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Mining and Health in the Arctic

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Abstract: The presentation focusses on the repercussions of mining on the relations between the physical and human environments in the Arctic. Direct and indirect effects of mining on Inuit health are discussed from the general perspective of environmental health. First, potential direct effects on the human environment are described from the viewpoint of occupational health (traumatic, physical, chemical, biological risks) and the population's risks in regard to marine and land transportation. Then, indirect toxicological risks (mainly through the contamination of the food chain) as well as social and cultural impacts on human health are discussed (e.g. through relational stress, consumption pattern changes, pressure on resource management and land use, etc). Finally, induced impacts of direct and indirect health effects are illustrated by case study examples of mineral resource development projects. Cumulative impacts of mining are highlighted in view of the need to evaluate and monitor long-term as well as short-term health effects through the integration of multidisciplinary evaluations and local knowledge, expectancies and issues.

Health and Environmental Impact Assessments of Arctic Mining

In Inuit territories, from Greenland to Alaska, mining and resource development such as megaproject hydroelectricity or oil field production are increasingly evaluated and put into production. Mining's attention to the North is stimulated not only by international market prices, but also because mineral resources are gradually being depleted and becoming more difficult to find in the southern latitudes. Moreover, technological advancements related to transportation, mining methods and infrastructure make it possible to consider new and less costly designs for projects in the Arctic.

The philosophy and objectives of environmental impact assessments are quite clear, and aim not only at the description of baseline data, but also the evaluation of effects (null, positive and negative) and the development of mitigation measures necessary. Because health issues are now gradually being considered, health professionals are starting to share responsibilities that include ensuring, for instance: adequacy in the evaluation process; efficient environmental communications; the participation of the population affected; and that global health effects are taken into account (from toxicological data to social issues).

Environmental impacts of Arctic mining on the physical and biological systems have been amply illustrated in the scientific literature. However, in addition these impacts can also have significant direct and indirect health effects on both mine workers and inhabitants of neighboring communities, the extent and amplitude of which depend on a variety of factors such as:

- the nature of the social, political, economic and cultural context in which the mining operation is planned;
- the nature of the mining operation (e.g. long-distance commuting versus a mining town);
- the substances and type of extraction (e.g. base metals versus petroleum, presence or not of smelter on site, underground versus open pit mining);
- ownership and operating conditions of the mine site (e.g. Native-owned versus non-Native owned and operated).

As can be seen in Table I, a comparative overview of some of the more recent mining projects located near Inuit communities outlines the fact that Arctic mining is characterized by intensive and long working periods but with great variations in personnel rotation on versus off site as well as in the rate of Native participation in the work force. Mining and transformation methods also vary considerably, as do environmental impacts. Most of the operations are of the commuting type, and very few are submitted to direct Inuit control.

The Potential Effects of Mining on Human Health

Mining can have repercussions on both socio-sanitary indicators (inactivity rates, education levels, economic well-being, etc.) as well as health and morbidity patterns of Arctic populations (e.g. greater availability and consumption of alcohol and drugs, marine transportation accidents due to track crossings after icebreaker passages, increased psychosocial and adaptational stress, etc.).

In order to adequately control the negative effects of Arctic mining and to better promote its positive

Table I. Comparative Characteristics of Selected Arctic Mining Projects[1]

Mineral, name and location	Operation period	Total employees on site (% of Inuit employees)	Rotation periods[2]	Work hours (per day)	Workdays (per week)
Asbestos					
Asbestos Hill (Nunavik/Québec)	1972-83	400 (1%)[3]	91/21, 70/14	10	6
Gold					
Lupin (Nunavut)	1982-	440 (8%)	14/14	12	7
Base metals (Ni, Cu, Zn, Pb)					
Black Angel (West Greenland)	1973-90	300 (45%)	91/30	10	6, 7
Raglan (Nunavik/Québec)	1991-92	120[4] (26%)	28/14, 14/14	12	7
Red Dog[5] (Alaska)	1990-	325 (54%)	28/14	12	7
Nanisivik[6] (Nunavut)	1976-	200 (25%)	91/21	9, 12	6, 7
Polaris (Nunavut)	1982-	275 (9%)	63/21, 42/28, 14/14	12, 11, 9	6, 7

1: Does not include a number of other projects both past (e.g. Rankin Inlet Nickel Mines) and forthcoming (particularly in Nunavut and in Greenland), as well as oil production facilities in the Arctic.

2: Expressed in days on site/days off site, with possible variations for Inuit employees shown in some instances.

3: Asbestos Hill was the first long-distance commuting operation in the Arctic. Inuit employment shown is an average, since the Inuit numbered about 50 at the beginning of the development phase, but few continued into the production phase and none were still working towards the end of the production.

4: This concerns only the underground exploration and feasibility phase. The total estimated workforce at start of operations should be about 300.

5: Native-owned (Iñupiat), non-Native operated (Cominco).

6: Some shareholding by Inuit and government, hybrid commuting as well as mining village operation.

effects, health professionals have a capital role to play in the evaluation of the impacts of Arctic mining and in the design of mitigation and follow-up measures. Unfortunately, health professionals are sometimes not aware of the extent of potential health effects of mining in the Arctic. The following is a brief review of some of Arctic mining's possible direct and indirect health effects[1]:

At the Work Site

- *Toxic releases at the work site* and direct exposition of workers to contaminants through skin or lungs;
- *High accident rate* due to absence of a training program specifically tailored to enhance worker safety in view of unfamiliar work environments and equipment;
- *Psychosocial stress and adaptation problems* due to:
  - Long periods of absence from home because of commuting operations, with effects on both the workers (inactivity, estrangement from support networks, loss of family control) and their families;
  - Cross-cultural adjustment problems between workers and staff or between co-workers aggravated by training background, cultural misunderstandings, religion, language and communication barriers, etc.;
  - High worker turnover in relation to a lack of incentives, of positive discrimination or of industrial time and space adjustment strategies;
- *Physical fatigue* from:
  - Long work periods (in commuting operations, work schedules are often 12 hours a day, seven days a week for the duration of the time on site);
  - Lack of adequate leisure and sport facilities;
  - Worker circadian rhythm maladjustment (sleep cycle perturbed, tension and stress);
- *Nutritional imbalances* due to lack of access to country food because of limited time available for hunting or of distancing of workers from their usual redistribution networks;

In the Neighboring Communities

- *Toxic releases in the environment* and direct exposition of neighboring populations to contaminants through drinking water, airborne gazes or particles and the contamination of the food chain;
- *Nutritional changes* due to:
  - Reduced access to country food because of the loss of providers working at the Mine site;
  - Land use pattern changes due to environmental impacts (noise, runoffs, increased circulation, leaks, etc.);
  - Changes in consumption and spending patterns due to increased cash flow;

1: This review does not take into account some of the long-term and more difficult to assess transformations related to indirect effects of increased encroachment of Inuit lands, accelerated acculturation, gradual demographic changes (mortality, morbidity and birth rates), and so on.

- *Psychosocial stress and problems* in the community because:
- Inadequate environmental communications by the promoter can induce undue fears, generate risk-related anxiety and create a climate of mistrust;
- Mining employment's appeal can have a skimming effect on community leadership and authority;
- Perceptions of environmental integrity of the land can be affected and foster a feeling loss of control as regards environmental health issues;
- Clan or political affiliations might create unequal access to employment;
- Absence of workers from home, increased worker substance abuse or inordinate gambling and spending patterns generate household tensions;
- Hunting and fishing by non-Natives on aboriginal lands, or a change in the Native/non-Native demographic ratio in the smaller communities can foster cross-cultural misunderstandings and tensions;
- *Increased pressure on health and municipal infrastructures* due to:
- Unplanified medical evacuations and regular support to the mining operation's nursing staff;
- Demographic pressure from migrant workers on the availability of housing, community services and equipment, and store supplies.

The Possible Input from Health Professionals

One of the objectives of health professionals is to make sure that negative health effects are reasonably evaluated and balanced with potential induced positive health impacts. The latter, for instance, might include such advantages as a greater infrastructure for search and rescue operations, an additional health care facility on the land, economic spin-offs and the reduction of transfer payments, an increase of the labor-market active population and a greater spending power for the workers.

However, health professionals are still often virtually excluded from the environmental impact assessment process or included too late to provide a significant input. In order to maximize their efforts it is necessary for them to be able to participate early in all phases of environmental evaluations, from the writing up of the guidelines for the environmental studies to the review of the assessments once they are completed. They should also be able to ensure that adequate mitigation measures and monitoring programs are prepared when necessary. Moreover, to be adequate and reasonable (a most important feature of their contribution), their input must be included in a cross-disciplinary perspective.

Finally, health professionals can make an important contribution to the promotion of public health by encouraging community participation through the dissemination of information, the follow-up of environmental and social issues through local expertise, and by making sure that concerns are addressed and taken into account by the promoters in a timely and efficient manner.

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