Mine Closure Regulations – Case Scenario in Northern Quebec

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Abstract Mine closure regulations have few provisions dealing with long-term monitoring or catastrophic events. Indigenous groups are usually left out in the process of restoration after the disaster. The northern Quebec dam failure causing tailings spill into the water stream is an illustration. Monitoring results compiled by the Cree first nation showed water and sediment quality impacted by elements not covered by government regulations. Tailings traces found up to 80 km downstream. Fish and fish habitat potentially impacted. To have sustainable development procedures for mine closure regulations, a review of long-term monitoring, catastrophic events responses and public engagement is required.

Keywords public participation, regulations, post-closure monitoring, catastrophic events, Northern Quebec

Introduction

In Canada, the provincial governments are responsible for the construction, management, reclamation and closure of mine sites. Federal involvement is specific in nature, limited to the list of acts for which the Quebec Ministry of Natural Resources (MNR) is responsible. Regarding mine restoration, the province of Quebec had a major reform in the mining act in 1995 which resulted in among other things obligating proponents to submit a restoration plan for approval before starting-up mining activities and the new act also requires proponents to deposit a financial guarantee for the restoration plan. The MNR is responsible for approving the restoration plans presented by the proponent. A guideline to prepare the mining rehabilitation plan was produced by MNR (Quebec 1997) in which general international components are included (Garcia 2008). For mines in operation and closure the evaluation of the environmental quality is restricted by directive 019 (Quebec 2012). Nevertheless, guidelines and legal frameworks for rehabilitation of abandoned sites as well as reclaimed sites do not include any participation of communities even if they are often directly impacted by the effects of mining activities. Furthermore, the legal framework is not clear for abandoned or reclaimed sites long-term monitoring policies such as inspection of the site, reporting, emergency responses procedures.

In 2003 the National Orphaned/Abandoned Mine initiative (NOAMI) produced a guideline pamphlet for community involvement in planning for rehabilitating abandoned and orphaned mines in Canada which could be used as a basis to develop a policy for citizen engagement plans and strategies for rehabilitation of such problematic sites, in order to provide equal opportunity for locals to contribute and participate in the decisions and processes that affect them. But in practice, the implementation of these guidelines for reclaimed sites or abandoned sites which need long term monitoring are almost inexistent.

The former Opemiska mine spill is the case scenario for this setting, located in the James Bay municipality, in operation from 1954 until 1991. The closure and rehabilitation phase finished in 2002 after government approval of restoration works, declaring its long term stability. Surprisingly, in 2008 the dyke of the tailing pond holding approximately 21 Mt

of tailings (Garon *et al.* 1992) broke. The mud carried down a section of route 113, the only municipal road in the area, it covered the nearby Slam Creek with tailings and traveled down the water network to the nearby Obatogamau River. Tailings where seen at the Cree First Nation of Waswanipi community, approximately 80 km downstream. MRN inspections on reclaimed and abandoned sites are planned to occur every two years but no inspection reports previous to the incident where shown after the dyke failure.

Methods

The Cree First Nation of Waswanipi is one of the ten Cree communities in James Bay municipality of Northern Quebec. The James Bay and Northern Quebec Agreement (JBNQA) is a treaty and the Cree rights in the agreement are protected by the Constitution of Canada. Under this agreement, administrative entities such as the Cree Regional Authority (CRA) where created in order to implement the dispositions therein. The Agreement establishes a system of three categories for the land, each having some preferential rights for traditional activities and other Cree rights. Fig. 1 shows the map of the traditional territory, the communities, the applicable agreement region and the different category lands.

Among other things an environmental and social protection regime to protect traditional activities for present and future generations was also established along with guar-

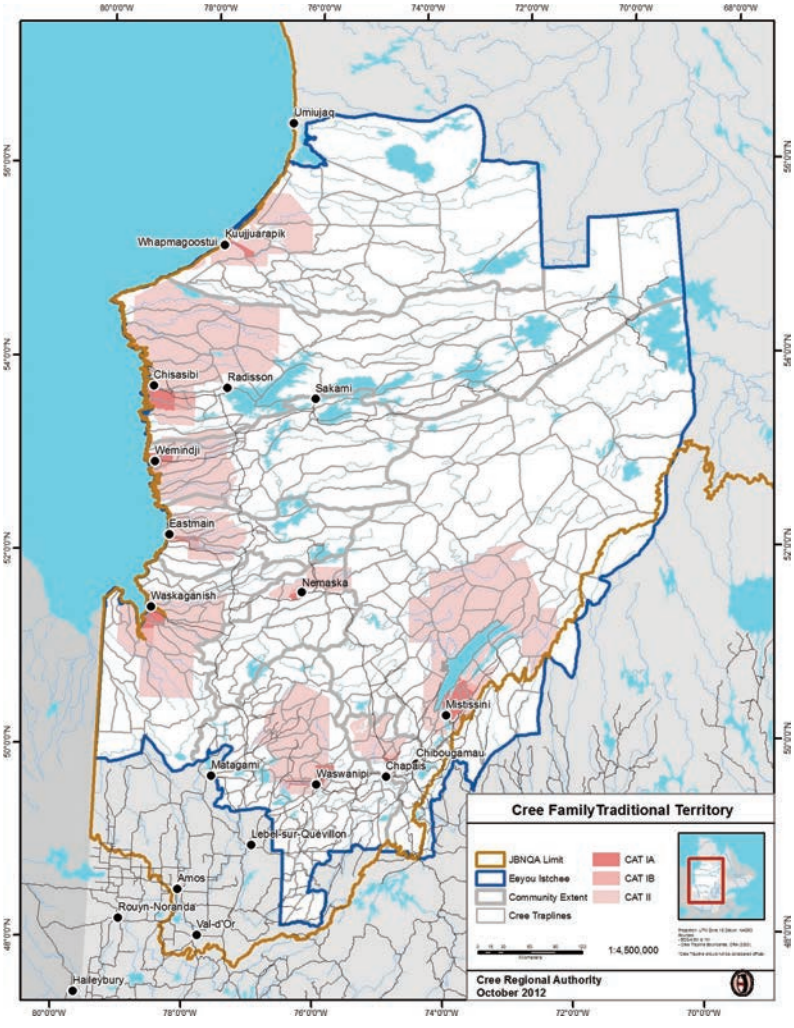

Fig. 1 *Northern Quebec Cree Family Territory under the JBNQA*

anties provided for hunting, fishing and trapping. The environmental protection regime has a process under which the Crees have special rights to participation in the review process that is greater than the general public, whenever a development project is subjected to the environmental and social impact assessment (ESIA). The list of subjected projects is included in the agreement, as well as a list of projects not subjected to the ESIA. The projects not included in either list have to be reviewed on a project by project basis in order to determine if they are subjected or not to the review process. Rehabilitation mining sites as well as catastrophic events on reclaimed sites are not included on either list.

In order to avoid time delays often related to the ESIA process and budget constraints, an alternative method for the Cree first nation consented to include a working group with members representing the government and the Cree First Nation. Since there were no structured procedures and no clearly defined roles for this new approach the communication, inclusiveness and integration of Cree concerns on the decision-making process were very limited. Information dissemination and facilitation was inconsistent for the rehabilitation works and concerns from the community where not properly considered.

Water quality, fish and fish habitat are the main concerns of the Cree First Nation. MRN results showed water quality was acceptable according to directive 019. But most of the concerns for the Cree Nation where not at or near mine site location but further downstream, and metal content associated to tailings larger than the directive 019 listing. Furthermore, already existing mistrust increased when concerns were not responded through regulations, forcing the Cree Nation to pursue a separate sampling campaign without any resources or assistance from governmental entities.

The sampling campaign was designed to answer the concerns of the Cree First Nation of Waswanipi. Fig. 2 shows the location of the mine site, the stations both from the government and the Cree first nation campaign near the mine site. Fig. 3 shows an overall sampling and monitoring region of the Cree First Nation sampling campaign covering a distance of more than 100 km downstream. The parameters sampled were more than those included in directive 019. Table 1 shows the different parameters analyzed for water quality. Sediments where also sampled at the different stations and an additional campaign for fish and fish habitat was conducted. The ministry of natural resources did not include any sediment sampling in their analysis.

MRN	CRA			
Directive 019 (2012)	Surface Water Quality			
Arsenic	Arsenic	Mercury	Manganese	Magnesium
Copper	Copper	Uranium	Molybdenum	
Iron	Iron	Chlorine	Selenium	
Nickel	Nickel	Antimony	Sodium	
Lead	Lead	Aluminum	Phosphorus	
Zinc	Zinc	Thallium	Boron	
Total Cyanide	Total cyanide	Chromium	Calcium	
Hydrocarbons	Hydrocarbons and PCB's	Cadmium	Beryllium	
Total suspended solids	Tot. suspended solids	Barium	Vanadium	
pH	pH	Silver	Tin	
	Turbidity	Cobalt	Potassium	

Table 1 *List of parameters analyzed by MRN and CRA for surface water quality*

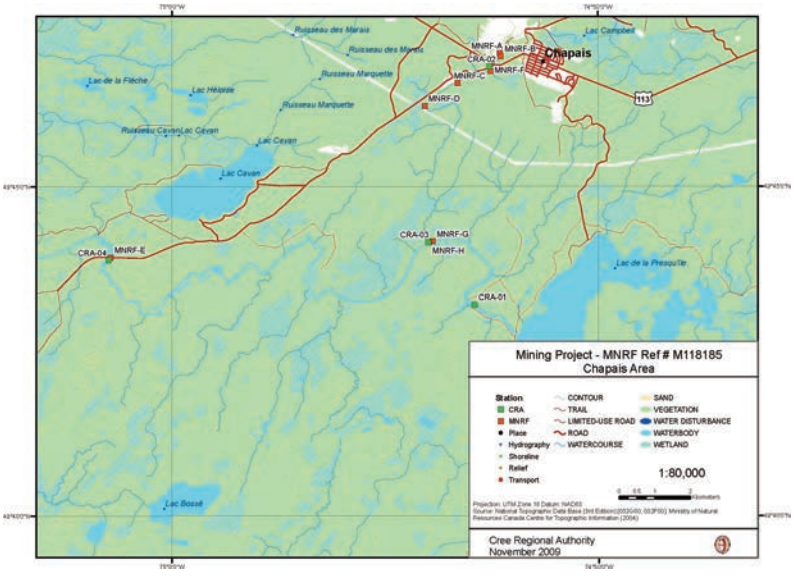

Fig. 2 *CRA & MNR sampling stations and former Opemiska mine site area*

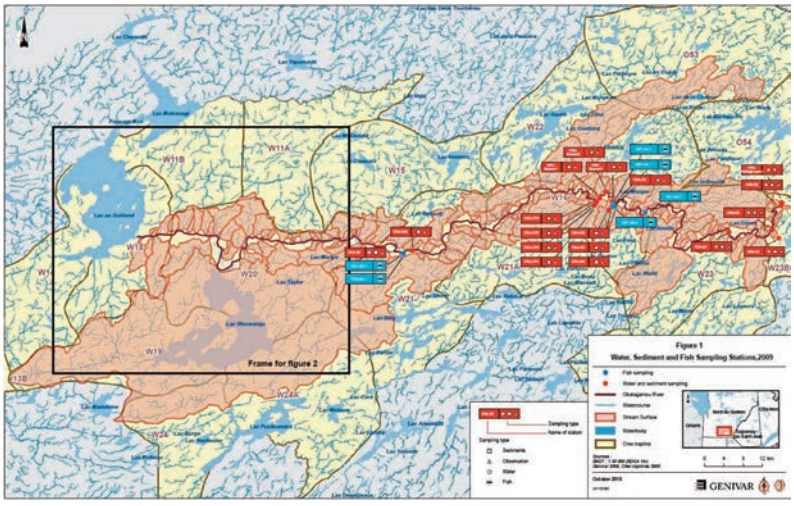

Fig. 3 *Global view of sampling stations and distance covered by the CRA sampling campaign*

Results

Five main sampling stations for water quality and sediments named CRA-01 representing the reference point, upstream from the Spill on Obatogamau River; CRA-02 closest station to the Opemiska site outflow after the road 113; CRA-03 on Slam Creek just before joint to Obatogamau River; CRA-04 on Obatogamau River about 10 km downstream of Slam Creek and CRA-05 near the Cree first Nation of Waswanipi community. In addition, different inspections on nearby lakes were done for sediments and two fish sampling areas are represented in bleu on Fig. 3.

Average and standard deviations calculations for each parameter where performed on the integrated data for surface water quality and sediments across all time points, Kruskal-Wallis Tests with post-hoc comparison of all stations to CRA-01, reference station upstream from the mine where included. Significant differences (when $p<0.05$) are highlighted in the data. The area of greatest interest by the Cree nation was beyond Slam Creek. The last station measured by MRN was at the junction of Slam Creek and Obatogamau River (near station CRA-03). Graphs and tables are available in attachments (http://bitly.com/IMWA2013_531).

For surface water, parameters exceeding a single measurement or average concentrations to the reference station (CRA-01) are: turbulence, manganese, sodium, magnesium, potassium, sulfate, aluminum and calcium. Significant differences (when $p<0.05$) further downstream than Slam Creek are turbidity, sodium, magnesium and aluminum. Exceeding regulation standards for surface water quality are turbidity, aluminum, manganese, iron and naphthalene.

For sediments, parameters exceeding a single measurement or average concentrations to the reference station (CRA-01) are: nitrate-nitrite, barium, aluminum, copper, manganese, vanadium, iron, nickel, zinc, sodium, chromium, magnesium, potassium and calcium. Significant differences (when $p<0.05$) further than the last Slam Creek (last station measured by MNR) are aluminum, copper, barium, manganese, vanadium, iron, nickel, zinc, sodium, chromium, magnesium, calcium and potassium. Exceeding regulations standards for probable or frequent effect level in sediments are mercury, arsenic and copper. Note that the regulation has no criteria for aluminum, manganese, molybdenum, sodium, zinc, molybdenum, iron, magnesium, potassium, vanadium and calcium which had which had concentrations in the hundreds and thousands mg/kg on the sediments measured.

Fish sampling program was conducted on Yellow Walleye and Lake Whitefish with the objective of evaluating metal levels in the dorsal muscle and comparing with data from nearby Lakes Chibougamau and Ouje-Bougamou study (Laliberté 2004), although those are areas also impacted by mining activities in the past, it was the only data available for comparison. Unfortunately the target of 10 male and 10 female walleye and whitefish was not attained. After an average of 105 hours of gill net fishing, the average catch per unit effort (CPUE) on average for both sampling stations was 0.86 for Yellow Walleye and 0.13 for Lake Whitefish. The objective to evaluate metal levels in the dorsal muscle was thus not accomplished due to the lack of fish. Historical data in Waswanipi Lake from 1989 was the only comparison available for CPUE in the area (Dion *et al.* 1992). The CPUE at the time was 15.7 for Yellow Walleye and 3.2 for Lake Whitefish.

MNR did a characterization of the Slam Creek to evaluate the impacts of the spill (Gagnon *et al.* 2008). The results revealed that the fish habitat was destroyed completely throughout Slam Creek but no further downstream studies where pursued even after the requested of the Cree First Nation of Waswanipi. Based on the results obtained by CRA, the Cree Nation Government requested Environment Canada (EC), federal entity responsible for fish and fish habitat to pursue a more detail study on the fish and fish habitat impacts due to the spill. EC prepared the guidelines for the study and mandated MNR to pursue it. The sampling campaign was finished in September 2011. The Cree Nation was not implicated in the sampling campaign nor have they access to the information or the results. The final study has not been shared and no date has been given to expect the results of the study.

Conclusion

The Opemiska spill occurred six (6) years after the site was reclaimed by the government. Today, there are still no regulations on the monitoring after the industry has been liberated from closing process. Furthermore, directive 019 does not request any monitoring on surface water quality, sediments and fish downstream from the final effluent, which makes it impossible to compare results when catastrophic events occur in order to relate its impacts on the environment. Most of the time, budget limitations regarding abandoned as well as reclaimed sites do not permit a thoughtful monitoring plan, including fish and fish habitat impacts further downstream from the mine area and long term treatment or monitoring (Chambers 2000), inspection measures and responses. Monitoring should be in place for reclaimed sites at least every season in order to have a periodical evaluation

of the reclaimed site. Communities should be involved in those plans.

Results based on past catastrophic events must be used to develop regulations on mining closure rehabilitation and monitoring, impacts related, and public participation implementation. If a collaborative approach would have been used as part of the rehabilitation plans after the Opemiska spill, the investment done by the Cree Nation on the sampling campaigned could have been used jointly for the benefit of all parties.

Although guidelines to work collaboratively with concerned stakeholders have been proposed worldwide, they are hardly implemented on abandoned or reclaimed sites. Nevertheless, to avoid conflict and to benefit from stakeholders resources, structured procedures and clearly defined roles for citizen participation are needed. Indigenous communities as well as municipalities can play an important role supporting rehabilitation plans if they are included in the decision-making process and their concerns are respected and integrated in the actions and final design of the site.

Indigenous communities need support to develop mechanisms to better participate in emergency responses and monitoring related to catastrophic events for closed as part of a skill transfer knowledge and capacity building system. It could be done in joint groups where industry, community, government & academics set goals, study options, plan together, develop monitoring plans, analyze results, share information and use it for implementation and development. These groups could not only focus on environmental aspects but social and economic as well, where knowledge is transferred to develop future generations and technical development is achieved under leading practices principles.

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An electronic attachment can be found here:
http://bitly.com/IMWA2013_531