Saskatchewan Environmental Society

# SASKATCHEWAN ENVIRONMENTAL SOCIETY COMMENTS ON ORANO CANADA INC.'S APPLICATION FOR THE RENEWAL OF THE URANIUM MINE DECOMMISSIONING LICENCE FOR THE CLUFF LAKE PROJECT

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Submitted to the Canadian Nuclear Safety Commission, 15 April 2019

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## 1. INTRODUCTION

SES supports Orano's request for a 5-year renewal of its decommissioning licence.

While stating this, we continue to question whether this is indeed a fully decommissioned site, and we challenge some of the requested changes in the licence. We anticipate that the licence renewal will allow Orano to continue to work on what we regard as remaining tasks, which may or may not be completed within the 5-year timeframe of the new licence.

The fundamental question on which a lack of consensus about the adequacy of decommissioning remains is:

How good is good enough?

Is "meeting decommissioning objectives" all that is required, when, for some parameters, no objectives were defined?

What degree of certainty about future social and environmental conditions is it reasonable to expect?

What degree of responsibility should we assume for the well-being of people and other life-forms in a very uncertain, distant future?

And how do we deal with a situation in which acceptable levels of a contaminant (uranium) have changed since the design objectives were written?

What about if things are just "trending towards results used in the original design work", as is the case for net percolation through a major waste rock pile?

These tend to be philosophical, rather than technological, questions, but they are questions that must inform the decision-making about the future of the Cluff Lake site.

We appreciate that the company has done a great deal of high-quality work in very significantly improving the site, in reducing environmental and safety risks and in responding to public concerns. However, a number of concerns have not yet been adequately addressed. These, for the most part, relate to future uncertainties and the adequacy of preparation for potential unknown conditions that may arise hundreds or thousands of years from now. The long-term unknowns are both physical/technological (e.g. geological change,

precipitation changes, microbiological changes, animal behaviour); and societal/regulatory (e.g. regulatory capacity, economics, land use, international or civil conflict, retention of knowledge, social cohesion, governance stability, population movement). This is why a plan that relies on hundreds of years of monitoring and maintenance in an unknown future, as assumed reassuringly in Appendix A (p. 22) of Orano's submission, is problematical. What we are hoping for is a more ambitious approach to improving the resilience of the site in order to minimize the likelihood of problems occurring in the distant future.

We divide our comments into two sections. In the first we discuss some broad issues that are relevant to the site as a whole; in the second we focus on specific locations within the site. References to Orano and CNSC documents are identified both by actual print page number and with pdf number (in brackets) in order to make it easy to find them in their electronic version.

## 2. BROAD ISSUES

The Follow-up Program v3 (FUP) p. 3-1 (32/505) has identified 2 primary sources of potentially adverse effects, seepage from the mining area (waste rock piles, underground mines and backfilled pits), and seepage from the Tailings Management Area (TMA). Orano relies mainly on covers and passive removal mechanisms to address these issues. While these are the primary sources, we would add to these the important secondary sources, i.e. the locations to which contaminants have already migrated and from which the potential exists for gradual release of contaminants.

Major uncertainties about the long-term behaviour of contaminants and changing hydrological systems need to be recognised. Modelling is a good start that can certainly provide guidance to planning, but it is based on our present understandings of the continuity of current trends and of factors that may affect the future condition of the site. We can never cover all the bases, but we could probably do more to reduce the chances that future change will require active intervention by future, unknown, regulators.

In some areas, we would argue that the decommissioning objectives are not appropriate. Admittedly, this is an issue that should have been addressed many years ago and is hard to change retroactively. In other areas, we have a parameter for which no decommissioning objective was set, but in which Lowest Effect Levels are exceeded. This situation, arguably, is not the same as "decommissioned".

We appreciate that under the CNSC, the uranium industry is the beneficiary of a significantly more robust regulatory system than most other industries in Canada. While there is every indication that Orano has done, and continues to do

responsible monitoring of present conditions at the Cluff Lake site, and is updating projections of future contaminant distribution, SES is concerned that long-term environmental uncertainties prevent sufficient confidence in forecasts of harm prevention.

**2.a) Precipitation and Flooding**

Particularly the uncertainty about future precipitation patterns is of concern. Not only the potential changes in annual precipitation, but also the distribution of this precipitation among various rainfall and snowfall events will impact the rate at which contaminants will move from present locations. The site may experience a series of alternating droughts and flooding, with impacts that are difficult to model.
In SNC Lavalin's "TMA Cover Evaluation Report" included in Orano's submission as Appendix A p.2 (69/111), 1994 data is used as the basis for prediction of Probable Maximum Precipitation (PMP).

However, A.N. Rousseau in a 2014 article (https://www.sciencedirect.com/science/article/pii/S0022169414008488) on evaluating PMP under changing climate conditions, shows that precipitable water in the atmosphere is an important climate parameter, which is expected to increase with global mean sea surface temperature. This implies that 20+ year-old precipitation data will not provide an adequate guide to future flood conditions.

Moreover, L. Mathier *(Probable Maximum Precipitation in Boreal Regions Phase III – Analysis of rainfall data from an automatic station in Canada. Espace.inri.ca/1076/1/R000410.pdf*) wrote: "according to expert meteorologists from Environment Canada, rainfall data recorded before 1988 are not reliable; quality of rainfall data from Environment Canada's automatic station network is poor; most of the errors detected by the quality control procedure are non-systematic errors. Thus, it is not possible to propose a general procedure to validate historical rainfall data."

So both the validity of historic data and our ability to predict future precipitation patterns are in question. We suggest therefore that SNC's conclusions about future maximum precipitation are not reliable, and that the risk of flooding and erosion could well be greater than they have concluded. SNC's partial acknowledgement of this uncertainty is reflected in their frequent use of cautious language along the lines of "we think everything should be OK given normal conditions". Meanwhile, we keep hearing about a future in which conditions will be anything but normal.

Other factors, including temperature increases and resulting ecological changes will contribute to the uncertainty. We may expect some northward migration of both animal (including human) and plant species that will affect both ecosystems and land use.

## 2.b) Changes in Water Balances

This issue relates to anticipated movement of meteoric water through reclaimed areas that have been covered (e.g. waste rock piles, tailings).

Researchers at the University of Saskatchewan *(Shahabul Alam and Lee Barbour, Journal of Hydrometeorology Nov. 2018, vol 19, No.11)* reported on the evaluation of long-term water balances for reclamation covers on oil sand landforms in northern Alberta, using both historical climate data and future climate projections. Their work is relevant in estimating the long-term effectiveness of covers on the Claude Waste Rock pile and the tailings site. They report that "Probability distributions of growing season (April–October) actual evapo-transpiration (AET) and net percolation (NP) for the baseline and future periods show that AET and NP at all sites are expected to increase throughout the twenty-first century regardless of pathway, time period, and soil profile. Greater increases in AET and NP are projected toward the end of the twenty-first century. The increases in future NP at the reclamation covers are larger (as a percentage increase) than at most of the natural sites. Increases in NP will result in greater water yield to surface water and may accelerate the rate at which chemical constituents contained within mine waste are released to downstream receptors".

This reduces our confidence in the long-term projections of movement of contaminants into groundwater.

## 2.c) Decommissioning Objectives

The Hydrogeology and Groundwater Modelling Technical Information Document (HG and GW TID) p. 6-3 (140/333) lists Decommissioning Surface Water Quality Objectives (DSWQOs) for various contaminants at various site locations. Objectives for Uranium range from 190 to 1,194 µg/L. These figures appear to still be linked to water hardness criteria which are now considered inappropriate. The Saskatchewan Surface Water Quality Objective (SSWQO) figure is 15 µg/L. The DSWQO for arsenic is 50 µg/L, while the SSWQO standard is 5 µg/L. Molybdenum DSQWOs range from 73-500 µg/L in different locations, while the SSWQO is 73.

Orano's submission, p. 2-12 (32/111) in fig 2.1 shows a number of locations where peak levels of some contaminants in surface water will exceed Saskatchewan

guidelines but "not exceed decommissioning objectives". The latter is true only because of the significant discrepancy between decommissioning objectives and SSWQO for certain elements, e.g.:

| | DSWQO (µg/L) | SSWQO (µg/L) |
|---|---|---|
| **Arsenic** | 50 | 5 |
| **Uranium** | 190 -1,194 | 15 |
| **Molybdenum** | 73 – 500 | 73 |
| **Lead** | 20 | 2 – 7 |

Presumably these discrepancies reflect the difficulty or cost of achieving SSWQOs rather than a decision that some locations do not need to be as clean as is expected elsewhere. We suggest that it is time for CNSC to review the basis on which DSWQOs are established.

**2.d) Uranium and Arsenic Chemistry**

Crucial to planning of management of uranium in mine wastes is a discussion of the potential changes in chemical format that can occur under varying environmental conditions. These changes can affect the mobility of uranium in groundwater. A Stanford University report summarized in Proceedings of the National Academy of Sciences (https://phys.org/news/2017-02-uranium-chemistry.html) points out that when uranium is bound to organic matter in sediments, generally in a stable tetravalent form, it is immobile under certain conditions. But this tetravalent uranium may become mobile if the water table drops and oxygen from the air enters spaces in the sediment that were formerly filled with water, particularly if the uranium is bound to organic matter in sediments rather than being stored in insoluble minerals.

Under some conditions uranium can be more or less completely flushed out of sediment, the Stanford report notes; under other conditions it will remain in the sediment and stay out of the groundwater or water column. But under fluctuating conditions, neither happens completely. This may result in persistent plumes of uranium contamination in groundwater that are hard to predict and to model.

With future, difficult-to-predict changes in precipitation, this would indicate that we should be cautious in relying on current monitoring data to project the future rate of release of uranium from sediments and marshy areas. It is also necessary to take into account both the grain size in specific sediments, which affects the rate of release of uranium, and also the effect of disturbance of sediment by wildlife.

Arsenic is another contaminant of concern whose biological availability depends on environmental conditions that may change over the long term. Micro-organisms present in soil (e.g. in the Claude pit) can metabolise stable pentavalent arsenic (with relatively low mobility and low toxicity) to trivalent arsenite compounds that are significantly more mobile and more toxic *(advice from Prof. Graham George, Dept. of Geology, U. of Saskatchewan)*. This can result in unanticipated rates of release of arsenic into groundwater, depending on fluctuating levels of microbial activity.

These examples illustrate the degree of uncertainty that exists regarding long-term behaviour of contaminants of concern, particularly in environments where they are associated with organic materials. Current behaviour may not be a very good predictor of long-term effects.

At this point there do not seem to be better tools available to predict long-term future conditions. Although Orano comments p.2-10 (30/111) that "revised modelling has improved confidence", we suggest that the remaining level of uncertainty will necessitate on-going responsibility for the site for the indefinite future by Orano and the CNSC, the bodies that have the most experience and resources to address future issues as they arise.

### 2.e) Mine Opening Covers

This is an issue on which we have commented before. What, we wonder, is the basis of the company's decision to use concrete rather than steel covers to cap mine openings? We are aware that at Beaverlodge, original concrete covers have been replaced with steel. At Gunnar, SRC has chosen to use steel (see Canadian Mining Journal, 1 April 2014, "*Sealed for Safety*").

According to AANDC (Aboriginal Affairs and Northern Development Canada) Remediation Guidelines for Abandoned Mine Openings, "methods such as concrete structural seals … are suitable in many cases; however, these methods are not permanent solutions. The design life of concrete structural seals has been estimated at approximately 50 years". We have seen estimates ranging from 100 to 1,000 years for the lifetime of steel caps. We simply ask for an explanation of the decision.

## 3. SPECIFIC SITE ISSUES

### 3.a) Claude Lake, Pit and Waste Rock Area

Contaminants from the Claude Waste Rock Pile and the Claude pit have been migrating into the marshy area bordering Claude Lake for several years. It seems that much of the contaminant load is retained in the organic material

surrounding the pit, while some has made its way via over-flowing surface water, drainage ditches and groundwater movement into Claude Lake.

We find it strange that Claude Lake, although it has been the recipient of contaminants from the Waste Rock Pile and the pit for several years, was not considered to be operationally influenced. Apparently, for this reason, sediment monitoring data were not presented in EPTID Vol 1, Table 4.3-1(275/561), as were those of Cluff, Snake and Island Lakes.

Despite this lack of data, modelling of predicted future levels of COPCs in Claude Lake water and sediment is presented in EPTID Vol 2. This document (p. 4-2)(48/397) notes that many input parameters for this modelling are uncertain or variable due to the limited availability of observational data and measurements. The model deals with the uncertainty by assigning a distribution of values to various parameters as opposed to single values used in deterministic analyses. While a variety of modelling parameters are possible, we do not know the likelihood of each actually occurring.

For example, the Follow-Up Plan reports that net percolation through the Claude Waste Rock pile is "trending towards design". However, we refer the reader to the Shahabul and Barbour study above (page 5), which anticipates increasing rates of net percolation by the end of this century. The impact of such change in NP on levels of contaminant migration is hard to predict. It is noted that nickel and uranium levels in the pit pore water have decreased; it would be good to know just where these elements have moved to – how much remains in the pit organic material, how much is in the lake sediment or downstream or in the organic material between the pit and the lake.

The Follow-Up Program (FUP p. xiv (16/505) reports that the capacity of the sediment to retain intercepted contaminants long-term is conservatively effective. It finds (FUP p. 3-12) (43/505) that there is enough carbon in the Claude sediment to attenuate all of the COPCs expected to eventually migrate from the Waste Rock Pile. Lab bench column tests were conducted to estimate the capacity of the sediment material to retain contaminants in the long-term. We understand that lake water was used to simulate actual conditions in the lake. However, we question whether the microbiological and benthic organism behaviour in sediment, or the disturbance of sediment by wandering moose, is reliably represented in an artificial environment.

We note in the graphical representations of anticipated future levels of COPCs in Claude Lake sediment (EPTID Vol 2, fig 6.2) (261/397) that sediment levels of several elements including arsenic start off very high at year 2000 and drop dramatically a few years later. This is presumably as inflow of contaminants from the waste rock pile and the pit slow down, and earlier, more contaminated

sediment is covered by cleaner sediment. However, we would still raise the concern that sediment may be disturbed by animals wading through it, thus further exposing the contaminated material to the risk of releasing contaminants into the water column. Also, as the site is now publicly accessible and generally uncontrolled, the possibility of disturbance of the sediment by human activity must be considered. It appears that the modelling is based on only the top 5 cm. of sediment, so quite minor disturbances of the sediment could invalidate the conclusions.

EPTID Vol 2 p. 4-1 (47/397) recognises that sediments may be a significant source of inorganic substances such as metal ions. We recommend that deep-core monitoring of Claude Lake sediment take place at several locations during the period of the new licence.

**3.b) Claude Creek**

Data on contaminant levels in Claude Creek reported in Appendix C of the Follow-up Program FUP (287/505) is confusing. Levels of various ions, both upstream (location CDE1000S) and downstream (location CDE2100S) of the plume of contaminant release from the waste rock pile vary up and down unpredictably over recent years. For example, the "sum of ions" both upstream and downstream of the plume increased significantly from 2007 onwards. In 2011 uranium upstream of the plume suddenly increased from 0.00037 to 0.0010 mg/L and remained at that level, while there is a less significant increase below the plume.

The level of Ag decreased markedly in about 2009 and stayed low, while the Na level increased significantly in 2011 upstream of the plume and stayed high. Na downstream of the plume increased in 2005 and remained elevated. Specific conductivity exhibited the same change. Pb dropped 5-fold in 2009 both up and downstream, as did Cr and Cd. It is suggested to us that these variations reflect different rates at which ions are released from the rock pile, and how much of the contaminant is coming directly from the waste rock to the Creek and how much is coming via the lake from the pit at any given time. It seems that we need a better understanding of what's going on in order to successfully predict future behaviour.

Fig 6-44 in the Hydrogeology and Groundwater modelling TID appears to indicate that in an "upper bound infiltration case" the uranium level in Claude Creek upstream of the Peter River confluence will peak in about 250 years at almost 300 µg/L. After 1,000 years the level is predicted to have fallen to 50 µg/L, still several times higher than SSWQO. Incremental loading of uranium to Claude Creek from the Claude Pile and Claude Pit is expected to increase steadily for

the next 300 years, and is projected to still be above pre-decommissioning loading in 1,000 years.

The complicated behaviour of movement of contaminants in the Claude area suggests that very long-term, detailed monitoring will be required for hundreds of years. This is a situation which, ideally, would be avoided, given the uncertainty of very long-term regulatory management. Given the situation that we are left with now as a result of much earlier decisions about waste management, priority should be given to ensuring indefinite future maintenance of oversight systems in circumstances of political and economic uncertainty.

### 3.c) Island Lake Fen

The Island Lake Fen is an area in which it is questionable whether objectives have been achieved. The Follow-up Program p. 4-5 (62/205) reports that the top 5 cm of sediment exceeds LEL and/or SEL in Mo, U, Ni, Se, As and Pb210. The Fen is reported to retain 57% of the total loading of U and 53% of the Mo, with 1% U getting through to Sandy Lake. Not surprisingly, Fen sediment and pore water showed high variability in chemistry, making future projections difficult. Orano has conducted numerous studies to evaluate the long-term stability of retention of contaminants by the fen organic materials. They conclude that a moderate to severe fire would be required to mobilize metals retained in the fen, and that this is unlikely to occur. Regulators will need to decide what degree of unlikeliness is acceptable.

### 3.d) Island Lake

Orano has asked to have Island Lake removed from the licence area, claiming that it has met decommissioning objectives and does not require further maintenance and monitoring. SES opposes this request.

Contaminants of concern are still an issue at Island Lake. Surface water concentration of uranium (2015-2017) ranged from 76-143 µg/L (see CNSC staff report Sec. D – Environmental Protection Review Report, (59/155)). While this is below the original decommissioning objective of 346-552 µg/L for Island Lake, it is well above the new guideline of 15 µg/L that Orano has agreed to recognise.

The sediment level of U in Island Lake is measured at 343.4 µg/g, projected to rise to 900 at its peak. This is approximately 10 times the natural level (see Table 3 in CNSC staff report, Sec. D). There does not appear to be a design objective for sediment uranium levels. However, the Lowest Effect Level (LEL) is 104 µg/g. It is predicted that it will take 150 years for the uranium level in Island Lake to get below the LEL as cleaner sediment covers the contaminated sediment. And this presumably assumes that the sediment will not be disturbed, which cannot be

guaranteed. We recall that at Beaverlodge Lake sediment has, after many years, started to release uranium from sediment into the water column. Predictions that surface water uranium levels at the Island Lake outlet will continue to decrease indefinitely should probably be read with some reserve.

In addition, Orano recognises that elevated levels of COPCs in Island Creek present a potential risk to local populations of mink, muskrat, otter and yellowlegs as well as to individual common nighthawks (a threatened species under SARA) (Orano submission p 2-18 (38/111).

We therefore suggest that it is inaccurate to claim that Island Lake has been satisfactorily decommissioned. It should remain within the licence area and be subject to on-going CNSC regulatory responsibility.

### 3.e) Core Storage

When we visited the Cluff Lake site with Orano staff in the fall of 2017, two core storage areas remained on the site. As far as we know, this is unchanged, although some tidying up has apparently taken place. One area contains several unprotected stacks of cores that are regarded as non-hazardous. The other is a fenced-off area labelled with radiation hazard warnings. This area contains poorly protected stacks of core material, buckets containing unidentified material, and miscellaneous trash. Apparently some of this core material may be of interest in future exploration work and is regarded as intellectual property – presumably belonging to Orano. Both core storage areas, we are told, are now outside of Orano's actual licence area and not subject to CNSC regulation, but are the responsibility of the Saskatchewan Ministry of Environment.

We believe it would be in the best interests of both Orano and the Saskatchewan Ministry to properly secure this fenced-off area to which we drew attention in our last review. The area is publicly identified as a radiation hazard, is ill-kempt, and remains subject to theft and vandalism.

### 3.f) Tailings Management Area and Snake Lake

According to the Hydrogeology and Groundwater TID p. 5-3 (68/333) Snake Lake is a major groundwater discharge site for the watershed, with groundwater moving east to west across the Tailings Management Area (TMA) towards Snake Lake. It is noted that water levels that are close to ground level or higher have been observed in some monitoring wells in the former liquids pond area, lower solids decant area and lower solids pond, both upstream and downstream of the main dam. This, suggests the TID, could indicate the existence of artesian conditions in these areas.

Because of the east to west movement of groundwater across the TMA, the possibility of contaminants eventually being carried from the solids area into the area where surface wetness is encountered should be considered. This continual rising of groundwater to the surface over the tailings area is a cause for anxiety for some local residents and presents potential ecological risks. Mr. Gardiner's evidence claims that the till cover was applied in winter over ice and was never compacted. We have not seen this claim challenged, so we assume it is true. It is unclear whether now adding additional cover over the tailings would ameliorate this situation. We suggest that a study of the potential effects of adding an additional 1 metre or more of till to the entire TMA cover should be undertaken soon, with results presented for public discussion.

We appreciate the fact that Orano recently commissioned a study by SNC Lavalin of the effectiveness of the TMA cover. This study is included as Appendix A in Orano's current CNSC submission. We note that SNC estimated Probable Maximum Flood based on 1994 precipitation data. As indicated above (p. 3) both the questionable validity of this early data and the uncertainty about future precipitation patterns and levels lead to concerns about the reliability of SNC's conclusion. Cautiously, SNC says on p. 2 (69/111), "surface water management for the TMA, under normal circumstances, is expected to function as intended". SES appreciates the tentativeness of this conclusion, and suggests that we need to recognise that future conditions may well not be "normal", and that "expectation" of "functioning as intended" is not very reassuring.

We also note SNC's quote in their report p.19 (86/111) from MEND 2007 that "In many cases the effect of biological and chemical processes specific to a site on long-term cover system performance can only be evaluated from a qualitative perspective."

We suggest that among the biological processes that need to be considered is the potential effect of sulfate-reducing bacteria on soil that is in contact with tailings. As reported in Miller, Landa and Updegraff "*Ecological aspects of microorganisms Inhabiting uranium mill tailings"* Microbial Ecology vol 14 No2 (Sept 1987) pp141-151. https://www.jstor.org/stable/4250948, "Sulfate-reducing bacteria, capable of leaching radium, were isolated in low numbers from tailings samples but were isolated in significantly high numbers from topsoil in contact with the tailings … the existence of sulfate-reducing bacteria in uranium mine tailings and overlying top soils raises the possibility that radium leaching may indeed occur as a result of their activity" … "Re-vegetated uranium mill tailings with a relatively high organic matter content contain more sulfate reducers than mill tailings with a poor vegetative cover and low organic carbon content. Organic rich cover materials have been used as a means of ensuring a stable growth of plants to suppress dust and to act as a Rn barrier."

This last condition would seem to describe the Cluff TMA and points to the need to be aware of the potential effect of microbial action on tailings in contact with soil. With MEND's warning that such effects can only be evaluated qualitatively, caution about future projections is appropriate.

### 3.g) Flooded Pits

Time pressure does not allow us to discuss in any detail the condition of the flooded D and DJX pits and our concerns about the elevated levels of contaminants in the lower parts of those pits. We continue to wonder about the potential for long-term leakage of contaminants into groundwater, or for disturbance of the chemocline which could bring contaminants into the upper part of a flooded pit.

## 4. FINANCIAL ASSURANCE

Orano is requesting a reduction of its financial guarantee to $3.5 million. This, they estimate, would be enough to cover CNSC fees for 5 years, monitoring costs for 3 years, the cost of a low-probability failure event and a lump sum to establish a Long-Term Monitoring and Maintenance Plan and an Unforeseen Events Fund. It is based on an assumed financial rate of return on investment of 3.7% (inflation plus 2%). We understand that until the site is eventually transferred to Institutional Control, Orano remains financially responsible for all and any costs for monitoring, maintenance and failure events, and that a final financial guarantee will be determined following a public review process at the time of transfer.

This looks reasonable so long as the company remains viable for the next 5 years, which we hope is the case. However, if Orano were to go out of business during that period, we would be left with a guarantee that, to the lay observer, seems quite minimal. It has not been subject to a detailed public analysis and is based on assumptions that may be convincingly challenged. Meanwhile it is clear that the provincial Institutional Control Program is, so far, seriously under-funded and would not be able to pick up major unforeseen event costs which could perhaps amount to several million dollars. For this reason, SES suggests that the proposed financial guarantee for this transition period be set significantly higher than the requested $3.5 million. We ask that this figure be reviewed and appropriately amended to take account of the possibility of company dissolution during the period of the licence.

## 5. SUMMARY OF RECOMMENDATIONS

In summary, SES suggests that:

1. Orano be granted a renewed, 5-year licence to continue decommissioning the Cluff Lake site;

2. Island Lake and the Island Lake Fen should remain within the licence area;

3. The decommissioning objective for uranium in surface water should be amended to 15 µg/L;

4. CNSC should review the basis on which Decommissioning and Design Objectives are established;

5. Contaminant levels above Lowest Effect Level should not be accepted as satisfactory for decommissioning;

6. An independent study should be conducted into the costs and benefits of increasing the depth of the cover on the Tailings Management Area;

7. The financial guarantee for the period of the new licence should be reviewed and increased to take account of the possibility of corporate collapse of Orano Canada Inc. during the licence period;

8. The radioactively hazardous materials in the fenced core storage area should be more securely protected from vandalism and theft;

9. Deep-core sediment at several locations in Claude Lake should be monitored for contaminant levels;

10. CNSC should initiate a process to review possible approaches to increasing the long-term resilience of regulatory systems, taking account of political and economic uncertainties and the identified need for hundreds of years of monitoring and maintenance.

## 6. Acknowledgements

SES very much appreciates the help of Orano staff, especially Diane Martens, in providing prompt access to requested documentation, in enabling us to visit the site, and in patiently responding to our questions.

We also acknowledge the support of CNSC's Public Participation Funding program in enabling SES's participation in this review.

*The Saskatchewan Environmental Society (SES) is a non-profit, registered charity that is committed to supporting sustainable living and sustainable resource use in Saskatchewan. SES's current action areas include sustainable energy and climate solutions, water protection, resource conservation, biodiversity preservation, and reduction of toxic substances. Our work in Saskatchewan spans Treaties 2, 4, 5, 6, 8, 10, and our office is located in Saskatoon on Treaty 6 territory, the traditional territory of Cree Peoples, and the homeland of the Métis Nation. Visit us online at: www.environmentalsociety.ca*