

The background of the slide is a photograph of a brick building, likely a utility or industrial facility. A sign on the building features the letters 'BWXT' in a stylized font with a red and blue graphic element. In the foreground, there is a chain-link fence and a paved area. The sky is blue with scattered white clouds.

Responding to Community Concerns

A Public Health Perspective on the BWXT licensing renewal

What are the **sources** of information and evidence that PPH basing its health-related recommendations upon?

- ATSDR - Agency for Toxic Substances and Disease Registry
- CAREX Canada (funded by the Canadian Partnership Against Cancer and hosted at Simon Fraser University)
- IAEA - International Atomic Energy Agency
- IARC - International Agency for Research on Cancer
- PHO - Public Health Ontario
- UNSCEAR - United Nations Scientific Committee on the Effects of Atomic Radiation

Federal Role

The Nuclear Safety and Control Act and its associated Regulations, is in place to regulate the development, production, and use of nuclear energy, and the production, possession, and use of nuclear substances, prescribed equipment and prescribed information. The use of nuclear power, radiation exposure devices, radioactive material, and high-energy x-ray systems, are all regulated under this federal system, including the transportation of radioactive material.

The Canadian Nuclear Safety Commission is responsible for regulating the use of nuclear energy, to protect Canadian's health, safety, security and environment.

Provincial Role

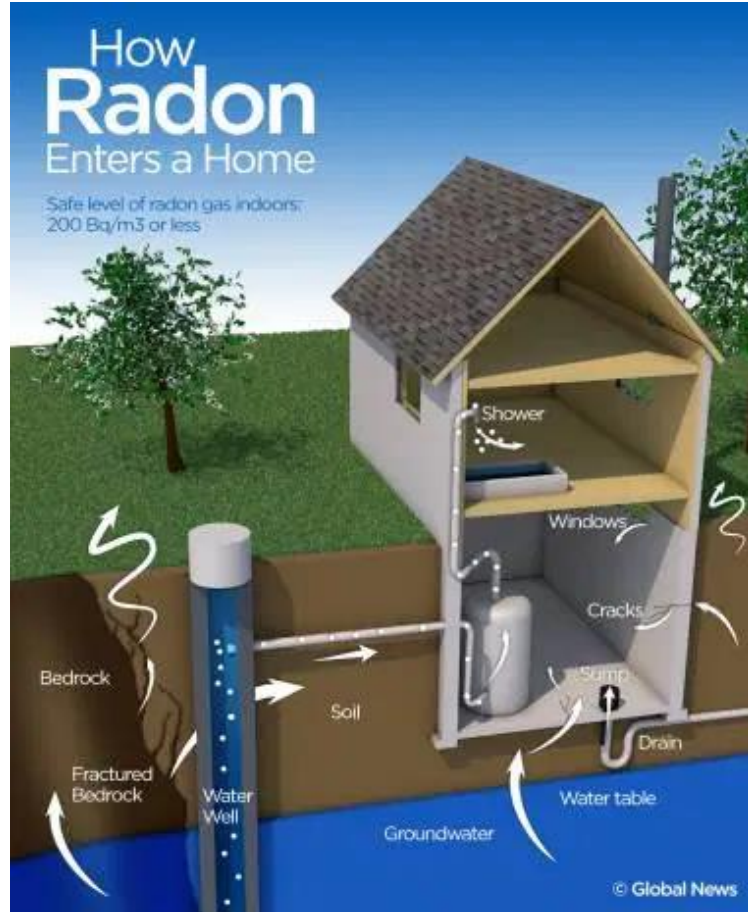
- All provinces and territories, and the federal regulators, may participate in the **Federal Provincial Territorial Radiation Protection Committee (FPTRPC)**.
- Individual provinces and territories are responsible for regulations around radiation use, for situations that are not under federal jurisdiction.
- Ontario Ministry of Labour is responsible for industrial and workplace exposures.
- Ontario Ministry of Health manages exposures due to the healthcare system.
- Ministry of Environment, Conservation and Parks regulates the environmental impacts

FACT: Peterborough is **not** dealing with the products of NUCLEAR FISSION

- BWXT processes natural uranium, mostly U238
- Beryllium is used for the fuel rods
- There is no fission of uranium
- There are no products of uranium enrichment or fission in the facility
- There is no risk of a catastrophic nuclear event



FACT: Uranium is an alpha emitter but it is **not** Radon Gas



- Radon ²²² is an alpha particle emitter, inhalable, and a known carcinogen
- Occupational studies of uranium miners and millers
- Second leading cause of lung cancer in Ontario
- **IARC does not classify uranium as a carcinogen**

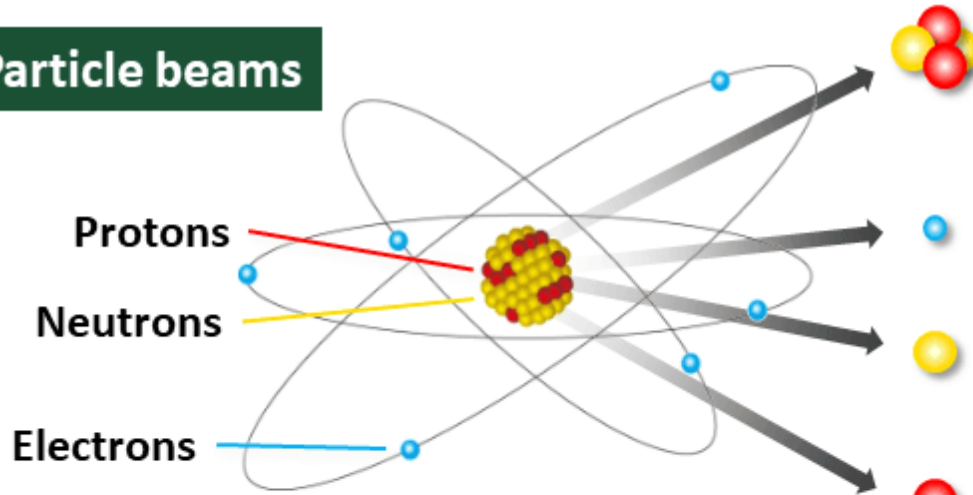
FACT: Uranium is **not** classified as a Carcinogen

- Most of natural uranium is U238
- Half-life of 4.5 billion years means very weak radioactivity
- Alpha particles have little kinetic energy
- Heavy solid (versus Radon gas)
- Chemical toxicity as well as radioactivity: KIDNEY (no indication that infants or children are more sensitive)
- Contributes to background radiation exposure
- Animal studies
- Occupational studies
- Population studies



Types of Ionizing Radiation

Particle beams



α -particles (helium nuclei ejected from a nucleus)



β -particles (electrons ejected from a nucleus)



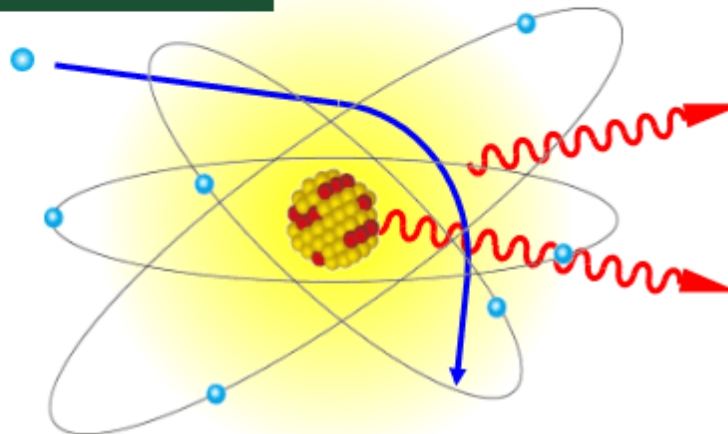
Neutron beams (produced in nuclear reactors, accelerators, etc.)



Proton beams (produced in accelerators, etc.)

Electromagnetic waves

Electrons
(β -particles)



X-rays (generated outside a nucleus)

* X-rays generated when electrons within an atom are caused to travel between orbits by incident electrons are called characteristic X-rays.

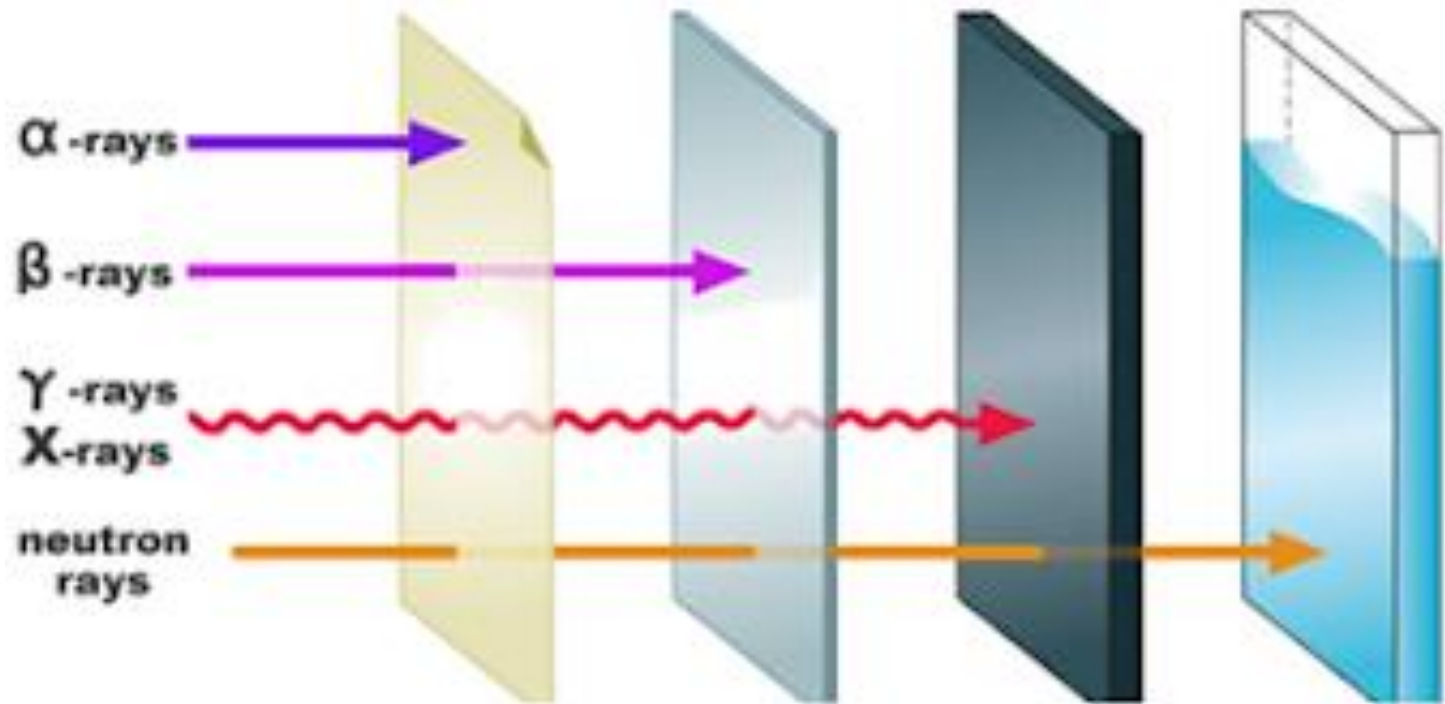
γ -rays (emitted from a nucleus)

How far different types of radiation travel and penetrate materials

Alpha particles, travel a few cm in air

Beta particles, travel a few m in air

Gamma rays (and X-Rays), travel hundreds of metres in air



Paper

Thick board such as aluminum or the human body

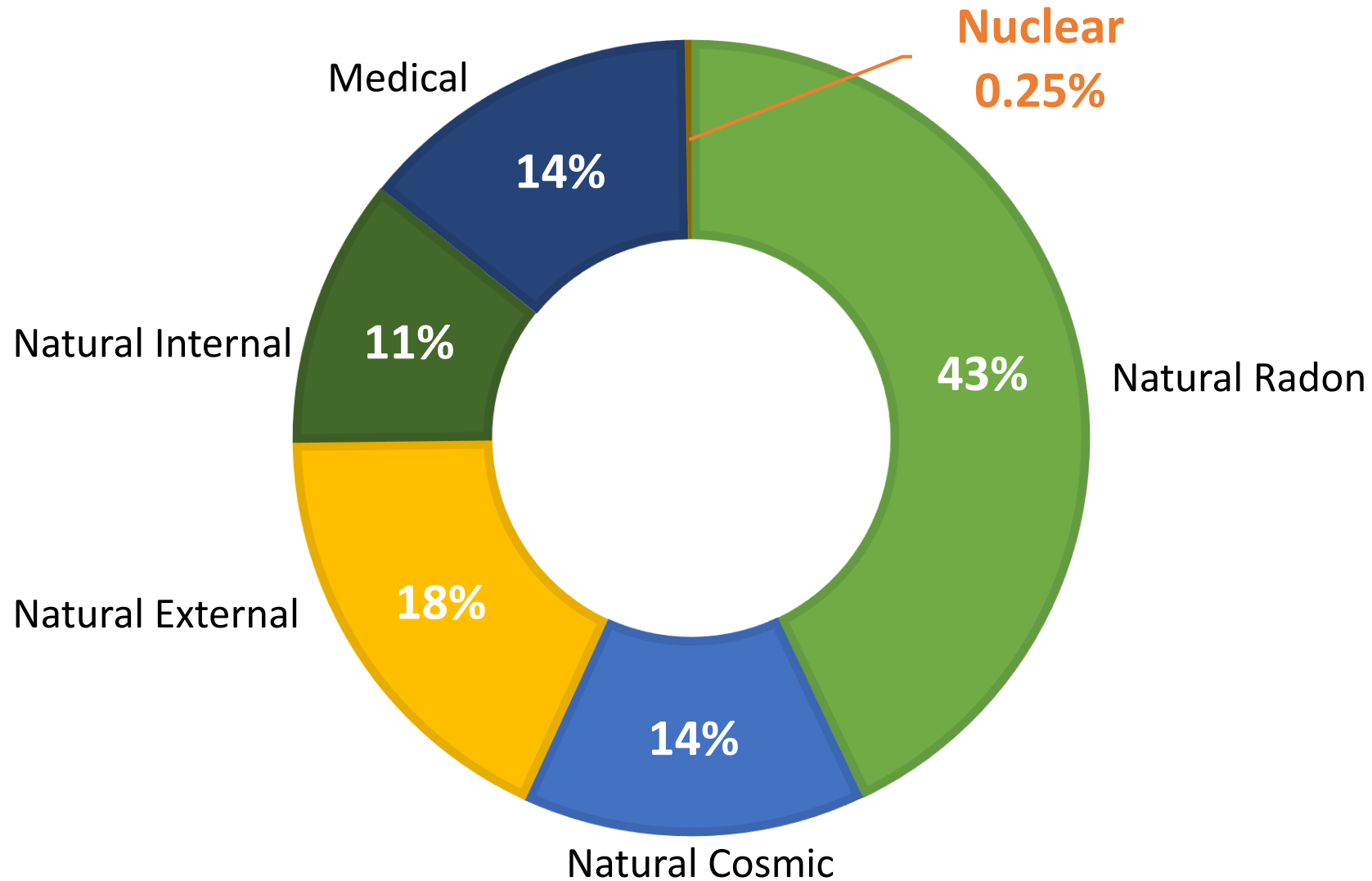
Thick board such as lead or many metres of concrete

Materials containing hydrogen, such as water, concrete

How do we measure exposures?

- **Equivalent dose** or Sievert: (absorbed dose X factor weighting for harm), e.g. Alpha particle = 20
- **Effective dose**: equivalent dose X weighting for risk associated with that tissue or organ
- **Annual global effective dose** = 2.8 mSv
- International Commission on Radiological Protection (ICRP) is an NGO, scientific organization founded in 1928 recommends “optimization of protection” to IAEA which has statutory function to establish safety standards.

We are all exposed to background radiation



Exposure levels in Canada



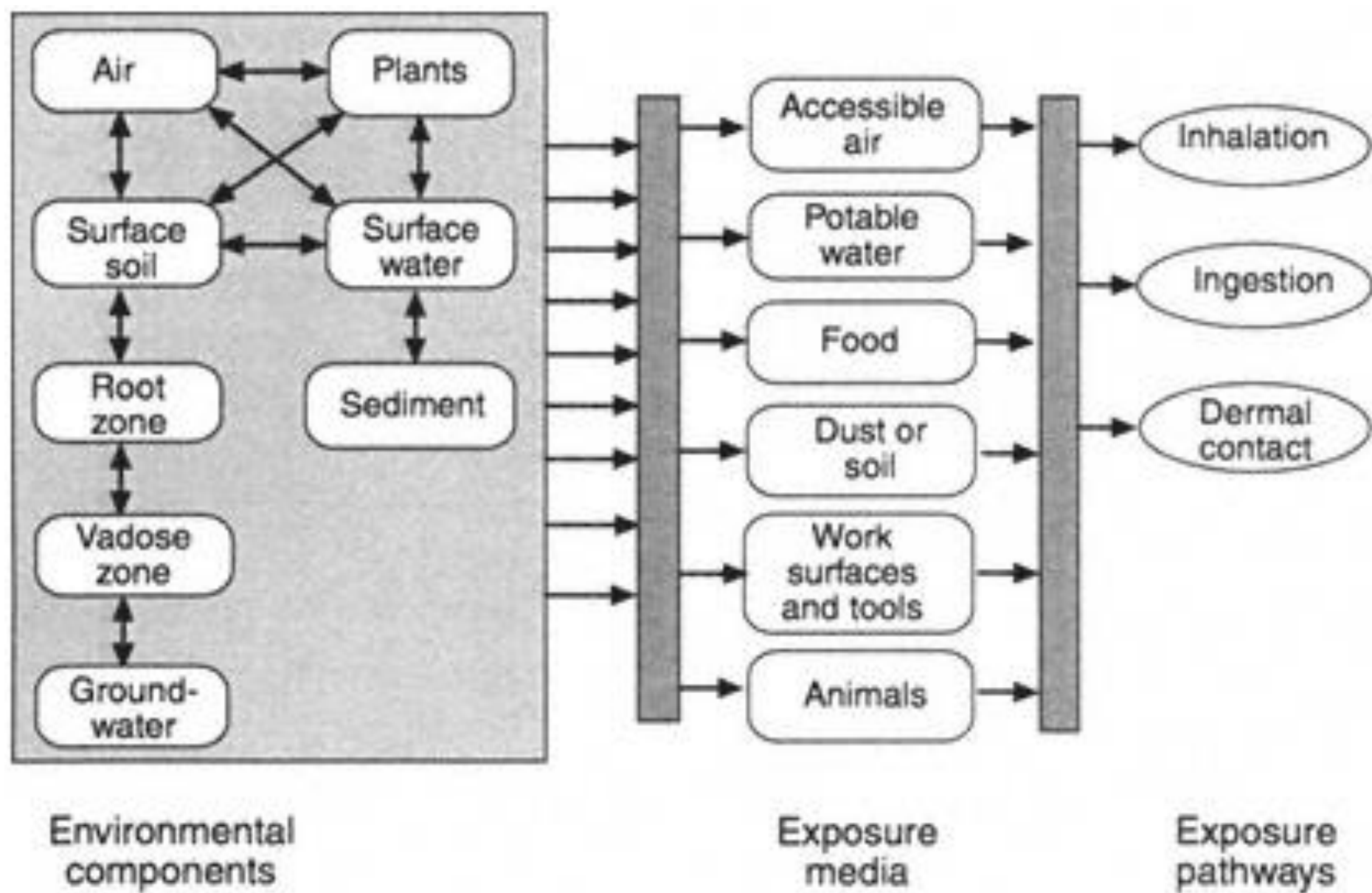
- The average Canadian is exposed to about **1.8 millisieverts (mSv)** of radiation annually from background radiation.
- Here are a few examples of radiation levels from various sources:
 - A dental X-ray could expose a patient to an estimated 0.01 mSv of radiation
 - A long, cross-country air flight could expose a person to about 0.03 mSv of radiation
 - A chest X-ray could expose a patient to an estimated 0.1 mSv of radiation
 - A mammogram could expose a patient to an estimated 3 mSv of radiation
 - A CT scan can expose a person to between 5 and 30 mSv of radiation depending on the area being scanned

Limit on public dose is 1 mSv:

Population	Maximum Annual Dose (mSv)
Nuclear Energy Worker	50
Pregnant Nuclear Energy Worker	4
General Population	1

Table 3.6: Estimated annual public doses from air emissions and environmental TLD for both Toronto and Peterborough facilities respectively [8-12]

Period	Toronto			Peterborough			Public dose limit [μSv]
	Gamma dose from TLD/Survey Meters [μSv]	Dose from air emissions [μSv]	Total [μSv]	Gamma dose from TLD [μSv]	Dose from air emissions [μSv]	Total [μSv]	
2014	4.8	0.41	5.2	N/A	0.00	0.00	1000
2015	9.4	0.41	9.8	N/A	0.00	0.00	
2016	0.00	0.7	0.7	0.00	0.00	0.00	
2017	17	0.49	17.49	0.00	0.00	0.00	
2018	0.00	0.41	0.41	0.00	0.00	0.00	



Building in Protection

Uncertainty Factor Default Values

Factor*	Extrapolation
H 10	Average Human to Sensitive Human
A 10 or 3	Animal to Human
S 10	Sub-chronic to Chronic Exposure
L 10	LOAEL to NOAEL
D 10 or 3	Minimum to Complete Database

*These factors are used by the U.S. EPA. Other health organizations use similar factors.

How is this then incorporated into regulatory limits?

- The Canadian Soil Quality Guidelines for Uranium (2007) and Beryllium (2015) are derived to provide both environmental and human health protection
- 2019 Drinking Water Guideline: A maximum acceptable concentration (MAC) of 0.02 mg/L (20 µg/L) is established for total natural uranium in drinking water. Uranium (2019) guidelines contain extensive toxicology review.
- Ambient Air Quality Criteria (AAQCs) developed by the Ontario Ministry of the Environment (MOE) to determine the maximum desirable concentration of a contaminant in air, based on protection against adverse effects on health or the environment.

Annual Uranium Emissions from BWXT into Air (kg)

Parameter	Uranium – Toronto	Uranium - Peterborough
Licence Limit (FLOLs)	0.76	0.55
2018	0.00628	0.000002
2017	0.00744	0.000002
2016	0.01080	0.000004
2015	0.01080	0.000003
2014	0.01090	0.000003
2013	0.00579	0.000013

Table 4.1 - Summary of the BWXT Peterborough IEMP results for 2014, 2018, and 2019

Substance	Results			Guideline
Water (µg/L)				
	2014	2018	2019	
Uranium	N/A	0.2	0.29 – 0.34	15 (2)
Beryllium	N/A	<0.1(1)	<0.01(1)	11(3)
Air (µg/m3)				
	2014	2018	2019	
Uranium	0.0013	<0.003(1)	<0.00009(1)	0.03(4)
Beryllium	0.000077	<0.003(1)	<0.0003(1)	0.01(4)
Soil (mg/kg dry weight)				
	2014	2018	2019	
Uranium	1.0 – 1.8	1.38 – 1.92	1.21 – 2.05	23(5)
Beryllium	0.7 – 1.1	1.08 – 1.34	1.10 – 2.34	4.0(5)

(1) The < symbol indicates that a result is below the detection limit for laboratory analysis ; (2) CCME Water Quality Guidelines for the Protection of Aquatic Life – Long Term Exposure; (3) Ontario Provincial Water Quality Objective (PWQO); (4) Ontario MECP air quality standards; (5) CCME Soil Quality Guidelines for the Protection of Environmental and Human Health – Residential/parkland

Table 3.4: Annual average concentrations of uranium in ambient air as measured around BWXT Toronto [4-12]

Parameter	2013	2014	2015	2016	2017	2018	Ontario Standard
Annual average concentration ($\mu\text{g}/\text{m}^3$)	0.0007	0.0006	0.0010	0.0010	< 0.0001	<0.0001	0.03

Let the discussions and the learning continue...

The screenshot shows the Peterborough Public Health website. At the top, there is a navigation bar with the logo and links for 'About Us', 'Inspections', and 'Contact Us'. Below this is a search bar and social media icons. The main content area features a large banner image of a woman and a child. Below the banner are three featured articles:

- FAQ - BWXT**: We encourage you to send us your health-related questions about upcoming re-licensing of BWXT in Peterborough.
- Novel Coronavirus (2019-nCoV)**: Peterborough Public Health is actively monitoring the Novel Coronavirus (2019-nCoV) and collaborating with local hospitals, Ministry of Health, provincial and national colleagues.
- Cannabis Edibles**: While they may look like common food or drink items, cannabis edibles are like other drugs and can affect the way we think, feel and act. [Learn More →](#)

FAQ – BWXT

We encourage you to **send us your health-related questions** about upcoming re-licensing of BWXT in Peterborough. All questions will be reviewed and those within the scope of Peterborough Public Health will be answered by a Public Health Inspector and posted below. If your question is not health-related, we will provide a referral for the agency that is better-suited to answer the question. Your question will remain anonymous except for your street name and municipality.

Here are some frequently asked questions updated as of February 6, 2020

- + 1. What are the health risks to local residents and students/staff of Prince of Wales School if BWXT starts producing uranium pellets?
- + 2. What are the health risks to employees of BWXT if starts producing uranium pellets?
- + 3. Isn't there a risk that the BWXT facility might produce fugitive dust?
- + 4. What is PPH doing to protect the public from uranium exposure?

QUICK LINKS

BWXT

[Beryllium](#)

[BWXT Licence Renewal](#)

[FAQ - BWXT](#)

[Submit a Question](#)

[Uranium](#)

Responding to Community Concerns:

- Current system includes limits, independent testing and action levels
– stronger community engagement is encouraged
- Thorough risk assessment actively done by PPH, with support from PHO
- Addressing misconceptions/misunderstandings in RISK
- Health related questions answered in an accessible way
- More data being requested
- Recommendations to CNSC/participation at Peterborough hearings