Canadian Nuclear Safety Commission | Commission canadienne de sûreté nucléaire

Canada

BWXT Nuclear Energy Canada Inc.

Beryllium Sampling Results
Peterborough Community

Webinar presentation

nuclearsafety.gc.ca

March 31, 2021

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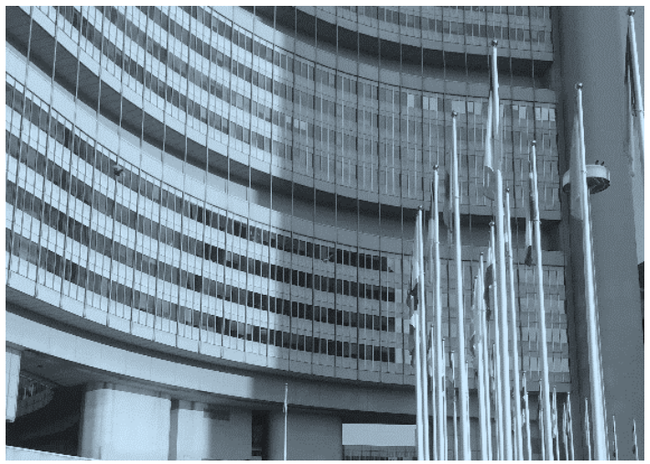
Review of today's objectives

- CNSC – Nuclear Regulator's role
- Independent Environmental Monitoring Program (IEMP) sampling and results near BWXT NEC in Peterborough-beryllium in soil
- Listen to your questions and concerns

OUR MANDATE

REGULATE
the use of **nuclear energy** and **materials** to **protect health, safety, and security** and the **environment**



IMPLEMENT
Canada's international commitments on the **peaceful use of nuclear energy**

DISSEMINATE
objective scientific, technical and regulatory information to the public

The Commission Tribunal (the Commission)

TRANSPARENT, SCIENCE-BASED DECISION MAKING

Quasi-judicial administrative tribunal

Agent of the Crown (Duty to Consult)

Reports to Parliament through Minister of Natural Resources

Commission members are independent and part-time

Commission hearings are public and Webcast

Staff presentations in public

Decisions are reviewable by Federal Court

Staff of the Canadian Nuclear Safety Commission (CNSC staff)

- Conduct assessments on information submitted by applicants and licensees to verify that they meet requirements
- Make recommendations to the Commission
- Implement Commission decisions
- Develop regulatory requirements and guidance for Commission approval
- Verify and enforce compliance with regulatory requirements
- Engage the public and Indigenous groups through outreach activities

Roles and Responsibilities

Regulator's responsibilities (CNSC)

- Set safety requirements, inform licensees, verify compliance
- Use a risk informed approach for regulatory action - graded approach
- Assure Parliament and Canadians that licensee responsibilities are properly discharged
- Make independent, objective and risk informed decisions

Licensee responsibilities

- Licensee has the first responsibility for safety
- Manage regulated activities in a manner that protects the health, safety, security and the environment while respecting Canada's international obligations (consistent with the licence application)

This aligns with International Atomic Energy Agency (IAEA) Safety Fundamentals

BWXT NEC Public Hearing and Commission Decision

- **2018: BWXT submits renewal application**. Also requested: authorization to conduct pelleting operations at the Peterborough facility
- **March 2020, Public hearings:** Intervenors express concerns over the levels of beryllium in soil observed during the CNSC IEMP sampling in 2014, 2018 and 2019
- **April 6, 2020:** Commission issues Notice of Continuation of Public Hearing and directs CNSC staff to carry out expedited soil resampling for beryllium, analyze the results, and identify potential source(s)
- **July 2020:** CNSC staff carries out resampling. Results reported back to the commission in October (CMD 20-H2.D)
- **December 18, 2020:** Commission issues a decision for the BWXT NEC licence which is available on the CNSC website
- **Commission direction to CNSC staff included:**
  - Conducting public outreach of beryllium sampling process and results
  - Conducting IEMP sampling campaign at Peterborough in 2021

Beryllium in Soil – where does it come from?

- Beryllium is naturally present in soil
- Important human activities that add to levels in soil include the burning of coal, fuel oil and petroleum-based products
- Other sources include foundries, ceramic plants, incinerators, municipal waste combustors, and open-burning waste disposal sites
- Natural background range for soils in Ontario not contaminated by industrial sources is up to 2.5 mg/kg
- The most restrictive criteria for beryllium concentrations in soil are the Canadian Council of Ministers of the Environment (CCME) soil quality guideline for the protection of environmental and human health (4 mg/kg)
- All concentrations of beryllium in soil measured in the CNSC's IEMP sampling campaigns during 2014-2020 are within the background range in Ontario

BWXT NEC – Beryllium

- Tubes, spacers and bearing pads that form the CANDU® nuclear fuel bundle (Figure-1a) are assembled through a process called brazing
- These parts are coated with beryllium prior to brazing (Figure-1b)
- The beryllium coating process creates airborne particulates of beryllium

(1a)

(1b)

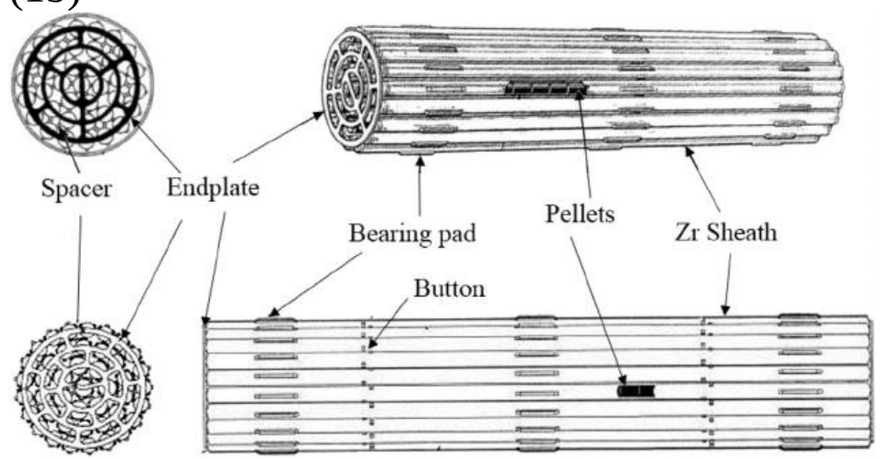
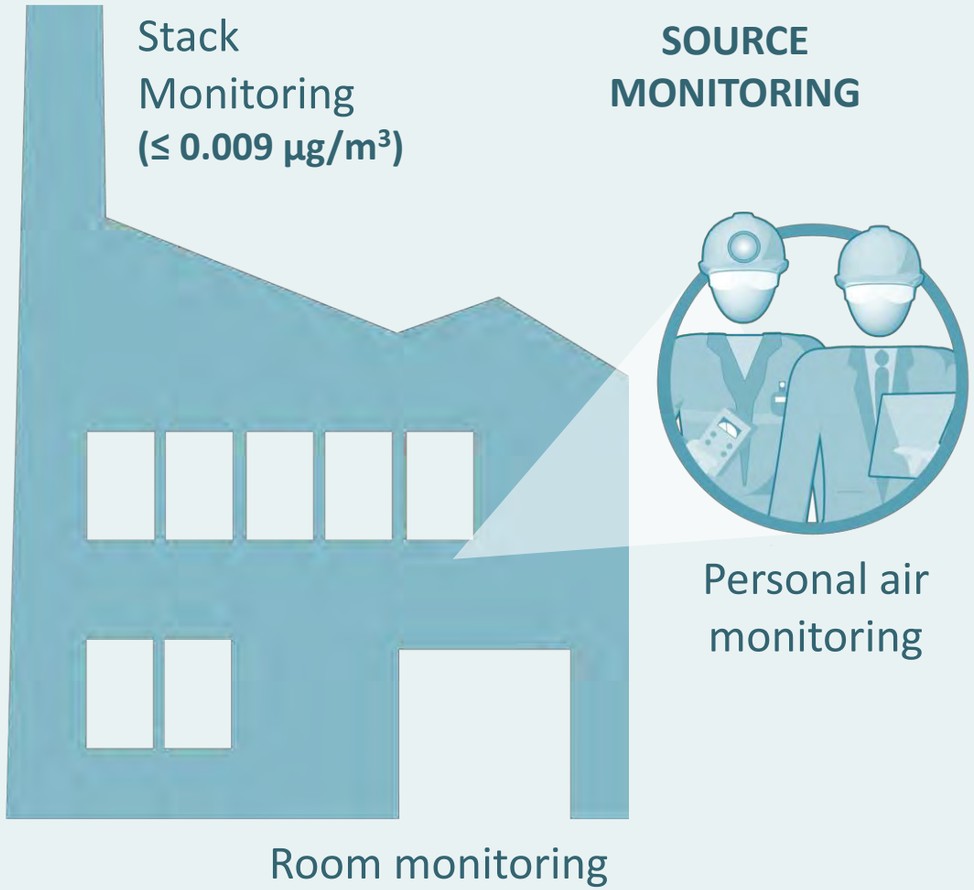


Figure 1: Picture of a CANDU® nuclear fuel bundle with a schematic showing individual components. Bearing pads and spacers are coated with beryllium so that they can be brazed onto the zircaloy tubes.

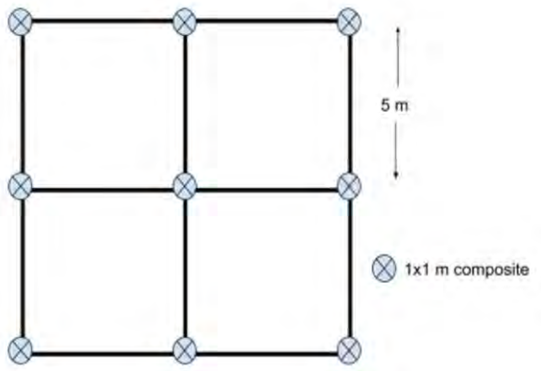
Beryllium Monitoring in Peterborough

BWXT ENVIRONMENTAL PROTECTION PROGRAM (EPP)

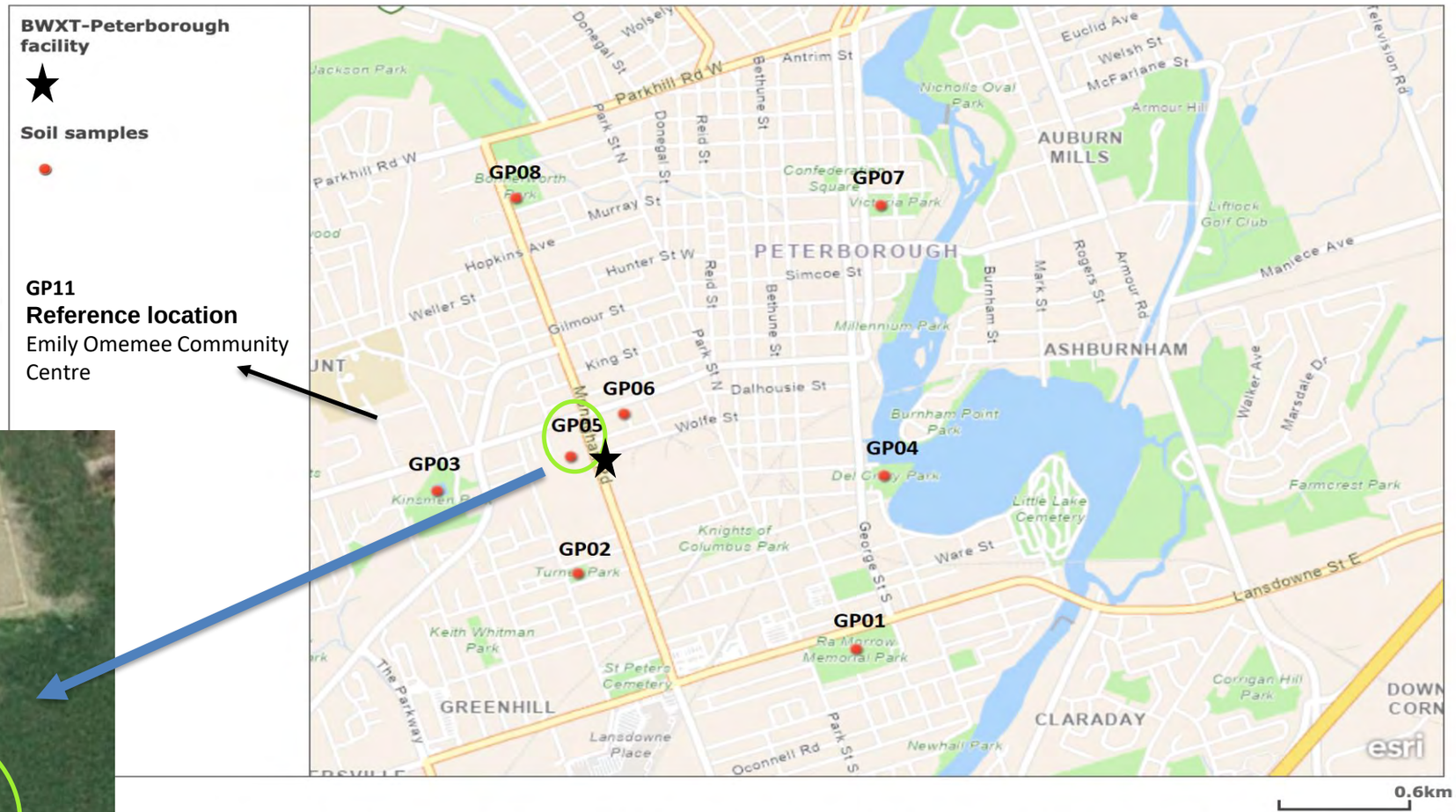


CNSC INDEPENDENT ENVIRONMENTAL MONITORING PROGRAM (IEMP)

Map of 2020 Soil Resampling



GP05 Prince of Wales Public School



Province of Ontario, Esri, HERE, Garmin, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada

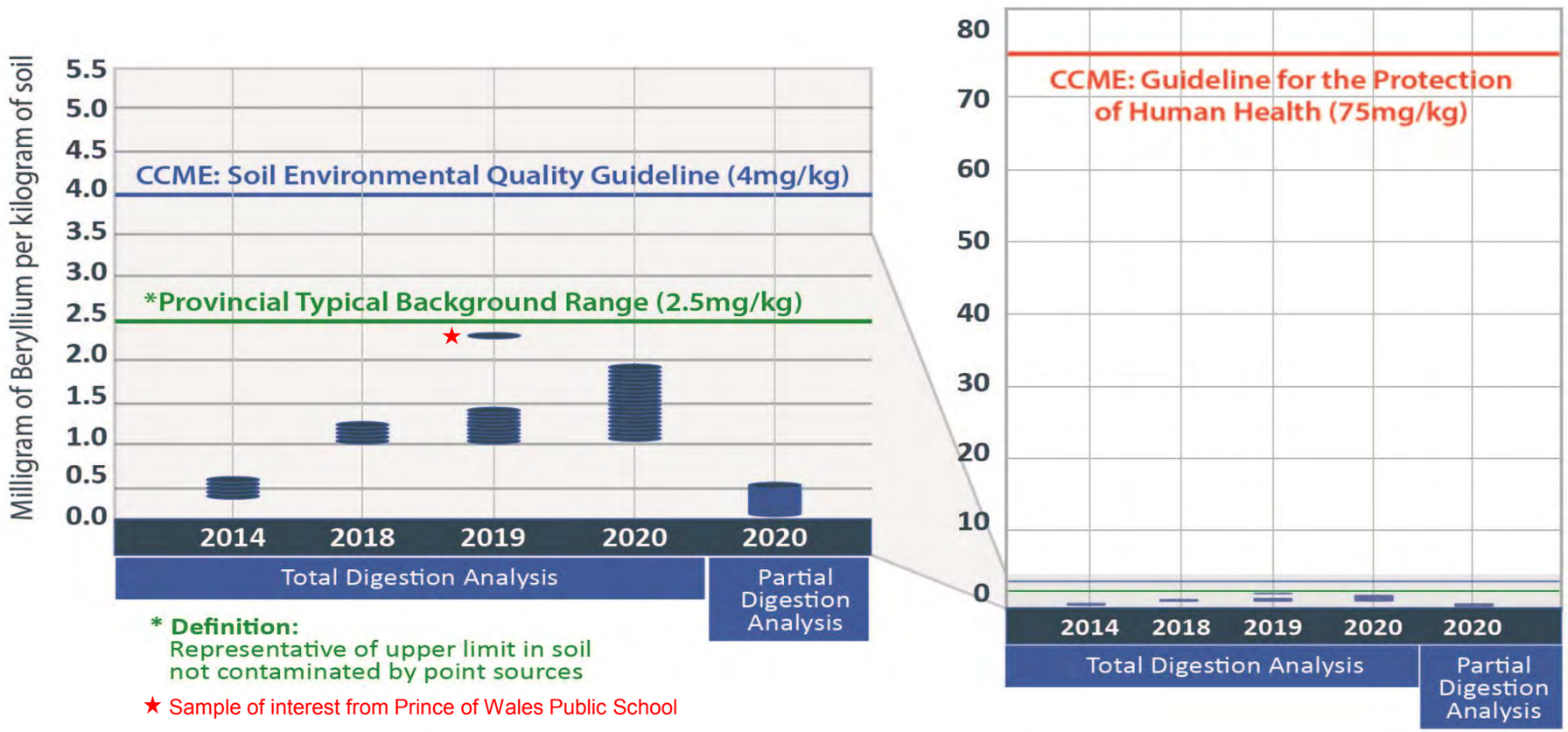
Lab Analysis - Partial Digestion & Total Digestion

- Total digestion used to analyse soil samples from 2014-2020
- July 2020 samples also analyzed by partial digestion which allows direct comparison to federal and provincial soil quality guidelines
- CNSC staff will use the partial digestion for future lab analyses of soil samples

Total Digestion	Partial Digestion
Very conservative; used for geological studies and forensic work	Used to determine the bio available portions of elements
Total decomposition of sample	Partial decomposition of sample
Digests environmentally available and environmentally inaccessible portions of elements	Digests environmentally available portions of elements only
Misleading to compare to the MECP soil standard and CCME SQG	Allows direct comparison to the MECP soil standard and CCME SQG

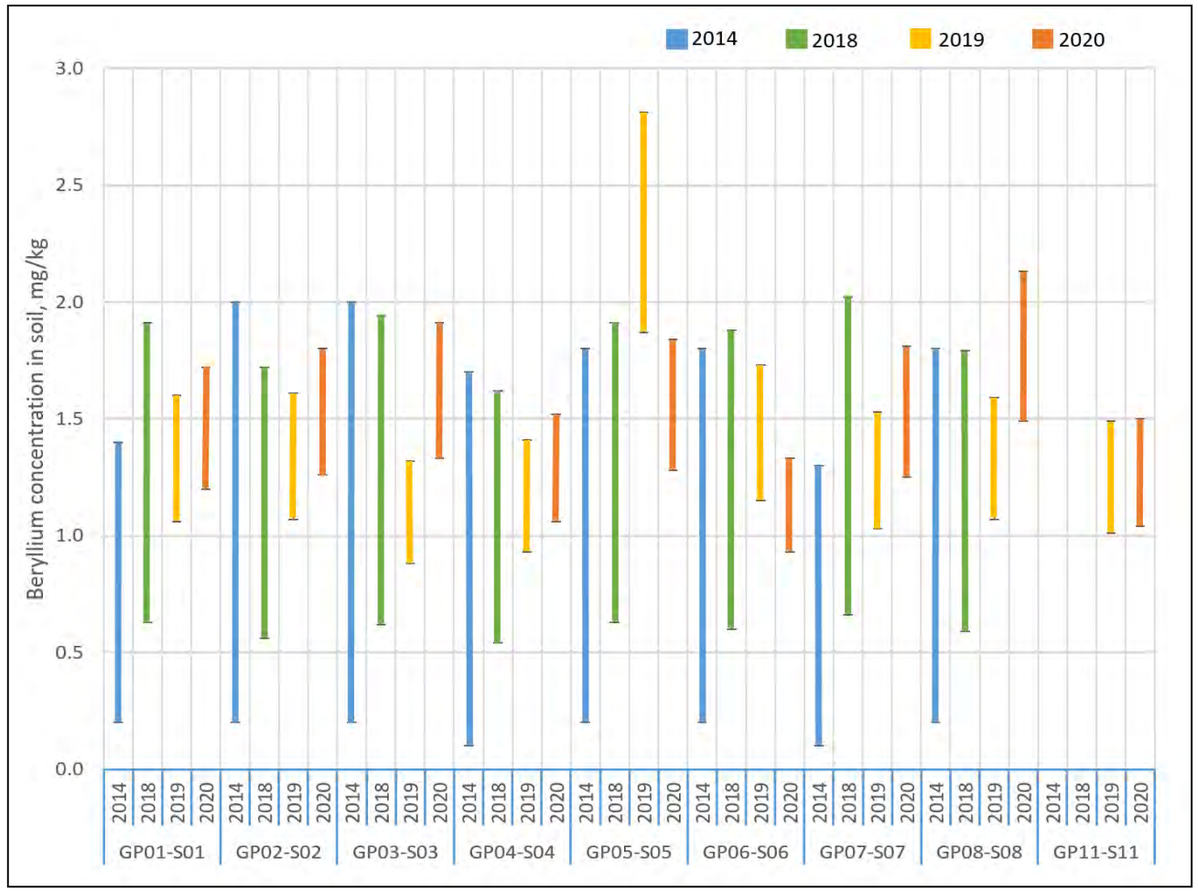
CNSC Measured Beryllium Concentrations in Soil

- Beryllium concentrations in soil measured by CNSC staff from 2014-2020
- NOTE: Only partial digestion results should be compared to federal and provincial guidelines



Total Digestion Results 2014-2020

- The uncertainties for total beryllium data using two standard deviations (95% confidence level):
  - 80% uncertainty in 2014
  - 50% uncertainty in 2018
  - less than 20% uncertainty in 2019 and 2020
  - Large error bar = higher uncertainty
- High uncertainties impact the interpretation of the dataset due to the large variation in measurement value.
- Considering the uncertainties, the dataset indicates:
  - Beryllium values are not statistically different
  - Data cannot be used to support any conclusions on potential trend
- Total digestion data cannot be compared to the MECP soil standard and CCME SQG

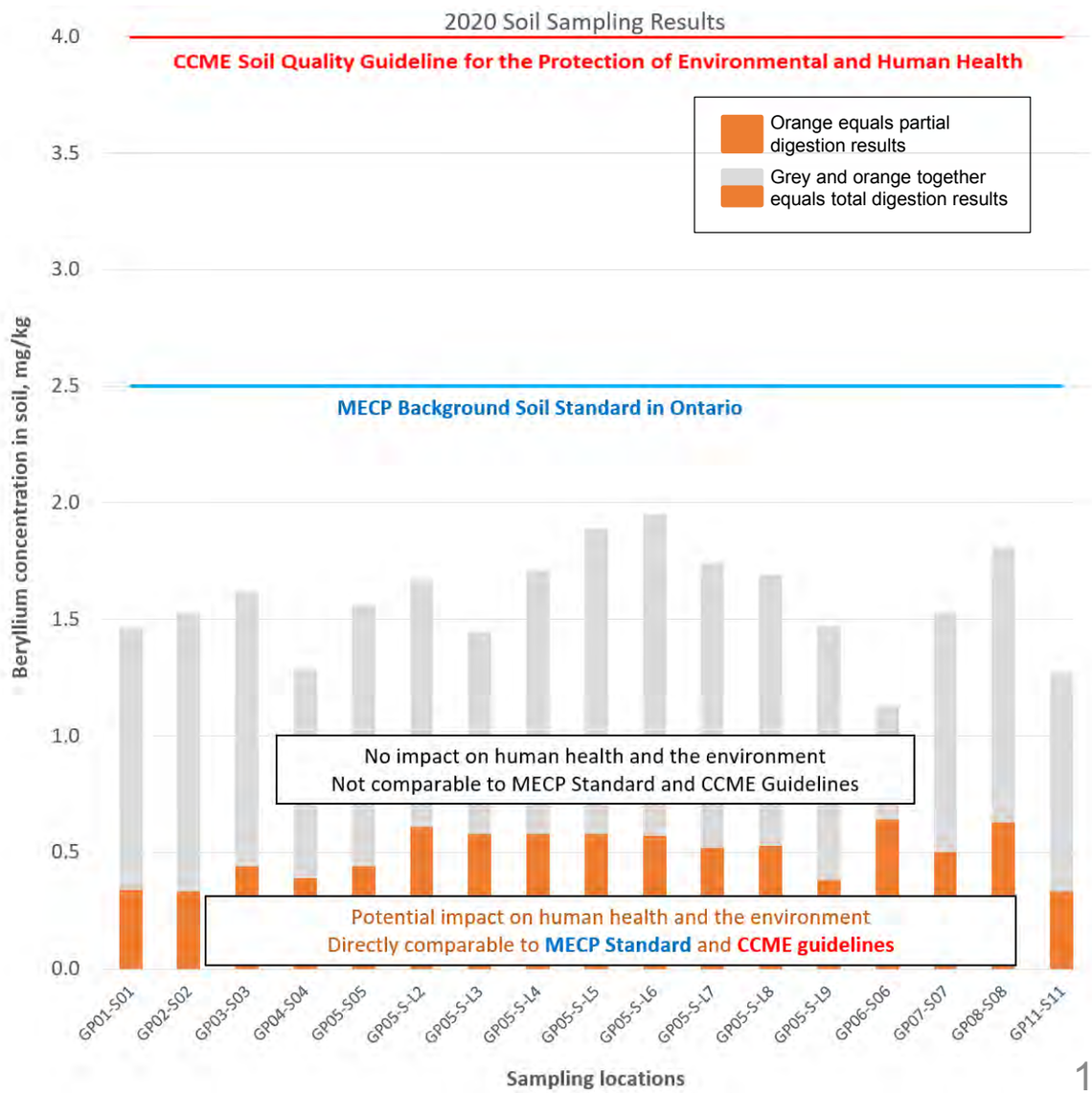


Impact of measurement uncertainties (two standard deviations) on beryllium concentrations using total digestion (2014-2020)

Soil Quality near BWXT in Peterborough

2020 Soil sampling results – Partial Digestion

- Beryllium concentrations in soil derived by partial digestion are well below the MECP upper limit of natural background in Ontario (2.5 mg/kg).
- Maximum concentration of environmentally available beryllium in soil was 6 times lower than the most restrictive CCME SQG for the protection of environmental and human health (4 mg/kg).
- The 2020 partial digestion data align with the results of the 2005 survey conducted by the Ontario MECP (up to 0.7 mg/kg)
- Soil concentrations of beryllium are very low
- No evidence that the BWXT facility emissions have affected soil quality in Peterborough



Beryllium Air Emissions-AAQC

- The Province sets the Ambient Air Quality Criteria (AAQC) for all contaminants. It is a concentration of a contaminant in air that is protective against adverse effects, regardless of the source.
- The AAQC is based on the most sensitive effect from the contaminant.
- The AAQC is set as a concentration (ug/m^3) with averaging times appropriate for the effect that they are intended to protect against.
- The AAQC is set for a point outside the facility where the highest concentration of the contaminant is expected to occur (the point on impingement)
- For beryllium, the AAQC is set at 0.01 ug/m^3 with and average of 24 hours.

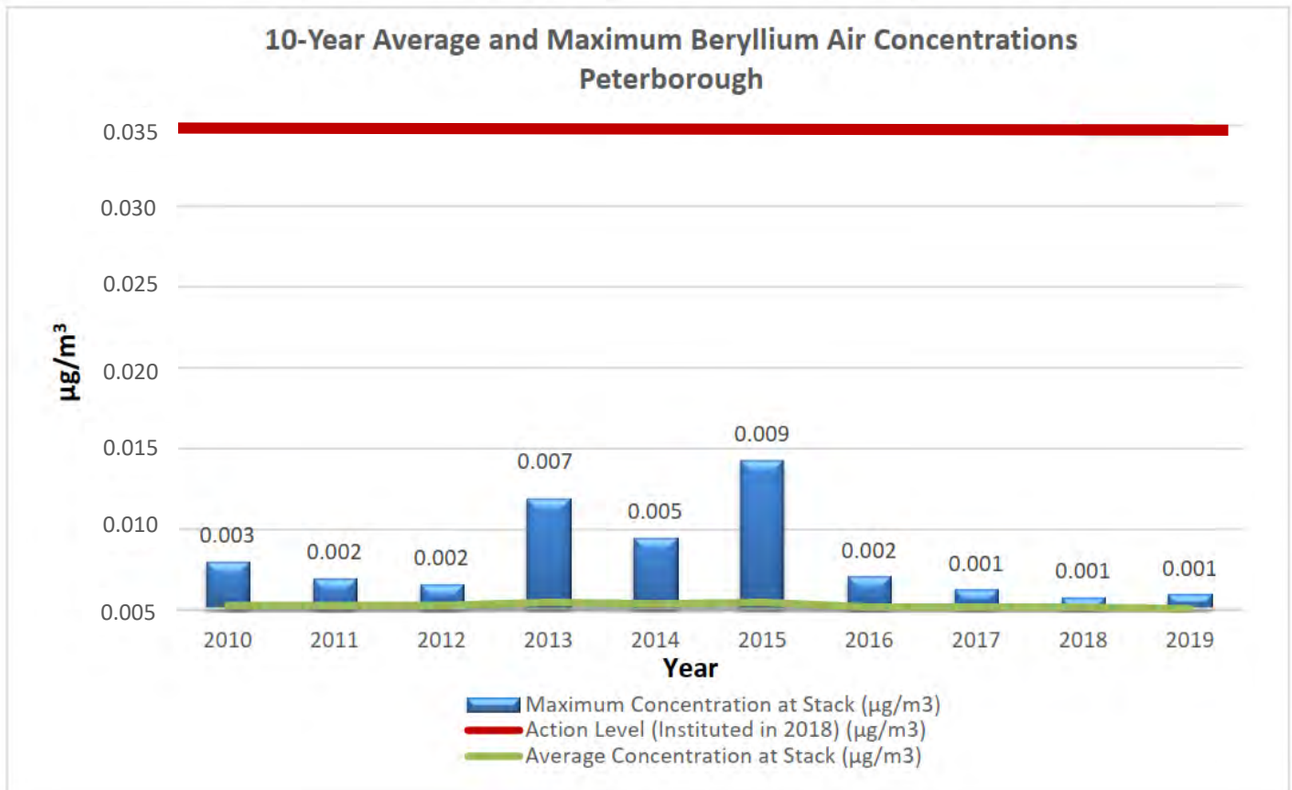
BWXT NEC Beryllium Air Emissions

- Beryllium air concentrations measured at the stacks are below Ontario's Ambient Air Quality Criteria (AAQC) of 0.01 µg/m3

Annual airborne beryllium concentrations (µg/m3)

Year	Average Beryllium concentration at the stacks	Maximum Beryllium concentration at the stacks	Ontario's AAQC* Beryllium
2013	0.0001	0.007	0.01
2014	0.0005	0.005	
2015	≤ 0.001	0.009	
2016	≤0.0005	0.002	
2017	≤0.0005	0.001	
2018	≤0.0005	0.001	
2019	≤0.0005	0.001	

**Ambient Air Quality Criteria (AAQC)*



Source: BWXT NEC Annual Compliance report 2020

Hypothetical Beryllium Calculation

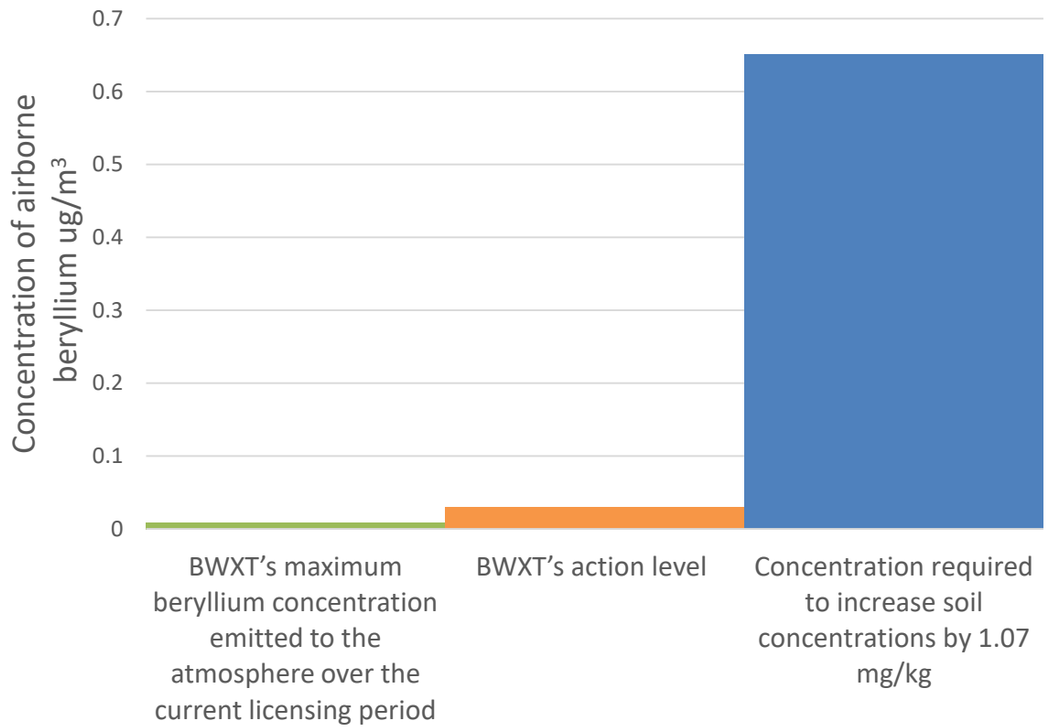
- Beryllium concentrations in soil samples changed from 1.27 mg/kg in 2018 to 2.34 mg/kg in 2019 – **a net increase of 1.07 mg/kg**

- **Question**:
  - How much beryllium must be emitted by BWXT to increase the soil concentration by 1.07 mg/kg in one year in the Prince of Wales Public School?
- **Answer:**
  - About 68 grams of beryllium must be released in one year to see this level of increase.

- **Actual maximum amount of beryllium released in one year by BWXT is 0.015 g (4000 times lower)**
  - Annex A: CNSC staff CMD 20-H2.D and 20-H2.E

Beryllium emissions from BWXT-NEC's Peterborough operations are at a level that could not results in the change in beryllium soil concentrations

Amount of airborne beryllium that would have to be emitted to account for the change in beryllium concentrations in soil found by the CNSC's IEMP



Beryllium Sampling - Conclusions

- Results of the soil resampling affirms CNSC staff conclusions presented to the Commission in CMD 20-H2 during the March 2020 public proceedings
- Sampling data demonstrates that there is no risk to the environment and to human health at the Prince of Wales Public School and on other properties adjacent to BWXT-NEC's Peterborough facility
- No evidence that the BWXT-NEC facility emissions affected soil quality in Peterborough
- Beryllium values measured by the total digestion of soil samples in 2014-2020 are not statistically different given the measurement uncertainties, and cannot be used to support any conclusions on potential trends of beryllium levels in soil
- CNSC will continue regulatory oversight of BWXT NEC to monitor emissions and IEMP sampling in publically accessible areas to confirm that the public and environment are protected

Future Sampling in Peterborough

- CNSC staff will conduct IEMP sampling in Peterborough in 2021 and in future years
  - Soil samples will be analyzed using partial digestion
- BWXT-NEC to start annual soil sampling in Peterborough
- Air monitoring in Peterborough
- Community needs?

IEMP sampling at the Prince of Wales Public School, Peterborough, Ontario

CNSC staff remain committed to continued engagement

Contact for more information

- Info Account
  - ✉ cnsc.info.ccsn@canada.ca

- Cassandre Roy-Drainville
  - Indigenous Consultation
  - ✉ Cassandre.roy-drainville@canada.ca

Questions?

Thank You!

Participate and Contribute!

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