Health Canada Environmental Monitoring Network, Laboratories and Gamma Detectors

2024 SNOLAB Users Meeting

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Health Canada Santé Canada

Outline

- HC's surveillance networks and labs
- SNOLAb CRMN and FPN stations
- Performance benchmarking study

Health Canada's Radiation Protection Bureau

MISSION - To promote and protect the health of Canadians by assessing and managing the risks posed by ionising radiation exposure in living, working and recreational environments

- Located in Ottawa on Brookfield
- Approximately 150 full time staff
- 4 scientific divisions

Surveillance

Emergency

Dosimetry

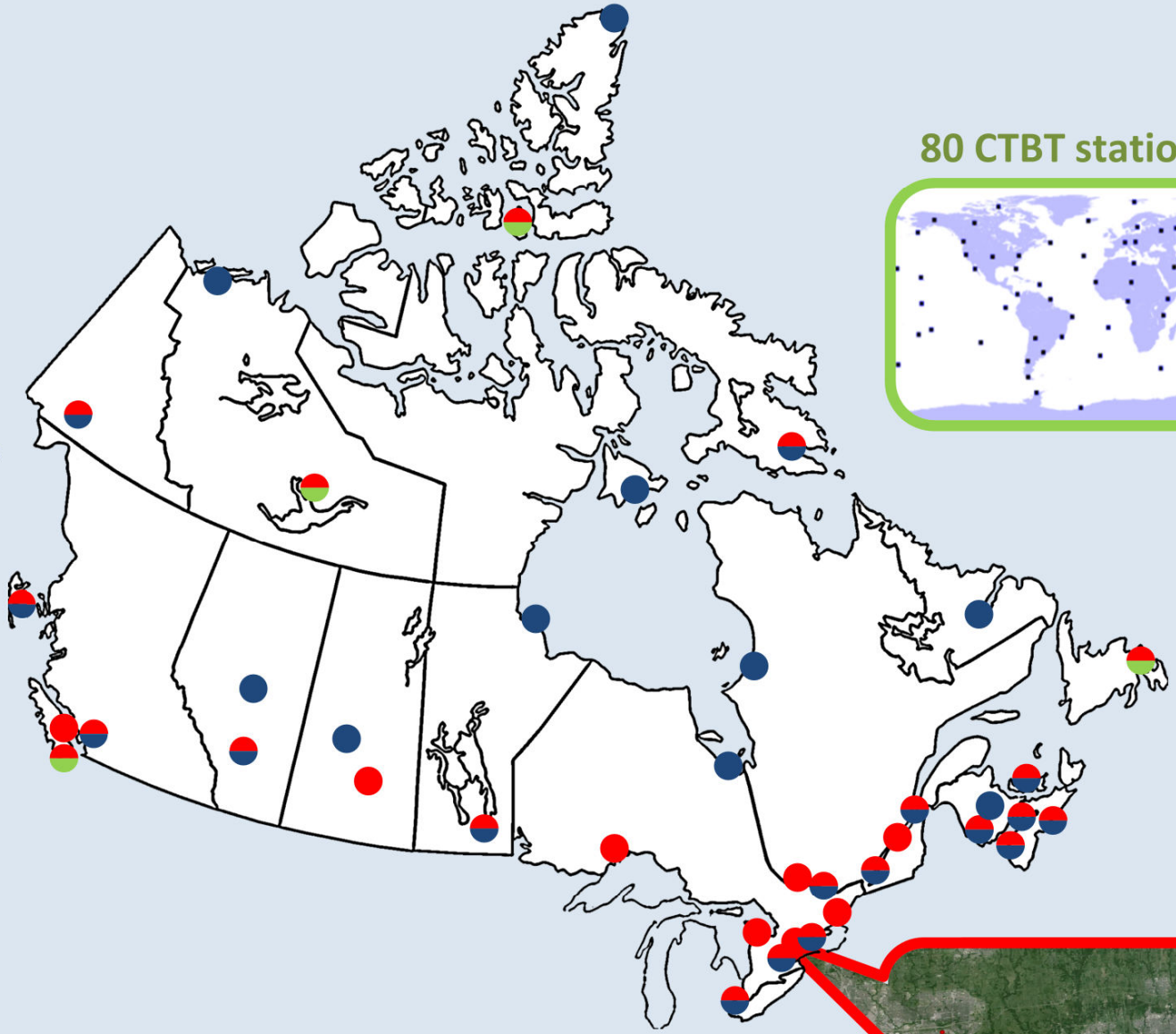
Health Impact

Environmental Radiation Surveillance at Health Canada

84 fixed point stations

4 Canadian CTBT stations

26 CRMN stations



80 CTBT stations

Environmental radiation surveillance at Health Canada

Radiation Surveillance Division, Radiation Protection Bureau

84 fixed point stations

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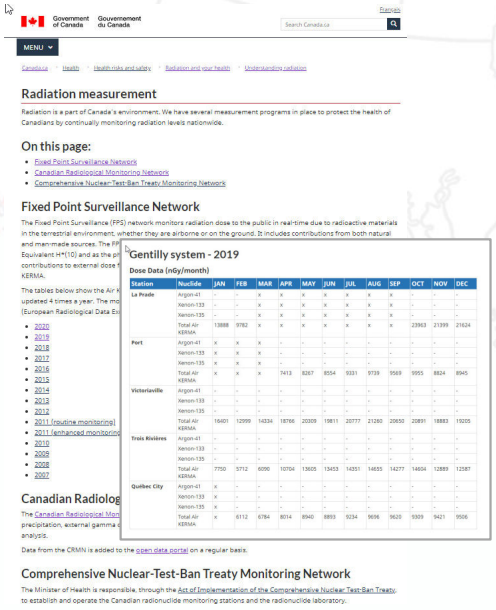
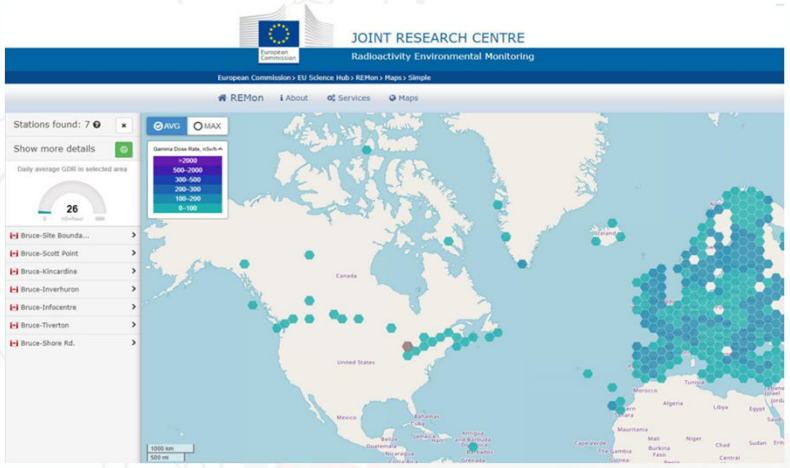
26 CRMN stations

Fixed Point Surveillance Network (FPN)

- Monitors radiation dose in real-time
- Each detector generates a data set every 15 minutes. Millions of measurement every year
- Results summary on HC's website
- Near real time results on the European Radiological Data Exchange Platform and on Open Maps.





https://remap.jrc.ec.europa.eu/Simple.aspx

https://search.open.canada.ca/openmap/f0d1c3a9-cf78-4b07-af55-9e8d4303449e

Environmental radiation surveillance at Health Canada

Radiation Surveillance Division, Radiation Protection Bureau

84 fixed point stations

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Fixed Point Surveillance Network (FPN)

SNOLAB

European Radiological Data Exchange Platform

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and on Open Maps.

SNOLAB

open.canada.ca Open Maps.
https://search.open.canada.ca/openmap/f0d1c3a9-cf78-4b07-af55-9e8d4303449e

Environmental radiation surveillance at Health Canada

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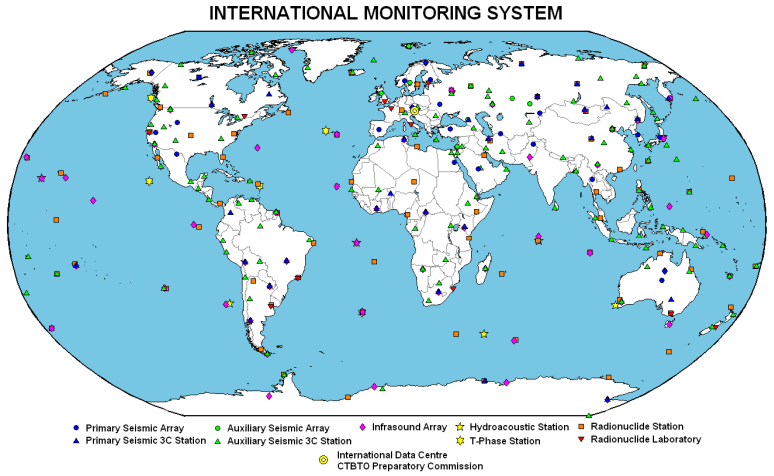
Comprehensive Nuclear-Test-Ban Treaty (CTBT) Monitoring Network

- Monitor Airborne radiation (particulate & noble gas)
- Part of a world wide network. Radionuclide detection, seismic, hydro acoustic and infrasound are used to monitor for nuclear explosions
- HC operates four radionuclide monitoring stations
- Results sent to the CTBT Organisation



Environmental radiation surveillance at Health Canada

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Canadian Radiological Monitoring Network (CRMN)

- In operation since 1959. Monitor airborne, dose and precipitation. Tritium in vapor (limited)
- Targeted program: water, milk and food
- More the 2500 measurements every year
- Data available on open data and open map

Air Particulates

Precipitation

Dosimeter

Water vapour (^{3}H)

Drinking Water
Ra-226, total U

Total Diet Study

Milk

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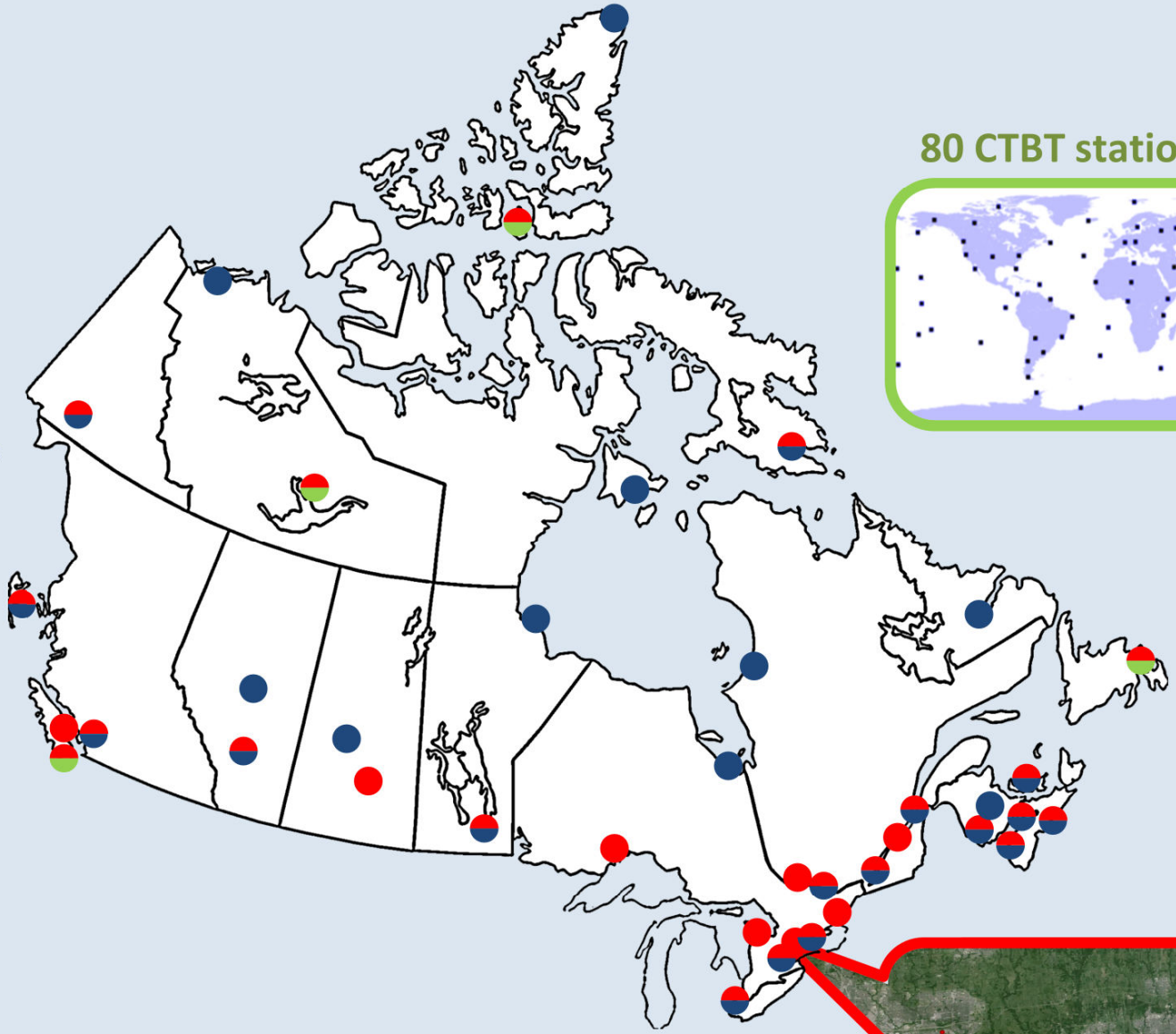


80 CTBT stations

Health Canada Santé Canada

Environmental radiation surveillance at Health Canada

Radiation Protection Bureau

Charlottetown

Moncton

Saint John

Point Lepreau

Greenwood

Digby

Halifax

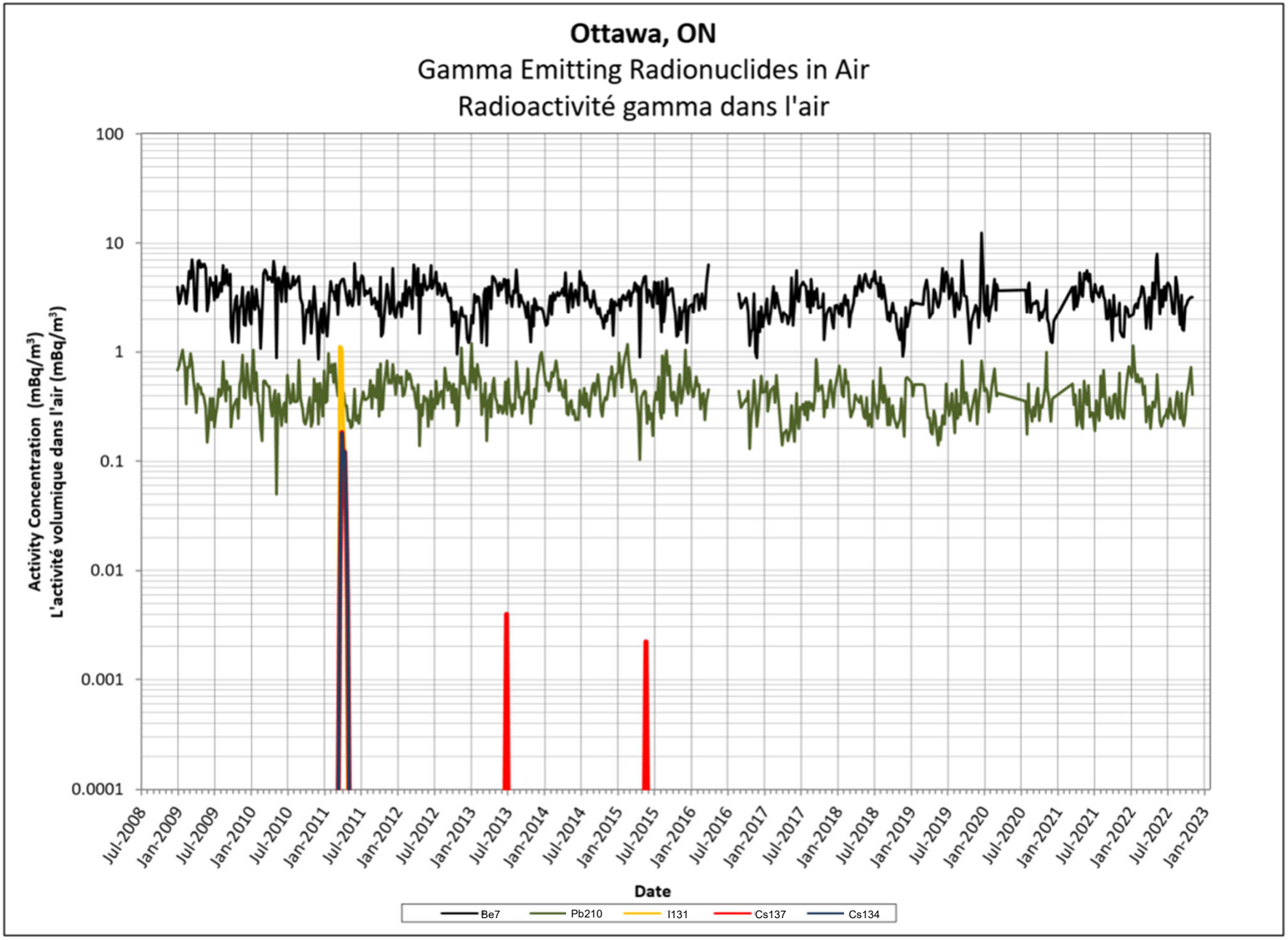
Point Lepreau

CRMN station

Fixed point station

Tritium station

Results


Ottawa, ON
Gamma Emitting Radionuclides in Air
Radioactivité gamma dans l'air
Activity Concentration (mBq/m³)
L'activité volumique dans l'air (mBq/m³)
100
10
1
0.1
0.01
0.001
0.0001
Jul-2008
Jan-2009
Jul-2009
Jan-2010
Jul-2010
Jan-2011
Jul-2011
Jan-2012
Jul-2012
Jan-2013
Jul-2013
Jan-2014
Jul-2014
Jan-2015
Jul-2015
Jan-2016
Jul-2016
Jan-2017
Jul-2017
Jan-2018
Jul-2018
Jan-2019
Jul-2019
Jan-2020
Jul-2020
Jan-2021
Jul-2021
Jan-2022
Jul-2022
Jan-2023
Date
Be7
Pb210
I131
Cs137
Cs134

Canadian Radiological Monitoring Network

84 fixed point stations

4 Canadian CTBT stations

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SNOLAB STATION: more collaboration

SNOLAB is now operating RSD stations

- Fixed point
- CRMN (air, deposition, dosimeter)

The air filters are currently measured at HC

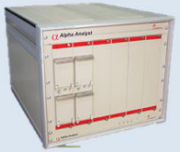
- Could we have them routinely measured at SNOLAB?

High volume sampling?
Interested in H3?

National Monitoring Section Laboratory

Gamma Spectroscopy

Liquid Scintillation Counting, Alpha Spectroscopy & Gas Proportional Counting



Inductively Coupled Plasma Mass Spectrometry

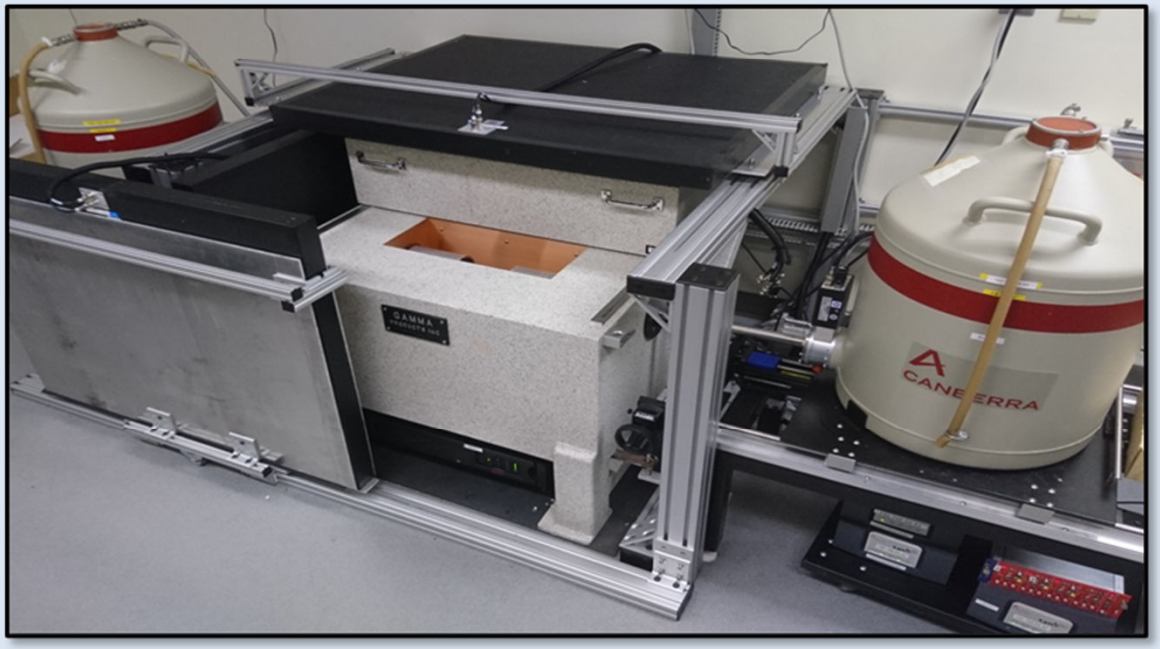
- ISO 9001:2015
- 7 to 10 Staffs (Lab + CRMN)
- Monitoring + emergency
- 2500 measurements per year

Sample Preparation

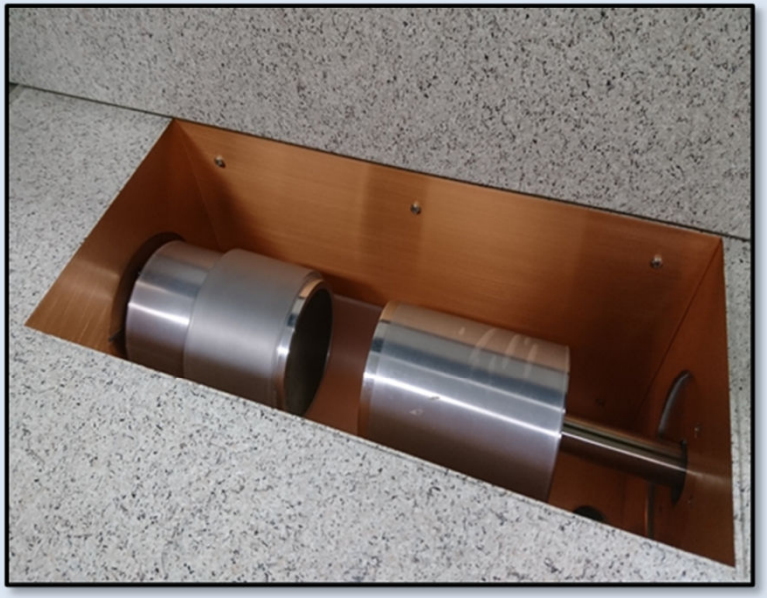
CTBT CAL05 Laboratories

- Certified particulate (2007) & noble gas (2022) laboratories
  - Analyze aerosol samples using gamma-ray spectrometry to detect for man-made radionuclides

Single HPGe Detector for particulate samples



Complete Dual HPGe detector system for noble gas samples



Dual HPGe Detector Heads

HC's Radiation Monitoring Objectives

To monitor, detect, and assess radiation in the environment across Canada and internationally.

This provides a basis for risk assessment and management. It also enables the identification of nuclear events.

- Routine
- Emergency
- Forensic (identification and attribution)

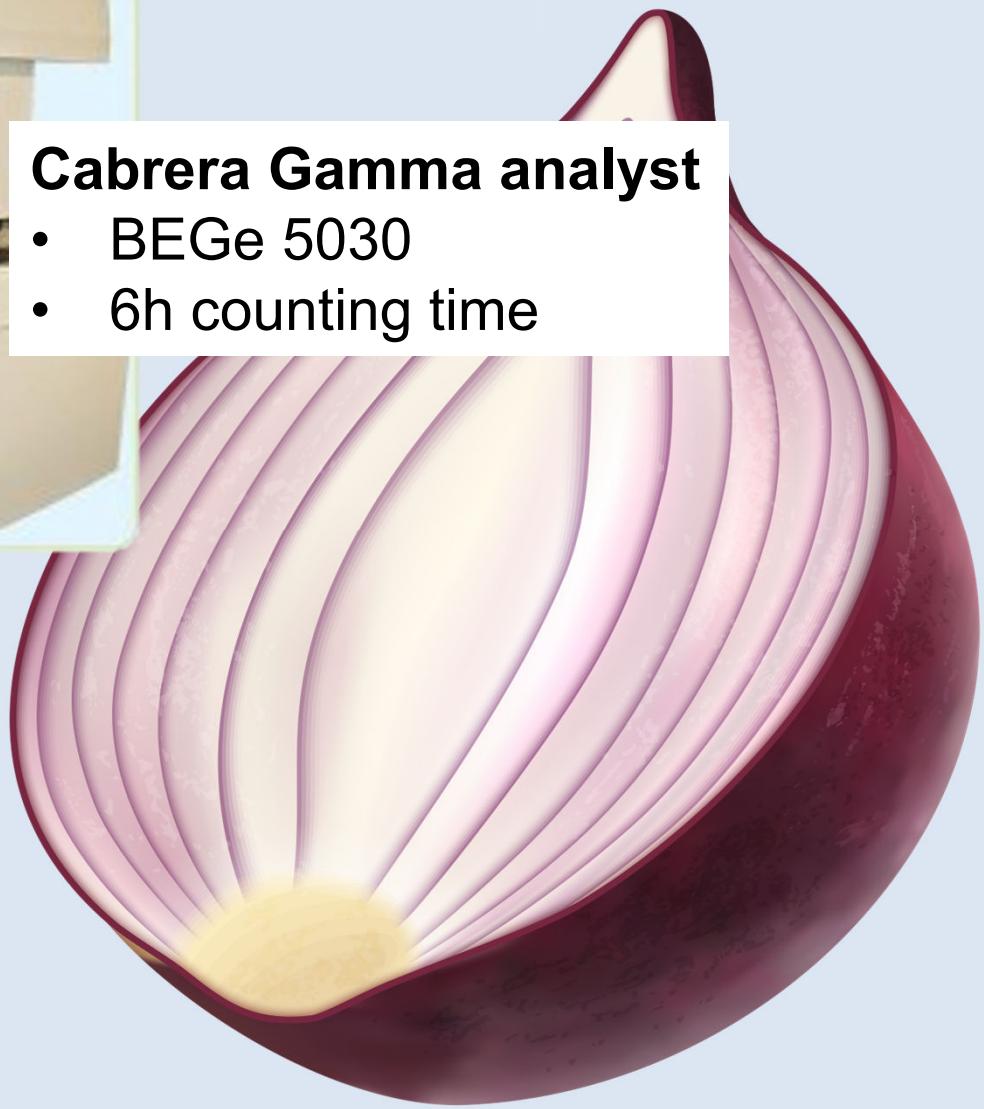
HC’s Radiation detection strategy

HC's Radiation detection strategy

1

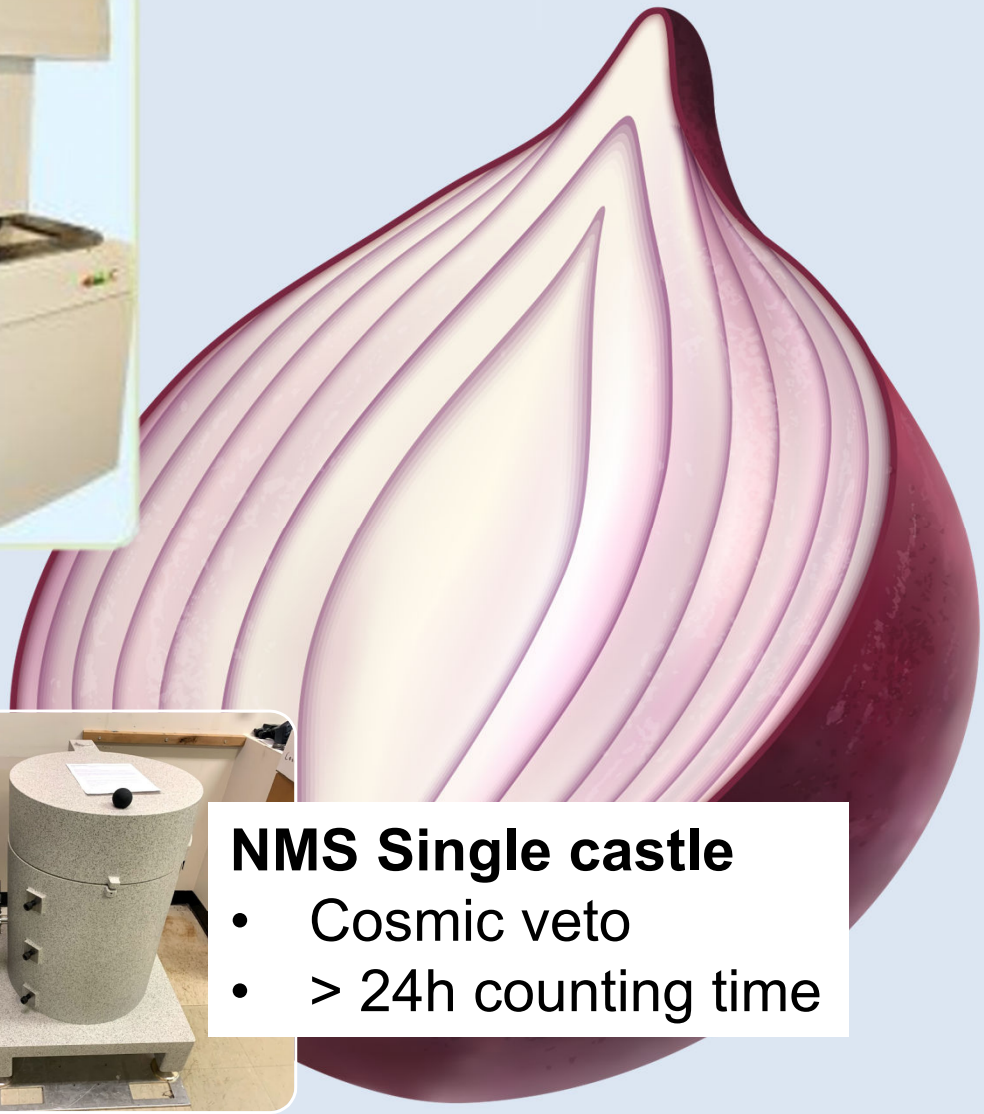
Cabrera Gamma analyst

- BEGe 5030
- 6h counting time



HC's Radiation detection strategy (CRMN)

1



2

NMS Single castle

- Cosmic veto
- > 24h counting time

HC's Radiation detection strategy (CRMN)

1

SAGe Well detector (VIMs)

- BEGe 5030
- CANBERRA ComsicGuard veto

2

3

HC's Radiation detection strategy (CRMN)

1

ThinMan Detector System

- Dual HPGe system
- Tin and copper liner,
- 5-inch lead,
- borated plastic
- Cosmic veto
- List mode
- Coincidence measurement

4

2

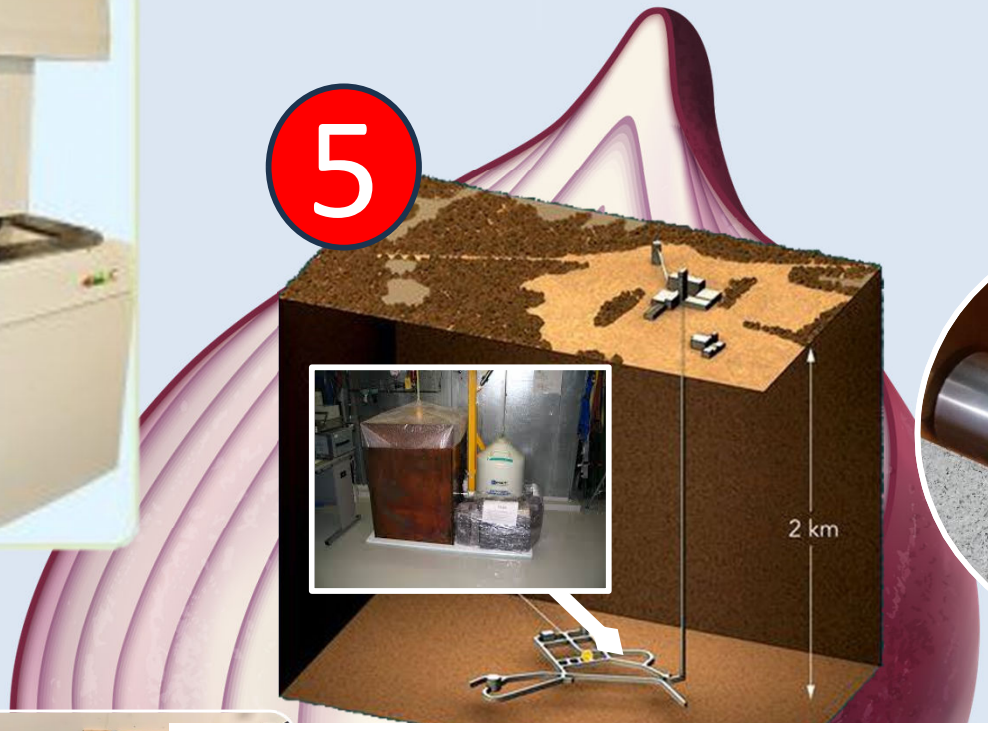
3

HC's Radiation detection strategy (CRMN)

1

3

5



2

Low Background Counting Facility
(@ SNOLAB ,Sudbury)

4

Performance Benchmarking Exercise

Performed an exercise in 2019-2020 to evaluate **nuclear forensic capabilities** of several Canadian laboratories

- Each laboratory measured the **same set** of environmental samples

Samples included a 50 mm compressed air filter (used in the CTBT network)

- Included a sample that did not filter any air, ie. a **'blank' sample**

Participating Laboratories

Health Canada (HC)

- CAL05 (BEGe5030)
- Dual BEGe5030 with veto
- Compton suppression system
- SAGe well detector with veto
- NMS laboratory detectors (BEGe5030s + assorted)

Defence Research and Development Canada (DRDC)

- GEM85P4
- GMX80P4

Canadian Nuclear Safety Commission (CNSC)

- BEGe5030

Sudbury Neutrino Observatory (SNOLAB)

- PGT coaxial detector
- Dual BEGe5030 (not here)

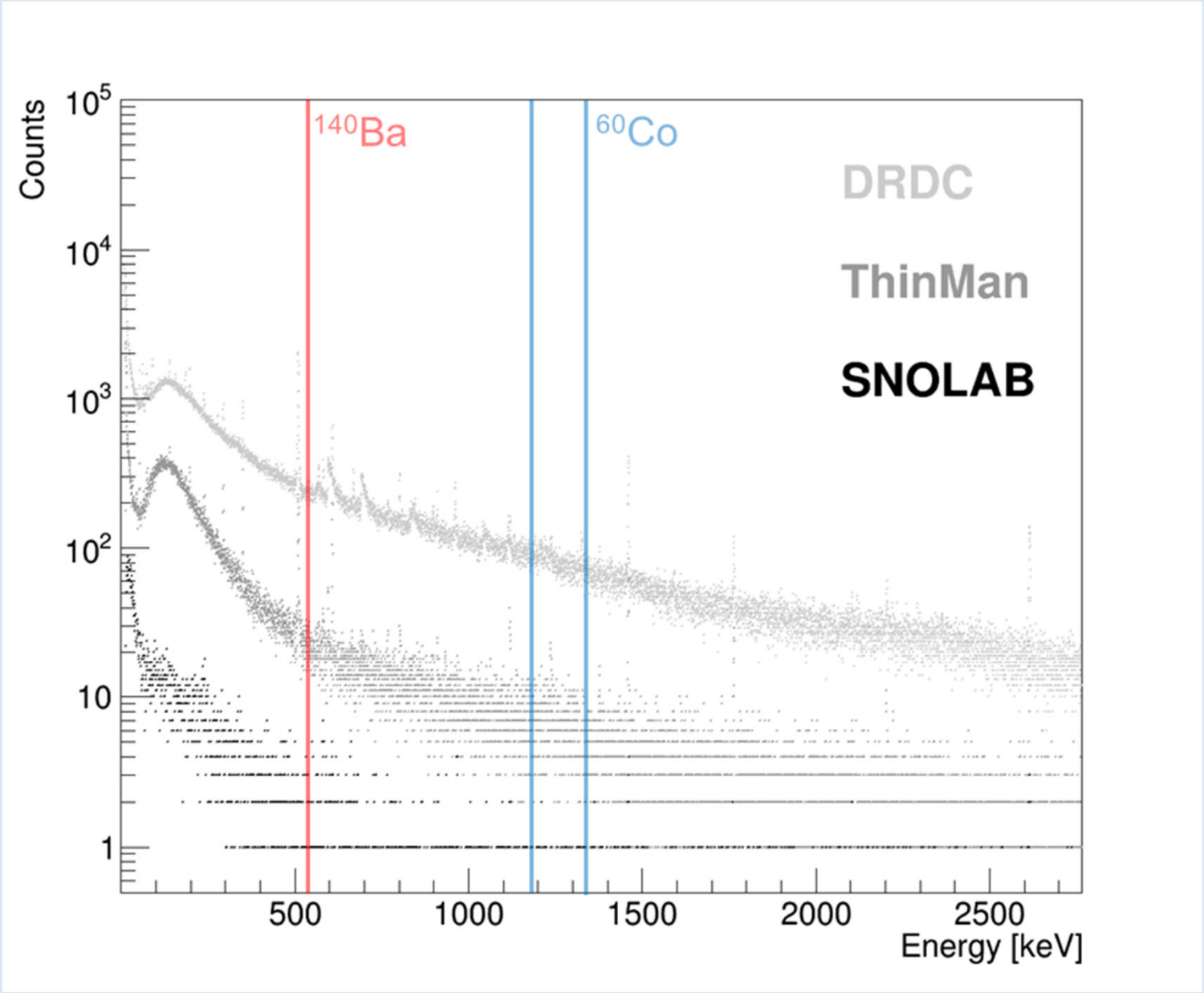
Atomic Weapons Establishment

- *GBL15 (BEGe5030 (ULB) with veto)*
- *Dual BEGe6530 with veto*
- *Dual BeGe5030 at Boulby Underground Science Facility*
- *(not shown here)*

Participants

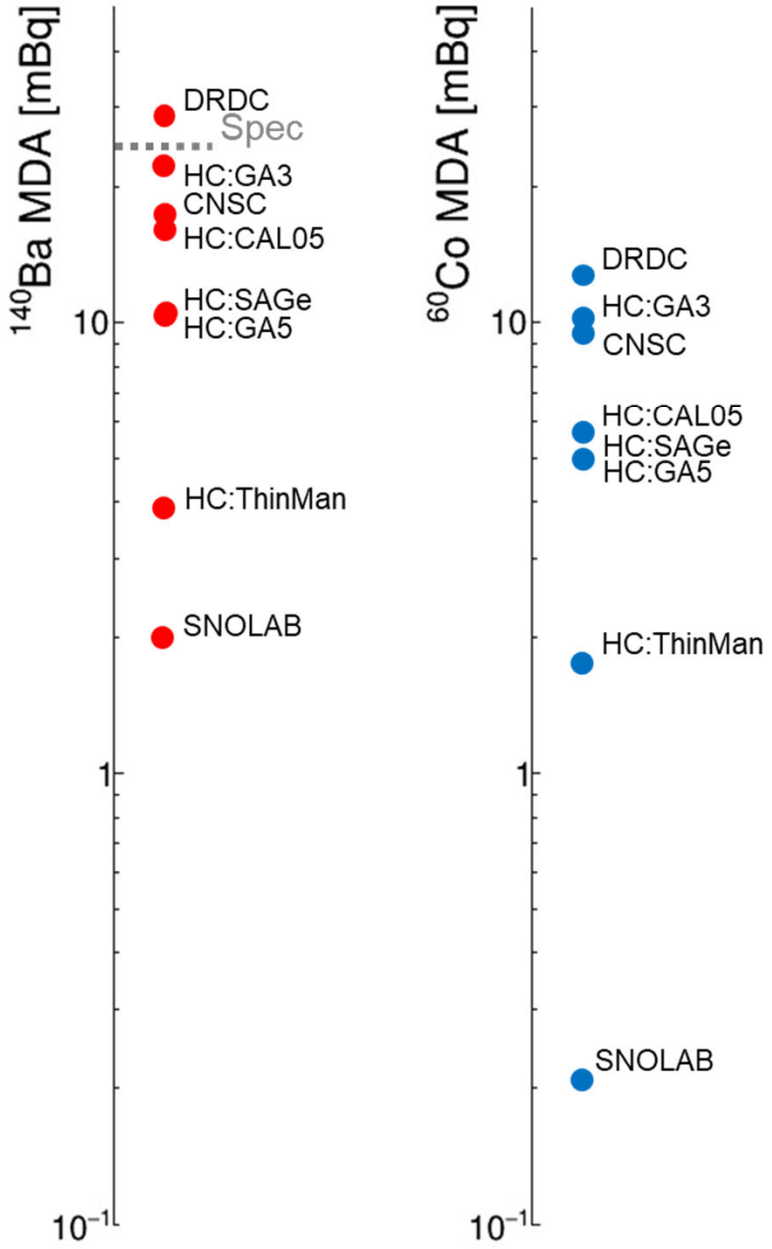
- **Health Canada**
  - Pawel Mekarski
  - Kurt Ungar
  - Jean-Francois Mercier
  - Michael Cooke
  - Weihua Zhang
- **Canadian Nuclear Safety Commission**
  - Ali El-Jaby
  - Nadereh St-Amant
  - Chris Cochrane
- **Defence Research and Development Canada**
  - Rodney Berg
  - Anna Rae Green
- **Sudbury Neutrino Observatory (SNOLAB)**
  - Jeter Hall
  - Ian Lawson
  - Dimpal Chauhan
- **Atomic Weapons Establishment**
  - Ashley Davies
  - Rich Britton

Sensitivity results



Sensitivity results

Laboratory	^{140}Ba MDA [mBq]	^{60}Co MDA [mBq]
CNSC	17.6	9.5
DRDC	28.0	12.8
HC:CAL05	16.9	5.7
HC:GA3	21.8	10.2
HC:GA5	10.5	5.0
HC:SAGe	10.6	5.0
HC:ThinMan	3.9	1.9
SNOLAB	2.0	0.2



Conclusion

SNOLAB is an important partner for Health Canada

Operates two stations (one CMRN + one fixed point)

- Could the samples be routinely measured at SNOLAB?
- High volume sampling?
- Interested in H3?

SNOLAB is HC's ultimate reach back detector

- Need to better integrate that capacity
- More intercomparisons?

Questions?

Contacts
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