

Office of the Minister  
of Health and the Minister  
for the Federal Economic Development  
Initiative for Northern Ontario



Cabinet du ministre  
de la Santé et Ministre de  
l'initiative fédérale du développement  
économique dans le Nord de l'Ontario

JAN 31 2008

Ottawa, Canada K1A 0K9

Ms. S. C. Dawe  
Director of Corporate Services/Municipal Clerk  
The Municipality of Port Hope  
56 Queen Street  
P.O. Box 117  
Port Hope, Ontario L1A 3V9

**RECEIVED**

FEB 06 2008

**MUNICIPALITY OF PORT HOPE**

Dear Ms. Dawe:

Thank you for your correspondence of November 21, 2007, addressed to the Honourable Tony Clement, Minister of Health, concerning Resolution Number 166/2007, adopted by the Council of the Municipality of Port Hope.

As per your request, Health Canada scientists have reviewed the report entitled "Radio-Biological Study Findings for Port Hope." They concluded that all reported uranium levels are low and are typical of the range in normal background values in individual Canadians. The highest reported uranium value would deliver a radiation dose, which is only a fraction of the public dose limit, regardless of whether all the uranium is natural or includes artificial material. A detailed summary is attached.

Departmental scientists continue to assess industrial activities in Port Hope and support the Port Hope Area Initiative to remove all contaminated materials to a permanent disposal site outside of the town. We are committed to working with you to ensure that Port Hope remains a safe and healthy community in which to live and raise a family.

Thank you for writing.

Sincerely,

A handwritten signature in black ink, appearing to read "Bill", written over the word "Sincerely,".

William King  
Chief of Staff

Enclosure

**Canada** The word "Canada" in a bold, serif font, followed by a small graphic of the Canadian flag.

# **REVIEW OF THE PORT HOPE COMMUNITY HEALTH CONCERNS COMMITTEE REPORT**

13 December 2007

The Council for the Municipality of Port Hope adopted a resolution on November 20, 2007, requesting Health Canada to review the Port Hope Community Health Concerns Committee (PHCHCC) document, "Radio-Biological Findings for Port Hope," together with any associated documentation. In response to this request, Health Canada has reviewed:

- the PHCHCC report;
- the Uranium Medical Research Centre (UMRC) poster presented at the European Association for Nuclear Medicine Congress in Copenhagen, Denmark, in October 2007;
- the UMRC report posted on the PHCHCC Web site at [www.porthopehealthconcerns.com](http://www.porthopehealthconcerns.com), which reproduces the poster material along with more details on the methodology;
- recent news releases and Web site material from PHCHCC.

Health Canada is always looking at new information with regard to the health and safety of Canadians and will continue to do so.

If further documents describing this study are brought to Health Canada's attention, the Department will also review those.

## **Degree of Peer Review**

The findings in the PHCHCC report are based on a poster presentation at the European Association for Nuclear Medicine Congress in Copenhagen, Denmark, in October 2007. The PHCHCC describes this as a peer-reviewed study. Health Canada contacted the conference organizers to determine the nature of their peer review process and learned that it is only the abstract that was reviewed by the selection committee. (See Annex I and II). It is a general practice at scientific conferences to assess submitted abstracts for interest and overall suitability to the conference theme. It can be seen from Annex II that there is insufficient information given in the abstract to judge the overall accuracy or scientific validity of the study. As far as Health Canada can ascertain, there was no peer review of the contents of the poster or report.

## **Study Design**

Health Canada notes the following shortcomings in the study design:

- A sample size of only nine subjects is too small to draw any firm conclusions. Furthermore, these subjects were highly variable, with four of them former

nuclear energy workers and the other five, members of the general community, one of which was a child. We would expect a high degree of variability in such a diverse group of people.

- The study used only two people as “control subjects,” which is insufficient to make valid comparisons given the high degree of variability noted previously.
- It is the amount of uranium excreted in a 24-hour period that is of relevance in assessing uranium exposure, not the concentration in nanograms per litre (ng/L), as reported in the study. The latter can vary widely, depending on the amounts of fluids consumed prior to testing and the amount of urine excreted. The PHCHCC states that 24-hour urine collections were carried out, but provides no further results. The Methodology section of the UMRC report mentions that a 500 ml sample of urine was used for analysis, but makes no attempt to calculate 24-hour excretions.

## **Results**

Uranium is a natural element which is widespread at the Earth’s surface. All foods, drinking water and bodily fluids contain small traces of uranium, which can be measured by ultra-sensitive techniques such as inductively coupled plasma mass spectrometry (ICPMS). The concentrations of total uranium in urine reported by the PHCHCC all fall within the normal range of values found in other Canadian communities. Annex III compares uranium in urine measurements for Ottawa and Port Hope residents. In other Canadian communities, with natural uranium in well water, uranium in urine concentrations can exceed 100 ng/L. Therefore all of the uranium concentrations measured in Port Hope fall within the range of natural values.

Table 1 provides a summary of world wide measurements of uranium in urine. In most cases, the results are given in nanograms excreted per day (ng/d), which the more relevant quantity. Some values are given in nanograms per litre (ng/L), similar to the Port Hope results. The values in ng/d can be converted to ng/L by dividing by an average daily urine volume of 1.6 L. If this is done, all of the Port Hope values fall within the range of world wide average values for unexposed subjects. Note that even the highest value in the nine subject from Port Hope is below 95th percentile values in the USA. From these statistics, one can estimate that 10 to 15 per cent of all uranium in urine measurements will be equal to or greater than 24.8 ng/L. Therefore, Health Canada concludes that all of the Port Hope values are within the range of natural concentrations.

**Table 1:** Urinary excretion in unexposed subjects from different countries.

Country	Urinary excretion values	Reference
Slovenia	9 ± 3 (ng/d)	Byrne and Benedik 1991
India	17 ± 14 (ng/L)	Dang et al 1992
USA	31 ± 20 (ng/d)	Medley et al. 1994
Germany	23 ± 18 (ng/d)	Werner et al. 1997
USA	7 ng/L (GM) 35 ng/L(95th)	Ting et al 1999
Italy	34 ± 14 (ng/d)	Bagatti et al 2003
Italy	10 ± 7 ng/L	Galettie et al. 2003
Jordan	135 (ng/d) (GM) 18 - 3425 (ng/d) (range)	Al-Jundi et al. 2004
Finland	64 ng/L (median) 2647 ng/L (95th)	Karpas et al 2005
USA	8 ng/L (GM) 46 ng/L (95th)	NHANES 2005

With regard to the isotope ratio measurements, great caution must be exercised at these very low uranium concentrations. A tiny contribution from U-235 hydride can give a false peak at U-236. Furthermore, this hydride can reduce the apparent amount of U-235, thus giving a false indication of depleted uranium. The German laboratory carrying out these analyses appears to have followed correct procedures. However, Health Canada would like to see the anomalous isotope ratio measurements confirmed by an independent laboratory.

The isotope ratio of U-238/U-235 in unprocessed natural uranium is 137.88. Depleted uranium, generated as a by-product of fuel enrichment, can have ratios up to twice this value. All of the Port Hope subjects showed U-238/U-235 ratios that are consistent with the natural ratio (within their error margins), except for Subject #3, who had a slightly elevated ratio of  $147.11 \pm 1.42$ . If this number holds up, it would imply that about 7 per cent of the uranium in the subject's urine was depleted.

Minute traces of U-236 occur in nature. The U-236/U-238 ratio in natural uranium is about  $5 \times 10^{-10}$ . In spent fuel that has been reprocessed, the typical ratio is about  $4 \times 10^{-3}$ . The highest ratio reported for Port Hope residents was  $5.53 \times 10^{-5}$ , which could imply about a one per cent mixture with natural uranium.

## Misinterpretations by PHCHCC and UMRC

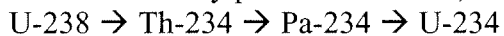
PHCHCC and UMRC draw a number of invalid and misleading conclusions from their results. For example:

1. “One adult subject’s uranium elevations were 8 times over average concentrations of the study’s controls....A child had uranium elevations about three times the controls’ average concentrations of uranium” [PHCHCC Report]

Based on their own figures, these statements are incorrect. The average of their controls is  $(5.6 + 2.1)/2 = 3.8$ . Thus, for the one adult subject (# 2),  $24.8/3.8 = 6.5$ , not 8. However, even the lower value is based on an inadequate number of controls (2). The poster abstract indicates an average uranium background of 7 ng/L in urine, which is consistent with the results in Annex III 1 below. Hence the value for the child is equal to the average background, and the value for the one adult is, at most, 3.5 times that average. As indicated above, occasional values several times higher than average background are to be found in the normal population.

2. “Enriched levels of the U-234 isotope in both retired workers and civilian Port Hope subjects, including a child.” [PHCHCC Report]

U-234 is a natural decay product of U-238, through the sequence:



At equilibrium, the natural ratio of U-234/U-238 is  $5.54 \times 10^{-5}$ . All of the ratios in the PHCHCC report are consistent with this natural value within their margins of error. Minor variations in these ratios are to be expected in environmental or biological materials due to chemical reactions involving the intermediate products Th-234 and Pa-234. The U-234/U-238 ratios are not enriched in any of the Port Hope subjects.

3. “Most recent studies of the Gulf War veterans have estimated a significant carcinogenic risk of inhaled depleted uranium.” [UMRC Poster]

We are not aware of any studies establishing a carcinogenic link with depleted uranium. The vast majority of health studies point to the opposite conclusion: that there are no ill health effects related to depleted uranium exposure at these levels of exposure.

4. The discussion in the UMRC poster attributes the higher risk of lung cancer in uranium miners to the inhalation of uranium dust.

It is now well recognized that the carcinogenic factor in these miners was radon gas and decay products. Improved ventilation in present-day uranium mines has eliminated this excess risk.

5. "The study of 11 samples included two controls and nine representative samples of residents and former workers, showed radioactive contaminants and anomalies in 100% of the Port Hope samples, including a child under age 14." [PHCHCC Web site]

The claim of anomalies in 100% of the subjects is puzzling, and not supported by their own results. If the statement refers to the presence of U-234 in all of the subjects, then it has been shown that all the U-234/U-238 ratios were natural, without any sign of abnormality. The poster presentation makes reference to anomalous isotope ratios in, at most, only four of the subjects (#2, #3, #4, and #6).

### **Health Assessment**

The nine subjects were chosen by the PHCHCC on the basis of their symptoms and their past associations with the Port Hope-based uranium company, Cameco. Based on these criteria, the selected subjects should have been the most likely to have shown evidence of uranium contamination. Nevertheless, all the uranium in urine concentrations in these subjects fell within the range of normal background values.

The possibility of traces of depleted uranium or uranium from spent fuel in the urine of four subjects cannot be confirmed or ruled out without further analyses. However, the PHCHCC and the UMRC incorrectly assume that artificial uranium is more toxic than natural uranium. The chief toxic effects of uranium are due to its chemical effects on the kidney, and this effect is the same for all isotopes of uranium. The radiological effects of uranium are generally regarded to be less damaging than the chemical effects. Furthermore, the amount of radioactivity per gram of depleted uranium is actually less than that of natural uranium because of the partial removal of the U-235 isotope in depleted uranium.

Nevertheless, Health Canada has estimated the highest likely radiation doses that might have resulted to the four subjects (#2, #3, #4, and #6) who were purported to show anomalous isotopic ratios. It was assumed that each subject was exposed to a single acute intake of uranium of artificial origin 25 years prior to the measurements. The amount and isotopic mixture of each intake was adjusted to account for the present day measurements. Doses were calculated using the computer program IMBA (Integrated Modules for Bioassay Analysis). The results were as follows:

<u>Subject</u>	<u>Maximum total radiation dose over 25 years (millisieverts or mSv)</u>
#2	1.3
#3	8.0
#4	0.1
#6	0.7
Background	50.0

All of these doses are insignificant, compared to a normal background radiation exposure of 2 mSv/year, or 50 mSv over 25 years. This background comes from cosmic ray

exposure, radon gas and naturally occurring radionuclides present in food, water and air. The highest dose is similar to the radiation dose from one chest CT scan.

### **Conclusions**

All of the uranium concentrations measured in the Port Hope subjects are within the range of normal background values. Any radiation doses resulting from exposure to artificial uranium over the lifetime of the subjects would be much smaller than exposure to other natural sources of radiation. Far from raising alarm, these results should prove reassuring to Port Hope residents and to anyone wishing to re-locate or visit there.

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## ANNEX I

### **Text of an e-mail response received from the European Association of Nuclear Medicine on December 5, 2007.**

Thank you for your message.

Every year, there are at least three reviewers "peer reviewing" each and every abstract. Depending on the grade point average, the abstract is either accepted as oral presentation or as poster or is denied acceptance (if really bad). We had a rejection rate of 9% for the Copenhagen congress.

Authors, who are selected either for an oral or poster presentation, do not receive a certificate, but the abstracts are all published in a supplementary abstract edition of the European Journal of Nuclear Medicine and Molecular Imaging (EJNMMI), which can be cited.

We hope to have been of assistance with this information and are at your disposal for any further questions you may have.

With kind regards,

Annetta Florentis  
Assistant to the Conference Manager

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## ANNEX II

**The abstract that was reviewed by the EANM Selection Committee and was printed  
in the book of abstracts**

Monday 15.10.2007 14:30h - 16:00h

Room: Poster Exhibition Area

P487 The Quantitative Analysis of Uranium Isotopes in the Population of Port Hope,  
Ontario, Canada

A. Durakovic<sup>1</sup>, A. Gerdes<sup>2</sup>, I. Zimmerman<sup>1</sup>; <sup>1</sup>Uranium Medical Research Centre,  
Toronto, ON, CANADA, <sup>2</sup>Institute for Mineralogy, JW Goethe University,  
Frankfurt, GERMANY.

The purpose of this study was the quantitative analysis of the internal contamination with four uranium isotopes in the population living near the uranium conversion facility in Port Hope, Ontario, Canada; the oldest operating uranium processing plant in the world. The urine samples of symptomatic patients presenting with symptoms of musculo-skeletal, CNS, immune system, and neoplastic disease were obtained from among a large population. Control samples were also analyzed. The urine samples were analyzed in a specialized radiochemistry laboratory by mass spectrometry, including pre-concentration of urine by co-precipitation, oxidation of organic matter, uranium purification by ion-exchange chromatography, and ICP-MS double-focusing Thermo Finnigan Neptune multi-collector. Natural uranium has a  $^{238}\text{U}/^{235}\text{U}$  ratio of 137.88 and does not contain  $^{236}\text{U}$ . Background total uranium concentration in the urine of humans is 7 ng/L (USA NCEH). Our results show 4 of 9 samples containing uranium of non-natural origin. One sample was highly positive for depleted uranium (DU) with a  $^{238}\text{U}/^{235}\text{U}$  of  $147.11 \pm 1.42$  and a relatively normal abundance of total uranium. This sample contained a concentration of  $^{236}\text{U}$  with a  $^{236}\text{U}/^{238}\text{U}$  ratio of  $4.38 \times 10^{-6} \pm 4.3 \times 10^{-7}$  indicating its reactor origin. Three samples contained detectable amounts of  $^{236}\text{U}$ , one being paradoxically high with a  $^{236}\text{U}/^{238}\text{U}$  ratio of  $5.53 \times 10^{-5} \pm 3.9 \times 10^{-6}$ . One of these three samples contained a higher than normal concentration of total uranium (24.8 ng/L). The  $^{236}\text{U}$  in these samples indicates its origin as contamination with non-natural uranium. The remaining five samples were negative for both depleted uranium and uranium-236. The history of uranium contamination of the vicinity of Port Hope has been verified in objective scientific literature<sup>1</sup>. Our results suggest long-term contamination and possible adverse effects on the body burden of the current population of Port Hope. These preliminary results warrant additional multidisciplinary studies.