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To: Canadian Nuclear Safety Commission

The attached compiled document comprises the comments from Saskatchewan Environmental Society on the proposed re-licensing of Cameco's Key Lake, Rabbit Lake, McArthur River operations.

The compilation consists of four sub-documents. Three of these deal with each site individually. The fourth is intended to be read as an addendum to each of the other three.

The authors, Ann Coxworth and Peter Prebble look forward to presenting their comments at the Commission's public hearings in early October.

Yours truly,

A handwritten signature in blue ink that reads 'Allyson Brady'.

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Prepared for submission to the Canadian Nuclear Safety Commission

by Ann Coxworth and Peter Prebble
of the Saskatchewan Environmental Society

COMMENTS FROM THE SASKATCHEWAN ENVIRONMENTAL SOCIETY ON CAMECO'S RE-LICENSING PROPOSAL FOR KEY LAKE

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Caution to reviewers

The following comments represent the Saskatchewan Environmental Society's views only with respect to the local environmental impacts of re-licensing the Key Lake operation. However, SES's serious concerns about Cameco's marketing policies and the destination of uranium mined and processed in Canada prevent us from supporting re-licensing of the operation. Readers are referred to the attached document: "Recommended New CNSC Conditions On Canadian Sales Of Uranium", which should be read in conjunction with the following, for an explanation of this position.

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1. PUTTING THE PRESENT REVIEW PROCESS IN CONTEXT

The Key Lake operation is facing expiration of its current operating licence in October 2013 and is seeking a 10-year renewal of this licence. At the same time, Key Lake is planning significant changes and expansions during the coming 10-year period, changes that have triggered the requirement for an Environmental Assessment. Guidelines for an EIS have been published but an EIS has not yet been produced.

We are thus in a situation in which the CNSC is being asked to promptly approve a licence for an operation that is planning a major expansion during the licence period, for which a required environmental impact assessment has not been produced, let alone approved. The theory seems to be that a licence will be granted on the false assumption that no expansion is planned. Then, if the environmental assessment is completed and approved, the licence will be amended to accommodate the expansion plans.

This is an unsatisfactory and unnecessarily confusing situation. It is clear that in applying now for a ten-year licence, Cameco has no intention of actually operating for the next 10 years in accordance with that licence's requirements. SES recommends that, in order to allow Key Lake to continue operation at the current level during the period of completion of the EA process, an interim two-year licence be approved at this time. If and when the EA is satisfactorily completed, a new licence application incorporating the requested expansion plans should be submitted to the CNSC.

Because there is currently no indication of whether public hearings with opportunities for intervenor participation will be provided for either the provincial environmental assessment process or the licence amendment process that would follow, we take the liberty of herewith identifying some major issues to which the expansion plans will give rise, in addition to discussing concerns with the current operations.

2. THE ROLE OF REGULATORY BODIES, TRANSPARENCY AND MANAGEMENT

The uranium industry in Canada generally operates in remote, isolated locations with security restrictions that limit public access to mine and mill sites. The industry has gained the social acceptability that it has on the basis of a belief that it is extremely well regulated and that its environmental management is above reproach. We see some indications that this belief may not always be well-founded, and that a greater degree of transparency would be justified. In order to create greater public confidence in their work, we ask the CNSC to assure themselves of the following with respect to the current Key Lake operation:

- a) That environmental management at the site is independent of the general mine management in terms of reporting to corporate office and to regulators. This is necessary so that environmental concerns that may impact productivity or the financial bottom line are not buried or disregarded.
- b) That regulators make unscheduled inspections of the site and carry out independent sampling and monitoring.
- c) That workers are encouraged to report environmental problems that they encounter, and to go directly to the regulators if they are unsatisfied with the company's response. It should be clear that whistle-blower protection is in place and that workers may not be punished for pursuing regulatory action.
- d) That all unplanned environmental incidents (e.g. temporary flushes of contaminant in water releases, transfer of contaminants on tires) are reported to CNSC, along with details of follow-up analysis and action.
- e) That all plant operators are fully trained and qualified for their responsibilities.
- f) That the Environmental Quality Committee be expanded to include several members with sufficient scientific background to play a responsible role in monitoring and challenging environmental performance.

3. AREAS OF CONCERN

a) General approach to decommissioning

The Key Lake Preliminary Decommissioning Plan (Cameco 2012) recognizes that "The industrial activity which has occurred at Key Lake over the life of the operation cannot be completely obscured or eliminated." This cannot be denied. "However," states the Plan, "it is the objective to decommission and reclaim the Key Lake site to an ecological condition that is as similar to the surrounding environment as is reasonably achievable." One may ask how "reasonably achievable" is to be defined. Another objective is to manage water and groundwater flows to mitigate (rather than prevent) contaminant transport outside the development footprint. Similarly the Plan announces that releases to surface water will be limited to a reasonable extent...and that radon and gamma radiation releases will be based on ALARA...to protect the general public during 'realistic' occupancy periods. What is a reasonable extent, and a realistic occupancy period? With such imprecise objectives, it will be difficult to determine whether they have been achieved when the time comes to decide if decommissioning has been successfully completed.

The cost estimate for decommissioning has been raised to over \$225 million. Huge though this sum is, it does not appear to include anything for the Province's costs for Institutional Control following decommissioning. Indeed, despite the comment in the original McArthur River EA report with respect to the Deilmann Pit, that "it is not likely that it will ever be possible to completely walk away from this pit once it has been filled with tailings", Cameco's decommissioning plan suggests that in the post abandonment phase (under Institutional Control) "A provincial representative would visit the site occasionally at their discretion for a visual inspection". We suggest that this would not constitute responsible care, especially given that the Preliminary Decommissioning Plan of January 2013 predicts that surface water quality objectives will remain unmet in some locations in the post-decommissioning period.

b) The Deilmann Tailings Management Facility

Along with decommissioning of the Above Ground Tailings Management Facility and the Deilmann North Waste Rock Pile, the future operation and eventual decommissioning of the Deilmann Tailings Management Facility (DTMF) present the greatest environmental challenges of the Key Lake site.

(i) The use of a water-cover system:

First, a general comment about the choice of tailings management system represented by the Deilmann pit and the decision to use a water-cover system. We were interested to read the following from the 2008 EPA publication EPA 402-R-08-005: Technologically Enhanced Naturally Occurring Radioactive Materials from Uranium Mining, Vol 1: Mining and Reclamation Background" Ch. 4 Uranium Mine and Extraction Facility Reclamation:

"Internationally two types of systems have been used for close-out of tailings impoundments to prevent radon emanation: dry-cover and water-cover systems. Only the dry-cover system is used in the United States; however, for information purposes only, the wet-cover systems are also described briefly.....While used in Canada and Europe, and in isolated instances for other types of mines in the U.S., water cover is not viewed as an acceptable means of remediation for uranium mill tailings in the U.S., is not permitted under NRC regulations unless approved as temporary water covers....and should not be viewed as EPA recommended procedures.....This technique has several potential problems, including sustaining the water cover, preventing human and biota intrusion from ingesting the water cover, and preventing further contamination of other water bodies through infiltration. A principal issue is mobility of uranium and other radionuclides, especially in either acidic or alkaline waters."

We would invite the CNSC to comment on their perception of the validity of the above, and to describe why the water-cover system is deemed acceptable in Canada but not in the United States.

(ii) Changes from the original design:

The D TMF was designed with the expectation that all of the tailings would be accommodated below 430 masl, entirely within the PreCambrian basement rock envelope which reaches up to about 460 masl in places. The current licence allows for final compacted tailings to come as high as 466 masl, which brings them up into contact with the more permeable sandstone. The proposed expansion to the 505 masl level would take the tailings well into the sand outwash and till overburden. The original expectation was that after operations cease, and normal water levels re-establish at about 518 masl, there would be room for some 90 metres of cover (combination of rock and water?) to provide shielding from radon emissions. Current plans reduce this cover depth to just a few metres. We note that following the recent sloughing events there is now a wet, sandy connection between the tailings and the surface environment. It seems unlikely that this will not impact the effectiveness of containment of contaminants.

There is a need for serious review of the implications of changes that have already taken place since the original design of the DTMF was approved and further changes that are planned for the future. Already we are allowing tailings deposition to a level where they are exposed to sandstone rather than basement rock. The final level of the pond water following deposition of tailings will be well into the overburden. The 1994 EIS prepared by Golder for use of the Deilmann pit for tailings disposal noted (p. 37, 6.2.3) that "Pond elevations greater than 514 masl would not ensure containment of solute migration and there would be outward flow from the Deilmann pit". However, it seems that after pumping stops, the water level in the pit will naturally rise to 518 masl, which raises questions about the adequacy of the cover layer to prevent continuous migration of contaminants from the compacted tailings into the pond water and thence into the surrounding surface waters. There appear to be unresolved problems with allowing the tailings level to rise above the basement rock envelope and with a final pond water cover above 514 masl. Approval of a 10-year re-licensing would imply acquiescence to deposition above 466 masl in the DTMF, because the tailings would certainly reach this level in less than 10 years.

(iii) Contaminants in the DTMF pond water:

The 2012 Key Lake Annual Report (p.26) provides a comparison of monitoring results for the Deilmann Pond water with previous years. It is noted that mean arsenic concentration in 2012 was 47 µ/L compared to 27 µ/L in 2011. Uranium

levels increased from a mean of 245 µ/L in 2011 to 278 in 2012. Ni concentrations in 2012 ranged from 1.90 to 1.93 mg/L compared to a mean of 0.29 mg/L in 2004; according to the annual report, the reason for this increase remains unclear. The January 2013 Key Lake Preliminary Decommissioning Plan (6.3) anticipates that guidelines for arsenic, cadmium, copper, molybdenum, nickel, selenium, uranium, zinc, lead 210, polonium 210 and radium 226 will all be exceeded in the pond sediment in the post-decommissioning period. The potential for these sedimentary contaminants to become mobile under changed atmospheric conditions (e.g. acid rain) should be taken into account.

(iv) Priorities for use of space in the pit:

Space in the DTMF is very valuable. Under present plans, the ability to continue mining at McArthur River (and potentially at Millennium) depends on the availability of tailings disposal space at Deilmann. It has also been suggested by some that the best way to deal with the Deilmann North Waste Rock Pile and the Above Ground Tailings Management Facility material would be to put it into the Deilmann pit. There is certainly some pressure to expand the capacity of the pit beyond what seems environmentally sound. Even the McArthur tailings will bring the level up to one that appears unwise. It would be advisable to realistically anticipate just what volume of waste can safely be accommodated within the pit while still allowing for a generous cover layer within a non-porous envelope, and then to assign priorities for use of that space. It may be that using the pit as a final resting place for existing wastes currently lying on the surface at Key Lake would, from an environmental perspective, make more sense than making it part of an extended regional mining future.

(v) Decommissioning and perpetual care:

A concern was expressed in the McArthur River section of the Report of the Joint Federal Provincial Panel on Uranium Mining Developments in Northern Saskatchewan that “if seepage from the DTMF into the surrounding groundwater were to occur, extensive contamination of the now pristine northern rivers and lakes could develop....It is not likely that it will ever be possible to completely walk away from this pit once it has been filled with tailings”.

The 2013 Key Lake Decommissioning Plan (Sec 2.4) comments that “future construction activities on and immediately surrounding the tailings management areas may need to be restricted to prevent damage to the cover systems and to mitigate any radiation exposure to local residents”. EcoMatrix 2012 suggests that the DTMF is expected to be restricted in perpetuity from future residential development. One always has to question the feasibility of effectively restricting anything ‘in perpetuity’. Signage, fences, institutional management systems and

even knowledge cannot be assumed to have eternal life. Perhaps we can rely on such controls to restrict access for 25 years, maybe even 50 years, but we have to assume that, at some time in the future, knowledge of the requirement to avoid such locations will be lost. A decommissioning plan needs to leave the site in a condition such that its safety is not dependent indefinitely on warning signs and zoning bylaws.

There seems to be a lack of consideration of probable future climate change and its potential impact on the site. Extreme precipitation events could result in flooding of the DTMF and Gaertner ponds as well as wash-out of till-covered areas. Should significant further oil sand development take place in north-eastern Alberta and/or north-western Saskatchewan, the potential impact of acid precipitation on the Key Lake region should be considered. Change of pH in surface waters would be reflected in changes in solubility of contaminants in sediment and in release of contaminants from surface-stored waste materials.

c) Above Ground Tailings Management Facility

Although an improvement on earlier practices of simply dumping tailings in convenient lakes or hollows, the Above Ground Tailings Management Facility (AGTMF) is one of those relics of past, regrettable, environmental practices that have burdened the nuclear industry throughout its history. Built on a bentonite liner, with drainage collection, this was the depository for the Key Lake tailings until 1996, after which it was used for disposal of contaminated debris and collection of contaminated water.

There are some unknowns about the AGTMF. It is currently leaking contaminants. The 2012 Key Lake Annual Report notes (p 58/584) that the pH of the seepage has shown a consistent increase of just over 1 pH unit over the past 4 years. Molybdenum shows a consistent increase in seepage concentration since 2002, and selenium has doubled since 2007. It is suggested that the increase in pH may be responsible for these latter effects. A similar trend is shown for Ra²²⁶ in both the seepage and supernatant at the AGTMF, with a significant spike in 2012. We are pleased to see that further monitoring and analysis is planned in order to better understand these trends. After the planned 2013 program of drilling and detailed geochemical analysis at several locations within the AGTMF is completed, Cameco will be in a better position to consider future management options. While it is clear that the general water flow from the AGTMF is north-eastward, because of its elevation it seems likely that some surface water from the facility may flow into David Lake, which could perhaps account for elevated nickel levels in that lake.

Tentative plans for decommissioning of the AGTMF involve a sequence of steps. These include applying an engineered cover which is predicted to reduce, but not prevent, percolation of precipitation into the tailings. Surface run-off and drainage from below the pile would be channeled into Wolf Lake. However ground water modeling predicts some resulting parameter exceedences within Wolf Lake, therefore Cameco has incorporated the contingency option of backfilling that lake. This could be combined with excavating Wolf Creek and Wolf Springs, and creating a widened, gravel-filled drainage surface to direct surface and ground-water run-off from the AGTMF into the infilled Wolf Lake. This contaminated water would then mix with clean ground and surface water down-gradient, resulting in downstream compliance with Saskatchewan Surface Water Quality Objectives. By dispersing the contamination in this manner, a "solution by dilution" approach is anticipated. The CNSC needs to consider the appropriateness of this technique. Incidentally, we might suggest that the fact that Wolf Springs currently does not show levels of contamination as high as those in Wolf Lake does not necessarily imply that the contamination in Wolf Lake comes from some source other than the AGTMF. It seems possible that the pressure from an artesian well feeding the Spring may cause the flow from the AGTMF to bypass the Spring en route to Wolf Lake.

We recommend that Cameco re-visit the option of mining the AGTMF for nickel and cobalt. It has been suggested to us that even if royalties are paid for these materials, this could be a profitable venture, would remove a source of nickel contamination to the environment, and would create additional employment opportunities for northerners. It would also provide an opportunity to design a better long-term disposal strategy for the remaining AGTMF material, possibly using some of the DTMF space.

d) Decommissioning of Deilmann North Waste Rock Pile

(i) Background:

The Deilmann North Waste Rock Pile (DNWRP) is located north of the DTMF. The DNWRP is estimated by Cameco to contain approximately 18,800,000 m³ of waste rock, comprised of 23% sand/till, 47% sandstone and 30% basement rock (Cameco, 2012 Annual Report, table 7.1.1 2013 Draft Decommissioning Plan). The risk of leachate from the pile is considered to be moderate to high. Cameco anticipates that 30 years of pump and treat containment will be required following the 11 years of pump and treat required for the DTMF (Cameco, 2013 Draft Decommissioning Plan).

Cameco is currently undertaking significant investigations into the feasibility of covering the pile as part of ongoing remediation and decommissioning efforts.

While the SES encourages Cameco to continually assess options for remediation and decommissioning, we are reluctant to support Cameco's decision to cover the pile until more hydrological and geochemical characterization of the pile is completed. We offer the following observations and suggestions in relation to the remediation and decommissioning of the pile:

(ii) Base the decommissioning plan on conservative predictions of the required pump and treat period.

Cameco's confidence in their 30 year pump and treat estimate is not clearly described in the decommissioning plan or the Dielmann North Waste Rock Management Plan 2011 Technical Update. The Technical Update notes that the previous estimate of 20 years has been changed to the current 30-year estimate in light of the updated estimation of saturated waste rock volume at closure (6,280,000 m³ from 3,460,000 m³, pg. 23), but does not provide the confidence interval of the new estimate. Golder's "Hydrogeological Modelling Update – Deilmann North Waste Rock Pile (January 2012)", acquiesces that a reasonable pump and treat period is "~30 years" (pg. 6) but does not appear to further describe its confidence in this period. It may be helpful if Cameco's pump and treat prediction of 30 years were to be described in terms of a range, say 30-50 years, or whatever the applicable range may be. Accordingly, SES encourages the CNSC to ascertain the confidence ascribed to the 30-year interval and the basis for the same.

SES recommends that the decommissioning plan be based on scenarios closer to "worst case" as opposed to "most likely", so as to assure with confidence that the Letters of Credit will be sufficient to cover decommissioning costs. If the 30-year pump and treat period is indeed Cameco's "worst-case" estimate, then no changes to the Preliminary Decommissioning Plan (PDP) in this regard are suggested. If 30-years pump and treat represents the "most likely" scenario, we suggest that the PDP and PDPC's be modified accordingly to cover a potentially larger cost associated with a longer pump and treat period.

It is anticipated that there is a lot of uncertainty surrounding the required pump and treat period. This suggestion is made in light of the relative complexity in predicting the long-term behavior of the various saturated and unsaturated zones of the pile in relation to the pile's leachate rates (permeability, sorption, etc.), outstanding data collection that Cameco acknowledges is required (see section 3.0 of the DNWRP Technical Update), and the potential environmental risks and impacts that could result from an insufficient pump and treat period. In the absence of a confidence interval on the 30-year pump and treat period, a factor of safety of 2.0 is suggested to cover the uncertainties associated in predicting the pump and treat period.

Having a better handle on the certainty (or lack thereof) of the pump and treat period required for the DNWRP could help the regulators and the public to better evaluate Cameco's momentum towards covering the pile as opposed to other potential decommissioning options, such as sub-aqueous deposition of the basement rock, the requirement for reactive barriers, cut off walls, etc. (see e.g. page 2-8 of the DNWRP Technical Update). For example, should it be found that it is entirely possible that the pile will require a 60-year pump and treat period, regulators and Cameco may be more ready to consider moving portions of the pile into the McArthur River mine, or the DTMF and Gaertner pits. As a general principle, SES suggests that pump and treat as a method of decommissioning increases in risk as the pump and treat period lengthens; a longer time frame for decommissioning requires more speculative assumptions in relation to external requirements such as electricity supply, economic stability and definable climatic conditions. A more rigorous analysis of external factors, and assurances that external factors will be controlled should be undertaken as the pump and treat period increases.

(iii) Invest in a drilling program that would improve our understanding of the chemical composition of the DNWRP

The CNSC should be convinced that Cameco has diligently characterized the hydrologic behavior and geochemical properties of the pile before approving any plan to decommission the pile. While the SES encourages Cameco to minimize percolation and runoff occurring near the surface of the DNWRP, we suggest that the design and implementation of a permeable cover should be considered only after the entire pile has been properly characterized. It has been suggested to SES that it was common practice during past years for Cameco to drill through its ore stockpile at intervals of 5 m. by 5 m. This helped Cameco to estimate the value of its ore reserves. Cameco should put similar efforts into characterizing and predicting the environmental legacy of the DNWRP. Only after Cameco fully understands the pertinent characteristics of the DNWRP should the CNSC be convinced that proceeding with the implementation of a cover is in the best interest of Cameco and Northern Saskatchewan.

The SES has been informed from confidential sources that it was not uncommon for trucks to deposit ore into the waste rock pile, though we have no way of verifying this, given the scant data available on the characterization of the pile. It is suggested to us that this practice took place at the discretion of ore truck drivers who did not want to continue to drive behind another ore truck for several hours. It was suggested that some truck drivers would dump a load of ore on the waste rock pile so as to "get to the front of the line". It was not suggested that management knew of this practice. However, if there should prove to be

accessible pockets of ore in the pile, this could influence the management of the pile and its decommissioning plan.

Should the above prove to be true, Cameco and the CNSC may resolve to remedy the situation by excavating portions of the pile and dealing with them appropriately. Accordingly, SES encourages Cameco to drill through the pile at intervals of 5 m. by 5 m., or any such interval as deemed appropriate by the regulators, to properly characterize the pile. Depending on the outcome of the drilling program, Cameco may consider excavating portions of the pile and processing them through the mill, or depositing them in other approved facilities.

The SES would hope that the CNSC is assured that the pile is sufficiently characterized before a full cover project proceeds. Once a cover design is implemented, it will be less likely that Cameco will have the economic incentive to undertake intensive drilling operations on the pile. Thus it would be more practical to characterize what is being covered before proceeding.

Even if the final outcome of the drilling program were to be a decision to cover the pile, better characterization of the pile would assist Cameco in establishing more reliable decommissioning timelines and plans in relation to the DNWRP. After all, the decommissioning of the pile is potentially the most important aspect of Cameco's decommissioning plan, and should proceed based on the best information that can be made available. A failure to properly characterize the pile before proceeding could prove to short change the future land users of Northern Saskatchewan, including First Nation groups.

(iv) Monitor groundwater quality in and around the pile

Cameco's annual report does not appear to include any of its monitoring results of the DNWRP. The report provides by way of reference the sampling locations required by the 1995 EIS. These locations appear to be consistent with the sampling locations required by Cameco's ongoing licensing requirements, as provided for in the draft Environmental Protection Program. It is noteworthy that there were no piezometer sampling locations required on top of or on the periphery of the pile as part of the EIS. It is unsurprising then that Cameco's proposed Environmental Protection Program does not include monitoring of the DNWRP. SES strongly requests that Cameco be required to monitor the pile as a condition of its licence, and that these results be reported in its annual report.

While SES understands that the water leaking from the pile will ultimately report to the DTMF, it would be desirable to quantify separately the effect on water quality of a) the pile leakage, and b) that of the increased water elevation in the DTMF following the west wall stabilization. This would facilitate understanding and prediction of long-term effects from the DNWRP upon decommissioning.

As Cameco moves to increase water levels in the DTMF following the west wall stabilization, it would be preferable to have the effects of DNWRP flushing monitored and reported, so as to provide opportunity for more meaningful scrutiny from the public, regulatory agencies and the Environmental Quality Committee.

In support of this suggestion we note that SRK's "2007-2011 Geochemical Characterization of Waste Rock from the Key Lake Mine and Potential Implications for Source Term Estimates" also recommends that the "[i]nstallation of additional wells, located and screened to either minimize or allow better quantification of dilution, would also be helpful".

Further, Cameco acknowledges in its 2011 DNWRP Technical Update a need for "collection, where possible, of water samples from the currently saturated base of the DNWRP in order to increase confidence in waste rock source term estimations". We agree that more water samples from the DNWRP would help to increase confidence in waste rock source terms predictions. However, we question why Cameco qualifies the need to collect this data with "where possible". We would like Cameco to clarify what obstacles, if any, exist in collecting water samples from the DNWRP. We would suggest that additional wells be built if the current ones are not functioning.

(v) Limits to effectiveness of cover on DNWRP

Cameco's annual report summarizes some of the preliminary results from the DNWRP cover investigation. SES appreciates Cameco taking the initial steps towards determining the effectiveness of a cover for the pile (though, as noted above, this effort should not circumvent the need to also better characterize the pile). The trial consists of three monitoring stations, two of which are on the pile and one reference station on natural vegetated terrain. The stations on the pile feature a 1.0 m cover of local till over the waste rock.

SES anticipates that it may not be practically feasible to achieve a cover design that reduces percolation more effectively than the results observed at the reference monitoring station over the long term (12% percolation rate). SES suggests that the long-term success of vegetation on the pile with the current design will be limited by wind exposure, more extreme weather, chemical migration from the underlying waste rock and limited opportunity for root formation.

SES invites Cameco's comments on the potential for, and implications of, perched water table conditions at the base of the proposed till cover layer. SES also suggests that the cover design might be improved by increasing the thickness of the till barrier so as to improve the opportunity for root formation and minimize concentrations of contaminants in the cover. An increased cover depth may also

reduce the potential for complete erosion of the layer over time, reduce net percolation and minimize the potential for perched aquifer conditions.

(vi) Alternatives to current plan

Cameco states in table 4.7.1 that its current decommissioning plan for the DNWRP, as alluded to above, is to grade, cover in situ, and pump and treat. SES does not accept Cameco's contingency plan, which is to isolate and cover only problematic areas. While SES understands that some areas of the pile are certainly more problematic than others, SES suggests that most likely, the entire pile is problematic. There appears to be no defensible rationale for covering only portions of the pile and not the whole pile. It would seem to make sense that the top portion of the pile consists primarily of basement rock. SES understands the basement rock to be particularly prone to acid generation. Acid would in theory dissolve minerals in the pile as it percolates through the pile and eventually reports to the ground water. Evidence of current acid generation within the pile could include the low pH observed in wells d-33 and d-34. To reduce this effect, SES suggests that moving acid generating portions of the pile to Gaertner Pond, the DTMF, or placement underground at MacArthur River might prove to provide environmental benefits. The sandstone in the pile could then be covered. In short, reducing the volume of the pile and covering the remainder would seem to offer a more acceptable contingency plan than the current one provided in the decommissioning plan.

e) The Reverse Osmosis Plant

The Reverse Osmosis (RO) plant at Key Lake draws contaminated water from the Gaertner dewatering system as a means of hydraulically containing the Gaertner and Deilmann pits. In 2012, The RO plant discharged over 5,000,000 m³ of treated water to Horsefly Lake in compliance with MMER water quality objectives. Following the DTMF west wall stabilization project, it is anticipated that the volume of contaminated water needing to be treated will decrease in the coming years. Nevertheless, the RO Plant will continue to be the central facility required for pump and treat activities for the duration of Key Lake's operational and decommissioning lifespan, which is likely to be at least another 40 years. SES's overall submission in relation to the RO Plant is that it be well designed, operated and maintained for present and future operations. We suggest that there may be reason for concern in relation to the design and operation of the RO Plant, as outlined in the following paragraphs.

(i) Eliminate the potential for “operator bypass”

It was suggested to SES that the instrumentation that monitors and controls the discharge from the RO Plant to Horsefly Lake should be improved. SES understands that the pH meter that controls the discharge of RO permeate is not permanently fixed. It has been suggested that operators have been known to take the pH probe out of the water awaiting discharge and place it in a clean cup of water to signal acceptable water quality, thus preventing the plant from shutting down in response to production of off-spec water. While there is no indication in the analysis of samples taken at Horsefly Lake that the alleged practice has resulted in exceedences of SSWQO, it is strongly suggested that instrumentation controlling discharge should be permanently affixed so as to prevent the discharge of off-spec water to Horsefly Lake.

(ii) Managing off-spec water at start-up and proposed RO overflow pipeline

In 2012, there were 21 reported utility power outages at Key Lake (Annual Report pg 9). SES is concerned that some off-spec water is probably discharged to Horsefly Lake during start-up of the plant following each power outage. SES requested technical documents concerning the start up procedures for the RO Plant from the CNSC and Cameco, however these were not made available to us.

It has been suggested to SES that the pumps used to divert off-spec water from the industrial water pump house to the industrial water reservoir have a lower capacity than the volume of permeate produced by four skids. We understand that, during start up, initially three skids will be turned on. Because of the low pressure in the skids during start up, the RO plant does not produce a normal amount of reject water, and the water quality of the permeate is off-spec. These skids will continue to produce off-spec water for a period until they become fully pressurized. The poor quality permeate produced at this time is captured in the industrial water pump house and sent to the industrial water reservoir. This prevents it from overflowing to the Horsefly discharge pipeline. Once the three skids are pressurized and producing good water, an additional skid can be turned on. At this point, one off-spec skid and three operational skids will be producing, but there is apparently only enough diversion capacity for three skids. It would appear then that $\frac{3}{4}$ of the blended, partially contaminated permeate will be pumped to the industrial water reservoir. The remaining $\frac{1}{4}$ will go to Horsefly at a quality of $\frac{3}{4}$ on-spec and $\frac{1}{4}$ off-spec. The pH may not be low enough to trigger a plant shut-down (especially if the pH meter has been re-located to a clean site), but this could be a significant source of cumulative metal contamination in the McDonald watershed.

SES suggests that, as a matter of routine practice, a water sample should be taken at the Horsefly discharge sampling station during plant start up.

SES also suggests that Cameco construct a pipeline to deal with excess off-spec water from the RO plant, a pipeline that would gravity drain into either the Deilmann or Gaertner pond. The Fresh and Contaminated Water Management manual suggested in section 1.4.2.2 that Key Lake Operations personnel identified a need for a RO plant overflow pipeline. This was suggested for three reasons:

- to handle off-spec permeate water;
- to reduce pressure fluctuations in the Gaertner piping system; and
- to handle RO reject water and/or overflow water during upset conditions in the plant (including during a potential power failure inside the plant).

SES questions whether this pipeline has been built.

(iii) Horsefly discharge pipeline

It has been suggested to us that the Horsefly discharge pipeline is a remnant from Key Lake's mining years. It has been suggested that the pipeline has become radioactively contaminated, perhaps as a result of the surrounding environment (which contains historic and natural sources of radiation), or from operation of the pipeline during mining years. SES is interested in knowing the level of radiological contamination of the pipeline. It is noted in fairness that the water samples collected at Horsefly do not suggest that the water being discharged is significantly affected by the pipeline. Nevertheless, SES is concerned about the potential future impacts of water being discharged through a radioactively contaminated pipeline and would like the CNSC to assure itself that there is no threat to the environment from discharging through this pipeline.

Given the importance of the RO Plant to the Key Lake operation, both present and future, SES suggests that a plan be put in place for the eventual replacement of the culvert-style pipeline, and that this cost be budgeted for in Cameco's operations budget or in its decommissioning plan. Alternatively, SES suggests that Cameco estimate the lifespan of the existing pipeline and present a report to the regulators on the pipeline's physical integrity.

(iv) Operator certification

Cameco has a policy requiring all RO Plant operators to be properly trained. However, it has been suggested to us that this policy is not always followed in practice. SES suggests that the CNSC assure itself that Cameco follows its own policies that require RO Plant operators to be trained.

(v) Install secondary containment where it is needed

It has been suggested to us that the RO plant's reject water surge tank (which contains some of the most hazardous water on site) does not have secondary containment. SES strongly recommends that Cameco install secondary containment on this vessel. Similarly, it was suggested that the overflow pipeline running from the reject tank to the Crusher sump lacks secondary containment. SES suggests that any pipeline containing the reject from the RO Plant should be provided with secondary containment and leak detection. One would hope that such precautions would be standard practice for a pipeline containing water characterized with such elevated concentrations of contaminants.

On a similar note, it is suggested that the containment berm housing the raw water and backwash tanks is undersized relative to the size of the raw water tank. SES recommends that appropriately sized berms with leak detection be constructed.

As with previous recommendations concerning the RO plant, the recommendations encouraging secondary containment are made, not only in light of the level of contamination of the water housed by the structures in question, but also in consideration of the lifespan in which the RO plant is intending to operate. The RO plant and its ancillary infrastructure should be well designed, maintained and operated proficiently to ensure optimal long-term environmental performance and containment.

f) Horsefly Lake

The Status of the Environment Report, 2005-2009, does not provide any information concerning the sediment quality in Horsefly Lake. The SES suspects that the COPC in the sediment is likely elevated given the lake's history of receiving water during mining. The SES would like to inquire as to whether Cameco has any data concerning the sediment quality in Horsefly Lake, and whether it plans any activities to remediate any sediment issues (should any exist) in Horsefly Lake as part of the site's decommissioning plan.

g) Site water balance

Table 3.42 of the 2012 annual report suggests that the RO plant received 6,755,425 m³ from the Gaertner wells. The same table also notes that the RO plant discharged a total of 6,851,585 m³ in the form of permeate, reject and industrial water. Please clarify the precision of these measurements. Alternatively, please clarify how the plant produced 100,000 m³ more discharge water than it received. The Key Lake Site Water Flow Diagram – Post RO Commissioning (page 123/417 in the 2007 Fresh and Contaminated Water Management Manual) would seem to

suggest that the RO Plant should operate at a balance based on the sources of input and output presented in table 3.42 of the 2012 annual report.

While on the topic, discussion of the site water balance is relatively brief considering the number of stations that Cameco monitors. SES would encourage the CNSC to determine whether Cameco has put the necessary resources (i.e. flow meters) in place to measure and interpret Key Lake's water balance. It would be helpful to know which of the values in table 3.42 are measured, and which are calculated. It has been suggested that a close investigation of much of the site water balance reveals that Cameco's data may be unreliable with respect to stream flow hydrology, the AGTMF, the RO Plant, as well as various other locations.

4. SUMMARY OF QUESTIONS AND RECOMMENDATIONS:

The following recommendations and questions are provided below for ease of reference and should not be taken to limit or replace the text above:

PUTTING THE PRESENT REVIEW PROCESS IN CONTEXT:

1. SES recommends that, in order to allow Key Lake to continue operation at the current level during the period of completion of the EA process, an interim two-year licence be approved at this time.

THE ROLE OF REGULATORY BODIES, TRANSPARENCY AND MANAGEMENT:

2. That environmental management at the site is independent of the general mine management in terms of reporting to corporate office and to regulators. This is necessary so that environmental concerns that may impact productivity or the financial bottom line are not buried or disregarded.

3. That regulators make unscheduled inspections of the site and carry out independent sampling and monitoring.

4. That workers are encouraged to report environmental problems that they encounter, and to go directly to the regulators if they are unsatisfied with the company's response. It should be clear that whistle-blower protection is in place and that workers may not be punished for pursuing regulatory action.

5. That all unplanned environmental incidents (e.g. temporary flushes of contaminant in water releases, transfer of contaminants on tires) are reported to CNSC, along with details of follow-up analysis and action.

6. That all plant operators are fully trained and qualified for their responsibilities.

7. That the Environmental Quality Committee be expanded to include several members with sufficient scientific background to play a responsible role in monitoring and challenging environmental performance.

AREAS OF CONCERN:

a) General approach to decommissioning

8. In regards to Cameco's decommissioning plans, what is a reasonable extent, and a realistic occupancy period?

9. We suggest that the provision for a provincial representative to visit the site "occasionally at their discretion for a visual inspection" would not constitute responsible care, especially given that the Preliminary Decommissioning Plan of January 2013 predicts that surface water quality objectives will remain unmet in some locations in the post-decommissioning period.

b) The Deilmann Tailings Management Facility

(i) The use of a water-cover system:

10. We would invite the CNSC to comment on their perception of the validity of the use of a water-cover system, and to describe why the water-cover system is deemed acceptable in Canada but not in the United States.

(ii) Changes from the original design:

11. There is a need for serious review of the implications of changes that have already taken place since the original design of the DTMF was approved and further changes that are planned for the future. Approval of a 10-year re-licensing would imply acquiescence to deposition above 466 masl in the DTMF, because the tailings would certainly reach this level in less than 10 years.

(iii) Contaminants in the DTMF pond water:

12. The January 2013 Key Lake Preliminary Decommissioning Plan (6.3) anticipates that guidelines for arsenic, cadmium, copper, molybdenum, nickel, selenium, uranium, zinc, lead 210, polonium 210 and radium 226 will all be exceeded in the pond sediment in the post-decommissioning period. The potential for these sedimentary contaminants to become mobile under changed atmospheric conditions (e.g. acid rain) should be taken into account.

(iv) Priorities for use of space in the pit:

13. It would be advisable to realistically anticipate just what volume of waste can safely be accommodated within the pit while still allowing for a generous cover layer within a non-porous envelope, and then to assign priorities for use of that space. It may be that using the pit as a final resting place for existing wastes currently lying on the surface at Key Lake would, from an environmental perspective, make more sense than making it part of an extended regional mining future.

(v) Decommissioning and perpetual care:

14. A decommissioning plan needs to leave the site in a condition such that its safety is not dependent indefinitely on warnings signs and zoning bylaws.

15. The decommissioning plan should consider the impacts of probable future climate change, as well as the potential impact of acid precipitation on the Key Lake region.

c) Above Ground Tailings Management Facility:

16. By dispersing the contamination from the AGTMF seepage as described by Cameco's contingency measure, a "solution by dilution" approach is anticipated. The CNSC needs to consider the appropriateness of this technique.

17. We recommend that Cameco re-visit the option of mining the AGTMF for nickel and cobalt.

d) Decommissioning of Deilmann North Waste Rock Pile:

(ii) Base the decommissioning plan on conservative predictions of the required pump and treat period:

18. SES encourages the CNSC to ascertain the confidence ascribed to the 30-year interval and the basis for the same.

19. SES recommends that the decommissioning plan be based on scenarios closer to "worst case" as opposed to "most likely", so as to assure with confidence that the Letters of Credit will be sufficient to cover decommissioning costs.

20. Alternatively, a factor of safety of 2.0 is suggested to cover the uncertainties associated in predicting the pump and treat period.

21. A more rigorous analysis of external factors, and assurances that external factors will be controlled should be undertaken as the pump and treat period increases.

(iii) Invest in a drilling program that would improve our understanding of the chemical composition of the DNWRP:

22. The CNSC should be convinced that Cameco has diligently characterized the hydrologic behavior and geochemical properties of the pile before approving any plan to decommission the pile.

23. Accordingly, SES encourages Cameco to drill through the pile at intervals of 5 m. by 5 m., or any such interval as deemed appropriate by the regulators, to properly characterize the pile. Depending on the outcome of the drilling program, Cameco may consider excavating portions of the pile and processing them through the mill, or depositing them in other approved facilities.

(iv) Monitor groundwater quality in and around the pile:

24. SES would prefer to have the effects of DNWRP flushing monitored and reported, so as to provide opportunity for more meaningful scrutiny from the public, regulatory agencies and the Environmental Quality Committee.

25. SRK's "2007-2011 Geochemical Characterization of Waste Rock from the Key Lake Mine and Potential Implications for Source Term Estimates" recommends that the "[i]nstallation of additional wells, located and screened to either minimize or allow better quantification of dilution, would also be helpful"

26. We would like Cameco to clarify what obstacles, if any, exist in collecting water samples from the DNWRP.

(v) Limits to effectiveness of cover on DNWRP:

27. SES invites Cameco's comments on the potential for, and implications of, perched water table conditions at the base of the proposed till cover layer. SES also suggests that the cover design might be improved by increasing the thickness of the till barrier so as to improve the opportunity for root formation and minimize concentrations of contaminants in the cover.

(vi) Alternatives to current plan:

28. Reducing the volume of the DNWRP and covering the remainder would seem to offer a more acceptable contingency plan than the current one provided in the decommissioning plan.

e) The Reverse Osmosis Plant

29. SES's overall submission in relation to the RO Plant is that it be well designed, operated and maintained for present and future operations.

(i) Eliminate the potential for "operator bypass":

30. It is strongly suggested that instrumentation controlling discharge should be permanently affixed so as to prevent opportunity for the discharging of off-spec water to Horsefly Lake through operator bypasses.

(ii) Managing off-spec water at start-up and proposed RO overflow pipeline:

31. The SES suggests that, as a matter of routine practice, a water sample should be taken at Horsefly discharge sampling station during the RO plant start-up.

32. SES also suggests that Cameco construct a pipeline to deal with excess off-spec water from the RO plant, a pipeline that would gravity drain into either the Deilmann or Gaertner pond.

(iii) Horsefly discharge pipeline:

33. SES is concerned about the potential future impacts of water being discharged through a radioactively contaminated pipeline and would like the CNSC to assure itself that there is no threat to the environment from discharging through this pipeline.

34. Given the importance of the RO Plant to the Key Lake operation, both present and future, SES suggests that a plan be put in place for the eventual replacement of the culvert-style pipeline, and that this cost be budgeted for in Cameco's operations budget or in its decommissioning plan. Alternatively, SES suggests that Cameco estimate the lifespan of the existing pipeline and present a report to the regulators on the pipeline's physical integrity.

(iv) Operator certification:

35. SES suggests that the CNSC assure itself that Cameco follows its own policies that require RO Plant operators to be trained.

(v) Install secondary containment where it is needed:

36. SES suggests that any pipeline containing the reject from the RO Plant should be provided with secondary containment and leak detection.

37. It is suggested that the containment berm housing the raw water and backwash tanks is undersized relative to the size of the raw water tank. SES recommends that appropriately sized berms with leak detection be constructed.



Saskatchewan Environmental Society

Prepared for submission to the Canadian Nuclear Safety Commission

by Ann Coxworth and Peter Prebble
of the Saskatchewan Environmental Society

COMMENTS FROM THE SASKATCHEWAN ENVIRONMENTAL SOCIETY ON CAMECO'S RE-LICENSING PROPOSAL FOR McARTHUR RIVER

August 2013

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Caution to reviewers

The following comments represent the Saskatchewan Environmental Society's views only with respect to the local environmental impacts of re-licensing the McArthur River operation. However, SES's serious concerns about Cameco's marketing policies and the destination of uranium mined and processed in Canada prevent us from supporting re-licensing of the operation. Readers are referred to the attached document: "Recommended New CNSC Conditions On Canadian Sales Of Uranium", which should be read in conjunction with the following, for an explanation of this position.

Introduction

The following constitutes the McArthur River section of the report to the CNSC from the Saskatchewan Environmental Society (SES) on Cameco's re-licensing proposals to be reviewed by the Commission in October 2013. This work was supported through the CNSC's Participant Funding Program.

The future of the rich McArthur River development depends primarily on Cameco's ability to deal with two key issues – the management of water inflows into the underground workings and the long-term availability of tailings disposal space.

In reviewing the re-licensing proposal for the McArthur River mine we have considered both the on-site mining operations at McArthur River and the ore processing which takes place at Key Lake. The operational and decommissioning plans for both sites are relevant. Most of our concerns focus on the latter.

Operations at the Mine Site

SES commends the McArthur River operation for continually improving its effluent quality. The decrease in molybdenum in effluent provides an example of McArthur River's continual environmental improvement. It appears that Cameco is now fairly well prepared to manage any future incursion of water into the underground workings. SES would encourage McArthur River to continue improving its environmental performance so as to reduce cumulative impacts over the anticipated lengthy lifespan of the mine.

With respect to the operation of the site, SES simply reiterates EcoMatrix's recommendations made in the "McArthur River Operation: Status of the Environment Report 2005 to 2009" concerning additional hydrological and ecological monitoring. In instances where additional monitoring is needed for the optimal management of the site, we suggest that these monitoring locations become part of the operational licence to ensure that the data is made publicly available in McArthur River's annual reports.

McArthur Mine Decommissioning Plan

The SES recognizes that there are relatively few concerns with the decommissioning plan for the McArthur River site, given that it is intended that no contaminated materials will be left on the surface. SES anticipates that the post-decommissioning impact of the mine on the surrounding environment will be small (in contrast to that of Key Lake and Rabbit Lake); McArthur River's decommissioning plan appears to assume the same. We accept the prediction that the site will be relatively stable over the long term.

However SES anticipates that the mineshafts and surrounding geological fractures at McArthur River could provide a means of groundwater entering the decommissioned

mine site. Cameco should confirm that there is no risk of groundwater interacting with mine water contaminated by the host bedrock and mineralized waste as a result of infiltration through the mine. While SES notes that the plan calls for most openings to be plugged with concrete, it can be assumed that eventually this concrete will erode and become porous, allowing water to infiltrate into the decommissioned mine. We would therefore invite Cameco's technical opinion on the potential for groundwater contamination resulting from migration of contaminated mine water within a 10,000-year timeframe.

Tailings disposal

The decision in the mid 1990s to use the Key Lake facilities for milling the McArthur River ore has both enabled the continued operation of the Key Lake mill after mining there ceased and created a dependence for McArthur River on a problematical tailings disposal site. The Deilmann Tailings Management Facility (DTMF) at Key Lake is currently in recovery mode following a partial collapse of the pit wall. A planned expansion of the pit capacity to enable accommodation of future McArthur River tailings is undergoing environmental assessment. As Cameco's McArthur River Technical Report 2012 noted under "Project Risks" (p.181), "A significant delay in obtaining, or a failure to receive the necessary regulatory approval for the DTMF expansion could interrupt or prevent the operation of the McArthur and Key Lake operations".

Issues to be resolved at the Key Lake site are discussed in our concurrent submission regarding that site. We have identified concerns about the advisability of allowing the tailings level in the Deilmann pit to be raised, about the long-term prevention of contaminant flow from the Deilmann pond into the surrounding environment, and about the perpetual care of the site after decommissioning. Until these issues are satisfactorily resolved, or until a good, alternative contingency plan for management of tailings is approved, we believe it would be irresponsible to license further mining at McArthur River. At most we would suggest that a two-year licence be considered, which would allow time for completion of the Key Lake Expansion Environmental Assessment process and for the making of decisions about the future of the Deilmann pit. It may be necessary at that time for Cameco to present a new McArthur River proposal containing a different tailings management approach.



Saskatchewan Environmental Society

Prepared for submission to the Canadian Nuclear Safety Commission

by Ann Coxworth and Peter Prebble
of the Saskatchewan Environmental Society

COMMENTS FROM THE SASKATCHEWAN ENVIRONMENTAL SOCIETY ON CAMECO'S RE-LICENSING PROPOSAL FOR RABBIT LAKE

August 2013

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Caution to reviewers

The following comments represent the Saskatchewan Environmental Society's views only with respect to the local environmental impacts of re-licensing the Rabbit Lake operation. However, SES's serious concerns about Cameco's marketing policies and the destination of uranium mined and processed in Canada prevent us from supporting re-licensing of the operation. Readers are referred to the attached document: "Recommended New CNSC Conditions On Canadian Sales Of Uranium", which should be read in conjunction with the following, for an explanation of this position.

The Saskatchewan Environmental Society is pleased to offer observations and recommendations on Cameco's application for a 10 year licence renewal on its Rabbit Lake operations.

1. If we look only at Cameco's record of operations at the Rabbit Lake mining and milling site, and exclude for a moment consideration of Cameco's uranium export record and uranium export plans, the calibre of site operations justifies licence renewal, but with important new conditions that we elaborate on below.

2. We recommend a 5 year licence renewal period for the Rabbit Lake operation, rather than the 10 year renewal period that Cameco is seeking. We also recommend that future licence renewal processes for Rabbit Lake require that an up-to-date *State of the Environment Report* has been prepared on the Rabbit Lake Operation.

The Rabbit Lake site is faced with many important environmental decisions and key site reclamation and decommissioning decisions that merit public input and formal CNSC review every 5 years. It needs to be kept in mind that while recent improvements have been made, Rabbit Lake is a site where total contaminant loading to the environment has been high.¹ Adding to public interest is the fact that the Rabbit Lake operations sit adjacent to and in bays of one of Saskatchewan's most important lakes.

Another reason to maintain a 5 year license is that the existing ore deposit being mined at Eagle Point is expected to be mined out in 4 years time, and plans for developing new ore deposits may well be underway at the 5 year mark. If new ore bodies are to be mined, it is possible that the Rabbit Lake Tailings North Pit expansion may also be underway. All these potential activities merit a regular 5 year review. The existing re-licensing process has been on a 5 year cycle (Nov 1, 2008 to Oct 31, 2013) and we see no reason to change this.

We are also of the view that the CNSC review process would benefit from having an up-to-date *State of the Environment Report* completed before considering Cameco's next application for licence renewal. Cameco commissions this important report every 5 years. Unfortunately, in the current application for the Rabbit Lake license renewal, the most recently completed *State of the Environment Report* on the Rabbit Lake site is for the period 2005 to 2009, and is thus not sufficiently up-to-date. **In the future, CNSC**

¹ For example, in the period 2003 to 2005: annual loadings at Monitoring Station 2.3.3 (Effluent treatment system discharge at final point of control) for arsenic averaged over 50 kg per year, average loadings for nickel averaged 100 kg per year, average loadings for uranium averaged more than 1,200 kg per year and annual loadings for molybdenum averaged over 22,000 kg per year. Fortunately, there have been significant reductions in annual loadings in recent years. Nevertheless, total loadings over the life of the mine/mill operation have been large. For further details refer to: 2012 Annual Report for the Rabbit Lake Operation, Table 6.10.9.7

For example, at the time of the PSL2 assessment (Second Priority Substances List of the Canadian Environmental Protection Act), Rabbit Lake had the highest concentration and total loadings of uranium of all Canadian uranium mines. This led to license requirements for improved effluent treatment.

should ask Cameco to ensure that its State of the Environment Report is timed to be in sync with the licence renewal process. Once again, this would fit nicely with a 5 year re-licensing cycle.

3. We recommend the formation of an Environmental Management Committee, in line with the original recommendation of the FEARO Panel that reviewed Cameco's application to develop the Eagle Point, A-Zone and D-Zone deposits in 1993. We further recommend that the Canadian Nuclear Safety Commission (CNSC) make the formation of such a Committee a condition of re-licensing the Rabbit Lake site.

To quote the 1993 FEARO Panel: "The Panel recommends that the Joint Review Group (Saskatchewan Environment, Environment Canada and Atomic Energy Control Board) be restructured and expanded to create an Environmental Management Committee for the Rabbit Lake operation....The following should be considered for membership:

- Present members of the Joint Review Group
- Athabasca Basin communities, including Wollaston Post
- Informed environmental interest groups....
- The scientific community
- Other federal departments, for example, Fisheries and Oceans and Health"²

The FEARO panel also considered it important to have aboriginal elders and women represented on the Environmental Management Committee.

The 1993 FEARO Panel carefully considered a proposed mandate for the Environmental Management Committee, most of which we still consider very relevant today. That mandate included:

- To ensure high standards of scientific analysis
- To address baseline conditions on site, environmental monitoring, waste rock management, tailings management, decommissioning, post-decommissioning, water use, cumulative impacts and research needs. (It was envisaged by the Panel that Cameco would have worked co-operatively with the Environmental Management Committee on all these issues.)
- To identify and address public concerns
- To communicate information to stakeholders
- To examine the nature of the regulatory process and how to improve it

² FEARO Panel Report, "Review of Rabbit Lake Uranium Mine A-Zone, D-Zone, Eagle Point" (K. Wayne Hindmarsh, Chair), November 1993, page 9.

- To consider the concerns of the public and other government agencies in an integrated and coordinated fashion.

The FEARO Panel had envisaged that the proposed Environmental Management Committee for Rabbit Lake would be able to seek out the advice of independent experts to advise the Committee on specific issues that needed to be addressed at Rabbit Lake, and would be provided with the financial resources to do so. It also envisaged a community based monitoring program with major involvement from residents of the Hatchet Lake Denesuline First Nation and Wollaston Lake community, including a training and education program on environmental monitoring in the local high school. The Panel suggested exploring “ways to integrate monitoring activities at the Rabbit Lake site into the curricula of community schools” with the view to developing individuals in the local community with the skills and education necessary to actively participate in monitoring the Rabbit Lake operation.³

The Saskatchewan Environmental Society is of the view that it is unfortunate that the regulators of the day did not implement this FEARO Panel recommendation, and urge that it be implemented now, specifically for the Rabbit Lake Operation. The Environmental Management Committee for the Rabbit Lake Operation would play a major role in the reclamation, decommissioning, monitoring and post-decommissioning monitoring process at the Rabbit Lake site. It would also work with Cameco and CNSC to facilitate a community based monitoring program with very significant participation from the community of Wollaston Lake and the Hatchet Lake Denesuline First Nation.

4. The Saskatchewan Environmental Society commends Cameco and CNSC on areas where important achievements or advances have been made at the Rabbit Lake site.

Some of these include:

- Cameco's achievement of ISO 14001 certification for its environmental management system at Rabbit Lake.
- CNSC's requirement that Cameco upgrade its risk assessment and fire protection plans, which has now been done.
- Installation of improved effluent treatment for selenium, molybdenum and uranium – resulting in reduced concentrations of these contaminants in effluent released to Hidden Bay over the past few years.
- Cameco's maintenance of radiation doses to workers well below regulatory limits.
- Good safety practices at the Rabbit Lake site resulting in an impressive record on 'Lost Time' incidents.
- Significant success in creating employment opportunities for Northern Saskatchewan residents.

³ FEARO Panel Report, “Review of Rabbit Lake Uranium Mine A-Zone, D-Zone, Eagle Point” (K. Wayne Hindmarsh, Chair), November 1993, page 10.

5. The Saskatchewan Environmental Society recommends that CNSC request Cameco to develop an improved cover plan for all mineralized waste rock that is not ultimately disposed of in the Rabbit Lake In-Pit Tailings Management Facility (RLITMF) or the Eagle Point mine.

The present conceptual decommissioning plan envisions movement of some mineralized waste rock into the RLITMF. It is important to recognize this plan is still conceptual and tentative in nature, and thus will evolve over time. **For mineralized waste rock piles that ultimately remain on the surface, we would like to see a cover plan that takes account of:**

- **Experience with waste rock reclamation at the decommissioned Cluff Lake uranium mine and mill site and other decommissioned sites**
- **Expected increases in precipitation, storms and heavy rainfall events in the Rabbit Lake area in the decades ahead**
- **The cumulative environmental impact of all waste rock, ore pad and tailings facilities on the Rabbit Lake site**

Waste rock management was anticipated to be a challenge at Rabbit Lake 20 years ago. Concerns about waste rock management were prominent in the 1993 FEARO Panel's review of A-Zone and D-Zone and were one of the reasons that the FEARO Panel gave the two open pit mine projects a 'yellow light' rather than a 'green' one. At the time the FEARO Panel noted: "The information presented to the Panel on waste rock management and decommissioning plans for the A-Zone and D-Zone open pit operations is insufficient to determine whether the environmental effects of these operations are acceptable....The Panel therefore recommends that mining of the A-Zone and D-Zone ore bodies not proceed until the required studies are completed and the specific issues identified in the report are resolved." ⁴

In assessing potential waste rock issues in the decommissioning phase at Rabbit Lake and at all of Cameco's sites, it is instructive to look at early results for AREVA's decommissioned Cluff Lake site, where the Claude Waste Rock Pile is the source of increases in the concentration of sulphate, uranium and nickel in groundwater, when compared to baseline. Nickel concentrations have been increasing since 2006. ⁵

It is also important to consider the future precipitation trends predicted by the National Oceanic and Atmospheric Administration (NOAA) and other meteorological organizations. Those predictions are for precipitation to increase substantially and to become more intense. For example, a major NOAA study released in April 2013

⁴ FEARO Panel Report, "Review of Rabbit Lake Uranium Mine A-Zone, D-Zone, Eagle Point" (K. Wayne Hindmarsh, Chair), November 1993, page 1 (Executive Summary). In contrast to the recommendations on A-Zone and D-Zone, the Panel did give full approval to the Eagle Point underground mine.

⁵ 2012 Annual Report for the Cluff Lake Site, pages C-22 and 23. Nickel concentration increases are at monitoring station HYDO321G.

concluded that a 20-30% increase in precipitation is likely over large portions of the northern hemisphere.⁶

In the past so-called high precipitation events in the Collins Bay area have been still relatively modest in nature. For example in the 2005-2009 period, the heaviest rainfall in a 24 hour period at Collins Bay was a mere 33.8mm.⁷ However, it will now become important to plan surface water management around much more intensive rainfall events.

We therefore recommend that all future reclamation work at Rabbit Lake and at other uranium mine sites in northern Saskatchewan be based on the assumption that total precipitation will increase, and that the frequency of intense precipitation events will rise sharply.

CNSC should therefore ask Cameco to undertake additional measures that will reduce the risk of accelerated erosion and gully formation on its waste rock piles over time, due to more intense precipitation events. Such measures should include: a thicker crushed clean waste rock and fill cover on mineralized waste rock piles that remain to be reclaimed (at least 1.5 metres thick); design of small catchment areas on waste rock piles to reduce peak flows during high precipitation events, use of meandering drainage paths on waste rock piles, successful establishment of vegetation on waste rock piles (with a good variety of species), and ensuring that drainage channels on mineralized waste rock piles are well armoured and sufficient in number to handle very intense rainfall.

A well designed surface water management system needs to be in place for each mineralized waste rock pile to mitigate the cumulative environmental impact of all the waste rock piles and the other waste management structures on the site.

The Saskatchewan Environmental Society is pleased to see the contouring, cover and seeding work that has recently been done on the B-Zone Waste Rock Pile, which has begun to integrate some of the above-mentioned suggestions. **Based on the three considerations mentioned above, we urge Cameco and CNSC to be even more ambitious in future waste rock cover projects, including making provisions for an even thicker cover than the 1.2 metres used on the B-Zone waste rock pile, and making provisions for cover designs that can handle triple the maximum rainfall that Rabbit Lake traditionally receives.**

The Saskatchewan Environmental Society also urges CNSC to require as a condition of re-licensing that Cameco explore and test the use of permeable reactive barrier covers on mineralized waste rock piles as a way of improving water quality in drainage channels and in local surface waters impacted by waste rock pile runoff and seepage on the Rabbit Lake site.

⁶ NOAA. *Probable Maximum Precipitation and Climate Change*, April 2013. Lead author Kenneth Kunkel, Ph.D noted: " We have high confidence that the most extreme events will become more intense as it is virtually certain that the atmosphere will provide more water to fuel these events."

⁷ Table 4.1.3-5, State of the Environment Report (2005-2009) for the Rabbit Lake site (2010)

Finally, SES asks CNSC to review the schedule Cameco proposes when applying for a designation of a waste rock pile as “undeveloped”. For example, Cameco proposes that it will apply to have the B-Zone Waste Rock Pile designated as undeveloped in 2022.⁸ This is surely an insufficient period of time to properly assess the migration of contaminants from a 22 hectare waste rock pile that is heavily loaded with arsenic and nickel.

6. Importance of Cameco Preparing An Environmental Impact Study On Their Decommissioning Plan For The Rabbit Lake Operation

To our surprise, Cameco expresses uncertainty about whether it will prepare an Environmental Impact Study (EIS) on its proposed decommissioning plan for the Rabbit Lake site.⁹ In the view of the Saskatchewan Environmental Society, it is imperative that an Environmental Impact Study be prepared as a foundation for proper site decommissioning. This EIS should include a comprehensive evaluation of the surrounding soils, geology and hydrogeology of the entire site, and should aim to carefully predict contaminant movement and surface water quality on the site over time under the recommended decommissioning scenario, and compare that with outcomes under alternative scenarios. It should also carefully assess cumulative impacts from all waste sources on the site over time. **We strongly recommend that CNSC require such a ‘decommissioning’ EIS to be prepared and that further site reclamation work then proceed, with the full benefit of the EIS analysis.**

As indicated earlier, we also recommend that the proposed Environmental Management Committee, the community of Wollaston Lake and the Hatchet Lake Denesuline First Nation be extensively consulted about their expectations with respect to Rabbit Lake site decommissioning. (We are pleased to see Cameco does plan for some community input in its decommissioning work.)

In addition to this broad recommendation on the overall approach to decommissioning, we make several more specific recommendations in the sections below on how we think the decommissioning plan for the site can be improved.

7. Link Lakes Decommissioning

Cameco recognizes that it faces a difficult contamination problem in the Link Lakes watershed and is actively considering decommissioning options. Over time this watershed has suffered the effects of dewatering and removal of sediments from Rabbit Lake, discharge of mine slimes and mine water, discharge of drainage from the mill complex, discharge of drainage from ore stockpiles and waste rock storage areas, and discharge of cooling waters. However, since 1997 there have been no direct releases to Link Lakes, and today there is only minor additional loading via groundwater

⁸ Rabbit Lake Operation Site Wide Reclamation Plan, 2013, Figure 6.1.

⁹ Rabbit Lake Operation Preliminary Decommissioning Plan, March 2013, p. 4-2. Cameco indicates it will prepare an EIS “if required.”

inputs and the north drainage ditch. While mill effluent treatment is in place, on-going loading to Link Lakes should continue to be low.

Fortunately, the size and depth of the Link Lakes makes the contamination problem there a more manageable one. (Upper Link Lake is 22.7 ha with an average depth of 1.4 metres; Lower Link Lake is 22.8 ha with an average depth of 3 metres.) More importantly, the contamination issues are contained to the Link Lakes; to date there is no indication that Pow Bay, which lies downstream, has suffered negative impacts.

However, the sediment of the Link Lakes is seriously contaminated with a broad array of radionuclides, heavy metals and other constituents. Sediment quality guidelines are exceeded for many primary contaminants, and, for the most part, substantial recovery has not occurred.¹⁰ Gradual sediment recovery is predicted over time.

Sediment contamination is significantly worse in Upper Link Lake, although uranium, radium and arsenic levels in sediments in Lower Link Lake are well above CNSC guidelines.¹¹ In general, however, the bulk of the contaminants have been contained in Upper Link Lake to a much larger degree that would normally be expected. One reason for this is the construction of a sedimentation dam built immediately downstream of Upper Link Lake - Lower Basin, that has minimized transport of contaminants to lower drainage areas and promoted sorption. A second reason is the transplanting of *Nitella* in 4 zones in Upper Link Lake from Lower Link Lake. For example, Ecometrix reports that the "accumulation of Radium 226 in plant tissues is most evident in *Nitella*... Radium 226 levels in *Nitella* in the Link Lakes has been as high as 10,000 times higher than those reported in the literature."¹²

Nevertheless, surface water quality in Lower Link Lake has still been negatively impacted. For example, in May of 2011 CNSC staff reported that Lower Link Lake exceeded Saskatchewan Surface Water Quality Objectives for both radium and uranium.¹³ There is reason to be concerned that sediment-based uranium and radium will make their way back into the water column.¹⁴

¹⁰ E-DOCS # 3349418 *Sediment Pore Water and Fish Investigations In The Link Lakes At The Rabbit Lake Operation*, Final Report (Canada North Environmental Services), January 2009, p. xv, pp. 24-25, and Table 10 in Appendix E: 'Results of chemical analysis performed on pore water samples from Upper Link Lake- Upper Basin, Upper Link Lake – Lower Basin and Lower Link Lake').

¹¹ Ibid, Table 2.4-1: Summary of Sediment Quality Data Collected in the Link Lakes between 1999 and 2005. Uranium in the top 5 centimetres of Link Lake sediment exceeded Lowest Effect Levels by at least an order of magnitude in all 3 basins. Radium in the same sediment horizon has risen since 1999 and exceeds Lowest Effect Levels in all 3 basins. (Reclamation Plan 2013, page 5-58).

¹² Link Lakes Drainage Compilation Report, EcoMetrix, 2006, 2-13.

¹³ Cameco Mid-Term Report on the Safety Performance of the Rabbit Lake Operation, May 24, 2011 (Submitted by CNSC staff), page 29. This submission notes: "SSWQO for uranium and radium are 0.015 mg/L and 0.11 Bq/L with Lower Link Lake at 0.080 mg/L and 0.13 Bq/L, respectively".

¹⁴ Link Lakes Drainage Compilation Report, Ecometrix Inc., 2006, p. i – ii and 2-7

In terms of decommissioning, the ecological risk clearly lies with the sediments and the potential for bioavailability of contaminants. With respect to sediment loading of radium and uranium in Link Lakes, Ecometrix reports on work done in 1999 which estimated loading as follows: 190,000MBq of Ra226 and 57,000kg of Uranium in the upper 5 centimetres of the Link Lakes sediment.¹⁵ In setting decommissioning plans, it is important that as little as possible of this radium and uranium makes its way into Pow Bay.

We have several observations and recommendations:

- a) We are glad Cameco is carefully studying options for reclamation of Link Lakes, and think that the option of partial cover of the sediment of Upper Link Lake with clean till or waste rock is particularly worth careful evaluation. We want to add another decommissioning tool to the mix being considered, namely permeable reactive barrier technology. **We are of the view that Rabbit Creek provides an excellent opportunity to apply permeable reactive barrier technology to remove uranium, radium and heavy metals from creek waters.** This creek runs for 700 metres between Upper Link Lake and Lower Link Lake and then extends another 350 metres beyond the Lower Link Lake outflow before reaching Pow Bay of Wollaston Lake. **PRB technology has the potential to help reduce loading on Lower Link Lake and on Pow Bay. We recommend that CNSC ask Cameco to carefully test and evaluate the application of PRB technology in Rabbit Creek.**
- b) **We are glad to see that Cameco is planning some form of community consultation component to the Link Lake decommissioning plan, although the details are as yet not specific.**¹⁶ In our judgment, the best approach to decommissioning Link Lakes is a matter on which the Wollaston Lake community and Hatchet Lake Denesuline First Nation should be closely consulted, and should have the opportunity to get independent scientific advice on (including funding to obtain such advice). They will live with the potential impacts on Pow Bay long after Cameco has left the Rabbit Lake site.
- c) **Nitella has clearly played a positive role in helping move contaminants in the Link Lakes out of surface waters and into the sediment. As CNSC will recall, we urged in our Beaverlodge presentation (April 2013) that Cameco make more extensive use of macrophytes to remove uranium and radium from surface waters. We repeat that recommendation here.**

8. Need To Plan For An Improved Cover On The Rabbit Lake Above Ground Tailings Management Facility

¹⁵ Ibid, Ecometrix, p. 3-4 (Refer to 'Inventory of Radium and Uranium in the Link Lakes')

¹⁶ Rabbit Lake Operation Site Wide Reclamation Plan 2013, p. 5-60

At this point in time, Cameco is planning a one metre thick till cover on the Rabbit Lake Above Ground Tailings Management Facility (AGTMF).¹⁷ This decision is not final; Cameco has indicated it may receive further study.

This is a critically important waste management facility that is 53 hectares in size and that will house 6.5 million tonnes of long-lived radioactive tailings, as well as a large portion of the Rabbit Lake site's more conventional hazardous waste for thousands of years into the future.¹⁸ The southern portion of this tailings facility has been graded and was covered with 1 metre of till in 2012. Placement of hazardous waste is ongoing in the northern portion of the facility, where a 0.3 metre till cover is to be put in place in 2013.¹⁹ Two spillways for removing precipitation have been incorporated into the design.

We note a 1 metre vegetated till cover is expected to reduce infiltration into the tailings by approximately half (85mm/year versus 160mm/year).²⁰ This is an improvement, but insufficient given the heavier rainfall events and increased annual precipitation that can be expected in the future. Cameco also needs to ensure the cover is thick enough to guard against burrowing animals, and to guard against chemical and biological processes acting on the cover system.

The Saskatchewan Environmental Society urges CNSC to require Cameco, as a condition of re-licensing, to plan for a more robust tailings cover for the Above Ground Tailings Management Facility, that will be able to withstand thousands of years of wind erosion, frost heave, snow melt, and exceptionally heavy precipitation events. As a starting point, any reactive waste materials should be encapsulated with inert waste. We would like to see a cover that is thicker (in the 2 metre range), includes a clean layer of compacted waste rock, is well vegetated (with a good diversity of vegetation), is designed to reduce wind velocity, and that builds in, where practical, extra armoured, meandering drainage paths, in addition to the two spillways that currently exist.

We also note that Cameco estimates that a final cover will be placed on the Above Ground Tailings Management Facility in 2047 and an application for designation of the facility as "undeveloped" will occur in 2049.²¹ **A two year period after completion of the cover is insufficient to assess whether such an application is in order. Instead, CNSC should signal to Cameco that it should expect to monitor its tailings management facilities and their impacts for at least 30-40 years after decommissioning, before any applications are made for undeveloped status and Institutional Control.**

¹⁷ Preliminary Decommissioning Plan for the Rabbit Lake Operation, March 2013, p. 6-5 and page ES i.

¹⁸ 2012 Annual Report for the Rabbit Lake Operation, p. 3-37

¹⁹ Preliminary Decommissioning Plan for the Rabbit Lake Operation, March 2013, p. 7-1.

²⁰ Rabbit Lake 2012 Annual Report, p. 3-40.

²¹ Rabbit Lake Operation Site Wide Reclamation Plan 2013, Figure 6.

9. Suggestion To Examine the Potential for Disposing Of Additional Mineralized Waste Rock In the Eagle Point Underground Mine Upon Decommissioning

At this point, Cameco is planning to use waste rock that originated from Eagle Point to backfill the Eagle Point mine access ramp to prevent access. (Some of this waste rock may also be used for general reclamation or may not be moved, but rather decommissioned in situ.)²²

The underground workings at Eagle Point may prove to be a useful area for other mineralized waste rock disposal, and we suggest this as another option to keep in mind. (This suggestion was originally put forward by Environment Canada during the FEARO Panel hearings on the Eagle Point, A Zone and D Zone mine.)

10. Need For Cameco To Incorporate Into Its Overall Decommissioning Objectives A Firm Commitment To Meet Saskatchewan Surface Water Quality Objectives Around Its Waste Rock Piles

Cameco presents its decommissioning objectives and decommissioning criteria on page 2-1 and 2-2 of its Preliminary Decommissioning Plan.²³ We suggest that Cameco should take full account of the Saskatchewan Guidelines for Northern Mine Decommissioning and Reclamation, and therefore add an important objective (or criteria) to its list, namely making a commitment to consistently meet Saskatchewan Surface Water Quality Objectives around all its waste rock piles.

The Saskatchewan Guidelines for Northern Mine Decommissioning and Reclamation currently state: "The quality of water running off waste rock piles should meet Saskatchewan Surface Water Quality Objectives."²⁴ This guideline should thus become a clearly stated and consistent Cameco decommissioning objective for Rabbit Lake waste rock; the SSWQO should not be replaced by weaker site specific objectives.

11. CNSC Should Seek Independent Advice On The Best Approach For Decommissioning The B-Zone Pond (B-Zone mined-out pit) And Should Ensure That The

²² Preliminary Decommissioning Plan for the Rabbit Lake Operation, March 2013, p. 6-4.

²³ Cameco's decommissioning 'objective' with respect to water quality is currently stated as: "Manage surface water and ground water flows to mitigate contaminant transport outside the development footprint." (Preliminary Decommissioning Plan for the Rabbit Lake Operation, March 2013, p. 2-1)

Cameco's decommissioning 'criteria' with respect to surface water quality is currently stated as follows: " Releases from decommissioned components to surface water will be limited to a reasonable extent in order to comply with the Saskatchewan Surface Water Quality Objectives (SOME 2006) or site specific water quality objectives at each designated closeout objective reference point." (Ibid., p. 2-2.)

²⁴ Guidelines for Northern Mine Decommissioning and Reclamation, November 30, 2008. Refer to section 3.2.3 Waste Rock Piles.

Northern Community Of Wollaston Lake And The Hatchet Lake Denesuline First Nation Are Consulted

The B-Zone pond continues to struggle to meet Saskatchewan Surface Water Quality Objectives. CNSC staff reported in 2011 that nickel and arsenic concentrations in the flooded pit were still significantly above Saskatchewan Surface Water Quality Objectives. (Nickel levels were 0.096 mg/L compared to the SSWQO guideline of 0.025 mg/L. Arsenic concentrations were at 0.009 mg/L compared to the SSWQO guideline of 0.005 mg/L.)²⁵ In 2012 Cameco reported that pit surface water quality samples for nickel and arsenic continued to significantly exceed SSWQO.²⁶ However, Cameco has seen a declining trend in contaminant levels over time, and hopes to see additional progress in the next few years.

Other than flooding the B-Zone pit, no reclamation activities or physical decommissioning activities have been done by Cameco on the B-Zone pond.²⁷ Nor does it appear that any are planned; rather Cameco simply hopes to remove sheet piling and breach the dyke in coming years, and allow the mined-out pit to mix with waters in Collins Bay.²⁸ Cameco anticipates this can occur by 2015.²⁹

SES notes that prior to decommissioning the A Zone pit and the D Zone pit, both pits were backfilled with clean waste rock and a 4 metre thick clean sand/till cap.³⁰ Only then were the pit dykes breached.

SES thus notes that the current decommissioning plan for the former B-Zone pit appears to be far less ambitious. Complicating matters may include possible issues of safety if the pond now covering the pit was to be pumped down. On the other hand, SES urges CNSC to be cautious that a precedent is not set for Cameco to embark on a less ambitious decommissioning plan for the B Zone pit than was implemented for A and D Zone.

SES observes that one of the 'alternative' decommissioning options Cameco has identified is backfilling the B-Zone Pond using the B-Zone Waste Rock Pile.³¹ SES suggests a preferable option might be backfilling the B-Zone Waste Rock Pile with clean, non-mineralized waste rock, which is certainly available on site. This is one of the options that deserves careful examination.

²⁵Cameco Mid-Term Report on the Safety Performance of the Rabbit Lake Operation, May 24, 2011 (Submitted by CNSC staff), page 28.

²⁶ 2012 Annual Report for the Rabbit Lake Operation, p. 6-8 and Table 6.8.2.1

²⁷ Preliminary Decommissioning Plan for the Rabbit Lake Operation, March 2013, p. 3-12.

²⁸ Ibid, page 4-6, Table 4.7.1

²⁹ Ibid, page 5-1.

³⁰ Preliminary Decommission Plan 2013, page 3-9 and Rabbit Lake Operation Site Wide Reclamation Plan 2013, pages 5-24 and 5-46.

³¹ Ibid, p. 4-6, Table 4.7:1 Alternatives for Rabbit Lake Decommissioning.

We therefore are of the view that it is premature for CNSC to grant approval for Cameco to remove a portion of the dyke and allow reincorporation of the B-Zone Pond with Collins Bay. Rather CNSC should obtain independent advice on decommissioning the B-Zone pond with a report that is then circulated to Cameco, the Hatchet Lake Indian Band, the community of Wollaston Lake, the North Saskatchewan EQC and the Saskatchewan Environmental Society and that is posted on the CNSC web site. The report should focus on how best (including worker safety considerations) to achieve ALARA decommissioning principles in the B-Zone Pond before it is permanently opened up to Collins Bay waters. Interested parties should then be brought together for a discussion on the report's findings, after which final decommissioning decisions can be made by CNSC in concert with Cameco.

12. SES Endorses Cameco's General Approach For Managing The Rabbit Lake In Pit Tailings Management Facility, But Seeks A More Robust Cover On The Facility And A Much Longer Period For Monitoring

The Rabbit Lake In-Pit Tailings Management Facility (RLITMF) has had 7.95 million tonnes of radioactive tailings deposited in it since 1984. This radioactive legacy will extend tens of thousands of years into the future.

Cameco has worked hard to address challenges with the RLITMF, but it must be recognized from the outset that decommissioning a pervious surround facility is still an experiment of sorts – there is no historical experience to go on. Predictions are thus largely based on modeling. As such, it will be many decades after decommissioning is complete before we can tell with reasonable confidence whether there will be substantial contaminant movement beyond the tailings management facility, and before we can be certain that groundwater flow is through the pervious surround, and not through the low permeability tailings. Cameco acknowledges that some contamination of groundwater will occur via diffusion and predicts this contaminant load from the RLITMF will be carried toward Upper Link Lake.³² Because it will take several decades to fully assess the impacts of the RLITMF, both CNSC and Saskatchewan Ministry of Environment should be in no hurry to approve the RLITMF for Institutional Control or to endorse Cameco's proposed decommissioning schedule for the facility. **Cameco proposes to monitor groundwater quality for only up to 10 years.³³ We recommend that CNSC deem this to be insufficient.**

Cameco's schedule for the RLITMF estimates placement of a till cover on the tailings in 2044, and an application for the site to be considered as "undeveloped" by December 2049.³⁴ **Again, we suggest that CNSC signal now that this is an insufficient time period (5 years) in which to be in a position to assess impacts and grant such an application. One example that underlines the problem is looking at uranium concentrations in the Link Lakes and how they are expected to change in the decades ahead. At first they**

³² Rabbit Lake Operation Site Wide Reclamation Plan 2013, p. 5-78.

³³ Rabbit Lake Operation Site Wide Reclamation Plan 2013, p. 5-79.

³⁴ Rabbit Lake Operation Site Wide Reclamation Plan 2013, Figure 6, p. 136.

are expected to decline, but then uranium concentrations in the Link Lakes are expected to rise again after about 40 years because of the impact of the RLITMF and nearby waste rock piles.³⁵

However, SES does endorse Cameco's recent decisions and near term management plans for the RLITMF, including its decision to create a 1.3 metre pond on the tailings surface (as a way of minimizing freezing of the tailings surface), its aim to avoid entry into the tailings management facility during times of heavy rainfall,³⁶ and its plans for actively thawing tailings in the facility to allow those tailings to properly consolidate, once RLITMF operations are complete. It is unfortunate that a significant portion of the tailings remain frozen. Upon decommissioning, it is essential that areas of ice not be allowed to remain in the RLITMF, since this could ultimately have a detrimental effect on surrounding water quality by expelling contaminated pore water, as the tailings thaw.

SES also supports Cameco's general plan to place some mineralized waste rock in the Rabbit Lake In-Pit Tailings Management Facility, once tailings placement is complete.³⁷ We are also pleased to see plans for a 2 metre thick drainage cover over the waste rock.

We note Cameco plans a one metre thick till cover followed by revegetation of the pit area. Again, we urge CNSC to consider the need for a thicker till cover, in light of the issues we have raised previously.

13. Application of Permeable Reactive Barrier Technology on the Rabbit Lake Site

Numerous studies carried out by, or for, the United States Environmental Protection Agency over the past ten years indicate the serious potential for management of uranium contamination in flowing surface or ground water using vertical permeable reactive barriers. In some cases, uranium concentrations have been reduced by 99%.

We encourage CNSC to ask Cameco to prepare a plan for testing PRB technology in numerous locations on the Rabbit Lake site. Examples for potential application include: Effluent Creek, Horseshoe Pond, Rabbit Creek, Link Lakes, drainage ditches around waste rock piles, drainage at Airport Road, surface waters downstream of the Above Ground Tailings Management Facility, and as part of waste rock pile covers and tailings covers. PRB technology could be very helpful in circumstances on the Rabbit Lake site where it is important to isolate the sediment storage of contaminants from the overlying water, and could be applied to organic, heavy metal and radionuclide contaminants.³⁸ In the case of Horseshoe Creek, where Cameco expects the accumulated contaminant mass in the creek ultimately to be released over a period of

³⁵ Rabbit Lake Solution Processing Plant EIS (2008), p. 6-217 and Figure 6.3.3.5a.

³⁶ Rabbit Lake 2012 Annual Report, p. 3-33.

³⁷ Rabbit Lake Operation Preliminary Decommissioning Plan, March 2013, pages 6-3 and 6-4.

³⁸ "Options For Remedial Technologies", prepared by Dr. G Laksham of Ecosystem Technologies and submitted by the Saskatchewan Environmental Society as part of our Beaverlodge submission, March 2013.

years, ³⁹ PRB technology could be helpful in capturing these contaminants and thus reducing their impact on Hidden Bay. We believe this passive, in situ technology is an excellent option to treat contamination problems at a reasonable cost.

Other Observations

We note that the last State of the Environment Report for the Rabbit Lake site (2005-2009) found high measurements of molybdenum, nickel and other constituents at the most upstream monitoring station on Collins Creek. SENES, who prepared the report, raised the possibility that this could be as a result of the influence of the McLean Lake operation.⁴⁰ Has this possibility been followed up on by CNSC staff?

Finally, we wish to express concern about Cameco's proposed period for "transitional monitoring" – monitoring that is conducted "post active decommissioning" to confirm decommissioning criteria are met and that the site is in stable or in improving condition. Cameco proposes a transitional monitoring period of 10 years, after which application would be made for Institutional Control.⁴¹ We urge CNSC to instruct Cameco that this is an unrealistically short period of time. The real test of the impact of any uranium mine/mill operation on the environment comes only after the pump and treat system is turned off. Many decades are then required to even begin to properly assess impacts.

³⁹ Rabbit Lake Operation Site Wide Reclamation Plan 2013, Section 5.17.4. By way of background, Horseshoe Creek flows 9 km from its headwaters to the outlet in Hidden Bay (State of the Environment Report, Senes (2010), p. 2-2.

⁴⁰ Rabbit Lake Integrated Environmental Risk Assessment and State of the Environment Report 2005-2009 (Prepared for Cameco by SENES Consultants Ltd., December 2010) Refer to Executive Summary.

⁴¹ Rabbit Lake Operation Preliminary Decommissioning Plan, March 2013, p. 13.1.



Saskatchewan Environmental Society

Prepared for submission to the Canadian Nuclear Safety Commission

by Ann Coxworth and Peter Prebble
of the Saskatchewan Environmental Society

RECOMMENDED NEW CNSC CONDITIONS ON CANADIAN SALES OF URANIUM

**Submitted by the Saskatchewan Environmental Society as an addendum to its
submissions to the CNSC on re-licensing of the Key Lake, McArthur River and
Rabbit Lake operations**

August 2013

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The Saskatchewan Environmental Society has serious concerns about the international nuclear fuel cycle, and the risks it poses to human welfare and our environment. Here we focus on just two of our specific concerns that are directly related to the licence applicant, Cameco, and that pertain directly to the upcoming licence period.

Review of policy following the Fukushima Accident

Following the 2011 Fukushima accident, CNSC asked Cameco to review lessons learned from the 2011 Japanese earthquake.¹ This review was wisely requested by CNSC but was, in our opinion, of insufficient scope, since it was focused on Cameco facilities, to the exclusion of Cameco marketing practices.

Cameco had been an important supplier of uranium to the Fukushima Daiichi nuclear power plant, so fission products from uranium of Saskatchewan origin are now part of the contamination problems the Japanese are struggling to address.

One clear lesson from Fukushima is that nuclear power stations depend on electricity to be available to run cooling pumps, even when the reactor has been successfully shut down. If those cooling systems are unavailable because of a loss of electricity and back-up electricity, as was the case at Fukushima, the uranium fuel bundles can reach temperatures of over 2,800 degrees Centigrade within a few days and melt down, releasing a vast store of dangerous radionuclides.

A second lesson is that the consequences that flow from a nuclear accident of this nature are very long lasting. In the case of Fukushima, approximately 80,000 people will probably never return home. Moreover, the accident exposed a spent fuel bay to the outside environment after a hydrogen explosion blew off part of the reactor building, posing significant new risks in the event of another earthquake.² Meanwhile, cooling the stricken reactors at Fukushima still requires injecting thousands of litres of water into the reactors each day, and this process is generating tens of thousands of tonnes of contaminated water. At the time of writing, the storage tanks in which that contaminated water is held have begun leaking. In August 2013 Tokyo Electric Power Company acknowledged that over 300 tonnes of this highly toxic water has already leaked, and the problem is likely to become more serious.³ Not surprisingly, financial costs associated with the Fukushima accident are now expected to exceed 200 billion dollars.

A third lesson from Fukushima is how much worse the consequences of the accident could have been. Mercifully, Japan's citizens were spared the full impact of the radioactive releases. Given the prevailing winds and the fact that the Fukushima Daiichi plant is adjacent to the ocean, the majority of radionuclides were blown out to

¹ Section 4.7 Mid-Term Report on the Safety of the Rabbit Lake Operation, May 24, 2011

² Nuke dangers nowhere near resolved: says ex-Prime Minister Kan's crisis adviser" by Reiji Yoshida, *Japan Times*, February 8, 2012. "Japan Admits Nuclear Plant Still Poses Dangers" by Hiroko Tabuchi, *New York Times*, March 29, 2012.

³ "Toxic Fukushima fallout threatens fishermen's livelihoods", *The Guardian*, August 9, 2013.

sea.⁴ Moreover, 3 of the 6 reactors at the Fukushima Daiichi site were out of service at the time of the accident, because of regularly scheduled maintenance, and were thus spared a meltdown.

Given Cameco's role as a supplier of the Fukushima Daiichi nuclear power plant, one would hope these lessons will have consequences for the way in which Cameco markets uranium in the future, but to date there is no sign of that.

In the view of the Saskatchewan Environmental Society, **one logical policy change would be for the CNSC to prohibit Canadian companies from selling uranium for use in nuclear reactors that are located in earthquake and tsunami zones, since serious reactor accident risks in these zones are clearly higher.**

We recommend that CNSC make establishment of such a policy a condition of renewal of the licences for Key Lake, McArthur River and Rabbit Lake.

Planned Uranium Shipments to India

Cameco is actively negotiating uranium sales to India and it is reasonable to expect that a growing portion of the uranium processed at and transported from the Key Lake mill and the Rabbit Lake mill over the next decade will make its way to utilities in India. This represents a major change in Canadian uranium export policy and a major change in Cameco's uranium marketing practices.

The Saskatchewan Environmental Society does not view this change favourably. Sales to India are highly objectionable because India steadfastly refuses to sign the Nuclear Non-Proliferation Treaty. That Treaty seeks to prevent the spread of nuclear weapons in the world, and has the support of 190 nations that have both signed and ratified it.

The Nuclear Non-Proliferation Treaty has the largest adherence of any arms control agreement in the world. In fact, only a few notable countries have either not signed or have withdrawn from the Treaty. These include India, Pakistan, Israel and North Korea. The most notable signatory country currently in violation of the Nuclear Non-Proliferation Treaty is Iran. From a uranium marketing point of view, this was hardly a large exclusion list for Cameco to live with.

The fact that Cameco has actively pursued a policy change to market to a country that refuses to sign the Nuclear Non-Proliferation Treaty does not reflect well on Cameco's judgment. In 1974, four years after the Nuclear Non-Proliferation Treaty came into force, India's government used imported Canadian nuclear technology in developing its first atomic bomb. In the intervening period, India has been building

⁴ A. Stohl et al. "Xenon-133 and caesium-137 releases into the atmosphere from the Fukushima Dai-ichi nuclear power plant: determination of the source term, atmospheric dispersion, and deposition, *Atmospheric Chemistry Physics Discuss.net*, 11, 28319-28394.

ever larger atomic bombs and delivery systems. This includes development of hydrogen bombs in recent years. Today, India has at least 80 nuclear weapons.⁵

The Saskatchewan Environmental Society understands that Cameco's uranium shipments to India will go to nuclear power facilities that are subject to International Atomic Energy Agency oversight, but this misses a fundamental point. The risk is not that India will use imported uranium from Saskatchewan to build nuclear weapons, but rather that large quantities of uranium from Cameco's Saskatchewan operations will help "free up" India's government to more easily utilize its small supplies of domestic uranium for expanding its atomic arsenal. (If the Indian government wishes, those domestic supplies will now no longer be needed for civilian electrical production.)

We recommend that CNSC reconsider allowing Cameco's planned sales to India while there is still time to do so. **We also recommend that a policy to prohibit sales of Canadian uranium to any country that has not signed the Nuclear Non Proliferation Treaty, or is not in compliance with the Nuclear Non-Proliferation Treaty be established. We recommend that CNSC make establishment of such a policy a condition of renewal of the licences for Key Lake, McArthur River and Rabbit Lake.**

Concluding Comments

It is Cameco's uranium marketing practices that have badly shaken our confidence in the company's judgment. On the basis of local practices at the Key Lake, McArthur River and Rabbit Lake sites, licence renewal for all 3 sites is justified, subject to the new conditions we have recommended. However, we cannot support such licence renewal without commitment that Canadian uranium will not be sold to any non-signatory of the Nuclear Non-Proliferation Treaty or for use in reactors in earthquake or tsunami prone regions.

⁵ 'Status of World Nuclear Forces 2012', Federation of American Scientists.