Update: Chalk River radioactive waste disposal

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In 1943, U.S. President Roosevelt and U.K. Prime Minister Churchill created a Committee to coordinate their two countries’ nuclear weapons research. In April 1944, with C.D. Howe, Canada’s Minister of Munitions and Supply in attendance, the Committee agreed that Canada should build a heavy water reactor to produce plutonium for nuclear weapons.

Chalk River Labs was still under construction when the war ended in August 1945, as shown in this picture. The Chalk River Labs were established without consultation or accommodation with Algonquin people, who never ceded their rights to the 3,700 hectare site. Their exclusion from the land, and environmental degradation of the land and water, make it impossible for them to exercise their traditional rights.

Canada’s contribution to the WW II Manhattan Project included mining uranium, processing it at a federally-owned processing facility at Port Hope, Ontario, and sending it to the U.S. for weapons. Canadian uranium may have been used in the Hiroshima bomb, and may have been used as feedstock to produce plutonium at Hanford, Washington for the Nagasaki bomb.
This slide shows Chalk River Labs in 1948. The original 10 megawatt version of the NRX reactor had been completed a year earlier, in July 1947. Plutonium was extracted from uranium irradiated in the NRX and shipped to the U.S. to make nuclear weapons. Later, irradiated targets containing plutonium were shipped to the U.S, for processing there. This continued until the mid-1960s.

Natural Resources Canada estimates that over half the nuclear wastes at Chalk River - including contaminated buildings, buried wastes, and contaminated lands - came from Cold War weapons-related activities.
This is a view of the original NRX reactor, taken in 1948.

C.D. Howe believed that atomic energy would yield great profits for the Government of Canada, both from plutonium sales and from nuclear power. He oversaw the creation of Atomic Energy of Canada Limited as a federal crown corporation in October 1952.

However, in December 1952, the NRX had a severe accident, with fuel melting and a hydrogen explosion.

A flatbed truck was used to haul away the intensely radioactive core. It was manned by a relay team of drivers, each spending just a few minutes behind the wheel before running away to make room for the next driver, to limit their exposure to lethal radiation.

The core was buried in the sand at “Waste Management Area A,” where it remains today. Accident details were kept from the media to avoid creating public doubt about the Government’s investment in nuclear power.
A more powerful 42 megawatt version of the NRX was rebuilt on the original foundation. It started up in 1954 in the building shown on the right.

To the left of the NRX is the Plutonium Recovery Lab.

Behind, a larger 135 megawatt reactor, the NRU, is under construction. The NRU ran from November 1957 until shut down in March 2018, when it was the world’s oldest operating nuclear reactor.

The NRU was a major source of medical isotopes, a profitable business for AECL that was privatized by the Mulroney government in a sweetheart deal that created Nordion but left Canadian taxpayers responsible for the wastes generated by isotope production.

All these facilities are now shut down but contain large quantities of long-lived radioactive wastes for which no long-term management plans are in place.
Here is a 1974 picture of nuclear waste going into in-ground concrete structures at Chalk River.

High-level waste fuel rods were put in similar concrete structures. Water has entered some of these, and the fuel rods are being taken out, dried, and put in newer above-ground temporary concrete structures.
Here is a 1984 picture of waste from the Port Hope uranium processing facility being shovelled from a wheelbarrow into an in-ground concrete structure at Chalk River.
CNL actively consolidating ALL federal wastes at CRL

- CNL “Integrated Waste Strategy”
  - consolidate all low- and intermediate-level waste and used fuel at CRL, even though
  - appropriate facilities for disposal do not exist

- Strategy being implemented in the absence of public consultation or environment assessment
  - CRL site seismically active, faults and fractured rock
  - problematic location for storage or disposal
  - transportation risks
  - no examination of alternatives

The Chalk River Laboratories (CRL) are now operated by Canadian Nuclear Laboratories or CNL, created as a subsidiary of AECL in 2014, then sold to a multinational consortium in 2015. Its members are SNC-Lavalin and two Texas-based companies, Fluor and Jacobs. These companies are shipping federally-owned wastes from across Canada to Chalk River under a strategy that was never reviewed or approved by the government.
This slide shows federally-owned sites from which wastes are being shipped to Chalk River, which is also Canada’s only licensed site for commercial waste storage.
A 2015 federal waste inventory shows about half a million cubic meters of Chalk River waste. In the early years, much was simply dumped in the sandy uplands, about a kilometer away from the Ottawa River.
This slide shows a close-up of radioactive tritium and strontium-90 plumes from the leaking waste management areas.

These plumes, along with plumes of radioactive carbon-14, which has a 5700-year half life and is not shown here, have contaminated lakes, streams, and wetlands on the CRL property.

Radioactive leachate is entering the Ottawa River via Perch Creek, shown in the lower right hand portion of the picture. More leachate flows through the Maskinonge Lake – Chalk Lake - Chalk River drainage, to the left of the picture.

CNL is proposing to put contents of the waste management areas, along with building demolition wastes, contaminated soils, and non-radioactive hazardous wastes in a giant mound near Perch Lake in the lower right of portion of the image. A pipeline would release radioactive and hazardous substances leaching from the mound into Perch Lake, from which they would flow from Perch Creek into the Ottawa River.
This figure shows the proposed waste mound, and direction of water flow through Perch Creek to the Ottawa River. During operation, leachate from the mound would be run through a waste water treatment plant, removing some contaminants, and then be discharged through a pipeline directly into Perch Lake. Radioactive tritium cannot be removed by waste treatment, and the radioactivity of Perch Lake would increase roughly threefold, to around 7000 disintegrations per liter per second.

Waste dumping would cease after around 50 years, a cover would be placed over the mound, wastes would dry out, leaching would stop, and the treatment plant would be closed. But then the top cover would fail, likely before the bottom liner. Water would again saturate the wastes in the mound. During snow melt or high rainfall leachate would pool in the bottom liner, overflow into Perch Creek, and flow into the Ottawa River. This would continue for hundreds of thousands of years.
CNL’s environmental impact statement has virtually no information on the wastes that would go in the mound. This slide shows information from another document called “Waste Acceptance Criteria”.

CNL wants to maintain maximum flexibility with regard to wastes to be dumped. Plans appear to be in constant flux. The base of the mound could be composed of uranium refinery wastes shipped from Port Hope in the 1970s, with tonnes of uranium and arsenic. This waste is currently in Waste Management Area F.

Trailer loads of building demolition waste would be driven directly into the mound, and the trailers abandoned. The trailers are currently stacked in Waste Management Area H.

The largest amount of radioactivity would be in the form of cobalt-60 industrial gamma irradiation devices made in Canada, shipped around the world, and re-imported as waste. Hundreds of tonnes of lead shielding would be required to limit worker exposure to these highly-radioactive wastes. These wastes are currently stored in buildings in Waste Management Area H.

Hazardous wastes such as lead batteries and fluorescent tubes containing mercury, asbestos-containing wastes, electronic wastes, etc. would also be dumped.
Through Access to Information we obtained a highly redacted 2013 document showing a 7.6 billion dollar cost for complete decommissioning of the CRL site. This prompted the previous Conservative government to hire private companies to do the clean-up, hoping to do it faster and cheaper than AECL.
That $7.6 billion figure will grow. The $163 million liability estimate for decommissioning of the NRX and NRU reactors is absurdly low – the real figure will likely be over a billion dollars.
Annual decommissioning and waste management expenditures have skyrocketed since the consortium took over in 2015. Huge sums have been wasted on subcontracts for studies on the mound, which could house only a tiny fraction of the Government of Canada’s radioactive waste without violating international safety norms.

The International Atomic Energy Agency says that only very low level waste can be put in an above-ground landfill-type facility.

CNL also has two other permanent radioactive waste disposal projects. These involve “entombment” in concrete and grout of shut-down federal research reactors – the WR-1 reactor at the Whiteshell Laboratories in Pinawa, Manitoba; and the NPD reactor in Rolphoton, Ontario.

The International Atomic Energy Agency says that entombment is not an acceptable method of reactor decommissioning.
In November 2019 CNL released a revised environmental impact statement with a new and greatly reduced inventory of most of the radioactive substances that would go in the mound. Their intent was to reduce estimates of human radiation exposures in the post-closure period. Cesium-137, for example, was reduced 100,000-fold.

However, the 2014 decommissioning plan, which has not to our knowledge been superseded, shows amounts of radiation in Waste Management Area F and the Liquid Dispersal Area alone that would vastly exceed the new inventory.

<table>
<thead>
<tr>
<th>Waste in Waste Management Area ‘F’ (WMA F) compared to Licensed Inventory</th>
<th>Radium-226 (GBq)</th>
<th>Arsenic (Mg)</th>
<th>Uranium (Mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WMA F</td>
<td>515</td>
<td>4-13</td>
<td>80</td>
</tr>
<tr>
<td>Proposed Licensed Inventory</td>
<td>36.5</td>
<td>unlimited</td>
<td>5.75</td>
</tr>
<tr>
<td>Portion of WMA F waste that could be put in the NSDF</td>
<td>7.1%</td>
<td>unlimited</td>
<td>7.2%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Waste in Liquid Dispersal Area (LDA) compared to Licensed Inventory</th>
<th>Beta/Gamma (TBq)</th>
<th>Alpha (TBq)</th>
<th>Tritium (TBq)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reactor Pit #1</td>
<td>100</td>
<td>0.1</td>
<td>?</td>
</tr>
<tr>
<td>Chemical Pit</td>
<td>230</td>
<td>0.4</td>
<td>70</td>
</tr>
<tr>
<td>Reactor Pit #2</td>
<td>500</td>
<td>0.5</td>
<td>1000</td>
</tr>
<tr>
<td>Total</td>
<td>830</td>
<td>1.0</td>
<td>1070</td>
</tr>
<tr>
<td>Proposed Licensed Inventory</td>
<td>14</td>
<td>0.3</td>
<td>891</td>
</tr>
<tr>
<td>Portion of LDA waste that could be put in the NSDF</td>
<td>1.7%</td>
<td>30%</td>
<td>83%</td>
</tr>
</tbody>
</table>

WMA F and LDA waste from 2014 Comprehensive Preliminary Decommissioning Plan (CPDP-508300-PDP-001, Revision 2, March 2014)  
Licensed Inventory from 2020 Waste Acceptance Criteria (232-508600-WAC-003, Revision 4, November 2020). Plutonium-241 (half-life of 14 years) excluded from alpha-emitting radionuclides. Uranium as U-238 converted from TBq to Mg.
The three companies that own CNL now seem more interested in building new reactors than in cleaning up the Chalk River site. They are promoting so-called “small modular reactors”, the nuclear industry’s latest attempt to reinvent itself.

**More reactor wastes without cleaning up what’s there now?**

- Key CNL S&T objective is to demonstrate the viability of Small Modular Reactors (SMRs)
- All three multinational consortium members active in SMR development
  - Fluor/NuScale
  - SNC Lavalin/Holtec
  - Jacobs/Rolls Royce
- Ontario Power Generation/Ultra Safe Nuclear “Micro Modular Reactor” already undergoing CNSC licensing and environmental assessment
- Construction as early as 2026???
The federal government may simply allow much of the Chalk River waste to be abandoned in place, instead of being cleaned up. Canada’s latest official national inventory of radioactive waste shows an unexplained 95% reduction in the volume of federally-owned intermediate-level waste, and a 59% reduction in the volume of low-level waste in the form of contaminated soils.
In summary,

- The Chalk River Laboratories property has large volumes of long-lived radioactive wastes from research activities, and plutonium and medical isotope production.
- This waste is the responsibility of the federal government.
- In 2015 the federal government contracted a multinational consortium to get this waste (“nuclear legacy liabilities”) off the federal accounts quickly and cheaply.
- The consortium wants to put wastes from Chalk River and other federal sites in a giant mound similar to a municipal landfill.
- Radioactive materials, toxic chemicals, and heavy metals would leak from the mound during operation and after closure. Human intrusion would result in excessive radiation exposures.
- The Canadian Nuclear Safety Commission will hold a hearing to approve the proposal later this year. If approved, contamination of the Ottawa River would essentially continue forever.

We are calling on Cabinet to initiate an independent panel review under the *Impact Assessment Act* of CNL’s waste disposal projects, and on Parliament to review the current contract with the multinational consortium.