Canadian Nuclear Safety Commission | Commission canadienne de sûreté nucléaire

Canada

Regulatory Oversight Report for Uranium and Nuclear Substance Processing Facilities in Canada: 2019

Commission Meeting
December 8, 2020
CMD 20-M36.A

CNSC Staff Presentation

e-Doc 6345506 (PPTX)
e-Doc 6376097 (PDF)

Presentation Outline

- **Overview of CNSC Regulatory Oversight**
  - Safety and control area performance ratings
  - Independent Environmental Monitoring Program
  - Public and Indigenous engagement
- **Safety Performance of Uranium Processing Facilities**
- **Safety Performance of Nuclear Substance Processing Facilities**
- **Participant Funding and Interventions**

Uranium Processing Facilities
Cameco Blind River Refinery
Cameco Port Hope Conversion Facility
Cameco Fuel Manufacturing Inc.
BWXT Nuclear Energy Canada Inc.

Nuclear Substance Processing Facilities
SRB Technologies (Canada) Inc.
Nordion (Canada) Inc.
Best Theratronics Ltd.

CNSC Regulatory Oversight Reports - 2019

- **November 5, 2020:** Use of Nuclear Substances in Canada
- **December 8 to 10, 2020:**
  - **Uranium Processing and Nuclear Substance Processing Facilities**
  - Canadian Nuclear Power Generating Sites
  - Canadian Nuclear Laboratories Sites
  - Uranium Mines and Mills

Summary and highlights of CNSC staff oversight activities across nuclear industry for 2019

CNSC Regulatory Oversight Reports - 2019

- November 4, 2020: Use of Nuclear Substances in Canada
- December 8 to 10, 2020:
  - Canadian Nuclear Laboratories Sites
  - Uranium Processing and Nuclear Substance Processing Facilities
  - Uranium Mines and Mills
  - Canadian Nuclear Power Generating Sites

Summary and highlights of CNSC staff oversight activities across nuclear industry for 2019

Follow Up from Last Year's Regulatory Oversight Report (ROR)

Commission requested two follow-up actions from last year's ROR

- Licensee to provide a direct point of contact to CNSC staff so that it can then be made publicly available to assist intervenors
  - Status: Completed
- CNSC staff to provide a summary of the basis behind Derived Release Limits (DRLs)
  - Status: Attached as Appendix M of CMD 20-M36

ROR for Uranium and Nuclear Substance Processing Facilities in Canada: 2019

Key Topics:

- CNSC's regulatory efforts
- Ratings of licensee performance for the 14 safety and control areas (SCAs) with a focus on:
  - Radiation protection
  - Environmental protection
  - Conventional health and safety
- Licensing and compliance verification activities, significant events and changes in performance ratings at uranium and nuclear substance processing facilities

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CNSC REGULATORY OVERSIGHT

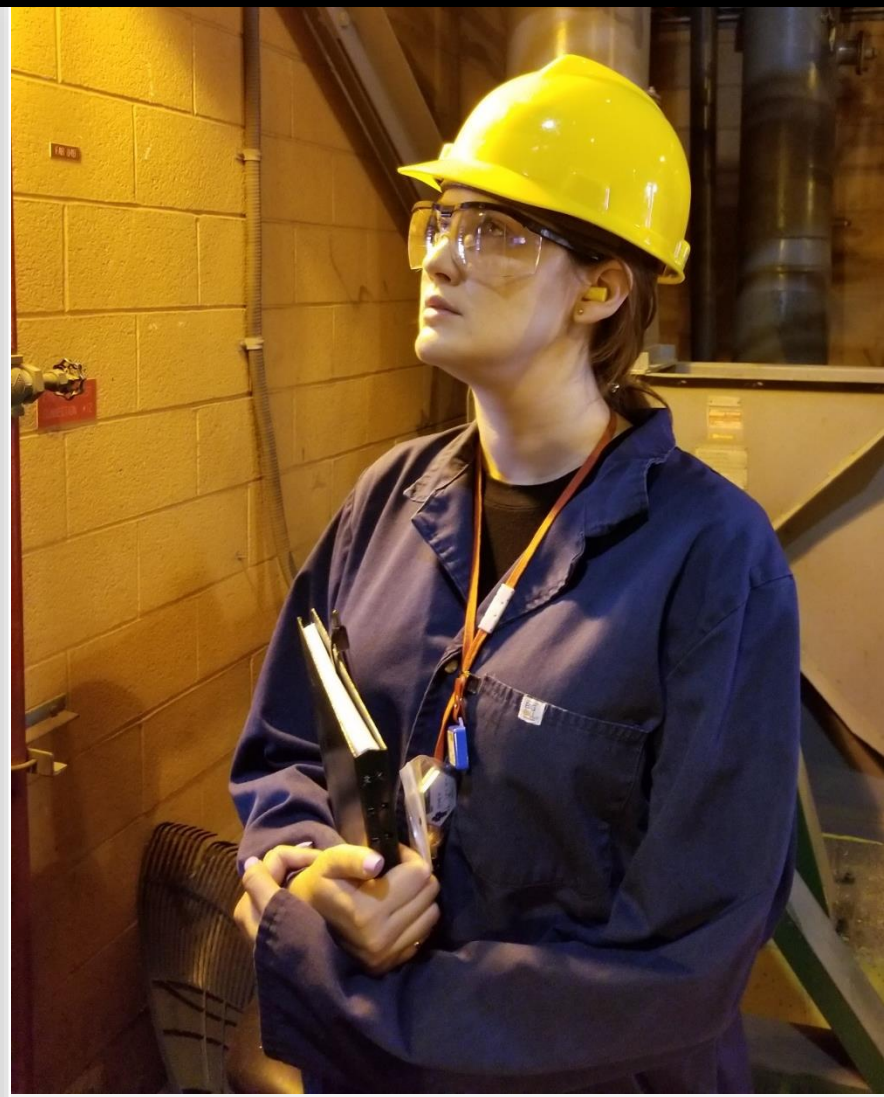
CNSC Regulatory Oversight

Regulatory oversight includes licensing, compliance verification and reporting activities.

Compliance is verified through:

- Inspection/verification activities
- Reviews of operational activities and documentation
- Licensee reporting of performance data, including annual reports and unusual occurrences

Risk-informed and performance-based approach



CNSC inspector during a facility walkdown at Cameco Blind River Refinery in 2019. *Source: CNSC*

CNSC Regulatory Oversight

Ratings and Performance

Safety and control areas (SCAs) are used to assess and evaluate licensee performance.

CNSC staff rate performance as:

- Satisfactory (SA)
- Below expectations (BE)

Ratings are derived from results of regulatory oversight activities.

Safety and Control Areas
Management System
Human Performance Management
Operating Performance
Safety Analysis
Physical Design
Fitness for Service
Radiation Protection
Conventional Health and Safety
Environmental Protection
Emergency Management and Fire Protection
Waste Management
Security
Safeguards and Non-Proliferation
Packaging and Transport

CNSC Regulatory Oversight

Ratings and Performance

CNSC staff use expert professional judgement to rate performance based on multiple inputs, including:

- Key performance indicators
- Results of compliance verification activities
- Repeat instances of non-compliance
- Effectiveness of licensee corrective actions

Ratings represent a holistic summary of each SCA

Independent Environmental Monitoring Program (IEMP)

CNSC staff sample air, water, soil, vegetation, and various foods to independently verify that the public and the environment are protected.

In 2019, CNSC staff conducted IEMP sampling around:

- BWXT Toronto
- BWXT Peterborough

All IEMP results are posted on the CNSC's website

CNSC staff taking soil samples near the BWXT facility in Peterborough, Ontario in 2019.

Source: CNSC

Public and Indigenous Engagement

CNSC staff routinely engage with the public and Indigenous groups. Examples include:

- Participation in relevant community events as a means to inform the public of the CNSC's role
  - Engagement with local municipalities
  - CNSC Open House events
  - Participation in licensee events
- Engagement and consultation with Indigenous groups to discuss issues of concern to CNSC-regulated activities

CNSC staff providing information to participants attending an open house in Peterborough, 2020.

Source: CNSC

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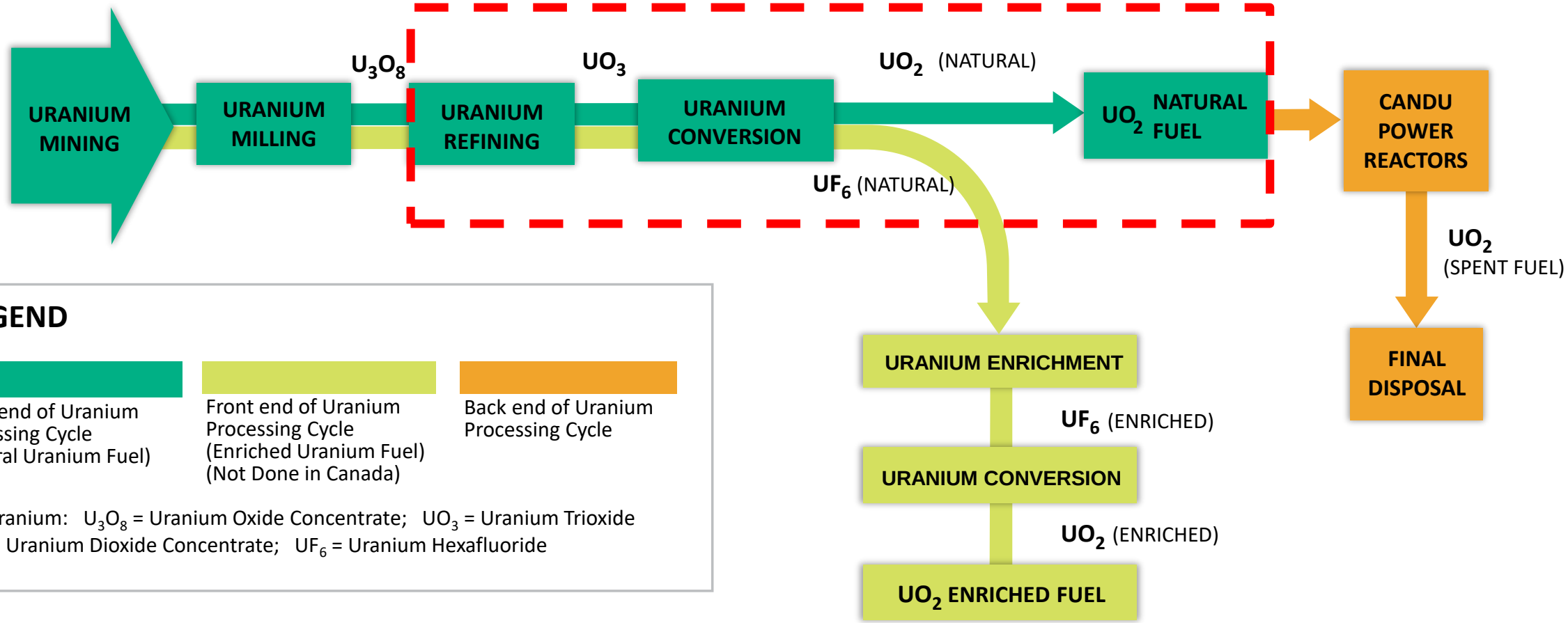
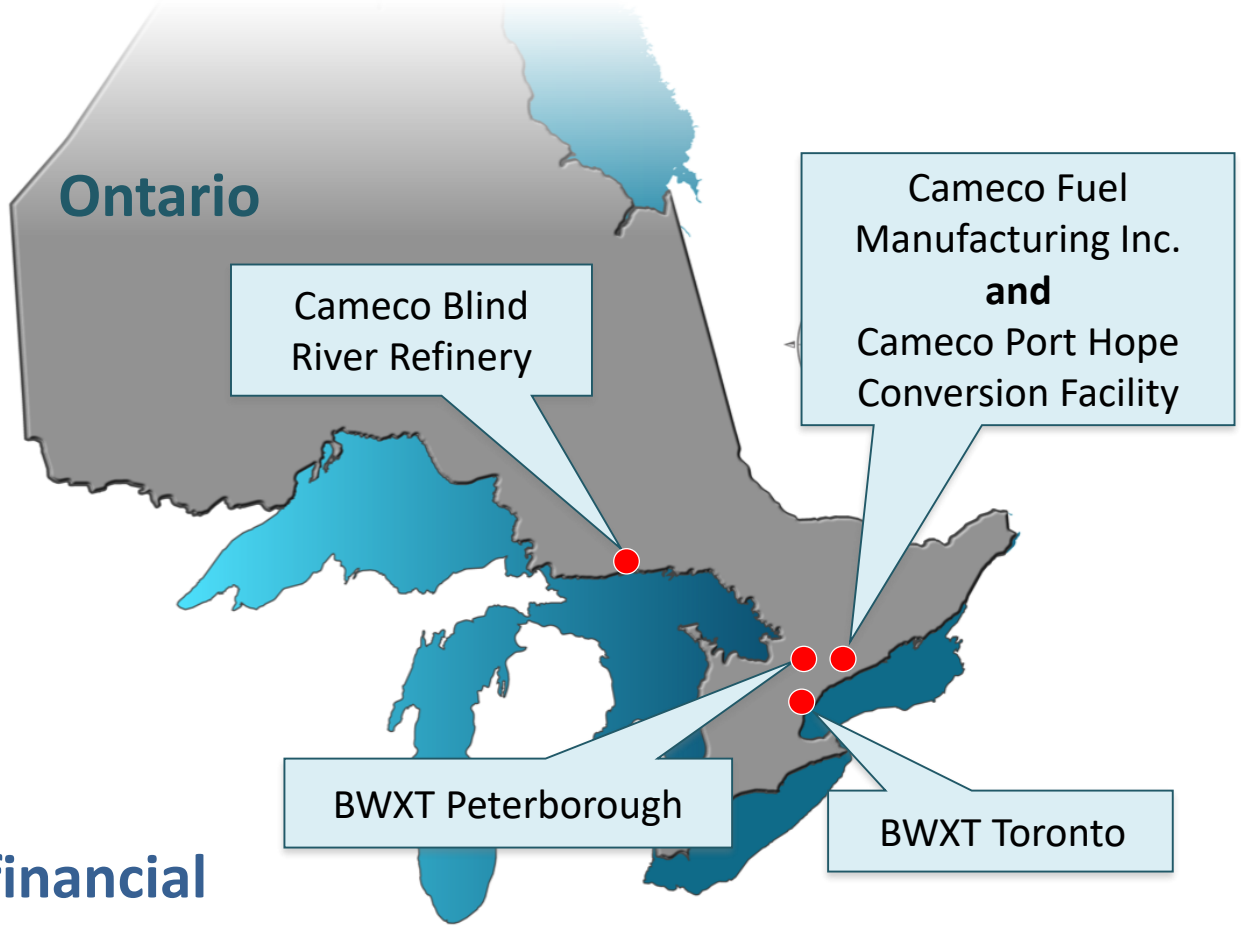
URANIUM PROCESSING FACILITIES

Nuclear Fuel Cycle



Uranium Processing Facilities

Facility	Licence Expiry	Financial Guarantee (approx.)
Cameco Blind River Refinery	February 2022	$48M
Cameco Port Hope Conversion Facility	February 2027	$128.6M
Cameco Fuel Manufacturing Inc.	February 2022	$21M
BWXT Toronto and Peterborough	December 2020	$52.4M



All uranium processing facilities have valid financial guarantees in place for decommissioning

Uranium Processing Facilities
Regulatory Oversight 2019

	Blind River Refinery	Port Hope Conversion Facility	Cameco Fuel Manufacturing	BWXT Toronto and Peterborough	Totals
Person Days for Licensing	11	7	17	302	**337**
Person Days for Compliance	157	275	200	232	**864**
Number of Inspections	4	4	3	3	**14**
Inspection Action Items	26	17	17	5	**65**
Enforcement Actions	0	0	0	0	**0**
Number of Safeguards Inspections led by IAEA*	3	6	4	6	**19**

*Note: Canada has met its international obligations on the peaceful use of nuclear energy.

Uranium Processing Facilities
Performance Ratings 2019

Legend

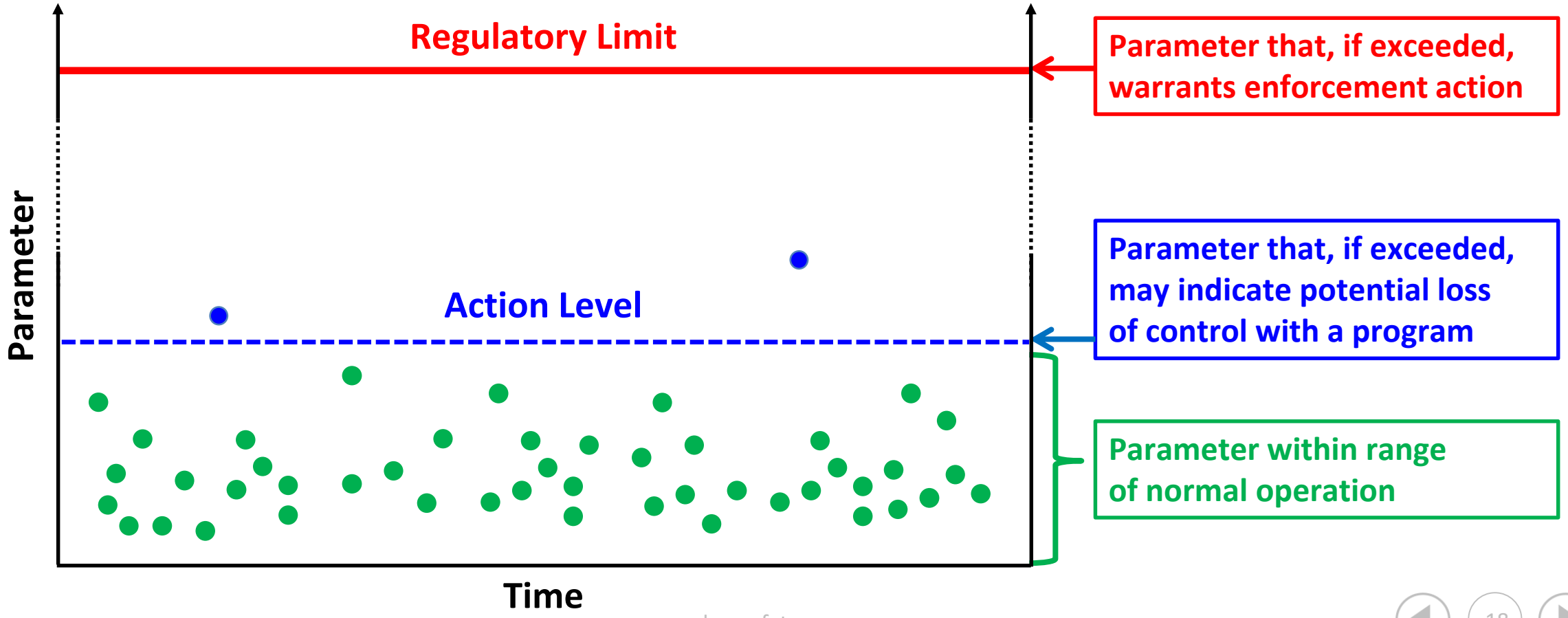
SA = Satisfactory

BE = Below Expectations

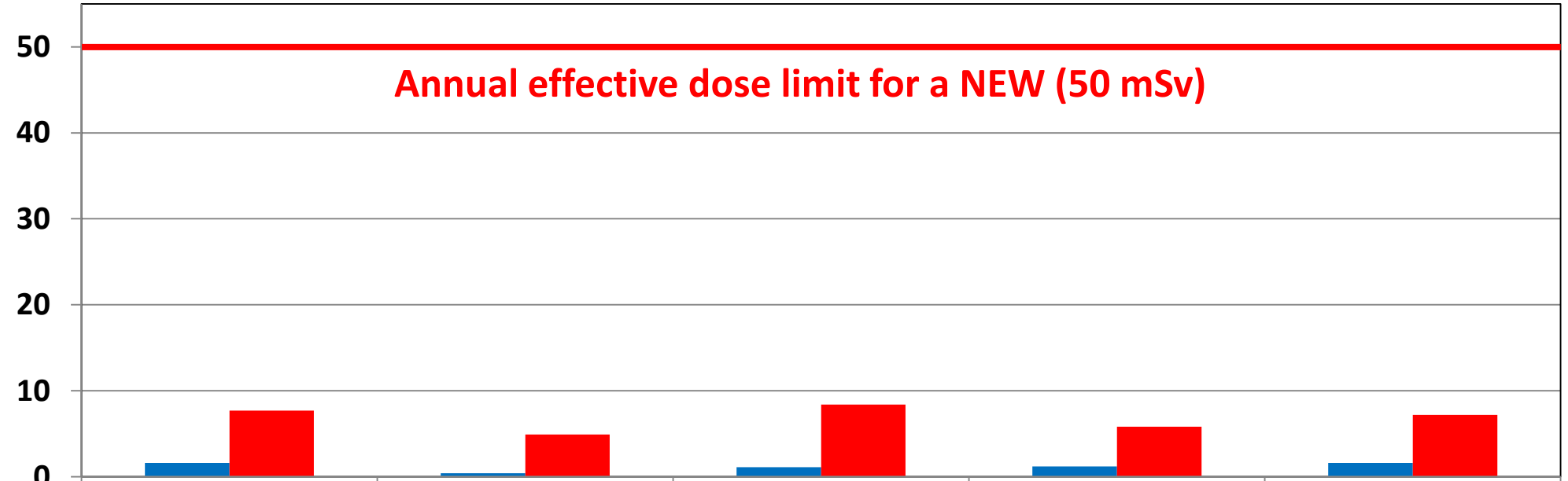
Safety and Control Area	Blind River Refinery	Port Hope Conversion Facility	Cameco Fuel Manufacturing	BWXT Toronto and Peterborough
Management System	SA	SA	SA	SA
Human Performance Management	SA	SA	SA	SA
Operating Performance	SA	SA	SA	SA
Safety Analysis	SA	SA	SA	SA
Physical Design	SA	SA	SA	SA
Fitness for Service	SA	SA	SA	SA
Radiation Protection	SA	SA	SA	SA
Conventional Health and Safety	SA	SA	SA	SA
Environmental Protection	SA	SA	SA	SA
Emergency Management and Fire Protection	SA	SA	SA	SA
Waste Management	SA	SA	SA	SA
Security	SA	SA	SA	SA
Safeguards and Non-Proliferation	SA	SA	SA	SA
Packaging and Transport	SA	SA	SA	SA

CNSC Regulatory Oversight

Regulatory Limits and Action Levels



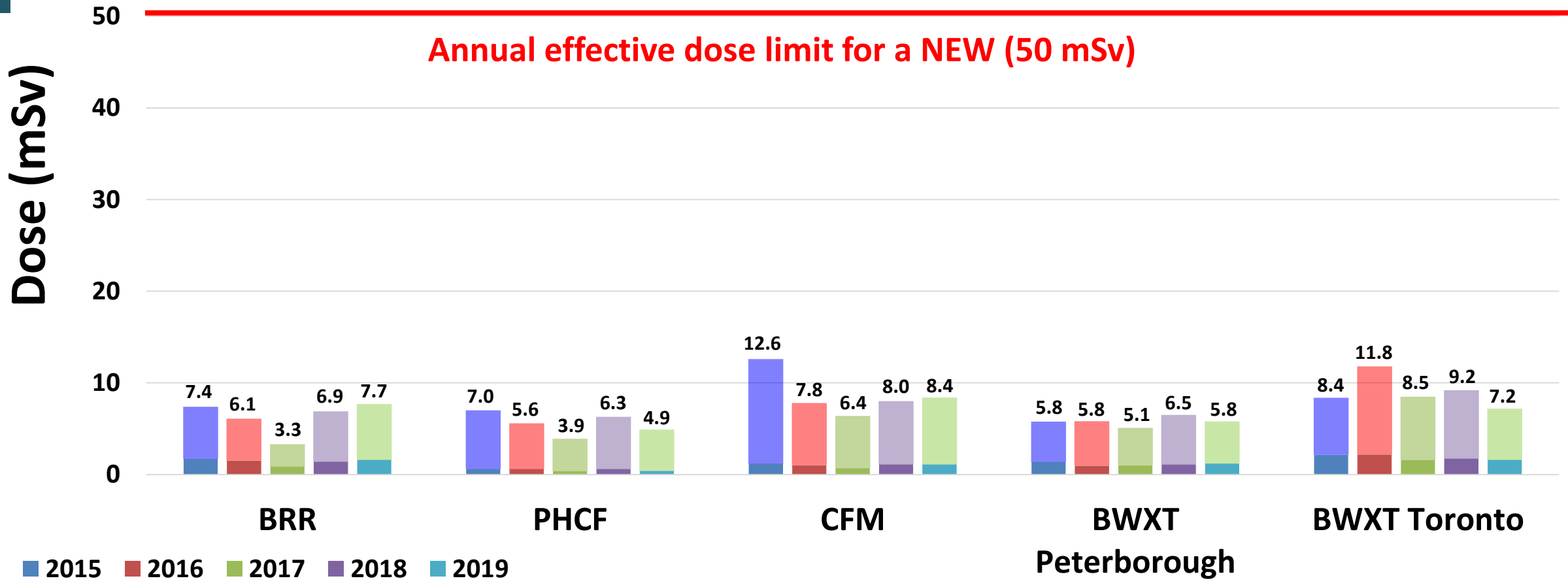
Radiation Protection
2019 Average and Maximum Effective Doses to Nuclear Energy Workers (NEWs)



	Cameco BRR	Cameco PHCF	CFM	BWXT Peterborough	BWXT Toronto
Average effective dose (mSv)	1.6	0.4	1.1	1.2	1.6
Maximum effective dose (mSv)	7.7	4.9	8.4	5.8	7.2

Note: In addition to the annual effective dose limit of 50 mSv in any one year, a regulatory dose limit of 100 mSv over a defined five-year dosimetry period is applied for a NEW

Radiation Protection
Dose to Nuclear Energy Workers (NEWs) 2015-2019 – 5 Year Trend



Radiation Protection

Action Level Exceedances

Two radiation protection action levels exceeded at BRR

Parameter	Dose (msV)	Action Level (mSv)
Quarterly Whole Body Dose	0.72	0.7
Quarterly Skin Dose	13.62	6.0

- Cameco initiated an investigation in accordance with their corrective action process, determined that exposures were mostly non-personal in nature
- Cameco has implemented additional administrative controls

CNSC staff reviewed and are satisfied with response taken by licensee

Radiation Protection

Action Level Exceedances

One radiation protection action level exceeded at CFM

Parameter	Dose (msV)	Action Level (mSv)
Quarterly Extremity Dose	73.7	55

- Cameco initiated an investigation in accordance with their corrective action process, determined that exposures were mostly non-personal in nature
- Cameco has implemented additional administrative controls

CNSC staff reviewed and are satisfied with response taken by licensee

Uranium Processing Facilities

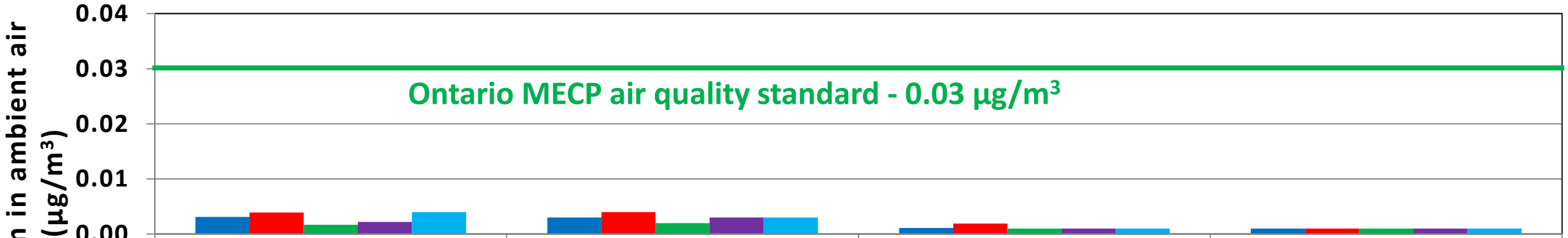
Dose to Public (mSv) 2015-2019 – 5 Year Trend

Facility	Year					Regulatory Limit
	2015	2016	2017	2018	2019	
Cameco Blind River Refinery	0.005	0.005	0.005	0.005	0.005	1 mSv/year
Cameco Port Hope Conversion Facility	0.006	0.020	0.153*	0.173	0.127	
Cameco Fuel Manufacturing	0.025	0.023	0.022	0.030	0.027	
BWXT Toronto	0.010	0.0007	0.0175	0.0004	0.023	
BWXT Peterborough	<0.001	<0.001	<0.001	<0.001	0.0115	

*For 2017, Cameco PHCF's increased dose to the public is due to an update to their public dose calculations which include a more conservative dose estimate compared to previous years. There has been no increase in environmental releases or gamma dose from the PHCF and, as a result, there is no increased risk to the public.

Environmental Protection

Uranium in Ambient Air 2015-2019 – 5 Year Trend

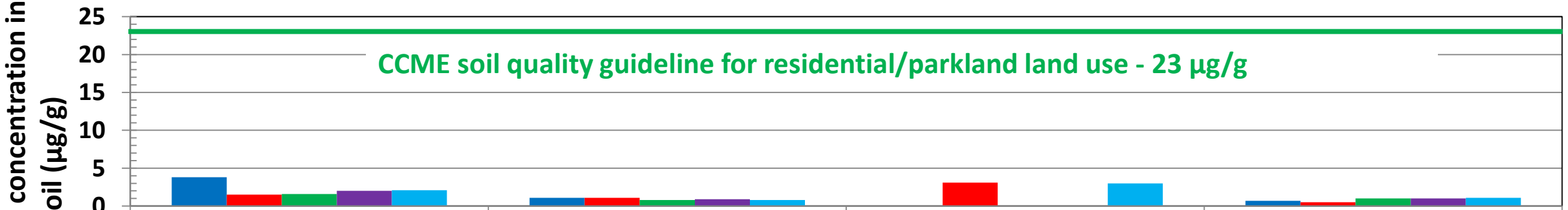


	Cameco BRR	Cameco PHCF	CFM	BWXT Toronto
2015	0.0031	0.0030	0.0011	0.0010
2016	0.0039	0.0040	0.0019	0.0010
2017	0.0017	0.0020	< 0.0010	<0.0010
2018	0.0022	0.0030	< 0.0010	<0.0010
2019	0.0040	0.0030	< 0.0010	<0.0010

Note: BWXT Peterborough does not conduct ambient air monitoring as emissions at the point of release are already below the Ontario Ministry of the Environment, Conservation and Parks (MECP) air quality standard for uranium.

Environmental Protection

Uranium Concentrations in Soil 2015-2019 – 5 Year Trend



	Cameco BRR	Cameco PHCF	CFM*	BWXT Toronto
2015	3.8	1.1	N/A	0.7
2016	1.5	1.1	3.1	0.5
2017	1.6	0.8	N/A	1.0
2018	2.0	0.9	N/A	< 1.0 **
2019	2.1	0.8	3.0	1.1

*Cameco Fuel Manufacturing (CFM) samples soil on a 3-year frequency
** Below Laboratory Detection Limit
Note: BWXT Peterborough does not conduct soil monitoring due to extremely low stack emissions.
CCME = Canadian Council of Ministers of the Environment

Environmental Protection

Action Level Exceedances

- In 2019, PHCF reported a fluoride measurement of 266 g HF/h which exceeds the action level of 230 g HF/h
- The action level was exceeded due to a cell gland failure and did not pose a risk to people or the environment
- Cameco isolated the cell which resulted in fluoride concentrations returning to normal
- Corrective actions include revising the procedure on how to troubleshoot a cell failure and how to adequately implement isolation and purging techniques.

CNSC staff reviewed and are satisfied with response taken by licensee

Environmental Protection

Action Level Exceedances

- In 2019, PHCF reported 18 action level exceedances for uranium discharges from the sanitary sewer
- Cameco's investigations attributed this to heavy rainfall leading to groundwater infiltration into sanitary sewer piping
- Releases were below regulatory limits with no impact on the environment
- Corrective actions include sealing the identified infiltration sources and upgrading the sanitary sewer system

CNSC staff reviewed and are satisfied with response taken by licensee

Conventional Health and Safety

Lost-Time Injuries (LTI) 2015-2019 – 5 Year Trend

Facility	Statistic	2015	2016	2017	2018	2019
Cameco Blind River Refinery	LTI	0	0	0	0	0
	Severity Rate	0	0	0	0	0
	Frequency Rate	0	0	0	0	0
Cameco Port Hope Conversion Facility	LTI	1	4	1	2	0
	Severity Rate	7.64	2.40	1.67	7.58	0
	Frequency Rate	0.26	0.80	0.28	0.49	0
Cameco Fuel Manufacturing	LTI	1	0	0	0	0
	Severity Rate	0.6	0	0	0	0
	Frequency Rate	0.6	0	0	0	0
BWXT Peterborough and Toronto	LTI	0	0	0	0	0
	Severity Rate	0	0	0	0	0
	Frequency Rate	0	0	0	0	0

Severity rate: Total days lost to injury/200,000 person-hours worked
Frequency rate: Number of LTIs/200,000 person-hours worked

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FACILITY HIGHLIGHTS

Facility Highlights

Uranium Processing Facilities

Highlights	BRR	PHCF	CFM	BWXT
Changes to facility operations	0	0	0	0
Licensing decisions	0	0	0	0
Licence Conditions Handbook Update	0	0	0	0
Regulatory limit exceedances	0	0	0	0
Action Level exceedances	2	19	1	0
Lost-time Injuries	0	0	0	0

Facility Highlights

Blind River Refinery

- Regular compliance verification activities
- CNSC staff conducted four inspections in 2019:
  - General
  - Emergency Management and Fire Protection
  - Packaging and Transport
  - Fitness for Service
- One event reported to the CNSC in accordance with CNSC reporting requirements

UO_3 tote bin loading and handling station at the Blind River Refinery.

Photo source: Cameco

Facility Highlights

Port Hope Conversion Facility

- Regular compliance verification activities
- CNSC staff conducted four inspections in 2019:
  - Two General
  - Security
  - Emergency Management and Fire Protection
- Thirteen events reported to the CNSC in accordance with CNSC reporting requirements

Side view of Port Hope Conversion Facility
Source: Cameco

Facility Highlights

Port Hope Conversion Facility

- Cameco continues to carry out work related to its Vision in Motion Project
  - Building demolition was completed at the Centre Pier and the demolition waste was transferred to the LTWMF
- CNSC staff conducted an inspection in 2019 to verify activities at Centre Pier
  - Confirmed that Centre Pier can be safely removed from PHCF's licensed area
  - Centre Pier is currently under the care and control of CNL to undergo further remediation

CNSC inspector observing demolition activities at Centre Pier in Port Hope, 2019.

Source: CNSC

Facility Highlights

Cameco Fuel Manufacturing

- Regular compliance verification activities
- CNSC staff conducted three inspections in 2019:
  - General
  - Management System
  - Emergency Management and Fire Protection
- One event reported to the CNSC in accordance with CNSC reporting requirements

A CFM worker performing a final inspection on a fuel bundle prior to packaging.

Photo source: Cameco

Facility Highlights

BWXT Toronto and Peterborough

- Increase in licensing effort due to licence renewal application submission in November 2018
- Regular compliance verification activities
- CNSC staff conducted three inspections in 2019:
  - General
  - Management System
  - Radiation Protection
- BWXT reported two events in accordance with its regulatory reporting requirements

CNSC inspector during a facility walkdown at BWXT Toronto, 2019.

Source: CNSC

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NUCLEAR SUBSTANCE PROCESSING FACILITIES

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Nuclear Substance Processing Facilities

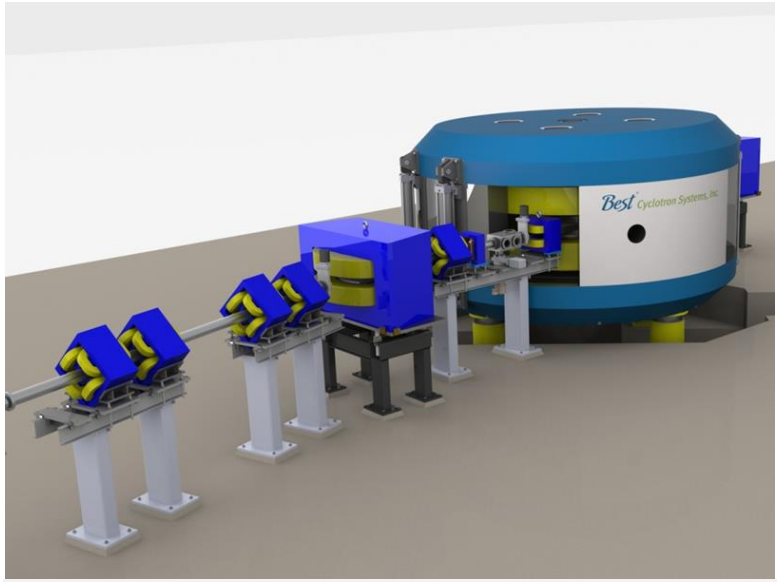
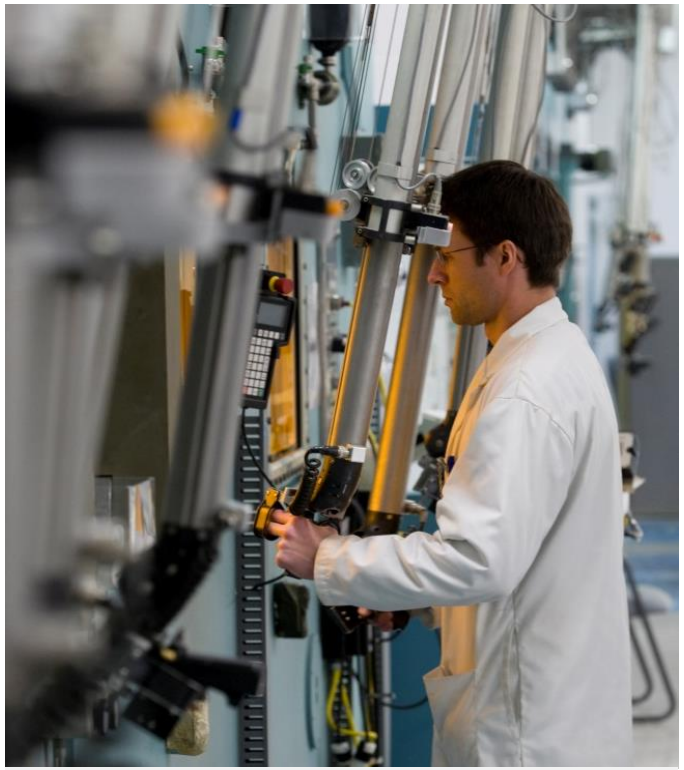


Image of a 70 MeV cyclotron manufactured by BTL.

Source: BTL



Nordion personnel working with a hot cell manipulator.

Source: Nordion

Exit Signs

Safety Markers

Raw Light Sources

Safety Signs

Tactical Devices

Source: SRB Technologies

Nuclear Substance Processing Facilities

Facility	Licence Expiry	Financial Guarantee (approx.)
SRB Technologies (Canada) Inc.	June 2022	$0.73M
Nordion (Canada) Inc.	October 2025	$45.1M
Best Theratronics Ltd.	June 2029	$1.8M

All nuclear substance processing facilities have valid financial guarantees in place for decommissioning

Nuclear Substance Processing Facilities
Regulatory Oversight in 2019

	SRB Technologies (Canada) Inc.	Nordion (Canada) Inc.	Best Theratronics Ltd.	Totals
Person Days for Licensing	2	20	225	**247**
Person Days for Compliance	110	91	66	**267**
Number of Inspections	2	4	1	**7**
Inspection Action Items	6	3	1	**10**
Enforcement Actions	0	0	0	**0**
Number of Safeguards Inspections led by IAEA*	0	1	0	**1**

*Note: Canada has met its international obligation on the peaceful use of nuclear energy.

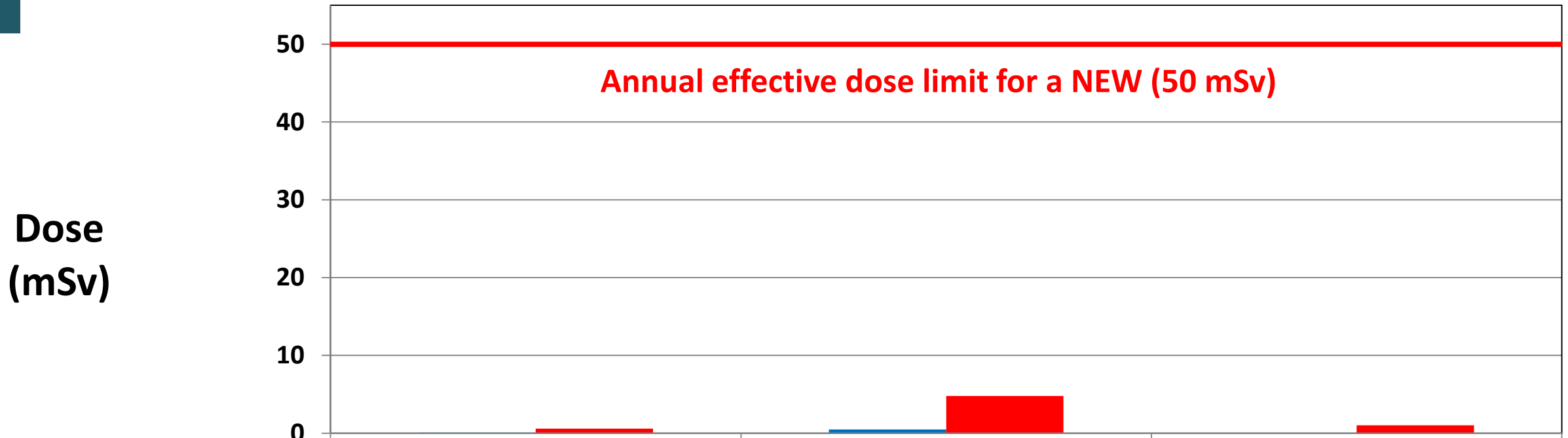
Nuclear Substance Processing Facilities
Performance Ratings 2019

Legend

SA = Satisfactory
BE = Below Expectations
N/A = Not Applicable

Safety and Control Area	SRB Technologies (Canada) Inc.	Nordion (Canada) Inc.	Best Theratronics Ltd.
Management System	SA	SA	SA
Human Performance Management	SA	SA	SA
Operating Performance	SA	SA	SA
Safety Analysis	SA	SA	SA
Physical Design	SA	SA	SA
Fitness for Service	SA	SA	SA
Radiation Protection	SA	SA	SA
Conventional Health and Safety	SA	SA	SA
Environmental Protection	SA	SA	SA
Emergency Management and Fire Protection	SA	SA	SA
Waste Management	SA	SA	SA
Security	SA	SA	SA
Safeguards and Non-Proliferation	N/A	SA	SA
Packaging and Transport	SA	SA	SA

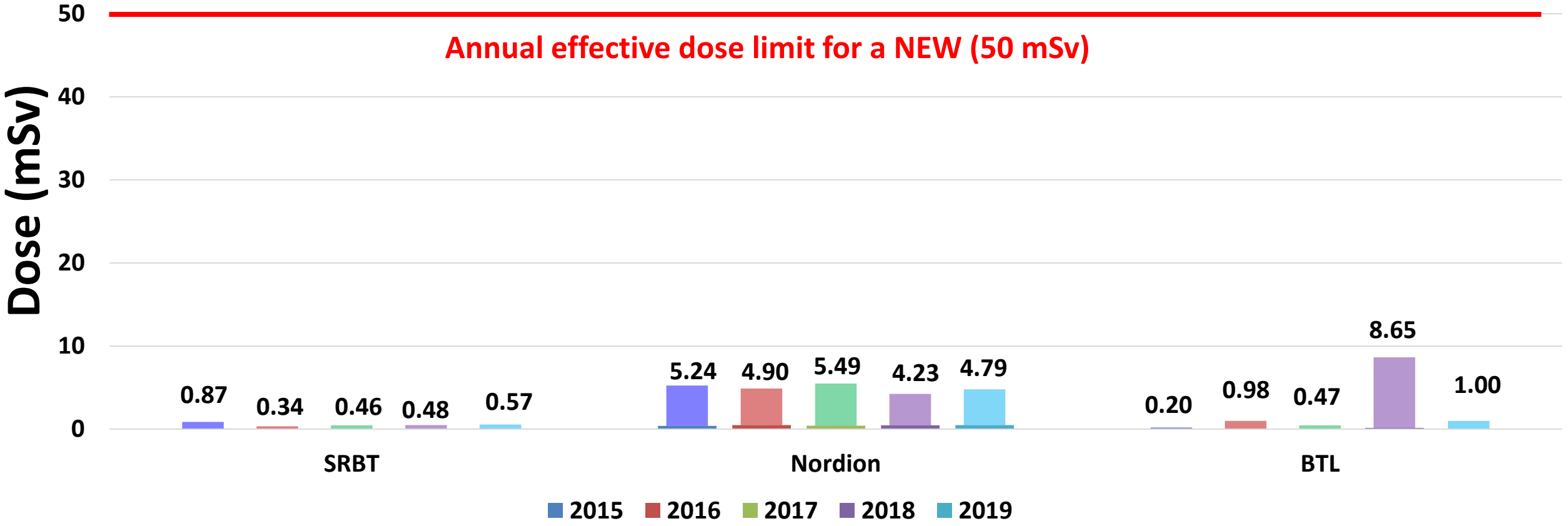
Radiation Protection
2019 Average and Maximum Effective Doses to Nuclear Energy Workers (NEWs)



	SRBT	Nordion	BTL
Average effective dose (mSv)	0.07	0.48	0.04
Maximum effective dose (mSv)	0.57	4.79	1.00

Note: In addition to the annual effective dose limit of 50 mSv in any one year, a regulatory dose limit of 100 mSv over a defined five-year dosimetry period is applied for a NEW

Radiation Protection
Dose to Nuclear Energy Workers (NEWs) 2015-2019 – 5 Year Trend



Nuclear Substance Processing Facilities

Dose to Public 2015-2019 (mSv) – 5 Year Trend

Facility	Year					Regulatory limit
	2015	2016	2017	2018	2019	
SRB Technologies	0.0068	0.0046	0.0033	0.0038	0.0021	1 mSv/year
Nordion	0.0057	0.0021	0.000052	0.000067	0.00087	
Best Theratronics	N/A	N/A	N/A	N/A	N/A	

N/A = Not applicable

Public dose estimates are not provided for Best Theratronics Ltd. because its licensed activities involve sealed sources and there are no discharges to the environment

Conventional Health and Safety

Lost-Time Injuries (LTI) 2015-2019 – 5 Year Trend

Facility	Statistic	2015	2016	2017	2018	2019
SRBT	LTI	0	0	3	0	0
	Severity Rate	0	0	17.7	0	0
	Frequency Rate	0	0	7.6	0	0
Nordion	LTI	0	3	1	0	2
	Severity Rate	0	70.04	5.61	0	4.15
	Frequency Rate	0	2.32	0.93	0	0.69
BTL	LTI	1	3	1	2	2
	Severity Rate	0.68	37.61	15.04	8.21	5.47
	Frequency Rate	0.68	2.05	0.68	1.37	1.37

Severity rate: Total days lost to injury/200,000 person-hours worked
Frequency rate: Number of LTIs/200,000 person-hours worked

Conventional Health and Safety

Lost-Time Injuries

Nordion reported two LTIs in 2019

- An employee sustained a low back injury when trying to open double lead doors on one of the hot cells
- An employee incurred lower back pain when removing wood bracing from the ground of a sea crate container.

Nordion conducted investigations and implemented corrective actions to prevent recurrence.

CNSC staff reviewed and are satisfied with response taken by licensee

Conventional Health and Safety

Lost-Time Injuries

BTL reported two LTIs in 2019

- An employee strained their back when physically moving wooden ramps to loading dock
- An employee cut their hand while working on a product that was not deburred

BTL conducted investigations and implemented corrective actions to prevent recurrence.

CNSC staff reviewed and are satisfied with response taken by licensee

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FACILITY HIGHLIGHTS

Facility Highlights

Nuclear Substance Processing Facilities

2019 Highlights	SRBT	Nordion	BTL
Changes to facility operations	0	0	0
Licensing decisions	0	1	1
Licence Conditions Handbook Updates	0	2	1
Regulatory limit exceedances	0	0	0
Action Level exceedances	0	0	0
Lost-time Injuries	0	2	2

Facility Highlights

SRB Technologies (Canada) Inc.

- Regular compliance verification activities
- CNSC staff conducted two inspections in 2019:
  - General
  - Environmental Protection
- Two events reported to the CNSC in accordance with SRBT's reporting requirements

SRBT employee performing tritium filling operations

Source: SRBT

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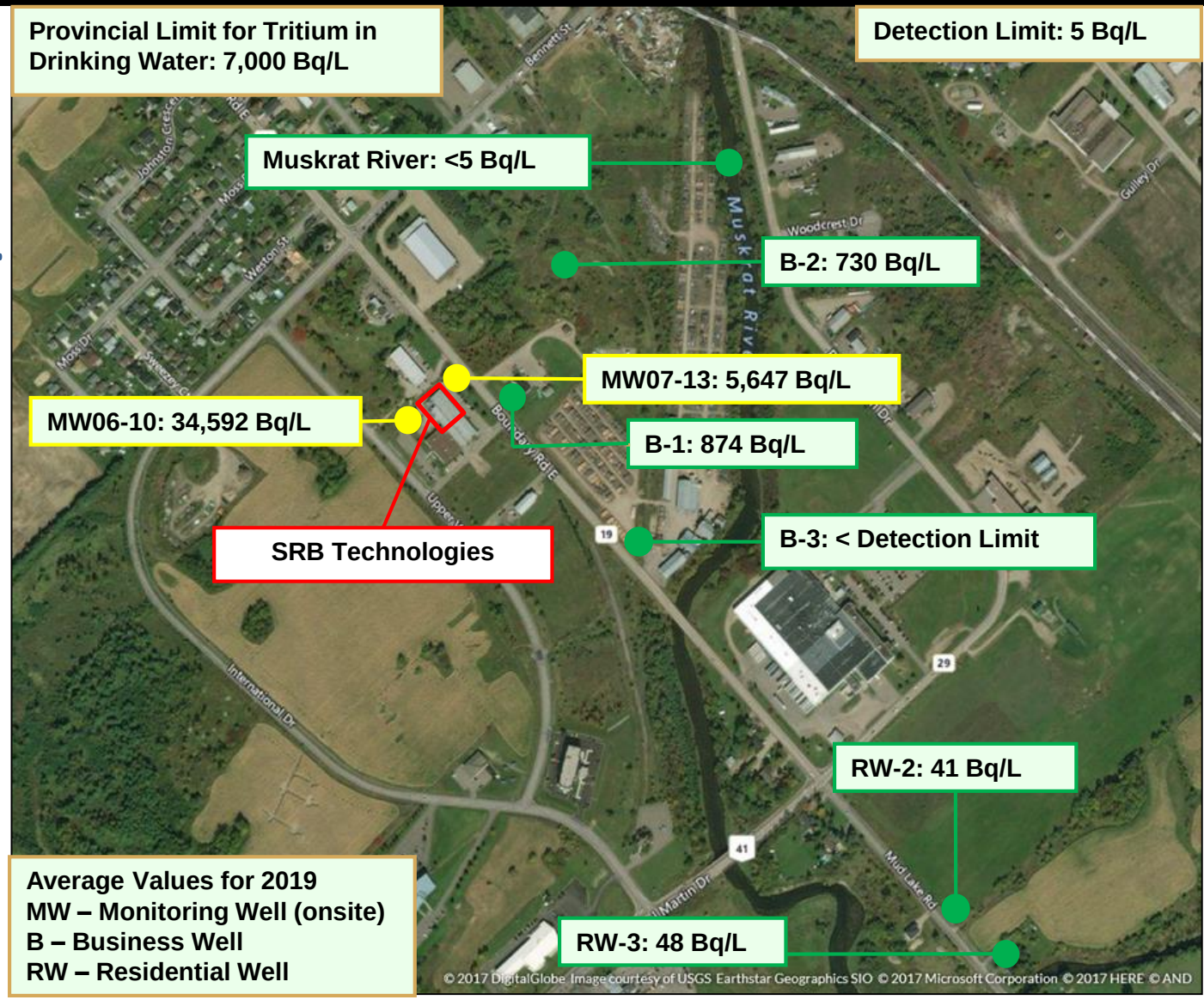
Facility Highlights
SRB Technologies (Canada) Inc.
Groundwater Concentrations

- Tritium levels surrounding the facility continue to decrease compared to previous years
- Elevated tritium concentrations originated from past operations
- Low values near and in Muskrat River and residential areas

Public and environment around the facility remain protected



Facility Highlights

Nordion (Canada) Inc.

- Regular compliance verification activities
- CNSC staff conducted four inspections in 2019:
  - Security
  - Packaging and Transport
  - Emergency Management and Fire Protection
- Four events reported to the CNSC in accordance with Nordion's reporting requirements

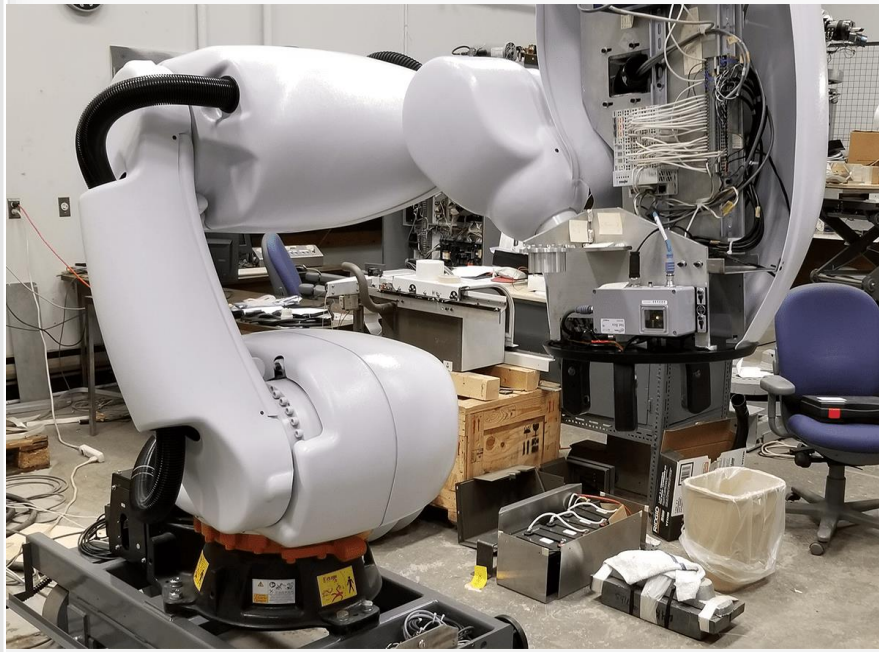
Nordion personnel working with a hot cell manipulator

Source: Nordion

Facility Highlights

Best Theratronics Ltd.

- Increase in regulatory effort due to licence renewal application submission in September 2018
- Regular compliance verification activities
- CNSC staff conducted one inspection in 2019
- BTL reported two events in accordance with its regulatory reporting requirements



Photograph of Cobalt-60 teletherapy machine

Source: BTL

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SAFETY PERFORMANCE CONCLUSIONS

Safety Performance Conclusions

Uranium and Nuclear Substance Processing Facilities

CNSC staff have confirmed that in 2019, licensees operating uranium and nuclear substance processing facilities in Canada:

- Adequately controlled radiation exposures to keep doses ALARA
- Maintained releases to levels protective of the environment
- Continued to protect workers with conventional health and safety programs
- Continued to effectively implement programs in support of all SCAs
- Addressed all areas of non-compliance in a timely manner

CNSC staff are satisfied that licensees continue to protect the health and safety of workers, public and the environment

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CONCLUSION

Conclusions

CNSC staff's regulatory oversight activities confirmed that:

- Licensees are taking action in a timely manner
- Licensees' programs are implemented effectively
- Priority areas using a risk-informed approach and verification activities are maintained
- Trends across the uranium and nuclear substance processing facilities demonstrate that the industry continues to operate safely

Operations at Uranium and Nuclear Substance Processing Facilities were conducted safely

2020 Regulating Under COVID-19 Restrictions

- Refer to CMD 20-M36 for more information on CNSC response to COVID-19 and modified oversight approach for the nuclear fuel cycle program
- Licensees implemented business continuity plans and shut down non-essential activities
- Where activities continued, enhanced hygiene, screening protocols and physical distancing were implemented while reducing onsite workforce to essential workers only
- CNSC staff continued:
  - Inspections using a combination of remote and onsite methods
  - Conduct of desktop reviews of licensee reports and submissions
  - Remote engagement with applicants and licensees
  - Remote engagement with Indigenous groups and the public

Safety and Security maintained at all times

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