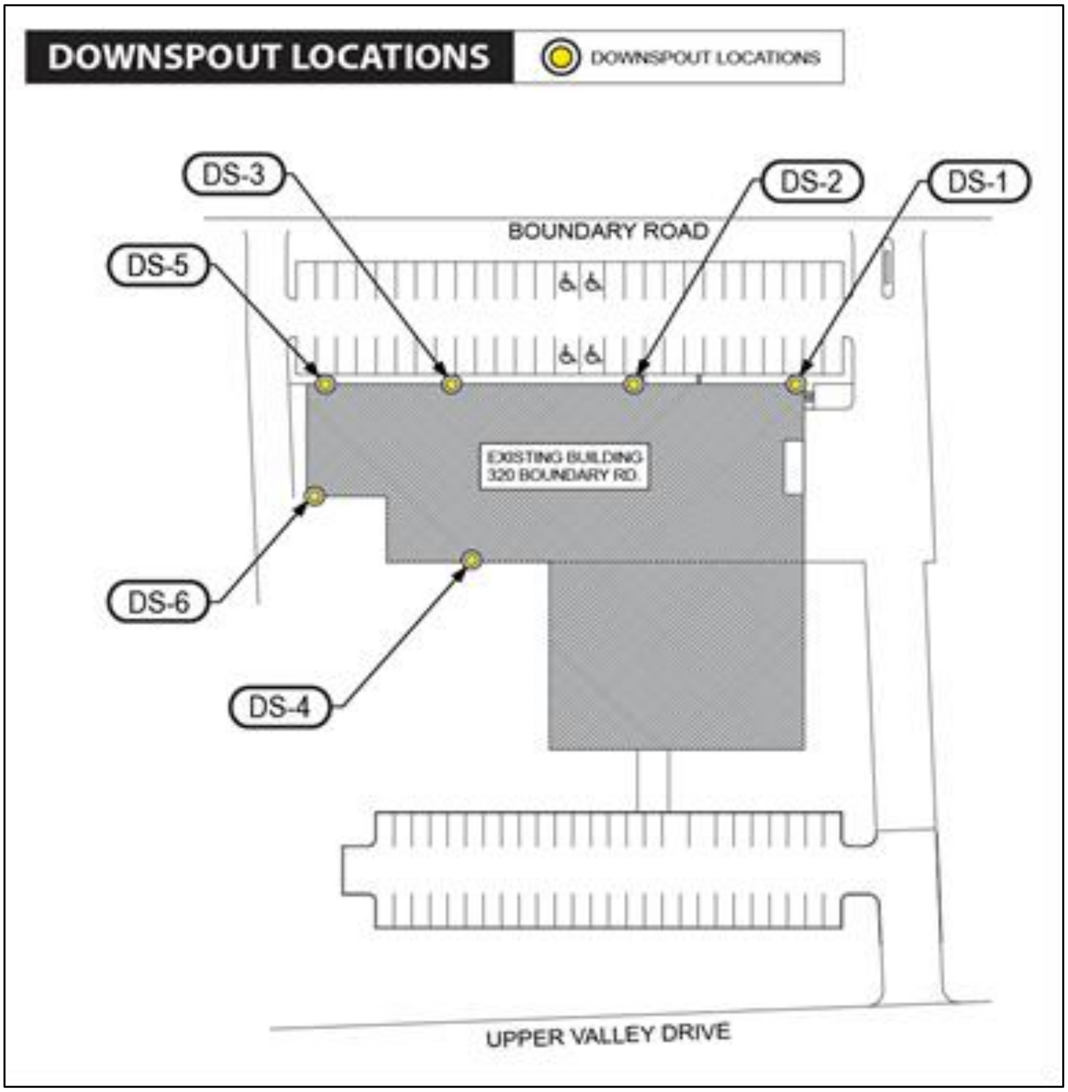
The duplicate sample was measured as lower than the MDA; however, the sample above the MDA was accepted as the representative sample for that period.

Receiving waters monitoring results are trended in **Appendix I** of this report.

4.3.1.4 Downspout Runoff Monitoring

Tritium concentrations are measured in all facility downspouts (DS). The samples were collected periodically by SRBT for tritium concentration assessment. The location of these sample points is given in Figure 15

FIGURE 15: LOCATION OF FACILITY DOWNSPOUTS



Runoff from downspouts was collected during five precipitation events during 2020, with a total of 27 samples being assessed.

The average tritium concentration for all downspouts / facility runoff in 2020 was 1,030 Bq/L; in 2019, this value was 432 Bq/L. The highest value measured was from DS-4 on May 29 (6,766 Bq/L), while the lowest values measured were nine individual measurements that were less than the MDA of between 43-50 Bq/L.

It is critical to understand that the practice of monitoring the water that is shed from the building rooftop drainage systems (the 'downspouts') represents only a very brief snapshot in time of the conditions at the time of sampling. It is equally important to recognize that there are several independent factors that influence the measured tritium concentration in any given sample, including:

- Significant rainfall after periods of time with elevated gaseous tritium-oxide releases tend to result in higher downspout concentrations being measured.
- How long it has been since a significant rainfall event has occurred – drier periods with high rates of tritium processing, followed by a significant rainfall tend to result in higher measured concentrations.
- The overlap between the time the rainfall event began and was detected, and the time it took to put tritium processing operations into a safe state. On occasion, quick onset of a heavy rainfall event can result in probable deposition from entrainment of any released tritium as processing operations are shut down.
- The time between the onset of precipitation and the act of obtaining the samples – the longer amount of time between these events, the lower the concentration of tritium is expected to be.
- Higher rainfall rates can lead to lower concentrations due to the sheer volume of water being drained; however, higher rates of rain can also cause rooftop ponding which will entrain surface tritium that may not have otherwise been taken up by a less intense rainfall.
- Weather factors during processing can influence deposition patterns. Rainfall that occurs quickly after periods of processing where west to east wind patterns dominate have a greater impact on downspout results, as opposed to other wind directions, since the active ventilation system effluent plume will drift over the facility.

With so many factors and influences on the instantaneously measured result, it is difficult to control for all variables in order to confidently ascribe any given variation to a particular event or condition.

Samples obtained on May 29, 2020 exhibited comparatively higher concentrations than usual. These samples were obtained quickly after the onset of a brief but heavy period of rainfall, where tritium processing was being performed up to the immediate detection of rainfall.

In addition, the environmental conditions in the period leading up to the date of sampling had been warm and dry for an extended period, likely resulting in an abnormally elevated rate of deposition on the building roof for a prolonged period. Weather station records show that the last significant accumulation of precipitation took place on May 15, 2020.

Both of these factors likely contributed to the elevated concentrations detected on May 29, 2020.

Note that the next sample set, obtained on June 10, 2020 exhibited significantly lower concentrations, ranging between 0 – 25 Bq/L. In the time between these two sample sets, precipitation took place on both May 30 and June 2, 2020.

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

The downspout collection point for DS-1, on the roof of the southeast corner of the building in which the SRBT facility is housed, is of a higher elevation that the other five points.

As such, water does not typically flow down through DS-1 during most periods of rain as it does not reach the drain on the roof, unless the rate of precipitation is heavy for prolonged periods. This is the reason why on three of the five sampling days, a sample was not acquired from this downspout.

4.3.1.5 Produce Monitoring

Produce from a local produce stand and from five local residential gardens were sampled in 2020.

The samples were collected and assessed by a third-party laboratory to establish free-water tritium concentration, as well as an assessment of organically-bound tritium (OBT) in specific samples (produce sample minimum detectable activity = approximately 3 Bq/kg).

The official results were compiled and reported to the participating members of the public, and are also posted on our website. This data is used in the calculations for annual estimated dose to the public for 2020.

The average free water tritium concentration in produce offered by local residents in 2020 was 29.8 Bq/kg, a value that is comparable to the 2019 value of 30.9 Bq/kg.

The maximum measured value in 2020 was 86 Bq/kg measured in a sample of tomatoes; this measurement represents less than 0.1% of the SRBT benchmark value, as well as the CNSC Independent Environmental Monitoring Program (IEMP) screening value for free water tritium in fresh produce.

The average free water tritium concentration in locally-grown produce offered commercial entities was measured as 3 Bq/kg, a measurement that is very comparable with the value of 4 Bq/kg obtained two years previously from the same farm gate located at 11333 Round Lake Road.

The traditional commercial produce-providing business (Boudens Gardens) was successfully sampled in 2019, and so the Round Lake Road farm gate was not sampled that year. Unfortunately, the Boudens farm was again not open for purchases in 2020, and it is suspected that the business has closed permanently.

For OBT, samples of tomatoes from a nearby residential garden showed a concentration of 3 Bq/kg, while tomatoes from the commercial garden were measured at 1 Bq/kg. Both values are at or below the MDA for these measurements.

Produce monitoring results and locations for calendar year 2020 can be found in **Appendix K** of this report, along with graphs comparing the five-year trends of each location.

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 and analyzed for tritium concentration by a qualified third-party laboratory. This data is also used in the calculations for critical group annual estimated dose for 2020.

Tritium concentrations in milk remained very low; all assayed samples were reported by the third-party laboratory to have measured less than the MDA of 3 - 5 Bq/L.

Milk monitoring results and locations for 2020 can be found in **Appendix L** of this report.

4.3.1.7 Wine Monitoring

Wine from a local producer is traditionally sampled once a year. The samples have been collected and analyzed for tritium concentration by a qualified third-party laboratory, with an MDA of approximately 3 – 5 Bq/L.

Unfortunately, the business that has traditionally been sampled for wine has closed permanently, and there are no other known suppliers of site-brewed product within the scoped area of the EMP at this time. As such, wine was not sampled in 2020.

Data for tritium concentration in wine can be found in **Appendix M** of this report with a graph trending these results since 2016.

As of the end of 2020, SRBT is considering eliminating wine sampling from the EMP, as the data is not used as a factor in public dose calculations, and was solely being collected in order to provide a trend over time.

4.3.1.8 Weather Data

A weather station near the facility collects data on a continuous basis. See weather data for 2020 in **Appendix N**.

Note that beginning with the April data, it is apparent that the weather station sensors that determine wind speed and direction have malfunctioned.

The SRBT Maintenance Committee has been tasked with diagnosing the problem and performing corrective maintenance, or if need be, instrument replacement. It is expected that the weather station will be returned to full service sometime in 2021.

4.3.1.9 Residential Drinking Water

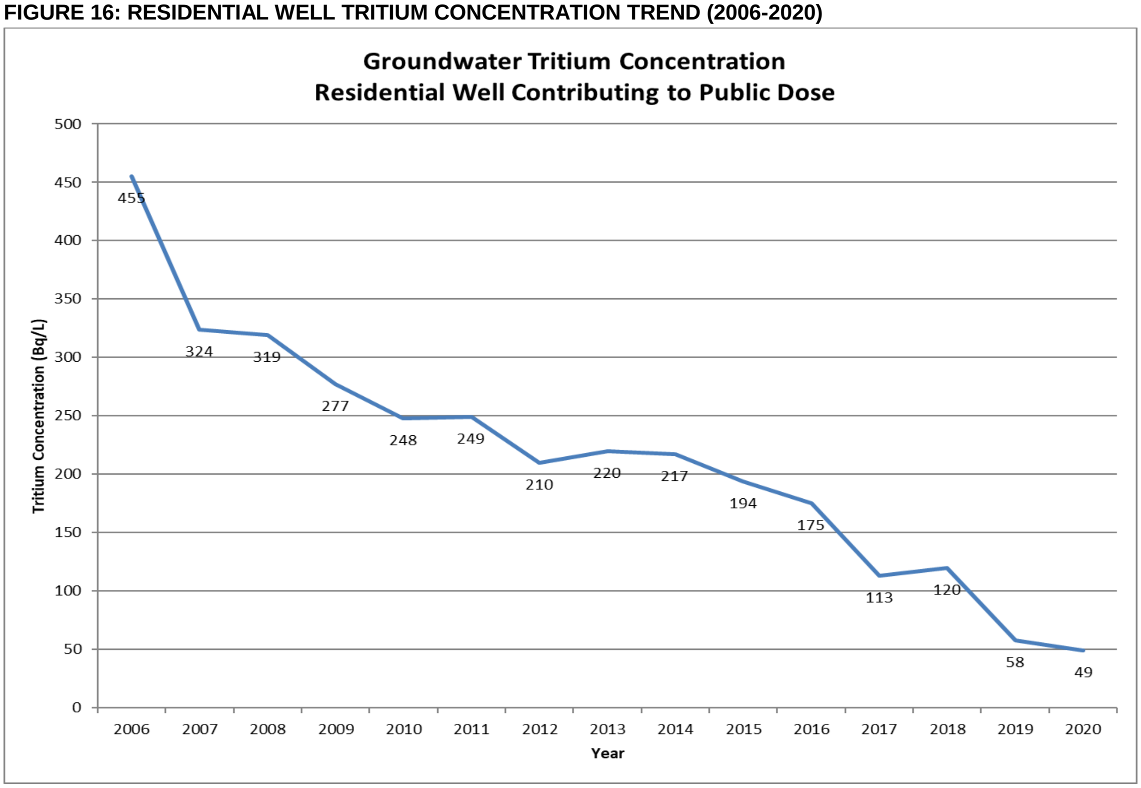
Several nearby local residences permit SRBT to acquire samples of drinking water three times annually, to provide additional data for our program.

A qualified, independent third-party laboratory collects and analyzes residential drinking water samples (MDA = approximately 3 – 4 Bq/L).

In 2020, the highest residential well tritium concentration value was measured at 49 Bq/L (in March at RW-3), a value that is well below the Ontario Drinking Water Quality Standard of 7,000 Bq/L. In 2019, the highest measured value was 58 Bq/L, again from RW-3.

Figure 16 illustrates the trend in maximum sampled tritium concentration in all sampled residential wells, since the program of monitoring began in 2006.

FIGURE 16: RESIDENTIAL WELL TRITIUM CONCENTRATION TREND (2006-2020)



Derived public dose values attributed to residential well water consumption have decreased since the inception of the monitoring program as a direct result of our efforts to minimize our environmental impact.

Residential well monitoring results for 2020 can be found in **Appendix O** of this report.

4.3.1.10 Deviations from Field Sampling Procedures

In 2020, there were no noted occurrences of deviations from field sampling procedures.

With the onset of the COVID-19 pandemic, beginning in March, SRBT developed, validated and implemented in-house procedures for performing field sampling of passive air samplers, precipitation and the Muskrat River.

These procedures were previously documented in the SRBT Environmental Management System (EMS); however, they referenced the procedural work performed by the third-party service provider.

As of the end of 2020, SRBT continues to perform field sampling activities in accordance with internal procedures for the following sample types:

- EMP passive air sampling
- Precipitation
- Muskrat River
- Facility downspouts

Qualified independent service providers continue to sample and analyze the following sample types:

- Produce
- Milk
- Residential drinking water
- Wine (to be discontinued)
- Sludge cake from the Pembroke Pollution Control Centre

All procedural development and changes were fully executed in accordance with SRBT's change control processes.

4.3.1.11 Deviations from Analytical and Data Management Procedures

In 2020, there were no noted occurrences of deviations from analytical and data management procedures.

With the onset of the COVID-19 pandemic, beginning in March, SRBT developed, validated and implemented in-house procedures for analyzing samples from passive air samplers, precipitation and the Muskrat River.

These procedures were previously documented in the SRBT EMS; however, they referenced the analytical work performed by the third-party service provider.

As of the end of 2020, SRBT continues to analyze the following samples in accordance with internal procedures for the following sample types:

- EMP passive air sampling
- Precipitation
- Muskrat River
- Facility downspouts

Qualified independent service providers continue to analyze the following sample types:

- Produce
- Milk
- Residential drinking water
- Wine (to be discontinued)
- Sludge cake from the Pembroke Pollution Control Centre

All procedural development and changes were fully executed in accordance with SRBT’s change control processes.

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

Field and laboratory EMP operations 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 samples obtained in the field.

Laboratory QA/QC activities include duplicate samples and blanks, as well as laboratory reference standards. Sample QC is tested using spike recovery and relative percent difference (RPD) tests.

In 2020, there were 301 QC checks and 647 benchmark value comparisons performed across all routinely-generated EMP data. For the year, 96.7% of all EMP QC checks met acceptance criteria, while 100% of all EMP measurements were below benchmark values.

There were ten instances where a QC acceptance criterion was not met, all of which related to a mathematical exceedance of the +/-40% limit for duplicated PAS relative percent difference (RPD).

The table below details these instances:

TABLE 19: EMP PAS RELATIVE PERCENT DIFFERENCE EXCEEDANCES

MONTH	SAMPLERS	Bq/m^3	RPD	ASSESSMENT / ACTIONS
Apr.	SW250	1.42 and 2.45	53%	The low absolute values of the compared measurements lead to a mathematically higher RPD. The base LSC results were compared (0.440 vs. 0.472 Bq/ml), showing a very small difference between these measurements of 0.032 Bq/ml. Higher result accepted with condition of trending at this location for repeat RPD fails over time.
Apr.	Maika Bkg	1.42 and 0.52	93%	One result was well below the MDA, while the other was just above. As these values are both very near the MDA, the higher result was taken as the acceptable value.
May	NW250	5.07 and 3.07	49%	The higher of the two measurements was accepted for the sampling period. OFI-477 was raised, and the sampler cap orifices were blown out using compressed air in order to remove any restrictions.

TABLE 19: EMP PAS RELATIVE PERCENT DIFFERENCE EXCEEDANCES (continued)

MONTH	SAMPLERS	Bq/m^3	RPD	ASSESSMENT / ACTIONS
May	Maika Bkg	0.27 and 0.67	85%	Both values <MDA for that month. High RPD is a consequence of extremely low numerical values used for QC check. Result of <MDA accepted for sampler this month.
Jul.	NW250	7.79 and 4.43	55%	The higher of the two measurements was accepted for the sampling period. OFI-481 was raised, and the samplers were re-oriented to an equal height on the pole, and the local vegetation cleared away to remove any turbulence effects that could influence the sampling.
Aug.	SW250	1.40 and 0.67	71%	One result was well below the MDA, while the other was just above. As these values are both very near the MDA, the higher result was taken as the acceptable value.
Aug.	Maika Bkg	1.40 and 0.53	90%	One result was well below the MDA, while the other was just above. As these values are both very near the MDA, the higher result was taken as the acceptable value.
Sep.	Maika Bkg	0.15 and 0.88	142%	One result was well below the MDA, while the other was just above. As these values are both very near the MDA, the higher result was taken as the acceptable value.
Dec.	SE250	2.50 and 4.00	46%	The low absolute values of the compared measurements lead to a mathematically higher RPD. The base LSC results were compared (0.282 vs. 0.237 Bq/ml), showing a very small difference between these measurements of 0.045 Bq/ml. Higher result accepted with condition of trending at this location for repeat RPD fails over time.
Dec.	SW250	0.07 and 0.47	148%	Both values <MDA for that month. High RPD is a consequence of extremely low numerical values used for QC check. Result of <MDA accepted for sampler this month.

Most instances of the acceptable RPD value being exceeded can be ascribed to the very low absolute values being compared, and the nature of the calculation. SRBT is considering formalizing a process wherein RPD failures of very low absolute value measurements have special consideration, and are not necessarily deemed a QC 'failure' per se.

The following table illustrates the five-year trend in QC acceptance criteria data for the EMP:

TABLE 20: EMP QUALITY CONTROL DATA (2016-2020)

CALENDAR YEAR	2016	2017	2018	2019	2020
BENCHMARK VALUE EXCEEDANCES	0	0	0	0	0
DUPLICATE RPD EXCEEDANCES	0	2	1	4	10
REFERENCE STANDARD ACCURACY EXCEEDANCES	0	0	0	0	0
BLANK SAMPLE COUNT RATE > MAX ACCEPTABLE	0	0	0	0	0
SAMPLE ACQUISITION SUCCESS RATE	97.6%	98.8%	98.8%	98.5%	98.5%
QC CHECK PASS RATE	100%	99.1%	99.6%	98.3%	96.6%

4.3.1.13 Supplementary Studies

One supplementary study was performed in 2020, in support of the development of SRBT's Environmental Risk Assessment.

In close consultation and collaboration with the Algonquins of Pikwakanagan First Nation (APFN) near Golden Lake, Ontario, SRBT performed the following environmental sampling and analysis activities in 2020:

- Two passive air sampling stations were set up at the western boundary of the community. The samplers were deployed for two months, measuring the average concentration of tritium in the air at this location. Samples were analyzed after each month.
- A precipitation collector station was also set up at this location for two months. The collected sample was analysed after each month.
- Samples of vegetation in the community were collected by SRBT staff, with the assistance of community knowledge holders. The selected plants were chosen due to their cultural significance and importance to the APFN. The samples were analyzed by the same third-party laboratory that analyzes residential and commercial produce samples as part of SRBT's routine EMP.

The results of this supplementary study are detailed in the SRBT Environmental Risk Assessment report, which is published on our website.

4.3.2 Effluent Monitoring

SRBT monitors two main effluent streams from the facility for tritium as part of our Effluent Monitoring Program (EffMP).

Tritium releases via the gaseous effluent pathway (active ventilation) are monitored in real time using ‘bubbler’ capture systems, 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 2020, SRBT operated well within release limits to atmosphere that are prescribed as part of the operating licence of the facility. The operating licence (NSPFOL-13.00/2022)[1] references limits defined in Appendix E of the Licence Conditions Handbook[2].

A summary of the releases of tritium oxide and total tritium in 2020 is tabulated below:

TABLE 21: GASEOUS EFFLUENT DATA (2020)

NUCLEAR SUBSTANCE AND FORM	ANNUAL LIMIT (GBq)	2020 RELEASED (GBq)	% LIMIT	WEEKLY AVERAGE (GBq)	HIGHEST WEEKLY RELEASE (GBq)
TRITIUM AS TRITIUM OXIDE (HTO)	67,200	9,755	14.52%	188	535 *(May 26 – Jun. 2)*
TOTAL TRITIUM AS TRITIUM OXIDE (HTO) AND TRITIUM GAS (HT)	448,000	25,186	5.62%	484	905 *(July 14-21)*

Please refer to **Appendix P** for a complete data set on tritium releases to atmosphere in 2020.

For comparison, in 2019 HTO emissions were 17.64% of the licence limit, while total tritium emissions were 7.09% of the licence limit.

Total air emissions in 2020 decreased by approximately 20.6% of what they were in 2019, while annual tritium processed decreased by about 8%.

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

TABLE 22: GASEOUS EFFLUENT FIVE-YEAR TREND (2016-2020)

NUCLEAR SUBSTANCE AND FORM	RELEASED 2016 (GBq)	RELEASED 2017 (GBq)	RELEASED 2018 (GBq)	RELEASED 2019 (GBq)	RELEASED 2020 (GBq)
TRITIUM OXIDE (HTO)	6,293	7,198	10,741	11,858	9,755
TOTAL TRITIUM AS TRITIUM OXIDE (HTO) AND TRITIUM GAS (HT)	28,945	24,822	33,180	31,769	25,186

When analyzing the operation's performance at reducing emissions it is important to assess the releases to atmosphere against the amount of tritium the facility 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 in the past five years.

TABLE 23: TRITIUM RELEASED TO ATMOSPHERE vs PROCESSED (2016-2020)

YEAR	TRITIUM RELEASED TO ATMOSPHERE (GBq/YEAR)	TRITIUM PROCESSED (GBq/YEAR)	% RELEASED TO PROCESSED	% INCREASE (+) REDUCTION (-)
2016	28,945	28,122,678	0.10	-50%
2017	24,822	32,968,695	0.08	-20%
2018	33,180	31,251,329	0.11	+38%
2019	31,769	30,327,048	0.10	-10%
2020	25,186	27,887,498	0.09	-10%

In 2020, the ratio of tritium released versus processed decreased by 10% versus the 2019 value. SRBT was able to achieve our internal target for this metric of 0.12% for the year.

4.3.2.2 Air Emission Target

SRBT set an annualized total tritium emission target at the beginning of 2020 of ≤ 650 GBq / week (averaged over the year), and was successful in meeting this target (484 GBq / week).

For calendar year 2021, SRBT has implemented a lower tritium emission target of 625 GBq / week or less, on average, based upon projected production rates and the value achieved in 2020.

The 2020 targeted tritium released to processed ratio of ≤ 0.12% was achieved (0.09%). The 2021 target has also been lowered to 0.11%.

4.3.2.3 Liquid Effluent

In 2020, SRBT operated well within release limits to sewer that are prescribed as part of the operating licence of the facility, as defined in Appendix E of the Licence Conditions Handbook[2].

TABLE 24: LIQUID EFFLUENT DATA (2020)

NUCLEAR SUBSTANCE AND FORM	LIMIT (GBq/YEAR)	RELEASED (GBq/YEAR)	% OF LIMIT
TRITIUM – WATER SOLUBLE	200	5.56	2.78%

Total liquid effluent releases in 2020 decreased when compared to 2019 values (5.56 GBq in 2020 vs 13.67 GBq in 2019).

The decrease is attributed mainly to a reduced rate of manufacture of miniature light sources, a type of light source which, when assayed for integrity via water-submersion testing, can typically introduce elevated concentrations of tritium in collected effluent.

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

TABLE 25: LIQUID EFFLUENT FIVE-YEAR TREND (2016-2020)

NUCLEAR SUBSTANCE AND FORM	RELEASED 2016 (GBq)	RELEASED 2017 (GBq)	RELEASED 2018 (GBq)	RELEASED 2019 (GBq)	RELEASED 2020 (GBq)
TRITIUM – WATER SOLUBLE	5.18	6.85	10.02	13.67	5.56

Please refer to **Appendix Q** for a complete data set of liquid effluent releases to sewer in calendar year 2020.

4.3.2.4 Liquid Effluent Target

SRBT set a total tritium release target at the beginning of 2020 of ≤ 12 GBq for the year, a target that was achieved.

SRBT has set the total liquid effluent release target at 11 GBq for 2021, as the current production projections suggest a potential increase in the rate of manufacture of miniature light sources this calendar year.

4.3.2.5 Action Level Exceedances

In 2020, there were no instances of an action level exceedance related to gaseous or liquid effluent monitoring at SRBT.

4.3.2.6 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 EffMP QA/QC results obtained in 2020 were acceptable with no identified non-conformances.

4.3.2.7 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.

The acceptance criterion for deviation between the assessed measurements of gaseous emissions is +/- 30%; in 2020, all results were within this acceptance criteria, with SRBT measurements ranging between 97.8% and 122.0% of those obtained by the independent third party. The next annual inter-comparison test is scheduled for February 2021.

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.

4.3.2.8 Supplementary Studies

In 2020, no supplementary studies were conducted relating to effluent monitoring at SRBT.

4.3.2.9 Hazardous Substance Releases

In 2020, SRBT continued to operate the facility under a Certificate of Approval (Air), number 5310-4NJQE2, issued by the Ontario Ministry of the Environment in accordance with section 9 of the Ontario Environmental Protection Act.

No hazardous non-radiological substances are released from the facility through either gaseous or liquid effluent pathways in any significant quantity.

4.3.3 Groundwater Monitoring

SRBT implements and maintains a comprehensive Groundwater Monitoring Program (GMP) as part of our Groundwater Protection Program.

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 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 continues to be confirmed by routine 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 2020, 357 samples of groundwater were successfully obtained and analyzed, with all planned groundwater monitoring activities being accomplished, except for the following eight instances:

- MW06-3 was found to be dry three times (January, February, March)
- MW07-19 and MW07-34 were inaccessible for sampling in March due to snow accumulation from plowing activities.
- Well B-3 was not accessible for the entire year (attempted samples in March, July and November) as the business operation located at that property has shut down permanently. This well will no longer be included as part of the set of routinely sampled wells.

4.3.3.1 Groundwater Tritium Concentration

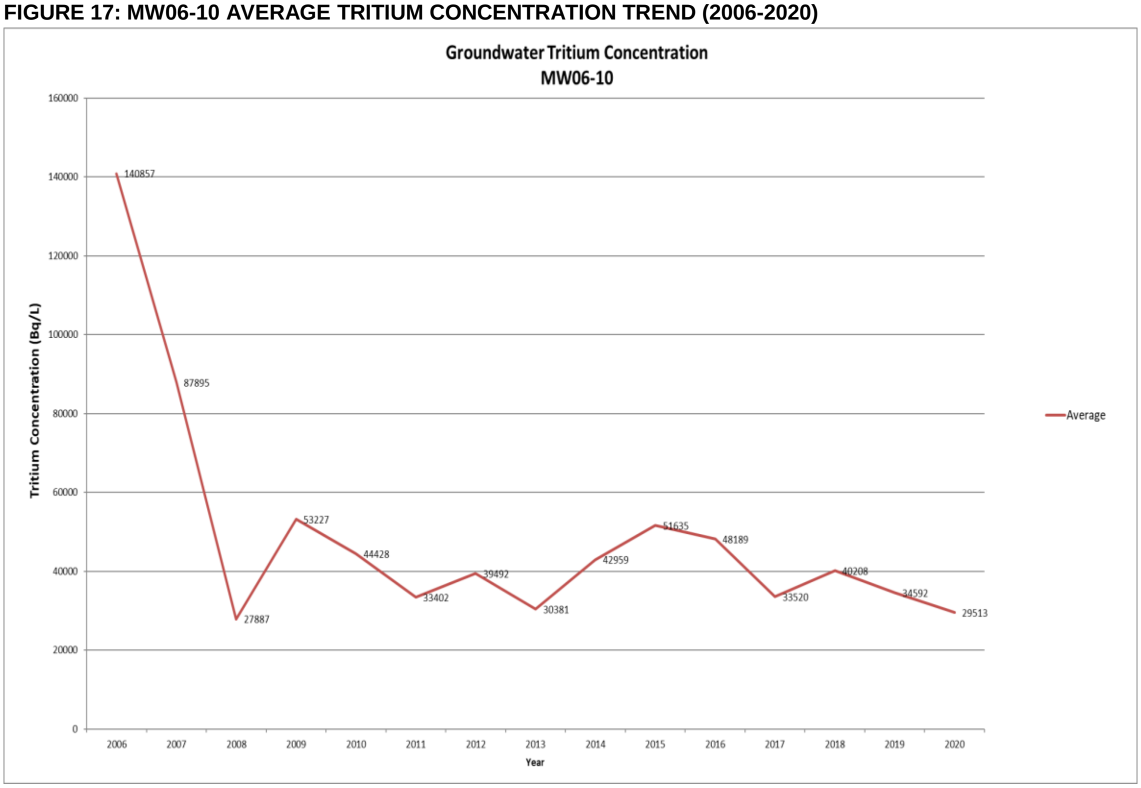
Groundwater monitoring well results for 2020 can be found in **Appendix O** of this report.

The highest average tritium concentration in any well remains in monitoring well MW06-10 which is directly beneath the area where the active ventilation stacks are located. As of the end of 2020, this represents the only well where tritium concentration exceeds the Ontario Drinking Water Guideline value of 7,000 Bq/L.

The average concentration of tritium measured in MW06-10 in 2020 was 29,513 Bq/L, a value that is approximately 15% lower than the average measured in 2019 (34,592 Bq/L).

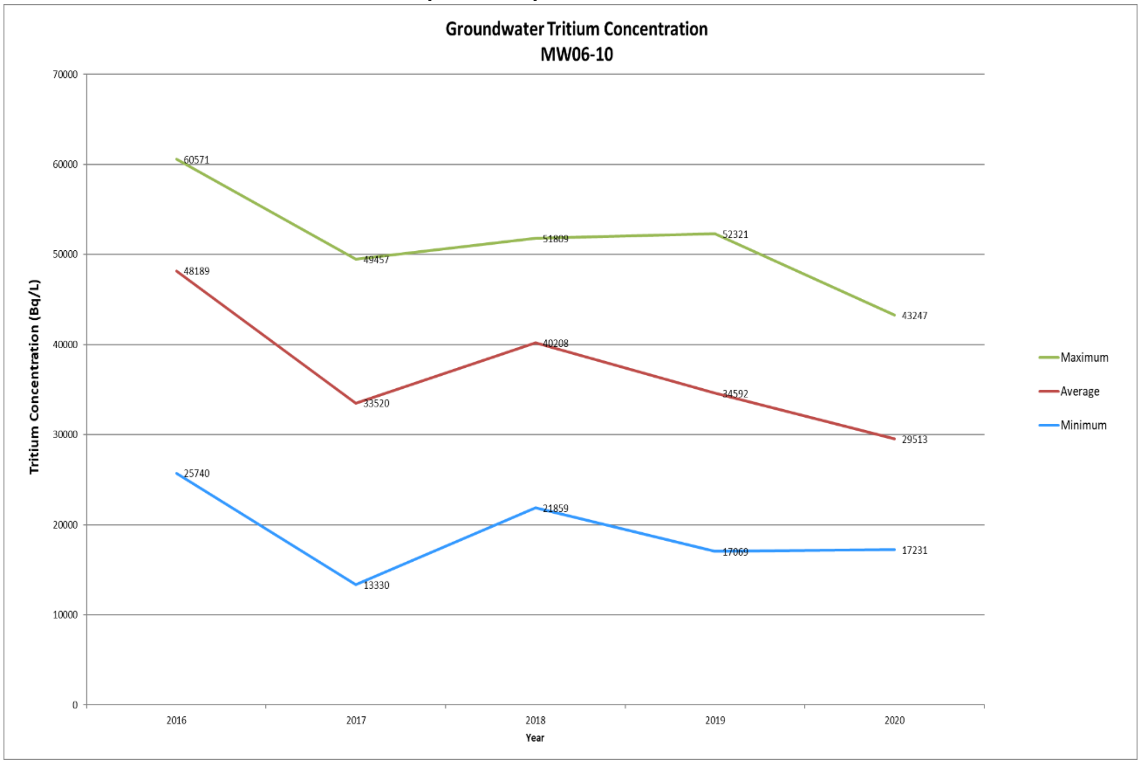
A graph trending the average annual concentration of tritium in MW06-10 since commissioning of the well is Figure 17.

FIGURE 17: MW06-10 AVERAGE TRITIUM CONCENTRATION TREND (2006-2020)



The five-year trend is highlighted in Figure 18 in red, along with trends of the maximum (green) and minimum (blue) monthly measurements each year.

FIGURE 18: MW06-10 FIVE-YEAR TREND (2016-2020)



The average concentration of MW07-13 continues to fall; in 2020 the average measurement was 4,406 Bq/L.

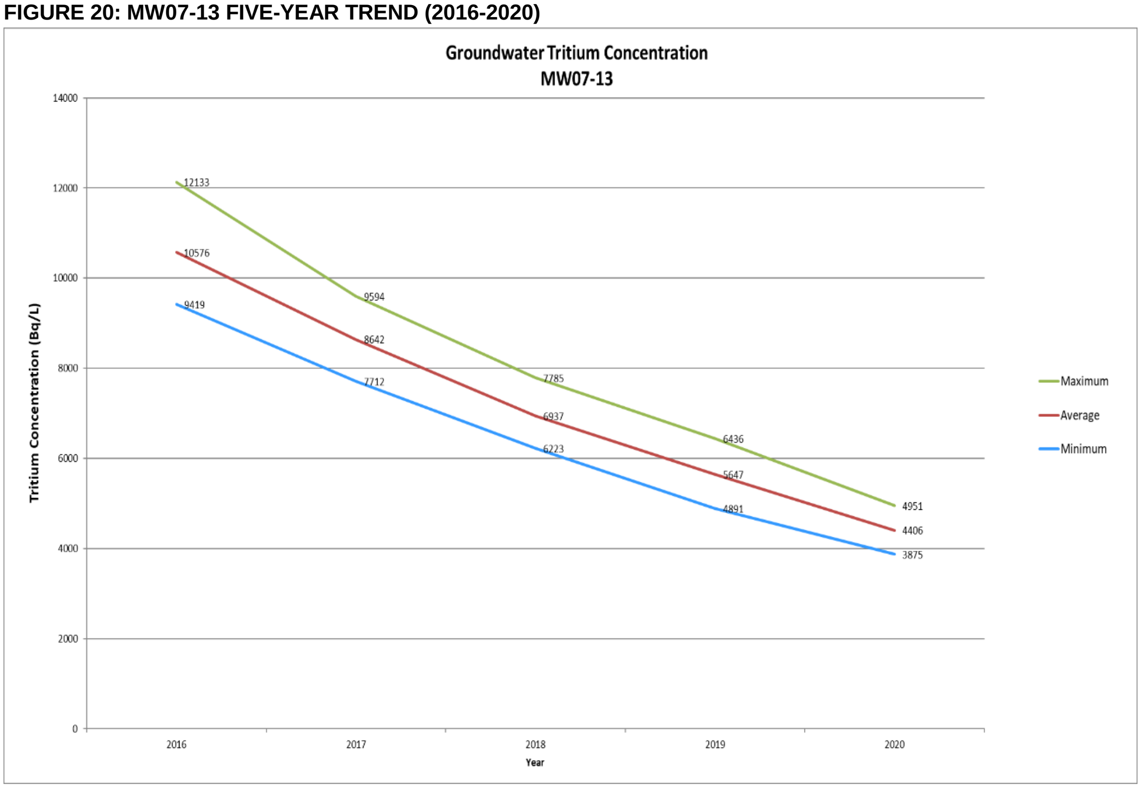
Other than MW06-10, this well was the last monitoring well to have been measured above the provincial drinking water guideline value of 7,000 Bq/L (April 2018), and has continued to consistently trend downward over time, averaging 5,647 Bq/L in 2019, 6,937 Bq/L in 2018, 8,642 Bq/L in 2017, and 10,576 Bq/L in 2016.

A graph trending the average annual concentration of tritium in MW07-13 since commissioning of the well is Figure 19.

FIGURE 19: MW07-13 AVERAGE TRITIUM CONCENTRATION TREND (2007-2020)

The five-year trend is highlighted in Figure 20 in red, along with trends of the maximum (green) and minimum (blue) monthly measurements each year.

FIGURE 20: MW07-13 FIVE-YEAR TREND (2016-2020)



In 2020, all SRBT-installed groundwater monitoring wells exhibited an average tritium concentration that was lower than the previous year; in fact, the average concentration measured in every well in 2020 is lower than the average measured over each of the previous five years.

The following table compares the annualized average tritium concentration of the 29 dedicated, SRBT-installed groundwater monitoring wells for six years, between 2015 through 2020.

Comparisons are made in the three columns on the right-hand side of the table using a three-colour gradient, where green indicates decreasing concentrations, white indicating stable, and orange indicating a relative increase.

TABLE 26: 2015-2020 AVERAGE TRITIUM CONCENTRATION IN SRBT MONITORING WELLS

Well ID	2020	2019	2018	2017	2016	2015	2020/2019	2020/2018	2020/2017	2020/2016	2020/2015
	(Bq/L)							(%)			
MW06-1	762	1,045	1,334	1,946	2,753	4,338	72.9	57.1	39.2	27.7	17.6
MW06-2	877	1,031	1,160	1,166	1,467	1,965	85.1	75.6	75.2	59.8	44.6
MW06-3	244	367	469	683	1,029	1,218	66.5	52.1	35.7	23.7	20.0
MW06-8	579	679	724	780	848	906	85.4	80.1	74.3	68.3	64.0
MW06-9	1,527	1,774	1,952	2,224	2,476	2,731	86.1	78.2	68.7	61.7	55.9
MW06-10	29,513	34,592	40,208	33,520	48,189	51,635	85.3	73.4	88.0	61.2	57.2
MW07-11	924	1,053	1,122	1,099	1,344	1,521	87.7	82.3	84.0	68.7	60.7
MW07-12	422	425	468	467	469	463	99.3	90.2	90.3	89.9	91.0
MW07-13	4,406	5,647	6,937	8,642	10,576	13,237	78.0	63.5	51.0	41.7	33.3
MW07-15	1,262	1,399	1,505	1,617	1,810	1,680	90.2	83.9	78.1	69.7	75.1
MW07-16	1,003	1,240	1,433	1,649	1,879	2,188	80.9	70.0	60.9	53.4	45.9
MW07-17	272	338	359	335	602	780	80.4	75.7	81.2	45.1	34.8
MW07-18	1,494	2,000	2,192	2,739	3,690	5,491	74.7	68.2	54.6	40.5	27.2
MW07-19	1,198	1,468	1,889	1,926	2,500	3,222	81.6	63.4	62.2	47.9	37.2
MW07-20	326	438	498	571	670	775	74.5	65.5	57.1	48.7	42.1
MW07-21	393	545	778	879	1,009	1,121	72.1	50.5	44.7	38.9	35.1
MW07-22	783	921	974	1,023	1,131	1,171	85.1	80.5	76.6	69.3	66.9
MW07-23	1,252	1,443	1,572	1,743	1,929	2,206	86.7	79.6	71.8	64.9	56.7
MW07-24	1,644	1,839	1,928	2,022	2,206	2,314	89.4	85.2	81.3	74.5	71.0
MW07-26	514	697	904	1,190	1,491	1,941	73.8	56.9	43.2	34.5	26.5
MW07-27	1,994	2,683	3,136	3,589	4,292	4,869	74.3	63.6	55.6	46.5	40.9
MW07-28	705	843	1,017	1,063	1,311	1,446	83.6	69.4	66.4	53.8	48.8
MW07-29	1,485	2,058	2,415	2,472	3,395	3,950	72.2	61.5	60.1	43.7	37.6
MW07-31	182	352	407	186	440	756	51.7	44.6	97.8	41.3	24.0
MW07-32	59	75	70	76	155	128	78.7	84.8	77.6	38.1	46.2
MW07-34	1,297	1,526	1,889	2,291	2,822	3,312	85.0	68.7	56.6	46.0	39.2
MW07-35	1,898	2,256	2,637	3,015	3,448	3,945	84.1	72.0	63.0	55.0	48.1
MW07-36	1,468	1,716	2,008	2,109	2,618	2,892	85.5	73.1	69.6	56.1	50.8
MW07-37	763	821	830	871	989	1,009	92.9	91.9	87.5	77.2	75.6
AVERAGE	**2,043**	**2,458**	**2,856**	**2,824**	**3,708**	**4,249**	**80.8**	**71.1**	**67.3**	**53.4**	**47.4**

Several factors can influence the concentration of tritium in any given well, including the rate of precipitation accumulation, contaminant dispersion patterns, and the lateral and vertical migration of historical contaminant plumes.

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 2020 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 include several quality assurance and quality control activities.

Quality control activities include duplicate sampling of certain wells, duplicate laboratory subsampling, and the use of trip / method blanks during sampling campaigns.

As well, several quality control checks are performed as part of the liquid scintillation counting procedures employed by both the third party and SRBT.

In 2020, 357 samples from MW-coded wells were attempted, with eight failures to obtain a sample, as detailed in section 4.3.3.

As such, 97.8% of all GMP samples were successfully obtained and measured in 2020, which is an excellent rate of sampling success.

There were no failures of field or laboratory quality control checks for GMP data during 2020.

SRBT's Groundwater Monitoring Program requires the completion of an inter-laboratory testing exercise on an annual basis. This exercise is typically completed during the May sampling period.

Five groundwater monitoring wells were sampled by SRBT in duplicate on May 5, 2020, and subsequently analyzed for tritium concentration by both SRBT and a qualified, independent laboratory.

The results obtained fell well within the acceptance criteria of +/-20% relative difference, adding confidence in the quality and accuracy of the data generated by the program.

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 provide assurance of accuracy and precision, SRBT conducts an intercomparison sampling and analysis activity with our primary contracted third party in May, as required by the GMP.

Five wells were sampled and measured by SRBT concurrently with the third party, with good agreement between the results obtained in-house and those obtained by the contracted service provider.

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 2020, no supplementary studies were conducted relating to groundwater monitoring at SRBT.

4.3.3.6 Data Quality, Performance and Acceptance Criteria

Overall, the quality of data gathered as part of 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.

All trip blanks, field duplicates, laboratory duplicates and quality control checks during liquid scintillation counting met performance criteria throughout 2020.

4.3.3.7 Program Objectives and Conceptual Site Model

The main objective of the GMP implemented by SRBT is to provide information to assess risks from site-affected groundwater to human health and the environment, ultimately to determine if the risk to the environment and the public from SRBT operations remains acceptably low.

Only one well monitored on a regular basis exceeds the Ontario Drinking Water Guideline value of 7,000 Bq/L. This well is a dedicated, engineered groundwater monitoring well very near to the facility within a secured area, and is not available to be used as a source of water consumption.

With respect to the conceptual site model, the highest average concentration of potable groundwater obtained from a residential well continues to show a generally stable or decreasing trend over time (see discussion in section 4.3.1.9 earlier in this report).

SRBT concludes that the comprehensive array of groundwater monitoring activities conducted continue to meet program objectives, and adheres to the conceptual site model developed as part of the Environmental Management System, as illustrated earlier in this report in Figure 8.

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

No soil monitoring was conducted in 2020.

4.3.4.2 Sludge Monitoring

In March and September 2020, SRBT collected routine samples of sludge cake from the Pembroke Pollution Control Centre.

These samples are analyzed for the concentration of tritium in the free water contained within (expressed in Bq/L), as well as for organically-bound tritium in the dry mass of material (expressed in Bq/kg).

Sludge data does not factor into the calculation of public dose; however, given previously expressed stakeholder interest, SRBT has integrated sludge cake monitoring as part of the routine EMP activities.

All sludge samples are analyzed by an independent laboratory. The averaged annual results obtained for the past five years are tabled below.

TABLE 27: SLUDGE MONITORING (2016-2020)

NUCLEAR SUBSTANCE AND FORM	2016	2017	2018	2019	2020
FREE-WATER TRITIUM (Bq/L)	27	57	40	41	31
OBT FRESH WEIGHT (Bq/kg)	567	901	420	216	260

4.3.5 Public Dose

The calculation methods used to determine the dose to the representative persons as defined in the SRBT Environmental Monitoring Program (EMP) are described in the program and in EMP-014, *Interpretation and Reporting Requirements for EMP Data.*

All data and tables relating to the calculation of the dose to the public can be found in **Appendix S**.

For 2020, the dose has been calculated using the effective dose coefficients found in Canadian Standards Association (CSA) Guideline N288.1-14[23].

TABLE 28: 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

NOTE: The dose coefficients listed for inhalation account for skin absorption, as per Table C.1 of N288.1-14.

The dose assessed for the group of representative persons 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}).

Dose due to inhalation

The closest residence to SRBT is located by passive air sampler NW250 approximately 240 meters from the point of release. The 2020 average concentration of tritium oxide in air at passive air sampler NW250 has been determined to be **3.89 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 representative person (adult worker) at samplers 1, 2, and 13. The sampler indicating the highest tritium oxide in air concentration is used to calculate the P_{19} dose values while at work. The highest average result for 2020 between these samplers is **7.25 Bq/m^3** at PAS # 1.

Using the inhalation rates found in CSA Guideline N288.1-14[24], and assuming 2,080 hours (23.744%) of work per year with 6,680 hours (76.256%) at home (a total of 8,760 hours per year):

TABLE 29: 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 representative person equals 3.89 Bq/m^3.

$P_{(i)19r}$ = [H-3_{air}] (Bq/m^3) x Resp. Rate (m^3/a) x Occup. Factor x DCF_{H3} (μSv/Bq)
= 3.89 Bq/m^3 x 8,400 m^3/a x 0.76256 x 3.0E-05 μSv/Bq
= 0.748 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 #1 at 7.25 Bq/m^3.

$P_{(i)19w}$ = [H-3_{air}] (Bq/m^3) x Resp. Rate (m^3/a) x Occup. Factor x DCF_{H3} (μSv/Bq)
= 7.25 Bq/m^3 x 8,400 m^3/a x 0.23744 x 3.0E-05 μSv/Bq
= 0.434 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 representative person equals 3.89 Bq/m^3:

$$
\begin{aligned}
P_{(i)19} &= [H\text{-}3_{air}]\ (Bq/m^3) \times \text{Resp. Rate}\ (m^3/a) \times DCF_{H3}\ (\mu Sv/Bq) \\
&= 3.89\ Bq/m^3 \times 8{,}400\ m^3/a \times 3.0E\text{-}05\ \mu Sv/Bq \\
&= 0.980\ \mu Sv/a
\end{aligned}
$$

$P_{(i)19}$: 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 representative person equals 3.89 Bq/m^3:

$$
\begin{aligned}
P_{(i)19} &= [H\text{-}3_{air}]\ (Bq/m^3) \times \text{Resp. Rate}\ (m^3/a) \times DCF_{H3}\ (\mu Sv/Bq) \\
&= 3.89\ Bq/m^3 \times 2{,}740\ m^3/a \times 8.0E\text{-}05\ \mu Sv/Bq \\
&= 0.853\ \mu Sv/a
\end{aligned}
$$

$P_{(i)19}$: 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 representative person equals 3.89 Bq/m^3:

$$
\begin{aligned}
P_{(i)19} &= [H\text{-}3_{air}]\ (Bq/m^3) \times \text{Resp. Rate}\ (m^3/a) \times DCF_{H3}\ (\mu Sv/Bq) \\
&= 3.89\ Bq/m^3 \times 7{,}850\ m^3/a \times 3.8E\text{-}05\ \mu Sv/Bq \\
&= 1.160\ \mu Sv/a
\end{aligned}
$$

Dose due to skin absorption

Beginning in 2016, the dose due to skin absorption is wholly accounted for by the application of the inhalation dose conversion factors applied above.

Please see CSA N288.1-14, Table C.1 footnotes for details on dose conversion factors and how they account for skin absorption.

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) derived from information found in CSA Guideline N288.1-14[25]:

TABLE 30: 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

In 2020, the highest average concentration in a residential well used as the sole source of the drinking water was found in RW-3 at 183 Mud Lake Road, equal to **47 Bq/L**. This value 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;
= [47 Bq/L] x 1,081.1 L/a x 2.0E-05 μSv/Bq
= 1.016 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;
= [47 Bq/L] x 305.7 L/a x 5.3E-05 μSv/Bq
= 0.761 μSv/a

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

P_{29} = $[H\text{-}3]_{well}$ x M x 2.5E-05 μSv/Bq;
= [47 Bq/L] x 482.1 L/a x 2.5E-05 μSv/Bq
= 0.566 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 assuming the consumption of 70% of the annual total of produce from this source, and by taking the average tritium concentration from local gardens and assuming the consumption of 30% of the annual total of produce from this source.

These fractions are based upon the site-specific survey previously conducted by SRBT, which determined that the home-grown fraction of plant products consumed by residents in the surrounding area was approximately 30% - a slightly higher value than that recommended in the generic guidance of N288.1-14 (20-25%).

Using the following annual consumption rates for produce derived using information found in CSA Guideline N288.1-14[26]:

TABLE 31: 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 2020 was **3.0 Bq/kg**, while the highest average concentration in produce from a local garden was **63.0 Bq/kg** at 408 Boundary Road.

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

P_{49HTO} = [[$H_{prod,market}$] + [$H_{prod,res}$]] x 2.0E-05 μSv/Bq
= [[H-3_{veg}] (Bq/kg) x (kg) x 0.7] + [H-3_{veg}] (Bq/kg) x (kg) x 0.3]] x 2.0E-5 μSv/Bq
= [[3.0 Bq/kg x 413.3 kg/a x 0.7] + [63.0 Bq/kg x 413.3 kg/a x 0.3]] x 2.0E-05 μSv/Bq
= [[867.93 Bq/a] + [7,811.37 Bq/a]] x 2.0E-05 μSv/Bq
= 0.174 μSv/a

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

P_{49HTO} = [[$H_{prod,market}$] + [$H_{prod,res}$]] x 5.3E-05 μSv/Bq
= [[H-3_{veg}] (Bq/kg) x (kg) x 0.7] + [H-3_{veg}] (Bq/kg) x (kg) x 0.3]] x 5.3E-5 μSv/Bq
= [[3.0 Bq/kg x 124.8 kg/a x 0.7] + [63.0 Bq/kg x 124.8 kg/a x 0.3]] x 5.3E-05 μSv/Bq
= [[262.08 Bq/a] + [2358.72 Bq/a]] x 5.3E-05 μSv/Bq
= 0.139 μSv/a

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
= [[3.0 Bq/kg x 265.2 kg/a x 0.7] + [63.0 Bq/kg x 265.2 kg/a x 0.3]] x 2.5E-05 μSv/Bq
= [[556.92 Bq/a] + [5,012.28 Bq/a]] x 2.5E-05 μSv/Bq
= 0.139 μSv/a

SRBT directly monitored organically bound tritium (OBT) concentrations in tomatoes in the garden at 408 Boundary Road, as well as from tomatoes from the commercial market garden. The average OBT concentration from the residential produce was measured as 3.0 Bq/kg, while for the commercial produce a value of 1.0 Bq/kg was measured.

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
= [[1 Bq/kg x 413.3 kg/a x 0.7] + [3 Bq/kg x 413.3 kg/a x 0.3]] x 4.6E-05 μSv/Bq
= [[289.31 Bq/a] + [371.97 Bq/a]] x 4.6E-05 μSv/Bq
= 0.030 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
= [[1 Bq/kg x 124.8 kg/a x 0.7] + [3 Bq/kg x 124.8 kg/a x 0.3]] x 1.3E-4 μSv/Bq
= [[87.36 Bq/a] + [112.32 Bq/a]] x 1.3E-4 μSv/Bq
= 0.026 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
= [[1 Bq/kg x 265.2 kg/a x 0.7] + [3 Bq/kg x 265.2 kg/a x 0.3]] x 6.3E-5 μSv/Bq
= [[185.64 Bq/a] + [238.68 Bq/a]] x 6.3E-5 μSv/Bq
= 0.027 μSv/a

Total dose due to consumption of produce:

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

P_{49} = P_{49HTO} + P_{49OBT}
= 0.174 μSv/a + 0.030 μSv/a
= 0.204 μSv/a

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

P_{49} = P_{49HTO} + P_{49OBT}
= 0.139 μSv/a + 0.026 μSv/a
= 0.165 μSv/a

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

P_{49} = P_{49HTO} + P_{49OBT}
= 0.139 μSv/a + 0.027 μSv/a
= 0.166 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 derived using information found in CSA Guideline N288.1-14[27]:

TABLE 32: 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 in 2020 was measured as 3.78 Bq/L; adjusting for the density of milk, a specific activity of 3.78 Bq/L x 0.97 L/kg = **3.670 Bq/kg** is calculated.

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

P_{59} = $[H\text{-}3]_{dairy}$ x M x 2.0E-05 μSv/Bq;
= [3.670 Bq/kg] x 188.5 kg/a x 2.0E-05 μSv/Bq
= 0.014 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;
= [3.670 Bq/kg] x 339.9 kg/a x 5.3E-05 μSv/Bq
= 0.066 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;
= [3.670 Bq/kg] x 319.6 kg/a x 2.5E-05 μSv/Bq
= 0.029 μSv/a

Representative persons annual dose due to tritium uptake based on EMP

Based on the EMP results and the coefficients and parameters taken or derived from N288.1-14[24,25,26,27], 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 **2.416 µSv** for an adult worker representative person in 2020, compared to 2.151 µSv in 2019, 3.792 µSv in 2018, 3.349 µSv in 2017, and 4.579 µSv in 2016.

TABLE 33: 2020 REPRESENTATIVE PERSONS 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 and ABSORPTION AT WORK	$P_{(I)19}$	0.434	[redacted]		
DOSE DUE TO INHALATION and ABSORPTION AT RESIDENCE	$P_{(I)19}$	0.748	0.980	0.853	1.160
DOSE DUE TO CONSUMPTION OF WELL WATER	P_{29}	1.016	1.016	0.761	0.566
DOSE DUE TO CONSUMPTION OF PRODUCE	P_{49}	0.204	0.204	0.165	0.166
DOSE DUE TO CONSUMPTION OF MILK	P_{59}	0.014	0.014	0.066	0.029
2020 PUBLIC DOSE	P_{TOTAL}	**2.416**	2.214	1.845	1.921

Statement of Uncertainties in Calculation of Public Dose:

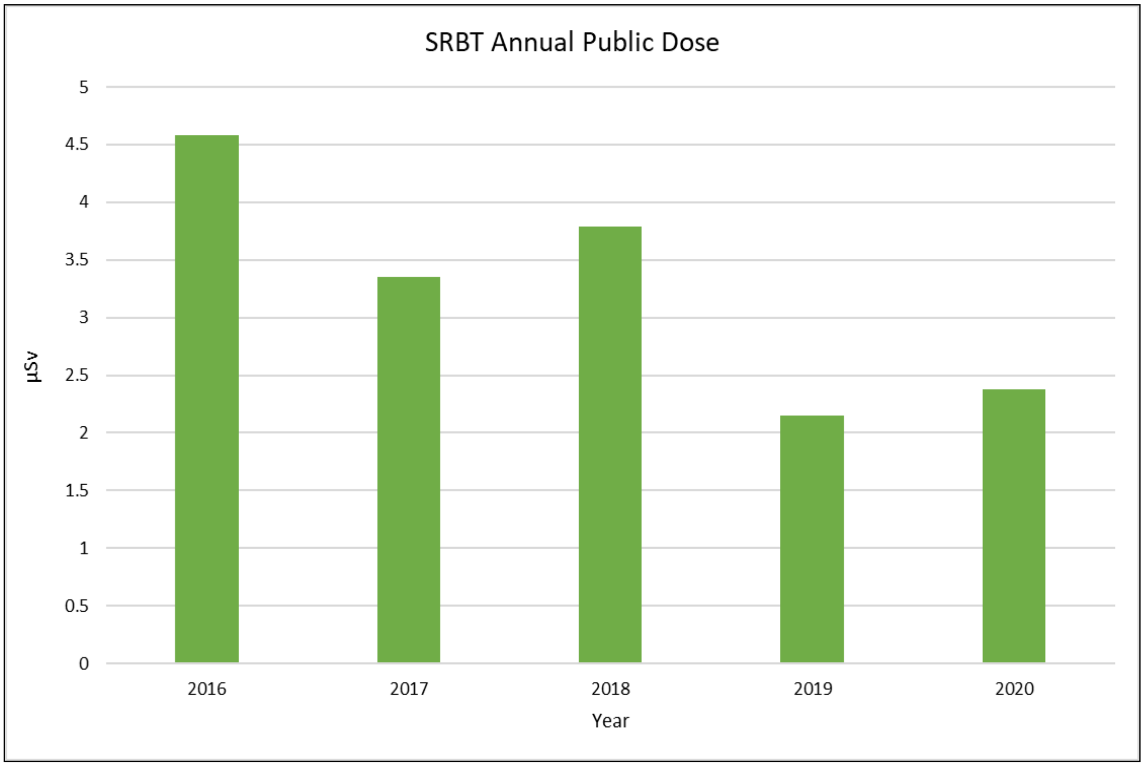
All parameters taken from N288.1-14 are at the 95th percentile where available. Actual ingestion and inhalation rates are likely to be lower for most of the population. Calculated doses are likely to be significantly higher than actual doses to persons as a result.

Statement of Compliance with Regulatory Limit:

Based upon the analysis of the data from the environmental and effluent monitoring programs, the maximum effective dose imparted in 2020 by SRBT, to persons who are not categorized as Nuclear Energy Workers (0.0024 mSv), falls well below the prescribed limit of 1 mSv.

The five-year trend for the effective dose to members of the public is illustrated below in Figure 21.

FIGURE 21: PUBLIC DOSE FIVE-YEAR TREND (2016-2020)



4.3.6 Program Effectiveness

The suite of 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.

The Environmental Monitoring Program continues to be implemented effectively. The past year represents the fourth full year of operation since the program revision to comply with the requirements of CSA standard N288.4-10, and the program continues to be improved over time.

Our passive air sampling array is effective and provides a picture of the full extent of tritium concentrations in air resulting from the emissions from the facility, and in turn providing real data to accurately estimate the dose to representative persons resulting from the emissions from the facility.

Total air emissions in 2020 decreased slightly when compared to 2019, as did several indicators pertaining to the EMP. An observed increase in cumulative average of all PAS data is understood to have been a by-product of SRBT taking on the field sampling and analysis of these samples, due to the onset of the COVID-19 pandemic.

Tritium concentrations in residential wells, and in 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 and potable water sources resulting from the emissions from the facility, and in turn providing data to reliably estimate the dose to representative persons resulting from the emissions from the facility.

The Effluent Monitoring Program was also implemented very effectively in 2020, and succeeded in achieving the defined objectives of the program, including confirming the adequacy of controls on releases from the source, providing high-quality data, and demonstrating adherence to licence limits.

The Groundwater Monitoring Program was highly effective at providing data on the full extent of tritium concentrations in groundwater resulting from the emissions from the facility, and demonstrating the effectiveness of operational changes that have taken place over the last several years.

4.3.7 Program Review and Audit Summary

All major elements of the Environmental Management System (EMS) are scheduled to be audited at least once every three years. As part of this cycle, the EMP was internally audited in July of 2020. Two non-conformances were identified, both of which have been addressed:

- Procedure EMP-001, *Overall Design Summary of the SRBT EMP*, was noted to be lacking a section pertaining to records. This section is required as per MSP-001, Document Control. EMP-001 was updated to include this section, and the NCR closed.
- Section 8.6 of the EMP program document requires annual inter-laboratory exercises to be carried out in order to add confidence to the measurements; however, an annual inter-comparison had not been performed recently. An exercise was conducted successfully with a qualified third-party laboratory in October, and the NCR was closed against this action. The plan going forth is for all three EMS-related monitoring program inter-laboratory exercises to be scheduled as follows each year: EffMP in February, GMP in May, and EMP in October.

Senior management also directed the Compliance Manager to conduct a supplementary audit of EMP sample preparation and handling processes in 2021, as SRBT gains experience conducting these processes in-house after taking over this work with the onset of the COVID-19 pandemic in 2020.

All programs under the EMS were subject to a full review, including comprehensive self-assessment and benchmarking, in the first quarter of 2020. The results of these review exercises were included as input into the annual facility management review process, as per SRBT procedure MSP-008, *Management Review*.

4.3.8 Proposed Modifications to EMS Programs

As of the end of 2020, there are no proposed significant major changes to the monitoring programs that comprise SRBT’s EMS, including the EMP, EffMP and GMP. Two minor changes are being considered at this time for 2021 – the removal of routine wine sampling for the EMP, and the removal of routine sampling of well B-3 from the GMP.

On December 23, 2020, SRBT submitted the first version of our Environmental Risk Assessment to CNSC staff for review and comment. Once accepted, there may be modifications to SRBT’s EMS programs in the coming years, based upon recommendations in the ERA report.

4.3.9 Emission Reduction Initiatives

SRBT continues to implement initiatives aimed at reducing the emission of tritium to the environment that is associated with our processing activities.

4.3.9.1 Miniature Light Source Leak Test Improvements

In order to reduce the amount of tritium being released via the liquid effluent pathway, actions have been taken to improve the process for conducting leak testing of certain types of miniature light sources that have historically been problematic.

All light sources manufactured by SRBT undergo a test where they are submerged for a period of time (either four or twenty-four hours, depending on the application), and then the water is sampled and tested for tritium concentration.

When the amount of tritium in the water exceeds certain criteria, the light source(s) are not moved to the next stage of production until it can be determined if a source is leaking.

For most lights, leak test failure is very infrequent; however, for miniature light sources cut with lasers, the frequency of light source leaks is typically higher. This can be especially pronounced with small-diameter sources.

In 2020, SRBT continued to implement several improvements aimed at lowering the amount of tritium that is transferred into water during these tests, which ultimately must be processed as liquid effluent.

The governing procedure was revised to permit an early screening test to be conducted for batches of miniature light sources, in order to quickly identify light sources that will not pass the leak test if left for the full submersion time.

Samples are permitted to be taken within 15 minutes of submersion, and quickly assessed via liquid scintillation counting. Using this screening technique, it will be clear if a set of sources is bound to fail. These can then be removed from the water immediately, while the remaining batches sampled as normal after the required submersion time has elapsed to ensure that the acceptance criteria are met.

Miniature light source manufacturing rates are expected to increase in 2021. It is hoped that with these improvements, SRBT will be able to meet our target of less than 11 GBq of tritium released via liquid effluent in 2021.

4.3.9.2 Augmented Visual Inspection of Certain Lights Before Filling

SRBT manufactures several shapes and sizes of bench-made light sources, and the amount of tritium activity in the lights varies as well, depending on the internal volume of the light source, and the tritium pressure required to achieve customer brightness requirements.

Some types of lights can be more technically challenging to manufacture than others. In particular, spherical light sources can present certain difficulties, as due to the nature of the shaping of the sphere, the thickness of the glass may not be uniform, particularly near the ‘pip’ side of the lights.

Thinner glass walls near the pip of the spherical light source can result in cracking and breakage after filling, especially for lights that are filled to higher tritium pressures to achieve higher brightness. The tritium then escapes into the work environment, and ultimately, to the environment through the active ventilation systems.

SRBT filled a large order of these types of light sources in 2020 without any significant breakage occurring in a light after filling. As an ALARA- and emission-reduction initiative, the Quality, Assembly and Rig Room departments cooperated to augment the visual inspection process on spherical light sources before they were filled with tritium gas, in order to reduce the incidence of leakage occurring after these lights were filled.

Each individual light source was visually inspected in detail by multiple technicians independently (as precise measurement of the thickness of glass is not readily feasible) prior to being sent to the Rig Room area for filling. If the visually assessed thickness of the glass at the shoulder of the pip area was thought to be too thin by any technician, the light source was rejected.

The higher level of inspection of these and other challenging light types before fill is an effective way at reducing gaseous tritium emissions.

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 2020 to improve and maintain fire safety. These activities included but were not limited to the following:

- A Fire Hazard Assessment (FHA) was conducted by a qualified and independent third-party contractor, in conformance with CSA standard N393-13, and a report issued and submitted to CNSC staff,
- Third party contractor completed a Site Condition Inspection at the facility (a detailed report was completed),
- The PFD completed an inspection of the SRBT facility,
- A gap analysis was completed in preparation for converting the SRBT Fire Protection Program from conforming to the National Fire Code of Canada (NFCC) 2010 to the NFCC 2015, and
- Enhanced training for one Fire Protection committee member.

4.4.1.1 Fire Protection Committee

In 2020, two 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.

4.4.1.2 Fire Protection Program, Fire Safety Plan and Procedures

A gap analysis was completed in preparation for converting the SRBT Fire Protection Program from conforming to the National Fire Code of Canada (NFCC) 2010 to NFCC 2015. The new revision of the Fire Protection Program is expected to be introduced in 2021.

This new revision of the Fire Protection Program will enhance the life safety and fire protection throughout the facility and all Fire Protection Procedures.

4.4.1.3 Update to the SRBT Fire Hazards Assessment (FHA)

In 2020, a qualified, independent third-party completed a Fire Hazard Assessment (FHA) for the SRBT facility, to meet the requirements of CSA Standard N393-13, *Fire protection for facilities that process, handle or store nuclear substances.*

The objective of the FHA was to identify the fire hazards at the facility, evaluate the impact of fires involving these hazards on the safety objectives at the facility, and assess the adequacy of the fire protection measures in place to mitigate these hazards.

The FHA was completed by inspecting the facility and its processes against the following codes and standards:

- NFCC-2015, *National Fire Code of Canada*
- NBCC-2015, *National Building Code of Canada*
- CSA standard N393-13, *Fire protection for facilities that process, handle, or store nuclear substances*.

The FHA assessed the entire facility, room-by-room, factoring in hazards and creating worst-case fire scenarios utilizing the Consolidated Fire and Smoke Transfer model (CFAST). The CFAST model factors in all hazards present in a room and simulates the worst-case fire scenarios in each situation.

It was determined by the FHA that fire hazards at the SRBT facility are being controlled, that worst-case fire events would not be expected to result in an unacceptable release of radiological or hazardous materials, and that there are adequate fire protection and life-safety features.

One opportunity for improvement (OFI) was found during the inspection for the FHA. This OFI was addressed immediately following the review of the FHA report.

The conclusion of the FHA is that the performance goals, objectives and criteria of CSA N-393-13 have been satisfied at the SRBT facility.

4.4.1.4 Maintenance of the Sprinkler System

In 2020, quarterly and annual maintenance was performed on the 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 2020, in-house routine inspection, testing and maintenance was performed on all fire protection and life safety equipment at the SRBT facility on a daily, weekly, monthly and annual basis by trained staff.

Qualified third party contractors also performed routine inspection, testing and maintenance of fire protection and life safety equipment at the SRBT facility. Annual inspection, testing and maintenance include fire extinguishers, emergency lighting, the fire panel and sprinkler system.

4.4.1.6 Fire Extinguisher Training

As a consequence of the COVID-19 pandemic, it was decided that the annual fire extinguisher training for all SRBT employees would not be conducted in 2020.

This training typically involves individuals from the Pembroke Fire Department (PFD) coming into the facility and interacting in close contact with SRBT employees, along with the shared use of training aids such as electronic fire extinguishers.

Throughout the pandemic, the PFD has been ensuring that their operational readiness to respond to emergency situations in their area of service remains uncompromised, by limiting their community activities to those deemed essential or safety-critical.

As such, considering the frequency of training that has been in place for several years, and the fact that there are no new SRBT employees currently working full-time in the facility that did not receive this training in 2019, it was determined that based on the balance of risk, cancelling this training for calendar year 2020 was a reasonable and prudent decision.

Considering the positive outlook on the future of the pandemic towards the second half of 2021, it is anticipated that this training will be resumed in the coming year as usual.

4.4.1.7 Fire Protection Committee Member Training

The Fire Protection Committee continues to include a member who volunteers as a firefighter for a local fire department, and receives fire protection training from this department.

4.4.1.8 Fire Alarm Drills

A total of four in-house fire alarm drills were conducted in 2020.

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

4.4.1.9 Fire Protection Consultant Inspection

In October, a qualified third party (PLC Fire Safety Solutions) was contracted to complete a Site Condition Inspection, 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 inspection was to evaluate the SRBT facility 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-2015, *National Fire Code of Canada*
- NBCC-2015, *National Building Code of Canada*
- CSA standard N393-13, *Fire protection for facilities that process, handle, or store nuclear substances*.

Following the inspection, PLC prepared a “Site Condition Inspection Report”, there were no non-conformities identified as a result of the inspection.

4.4.1.10 Pembroke Fire Department Inspection

The Pembroke Fire Department conducted a facility inspection to confirm compliance with the Ontario Fire Code in October, with no violations being identified.

4.4.2 Emergency Preparedness

SRBT ensures that we are prepared for an emergency at our facility. Staff, equipment and infrastructure are in place and ready to respond to an emergency in accordance with documented procedures.

4.4.2.1 Emergency Plan

The SRBT Emergency Plan has been developed based on the probability and potential severity of emergency scenarios associated with the operation of the facility.

The plan includes preparing for, responding to, and recovering from the effects of accidental radiological and/or hazardous substance releases from the SRBT facility.

The plan was last revised in 2017, and remains up-to-date for the facility's current state.

4.4.2.2 Emergency Exercises

In 2020 SRBT did not conduct an emergency exercise. The last full scale emergency exercise was conducted in 2015.

As per the Emergency Plan, SRBT conducts such exercises at least once every five years.

The next exercise had been projected to be conducted in 2020; however, the onset of the COVID-19 pandemic resulted in this exercise being deferred into 2021, with the approval of CNSC staff[28].

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*

4.5.1 Radioactive Consignments – Waste

Thirteen shipments of low-level waste (LLW) were made to Canadian Nuclear Laboratories (CNL) in 2020.

All thirteen shipments included expired gaseous tritium light sources. A total of 445 packages of expired gaseous tritium light sources were generated and safely shipped to CNL in 2020, an increase in comparison to 2019 where 251 packages were generated. This increase was expected given the accelerated processing rate of expired tritium signs between the fourth quarter of 2019, and through the 2020 calendar year.

All thirteen shipments also included tritium-contaminated waste materials generated by other processes, including material such as used protective clothing, used equipment components, crushed glass, filters, broken lights and cleaning material.

Four drums of waste liquid scintillation counting vials were also generated and disposed of through EnergySolutions in 2020.

A total LLW waste volume of 10.06 m^3 in 485 packages was generated and shipped by SRBT in 2020.

According to the 2016 report titled 'Inventory of Radioactive Waste in Canada 2016' published by Natural Resources Canada, the volume of waste generated at SRBT is significantly lower than other Class 1 nuclear facilities.

For example, in 2016, nuclear power generation in Ontario resulted in the generation of 3,217 m^3 of LLW, while licenced activities at another major licensee in Ontario resulted in a total accumulation rate of 1,222 m^3. As such, SRBT's contribution to the total generated LLW in Canada is relatively small.

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 2020.

TABLE 34: RADIOACTIVE WASTE CONSIGNMENTS (2020)

RECEIVER	DATE OF SHIPMENT	WASTE TYPE	NUMBER OF PACKAGES	DESCRIPTION	TOTAL kg	TOTAL TBq	REFERENCE
CNL	Jan. 22, 2020	LLW	48	Expired light sources	192	782.870	WM-2020-01
			0	Crushed stub glass	0	0.000	
			2	Drums of LLW	200	0.220	
	Feb. 19, 2020	LLW	58	Expired light sources	232	918.980	WM-2020-02
			3	Crushed stub glass	63	0.027	
			2	Drums of LLW	230	0.890	
	Mar. 18, 2020	LLW	46	Expired light sources	184	748.280	WM-2020-03
			2	Crushed stub glass	42	0.018	
			2	Drums of LLW	140	0.020	
	Apr. 30, 2020	LLW	47	Expired light sources	188	805.460	WM-2020-04
			3	Crushed stub glass	63	0.027	
			1	Drums of LLW	70	0.010	
	Jun. 3, 2020	LLW	18	Expired light sources	72	252.020	WM-2020-05
			2	Crushed stub glass	42	0.018	
			1	Drums of LLW	70	0.010	
	Jun. 17, 2020	LLW	14	Expired light sources	56	171.710	WM-2020-06
			2	Crushed stub glass	42	0.018	
			1	Drums of LLW	70	0.010	
	Jul. 22, 2020	LLW	24	Expired light sources	96	401.750	WM-2020-07
			2	Crushed stub glass	42	0.018	
			0	Drums of LLW	0	0.000	
	Aug. 19, 2020	LLW	19	Expired light sources	76	257.742	WM-2020-08
			2	Crushed stub glass	42	0.018	
			1	Drums of LLW	70	0.010	
	Sep. 16, 2020	LLW	38	Expired light sources	152	632.672	WM-2020-09
			2	Crushed stub glass	42	0.018	
			1	Drums of LLW	70	0.010	
	Oct. 14, 2020	LLW	52	Expired light sources	208	782.630	WM-2020-10
			1	Crushed stub glass	21	0.009	
			0	Drums of LLW	0	0.000	
	Nov. 24, 2020	LLW	28	Expired light sources	112	381.845	WM-2020-11
			1	Crushed stub glass	21	0.009	
			1	Drums of LLW	70	0.010	
	Dec. 2, 2020	LLW	36	Expired light sources	144	491.530	WM-2020-12
			2	Crushed stub glass	42	0.018	
			1	Drums of LLW	70	0.687	
	Dec. 9. 2020	LLW	17	Expired light sources	68	250.960	WM-2020-13
			1	Crushed stub glass	21	0.009	
			0	Drums of LLW	0	0.000	
ENERGY SOLNS	Jan. 31, 2020	LLW	2	Drums of LLW	181	0.010	TEND/TN/2570 W200135
	Aug. 25, 2020	LLW	2	Drums of LLW	181	0.010	TEND/TN/2582 W200949

4.5.2 Storage of Radioactive Waste

Radioactive waste was stored on-site and inventory records of the waste were maintained throughout the year, as per the WMP.

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, etc.

LLW was collected in dedicated 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 (CNL), using approved processes.

TABLE 35: INTERIM STORAGE OF LOW-LEVEL WASTE (ZONE 3)

AMOUNT IN STORAGE AT YEAR END 2019	AMOUNT GENERATED THROUGHOUT 2020	TRANSFERRED OFF SITE 2020	AMOUNT IN STORAGE AT YEAR END 2020
5 x 200 L drums	9 x 200 L drums	13 x 200 L drums	1 x 200 L drum
1.12 TBq	1.45 TBq	1.88 TBq	0.69 TBq

As well, six drums of liquid scintillation counting vials were managed and stored in 2020, four of which were sent for disposal (via EnergySolutions). Two drums remain in interim storage for disposal once filled in early 2021.

4.5.2.2 Clearance-level Waste Generation

Waste materials in Zone 2 and 3 that may be minimally contaminated and are likely to meet accepted clearance criteria are classified as very low-level waste (VLLW). This classification is temporary, as ultimately VLLW is assessed radiologically, 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, and other such materials that are collected in various receptacles in the active areas of the facility. These materials are assessed, and should they meet the clearance criteria, disposed of via conventional pathways.

The approved WMP clearance criteria is set at 0.15 MBq/g, up to a maximum of 5,000 kg of cleared material per pathway. The mass of CLW generated in 2020 is tabulated below.

TABLE 36: CLEARANCE-LEVEL WASTE (2020)

TYPE OF MATERIAL	PATHWAY	AMOUNT GENERATED (kg)
GENERAL WASTE	LANDFILL	3,110
METAL	RECYCLER	133

4.5.2.3 Subject Waste

SRBT routinely manages and ships two types of non-radiological 'subject' waste at the facility.

Phosphorescent (zinc sulfide) powder (classified as mild environmental contaminant) is collected and shipped to a licenced hazardous waste management contractor. In addition, waste liquids from the 3-D printing process are also collected and shipped routinely when they are generated.

This waste is picked up quarterly, and disposed of in accordance with the requirements of the Ontario Ministry of Environment and Climate Change.

In 2020, 300 kg of zinc sulfide powder and 36.91 kg of 3-D printing waste were safely disposed of through this program.

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 three times in 2020 to review and discuss initiatives that could ultimately minimize the amount of radioactive waste routed to licenced waste management facilities.

The scope of oversight of the committee was also revised in 2020, to accelerate the organizational focus beyond radiological waste considerations, and to continue to look at ways to minimize non-radiological waste and other environmental impacts of facility operations.

Continued segregation of material prior to bringing items into active zones remains effective at reducing waste materials that require management.

The implementation of Conditional Clearance Levels for waste materials has continued to be successful in reducing the amount of waste material that is needlessly disposed of as radioactive waste.

4.5.2.5 Expired Product Management

SRBT continues to offer return and disposal services to customers who possess expired tritium-illuminated devices, such as ‘EXIT’ signs.

In 2020, a total of 34,081 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 5,360.02 TBq of tritium. For comparison, in 2019, a total of 28,073 signs were processed representing 5,144.93 TBq of tritium.

As well, an additional 179.69 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. These were also processed for shipment to a licenced waste management facility.

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.

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, and would represent a very small fraction of the total light sources managed.

4.6 SCA – Security

SRB Technologies (Canada) Inc. implements an accepted Facility Security Program for the facility, in accordance with CNSC regulatory requirements and expectations.

SRBT did not experience any security-related events in 2020.

There were no CNSC inspections focused on the Security SCA in 2020.

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 facility security system is performed by a qualified, independent third party at least every 6 months.

4.7 SCA – Safeguards and Non-proliferation

SRBT possesses, uses, stores and manages a small quantity of depleted uranium, which is a controlled nuclear substance.

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.

SRBT possessed a reported 9.523 kg of depleted uranium in metallic form at the beginning of 2020.

The inventory of material changed once in 2020; as a result of the annual detailed mass assessment in July, the total inventory was adjusted downward by 155 grams.

An analysis of the variation in the mass of material measured by weigh scale versus the inventory values suggests three potential factors influencing the discrepancy:

- Rig Room staff have continued to remove non-uranium material from the container, when building traps using the material in Container 1.
- Previous measurements performed on Container 2 were done in several smaller batches, which may have increased the uncertainty of the overall measurement. Only two divided measurements of the material in Container 2 were performed this year. The weigh scale limit is 3,000 grams, thus necessitating multiple measurements for this container.
- The scale was calibrated in February 2020, and it was noticed at that time that the unit was not level. This condition was corrected.

At the conclusion of 2020, the total mass of depleted uranium on site is listed as 9.368 kg. A limit of 10 kg of this material in inventory is applied as part of the operating limits and conditions in the SAR.

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.*

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 (PTNSR)
- 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, 827 consignments were safely shipped to various customers located in 19 countries around the world, including Canada. A table is provided comparing the number of outgoing shipments of our products over the past five years.

TABLE 37: OUTGOING SHIPMENTS OF PRODUCT FIVE-YEAR TREND (2016-2020)

YEAR	2016	2017	2018	2019	2020
NUMBER OF SHIPMENTS*	1,001	970	948	949	827
NUMBER OF COUNTRIES	18	23	22	20	19

*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. 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 2020 can be found in **Appendix T** of this report.

4.8.2 Incoming Shipments

In total, 272 consignments of radioactive shipments were received from various customers located in 8 countries around the world, including Canada. These returns held a total activity of 5,539.72 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 incoming shipments of radioactive products that have been made over the past five years.

TABLE 38: INCOMING SHIPMENTS OF PRODUCT FIVE-YEAR TREND (2016-2020)

YEAR	2016	2017	2018	2019	2020
NUMBER OF SHIPMENTS	562	539	518	484	272
NUMBER OF COUNTRIES	9	6	7	8	8

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 2020 can be found in **Appendix U** of this report.

4.8.3 Reportable Events

No packaging and transport-related reportable events took place in 2020.

5. Other Matters of Regulatory Interest

5.1 Public Information and Disclosure

This section of the report will provide public information initiatives taken in 2020.

5.1.1 Direct Interaction with the Public

Historically, almost all public inquiries occur during re-licensing.

In late 2020, SRBT received a phone call from an individual living in Gatineau, Quebec, asking if we knew anything about the “Geiger counters” that were broken down and not measuring the level of radiation in the Ottawa River near her residence.

SRBT’s President took the call and explained that SRBT used tritium and explained that tritium had too low of energy to be detected by a “Geiger counter” and that any radiation emitted by SRBT would be too low to be detected in Gatineau. It was also explained that the river next to the facility measured near background levels.

She explained she was sick due to radiation, nobody took her seriously and she couldn’t find any measurements posted anywhere. It was noted to her that all SRBT’s measurements were posted on our website and she was urged to visit the CNSC’s website and contact the CNSC for any questions and concerns regarding radiation in her area or industry regulations and limits.

In 2020, water was sampled from a number of wells belonging to the public, in line with our Environmental Monitoring Program. Sampling for tritium concentration was performed every four months. On a yearly basis, SRBT also samples produce from gardens belonging to members of the public for tritium concentration.

Participating members of the public are provided with a report of their 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. No questions or comments were received in 2020.

Plant tours have proven to be a useful tool for SRBT to reach the public. In 2020, we have provided plant tours to 10 members of the general public (compared to 17 in 2019) who had expressed interest in our facility. COVID 19 restrictions did not permit visitors to the facility for several months which contributed to the lower number.

In 2020 we provided plant tours to local representatives of:

- Renfrew County Community Futures Development Corporation,
- The City of Pembroke,
- Underwriters Laboratories,
- Your TV,
- Province of Ontario,
- Pembroke Observer, and
- MyFM

In 2020 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:

- Black and MacDonald,
- Edmunds Insurance, and
- Pegasus

In 2020 we also provided plant tours to existing and prospective customers including:

- MB Microtec, and
- East Side Mario's

TABLE 39: FACILITY TOURS (2020)

	2020
GENERAL PUBLIC	10
LOCAL INSTITUTIONS	7
LOCAL SUPPLIERS	3
CUSTOMERS	2
TOTAL	**22**

A public meeting was held by the CNSC on December 8, 2020 regarding the annual regulatory oversight report. There were no questions directed at the attending staff of SRBT[29].

In 2020, letters were sent to the Algonquins-Anishinabeg Nation[30] and to the Algonquins of Pikwakanagan[31] with an invitation to contribute to SRBT's Environmental Risk Assessment.

The letter described who we are, what we do, the details of the project, how they can contribute and collaborate on the project and the next steps. We have only received a response from the Algonquins of Pikwakanagan[32], who did contribute and provide knowledge and access to their land.

In 2020, SRBT made presentations to members of the public:

- The President of SRBT is a member of the Pembroke Economic Development Tourism Advisory Committee, attending monthly meetings where updates on SRBT are often discussed. The Mayor of Pembroke and one Pembroke City Councillor are also members of this committee.
- The President of SRBT is also a member and chair of the Community Improvement Plan, attending meetings and discussing SRBT on occasion. The Mayor of Pembroke is also on the Committee.
- The President of SRBT is also a member of the Ontario River Energy Solutions, attending meetings and discussing SRBT on occasion. Pembroke's Deputy Mayor is also a member of this committee.

5.1.2 Program Revision

Revision 9 of SRBT's Public Information Program (PIP) continues to demonstrate SRBT's commitment to openness and transparency.

In 2021, there will be a review of the PIP to determine if changes or improvements can be made to better include non-local stakeholders, as well as to review the program against the requirements of both REGDOC 3.2.1, *Public Information and Disclosure* (which has superseded RD-99.3), and REGDOC 3.2.2, *Indigenous Engagement,* Version 1.1.

5.1.3 Program Audit

There were no internal audits conducted on the Public Information Program in 2020. The next internal audit is scheduled to take place in July 2022.

5.1.4 Public Information Committee

The Public Information Committee held three formal meetings in 2020, focused on COVID-19 restrictions, and outreach to the Algonquins of Pikwakanagan indigenous community.

5.1.5 Website and Social Media

SRBT continues to operate a website at www.srbt.com, which continues to provide current environmental monitoring data, information about tritium, content on emergency preparedness, the safe transport of tritium to the facility and products from the facility, how to safely dispose of products, and our Operating Licence and Licence Condition Handbook.

The main page provides a number of possible information sources for the public on tritium and radiation exposure.

The following information and documentation were added to our website in 2020:

- SRBT Licence Condition Handbook, Revision 3,
- CNSC Compliance Inspection 2019-2,
- Preliminary Decommissioning Plan, November 2019,
- Two reportable events documents,
- CNSC IEMP 2018,
- Updated pamphlet and brochures,
- SRBT Annual Compliance Report, 2019, including addenda,
- CNSC staff's Regulatory Oversight Report, 2019, and,
- Press Release and Record of Decision for the Commission's acceptance of SRBT's revised Financial Guarantee.

With respect to social media, SRBT also maintains Facebook, Instagram, Twitter, LinkedIn and Reddit accounts, all of which are updated periodically. In 2020, SRBT created a new social media account on TikTok.

Since being initiated on February 3, 2015, our Facebook account has gained a total of 1,179 followers (888 new in 2020), with a total of 72 posts (24 in 2020). The account has received 18 reviews to date (0 in 2020), all of which are positive, along with a total of 1,128 page likes (846 in 2020).

Since its inception on December 11, 2016, SRBT's Instagram account has gained a total of 249 followers (82 new in 2020), with a total of 37 posts (10 in 2020). The account received an average of 30 likes per post in 2020.

SRBT's Twitter account was started on April 6, 2017 and has since gained 84 followers (29 new in 2020). A total of 27 posts have been made (10 in 2020), receiving 125 likes (51 in 2020).

In 2020, in order to bring more awareness to SRBT's social media, a contest was posted to our Facebook and Instagram accounts. This contest generated approximately 1,000 additional page likes on Facebook, and added 80 followers on Instagram.

5.1.6 Community Support

SRBT continues to support the local community by providing support to various organizations and causes. Due to the pandemic, all in-person fundraising event were cancelled (trivia nights, skating, sports, etc.), which unfortunately resulted in less realized opportunities to provide community support in 2020.

During the Christmas season, SRBT donated several items to both Valley Animal Rescue and Destig: Mental Health Clothing, as auction items to raise money. SRBT also supported the Christmas Angels gift collection for children in the area, aimed at supporting families who couldn't afford gifts at Christmas.

SRBT donated face shields to the Woman's Sexual Assault Centre of Renfrew County, and various long-term care facilities for the elderly in the area.

SRBT is a member of the Upper Ottawa Valley Chamber of Commerce. SRBT is a club member of the Muskrat Watershed Council in support of the water quality monitoring data report and ongoing work. The Manager – Health Physics and Regulatory Affairs is a member of the Algonquin College Radiation Safety Program Advisory Committee.

SRBT has supported the Main Street Community Services who provides research-based programs for children with special needs.

SRBT has supported causes such as Community Living Upper Ottawa Valley, Bernadette McCann House for Women, the Robbie Dean Family Counseling Center, and the Ontario Society for the Prevention of Cruelty to Animals.

SRBT also supports Festival Hall (Pembroke's local community theater), the Alice and Fraser Horse Association, and the Renfrew County Regional Science and Technology Fair.

5.2 Preliminary Decommissioning Plan and Financial Guarantee

The SRBT Preliminary Decommissioning Plan (PDP) underwent a significant revision in 2019, in compliance with compliance verification criteria 3 for Licence Condition 12.2, as described in the SRBT LCH.

The revised and updated plan was submitted to CNSC staff on November 29, 2019; details on the changes contained in the plan were previously summarized in the 2019 Annual Compliance Report.

CNSC staff accepted the revised PDP on February 3, 2020[6], and requested that SRBT provide updated draft Escrow Agreement and Financial Security and Access Arrangement documents, in order to support consideration by the Commission on the final regulatory acceptability of the revised PDP and updated value of the Financial Guarantee (FG) value of $727.327.

On February 4, 2020, SRBT submitted the revised documents[33], as well as a proposal to fully fund the FG to $727,327.00 by the end of April 2020. CNSC staff accepted the revised documents on April 3, 2020[34].

On April 24, 2020, SRBT provided evidence to CNSC staff that the FG was fully funded to the updated value[35], in advance of consideration by the Commission of the acceptability of the PDP and FG.

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

The Record of Decision on the matter was issued on December 8, 2020[7], noting that the Commission accepted SRBT's revised financial guarantee amount of $727,327.00. Details on our revised PDP, updated FG, and the CNSC's hearing and decision were added to our website.

The SRBT Financial Guarantee is a cash fund held in escrow, and does not rely on any letters of credit, bonds, insurance or other expressed commitments. Interest accrued on the funds deposited remain held in escrow over time; as a result, at the end of 2020 the FG is funded to $735,622.44, a level that exceeds the required amount by $8,295.44.

6 Improvement Plans and Forecast

6.1 Emission Reduction Initiatives

SRBT continues to explore ways toward reducing tritium emissions from the facility in all forms, as per our continuing commitment to environmental protection and the 'as low as reasonably achievable' (ALARA) philosophy.

We expect that the changes that are being introduced to the manufacturing and leak testing of miniature light sources should continue to keep the rate of generation of tritium-contaminated liquid effluent very low in 2021.

Continued, systematically developed training of employees who process tritium and handle light sources will continue to impact our gaseous emissions in a positive way.

6.2 Safety Performance Targets for 2021

For the coming year, our safety committees, in consultation with SRBT Senior Management, have approved a set of performance targets which will be tracked and reported on as part of the 2021 ACR.

The following table documents the safety performance targets for SRBT in 2021:

TABLE 40: SRBT SAFETY AND PERFORMANCE TARGETS FOR 2021

PARAMETER	2021 TARGET
MAXIMUM WORKER DOSE	≤ 0.60 mSv
AVERAGE WORKER DOSE	≤ 0.060 mSv
CALCULATED DOSE TO MEMBER OF THE PUBLIC	≤ 0.0040 mSv
TOTAL TRITIUM EMISSIONS TO ATMOSPHERE (PER WEEK AVERAGE)	≤ 625 GBq / week
RATIO – TRITIUM EMISSIONS VS. PROCESSED	≤ 0.11
TOTAL TRITIUM EMISSIONS – LIQUID EFFLUENT PATHWAY	≤ 11 GBq
ACTION LEVEL EXCEEDANCES – ENVIRONMENTAL	≤ 1
ACTION LEVEL EXCEEDANCES – RADIATION PROTECTION	≤ 1
CONTAMINATION CONTROL – FACILITY-WIDE PASS / FAIL RATE	≥ 95%
LOST TIME INJURIES	0
MINOR INJURIES REPORTABLE TO WSIB	≤ 5
MINOR INCIDENTS / FIRST AID INJURIES (NON-REPORTABLE)	≤ 15

6.3 Planned Modifications and Foreseen Changes

The upcoming year of operation is not expected to involve significant modifications to the facility or our licensed activities, and production levels are expected to remain stable.

The coming year will see SRBT file an application for the renewal of our nuclear substance processing facility operating licence. Licence NSPFOL-13.00/2022 expires on June 30, 2022, thus 2021 represents the final full year of operations under the current licence.

We expect that several management system programs and procedures will be reviewed and considered for revision in 2021, as SRBT prepares for the licence renewal process to take place, and as updated REGDOCs are published.

SRBT will be continuing to pursue and explore opportunities to reduce emissions in all forms, as part of our ongoing commitment to ensure that our environmental impacts are as low as reasonably achievable.

7 Concluding Remarks

Throughout the year, the management and staff of SRBT complied with all regulatory requirements and the conditions of our operating licence.

Our management system remains effective at achieving our operational and safety-related goals, and ensuring effective control of our operations. We continue to adjust and improve our processes in support of the safe and effective operation of our facility, and we continue to use operating experience to continuously improve the system.

Our facility remains within its designed safety basis, and continues to be fit for service. Key structures, systems and components have continued to be maintained diligently and effectively throughout 2020 through the implementation of our Maintenance Program.

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

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

Our conventional health and safety program has continued to ensure our workers are safe, and the security of the facility and all nuclear substances was maintained at all times.

SRBT remains well protected from fire hazards, and have maintained an accepted plan should an emergency condition arise. Although the full-scale emergency exercise was delayed due to the onset of the COVID-19 pandemic, we are looking forward to conducting a full-scale emergency exercise in 2021, in order to practice our response as described in our Emergency Plan, should an emergency arise at our facility.

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.

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

Our decommissioning responsibilities are documented and accepted, and our financial guarantee is fully funded after having been updated in 2020. Although we plan on operating the facility for at least the next two decades, if not longer, having a complete, self-funded financial guarantee is an important consideration with respect to our regulatory standing, as well as our commitment of being a good community partner.

Safety and excellence in operations shall always remain as the number one overall priority in everything we do, and 2020 was a direct reflection of the success at achieving these goals.

We will continue to improve our operations and minimize our impact on people and the environment as our company continues to sustainably grow over the coming years. We also look forward to filing our application for renewal of our operating licence in 2021.

8 References

[1] Nuclear Substance Processing Facility Operating Licence NSPFOL-13.00/2022, valid from July 1, 2015 to June 30, 2022. Link

[2] Licence Condition Handbook – SRB Technologies (Canada) Inc. Nuclear Substance Processing Facility Operating Licence NSPFOL-13.00/2022 (CNSC e-Doc 4624621 (Rev. 0), 4899130 (Rev.1), 5127037 (Rev. 2), 6089149 (Rev. 3)). Link

[3] CNSC Compliance Inspection Report SRBT-2020-01, Report Date March 26, 2020 (CNSC e-Doc 6094385). Link

[4] CNSC Compliance Inspection Report SRBT-2020-02, Report Date January 14, 2021 (CNSC e-Doc 6458352). Link

[5] Letter from L. Posada (CNSC) to R. Fitzpatrick (SRBT), *CNSC Staff Review of SRB Technologies (Canada) Inc.'s Revised Fire Protection Program and Fire Safety Plan*, dated January 29, 2020 (CNSC e-Doc 6104155).

[6] Letter from L. Posada (CNSC) to S. Levesque (SRBT), *CNSC Staff Review of SRB Technologies (Canada) Inc.'s Revised Preliminary Decommissioning Plan - 2019*, dated February 3, 2020 (CNSC e-Doc 6111181).

[7] CNSC Record of Decision DEC 20-H105, dated December 8, 2020. Link

[8] Letter from S. Levesque (SRBT) to L. Posada (CNSC), *Submission of Revised Regulatory Reporting Program,* dated February 27, 2020.

[9] Letter from L. Posada (CNSC) to S. Levesque (SRBT), *CNSC Staff Review of SRB Technologies (Canada) Inc.'s Revised Regulatory Reporting Program*, dated March 27, 2020 (CNSC e-Doc 6260355).

[10] Letter from S. Levesque (SRBT) to L. Posada (CNSC), *Submission of LCH-listed Procedures,* dated March 4, 2020.

[11] Letter from S. Levesque (SRBT) to L. Posada (CNSC), *Submission of Revised Groundwater Monitoring Program,* dated March 12, 2020.

[12] Letter from L. Posada (CNSC) to S. Levesque (SRBT), *CNSC Staff Review of SRB Technologies (Canada) Inc.'s Revised Groundwater Monitoring Program*, dated April 1, 2020 (CNSC e-Doc 6269762).

[13] Letter from S. Levesque (SRBT) to L. Posada (CNSC), *Response to Inspection Report SRBT-2020-01,* dated May 11 2020.

[14] Letter from L. Posada (CNSC) to S. Levesque (SRBT), *CNSC Staff Review of SRBT's Response to Inspection Report SRBT-2020-01*, dated May 15, 2020 (CNSC e-Doc 6296642).

[15] Email from J. MacDonald (SRBT) to L. Posada (CNSC), *Submission of Two Revised Procedures (LCH Appendix C),* dated August 19, 2020.

[16] Letter from L. Posada (CNSC) to S. Levesque (SRBT), *CNSC Staff Review of SRB Technologies (Canada) Inc.'s Revised Two Procedures*, dated September 14, 2020 (CNSC e-Doc 6377120).

[17] Letter from R. Fitzpatrick (SRBT) to L. Posada (CNSC), *Submission of Updated SRBT Fire Hazard Assessment (FHA),* dated December 11, 2020.

[18] Letter from S. Levesque (SRBT) to L. Posada (CNSC), *Submission of SRBT Environmental Risk Assessment (ERA),* dated December 23, 2020.

[19] Email from J. MacDonald (SRBT) to S. Rodrigue (CNSC), *2020 Annual Compliance Report – 11341-3-28.2 – SRB Technologies (Canada) Inc.,* dated January 20, 2021.

[20] Email from A. Pochopsky (Health Canada) to S. Levesque (SRBT), *Your New MDEL – 11-05-2020: SRB TECHNOLOGIES (CANADA) INC., MDEL 12643 (Company ID 155257),* dated May 11, 2020.

[21] Letter from M. Tremblay (Health Canada) to J. MacDonald (SRBT), *Certificate of Achievement*, dated August 17, 2020.

[22] Letter from S. Rodrigue (CNSC) to J. MacDonald (SRBT), *Dosimetry Service Licence No. 11341-3-28.2,* dated July 3, 2020.

[23] CSA standard N288.1-14, *Guidelines for calculating derived release limits for radioactive material in airborne and liquid effluents for normal operation of nuclear facilities*

[24] CSA standard N288.1-14, *Guidelines for calculating derived release limits for radioactive material in airborne and liquid effluents for normal operation of nuclear facilities*, Tables C.1, C.2.

[25] CSA standard N288.1-14, *Guidelines for calculating derived release limits for radioactive material in airborne and liquid effluents for normal operation of nuclear facilities*, Table 19.

[26] CSA standard N288.1-14, *Guidelines for calculating derived release limits for radioactive material in airborne and liquid effluents for normal operation of nuclear facilities*, Table 21.

[27] CSA standard N288.1-14, *Guidelines for calculating derived release limits for radioactive material in airborne and liquid effluents for normal operation of nuclear facilities*, Table G.9c.

[28] Letter from L. Posada (CNSC) to S. Levesque (SRBT), *CNSC Staff Review of SRB Technologies (Canada) Inc.'s Request for Deferral of Emergency Exercise,* dated May 4, 2020 (CNSC e-Doc 6289242).

[29] Transcript of CNSC Meeting held December 8, 2020. Link

[30] Letter from J. MacDonald (SRBT) to Grand Chief V. Polson (Algonquin-Anishinabeg Nation), *Invitation to Contribute – SRBT Environmental Risk Assessment,* dated June 17, 2020.

[31] Letter from J. MacDonald (SRBT) to Chief W. Jocko (Algonquins of Pikwakanagan), *Invitation to Contribute – SRBT Environmental Risk Assessment,* dated June 17, 2020.

[32] Email from W. Jocko Chief W. Jocko (Algonquins of Pikwakanagan) to J. MacDonald (SRBT), *RE: Invitation to Contribute – SRBT Environmental Risk Assessment*, dated June 17, 2020.

[33] Letter from S. Levesque (SRBT) to L. Posada (CNSC), *Draft Escrow Agreement and Financial Security and Access Arrangement, with Proposal to Fund Updated Financial Guarantee,* dated February 4, 2020.

[34] Letter from L. Posada (CNSC) to S. Levesque (SRBT), *CNSC Staff Review of SRB Technologies (Canada) Inc.'s Revised Escrow Agreement and Revised Security Access Agreement*, dated April 3, 2020 (CNSC e-Doc 6256577).

[35] Letter from S. Levesque (SRBT) to L. Posada (CNSC), *SRBT Financial Guarantee Update,* dated April 24, 2020.

9 Appendices

DESCRIPTION **LETTER**

Tritium Activity on Site During 2020 .... A
Equipment Maintenance Information for 2020 .... B
Ventilation Equipment Maintained in 2020 C
Radiological Occupational Annual Dose Data for 2020 .... D
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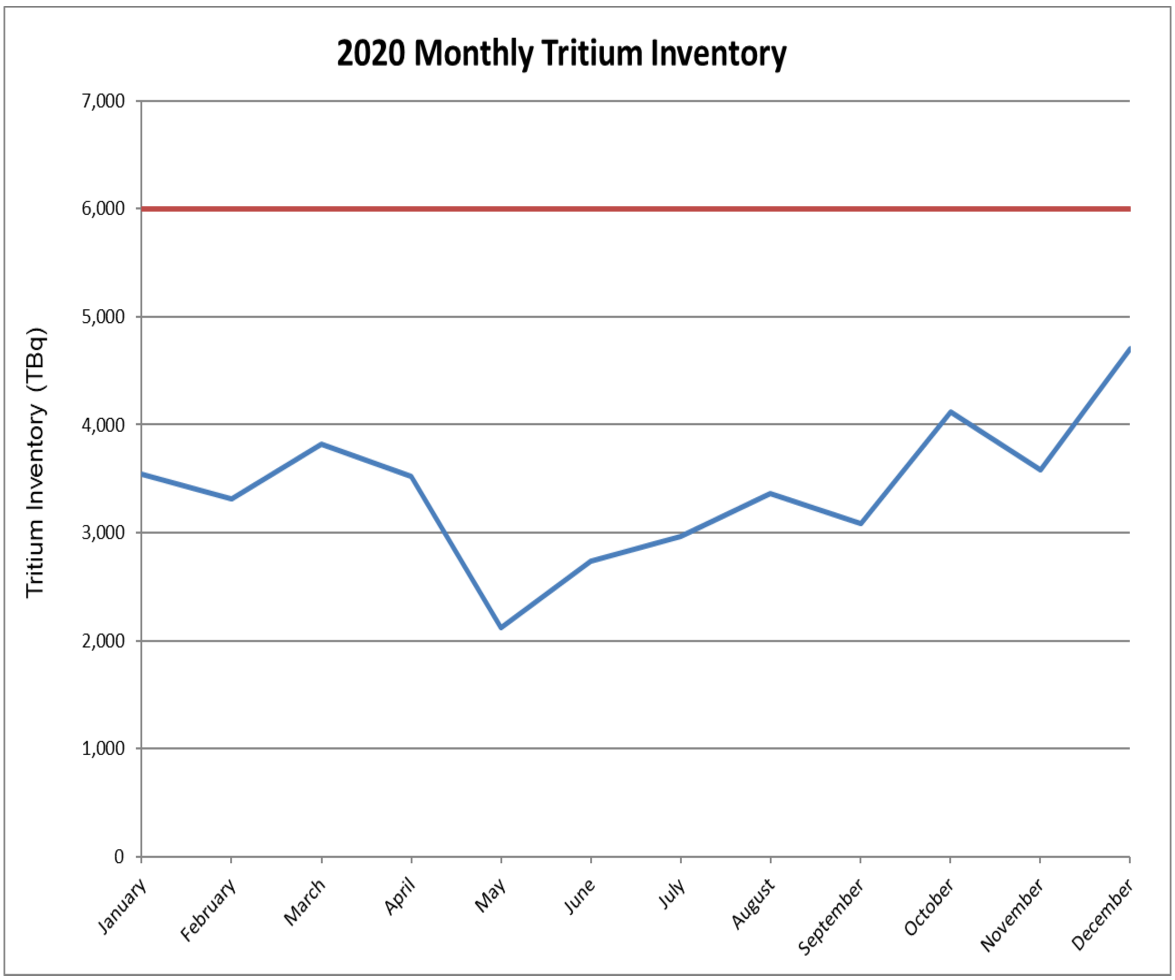
APPENDIX A

Tritium Activity on Site During 2020

Tritium Activity on Site During 2020

Month	Month-end H-3 Activity On-Site (TBq)	Percent of Licence Limit (%)
January	3,544	59.1
February	3,310	55.2
March	3,817	63.6
April	3,525	58.8
May	2,117	35.3
June	2,735	45.6
July	2,964	49.4
August	3,360	56.0
September	3,086	51.4
October	4,116	68.6
November	3,581	59.7
December	4,707	78.5
2020 Monthly Average	**3,405**	**56.8**

Note: Tritium possession limit = 6,000 TBq.



APPENDIX B

Equipment Maintenance Information for 2020

Equipment Maintenance Information for 2020

Semi-Annual maintenance on HVAC equipment: **Contract:** Black and McDonald	June 16, 2020 Sept 9, 2020
Quarterly maintenance on Rig & Bulk stack units: **Contract:** Black and McDonald	March 16, 2020 June 16, 2020 Sept 23, 2020 Dec 18, 2020
Annual stack verification by a third party on Rig & Bulk stack units: **Contract:** Tab Inspection	Sept 20, 2020
Sprinkler System quarterly maintenance by a third party: **Contract:** Drapeau Automatic Sprinkler Corp	May 29, 2020 June 26, 2020 Sept 18, 2020 Dec 18, 2020
Emergency Lighting & Fire Extinguisher annual inspection by a third party: **Contract:** Layman Fire and Safety	March 10, 2020
Sprinkler System inspection by SRBT:	Weekly
Fire Alarm Components inspection by SRBT:	Weekly
Fire Separation doors inspection by SRBT:	Weekly
Fire Extinguisher inspection by SRBT:	Monthly
Emergency Lights inspection by SRBT:	Monthly
Quarterly maintenance carried out on the compressor: **Contract:** Valley Compressor	Jan 16, 2020 Feb 28, 2020 Apr 28, 2020 July 2, 2020 Oct 13, 2020
Fume Hood 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	Feb 21, 2020
Liquid Scintillation Counters third party annual maintenance: **Contract:** PerkinElmer	October 1, 2020
Real-time Stack Monitoring system verification by SRBT:	March 3, 2020 June 2, 2020 Sept 2, 2020 Dec 1, 2020

Equipment Maintenance Information for 2020

Monitoring well inspection by SRBT:	Feb 5, 2020 June 1, 2020 Oct 5, 2020
Annual IT maintenance inspection by SRBT:	September 16, 2020
Non-active air filter inspection by SRBT:	Monthly
Annual Zone Differential Pressure Test by SRBT:	December 21, 2020
UV printer maintenance by SRBT:	Monthly
Molding machine maintenance by SRBT:	Mar 19, 2020 Jun 29, 2020 Sept 18, 2020 Dec 21, 2020
3D printer maintenance by SRBT:	Mar 25, 2020 Jun 17, 2020 Sept 4, 2020 Dec 22, 2020
Fork-crane maintenance by SRBT:	Jan 3, 2020
Forklift maintenance by a third party: **Contract: Hyster**	May 7, 2020
Report of any weakening or possible major failure of any components:	None

All ventilation systems were maintained at a high fitness for service. Corrective maintenance was performed as required. 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.

Corrective maintenance is performed on equipment as required, and recorded and tracked over time.

APPENDIX C

Ventilation Equipment Maintained in 2020

Ventilation Equipment Maintained In 2020

#	TYPE	ZONE SERVICED	LOCATION OF UNIT
1	Gas Furnace	1	Front office / server hallway
1	Mid efficient gas furnace	1	Receiving area
1	Mid efficient gas furnace & central air	1	Stores
1	Mid efficient gas furnace	1	Back bay
1	Heat Recovery unit	1	Receiving area
1	HRV with reheat	2	Coating
2	Makeup air units	1 & 2	Coating room
3	Unit heaters	1 & 3	Rig room, Glass shop, Receiving area
1	A/C wall unit	1	Glass shop
4	Exhaust fans	1 & 2	Coating, Assembly, Glass room, Paint Booth
1	Electric furnace with central air	1	Front office
1	Bulk stack air handling unit	3	Compound
1	Rig stack air handling unit	3	Compound
2	Rig and Bulk stack air handling units pitot tubes	3	Compound
1	Gas furnace with central air	1	Milling / molding

APPENDIX D

Radiological Occupational Annual Dose Data for 2020

RADIOLOGICAL OCCUPATIONAL ANNUAL DOSE DATA FOR 2020

SRBT ROLLING FIVE-YEAR EFFECTIVE DOSE DATA (2016 - 2020)

ANNUAL DOSE (mSv)	2016	2017	2018	2019	2020	FIVE YEAR AVERAGE
Maximum Dose	0.34	0.46	0.48	0.57	0.43	**0.46**
Average Dose (all records)	0.049	0.045	0.044	0.065	0.077	**0.056**
Average Dose (excluding <0.01))	0.095	0.113	0.130	0.115	0.093	**0.109**
Collective Dose	2.21	1.96	2.06	2.95	3.30	**2.50**

EFFECTIVE DOSE RANGE (mSv)	2016	2017	2018	2019	2020	FIVE YEAR AVERAGE
< 0.01 (‘zero dose’)	25	28	32	20	8	**23**
0.01 – 0.05	7	8	7	10	18	**10**
0.05 – 0.10	7	4	1	6	7	**5**
0.10 – 0.25	3	2	5	5	6	**4**
0.25 – 0.50	3	3	2	3	4	**3**
0.50 – 1.00	0	0	0	1	0	**0**
>1.00	0	0	0	0	0	**0**
Number of Workers Monitored	45	45	47	45	43	**44**

APPENDIX D

APPENDIX E

Swipe Monitoring Results for 2020

SWIPE MONITORING RESULTS FOR 2020

Q1 2020 Routine Contamination Assessment Summary - Zone 3

Zone 3 Swipe Areas	No. of swipes	Amount pass	Average Pass
Rig 7 Floor	61	58	95.08%
Rig 7	61	60	98.36%
Rig 1 Floor	61	61	100.00%
Rig 1	61	60	98.36%
Flr @ Rig 6	61	59	96.72%
Rig 6	61	61	100.00%
Floor @ Rig 8	61	59	96.72%
Rig 8	61	61	100.00%
Floor @ Rig 5	61	58	95.08%
Rig 5	61	60	98.36%
Waste Room Floor	59	57	96.61%
Scint Table	59	58	98.31%
Laser Room Floor West	61	61	100.00%
Laser Room Desk	59	59	100.00%
Flr @ Barrier	61	58	95.08%
Laser rm flr East	61	61	100.00%
EIP Area	61	61	100.00%
Laser Rm F/H	61	61	100.00%
Shoe Covers	61	58	95.08%
Trit Lab Flr random	61	59	96.72%
Bulk Fume Hood	61	56	91.80%
Disassembly Fumehood	61	54	88.52%
Wash Fume hood	59	59	100.00%
LLW Drums	61	61	100.00%
Muffle Fume hood	2	2	100.00%
Waste Room Shelf	2	2	100.00%
Photometer Room	2	2	100.00%
Table at Barrier	2	2	100.00%
	1464	1428	97.54%

Q1 2020 Routine Contamination Assessment Summary - Zone 2

Zone 2 Swipe Areas	No. of swipes	Amount pass	Average Pass
Floor at Barrier	36	36	100.00%
Work Area Floors	36	33	91.67%
Work Counters	36	36	100.00%
Cart at Barrier	36	35	97.22%
Shoe Covers	36	35	97.22%
Shoe Storage	35	35	100.00%
Floor Beside Disassembly	36	36	100.00%
Disassembly Bins	36	35	97.22%
Microscope Area	36	34	94.44%
Photometer Room Floor	35	34	97.14%
Silk Screen Room Floor	35	34	97.14%
Insp. Prep. Counter	36	36	100.00%
Paint Booth	1	0	0.00%
Storage Cabinets	1	1	100.00%
Foot Rest	1	1	100.00%
	432	421	97.45%

Q1 2020 Routine Contamination Assessment Summary - Zone 1

Zone 1 Swipe Areas	No. of swipes	Amount pass	Average Pass
Lunch Room	13	13	100.00%
LSC Room	13	13	100.00%
RR Ante Rm	13	12	92.31%
RR Barrier	13	12	92.31%
Assy Barrier	13	13	100.00%
Disassembly Table	13	13	100.00%
Disassembly Cart	13	12	92.31%
Shipping Floor	13	13	100.00%
Disassy Floor	12	12	100.00%
Disassy Cabinet	12	11	91.67%
2nd RMA Storage Area	13	12	92.31%
Shipping Counter	13	13	100.00%
Hallway at Z2	1	1	100.00%
RMA Storage Area	1	1	100.00%
	156	151	96.79%

Q2 2020 Routine Contamination Assessment Summary - Zone 3

Zone 3 Swipe Areas	No. of swipes	Amount pass	Average Pass
Rig 7 Floor	61	59	96.72%
Rig 7	61	60	98.36%
Rig 1 Floor	61	60	98.36%
Rig 1	61	60	98.36%
Flr @ Rig 6	61	58	95.08%
Rig 6	61	61	100.00%
Floor @ Rig 8	61	57	93.44%
Rig 8	61	60	98.36%
Floor @ Rig 5	61	56	91.80%
Rig 5	61	61	100.00%
Waste Room Door	56	56	100.00%
Scint Table	61	60	98.36%
Liquid Nitrogen Hose	56	56	100.00%
Holding Chambers	56	53	94.64%
Flr @ Barrier	61	60	98.36%
Laser Room Floor	61	60	98.36%
EIP Area	61	59	96.72%
Laser Rm F/H	61	58	95.08%
Trit Lab Desk	56	54	96.43%
Trit Lab Flr random	61	57	93.44%
Bulk Sash	56	55	98.21%
Disassembly Fumehood	61	45	73.77%
Wash Fume hood	61	60	98.36%
Shoe Covers	61	55	90.16%
Laser Room Floor West	5	5	100.00%
Laser Room Desk	5	5	100.00%
Waste Room Floor	5	5	100.00%
LLW Drums	5	5	100.00%
Bulk Fume Hood	5	5	100.00%
	1464	1405	95.97%

Q2 2020 Routine Contamination Assessment Summary - Zone 2

Zone 2 Swipe Areas	No. of swipes	Amount pass	Average Pass
Floor at Barrier	37	37	100.00%
Work Area Floors	37	37	100.00%
Work Counters	37	36	97.30%
Cart at Barrier	37	36	97.30%
Storage Cabinets	33	31	93.94%
Air Hose / Glue Gun Handle	33	33	100.00%
Floor Beside Disassambly	37	36	97.30%
Disassembly Bins	37	32	86.49%
Silk Screening Room Racks	33	30	90.91%
Microscope Area	37	37	100.00%
Photometer Room Floor	37	37	100.00%
Insp. Prep. Counter	37	36	97.30%
Shoe Storage	4	4	100.00%
Shoe Covers	4	4	100.00%
Silk Screen Room Floor	4	4	100.00%
	444	430	96.85%

Q2 2020 Routine Contamination Assessment Summary - Zone 1

Zone 1 Swipe Areas	No. of swipes	Amount pass	Average Pass
Lunch Room	13	13	100.00%
LSC Room	13	13	100.00%
RR Ante Rm	13	12	92.31%
RR Barrier	13	11	84.62%
Assy Barrier	13	13	100.00%
Disassembly Table	13	12	92.31%
Disassembly Cart	13	11	84.62%
Disassembly Floor	13	12	92.31%
Disassembly Cabinet	13	11	84.62%
Disassembly Racks	12	11	91.67%
Shipping Floor	13	13	100.00%
Sanitizer Dispenser	12	12	100.00%
Shipping Counter	1	1	100.00%
2nd RMA Storage Area	1	1	100.00%
	156	146	93.59%

Q3 2020 Routine Contamination Assessment Summary - Zone 3

Zone 3 Swipe Areas	No. of swipes	Amount pass	Average Pass
Rig 7 Floor	64	61	95.31%
Rig 7	64	64	100.00%
Rig 1 Floor	64	61	95.31%
Rig 1	64	64	100.00%
Flr @ Rig 6	64	64	100.00%
Rig 6	64	64	100.00%
Floor @ Rig 8	64	62	96.88%
Rig 8	64	63	98.44%
Floor @ Rig 5	64	60	93.75%
Rig 5	64	64	100.00%
Waste Room Shelves	54	53	98.15%
Counter at Porthole	54	54	100.00%
Low-Level Waste Canister	54	51	94.44%
Holding Chambers	64	64	100.00%
Flr @ Barrier	64	62	96.88%
Laser Room Floor	64	62	96.88%
EIP Area	64	64	100.00%
Laser Rm F/H	64	62	96.88%
Trit Lab Desk	64	56	87.50%
Trit Lab Flr random	64	57	89.06%
Bulk Lower Cabinets	54	49	90.74%
Disassembly Fumehood	64	48	75.00%
Muffle Fume Hood	54	52	96.30%
Shoe Covers	64	60	93.75%
Waste Room Door	10	10	100.00%
Scint Table	10	10	100.00%
Liquid Nitrogen Hose	10	10	100.00%
Bulk Sash	10	9	90.00%
Wash Fume hood	10	9	90.00%
	1536	1469	95.64%

Q3 2020 Routine Contamination Assessment Summary - Zone 2

Zone 2 Swipe Areas	No. of swipes	Amount pass	Average Pass
Floor at Barrier	38	38	100.00%
Work Area Floors	38	37	97.37%
Work Counters	38	37	97.37%
Cart at Barrier	38	37	97.37%
Storage Cabinets	38	37	97.37%
Drying Area	32	32	100.00%
Floor Beside Disassambly	38	35	92.11%
Disassembly Bins	38	36	94.74%
Silk Screen Room Racks	38	38	100.00%
Silk Screening Room Table	32	32	100.00%
UV Printing Area	32	32	100.00%
Insp. Prep. Counter	38	36	94.74%
Air Hose / Glue Gun Handle	6	6	100.00%
Microscope Area	6	6	100.00%
Photometer Room Floor	6	6	100.00%
	456	445	97.59%

Q3 2020 Routine Contamination Assessment Summary - Zone 1

Zone 1 Swipe Areas	No. of swipes	Amount pass	Average Pass
Lunch Room	13	13	100.00%
LSC Room	13	12	92.31%
RR Ante Rm	13	13	100.00%
RR Barrier	13	13	100.00%
Assy Barrier	13	13	100.00%
Disassembly Table	13	13	100.00%
Disassembly Cart	13	13	100.00%
Disassembly Floor	13	12	92.31%
Disassembly Cabinet	13	12	92.31%
Disassembly Racks	13	13	100.00%
Z2 Barrier Supply Cab’t	11	9	81.82%
Shipping Floor	13	13	100.00%
Sanitizer Dispenser	2	2	100.00%
	156	151	96.79

Q4 2020 Routine Contamination Assessment Summary - Zone 3

Zone 3 Swipe Areas	No. of swipes	Amount pass	Average Pass
Rig 7 Floor	59	53	89.83%
Rig 7	59	59	100.00%
Rig 1 Floor	59	54	91.53%
Rig 1	59	58	98.31%
Flr @ Rig 6	59	56	94.92%
Rig 6	59	59	100.00%
Floor @ Rig 8	59	57	96.61%
Rig 8	59	58	98.31%
Floor @ Rig 5	59	58	98.31%
Rig 5	59	57	96.61%
Waste Room Floor	54	54	100.00%
Porthole	54	54	100.00%
Low-Level Waste Canister	59	55	93.22%
Flr @ Barrier	59	57	96.61%
Laser Room Floor	59	54	91.53%
EIP Area	59	56	94.92%
Laser Rm F/H	59	55	93.22%
Trit Lab Desk	59	58	98.31%
Trit Lab Flr random	59	48	81.36%
Shoe Covers	59	49	83.05%
Disassembly Fumehood	59	51	86.44%
Bulk Fume Hood	54	54	100.00%
Wash Fume Hood	54	53	98.15%
Wash Fume Hood Tap	54	54	100.00%
Counter at Porthole	5	5	100.00%
Holding Chambers	5	5	100.00%
Waste Room Shelves	5	5	100.00%
Muffle Fume Hood	5	5	100.00%
Bulk Lower Cabinets	5	5	100.00%
	1416	1346	95.06%

Q4 2020 Routine Contamination Assessment Summary - Zone 2

Zone 2 Swipe Areas	No. of swipes	Amount pass	Average Pass
Floor at Barrier	36	34	94.44%
Work Area Floors	36	34	94.44%
Work Counters	36	35	97.22%
Cart at Barrier	36	35	97.22%
Storage Cabinets	36	32	88.89%
Drying Area	36	33	91.67%
Floor Beside Disassambly	36	34	94.44%
Disassembly Bins	36	35	97.22%
Silk Screening Floor	33	32	96.97%
Bubbler Fume Hood	33	33	100.00%
Inspection Room Table	33	30	90.91%
Insp. Prep. Counter	36	34	94.44%
Silk Screening Racks	3	3	100.00%
Silk Screening Room Table	3	3	100.00%
UV Printing Area	3	3	100.00%
	432	410	94.91%

Q4 2020 Routine Contamination Assessment Summary - Zone 1

Zone 1 Swipe Areas	No. of swipes	Amount pass	Average Pass
Lunch Room	12	12	100.00%
LSC Room	12	12	100.00%
RR Ante Rm	12	12	100.00%
RR Barrier	12	12	100.00%
Assy Barrier	12	12	100.00%
Disassembly Table	12	12	100.00%
Disassembly Cart	12	11	91.67%
Disassembly Floor	12	12	100.00%
Disassembly Cabinet	12	11	91.67%
Zone 2 Barrier Supply Cabinet	12	12	100.00%
Disassembly Storage Area	11	11	100.00%
Shipping Floor	12	12	100.00%
Disassembly Racks	1	1	100.00%
	144	142	98.61%

Overall Facility Summary

Facility Zone	Assessments	Pass	Pass Rate
ZONE 3	5,880	5,648	96.05%
ZONE 2	1,764	1,706	96.71%
ZONE 1	612	590	96.41%
2020	8,256	7,944	96.22%

APPENDIX F

Passive Air Sampler Results for 2020

PASSIVE AIR SAMPLER RESULTS FOR 2020

Sampler No.	Sampler ID	Location	Dist. to SRBT	(Bq/m^3)												
				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
				Jan 7 - Feb 4	Feb 4- Mar 2	Mar 2 - April 2	Apr 2 - May 2	May 2 - June 2	Jun 2- Jun 30	Jun 30 - Jul 30	Jul 30 - Sept 1	Sept 1 - Oct 1	Oct 1 - Nov 3	Nov 3 - Dec 2	Dec 2 - Dec 29	
			Minimum Detectable Activity (Bq/m^3)	*0.38*	*0.39*	*0.84*	*0.82*	*0.82*	*0.82*	*0.79*	*0.79*	*0.71*	*0.68*	*0.76*	*0.83*	*0.72*
1	N250	N 45º 48.486' W 077º 07.092' Elev. 137m	322m	2.20	0.41	1.42	1.07	4.45	2.64	0.79	1.79	2.97	1.18	10.13	4.56	**2.80**
2	N500	N 45º 48.572' W 077º 07.008' Elev. 134m	493m	1.70	0.39	1.55	0.93	1.55	2.14	0.79	0.79	1.39	0.68	2.70	2.63	**1.44**
3	N1000	N 45º 48.869' W 077º 06.997' Elev. 135m	1040m	0.58	0.39	0.84	1.33	0.82	1.93	1.13	1.45	1.06	1.00	0.76	3.59	**1.24**
4 (PAS #4)	NW250	N 45º 48.412' W 077º 07.189' Elev. 137m	222m	1.80	0.43	4.00	5.47	4.52	7.79	1.73	2.09	5.42	3.03	5.07	5.33	**3.89**
5	NW500	N 45º 48.577' W 077º 07.382' Elev. 134m	615m	0.99	0.40	3.61	1.47	2.13	3.21	2.47	2.15	1.61	0.73	2.10	1.85	**1.89**
6 (PAS # 8)	NW1000	N 45º 48.754' W 077º 07.599' Elev. 130m	1050m	0.59	0.39	2.19	0.82	1.48	1.71	0.79	0.79	0.71	1.15	1.80	1.30	**1.14**
7	NW2000	N 45º 49.141' W 077º 08.090' Elev. 139m	2000m	0.38	0.40	1.03	1.20	1.03	2.57	1.67	0.79	0.94	1.15	0.76	1.22	**1.10**
8	W250	N 45º 48.300' W 077º 07.323' Elev. 138m	297m	1.10	1.10	3.35	2.40	1.68	3.00	0.79	14.42	0.71	0.68	7.50	7.30	**3.67**
9	W500	N 45º 48.288' W 077º 07.393' Elev. 137m	389m	0.78	0.63	2.45	0.82	2.90	4.50	3.53	2.88	1.03	0.85	1.83	1.59	**1.98**
10	W1000	N 45º 48.306' W 077º 07.630' Elev. 134m	691m	0.98	*No sample*	*No sample*	2.13	0.90	2.64	0.93	0.79	0.71	1.21	0.76	2.48	**1.35**
11	SW250	N 45º 48.247' W 077º 07.206' Elev. 140m	183m	0.65	0.50	2.45	2.40	1.74	3.64	1.40	1.42	1.58	0.68	0.76	2.63	**1.65**
12	SW500	N 45º 47.896' W 077º 07.307' Elev. 148m	839m	0.60	0.39	0.84	4.00	0.84	3.14	1.40	6.45	0.87	0.68	0.76	1.70	**1.81**
13	SW1000	N 45º 47.599' W 077º 07.543' Elev. 149m	1470m	0.38	0.39	0.84	0.82	0.82	2.07	0.80	0.79	1.35	*Sample lost*	0.76	1.48	**0.95**
14	SW2000	N 45º 47.408' W 077º 07.866' Elev. 155m	2110m	0.38	0.39	0.84	0.82	0.82	2.93	1.27	0.79	0.71	0.85	0.76	1.67	**1.02**
15	S250	N 45º 48.129' W 077º 07.014' Elev. 131m	356m	1.50	2.20	0.84	1.33	2.39	3.57	2.00	2.48	1.61	0.76	2.00	2.37	**1.92**
16	S500	N 45º 48.029' W 077º 07.110' Elev. 143m	532m	0.39	0.46	0.84	0.82	0.82	1.50	0.79	0.79	1.16	0.82	0.76	2.44	**0.97**
17 (PAS # 12)	S1000	N 45º 46.466' W 077º 07.441' Elev. 158m	1450m	0.38	0.39	0.84	0.93	0.82	2.93	0.79	0.79	0.97	0.68	0.76	2.00	**1.02**
18	SE250	N 45º 48.189' W 077º 06.874' Elev. 132m	365m	2.80	3.20	2.58	6.53	2.58	2.50	3.13	4.36	3.65	1.55	5.97	11.48	**4.19**
19	SE500	N 45º 48.108' W 077º 06.783' Elev. 123m	554m	2.00	2.00	1.68	3.73	1.48	1.86	1.73	2.24	1.48	0.68	11.97	5.30	**3.01**
20	SE1000	N 45º 47.894' W 077º 06.501' Elev. 120m	1090m	0.57	0.40	0.84	1.20	1.81	3.07	2.20	2.12	1.13	1.09	1.20	3.04	**1.56**
21	SE2000	N 45º 47.505' W 077º 05.978' Elev. 137m	2080m	0.38	0.39	1.29	1.33	0.82	1.43	0.87	0.79	0.74	0.94	0.76	1.70	**0.95**
22	E250	N 45º 80.564' W 077º 11.556' Elev. 131m	220m	0.92	1.20	3.61	6.27	5.16	12.29	12.00	6.15	2.35	2.09	2.93	2.85	**4.82**
23	E500	N 45º 48.333' W 077º 06.693' Elev. 132m	520m	0.38	0.39	1.03	2.93	0.82	2.00	2.73	1.24	0.97	1.09	1.90	1.74	**1.44**
24	E1000	N 45º 48.303' W 077º 06.260' Elev. 143m	1080m	0.38	0.39	0.90	1.33	0.82	1.71	1.40	0.94	0.71	1.03	0.76	1.89	**1.02**
25	NE250	N 45º 48.371' W 077º 06.964' Elev. 124m	198m	1.10	2.70	2.97	3.33	3.29	6.36	6.80	2.33	3.61	1.48	2.60	2.26	**3.24**
26	NE500	N 45º 48.421' W 077º 06.732' Elev. 131m	508m	0.38	0.61	1.03	1.33	0.82	3.21	2.27	0.79	1.10	0.68	0.87	1.52	**1.22**
27	NE1000	N 45º 48.683' W 077º 06.441' Elev. 148m	1100m	0.38	0.39	0.84	0.82	0.90	2.43	1.13	0.79	1.68	0.73	0.76	1.44	**1.02**
28	NE2000	N 45º 49.116' W 077º 05.843' Elev. 156m	2200m	0.38	0.38	1.68	0.82	0.82	1.50	0.79	0.79	0.71	1.09	0.76	1.00	**0.89**
(PAS #1)		N 45º 48.287' W 077º 07.123' Elev. 129m	94.1m	2.60	7.00	3.48	9.87	8.77	13.29	9.27	11.48	8.45	6.88	3.10	2.78	**7.25**
(PAS #2)		N 45º 48.325' W 077º 07.132' Elev. 132m	52.8m	4.00	1.00	3.74	12.40	8.32	6.00	10.00	3.61	1.81	1.30	4.10	2.59	**4.91**
(PAS #13)		N 45º 48.262' W 077º 07.093' Elev. 132m	61.5m	0.50	2.90	3.74	8.67	4.90	11.36	4.80	0.79	4.45	2.18	1.20	1.59	**3.92**
4-2	NW250	N 45º 48.412' W 077º 07.189' Elev. 137m	222m	1.70	0.39	3.10	2.80	3.35	4.43	1.60	1.42	2.39	2.45	4.40	4.59	**2.72**
11-2	SW250	N 45º 48.247' W 077º 07.206' Elev. 140m	183m	0.63	0.43	1.42	2.13	1.48	3.36	0.79	0.97	1.06	0.68	0.76	2.41	**1.34**
18-2	SE250	N 45º 48.189' W 077º 06.874' Elev. 132m	365m	2.70	3.00	2.58	4.93	2.19	2.21	2.93	3.61	3.06	1.30	4.07	6.70	**3.27**
25-2	NE250	N 45º 48.371' W 077º 06.964' Elev. 124m	198m	0.92	2.50	2.19	2.27	3.03	6.29	6.40	2.18	3.29	1.15	1.80	2.11	**2.84**
Maika (PAS # 10)	SW	N 45º 46.367' W 077º 11.447' Elev. 149m	6690m	0.38	0.39	1.42	0.82	0.82	2.36	1.40	0.79	0.87	0.68	0.76	0.83	**0.96**
Maika	Duplicate	Same as above	6690m	0.35	0.35	0.84	0.82	0.82	2.00	0.79	0.88	0.87	0.68	0.76	0.83	**0.83**
Fitzpatrick	SE	N 45º 44.818' W 076º 59.822' Elev. 159m	11400m	0.38	0.39	0.84	0.82	0.82	2.71	2.13	0.79	0.87	0.68	0.93	3.52	**1.24**
Petawawa	NW	N 45º 51.497' W 077º 12.828' Elev. 149m	9480m	0.38	0.39	0.84	1.60	0.82	3.71	1.27	0.79	0.74	0.68	0.76	4.96	**1.41**
Farm	NE	N 45º 53.071' W 076º 56.768' Elev. 142m	16000m	0.38	0.39	1.16	0.82	1.74	4.43	1.07	0.79	0.94	0.68	0.76	1.70	**1.24**
Results shaded in blue are below minimum detectable activity			*Sum*	39.97	40.44	71.73	106.33	86.09	152.42	100.57	92.09	71.73	47.92	93.85	114.97	85.15

APPENDIX F

APPENDIX G

Wind Direction Graphs for 2020

WIND DIRECTION GRAPHS FOR 2020

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	2.20	1.70	0.58		0.41	0.39	0.39		1.42	1.55	0.84	
North West	1.80	0.99	0.59	0.38	0.43	0.40	0.39	0.40	4.00	3.61	2.19	1.03
West	1.10	0.78	0.98		1.10	0.63	No sample		3.35	2.45	No sample	
Southwest	0.65	0.60	0.38	0.38	0.50	0.39	0.39	0.39	2.45	0.84	0.84	0.84
South	1.50	0.39	0.38		2.20	0.46	0.39		0.84	0.84	0.84	
South East	2.80	2.00	0.57	0.38	3.20	2.00	0.40	0.39	2.58	1.68	0.84	1.29
East	0.92	0.38	0.38		1.20	0.39	0.39		3.61	1.03	0.90	
North East	1.10	0.38	0.38	0.38	2.70	0.61	0.39	0.38	2.97	1.03	0.84	1.68

2nd Quarter

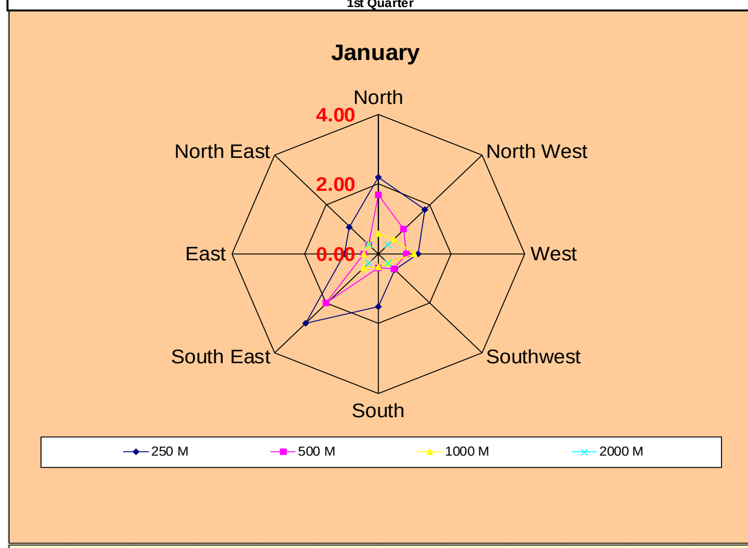
Direction	April 250 M	April 500 M	April 1000 M	April 2000 M	May 250 M	May 500 M	May 1000 M	May 2000 M	June 250 M	June 500 M	June 1000 M	June 2000 M
North	1.07	0.93	1.33		4.45	1.55	0.82		2.64	2.14	1.93	
North West	5.47	1.47	0.82	1.20	4.52	2.13	1.48	1.03	7.79	3.21	1.71	2.57
West	2.40	0.82	2.13		1.68	2.90	0.90		3.00	4.50	2.64	
Southwest	2.40	4.00	0.82	0.82	1.74	0.84	0.82	0.82	3.64	3.14	2.07	2.93
South	1.33	0.82	0.93		2.39	2.39	0.82		3.57	1.50	2.93	
South East	6.53	3.73	1.20	1.33	2.58	1.48	1.81	0.82	2.50	1.86	3.07	1.43
East	6.27	2.93	1.33		5.16	0.82	0.82		12.29	2.00	1.71	
North East	3.33	1.33	0.82	0.82	3.29	0.82	0.90	0.82	6.36	3.21	2.43	1.50

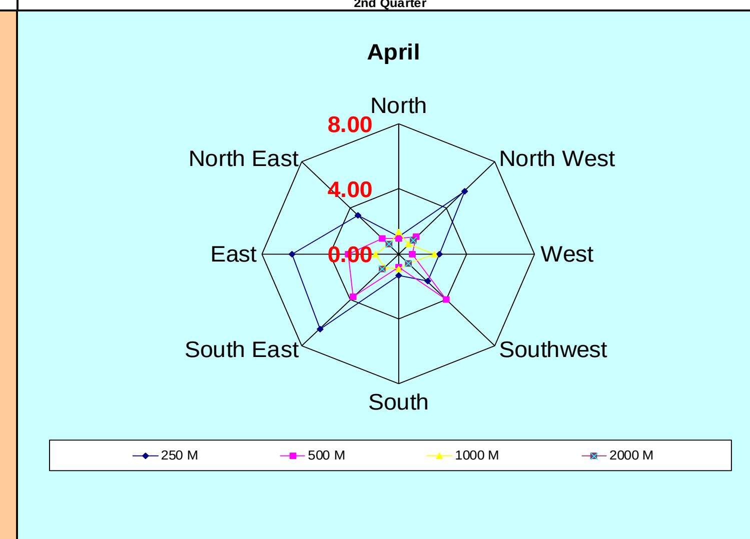
3rd Quarter

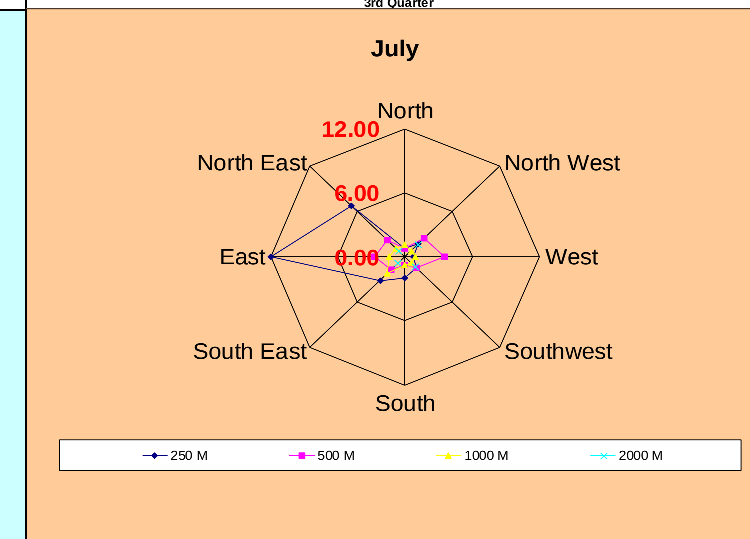
Direction	July 250 M	July 500 M	July 1000 M	July 2000 M	August 250 M	August 500 M	August 1000 M	August 2000 M	September 250 M	September 500 M	September 1000 M	September 2000 M
North	0.79	0.79	1.13		1.79	0.79	1.45		2.97	1.39	1.06	
North West	1.73	2.47	0.79	1.67	2.09	2.15	0.79	0.79	5.42	1.61	0.71	0.94
West	0.79	3.53	0.93		14.42	2.88	0.79		0.71	1.03	0.71	
Southwest	1.40	1.40	0.80	1.27	1.42	6.45	0.79	0.79	1.58	0.87	1.35	0.71
South	2.00	0.79	0.79		2.48	0.79	0.79		1.61	1.16	0.97	
South East	3.13	1.73	2.20	0.87	4.36	2.24	2.12	0.79	3.65	1.48	1.13	0.74
East	12.00	2.73	1.40		6.15	1.24	0.94		2.35	0.97	0.71	
North East	6.80	2.27	1.13	0.79	2.33	0.79	0.79	0.79	3.61	1.10	1.68	0.71

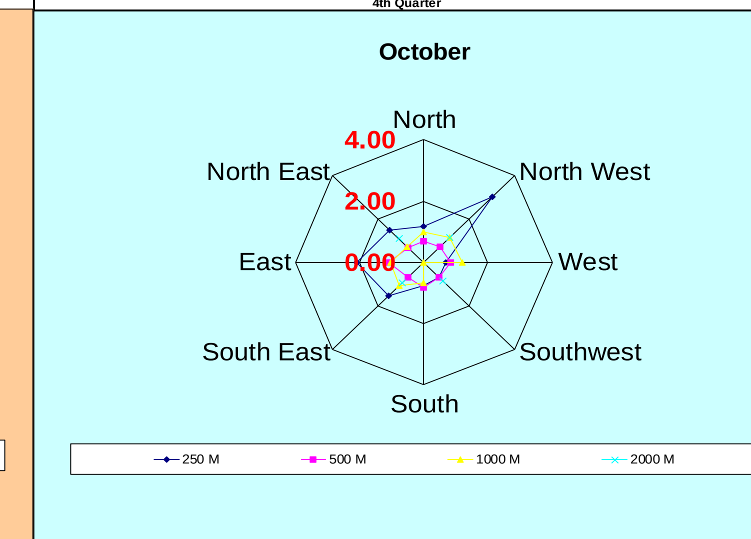
4th Quarter

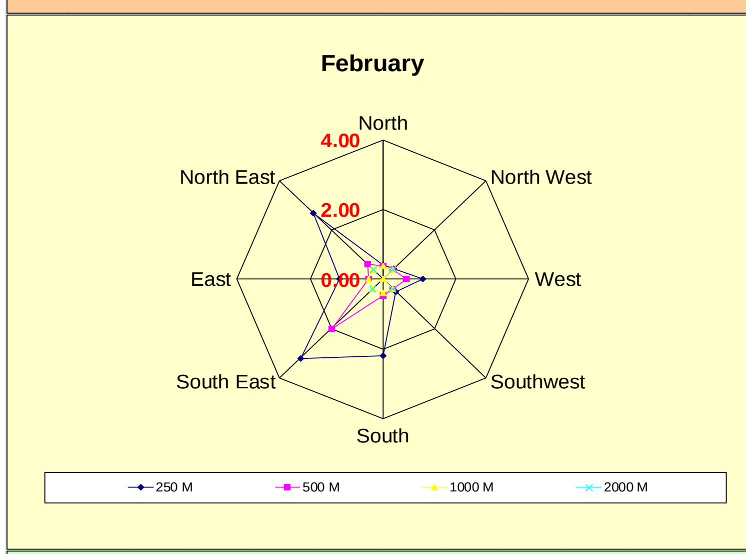
Direction	October 250 M	October 500 M	October 1000 M	October 2000 M	November 250 M	November 500 M	November 1000 M	November 2000 M	December 250 M	December 500 M	December 1000 M	December 2000 M
North	1.18	0.68	1.00		10.13	2.70	0.76		4.56	2.63	3.59	
North West	3.03	0.73	1.15	1.15	5.07	2.10	1.80	0.76	5.33	1.85	1.30	1.22
West	0.68	0.85	1.21		7.50	1.83	0.76		7.30	1.59	2.48	
Southwest	0.68	0.68	Sample l	0.85	0.76	0.76	0.76	0.76	2.63	1.70	1.48	1.67
South	0.76	0.82	0.68		2.00	0.76	0.76		2.37	2.44	2.00	
South East	1.55	0.68	1.09	0.94	5.97	11.97	1.20	0.76	11.48	5.30	3.04	1.70
East	2.09	1.09	1.03		2.93	1.90	0.76		2.85	1.74	1.89	
North East	1.48	0.68	0.73	1.09	2.60	0.87	0.76	0.76	2.26	1.52	1.44	1.00

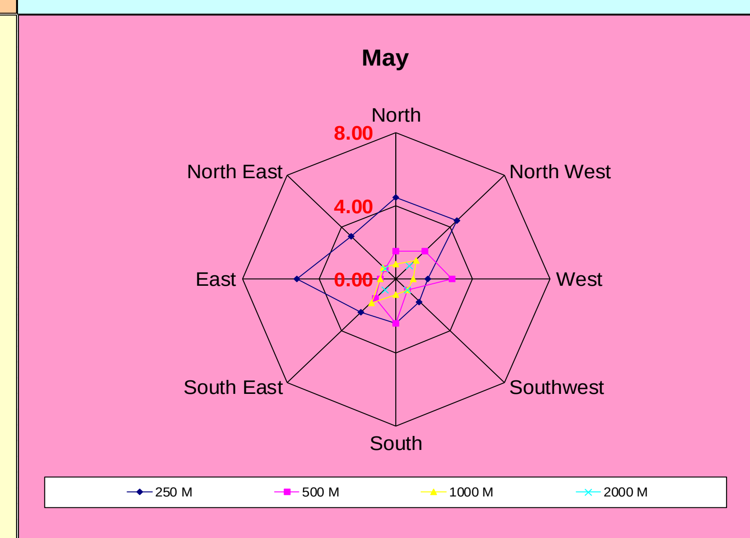


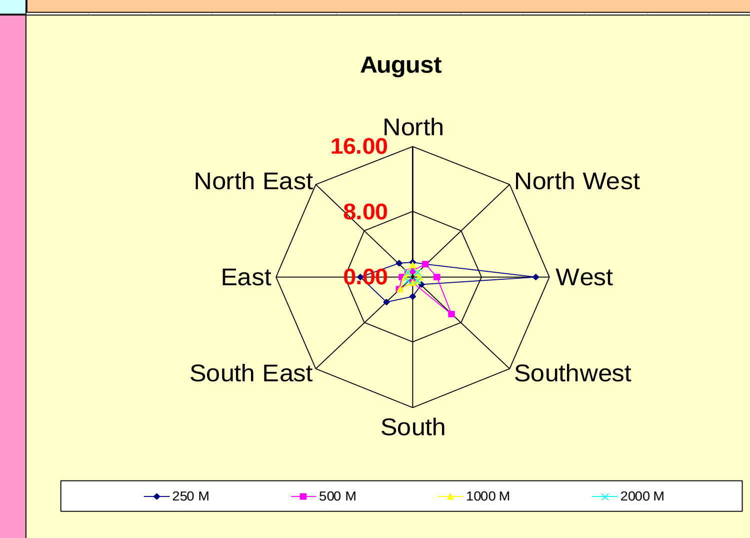


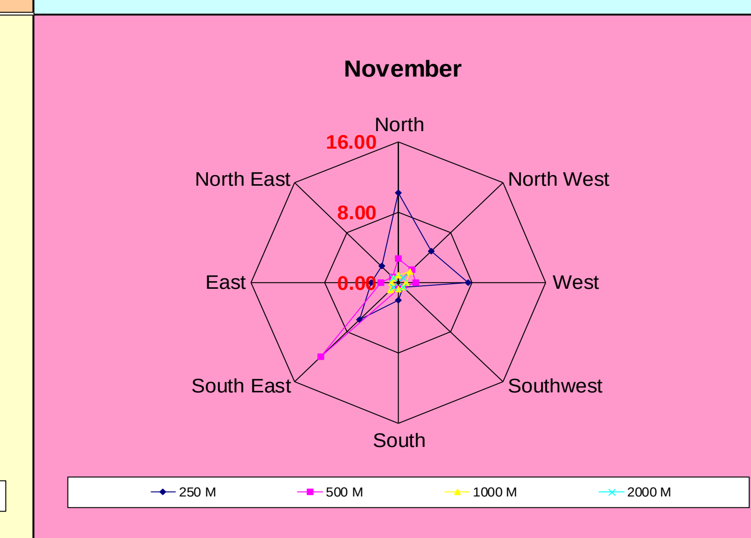


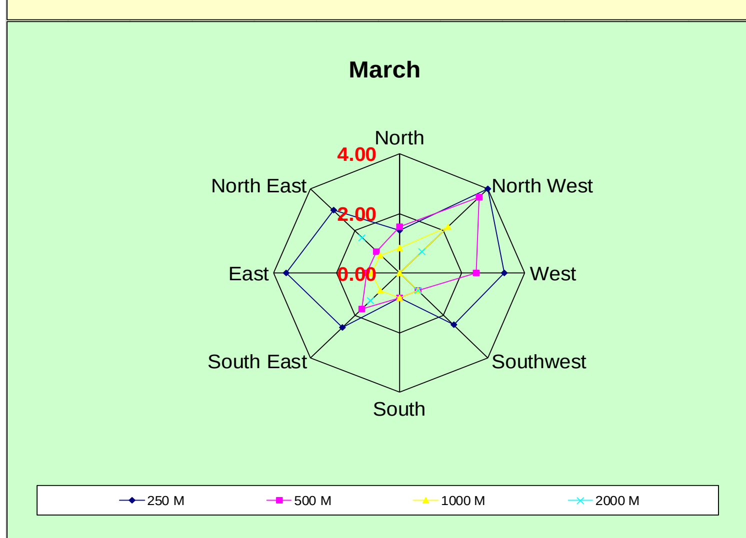


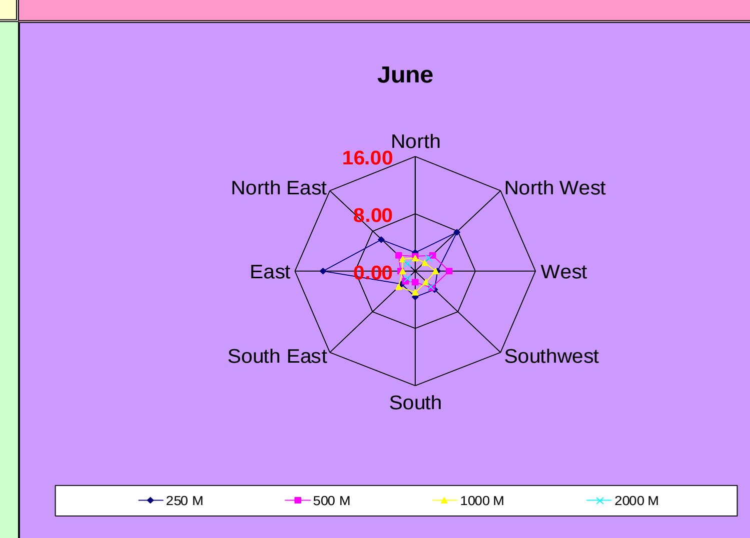


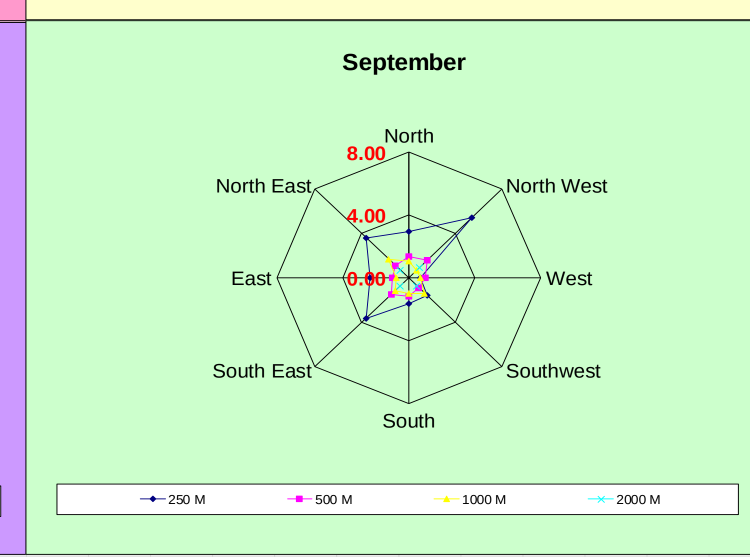


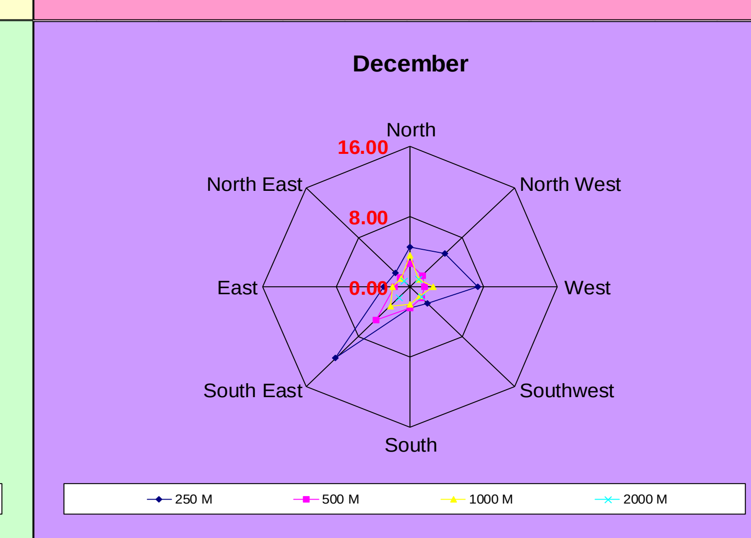












APPENDIX G

APPENDIX H

Precipitation Monitoring Results for 2020

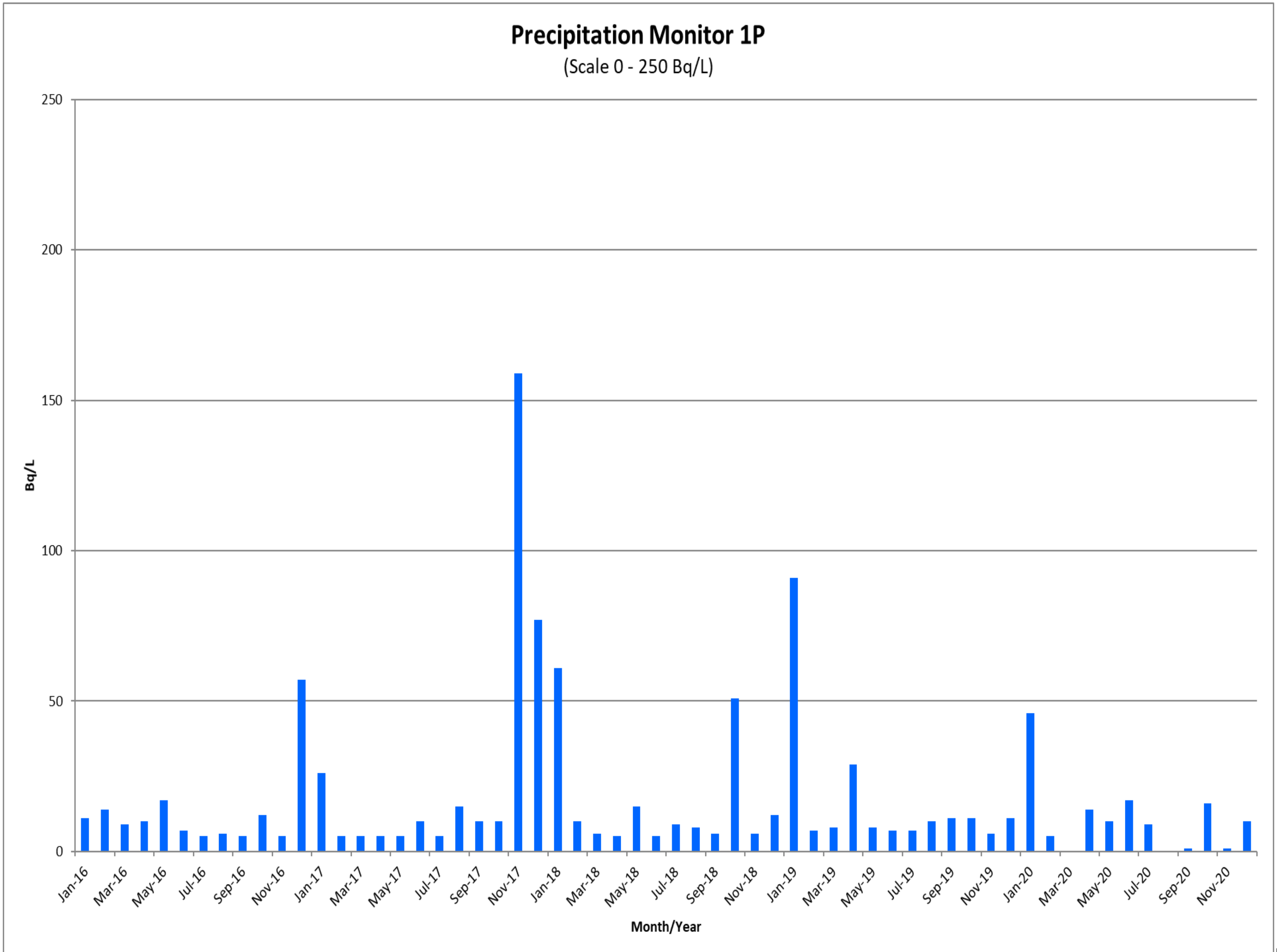
PRECIPITATION MONITORING RESULTS FOR 2020

PRECIPITATION SAMPLERS										
Date Range	*MDA*	1P	4P	8P	11P	15P	18P	22P	25P	AVG
	Bq/L									
January 7 - February 4, 2020	*5.0*	46	44	32	18	33	141	31	44	49
February 4 - March 2, 2020	*5.0*	5	5	20	6	70	287	21	10	53
March 2 - April 2, 2020	*23.7*	0	38	2	98	22	218	120	0	62
April 2 - May 2, 2020	*21.0*	14	518	20	16	11	135	25	17	95
May 2 - June 2, 2020	*23.3*	10	6	3	45	13	60	52	96	36
June 2 - June 30, 2020	*21.6*	17	42	57	12	21	21	36	49	32
June 30 - July 30, 2020	*21.2*	9	50	11	11	14	31	39	19	23
July 30 - September 1, 2020	*22.1*	0	2	0	27	20	0	49	0	12
September 1 - October 1, 2020	*21.8*	1	19	0	0	0	0	0	0	3
October 1 - November 2, 2020	*21.5*	16	31	0	10	0	14	15	3	11
November 2 - December 2, 2020	*22.5*	1	43	27	13	14	67	8	0	22
December 2 - December 29, 2020	*20.6*	10	36	14	2	7	31	10	5	14
AVERAGE	*19.1*	11	70	16	22	19	84	34	20	34

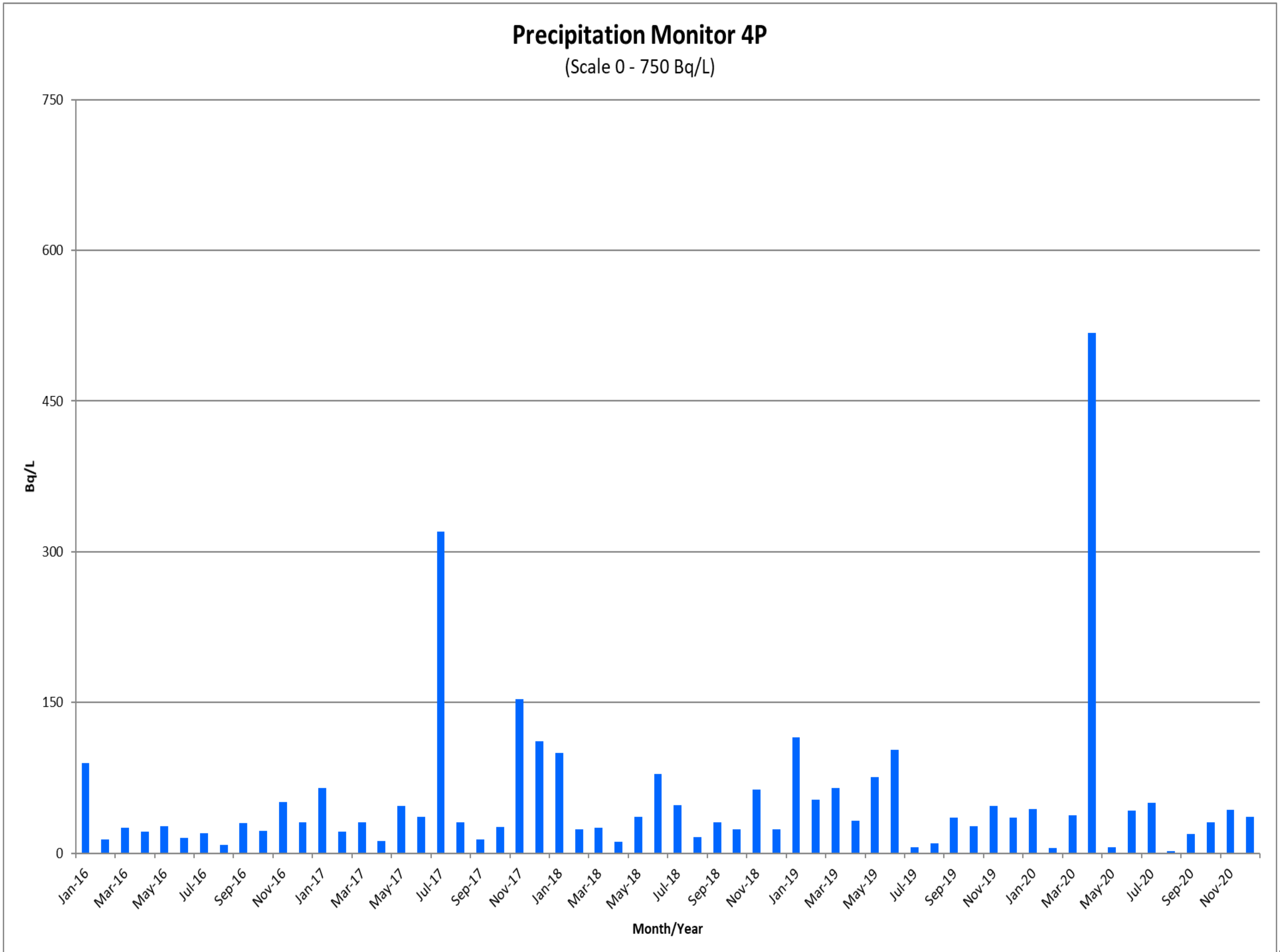
Results shaded in blue are <minimum detectable activity (MDA)

MAP OF AIR AND PRECIPITATION MONITORING STATIONS

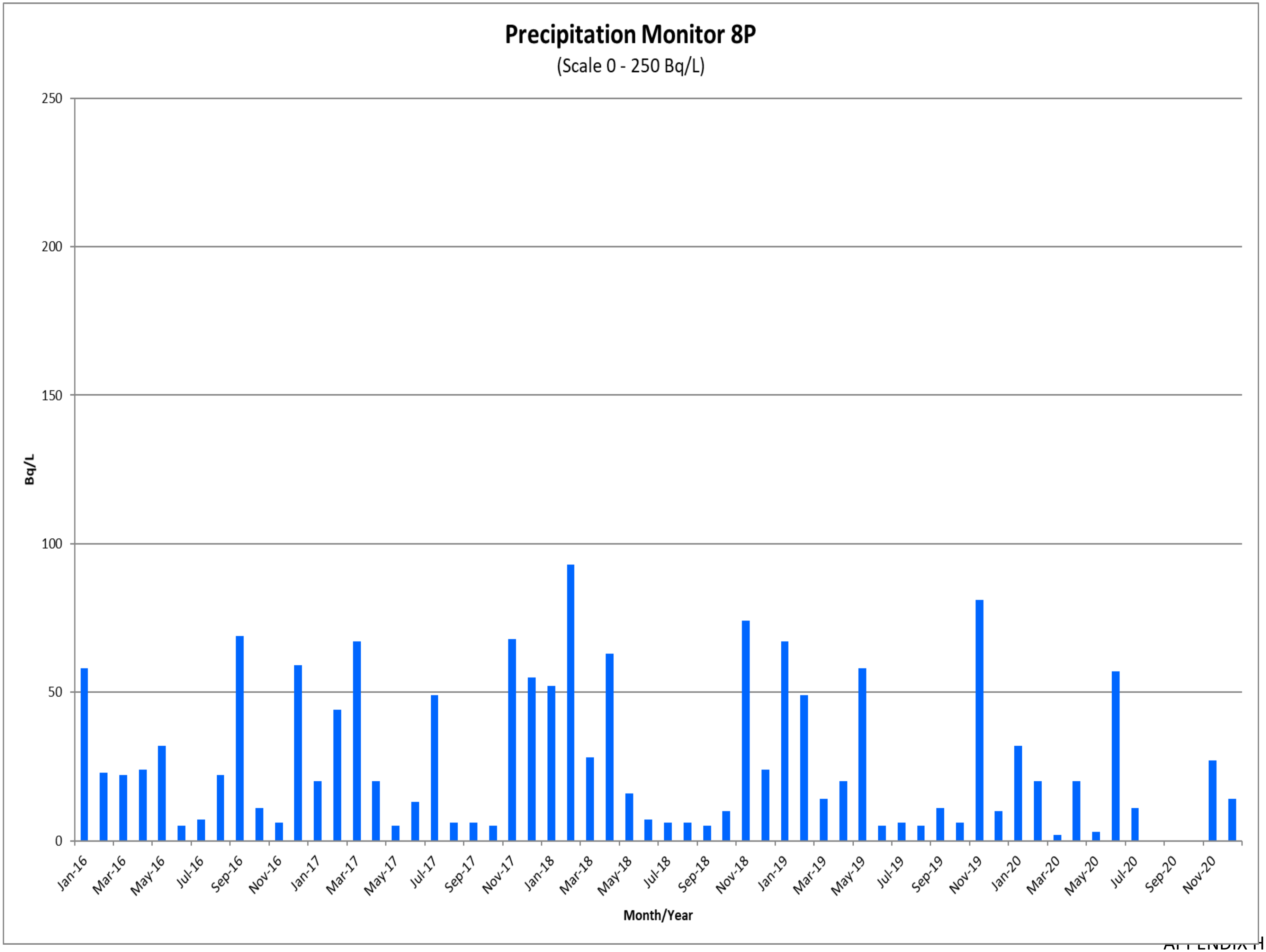
PRECIPITATION MONITORING RESULTS FOR 2020



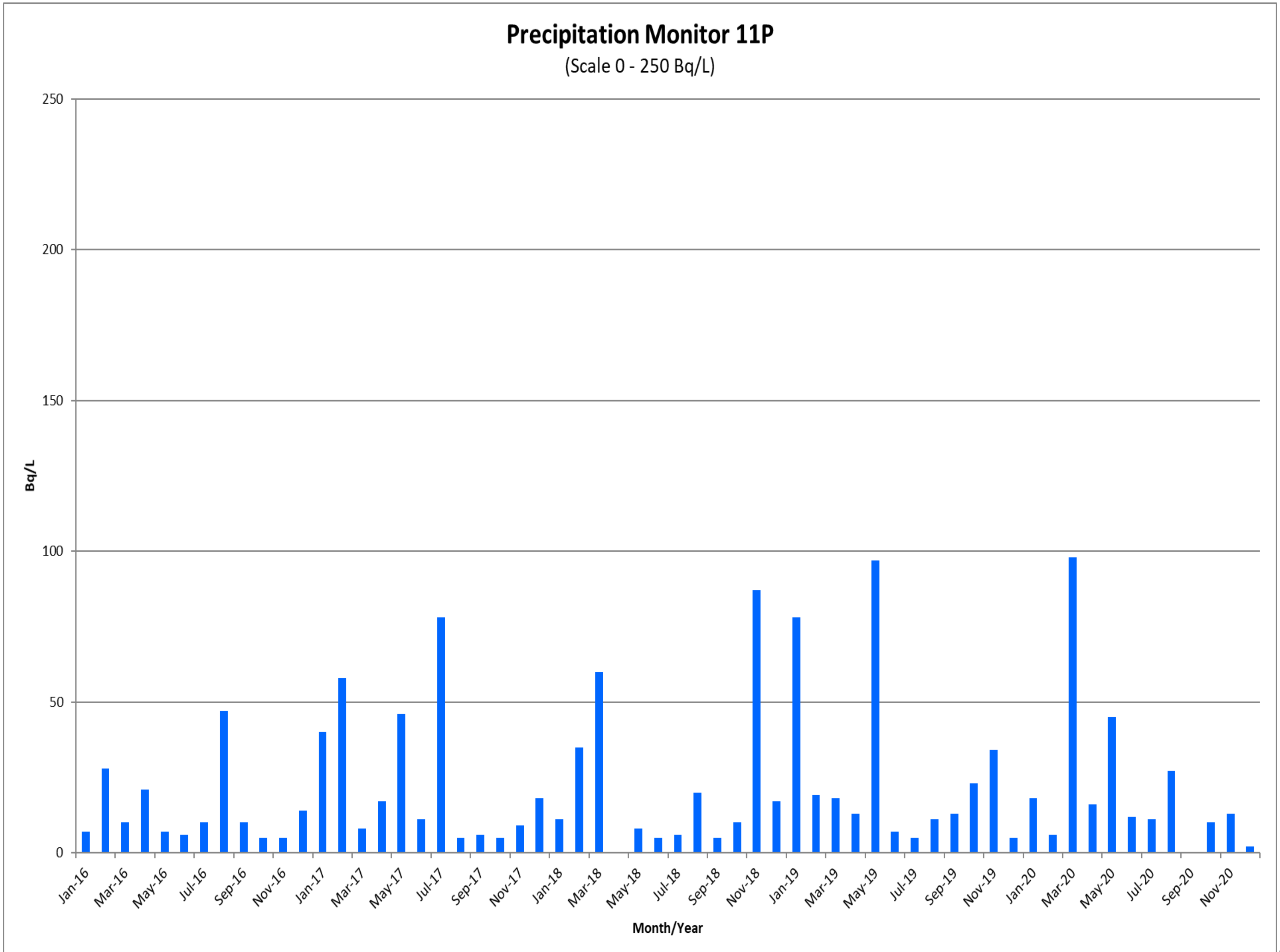
PRECIPITATION MONITORING RESULTS FOR 2020



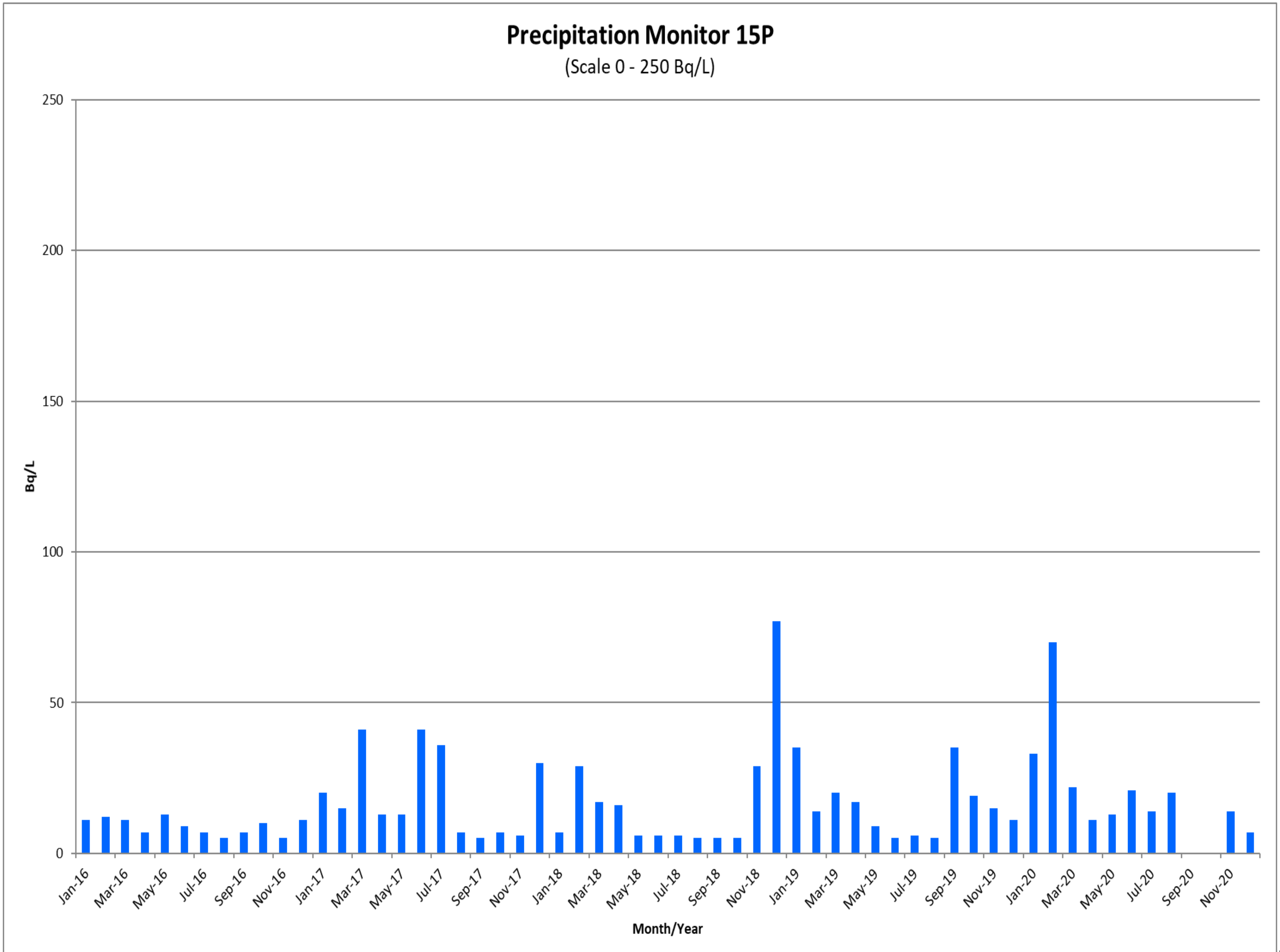
PRECIPITATION MONITORING RESULTS FOR 2020



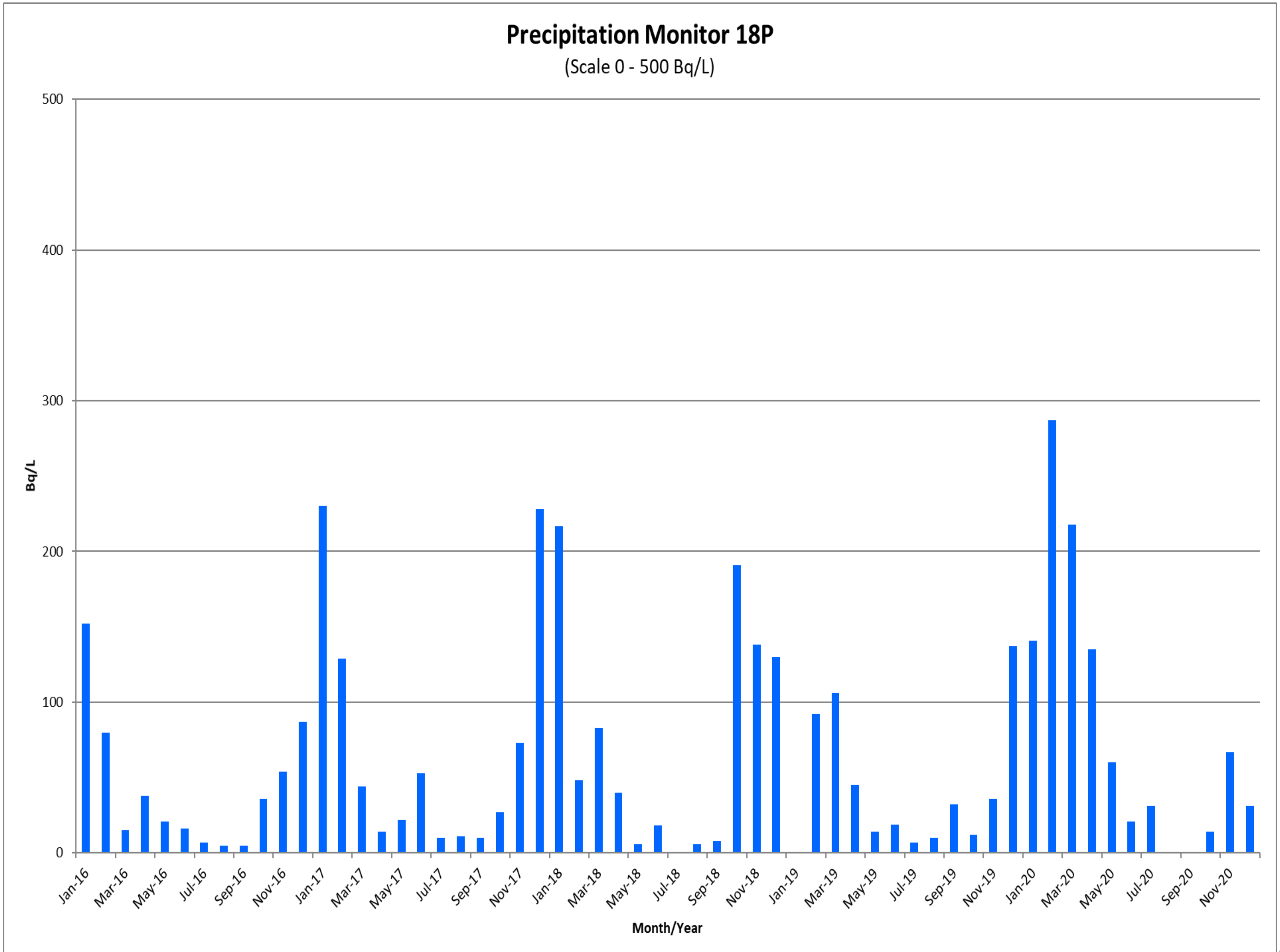
PRECIPITATION MONITORING RESULTS FOR 2020



PRECIPITATION MONITORING RESULTS FOR 2020

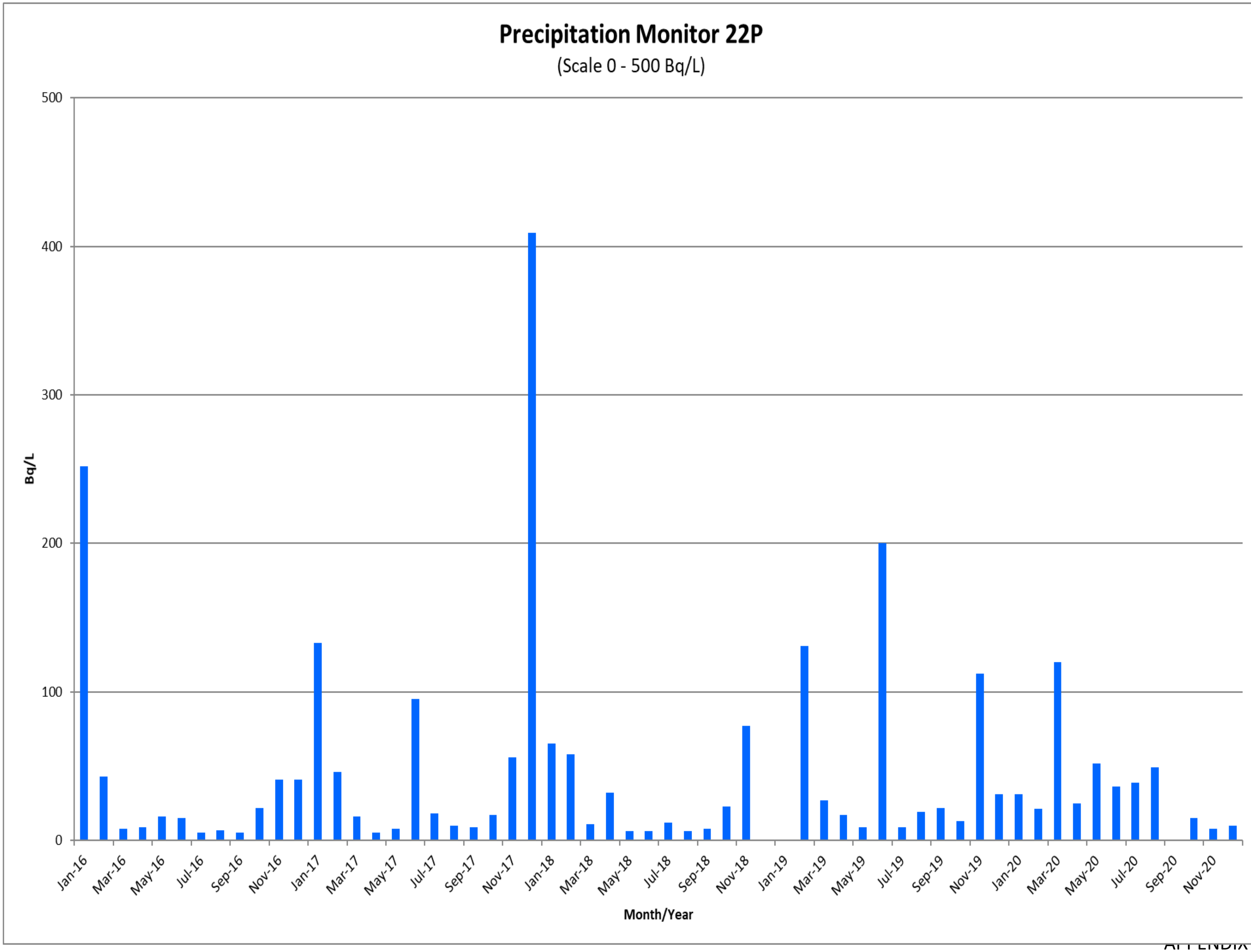


PRECIPITATION MONITORING RESULTS FOR 2020



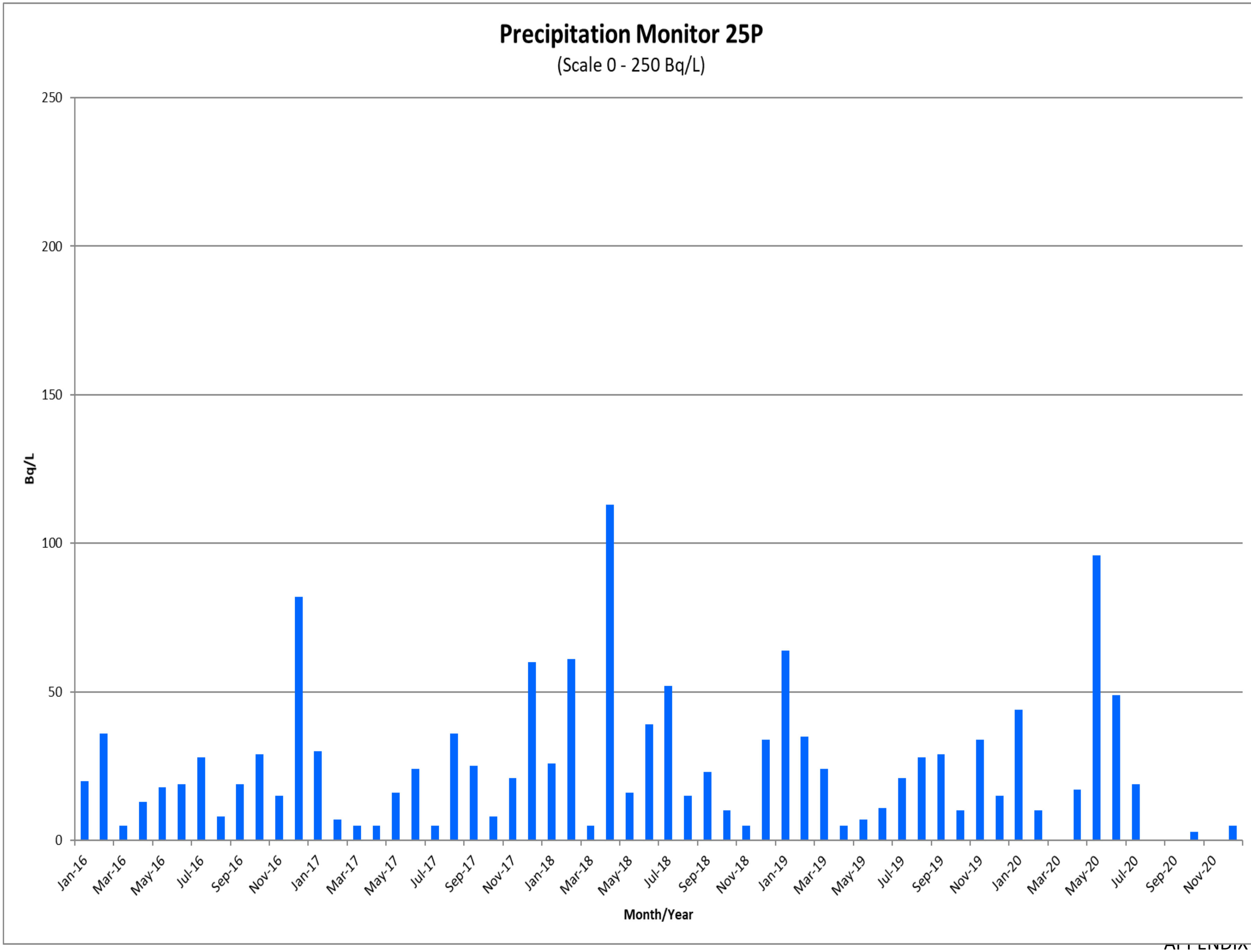
APPENDIX H

PRECIPITATION MONITORING RESULTS FOR 2020



APPENDIX H

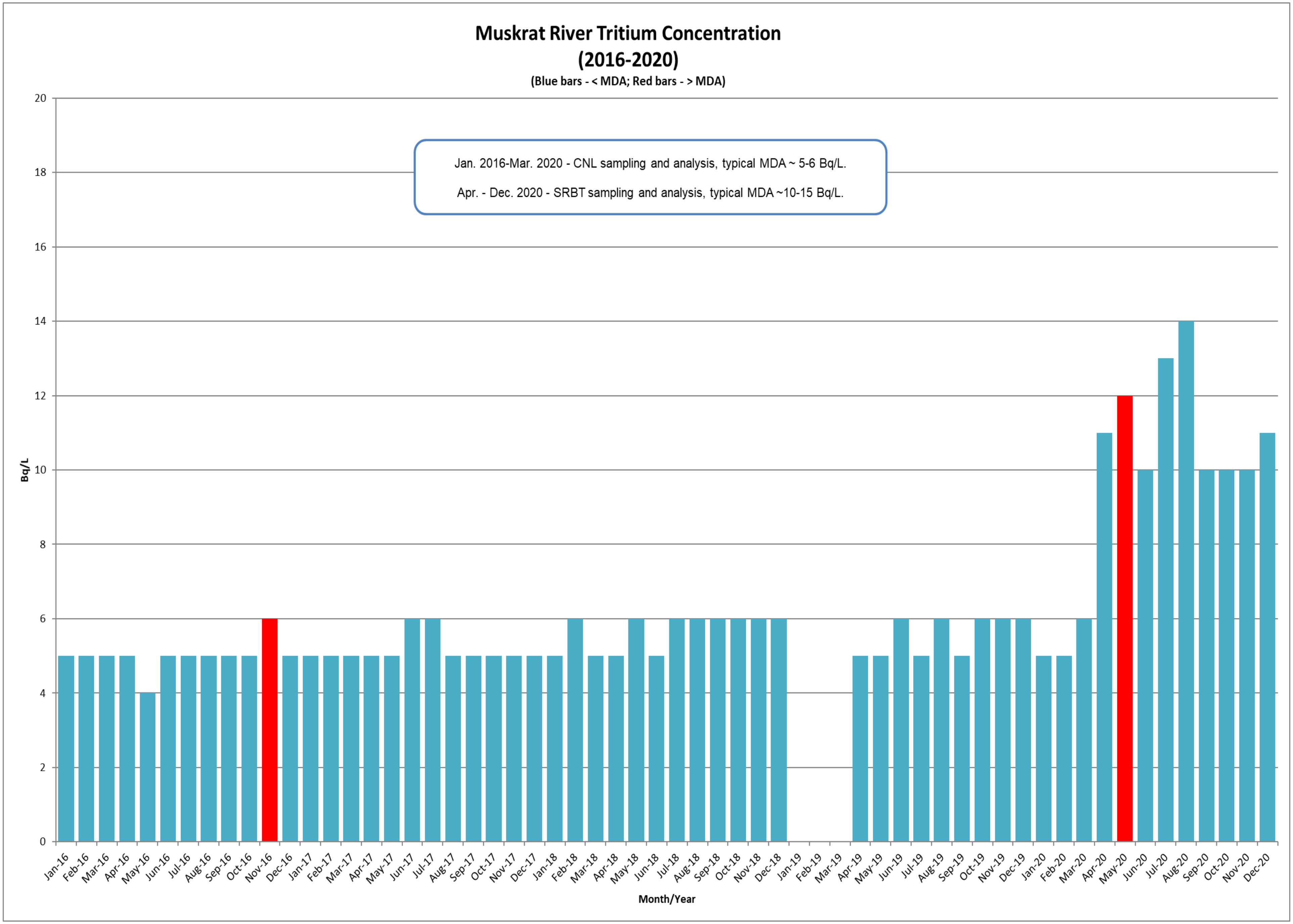
PRECIPITATION MONITORING RESULTS FOR 2020



APPENDIX H

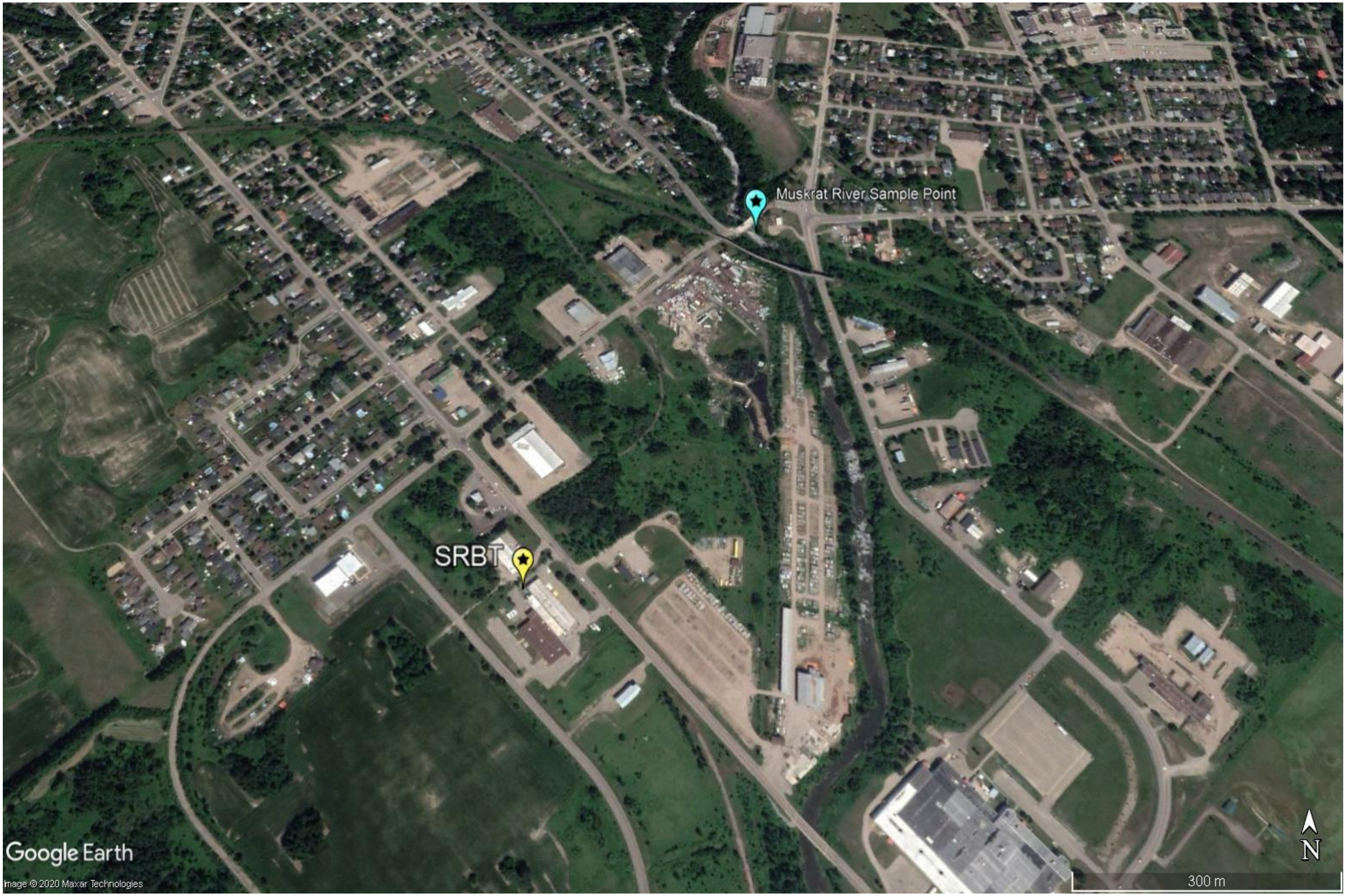
APPENDIX I

Receiving Waters Monitoring Results for 2020


Muskrat River Tritium Concentration
(2016-2020)
(Blue bars - < MDA; Red bars - > MDA)
Jan. 2016-Mar. 2020 - CNL sampling and analysis, typical MDA ~ 5-6 Bq/L.
Apr. - Dec. 2020 - SRBT sampling and analysis, typical MDA ~10-15 Bq/L.
Bq/L
0
2
4
6
8
10
12
14
16
18
20
Jan-16
Feb-16
Mar-16
Apr-16
May-16
Jun-16
Jul-16
Aug-16
Sep-16
Oct-16
Nov-16
Dec-16
Jan-17
Feb-17
Mar-17
Apr-17
May-17
Jun-17
Jul-17
Aug-17
Sep-17
Oct-17
Nov-17
Dec-17
Jan-18
Feb-18
Mar-18
Apr-18
May-18
Jun-18
Jul-18
Aug-18
Sep-18
Oct-18
Nov-18
Dec-18
Jan-19
Feb-19
Mar-19
Apr-19
May-19
Jun-19
Jul-19
Aug-19
Sep-19
Oct-19
Nov-19
Dec-19
Jan-20
Feb-20
Mar-20
Apr-20
May-20
Jun-20
Jul-20
Aug-20
Sep-20
Oct-20
Nov-20
Dec-20
Month/Year

APPENDIX I

MUSKRAT RIVER SAMPLING LOCATION



APPENDIX I

APPENDIX J

Runoff Monitoring Results for 2020

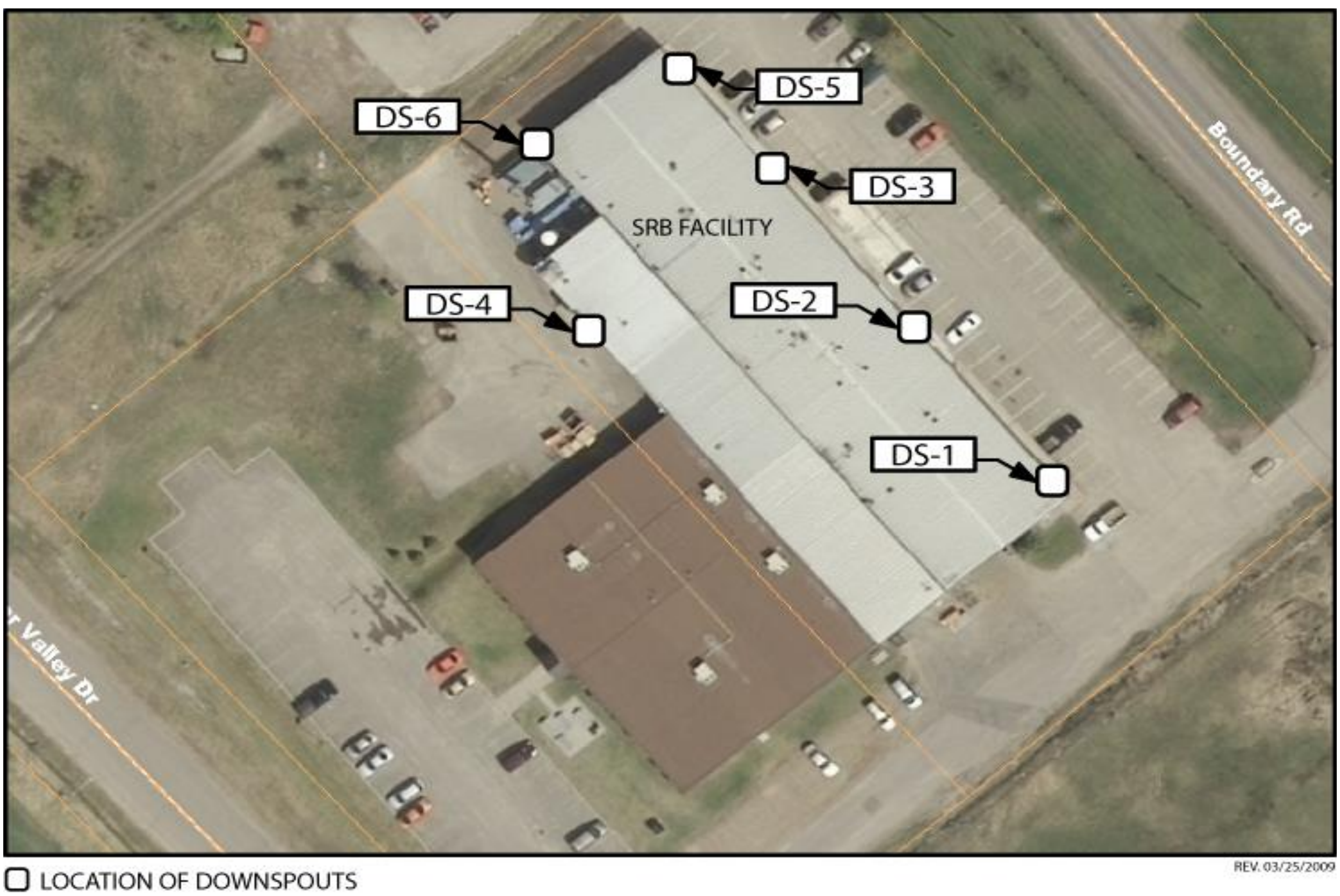
RUNOFF MONITORING RESULTS FOR 2020

DOWNSPOUTS (Bq/L)								
Date	**Time**	**DS-1**	**DS-2**	**DS-3**	**DS-4**	**DS-5**	**DS-6**	**MDA**
24-Feb-20	1400h	No sample	996	409	861	2,483	753	50
29-May-20	1400h	No sample	4,218	4,610	6,766	2,221	1,706	43
10-Jun-20	1100h	0	0	3	0	25	56	47
11-Aug-20	1135h	530	191	76	379	38	184	47
30-Nov-20	1140h	No sample	0	0	0	80	200	51
Average (Bq/L)		265	1,081	1,020	1,601	969	580	48

Average (excluding < MDA)	1,484 Bq/L
Average of all results	1,030 Bq/L

*MDA = Minimum Detectable Activity (measurements shaded in are <MDA)

<u>Note on results obtained on May 29, 2020</u>: Samples were acquired shortly after a period of extremely heavy rainfall; however, not in time to capture water from DS-1. Elevated results are not unexpected given the conditions that preceded the sampling (extended warm and dry period of heavy tritium processing, sampling done shortly after processing shutdown).

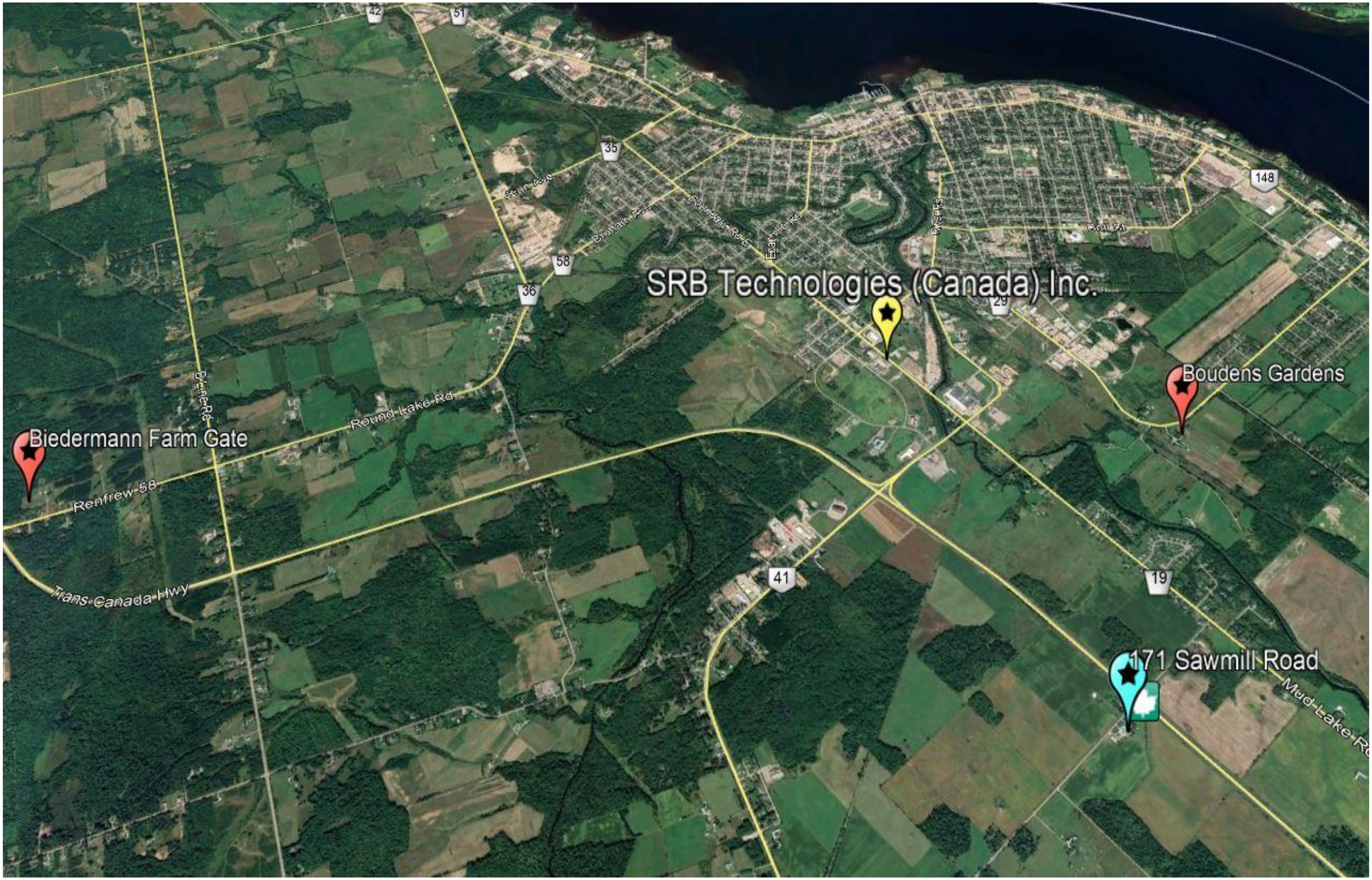


APPENDIX K

Produce Monitoring Results for 2020

Map – Produce Sampling 2020

Map – Produce Sampling 2020



APPENDIX K

2020 Residential Produce Sampling – Free-water Tritium Concentration

Sample	Units	Result
Apples 406 Boundary Road	Bq/kg Fresh weight	48
Tomatoes 408 Boundary Road	Bq/kg Fresh weight	63
Apples 413 Sweezey Court	Bq/kg Fresh weight	75
Peppers 413 Sweezey Court	Bq/kg Fresh weight	32
Green Onions 413 Sweezey Court	Bq/kg Fresh weight	62
Mixed Herbs 413 Sweezey Court	Bq/kg Fresh weight	11
Tomatoes 611 Moss Drive	Bq/kg Fresh weight	86
Carrots 611 Moss Drive	Bq/kg Fresh weight	16
Zucchini 171 Sawmill Road	Bq/kg Fresh weight	4
Carrots 171 Sawmill Road	Bq/kg Fresh weight	4
Onions 171 Sawmill Road	Bq/kg Fresh weight	3
Corn 171 Sawmill Road	Bq/kg Fresh weight	5
Beets 171 Sawmill Road	Bq/kg Fresh weight	3
Beans 171 Sawmill Road	Bq/kg Fresh weight	5
AVERAGE	**Bq/kg Fresh weight**	**29.8**

2020 Residential Produce Sampling – Organically-bound Tritium (OBT) Concentration

Sample	Units	Result
Tomatoes 408 Boundary Road	Bq/kg Fresh weight	3

2020 Commercial Produce Sampling – Free-water Tritium Concentration

Sample	Units	Result
Beans Biedermann Farm Gate	Bq/kg Fresh weight	4
Tomatoes Biedermann Farm Gate	Bq/kg Fresh weight	3
Onions Biedermann Farm Gate	Bq/kg Fresh weight	3
Carrots Biedermann Farm Gate	Bq/kg Fresh weight	2
AVERAGE	**Bq/kg Fresh weight**	**3.0**

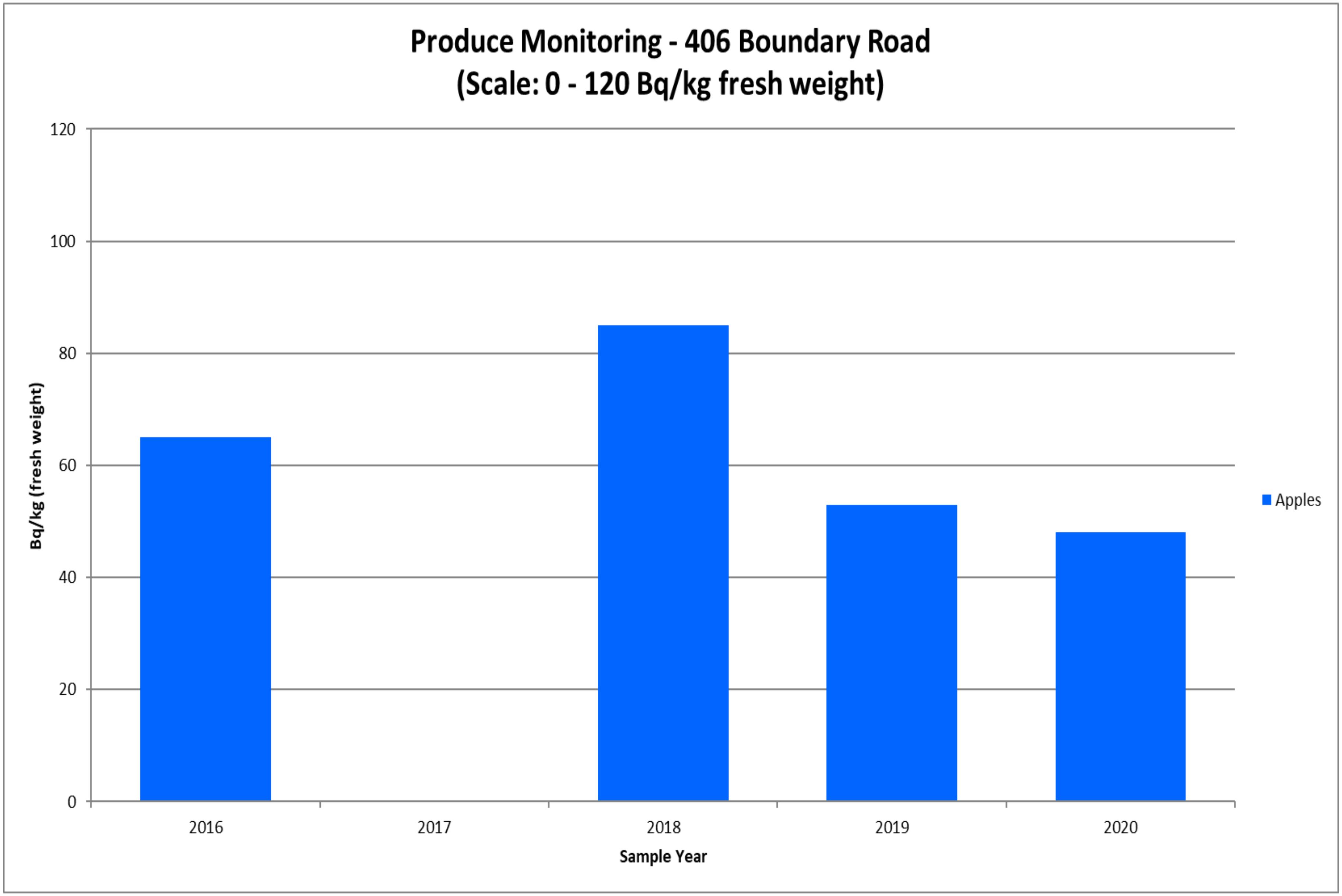
2020 Commercial Produce Sampling – Organically-bound Tritium (OBT) Concentration

Sample	Units	Result
Tomato Biedermann Farm Gate	Bq/kg Fresh weight	1

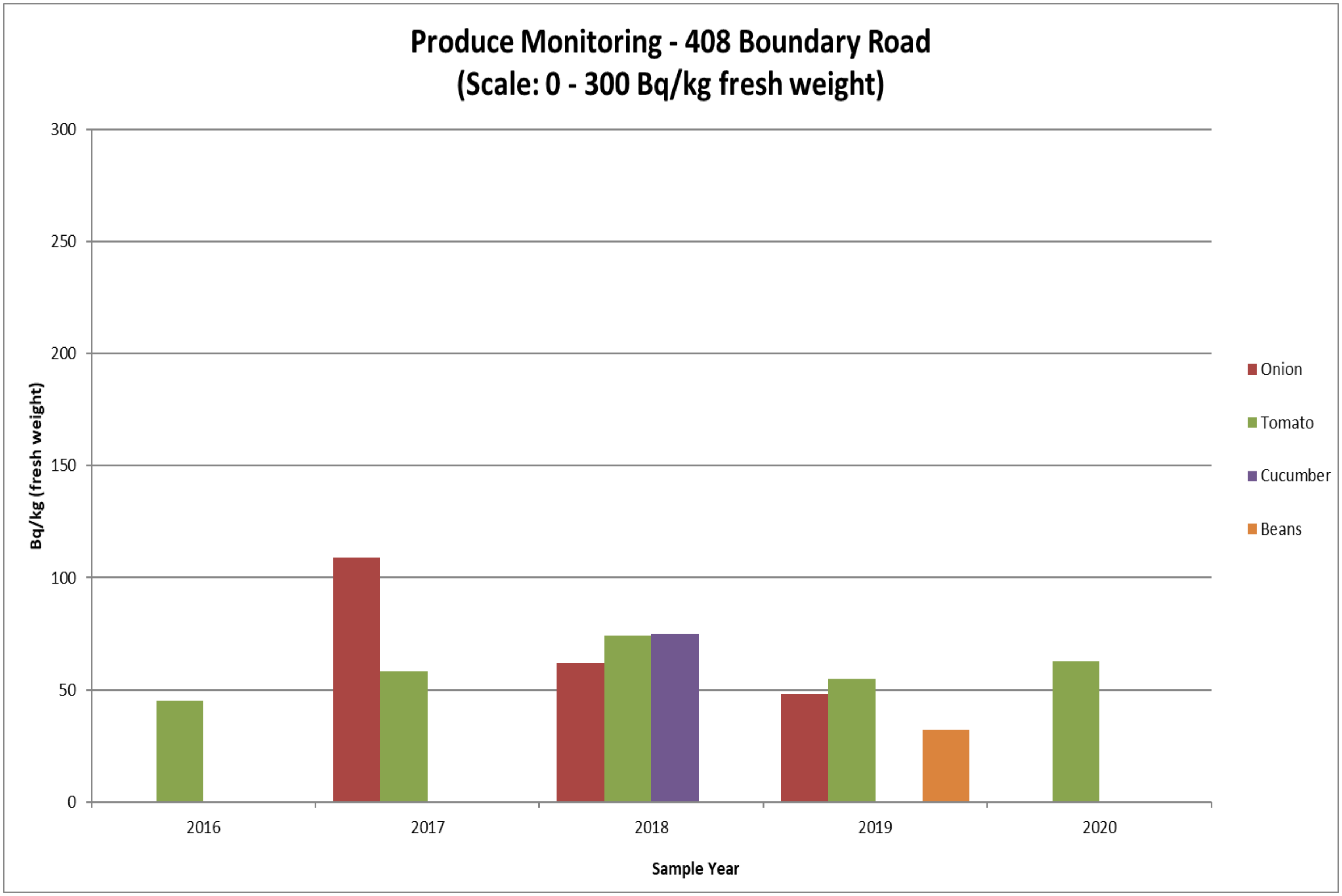
Produce Sampling Data Trends

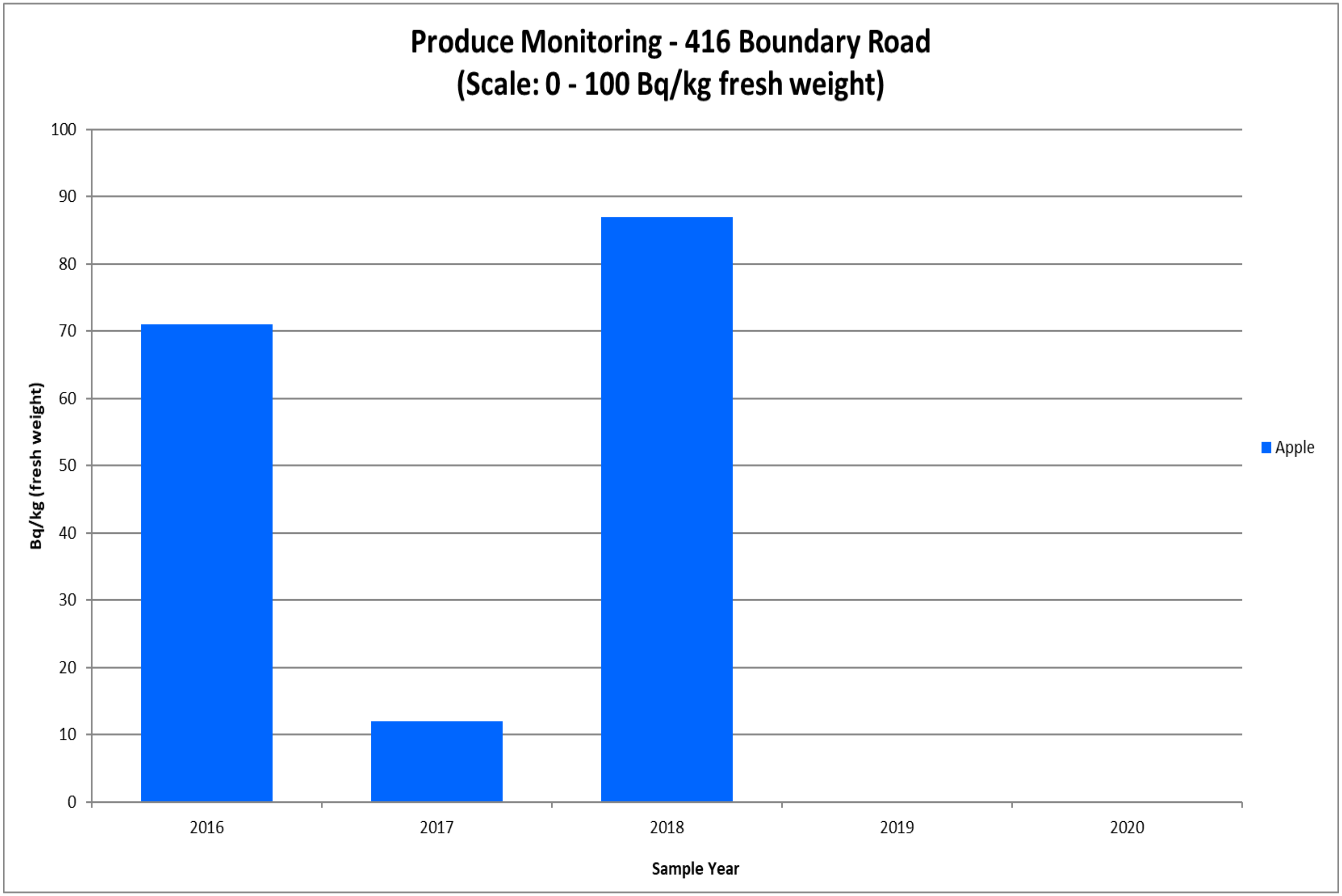
2016-2020

APPENDIX K

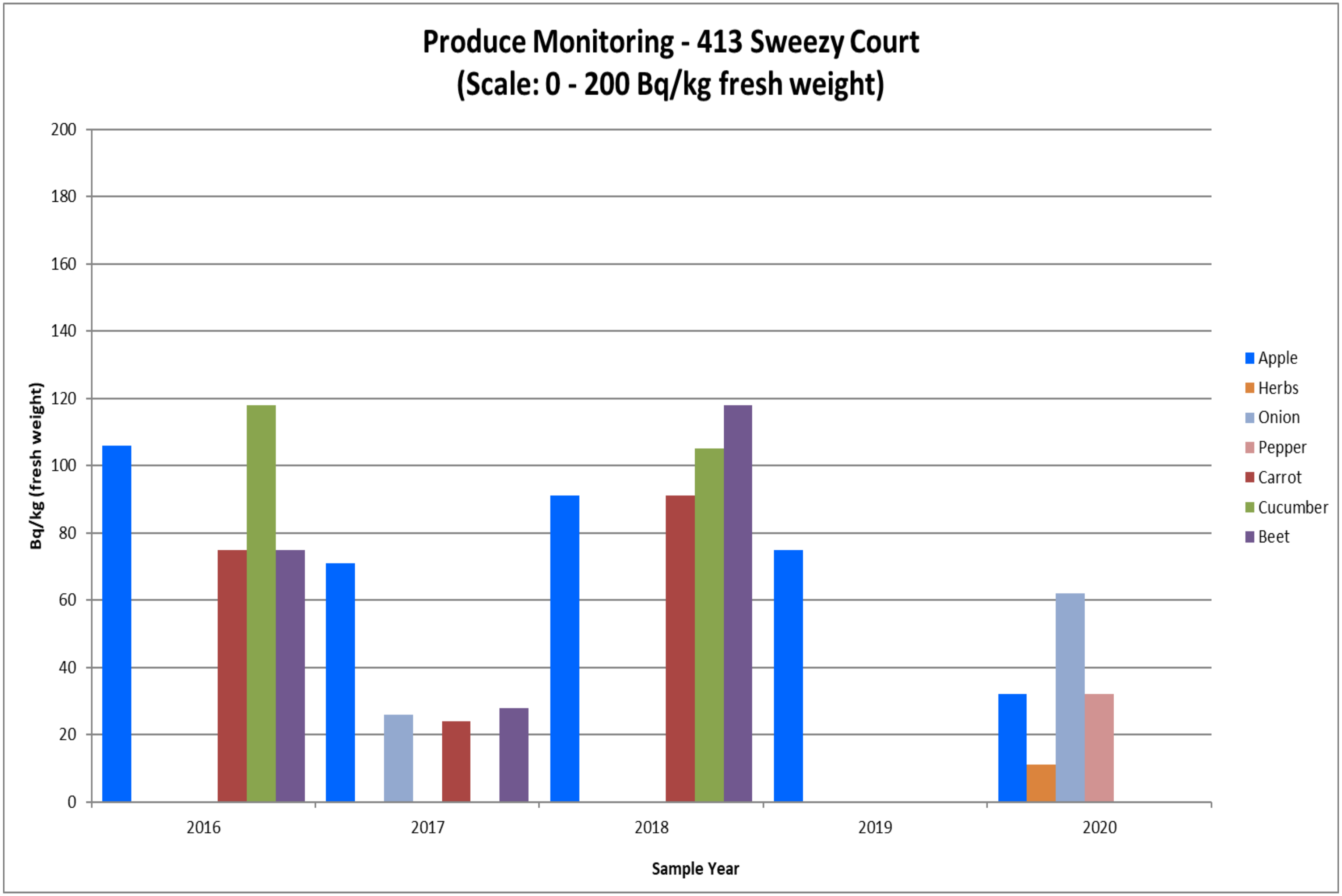

Produce Monitoring - 406 Boundary Road
(Scale: 0 - 120 Bq/kg fresh weight)
120
100
80
60
40
20
0
Bq/kg (fresh weight)
2016
2017
2018
2019
2020
Sample Year
Apples

APPENDIX K


Produce Monitoring - 408 Boundary Road
(Scale: 0 - 300 Bq/kg fresh weight)
Bq/kg (fresh weight)
300
250
200
150
100
50
0
2016
2017
2018
2019
2020
Sample Year
Onion
Tomato
Cucumber
Beans

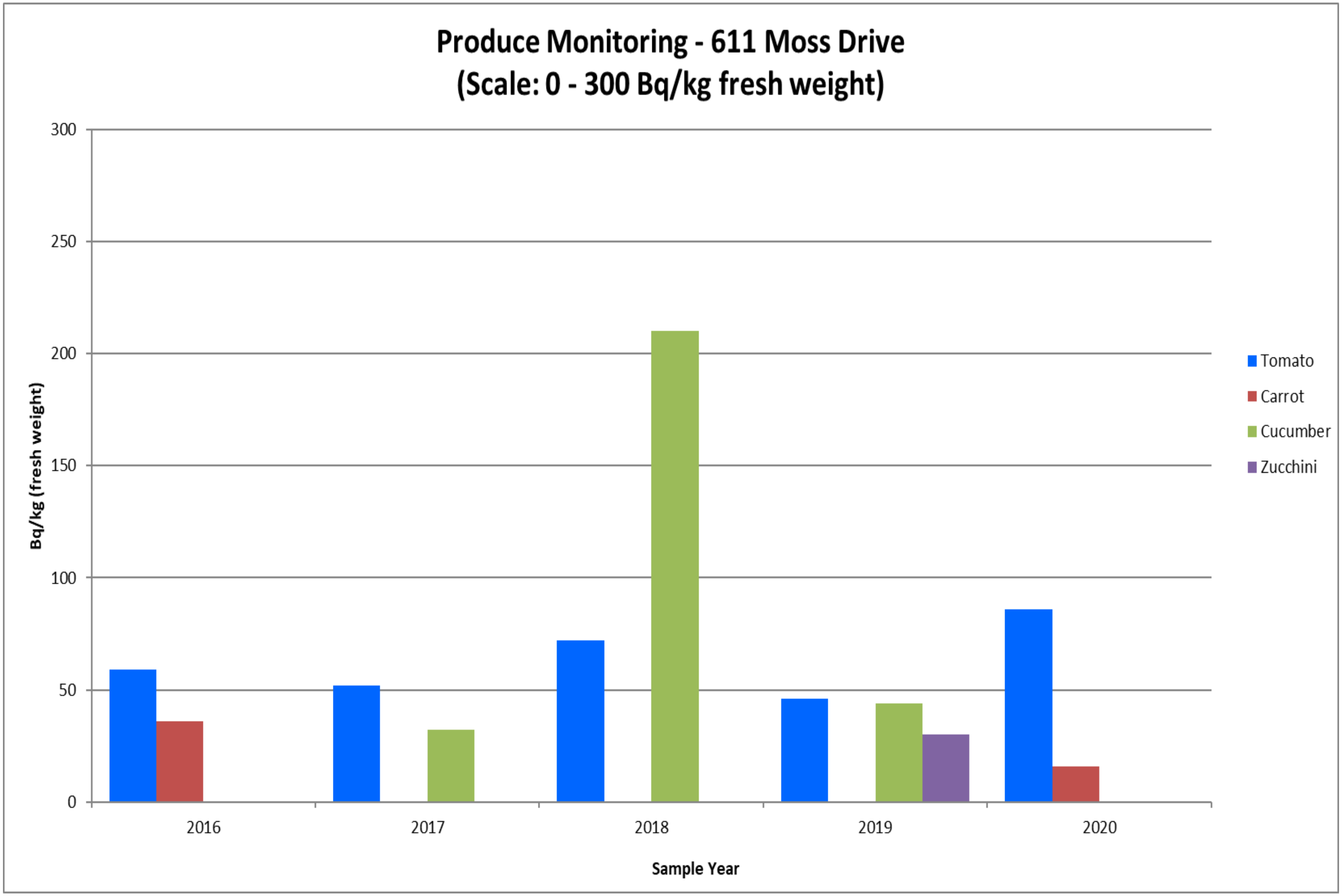

Produce Monitoring - 416 Boundary Road
(Scale: 0 - 100 Bq/kg fresh weight)
Bq/kg (fresh weight)
100
90
80
70
60
50
40
30
20
10
0
2016
2017
2018
2019
2020
Sample Year
Apple

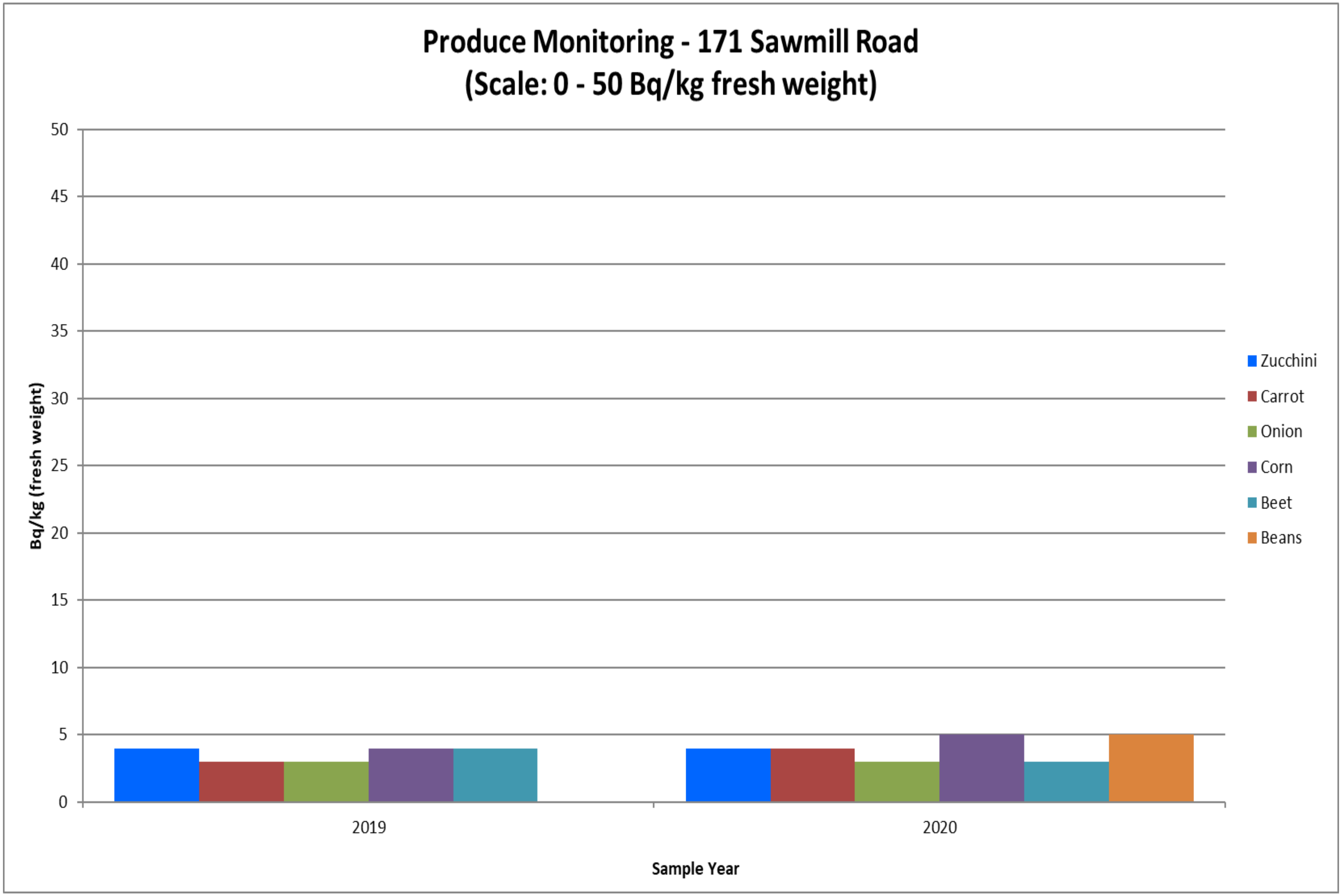
APPENDIX K



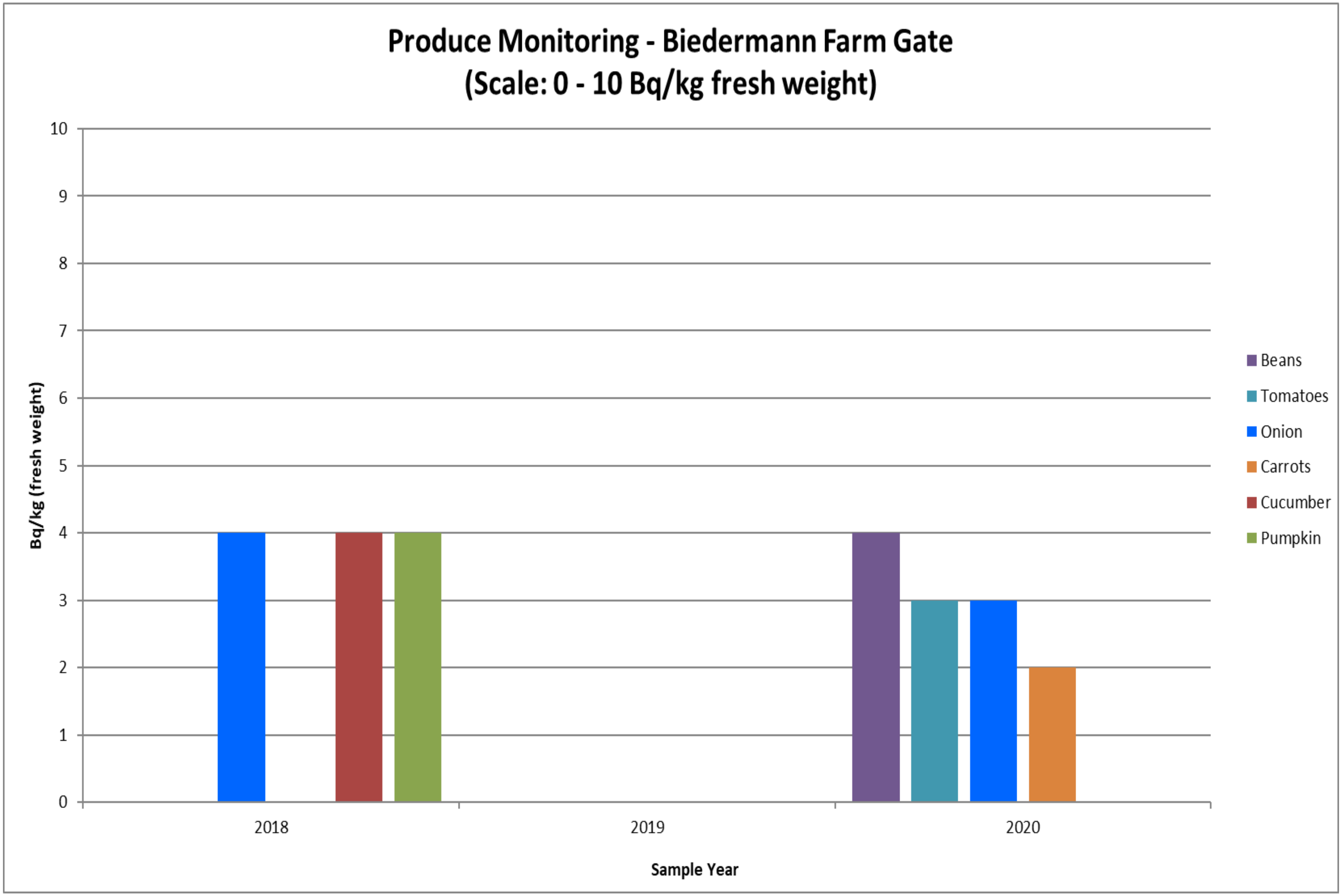
Produce Monitoring - 413 Sweezy Court
(Scale: 0 - 200 Bq/kg fresh weight)
200
180
160
140
120
100
80
60
40
20
0
Bq/kg (fresh weight)
2016
2017
2018
2019
2020
Sample Year
Apple
Herbs
Onion
Pepper
Carrot
Cucumber
Beet

APPENDIX K

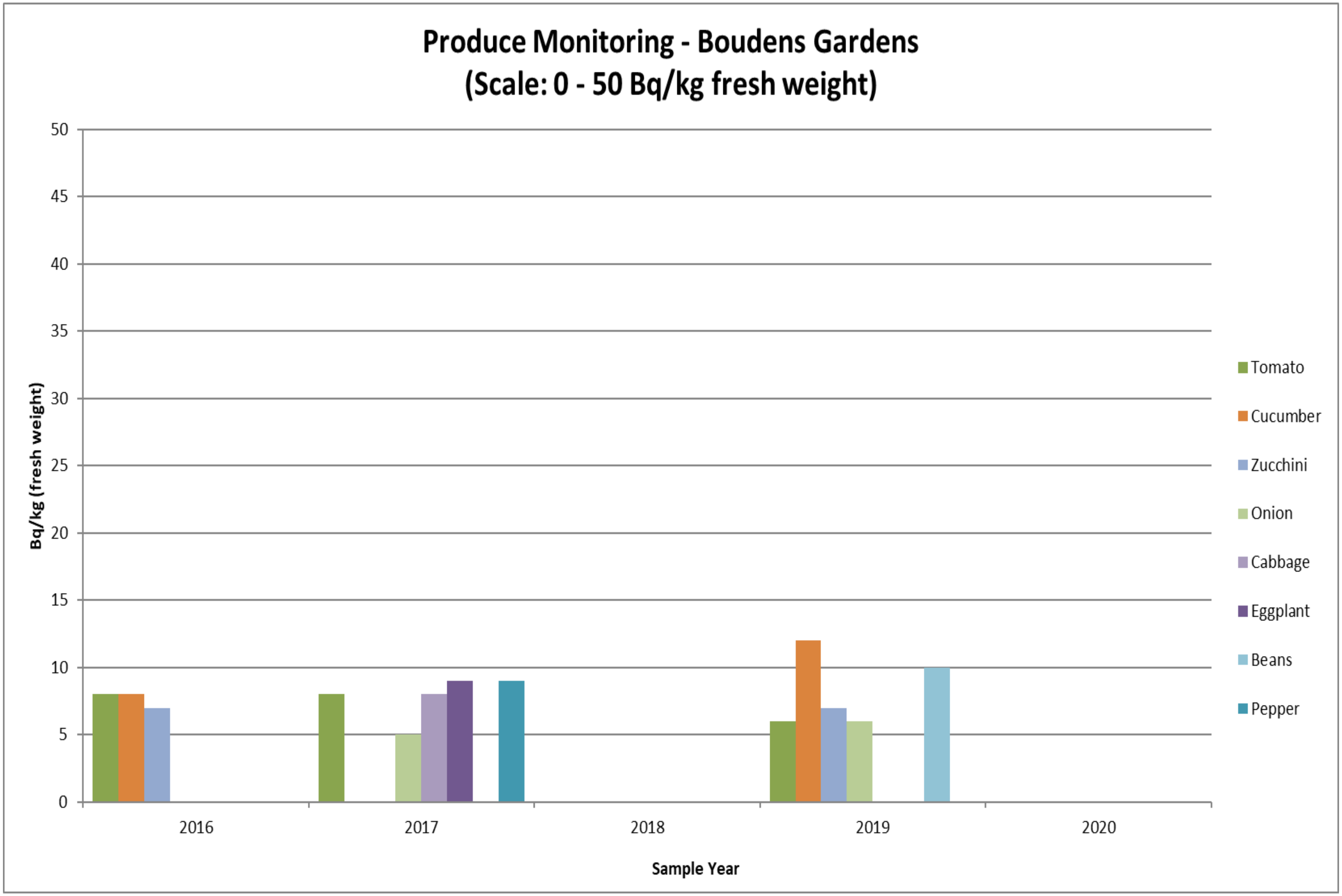

Produce Monitoring - 611 Moss Drive
(Scale: 0 - 300 Bq/kg fresh weight)
300
250
200
150
100
50
0
Bq/kg (fresh weight)
2016
2017
2018
2019
2020
Sample Year
Tomato
Carrot
Cucumber
Zucchini


Produce Monitoring - 171 Sawmill Road
(Scale: 0 - 50 Bq/kg fresh weight)
Bq/kg (fresh weight)
0
5
10
15
20
25
30
35
40
45
50
2019
2020
Sample Year
Zucchini
Carrot
Onion
Corn
Beet
Beans

APPENDIX K


Produce Monitoring - Biedermann Farm Gate
(Scale: 0 - 10 Bq/kg fresh weight)
Bq/kg (fresh weight)
10
9
8
7
6
5
4
3
2
1
0
2018
2019
2020
Sample Year
Beans
Tomatoes
Onion
Carrots
Cucumber
Pumpkin

APPENDIX K



Produce Monitoring - Boudens Gardens
(Scale: 0 - 50 Bq/kg fresh weight)
Bq/kg (fresh weight)
50
45
40
35
30
25
20
15
10
5
0
2016
2017
2018
2019
2020
Sample Year
Tomato
Cucumber
Zucchini
Onion
Cabbage
Eggplant
Beans
Pepper

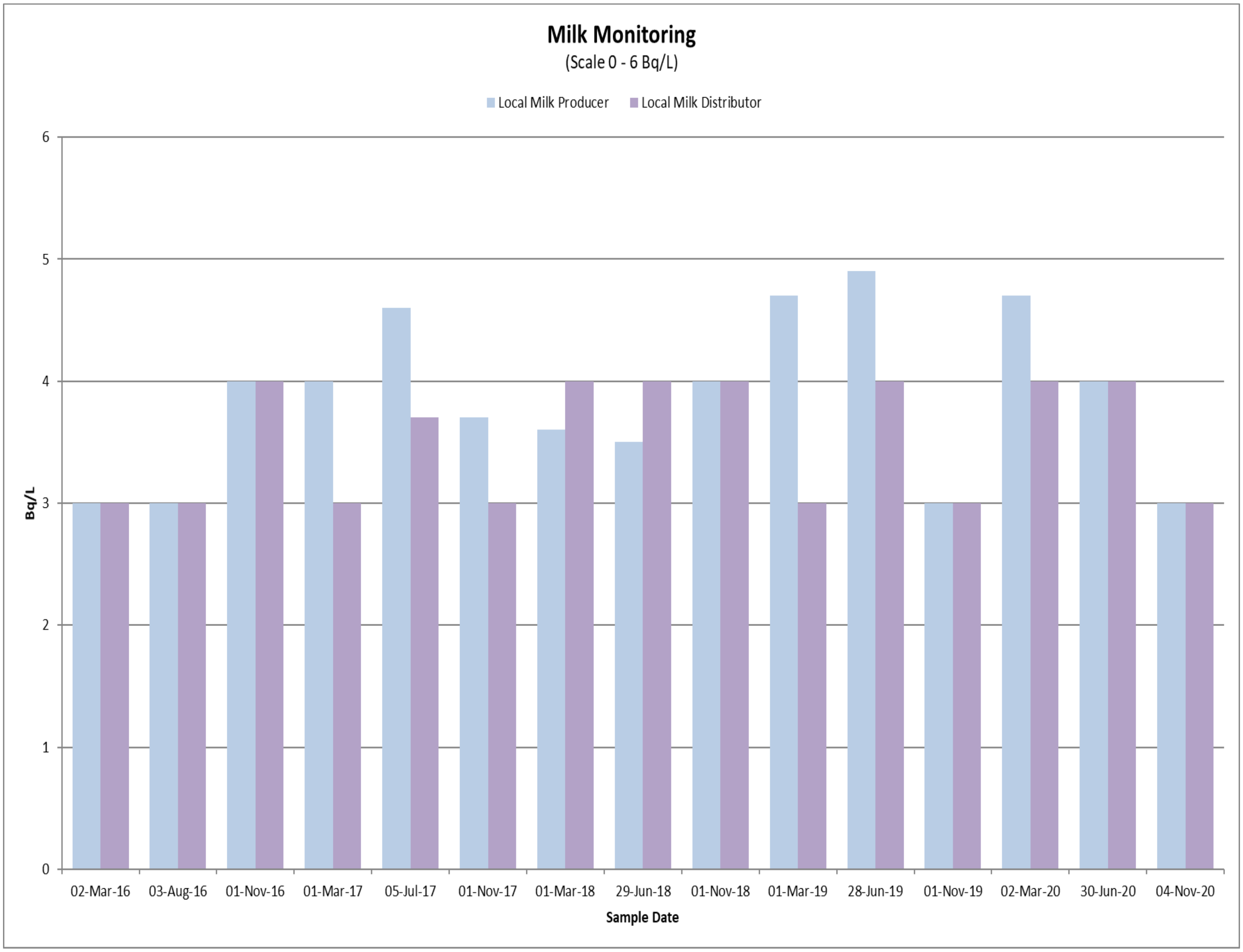
APPENDIX K

APPENDIX L

Milk Monitoring Results for 2020

MILK MONITORING RESULTS FOR 2020

MILK MONITORING		
Results shaded in blue are <MDA (minimum detectable activity)		
	LOCAL MILK PRODUCER	LOCAL MILK DISTRIBUTOR
	Bq/L	Bq/L
02-Mar-16	3	3
03-Aug-16	3	3
01-Nov-16	4	4
01-Mar-17	4	3
05-Jul-17	4.6	3.7
01-Nov-17	3.7	3
01-Mar-18	3.6	4
29-Jun-18	3.5	4
01-Nov-18	4	4
01-Mar-19	4.7	3
28-Jun-19	4.9	4
01-Nov-19	3	3
02-Mar-20	4.7	4
30-Jun-20	4	4
04-Nov-20	3	3



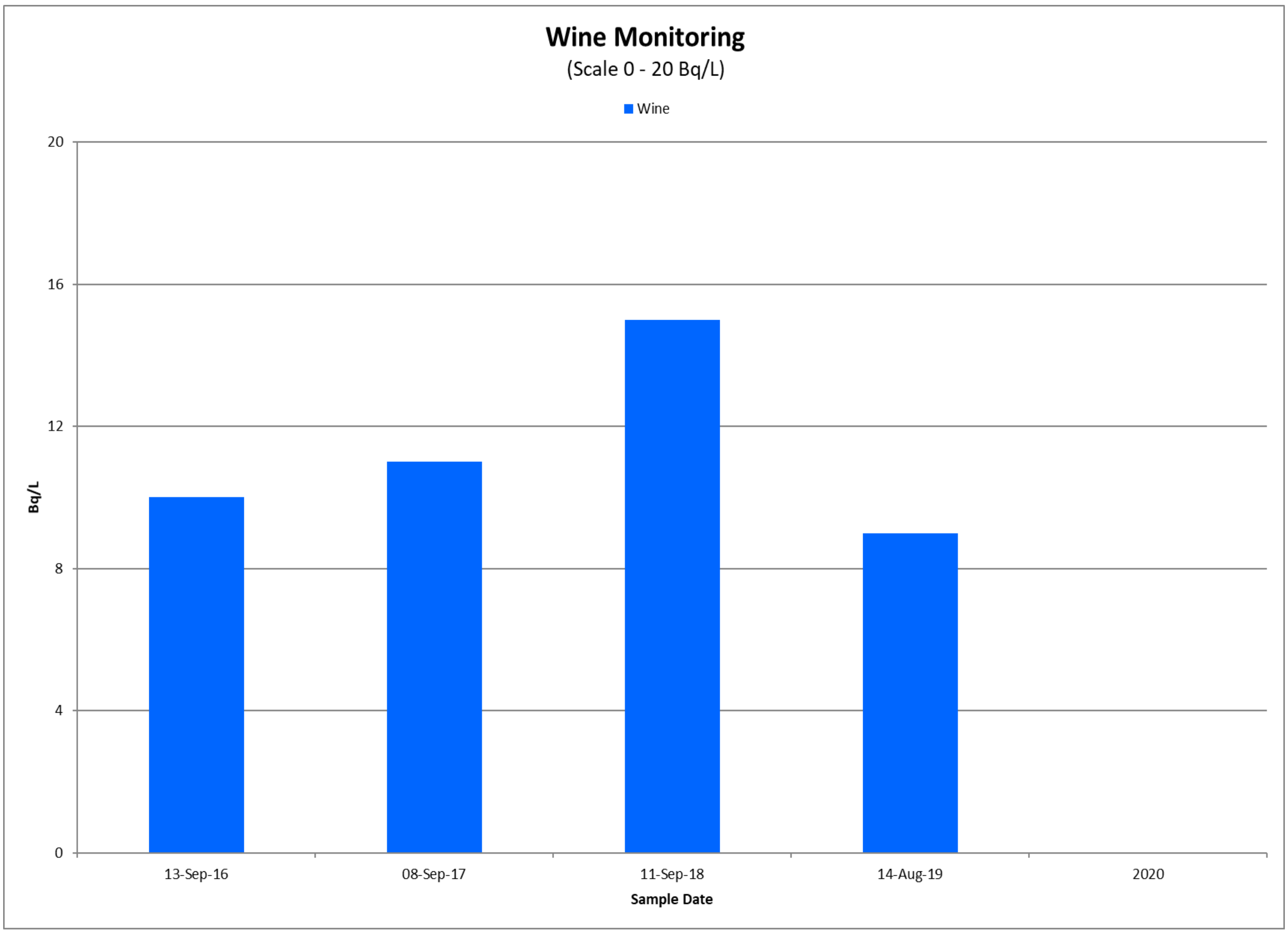
APPENDIX L

APPENDIX M

Wine Monitoring Results for 2020

WINE MONITORING RESULTS FOR 2020

WINE MONITORING	
Results shaded in blue are <MDA (minimum detectable activity)	
	Bq/L
13-Sep-16	10
08-Sep-17	11
11-Sep-18	15
14-Aug-19	9
2020	No sample - business closed



APPENDIX M

APPENDIX N

Weather Data for 2020

WEATHER DATA SUMMARY (2016-2020)									
Month	**Precip Counts, # (TOTAL)**	**Wind Speed, m/s (AVG)**	**Gust Speed, m/s (AVG)**	**Wind Direction, ø (AVG)**	**Temp, °C (AVG)**	**RH, % (AVG)**	**DewPt, °C (AVG)**	**Wind sector (nesw)**	**Total rain (mm)**
January-2016	151	3.1	4.4	166.1	-7.5	83.6	-9.9	SSE	30.2
February-2016	122	2.7	4.1	171.8	-9.7	77.7	-13.0	SSE	24.4
July-2016	401	1.9	3.2	254.8	21.3	72.5	15.7	WSW	80.2
August-2016	576	2.1	3.4	268.3	21.2	74.9	16.1	WSW	115.2
September-2016	331	1.8	2.9	230.0	15.8	79.7	12.0	SW	66.2
October-2016	140	2.9	4.4	214.9	7.9	80.1	4.4	SW	28
November-2016	330	2.7	4.1	192.2	3.0	84.5	0.4	SSW	66
December-2016	165	2.9	4.2	184.2	-5.8	83.1	-8.2	SSW	33
January-2017	113	3.0	4.4	187.5	-5.8	82.0	-8.4	SSW	22.6
February-2017	246	2.8	4.1	160.3	-5.2	79.4	-8.4	SSE	49.2
March-2017	209	2.9	4.4	227.5	-4.7	67.0	-10.3	SW	41.8
April-2017	857	2.6	4.1	179.4	6.8	75.1	2.1	SSE	171.4
May-2017	552	2.6	4.2	202.9	11.9	74.4	6.9	SSW	110.4
June-2017	1041	2.2	3.5	249.5	18.2	75.0	13.1	WSW	208.2
July-2017	712	1.7	2.8	221.6	20.0	76.0	15.2	SW	142.4
August-2017	433	2.0	3.3	241.1	17.5	79.3	13.6	WSW	86.6
September-2017	284	1.4	2.3	227.9	16.2	81.5	12.7	SW	56.8
October-2017	534	2.5	4.0	210.1	11.0	79.4	7.3	SSW	106.8
November-2017	286	3.2	4.6	162.8	-0.4	79.4	-3.7	SSE	57.2
December-2017	79	2.8	4.1	135.1	-10.9	79.2	-13.8	SE	15.8
January-2018	167	3.3	4.9	146.0	-9.7	80.2	-12.6	SE	33.4
February-2018	169	3.3	3.7	154.8	-5.6	77.9	-9.1	SSE	33.8
March-2018	158	3.9	5.1	94.1	-2.3	68.6	-7.7	ESE	31.6
April-2018	348	2.8	4.2	146.6	3.5	66.5	-3.1	SE	69.6
May-2018	276	2.4	3.9	202.6	15.1	60.7	6.4	SSW	55.2
June-2018	273	2.1	3.4	221.4	17.2	70.1	11.0	SW	54.6
July-2018	340	2.1	3.3	250.8	22.4	69.7	15.9	WSW	68
August-2018	336	1.8	2.9	213.2	21.0	78.7	16.8	SW	67.2
September-2018	352	2.1	3.3	205.2	14.5	81.1	11.1	SSW	70.4
October-2018	234	2.8	4.3	213.7	6.0	79.0	2.4	SW	46.8
November-2018	352	2.9	4.3	204.3	-2.3	85.6	-4.4	SSW	70.4
December-2018	170	2.3	3.4	195.0	-8.0	85.6	-10.0	SSW	34
January-2019	767	2.7	4.0	215.7	-13.0	79.2	-15.9	SW	153.4
February-2019	116	2.6	3.9	196.8	-9.7	74.9	-13.5	SSW	23.2
March-2019	178	3.0	4.5	231.7	-3.6	68.1	-9.2	SW	35.6
April-2019	778	3.0	4.5	204.9	4.1	73.3	-0.8	SSW	155.6
May-2019	369	2.6	4.0	212.2	10.8	72.9	5.6	SW	73.8
June-2019	493	2.3	3.7	248.4	16.8	70.5	10.7	WSW	98.6
July-2019	321	1.9	3.1	264.1	21.9	71.2	15.9	WSW	64.2
August-2019	285	2.0	3.2	239.8	19.4	71.7	13.6	SW	57
September-2019	228	2.1	3.3	246.7	14.6	78.8	10.6	WSW	45.6
October-2019	690	2.4	3.7	246.2	7.8	80.9	4.5	WSW	138
November-2019	219	2.1	3.3	249.3	14.8	78.9	10.8	WSW	43.8
December-2019	190	1.7	2.8	237.0	-5.0	84.7	-7.2	SW	38
January-2020	246	1.6	2.7	245.3	-7.4	84.1	-9.7	WSW	49.2
February-2020	165	1.9	3.4	251.2	-7.4	73.2	-11.6	WSW	33
March-2020	374	1.8	3.2	232.0	0.2	71.3	-4.9	SW	74.8
April-2020	261	2.0	3.8	-	4.6	61.4	-3.1	-	52.2
May-2020	375	1.2	2.8	-	12.1	59.4	3.2	-	75
June-2020	297	1.3	2.7	-	19.0	70.2	12.9	-	59.4
July-2020	358	1.0	2.2	-	23.2	72.5	17.4	-	71.6
August-2020	1131	0.6	1.3	-	18.6	82.1	15.1	-	226.2
September-2020	344	-6.9	-6.7	-	13.5	79.3	9.7	-	68.8
October-2020	296	0.0	0.2	-	5.9	78.1	2.2	-	59.2
November-2020	259	0.0	1.5	-	3.7	78.7	-0.9	-	51.8
December-2020	192	0.0	1.1	-	-4.6	84.9	-6.8	-	38.4

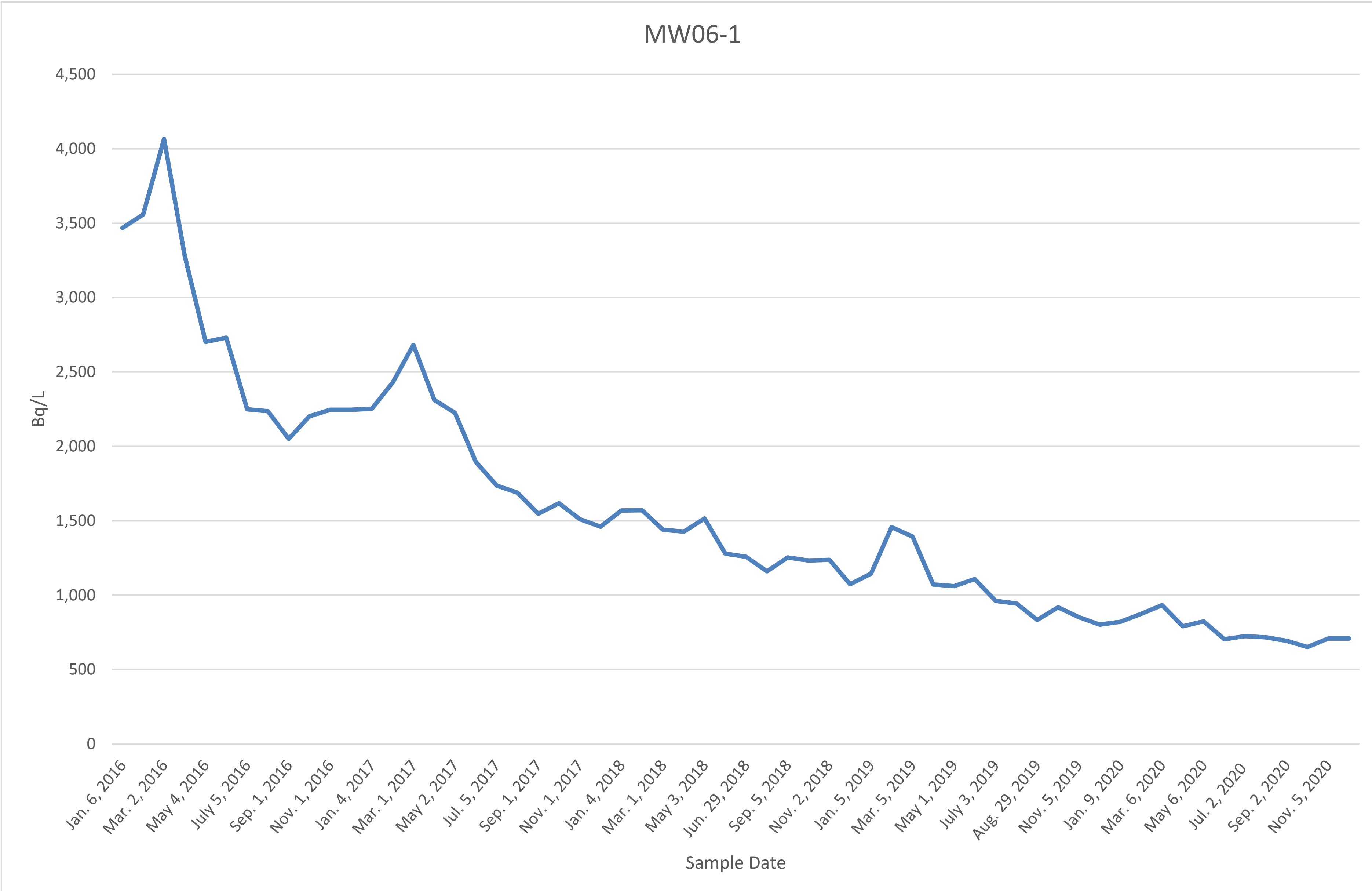
NOTE: Weather station anemometer and wind direction sensor malfunction starting in April 2020. Corrective maintenance planning in progress.

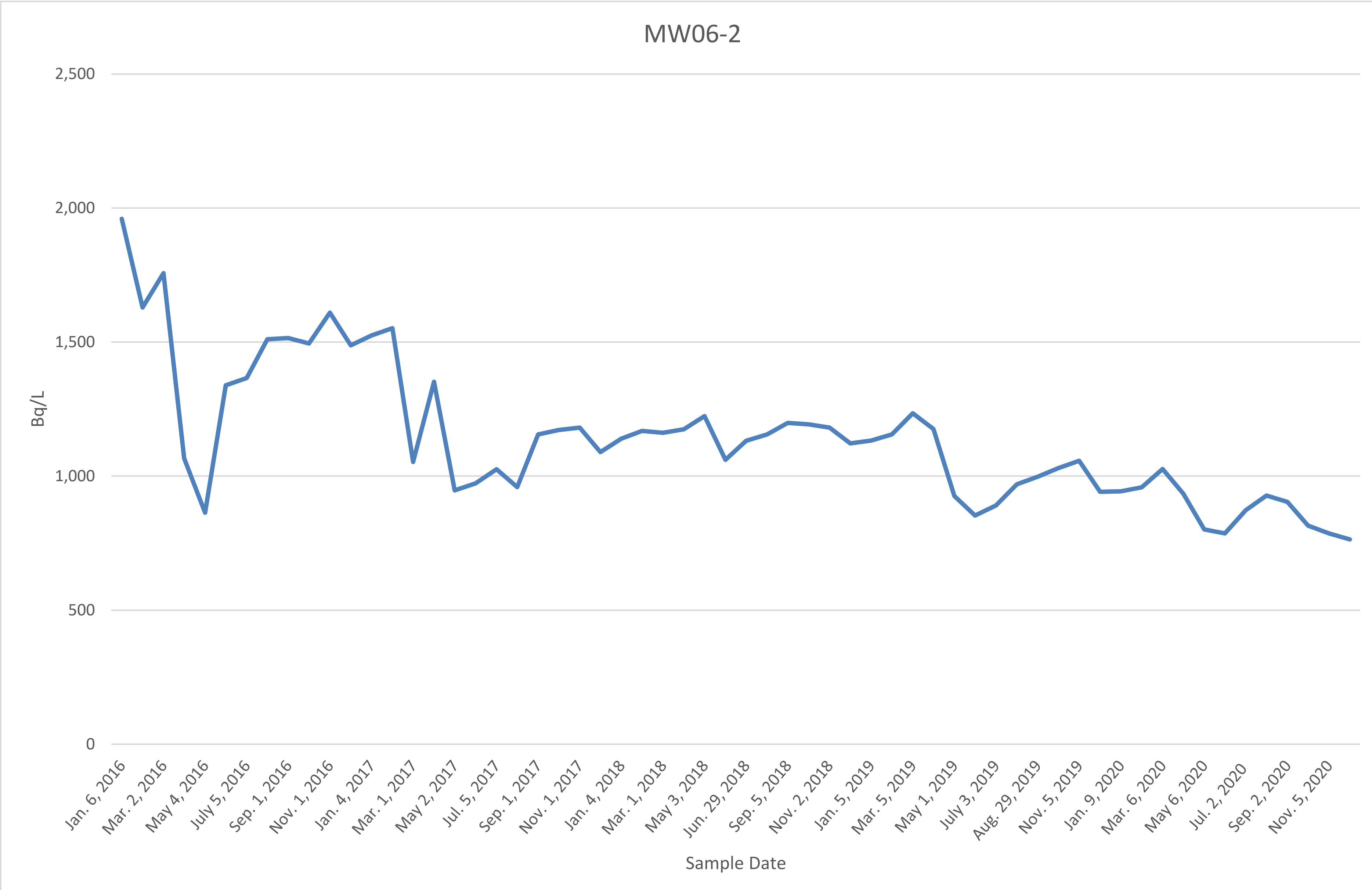
APPENDIX O

Well Monitoring Results for 2020

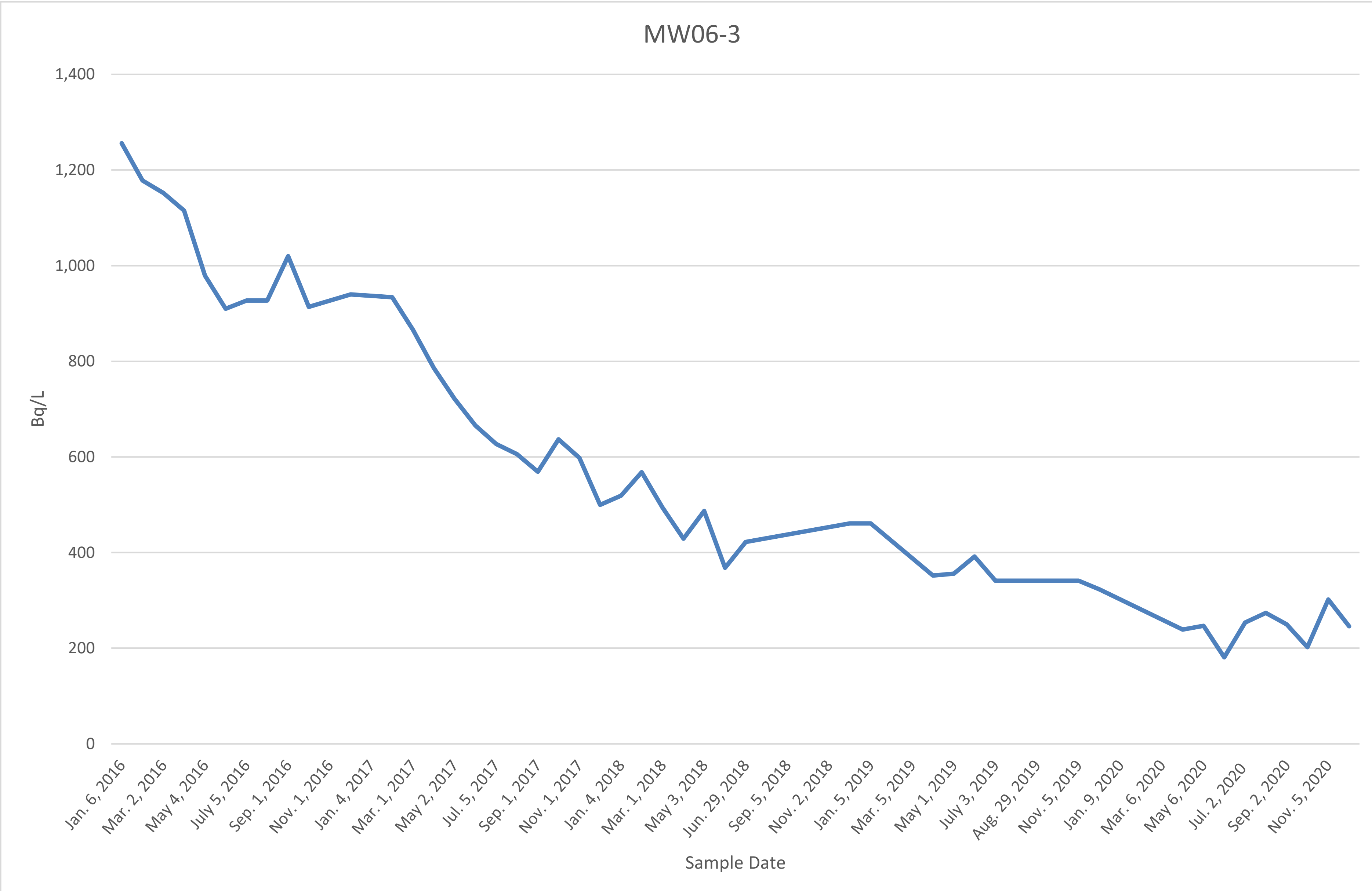
WELL MONITORING DATA FOR 2020

WELL I.D.	DESCRIPTION		DISTANCE FROM STACKS (m)	Jan. 9, 2020	Feb. 6, 2020	Mar. 6, 2020	Apr. 3, 2020	May 6, 2020	Jun. 2, 2020	Jul. 2, 2020	Aug. 5, 2020	Sep. 2, 2020	Oct. 5, 2020	Nov. 5, 2020	Dec. 4, 2020	WELL I.D.
MW06-1	SRB SITE	IN SOIL	50	821	874	932	791	824	704	724	716	693	651	709	709	MW06-1
MW06-2	SRB SITE	IN SOIL	75	943	958	1,027	935	801	786	873	928	904	815	786	764	MW06-2
MW06-3	SRB SITE	IN SOIL	50	Dry	Dry	Dry	239	247	181	254	274	250	202	302	246	MW06-3
MW06-8	SRB SITE	IN SOIL	55	585	579	608	568	615	526	602	591	600	532	575	570	MW06-8
MW06-9	SRB SITE	IN SOIL	25	1,577	1,596	1,642	1,545	1,607	1,527	1,536	1,522	1,465	1,408	1,446	1,450	MW06-9
MW06-10	SRB SITE	SURFACE OF BEDROCK	0	42,110	43,247	40,031	25,974	22,773	17,231	33,071	37,026	20,156	28,271	25,738	18,529	MW06-10
MW07-11	SRB SITE	SURFACE OF BEDROCK	75	1,073	1,091	1,038	929	827	809	774	985	960	932	913	753	MW07-11
MW07-12	SRB SITE	SURFACE OF BEDROCK	55	402	372	405	452	469	380	432	430	453	383	451	429	MW07-12
MW07-13	SRB SITE	SURFACE OF BEDROCK	50	4,951	4,933	4,776	4,628	4,557	4,401	4,313	4,256	4,139	4,033	4,011	3,875	MW07-13
MW07-15	SRB SITE	SURFACE OF BEDROCK	25	1,330	1,350	1,376	1,316	1,258	1,165	1,223	1,229	1,256	1,195	1,218	1,230	MW07-15
MW07-16	SRB SITE	SURFACE OF BEDROCK	15	995	1,115	1,117	956	1,053	965	1,031	1,022	980	895	979	932	MW07-16
MW07-17	SRB SITE	DEEPER BEDROCK	15	322	320	349	314	257	143	234	253	316	218	269	263	MW07-17
MW07-18	SRB SITE	SURFACE OF BEDROCK	10	1,836	1,847	1,913	1,335	1,373	1,225	1,472	1,500	1,390	1,353	1,343	1,346	MW07-18
MW07-19	SRB SITE	SURFACE OF BEDROCK	20	1,670	1,562	buried	1,173	925	971	1,143	1,276	1,125	1,034	977	1,322	MW07-19
MW07-20	SUPERIOR PROPANE PROPERTY	SURFACE OF BEDROCK	90	325	308	340	332	368	296	341	312	329	266	317	380	MW07-20
MW07-21	SUPERIOR PROPANE PROPERTY	SURFACE OF BEDROCK	110	480	444	485	251	366	376	418	443	394	351	402	306	MW07-21
MW07-22	SRB SITE	SURFACE OF BEDROCK	70	776	849	891	728	886	727	835	780	794	666	709	760	MW07-22
MW07-23	SRB SITE	SURFACE OF BEDROCK	90	1,235	1,297	1,324	1,308	1,312	1,215	1,261	1,268	1,208	1,164	1,211	1,216	MW07-23
MW07-24	HARRINGTON PROPERTY	SURFACE OF BEDROCK	115	1,597	1,749	1,752	1,721	1,753	1,621	1,604	1,641	1,610	1,532	1,595	1,549	MW07-24
MW07-26	SRB SITE	SURFACE OF BEDROCK	50	566	586	590	486	544	453	498	561	502	429	488	469	MW07-26
MW07-27	CITY PROPERTY	SURFACE OF BEDROCK	55	2,592	2,273	2,641	1,258	1,276	1,701	1,855	2,265	2,092	1,940	1,973	2,061	MW07-27
MW07-28	CITY PROPERTY	DEEPER BEDROCK	55	731	710	812	769	816	668	713	665	648	601	643	688	MW07-28
MW07-29	SRB SITE	DEEPER BEDROCK	10	2,010	1,926	2,788	1,060	1,269	1,157	1,356	1,731	1,147	1,175	957	1,247	MW07-29
MW07-31	SRB SITE	DEEPER BEDROCK	70	260	253	236	58	115	235	252	397	92	104	85	95	MW07-31
MW07-32	HARRINGTON PROPERTY	DEEPER BEDROCK	115	<MDA (59)	<MDA(59)	<MDA(46)	<MDA(50)	<MDA(41)	<MDA(50)	<MDA(43)	<MDA(42)	63	<MDA (47)	<MDA(39)	55	MW07-32
MW07-34	SRB SITE	SHALLOW BEDROCK	10	1,370	1,320	buried	1,280	1,406	1,294	1,326	1,403	1,259	1,243	1,216	1,151	MW07-34
MW07-35	CITY PROPERTY	SHALLOW BEDROCK	55	2,601	2,066	2,063	1,848	1,844	1,767	1,768	1,867	1,788	1,662	1,777	1,725	MW07-35
MW07-36	CITY PROPERTY	SHALLOW BEDROCK	80	1,855	1,787	1,788	1,208	1,124	1,058	1,374	1,525	1,391	1,469	1,537	1,500	MW07-36
MW07-37	SRB SITE	SHALLOW BEDROCK	60	743	827	813	759	788	723	749	760	755	699	760	777	MW07-37
RW-2	185 MUD LAKE ROAD		1,100			39				38				35		RW-2
RW-3	183 MUD LAKE ROAD		1,100			49				47				45		RW-3
RW-5	171 SAWMILL ROAD		2,300			7				4				7		RW-5
RW-6	40987 HWY 41		1,400			6				4				5		RW-6
RW-7	40925 HWY 41		1,600			4				<4				4		RW-7
B-1	VALLEY POOL SERVICE OFFICE		160			842				938				797		B-1
B-2	SUPERIOR PROPANE TRUCK WASH		250			607				469				506		B-2
B-3	HEIDEMAN & SONS LUMBER		385			No sample				No sample				No sample		B-3


MW06-1
Bq/L
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Jan. 6, 2016
Mar. 2, 2016
May 4, 2016
July 5, 2016
Sep. 1, 2016
Nov. 1, 2016
Jan. 4, 2017
Mar. 1, 2017
May 2, 2017
Jul. 5, 2017
Sep. 1, 2017
Nov. 1, 2017
Jan. 4, 2018
Mar. 1, 2018
May 3, 2018
Jun. 29, 2018
Sep. 5, 2018
Nov. 2, 2018
Jan. 5, 2019
Mar. 5, 2019
May 1, 2019
July 3, 2019
Aug. 29, 2019
Nov. 5, 2019
Jan. 9, 2020
Mar. 6, 2020
May 6, 2020
Jul. 2, 2020
Sep. 2, 2020
Nov. 5, 2020
Sample Date

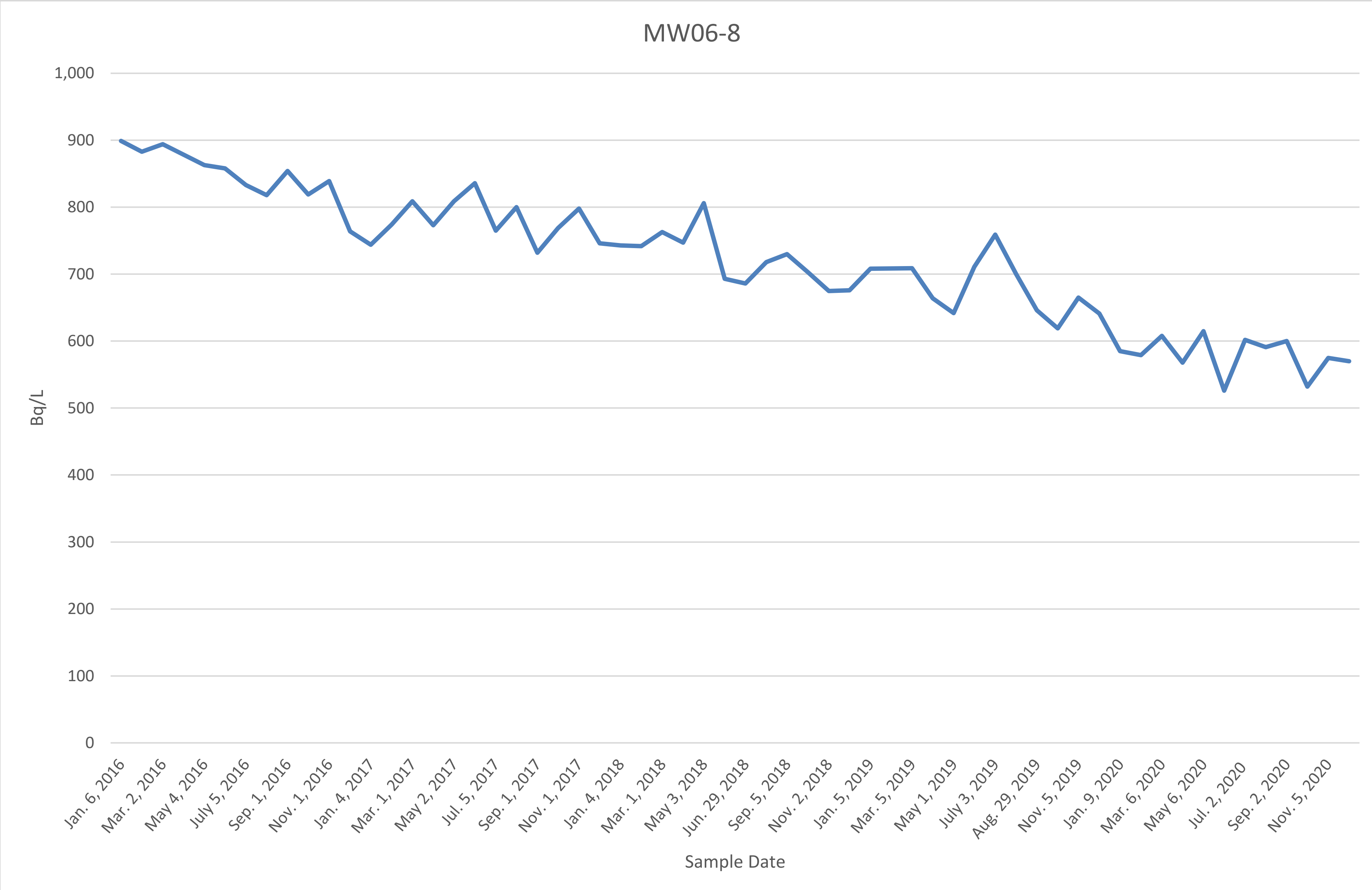

MW06-2
2,500
2,000
1,500
1,000
500
0
Bq/L
Jan. 6, 2016
Mar. 2, 2016
May 4, 2016
July 5, 2016
Sep. 1, 2016
Nov. 1, 2016
Jan. 4, 2017
Mar. 1, 2017
May 2, 2017
Jul. 5, 2017
Sep. 1, 2017
Nov. 1, 2017
Jan. 4, 2018
Mar. 1, 2018
May 3, 2018
Jun. 29, 2018
Sep. 5, 2018
Nov. 2, 2018
Jan. 5, 2019
Mar. 5, 2019
May 1, 2019
July 3, 2019
Aug. 29, 2019
Nov. 5, 2019
Jan. 9, 2020
Mar. 6, 2020
May 6, 2020
Jul. 2, 2020
Sep. 2, 2020
Nov. 5, 2020
Sample Date

APPENDIX O

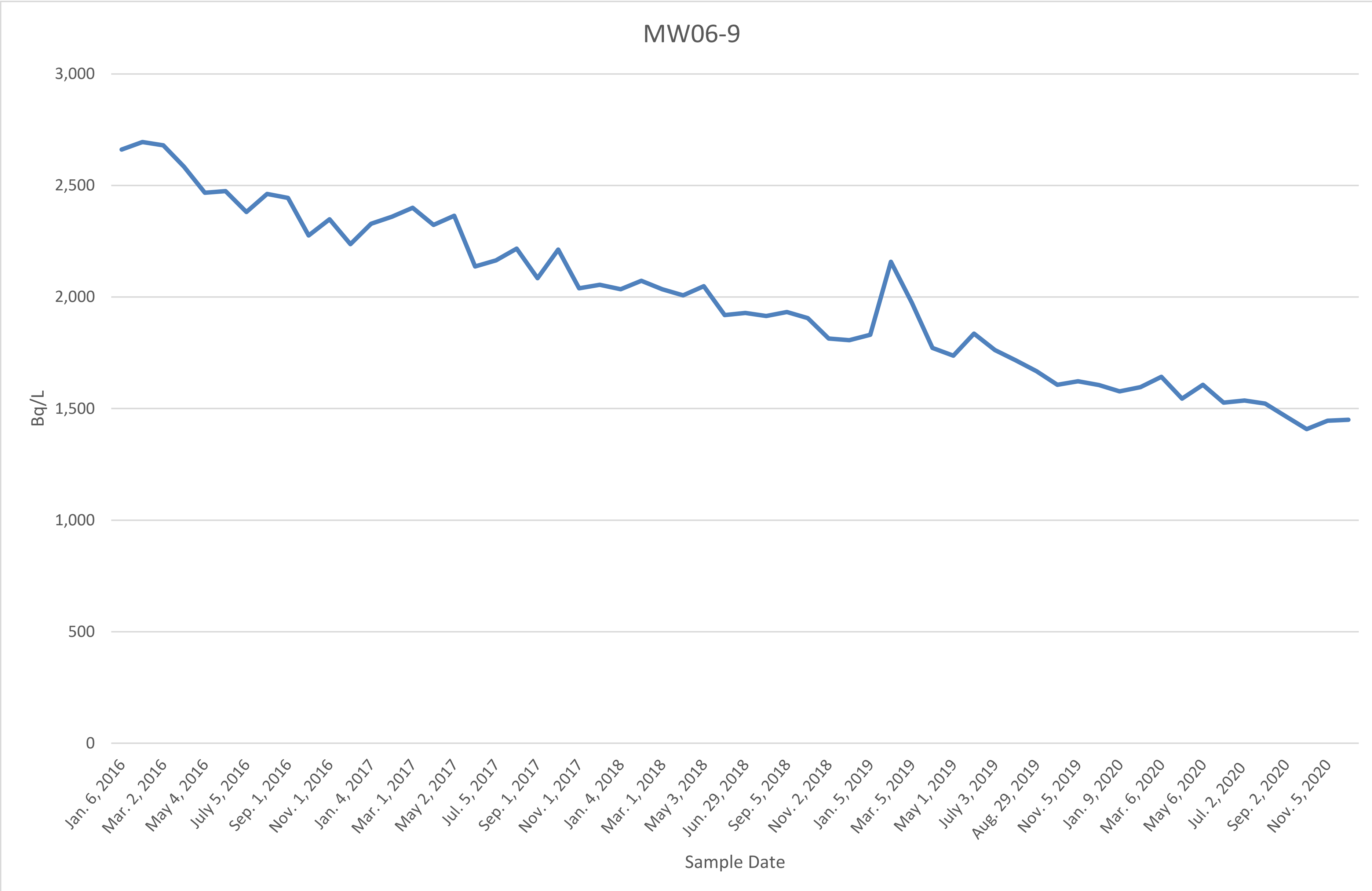


MW06-3
1,400
1,200
1,000
800
600
400
200
0
Bq/L
Jan. 6, 2016
Mar. 2, 2016
May 4, 2016
July 5, 2016
Sep. 1, 2016
Nov. 1, 2016
Jan. 4, 2017
Mar. 1, 2017
May 2, 2017
Jul. 5, 2017
Sep. 1, 2017
Nov. 1, 2017
Jan. 4, 2018
Mar. 1, 2018
May 3, 2018
Jun. 29, 2018
Sep. 5, 2018
Nov. 2, 2018
Jan. 5, 2019
Mar. 5, 2019
May 1, 2019
July 3, 2019
Aug. 29, 2019
Nov. 5, 2019
Jan. 9, 2020
Mar. 6, 2020
May 6, 2020
Jul. 2, 2020
Sep. 2, 2020
Nov. 5, 2020
Sample Date

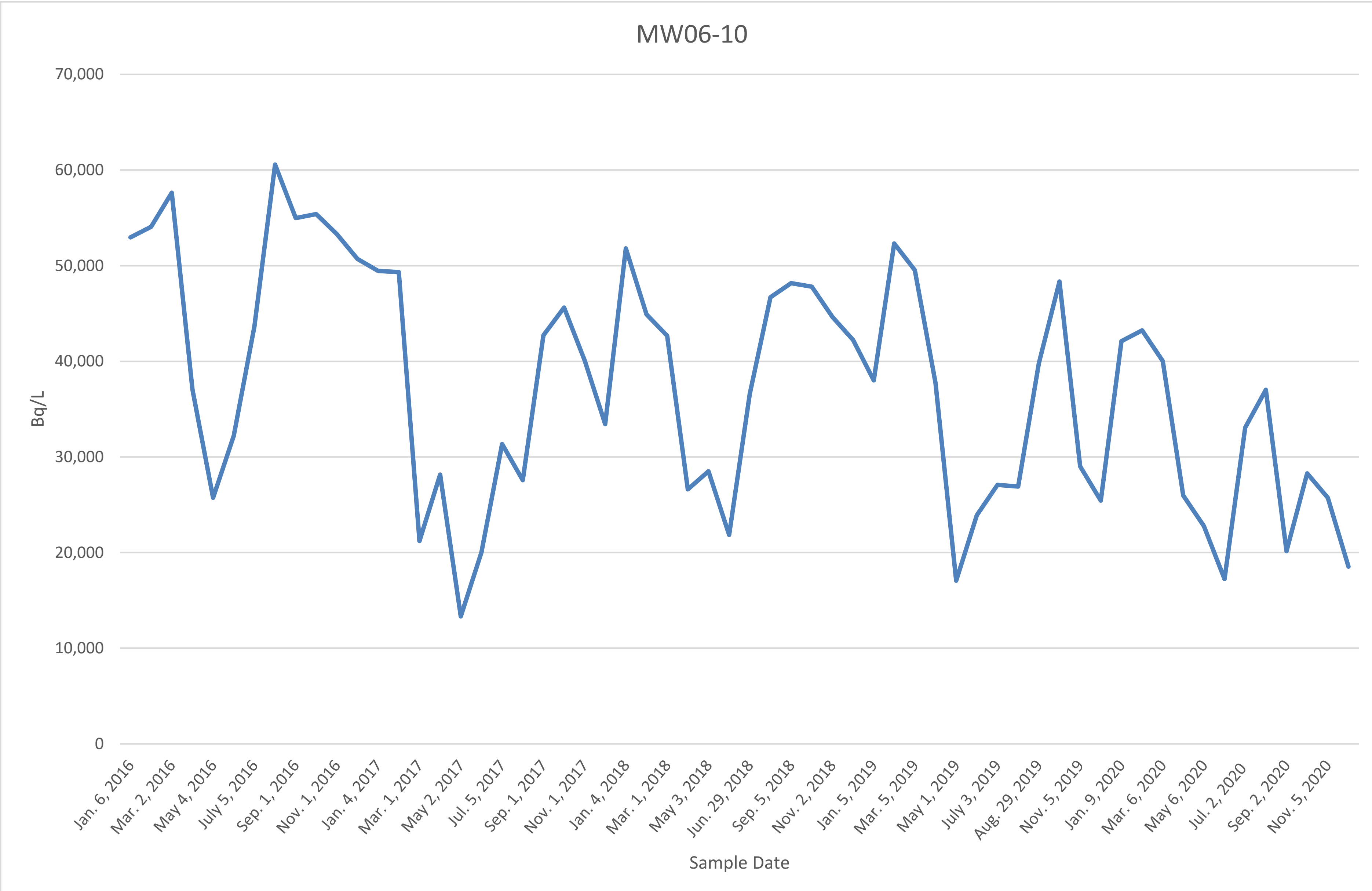
APPENDIX O


MW06-8
1,000
900
800
700
600
500
400
300
200
100
0
Bq/L
Jan. 6, 2016
Mar. 2, 2016
May 4, 2016
July 5, 2016
Sep. 1, 2016
Nov. 1, 2016
Jan. 4, 2017
Mar. 1, 2017
May 2, 2017
Jul. 5, 2017
Sep. 1, 2017
Nov. 1, 2017
Jan. 4, 2018
Mar. 1, 2018
May 3, 2018
Jun. 29, 2018
Sep. 5, 2018
Nov. 2, 2018
Jan. 5, 2019
Mar. 5, 2019
May 1, 2019
July 3, 2019
Aug. 29, 2019
Nov. 5, 2019
Jan. 9, 2020
Mar. 6, 2020
May 6, 2020
Jul. 2, 2020
Sep. 2, 2020
Nov. 5, 2020
Sample Date

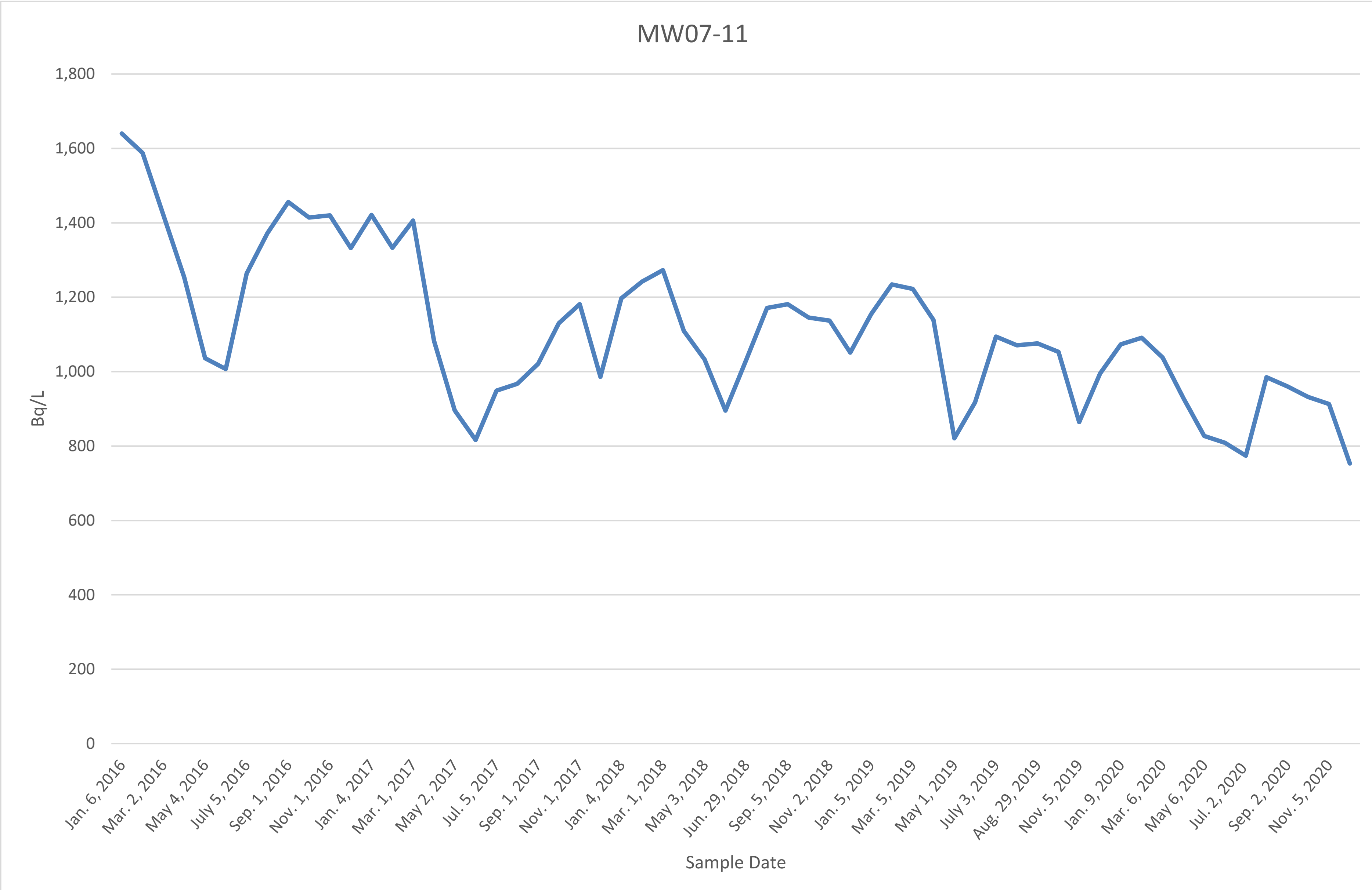
APPENDIX O


MW06-9
3,000
2,500
2,000
1,500
1,000
500
0
Bq/L
Jan. 6, 2016
Mar. 2, 2016
May 4, 2016
July 5, 2016
Sep. 1, 2016
Nov. 1, 2016
Jan. 4, 2017
Mar. 1, 2017
May 2, 2017
Jul. 5, 2017
Sep. 1, 2017
Nov. 1, 2017
Jan. 4, 2018
Mar. 1, 2018
May 3, 2018
Jun. 29, 2018
Sep. 5, 2018
Nov. 2, 2018
Jan. 5, 2019
Mar. 5, 2019
May 1, 2019
July 3, 2019
Aug. 29, 2019
Nov. 5, 2019
Jan. 9, 2020
Mar. 6, 2020
May 6, 2020
Jul. 2, 2020
Sep. 2, 2020
Nov. 5, 2020
Sample Date

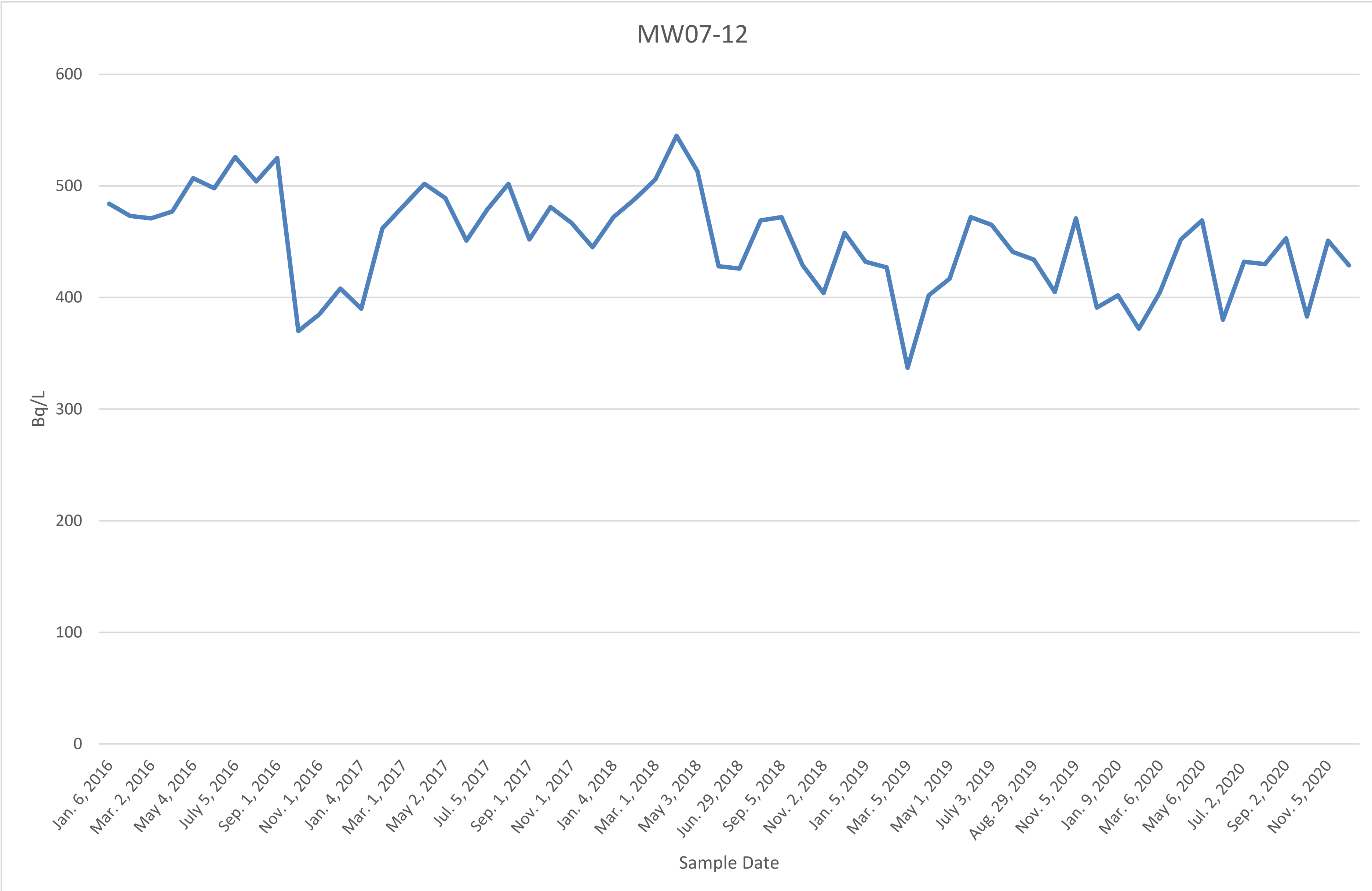
APPENDIX O



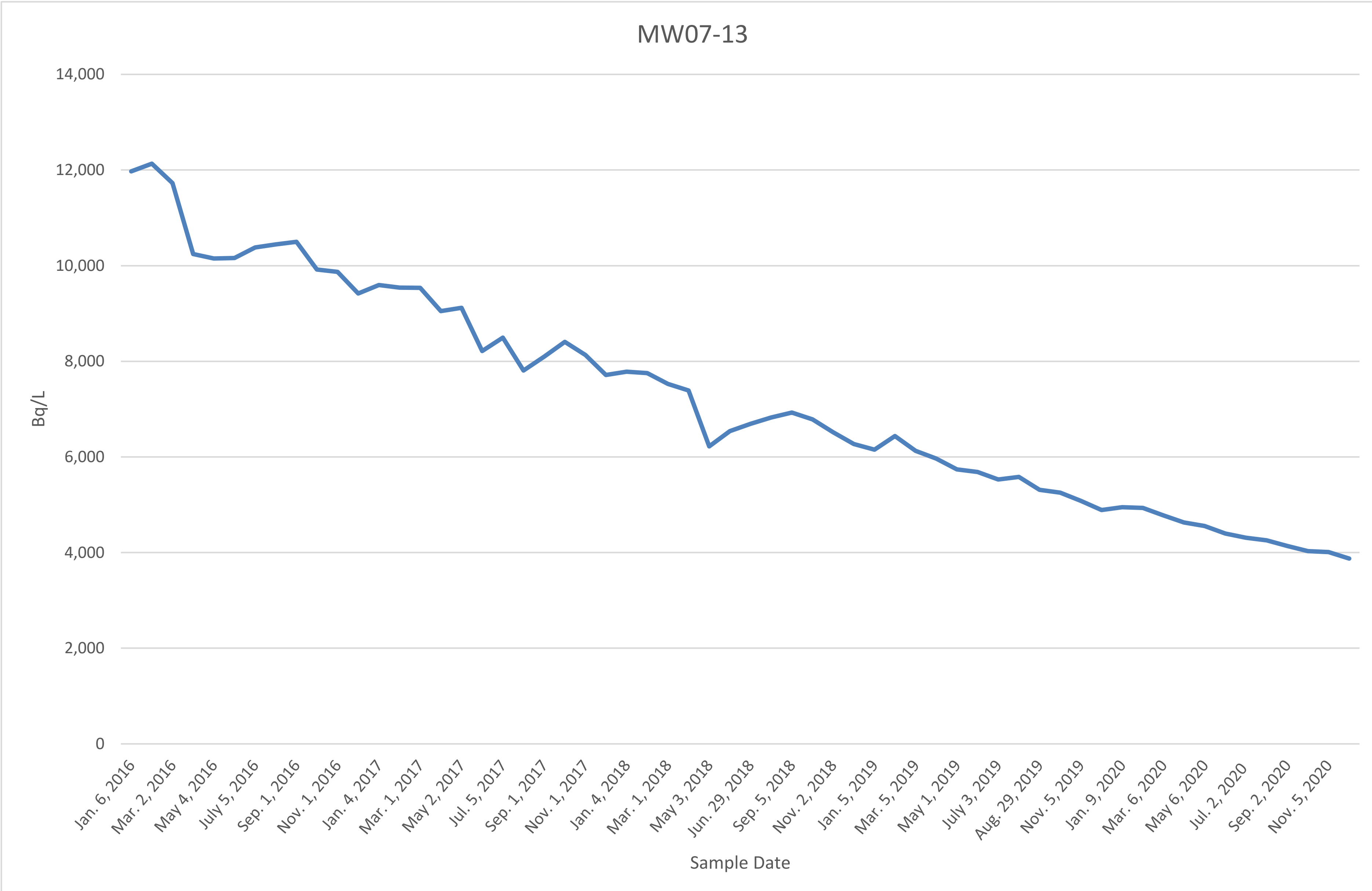
MW06-10
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
Bq/L
Jan. 6, 2016
Mar. 2, 2016
May 4, 2016
July 5, 2016
Sep. 1, 2016
Nov. 1, 2016
Jan. 4, 2017
Mar. 1, 2017
May 2, 2017
Jul. 5, 2017
Sep. 1, 2017
Nov. 1, 2017
Jan. 4, 2018
Mar. 1, 2018
May 3, 2018
Jun. 29, 2018
Sep. 5, 2018
Nov. 2, 2018
Jan. 5, 2019
Mar. 5, 2019
May 1, 2019
July 3, 2019
Aug. 29, 2019
Nov. 5, 2019
Jan. 9, 2020
Mar. 6, 2020
May 6, 2020
Jul. 2, 2020
Sep. 2, 2020
Nov. 5, 2020
Sample Date


MW07-11
Bq/L
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
Jan. 6, 2016
Mar. 2, 2016
May 4, 2016
July 5, 2016
Sep. 1, 2016
Nov. 1, 2016
Jan. 4, 2017
Mar. 1, 2017
May 2, 2017
Jul. 5, 2017
Sep. 1, 2017
Nov. 1, 2017
Jan. 4, 2018
Mar. 1, 2018
May 3, 2018
Jun. 29, 2018
Sep. 5, 2018
Nov. 2, 2018
Jan. 5, 2019
Mar. 5, 2019
May 1, 2019
July 3, 2019
Aug. 29, 2019
Nov. 5, 2019
Jan. 9, 2020
Mar. 6, 2020
May 6, 2020
Jul. 2, 2020
Sep. 2, 2020
Nov. 5, 2020
Sample Date

APPENDIX O

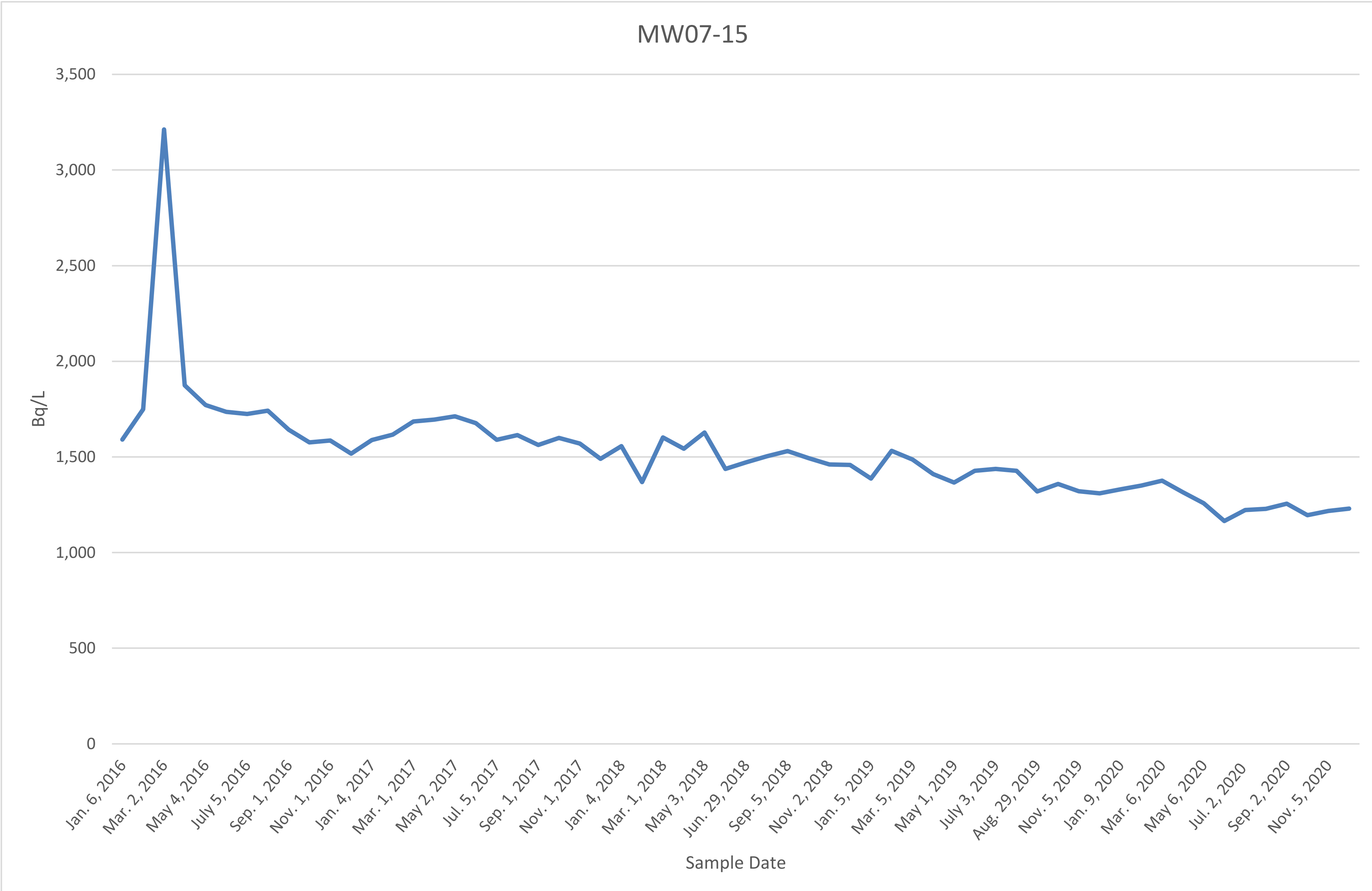

MW07-12
600
500
400
300
200
100
0
Bq/L
Jan. 6, 2016
Mar. 2, 2016
May 4, 2016
July 5, 2016
Sep. 1, 2016
Nov. 1, 2016
Jan. 4, 2017
Mar. 1, 2017
May 2, 2017
Jul. 5, 2017
Sep. 1, 2017
Nov. 1, 2017
Jan. 4, 2018
Mar. 1, 2018
May 3, 2018
Jun. 29, 2018
Sep. 5, 2018
Nov. 2, 2018
Jan. 5, 2019
Mar. 5, 2019
May 1, 2019
July 3, 2019
Aug. 29, 2019
Nov. 5, 2019
Jan. 9, 2020
Mar. 6, 2020
May 6, 2020
Jul. 2, 2020
Sep. 2, 2020
Nov. 5, 2020
Sample Date

APPENDIX O



MW07-13
Bq/L
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Jan. 6, 2016
Mar. 2, 2016
May 4, 2016
July 5, 2016
Sep. 1, 2016
Nov. 1, 2016
Jan. 4, 2017
Mar. 1, 2017
May 2, 2017
Jul. 5, 2017
Sep. 1, 2017
Nov. 1, 2017
Jan. 4, 2018
Mar. 1, 2018
May 3, 2018
Jun. 29, 2018
Sep. 5, 2018
Nov. 2, 2018
Jan. 5, 2019
Mar. 5, 2019
May 1, 2019
July 3, 2019
Aug. 29, 2019
Nov. 5, 2019
Jan. 9, 2020
Mar. 6, 2020
May 6, 2020
Jul. 2, 2020
Sep. 2, 2020
Nov. 5, 2020
Sample Date

APPENDIX O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Bq/L
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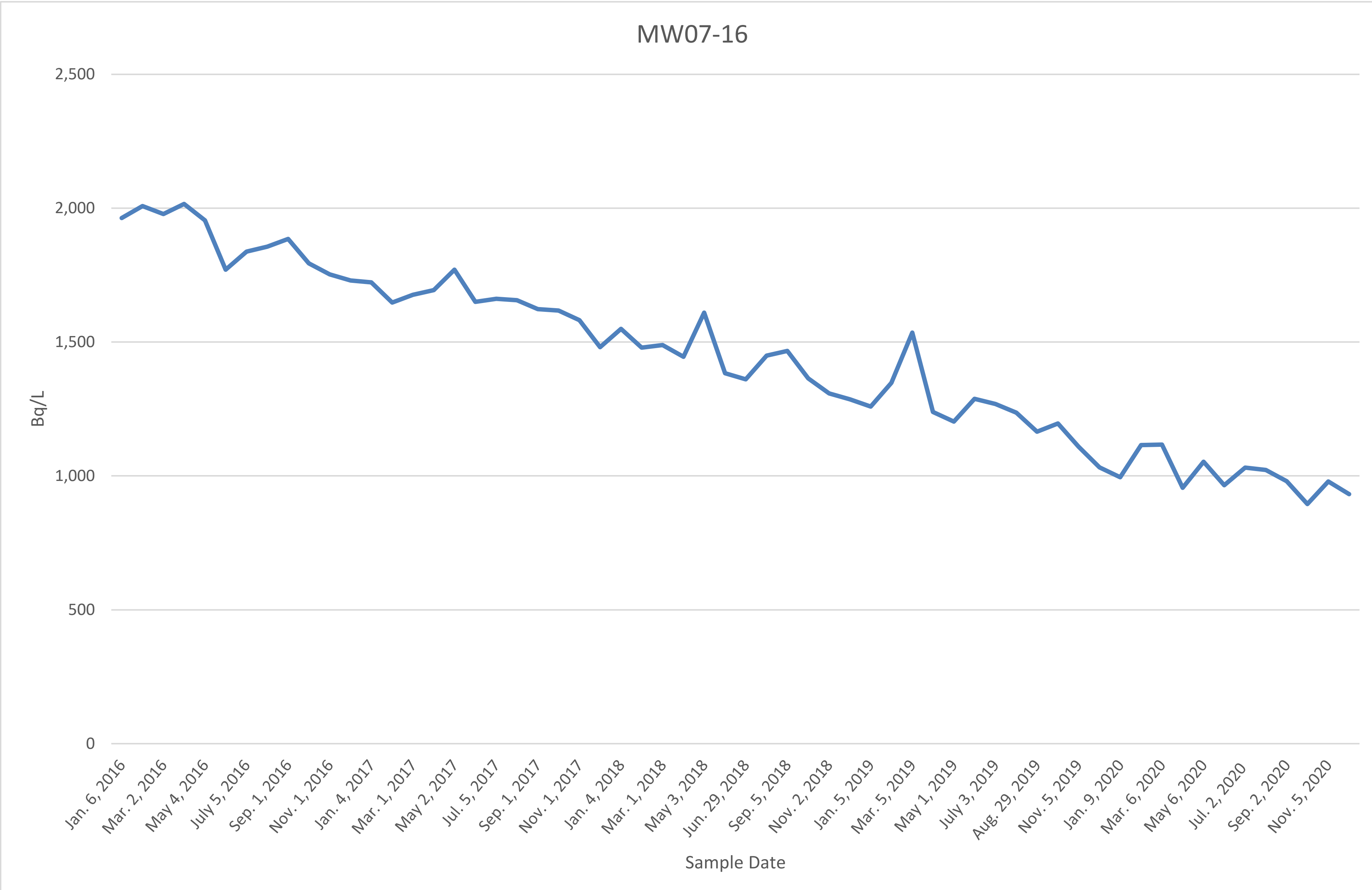
May 4, 2016
July 5, 2016
Sep. 1, 2016
Nov. 1, 2016
Jan. 4, 2017
Mar. 1, 2017
May 2, 2017
Jul. 5, 2017
Sep. 1, 2017
Nov. 1, 2017
Jan. 4, 2018
Mar. 1, 2018
May 3, 2018
Jun. 29, 2018
Sep. 5, 2018
Nov. 2, 2018
Jan. 5, 2019
Mar. 5, 2019
May 1, 2019
July 3, 2019
Aug. 29, 2019
Nov. 5, 2019
Jan. 9, 2020
Mar. 6, 2020
May 6, 2020
Jul. 2, 2020
Sep. 2, 2020
Nov. 5, 2020
Sample Date

APPENDIX O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July 5, 2016
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Nov. 1, 2016
Jan. 4, 2017
Mar. 1, 2017
May 2, 2017
Jul. 5, 2017
Sep. 1, 2017
Nov. 1, 2017
Jan. 4, 2018
Mar. 1, 2018
May 3, 2018
Jun. 29, 2018
Sep. 5, 2018
Nov. 2, 2018
Jan. 5, 2019
Mar. 5, 2019
May 1, 2019
July 3, 2019
Aug. 29, 2019
Nov. 5, 2019
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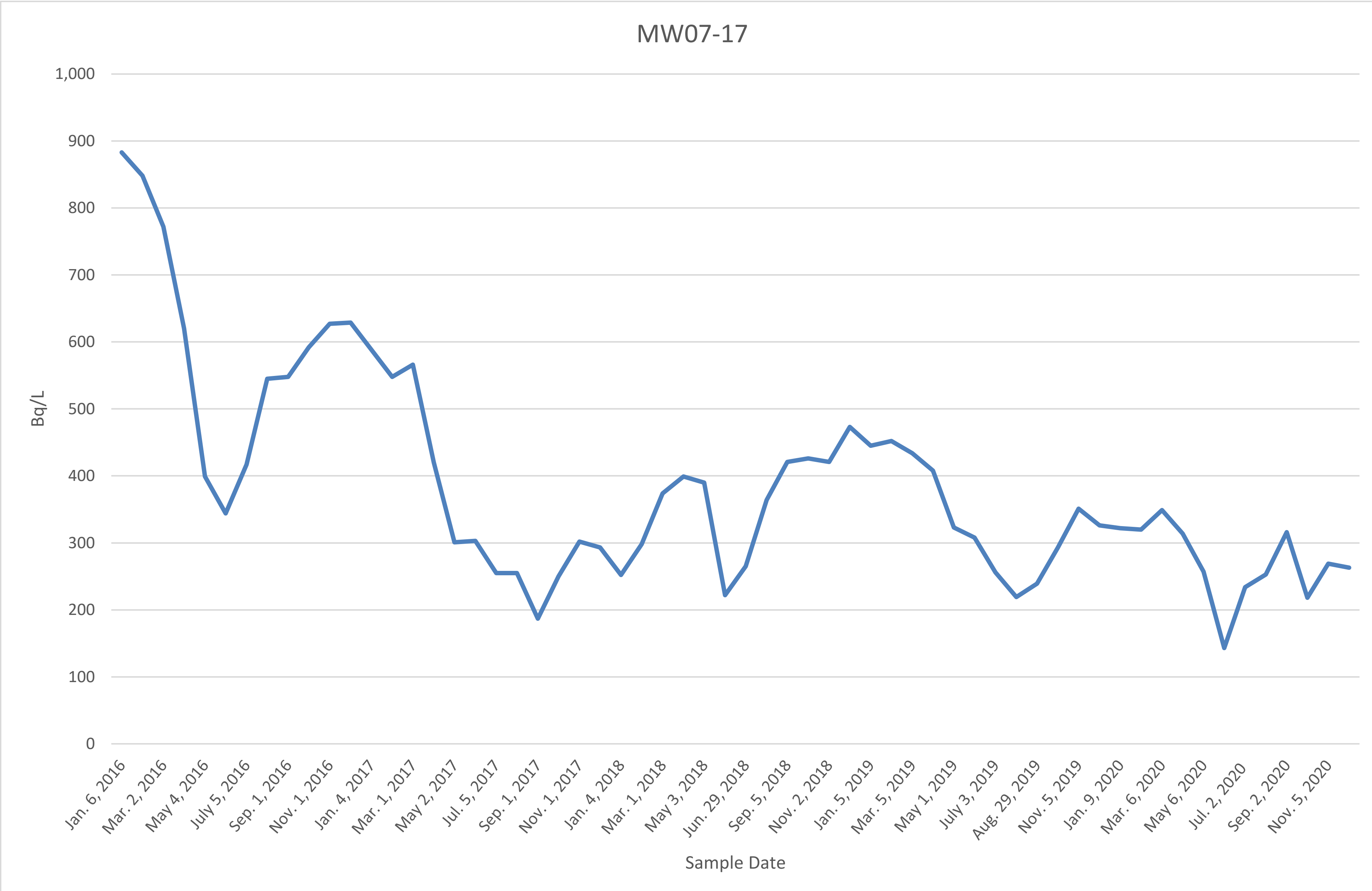
Mar. 6, 2020
May 6, 2020
Jul. 2, 2020
Sep. 2, 2020
Nov. 5, 2020
Sample Date

APPENDIX O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500
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300
200
100
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Bq/L
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July 5, 2016
Sep. 1, 2016
Nov. 1, 2016
Jan. 4, 2017
Mar. 1, 2017
May 2, 2017
Jul. 5, 2017
Sep. 1, 2017
Nov. 1, 2017
Jan. 4, 2018
Mar. 1, 2018
May 3, 2018
Jun. 29, 2018
Sep. 5, 2018
Nov. 2, 2018
Jan. 5, 2019
Mar. 5, 2019
May 1, 2019
July 3, 2019
Aug. 29, 2019
Nov. 5, 2019
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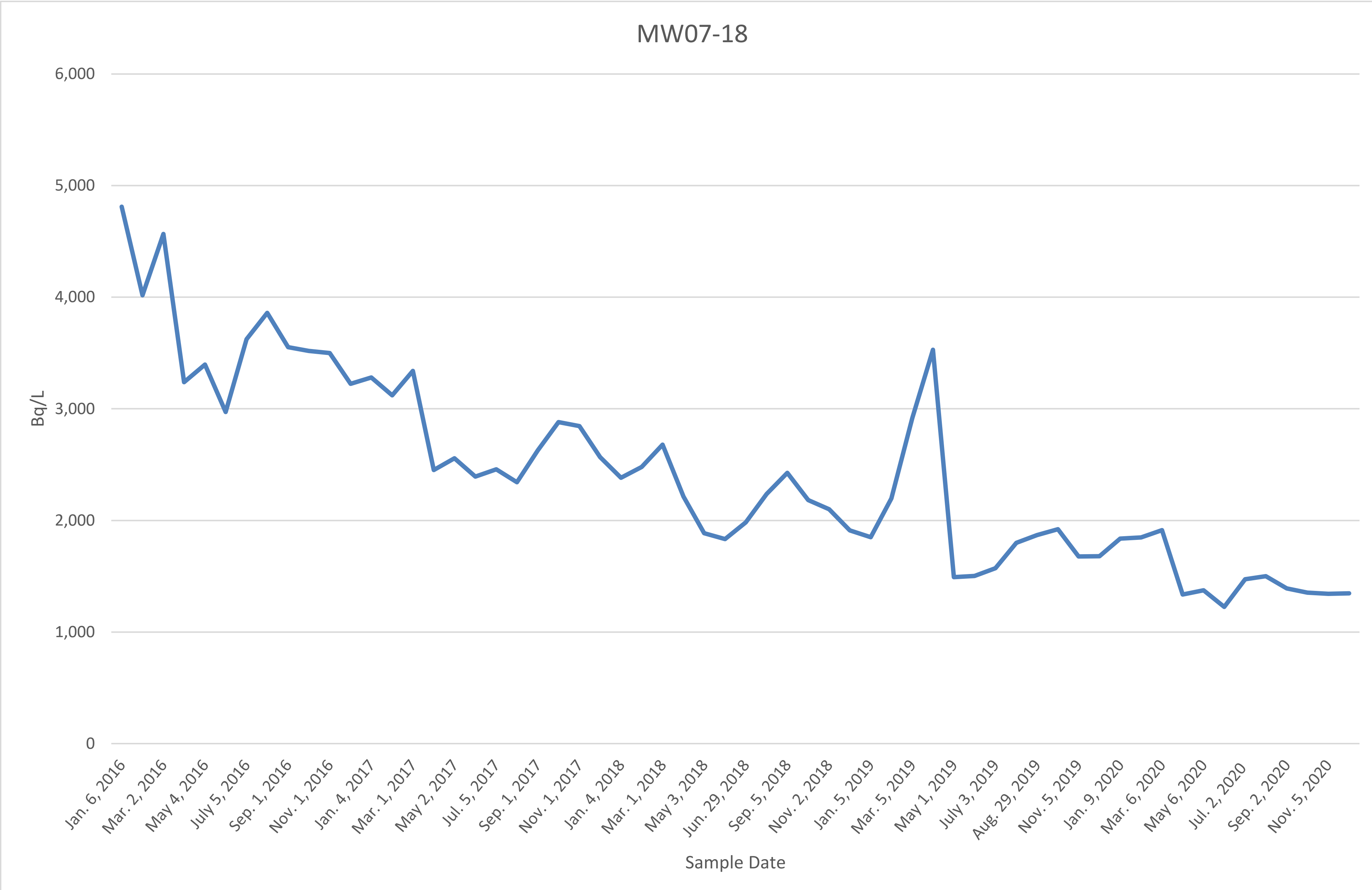
May 6, 2020
Jul. 2, 2020
Sep. 2, 2020
Nov. 5, 2020
Sample Date

APPENDIX O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4,000
3,000
2,000
1,000
0
Bq/L
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July 5, 2016
Sep. 1, 2016
Nov. 1, 2016
Jan. 4, 2017
Mar. 1, 2017
May 2, 2017
Jul. 5, 2017
Sep. 1, 2017
Nov. 1, 2017
Jan. 4, 2018
Mar. 1, 2018
May 3, 2018
Jun. 29, 2018
Sep. 5, 2018
Nov. 2, 2018
Jan. 5, 2019
Mar. 5, 2019
May 1, 2019
July 3, 2019
Aug. 29, 2019
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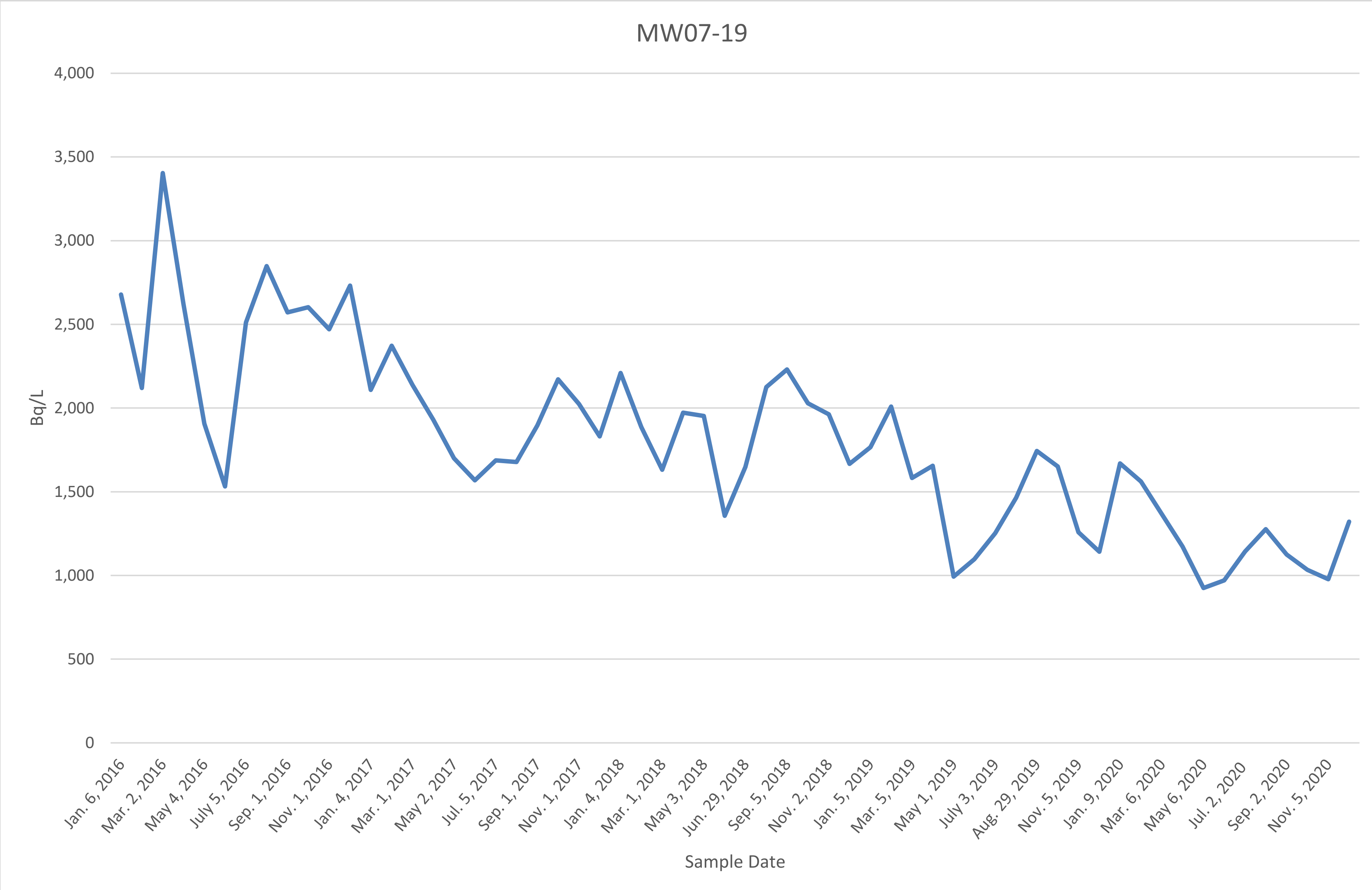
May 6, 2020
Jul. 2, 2020
Sep. 2, 2020
Nov. 5, 2020
Sample Date

APPENDIX O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3,000
2,500
2,000
1,500
1,000
500
0
Bq/L
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July 5, 2016
Sep. 1, 2016
Nov. 1, 2016
Jan. 4, 2017
Mar. 1, 2017
May 2, 2017
Jul. 5, 2017
Sep. 1, 2017
Nov. 1, 2017
Jan. 4, 2018
Mar. 1, 2018
May 3, 2018
Jun. 29, 2018
Sep. 5, 2018
Nov. 2, 2018
Jan. 5, 2019
Mar. 5, 2019
May 1, 2019
July 3, 2019
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May 6, 2020
Jul. 2, 2020
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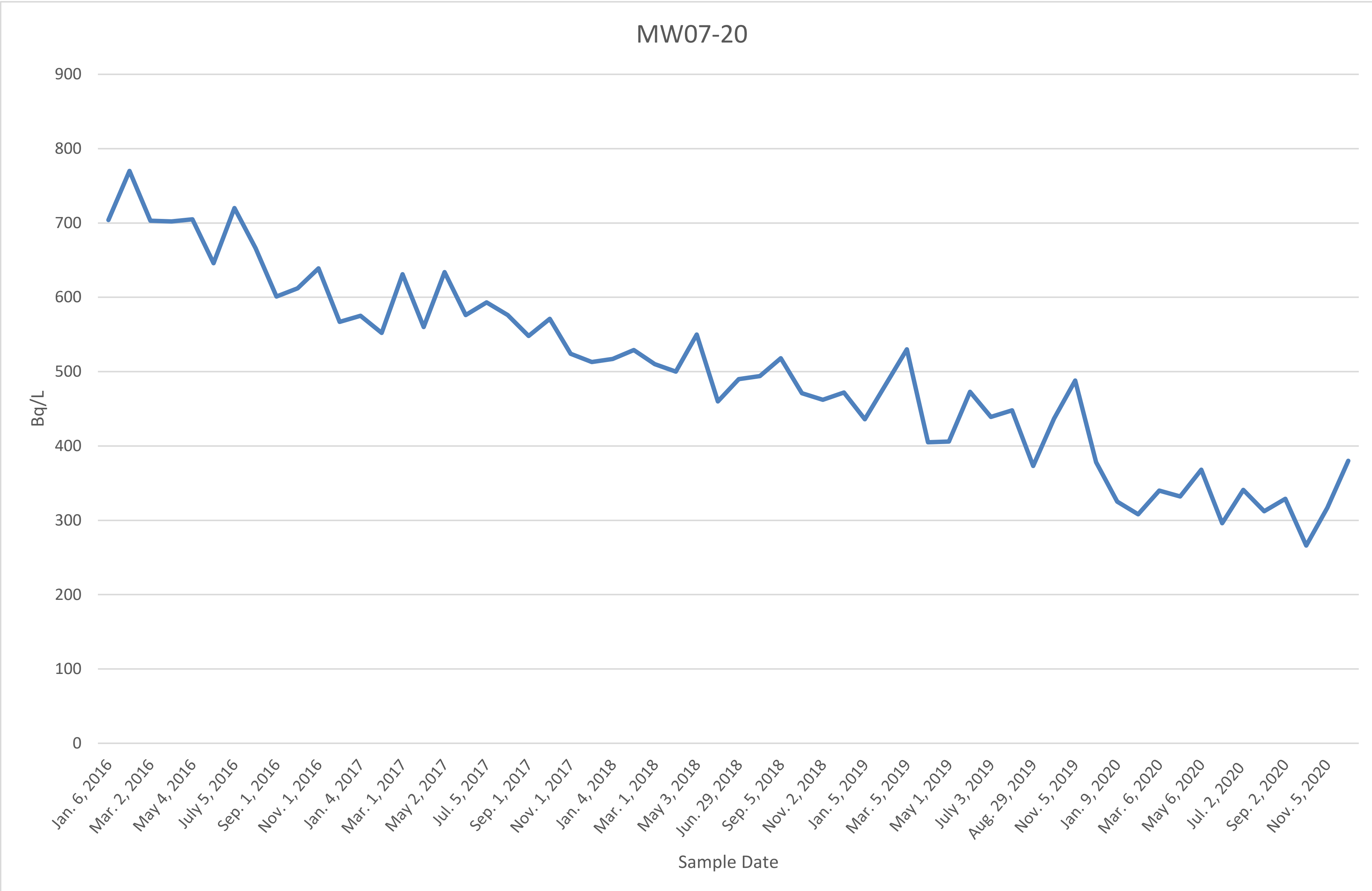
Nov. 5, 2020
Sample Date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800
700
600
500
400
300
200
100
0
Bq/L
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July 5, 2016
Sep. 1, 2016
Nov. 1, 2016
Jan. 4, 2017
Mar. 1, 2017
May 2, 2017
Jul. 5, 2017
Sep. 1, 2017
Nov. 1, 2017
Jan. 4, 2018
Mar. 1, 2018
May 3, 2018
Jun. 29, 2018
Sep. 5, 2018
Nov. 2, 2018
Jan. 5, 2019
Mar. 5, 2019
May 1, 2019
July 3, 2019
Aug. 29, 2019
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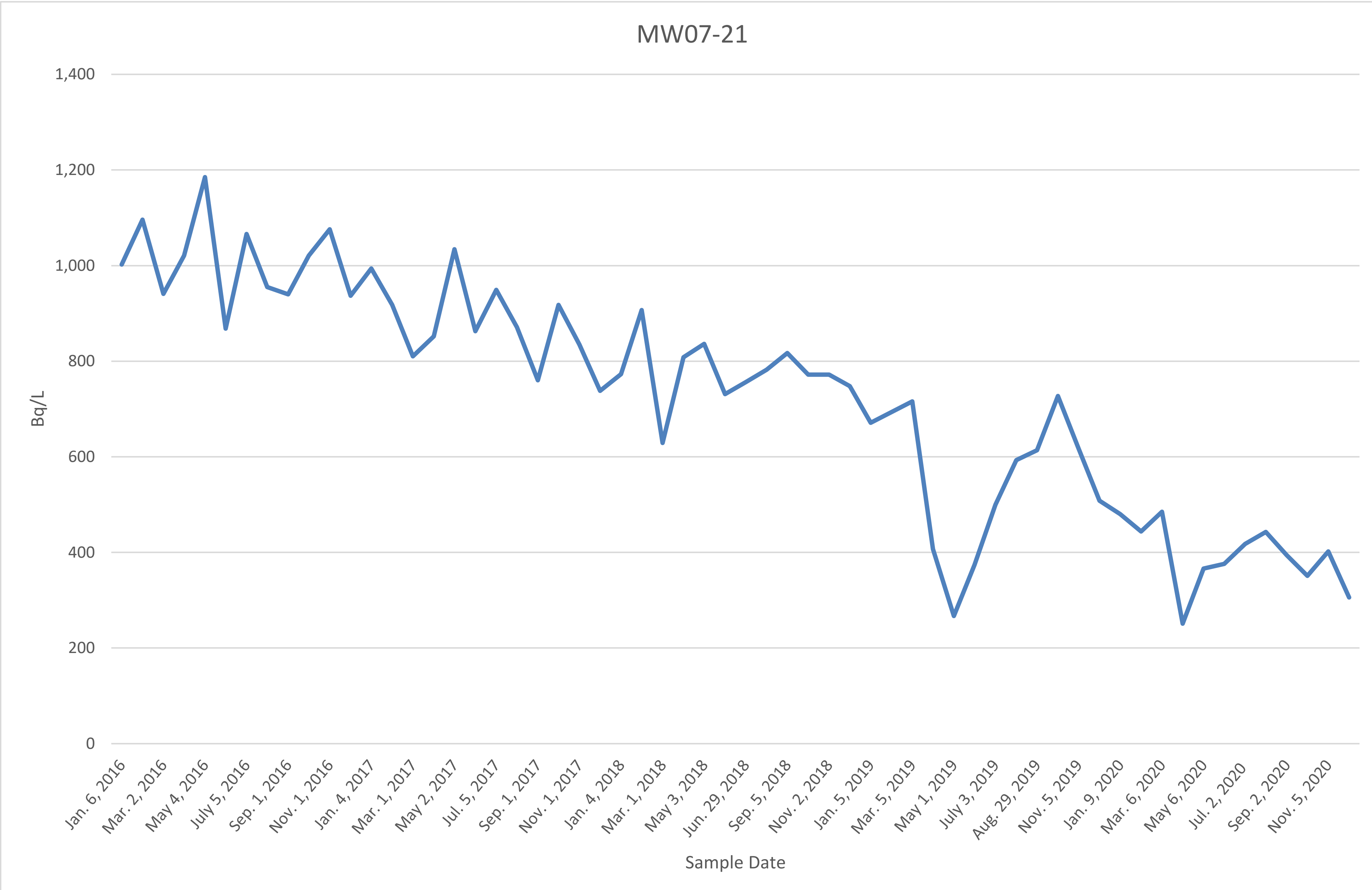
May 6, 2020
Jul. 2, 2020
Sep. 2, 2020
Nov. 5, 2020
Sample Date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1,200
1,000
800
600
400
200
0
Bq/L
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July 5, 2016
Sep. 1, 2016
Nov. 1, 2016
Jan. 4, 2017
Mar. 1, 2017
May 2, 2017
Jul. 5, 2017
Sep. 1, 2017
Nov. 1, 2017
Jan. 4, 2018
Mar. 1, 2018
May 3, 2018
Jun. 29, 2018
Sep. 5, 2018
Nov. 2, 2018
Jan. 5, 2019
Mar. 5, 2019
May 1, 2019
July 3, 2019
Aug. 29, 2019
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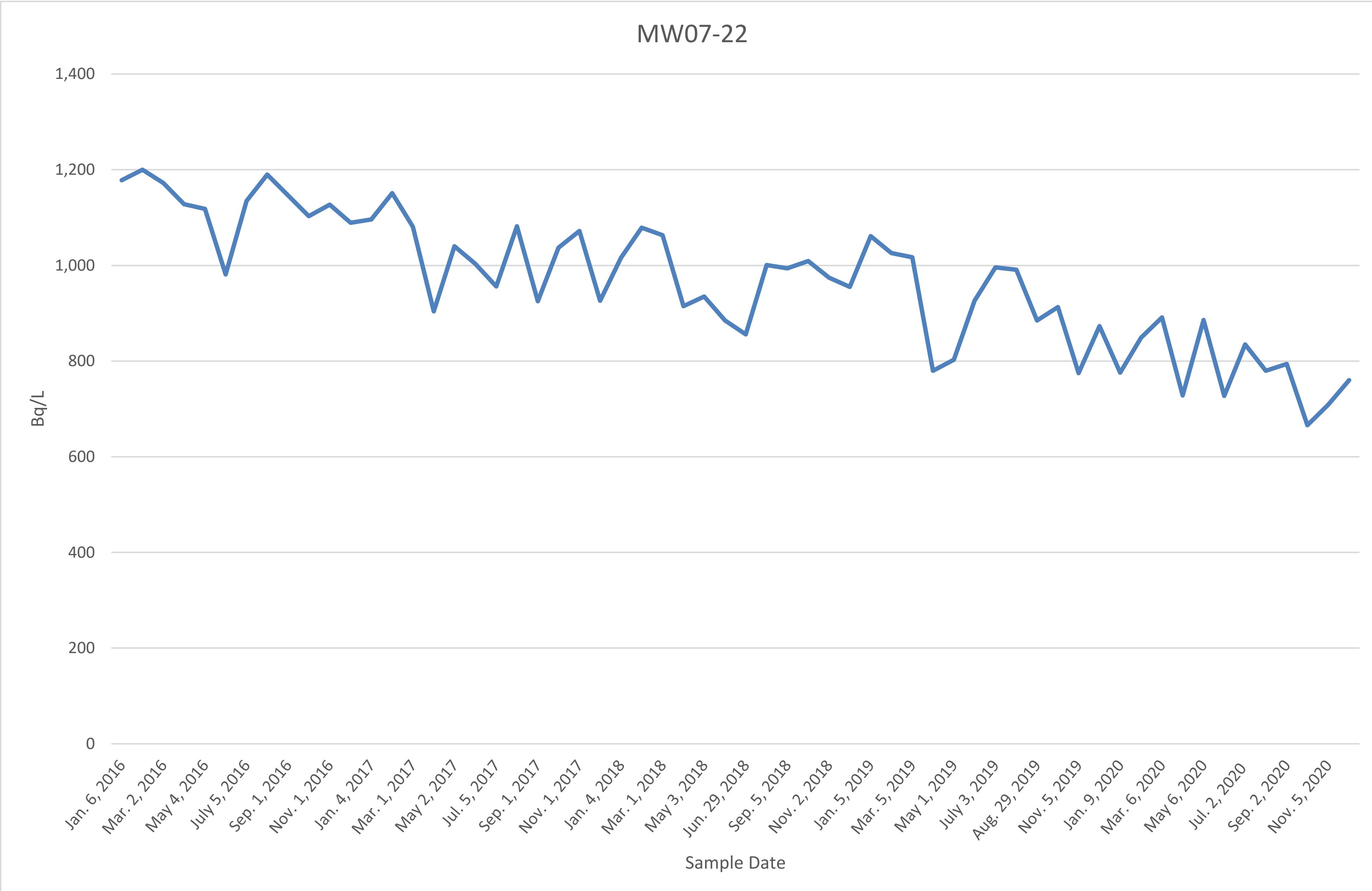
May 6, 2020
Jul. 2, 2020
Sep. 2, 2020
Nov. 5, 2020
Sample Date

APPENDIX O


MW07-22
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1,200
1,000
800
600
400
200
0
Bq/L
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July 5, 2016
Sep. 1, 2016
Nov. 1, 2016
Jan. 4, 2017
Mar. 1, 2017
May 2, 2017
Jul. 5, 2017
Sep. 1, 2017
Nov. 1, 2017
Jan. 4, 2018
Mar. 1, 2018
May 3, 2018
Jun. 29, 2018
Sep. 5, 2018
Nov. 2, 2018
Jan. 5, 2019
Mar. 5, 2019
May 1, 2019
July 3, 2019
Aug. 29, 2019
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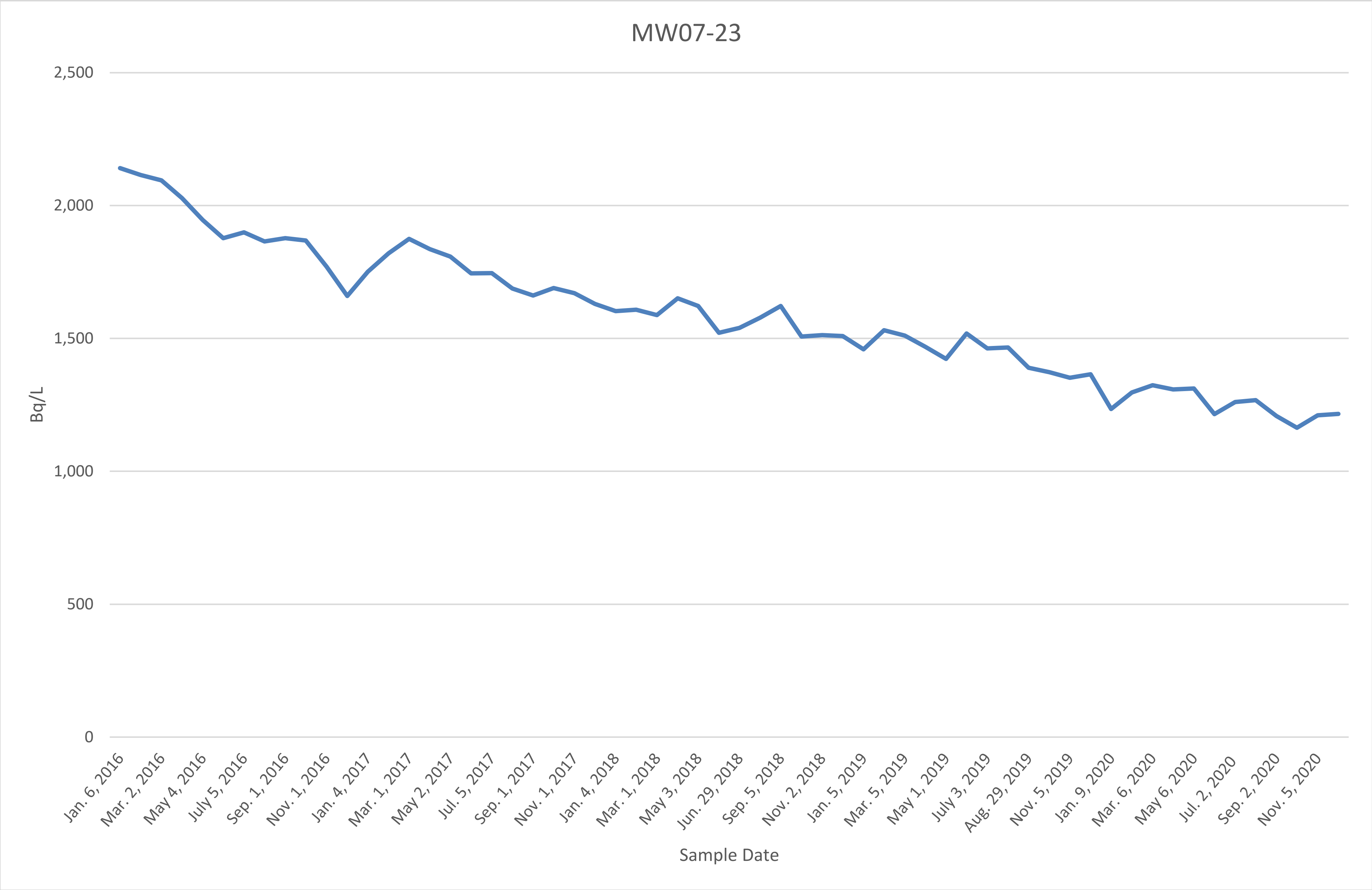
May 6, 2020
Jul. 2, 2020
Sep. 2, 2020
Nov. 5, 2020
Sample Date

APPENDIX O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1,000
500
0
Bq/L
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Nov. 1, 2016
Jan. 4, 2017
Mar. 1, 2017
May 2, 2017
Jul. 5, 2017
Sep. 1, 2017
Nov. 1, 2017
Jan. 4, 2018
Mar. 1, 2018
May 3, 2018
Jun. 29, 2018
Sep. 5, 2018
Nov. 2, 2018
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July 3, 2019
Aug. 29, 2019
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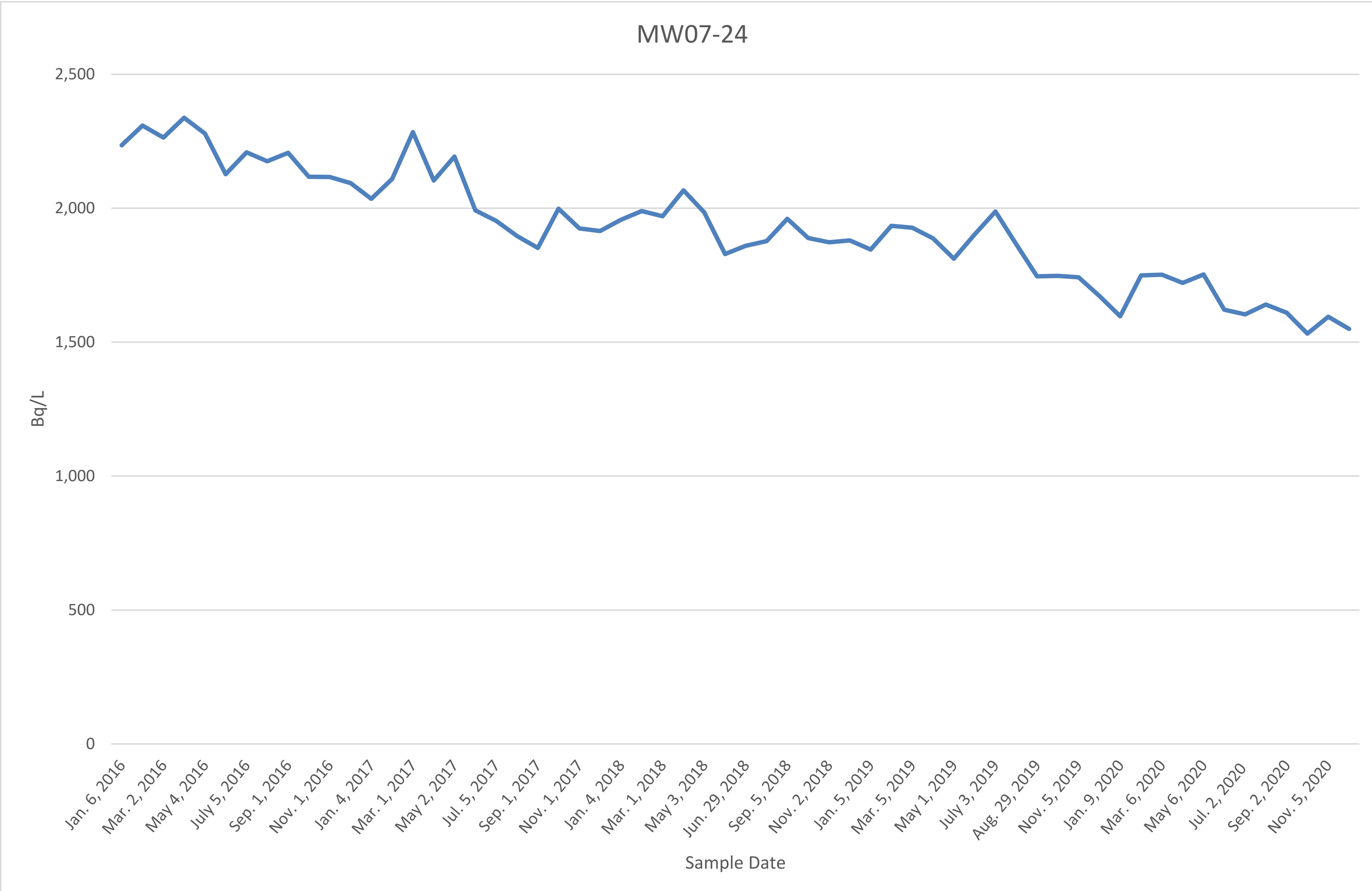
May 6, 2020
Jul. 2, 2020
Sep. 2, 2020
Nov. 5, 2020
Sample Date

APPENDIX O



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1,000
500
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Bq/L
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Nov. 1, 2016
Jan. 4, 2017
Mar. 1, 2017
May 2, 2017
Jul. 5, 2017
Sep. 1, 2017
Nov. 1, 2017
Jan. 4, 2018
Mar. 1, 2018
May 3, 2018
Jun. 29, 2018
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Nov. 2, 2018
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Mar. 5, 2019
May 1, 2019
July 3, 2019
Aug. 29, 2019
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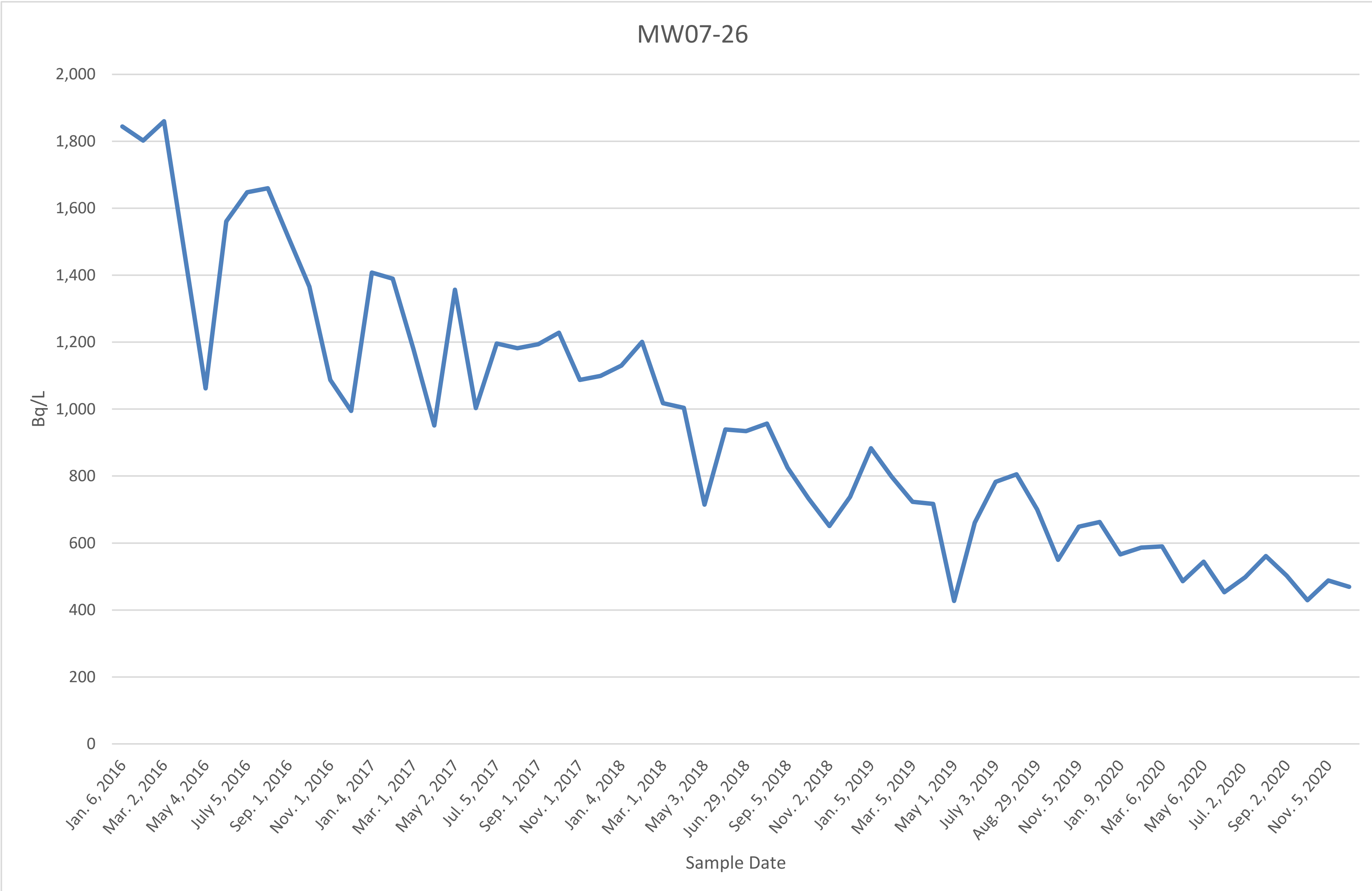
Mar. 6, 2020
May 6, 2020
Jul. 2, 2020
Sep. 2, 2020
Nov. 5, 2020
Sample Date

APPENDIX O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Bq/L
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1,600
1,400
1,200
1,000
800
600
400
200
0
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Mar. 2, 2016
May 4, 2016
July 5, 2016
Sep. 1, 2016
Nov. 1, 2016
Jan. 4, 2017
Mar. 1, 2017
May 2, 2017
Jul. 5, 2017
Sep. 1, 2017
Nov. 1, 2017
Jan. 4, 2018
Mar. 1, 2018
May 3, 2018
Jun. 29, 2018
Sep. 5, 2018
Nov. 2, 2018
Jan. 5, 2019
Mar. 5, 2019
May 1, 2019
July 3, 2019
Aug. 29, 2019
Nov. 5, 2019
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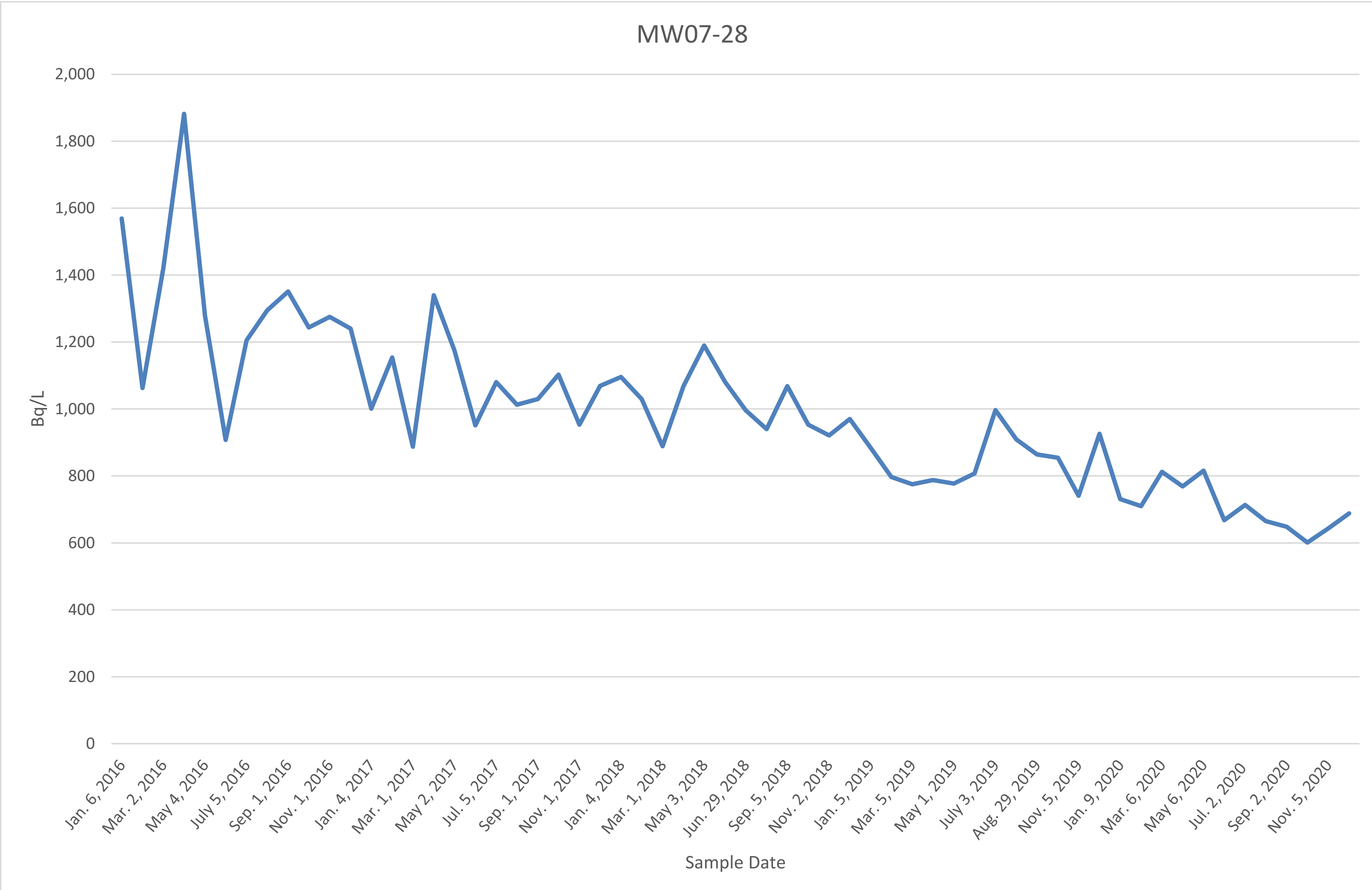
Mar. 6, 2020
May 6, 2020
Jul. 2, 2020
Sep. 2, 2020
Nov. 5, 2020
Sample Date

APPENDIX O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1,600
1,400
1,200
1,000
800
600
400
200
0
Bq/L
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Mar. 2, 2016
May 4, 2016
July 5, 2016
Sep. 1, 2016
Nov. 1, 2016
Jan. 4, 2017
Mar. 1, 2017
May 2, 2017
Jul. 5, 2017
Sep. 1, 2017
Nov. 1, 2017
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May 3, 2018
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July 3, 2019
Aug. 29, 2019
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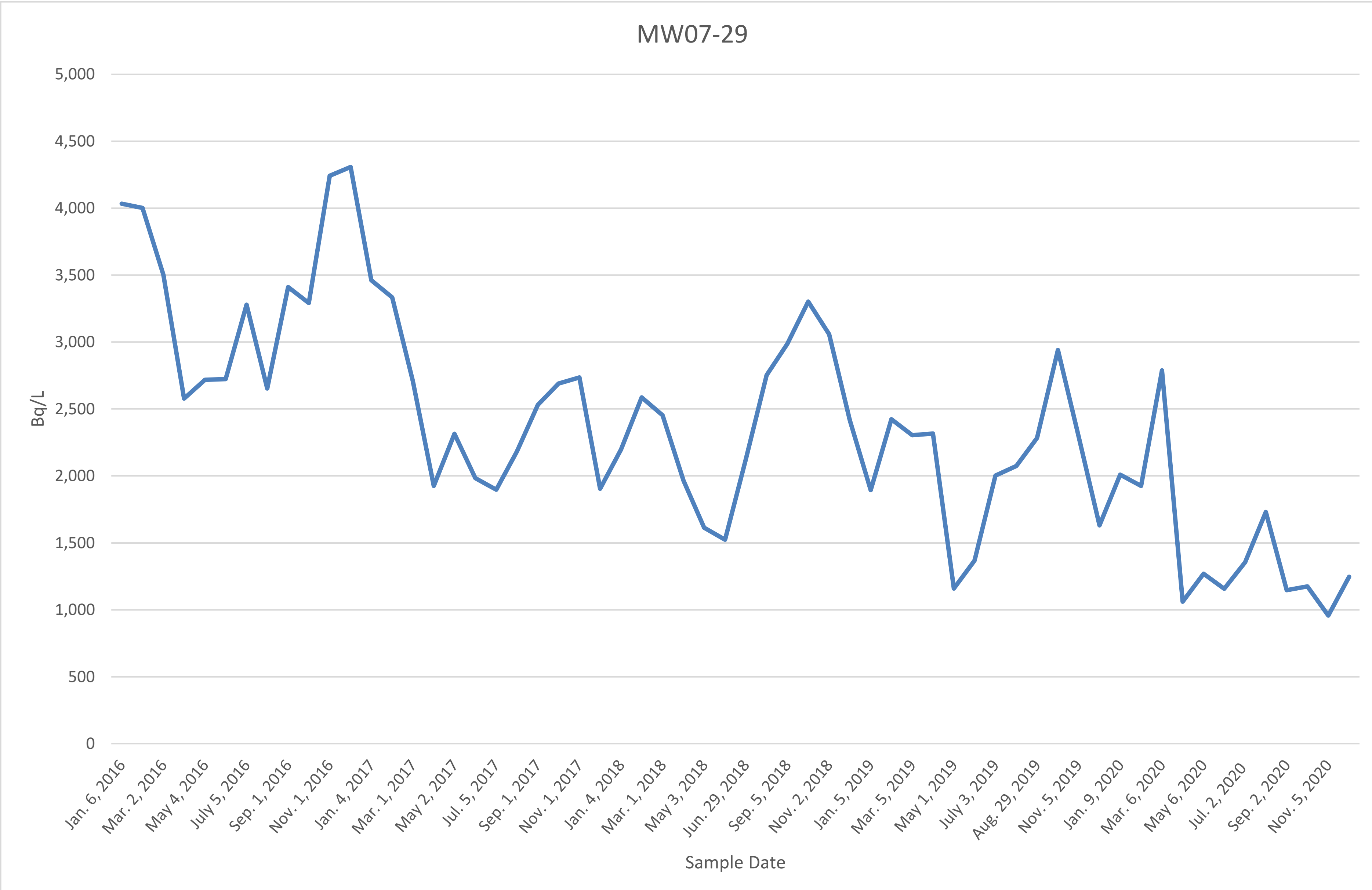
May 6, 2020
Jul. 2, 2020
Sep. 2, 2020
Nov. 5, 2020
Sample Date

APPENDIX O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Bq/L
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Jan. 6, 2016
Mar. 2, 2016
May 4, 2016
July 5, 2016
Sep. 1, 2016
Nov. 1, 2016
Jan. 4, 2017
Mar. 1, 2017
May 2, 2017
Jul. 5, 2017
Sep. 1, 2017
Nov. 1, 2017
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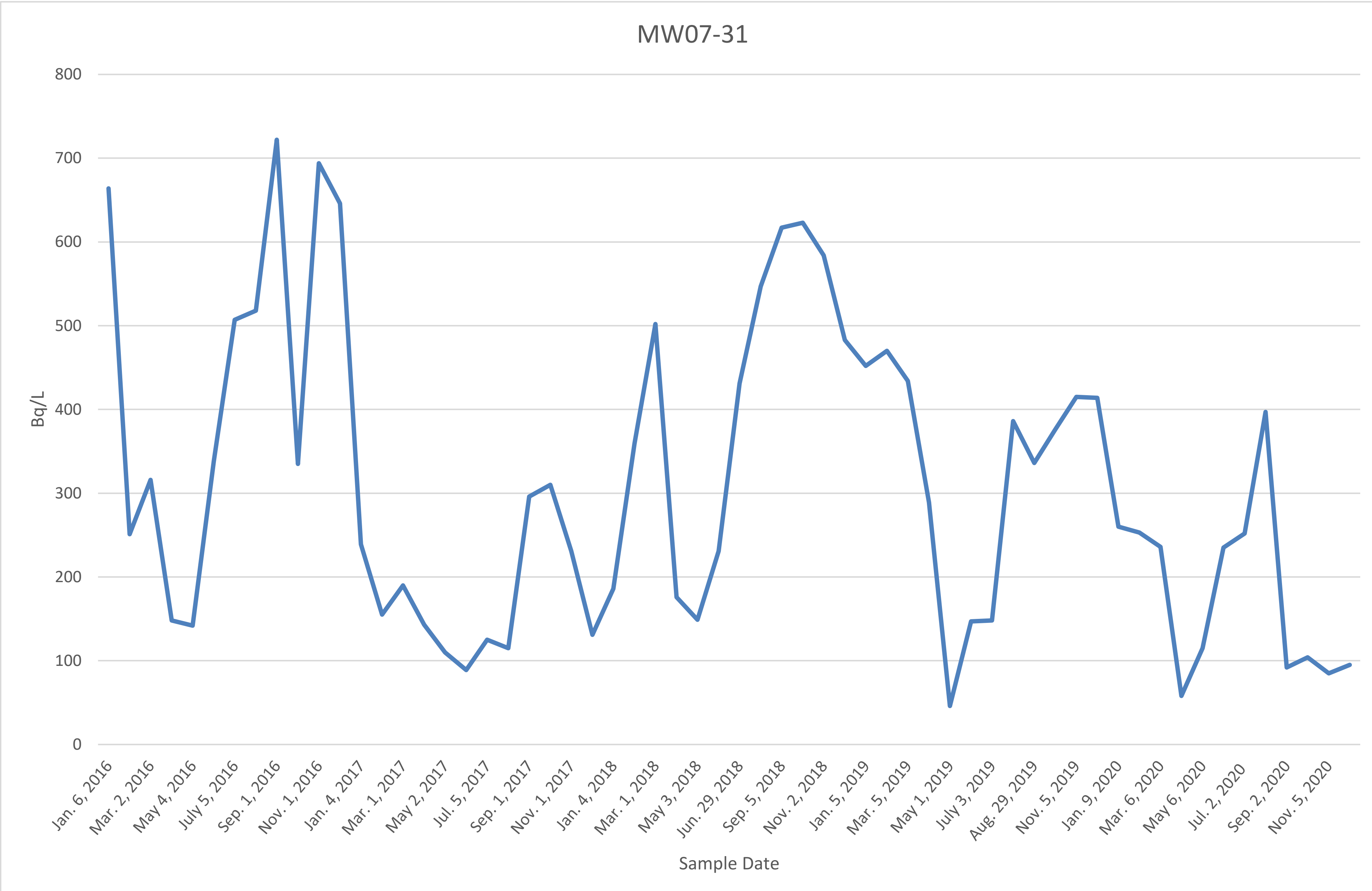
May 3, 2018
Jun. 29, 2018
Sep. 5, 2018
Nov. 2, 2018
Jan. 5, 2019
Mar. 5, 2019
May 1, 2019
July 3, 2019
Aug. 29, 2019
Nov. 5, 2019
Jan. 9, 2020
Mar. 6, 2020
May 6, 2020
Jul. 2, 2020
Sep. 2, 2020
Nov. 5, 2020
Sample Date

APPENDIX O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700
600
500
400
300
200
100
0
Bq/L
Jan. 6, 2016
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May 4, 2016
July 5, 2016
Sep. 1, 2016
Nov. 1, 2016
Jan. 4, 2017
Mar. 1, 2017
May 2, 2017
Jul. 5, 2017
Sep. 1, 2017
Nov. 1, 2017
Jan. 4, 2018
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May 3, 2018
Jun. 29, 2018
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Jan. 5, 2019
Mar. 5, 2019
May 1, 2019
July 3, 2019
Aug. 29, 2019
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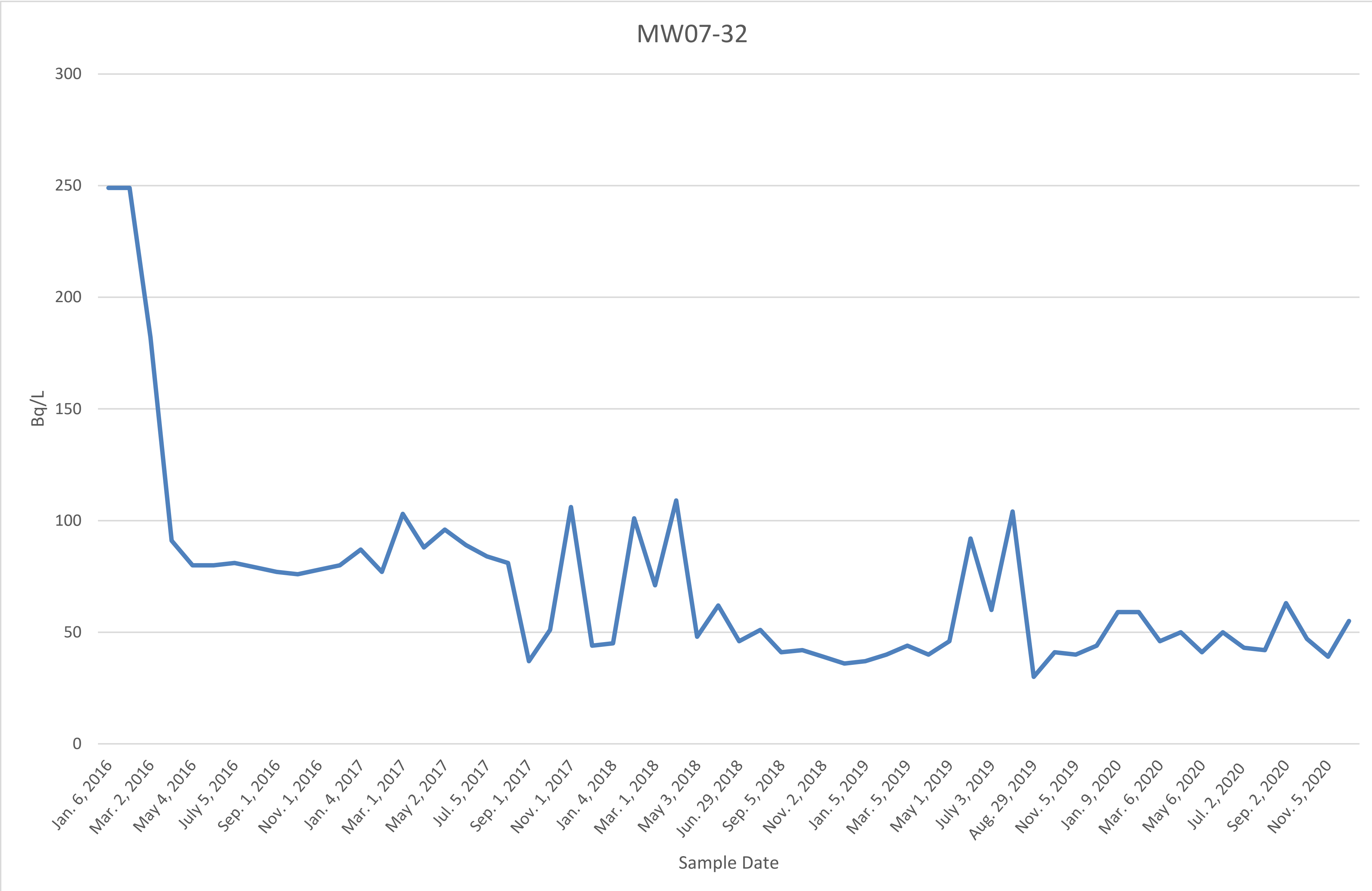
Mar. 6, 2020
May 6, 2020
Jul. 2, 2020
Sep. 2, 2020
Nov. 5, 2020
Sample Date

APPENDIX O



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200
150
100
50
0
Bq/L
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May 4, 2016
July 5, 2016
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Nov. 1, 2016
Jan. 4, 2017
Mar. 1, 2017
May 2, 2017
Jul. 5, 2017
Sep. 1, 2017
Nov. 1, 2017
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Mar. 1, 2018
May 3, 2018
Jun. 29, 2018
Sep. 5, 2018
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Mar. 5, 2019
May 1, 2019
July 3, 2019
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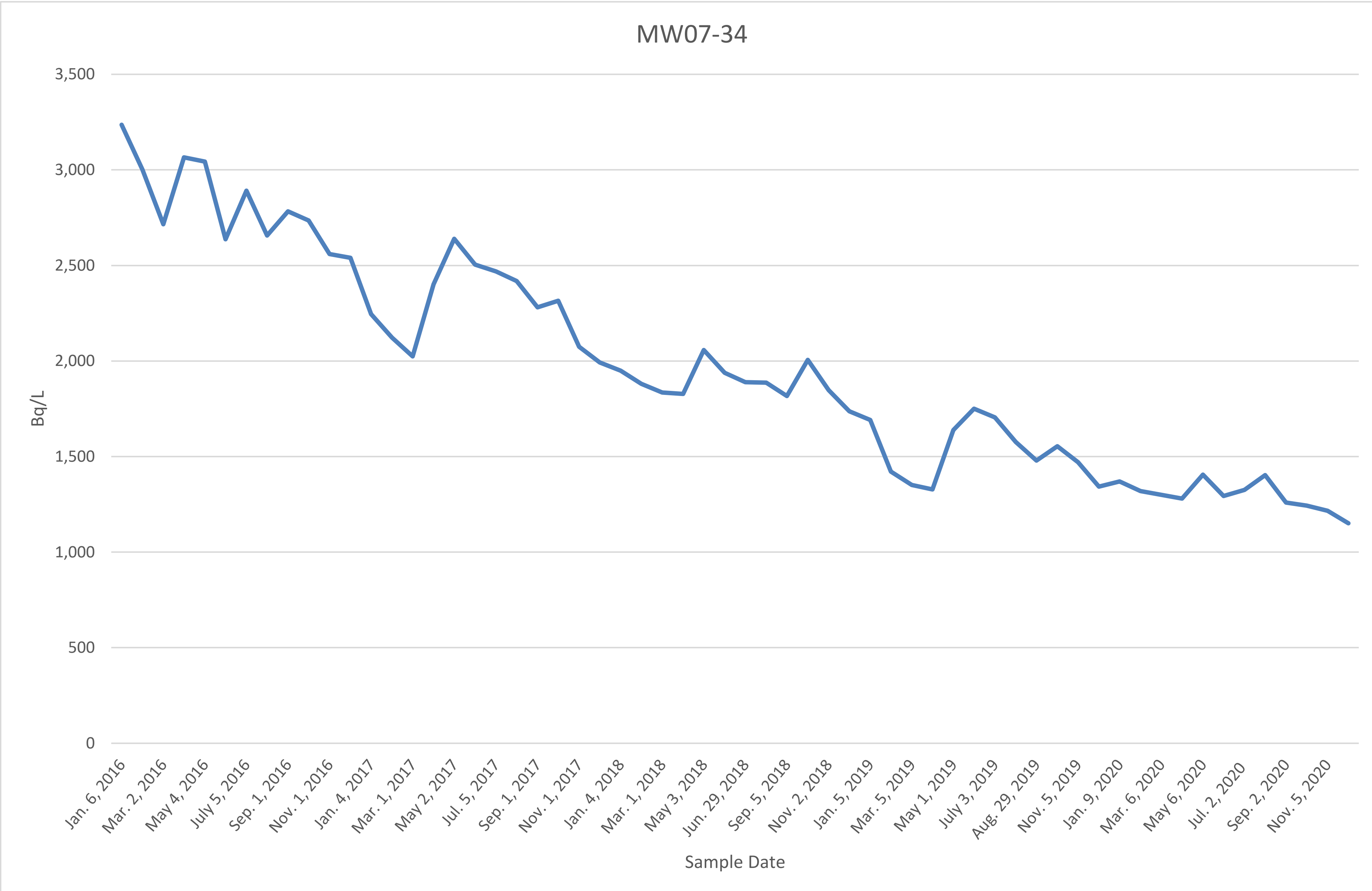
May 6, 2020
Jul. 2, 2020
Sep. 2, 2020
Nov. 5, 2020
Sample Date


MW07-34
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2,000
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1,000
500
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Bq/L
Jan. 6, 2016
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May 4, 2016
July 5, 2016
Sep. 1, 2016
Nov. 1, 2016
Jan. 4, 2017
Mar. 1, 2017
May 2, 2017
Jul. 5, 2017
Sep. 1, 2017
Nov. 1, 2017
Jan. 4, 2018
Mar. 1, 2018
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Jun. 29, 2018
Sep. 5, 2018
Nov. 2, 2018
Jan. 5, 2019
Mar. 5, 2019
May 1, 2019
July 3, 2019
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May 6, 2020
Jul. 2, 2020
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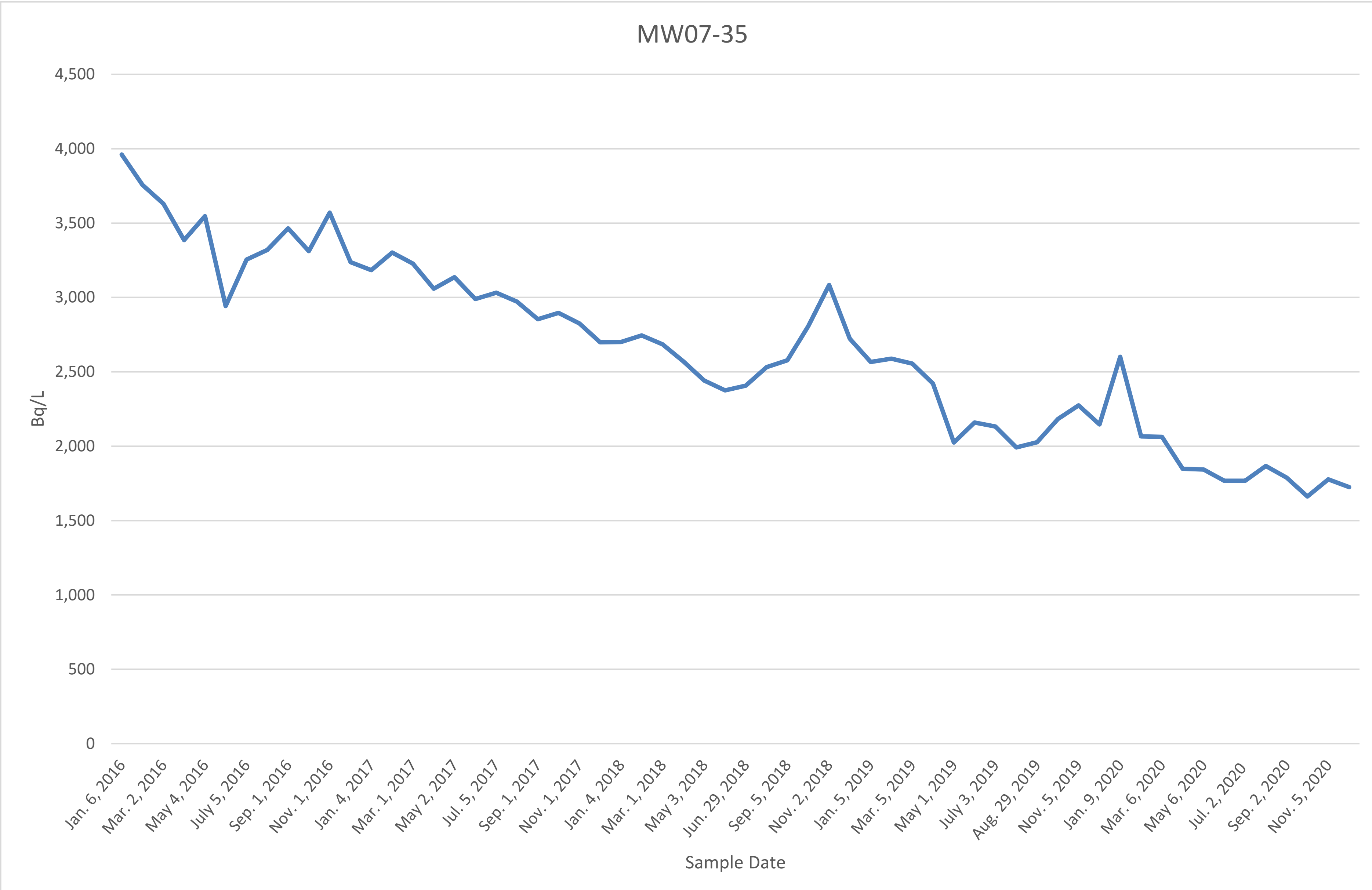
Nov. 5, 2020
Sample Date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4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Bq/L
Jan. 6, 2016
Mar. 2, 2016
May 4, 2016
July 5, 2016
Sep. 1, 2016
Nov. 1, 2016
Jan. 4, 2017
Mar. 1, 2017
May 2, 2017
Jul. 5, 2017
Sep. 1, 2017
Nov. 1, 2017
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May 3, 2018
Jun. 29, 2018
Sep. 5, 2018
Nov. 2, 2018
Jan. 5, 2019
Mar. 5, 2019
May 1, 2019
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Jul. 2, 2020
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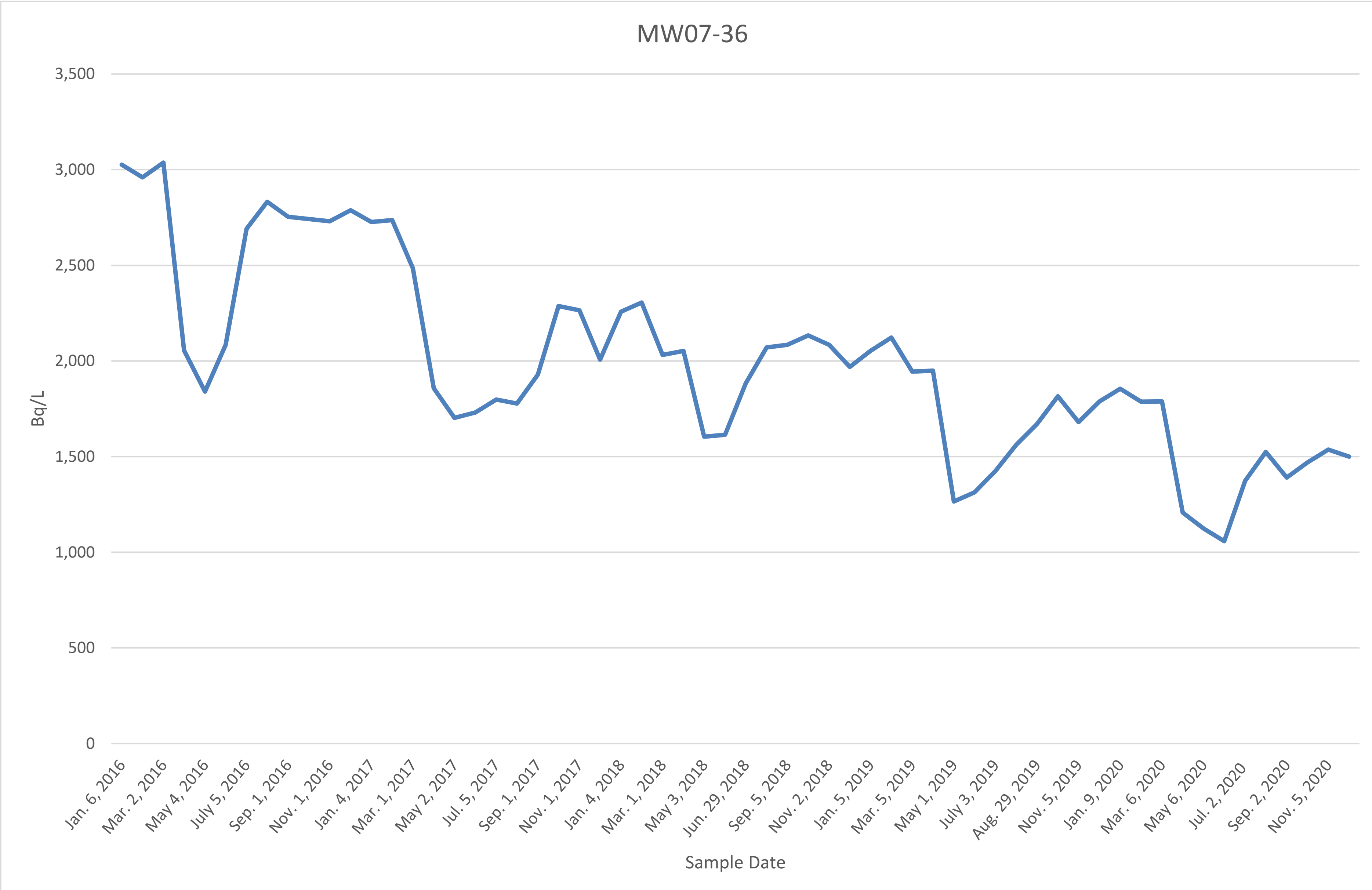
Nov. 5, 2020
Sample Date


MW07-36
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1,500
1,000
500
0
Bq/L
Jan. 6, 2016
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May 4, 2016
July 5, 2016
Sep. 1, 2016
Nov. 1, 2016
Jan. 4, 2017
Mar. 1, 2017
May 2, 2017
Jul. 5, 2017
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Nov. 1, 2017
Jan. 4, 2018
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Sep. 5, 2018
Nov. 2, 2018
Jan. 5, 2019
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July 3, 2019
Aug. 29, 2019
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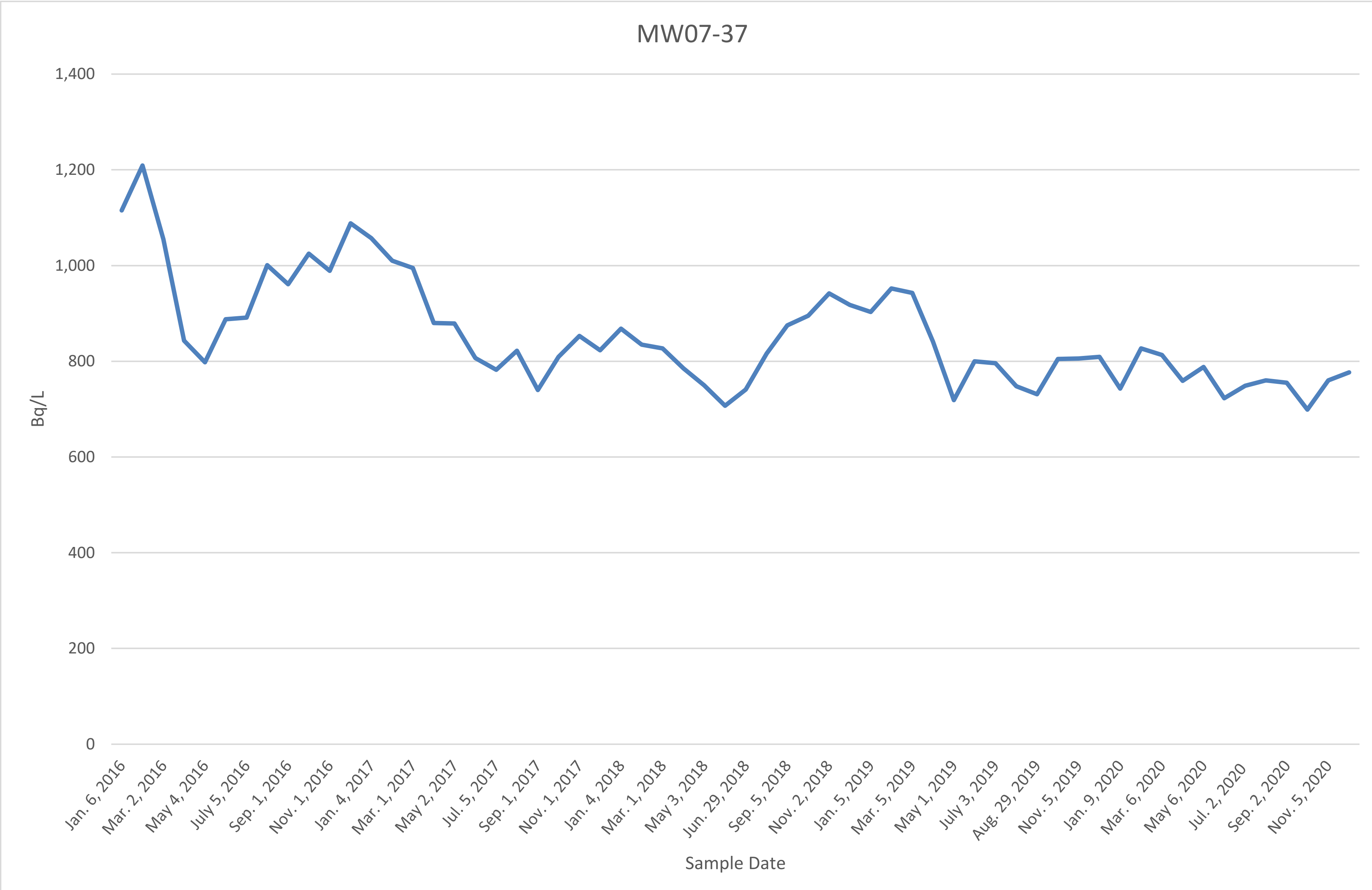
May 6, 2020
Jul. 2, 2020
Sep. 2, 2020
Nov. 5, 2020
Sample Date

APPENDIX O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200
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Bq/L
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July 5, 2016
Sep. 1, 2016
Nov. 1, 2016
Jan. 4, 2017
Mar. 1, 2017
May 2, 2017
Jul. 5, 2017
Sep. 1, 2017
Nov. 1, 2017
Jan. 4, 2018
Mar. 1, 2018
May 3, 2018
Jun. 29, 2018
Sep. 5, 2018
Nov. 2, 2018
Jan. 5, 2019
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May 1, 2019
July 3, 2019
Aug. 29, 2019
Nov. 5, 2019
Jan. 9, 2020
Mar. 6, 2020
May 6, 2020
Jul. 2, 2020
Sep. 2, 2020
Nov. 5, 2020
Sample Date

APPENDIX O

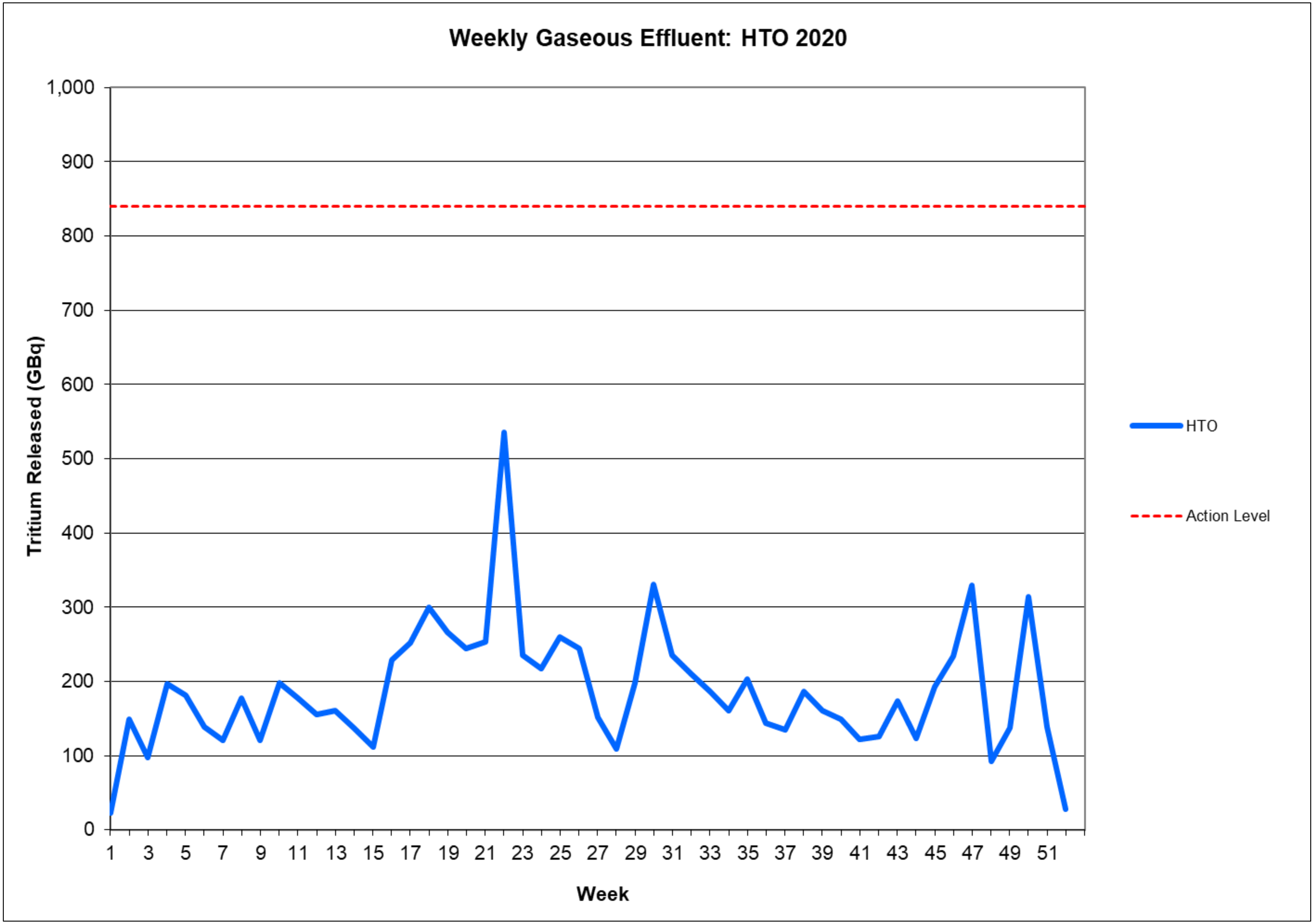
APPENDIX P

Gaseous Effluent Data for 2020

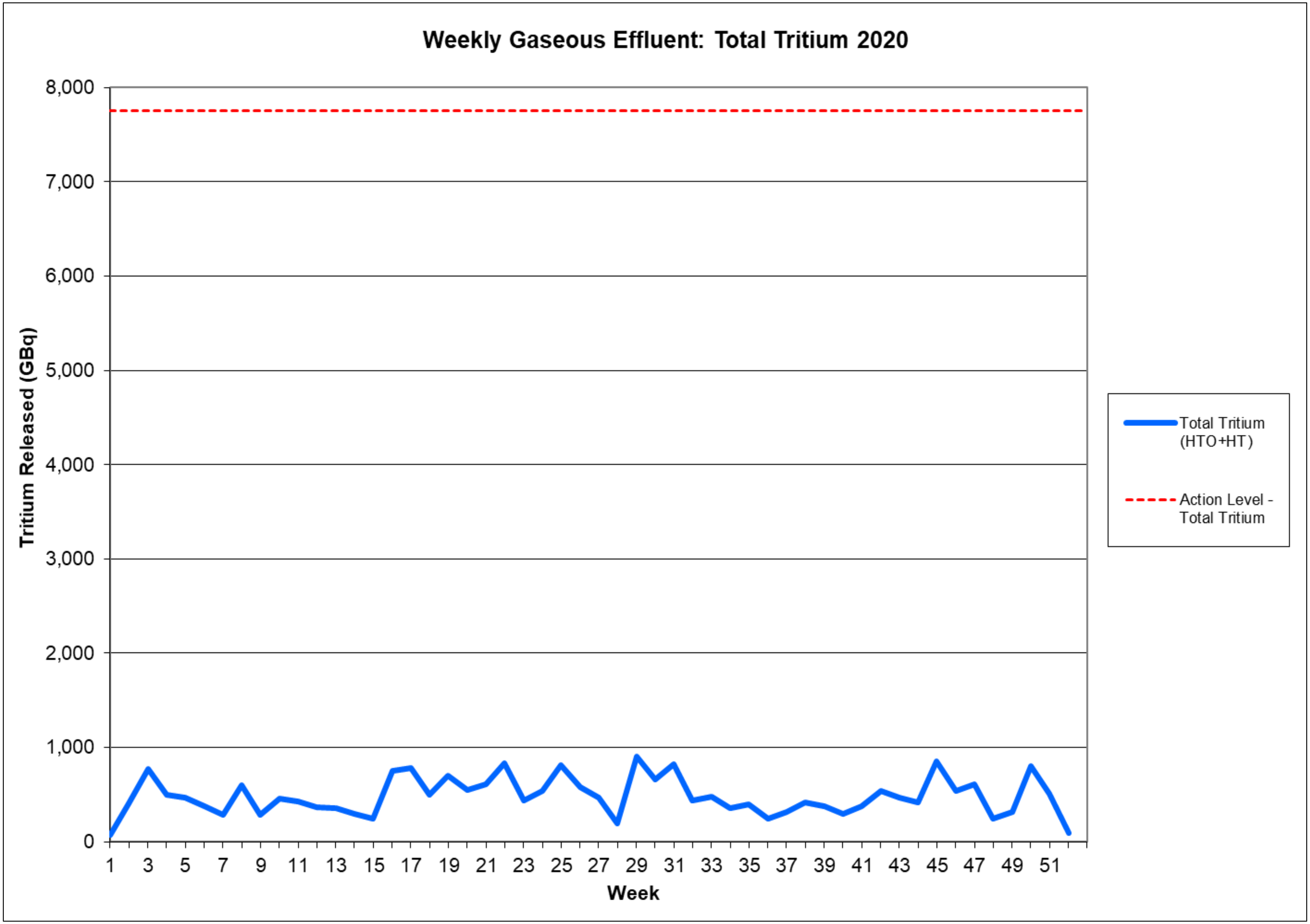
GASEOUS EFFLUENT DATA FOR 2020

2020 Gaseous Effluent Data													
Week	Date		H-3 in Air (GBq)			(GBq)		% 2016 SRBT DRL (12 hr. TJF Data)				Weekly Action Levels	
	Initial	Final	HTO	HT	Total	∑(HTO)	∑(HTO + HT)	1 year old	10 year old	Adult Resident	Adult Worker	HTO (840 GBq)	HTO+HT (7,753 GBq)
1	2019-12-31	2020-01-07	22.80	51.51	74.31	22.80	74.31	0.01	0.01	0.01	0.01	3%	1%
2	2020-01-07	2020-01-14	149.53	259.10	408.63	172.33	482.94	0.07	0.08	0.08	0.10	18%	5%
3	2020-01-14	2020-01-21	97.37	674.20	771.57	269.70	1254.51	0.05	0.06	0.06	0.07	12%	10%
4	2020-01-21	2020-01-28	196.60	302.40	499.00	466.30	1753.51	0.09	0.11	0.10	0.13	23%	6%
5	2020-01-28	2020-02-04	181.85	284.79	466.64	648.15	2220.15	0.09	0.10	0.09	0.12	22%	6%
6	2020-02-04	2020-02-11	139.28	241.37	380.65	787.43	2600.80	0.07	0.08	0.07	0.09	17%	5%
7	2020-02-11	2020-02-18	121.23	160.00	281.23	908.66	2882.03	0.06	0.07	0.06	0.08	14%	4%
8	2020-02-18	2020-02-25	176.96	424.62	601.58	1085.62	3483.61	0.09	0.10	0.09	0.12	21%	8%
9	2020-02-25	2020-03-03	120.91	167.83	288.74	1206.53	3772.35	0.06	0.07	0.06	0.08	14%	4%
10	2020-03-03	2020-03-10	198.12	256.29	454.41	1404.65	4226.76	0.09	0.11	0.10	0.13	24%	6%
11	2020-03-10	2020-03-17	177.57	250.63	428.20	1582.22	4654.96	0.08	0.10	0.09	0.11	21%	6%
12	2020-03-17	2020-03-24	154.83	214.66	369.49	1737.05	5024.45	0.07	0.09	0.08	0.10	18%	5%
13	2020-03-24	2020-03-31	160.33	201.63	361.96	1897.38	5386.41	0.07	0.09	0.08	0.10	19%	5%
14	2020-03-31	2020-04-07	136.84	155.57	292.41	2034.22	5678.82	0.06	0.08	0.07	0.09	16%	4%
15	2020-04-07	2020-04-14	111.35	132.24	243.59	2145.57	5922.41	0.05	0.06	0.06	0.07	13%	3%
16	2020-04-14	2020-04-21	228.98	521.01	749.99	2374.55	6672.40	0.11	0.13	0.12	0.15	27%	10%
17	2020-04-21	2020-04-28	252.19	532.37	784.56	2626.74	7456.96	0.12	0.14	0.13	0.16	30%	10%
18	2020-04-28	2020-05-05	299.28	195.89	495.17	2926.02	7952.13	0.14	0.16	0.15	0.19	36%	6%
19	2020-05-05	2020-05-12	265.96	440.43	706.39	3191.98	8658.52	0.13	0.15	0.14	0.17	32%	9%
20	2020-05-12	2020-05-19	244.95	308.23	553.18	3436.93	9211.70	0.11	0.14	0.12	0.16	29%	7%
21	2020-05-19	2020-05-26	253.08	359.66	612.74	3690.01	9824.44	0.12	0.14	0.13	0.16	30%	8%
22	2020-05-26	2020-06-02	534.79	294.14	828.93	4224.80	10653.37	0.24	0.29	0.26	0.33	64%	11%
23	2020-06-02	2020-06-09	234.77	208.09	442.86	4459.57	11096.23	0.11	0.13	0.12	0.15	28%	6%
24	2020-06-09	2020-06-16	217.92	320.28	538.20	4677.49	11634.43	0.10	0.12	0.11	0.14	26%	7%
25	2020-06-16	2020-06-23	260.26	555.60	815.86	4937.75	12450.29	0.12	0.15	0.14	0.17	31%	11%
26	2020-06-23	2020-06-30	244.04	333.39	577.43	5181.79	13027.72	0.11	0.14	0.12	0.16	29%	7%
27	2020-06-30	2020-07-07	151.85	314.03	465.88	5333.64	13493.60	0.07	0.09	0.08	0.10	18%	6%
28	2020-07-07	2020-07-14	109.03	85.36	194.39	5442.67	13687.99	0.05	0.06	0.05	0.07	13%	3%
29	2020-07-14	2020-07-21	198.13	707.27	905.40	5640.80	14593.39	0.10	0.12	0.11	0.13	24%	12%
30	2020-07-21	2020-07-28	330.52	335.60	666.12	5971.32	15259.51	0.15	0.18	0.16	0.21	39%	9%
31	2020-07-28	2020-08-04	235.54	584.59	820.13	6206.86	16079.64	0.11	0.14	0.12	0.15	28%	11%
32	2020-08-04	2020-08-11	210.13	223.09	433.22	6416.99	16512.86	0.10	0.12	0.11	0.13	25%	6%
33	2020-08-11	2020-08-18	186.23	296.08	482.31	6603.22	16995.17	0.09	0.10	0.09	0.12	22%	6%
34	2020-08-18	2020-08-25	160.60	197.49	358.09	6763.82	17353.26	0.07	0.09	0.08	0.10	19%	5%
35	2020-08-25	2020-09-01	202.69	195.89	398.58	6966.51	17751.84	0.09	0.11	0.10	0.13	24%	5%
36	2020-09-01	2020-09-08	144.30	100.63	244.93	7110.81	17996.77	0.07	0.08	0.07	0.09	17%	3%
37	2020-09-08	2020-09-15	135.27	183.38	318.65	7246.08	18315.42	0.06	0.08	0.07	0.09	16%	4%
38	2020-09-15	2020-09-22	185.79	230.92	416.71	7431.87	18732.13	0.09	0.10	0.09	0.12	22%	5%
39	2020-09-22	2020-09-29	160.39	212.45	372.84	7592.26	19104.97	0.07	0.09	0.08	0.10	19%	5%
40	2020-09-29	2020-10-06	149.24	145.57	294.81	7741.50	19399.78	0.07	0.08	0.07	0.09	18%	4%
41	2020-10-06	2020-10-13	122.35	258.38	380.73	7863.85	19780.51	0.06	0.07	0.06	0.08	15%	5%
42	2020-10-13	2020-10-20	126.29	411.08	537.37	7990.14	20317.88	0.06	0.07	0.07	0.08	15%	7%
43	2020-10-20	2020-10-27	173.69	297.88	471.57	8163.83	20789.45	0.08	0.10	0.09	0.11	21%	6%
44	2020-10-27	2020-11-03	123.76	294.73	418.49	8287.59	21207.94	0.06	0.07	0.06	0.08	15%	5%
45	2020-11-03	2020-11-10	192.79	659.99	852.78	8480.38	22060.72	0.10	0.11	0.10	0.13	23%	11%
46	2020-11-10	2020-11-17	233.82	309.73	543.55	8714.20	22604.27	0.11	0.13	0.12	0.15	28%	7%
47	2020-11-17	2020-11-24	329.50	285.89	615.39	9043.70	23219.66	0.15	0.18	0.16	0.21	39%	8%
48	2020-11-24	2020-12-01	92.46	149.19	241.65	9136.16	23461.31	0.04	0.05	0.05	0.06	11%	3%
49	2020-12-01	2020-12-08	137.81	180.14	317.95	9273.97	23779.26	0.06	0.08	0.07	0.09	16%	4%
50	2020-12-08	2020-12-15	313.66	489.13	802.79	9587.63	24582.05	0.15	0.18	0.16	0.20	37%	10%
51	2020-12-15	2020-12-22	139.08	374.73	513.81	9726.71	25095.86	0.07	0.08	0.07	0.09	17%	7%
52	2020-12-22	2020-12-29	27.88	62.13	90.01	9754.59	25185.87	0.01	0.02	0.01	0.02	3%	1%
	Annual Total		9754.59	15431.28	25185.87			Average % DRL					
	Weekly Average		187.59	296.76	484.34			0.09	0.11	0.10	0.12		
				(Bq/a)	% Release Limit			Projected Dose (uSv/a)					
% Annual Release Limit:			HTO	6.72E+13	14.52			0.88	1.05	0.96	1.20		
			HTO + HT	4.48E+14	5.62			1 year old	10 year old	Adult Resident	Adult Worker		
Derived Weekly HTO Release/Emission Limit (GBq/week)								2.24E+05	1.88E+05	2.08E+05	1.63E+05		
Derived Weekly HT Release/ Emission Limit (GBq/week)								6.32E+06	5.61E+06	5.54E+06	5.69E+06		

APPENDIX P


Weekly Gaseous Effluent: HTO 2020
Tritium Released (GBq)
1,000
900
800
700
600
500
400
300
200
100
0
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
Week
HTO
Action Level

GASEOUS EFFLUENT DATA FOR 2020



APPENDIX Q

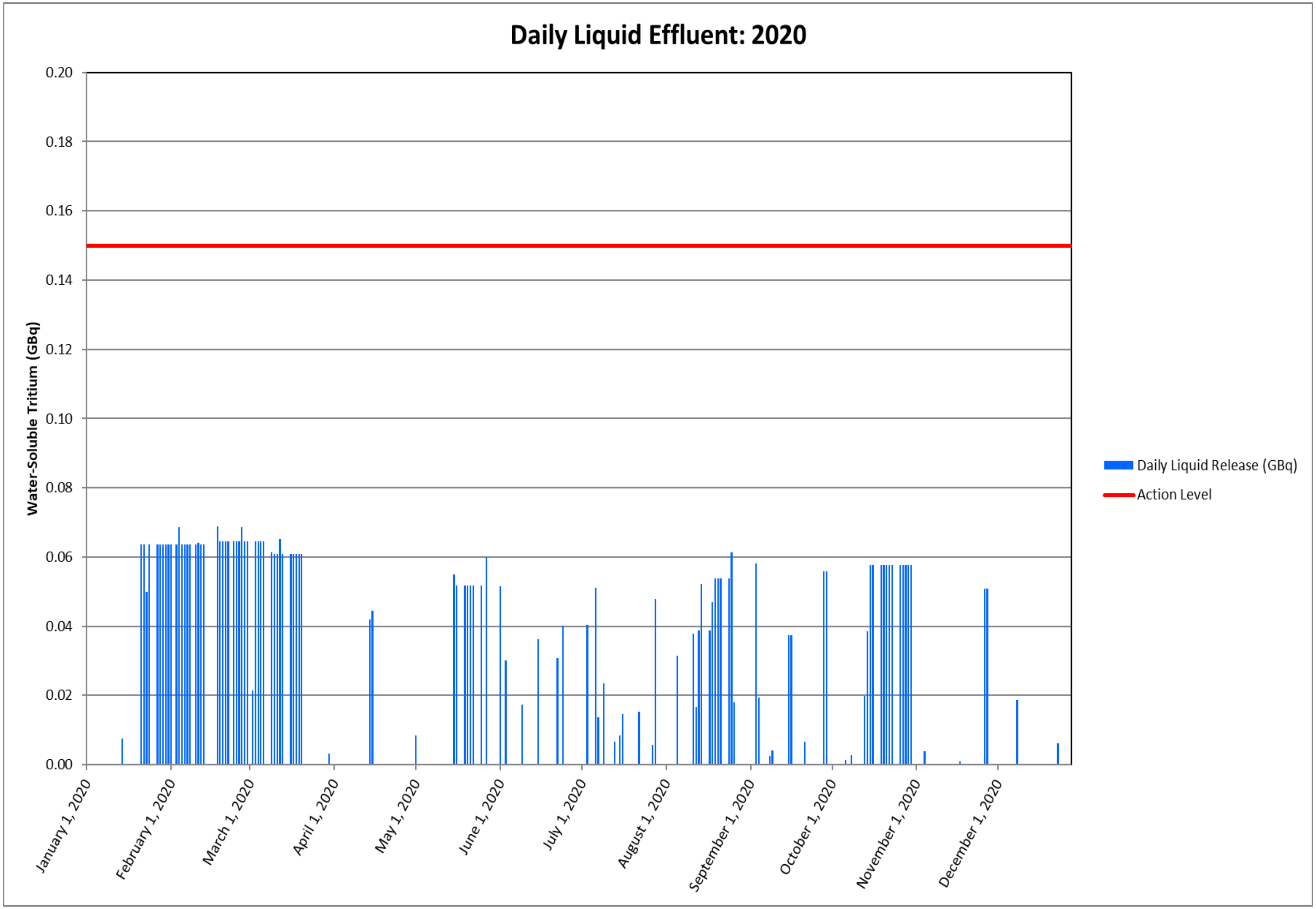
Liquid Effluent Data for 2020

LIQUID EFFLUENT DATA FOR 2020

ANNUAL LIQUID EFFLUENT TRACKING TABLE		
Year = 2020		
WEEK ENDING	**WEEKLY RELEASE (Bq)**	**WEEK**
5-Jan-20	0	1
12-Jan-20	0	2
19-Jan-20	7,564,749	3
26-Jan-20	240,107,520	4
2-Feb-20	382,152,960	5
9-Feb-20	387,010,673	6
16-Feb-20	255,040,450	7
23-Feb-20	327,026,938	8
1-Mar-20	391,432,592	9
8-Mar-20	279,797,427	10
15-Mar-20	309,261,809	11
22-Mar-20	304,845,715	12
29-Mar-20	0	13
5-Apr-20	3,272,967	14
12-Apr-20	233,160	15
19-Apr-20	86,386,353	16
26-Apr-20	0	17
3-May-20	8,342,053	18
10-May-20	241,463	19
17-May-20	106,847,403	20
24-May-20	207,322,620	21
31-May-20	111,810,955	22
7-Jun-20	81,917,060	23
14-Jun-20	17,310,920	24
21-Jun-20	36,301,320	25
28-Jun-20	70,968,153	26
5-Jul-20	40,555,183	27
12-Jul-20	88,143,880	28
19-Jul-20	29,770,980	29
26-Jul-20	15,305,950	30
2-Aug-20	53,452,393	31
9-Aug-20	31,542,533	32
16-Aug-20	145,570,414	33
23-Aug-20	247,259,916	34
30-Aug-20	133,109,764	35
6-Sep-20	77,365,680	36
13-Sep-20	6,708,170	37
20-Sep-20	74,859,876	38
27-Sep-20	6,723,593	39
4-Oct-20	111,937,680	40
11-Oct-20	4,227,940	41
18-Oct-20	173,569,452	42
25-Oct-20	288,347,535	43
1-Nov-20	288,347,535	44
8-Nov-20	3,790,887	45
15-Nov-20	0	46
22-Nov-20	1,018,107	47
29-Nov-20	101,778,606	48
6-Dec-20	279,833	49
13-Dec-20	18,596,980	50
20-Dec-20	0	51
27-Dec-20	6,062,000	52
3-Jan-21	0	53
Annual Total (Bq)	5,563,520,147	
Annual Total (GBq)	5.56	
Limit (GBq)	200	
% of limit	**2.78**	

APPENDIX Q

LIQUID EFFLUENT DATA FOR 2020



APPENDIX R

Compilation of Water Level Measurements for 2020

COMPILATION OF WATER LEVEL MEASUREMENTS FOR 2020

	MW06-1	MW06-2	MW06-3	MW06-8	MW06-9	MW06-10	MW07-11	MW07-12	MW07-13	MW07-15	MW07-16	MW07-17	MW07-18
Easting	335449	335478	335363	335464	335401	335408	335478	335465	335448	335403	335393	335392	335387
Northing	5074615	5074578	5074535	5074590	5074605	5074506	5074576	5074588	5074616	5074605	5074599	5074599	5074595
TOP Elevation (m)	130.99	130.03	133.09	130.30	131.15	131.32	130.06	130.41	130.92	130.84	130.98	131.08	131.23
GS Elevation (m)	130.17	129.24	132.32	129.58	129.86	130.24	129.15	129.58	130.03	129.93	130.16	130.16	130.37
Well Diameter (m)	0.051	0.051	0.051	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.051	0.032
Well Depth (m)	5.165	5.330	6.130	6.700	5.930	7.770	7.215	7.450	6.615	7.230	7.050	14.610	7.250
Stick-up (m)	0.820	0.788	0.767	0.720	1.290	1.077	0.905	0.835	0.893	0.910	0.822	0.915	0.868
dd/mm/yy	All levels expressed in metres above sea level (masl)												
08-Jan-20	127.38	126.93	127.04	125.98	127.08	126.52	126.06	125.95	125.66	126.45	126.34	121.31	126.32
05-Feb-20	127.05	126.79	127.05	125.80	126.56	126.28	125.88	125.72	125.39	126.13	126.07	121.20	125.99
05-Mar-20	127.61	126.83	127.05	125.91	126.63	126.38	125.92	125.91	125.71	126.26	126.22	120.92	126.25
02-Apr-20	129.14	129.41	130.64	128.27	129.75	129.80	128.21	128.32	128.32	129.24	129.77	124.78	129.92
05-May-20	129.00	128.05	129.97	128.08	129.60	129.34	128.08	128.11	128.04	129.32	129.08	124.50	129.43
01-Jun-20	128.88	127.84	130.26	127.65	129.05	129.02	127.66	127.67	127.60	128.83	128.77	123.34	128.78
01-Jul-20	128.55	127.53	127.74	126.91	128.44	127.77	126.95	126.90	126.79	127.84	127.74	122.53	127.70
04-Aug-20	128.69	127.29	128.06	126.75	127.92	127.65	126.81	126.77	126.76	127.82	127.69	121.81	127.53
01-Sep-20	128.93	127.95	129.66	127.66	129.11	128.76	127.70	127.68	127.56	128.75	128.69	123.54	128.73
04-Oct-20	128.71	127.77	127.90	127.11	128.55	127.92	127.26	127.09	126.93	128.02	127.92	122.56	127.85
04-Nov-20	130.99	130.03	133.06	130.30	131.15	131.32	130.06	130.41	130.92	130.84	130.98	131.08	131.23
03-Dec-20	130.99	130.03	133.06	130.30	131.15	131.32	130.06	130.41	130.92	130.84	130.98	131.08	131.23

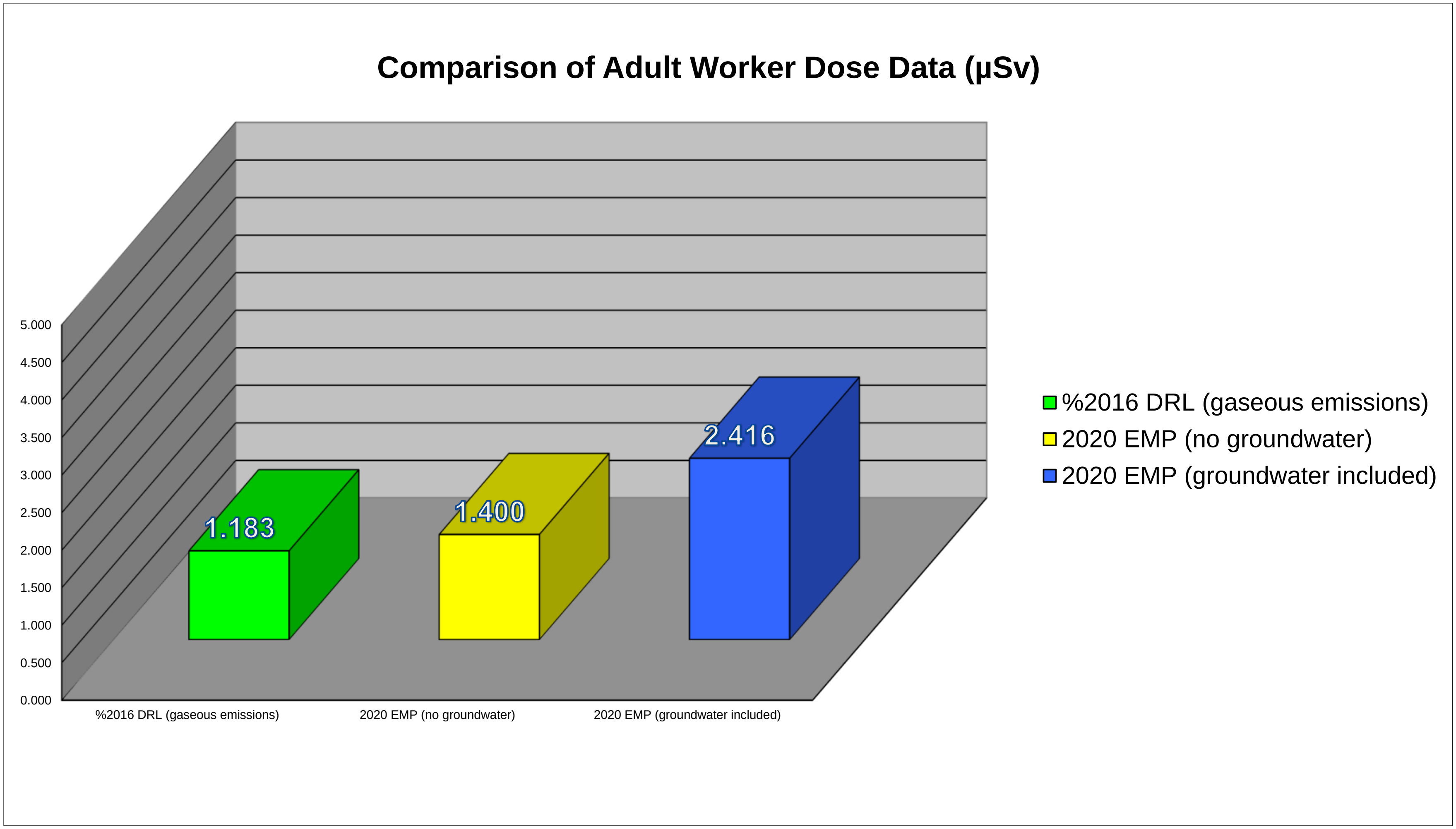
	MW07-19	MW07-20	MW07-21	MW07-22	MW07-23	MW07-24	MW07-26	MW07-27	MW07-28	MW07-29	MW07-31	MW07-32	MW07-34	MW07-35	MW07-36	MW07-37
Easting	335378	335296	335522	335472	335492	335519	335357	335354	335352	335384	335471	335517	335393	335354	335338	335468
Northing	5074587	5074616	5074584	5074584	5074560	5074530	5074567	5074611	5074612	5074592	5074583	5074530	5074591	5074613	5074629	5074589
TOP Elevation (m)	131.61	130.70	129.51	130.25	130.04	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)	130.79	129.85	128.78	129.05	129.29	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	0.032	0.032	0.032	0.032	0.032
Well Depth (m)	7.400	7.820	7.580	7.465	5.905	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)	0.815	0.850	0.730	1.200	0.750	0.810	0.570	0.870	0.670	0.520	0.780	0.630	0.410	0.730	0.790	0.590
08-Jan-20	126.44	125.29	124.24	125.85	126.66	126.00	126.12	125.55	122.32	121.35	120.29	120.28	125.39	125.35	124.82	126.08
05-Feb-20	126.32	124.66	124.14	125.67	126.52	125.90	126.00	125.36	121.15	121.16	120.22	120.10	125.19	125.20	124.71	125.96
05-Mar-20	-	124.90	124.21	125.77	126.61	125.98	126.02	125.52	120.93	120.96	119.96	120.14	-	125.27	124.74	126.04
02-Apr-20	130.07	128.05	127.61	128.20	128.40	127.48	130.73	130.05	124.93	124.80	125.38	125.36	128.89	129.62	128.66	128.43
05-May-20	129.56	127.58	127.08	128.00	128.25	127.34	129.84	129.34	124.34	124.33	124.02	124.02	128.48	128.99	128.04	128.23
01-Jun-20	128.93	127.07	126.19	127.56	127.95	127.08	129.09	128.41	123.38	123.39	122.52	122.49	127.73	128.04	126.87	127.79
01-Jul-20	127.45	126.02	124.96	126.85	127.38	126.44	127.55	127.16	122.51	122.54	121.51	121.49	126.61	126.79	125.55	127.02
04-Aug-20	127.63	125.78	124.74	126.64	127.24	126.36	127.13	126.69	121.93	121.94	120.50	120.52	126.37	126.37	125.30	126.89
01-Sep-20	128.89	127.12	126.74	127.59	128.05	127.14	129.18	128.29	123.49	123.49	123.26	123.26	127.62	127.91	126.70	127.81
04-Oct-20	127.96	126.15	125.52	127.00	127.70	126.83	127.59	127.15	122.58	122.59	121.70	121.70	126.67	126.80	125.53	127.21
04-Nov-20	131.61	130.70	129.51	130.25	130.04	129.03	132.42	132.89	132.71	131.09	130.16	128.86	131.12	132.89	133.10	130.06
03-Dec-20	131.61	130.70	129.51	130.25	130.04	129.03	132.42	132.89	132.71	131.09	130.16	128.86	131.12	132.89	133.10	130.06

APPENDIX S

Data and Calculations for Public Dose in 2020

ADULT WORKER

Dose Calculation	2020 µSv
%2016 DRL (gaseous emissions)	1.183
2020 EMP (no groundwater)	1.400
2020 EMP (groundwater included)	2.416



ADULT WORKER

Stack Emissions

	2020 Emissions as %2016 SRBT DRL	
	ADULT WORKER	
Sample End	**% weekly DRL**	**(uSv)**
2020-01-07	0.01	0.0029
2020-01-14	0.10	0.0185
2020-01-21	0.07	0.0138
2020-01-28	0.13	0.0242
2020-02-04	0.12	0.0224
2020-02-11	0.09	0.0172
2020-02-18	0.08	0.0148
2020-02-25	0.12	0.0223
2020-03-03	0.08	0.0148
2020-03-10	0.13	0.0242
2020-03-17	0.11	0.0218
2020-03-24	0.10	0.0190
2020-03-31	0.10	0.0196
2020-04-07	0.09	0.0167
2020-04-14	0.07	0.0136
2020-04-21	0.15	0.0288
2020-04-28	0.16	0.0316
2020-05-05	0.19	0.0360
2020-05-12	0.17	0.0329
2020-05-19	0.16	0.0299
2020-05-26	0.16	0.0311
2020-06-02	0.33	0.0641
2020-06-09	0.15	0.0284
2020-06-16	0.14	0.0268
2020-06-23	0.17	0.0326
2020-06-30	0.16	0.0299
2020-07-07	0.10	0.0190
2020-07-14	0.07	0.0132
2020-07-21	0.13	0.0258
2020-07-28	0.21	0.0401
2020-08-04	0.15	0.0298
2020-08-11	0.13	0.0255
2020-08-18	0.12	0.0230
2020-08-25	0.10	0.0196
2020-09-01	0.13	0.0246
2020-09-08	0.09	0.0174
2020-09-15	0.09	0.0166
2020-09-22	0.12	0.0227
2020-09-29	0.10	0.0196
2020-10-06	0.09	0.0181
2020-10-13	0.08	0.0153
2020-10-20	0.08	0.0163
2020-10-27	0.11	0.0215
2020-11-03	0.08	0.0156
2020-11-10	0.13	0.0250
2020-11-17	0.15	0.0286
2020-11-24	0.21	0.0398
2020-12-01	0.06	0.0114
2020-12-08	0.09	0.0169
2020-12-15	0.20	0.0387
2020-12-22	0.09	0.0177
2020-12-29	0.02	0.0035
2021-01-05	0.01	0.0023
Sum (uSv)		**1.205**
Ave. (%DRL)	**0.12**	
Annual Dose Est.	**1.183 uSv/a**	

ADULT WORKER
EMP Factors for Dose

Pathways Analysis of Dose to the Public		
		per annum
Atmospheric HTO inhalation, immersion	P(i)19, P(e)19	1.182
Surface HTO ingestion	P(i)29	1.016
Surface HTO immersion	P(e)29	0.000
External soil exposure	P39	0.000
Forage & crop ingestion	P49	0.204
Animal produce ingestion	P59	0.014
Aquatic animal ingestion	P69	0.000
Aquatic plant ingestion	P79	0.000
External sediment exposure	P89	0.000
Total (uSv)		**2.416 uSv/a**
Total without P_{29} (uSv)		**1.400 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, and also implicitly captures skin absorption dose P(e)19 as per CSA N288.1-14 Table C.1.

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/m^3)	Volume (m^3)	(uSv/Bq)	(uSv/a)	(uSv/a)	(uSv/a)	Maximum (uSv/a)	
1	0.434	7.250	1994.496	3.000E-05	0.434				
2	0.294	4.910	1994.496	3.000E-05		0.294			
3	0.000			3.000E-05					
4	0.748	3.890	6405.504	3.000E-05	0.748	0.748	0.748		
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	0.235	3.920	1994.496	3.000E-05			0.235		
			P(i)19	**Sum**	**1.182**	**1.041**	**0.983**	**1.182**	**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)	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	1081.1	2.00E-05	Jan. 9, 2020												
2	0.807	37	1081.1	2.00E-05	Feb. 6, 2020												
3	1.016	47	1081.1	2.00E-05	Mar. 6, 2020		39	49		7	6	4					
4	0.000	0	1081.1	2.00E-05	Apr. 3, 2020												
5	0.130	6	1081.1	2.00E-05	May 6, 2020												
6	0.108	5	1081.1	2.00E-05	Jun. 2, 2020												
7	0.086	4	1081.1	2.00E-05	Jul. 2, 2020		38	47		4	4	4					
8	0.000	0	1081.1	2.00E-05	Aug. 5, 2020												
9	0.000	0	1081.1	2.00E-05	Sep. 2, 2020												
10	0.000	0	1081.1	2.00E-05	Oct. 5, 2020												
11	0.000	0	1081.1	2.00E-05	Nov. 5, 2020		35	45		7	5	4					
12	0.000	0	1081.1	2.00E-05	Dec. 4, 2020												
Avg P(i)29	**0.179**	**uSv/annum**															
					Average		**37**	**47**		**6**	**5**	**4**					

Well 1	*No longer sampled*
Well 2	185 Mud Lake Road
Well 3	183 Mud Lake Road
Well 4	*No longer sampled*
Well 5	171 Sawmill Road
Well 6	40987 Highway 41
Well 7	40925 Highway 41
Well 8	*No longer sampled*
Well 9	*No longer sampled*
Well 10	*No longer sampled*
Well 11	*No longer sampled*
Well 12	*No longer sampled*

P(e)29 is the pathway of exposure to HTO due to immersion in surface water.
P(e)29 is considered negligible as surface waters throughout 2019 were measured as <detectable.

P(e)29 = 0.000 uSv/a

RW-3	**P(i)29**	**1.016**	**uSv/a**
	P(e)29	**0.000**	**uSv/a**
	P29	**1.016**	**uSv/a**

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 free water tritium / kg fresh weight)																		
Source	Market						Home											
Type	Beans	Tomato	Onion	Carrot		Average	LOCATION	Tomato	Apple	Pepper	Onion	Herbs	Carrot	Zucchini	Corn	Beet	Bean	Average
	4	3	3	2		3.0	413 SWEEZEY COURT		75	32	62	11						45.0
							406 BOUNDARY ROAD		48									48.0
							408 BOUNDARY ROAD	63										63.0
							611 MOSS DRIVE	86					16					51.0
							171 SAWMILL ROAD						4	4	5	3	5	4.2
Average						3.0		74.5	61.5	32.0	62.0	11.0	10.0	4.0	5.0	3.0	5.0	42.2
Produce Sample Results (Bq organically bound tritium / kg fresh weight)																		
Comm.				Tomato	1.00	1.0	408 BOUNDARY ROAD	3.0										3.0

Produce Consumption						
100%=	413.300	kg/a	[HTO] (Bq/kg)	(Bq/a)	[OBT] (Bq/kg)	(Bq/a)
70%	289.310	kg/a	3.0	867.93	1.0	289.31
30%	123.990	kg/a	63.0	7811.37	3.0	371.97

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)
0.204	8679.30	2.00E-05	661.28	4.60E-05

P49	0.204	uSv/a

ADULT WORKER
EMP Factors for Dose P59

P59 is the exposure to HTO due to ingestion of animal produce.

2020 Sample Results

Local Producer	
	(Bq/L)
1	4.70
2	4.00
3	3.00
Average	3.90

Local Distributor	
	(Bq/L)
1	4.00
2	4.00
3	3.00
Average	3.67

TOTAL AVERAGE	3.78	Bq/L

Milk Density Adjustment		
Milk Average (Bq/L) x Milk density (L/kg)		
Bq/L	**L/kg**	**Bq/kg**
3.78	0.97	3.670

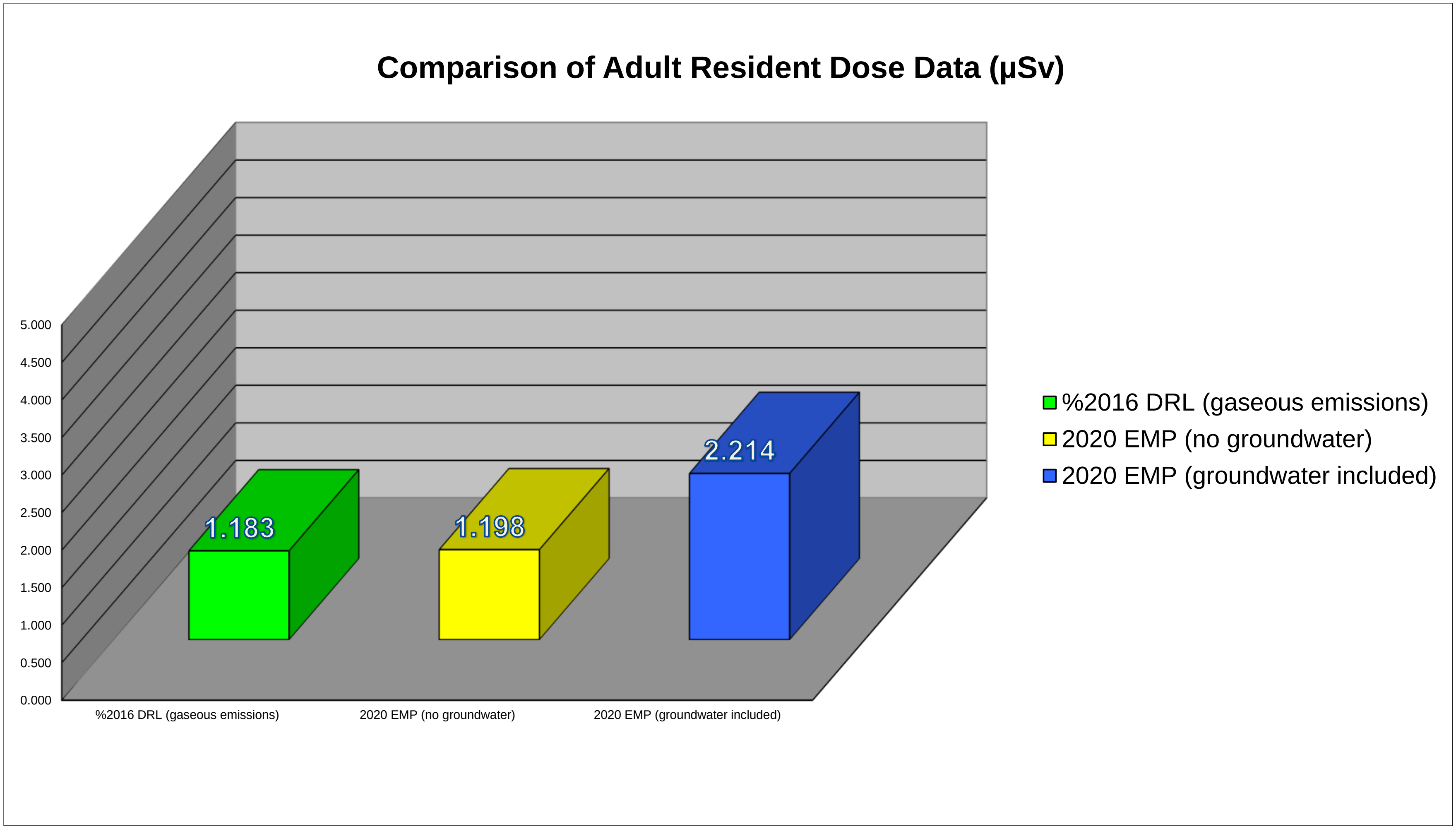
Consumption kg/da x da/a = kg/a		
(kg/da)	**(da/a)**	**(kg/a)**
0.516	365.25	188.5

P59 = [HTO]animal produce (Bq/kg) x Ingestion (kg) x DCF				
P59	**[HTO]**	**Ingested**	**DCF**	
(uSv/a)	**(Bq/kg)**	**(kg/a)**	**(uSv/Bq)**	
0.014	3.67	188.5	2.00E-05	

P59	0.014	**uSv/a**

ADULT RESIDENT

Dose Calculation	2020 µSv
%2016 DRL (gaseous emissions)	1.183
2020 EMP (no groundwater)	1.198
2020 EMP (groundwater included)	2.214



ADULT RESIDENT

Stack Emissions

	2020 Emissions as %2016 SRBT DRL	
	ADULT RESIDENT	
Sample End	% weekly DRL	(uSv)
2020-01-07	0.01	0.0029
2020-01-14	0.10	0.0185
2020-01-21	0.07	0.0138
2020-01-28	0.13	0.0242
2020-02-04	0.12	0.0224
2020-02-11	0.09	0.0172
2020-02-18	0.08	0.0148
2020-02-25	0.12	0.0223
2020-03-03	0.08	0.0148
2020-03-10	0.13	0.0242
2020-03-17	0.11	0.0218
2020-03-24	0.10	0.0190
2020-03-31	0.10	0.0196
2020-04-07	0.09	0.0167
2020-04-14	0.07	0.0136
2020-04-21	0.15	0.0288
2020-04-28	0.16	0.0316
2020-05-05	0.19	0.0360
2020-05-12	0.17	0.0329
2020-05-19	0.16	0.0299
2020-05-26	0.16	0.0311
2020-06-02	0.33	0.0641
2020-06-09	0.15	0.0284
2020-06-16	0.14	0.0268
2020-06-23	0.17	0.0326
2020-06-30	0.16	0.0299
2020-07-07	0.10	0.0190
2020-07-14	0.07	0.0132
2020-07-21	0.13	0.0258
2020-07-28	0.21	0.0401
2020-08-04	0.15	0.0298
2020-08-11	0.13	0.0255
2020-08-18	0.12	0.0230
2020-08-25	0.10	0.0196
2020-09-01	0.13	0.0246
2020-09-08	0.09	0.0174
2020-09-15	0.09	0.0166
2020-09-22	0.12	0.0227
2020-09-29	0.10	0.0196
2020-10-06	0.09	0.0181
2020-10-13	0.08	0.0153
2020-10-20	0.08	0.0163
2020-10-27	0.11	0.0215
2020-11-03	0.08	0.0156
2020-11-10	0.13	0.0250
2020-11-17	0.15	0.0286
2020-11-24	0.21	0.0398
2020-12-01	0.06	0.0114
2020-12-08	0.09	0.0169
2020-12-15	0.20	0.0387
2020-12-22	0.09	0.0177
2020-12-29	0.02	0.0035
2021-01-05	0.01	0.0023
Sum (uSv)		**1.205**
Ave. (%DRL)	**0.12**	
Annual Dose Est.	**1.183 uSv/a**	

ADULT RESIDENT
EMP Factors for Dose

Pathways Analysis of Dose to the Public		
		per annum
Atmospheric HTO inhalation, immersion	P(i)19, P(e)19	0.980
Surface HTO ingestion	P(i)29	1.016
Surface HTO immersion	P(e)29	0.000
External soil exposure	P39	0.000
Forage & crop ingestion	P49	0.204
Animal produce ingestion	P59	0.014
Aquatic animal ingestion	P69	0.000
Aquatic plant ingestion	P79	0.000
External sediment exposure	P89	0.000
Total (uSv)		**2.214 uSv/a**
Total without P_{29} (uSv)		**1.198 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 inhalation of HTO, and also implicitly captures skin absorption dose P(e)19 as per CSA N288.1-14 Table C.1.

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/m^3)	Volume (m^3)	(uSv/Bq)	(uSv/a)	(uSv/a)	(uSv/a)	Maximum (uSv/a)
1	0.000			3.000E-05				
2	0.000			3.000E-05				
3	0.000			3.000E-05				
4	0.980	3.890	8400.000	3.000E-05	0.980	0.980	0.980	
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				
			P(i)19	**Sum**	**0.980**	**0.980**	**0.980**	**0.980** 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	0.807	37	1081.1	2.00E-05
3	1.016	47	1081.1	2.00E-05
4	0.000	0	1081.1	2.00E-05
5	0.130	6	1081.1	2.00E-05
6	0.108	5	1081.1	2.00E-05
7	0.086	4	1081.1	2.00E-05
8	0.000	0	1081.1	2.00E-05
9	0.000	0	1081.1	2.00E-05
10	0.000	0	1081.1	2.00E-05
11	0.000	0	1081.1	2.00E-05
12	0.000	0	1081.1	2.00E-05
Avg P(i)29	**0.179**	**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)
Jan. 9, 2020												
Feb. 6, 2020												
Mar. 6, 2020		39	49		7	6	4					
Apr. 3, 2020												
May 6, 2020												
Jun. 2, 2020												
Jul. 2, 2020		38	47		4	4	4					
Aug. 5, 2020												
Sep. 2, 2020												
Oct. 5, 2020												
Nov. 5, 2020		35	45		7	5	4					
Dec. 4, 2020												
Average		**37**	**47**		**6**	**5**	**4**					

Well 1	*No longer sampled*
Well 2	185 Mud Lake Road
Well 3	183 Mud Lake Road
Well 4	*No longer sampled*
Well 5	171 Sawmill Road
Well 6	40987 Highway 41
Well 7	40925 Highway 41
Well 8	*No longer sampled*
Well 9	*No longer sampled*
Well 10	*No longer sampled*
Well 11	*No longer sampled*
Well 12	*No longer sampled*

P(e)29 is the pathway of exposure to HTO due to immersion in surface water.
P(e)29 is considered negligible as surface waters throughout 2019 were measured as <detectable.

P(e)29 = 0.000 uSv/a

RW-3	**P(i)29**	**1.016**	**uSv/a**
	P(e)29	**0.000**	**uSv/a**
	P29	**1.016**	**uSv/a**

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 free water tritium / kg fresh weight)																	
Source	Market					Home											
Type	Beans	Tomato	Onion	Carrot	Average	LOCATION	Tomato	Apple	Pepper	Onion	Herbs	Carrot	Zucchini	Corn	Beet	Bean	Average
	4	3	3	2	3.0	413 SWEEZEY COURT		75	32	62	11						45.0
						406 BOUNDARY ROAD		48									48.0
						408 BOUNDARY ROAD	63										**63.0**
						611 MOSS DRIVE	86					16					51.0
						171 SAWMILL ROAD						4	4	5	3	5	4.2
Average					**3.0**		74.5	61.5	32.0	62.0	11.0	10.0	4.0	5.0	3.0	5.0	42.2
Produce Sample Results (Bq organically bound tritium / kg fresh weight)																	
Comm.				Tomato 1.00	**1.0**	408 BOUNDARY ROAD	3.0										**3.0**

Produce Consumption						
100%=	**413.300**	**kg/a**	**[HTO] (Bq/kg)**	**(Bq/a)**	**[OBT] (Bq/kg)**	**(Bq/a)**
70%	289.310	**kg/a**	3.0	867.93	1.0	289.31
30%	123.990	**kg/a**	63.0	7811.37	3.0	371.97

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)
0.204	**8679.30**	2.00E-05	**661.28**	4.60E-05

P49	**0.204**	**uSv/a**

ADULT RESIDENT
EMP Factors for Dose P59

P59 is the exposure to HTO due to ingestion of animal produce.

2020 Sample Results

Local Producer	
	(Bq/L)
1	4.70
2	4.00
3	3.00
Average	3.90

Local Distributor	
	(Bq/L)
1	4.00
2	4.00
3	3.00
Average	3.67

TOTAL AVERAGE	3.78	Bq/L

Milk Density Adjustment		
Milk Average (Bq/L) x Milk density (L/kg)		
Bq/L	L/kg	Bq/kg
3.78	0.97	3.670

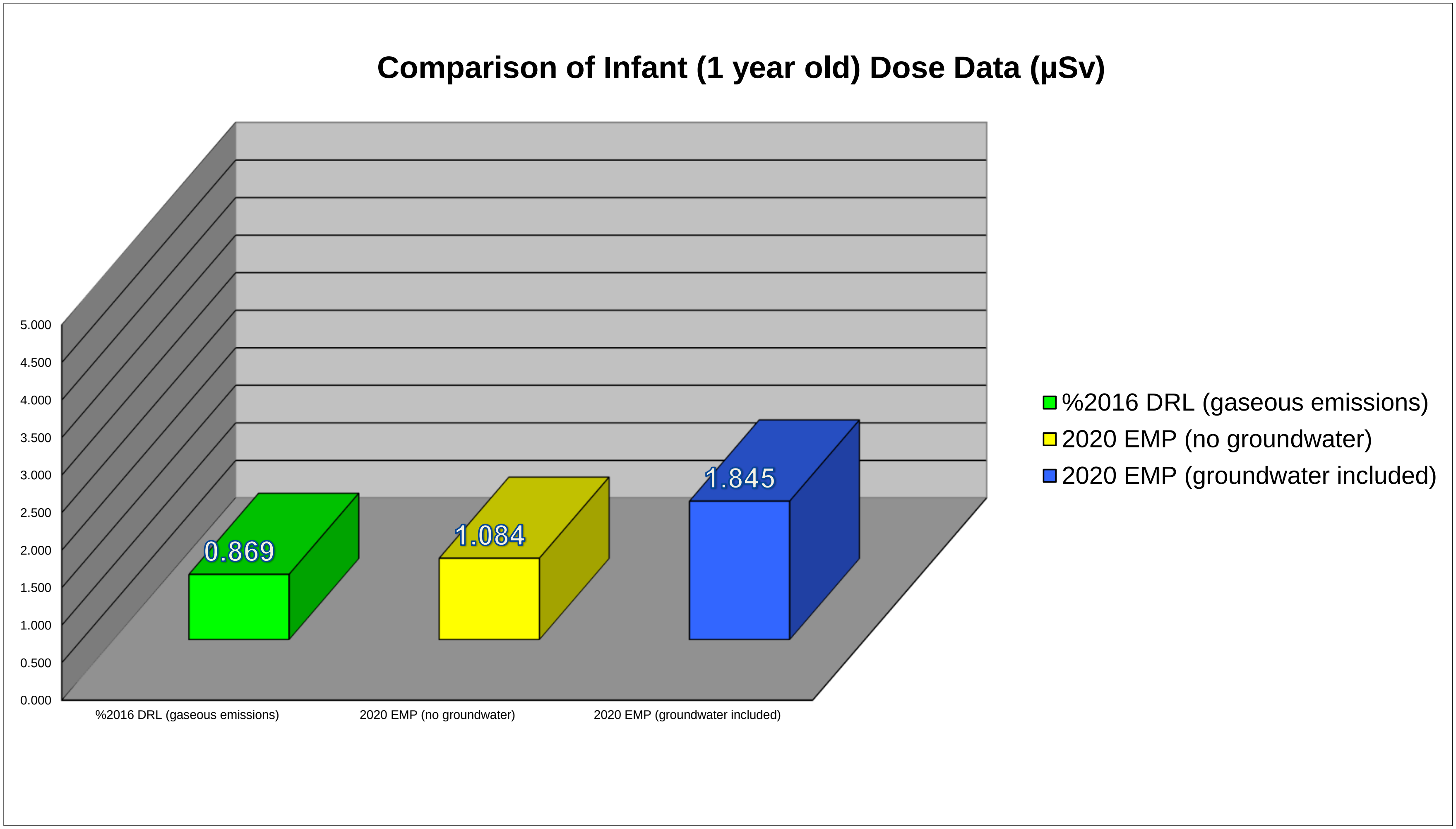
Consumption kg/da x da/a = kg/a		
(kg/da)	(da/a)	(kg/a)
0.516	365.25	188.5

P59 = [HTO]animal produce (Bq/kg) x Ingestion (kg) x DCF				
P59	[HTO]	Ingested	DCF	
(uSv/a)	(Bq/kg)	(kg/a)	(uSv/Bq)	
0.014	3.67	188.5	2.00E-05	

P59	0.014	uSv/a

INFANT (1 year old)

Dose Calculation	2020 µSv
%2016 DRL (gaseous emissions)	0.869
2020 EMP (no groundwater)	1.084
2020 EMP (groundwater included)	1.845



INFANT (1 year old)

Stack Emissions

	2020 Emissions as %2016 SRBT DRL	
	INFANT (1 year old)	
Sample End	**% weekly DRL**	**(uSv)**
2020-01-07	0.01	0.0021
2020-01-14	0.07	0.0136
2020-01-21	0.05	0.0104
2020-01-28	0.09	0.0178
2020-02-04	0.09	0.0165
2020-02-11	0.07	0.0127
2020-02-18	0.06	0.0109
2020-02-25	0.09	0.0165
2020-03-03	0.06	0.0109
2020-03-10	0.09	0.0178
2020-03-17	0.08	0.0160
2020-03-24	0.07	0.0139
2020-03-31	0.07	0.0144
2020-04-07	0.06	0.0122
2020-04-14	0.05	0.0100
2020-04-21	0.11	0.0212
2020-04-28	0.12	0.0233
2020-05-05	0.14	0.0263
2020-05-12	0.13	0.0242
2020-05-19	0.11	0.0220
2020-05-26	0.12	0.0228
2020-06-02	0.24	0.0468
2020-06-09	0.11	0.0208
2020-06-16	0.10	0.0197
2020-06-23	0.12	0.0240
2020-06-30	0.11	0.0220
2020-07-07	0.07	0.0140
2020-07-14	0.05	0.0096
2020-07-21	0.10	0.0192
2020-07-28	0.15	0.0294
2020-08-04	0.11	0.0220
2020-08-11	0.10	0.0187
2020-08-18	0.09	0.0169
2020-08-25	0.07	0.0144
2020-09-01	0.09	0.0180
2020-09-08	0.07	0.0127
2020-09-15	0.06	0.0122
2020-09-22	0.09	0.0167
2020-09-29	0.07	0.0144
2020-10-06	0.07	0.0133
2020-10-13	0.06	0.0113
2020-10-20	0.06	0.0121
2020-10-27	0.08	0.0158
2020-11-03	0.06	0.0115
2020-11-10	0.10	0.0186
2020-11-17	0.11	0.0210
2020-11-24	0.15	0.0292
2020-12-01	0.04	0.0084
2020-12-08	0.06	0.0124
2020-12-15	0.15	0.0284
2020-12-22	0.07	0.0131
2020-12-29	0.01	0.0026
2021-01-05	0.01	0.0017
Sum (uSv)		**0.886**
Ave. (%DRL)	**0.09**	
Annual Dose Est.	**0.869 uSv/a**	

INFANT (1 year old)
EMP Factors for Dose

Pathways Analysis of Dose to the Public		
		per annum
Atmospheric HTO inhalation, immersion	P(i)19, P(e)19	0.853
Surface HTO ingestion	P(i)29	0.761
Surface HTO immersion	P(e)29	0.000
External soil exposure	P39	0.000
Forage & crop ingestion	P49	0.165
Animal produce ingestion	P59	0.066
Aquatic animal ingestion	P69	0.000
Aquatic plant ingestion	P79	0.000
External sediment exposure	P89	0.000
Total (uSv)		**1.845 uSv/a**
Total without P_{29} (uSv)		**1.084 uSv/a**

INFANT (1 year old)
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, and also implicitly captures skin absorption dose P(e)19 as per CSA N288.1-14 Table C.1.

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/m^3)	Volume (m^3)	(uSv/Bq)	(uSv/a)	(uSv/a)	(uSv/a)	Maximum (uSv/a)	
1	0.000			8.000E-05					
2	0.000			8.000E-05					
3	0.000			8.000E-05					
4	0.853	3.890	2740.000	8.000E-05	0.853	0.853	0.853		
5	0.000			8.000E-05					
6	0.000			8.000E-05					
7	0.000			8.000E-05					
8	0.000			8.000E-05					
9	0.000			8.000E-05					
10	0.000			8.000E-05					
11	0.000			8.000E-05					
12	0.000			8.000E-05					
13	0.000			8.000E-05					
			P(i)19	**Sum**	**0.853**	**0.853**	**0.853**	**0.853**	**uSv/a**

INFANT (1 year old)
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	0.605	37	305.7	5.30E-05
3	0.761	47	305.7	5.30E-05
4	0.000	0	305.7	5.30E-05
5	0.097	6	305.7	5.30E-05
6	0.081	5	305.7	5.30E-05
7	0.065	4	305.7	5.30E-05
8	0.000	0	305.7	5.30E-05
9	0.000	0	305.7	5.30E-05
10	0.000	0	305.7	5.30E-05
11	0.000	0	305.7	5.30E-05
12	0.000	0	305.7	5.30E-05
Avg P(i)29	**0.134**	**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)
Jan. 9, 2020												
Feb. 6, 2020												
Mar. 6, 2020		39	49		7	6	4					
Apr. 3, 2020												
May 6, 2020												
Jun. 2, 2020												
Jul. 2, 2020		38	47		4	4	4					
Aug. 5, 2020												
Sep. 2, 2020												
Oct. 5, 2020												
Nov. 5, 2020		35	45		7	5	4					
Dec. 4, 2020												
Average		**37**	**47**		**6**	**5**	**4**					

Well 1	*No longer sampled*
Well 2	185 Mud Lake Road
Well 3	183 Mud Lake Road
Well 4	*No longer sampled*
Well 5	171 Sawmill Road
Well 6	40987 Highway 41
Well 7	40925 Highway 41
Well 8	*No longer sampled*
Well 9	*No longer sampled*
Well 10	*No longer sampled*
Well 11	*No longer sampled*
Well 12	*No longer sampled*

P(e)29 is the pathway of exposure to HTO due to immersion in surface water.
P(e)29 is considered negligible as surface waters throughout 2019 were measured as <detectable.

P(e)29 = 0.000 uSv/a

RW-3			
	P(i)29	**0.761**	**uSv/a**
	P(e)29	**0.000**	**uSv/a**
	P29	**0.761**	**uSv/a**

INFANT (1 year old)
EMP Factors for Dose P49

P49 is the pathway for exposure to HTO due to ingestion of forage and crops.

Produce Sample Results (Bq free water tritium / kg fresh weight)																	
Source	Market					Home											
Type	Beans	Tomato	Onion	Carrot	Average	LOCATION	Tomato	Apple	Pepper	Onion	Herbs	Carrot	Zucchini	Corn	Beet	Bean	Average
	4	3	3	2	3.0	413 SWEEZEY COURT		75	32	62	11						45.0
						406 BOUNDARY ROAD		48									48.0
						408 BOUNDARY ROAD	63										63.0
						611 MOSS DRIVE	86					16					51.0
						171 SAWMILL ROAD						4	4	5	3	5	4.2
Average					3.0		74.5	61.5	32.0	62.0	11.0	10.0	4.0	5.0	3.0	5.0	42.2
Produce Sample Results (Bq organically bound tritium / kg fresh weight)																	
Comm.				Tomato 1.00	1.0	408 BOUNDARY ROAD	3.0										3.0

Produce Consumption						
100%=	124.800	kg/a	[HTO] (Bq/kg)	(Bq/a)	[OBT] (Bq/kg)	(Bq/a)
70%	87.360	kg/a	3.0	262.08	1.0	87.36
30%	37.440	kg/a	63.0	2358.72	3.0	112.32

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)
0.165	2620.80	5.30E-05	199.68	1.30E-04

P49	0.165	uSv/a

INFANT (1 year old)
EMP Factors for Dose P59

P59 is the exposure to HTO due to ingestion of animal produce.

2020 Sample Results

Local Producer	
	(Bq/L)
1	4.70
2	4.00
3	3.00
Average	**3.90**

Local Distributor	
	(Bq/L)
1	4.00
2	4.00
3	3.00
Average	**3.67**

TOTAL AVERAGE	**3.78**	Bq/L

Milk Density Adjustment		
Milk Average (Bq/L) x Milk density (L/kg)		
Bq/L	**L/kg**	**Bq/kg**
3.78	0.97	**3.670**

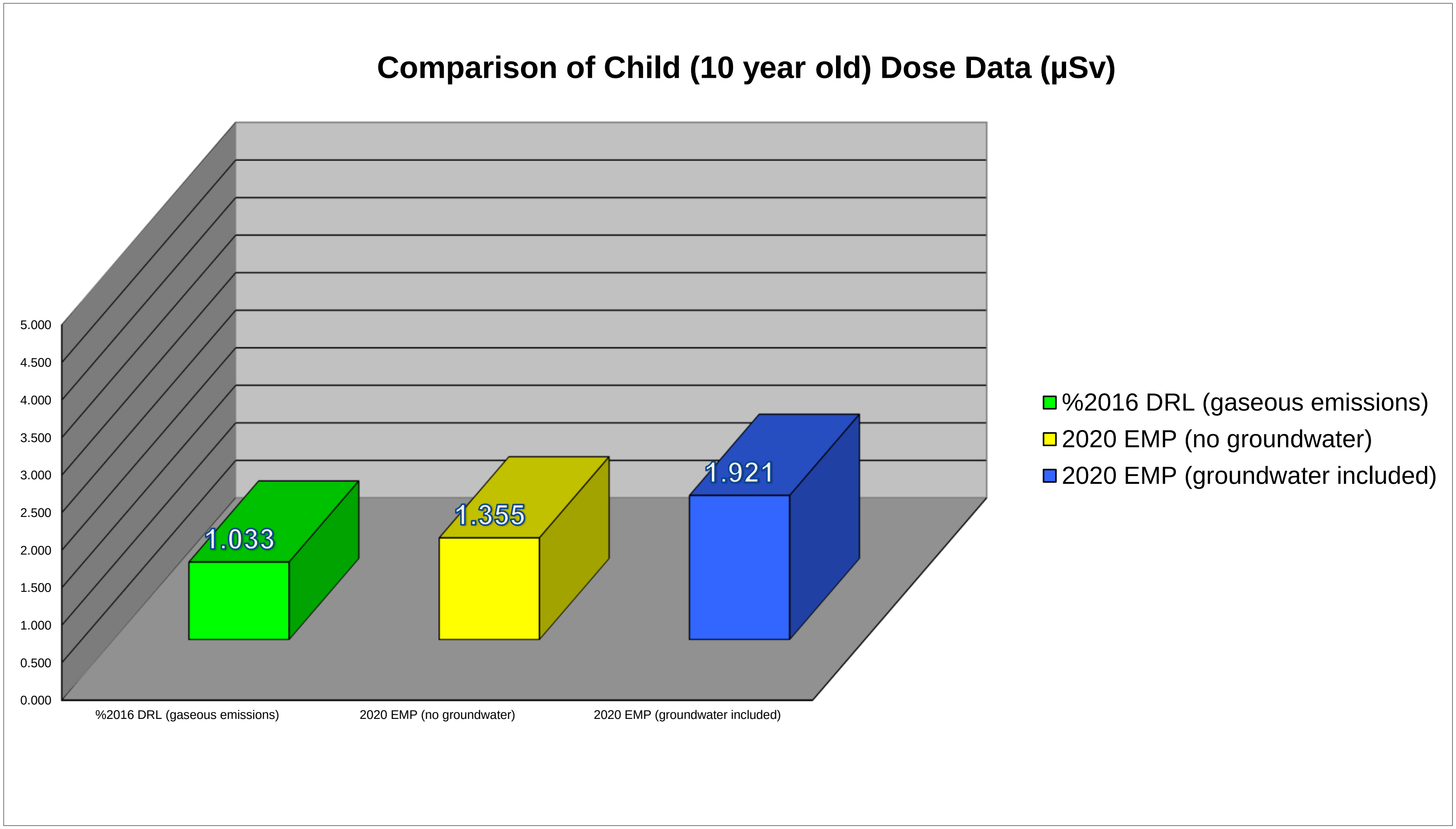
Consumption kg/da x da/a = kg/a		
(kg/da)	**(da/a)**	**(kg/a)**
0.931	365.25	**340.0**

P59 = [HTO]animal produce (Bq/kg) x Ingestion (kg) x DCF				
P59	**[HTO]**	**Ingested**	**DCF**	
(uSv/a)	**(Bq/kg)**	**(kg/a)**	**(uSv/Bq)**	
0.066	**3.670**	**340.0**	5.30E-05	

P59	**0.066**	**uSv/a**

CHILD (10 year old)

Dose Calculation	2020 µSv
%2016 DRL (gaseous emissions)	1.033
2020 EMP (no groundwater)	1.355
2020 EMP (groundwater included)	1.921



CHILD (10 year old)

Stack Emissions

	2020 Emissions as %2016 SRBT DRL	
	CHILD (10 year old)	
Sample End	% weekly DRL	(uSv)
2020-01-07	0.01	0.0025
2020-01-14	0.08	0.0162
2020-01-21	0.06	0.0123
2020-01-28	0.11	0.0211
2020-02-04	0.10	0.0196
2020-02-11	0.08	0.0151
2020-02-18	0.07	0.0129
2020-02-25	0.10	0.0196
2020-03-03	0.07	0.0129
2020-03-10	0.11	0.0211
2020-03-17	0.10	0.0190
2020-03-24	0.09	0.0166
2020-03-31	0.09	0.0171
2020-04-07	0.08	0.0145
2020-04-14	0.06	0.0118
2020-04-21	0.13	0.0252
2020-04-28	0.14	0.0276
2020-05-05	0.16	0.0313
2020-05-12	0.15	0.0287
2020-05-19	0.14	0.0261
2020-05-26	0.14	0.0271
2020-06-02	0.29	0.0557
2020-06-09	0.13	0.0247
2020-06-16	0.12	0.0234
2020-06-23	0.15	0.0285
2020-06-30	0.14	0.0261
2020-07-07	0.09	0.0166
2020-07-14	0.06	0.0114
2020-07-21	0.12	0.0227
2020-07-28	0.18	0.0350
2020-08-04	0.14	0.0261
2020-08-11	0.12	0.0223
2020-08-18	0.10	0.0201
2020-08-25	0.09	0.0171
2020-09-01	0.11	0.0214
2020-09-08	0.08	0.0151
2020-09-15	0.08	0.0145
2020-09-22	0.10	0.0198
2020-09-29	0.09	0.0171
2020-10-06	0.08	0.0158
2020-10-13	0.07	0.0134
2020-10-20	0.07	0.0143
2020-10-27	0.10	0.0188
2020-11-03	0.07	0.0137
2020-11-10	0.11	0.0220
2020-11-17	0.13	0.0250
2020-11-24	0.18	0.0347
2020-12-01	0.05	0.0100
2020-12-08	0.08	0.0147
2020-12-15	0.18	0.0338
2020-12-22	0.08	0.0155
2020-12-29	0.02	0.0031
2021-01-05	0.01	0.0020
Sum (uSv)		**1.053**
Ave. (%DRL)	**0.10**	
Annual Dose Est.	**1.033 uSv/a**	

CHILD (10 year old)
EMP Factors for Dose

Pathways Analysis of Dose to the Public			
		per annum	
Atmospheric HTO inhalation, immersion	P(i)19, P(e)19	1.160	
Surface HTO ingestion	P(i)29	0.566	
Surface HTO immersion	P(e)29	0.000	
External soil exposure	P39	0.000	
Forage & crop ingestion	P49	0.166	
Animal produce ingestion	P59	0.029	
Aquatic animal ingestion	P69	0.000	
Aquatic plant ingestion	P79	0.000	
External sediment exposure	P89	0.000	
Total	**(uSv)**	**1.921**	**uSv/a**
Total without P_{29}	**(uSv)**	**1.355**	**uSv/a**

CHILD (10 year old)
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, and also implicitly captures skin absorption dose P(e)19 as per CSA N288.1-14 Table C.1.

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/m^3)	Volume (m^3)	(uSv/Bq)	(uSv/a)	(uSv/a)	(uSv/a)	Maximum (uSv/a)
1	0.000			3.800E-05				
2	0.000			3.800E-05				
3	0.000			3.800E-05				
4	1.160	3.890	7850.000	3.800E-05	1.160	1.160	1.160	
5	0.000			3.800E-05				
6	0.000			3.800E-05				
7	0.000			3.800E-05				
8	0.000			3.800E-05				
9	0.000			3.800E-05				
10	0.000			3.800E-05				
11	0.000			3.800E-05				
12	0.000			3.800E-05				
13	0.000			3.800E-05				
			P(i)19	**Sum**	**1.160**	**1.160**	**1.160**	**1.160** uSv/a

CHILD (10 year old)
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	Jan. 9, 2020												
2	0.450	37	482.1	2.50E-05	Feb. 6, 2020												
3	0.566	47	482.1	2.50E-05	Mar. 6, 2020		39	49		7	6	4					
4	0.000	0	482.1	2.50E-05	Apr. 3, 2020												
5	0.072	6	482.1	2.50E-05	May 6, 2020												
6	0.060	5	482.1	2.50E-05	Jun. 2, 2020												
7	0.048	4	482.1	2.50E-05	Jul. 2, 2020		38	47		4	4	4					
8	0.000	0	482.1	2.50E-05	Aug. 5, 2020												
9	0.000	0	482.1	2.50E-05	Sep. 2, 2020												
10	0.000	0	482.1	2.50E-05	Oct. 5, 2020												
11	0.000	0	482.1	2.50E-05	Nov. 5, 2020		35	45		7	5	4					
12	0.000	0	482.1	2.50E-05	Dec. 4, 2020												
Avg P(i)29	**0.100**	**uSv/annum**															
					Average		**37**	**47**		**6**	**5**	**4**					

Well 1	*No longer sampled*
Well 2	185 Mud Lake Road
Well 3	183 Mud Lake Road
Well 4	*No longer sampled*
Well 5	171 Sawmill Road
Well 6	40987 Highway 41
Well 7	40925 Highway 41
Well 8	*No longer sampled*
Well 9	*No longer sampled*
Well 10	*No longer sampled*
Well 11	*No longer sampled*
Well 12	*No longer sampled*

P(e)29 is the pathway of exposure to HTO due to immersion in surface water.
P(e)29 is considered negligible as surface waters throughout 2019 were measured as <detectable.

P(e)29 = 0.000 uSv/a

RW-3	**P(i)29**	**0.566**	**uSv/a**
	P(e)29	**0.000**	**uSv/a**
	P29	**0.566**	**uSv/a**

CHILD (10 year old)
EMP Factors for Dose P49

P49 is the pathway for exposure to HTO due to ingestion of forage and crops.

Produce Sample Results (Bq free water tritium / kg fresh weight)																	
Source	Market					Home											
Type	Beans	Tomato	Onion	Carrot	Average	LOCATION	Tomato	Apple	Pepper	Onion	Herbs	Carrot	Zucchini	Corn	Beet	Bean	Average
	4	3	3	2	3.0	413 SWEEZEY COURT		75	32	62	11						45.0
						406 BOUNDARY ROAD		48									48.0
						408 BOUNDARY ROAD	63										63.0
						611 MOSS DRIVE	86					16					51.0
						171 SAWMILL ROAD						4	4	5	3	5	4.2
Average					3.0		74.5	61.5	32.0	62.0	11.0	10.0	4.0	5.0	3.0	5.0	42.2
Produce Sample Results (Bq organically bound tritium / kg fresh weight)																	
Comm.				Tomato 1.00	1.0	408 BOUNDARY ROAD	3.0										3.0

Produce Consumption						
100%=	265.200	kg/a	[HTO] (Bq/kg)	(Bq/a)	[OBT] (Bq/kg)	(Bq/a)
70%	185.640	**kg/a**	3.0	556.92	1.0	185.64
30%	79.560	**kg/a**	63.0	5012.28	3.0	238.68

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)
0.166	5569.20	2.50E-05	424.32	6.30E-05

P49	**0.166**	**uSv/a**

CHILD (10 year old)
EMP Factors for Dose P59

P59 is the exposure to HTO due to ingestion of animal produce.

2020 Sample Results

Local Producer	
	(Bq/L)
1	4.70
2	4.00
3	3.00
Average	3.90

Local Distributor	
	(Bq/L)
1	4.00
2	4.00
3	3.00
Average	3.67

TOTAL AVERAGE	3.78	Bq/L

Milk Density Adjustment		
Milk Average (Bq/L) x Milk density (L/kg)		
Bq/L	L/kg	Bq/kg
3.78	0.97	3.670

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)	
0.029	3.670	319.6	2.50E-05	

P59	0.029	uSv/a

APPENDIX T

Outgoing Shipments Containing Radioactive Material for 2020

Outgoing Shipments Containing Radioactive Material - 2020

Month	Number of Shipments
January	95
February	70
March	91
April	71
May	60
June	55
July	68
August	52
September	59
October	81
November	75
December	50
TOTAL	**827**
Average per month	69

Distribution of Outgoing Shipments

Country	Number of Shipments
United States	455
Canada	310
United Kingdom	22
Mexico	8
Israel	5
The Netherlands	4
Switzerland	4
South Korea	4
Singapore	3
France	2
Germany	2
Australia	1
Bulgaria	1
China	1
New Zealand	1
Norway	1
South Africa	1
Thailand	1
Turkey	1

APPENDIX U

Incoming Shipments Containing Radioactive Material for 2020

Incoming Shipments Containing Radioactive Material - 2020

Month	Number of Shipments
January	42
February	42
March	17
April	21
May	10
June	15
July	19
August	27
September	10
October	21
November	17
December	31
TOTAL	**272**
Average per month	23

Distribution of Incoming Shipments

Country	Number of Shipments
United States	251
Canada	12
Japan	3
United Kingdom	2
Belgium	1
Germany	1
Singapore	1
South Korea	1