MINING RARE EARTH ELEMENTS: How could it impact our health?

The Kipawa Rare Earths Project was registered in 2013 for an environmental impact assessment by the Canadian Environmental Assessment Agency. This operation proposes to mine rare earth elements (REE) near the Timiskaming First Nation's traditional territory. At this time, only a general description of the proposed mine and guidelines for the environmental impact assessment are available. This briefing note was prepared to outline some of the environmental and health impacts associated with rare earth mining in order to help prepare Timiskaming First Nation and their neighbouring First Nations to participating in or commenting on the environmental impact assessment.

The information presented is summarized from the recent US Environmental Protection Agency (US EPA) report called: "Rare Earth Elements: A Review of Production, Processing, Recycling, and Associated Environmental Issues".[1] This briefing note, and the US EPA report can be used to better understand some of the possible health and environmental impacts a rare earth element mine would mean to those living nearby.

WHAT ARE RARE EARTH ELEMENTS?

Rare earth elements (REE) occur naturally in the earth's crust. They occur in many places, but are called rare because they usually occur in small amounts. REEs are used for electronics, magnets, dyes, lasers, and batteries. Mining for REE is not very common, but new operations are being proposed to meet an increasing demand.

https://en.wikipedia.org/wiki/Rare_earth_element

MINING RARE EARTH ELEMENTS:

Compared to other hard rock mining, there are very few REE mines throughout the globe. The largest production of REE takes place in China and the USA, though Canada aims to provide 20% of the global supply by 2018.[2] The REE mines that exist are open pit mines and underground mines, typically of small to medium scale. The lifecycle of a REE mine generally follows the following 4 stages:

- Exploration – The REE deposit is found and the types and amounts of REE present are identified.
- Development – the feasibility of the mine is assessed, including its economic, environmental, social, health, access, and legal requirements. The required roads, power and buildings are constructed and machinery is installed.
- Ore mining and processing – REE are extracted from the ground and processed to enter the supply chain.
- Closure – the shutdown, reclamation, and long-term monitoring of a mine site.

SSRL Spatial Sciences Research Lab · CAREX Canada · PROPEL Centre for Population Health Impact · FNEHIN · Canadian Partnership Against Cancer / Partenariat canadien contre le cancer · CIHR IRSC

HEALTH EFFECTS OF RARE EARTH ELEMENT MINING:

Any kind of mining has the potential to create negative impacts, depending on mine management and safety protocols, processing methods, and waste handling systems. Impacts are also influenced by the type of rock surrounding the REE deposit (and the potential presence of other metals and agents within it), the climate, and where streams, lakes and underground aquifers are in relation to the mine. Some of the possible health impacts are due to the potential impact of the general mining activities on the local environment and some are due to the possibility of exposure to REE themselves.

Mining, the Environment, and Health:

Water – Streams and lakes may be impacted by the construction and use of access roads, leakage of drilling fluids, and increased sediments that may alter the water chemistry, causing acid to drain from the rock. Acid drainage can harm the local aquatic environment such as the river or lake fish. Mining activities can also impact deep ground waters that may supply wells and drinking water systems. Processing ore to remove the REE typically uses water that must then enter a waste water stream to be contained or reused. A proper waste water system is a critical aspect of most mining operations. The ore that contains the REE can also contain radioactive materials, which needs to be properly managed to ensure it does not enter water sources. Discharge limits for concentrations of metals and other constituents (radioactive materials, sediments, chemicals, etc.) must be met before any waste water can be released into local surface waters.

Air - Mining activities that can release dust and chemicals into the air include cutting, drilling, blasting, transportation, stockpiles, and processing. Dust from over burden (the soil and rocks removed from the surface to expose the ores) and waste rock piles can be a concern. Overburden rock piles typically do not have high concentrations of metals or other minerals, however they can be a source of small particulate material, which is known to cause lung health issues including lung cancer to those exposed. For example, crystalline silica is a fine particulate dust that causes lung cancer and irreversibly damages the lungs when mine workers inhaled it. The ore that contains the REE can also contain radioactive material, which can be liberated during mining activities into the air. Proper dust suppression methods for the various potential sources are needed. Disease exhaust from mining equipment and machinery is also a known occupational carcinogen for those who may be exposed at work.

Soil – Waste rock and dust from the mine may contaminate local soils, which can impact local wildlife and vegetation. It is possible for some types of REE to enter crops grown in contaminated soils,[4] which could contribute towards dietary exposure to REE. The waste rock that is extracted from the ground may be placed in stockpiles or used as an aggregate for other construction purposes (roads, berms, building foundations) either on the mine site or outside of it. This rock must be protected from the weather to prevent erosion and the possibility of acid drainage. The ore that contains the REE can also contain radioactive material, such that any waste rock would have to be properly managed and contained for very long periods of time.

Health Effects of REE Exposure:

Almost all of the information about the harmful effects of REE comes from studies of mine workers and other workers who regularly use REE, where exposure is typically much higher than what the general population would experience. At these high levels, exposures to REE are associated with:

- increased risk of heart attack.[5]
- a lung disease called pneumoconiosis in workers who inhale mine dust and metal fumes.[6-9]
- rare condition called nephrogenic systemic fibrosis, where excess connective tissue forms in the skin, joints, eyes, and internal organs.[10]
- people residing in an area with high levels of REE had abnormal levels of some blood proteins.[11]
- children exposed to REE had significantly lower IQ scores.[12,13] This is thought to result from disrupted brain neurotransmitters.[14,15]
- altered the way human red blood cells divide and duplicate[16]. It also affected the synthesis and repair of DNA.[17]
- leukemia was associated with environmental pollution from REEs.[18]

> **We want to move forward in improving environmental quality: the air we breathe, the land we walk on, the water we drink, the food we eat; that's who we are as a people. If our earth is health, we are healthy.[19]**

Protecting Our Health:

The information summarized above outlines some of the general impacts that may occur with REE mining. Some of these impacts might occur at the proposed Kipawa Rare Earth Mine, and there may be other impacts not listed in this overview.

Both the provincial and federal Canadian governments have mining acts and regulations that specify the way a mine must be operated throughout its lifecycle. In addition, there are provincial occupational health and safety codes to protect the workers who work on the mine site. The environmental impact assessment of the proposed mining activities will also need to be completed and accepted before any activities begin. It is critical that First Nations representatives are aware of the requirements and form appropriate strategies for participating in or commenting on these assessments at the earliest possible opportunity.

Key questions for the developers could include:

- What is the monitoring plan to ensure our air, water, soil and foods are safe for us?
- What would happen if radioactive material is found in our water or around the mine site on the land?

- What is done with the water that is used to process the REE ore? Is it recycled on site or discharged into the water? Is there regular testing of the discharged water?
- What are the long-term plans to continue to monitor the safety of the local water, soil, and food after the mine is closed? How long after closure are you responsible for this? What would happen if the mine is found to leach a dangerous chemical into our water 10 years after the mine is closed?
- Will acid rock drainage be monitored through the life cycle of the mine?
- How will the dust be suppressed to ensure it doesn't blow into the community or on our land?
- Will any hazardous materials remain on the site after the mine closes (fuels, lubricants, drilling fluids, radioactive waste material)?

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