



Saskatchewan
Environmental
Society

Submission to the Canadian Nuclear Safety Commission on the Gunnar Tailings Reclamation Plan

Prepared by the Saskatchewan Environmental Society

August 14, 2015



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Background on the Authors

This submission was prepared by Ann Coxworth and Peter Prebble on behalf of the Saskatchewan Environmental Society. The Society is a non-profit organization with a long history of involvement in the uranium mining issue in the province of Saskatchewan, and has formally intervened in numerous public hearings on proposed uranium mine developments dating as far back as 1977.

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1. Introduction

The Saskatchewan Environmental Society (SES) is pleased to submit comments to the Canadian Nuclear Safety Commission on the proposed reclamation plan for the radioactive tailings at the abandoned Gunnar uranium mine and mill site. We are grateful to CNSC for building into the Gunnar decision making process an opportunity for public review of this plan.

Our comments are written following the CNSC July 28th 2015 workshop but before responses to some of the questions raised at that workshop had been provided. In particular, we await O'Kane's description of strategies to prevent or respond to the 21 potential failure modes identified in their report. Depending on the nature of those responses, we may need to submit supplementary comments after the August 19th deadline.

Over the past year, the Saskatchewan Research Council (SRC) and O'Kane Consulting Inc. have done good work in delineating the extent of the tailings problem at the Gunnar site and developing a detailed plan for tailings reclamation. In general we found the O'Kane report well written and accessible, which was much appreciated. Our organization supports most elements of the proposed plan, but with some important modifications and additions.

The site presents a major challenge, with radioactive tailings now spread over an area of approximately 70 hectares, including in Langley Bay of Lake Athabasca. We have no argument with the basic concept of covering the exposed tailings and changing the landforms and creating channels to minimize contact between meteoric water and contaminants. We recognize that a "complete clean-up" of the site is not feasible and that the objective has to be one of improvement rather than perfection.

We will focus our presentation on both the merits of the reclamation plan and on areas where we think further improvement is needed.

2. Our Response to SRC's Overall Approach to Tailings Reclamation and to SRC's Proposed Design Criteria for the Tailings Cover

a) The Saskatchewan Environmental Society supports the basic approach the Saskatchewan Research Council wants to take to Gunnar tailings reclamation, namely to create a landform over the Gunnar Main, Gunnar Central, and Langley Bay tailings that significantly reduces gamma radiation, is water-shedding and is suitable for revegetation by native plant species.

b) As CNSC recognizes, the design criteria for the tailings cover are extremely important, and will be one key element in determining the final performance of the cover.

The Saskatchewan Environmental Society is, in general, supportive of the Gunnar Tailings Remediation Design Criteria outlined in Table 2.2 of the O'Kane Consulting / SRC July 7, 2015 report entitled *Gunnar Site Remediation Project – Tailings Remediation*. However, SES recommends that CNSC ask that one additional design criterion be added. What is missing from the current set of design criteria is a formal recognition that the tailings on the Gunnar site pose a radioactive and toxic hazard that extends many thousands of years into the future. Thus, it is important that when the tailings cover design is being finalized, there be confidence that the new cover will hold up for several thousand years. An additional tailings cover design criterion should therefore be: "Long term stability of the tailings covers on the Gunnar site for well in excess of one thousand years." Adopting this addition to the list of criteria will mean further improvements are needed in the cover design.

c) With our concerns about long term stability of the tailings cover in mind, we recommend that CNSC ask SRC to re-evaluate the thickness of the proposed till cover on the tailings, with the view to increasing the thickness. The July 7, 2015 *Gunnar Site Remediation Project – Tailings Remediation* report proposed that the till cover in general be 0.5 metres. O'Kane Consultants staff participating in a CNSC workshop on Gunnar Remediation Design held on July 28, 2015 in Saskatoon indicated that till cover thickness would be increased to 0.6 metres.

The Saskatchewan Environmental Society is of the view that this thickness of till cover may well fail to hold up over the centuries. It will tend to wear down in the face of significant wind and water erosion events, and other impacts such as burrowing animals. A till cover of 0.9 metres to 1 metre in thickness is, in our judgment, the minimum that should be applied. We recognize that this will have implications with respect to the amount of borrow material required. The sources of additional till for cover material, and the ecological impacts of its excavation will need further study.

d) We are pleased to see that SRC gave consideration to the future impacts of climate change in sizing planned drainage channels, but are concerned that even planning for a 1 in 200 year rainfall event may be insufficient to manage future intensive rainfall events the site is likely to experience over the centuries.

e) The Saskatchewan Environmental Society would like to see a more ambitious SRC tailings remediation design criterion set for 'Surface Water Quality'. The proposed criterion is currently focused on meeting "site-specific objectives for water quality in

St. Mary's Channel, Zeemel Bay and Langley Bay". In general, the site specific remedial objectives for 'constituents of potential concern' (COPC) that are being proposed are being set at concentrations much higher than the current levels of pollution. In that context, the proposed site specific remedial objectives for surface water quality do not serve a useful purpose for this remediation project.

We recommend that CNSC ask SRC to set more ambitious and more relevant objectives for surface water quality that reflect the anticipated improvement in water quality that can actually be achieved. For instance, for all constituents of concern, using Saskatchewan Surface Water Quality Objectives would be appropriate and achievable in Langley Bay.

f) At the July 28, 2015 CNSC workshop in Saskatoon on Gunnar site remediation, in response to a question asked by the Saskatchewan Environmental Society regarding the potential use of permeable reactive barrier (PRB) technology on the Gunnar site, SRC expressed interest in the idea of trying PRB technology as a supplement to its remediation plan. SRC viewed PRB technology as potentially offering "added value", although SRC did not see it as part of the approved reclamation plan.

We commend the Saskatchewan Research Council for its openness to experimenting with the use of PRB technology at the Gunnar site, and recommend that CNSC ask for a report from SRC on such experimentation and how it might be applied to other uranium mine remediation efforts in the future.

g) The Saskatchewan Environmental Society has identified a number of locations on the Gunnar site where application of permeable reactive barriers should be considered. These include: (i) groundwater pathways that carry radionuclides from the tailings into Lake Athabasca; (ii) surface water pathways that move through the waste rock piles carrying radionuclides into Zeemel Bay; and (iii) the potential application of PRB technology as part of the cover system for the tailings piles and waste rock piles.

In the case of groundwater, a PRB could be used as a wall to intercept a groundwater plume for treatment.

In the case of surface water pathways, PRB technology could be used as a vertical barrier, intercepting horizontal flows and adsorbing the contaminants during the flow. One option to achieve this would involve using a 'funnel and gate operation' where the flow is directed by an impermeable wall toward the reactive barrier. The



permeability of the reactive material will need to be compatible with anticipated flow regimes.

Experimenting with both peat and zero valent iron as reactive materials would be useful. Other reactive materials that have been used elsewhere with some success for removal of uranium, and that should be readily available on the Gunnar site include: pine bark, pine mulch and composted leaf mulch.

One of the advantages of PRB technology is that there is a high degree of flexibility in how it can be used to address treatment requirements. As implied above, PRBs can be used to treat groundwater flows, to treat surface flows in lakes and rivers, to intercept leachate from waste rock piles, to cover tailings, and to cap sediments in lakes. A second advantage of PRB technology is the relatively low cost of its application. Both operational and maintenance costs are reasonable. A third advantage is the demonstrated record of high radionuclide removal. Experience in the United States suggests over 90% of uranium in contaminated water can be captured, and that some barriers have performance lives lasting decades.

We recommend that PRB technology be used extensively at the Gunnar site throughout the remediation and post-remediation monitoring period.

3. Financial Resources for Reclamation Work and Monitoring

The Saskatchewan Environmental Society is pleased that the Government of Saskatchewan has made a serious financial commitment to proper reclamation of the Gunnar site – with a plan to spend up to \$208.5 million in order to finance the necessary work. Fortunately, this will allow important work on remediation to proceed.

The lack of a serious federal government funding commitment to Gunnar site rehabilitation, beyond the \$12.3 million originally promised in 2006, continues to be of concern to our organization. Given the Government of Canada's major role in encouraging the extraction of uranium ore at the Gunnar site during the 1950's and 1960's, the time is now overdue for the federal government to accept its responsibilities and properly cost share remediation of the Gunnar property.

Adequate federal funds will not only be needed in order to implement a comprehensive reclamation plan, but will also be needed to ensure sufficient resources are available for ongoing site monitoring and maintenance.



4. Site Monitoring and Maintenance

The Saskatchewan Research Council and O'Kane Consulting Inc. are to be congratulated for their effort to identify potential failure modes for their recommended remediation design (refer to section 5.8 of their July 7, 2015 report). The fact that the proponent is compiling such a list and is thinking about how these potential failure modes can be addressed increases the confidence the Saskatchewan Environmental Society has in SRC and O'Kane Consulting successfully carrying out the remediation work.

Nevertheless, the list of potential failure modes underlines the challenge of achieving long term success with the remediation effort. In the real world, we believe a number of the potential failure modes identified are likely to occur and to interact with one another, so that their combined effect becomes significant.

Examples of potential failures we think are most likely to occur over time include:

- Beavers build dams in the drainage channels;
- Storm events occur that are greater than what the tailings cover and drainage channels are designed for;
- Brush / forest fire leads to at least a partial loss of vegetation cover;
- Disruption of the cover system due to tree blow-down;
- Freeze /thaw cycling of the cover system; and
- Climate change leading to both wetter and drier conditions than have been addressed during the EIS stage.

Given the likelihood of some potential failure modes becoming reality, and given the potential for these failures to have interactive effects, we think a much longer post – remediation monitoring period is needed at the Gunnar site than SRC currently proposes.

In the July 28, 2015 Gunnar Remediation Design Workshop sponsored by CNSC, the Saskatchewan Research Council presented a remediation timeline that envisaged post remediation monitoring running to 2026, at which time it is expected the Gunnar site would enter into the Saskatchewan Institutional Control Program (ICP). Once the site gains entry to ICP, monitoring is expected to be much more infrequent (approximately every 5 years) and the Saskatchewan Ministry of Environment has indicated it does not expect maintenance to be required.

We think this timeline is unrealistic and underestimates the ongoing need for annual maintenance at the Gunnar site. As pointed out by an SRC spokesperson, *any* kind of cover system requires maintenance over time. The whole issue of on-going care and



maintenance under the ICP is a big one and is of major concern to northern residents. We suggest that the CNSC's responsibility should not end after only a few years of post-project monitoring, but that the Commission's oversight should continue for several decades.

A more realistic planned period for twice-yearly monitoring and maintenance would be 50 years. SES thinks it will take that long before regulators really have a sense of how well the Gunnar site will hold up to potential failures, and how frequently monitoring and maintenance will be needed over the long term.

Our recommendation has significant budgetary implications and is another reason that we ask CNSC to encourage a long term cost-sharing commitment by the Government of Canada to site remediation, maintenance and monitoring. If additional federal funding – beyond the \$12.3 million already committed – is not secured, then we suggest that at least \$15 million of the \$208.5 million the Province of Saskatchewan has designated for site remediation be set aside as an investment specifically for ongoing monitoring and maintenance for this site under the ICP.

Our concerns also mean that careful thought must be given to who will be responsible for regular monitoring and maintenance of the Gunnar site over the next 50 years.

Finally, we would like to emphasize that even when the Gunnar site is turned over to Institutional Control, it is unrealistic to think that maintenance will be an extremely low cost item, as Saskatchewan's Ministry of Environment appears to envisage. The reality is that any tailings cover system, even if performing well, will need regular maintenance over time.

5. Recommended Details on Gunnar Site Remediation, Regulatory Measures, and Ongoing Monitoring and Maintenance

The foregoing sections have focused on the big picture questions we hope CNSC and SRC will grapple with. In this section, we offer suggestions on the finer details of the regulatory process and of the proposed SRC approach to site remediation. We hope these suggestions are useful to CNSC and to the ongoing discussions between CNSC and SRC.

a) There is significant radioactive debris in the Gunnar waste rock piles, plus pockets of higher radionuclide content in the waste rock. As SRC and the companies it contracts with make use of waste rock on site to help build and recontour the landform over the tailings, it will be important for SRC to ensure that those who carry out this work are



properly scanning the radioactive and toxicity content of the waste rock. We hope that CNSC will make clear an expectation that waste rock with higher levels of radioactivity or other hazardous contaminants should not be used to build the landforms over tailings piles.

b) We note the absence of SSROs for Radium226, and the apparent lack of information about its impact on small aquatic biota. There does not appear to be a Saskatchewan Surface Water Quality Guideline for this radionuclide, however the EPA drinking water standard is 5pCi/l, or 0.185 Bq/l. We note that Back Bay's level is 0.75 Bq/l., while some parts of Catchment 3 record 14 Bq/l. We would like to see a more thorough analysis of the ecological impact of the Radium 226 contamination throughout the site, as well as an appropriate remediation objective for each area.

c) Tailings in Catchment 3 pose a significant challenge for site remediation, particularly given problems with accessibility. The current plan appears to be to leave most of the spilled tailings in Catchment 3 undisturbed. We advise that more attention needs to be given to how radionuclide concentrations in this area can be reduced, particularly given the evidence that some contaminants are being carried by water well beyond Catchment 3 itself. Of special concern are the high levels of radium in some parts of Catchment 3. The Saskatchewan Environmental Society recommends that serious consideration be given to the planting of macrophytes in Catchment 3 to help remove uranium and radium from the muskeg. For instance, cattails and reeds could play an important role in helping sequester radionuclides through bio-accumulation. These aquatic plants offer the additional advantage of being robust and having the capacity to tolerate a wide range of temperature, pH and salinity.

d) The Saskatchewan Environmental Society suggests that applied research be conducted at the Gunnar site into the use of the alga Chara (stonewort) to aid in remediation efforts. In water bodies such as Back Bay and Zeemel Creek, one option would be to use stonewort to convert dissolved uranium into a mineralized form which sinks into the sediment. Such an approach would remove pollutants from surface waters, and at the same time help minimize concerns about the potential for wildlife to feed on contaminated algae.

e) During the period when regular monitoring and maintenance is being done on the Gunnar site, phyto-remediation is also an option worth considering in Langley Bay. Once again, the potential use of stonewort merits consideration.

f) The Saskatchewan Environmental Society was pleased to see the willingness of SRC and O'Kane Consulting Inc. to consult with local elders regarding the choice of vegetative cover on the re-contoured tailings landforms, and hopes the involvement of

elders in this process will be recorded, and will help shape the approach used at other uranium mine sites in Saskatchewan. We await further reports from SRC and O'Kane on the availability of appropriate seed supplies to meet the re-vegetation requirements, not only for the tailings covers but also for the remediated borrow sites.

6. Conclusion

The Saskatchewan Environmental Society supports the Saskatchewan Research Council receiving approval to proceed with its tailings reclamation plan, with the provision that the key additions discussed above become part of the remediation plan. The most important additions include:

- Taking additional measures to ensure long term site stability, including increasing the thickness of the till cover over the three main tailings areas.
- Formally adding the use of permeable reactive barriers and phyto-remediation to the Gunnar site remediation plan.
- Ensuring a much longer period of post-remediation monitoring and maintenance than is currently planned for.