



## Frequently Asked Questions (FAQs)

### **Synthesis Report: Understanding Health Studies and Risk Assessments Conducted in the Port Hope Community from the 1950s to the Present**

#### **Q1. What did the synthesis report conclude?**

A1. Based on the environmental and epidemiological studies conducted in Port Hope and the findings of research studies conducted in other countries, the Canadian Nuclear Safety Commission (CNSC) concluded that no adverse health effects have occurred or are likely to occur in Port Hope as a result of the operations of the nuclear industry in the community.

#### **Q2. Is Port Hope a safe place to live?**

A2. Yes. Residents of Port Hope are just as likely to live safe and healthy lives as people in any other communities in Ontario or Canada. No adverse health effects have occurred or are likely to occur in Port Hope as a result of the operations of the nuclear industry in the town.

#### **Q3. Why was the synthesis report prepared?**

A3. Many health studies have been performed throughout the years because of the historic and current presence of the nuclear industry in Port Hope and because some residents have expressed concerns about possible health effects in the community.

The CNSC's Commission Tribunal therefore requested CNSC staff to draft a report to integrate the results and conclusions of all Port Hope health studies that had been conducted over the years. The synthesis report was prepared to meet this commitment.

#### **Q4. What information does the synthesis report contain?**

A4. The report contains information that dates between the early 1930s and 2006 and that comes from various sources —some specific to Port Hope and others from scientific research conducted in other countries.

The synthesis report contains scientific information on the toxicological and radiological properties and known health effects of radiation, uranium and other chemicals found in Port Hope. Over 30 environmental studies and 13 epidemiological studies that were conducted in Port Hope are included, along with several major reviews of more than 40 epidemiological studies on the health effects in the following populations: people living near uranium mills and processing facilities; people exposed to naturally high levels of

uranium in their drinking water; workers in uranium mills, processing and fuel fabrication facilities; and veterans who had been exposed to depleted uranium.

**Q5. What Port Hope health studies were reviewed in the synthesis report?**

A5.

- Thirteen epidemiological studies that were conducted over the last 30 years, and that focused on the overall health status of the residents and radium and uranium workers of Port Hope and that assessed the relationship between radiation exposure and health effects.
- Nine descriptive ecological studies that covered the time period between 1954 and 2006: These compared the overall health status of the general population with that of other similar communities, Ontario or Canada and looked at all causes of death, newly diagnosed cancers (incidence) and birth defects;
- Ecological studies covered time periods both before and after remediation and implementation of mitigation measures at the Port Hope Conversion Facility: (PHCF):
  - Five studies that examined 30 years of cancer incidence
  - Five studies that examined 50 years of mortality
  - Six studies that looked at birth defects, childhood cancer or infant mortality
- Two case-control studies that were conducted in Port Hope: The first assessed the relationship between lung cancer and residential radon exposure, and the second assessed the relationship between offspring with childhood leukemia and fathers' occupational radiation exposure;
- The original and recently updated Eldorado cohort studies: These looked at 3 000 Port Hope radium and uranium workers who were first employed any time from 1932 to 1980. Detailed information on individual occupational radiation exposures from 1932 up to 1999 was collected. The cohort studies provided 50 years of mortality and 30 years of cancer incidence information on individual workers to assess the relationship between occupational radiation exposures and health effects. These were the most important epidemiological studies conducted in Port Hope.

Findings from the 13 Port Hope epidemiological studies were compared with over 40 other epidemiology studies of other similar populations conducted in other countries.

**Q6. What is the purpose of peer review?**

A6. The purpose of peer review is to have scientific work reviewed by experts in the relevant field to ensure its scientific quality. In scientific and academic circles, the phrase "peer-reviewed study" can refer to a study that was peer-reviewed and published by refereed scientific journals. Scientists also often recognize and reference scientific literature in books or by governments and other authoritative scientific institutions, since these also undergo scientific peer review.

**Q7. Was the synthesis report peer-reviewed? What was the peer-review process?**

A7. Yes, the report was peer-reviewed.

Dr. Naomi H. Harley reviewed the final draft document. As an international radiation expert who has done extensive research on uranium and radon, she is highly qualified to give an objective scientific assessment.

The report was also reviewed at earlier stages:

- In August 2008, SENES Consultants Limited, Health Canada, and Natural Resources Canada reviewed it for factual correctness of the history of Port Hope and for accurate descriptions and completeness of the studies done by their organizations.
- From December 2008 to January 2009, Health Canada and the Ontario Ministry of the Environment gave an in-depth peer review of a near-final draft of the report. These organizations have published several documents on Port Hope, developed or are in the process of developing uranium drinking water and air quality guidelines and their expert opinions were vital to the creation of this document.

CNSC staff reviewed comments received from all these sources and considered them when preparing the final document.

The studies included in the synthesis report were also individually peer-reviewed. Scientific journal articles are often written about small parts of larger government documents. Several such journal articles were based on government documents of studies conducted in Port Hope.

**Q8. Who is Dr. Naomi H. Harley and why was she selected as a peer reviewer?**

A8. Dr. Harley was the report's principal peer reviewer and was selected for her background and qualifications as an international radiation expert who has done extensive research on uranium and radon. Dr. Harley is an authority in radiation physics, obtained her Ph.D. in radiological physics at New York University and is currently a research professor at New York University School of Medicine, Department of Environmental Medicine. She has authored or co-authored about 150 refereed journal articles on the measurement, dosimetry and risk of internal radionuclides and external radiation, with an emphasis on natural background radiation. She has written six book chapters dealing with radiation or toxicology and has three patents for radiation measurement devices. She is a council member of the National Council on Radiation Protection and Measurement, an advisor to the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), and an editor of the journal *Environmental International*.

**Q9. What evidence did the CNSC use when assessing if the Port Hope nuclear industry could have caused adverse health effects in local residents?**

A9. The CNSC evaluated the information collected along two principal lines of evidence using a weight-of-evidence approach:

- **Environmental studies**, which analyzed and measured the environmental concentrations of contaminants attributable to the nuclear industry in Port Hope and compared them with national and international benchmarks to assess potential risks
- **Epidemiological studies**, which compared the health status of the residents and nuclear workers of Port Hope with the general population (descriptive, ecological studies), and assessed the relationship between occupational and residential exposures and potential adverse health effects (case-control and cohort studies)

The CNSC also needed to examine many other factors when determining if environmental contamination levels could have affected human health or the environment in Port Hope:

- Is a substance toxic and if so, at what levels?
- What was/is the level of exposure, if any?
- When did the exposure occur?
- Have health effects from this exposure been observed?
- Of what the quality is the information (qualitative, quantitative, sources of uncertainty, etc.)?

The report discusses these factors and related findings, and outlines sources of natural and man-made radiation to put radiation from the Port Hope nuclear industry into perspective. A detailed history of the nuclear industry in Port Hope identifies the sources of contamination and the remediation activities undertaken to reduce these levels. The scientific understanding of the sources and health effects of radiation, uranium and other contaminants are identified and the most plausible potential health effects associated with the nuclear industry in Port Hope are identified. The levels of human exposure to contaminants were identified in 30 environmental studies to assess their potential risk to human health. Current regulatory limits, benchmarks and guidelines to protect human health were discussed along with current levels of exposure. Thirteen epidemiological studies were conducted to assess the health of the community and workers in association with the historic and present nuclear industry in Port Hope. The environmental and epidemiological studies were compared for consistency of findings. Port Hope findings were compared with international scientific reviews of over 40 epidemiological studies of populations with similar situations and exposures for consistency of findings.

The CNSC based its conclusions on a comprehensive review and interpretation of all of these lines of evidence.

**Q10. What are the contaminants of concern in Port Hope?**

A10. The main sources of radiological contaminants of concern in Port Hope come from the historic low-level radioactive waste and are part of uranium's decay chain. They include **radium, radon and radon decay products, long-lived radioactive dusts and very small amounts of gamma radiation**. These sources of radiation represented less than 1% of a Port Hope resident's total sources of ionizing radiation each year (other than natural background and medical sources of radiation) throughout the time the nuclear industry was in the town.

The main non-radiological contaminants of concern in Port Hope are **uranium, ammonia, fluoride**, which have come from the Port Hope conversion facility's stack emissions, and **arsenic**, due to historic contamination. Other heavy metals are only found in trace amounts in Port Hope so are not considered contaminants of concern.

**Q11. What are the most plausible potential health effects in Port Hope associated with the nuclear industry?**

A11. **Lung cancer, bone cancer and kidney disease are the most plausible (although unlikely) potential health effects in Port Hope residents and nuclear workers**. This is based on an assessment of environmental contaminants present in the community, existing scientific understanding of the toxicological and radiological properties of contaminants, their known health effects, and their levels of exposure within the community and workplace.

**Lung cancer:** Radon and its decay products, and long-lived radioactive dust (uranium dioxide/UO<sub>2</sub>) are known to cause lung cancer. No other cancer or other disease is known to be associated with these types of radiation.

**Bone cancer:** Radium at very high levels (above 10 Sv) can increase the risk of bone cancer.

**Kidney disease:** Uranium at very high levels can cause kidney disease in animal experiments. High levels of uranium can cause changes to kidney cells, which are largely reversible, in humans. No human cancer or any type of genetic effect has ever been seen as a result of exposure to natural or depleted uranium.

However, the Port Hope studies assessed all causes of death, all cancer types, and all birth defects in Port Hope residents and nuclear workers.

**Q12. Why were certain diseases associated with the contaminants of concern in Port Hope considered to be implausible health effects of the Port Hope nuclear industry?**

A12. Cancers like breast cancer and leukemia are associated with high doses of gamma radiation to the whole body. These types of cancers are considered implausible health effects in Port Hope because the dose from even extraordinarily high levels of these uranium decay products is very low. Such a low dose cannot be considered an additional

carcinogen. Uranium miner cohort studies show no convincing link between gamma doses from uranium and excess incidence of leukemia.

Health effects from human exposure to arsenic, ammonia and fluoride in Port Hope are also considered implausible. Health effects from these contaminants are only seen at very high concentrations. These contaminants are all at low levels, below those at which health effects would be expected.

Other heavy metal contaminants found in Port Hope are not considered contaminants of potential concern because they occur in trace amounts.

Even the plausible potential health effects from uranium (kidney disease), radium (bone cancer), and radon and its decay products (lung cancer) are unlikely in Port Hope because exposures are so low.

**Q13. Can uranium cause kidney disease in humans?**

A13. The main potential health effect of uranium exposure is kidney disease. Exposure to very high levels of uranium can cause kidney disease in animal experiments. In humans, very high concentrations can cause changes to kidney cells, which are largely reversible. However, based on scientific reviews of over 40 epidemiological studies, there is no evidence of increased kidney disease in the large occupational populations chronically exposed to uranium at above-normal concentrations, or in people exposed to environmental uranium. The scientific reviews concluded there is no evidence to link the levels of uranium exposure in the studies to kidney disease or to any other cause of death or cancer.

Very rare acute uranium exposure at high levels (for example, deliberate poisoning) can result in kidney failure in humans. However, the levels of environmental and occupational uranium exposure in Port Hope are far lower than the levels linked to these effects.

**Q14. Was there sufficient evidence of excess kidney disease, lung cancer or bone cancer in Port Hope to conclude health effects were associated with the nuclear industry within the town?**

A14. No. There was no evidence of significant excess kidney disease or bone cancer in Port Hope. Although there was evidence of excess lung cancer incidence in women from 1986 to 1996, the vast weight of evidence (the lack of excess lung cancer in the following situations : lung cancer incidence in men and in other time periods, lung cancer mortality in men and women, lung cancer incidence and mortality in Port Hope nuclear workers, no relationship between occupational radiation exposures and lung cancer, no conclusive evidence of a relationship between lung cancer and residential radon in Port Hope), did not support lung cancer being associated with the nuclear industry in Port Hope.

These findings were consistent with the international scientific literature on toxicological and radiological understanding of uranium, radium, radon and its decay products, the low levels of exposure to these contaminants in Port Hope environmental studies and international reviews of over 40 epidemiological studies conducted worldwide of similar exposures and populations as Port Hope.

**Q15. The epidemiological studies in Port Hope found “increased frequency of some disease”. Should this be a concern for the community?**

A15. No. The report’s overall conclusions are correct:

- None of the studies reviewed showed unusual patterns of cancer or any other diseases **related to the nuclear industry**, either in workers or members of the community.
- The health of Port Hope residents is consistent with the rest of the population of Ontario and Canada.

The synthesis report discusses all the findings within the individual studies. Any elevated rates of disease are noted, discussed and are put into context in the detailed discussion section. For example, there was evidence of significant excess cirrhosis of the liver and pneumonia in Port Hope. The main risk factor for cirrhosis of the liver is heavy alcohol use, and pneumonia is an infection of the lungs caused by bacteria, viruses and fungi. It is highly implausible that the excess mortality in Port Hope for these two causes of death was a result of the nuclear industry.

On the basis of this work, the CNSC stands behind its conclusions.

**Q16. Should I be concerned that the significant excess circulatory disease found in Port Hope could be a result of the nuclear industry in the town?**

A16. No. The excess circulatory disease found in Port Hope is highly unlikely to be related to the nuclear industry in the town.

Statistically significant excess of *circulatory disease (heart disease, arteriosclerosis, hypertension, diseases of the arteries, arterioles and capillaries)* was found in Port Hope and represented over half of all deaths in Port Hope residents. Excess circulatory disease was found consistently in the various ecological studies of residents’ mortality in Port Hope and excess hypertensive disease mortality was also found in radium and uranium workers in Port Hope. In the Eldorado study, there was **no relationship between workers’ occupational exposures and any type of circulatory disease mortality**, so their exposures did not cause their excess hypertensive disease. Excess circulatory disease was also found in all Northumberland County (excluding Port Hope), so these findings are not specific to Port Hope and are consistent with the rest of the community.

*Circulatory disease* is the leading cause of death in Ontario and Canada. The main risk factors are smoking, obesity, physical inactivity, high blood pressure, diabetes, stress, and alcohol consumption. High rates of many of these risk factors were found in the Rapid

Risk Factor Surveillance System for the Haliburton Kawartha Pine Ridge (HKPR) Health District, which includes Port Hope.

There is no evidence in the scientific literature of a relationship between radiation exposure and circulatory disease at exposures below about 1 000 to 2 000 mSv. Even the average cumulative exposures to nuclear workers are much lower (below 100 mSv) than the levels at which circulatory disease are seen.

CNSC staff have discussed the excess circulatory disease with the past HKPR Medical Officer of Health and the Ontario Ministry of Health epidemiologist. They concluded that the excess circulatory disease in Port Hope is most likely attributable to the main risk factors of the disease, as noted by the HKPR Health District.

**Q17. Should I be concerned that childhood cancers could be a result of the nuclear industry in Port Hope?**

A17. No. The incidence and mortality of *all childhood cancer (combined) and childhood leukemia* in Port Hope was comparable to that of the general Ontario and Canadian population. Three separate ecological studies found no significant excess cancer incidence (1964–1996) or mortality (1950–1997) from *all childhood cancer* or *childhood leukemia* for the entire period of study. Similarly, there was no significant relationship between leukemia in offspring and paternal radiation exposures in the case-control study. Leukemia is a cancer very sensitive to radiation exposure; however, environmental and occupational radiation exposures in Port Hope are much lower than levels at which one would expect to see excess childhood leukemia. It is therefore not surprising that there was no significant excess childhood leukemia and no relationship between childhood leukemia and parental occupational exposure, because exposures were so low.

One ecological study did find a significant excess of childhood brain cancer and non-Hodgkin's lymphoma incidence from 1971 to 1996. However, these excesses were based on fewer than 5 cases. There was no significant excess childhood brain cancer or non-Hodgkin's disease mortality from 1956 to 1997. There were less than 5 deaths for each of these childhood cancers in the 42 year period of study. In the scientific literature, there is little evidence of an association between brain cancer and non-Hodgkin's disease and radiation exposure or other contaminants of potential concern in Port Hope. The rarity of these cancers, the very small number of observed cases (5 or less) and the limitations of ecological studies makes any interpretation of results very uncertain.

**Q18. Should I be concerned that the Port Hope nuclear industry could cause birth defects?**

A18. No. There were no significant excess birth defects or infant mortality in Port Hope. In fact, female infants in Port Hope had significantly lower rates of birth defects compared with the general Ontario population. This finding is not surprising, since **no hereditary effects from radiation, or exposures to uranium, have been seen in human offspring.**

**Q19. Should I be concerned about brain cancer as a result of the nuclear industry in Port Hope?**

A19. No. A significant excess of female *brain and other nervous system cancer* incidence (1986–1996) and mortality (1986–1997) was found for single time periods. There were no excesses in other time periods or in men. In the scientific literature, the relationship between radiation and brain and other nervous system cancer is not strong, and most of the radiation-associated tumor risk occurs for tumors that are benign. There is no evidence of brain cancer associated with the other contaminants of potential concern. There was no evidence of excess brain cancer in Port Hope nuclear workers and there was no relationship between occupational radiation exposures and brain cancer incidence or mortality. Brain cancer is susceptible to inaccurate reporting because non-brain cancer will often present as brain metastasis. The rarity of this cancer, the small number of observed female brain cancers, the lack of findings in men and in other time periods, and the limitations of ecological studies result in very uncertain interpretation of these findings.

**Q20. Dr. Mintz, the reviewer selected by the Port Hope Community Health Concerns Committee (PHCHCC), noted elevated rates of disease and significant disease trends in the Port Hope cancer incidence and cancer and general mortality reports conducted by Health Canada. Were his concerns addressed in the synthesis report?**

A20. Yes. The CNSC has heard and considered all of Dr. Mintz's concerns, but maintains its position that the cancer incidence and mortality in Port Hope are comparable to those of the general population in Ontario and Canada, and that no adverse health effects have occurred or are likely to occur as a result of the operations of the nuclear industry in the town. The synthesis report addresses the issues raised by Dr. Mintz in his review.

**Q21. Dr. Blecher, the reviewer selected by Families Against Radiation Exposure (FARE), noted that the synthesis report's findings about the Eldorado workers conflict with those in the final report of the recently updated Eldorado Study. Why?**

A21. Dr. Blecher quoted only the abstract of the entire updated Eldorado study, which included uranium workers at the Beaverlodge and Port Radium mine sites, Port Hope facility, and workers at other sites.

The CNSC's synthesis report discusses the findings for **only the Port Hope radium and uranium workers at the Port Hope facility**, who had very different health outcomes from uranium miners due to their very different exposures. These findings can be found in the detailed final report of the recently updated Eldorado study. The synthesis report correctly states the findings about Port Hope nuclear workers in the original and recently updated Eldorado studies.

**Q22. Is there a safe level of radiation?**

A22. An enormous amount of scientific research has gone into understanding radiation. Its effects have been studied for decades to understand how and at what levels radiation doses can cause health effects.

A radiation dose above 100 mSv is known to increase the likelihood of cancer depending on the amount and type of radiation, the person's sensitivity to the radiation and other factors. Doses below 100 mSv are also believed to increase the likelihood of cancer, but so far, the incidence of radiation-related cancer at doses below 100 mSv cannot be distinguished from that of the general population. Human health studies provide no evidence of cancer at much smaller, chronic radiation doses like those found in Port Hope's environment.

Nonetheless, to protect members of the public and to address any uncertainties in radiation risk, the CNSC has set the radiation dose limits at 1 mSv/year for members of the public (for artificial sources over and above natural background and medical radiation). Canadians (and residents of Port Hope) receive, on average, 2.4 mSv of radiation each year from all sources. Radiation as a result of Port Hope's nuclear industry has represented less than 1% of residents' annual exposure, throughout the history of the nuclear industry in the town.

**Q23. What are the levels of radon exposure in Port Hope?**

A23. Radon represents the most important source of naturally occurring radiation exposure for humans. Radon exposure in Port Hope is about 0.6 mSv/year, which represents 23% of the region's total average annual radiation dose. This is comparatively lower than rates in other regions of Canada and around the world:

- For all of Canada, radon exposure is about 0.92 mSv/year, which represents 32% of the total average annual radiation dose.
- Worldwide, radon exposure is about 1.2 mSv/year, representing 43% of the total average annual radiation dose

Historic low-level radioactive wastes near residential and commercial buildings are an additional source of radon and its decay products in Port Hope. Before remediation, some homes in Port Hope had radon concentrations as high as 350 Bq/m<sup>3</sup>.

Following remediation, typical median indoor air concentrations of radon were about 25 Bq/m<sup>3</sup> in living areas and about 40 Bq/m<sup>3</sup> in basements of Port Hope homes. The upper radon concentrations detected were approximately 155 Bq/m<sup>3</sup> in the basements. These numbers are all below Health Canada's current guideline of 200 Bq/m<sup>3</sup> for indoor radon.

**Q24. What is the basis for uranium safety standards established to protect human health?**

A24. Many studies have documented the biological mechanisms involved in uranium toxicity and the concentrations of uranium at which effects are observed. These effects have been studied at the organism level, at the organ level and at cellular and sub-cellular levels.

This information is used by national and international organizations — such as Health Canada, the United States Environmental Protection Agency, the United States Agency for Toxic Substances and Disease Registry, and the World Health Organization — to establish safe levels of uranium in drinking water and air. These safe levels, called “tolerable daily intake” or “oral reference dose,” typically incorporate safety margins; for example, a safe level would be established at a benchmark of 10 to 30 times lower than what is actually considered toxic, to account for uncertainties and varying susceptibility in a population exposed to uranium.

**Q25. What are the current guidelines/standards for uranium in air, water and soil?**

A25. The following table summarizes the Canadian and Ontario guidelines/standards.

	<b>Air</b>	<b>Water</b>	<b>Soil</b>	<b>Vegetation</b>
<b>Uranium</b>	0.02-0.5 µg/m <sup>3</sup> (1)	0.02 mg/L (2)	23 mg/kg (3)	N/A

(1) Proposed Ontario Ambient Air Quality Criterion for Uranium

(2) Ontario Drinking Water Standards

(3) CCME Soil Quality Guideline (Residential/Parkland Land Use)

**Q26. What are the estimated daily intakes of uranium in Port Hope?**

A26. The estimated intakes of uranium in Port Hope are from 0.6 to 3.2 µg/day. These values are comparable to the Ontario average and are only about 1/10 of the tolerable daily intake value recommended by the World Health Organization, whose established limits are considerably more restrictive than those of other organizations.

**Q27. Uranium soil concentrations at some public properties in Port Hope exceed the levels considered safe by the Canadian Council Ministers of the Environment. Are these soil concentrations hazardous?**

A27. Risk assessments conducted in Port Hope indicate that elevated uranium concentrations in some of the region’s soils pose no risk to Port Hope residents’ health.

The Ontario Ministry of the Environment (MOE) has monitored soil and vegetation near Cameco’s facility since 1968. In 1991, a human health risk assessment conducted by the MOE concluded that exposures to reported levels of uranium in Port Hope soils (135

mg/kg) were not expected to result in adverse health consequences. In 2008, the maximum uranium concentration in Port Hope soil was lower than in 1991 and measured only 93.6 mg/kg. The limited contamination of parklands in Port Hope therefore cannot be expected to result in any adverse health consequences.

The Canadian Council of Ministers of the Environment (CCME) recently published the following Canadian Soil Quality Guidelines for uranium, for the protection of human health and the environment:

- 23 mg/kg of uranium for agricultural land use
- 23 mg/kg for residential or parkland land use
- 33 mg/kg for commercial land use
- 300 mg/kg for industrial land use

It is important to note that the CCME criteria are extremely conservative because they are intended for screening purposes. For example, the CCME guidelines use a highly conservative assumption of 100 % biological availability of ingested soil (that is, that 100% of any ingested uranium would be absorbed through a person's gastrointestinal tract), but uranium is **not** efficiently absorbed by the gastrointestinal tract. The International Commission on Radiological Protection recommends using assumptions of 2% and 0.2% for absorption of soluble and insoluble uranium compounds, respectively. Estimates of bioavailability have been made in Port Hope using acid leaching methods to mimic stomach acid levels, resulting in a value of about 18%.

**Q28. Are the elevated levels of soil uranium in the park downwind from Cameco's Port Hope Conversion Facility (PHCF) a recent development? Do they invalidate the synthesis report's conclusions?**

A28. Historical uranium and other metal contamination in the Port Hope region have long been recognized and has always been the focus of clean-up activities. Many environmental studies were conducted to identify areas with elevated levels of uranium and other metals, in order to direct future remediation. These studies identified that the park downwind from Cameco had elevated concentrations of uranium, arsenic, lead, antimony and other chemical elements.

A soil uranium concentration of 135 mg/kg was measured in 1987 in the park area south of Madison Street, the vicinity documented in 1991 as measuring approximately 94 mg/kg.

Previous work in the Port Hope area has demonstrated that historical uranium levels are associated with elevated levels of other heavy metals like arsenic and lead. Arsenic and lead are not currently being released by Cameco's PHCF, but recent measurements show these two metals are clearly elevated in the park sample with the highest uranium concentrations. Therefore, the elevated arsenic and lead levels measured by Cameco in 2008, along with the previous substantially higher uranium concentrations measured in 1987, suggest that historical contamination is the most likely source of arsenic, lead and uranium.

These findings do not invalidate the findings of the synthesis report. The conclusions took past and present exposures into consideration.

**Q29. Why does the synthesis report not discuss the Uranium Medical Research Centre's Port Hope study?**

A29. CNSC staff excluded the data from the Uranium Medical Research Centre (UMRC) Port Hope study in the synthesis report because the UMRC's data were unreliable.

Dr. Asaf Durakovic, the UMRC study's author, stated in the *Summary of the Royal Society Reports on the Health Hazards of Depleted Uranium*, that there are uncertainties about the reliability of measurements of depleted uranium in urine. These uncertainties were due to difficulties obtaining reliable isotope ratios from urine samples that contained small amounts of uranium.

CNSC staff, Health Canada and other experts reviewed the UMRC study and concluded that all uranium levels measured in the urine of a few Port Hope residents were well below toxicological and radiological concern and were within the background ranges reported in many countries. The findings do not represent a health concern to the people of Port Hope.

**Q30. Is uranium continuing to accumulate in Port Hope soil?**

A30. Recent measurements do not indicate any accumulation of uranium in Port Hope soil. Current concentrations of uranium in soil observed at locations expected to be exposed to the highest air concentrations of uranium in Port Hope are below the values measured in previous studies. Median level of uranium soil concentrations is 3.1 mg/kg, which is within the range of the Ontario background concentrations for uranium.

Cameco's soil model predicts that uranium soil concentrations could increase in surface soils at a rate of around 0.2 mg/kg per year at the locations with the highest expected deposition from the air. However, the CNSC believes that Cameco's forecasted results are somewhat high (as they are based on highly conservative estimates of both air concentrations and uranium deposition rates). CNSC staff has estimated that operation of Cameco's PHCF will not result in accumulation of uranium at such locations to levels that would be a concern for human health or the environment, even for an assumed additional operating period of more than 100 years. The potential accumulation of uranium in the future must be validated by direct measurements of uranium soil concentrations.

The Ontario Ministry of Environment has redesigned its long-term soil uranium monitoring program and resumed soil test activities using larger areas, which have been remediated with clean soil, to avoid interference from historic uranium soil contamination. This provides a good opportunity to study more rigorously the potential accumulation of uranium in Port Hope soil as a result of the operation of Cameco's

PHCF. The CNSC will continue to communicate with the Ministry of Environment on this issue.

Cameco also redesigned its long-term soil monitoring program in 2005, and now monitors the uranium concentrations in soil annually at 26 Port Hope locations. The results obtained to date (from 2005 to 2009) indicate no accumulation of uranium in soil, including the location filled with clean soil four years ago.

**Q31. What are the current concentrations and regulatory benchmarks for major contaminants in the Port Hope environment?**

A31. The current concentrations of uranium, arsenic, fluoride, and ammonia in air, water and vegetation in Port Hope are below the respective benchmarks (see table below). Concentrations of uranium and arsenic in some soil samples are above the respective CCME soil quality guidelines due to the historical contamination in Port Hope. These exceedances are very limited and are not expected to result in any health consequences.

**Current Levels in Port Hope and Benchmarks**

	Air		Water		Soil		Vegetation	
	Port Hope	Benchmark	Port Hope	Benchmark	Port Hope	Benchmark	Port Hope	Benchmark
<b>Uranium</b>	0.00028-0.005 µg/m <sup>3</sup>	0.02-0.5 µg/m <sup>3</sup> (1)	0.00055 mg/L	0.02 mg/L (2)	0.24-93.6 mg/kg	23 mg/kg (3)	N/A	N/A
<b>Arsenic</b>	N/A	N/A	0.0005-0.002 mg/L	0.025 mg/L (2)	1-94 mg/kg	12 mg/kg (3)	N/A	N/A
<b>Fluoride</b>	2-22 µg/100cm <sup>2</sup>	40 and 80 µg/100cm <sup>2</sup> (4)	<0.25-0.25 mg/L	1.5 mg/L (2)	N/A	N/A	5-12 ppm	35 ppm
<b>Ammonia</b>	N/A	N/A	0.12-0.21 mg/L	1 mg/L	N/A	N/A	N/A	N/A

Exceeds benchmark due to historical contamination

(1) Proposed Ontario Ambient Air Quality Criterion for Uranium

(2) Ontario Drinking Water Standards

(3) CCME Soil Quality Guideline (residential/parkland land use)

(4) Ontario Ambient Air Quality Criterion for Fluoride in Vegetation (40 µg/100cm<sup>2</sup> during growing season, changing to 80 µg/100cm<sup>2</sup> during non-growing season)

(5) Ontario Objective for Fluoride in Forage for Livestock Consumption

**Q32. Has the federal government fulfilled its commitment to conduct health studies in Port Hope?**

A32. Yes. The Government of Canada has conducted extensive work in Port Hope that has fulfilled and exceeded commitments to conduct comprehensive health studies in the community. The CNSC's synthesis report outlines this work and provides a comprehensive assessment of the health of Port Hope.

Federal and provincial authorities, along with other groups, have invested tremendous effort in:

- measuring Port Hope's levels of environmental contamination
- estimating exposures and assessing risk to human health
- conducting epidemiological studies to assess the health of Port Hope residents and nuclear workers, and to assess the relationship between residential and occupational radiation exposure and the health effects

More than 40 different studies were conducted, consistently indicating low levels of exposure to all types of contaminants in Port Hope and that the town's nuclear industry has not caused health effects.

These findings are consistent with international scientific literature about the health effects of contaminants found in Port Hope, and with the findings of more than 40 epidemiological studies of other populations exposed to similar environmental or occupational exposures.

The combined efforts and findings of these studies provide a comprehensive assessment of the health of Port Hope residents and nuclear workers associated with the nuclear industry within the town.

**Q33. Is the CNSC carrying out its mandate to protect the health of Canadians and the environment if it allows the Cameco PHCF to continue operating? Will the facility's continued operation further increase uranium accumulation levels in Port Hope soil?**

A33. The CNSC license for the facility stipulates that Cameco must implement measures to limit uranium releases to the atmosphere. Because of questions related to the potential long-term accumulation of uranium in soils from the facility's ongoing operations, the CNSC asked Cameco to undertake several special studies. The CNSC also conducted many research projects in Port Hope to better understand how uranium was behaving there.

From all this work, the CNSC concluded that the PHCF's operation would not result in accumulation of uranium in Port Hope soils to levels that would be a concern for human health or the environment — even if the facility continued operating for the next hundred years or more.

**Q34. If there are no adverse health effects as a result of the nuclear industry in Port Hope, why is the government spending so much money to clean up the historic contamination throughout the community?**

A34. The federal government made a commitment to clean up Port Hope because Eldorado, a Crown corporation, was responsible for past waste management practices, which resulted in contamination throughout the community. The federal government is honouring this past commitment.