



## Current MITHE-SN Projects Metadata

**I2 Dr. Heather Jamieson** (P.I.) – Department of Geological Sciences & Engineering, Queen's University

**Arsenic, thallium and mercury speciation in dust from abandoned gold mine tailings in Nova Scotia** (Foods + Ingested Particles)

### Objectives being Investigated

We have determined that relatively high concentrations of arsenic and mercury are found in abandoned gold mine tailings in Nova Scotia. Some of these sites used for recreational activities (riding dirt bikes and all-terrain vehicles), raising dust that may be ingested or inhaled by participants, including children. Our project is focused on the collection and analysis of airborne particulates and near-surface samples, and the use of advanced microanalytical techniques to determine the chemical form or mineralogical host of the arsenic. We hypothesize that the arsenic mineralogy is related to the bioaccessibility, or the amount of arsenic soluble in the human gastrointestinal system. This is being tested in collaboration with other MITHE-RN colleagues.

### Study/Sampling Design

Gold mine tailings were collected from three historic mine sites in Nova Scotia, where recent studies by Natural Resources Canada have demonstrated high concentrations of both As and Hg. Elevated metal(loid) concentrations in near-surface particulate matter and windblown and vehicle-raised dust from these sites pose a potential health risk to recreational users of these areas who are occasionally exposed, and nearby residents who are chronically exposed to tailings-derived dust. Samples were collected from the top 0-10 cm of the tailings to assess potential exposure through ingestion. Airborne particulates were sampled using a PIXE Cascade Impactor to evaluate potential exposure through inhalation. Multiple techniques were used to identify all As-bearing species present and their relation to particle size, including scanning electron microscopy, X-ray diffraction (XRD), electron microprobe, and sequential leach extractions. Proton-induced X-ray Emission (PIXE) was used to measure elemental concentrations in airborne particulates. Synchrotron-based microanalysis (including micro-X-ray diffraction ( $\mu$ -XRD), micro-X-ray-fluorescence ( $\mu$ -XRF), and  $\mu$ -X-ray-absorption near edge structure ( $\mu$ -XANES)) were employed to characterize the solid-phase speciation of arsenic in the tailings and particulate samples. Characterization of As bioaccessibility on these tailings samples is being assessed by other MITHE-RN researchers

(Project I5) using in vitro methods to assess the solubility of As in the tailings, and the feasibility of using mineralogical analysis as an alternate/surrogate for direct bioaccessibility assays.</p></div>

**Number of projects providing material for study: 0**

</div>

**Location of Field Site(s)**

</div>

Montague Gold District, NS (44° 42.9' N, 63° 31.3' W)  
Goldenville Gold District, NS (45° 10.1' N, 62° 1.0' W)  
Lower Seal Harbour Gold District, NS (45° 10.1' N, 61° 35.9' W)

</div>

**Human Studies**

</div>

*Outcome or Process Studied*

</div>

--- none provided ---

</div>

*Exposure Medium, and Metals/Substances Quantified*

</div>

--- none provided ---

</div>

*Biological Endpoint(s) Monitored*

</div>

--- none provided ---

</div>

**Biota Studied**

</div>

*Species*

</div>

--- none provided ---

</div>

*Metals, etc. Quantified*

</div>

--- none provided ---

</div>

*Biological Endpoint(s)*

</div>

--- none provided ---

</div>

**Physical Material(s) Studied**

</div>

*Medium/Media*

</div>

Tailings, airborne particulates

</div>

*Metals, etc. Quantified*

</div>

The principal focus has been arsenic, as this metalloid is present in elevated values and represents the most significant human health risk at our field sites. Data has also been collected for Ag, Al, Au, B, Ba, Be, Bi, Ce, Co, Cr, Cs, Cu, Fe, Ga, Ge, Hf, Hg, In, K, La, Li, Mn, Mn, Mo, Na, Nb, Li, P, Pb, Rb, Se, S, Sb, Sc, Se, Sn, Sr, Ta, Te, Th, Ti, Tl,U, V, W, Y, Zn, Zr as part of the ICP-

</div>

MS analysis of the bulk tailings samples Most of these elements are present at above detection levels in many of our samples

**Bibliographic References on-file with Secretariat:** Yes

**Data Available:** Yes

**Data Archived with MITHE-SN:** No

### **Collaborators**

**Dr. J.L. Campbell** (Co-Inv.) – Department of Physics, University of Guelph

**Dr. Mike B. Parsons** (Co-Inv.) – Geological Survey Canada, Natural Resources Canada

### **Metals in the Human Environment Strategic Network**

MITHE-SN Secretariat c/o The Canadian Network of Toxicology Centres Head Office  
University of Guelph, Gordon Street, Edmund Bovey Bldg. #80, 2nd Floor, Guelph, Ontario,  
N1G 2W1

Tel: 519.824.4120 ext. 52950 | Fax: 519.837.3861 | Email: [dwarner@uoguelph.ca](mailto:dwarner@uoguelph.ca)

Updated: Jan. 07, 2008 | [© MITHE-SN 2010](http://www.mithe-sn.org/data_management/project_metadata_details.cfm) | [www.mithe-sn.org/data\\_management/project\\_metadata\\_details.cfm](http://www.mithe-sn.org/data_management/project_metadata_details.cfm)