Toxic Heavy Metal Bioaccumulation and Genotoxicity in Small Mammal Population Inhabiting Post-Mining Areas of Nunavut: Case study of Nanisivik Mine

The purpose of this research is to monitor toxic heavy metal bioaccumulation and genotoxicity (DNA damage, chromosomal aberrations and mutation inductions) in selected small mammal population (Arctic hare) inhabiting the Nanisivik mine area. Additionally, our study is also interested in investigating from a post-closure perspective the concentration of heavy metals, including lead isotopic signatures of soils and vegetation near the vicinity of the Nanisivik mine, with those farther away (near the community of Arctic Bay), to determine the different sources of contamination and to ascertain if significant differences exist since cessation of mining operations.

- Purpose, Goals and Objectives.

The objective of our study is to develop an increased understanding of the spatial distribution of trace metals in the environment (soil and vegetation), as well as physiological changes and genetic responses of selected small mammal population (arctic hare) exposed to historical mine wastes residues in the post-mining area of the Nanisivik mine. The short term objectives of this research project are as follows:

1. To monitor the bioavailability of heavy metals in the vicinity of the former mining area
(soils, berries and lichens) and in target organs/tissues (kidneys, liver, brain, muscles and bones) of selected small mammal models inhabiting the area. The focus is to compare contaminant load in surface soils (15-20 samples), vegetation (25-30 samples) and target tissues of small mammal species (12 animals) sampled from the vicinity of the former mining area, with those farther away (~40-80 km) from the site to determine if significant differences exist between the two groups. Our analyses would focus on the measurements of metals such as As, Cd, Cr, Cu, Ni, Pb, Zn).

2. To compare extent of DNA damages, chromosomal aberrations or mutation inductions in selected small mammal species inhabiting the vicinity of the historical mining area, with those from control areas. Blood samples or bone marrow tissues will be collected from the selected animals and analyzed using in vivo COMET assay or Micro nuclei assay.

Soil and Vegetation Sampling:

Surface soil (20 samples-1 sample per area) from depth of up to 20cm will be collected from different locations within the area, and with increasing distance from the mine area. Top soil samples will be collected using a hand trowel. 25-30 plant samples (lichens, berries and moss-1 to 3 samples per area) will be collected by hand from different locations within the study area, and with increasing distance from the mine area. Samples will be collected in areas around the mine area, as well as from background sites. Plant species will be chosen for their ethno-botanical significance to Inuit residents, based on consultation with the local HTO and other knowledgeable people from the community of Arctic bay. No significant disturbance to the ecosystem is expected to result from this sampling program. No waste is expected to be generated from this activity.

Biological Sampling:

We are presently collaborating with the Ikajutit Hunters and Trappers Association in Arctic Bay to capture a total of 12 Arctic hares for our study. Animals will be trapped from within and around the vicinity of the Nanisivik area, and euthanized (no use of lead shots). The weight, length and gender of each animal will be recorded immediately. Blood samples will be collected from each animal and stored in prepared vials. Each animal will be dissected for the removal of target organs, such as kidney, liver, testicles and femoral bone. Tissue samples are to be stored in appropriate polyethylene vials for metal analyses at University of Saskatchewan, and also in histology jars containing formalin for preservation of samples for histopathological studies at Guelph University. All biological samples will be stored in cooler to facilitate transportation of tissues for analyses. No significant disturbance to the ecosystem is expected to result

from this sampling problem. Waste biological tissues resulting from onsite dissection of aninals will be carefully collected, bagged and disposed offsite in Arctic Bay.