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NUNAVIK REGIONAL BOARD OF HEALTH AND SOCIAL SERVICES
RÉGIE RÉGIONALE DE LA SANTÉ ET DES SERVICES SOCIAUX NUNAVIK

THE FUTURE OF MINING IN NUNAVIK: PUBLIC HEALTH ISSUES RELATED TO URANIUM MINING IN A NORTHERN ENVIRONMENT

BRIEF SUBMITTED
BY THE NUNAVIK DEPARTMENT OF PUBLIC HEALTH

TO THE *BUREAU D'AUDIENCES PUBLIQUES SUR L'ENVIRONNEMENT*
(ENVIRONMENTAL PUBLIC HEARINGS OFFICE)
AND TO THE KATIVIK ENVIRONMENTAL ADVISORY COMMITTEE (KEAC)

DECEMBER 8, 2014
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The Future of Mining in Nunavik:
Public Health Issues related to Uranium Mining in a Northern Environment

Brief submitted to the *Bureau d'audiences publiques sur l'environnement* (Environment Public Hearings Office, BAPE) on the issues of uranium mining in Québec and to the Kativik Environmental Advisory Committee (KEAC)

By the Nunavik Department of Public Health, Nunavik Regional Board of Health and Social Services

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Quebec City

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SUMMARY OF CONCERNS AND RECOMMENDATIONS

The following is an extract from the main document detailing the concerns and recommendations of the Nunavik Department of Public Health (DPH). They apply to mining development in general, except when uranium exploration or extraction is specifically mentioned.

Economic impacts

1. The DPH considers that better access to employment and business opportunities and receiving financial compensations for the local population are significant additional sources of income for Nunavik residents overwhelmed by high unemployment and low income.

2. The DPH would expect measures to be implemented to promote training, employment and business opportunities for Inuit by way of : appropriate training programs, employee support, programs to foster intercultural coexistence, targeted dissemination of information on employment opportunities in Nunavik's communities, and so forth.

3. The DPH believes that a special attention should be paid to the financial compensation distribution system (individual vs collective) in order to minimize the negative effects and maximize the positive economic spinoffs of mining development.

Impacts on population health in Nunavik

4. The DPH supports further research to better document the health effects associated with uranium exploration and exploitation activities. These studies would however prove difficult to conduct in Nunavik. With its small population, it would be problematic, if not impossible, to successfully document a statistically significant increase in risk for the region.

5. The DPH is of the opinion that uncertainty about children's specific vulnerability to the effects of uranium should be taken into account in the assessment of health risks for the population of Nunavik, especially in view of its large youth population and rapid growth.

6. The DPH stresses the need to clearly characterize the environmental background noise and current state of health of the people of Nunavik before any uranium mining projects are launched. To that end, the Nunavik 2016 Health Survey should provide baseline data on the population's health status and serve as a reference point for assessing the future impact of any development project.

7. Should a uranium mine be established in the region, the DPH considers that it would be critical to estimate exposure using a model that approximates the

eating habits of Inuit, and then properly monitor the health status of the population and establish an environmental contamination monitoring program

8. The DPH is concerned about cumulative effects that may potentially result from the combination of substances emitted into the environment by mining activities and various contaminants to which Nunavimmiut are already exposed, whether from other parts of the world, (e.g. mercury, PCBs, etc.) or from hunting (e.g. lead) or lifestyle (e.g. cadmium in cigarettes).

9. Given the great importance of country food for Inuit health, well-being and cultural identity, the DPH is concerned that perceived or actual contamination of the environment caused by the establishment of a uranium mine in Nunavik may cause distrust in the safety of Inuit food. Any reduction in consumption of country food could significantly impact on the food security of Nunavimmiut, which is already being compromised by many socio-economic and environmental factors.

10. The DPH estimates that the presence of mining companies may affect the Inuit way of life, and particularly their hunting, fishing, and gathering activities.

11. In view of the Inuit people's strong attachment to their territory, the DPH estimates that mining companies must demonstrate great social responsibility and a commitment to reduce the impacts of their activities on the environment and the local population.

12. The DPH stresses the importance to consider archaeological sites, including burial sites, during impact assessments carried out prior to a mining project.

13. The DPH is concerned that an influx of workers from outside of Nunavik may have psychosocial impacts, especially in communities near the mine. Of particular concern is the difficulty that individuals, families and gateway communities will experience in adapting to this new reality.

14. The DPH raises concerns about the psychosocial problems pervading Nunavik that could be exacerbated by the establishment of a mining project. In the case of a uranium mine in particular, the negative psychosocial impacts could outweigh any advantages for Nunavimmiut.

15. Given the scarcity of studies on the subject, the DPH considers that psychosocial impacts on Inuit populations must be documented as the mining projects progress, beginning at the exploration phase.

Protection of workers

16. The DPH is concerned about the degree of enforcement of the principles and regulations regarding workers protection during uranium exploration activities in a remote region like Nunavik.

17. Given the high proportion of smokers in Nunavik and the cumulative and even synergistic effect of occupational exposure to various carcinogenic contaminants (including radon) coupled with tobacco use, the DPH insists that control

measures must be implemented to prevent pulmonary health issues in Inuit workers.

18. The DPH is concerned about the risks inherent in working in remote regions and, given Nunavik's harsh and unpredictable weather, about the dangers of medical evacuations of injured workers and the consequences for other people involved (pilots, medical personnel, etc.).

19. The DPH underlines that it is vital and even critical to consider, for all stakeholders, the potential added value of including occupational health and safety concerns at the initial design and construction phase of mining facilities in Nunavik.

Impacts on the organization of services

20. The DPH raises concerns about the challenge posed by the increased number of users who would be served by Nunavik's health facilities as a result of the influx of hundreds of workers from outside the region.

***Nungujuittuq* or « something that will never perish »**

21. The DPH considers that tailings from uranium mines pose a long-term danger that can affect future generations, especially if tailings containment is compromised.

Social acceptability

22. The DPH estimates that mining companies that want to establish themselves in Nunavik, including uranium mines, must pass the test of social acceptability with the Inuit population. To this end, they must clearly guarantee advantages that exceed the negative impacts for Inuit. Transparency and Inuit participation in the process must be emphasized. Mining companies must maintain acceptability by sustaining an ongoing dialogue throughout the lifespan of mining sites.

23. Inuit must exercise their empowerment[1] and choose the type of economic focus they wish to emphasize on their territory (mines, tourism or other) and, in terms of mining development, the type of mining they would allow.

[1] Empowerment is a guiding principle for managing health risks (see Appendix 1).

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1. INTRODUCTION

1.1. Scope of brief

As stated last March by the Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques (sustainable development, environment and fight against climate change, MDDELCC) when it gave its instructions to the Bureau d'audiences publiques sur l'environnement (environmental public hearings office, BAPE), the current process does not assess specific mining projects but rather the general impacts of the uranium industry across Québec, including exploration and extraction activities. In addition, the current process excludes the assessment of nuclear energy production, nuclear weapons and nuclear waste management.

The Nunavik Department of Public Health (DPH) has produced this brief to draw attention to public health implications for Nunavimmiut.[2] The transcripts of the preliminary hearings held in Kuujjuaq on June 12, 2014, highlight some of the public health concerns expressed by Inuit in regard to the possible development of uranium mines in Nunavik:

- Contamination of the land, country food[3] and drinking water;
- Impacts on fishing practices, hunting, gathering, and lifestyles;
- Anticipated increase in anxiety;
- Protection of workers' health;
- Anticipated impacts of environmental accidents and emergencies;
- Importance of transparency and the use of simple, understandable language in communications.

Most of these concerns are addressed in the present document.

1.2. Guiding principles for managing health risks

The present brief is based on the guiding principles adopted in the *Cadre de référence en gestion des risques pour la santé dans le réseau québécois de la santé publique* (Reference framework for the management of health risk in the Québec public health network), adopted in 2003 by public health directors in all of Québec's regions (INSPQ, 2003). The following principles, which are defined in appendix 1, underlie this entire brief:

- Caution;
- Empowerment;

[2] Nunavimmiut are the inhabitants of Nunavik.

[3] i.e. animal and plant species culturally identified as food and harvested from the local environment (Kuhnlein *et al*., 2004).

- Fairness;
- Openness;
- Primacy of the protection of human health;
- Scientific rigour;
- Transparency.

2. CONTEXT

2.1. Nunavik

Nunavik is located north of the 55th parallel and covers about a third of the area of Québec (KRG and Makivik Corporation, 2010). This region is characterized by a harsh climate, fragile ecosystems and remoteness from major centres. There are no roads connecting Nunavik communities to each other or to communities outside the region. The region is accessible primarily by air (or water, mainly for the transportation of goods during the short summer season).

The New Québec (Labrador Trough), Torngat, and Ungava (Cape Smith Belt) orogens cover a significant area of northern Québec. These zones are rich in mineral resources, including iron, nickel, copper, cobalt, zinc, silver, platinum group elements and uranium (Ministère de l'Énergie et des Ressources naturelles - energy and natural resources[4]).

The population is divided into 14 communities located in two sub-regions, Ungava Bay and Hudson Bay. These sub-regions are served by the Ungava Tulattavik and Inuulitsivik health centres respectively. Each community has a local point of service (CLSC) associated with one of the health centres (Figure 1). As in many parts of the north, only a limited range of healthcare services is available. Patients are referred to cities in the south of the province for a wide range of screenings, diagnostic activities and medical treatments.

According to the 2011 census, the population of Nunavik was slightly over 12,000 people, the vast majority of whom are Inuit (89%). The population of each community ranges from 195 to 2,350 residents, with varying percentages of non-Inuit (generally 5 to 10%). Only Kuujjuaq, Puvirnituq, Salluit and Inukjuak have a population of more than 1,000 residents. The administrative centre of Kuujjuaq stands apart with its population of 2,350 residents, approximately 24% of whom are non-Inuit. The population of Nunavik is growing rapidly, having doubled over the last 30 years (NRBHSS and INSPQ, 2011).

Nunavik Inuit are part of an even larger group, as they share their cultural heritage with Canadian Inuit living in Nunavut, Nunatsiavut (Labrador) and in the Inuvialuit region of the Northwest Territories. This larger group is collectively referred to as Inuit Nunangat (NRBHSS, 2014).

[4] Distribution des minéralisations Ni-Cu-EGP dans la Ceinture de Cape Smith (Orogène d'Ungava) : pistes d'exploration (Distribution of Ni-Cu-PGE mineralization in the Cape Smith Belt (Ungava Orogen): avenues of exploration). Retrieved October 27, 2014, from https://www.mern.gouv.qc.ca/mines/quebec-mines/2005-11/capesmith.asp

Figure 1. Nunavik and its Health and Social Services Network

2.1. Plan Nord and Plan Nunavik

An initial economic development program for Québec's northern regions was proposed in 2008 and was formalized by the tabling of the Plan Nord by the Québec government in May 2011 following hearings with the regions concerned. The region in question is located north of the 49th parallel and encompasses areas in the Nord-du-Québec, Côte-Nord and northern part of Saguenay-Lac-St-Jean regions. The plan provides for $80 billion in investments over 25 years to be allocated mainly to mining, natural resources, tourism and the construction of transportation infrastructure. The government expects this measure to create 20,000 jobs per year over the life of the plan. The Plan Nord was put on hold when the Parti Québecois took power in 2012, but the current government has recently revived it.[5]

The Nunavik region is at the centre of the area considered for northern development initiatives, especially mining development. With this in mind and in response to the Plan Nord project, a document outlining the policies that Nunavimmiut want to apply to regional development (Plan Nunavik) was published in 2010 by the Kativik Regional Government and Makivik Corporation (KRG and Makivik Corporation, 2010) in association with the Kativik School Board and the Nunavik Regional Board of Health and Social Services (NRBHSS).

[5] Résumé du Plan Nord du gouvernement du Québec (Summary of the Québec government's Plan Nord). Retrieved October 10, 2014, from http://www.cldacton.qc.ca/coe/nouvelles/resume_plan_nord.pdf

Wide-ranging public hearings titled Parnasimautik[6] were held in the region in connection with Plan Nunavik, ending in the spring of 2014. The goal of this process was to define, within a sustainable development framework acceptable to Nunavimmiut, a global development vision in which Inuit traditional lifestyle and the environment would be protected and enhanced, and development conditions for the region would be spelled out.

2.2. Operating and prospective mines in Nunavik

Raglan Mine

Located near the Pingualuk Crater and the communities of Salluit and Kangiqsujuaq, the Raglan mine[7] began operating in December 1997. The property covers approximately 70 km from east to west and consists of a series of high-grade deposits, mainly nickel and copper. The ore extracted is crushed, ground and processed on site to produce a nickel-copper concentrate. Approximately 1.3 million tonnes of ore are treated yearly, resulting in more than 30,000 tonnes of nickel-in-concentrate annually as well as over 8,000 tonnes of copper and a few hundred tonnes of cobalt.

The facilities include underground mines, a concentrator, a power plant, administrative and accommodation facilities, a fresh water supply plant, a wastewater treatment plant, and fuel tanks. An airstrip can accommodate large aircraft such as the Boeing 737 and the Hercules. Roads that are passable throughout the year link the mining complex to warehouses and seaport facilities located at Deception Bay, 100 km from the mine. An oil storage park is also located at the seaport, and diesel tanks are found near the mine.

The concentrate is trucked to the Deception Bay seaport where it is stored and then transported at sea over a distance of 2,600 km to the Port of Québec aboard an icebreaker with a capacity of 27,000 metric tonnes. The concentrate is then loaded on a train and taken to Glencore smelter in Sudbury (Ontario), where the nickel concentrate is melted and cast into matte. The product is then returned to Quebec City by rail, from where it is shipped to a refinery in Norway.

[6] Parnasimautik. Retrieved October 10, 2014, from http://www.parnasimautik.com/fr/
[7] Glencore Raglan Mine. Retrieved October 10, 2014, from http://www.mineraglan.ca/FR/Pages/default.aspx

Nunavik Nickel

In 2001, Canadian Royalties Inc.[8] discovered and has since delineated several deposits of nickel, copper, cobalt, platinum, palladium and gold. The Nunavik Nickel mine, located about 20 km west of the Raglan mine, began production in 2014. The infrastructure, which is shared with the Raglan mine, includes a mill, an oil depot, accommodation facilities and roads.

Goodwood and Sunny 1

Tata Steel Minerals Canada Ltd. extracts iron deposits in Nunavik about fifty kilometres northwest of Schefferville. These sites consist of two open pits (Goodwood and Sunny 1). Only the mining and transportation of ore and waste rock are carried out at these sites, as the ore is processed in Labrador. The ore is transported by rail to Sept-Îles for onward shipment by sea to Europe. The Goodwood pit will be operational for nine years, while Sunny 1 will be open for six. This mining project is expected to create about 12 jobs and maintain employment for approximately 55 people (Tata Steel Minerals Canada Ltd.).

Oceanic Iron Ore

Oceanic Iron Ore Corp. has deposits located only 10 km from Aupaluk, Nunavik's smallest community, with a population of less than 200 people. The mine, scheduled to begin operations in 2016, will generate between 10 and 20 million tonnes of high-grade iron ore annually for up to 48 years. The concentrate will be pumped to the port through a 26-km long pipeline. To transport iron ore to European and Asian markets, Oceanic plans to build a deepwater port in Ungava Bay with a 330-metre loading dock. The mining complex will be powered by diesel energy until Hydro-Québec extends its transmission line to Ungava Bay, by about 2025 (Oceanic Iron Ore Corp., 2012, George, 2012; 2013).

2.3. Uranium deposits in Nunavik

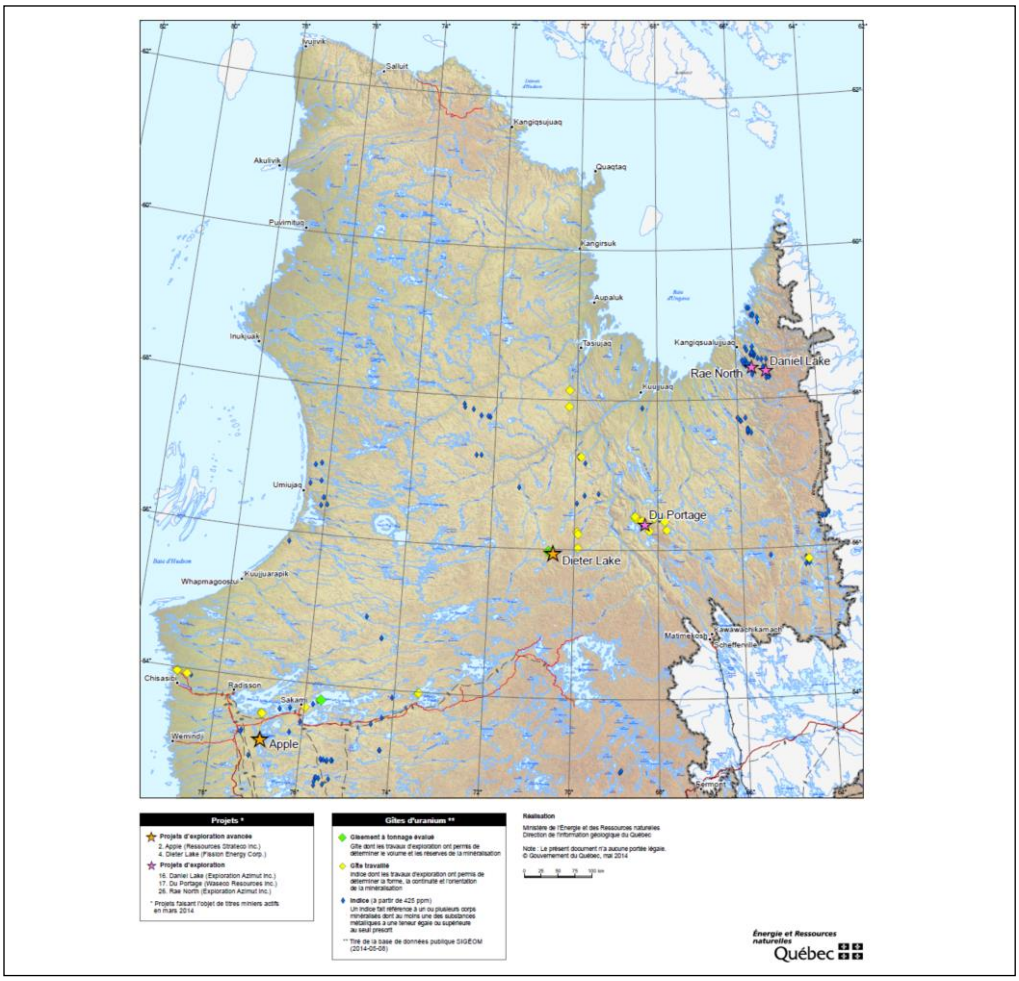
Several hundred mineral occurrences and uranium deposits have been identified in Nunavik. While most of these sites are clustered around the George River, a few have been identified in the central part of the region and near the community of Umiujaq (Figure 2).

Along the southern boundary of Nunavik, Waseco Resources Inc. is in the advanced exploration stage of its Dieter Lake uranium deposit, which extends for about 8,000 hectares. The company acquired five properties covering a total area of 330,000 hectares located in an area extending from 200 to 300 kilometres northwest of Schefferville and up to about 140 to 280 kilometres southeast of Kuujjuaq. The uranium there is sometimes mingled with copper, gold, silver, lead, zinc and cobalt.

[8] Canadian Royalties Inc., About Nunavik Nickel. Retrieved October 10, 2014 from http://www.canadianroyalties.com/fr/

In addition, there are two early-stage exploration projects southeast of the community of Kangiqsualujjuaq: North Rae and Daniel Lake, which belong to Azimut. The company also owns three other deposits in the same area.

Figure 2. Uranium Exploration Projects and Uranium Deposits in Northern Québec



Source : Ministère de l'Énergie et des Ressources naturelles, 2014.

3. NUNAVIK DEPARTMENT OF PUBLIC HEALTH

3.1. Inuit definition of health

The Ottawa Charter defines health as follows: « To reach a state of complete physical, mental and social well-being, an individual or group must be able to identify and to realize aspirations, to satisfy needs, and to change or cope with the environment. Health is, therefore, seen as a resource for everyday life, not the objective of living. Health is a positive concept emphasizing social and personal resources, as well as physical capacities.» (Canadian Public Health Association, Health and Welfare Canada and World Health Organization, 1986). The concept of health therefore combines physical, psychological and social dimensions.

In the Inuit view, health and well-being are based on a strong sense of identity and belonging, understanding one's role in relation to others, and a sense of contributing to the common good. This collective vision of health and well-being has been passed down among Inuit for generations and is rooted in Inuit cultural tradition. It is a holistic view in that it considers that all aspects of life and the environment are interconnected. From this standpoint, health encompasses physical, psychological, social and spiritual dimensions, making it a broader concept than in the Western medical model (NRBHSS, 2014). This brief has been written with this perspective of holistic health in mind.

3.2. Duty to promote, prevent and protect in connection with mining development

The Nunavik Department of Public Health (DPH) fulfills its mandate by operating in a multitude of areas that influence public health.

Québec legislation has given directors of public health the responsibility of ongoing surveillance of public health and its determinants and of identifying potential threats to public health, whether biological, chemical, physical or radioactive, conducting the necessary investigations to that end and recommending or ensuring that measures are deployed to help prevent or reduce the impact of these threats. One of the Department's roles is to conduct prevention activities and develop a response should these threats occur within the region. It also has responsibilities during and after an event (respectively, implementing emergency measures and monitoring the population and reviewing operations).

The public health director is responsible, in the region, for informing the population of its general state of health and major health problems, the groups most at risk, the principal risk factors, and the interventions he considers the most effective […].[9]

In regard to worker protection, the public health director sees to the application of specific health programs for establishments (section 127 of the *Act respecting*

[9] See the *Public Health Act* (CQLR, c. S-2.2) and the *Act respecting Health Services and Social Services* (CQLR, c. S-4.2).

Occupational Health and Safety, c. S-2.1), which must also be implemented on mine sites. Section 113 of the Act prescribes the conditions that must be in place for these programs, especially measures designed to identify health risks to which a worker is exposed in the course of working and to ensure the supervision and assessment of the quality of the work environment.

Because nutrition and food security are recognized as important determinants of health, public health measures also include the promotion of a healthy diet and improved food security, and especially the consumption of country food (Arctic char, caribou, ptarmigan, beluga, etc.). Programs and initiatives are aimed at reducing the incidence of cardiovascular disease, diabetes and being overweight caused by overconsumption of energy-dense and low-nutrient foods. These programs also seek to create partnerships with other regional and local organizations to improve food security and promote healthy eating habits.

A department of public health may be asked to participate in environmental and social impact assessments within the context of a project in its jurisdiction, including those related to mineral development. Its role is to ensure that public health interests are taken into account in this assessment, and its involvement can include the submission of recommendations.

4. SOCIODEMOGRAPHIC AND HEALTH PORTRAIT OF THE POPULATION OF NUNAVIK

Nunavik has a young population. Over half of its residents (58.4%) are under the age of 25, double the percentage in Québec as a whole (Table 1). With its high birth rate, Nunavik's population is flourishing. The average number of children per woman is 3.29 in Nunavik vs. 1.72 in Québec. Women in Nunavik become mothers at a younger age, are more likely to give birth to premature or low-birth weight babies, have more children, and are more likely to raise children alone than women across Québec.

Rapid population growth, low socio-economic status and isolation of the communities have resulted in an acute housing shortage, leading to overcrowding. In 2006, there were four to five people in 30% of Nunavik's households, compared to 10% of households in Québec. This longstanding housing crisis has significant physical, psychological and social consequences (contagious diseases, tuberculosis, lack of sleep, depression, family problems, etc.) (NRBHSS, 2014).

The incidence of some infectious diseases has declined in Nunavik over the years. However, the rates of some conditions remain much higher than for all of Québec. Sexually transmitted and bloodborne infections (STBBIs), particularly chlamydia and gonococcal infections, have reached almost epidemic rates in Nunavik (NRBHSS, 2013). Tuberculosis is now a major public health concern in view of major outbreaks in some communities in recent years.

Table 1. Some Health Indicators for Nunavimmiut

Health Indicators	Nunavik	Across Québec
Percentage of the population under age 25, 2011	58.4%	28%
Fertility rate, 2007-2011	3.29	1.72
Average age of mothers, 2007-2011	24.7	29.4
Percentage of premature live births, 2007-2011	11.8%	7.3%
Percentage low-birthweight live births (2,500 g), 2007-2011	6.4%	5.7%
Percentage of families with three or more children at home, 2006	43%	15.%
Percentage of single-parent families with children under 18, 2011	38.8%	24.3%
Percentage of households with 4-5 people, 2006	30%	10%
Percentage of smokers in Nunavik (2004) and Québec (2009-2010)	77%	23%
Heavy drinking,[10] Nunavik (2004) and Québec (2009-2010)	68%	18%
Drug use, Nunavik (2004) and Québec (2009-2010)	60%	-
Rate of hospitalization for short-term physical care, adjusted for age (per 10,000), all causes, 2008-2012	2,496.6	764.6
Mortality rates adjusted for age (per 10,000), all causes, 2007-2011	151.4	70.2
Adjusted incidence rates of lung cancer (per 10,000), 2007-2011	32.9	9.0
Infant mortality rates (per 1,000), 2007-2011	22*	4.6
Adjusted rates of mortality by suicide (per 10,000), 2007-2011	9.6	1.4
Life expectancy at birth, 2007-2011 – Men – Women	 64.8 years 69.7 years	 79.0 years 83.5 years

*Interpret with caution.
Source: Institut de la statistique du Québec (2011); Census (2006); Nunavik Inuit Health Survey (2004), Canadian Community Health Survey (2009-2010); MSSS birth records; MSSS hospitalization records (MED-ECHO); MSSS tumour records; MSSS death records.

According to Qanuipittaa Nunavik Inuit Health Survey carried out in 2004,[11] smoking is a widespread lifestyle in Nunavik, where more than three out of four individuals (77%) are daily smokers, a much higher percentage than in the rest of Québec (23%) (Table 1). The survey also found a large proportion of heavy drinkers (68% vs. 18% across Québec) and of women who said they drank alcohol during pregnancy. In addition to alcohol, 60% of respondents said they took drugs during the year preceding the 2004 Nunavik Inuit Health Survey.

Heavy drinking is a major factor in the occurrence of violence, unintended injuries, unwanted sexual contact and family and work problems (NRBHSS, 2014). The Nunavik

[10] Heavy drinking is defined as the consumption of five or more drinks on a single occasion at least once a month (MSSS, 2012).
[11] The 2004 Qanuipittaa Health Survey is the most recent investigation carried out in the region. It provides information on the health status, well-being, socio-demographic conditions, lifestyle, nutrition, and physical and social environments of over 1,000 individuals age 15 or older in Nunavik's 14 communities.

Inuit Health Survey (2004) highlighted that crimes against persons (assault, sexual assault, and theft) occur 2.5 to 5 times more frequently in Nunavik than in the rest of Québec, and that women are six to 10 times more likely to experience domestic violence.

The Qanuipittaa Nunavik Inuit Health Survey also reports that 13% of the population is struggling with high levels of psychological distress and is likely to experience depression or develop mental health problems.

The adjusted incidence rate of lung cancer is about four times higher in Nunavik than in Québec (32.9 per 10,000, against nine). Hospitalization, infant mortality and suicide mortality rates, and therefore life expectancy, reflect the precarious health status of Inuit. Taken as a whole, the indicators clearly illustrate the adverse health conditions Nunavimmiut experience compared to the general population of Québec.

5. BASIC CONCEPTS

5.1. Uranium and its decay products

Uranium is ubiquitous in nature and found in varying but trace amounts in rocks, soil, water, air, plants, animals and human beings. Natural uranium consists of a mixture of three isotopes that have an atomic weight of 238 (about 99.27%), 235 (about 0.72%) or 234 (Lauwerys, 2007). The three isotopes behave identically chemically but have different radioactive properties (ATSDR, 2013b).

When uranium decays, it emits a series of decay products. Uranium-238 decays into radium (Ra-226) and radon (Rn-222). The decay chain ends with Lead-206, a stable element (Figure 3). Each new radionuclide has a half-life of its own, which may vary from a fraction of a second to billions of years. Half-life is the time required for half of the radioactive nuclei of a given substance to decay into another product. For example, the half-life of U-238 is 4.5×10^{9} years (4.5 billion years), whereas polonium-214 (Po-214) has a half-life of 1.5×10^{-4} seconds (or 1.5 ten-thousandths of a second). Radionuclides emit several types of ionizing radiation: alpha particles, beta particles and gamma rays (CNSC, 2014).

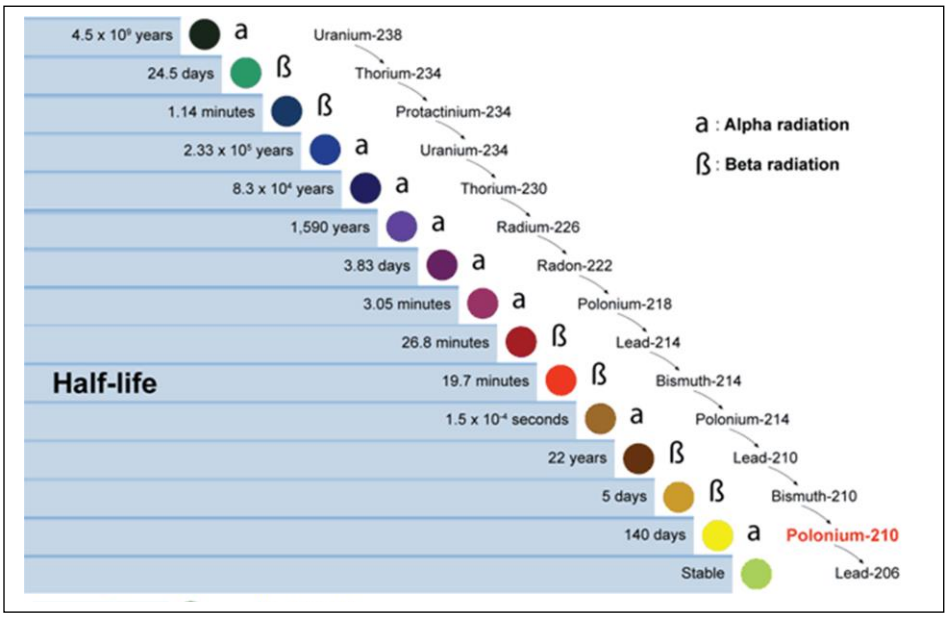
Note that radon is a generic term frequently used to denote both radon and radon decay products. Decay products that may cause lung cancer are those with a short half-life that emit alpha radiation, such as polonium-218 and polonium-214 (Figure 3) (CNSC, 2014).

As a radioactive element, each radionuclide has specific physical characteristics (half-life and type of radiation). Like all other elements, it also has physical and chemical characteristics of its own. It can be in different chemical forms, which determines its bioavailability, affinity towards lipids, and major routes of absorption (inhalation, ingestion, transdermal) (Lauwerys, 2007).

5.1. Other chemicals involved

In addition to uranium and its decay products, waste from uranium mines may contain more or less significant concentrations of chemical reagents and substances typically associated with uranium ore such as molybdenum, vanadium, selenium, iron, lead, and arsenic (Diehl, 2011). These contaminants are likely to be released in various environmental media (air, soil, water), become absorbed by living organisms and end up in mine tailings.

Figure 3. Decay Chain of Uranium-238



Source : CNSC, 2014.

5.2. Exposure factors

The release of chemicals in the environment does not always lead to human exposure. Exposure occurs when a person comes into contact with a substance by inhalation, by ingestion or transdermally. Moreover, in the case of radioactive substances, ionizing radiation can cause external exposure (ATSDR, 2013; 2013b).

Exposure to a substance does not necessarily lead to adverse health effects. The presence or absence of effects and their extent depends on factors such as dose, duration, and route of exposure. The effects can also be influenced by exposure to other chemical or radioactive substances, as well as age, sex, diet, lifestyle, genetic predisposition and health (ATSDR, 2013; 2013b).

6. ECONOMIC IMPACTS

6.1. Education, employment and low income in Nunavik

Nunavik has been producing an increasing number of graduates but remains poorly educated overall. In 2006, half of those aged 25 to 64 had a diploma (against 83% for all of Québec), as follows: 10% had a high school diploma, 30% a postsecondary diploma below the bachelor's level and 10% had a university degree (NRBHSS and INSPQ, 2011). Note that the proportion holding a university degree includes both Inuit and non-Inuit, the former group accounting for only 2% of degree-holders (NRBHSS and INSPQ, 2011). However, school attendance and education levels have both risen in Nunavik over the last twenty years, as in the rest of Québec (NRBHSS, 2014).

According to the NRBHSS and the INSPQ (2011), the unemployment rate for those aged 25 or older in 2006 was 15% in Nunavik vs. 6% in Québec. Among young people aged 15 to 24, the rate was 27% and 12% respectively. Percentage of low-income families are higher in Nunavik that across Québec, especially single-parent families (33% vs 26%). Nearly one in five families in Nunavik lived below the poverty line in 2006 (Duhaime, 2008).

Lack of jobs in Nunavik limits money-earning potential, despite the steady growth of the public service sector since the 1960s. This is due to the fact that a significant proportion of full-time jobs are held by people from outside the region, mainly because of the qualifications required. Therefore, although the entire population is almost exclusively Inuit, barely more than half of the full-time jobs are filled by Inuit (NRBHSS, 2014).

Table 2. Education, Unemployment and Low Income

Indicators	Nunavik	Across Québec
Percentage of individuals age 25 to 64 with a diploma, 2006	50%	83%
Unemployment rate for individuals age 15 to 24, 2006	27%	12%
Unemployment rate for individuals age 25 to 64, 2006	15%	6%
Percentage of low-income families, 2011 – couples – single-parent families	19.2% 8.6% 33%	8.8% 9% 26%

Sources: Census (2006); Institut de la statistique du Québec (2011).

The public and para-public sectors generate the highest number of job opportunities in Nunavik, with nearly 2,800 jobs provided by federal, provincial and municipal organizations (NRBHSS, 2013). Mining operations are the second largest employers: the Raglan mine has more than 1,000 employees (NRBHSS, 2014) and Nunavik Nickel employs some 600 workers (including subcontractors).[12] Oceanic Iron Ore mine will create approximately 500 jobs, with as many as 1,250 to 1,750 workers during the

[12] Canadian Royalties Inc., personal communication, October 27, 2014.

construction phase (Oceanic Iron Ore Corp., 2012). Several mineral exploration activities employ nearly 375 prospectors (NRBHSS, 2013).

Apart from these two sectors, there are few employers in Nunavik. The NRBHSS document (2013) indicates that 415 jobs, including 115 part-time positions, are available in air and maritime transport, 550 in the construction sector, 420 (including 150 part-time jobs) by private companies, 27 by power plants serving the 14 communities, and 140 seasonal positions by various outfitters. In addition, the Fédération des coopératives du Nouveau-Québec owns and operates hotels and shops that employ 135 people, including 50 part-time workers (NRBHSS, 2013).

6.2. Positive economic impacts

The economic boom associated with mining development can result in benefits for Nunavik families through the distribution of financial compensations as well as job creation and business opportunities (Moorhouse *et al.*, 2011).

According to the Plan Nunavik (KRG and Makivik Corporation, 2010), exploitation of some of the region's mineral deposits could create employment for more than 50 years. Mining development in Nunavik is expected to boost the 1,935 direct jobs projected for the region in 2014-2015 to 5,076 direct jobs in 2022-2023 (Gosselin *et al.*, 2014). According to Moorhouse *et al.* (2011), mining also offers the highest wages in the resource sector in Canada. In 2000, mining employees earned on average $1,130.50/week compared to $626.45/week in other industries.

In Nunavik, the Raglan mine signed an Impact and Benefit Agreement (IBA[13]) with the Makivik Corporation, the two communities located closest geographically to the mine (Salluit and Kangiqsujuaq) and the two corresponding landholding corporations. One of the goals of the agreement is to promote the training and employment of Inuit during the development and operation phases. The Raglan mine must also promote the use of Inuit businesses whenever possible for supplying good and services. Upon final closure of the mine, it must strive to find appropriate employment alternatives for Inuit employees elsewhere (Benoît, 2004).

The Inuit communities of Salluit and Kangiqsujuaq are the main beneficiaries of the Raglan agreement. Although both communities benefit from financial compensations and are first in line for job opportunities, other Inuit in Nunavik are second in line for employment, bids and joint ventures (Benoît, 2004).

[13] Impact and benefit agreements (IBAs) are formal written agreements between organizations and Aboriginals that manage the anticipated impacts (including environmental impacts) associated with an industrial development project and ensure that affected neighbouring communities derive the best possible economic benefits. The negotiation of an IBA has become a standard procedure for Canadian mining companies seeking to develop a project on Native land (Benoit, 2004). For more information on IBAs, see "Relations with Aboriginal Communities" at http://www.mern.gouv.qc.ca/english/publications/mines/publications/publication-2012-chapter8.pdf and MiningFacts at http://www.miningfacts.org/Communities/What-are-Impact-and-Benefit-Agreements-(IBAs)/.

Concerns and recommendations

The DPH considers that better access to employment and business opportunities and receiving financial compensations for the local population are significant additional sources of income for Nunavik residents overwhelmed by high unemployment and low income.

6.3. Challenges to Inuit obtaining jobs

The initial certificate of authorization delivered by the Québec government for the Raglan mine in 1995 set a target to fill 20% of the positions with Inuit (Blais, 2013). At the time data were collected for the study by Benoît (2004), 56 positions were held by Inuit, making them 13% of the workforce. In 2010, more than 10 years after the start of operations, the rate barely reached 16.7%, or the equivalent of 122 employees (Blais, 2013). According to Gosselin *et al.* (2014), the proportion of jobs held by Nunavik residents is expected to decline somewhat between 2014-2015 and 2022-2023, from 15.3% (297/1,935) to 12.6% (642/5,076). The low job rate for Inuit can be explained by the fact that some positions require skills that are rare among Inuit. Skilled labour therefore generally comes from the south of the province (Benoît, 2004; Blais, 2013).

Under these circumstances, it is critical to provide training to ensure that Inuit fill the greatest number of mining positions possible. The Plan Nunavik points out that no educational provider in the region has designed earth science or mining technology programs to help Nunavimmiut obtain employment in mineral exploration and mining projects (KRG and Makivik Corporation, 2010).

Worker turnover is extremely high. More than 350 Inuit employees had worked at the Raglan mine between the start of operations in 1998 and completion of Benoît's study (2004). Several reasons for the turnover have been proposed, including difficulty adapting to a busy work schedule, discrimination perceived by Inuit, and addiction issues.

In addition, Inuit do not hold the best-paying jobs. Benoît (2004) reports that most of them work as dishwashers, maintenance employees, assistant cooks and receptionists.

Concerns and recommendations

The DPH would expect measures to be implemented to promote training, employment and business opportunities for Inuit by way of : appropriate training programs, employee support, programs to foster intercultural coexistence, targeted dissemination of information on employment opportunities in Nunavik's communities, and so forth.

6.4. Impact of the method of financial compensations distribution

According to the IBA, communities decide, either individually or collectively, how to distribute financial compensations (Rodon *et al.*). In the case of the Raglan agreement, the two main beneficiary communities are Salluit and Kangiqsujuaq.[14] In Salluit, financial compensations are paid primarily to individuals, while in Kangiqsujuaq they are used mainly for community projects, with the rest going to individuals (Blais, 2013). The method of financial compensations distribution is an important issue. Direct distribution to individuals could potentially yield positive benefits such as helping to improve the financial situation of low-income families and promoting the practice of traditional activities, but in most cases these benefits have a mixed, or even negative, effect (Blais, 2013). Some residents have stated that the financial compensations paid directly to individuals have already led to increased consumption of drugs and alcohol. Absenteeism at work stemming from increased consumption and excursions outside of the village have become problematic due to the small size of the communities, and affect, among other things, basic services such as emptying septic tanks. Conversely, Rodon *et al.* hypothesize that the use of financial compensations for community projects enhances quality of life in the community, for example by increasing safety outside the village through the construction of emergency cabins and trail development. They can also lead to job creation projects such as small businesses and the construction of gyms, pools, garages and so forth.

Concerns and recommendations

The DPH believes that a special attention should be paid to the financial compensation distribution system (individual vs collective) in order to minimize the negative effects and maximize the positive economic spinoffs of mining development.

[14] According to Blais (2013), the Raglan Agreement stipulates that 4.5% of the mine's profits must be allocated as follows: 45% to Salluit, 30% to Kangiqsujuaq and 25% to the rest of the region.

7. IMPACTS ON POPULATION HEALTH IN NUNAVIK

According to the INSPQ (2013), the literature contains considerable data in relation to the contamination of surface water and groundwater, soil, air and biota through the dispersion of various pollutants generated by the operation of uranium mining projects. Communities near the mining areas may therefore be exposed to several radioactive and chemical substances through different routes of exposure. The extent of exposure is moderated by population lifestyle and is likely to pose health hazards. In addition to these potential risks to physical health, there are psychological and social impacts that arise from changes in the natural and human environment (INSPQ, 2013).

The following sections review the findings of the INSPQ's (2013) study on health effects on the population. The INSPQ analyzed epidemiological research found in the literature and presented a toxicological risk assessment based on an exposure scenario that considers several radiological and chemical contaminants and multiple routes of exposure. The conclusions that cause concern for the DPH are highlighted and rounded out with the findings of studies carried out on Inuit territories that raise additional concerns for the people of Nunavik. It should be emphasized that direct observation data and Inuit traditional knowledge about the environment are not qualitatively different from other types of scientific data and should be considered valid information (Wenzel, 1999).

As health risks for uranium miners are already well documented, the INSPQ's analysis was limited to health effects on the general population. The protection of workers is the subject of a separate chapter in this brief.

7.1. Epidemiological study

The INSPQ (2013) analyzed data from 10 epidemiological studies of populations living near uranium mines. The following excerpts describe the main observations of this survey:

- *For cancer deaths, meta-analyses were carried out for 13 types of cancer:*
    - *For lung cancer, there was sufficient evidence of no additional risk of [death by] lung cancer in women; in men, the higher risk of [death by] lung cancer was probably due to mining employment.*
    - *For leukemia, a slight increase in the risk of death was suspected.*
    - *For the other 11 types of cancer, there was suspicion of no increased risk of death, or the data were insufficient to conclude.*
- *For cancer incidence, most of the findings were taken from one study, where only one statistically significant excess was observed: lung cancer in men, which was consistent with the findings concerning deaths from lung cancer. A recent Ukrainian study reported statistically higher incidence levels for certain cancers, which the authors felt may have been due to a screening effect caused by earlier*

detection of cases among uranium workers or low radioactivity safety standards in the former Soviet Union.

- *For non-cancer deaths, statistically significant excesses were observed for tuberculosis, accidents other than motor vehicles, and suicide among men. However, methodological limitations, lack of consistency and lack of biological plausibility meant that it was not possible to confirm a connection between the fact of living near a uranium mine and non-cancer deaths.*

- *The findings from two of the studies raised suggestions concerning abnormal responses to DNA repair and increased frequency of certain negative pregnancy issues, but the data were insufficient to conclude.*

According to the ATSDR (2013; 2013b), it is uncertain whether children are more susceptible than adults to uranium effects. In particular, it is not known whether uranium can cause birth defects in people. Some studies suggest that exposure to depleted uranium increases the frequency of birth defects, but there is no evidence-based data that lead to solid conclusions about humans.

Concerns and recommendations

The DPH supports further research to better document the health effects associated with uranium exploration and exploitation activities. These studies would however prove difficult to conduct in Nunavik. With its small population, it would be problematic, if not impossible, to successfully document a statistically significant increase in risk for the region.

The DPH is of the opinion that uncertainty about children's specific vulnerability to the effects of uranium should be taken into account in the assessment of health risks for the population of Nunavik, especially in view of its large youth population and rapid growth.

7.2. Assessment of the toxicological and radiological risk

INSPQ assessment of toxicological and radiological risk by exposure scenario

The INSPQ (2013) reviewed the scientific literature on risk assessment and environmental contamination associated with uranium mining. Its findings are based on an analysis of 68 articles covering recent uranium mining, i.e. after 1990.

Because of the mobility of the radionuclides and chemicals involved in problems caused by uranium mining, the INSPQ considered multiple routes of exposure to environmental contaminants caused by mining in order to define its exposure scenario. These pathways include internal exposure to gases and particles (radioactive or not) by way of air, water and food (fish, seafood, meat, eggs, fruits and vegetables) and airborne exposure to gamma radiation (external exposure). All radionuclide decay chains of U-238 and Th-232 were incorporated in the exposure scenario, as were the following chemicals: arsenic, barium, cadmium, cobalt, chromium, mercury, molybdenum, lead, selenium and uranium.

In the INSPQ's opinion, risk assessment studies of uranium mining are limited and often incomplete. Moreover, the mine's actual contribution is unclear because, in many cases, regional background radiation is not subtracted from the calculations. However, taking into account the limitations of the available data, the review identified the following findings, as outlined in the following excerpt:

- *Uranium-producing regions have higher background concentrations from radionuclides and other associated chemical elements, and local populations will be exposed to higher levels of these elements. The highest radiological and chemical doses appear to be from ingestion of fish and seafood and inhalation of radon.*

- *The presence of a uranium mine may lead to additional exposure of local populations.*

- *Although the data are extremely limited, there appears to be a possibility that uranium mining generates additional exposure for the population, and that 1 mSv*[15] *and IR*[16]*>1 values will be exceeded (although it is impossible to state by how much).*

- *The data gathered are not complete enough to reach a conclusion on the area of influence of a uranium mine for radionuclides (including radon) and chemical elements. […] Based on limited data reported by the authors of selected scientific articles, the contribution of mining in Canada to selenium in water and fish was observed within a distance of two to 15 km from mines. In Portugal, radionuclides were reported in water within about 7 km from mines.*

- *Upstream of these observations, one major element emerged from the study of the scientific literature: the rarity of data on regional background prior to the arrival of the uranium mine. Information on the environmental background is vital in monitoring the health of populations living near uranium mines.*

Impacts specific to northern populations

The INSPQ prepared its risk analysis on the basis of a conservative generic exposure scenario not specifically based on the dietary patterns of a particular community (e.g. Inuit) (INSPQ, 2014). Although caribou consumption was considered in this scenario, it should be noted that Nunavimmiut consume a wide variety of other types of country food, including ptarmigan, Canada geese, snow geese and other birds; Arctic char, whitefish, salmon and other fish; and seal, beluga, walrus and other sea mammals. Blueberries, cloudberries and other small fruits are also part of their diet (NRBHSS,

[15] Canadian regulated dose limit for planned exposures (INSPQ, 2013).

[16] Ratio between daily exposure dose and acceptable daily intake. An indicator greater than 1 indicates the possibility of occurrence of toxic effects (http://www.actu-environnement.com/ae/dictionnaire_environnement/definition/indice_de_risque.php4).

2014). The INSPQ study did not document contribution to exposure by this specific food intake in the Inuit diet.

Environmental contamination and exposure to heavy metals have long been major concerns for public health authorities and Nunavik residents. Several sources of anthropogenic contaminants, such as mercury and PCBs, are likely to enter the food chain, where they accumulate in different animal species. However, interactions and additive effects of these substances with substances emitted by uranium mines have been poorly documented. For example, as noted by the Groupe scientifique sur l'eau (scientific group on water, 2003), the influence of other substances on the toxicity of uranium has not been documented, although simultaneous exposure to other heavy metals known for their nephrotoxicity (such as lead and cadmium) may have an additive effect on toxicity.

Concerns and recommendations

The DPH stresses the need to clearly characterize the environmental background noise[17] and current state of health of the people of Nunavik before any uranium mining projects are launched. To that end, the Nunavik 2016 Health Survey should provide baseline data on the population's health status and serve as a reference point for assessing the future impact of any development project.

Should a uranium mine be established in the region, the DPH considers that it would be critical to estimate exposure using a model that approximates the eating habits of Inuit, and then properly monitor the health status of the population and establish an environmental contamination monitoring program

The DPH is concerned about cumulative effects that may potentially result from the combination of substances emitted into the environment by mining activities and various contaminants to which Nunavimmiut are already exposed, whether from other parts of the world, (e.g. mercury, PCBs, etc.) or from hunting (e.g. lead) or lifestyle (e.g. cadmium in cigarettes[18]).

[17] It is interesting to note that the *Regulation respecting the Quality of Drinking Water* (c. Q-2, r. 40) stipulates taking samples annually to analyze inorganic materials, including uranium, in distribution systems that supply water to more than 20 people (section 14). According to the KRG, all the values measured in Nunavik's drinking water distribution systems are below the limits of detection devices (G. Bédard, Assistant Director, Municipal Public Works Department, KRG, personal communication, October 24, 2014). In section 42, it is also stipulated that the head of the distribution system must take appropriate measures to verify the presence and concentration of radioactive substances, especially Pb-210 and Ra-226, as soon as he has reasons to suspect that the water made available to users has a gross alpha activity greater than 0.5 Bq/L or a beta activity greater than 1 Bq/L. These parameters have not been analyzed in Nunavik given the lack of suspicion that its drinking water is contaminated with radioactive substances (G. Bédard, op. cit.).

[18] Blood cadmium concentrations in Nunavimmiut are associated primarily with smoking (Dewailly *et al.*, 2007).

7.3. Impacts on eating habits of Inuit

Importance of country food

Country food contributes significantly to the dietary intake of Nunavik Inuit (Blanchet *et al*., 2000; Blanchet and Rochette, 2008). Despite all the changes that Nunavik has experienced in recent decades, subsistence hunting and fishing as well as berry picking are still preeminent in the lifestyle of many Inuit (INAC, 2009). According to the 2004 Qanuipittaa Nunavik Inuit Health Survey:

- Forty-five percent of adults, especially men, said they hunted frequently. This percentage climbed to 54% among men 50 years and older.
- One-third of residents (33%) fished frequently.
- About half of the population, especially women, picked berries.
- Sixteen percent of dietary energy intake was supplied by country food. This contribution rose up to 28% in some older Inuit (Blanchet and Rochette, 2008).

These activities appear to be carried out more frequently by older, married respondents with a higher personal annual income. It is claimed that these activities have declined significantly since 2004[19] due to the cost of the equipment, loss of traditional knowledge and environmental changes (unstable ice, decrease in caribou populations and changes in animal migration routes) (NRBHSS, 2014).

Country food is an excellent source of many vitamins and nutrients, including protein, iron, magnesium and zinc. It therefore plays a key role in the nutritional status of the population (Blanchet *et al.*, 2000; Kuhnlein and Receveur, 2007). According to the 2004 Qanuipittaa Nunavik Inuit Health Survey, country food contributed positively to meeting nutrient and micronutrient requirements by providing more than 25% of the intake of protein, niacin and riboflavin, vitamins B6 and B12, omega-3 fatty acids, selenium, zinc, iron and phosphorus in the diet of those surveyed (Blanchet and Rochette, 2008). Generally, hunting, fishing and gathering and eating country food can help reduce the risk of diabetes, heart disease and obesity (Canada North Environmental Services, 2014).

Generally speaking, the production, sharing and consumption of country food are integral to Inuit culture and plays a central role in the well-being of Inuit communities and their cultural identity (Chan *et al.*, 2006; Lambden *et al.*, 2007; Searles, 2002). Preservation of animals and promoting hunting, fishing and gathering are among the priorities raised by the public during the Parnasimautik hearings (Makivik Corporation *et al.*, 2014).

[19] However, unpublished survey findings tend to show that although there are fewer regular hunters and fishers, they nevertheless harvest the same amount as larger numbers did previously.

The DPH takes into account the multiple effects of country food on Inuit health and well-being and actively promotes its consumption, in addition to hunting, fishing and gathering.

Food security

Food security in Nunavik is a priority for the DPH. Food security exists when all people, at all times, have physical, social and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. (Government of Canada, 1998). A number of families have difficulty obtaining enough safe and nutritious food in the region, a situation that affects their physical and mental health and may be linked to conditions like chronic disease, obesity and depression (Vozoris et Tarasuk, 2003).

In the 2004 Nunavik Inuit Health Survey, nearly a quarter of individuals stated they had lacked food during the month prior to the survey. The problem of food insecurity in Inuit communities is due to a combination of factors including poverty, the high cost of food, the cost of living, availability of healthy food in grocery stores, and climate and environmental changes (Chan *et al.*, 2006 ; Ford and Beaumier, 2011). The cost of store-bought food is 81% higher in Nunavik than in Quebec City (Duhaime and Caron, 2012). Access to country food is an integral part of food security in Nunavik. The role of country food in food security is all the more important in view of the cost of imported food in stores.

Impacts on hunting, fishing and gathering

Uranium mining exploration is likely to disturb animals, especially caribou, and cause them to move away from mineral extraction sites, access roads, port facilities, and from communities located nearby. The cost of hunting, which is already a barrier to accessing country food in Nunavik, would increase even further if hunters have to go further afield to locate it (Makivik Corporation *et al*., 2014).

As underscored in the Plan Nunavik, the habitats of species on which Inuit depend for their subsistence, such as caribou, Arctic char and water fowl, are usually the same areas eyed for mineral exploration and extraction (KRG and Makivik Corporation, 2010). According to Salluit and Kangiqsujuaq residents who were interviewed on the impacts and benefits of the Raglan mine, when helicopter traffic is too busy in one location, animals tend to run away to avoid it. However, helicopters are highly useful for search and rescue operations and would be made available by the mine (Blais, 2013). Inuit have also already raised other concerns, including the possible impacts on hunting beluga and seal in Deception Bay if they are disturbed by the noise of maritime traffic (Kirwin, 2008).

Residents in Salluit and Kangiqsujuaq have also remarked that the clearance of paths by icebreakers carrying ore can impact on winter and spring snowmobile trails by weakening the ice, which must then be avoided by hunters (Blais, 2013). Locations may therefore be more difficult to access after the passage of one of these ships, and excursions to hunting sites may take longer and be more hazardous.The Raglan mine is aware of these impacts and avoids maritime traffic between March 15 and June 15. It

also marks secure paths where ships have opened passages in the ice. Some residents (Blais, 2013) have pointed out that the dust tends to accumulate on the snow, making it darker. As a result, it melts quicker in the spring, and consequently, some snowmobile paths lose their snow earlier in the year, making it difficult for hunters to access their hunting sites.

As explained by Rodon *et al.* and Blais (2013), the opening of a mine is often viewed as having a mixed impact on food security because of its financial benefits (jobs and financial compensations). Mines are often touted as an additional source of income that increases material comfort by making it possible to purchase food, hunting and fishing equipment, and so forth. However, the increase of jobs in the mining field could result in decreasing the number of hunters and, consequently, the amount of country food available to the population. It could also jeopardize the transmission of skills and knowledge to younger generations.

Contamination fears

Usher *et al.* (1995) point out that the gravest potential consequences of environmental contamination for Aboriginals is not the actual occurrence of toxic effects but the negative consequences of the worry and anxiety generated by the prospect of contamination. Fear of contamination of country food, even if unproven, could undermine confidence in the safety of hunting, fishing and gathering products. Adverse effects would therefore arise primarily from the disruption of these activities, country food consumption, and nutrition.

Changes in the fauna and flora in connection with neighbouring mining activities have already been observed in Nunavik. Blais (2013) reports that some residents in Salluit and Kangiqsujuaq, close to the Raglan mine, have noted changes in the taste and quality of fish harvested in areas near the mine. Several women in these regions also commented that berries harvested off heavily travelled roads near the mine were covered in dust. Other residents claimed they have even stopped eating some country food.

Contamination or fear of contamination of the environment and food by mines can lead to major changes in lifestyle, including more sedentary activities and a decrease in the consumption of country food (Richmond and Ross, 2009, Egeland et al., 2010).

Concerns and recommendations

Given the great importance of country food for Inuit health, well-being and cultural identity, the DPH is concerned that perceived or actual contamination of the environment caused by the establishment of a uranium mine in Nunavik may cause distrust in the safety of Inuit food. Any reduction in consumption of country food could significantly impact on the food security of Nunavimmiut, which is already being compromised by many socio-economic and environmental factors.

The DPH estimates that the presence of mining companies may affect the Inuit way of life, and particularly their hunting, fishing, and gathering activities.

In view of the Inuit people's strong attachment to their territory, the DPH estimates that mining companies must demonstrate great social responsibility and a commitment to reduce the impacts of their activities on the environment and the local population.

7.4. Psychosocial impacts

This section lists the positive and negative psychosocial impacts that may result from mining development in Nunavik. We present the results of the INSPQ (2013) report that reviewed 14 articles and documented the psychosocial effects of uranium exploration, extraction, storage, transport and waste management. As Blais (2013) notes, the psychosocial impacts of past or present mines in Nunavik have been poorly documented. We nonetheless complement this section of the brief with a discussion of the study by Moorhouse *et al.* (2011) that reviewed the potential impacts of the establishment of a uranium mine in Nunavut, as well as studies by Blais (2013) and Rodon *et al.* outlining the impacts and benefits of the Raglan mine, as reported by residents in the communities of Salluit and Kangiqsujuaq, Nunavik. We also discuss the potential psychosocial impacts of mining development in Nunavik as delineated in a document by the NRBHSS (2013).

Literature review by the INSPQ on the social and psychosocial effects of uranium exploration, extraction, storage, transport and waste management

The results presented by the INSPQ (2013), classified by topic, deal with three categories of specific effects, as stated in the following excerpt:

- *Effects associated specifically with uranium mines were identified in connection with overall quality of life in the event of technological accidents. The literature on uranium mines contained no conclusions regarding other impacts on quality of life, although these elements were addressed in the literature on mines in general.*

- *With regard to psychological health specifically in connection with uranium mines, several types of people experienced anxiety regarding radioactivity and its (real or feared) impacts. Mining processes and mining facilities, regardless of the type of mineral, also caused economic changes that had impacts on material consumption and drugs or alcohol use, and these, in turn, generated other psychological and physical impacts. [For example, debt anxiety can arise once the mining boom subsides, or stress can result from the arrival of foreigners in a community.]*

- *As for aspects relating to social health, uranium mines appeared to be directly associated with alteration of the social climate and loss of public trust in the authorities. Regardless of the type of mineral concerned, negative socio-economic impacts were observed, and were perceived as being more important than the positive impacts, given the overall duration of mining projects and their rapid growth-degrowth cycle (the boomtown effect). Social inequalities in the sharing of the costs and benefits of mining projects were also identified.*

- *Some social groups were found to be more vulnerable, and the Aboriginal peoples appeared to be more affected by the changes.*

Impacts specific to northern populations

Not all communities are affected in the same way by the opening of a mine. An important factor to take into account when assessing impacts, especially psychosocial effects, is the proximity of the mine and the potential for mine workers to enter the community. Generally speaking, the anticipated impacts will be more significant in smaller and more remote communities and in communities close to the mine, and especially if the community already has adverse psychosocial characteristics (Gosselin *et al*., 2014; Brisson, 2014).

In Nunavik, two scenarios are likely: a mining camp whose workers are all ferried to the mine by plane (fly-in/fly-out or FIFO) (as is the case with the Raglan mine), or a hybrid mining formula with FIFO but located nearby a transit community that is generally small, as in the case of Oceanic Iron Ore and Aupaluk (Gosselin *et al*., 2014). It is in the latter case that the most significant impacts are likely to occur in communities due to land use conflicts and possible contact between workers and the local population.

The FIFO system is characterized by atypical schedules, requiring for example, a two-week stay at the mine site and two consecutive weeks at home (Blais, 2013). For Inuit workers, this schedule may result in disengagement from the community, a sense of guilt, work overload, escalating emotions, and increased family discord (Brisson, 2014). According to Blais (2013), FIFO is a boon to some because it offers a respite from family responsibilities. However, it can be very hard for young couples with children, to the extent that many will quit their jobs to stay with their families (Blais, 2013). Moorhouse *et al.* (2011) also observed that spouses of mine workers, mainly women, are burdened by their increased domestic responsibilities. Changing traditional male roles can also increase family stress. The Government of the Northwest Territories has concluded that with the development of diamond mines, the percentage of single-parent families has doubled from 15% to over 30% in small local communities. Women who are forced to move to remote mining areas lose their support network and often struggle to function in male-dominated social structures. It is also known that violence against women increases in mining communities.

Several respondents interviewed by Blais (2013) reported that Inuit working at the mine were discriminated against and could be culturally marginalized. Coping mechanisms often involve alcohol and drug abuse. This phenomenon has been reported in communities located near the Nanisivik mine in Nunavut (Moorhouse *et al.*, 2011).

Moreover, given that Inuit health and well-being is closely tied to spiritual factors (according to the Inuit definition of health as explained previously), the fate of archaeological sites, especially burial sites, should be addressed as they could be disturbed by exploration and extraction activities. Before their settlement in the 1960s, Inuit roamed the land surrounding present-day communities, and these areas are dotted with numerous burial sites that must not be disturbed under any circumstance.

According to Moorhouse *et al.* (2011), the social fabric of Inuit communities could be disrupted by influxes of transient workers and lead to loss of cultural identity and erosion

of community support networks. An increase in the population could also reduce access to housing and worsen the overcrowding problem.

The NRBHSS (2013) document lists the psychosocial impacts that could arise in the wake of a mining boom in Nunavik. The negatively anticipated impacts that would follow an increase in income for some Inuit residents and the massive influx of non-Inuit workers in some of Nunavik's communities include reduced access to housing and increased overcrowding, an increase in excessive drug and alcohol consumption and trafficking, unprotected sex, intravenous drug use, STBBIs (including HIV), unwanted or high-risk pregnancies, increased numbers of single-parent families, financial difficulties, domestic and sexual violence, harassment and sexual exploitation. These factors suggest an erosion of the region's cultural capital (language and cultural identity) and could play a role in the local population's increased psychological distress.

On the other hand, Moorhouse *et al.* (2011) argue that better financial health is likely to foster a feeling of independence, freedom and pride. Blais (2013) also points out that a mine job can be a source of pride for workers.

Nonetheless, most respondents in a study by Rodon *et al.* are of the opinion that mines negatively affect Inuit culture, health, well-being, gender relations, families and communities.

Given that non-renewable resources are extracted by mines, these facilities must be conceived of as having a limited life, with a beginning, an operating period and an end (INSPQ, 2013b). At the closure of a mine site, the positive benefits of job creation disappear, and abandoned sites are often the resulting outcome. At this stage, the negative impacts weigh even more heavily in the balance (Gosselin *et al*., 2014).[20] Brisson's (2014) literature review confirms that despite its potential benefits, a mine often results in negative psychosocial effects. The impact is potentially greater for Aboriginal communities, which are especially affected by changes in income, lifestyle and values (shift to individualism and consumerism). Because of their special attachment to the environment and the importance it holds, they are much more affected by any change in the natural environment than other populations. As regards uranium mines, radioactive products are known to raise specific fears about contamination of the environment and country food (see the preceding section) because the public instinctively relates these factors to the dangers of nuclear industry (INSPQ, 2013). These fears as well as those about the human health effects that these substances are likely to cause make a greater case for the negative nature of the impacts.

Nunavik's communities would also be more vulnerable in view of the psychosocial problems they already have. A large array of indicators (including number of people with drug addictions, prevalence of domestic and sexual violence, and high suicide rate) confirm the extent of their existing psychosocial problems.

[20] Unfortunately, Nunavik already has a number of abandoned sites that now must be rehabilitated (KRG, 2012).

Concerns and recommendations

The DPH stresses the importance to consider archaeological sites, including burial sites, during impact assessments carried out prior to a mining project.

The DPH is concerned that an influx of workers from outside of Nunavik may have psychosocial impacts, especially in communities near the mine. Of particular concern is the difficulty that individuals, families and gateway communities will experience in adapting to this new reality.

The DPH raises concerns about the psychosocial problems pervading Nunavik that could be exacerbated by the establishment of a mining project. In the case of a uranium mine in particular, the negative psychosocial impacts could outweigh any advantages for Nunavimmiut.

Given the scarcity of studies on the subject, the DPH considers that psychosocial impacts on Inuit populations must be documented as the mining projects progress, beginning at the exploration phase.

8. PROTECTION OF WORKERS

Legal protection of workers

The Canadian Nuclear Safety Commission (CNSC) is responsible for the regulation and authorization of all current and future uranium extraction and concentration in Canada. The *Radiation Protection Regulations* stipulate the maximum radiation dose limits to which nuclear workers can be exposed in Canada, i.e. 50 mSv per year and 100 mSv over five years. The limit for a pregnant worker, once pregnancy has been declared, is 4 mSv for the remainder of the pregnancy. The Regulation also requires the employer to implement a radiation protection program to keep doses as low as reasonably achievable (ALARA principle) and to monitor and record doses received by workers (CNSC, 2014).

In Québec, the *Act respecting Occupational Health and Safety* (c. S-2.1) stipulates that every worker has a right to working conditions that have proper regard for his or her health, safety and physical well-being (section 9). Furthermore, every employer must take the necessary measures to protect workers (section 51). The *Programme spécifique à l'établissement* (specific health program for an establishment, PSSE) provide for activities to inform workers about the nature of occupational hazards and necessary preventive measures (section 113).

In Québec, a cautious attitude in matters of occupational health is advocated. The primary goal of the regulations is to eliminate at the source dangers for the health, safety and physical well-being of workers, to avoid the risks by implementing safer alternatives or to reduce risks to the extent possible. This approach is advocated even when risks are known, and, for some contaminants, when workers' exposure levels are lower than

the limits set out in the regulations or current standards (*Regulation respecting Occupational Health and Safety*, c. S-2.1, r. 19.01, section 42).

Worker protection at uranium exploration sites

During the preliminary hearings in Kuujjuaq in June 2014, there were concerns about whether Inuit employees working on drilling were given proper protection (especially due to the fact that they were not wearing a mask). Fears were expressed about the type of risks to which they may have been exposed in the course of uranium exploration in Nunavik.

It is difficult to know the exact circumstances surrounding the allegations reported. Be that as it may, the employer must inform workers of risks they face, even during the exploration phase, and how to minimize them even if they are negligible and do not justify wearing a mask or other personal protective equipment. The employer must ensure that workers understand the information given to them. Section 10 of the *Act respecting Occupational Health and Safety* is specific in this regard, as it states that the worker is entitled to "training, information and counselling services in matters of occupational health and safety, especially in relation to his work and his work environment, and to receive appropriate instruction, training and supervision; [and] to receive the preventive and curative health services relating to the risks to which he may be exposed […]."

Increased risk associated with tobacco use

The health risks of uranium miners are well documented (INSPQ, 2013). According to the CNSC (2014), workers are mainly exposed to external radiation as they inhale uranium dust or radon (and its decay products). Historically, the latter form of exposure was the primary cause of health effects in uranium mine workers. There is a linear relationship between cumulative exposure to low concentrations of radon and the risk of developing lung cancer (CNSC, 2014). There is no known threshold below which there is no risk.[21] In modern mines, workers are rarely exposed to high doses of radiation. In 2013, the average annual dose was 0.53 mSv for Canadian miners, and the maximum dose was under 15 mSv (CNSC, 2014).

In Nunavik, high levels of tobacco use (77% of smokers) are a significant factor to consider because of its synergistic effect with radon. In fact, the National Research Council (NRC 1998 in Moorhouse *et al.*, 2011) has indicated in the following terms that there is enough evidence to support this statement: "[…] the number of cancers induced in ever-smokers by radon is greater than one would expect from the additive effects of smoking alone and radon alone." This is all the more cause for concern given that, as emphasized by Moorhouse *et al.* (2011), lung cancer rates among Inuit are among the

[21]According to the Committee on the Biological Effects of Ionizing Radiations (BEIR), household radon is responsible for 10 to 14% of lung cancer cases in the U.S. (CNSC, 2014). Radon is the main cause of lung cancer in non-smokers and the second main cause of cancer in smokers, after tobacco use (Canadian Cancer Society, retrieved October 10, 2014, from http://www.cancer.ca/fr-ca/cancer-information/cancer-type/lung/risks/?region=qc)

highest in the world and are rising. In fact, they are four times higher in Nunavik than in Québec.

Therefore, higher radon levels caused by underground mining activities combined with high rates of smoking could aggravate lung problems in Nunavik workers. Note, however, that Québec regulations require strong ventilation of galleries to ensure control of occupational risks due to air quality.

Lung problems noted in uranium miners could also arise from exposure to silica or the emission of diesel combustion gases, also aggravated by tobacco use (Lauwerys, 2007; Moorhouse *et al*., 2011). Deposits in the Cape Smith belt region, where the Raglan and Nunavik Nickel mines are located, may contain asbestos. During the environmental assessment of a uranium project, the presence of asbestos must be evaluated and, where asbestos is present, must be taken into account when occupational hazards are characterized.

Medical emergencies

Health services for workers are usually provided by the establishment (section 115 of the *Act respecting Occupational Health and Safety*) on the mine site. However, access to health care is inherently limited at mining facilities in remote areas like Nunavik, as it is in the communities. A worker in need of urgent health care beyond that offered by the mine must be transferred either to the nearest community or to one of two health centres (located in Kuujjuaq and Puvirnituq). The worker may even be referred to a large centre like Montreal or Quebec City. Except in the case of mines connected by road to a community, the transfer is often carried out by government air ambulance or helicopter. Adverse weather that prevents planes from taking off and landing are not uncommon in Nunavik. Any delay in transporting a worker requiring emergency care from a mining or exploration site to a healthcare facility may have serious consequences for the worker.

Accidents can indeed happen. According to an inspection report by occupational health resources of DPH, an incident on a mine site in March 2012 caused the carbon monoxide poisoning of 27 workers. Two workers were evacuated to Kuujjuaq, after which one was sent to Montreal the following day for treatment in a hyperbaric chamber. Note that air transportation of workers with carbon monoxide poisoning can be particularly risky in view of lower oxygen levels at high altitude.

Advance planning of occupational health and safety

Mining companies are urged to plan for health and safety considerations right from the initial design of their facilities, whether for extraction or ore concentration, or for other activities such as water treatment or machinery maintenance. This proactive attitude may prevent faulty engineering designs, causing occupational health or safety risks, which must then be corrected after the expensive work is already underway or has been completed[22]. In-depth examination of issues specific to mining development in very

[22] For example, power plant generators should be individually contained in order to prevent massive overexposure to noise, a problem that can cost millions of dollars to correct after the fact.

isolated areas should begin very early in the planning process, of design and construction, with the involvement of the occupational health resources of the DPH. These upstream interventions could prevent exposure or accidents with serious, if not dramatic, consequences for workers.and for those who are called upon to evacuate them by air.

Concerns and recommendations

The DPH is concerned about the degree of enforcement of the principles and regulations regarding workers protection during uranium exploration activities in a remote region like Nunavik.

Given the high proportion of smokers in Nunavik and the cumulative and even synergistic effect of occupational exposure to various carcinogenic contaminants (including radon) coupled with tobacco use, the DPH insists that control measures must be implemented to prevent pulmonary health issues in Inuit workers.

The DPH is concerned about the risks inherent in working in remote regions and, given Nunavik's harsh and unpredictable weather, about the dangers of medical evacuations of injured workers and the consequences for other people involved (pilots, medical personnel, etc.).

The DPH underlines that it is vital and even critical to consider, for all stakeholders, the potential added value of including occupational health and safety concerns at the initial design and construction phase of mining facilities in Nunavik.

9. IMPACT ON THE ORGANIZATION OF SERVICES

In view of the precarious health status of Nunavimmiut and the current vulnerability of the regional health and social services network, mining development could affect the organization of these services. In this regard, the main challenge would be to contain the additional pressure that would be generated by an increase in population and a rise in health risks on a system already functioning at full capacity. The system's human and material resources are already lacking, and are insufficient to meet current demands.

Impacts on the organization of health and social services are well described in a document edited by the NRBHSS in 2013. This document was submitted to the MSSS in 2013 and the BAPE on uranium mining issues in September 2014. It briefly describes the services currently available in the region, the problems surrounding current delivery and the anticipated increase in service demand.

Readers must view the document as integral to the concerns raised by the NRBHSS.

Concerns and recommendations

The DPH raises concerns about the challenge posed by the increased number of users who would be served by Nunavik's health facilities as a result of the influx of hundreds of workers from outside the region.

10. *NUNGUJUITTUQ* OR « SOMETHING THAT WILL NEVER PERISH »

> *"The word that we use for the word uranium in our language (inuktitut) is […] "nungujuittuk [sic]", it is something that will never perish. It will be there forever. And it is a very strong word and it always catches everyone's attention when we use that word".* – Tunu Napartuk, BAPE Hearings on the Issues of Uranium Mining in Québec, Kangiqsualujjuaq, September 25, 2014.

The extraction and concentration of ore generates a large amount of mining waste which is stored close to the site in specially designed storage tanks (INSPQ, 2013). Mine waste contains components from the original ore, i.e. a fraction of the uranium that could not be extracted, as well as long-term decay products such as radium-226 and thorium-230 and chemical reagents used in processing.

Moorhouse *et al.* (2011) lists the hazards associated with mine tailings, which include:

- Gamma (and beta) radiation from the surface of the tailings pile;
- Dust blowing containing radioactive and toxic constituents;
- Radon gases (new radon continuously formed by decay of radium) being released and transported to large distances;
- Seepage release containing radioactive and toxic constituents into the soil and into the ground and surface water (figure 4).

Because of the long half-life of the radioactive compounds involved, it is imperative to guarantee the long-term safety of mine tailings (Diehl, 2011). The DPH is concerned about the ability of managers to ensure long-term environmental monitoring and to measure health impacts associated with the presence of these waste products in the region, particularly in view of the fact that they will remain contaminated for several thousands of years.

As the INSPQ (2013) points out, although mine waste management systems have greatly improved over the last decades, even the most modern mines are not immune to malfunction. Our concerns are therefore justified, particularly in view of significant long-term effects on the environment, human health and the Inuit way of life that could result from the dispersal of mine waste into the environment by a dam failure or other occurrence (figure 4). A number of such cases have arisen in the last few decades, most notably a tragic event in a small Navajo community in 1979.[23] More recently, a radioactive substance was spilled due to a containment breach in a uranium mine in Australia (2013).[24] Closer to home, a dam in a gold and copper mine failed in British

[23] Church Rock uranium mill spill. Retrieved October 10, 2014, from http://en.wikipedia.org/wiki/Church_Rock_uranium_mill_spill

[24] Spill of contaminated material at Ranger uranium mine; locals fear for Kakadu National Park. News article published December 8, 2013, retrieved from http://www.abc.net.au/news/2013-12-07/spill-at-nt-uranium-mine-near-kakadu/5142148

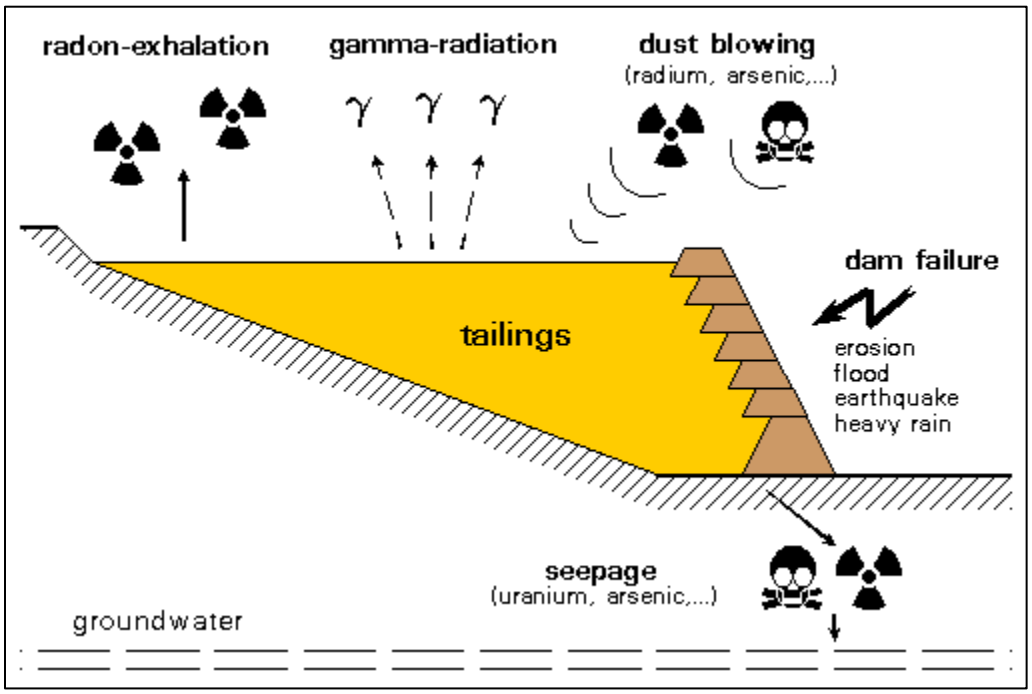
Columbia in August 2014, releasing an estimated 25 million cubic metres of mine waste into the environment.[25]

Although not all accidents happen in uranium mines, the radioactive and long-lasting properties of substances in the uranium mine tailings amplify the environmental and human consequences of a possible accident.

Concerns and recommendations

The DPH considers that tailings from uranium mines pose a long-term danger that can affect future generations, especially if tailings containment is compromised.

Figure 4: Uranium Mill Tailings Hazards



Source: Diehl (2011)

[25] Mount Polley mine spill 78% larger than 1st estimates. News article published September 4, 2014, retrieved from http://www.cbc.ca/news/canada/british-columbia/mount-polley-mine-spill-78-larger-than-1st-estimates-1.2755974

11. SOCIAL ACCEPTABILITY

According to Rodon (2014), the establishment of a mine in Aboriginal territory is subject to a tremendous social acceptability hurdle. The colonialist attitude that historically strained relations between the government and indigenous peoples may increase mistrust of authority, thus making openness and transparency essential. These principles are all the more important in view of the fact that the interested and affected parties have trouble airing their concerns because they come from communities far from decision centres, are principally underprivileged and have little formal education (Brisson, 2014).

Ensuring equity is also an important issue. While profits flow out of the area, local communities near mining sites may be exposed to the drawbacks of environmental erosion and psychosocial impacts far in excess of those that affect the rest of the population in the region or province. Few benefits from employment accrue to highly vulnerable and underprivileged populations. The growth benefits of mines may even serve to keep vulnerable populations from flourishing (Brisson, 2014).

There are a number of factors that can increase the social acceptability of a project, namely openness, transparency and equity.

Openness and transparency for better public participation

Transparency ensures easy and quick access to all critical information and all relevant explanations for interested and affected parties (INSPQ, 2003), i.e. the Inuit population. Openness ensures that Inuit take part in the process, express their viewpoint and concerns, and help search for solutions and influence management decisions. Ongoing two-way dialogue must be initiated without delay between mining project proponents and the population (INSPQ, 2003), and be maintained throughout the life of a mining project. For example, the Raglan mine communicates regularly with stakeholders in regard to mutual issues and concerns. The company acknowledges that it must constantly strive to maintain social acceptability in order to carry out its activities.[26]

In terms of evaluation and assessment of environmental and social impacts in Nunavik, the Kativik Environmental Advisory Committee (KEAC) has stated that section 23 of the JBNQA does not guarantee Inuit or public participation or access to information in regard to the procedure. The KEAC maintains the following: “For example, the decision to hold public hearings or not and the conditions governing participation are at the discretion of the administrative agencies involved.” The KEAC highlights problems that could “jeopardize the effectiveness of the assessment and review procedure,” such as:

- *The current information and public consultation processes lack transparency.*
- *Documents prepared by project proponents are not readily accessible to Inuit or to those interested in development projects in Nunavik. No website displays project information. In addition, the opinions of specialists from the various government departments and agencies are not known to the general public.*

[26] Glencore Mine Raglan. Website found on October 10, 2014, at http://www.mineraglan.ca/FR/Pages/default.aspx

- *Technical information can not be easily understood by the general public due to the absence of interpretive summary versions.*

- *Information about information sessions and public consultations (dates, places, participation means, etc.) are not readily accessible to the general public.*

- *The timeframe between the availability of complete documentation on the development projects and the start of consultations varies and is sometimes too short to allow the full participation of Inuit in the consultation process.*

- *The decision-making mechanism and criteria regarding the holding of information sessions and public consultations is not known to the general public.*

The DPH supports the KEAC's recommendations in regard to strengthening transparency and Inuit participation in the process.

Impact and Benefit Agreements (IBAs)

Impact and benefit agreements (IBAs) are one way to ensure that the principle of equity is applied by spreading out the benefits and disadvantages of a mining project in a fair way. It is therefore important to accurately identify the disadvantages that Inuit might experience, particularly the most vulnerable of them. IBAs leverage Inuit involvement in economic development through various measures such as training and job creation, ensuring the implementation of mitigation measures, and financial compensation for disadvantages.

An IBA alone is not a guarantee of social acceptability. The agreement must be based on genuine transparency and the participation of not only community representatives but of the population as a whole. Inuit must be consulted early in the process so every possible facet of the project is discussed and their opinions and concerns are taken into account (Rodon, 2014).

Inuit and appropriation of powers

Above all, Inuit must make their own choice in regard to the type of economic focus they wish to emphasize on their territory (mines, tourism or other). In terms of mining development, the benefits and disadvantages vary according to the type of mineral extracted, the configuration of the mining project (e.g., proximity to communities), and the characteristics of the communities most directly affected (size, population health status, etc.). When making these choices, Nunavimmiut must have access to relevant information for weighing the benefits and disadvantages and therefore making an enlightened decision.

Concerns and recommendations

The DPH estimates that mining companies that want to establish themselves in Nunavik, including uranium mines, must pass the test of social acceptability with the Inuit

population. To this end, they must clearly guarantee advantages that exceed the negative impacts for Inuit. Transparency and Inuit participation in the process must be emphasized. Mining companies must maintain acceptability by sustaining an ongoing dialogue throughout the lifespan of mining sites.

Inuit must exercise their empowerment and choose the type of economic focus they wish to emphasize on their territory (mines, tourism or other) and, in terms of mining development, the type of mining they would allow.

12. CONCLUSION

Nunavik holds considerable mineral resources coveted by mining companies. Mining development could be an important economic engine in northern areas where there is a critical need for job creation.

However, the risks would undoubtedly vary according to the mineral extracted, the configuration of the mine (proximity to communities) and the communities most directly affected (size, population health status, etc.). Projects must be selected carefully to maximize positive spinoffs while minimizing negative impacts. As radioactive substances, uranium and its decay products have the potential to cause chemical and radioactive health effects. What is more, they raise fears of environmental and country food contamination and concerns about their likely health effects. Real or only imagined, these concerns could be a barrier to the maintenance of the Inuit way of life, especially hunting, fishing and berry picking activities, and they may also have negative psychosocial effects.

The literature demonstrates the imbalance between the negative and positive impacts of uranium mines and that their long-term adverse consequences, particularly on psychosocial health, eventually outweigh the anticipated advantages. There is reason to fear that the already fragile health status of the Inuit population stands to worsen. Given the primacy of the principles of human health and fairness, the negative consequences and the benefits of such a project must be weighed in order to ensure that the outcome is favourable for the Inuit.

Many uncertainties remain as to the effects a uranium mine would have on the physical, psychological, social, and spiritual health of Inuit. These uncertainties call for the greatest caution and scientific rigour in the pursuit of research documenting the impacts of this type of project on northern populations.

Finally, it is essential that Inuit appropriate their powers and choose the type of economic focus they wish to emphasize on their territory (mines, tourism or other), and, in terms of mining development, the type of mining they want to promote. Their ability to make informed decisions and take action against the risks that concern them must be reinforced by the application of the principles of transparency and openness throughout the lifetime of any project.

13. REFERENCES

ATSDR. 2013. Public health statement: Uranium. United States Department of Health and Human Services, Agency for Toxic Substances and Disease Registry.

ATSDR. 2013b. Natural and Depleted Uranium: ToxFAQs. United States Department of Health and Human Services, Agency for Toxic Substances and Disease Registry.

Benoît C. 2004. L'entente Raglan : outil efficace pour favoriser la formation et l'emploi Inuit ? : Évaluation et documentation de la situation de l'emploi des Inuits à la mine Raglan, au Nunavik, dans le cadre de l'entente sur les impacts et bénéfices. Mémoire de Maîtrise en sciences de l'environnement. Université du Québec à Montréal, 288 p.

Blais J. 2013. Les impacts et bénéfices de la mine Raglan auprès des communautés inuit de Salluit et Kangiqsujuaq au Nunavik au niveau social. Rapport final présenté au Ministère des ressources naturelles du Québec et à Géologie Québec. Université Laval, Chaire de recherche sur le développement durable du Nord, 45 p.

Blanchet C., Dewailly É., Ayotte P., Bruneau S., Receveur O., Holub B.J. 2000. Contribution of selected traditional and market foods to the diet of Nunavik Inuit women. Canadian Journal of Dietetic Practice and Research, 61(2): 50-59.

Blanchet C., Rochette L. 2008. Nunavik Inuit Health Survey Qanuippitaa ? How are we ?, 2004 : Nutrition and food consumption among the Inuit of Nunavik. Québec: Institut national de santé publique du Québec and Nunavik Regional Board of Health and Social Services, 143 p.

Brisson G. 2014. Presentation to the BAPE on the Issues of Uranium Mining in Québec, september 17, 2014.

Canada North Environmental Services. 2014. Eastern Athabasca Regional Monitoring Program 2012 community report: Final report. Rapport préparé pour le Gouvernement de la Saskatchewan. Saskatoon (Sask.).

Canadian Public Health Association, Health and Welfare Canada and World Health Organization. 1986. Health Promotion : Ottawa Charter. Adopted at an international conference on health promotion *The move towards a new public health*, November 17-21, 1986, Ottawa, Ontario, Canada.

Chan H.M., Fediuk K., Hamilton S., Rostas L., Caughey A., Kuhnlein H.V., *et al*. 2006. Food security in Nunavut, Canada: barriers and recommendations. International Journal of Circumpolar Health, 65(5): 416-431.

CNSC. 2014. Exposition et risque encouru par les travailleurs des mines d'uranium depuis l'entrée en vigueur de la Loi sur la sûreté et la réglementation nucléaires (LSRN) en 2000. Canadian Nuclear Safety Commission, 24 p.

Dewailly E., Ayotte P., Pereg D., Déry S., Dallaire R., Fontaine J., Côté S. 2007. Nunavik Inuit Health Survey Qanuippitaa ? How are we ?, 2004 : Exposure to environmental

contaminants in Nunavik: metals. Québec: Institut national de santé publique du Québec and Nunavik Regional Board of Health and Social Services, 13 p.

Diehl P. 2011. Uranium mining and milling wastes: an introduction. Available online : http://www.wise-uranium.org/uwai.html

Duhaime G. 2008. Profil socioéconomique du Nunavik édition 2008. Québec : Chaire de recherche du Canada sur la condition autochtone comparée.

Duhaime G., Caron A. 2012. Indices comparatifs des prix du Nunavik 2011. Québec: Université Laval.

Egeland G.M., Faraj N., Osborne G. 2010. Cultural, socioeconomic, and health indicators among Inuit preschoolers: Nunavut Inuit Child Health Survey, 2007-2008. Rural Remote Health. 10(2):1365.

Ford J., Beaumier M. 2011. Feeding the family during times of stress: experience and determinants of food insecurity in an Inuit community. The Geographical Journal, 177.

George J. 2012. Big Nunavik iron mine project heads into federal review. Nunatsiaq News article published October 15, 2012, retrieved from : http://www.nunatsiaqonline.ca/stories/article/65674big_nunavik_iron_mine_project_heads_into_federal_review

George J. 2013. Quebec eyes partnership on Nunavik iron mine project. Nunatsiaq News article published July 29, 2013, retrieved from : http://www.nunatsiaqonline.ca/stories/article/65674quebec_eyes_partnership_on_nunavik_iron_mine_project

Government of Canada. 1998. Plan d'action du Canada pour la sécurité alimentaire. En réponse au Plan d'action du sommet mondial de l'alimentation.

Groupe scientifique sur l'eau. 2003. Uranium. Fiches synthèses sur l'eau potable et la santé humaine. Québec : Institut national de santé publique du Québec, 9 p.

Gosselin P., Grondin J., Levasseur M.-È. 2014. La distribution des impacts des projets miniers au Québec : Qui en profite, qui en paie le prix et quand ? Presentation to the BAPE on the Issues of Uranium Mining in Québec, September 16, 2014. Québec : Institut national de santé publique, 41 p.

INAC. 2009. The James Bay and Northern Quebec Agreement and the Northeastern Quebec Agreement - 2005-2006 and 2006-2007 Annual Report. Government of Canada, Indian and Northern Affairs Canada. https://www.aadnc-aandc.gc.ca/eng/1100100030830/1100100030835

INSPQ. 2003. Cadre de référence en gestion des risques pour la santé dans le réseau québécois de la santé publique. Québec : Institut national de santé publique, 85 p.

INSPQ. 2013. Les impacts sanitaires en lien avec les projets uranifères nord-côtiers. Québec : Institut national de santé publique, Direction de la santé environnementale et de la toxicologie, 344 p.

INSPQ. 2013b. Survol de l'encadrement législatif et réglementaire des mines d'uranium au Québec. Politiques publiques et santé. Québec : Institut national de santé publique, 12 p.

INSPQ. 2014. Réponse de l'INSPQ à la question du BAPE sur les enjeux de la filière uranifère (QUES10). Québec : Institut national de santé publique, Direction de la santé environnementale et de la toxicologie, 7 p.

KEAC. 2009. KEAC position paper on strengthening the environmental and social impact assessment and review procedure in Nunavik. Kuujjuaq : Kativik Environmental Advisory Committee, 11 p.

Kirwin S. 2008.Canadian Royalties signs IBA with Nunavik Inuit. News article published May 5, 2008, retrieved from : http://www.northernminer.com/news/canadian-royalties-signs-iba-with-nunavik-inuit/1000221831/?&er=NA

KRG. 2012. Abandoned Mineral Exploration Sites in Nunavik Rehabilitation Project 2005-2012 Summary Report and Update of the General Response Plan. Kuujjuaq : Kativik Regional Government, 61 p. + appendixes.

KRG and Makivik Corporation. 2010. Plan Nunavik. Kuujjuaq : Kativik Regional Government and Makivik Corporation.

Kuhnlein H.V., Receveur O. 2007. Local cultural animal food contributes high levels of nutrients for arctic canadian indigenous adults and children. The Journal of Nutrition, 137(4): 1110-1114.

Kuhnlein H.V., Receveur O., Soueida R. Egeland G.M. 2004. Arctic indigenous peoples experience the nutrition transition with changing dietary patterns and obesity. Journal of Nutrition, 124: 1447-1453.

Lambden J., Receveur O., Kuhnlein H.V. 2007. Traditional food attributes must be included in studies of food security in the canadian arctic. International Journal of Circumpolar Health, 66(4): 308-319.

Lauwerys R. 2007. Toxicologie industrielle et intoxications professionnelles. Elsevier Masson, 5e édition. pp. 474-480.

Ministère de l'Énergie et des Ressources naturelles. 2014. Gîtes d'uranium et projets d'exploration uranifère au Québec, Nord du Québec. Document cartographique déposé au BAPE sur les enjeux de la filière uranifère au Québec. Québec: Ministère de l'Énergie et des Ressources naturelles.

Moorhouse R., Habibi G., Richard D., Byambaa T., Fabro T. 2011. Uranium mining: Assessing the potential health impact of uranium mining in Nunavut. Simon Fraser University.

MSSS. 2012. La santé de la population des communautés du territoire du Plan Nord. Power Point Presentation. Québec: Direction générale de la santé publique, Ministère de la santé et des services sociaux (MSSS).

NRBHSS and INSPQ. 2011. Portrait de santé du Nunavik 2011: Conditions démographiques et socioécnomoniques. Québec Government, Nunavik Regional Board of Health and Social Services in collaboration with the Institut national de santé publique du Québec, 32 pages + appendixes.

NRBHSS. 2013. Health of the Nunavik population: Northern development plan. Nunavik Regional Board of Health and Social Services, Unpublished document, 40 p.

NRBHSS. 2014. Health profile of Nunavik 2013 : Focus on youth and adult populations. Version non finale, révisée le 5 août 2014. Nunavik Regional Board of Health and Social Services, 98 p.

Oceanic Iron Ore Corp. 2012. Oceanic Iron Ore Corp.'s Hopes Advance Projet : Description of a designated project under the Canadian Environmental Assessment Act, 2012. Montréal : Golder Associés, 23 p.

Richmond C.A.M., Ross N.A. 2009. The determinants of First Nation and Inuit health: A critical population health approach, Health & Place, 15(2): 403-411.

Rodon T. 2014. Presentation to the BAPE on the Issues of Uranium Mining in Québec, September 23, 2014.

Rodon T., Riva M., Giberyen T. Mining impacts on community wealth and well-being – evidence from Salluit and Kangiqsujuaq. Québec : Université Laval, 9 p.

Searles E. 2002. Food and the making of Inuit modern identities. Food & Food ways, 10: 55-78.

Makivik Corporation, Kativik Regional Government, Kativik School Board, Nunavik Landholdings Corporations Association, Saputiit Youth Association of Nunavik, Nunavik Regional Board of Health and Social Services, Avataq Cultural Institute. 2014. Parnasimautik Consultation Report on the consultations carried out with Nunavik Inuit in 2013. 219 p.

Tata Steel Minerals Canada Ltd. Projet de minerai de fer à enfournement direct 2a: aperçu environnemental. Retrieved October 28, 2014: http://www.keqc-cqek.ca/sites/default/files/img-pdf/file/DSOP%202a%20EnviroOverview%20French.pdf

Usher P.J., Baikie M., Demmer M., Nakashima D., Stevension M.G., Stiles M. 1995. Communicating about contaminants in country food: the experience in aboriginal communities. Ottawa (Ont.): Inuit Tapirisat of Canada, 238 p.

Vozoris N.T., Tarasuk V.S. 2003. Household Food Insufficiency Is Associated with Poorer Health. The Journal of Nutrition, 133: 120-126.

Wenzel G. 1999. Traditional Ecological Knowledge and Inuit : Reflections on TEK research and ethics. Arctic, 52(2) : 113-124.

Appendix 1
Guiding principles of risk management (INSPQ, 2003)

Caution

Risk management in public health must advocate the reduction or elimination of risks whenever it is possible to do so, and the adoption of a vigilant attitude to act to avoid unnecessary risks. This attitude extends both in a context of relative certainty (prevention) and scientific uncertainty (precaution).

Empowerment

Risk management in public health must help strengthen the capacity of individuals and communities to make informed decisions and act on the risks that concern them.

Fairness

Risk management in public health must ensure the fair distribution of the benefits and disadvantages associated with risks within communities.

Openness

Risk management in public health must allow interested and affected parties to participate in the process so they can express their views, share their perceptions and concerns about the situation, contribute to finding solutions and influence management decisions.

Primacy of the protection of human health

Risk management in public health must give priority to the protection of human health.

Scientific rigour

Risk management in public health must be based on the best available knowledge, and on scientific advice from experts from all relevant disciplines; it must consider minority views and opinions from various schools of thoughts; and it must follow a structured and systematic approach.

Transparency

Risk management in public health must provide easy access to all critical information and explanations that are relevant to interested and affected parties as fast as possible, while respecting the legal requirements of confidentiality.