

Potential health and psychosocial impacts of uranium development in Eeyou Istchee

**Bureau des audiences publiques sur l'environnement and
James Bay Advisory Committee on the Environment**

**Submitted by the regional Public Health Department of the
Cree Board of Health and Social Services of James Bay**

October 26, 2014.

SUMMARY

This statement is presented by the Public Health Department of the Cree Board of Health and Social Services of James Bay (CBHSSJB) in the context of the 3rd phase of the Bureau d'audiences publiques sur l'environnement (BAPE) public hearings on Uranium. It is written to share the Public Health Department's understanding of the impact of uranium mining on the population of Eeyou Istchee (EI) with regional authorities and provincial partners. The brief describes the Cree population's health status and determinants, discusses issues faced by communities related to the presence of natural uranium, and presents new concerns on potential health and psychosocial impacts of uranium development in EI.

The James Bay Cree population consists of 16,262 persons based in nine communities. The Cree face important public health challenges, such as high rates of diabetes, obesity, sexually transmitted infections and social problems, which are attributable in a large part to poor health determinants. On the positive side, few persons in EI are socially isolated and important aspects of traditional culture, like language and bush food consumption, have been retained. As well, blood levels of environmental contaminants are of little concern and zoonotic diseases are not causing significant problems. The natural presence of uranium in soil and bedrock has already been a public health issue in EI; uranium levels in the water distribution system of one community and above-normal radon concentrations in houses have been documented. The problem of water supply was solved in 2009 when the community decided to use the water from a river instead of groundwater wells. Radon measurements are still ongoing in EI.

During the BAPE hearings, concerns about the impacts of uranium development on communities and workers as well as on the environment, an essential component of the Cree vision of health, were raised. Concerning the health impacts on communities, uranium mining could increase exposure to radiation and chemicals in a population that is naturally exposed to these elements due to background concentrations. Moreover, even if

mining developments have economic spinoffs, negative impacts, such as psychological and social health problems, may outweigh the positive ones. Regarding occupational health and safety in uranium mining, workers are not exposed to higher levels of radiation because regular radiation monitoring and workplace preventive measures are now implemented in modern mines. Lastly, concerning the impacts on the environment, some presentations to the BAPE were reassuring, while others raised concerns regarding the management of waste rock and tailings and the contamination of water, fish and other wildlife.

In conclusion, the Public Health Department of the CBHSSJB is concerned that uranium development in EI might add to the significant burden of physical and social health problems already occurring in the communities. It also acknowledges the clear decision taken by the Cree Nation Government in their 'Eeyou / James Bay Cree Nation / Eeyou Itchee Permanent Uranium Moratorium' (Resolution 2014-15).

TABLE OF CONTENT

SUMMARY	2
LIST OF ABBREVIATIONS	5
PRESENTATION OF THE REGIONAL PUBLIC HEALTH DEPARTMENT OF THE CREE BOARD OF HEALTH AND SOCIAL SERVICES OF JAMES BAY (CBHSSJB)	6
INTRODUCTION	7
HEALTH PORTRAIT OF THE JAMES BAY CREE	9
HEALTH ISSUES RELATED TO THE PRESENCE OF NATURAL URANIUM IN SOIL AND BEDROCK.....	11
HEALTH IMPACTS OF URANIUM DEVELOPMENT ON COMMUNITIES	12
URANIUM MINERS' HEALTH ISSUES.....	15
POTENTIAL IMPACTS OF URANIUM MINING ON THE ENVIRONMENT	16
Contaminants in the air, water and soil near uranium mines.....	16
Contaminants in wildlife	18
Management of waste rock and tailings	19
Emergencies and climate change.....	20
CONCLUSION	22
REFERENCES.....	23
APPENDIX 1- Map of the nine Eeyou Istchee communities.	27
APPENDIX 2- Cree Nation Government in their ‘Eeyou / James Bay Cree Nation / Eeyou Itchee Permanent Uranium Moratorium’ (Resolution 2014-15).....	28

LIST OF ABBREVIATIONS

BAPE : Bureau d'audiences publiques sur l'environnement

CBHSSJB: Cree Board of Health and Social Services of James Bay

CCSN/CNSC: Commission Canadienne de Sûreté Nucléaire/ Canadian Nuclear Safety Commission

EARMP: Eastern Athabasca Regional Monitoring Program

EI : Eeyou Istchee

INSPQ : Institut national de santé publique du Québec

MSSS : Ministère de la santé et des services sociaux

mSv : milliSieverts (a measure of radiation dose)

PCB: Polychlorinated Biphenyls

SIR: Standardized incidence ratio

SRIC: Southwest Research and Information Center

**PRESENTATION OF THE REGIONAL PUBLIC HEALTH DEPARTMENT OF
THE CREE BOARD OF HEALTH AND SOCIAL SERVICES OF JAMES BAY
(CBHSSJB)**

The Cree Board of Health and Social Services of James Bay provides services to permanent and temporary residents of the nine communities (Waskaganish, Eastmain, Wemindji, Chisasibi, Whapmagoostui, Waswanipi, Nemaska, Oujé Bougoumou and Mistissini) within Health Region 18 (see figure in appendix 1). Of the 16,262 community residents, 95% are Eeyouch/Eenouch (Cree).

The regional Public Health Department of the Cree territories of James Bay within the Cree Board of Health and Social Services of James Bay has a mandate established under *An Act Respecting Health Services and Social Services for Cree Native Persons*. This includes a responsibility: (1) to inform the population on its general state of health, (2) to identify situations which could pose a threat to population's health, (3) to ensure expertise in preventive health and health promotion, and (4) to identify situations where intersectorial action is necessary to prevent diseases, trauma, or social problems which have an impact on the health of the population.

INTRODUCTION

This brief is presented in the context of the third phase of the Bureau d'audiences publiques sur l'environnement (BAPE) public hearings on Uranium, following the public sessions held in the province of Quebec during September 2014.

During this period of public information, the regional Public Health Department of the Cree territories of James Bay within the CBHSSJB attended some sessions of the BAPE uranium hearings in an effort to expand its understanding of the health risks and benefits of mining within the territory of Eeyou Istchee (EI). Documents and presentations placed on the BAPE website were also consulted. This statement is written to share the Public Health Department's understanding of the impact of uranium mining on the population of Eeyou Istchee with regional authorities such as the Cree Board of Health and Social Services, the Cree Nation Government, as well as our provincial partners such as the Ministère de la santé et des services sociaux (MSSS) and the BAPE commissioners.

A brief description of the Cree population's health status and health determinants will be presented. Then, public health issues faced by the communities related to the presence of natural uranium in the soil, such as high levels of uranium in drinking water and of radon in houses, will be discussed. Lastly, new concerns on potential health and psychosocial impacts of uranium development in EI, as learned during the course of the BAPE consultation, will be presented under three headings: impacts on the health of the communities, impacts on mine workers and impacts on the environment. Importantly, this brief is complementary to previous statements that were made during regional consultations around specific proposed uranium developments.

The natural environment is an important element in the Cree vision of health. Within this concept, the hunting and gathering of game animals, fish, birds and berries for food as well as traditional medicine, are essential and help to support identity and culture. The Cree health vision is holistic and does not only focus on the state of one's own physical

and social well-being (Adelson, 1998). There is no word in Cree that translates back to English as health. The term that is used to express wellness is miyupimaatisiun, which translates to 'living well' or 'being alive well', and is a statement of how one lives and interacts. Miyupimaatisiun takes into account all aspects of Cree life, including the affinity between the Cree person, hunting, the land, and food, protection from the cold and physical activity (Adelson, 1998). As well, indigenous people generally consider that appropriate behaviour towards all aspects of the environment is essential to ensure the maintenance of good health, as they traditionally depended on environmental resources for their survival (Wheatley, 1994).

Over the past 40 years, the health sector has come to understand that the health and well-being of individuals and communities depend on a large number of factors other than the availability of hospitals and clinics. These other factors influencing health - called health determinants - include:

- age, sex, and inherited factors that can't be changed
- individual behaviours and coping skills
- a person's educational level, income, and working conditions and those of his or her family
- whether a child is fed properly, loved, and included in activities to stimulate his or her development
- whether a person is isolated or has the support of extended family or community services
- community factors - quality of childcare services and schools, recreation and physical activity opportunities, housing, health services and access to a clean natural environment (air, soil, water)
- cultural factors - First Nations people who understand and practise their culture are healthier
- regional, provincial and federal programs and policies for health, education, land use planning

HEALTH PORTRAIT OF THE JAMES BAY CREE

The Cree population is younger than the rest of Quebec -

- 38% are under 18 years old compared with 19% - half as many - in Quebec overall
- 5.2% are over 64 years old compared to 15.8% in Quebec.

The healthy life expectancy is shorter than the overall population of Quebec (63.2 years old in EI compared to 67.4 in Quebec) (Andermann, 2012; MSSS, 2011).

Among the Cree, sedentary lifestyle and major changes in diet contribute to high rates of diabetes and obesity. The majority of adults in all communities are either overweight or obese, and more than one adult in five has diabetes, while another 9% was identified as being at the pre-diabetes stage (Bobet, 2013). The rate of sexually transmitted infections is also elevated in EI, with rates of chlamydia and gonorrhea infections 7 to 11 times higher than those in the rest of Quebec (CBHSSJB, 2013). Injuries, suicide attempts, children signaled to youth protection and alcohol abuse are also more common than in the rest of Quebec.

These health problems are attributable in large part to factors influencing health such as rapid cultural change due to modernization and development, low employment rates and unstable jobs, low high school graduation rates, overcrowded and poor quality housing, the high costs of healthy food (Montreal Diet Dispensary, 2013), and the history of colonization and residential schools.

On the positive side, a recent study (2002-2009) on environmental health issues (Bobet, 2013) concluded that few residents of EI were exposed to environmental contaminant levels that pose health risks (lead, mercury, arsenic, selenium, iodine, and some PCBs and pesticides). Although levels of mercury and PCBs are higher than in southern

Canadians, they are below the level of action¹ for most people of EI. The same study was also reassuring with respect to the presence of pathogens found in animals that could be transmitted to human², indicating that even though three quarter of the population tested positive for at least one pathogen, there was no evidence that serious illness resulted from this exposure. Moreover, study participants reported that children ate traditional food (game, fish, birds or berries) 12 times per month and adults 17 times per month on average over the year before the study. In the 2011 census, data showed that social isolation (an important health determinant) is not an issue in EI - few people live alone. The vast majority have retained an important aspect of their culture by speaking Cree at home.

Overall, this brief presentation of the health portrait of the James Bay Cree highlights some of the major public health challenges in EI. Underlying social issues such as education, employment and housing, need to be addressed first, and effective, culturally appropriate interventions in the areas of mental health, nutrition and inactive lifestyles are urgently needed.

¹ The action level suggests that an intervention may be needed to reduce the exposure of a population.

² Studied zoonotic pathogens : *Coxiella burnetii*, *Francisella tularensis*, *Leptospira* sp., *Echinococcus granulosus*, *Toxocara gondii*, *Trichinella* sp., California serogroup viruses -Jamestown Canyon, Snowshoes hare- and Sin Nombre virus.

HEALTH ISSUES RELATED TO THE PRESENCE OF NATURAL URANIUM IN SOIL AND BEDROCK.

The presence of natural uranium in soil and bedrock³ in the Cree region has already led to the involvement of the Public Health Department in two issues: uranium in drinking water and radon gas levels in homes.

First, one community experienced the presence of uranium levels above normal levels in its water distribution system between 2001 and 2009. During this time, filters were installed to remove uranium from the water, but they were not always effective. A study carried out in collaboration with the INSPQ showed that between 2001 and 2006, 18 cases of cancer were reported from that community. Compared with other Cree communities, there was no significant excess of the types of cancer related to uranium exposure⁴ (CBHSSJB internal document, 2010). Long term consumption of water containing above normal levels of uranium can cause kidney damage (not cancer), but the study stated that hospitalizations due to kidney disease were no more frequent in that community than the others. The main cause of kidney damage in EI is diabetes. The problem of uranium in the water supply was solved when the community decided to stop using groundwater wells, and to use water from a river close to the community instead.

Radon is a radioactive gas found naturally in rocks and soil in some areas. It can accumulate in poorly ventilated basements and can increase people's risk of getting lung cancer. In 2011, the Public Health Department placed radon dosimeters in 290 buildings

³ We are all exposed to radioactivity; around 3 mSv/year for the general population (UNSCEAR, 2010 cited in INSPQ, 2013). The sources of this radiation are mostly natural – from the sun, from some radioactive substances naturally in food, and from breathing in radon found naturally in soil and rocks. We also receive some radiation from Xrays and medical scans.

⁴ In total almost twice as many cancers as would have been expected (Standardized incidence ratio-SIR: 1.9; 95% confidence interval:1.126-3.003) were reported from this community during the 6 -year period. Most of these excess cases of cancer were in the digestive system, breast or kidneys. However, during the longer period of 1985-2006, the rate of cancers in this community was identical to the regional average (SIR = 1.04) (CBHSSJB, 2012).

in EI for 3 months. Two thirds of the houses in one community had levels of radiation above Health Canada guideline levels (200 Bq/m³) (CBHSSJB internal document, 2011). Further radon measurements are currently being conducted, and results should be obtained in autumn 2014. Cigarette smoking is still the main cause of lung cancer in EI and elsewhere in the world. Rates of cancer in EI are not increasing with time, and they are lower for males, and similar for females, compared to Quebec as a whole (CBHSSJB, 2012).

HEALTH IMPACTS OF URANIUM DEVELOPMENT ON COMMUNITIES

In 2013, the Institut National de santé publique du Québec (INSPQ) produced a report on the potential health risks of a uranium mine located nearby to a community. Experts documented epidemiological evidences of health problems in the population living close to uranium mining establishments, conducted a preliminary toxicological risk assessment and synthesized the psychological and social effects of uranium development (INSPQ, 2013).

Physical health impacts

From this report, the Public Health Department understands that evidence from ten epidemiological studies was sufficiently strong to confirm that women living near uranium mines did not have an excess rate of lung cancer, while men did, probably due to work in the mines. There was a slight suspicion in one study of an increased rate of leukemia. Overall, study results of populations living near uranium mines were insufficient to assert that living near a uranium mine caused health problems (INSPQ, 2013).

A second study from the INSPQ - a toxicological risk assessment - looked for published scientific literature on levels of contaminants in various environmental components around a uranium mine (air, water, soil, fish and other wildlife), and estimated health risks potentially associated with uranium mining. This study reported that people living

in uranium-producing regions where higher background concentrations from radionuclides and other associated chemical elements are found, could be exposed naturally to higher levels of these elements even without the presence of a mine.

However, in the presence of a mine, it was estimated that consumption of fish caught nearby could increase people's exposure to radiation levels higher than 1mSv/year⁵ due to the presence of polonium 210 and uranium. People might also be exposed to levels higher than the tolerable daily intake for selenium, cadmium and uranium (INSPQ, 2014).

Selenium and uranium were also identified by Mr Barr from the CNSC in the presentation of environmental monitoring results (2000-2012) from active uranium mines and mills processing in Canada (BAPE, 2014a). Overall, Mr Barr reported that levels of radionuclides (i.e. radium 226 and polonium 210) observed in fish caught at a distance of between two and 10 kilometres downstream from uranium processing mills were similar to background levels for all mining establishments. Levels of tested non-radioactive toxic substances were below Health Canada guidelines with the exception of uranium and selenium. Following this assessment, improvements to the effluent (mine waste water) treatment systems were made and uranium levels are now below Health Canada guidelines, while levels of selenium are expected to decrease in the near future (BAPE, 2014a).

Like other mining, uranium mining may have other physical health impacts on communities – including the potential for more road traffic injuries due to increased large truck traffic on regional roads.

⁵ The allowable additional dose limit was set at 1mSv/year by the International Commission on Radiological Protection and is the prescribed limit for the general population in the Radiation Protection Regulation of the Nuclear Safety and Control Act of Canada (INSPQ, 2013). An extra 1 mSv per year over a lifetime would lead to 4 more cases of cancer in 1000 people. As a point of comparison, right now for every 1000 persons in EI, 200 will die of cancer.

Psychological and social health impacts

The INSPQ (2013) study also reported psychological and social effects in populations living near uranium mines. Higher anxiety regarding radioactivity and its (real or feared) health impacts at the individual level, and alteration of the social climate and loss of public trust in the authorities at the social level are among the reported effects. These consequences would be in addition to the known impacts occurring in the context of mining activities regardless of the type of mineral (i.e. boomtown effect, social inequalities in the sharing of costs and benefits, increase of drugs or alcohol use, etc.).

Population anxiety about uranium and radioactivity are often related to worries about accidents in nuclear power plants, the disposal of highly radioactive waste from these facilities, and the use of uranium for atomic weapons. These activities are not being examined by the BAPE, which is looking only at uranium mining and milling, and transport of the processed ore within the province. The concerns about how Quebec's uranium might be used by people outside of the province were voiced more than once in the hearings which took place in the Cree communities. In relation to this issue, Mr Leclair from the CNSC reported that Canada has international agreements with countries to which it exports uranium and that the mineral will be used for electricity generation only. The International Atomic Energy Agency has inspectors in these countries to check how the uranium is used (BAPE, 2014b). However, nuclear power generation does produce highly radioactive nuclear waste, and it is not clear that any country has a satisfactory solution for its disposal, which will require monitoring for hundreds of thousands of years.

Fear of contaminants could also lead to individuals of EI stopping hunting and fishing traditional food, which could affect Cree culture and increase sedentary lifestyle and the consumption of high carbohydrate diets. In fact, the health impact of lower physical activity levels and eating more market food could be worse than the health impact of slightly higher exposure to some contaminants due to eating traditional food.

As aboriginal populations appear to be more vulnerable (INSPQ, 2013) to the psychological and social changes associated with resource development, the Public Health Department of the Cree Board of Health and Social Services is concerned that uranium development in EI might add to the significant burden of physical and social health problems already occurring in the communities. Even if some positive impacts, such as collective and individual economic spinoffs and improvements of infrastructures, have been associated with mining development regardless the type of mineral concerned (INSPQ, 2013), the negative impacts described earlier could outweigh the positive ones given the relatively short duration of mining projects and their rapid growth-degrowth cycle (the boomtown effect). These were the conclusions of Dr Brisson from the INSPQ (BAPE, 2014c), and of Dr Thierry Rodon (BAPE, 2014d), in his presentation to the BAPE on the impacts of the Raglan mine in Nunavik.

URANIUM MINERS' HEALTH ISSUES

As mentioned by the INSPQ (2013), the health risks to uranium miners have been well documented. The combined results of several studies demonstrated an increased risk of lung cancer correlated with cumulative exposure to radon and caused by radon decay products, even among non-smokers. Exposure to radon in uranium miners has not been associated with other types of cancer. Radon was declared a carcinogen in 1988.

The discovery of this link between radon gas in mines and lung cancer among uranium miners led to the installation of ventilation systems in the underground tunnels to remove radon gas and dust. In modern uranium mines, workers at higher risk of exposure wear badges which measure their exposure to various types of radiation. In addition, levels of radiation in air are regularly monitored. It is now rare that uranium mine workers are exposed to excessive doses of radiation.

In a presentation to the BAPE entitled “Protecting the Health of Uranium Mine Workers: the situation from the 1930s to the Present Day” (CCSN, 2014a), the Canadian Nuclear Safety Commission showed pictures of personal dosimeters worn by miners today. They estimate that Canadian mine workers’ exposure to radon in the 1940’s was about 2000 mSv per year, but by 1970 it was down to 11.5 mSv per year. Since 2000, total radiation received by mine workers from radon decay products, radioactive dust and external doses has been under 1.5 mSv per year .

Mining is a dangerous occupation. All mine workers are at higher risk of injuries due to accidents, lung diseases due to dust, and deafness due to working long hours in noisy environments.

POTENTIAL IMPACTS OF URANIUM MINING ON THE ENVIRONMENT

Concerns about negative impacts on water, fish and other wildlife, both in the vicinity of a uranium mine and extending to whole watersheds, were often raised by members of the public during the hearings in EI. And while presentations to the BAPE Commission in September from the CNSC on modern uranium mines were reassuring, other presentations raised concerns. The Public Health Department of the CBHSSJB does not have specific expertise in the environment - our expertise is in the area of human health. However, since the health of the environment and of humans are so closely linked in the Cree perception of health, some information and questions retained from the BAPE presentations and from reading other material are presented.

Contaminants in the air, water and soil near uranium mines

According to the CNSC presentations during the BAPE hearings (CCSN, 2014b and c), in uranium mines presently operating in Saskatchewan, up to seven nuclear substances (radionuclides) and up to 20 hazardous substances (chemicals that may be toxic to living organisms depending on the dose) are monitored regularly in air, surface and ground water, sediments and soils, and fish, around the mine. Humans, animals, fish and birds

may be exposed to these substances by breathing them in the air, by eating smaller animals that are contaminated, by drinking contaminated water or by direct exposure through the skin.

During the BAPE hearings, the CNSC presented results of environmental monitoring of all mines in operation in Canada, from 2000 when the agency was created, until 2012 (CCSN, 2014c). During this 13-year period, average levels of nuclear and hazardous substances in the air around all these mines were at safe levels. The one exception was radon within two kilometres of the mine, where an average of about 220 Bq/m³ was recorded once during the period of study. This is slightly above Health Canada's acceptable level of 200 Bq/m³ for radon in houses.

Regarding surface water effluents, all substances were below Health Canada's Drinking water guidelines except in Rabbit Lake (Saskatchewan), where uranium levels were slightly above normal. In the past 2 years, the uranium mining company located in Rabbit Lake has been able to better treat the effluent and uranium levels have come down (CCSN, 2014c). Different norms and regulations exist for the protection of aquatic ecosystems. Downstream from uranium mines, norms were sometimes exceeded for uranium, molybdenum and selenium and fish malformations were observed. CNSC asked for improved effluent treatment and contaminant levels decreased. Long term monitoring around uranium mines is essential.

These CNSC reports on present-day mining operations contrast with studies published by Clulow et al.,(1998a and b). In 1990, this scientist and his team measured nuclear substances (radionuclides) in fish, water and sediments in a watershed around Elliot Lake, where uranium mining started in 1955 and continued until 1996. These authors compared radionuclide levels downstream from uranium mines with levels in nearby lakes and rivers not affected by uranium mining, and found that radionuclide levels were higher in waterways downstream from mines. Thomas (2000) measured radionuclide levels in plants and small mammals at a uranium milling site presently operating in

Saskatchewan, and found that they were at higher levels than on a control site upstream. The author also expressed concern about windblown contaminants from dry tailings at abandoned sites.

Contaminants in wildlife

Thomas and Gates (1999) measured radionuclides in 18 caribou from northern Saskatchewan in 1995, in an area where the ore is very rich and contains around 18% uranium (compared with about 1% for the Matoush site in EI). Some uranium mining was already taking place in this area but two more mines were under development at the time. Caribou eat lichen, which absorbs radionuclides (both naturally-occurring and from human activity) easily. In their study, Thomas and Gates (1999) estimated that radiation doses from eating 100 g of caribou meat daily could lead to an extra 0.85 mSv per year, and 1.7 mSv per year if 10 kidneys and one liver were eaten per year. If new mines led to more radioactive dust production, the figures could increase. These authors mentioned studies of caribou near Baker Lake (Nunavut), carried out before uranium mining was begun there. Baker Lake caribou had higher levels of radioactivity than caribou studied in Saskatchewan, due in part to rock outcrops naturally high in uranium.

Another study conducted in Saskatchewan presented reassuring environmental contamination data about mining sites operated between 1953 and 1982, decommissioned from 1983 to 1985 and still monitored today (Canada North Environmental Services, 2014). The Eastern Athabasca Regional Monitoring Program (EARMP), which aims at monitoring the safety of traditionally harvested country foods from seven communities located downstream of the decommissioned uranium mining and milling operations in the Eastern Athabasca region, Saskatchewan, concluded that most tested chemical concentrations were below applicable guidelines and similar to concentrations expected for the region for water, berries, fish, moose, and barren-ground caribou. The report mentioned that a Human Health Risk Assessment using the EARMP community data confirmed that the country foods assessed were safe to eat.

Traditional foods (game, birds and fish) contain high levels of nutrients important for health, such as protein, omega-3 fatty acids, iron and zinc. Bush meats are organic, antibiotic-free and free range, and they contain almost no sugar or simple starches. Berries contain anti-oxidants which help prevent cancer. Monitoring of contaminants in Cree residents of all communities (Bobet, 2013) has shown that the benefits of eating traditional food are extensive and that people's contaminant levels are low. The CBHSSJB actively promotes traditional foods in its nutrition health promotion programs for children and adults, and has made efforts to obtain bush food for serving to patients and beneficiaries at its hospital, multiservice day centers and other facilities.

Management of waste rock and tailings

At a uranium mine, ore is dug up out of the earth and ground up in order to remove the parts of the rock that do not contain uranium. This grinding process – called milling – involves mixing the ore with water and chemicals. The products of milling are a partly refined form of uranium called yellowcake, and waste products called tailings.

Both waste rock and tailings are left at the mine site. Waste rock is rock that has been dug out of the ground in order to reach the ore. Tailings are still somewhat radioactive and will remain so indefinitely. They also contain other harmful substances which were either in the rock naturally or were added to help remove the uranium. Before the mine is in operation, careful plans need to be made to ensure the tailings, waste rock and waste water (effluent) do not damage the environment during mining operations and for many years after the mine closes.

The CNSC and SRIC presentations at the BAPE hearings (CCSN, 2014d and SRIC, 2014) showed several examples of modern approaches to tailings management. A special area is set aside, and a surrounding embankment is built; tailings are deposited into this pit and covered by water to prevent blowing dust. Excess water around the tailings is pumped out and treated before returning it to the environment. There is no dam because

the tailings pond is completely surrounded by the embankment. Another approach is to put the tailings into a mining shaft that is no longer used.

Mr WP Robinson mentioned problems with the pit solution proposed by the CNSC: it will require constant maintenance because water must be pumped out from the tailings and treated – indefinitely (Robinson, WmP, SRIC). The materials lining the pit and used in the embankments surrounding it are not guaranteed to last forever. And the INSPQ study (2013), reported that uranium mining establishments, even modern ones, are not safe from failures, such as breakdown, material damage and human errors. In the 243 published articles evaluated by the INSPQ (2013) for the toxicological risk evaluation section, 53 radiological or toxic substances were identified as environmental contaminants in relation to uranium mines. Most of these substances were radionuclides (uranium, ^{226}Ra , ^{210}Pb , ^{222}Rn , ^{232}Th , ^{210}Po) and uranium, selenium and arsenic.

Ideally, tailings and waste rock would be stored or disposed of in a way that eventually would not require constant maintenance and monitoring. But that is not what is happening now – a majority of closed uranium mines across Canada are still being monitored with respect to environmental contamination. According to BAPE presentations, the modern mines now operating in Canada are not contaminating the environment, but they will likely require active maintenance and monitoring for thousands of years to come.

Emergencies and climate change

Concerns in relation to climate change impacts were raised during BAPE hearings which took place in the Cree communities. It was reported by Dr Pierre Gosselin from INSPQ (BAPE, 2014a) that climate change will modify rainfalls and increase the frequency of extreme weather events and of forest fires. Overall, this expert indicated that these elements should be considered in the environmental assessment and risk management strategies of any mining projects in the northern regions. Moreover, risk management

should also consider the potential impacts of other natural disasters, such as earthquake and flooding, in their emergency planning, as these disasters could increase the risk of environmental contamination and health impacts (INSPQ, 2013).

CONCLUSION

The Public Health Department of the Cree Health Board is concerned that uranium development in EI might add to the significant burden of physical and social health problems already occurring in the communities.

Even though extensive environmental controls have been achieved in modern uranium mines operating in Canada, the large quantities of tailings on closed mine sites will require maintenance and monitoring indefinitely and are at risk of contaminating the environment at some point in the future.

The regional Public Health Department acknowledges the clear decision taken by the Cree Nation Government in their ‘Eeyou / James Bay Cree Nation / Eeyou Itchee Permanent Uranium Moratorium’ (Resolution 2014-15) (see appendix). The Public Health Department of the CBHSSJB supports the right of the Cree Nation to make such decisions under their jurisdiction.

The Public Health Department of the CBHSSJB recommends that the BAPE take into account the specific concerns of the Cree people with respect to uranium mining in lands of which they have been the main inhabitants for thousands of years:

- the health of humans is closely linked to the health of the environment – its water, air, soil, flora and fauna
- indigenous peoples consider themselves stewards of the land and they wish to keep the environment safe and healthy for future generations
- the people would not want uranium to be produced from their traditional lands if it might (through use for weapons or accidents related to nuclear fuel) cause disease and death among people anywhere on the planet.

REFERENCES

- Adelson, N. (1998). Health beliefs and the politics of Cree well-being. *Health* 2(1), 5-22.
- Andermann, A. (2012). How healthy are the Cree in Region 18? Presentation updated using INSPQ Portrait de santé 2011. Powerpoint presentation, January 2012. 50p.
- BAPE-Bureau d'audiences publiques sur l'environnement. (2014a). Transcription 40- Séance tenue le 16 septembre 2014 en soirée à Québec. 105p.
- BAPE-Bureau d'audiences publiques sur l'environnement. (2014b). Transcription 21- Séance tenue le 3 septembre 2014 en soirée à Mistissini. 138p.
- BAPE-Bureau d'audiences publiques sur l'environnement. (2014c). Transcription 42- Séance tenue le 7 septembre 2014 en soirée à Québec. 57p.
- BAPE-Bureau d'audiences publiques sur l'environnement. (2014d). Transcription 45- Séance tenue le 19 septembre 2014 en avant-midi à Québec. 78p.
- Bobet, E. (2013). Summary Report on the Nituuchischaayihititaa Aschii Multi-Community Environment-and-Health Study. Public health report series 4 on the Health of the Population. Chisasibi QC: Cree Board of Health and Social Services of James Bay.
- Canada North Environmental Services, 2014. Eastern athabasca regional Monitoring program 2012 community report. Available at <http://www.earmp.ca/links/EARMP%20Community%20Report.pdf> [Last accessed 02.10.2014].
- CBHSSJB- Cree Board of Health and Social Services of James Bay (2013). Overview of the Health of the Population of Region 18. Available at <http://creehealth.org/surveillance-data/population-health> [Last accessed 24.09.2014].

CCSN- Commission canadienne de sûreté nucléaire. (2014b). Impacts sur l'environnement mesurés autour des sites en exploitation et cadre réglementaire, présentation PowerPoint, 15 septembre 2014, 20 p.

CCSN- Commission canadienne de sûreté nucléaire. (2014c). Les rejets des mines et usines de concentration d'uranium dans l'environnement posent-ils un risque pour la santé de la population?, présentation PowerPoint, 17 septembre 2014, 20 p.

CCSN- Commission canadienne de sûreté nucléaire. (2014d). La gestion des résidus miniers uranifères et la réglementation, présentation PowerPoint, 10 septembre 2014, 27p.

CCSN- Commission canadienne de sûreté nucléaire. (2014a) La protection de la santé des travailleurs des mines d'uranium : Évolution de la situation des années 1930 à aujourd'hui, présentation PowerPoint, 16 septembre 2014, 25 p.

Clulow, F. V., Dave, N. K., Lim, T. P. and Avadhanula, R. (1998a). Radionuclides (lead-210, polonium-210, thorium-230, and -232) and thorium and uranium in water, sediments, and fish from lakes near the city of Elliot Lake, Ontario, Canada. *Environ. Pollut*, 99(2): 199-213.

Clulow, F. V., Dave, N. K., Lim, T. P., and Avadhanula, R. (1998b). Radium-226 in water, sediments, and fish from lakes near the city of Elliot Lake, Ontario, Canada. *Environ. Pollut*, 99(1): 13-28.

CBHSSJB. (2012). Cancer Incidence and Mortality in Eeyou Istchee. Available at <http://www.creehealth.org/library/online/cancer-incidence-and-mortality-eeyou-istchee>. [Last accessed 02.10.2014].

INSPQ- Institut national de santé publique du Québec. (2013). Les impacts sanitaires en lien avec les projets uranifères nord-côtiers, 344 p.

INSPQ- Institut national de santé publique du Québec. (2014). Réponse à la question du document QUES10. Bureau d'audiences publiques sur l'environnement. 7 p.

Montreal diet dispensary. (2013). Access to a nutritious food basket in Eeyou Istchee- Project Report. Available at http://www.dispensaire.ca/files/-_13-03-12_Rapport.pdf [Last accessed 02.10.2014].

MSSS- Ministère de la santé et des services sociaux en collaboration avec l'Institut nationale de santé publique du Québec et l'Institut de la statistique du Québec. (2011). Pour guider l'action-Portrait de santé du Québec et de ses régions: les statistiques, gouvernement du Québec, p. 287.

Robinson E, and L, Atikesse. (2011).Radon levels in 4 communities of Eeyou Istchee. Report from the Public Health Department of Cree Board of Health and Social services of James Bay. November 2011. 6p.

SRIC- Southwest research and information center. (2014). Environmental Impacts and Challenges Associated with Uranium Exploration and Uranium Mill Tailings, présentation PowerPoint, 10 septembre 2014, 45 p.

Thomas, P. A. (2000). Radionuclides in the terrestrial ecosystem near a Canadian uranium mill--Part I: Distribution and doses. *Health Phys*, 78(6): 614-624.

Thomas, P. A. and Gates, T. E. (1999). Radionuclides in the lichen-caribou-human food chain near uranium mining operations in northern Saskatchewan, Canada. *EHP*, 107(7): 527-537.

Wheatley M.A. (1994). Aboriginal Health and the Environment. *Arctic Medical Research*; 53(suppl 2): 265-267.

APPENDIX 1- Map of the nine Eeyou Istchee communities.



Source : Cree Health Board website, 2014.

APPENDIX 2- Cree Nation Government in their 'Eeyou / James Bay Cree Nation / Eeyou Itchee Permanent Uranium Moratorium' (Resolution 2014-15).

See pdf document.