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Regulatory Oversight Report for Uranium Mines, Mills, Historic and Decommissioned Sites in Canada: 2017

Commission Meeting

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Saskatchewan Environmental Society

COMMENTS ON CNSC REGULATORY OVERSIGHT REPORT FOR URANIUM MINES, MILLS, HISTORIC AND DECOMMISSIONED SITES IN CANADA: 2017

Prepared by Ann Coxworth for submission to the Canadian Nuclear Safety Commission on behalf of the Saskatchewan Environmental Society

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Saskatchewan Environmental Society
P.O. Box 1372
Saskatoon SK S7K 3N9
www.environmentalsociety.ca
306.665.1915
annc@environmentalsociety.ca

The Saskatchewan Environmental Society acknowledges that the areas affected by uranium mining in Saskatchewan lie within Treaty 8 and Treaty 10 lands and the Homelands of the Métis Nation.

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1. Introduction

The annual Regulatory Oversight Reports (RORs) provide a very useful summary of the conditions at the various uranium mining and milling locations in Canada, and we appreciate the effort that goes into producing them. The current report is clearly written and accessible. While such reports cannot contain the level of detail that would be found in the site-specific documents that accompany licence renewal and environmental assessment processes, they do provide a valuable opportunity to review generic regulatory issues that are relevant to the industry as a whole.

2. SES Focus

Over the past 4 or 5 decades the Saskatchewan Environmental Society has raised public awareness and understanding of several issues related to the nuclear fuel chain, from its starting point in Saskatchewan's uranium mines to its present end-point in temporary nuclear waste holding sites around the world. Prominent among the specific issues we have addressed are the still unsolved problem of high-level radioactive waste management, the risk of diversion of nuclear materials for destructive purposes, and the protection of northern Saskatchewan's ecosystems from harmful impacts of uranium extraction and processing.

It is this last issue that has motivated our long-term involvement in those regulatory processes that are specifically related to Saskatchewan's uranium industry. More recently our focus for activity within this field has narrowed somewhat, to look especially carefully at the long-term risks associated with decommissioned mine and mill sites and those undergoing or awaiting remediation. This is an area that will remain of general societal concern regardless of whether or not the extraction and processing of uranium has a significant economic future. Our recent participation in reviews of licence renewals for the Beaverlodge, Gunnar, Lorado and Cluff Lake sites exemplifies this specific focus.

At the same time we try, to the best of our ability, to monitor issues at the actively operating sites, with the goal of contributing to a minimization of long-term negative impacts of the industry. In this context we have recently provided comments and suggestions during reviews of the Key Lake, McClean Lake, McArthur River and Rabbit Lake operations. We have also participated in reviewing the past two Regulatory Oversight Reports on Uranium Mine and Mill Sites. Because of this long and extensive involvement, SES has over the years raised many issues with the CNSC. A few of these have been raised over and over again, and some, if still unsettled, will be raised again today. If this repetition seems unnecessary, it is happening simply because adequate responses have not been provided in the past.

Our present review of the ROR for 2017 includes, first, a number of observations that apply generally to several or all of the sites. This is followed by some comments on individual sites, and finally an itemised list of the topics of our questions, comments and suggestions to which we would appreciate receiving a response from the CNSC.

3. General issues

What follows in this section are several observations and questions that relate to all or several of the sites. Some of these are things that we have raised in our comments on previous Regulatory Oversight Reports or licensing submissions, and to which we feel we have not received adequate responses.

3.1 Lack of consensus on how good is good enough

This is such a hard issue to deal with! Several times in the past we have questioned the application of the ALARA principle, given the lack of agreement among stakeholders as to what is 'reasonable'. We can dispassionately compare the scientific health risks of living beside a mine site to the risk associated with a medical X-ray or of flying across the country, risks that most of us accept.

Wikipedia tells us that "*the key question in determining whether a risk is ALARP (As Low as Reasonably Practicable) is the definition of reasonably practicable. This term has been enshrined in the UK case law since the case of Edwards v. National Coal Board in 1949. The ruling was that the risk must be significant in relation to the sacrifice (in terms of money, time or trouble) required to avert it: risks must be averted unless there is a gross disproportion between the costs and benefits of doing so.*" But for some people, the potential for unknown harm to future generations, and particularly, the lack of personal control over the risk to which one is exposed, become at least as weighty as the economic cost/benefit analysis. The lack of broad consensus on what constitutes a benefit, how to attach a dollar value to factors such as peace of mind, makes judgement about whether ALARA has been achieved very difficult. It is therefore questionable whether ALARA is a particularly useful concept.

3.2 Inadequate long-term planning, climate change

While both the regulator and the licensees are clearly quite meticulous in considering the impact of the uranium mining and milling industry on workers and on present-day neighbours of the industrial sites, we are concerned that inadequate attention is paid to potential longer-term changes and impacts.

3.2.1 Precipitation:

In particular, the impact of climate change on decommissioned waste sites is of concern. The hardest thing for climate scientists to forecast is the nature, size, location and timing of huge precipitation events. That being said, recent history worldwide demonstrates an alarming trend towards an increasing level of unprecedented, spectacular flooding events. It is no longer adequate to rely on rainfall figures from the past 50 or 100 years to estimate future precipitation patterns. This creates a particular challenge in decision-making about the coverage of above-surface waste sites. Erosion of the cover of surface waste disposal sites is already observed in one or two locations (e.g. Agnew, Cluff Lake). It may be time to re-consider the depth and make-up of coverage required to better take into account potential future precipitation extremes.

3.2.2 Movement of contaminants:

Another long-term concern relates to the potential movement of buried contaminants as a result of natural causes many years after they have apparently remained stable and in place. There is an assumption that if monitoring figures over a period of several years indicate no movement or extremely slow movement of contaminants, then there will no unpleasant surprises in the distant future. However, because there is always the possibility of geological shifting, changing groundwater movement patterns, and changes in the solubility of chemical contaminants resulting from slow oxidation or reduction processes, we should not assume that contaminant movement trends experienced during the first decade or two following decommissioning will be followed indefinitely. This has implications for very long-term monitoring and maintenance requirements and costs.

3.2.3 Land Use changes:

At present most, if not all of the mine/mill sites are in sparsely populated regions of Canada. The intention is to remediate them to a condition suitable for traditional land use. This generally means no permanent residents, just temporary visits by a few people for hunting and gathering. If we take seriously the projections of climate change impacts on living conditions in many parts of the world, we should recognise the possibility that northern Saskatchewan may become something of a haven for people displaced from other places. It may be that simply erecting fences and writing regulations about not building on tailings sites or eating fish from impacted lakes will be insufficient to prevent future settlers from exposure to unacceptable risks.

3.3 Access to inspection reports, participation in inspections

The task of the regulator depends heavily on inspection. In carrying out and reporting on an inspection, the CNSC is representing the interests of the general public, ecosystems and future generations. We need to be assured that regulators (both federal and provincial) have the time, resources and mandate to search for and identify any problems. The public, as your clients, should be privy to how the inspector carries out his/her work and what he/she observes and reports to the Commission. While Appendix B lists the kind of issues that were reported on in each site inspection, it does not provide any insight into how the inspection was carried out or what were the specific findings. Basically we are suggesting that detailed inspection reports be publicly accessible and that concerned members of the public be allowed to accompany inspectors when they do their site visits. This would improve public confidence in the regulatory process.

3.4 Acceptable Level of Radon Gas

Two questions arise about the Report's graphs showing RnG in ambient air at several of the sites. Both questions relate to the acceptable level of RnG as indicated by the red line in graphs such as Fig. 3.4, which is set at 55 Bq/m3. This level corresponds to the addition of 30 Bq/m3 to the highest background level that has been measured anywhere in northern Saskatchewan. 30 Bq/m3 is associated with an exposure of 1 mSv/year.

a) There is obviously considerable variation in the background ambient air level of RnG in northern Saskatchewan. If the background at a given location is only around 7 Bq/m3 (as is obviously the case at most locations), adding one further mSv/yr of exposure would seem to justify a total Rn level of only 37 Bq/m3, not 55. It would be interesting to see a detailed survey of background levels across the region to see the pattern of variation. How common is the 25 Bq/m3? Does it vary with the weather? Because almost all of the total radon levels reported in the ROR from the various sites are below 10 Bq/m3, one might assume that 7 rather than 25 would be a more realistic figure to use as a standard background level for the region.

b) Public exposure to radiation is supposed to be limited to 1 mSv/yr above background. This presumably is intended to include the effect not only of RnG in the air, but also that of all other radiation sources in the local environment. If we allow the RnG to contribute up to 1 mSv/yr, this leaves no room for other radiation sources, e.g. solid radon progeny on the ground, uranium.

Radon gas levels in ambient air are elevated at some sites in the immediate vicinity of the mine and, as expected, are found to diminish to background levels as one moves away from the mine. It would

be interesting to see the size and shape of the "radon halo" surrounding such sites rather than just the level at a single downwind site.

It is recognised that substantially higher background radon gas levels are encountered in southern Saskatchewan. This is certainly a concern for southern residents, but it does not mean that northern levels are insignificant. We are glad that exposure of northern workers, residents and ecosystems to radon is being taken as seriously as it is.

3.5 Ammonia releases

There seems to be an on-going problem at several sites with ammonia releases. These events are apparently related to equipment failures. While the releases appear to cause very little harm, it is disturbing to see the rather frequent failure of relatively simple technology which could indicate inadequate attention to basic maintenance procedures.

3.6 Impact of ventilation on the outside environment

At several sites worker safety has been improved by improving workplace ventilation. This is, of course, very desirable. However, simply moving contaminants such as RnG from the workplace to the outside environment for dilution in the atmosphere is not the total solution. Once the radon is vented it is virtually impossible to know how far its progeny will be carried by the wind before descending to the earth in rain. Because of the relatively long (22.3 yrs) half-life of Pb210, radon progeny derived from Saskatchewan mines could be landing in Manitoba or Ontario. The fact that they are not found at the mine site boundary does not mean that they have disappeared. We have been told (although we do not have documentation) that because of prevailing west winds across Canada, background levels of radon generally become higher as one moves eastwards.

Is there any possibility of capturing radon before venting it? As a non-reactive noble gas, radon presents significant challenges. It is reported that the $[RnF]^+$ ion is believed to form by the following reaction:

$$Rn\ (g) + 2\ [O_2]^+[SbF_6]^-\ (s) \rightarrow [RnF]^+[Sb_2F_{11}]^-\ (s) + 2\ O_2\ (g)$$

For this reason, antimony fluoride together with chlorine trifluoride and $N_2F_2Sb_2F_{11}$ have been considered for radon gas removal in uranium mines due to the formation of radon–fluorine compounds. (*Holloway, J., Journal of Fluorine Chemistry 33.149; Keller, Wolf and Shani in Ullman's Encyclopedia of Industrial Chemistry*.) Has the possibility of using such technology at the ventilation release point been seriously pursued – or is it impractical?

3.7 Effluent toxicity

The standard tool used for evaluating aquatic toxicity is the trout acute lethality test. This has been used to demonstrate (justify?) the acceptability of toxin levels in effluent streams. To fail the test requires that the effluent is fatal to 50% of trout exposed to it for 96 hours. "A mine is considered compliant if, throughout the year, the effluent passes all trout acute lethality tests" (p. 33). It is encouraging to see that none of the uranium sites failed the test. However, we question the appropriateness of a standard that would allow exposure of aquatic organisms to a toxicity level that could kill almost half of them. We obviously recognise the difference between the toxicity levels in effluent at the point of release and the levels in diluted effluent in the receiving water body, and presumably few fish hang around the point of release for 96 hours (although perhaps they are attracted to this location by the local elevation of oxygen?). But are there sub-lethal impacts on

organisms that are in that locality for shorter periods of time? What about the impact on non-commercial organisms?

3.8 Participation in EQC

The Northern Saskatchewan Environmental Quality Committee provides a good opportunity for representatives of communities directly affected by the uranium industry to periodically tour the sites and to bring concerns to the attention of the licensees and the regulators. It should be fairly easy to slightly expand the committee to include one or two representatives of organisations such as SES that have a consistent and committed interest in the environmental quality of the mine/mill sites. An opportunity to periodically tour the sites with the EQC group and to listen to, and participate in, discussions with the community representatives, would enable us to better focus our on-going work that is aimed at minimizing the negative impacts of the industry on Saskatchewan's ecosystems and people.

3.9 Financial Guarantees

The Nuclear Safety and Control Act (NSCA) stipulates that every licence application must include a description of a proposed financial guarantee. This means that licensees of all nuclear facilities, including those for uranium mines and mills, must provide a guarantee that sufficient financial resources are available to fund all approved decommissioning activities should the licensee not be available to fulfill its obligations. These include:

- any post-decommissioning monitoring or institutional control measures that may be required;
- subsequent long-term management or disposal of all wastes.

If a licensee is not available to fulfill its obligations for decommissioning, the CNSC must be assured that it can access adequate funding measures upon demand. These measures may involve several types of financial guarantees, including cash, letters of credit, surety bonds, insurance and legally binding commitments from either the provincial or federal government.

The ROR lists financial guarantees for some of the sites, but not for those that are described as "responsibility of a provincial or federal government". We note that Gunnar is a site described as the Responsibility of Provincial Government, and that the costs of remediation so far, that were originally agreed to be shared equally by the federal and provincial governments, have so far hugely exceeded the budgeted amount almost 9-fold. This leads to a lack of confidence that adequate funds will actually be available if a site is abandoned without full decommissioning. Do you have figures for the amounts set aside by governments in restricted funds for decommissioning and remediation of such sites (as distinct from monitoring and maintenance of decommissioned sites that have been turned over to a province)?

3.10 Future liability for transferred sites

Some decommissioned sites have already been turned over to provincial government responsibility. In Saskatchewan such sites have become the responsibility of the province's Institutional Control Program (ICP). There are two Funds into which a site owner makes a payment at the time of the site's entry into the ICP. The 2016/2017 ICP Annual Report notes that payment into the Monitoring and Maintenance Fund is intended to be "an amount representing the present value of the future costs associated with the monitoring and maintenance of the site". At the end of 2017 this Fund's accumulated surplus was $148,166. The other fund, the Unforeseen Events Fund, held $29,036. Interest

is paid from the government's General Revenue Fund, currently at 0.54%. This is supposed to be adequate to cover monitoring, maintenance and unforeseen events in perpetuity for the several Beaverlodge sites already in the program. Noting that we have been told that a 1-day visit for a small crew without heavy equipment from Saskatoon to a northern mine site currently costs in the neighborhood of $10,000, we would ask the CNSC's opinion on these fund figures and what assumptions the Commission makes about future liability and discount rates when sites are transferred to provincial control.

We would also ask for a statement of what kind of responsibility the CNSC still has for a site that has been transferred to provincial control.

4. Site-specific comments

4.1 Cigar Lake

We note (p. 39) that Cigar Lake is carrying forward a cumulative production shortfall of 12.7 million Kg of uranium, which can be re-couped in future years. So one wonders what is the purpose of defining authorized annual production? Is this a restriction for market control purposes? Or is a limit required for safe operation? What would be the impact of significantly exceeding the limit some years if the company chose to re-coup past shortfalls?

In fig 3.3, p. 41, it appears that figures in the bar graph for 2013 and 2014 total emissions have been reversed. The quoted numbers show a decrease in total emissions from 2013 to 2014, while the bar graph shows an increase. The quoted numbers show an increase (rather than a decrease as shown in the bar graph) from 2014 to 2015. What accounts for this increase? The relatively high 2013 figure for RnP while there is apparently no detectable RnG is interesting. Is this the result of ventilation improvements while progeny remaining from previous years remains in the worksite? For RnP levels, after the significant drop from 2013 to 2014, there is no consistent change in subsequent years. Is this expected to change in future years?

It is noted (p.42)that 2017 arsenic levels in receiving water and sediment had increased and exceeded predictions in the EA, and that measures are under way to reduce future releases. It would be interesting to know in what chemical form the As is present, both in the water column and in the sediment, given the difference in toxicity among arsenic in different valences. Information on the stability of these compounds under changing conditions of oxidation, pH and microbial activity would be useful if we want to review the cumulative impact of As already released to receiving water bodies.

As mentioned above, there is obviously considerable variation in the background level of RnG in northern Saskatchewan. Fig 3.4 shows a level of RnG that corresponds to "an exposure of 1 mSv/yr above background". It appears that in deriving this figure, the assumption has been made that background is 25 Bq/m3, the highest detected anywhere in northern Saskatchewan. This then seems to allow for the measured Rn level (including 30 Bq/m3 of excess over background) to go up to 55 Bq/m3. However, if the background at a given location was actually only around 7 Bq/m3, adding a further mSv/yr of exposure would seem to justify a total Rn level of only 37 Bq/m3. If this were the case, the observed level reported in 2014 came fairly close to the allowed limit. It would be interesting to see how much variation among test sites was observed (we are provided here only with averages). As the reported levels for years following 2014 are all around 7 Bq/m3, it appears that the actual background level at the mine site is quite low, so perhaps the red line in figure 3.4 indicating

the level corresponding to an increased exposure over background of 1 mSv/yr should be lowered accordingly.

On p. 47 we read that Cigar Lake received a Fully Satisfactory rating for Conventional Health and Safety in 2013, but not in subsequent years. What changed?

4.2 McArthur River site

It is noted that 6 non-compliances at the McArthur River site were reported in 2017 (including in radiation protection). These were responded to positively by the licensee, only when brought to its attention by the regulator. This demonstrates the important role played by the CNSC, but also illustrates the fact that, like all of us, the industry itself is fallible and will always require independent and effective compliance enforcement.

The numbers in Fig. 4.2 (p. 52) show that RnP peaked in 2015 although RnG levels were stable over the previous 3 years and increased in 2016. The timing of the relationship between RnG and RnP levels is confusing – presumably dominated by the relatively long half-life of Pb210. Why did progeny levels fall in 2016 while gas levels rose?

The description of the effluent flow illustrated in fig 4.4 (p.54) is confusing. Originally the flow was released into the fen bordering Boomerang Lake. The map seems to indicate that it now flows through the north-east end of Boomerang Lake and back up towards the new sampling point 2.3.1. But the new Read Conveyance Channel runs eastward to a point apparently well north of the new sampling point. Does the treated effluent now run eastward though the Read Channel and then south along Read Creek into Boomerang Lake? If so, what is the benefit of this change? Please clarify.

The same question arises about fig 4.6 (p. 56) as was discussed above with respect to Fig 3.4 and Cigar Lake. The red line indicating the acceptable level of radon concentration in ambient air appears to be too high if the background level is actually only round 6 Bq/m3 rather than 25.

McArthur River is one of the sites that suffers from unplanned ammonia releases, which, although apparently of small environmental impact, may indicate a lack of attention to routine inspection and maintenance by the licensee.

The report notes that terrestrial monitoring includes triennial measurement of metals and radionuclides in soil and blueberry samples. We question whether this is a sufficient frequency of measurement and would ask for an explanation of the decision to sample only every third year. We also note that the next lichen sampling was scheduled to take place this year, and we suggest that the species of lichen collected should be defined.

4.3 Rabbit Lake

The Rabbit Lake site currently sits in a strange state of suspended animation without a decision having been made to permanently close and decommission the operation. This situation will presumably now also be the case at the Key Lake and McArthur mines. It requires a different approach from those sites that are either decommissioned or in the process of remediation.

We note the improvements in worker exposure levels resulting from the cessation of production activity. Last year we commented on the fact that the RadonG collective exposure had tripled in 2016 compared to 2015. This year the figure is dramatically lowered. It would be interesting to know how much of this reduction is due to there being fewer workers on site and how much is attributed to better control of radon. Effective radiation dose contributions to NEWS at Rabbit Lake were dominated by RnP (74%). This compares to 33% at McClean Lake, an interesting difference. Why would this happen?

We wonder what would be the expected ratio between RnG and RnP levels in a worksite. From ICRP International Conference on Occupational Radiation Protection, Dec.2014: *Current and Forthcoming ICRP Recommendations on Radon Exposures* we learn that "F is a measure of the dis-equilibrium between radon gas concentrations and its progeny concentrations, and that for F=0.3 (typical for a ventilated site), if Rn222 level is 1.0 Bq/m3, we would expect 0.6 Bq/m3 of Po218, 0.3 of Pb214, and 0.2 of Bi214". In practice we seem to often see a different picture. Comments?

As in the previous report, we note that uranium levels in Rabbit Lake effluent are still notably higher than at other sites.

In our comments on last year's ROR we commented that "Despite the plant being placed into care and maintenance mode in April 2016, the Rn gas collective exposure level appears to have nearly tripled in 2016 compared to 2015." We requested an explanation for this.

CNSC seems to be satisfied (p.63) with Rabbit Lake's target for U concentration in treated effluent released to the environment of 0.1 mg/L. It has been reported to us that this effluent stream has been responsible for the elimination of the fingernail clam at this site. Can you confirm this? It is interesting that the reported level of U in Rabbit Lake treated effluent is much higher than that at other operations.

4.4 Key Lake site

Although RnG levels in ambient air are well below allowable limits, it is noted that they have increased each year since 2015 (Fig. 6.4). At the same time, worker exposure to RnP has decreased (Fig 6.3). To what extent are these trends connected?

Fig 6.5 shows that ambient SO2 levels downwind remained disappointingly high in 2013, 2014 and 2015 following construction of the new acid plant in 2012. The dramatic drop in 2016 and 2017 is attributed to a decline in acid production. Is this decline likely to be a permanent situation, or should we expect SO2 levels to once again reach the provincial standard of 20 µg/m3 when production levels increase?

Lichen monitoring shows elevated concentrations of some metals and radionuclides at one exposure station compared to previous years (p.85). We hope to learn the cause of this, and, as at other sites, we would like to see what species of lichen is being collected. Is it always the same species?

The concern we have raised previously about the Deilman Pit remains. This relates to the decision to allow the tailings level in the Deilman Pit to be raised to a level where tailings would come in contact with the sandstone upper layer of the pit, thus increasing the likelihood of contaminants leaching into the surrounding area. We still feel that this concern has not been adequately addressed.

4.5 McClean Lake site

As we recently commented on this site in our 2017 licence renewal submission, we refer you to that submission for issues we raised at that time.

4.6 Beaverlodge sites

It is reported that there has been no significant change since the 2016 ROR. This is discouraging, given the concerns we raised in reviewing that document a year ago. We noted then that the site is far too contaminated to meet Saskatchewan guidelines for Northern Mine Decommissioning and Reclamation and that it continues to be a source of contamination to downstream water bodies. We note that radium levels are still a concern in some areas of the site, there are still elevated selenium levels and fishing restrictions at some water bodies, and very high radon levels, over 300 Bq/m3 at Ace Creek. We still hold that a regional remediation plan should be a prerequisite for any move to transfer more of the Beaverlodge properties to Saskatchewan's ICP.

Last year we raised a question about the relative merits of stainless steel and concrete covers for closure of mine openings. Orano staff have told us that concrete has been shown to be superior. Cameco still seems to favour steel as recommended by Ontario, and is installing steel covers over previously remediated openings. Is there a significant difference? One might assume that concrete has a limited lifetime. Please comment on the pros and cons of these options.

In (Table F-2) on p. 175 the financial guarantee for Beaverlodge is described as the responsibility of the Canadian government, with no figure provided. Presumably this refers only to those Beaverlodge sites that have not been transferred to the provincial ICP? As mentioned earlier, it appears that Saskatchewan has a total of only $177,200 assigned for future monitoring, maintenance, and unforeseen events care of the sites for which it is responsible.

4.7 Cluff Lake

The four pages devoted to Cluff Lake suggest that decommissioning is virtually complete. It is reported that no significant changes have taken place since the 2016 ROR. We note, however, that:

4.7.1 Completeness of decommissioning:

There is now uncontrolled access to the site, although as of September 2017 (and presumably still), there is a fenced area containing somewhat radioactive ore cores and plastic tubs of other wastes, bearing radiation hazard warnings. Apparently local kids are known to break open the gate or climb over the fence and explore the area. Someone has stolen plywood sheets used to protect core piles from the weather. Does CNSC regard this as a satisfactory condition in which to permanently leave the site? Are there liability issues in the event of a child being injured? Is a warning sign adequate? (This question is a small example of an issue that will presumably turn up at several other decommissioned industrial sites that may plan to rely on signage to prevent future human exposure to contaminants.)

4.7.2 Coverage of tailings:

There are also some on-going concerns about the adequacy of the coverage of the tailings site, where persistently wet areas produce lush growth that attracts moose. While Orano staff have patiently tried to convince everyone of the adequacy of the

1 metre cover, concerns remain about future erosion and potential uprising of contaminants through the cover material. We would like to see an independent review of options for improving confidence in the reliability of tailings confinement at this site. We look forward to seeing new risk assessment figures promised for this fall.

4.7.3 Cover material for mine openings:
As noted in the Beaverlodge comments above, we would like to see an analysis of the relative merits of concrete and steel covers for mine openings.

4.7.4 IEMP monitoring: A couple of points arise about the IEMP monitoring. The ROR states on p.135 that "IEMP results indicate that all persons and the environment in the vicinity of the Cluff Lake site are protected". However we note that the IEMP website comments that "radon in ambient air results are not yet available". So perhaps the ROR's statement is premature. We also question why no IEMP monitoring takes place at Island Lake. Is it fair to conclude that all residents and the environment are protected without including data from this site?

4.8 Gunnar

We have closely followed the Gunnar remediation process over the years and have commented on each phase of the licensing. We are pleased to see progress there, although concerns persist about the on-going funding of the project. Table F-2 (p. 175) shows the financial guarantee to be the responsibility of the provincial government despite the fact that the original agreement called for an equal sharing of costs between the federal and Saskatchewan governments.

4.9 Rayrock site

We were surprised to see that for 2017 the SCA for radiation protection was rated Satisfactory despite the finding that "elements of the radiation protection program were not consistently followed nor formally documented". It is also surprising to see that Rayrock is subject to a minimum of only one compliance inspection every three years. Radon and gamma monitoring is carried out every five years, and surface water quality monitoring every three years. This seems inadequate given that remediation is still far from completion.

4.10 Port Radium site

Remediation of the site was completed in 2007 (p.139) and it is now apparently at the stage of post-remediation monitoring and maintenance. However, elevated concentrations of several contaminants are still found in onsite waterbodies (p.141). Does this mean that such concentrations are acceptable and that further remediation is not required? This is one of the sites for which the financial guarantee is simply described as "Responsibility of Canadian government". Do we know how much the Canadian government has designated for future costs of monitoring, maintenance and any future remediation at Port Radium?

4.11 Elliott Lake

How does it happen that Rio Algam's waste facility operating licence (also that of the Denison and Stanrock property) is for an indefinite term when other licences are issued for a limited time period? We note that there are on-going problems with Ra levels in effluent from the Stanleigh treatment

plant although decommissioning is said to be completed (p.149). It is hard to understand why a site can be described as decommissioned when it still requires water treatment and a new corrective action plan is needed.

4.12 Agnew Lake

It was interesting to learn that 25 years after this site was turned over to Ontario's care, the tailings cover had degraded to the point where tailings were exposed and high gamma emissions were detected. What had happened to the monitoring and maintenance program during that 25 year period to allow this situation to develop? What kind of inspection and monitoring program does Ontario use? What is its funding base?

It is discouraging, but not surprising, to learn that radiation warning signs on the Agnew Lake TMA were ignored. Hazard signage does not appear to be a particularly effective way of preventing people from entering contaminated areas

5. Summary of topics of comments, suggestions and questions to which we would like a response

Paragraph numbers in brackets following each item indicate where to find the (underlined) comment, suggestion or question in this document.

a) Judgement about achievement of ALARA (see 3.1)
b) Long-term impacts of climate change, heavy precipitation on tailings cover (see 3.2.1)
c) Potential long-term changes in tailings stability (see 3.2.2)
d) Potential changes in future land use and occupancy (see 3.2.3)
e) Transparency re inspections (see 3.3)
f) Implications of assumptions about background level of RnG (see 3.4)
g) Size and shape of radon halo (see 3.4)
h) Possibility of capturing radon before ventilation? (see 3.6F)
i) Persistent problems with ammonia equipment (see 3.5)
j) Effluent toxicity sub-lethal impacts? (see 3.7)
k) Participation in EQC (see 3.8)
l) Funding provision for remediating sites that are government responsibility? (see 3.9)
m) Adequacy of ICP funds for decommissioned sites (see 3.10)
n) On-going CNSC responsibility for transferred sites (see 3.10)
o) Any impact of exceeding authorized annual production limit some years? (see 4.1)
p) Fig. 3.3 error? (see 4.1)
q) Chemical form of arsenic in water and sediment? (see 4.1)
r) Change in Cigar Lake Health and Safety rating (see 4.1)
s) McArthur RnG and RnP levels (see 4.2)
t) McArthur effluent path (see 4.2)
u) McArthur terrestrial sampling frequency (see 4.2)
v) Difference in RnP contribution to worker dose between Rabbit L and McClean (see 4.3)
w) RnG/RnP ratio (see 4.3)
x) Rabbit L. tripling of RnG from 2015 to 2016 (see 4.3)
y) Impact of effluent toxicity at Rabbit L. (see 4.3)
z) Key L. RnG in ambient air increase/RnG worker exposure decrease (see 4.4)
aa) Key L. SO2 level changes (see 4.4)

bb) Tailings level in Deilman pit (see 4.4)
cc) Beaverlodge regional remediation (see 4.6)
dd) Stainless steel vs concrete covers for mine openings (see4.6)
ee) Cluff L. remaining surface hazards (see 4.7.1)
ff) Cluff L. tailings cover adequacy (see 4.7.2)
gg) Cluff L. IEMP data (see 4.7.4)
hh) Frequency of monitoring at Rayrock (see 4.9)
ii) Indefinite term of Elliott L. licences (see 4.11)
jj) Gunnar remediation funding (see 4.8)
kk) Ontario's monitoring and maintenance at Agnew L. (see 4.12)
ll) Ineffectiveness of hazard signage (see 4.12)

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