

# Cluff Lake Decommissioning: Is it complete?

## One man's questions, the company view and what the regulators say

**A**s AREVA continues to prepare the decommissioned Cluff Lake mine site for eventual transfer to the province, one northern man is asking questions to make sure everything is safe.

Rod Gardiner of Ile a la Crosse, a retired AREVA employee, wonders about some of the decommissioning work at the former Cluff Lake mine. Rod worked at the mine for 33 years and retired in 2013, seven years after the initial decommissioning was completed. He was personally involved in some of the decommissioning work.

Rod asked Opportunity North to publicize his concerns. For a wider understanding of the situation, Opportunity North has talked with Mr. Gardiner and with AREVA and the regulators to get all sides of the story. To help readers understand, we devote considerable space to including comments from all.

### The background story

The mine operated from 1980 to 2002, producing 62 million pounds of uranium concentrate from three open pits, two underground mines and one extension pod. Most decommissioning was carried out between 2004 and 2006, with additional work in 2013. Monitoring of the site has continued since.

Eventually, when the company and the regulators are satisfied that the site is performing as predicted in the Environmental Assessment Comprehensive Study Report (CSR) approved by regulators before decommissioning began, the property will be transferred to the provincial Institutional Control Program (ICP) under the Reclaimed Industrial Sites Act. With the transfer will come enough of AREVA's money to monitor and maintain the site in perpetuity. At that point, the province will assume responsibility for ongoing monitoring to make sure the site continues to be safe.

There will always be an owner, and the money will be there to look after the site, unlike legacy mines such as Gunnar, where the owner walked away and taxpayers are currently paying the cost of cleanup.

Cluff Lake will be the first major uranium site to come under Institutional Control. Several small satellite sites of Uranium City's Beaverlodge operation are already in the program, along with the former Contact Lake gold mine near La Ronge.

Decommissioning activities are governed

by strict regulations, and are pre-approved by both Saskatchewan Environment and the Canadian Nuclear Safety Commission (CNSC). The site is monitored by both regulators during and following decommissioning activities. Following entry into the ICP, monitoring is conducted by the province, and continues forever.

The Northern Saskatchewan Environmental Quality Committee (NSEQC) was the vehicle for involving communities in the decommissioning process.

The 2003 pre-decommissioning Environmental Assessment CSR established decommissioning objectives and desired end points, which the site is meeting according to both the company and the regulators.

"It's pretty hard to resolve stakeholder concerns about the agreed-upon endpoints after the work has been completed", says AREVA's Dale Huffman.

### Rod's concerns

Since 2015, Mr. Gardiner has corresponded extensively with AREVA and uranium industry regulators, Saskatchewan Environment (SE) and the CNSC. He has been assured that everything is performing according to predictions and that the land is safe for traditional use. But he continues to push for further work.

"I'm in full support of uranium mining; I just want the cleanup to be done properly, and the land to be safe for us to use," he says. "I'm not yet confident that it is".

In September 2017, Mr. Gardiner

accepted AREVA's ongoing invitation to visit the site with AREVA personnel and representatives of the Saskatchewan Environmental Society. An independent environmentalist, Val Drummond, was also present; Val and her husband have been helping Mr. Gardiner by writing letters and submissions to the company and regulators, including an intervention to the CNSC Commission in December 2016.

Here are AREVA's and the CNSC's responses, topic by topic. Saskatchewan Environment's blanket response is included at the end.

### The conversation by topic:

**Mr. Gardiner says: The depth of clean cover on the tailings management area (TMA) is insufficient. He says one metre of clean till was placed on top of frozen tailings; he feels it should be at least four metres to prevent root penetration. With the spring thaw, he says, some of this material sank into the tailings, resulting in tailings material bubbling up and becoming available as a salt supply for moose. He has seen moose eat grey material which he assumed to be tailings or tailings salts.**

**Moose browse on the vegetation that is now well established on the tailings cover. Some of those roots, says Rod, must by now be firmly established in tailings material. His conclusion is that the leaves the moose browse on must also be contaminated.**

**There are soft areas on the tailings; Rod claims he could push a 10-foot pole in for its**



**A gamma radiation survey was done on the whole site to make sure everything was safe. File photo**

entire length, although during a September 2017 visit with Mr. Huffman, he got about three feet in (and the radiation detector demonstrated that it was clean. clean). He claims moose sink through the cover into the tailings.

**AREVA says:** The tailings were originally covered in 2005 with a minimum of one and up to five metres of clean material, depending on the area. "The liquids ponds, which did not contain any tailings but collected the runoff water from the tailings, got the most cover material in order to fill the former pond," says AREVA's Dale Huffman. The minimum of one metre of cover is sufficient to prevent intrusion by plants and animals, reduce radiation exposure to near background, and limit infiltration of water into the tailings.

Some areas that had subsided received additional material in 2013, and the cover is effectively isolating the tailings material from the environment. No tailings have been observed at the tailings area. Gamma radiation surveys show near background levels; any exposed tailings would emit 20-30 mSv per hour.

Roots of the vegetation so far established, and of trees in the area, are shallow and would not reach the tailings, says Huffman, and even if they did, not enough contaminants would transfer to affect the trees or the animals that ate them.

The observed grey material the moose may encounter would be glacial till, says Huffman. Moose are well adapted to walking in soft areas like muskogs..

The areas with thinner cover are where it was contoured and fanned at the edges to promote runoff; the thinner areas cover regular ground, not tailings.

**The CNSC says:** During the December 2016 Commission meeting on the Regulatory Oversight Report for Uranium Mines, Mills, Historic and Decommissioned Sites in Canada: 2015 [3], the 1-metre thick till cover over the Tailings Management Area was discussed. CNSC staff presented that monitoring data and inspection observations indicate the cover is performing as designed. The Commission was satisfied that the tailings cover at the Cluff Lake site remains sufficient.

The monitoring data and CNSC staff inspections indicate the cover is preventing animals from accessing the tailings. CNSC staff's calculations indicate that moose and other wildlife are safe to drink ponded water on the Tailings Management Area and lick the clean till cover.

**Mr. Gardiner says:** *The tailings are not lined to prevent leakage.*

**AREVA says:** The tailings area was never designed to be lined. The design of the Tailings Management Area was considered and approved by regulators in the early 1980s, before it was constructed.

**The CNSC says:** A lined Tailings Management Area was never proposed by AREVA. An unlined Tailings Management Area was assessed within the project's environmental assessment. CNSC staff monitor contaminant transport from the tailings to the environment through compliance verification activities, including review of AREVA's annual environmental performance and risk assessment reports.

Results show environmental performance is consistent with predictions made in the Comprehensive Study Report and the environment is protected.

**Mr. Gardiner and his advisors suggest that contaminants from the tailings area are not disappearing, but moving into the wider ecosystem.**

**AREVA says:** Contaminant movement from all areas of the site is measured, monitored and reported. The geotechnical stability of the TMA is monitored every two years by an independent consultant. The 2016 inspection concluded that the Cluff Lake TMA is a low risk for failure, since the tailings are solid and not liquid. Risk of vegetation damaging the clay core is low.

**The CNSC says:** Engineered covers reduce releases to a rate that is predicted to be safe for the health of the environment and safe for human consumption of fish, game animals, berries and medicinal plants.

CNSC staff review annual monitoring results and conclude that AREVA's environmental performance is meeting the Cluff Lake decommissioning objectives and predictions.

CNSC's 2017 Independent Environmental Monitoring Program results are consistent

with the environmental monitoring results provided by AREVA, demonstrating that the licensee's environmental protection program is effective in protecting the health and safety of people and the environment.

**Mr. Gardiner says:** *There has been significant fish die-off in Island Lake, which he attributes to contamination from uranium, molybdenum and selenium leaking from the tailings..*

**AREVA says:** Five fish die-off events between 2002 and 2011 were attributed to low oxygen concentrations in the water. Since operations ceased in 2002 and no more oxygen- and nutrient-rich treated effluent was added to Island Lake, the lake has frozen over in winter, limiting oxygen exchange. Most of the dead fish were white sucker, which are not tolerant of low oxygen conditions. They became established while the lake was kept partially open by the warmer effluent. As Island Lake recovers and returns to baseline conditions, the low-oxygen-tolerant northern pike are again becoming the dominant fish. There is no indication that the fish die-off is related to contaminants.

**The CNSC says:** Current levels of contaminants in Island Lake and downstream are consistent with predictions made in the 2003 Cluff Lake Decommissioning Project Comprehensive Study Report [1]. CNSC staff continue to review AREVA's performance as part of our compliance activities.

As presented in the 2003 Comprehensive Study Report, as well as presented to the Commission during the 2009 public hearing for the Cluff Lake Project and again at the December 2017 public Commission meeting to discuss the CNSC's Regulatory Oversight Report for Uranium Mines and Mills in Canada: 2016 [2], the fish die-off was not caused by contaminants in the water. The 2003 Comprehensive Study Report predicted some winter fish mortality as fish population numbers return to pre-mining levels due to the return to natural water flow in the region.

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The observed fish mortality was attributed to oxygen depletion over winter due to lower oxygen contribution and the ice covering the entire lake as a result of no discharge of treated effluent.

Contaminants in Sandy Lake fish are at levels that are of no concern to health. This was also confirmed by CNSC independent environmental monitoring. Fish collected from Sandy Lake display contaminant levels that do not require advisories and are safe for human consumption.

**Mr. Gardiner says:** *Wildlife in the area are being affected, showing sores on fish, abnormalities in organs and game. He shared analysis results from a five-year-old bull moose he harvested in the area in 2016, with CNSC funding, quoting what he considers high numbers for several elements of concern, such as cadmium, selenium and molybdenum. The moose's liver was also pale and soft, and tasted like battery acid, he said. This could have been caused by fighting, he says, but what if it was from chemicals?*

**AREVA says:** AREVA reviewed the independent sampling results collected by Mr. Gardiner and presented at the CNSC regulatory oversight meeting, and found the results to be very reassuring that moose were not contaminated and are safe to eat.

Cadmium was not present in Cluff Lake ore, so it occurs naturally. Selenium and molybdenum values in water in the immediate area have been decreasing as predicted since the mine closed.

**The CNSC says:** Abnormalities in fish and game are a normal phenomenon found

throughout Saskatchewan.

The data consistently shows that the concentrations of contaminants in the moose harvested by Mr. Gardiner in 2016 are similar to other moose sampled from various areas in northern Saskatchewan and Alberta, including moose from areas that are not affected by mining. Dr. James Irvine, Medical Health Officer with the Province of Saskatchewan's Population Health Unit, explained this at both the December 2016 and the December 2017 public Commission meetings for the Uranium Mines and Mills CNSC Regulatory Oversight Reports [2][3].

Mr. Gardiner was provided funding through the CNSC's participant funding program in 2016 to harvest a moose in the Cluff Lake area, have body parts from the moose analyzed and prepare a report outlining the results. The results were presented and discussed in two Commission meetings of December 2016 and December 2017. There is consensus among the Province, including Dr. James Irvine, Medical Health Officer with the Province of Saskatchewan's Population Health Unit, and CNSC staff, that the moose chemistry was comparable to moose samples collected throughout northern Saskatchewan and Alberta not affected by mining.

There have been several moose studies over the years in the Athabasca region and elsewhere, and they have all showed similar levels and been deemed found safe to eat.

**Dr. James Irvine says:** The results of the analysis show that the values in Rod's moose fall well within the range of other moose harvested in other areas of the north as well

as near Meadow Lake and Hudson Bay. Dr. Irvine sees no reason not to eat the moose meat.

As for the condition of the liver, Irvine says there could be many causes, including a possible unrelated illness in the animal.

**Mr. Gardiner says:** *There are oily smells at the former fuel tank farm area; was it remediated properly?*

**AREVA says:** Contaminated soil was placed in thin layers on the land farm to allow natural degradation of the hydrocarbons. Periodic tilling and addition of fertilizer promoted soil biological activity and speeded the remediation process. By 2013 soil samples showed the former fuel tank area met provincial guidelines. The material was scooped into mounds, which will be flattened before the site is released. Areas like this remediate themselves through exposure to air and sunlight.

**The CNSC says:** Fuel storage is not regulated by CNSC.

**Mr. Gardiner says:** *A pipe that carried contaminated water to the bottom of the DJX pit was pulled out and left on the side. Mr. Gardiner worries that people could cut it up and use it for sled sliders, or for handling fresh water.*

**AREVA says:** The pipe was placed in the pit in 2005 with regulatory approval. It surfaced in 2016 and was removed from the pit. It was disposed of as industrial waste in 2017.

**The CNSC says:** The CNSC did not comment on this.

**Mr. Gardiner says:** *The water level in the DJX pit is high, and could overflow into Cluff Lake, having already covered a berm.*

**AREVA says:** The water level in the DJX pit is almost at its natural level and stable. It would have to come up by approximately two metres to cross the road that separates the pit and Cluff Lake. If it exceeds the approved level, remedial action will be taken. The old safety berm observed by Mr. Gardiner was important during mining, but is not relevant to decommissioning. The surface water is relatively clean.

**The CNSC says:** AREVA has committed to a steady state water level for the DJX pit to control the flow into the surrounding area, including Cluff Lake. CNSC staff will continue to monitor this as part of on-going compliance activities.

**Mr. Gardiner says:** *Beavers are swimming in the former D pit, which raises concerns about contamination of the meat.*

**AREVA says:** The top half of the water in



**A community member checks the vegetation on top of the Claude waste rock pile in 2008. Vegetation was already growing well on the clean cover. Claude Lake is in the background. File photo**

the D pit, as well as in the DJX pit, meets Saskatchewan Surface Water Quality Objectives, with slightly elevated values of uranium. The heavy chemicals settle out and concentrate towards the bottom of the pit, forming a chemocline with the freshest water at the top. There is no danger to anything swimming on surface.

**The CNSC says:** AREVA's 2015 *Environmental Risk Assessment* [4] included consumption of beaver harvested from Island Lake; however the consumption of beavers from D Pit and DJX Pit were not included as the pits were thought to provide poor habitat for beavers. CNSC staff reviewed and were satisfied with AREVA's conclusions within their 2015 Environmental Risk Assessment.

In December 2016, AREVA conducted further examination of the potential risks of beavers spending time in D Pit and DJX Pit at the Cluff Lake Project. AREVA provided a summary of the results and the methodology to CNSC staff. AREVA concluded that there are no risks to beavers that would live in the pits and no risks to people consuming those beavers. After review of the data, CNSC staff confirm that visitors can safely eat beavers living in D and DJX pits.

**Mr. Gardiner says:** *There are high levels of contaminants in Cluff Lake, and wonders if there is seepage from contaminated areas.*

**AREVA says:** Concentrations of constituents of potential concern in Cluff Lake are observed to meet water quality objectives for all parameters. Reports produce by AREVA related to Cluff Lake can be accessed through the "News & Info" section of AREVA's website ([www.avevaresources.com](http://www.avevaresources.com)).

**The CNSC says:** Fish populations in Cluff Lake were predicted within AREVA's 2003 Comprehensive Study Report to be safe at all times. CNSC staff continue to review levels of contaminants through AREVA's annual and five year performance monitoring reports. The concentrations of contaminants in Cluff Lake are currently within the accepted long-term predictions and are at safe levels for the environment and the public. Seepage to Cluff Lake is under control and the environment is protected.

**Mr. Gardiner says:** *Water coming to surface near the old DP mining area may be contaminated.*

**AREVA says:** Surface water was observed in the DP fresh air raise from 2001 to 2004 following the closure of the DP mine. A work plan was completed in 2004 to improve drainage, and the area was re-graded. Since 2004, the water has

consistently been at least two metres below the regraded ground elevation.

**The CNSC says:** Based on previous correspondence from Mr. Gardiner, it is believed that he is referring to the former Dominique Peter Mine fresh air raise. Water quality is monitored from a well inside the raise. Additionally there are three groundwater monitoring wells in the general vicinity. The concentrations of contaminants in the monitored water are within AREVA's predictions and wildlife can drink this water without harmful effects. CNSC staff will continue to review monitoring results in this area.

**Mr. Gardiner says:** *The Claude area has some issues: Ore was dumped in the waste rock pile; the old pit is seeping; and old equipment in the peat trenches should be removed.*

**AREVA says:** Ore placed in the Claude waste rock pile by mistake would typically have been removed for processing; however, it is not concerning if some ore material remains in the waste rock pile.

The pile was decommissioned knowing it contained special waste or low-grade ore. The surface was compacted, covered with clean till cover and revegetated to limit water infiltration. The cover is sufficient to limit rain and snow from penetrating the pile, therefore leaching of waste rock has been minimized.

The peat trenches, constructed downslope from the Claude waste rock pile in 2006 and 2007, were experimental and not critical to the long-term performance of this site. The iron in the buried equipment chemically helps limit the movement of nickel and uranium in groundwater. Radioactivity on the buried equipment was minimal. Removing or refreshing the peat barriers is unnecessary and would be locally destructive to the environment.

**The CNSC says:** The Claude pit was filled with waste rock and covered with clean till when decommissioned. CNSC staff inspect the Claude waste rock pile to ensure the cover is performing as designed. Run-off water over the cover does not contact the waste rock and is therefore safe to consume by animals and birds.

**Mr. Gardiner says:** *There may be spilled ore still on the roadways.*

**AREVA says:** Radiological clearances in 2007 and 2013 indicate no elevated radiation readings anywhere on site.

**The CNSC says:** Historical spills were fully decommissioned according to regulatory requirements. Comprehensive gamma

radiation surveys were completed to ensure areas were clean. For petroleum hydrocarbon spills, contaminated soil was removed and remediated.

**Mr. Gardiner says:** *AREVA should not be telling people the area is safe and that country foods are safe to eat. He requests a study, done by local people and incorporating traditional knowledge, on the health of animals and fish in the area, and for better communication from AREVA.*

**AREVA says:** We took local concerns seriously and are updating our risk assessment calculations to reflect larger intakes of traditional food.

We assessed moose at 10x the consumption previously assumed, and concluded that a person could eat 1,095 lbs of moose meat and 80 lbs of organ meat annually, harvested on the site, before reaching reference levels provided by Health Canada. A person could consume 22 cups of berries a day without reaching a reference value. They could safely eat 25 fish from Island Lake each year, and drink six cups of water a day. Beaver, ducks, muskrat, including those harvested around the former open pits, are also safe to eat.

Molybdenum and selenium, along with other elements, also occur in store-bought foods and in the natural background.

**The CNSC says:** In the summer of 2017, CNSC staff independently collected samples of radon in ambient air, water, fish, blueberries, and medicinal/edible plants in publicly accessible areas around the Cluff Lake site. CNSC staff sampled a reference location, Saskatoon Lake, which is unaffected by mining activities and two exposure locations, Sandy Lake and Cluff Lake, which are locations that could potentially be impacted by previous mining activities.

The summary results from the Independent Environmental Monitoring Program (IEMP) are as follows:

- Visitors can safely utilize water from Saskatoon Lake, Cluff Lake and Sandy Lake.
- Visitors can safely consume blueberries and Labrador tea on the shore of Saskatoon Lake, Cluff Lake and Sandy Lake.
- Visitors can safely eat fish in Saskatoon Lake, Cluff Lake and Sandy Lake.

IEMP results are consistent with the environmental monitoring results provided by AREVA, demonstrating that the licensee's environmental protection program is effective in protecting the health and safety

of people and the environment.

Results from the IEMP will be available on the CNSC's webpage by the summer of 2018.

Based on the monitoring information provided by AREVA, and CNSC's Independent Environmental Monitoring Program, CNSC staff conclude that visitors to the Cluff Lake site can safely use waterbodies around the site, and consume fish and traditional foods in the area.

**Mr. Gardiner says:** *The contaminated core storage area is not safe; plywood sheeting on top of the core racks has deteriorated or been taken, and runoff ends up in Cluff Lake.*

**AREVA says:** Core storage meets provincial

regulations for core stored in the bush. We exceed requirements by fencing and locking the area, signposting it and covering the core. AREVA staff regularly tidy and repair the area. Vandalism is a concern, but is not anticipated to result in a health risk. The area is the required distance from Cluff Lake.

**The CNSC says:** Core storage is not regulated by CNSC.

#### Sask Environment's response

Saskatchewan Environment issued a statement covering all the topics raised by Mr. Gardiner as follows:

"Monitoring data collected by AREVA, third party qualified professionals and the Ministry of Environment confirm that the environmental performance of the Cluff Lake

site is consistent with objectives in the decommissioning plan approved by both the ministry and the Canadian Nuclear Safety Commission.

The ministry is satisfied at this time that the containment systems for tailings and waste rock continue to function within the agreed decommissioning plan. Additional samples including sediment and biological samples are scheduled for collection in 2019. Should the results of any of the ongoing monitoring indicate issues outside the agreed-to endpoints, the ministry will require additional work to be completed".

#### Conclusions:

Often, people expect background levels of common elements like selenium, molybdenum or uranium to be zero, and they never are, says Huffman. Elements of concern are commonly found in the soil and water naturally, and are taken up by animals and plants.

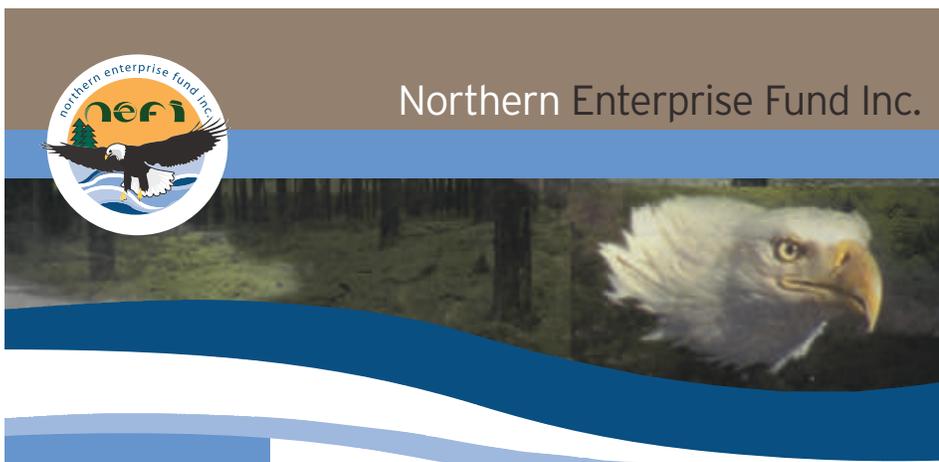
Advancement of science has resulted in improvements in analytical techniques, which make detection limits lower, which means elements are "below detection limits" less and less. Scientists work hard to determine what levels are safe for human consumption, and to issue warnings when those levels are exceeded.

#### Final round of work planned

Before the site is accepted into Institutional Control, which at the earliest would be in 2019, there will be a last round of work. Minor works and final site cleanup are planned for 2018, Huffman says.

This work will include removing some unused piezometer (monitoring) wells; flattening some mounds on the TMA where the additional material was added in 2013; covering miscellaneous garbage that was placed in a dry trench which was a former water treatment pond; and removing remaining culverts unless an agreement can be reached with local property owners or the province to maintain them. There are currently no plans to add more cover to the tailings area.

AREVA has agreed to continue to make environmental monitoring results available to interested stakeholders, and routinely assesses the communication and stakeholder engagement programs to ensure that the correct information is being shared with those interested in the activities.



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www.nefi.ca

## Northern Enterprise Fund Inc.

Box 220, Beauval, SK. S0M 0G0. Phone 306.288.2258 or 1.800.864.3022. Fax 306.288.4667  
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