Tritium Standard Review

Submission to Ontario Drinking Water Advisory Council

March 27, 2008

The Registered Nurses' Association of Ontario (RNAO)

RNAO Submission on Tritium in Drinking Water

The Registered Nurses' Association of Ontario (RNAO) is the professional association for registered nurses in Ontario. RNAO members practice in all roles and sectors across the province. Our mandate is to advocate for healthy public policy and for the role of registered nurses in enhancing the health of Ontarians. We welcome this opportunity to present to the Ontario Drinking Water Advisory Council (ODWAC) our views on Ontario's drinking water quality standard for tritium.

Tritium is a Toxic Material

RNAO congratulates the Ministry of the Environment for acting on the request of Toronto's Medical Officer of Health to review Ontario's drinking-water quality standards for tritium and other radionuclides.[1] [2] There is concern among health professionals about the level of protection that Ontario's drinking water quality standards provide against tritium, a radioactive isotope of hydrogen with a half-life of 12.3 years. [3] This persistent toxic substance moves quickly through the environment once it is released, and is not readily removed from drinking water, so reducing or stopping releases is the most practical way of proceeding. The Canadian Nuclear Safety Commission recognizes tritium as a risk to human health when it is ingested in drinking water or food, or when it is inhaled or absorbed through the skin.[4] Like other radionuclides, tritium emits ionizing radiation when in the body, and this radiation has been shown to be a teratogen, mutagen and carcinogen.[5] A recent review of the data concludes that there is no safe level of ionizing radiation: rather, the data show a linear relationship between cancer and exposures to ionizing radiation.[6] Accordingly, as health professionals, we believe that industry should minimize and preferably eliminate exposures that the public and workers receive from tritium and other radionuclides.

The isotope tritium occurs naturally, but it is also known to have been released into the environment in large quantities by Ontario's nuclear reactors. As of March 2008, Ontario's and Canada's water quality standards for tritium are very liberal by global standards. The current Ontario standard is a ceiling of 7,000 Bequerels per Liter (7,000 Bq/L), in contrast to 100 Bq/L for the European Union and 740 Bq/L for the US. We do not believe it is desirable to have comparatively lax standards and to substantially lag many advanced industrial countries.

The ACES Report

In 1994, the Advisory Committee on Environmental Standards (ACES) recommended that Ontario Drinking Water Objective for Tritium immediately be set at a much more protective 100 Bq/L,[7] which ACES deemed achievable given monitoring data available under the then-Ministry of Environment and Energy's Drinking Water Surveillance Program. It further recommended tightening the standard to a more protective level of 20 Bq/L within five years. It allowed these five years for the nuclear industry to routinely achieve the tighter standard, and advised setting a goal of further reduction. ACES calculated that these levels would be respectively consistent with five excess fatal cancers and one excess fatal cancer per million people exposed over their lives. It estimated that exposure to the current standard of 7,000 Bq/L would result in 340 excess fatal cancers per million exposed over their lives.[8] This estimate is consistent with figures derived from Health Canada risk assessments.[9] Toronto's Medical Officer of Health asked the Minister of the Environment to give consideration and weight to the recommendations in the ACES report.[10] Dr. McKeown noted in his letter that had the ACES recommendations been adopted by Ontario, the standard would already have been 20 Bq/L.

A precautionary approach would be appropriate, as there is no safe level of exposure to tritium. Furthermore, the above estimates of risk may bear further investigation, since the full impact on human health is complex and not fully understood: there are multiple health endpoints (and not just cancer mortality); the exposed population is diverse, with many who are vulnerable due to compromised immune systems or due to their stage of development (such as young children and

pregnant women); the interaction of chemicals and radioactive nuclides alters health effects; the mechanisms of health impacts are complex; and multiple forms of tritium enter the body (elemental tritium, tritiated water, and organically bound tritium). Some studies have called into question tritium's official dosimetry, suggesting further review is in order.[11]

A Time for Action

Tighter standards are not a mere academic matter, as Ontario's and Canada's heavy water nuclear reactors have been known to release large amounts of tritium due to their design. Depending upon the comparator, heavy water reactors have been estimated to release from over 20 times to over 100 times as much tritium per unit of energy produced (compared to pressurized water reactors and boiling water reactors respectively).[12] By one estimate, in the first half of this decade, major Canadian nuclear facilities were releasing amounts of tritium equaling about 10% of natural production of tritium in the Northern hemisphere.[13] The majority of the releases come from Ontario reactors, and the impact will be greatest near nuclear facilities.

We believe that the tighter standard is attainable, as per Ontario Power Generation's own reporting. OPG has an internal goal of 100 Bq/L, and reports that in 2006, its testing of water from the water filtration plants closest to its reactors showed tritium levels of five to seven Bq/L, well under the requested 20 Bq/L.[14]

Recommendations

1. **Implement the ACES recommendation that the Ontario Drinking Water Quality Standard for tritium to be lowered to 20 Bq/L, with a longer-term goal of lowering it much further.**
2. **Adopt a similar level of protection in drinking water for all radionuclides listed in the Canadian guidelines for drinking water. That is, set standards analogous to current Ontario Drinking Water Objectives for chemicals: no more than one excess death per million exposed, and with protection against nonfatal illnesses as well.**
3. **Require monitoring and public reporting of levels of tritium and other rationuclides in drinking water. Frequency of monitoring should be specified in guidelines.**
4. **Use a precautionary approach in deliberations on tritium and other radionuclides.**
5. **Reduce and eventually eliminate discharges of tritium and other radionuclides in Ontario.**
6. **Establish a committee with the Federal Government to examine tritium's dosimetry and risks. This committee should include scientist representatives from environmental and health groups.**

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[1] McKeown, D. (2006). *Request for review of Ontario Drinking-water Quality Standard for Tritium*, addressed to the Honourable Laurel Broten, Minister of the Environment, September 27.
[2] ODWAC. (2008). *Tritium Standard Review*, retrieved February 25, 2008 from http://www.odwac.gov.on.ca/standards_review/tritium/tritium.htm.
[3] Canadian Nuclear Safety Commission. (February 2008). *Standards and Guidelines for Tritium in Drinking Water*.
[4] Ibid.
[5] E.g., see US Environmental Protection Agency. (November 2007). *User Guide: Radionuclide Carcinogenicity*. Retrieved March 24, 2008 from http://www.epa.gov/rpdweb00/heast/userguid.html.
[6] See the Biologic Effects of Ionizing Radiation (BEIR VII): The National Academies. (undated). *Report in Brief: BEIR VII: Health Risks from Exposure to Low Levels of Ionizing Radiation.* Retrieved March 24, 2008 from http://dels.nas.edu/dels/rpt_briefs/beir_vii_final.pdf.
[7] Advisory Committee on Environmental Standards. (May 1994). *A Standard for Tritium: A recommendation to the Minister of the Environment and Energy*, i.
[8] Ibid, i.
[9] Health Canada estimated the risk of fatal and weighted non-fatal conditions at a lifetime exposure (70 years) of 0.1 milliSieverts/year at 600 per million. This would correspond to a level of 7,610 Bq/L. Canada and Ontario have slightly lower tritium limit of 7,000 Bq/L. Assuming a proportional relationship between exposure and risk, a lifetime exposure to 7,000 Bq/L would correspond to a risk of 552 fatal and non-fatal

conditions. See: Canadian Nuclear Safety Commission, op. cit. 2.2, which cites Health Canada. (1995). *Approach to the Derivation of Drinking Water Guidelines*, Ottawa.

[10] McKeown, op. cit.

[11] E.g., UK Advisory Group on Ionizing Radiation (November 2007). *Review of Risks from Tritium: Report of the independent Advisory Grou on Ionizing Radiation.* Retrieved March 25, 2008 from http://www.hpa.org.uk/publications/2007/tritium_advice/RCE_Advice_on_tritium.pdf. E.g., Fairlie, I. (May 2007). RBE and W_R values of Auger emitters and low-range beta emitters with particular reference to tritium, *Journal of Radiologial Protection,* V 27, 157-168.

[12] Nuclear Energy Agency of OECD. (1980). *Radiological Significance and Management of Tritium, Carbon-14, Krypton-85, and Iodine-129 Arising from the Nuclear Fuel Cycle,* Paris; United Nations Scientific Committee on the Effects of Atomic Radiation. (2000). *Sources and Effects of Ionizing Radiation*, New York.; European Commission. (2000). *Radioactive effluents from nuclear power stations and nuclear fuel reprocessing plants in the European Union, 1995-1999. Report – Radiation Protection;* all cited in Fairlie, I. (June 2007). *Tritium Hazard Report: Pollution and Radiation Risk from Canadian Nuclear Facilities.* Greenpeace, 10. Retrieved February 28, 2008 from http://www.greenpeace.org/raw/content/canada/en/documents-and-links/publications/tritium-hazard-report-pollu.pdf.

[13] Fairlie, I. (June 2007). *Tritium Hazard Report: Pollution and Radiation Risk from Canadian Nuclear Facilities*. Greenpeace, 9-10.

[14] Ontario Power Generation. (undated). *Nuclear Safety.* Retrieved March 24, 2008 from http://www.opg.com/safety/nsafe/nuclear/.