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January 24, 2018

Canadian Nuclear Safety Commission (CNSC)  
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### **Re: Re-licensing of Chalk River Laboratories**

*Prevent Cancer Now* is a Canadian national civil society organization that works to stop cancer before it starts, with scientific research, education and advocacy.

Former *Prevent Cancer Now* board member Mark MacKenzie is reading this submission on behalf of the organization.

*Prevent Cancer Now* wishes to make three points in support of the recommendation that at most a short-term licence be granted to CNL:

1. The hazardous substances to be cleaned up and stored in perpetuity at the Chalk River Nuclear Laboratories, by the for-profit consortium Canadian Nuclear Laboratories (CNL), include large quantities of carcinogens that will remain toxic by merit of both chemistry, as well as radioactive decay;
2. CNL plans and aspirations are broad, and development of new reactor designs will involve substantial hazards and generation of waste. If it is merited in today's world of renewable energy, any program requires careful scrutiny. It is at best premature to grant a long-term 10 year licence for this consortium;
3. Plans for containment are imperfect and may be thwarted by the fact that the Ottawa Valley is seismically active. Importing waste to the site, and long term abandonment, particularly of higher level wastes, are not supported.

#### **Discussion:**

##### **1. Primary cancer prevention begins with preventing the creation and exposure to carcinogens, including radionuclides. Radionuclides<sup>1</sup> have long been known to cause cancer,**

as was comprehensively described by the International Agency for Research on Cancer – an organization affiliated with the World Health Organization – in 2001.<sup>2</sup> Apart from the carcinogenic effects of radiation arising from nuclear decay, many of these substances are toxic by merit of their chemical effects. For example uranium, thorium, plutonium, strontium and many others - no matter what the isotope, accumulate in tissues and are toxic to numerous organ systems, in addition to effects of radiation as they decay<sup>3</sup> and toxicities of subsequent chemicals. Either, and both properties may lead to cancer and other diseases.<sup>4</sup> Some substances with very short half-lives will essentially vanish from the waste in less than a human lifetime. Substances with half-lives of tens or hundreds of years will exert both types of toxicity, whereas substances with extraordinarily long half-lives will decay so slowly that the parent compound is principally of a chemical toxicity risk. Notwithstanding this, radioactive breakdown is frequently a chain reaction with additional steps following an initial decay. In such cases, depending upon the type of radiation emitted (alpha particles that travel short distances, or beta- or gamma-radiation with increasing penetration), the radiation hazard may be magnified in spite of a very long half-life of the parent element. For example, when uranium decays to radon, that then more quickly decays further.

In this light, what is the actual quantity of toxic waste on site presently, in wastes, facilities yet to be dismantled, soils, wetlands, air and water. This is difficult to discern, but others in this hearing have

<sup>1</sup> US EPA. Radionuclide Carcinogenicity. [https://www.epa.gov/sites/production/files/2015-02/documents/heat\\_ug\\_0401.pdf](https://www.epa.gov/sites/production/files/2015-02/documents/heat_ug_0401.pdf)

<sup>2</sup> <https://monographs.iarc.fr/ENG/Monographs/vol78/mono78.pdf>

<sup>3</sup> [https://www.epa.gov/sites/production/files/2015-02/documents/heat\\_ug\\_0401.pdf](https://www.epa.gov/sites/production/files/2015-02/documents/heat_ug_0401.pdf)

<sup>4</sup> See links to resources on Radionuclides by the Agency for Toxic Substances and Disease Registry (USA). <https://www.atsdr.cdc.gov/substances/toxchemicallisting.asp?sysid=27>

estimated very large quantities, with radon and tritium in the air and being emitted from soil, and large quantities of uranium and other toxic substances to be disposed of and contained *in perpetuity*.

This brings up the question of exactly how much toxic waste is at the Chalk River site – a topic that requires further investigation and cataloging, including of soils, wetlands, groundwater and biota. Contamination can pose environmental hazards, such as uranium in the soil resulting in chemical toxicities as well as high radon exposures in some locations and for burrowing animals, not to mention workers, neighbours, visitors and downstream residents.

**2. Containment of wastes is of key importance. Hazardous exposures occur when substances evade the containment design, or when the containment is breached. Both are likely in the long term.**

Radon and tritium (commonly in tritiated water vapour, although also in organic materials with a tritium atom replacing a hydrogen atom) are two gases that are difficult to contain. Radon remains as a gas until it decays further and attaches to dust. Tritium becomes incorporated into tritiated water and biomass, although when inhaled or ingested it acts much as commonplace hydrogen atoms. In this way, tritium irradiates all tissues. Chalk River levels of tritium are doubtless much higher than in Pembroke, but a French research group gained attention when it studied tritium emitted from Pembroke's SRB – a facility licensed by the CNSC, which manufactures lights containing tritium.<sup>5</sup> Tritium has been used historically for many luminescent products, is incorporated into water and distributes to every environmental and biological compartment. A 2018 review describes in detail that organically bound tritium is important in the biosphere.<sup>6</sup>

We take this opportunity to correct a misconception that we perpetuated in our request to appear document. The underlying rock on the site is composed of granite-like rock, that includes fractures filled with salts deposited at low temperatures – in other words, following fracturing from seismic events rather than during early formation.<sup>7</sup> Thus, as well as chemical vapours escaping containment, it is possible that a disposal mound may be breached during an earthquake. Indeed, Natural Resources Canada notes that earthquakes concentrate in a sub-zone along the Ottawa River in this vicinity.<sup>8</sup> As well, climate change is bringing more and more extreme weather events that also may impact containment, for example clay containment layers.

**3. Protection of workers', public and environmental health must over-ride private interests.**

We will not belabor the point, but many intervenors and the press have described less-than-stellar records of consortium members. CNSC is responsible to ensure environmental and public health in the long term.

**In conclusion**, until and unless the consortium demonstrates transparent, comprehensive plans and actions, and future plans are clear and commitments are firm and backed by sufficient contingency funds, any licence should be short term only. Waste and contamination on site should be investigated, catalogued and reported, with best practices and ongoing monitoring to ensure containment over the short and long term. The very long term legacy of hazardous wastes, to generations that will experience no benefit, should give pause to continued advancement of nuclear energy.

We thank you for consideration. Please do not hesitate to ask, should you wish assistance in this matter.

Sincerely,

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<sup>5</sup> <http://www.preventcancer.ca/nuclear-update-2-studies-in-pembroke-ontario-yield-worrisome-new-findings-about-tritium>

<sup>6</sup> Eyrolle, Frédérique, Loïc Ducros, Séverine Le Dizès, Karine Beaugelin-Seiller, Sabine Charmasson, Patrick Boyer, and Catherine Cossonnet. "An Updated Review on Tritium in the Environment." *Journal of Environmental Radioactivity* 181 (January 1, 2018): 128–37. <https://doi.org/10.1016/j.jenvrad.2017.11.001>.

<sup>7</sup> <http://pubs.cnl.ca/doi/pdf/10.12943/CNR.2016.00015>

<sup>8</sup> [www.seismescanada.nrcan.gc.ca/zones/eastcan-en.php](http://www.seismescanada.nrcan.gc.ca/zones/eastcan-en.php)