



ICUCEC's comments re--the Draft "Scope for Assessment of the Decommissioning of the Cluff Lake Uranium Facility," August 31st, 1999--CEAA Comprehensive Study for the Long-Term--Effects for Future Generations

I. Introduction

Decommissioning a high-grade uranium mine is vitally important to future generations because of the long half-lives of alpha-emitting Thorium-230 and Radium-226. These radionuclides will be generating four more alpha-emitters for many thousands of years. During operations, these alpha-emitting radionuclides can (to an extent) be controlled. But these controls (pumping and treatment) cannot be continued for the necessary thousands of years. How these radionuclides will be contained by natural means for the necessary thousands of years depends upon many climatic and geological uncertainties. There are also many biological uncertainties as to how alpha-irradiation affects the terrestrial and aquatic biota. These could be understood better if more scientific investigative work were to be conducted.

If these alpha-emitting radionuclides, at small dose rates, escape into the biota in the long-term this will potentially result in uncontrolled 'genetic modification' spreading throughout the food chain.

The InterChurch Uranium Committee Educational Co-operative (ICUCEC) believes that it is the alpha-emitting radionuclides getting into the biota that may result in potentially significant long-term effects from the decommissioning of Cluff Lake because the alpha-emitting Polonium-210 will potentially affect genetic cells, chromosomes, DNA, etc. in plants and

animals.

P. Thompson and L. Chamney provided a copy of Canada's Environmental Protection program in an Annex to the IAEA TECDOC-1091, July 1999. This Canadian document gives definitions regarding a "unreasonable risk" that is to be avoided. It describes five different degrees of effects: no effect; negligible effect; minor effect; moderate effect; and major effect. The first three it equates with "no unreasonable risk." It describes "moderate effect" as:

"one affecting a portion of a population which may result in a change in abundance and/or distribution over one or more generations of that population or any population dependent on it, but does not change the integrity of any populations as a whole . . ."

We understand this to mean that a "moderate effect" is likely to be an "unreasonable risk." Further, we interpret that as meaning that there will be genetic effects. We see that the IAEA TECDOC-1091 (page 8) says that:

"Genetic damage can be measured in organisms at dose rates well below those known to impair reproduction . . . Some studies show that effects expressed at the population level from genetic changes are far more complex than would be suggested by the simple dose of deleterious genes through natural selection . . ."

Two 1994 studies are cited for this information.

A "moderate effect" in the Thompson and Chamney paper, they say, "would get further assessment."

ICUCEC questions whether this is sufficient when considering the long-term consequences of decommissioning. We believe that no work should be allowed to go ahead if a "moderate (genetic) effect" is predicted until scientific investigations regarding genetic effects caused by alpha radiation have been conducted and seriously considered by the public.

From studies such as NCRP-104, the 1966 L. D. Samuels study of the results of Polonium-210 on mouse ovaries, etc., we have deduced that Po-210 is likely to give "moderate effects" in the long-term to plants and animals that take it in. We question the assumption that because there is no evidence to be observed in the field that genetic harm from alpha radiation can be ignored.

ICUCEC cannot comprehend why tests on genetic effects from alpha radiation have not been undertaken. There are alpha-irradiated lakes in Saskatchewan. And apparently, the technology is there because a number of tests have been done on aquatic organisms inhabiting beta- and gamma- irradiated lakes.

We believe that it is urgent that genetic tests on aquatic organisms in alpha-irradiated lakes be undertaken in order to provide this evidence.

The 1992 NCRP-109 study (page 75) leads us to believe that insufficient data in 1992 renders it impossible to calculate the internal dose from alpha-irradiation on biota. NCRP-109 therefore recommends multiplying the external dose and the beta dose by 20. This appears to be confirmed again by the Cogema investigations of the 1996-98 Snake Lake spill.

If the above reasoning is correct about Canada's present lack of evidence regarding long-term impacts, it therefore is not possible to state confidently that [CEAA section 20(1)(a)]: the proposed decommissioning plan "is not likely to cause significant adverse environmental effects"; nor vice versa [Section 20(1)(b)]: that "it is likely to cause significant effects." Thus, we would suggest that Section 20(1)(c)(i) would be appropriate, which says:

"where it is uncertain whether the project . . . is likely to cause significant adverse environmental effects . . . the responsible authority shall refer the project to the Minister for referral to a mediator or a panel review . . . "

"Environmental effect" is defined in Section 2 as: "(a) any change that the project may cause in the environment" and the act includes a number of changes that do not appear to be exhaustive. We suggest that changes to genetic cells from long-lived, alpha-emitting radionuclides could be included in this definition of an "environmental effect." We would further suggest that it is not possible to mitigate genetic harm caused by internal alpha-irradiation since it is not likely that this impact will be repaired internally.

The CEAA Comprehensive Study List (Part VI, Section 19) includes:

"The proposed decommissioning or abandonment of: (b) a uranium mining facility on a site within the boundaries of an existing licensed uranium facility, if the proposal involves processes for the milling

or uranium tailings management that are not authorised under the existing license."

Therefore, there are two triggers in this decommissioning case that call for a comprehensive study. The difference between them appears to be that Section 20(1)(c)(i) directs the responsible authority to refer the study to the Minister of the Environment for referral to a mediator or panel review; whereas, the present government directive (August 31, 1999) says it will be sent to the Minister, and that it may be referred to a panel review.

CEAA Section 16(2)(d) says (in part):

"Every comprehensive study of a project and every mediation and assessment by a review panel shall include the consideration of the following factors: . . . (d) " The capacity of renewable resources that are likely to be significantly affected by the project to meet the needs of the present and those of the future."

"Renewable resource" is not defined in Section 2 (however, we did ask an officer in the Saskatoon office a few months ago whether "the biota" would be considered a "renewable resource" and we received an affirmative answer).

If the genetic cells in plants and animals will be adversely affected in the long-term by some of the unfortunate things that have taken place at the Cluff Lake site since 1980, and by what will take place after decommissioning, these "renewable resources" are likely to be "significantly affected to meet the needs of the present and those of the future."

Some of the unfortunate things that have happened at the Cluff Lake site since 1980 include:

- November 1981, spill of a number of barrels containing "leach residue" (Ra-226 @ 6,700 Bq/g) adjacent to the tailings pond. In the Nov 3 provincial Inspection Report, Tim Meadley, Amok's Occupation, Health and Safety officer, reported that the leach tails have a radioactivity level similar to 300% uranium ore;
- Rubber tired vehicles drove through that spilled material, presumably spreading this highly radioactive material further afield. (The spilled material on the rubber tires was reported to be 20 milliRem on contact);
- April 1983 about two tonnes (six more barrels of this highly radioactive leach residue materials) were spilled on the edge of the storage pad;
- There were leaks from these leach residue barrels on the

pad from 1980-1988. The April 26 Inspection Report said: liquid collected on the plastic that was under some of the barrels tested 90 Bq/Litre Ra-226. Many of the barrels were not on plastic;

- 1987 and 1988, the barrels were transported to the mill.

We suspect that some of that leaked liquid could have contaminated the ground on the transport route;

- The leach residue was blended with low grade ore, recycled and gold was extracted 1987 and 1988;

- The enriched tailings and the barrels were placed in the tailings pond @ 300 Bq/gram; 1996-1998, Radium-226 @ 5 Bq/gram to 17 Bq/gram was spilled into Snake Lake (184 million litres). Thus both Snake Lake and the terrestrial area (80 metres) between the end of the diversion pipe and Snake Lake were contaminated;

- The open pits and underground mines from 1980-1999 remain problematic. Uranium ore, with a 2% concentration in a partially mined-out underground mine is to be left unmined;

- There are waste storage stockpiles at each pit. Amok intentionally did not follow the regulators' recommendation that no waste containing over 0.03% uranium should be put on these stockpiles;

- etc.

Since much of the contamination from the spills and from the unlined waste rock piles might have gotten into the soil, and some into the leaves, stems or bark, monitoring of living plants(whether natural or seeded) in extensive areas of the site needs to be part of the decommissioning task, ICUCEC believes.

The leach residue storage pad soil has been put into the TMA and the area has been reseeded. Contaminated areas have been tested for gamma radiation.

We believe the soil and living plants (whether natural or seeded) should be tested for internal Ra-226, Pb-210 and Po-210 at all the contaminated terrestrial and aquatic locations--invertebrates and fish also.

If Canada fails to do such extensive monitoring, "the best country in the world" will only be doing a cover-up job in order to make the general public believe that it has all been cleaned up and there is nothing more to worry about.

Thus, ICUCEC believes that the scope of the assessment for this decommissioning project at the Cluff Lake site should include monitoring for Ra-226, Pb-210 and Po-210 in living plants in all the contaminated areas. The proposed scoping draft has called for some monitoring of VECs in contaminated areas. As we say below, we would like to see this monitoring of plants and invertebrates be added to the monitoring of invertebrates and fish. And we

would like to see the metals and radionuclides specified.

We believe the results of this monitoring should be compared to the Cluff Lake Baseline Study that was prepared by Patricia Tomes in 1979. We suggest that this monitoring study should also serve as a 1999 Baseline study with which future monitoring results can be compared.

Another area of potential contamination in living plants is "a transect downwind of the mill" that was mentioned in the Cluff Lake 1992 Status of Environment report by Stella Swanson as having relatively high Ra-226 and Pb-210 in a number of different plants. On page 4.58 (1992 Status of Environment report), Swanson said:

"Sheard et al (1988) compared the radionuclide levels in a variety of species among several sites in the Cluff Lake area. The only site with levels above baseline was 'the mill site', located 500 metres downwind of the mill. Plants at this site had significantly higher Lead-210 and Radium-226 and Uranium levels than baseline . . . Jackpine, blueberry, alder, cranberry and Cladina mitis had from 4 to 310 times (Ra-226 and Uranium) levels than found in plants at other Cluff Lake sites . . .

ICUCEC has never seen any CRI or Cluff Lake follow-up report regarding this revelation, whether or not there has been

an attempt to clean this up. Therefore, we will be watching for this during this assessment. We regretfully note that measurements of Polonium-210 in these plants were not given in either the 1992 Status of Environment report or in the 1979 Baseline study. Therefore we believe that Po-210 in plants should receive extensive monitoring.

Such monitoring will cost money and time. It may be that the proponent will argue against such extensive monitoring. We hope the responsible authority will stand firm about this. If Saskatchewan and Canada, and the proponents, are prepared to take the risk of developing high-grade uranium before having acquired evidence--through scientific testing--regarding what the genetic effects from alpha-emitting long-lived radionuclides (from the U-238 decay series) are likely to be, these governments and the proponents who take up this offer, must be prepared to pay for the necessary monitoring. The effects of the environmental damage are likely to be passed on to future generations.

At Cluff Lake, a number of serious mistakes have been made by both the governments and by Cogema and Amok. The fact that Cogema has so recently (1996-1998) made such a serious mistake points to the fact that it does not appear that this French company has learned by their previous mistakes. Thus, our confidence is not very high.

Our conclusion regarding the scope for the assessment of the decommissioning of the Cluff Lake uranium complex is that there needs to be added to the government of Canada's August 31, 1999 list of projects: data collection of internal Ra-226, Lead-210 and Polonium-210 at all the contaminated areas since 1980 in plants and animals in the ecosystem and in the soils and sediments (rather than restricted to VECs and fish; and in all areas that were measured during the 1979 Baseline study; and furthermore, in all areas that have been contaminated by spills or accidents since 1980.

We believe that this is likely to graphically highlight the need for governments and proponents to obtain evidence of genetic impacts from alpha-emitting radionuclides. We believe this could be carried out through licensing requirements.

## II. Section 16(2)(d) CEEA Act

We have already quoted subsection 16(2)(d) that says that a comprehensive study should consider the capacity of the existing biota to meet the needs of the present and those of the future.

AECB, the responsible authority, has indeed included the monitoring of contaminants in the food chain in their Draft "Scope." However, ICUCEC finds that the August 31, 1999 Draft "Scope for Assessment" has put greater stress on today's human values, such as commerce and recreation (anthropocentric values), than upon the potential long-term ecological values. Subsistence will always be a high priority, but we believe that the possible long-term ecological problems from alpha-irradiation also has go be given a high priority.

Sections 2.1 and 4.1 of the AECB "Scope" we find to have a strong anthropocentric lean. There is some direction regarding the ecosystem in Section 4.5, which says:

"Relevant information on aquatic and terrestrial ecology must be included in the E.A. "The E.A. should include information on: the numbers and population characteristics of potentially affected fish species, the location of sensitive habitats,

winter kills; invertebrate fauna (species richness and diversity) and the possible effects on aquatic resources . . . "CRI must gather and present those data that will directly assist in substantiating the decommissioning performance objectives. This will include the sampling of sediments, fish, aquatic macrophyte, and an assessment of invertebrate fauna (species richness and diversity) at locations that may be affected. Fish should be recently collected from potentially affected lakes, and tissues analysed for contaminants, particularly heavy metals and radionuclides. Fish tissues analysed should include fish kidney, liver and gill for purposes of assessing implications to both fishes and the consumers of fishes. "CRI should present relevant data "on potentially affected soil and vegetation, including rare and endangered flora . . . "

Information on wildlife includes "species composition changes since the inception of mining."

We see 4.5 as being strongly anthropocentric for a number of reasons that the following questions may make clear:

- What is considered to be "relevant information"?
- CRI must collect data that will help substantiate "decommissioning performance objectives." Where does one find these "objectives"?
- Would we be right to interpret 4.5 as meaning that the only organisms to be analysed for heavy metals and radionuclides would be fish?
- Would "relevant data on potentially affected soil and vegetation" include an analysis of internal Ra-226, Pb-210 and Po-210?

ICUCEC would like to see more of an 'ecocentric' approach in this Environmental Assessment statement. We agree the subsistence must be given a high priority both for the present day and for the future. We would like to see more stress put on the long-term environment.

The International Atomic Energy Agency (IAEA) has recently (July 1999) put out a Technical Report for discussion, based on studies that have more recently been done that tend to confirm (What IAEA says "is coming to be recognized") that "a healthy environment is essential to the well-being of humans." With the long half-lives of Th-230 and Ra-226, ICUCEC believes we must consider the well-being of humans in the centuries to come as a consequence of the twenty years of mining at Cluff Lake.



And that this means we must consider the consequences to the environment of the alpha radionuclides that have escaped into it during mining and that will continue to escape into it from the TMA and the waste-rock piles. Because these contaminants are radioactive they will continue for thousands of years to produce more shorter-lived radionuclides.

Below, we enlarge on these thoughts and concerns.

### III. IAEA TECDOC-1091

If ICUCEC understands correctly, the ICRP and the IAEA, as well as UNSCEAR, are international agencies that recommend national standards on nuclear matters that are based on serious and updated studies. National governments appoint members to sit on these international bodies, but national governments are not obliged to follow the recommendations when they set their own standards.

Many countries follow the ICRP recommendations, including Canada. However, the ICRP has not made any specific recommendations regarding the protection of the biota. Indeed, their philosophy in this regard is to consider that:

"The standard of environmental control needed to protect man to the degree currently thought to be desirable will ensure that other species are not put at risk. Occasionally, individual members of non-human species might be harmed, but not to the extent of endangering whole species or creating imbalance between species."  
(ICRP-60-1991)

Since the 1972 United Nations Conference in Stockholm; 1976 in Vancouver; 1987 World Commission Report on Environment and Development; Rio de Janeiro Conference 1992; 1998 Kyoto Conference; etc., national governments have come to accept the importance of the protection of the environment from industrial development and have set laws and regulations accordingly. Therefore, a number of countries who are developing nuclear and uranium industries have established laws and licensing procedures in order to protect human health from the consequences of these radiological developments.

The problem for jurisdictions such as the province of Saskatchewan, which is developing grades of uranium ore far higher than anywhere else in the world, in northern, sparsely populated areas, there are few

guidelines or recommendations to follow for the protection of the biota from the eight alpha-emitting radionuclides in the U-238 decay series. These are 'natural' radionuclides in very small quantities. Mining high grades of uranium creates many more of these 'natural radionuclides' in the environment.

The July 1999 TECDOC-1091 Discussion Paper questions whether the ICRP philosophy that 'as long as humans are protected the environment will not suffer' is legitimate in all circumstances. IAEA says: "reliance on this (the ICRP philosophy) may not be adequate for all possible space or time scale nor for all circumstances."

ICUCEC finds this to be very relevant to the Cogema proposal to decommission the Cluff Lake facility, which is likely to have a serious impact on the long-term wide space-scale (carried by birds, insects, wind and water). We would suggest that in the case of decommissioning Cluff Lake, with high-grade, alpha-emitting uranium decay series radionuclides, that the ICRP philosophy is not adequate. This has been a very useful philosophy that has helped industry establish. But this philosophy is being questioned when considering the long-term. Thus, ICUCEC believes that the long-term/wide space-scale/high-grade/highLET/alpha-emitting radionuclides do need to be considered as a "special circumstance."

There are a number of other facts that this IAEA short document reveals (and in most cases the studies are cited) and that ICUCEC find relevant to the assessment of the decommissioning of Cluff Lake facility. Following, we give you examples that coincide with our own study:

- "the concept of 'sustainable development' places environmental protection on an equal footing with human protection on the basis that it is necessary first to protect the environment in order to protect human populations. It is therefore necessary to demonstrate protection of the environment explicitly.

OUR COMMENT: The document warns that gaining public confidence may become difficult without such explicit demonstration and may lead to legal difficulties. We endorse such a suggestion especially regarding alpha-emitting radionuclides.

- The IAEA Principle 4 deals with protection of future generations." (This) has relevance from the general point of view that detrimental effects occurring in the future should be of no less concern than such effects occurring today."

OUR COMMENT: We endorse this. In fact, we have been saying this for some time. We believe it is especially

relevant in Saskatchewan's high-grade uranium development and decommissioning on account of the long half-lives of Th-230 and Ra-226 and of the potential genetic effects. We did not see this reflected in the AECB draft.

-IAEA cites studies regarding deep sea marine fauna that could be harmed at lower doses than 1 mSv/a.

OUR COMMENT: This brings to mind the study done by Tom Gates, SERM, that found mussels in Sandy Lake that were as high or higher than 1 mSv/a. We believe that this indicates the necessity of constant monitoring and, if possible, analysis of genetic or somatic cell damage.

- IAEA reports that Agenda 21 (Rio Conference) contains specific recommendations concerning radioactive waste and the environment.

OUR COMMENT: We will be trying to follow this up. We wonder whether AECB has seen a copy of this Agenda 21 paper.

- IAEA gives as an example of an "ecologically relevant end point" for the growth and development of longer-lived plant tissues--"coniferous forests (that) can die at relatively low radiation dose rates because of reductions in photosynthetic production and growth." We are told that this was observed following the Chernobyl accident.

OUR COMMENT: This may be relevant in our case because this mine is in a coniferous forest area.

- IAEA reports that "genetic damage can be measured in organisms at dose rates well below those known to impair reproduction . . . Some studies show that effects expressed at population levels from genetic changes are far more complex than would be suggested by the simple loss of deleterious genes through natural selection." Two studies are cited. It continues: "Hence, genetic damage may need to be kept under review at radiation dose rates less than those needed to cause reproductive changes."

OUR COMMENT: This concerns us very much for the long-term contemplation for releases from the TMA from waste-rock piles, from the Snake Lake sediment, from Sandy Lake, etc. We also see this to be an important implication for Canada's definition of a "moderate effect."

-Regarding dose rates below which no detrimental effect is expected, UNSCEAR 1996 reported: "detrimental effects on the most sensitive populations would not be expected at dose rates below 1 - 2 mGy/Day for lowLET radiation." OUR COMMENT: At the Cluff Lake decommissioning, we are talking about highLET radiation, which means that the lowest dose rate at which detrimental effects can be expected would be considerably

lower than 1 - 2 mGy/Day.

-IAEA reports "there is a scarcity of data on the effects of internally deposited alpha and beta emitters on flora and fauna."

AND TALKING ABOUT UNCERTAINTIES:

- "RBE for alpha particles may range as high as 200 - 300." (two studies cited) The paragraph ends: "This might lead to the need for new dosimetric quantity for organisms other than man."

OUR COMMENT: As we have stated earlier, this makes assessing this decommissioning project very "uncertain" and therefore we believe that CEEA Section 20(1)(c)(i) needs to be followed.

-On biological surveillance this IAEA document says: "reliance solely on biological surveillance is not recommended."

In 4.5 of AECB Draft Requirements for an Assessment, "CRI must gather and present data . . . including the sampling of sediments, fish, aquatic macrophyte and an assessment of invertebrate fauna (species richness and diversity) at locations that may be affected." As we have said earlier we do not believe this is adequate.