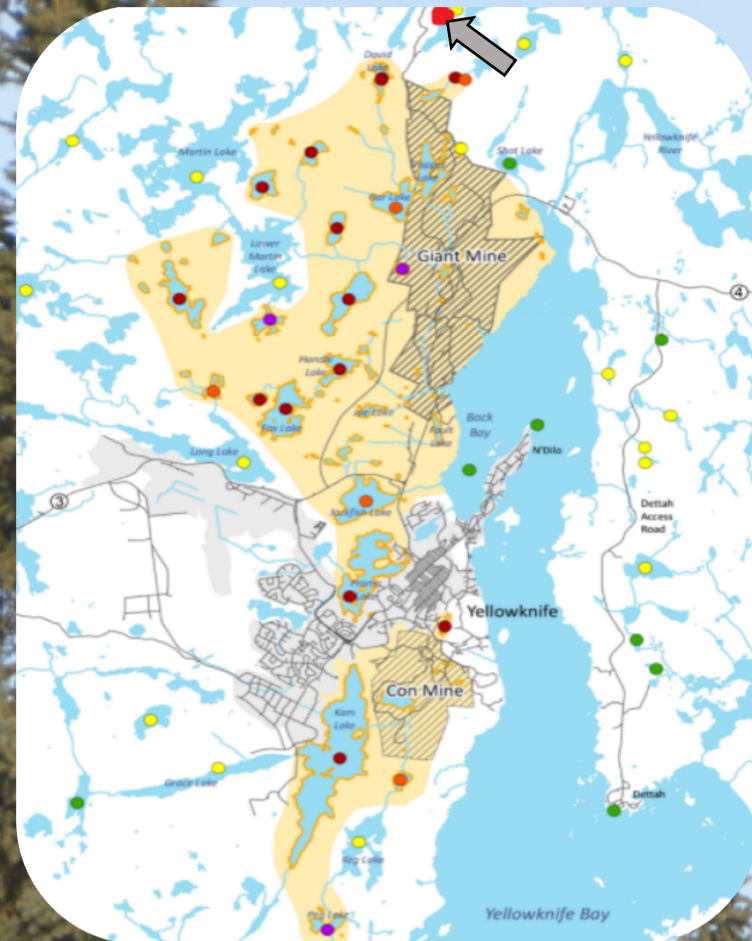




## Introduction

- Arsenic in its inorganic form is extremely toxic to living organisms.
- It enters the environment through the burning of fossil fuels, metal production, agricultural use, and waste burning.
- Concern about possible contamination was brought to the attention of our personal connection through a local Elder of the Dene community in Yellowknife who makes traditional bark tea.
- Our study focuses on various levels of chemical contamination caused by the presence of gold mining activities in Yellowknife between the years of 1948-1997.
- Estimated 19,000 tonnes of airborne arsenic trioxide dust was expelled while the mine was in operation.
- The goal of this study was to assess the level of biological accumulation of the pollution contaminants in local trees through the use of dendrochronological, xray fluorescence, and chemical analysis.



Map (above): Map of contaminated area surrounding Yellowknife city. Samples location indicated by arrow. (N.W.T. Department of Health and Social Services, 2017)<sup>1</sup>

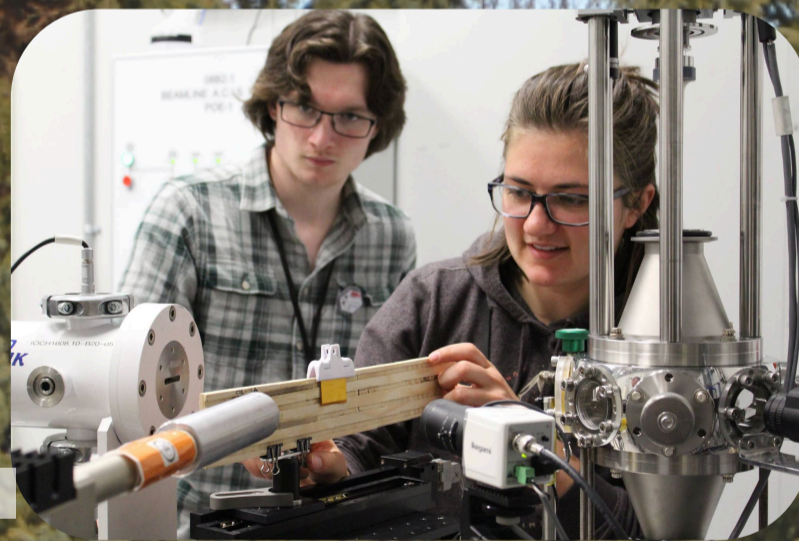


Photo (right): Perfecting sample orientation and angle for XRF analysis.

## The Process

### X-Ray Fluorescence Analysis

- X-ray fluorescence is a technique which involves measuring the fluorescence of an element in a sample under xray. (See above photo)
- Each element possesses its own set of fluorescence characteristics that makes it identifiable for analysis.

### Chemical Digestion

- The goal of the chemical digestion was to ascertain the level of arsenic present in the sample in parts per million (mg/L).
- For the digestion, the samples were blended and 0.5g of tree core sample was digested in 10mL of 65% nitric acid by microwave digestion.

## Our Findings

- White spruce contained more arsenic than white birch (Table 1).
- White spruce held most of its arsenic in the sapwood portion of the tree, with a relatively small amount in the bark (Fig. 1).
- Arsenic was found chiefly in the heartwood of white birch, with little in the bark or sapwood (Fig. 2).
- White spruce core samples contained a high total concentration of arsenic, with an average concentration of 0.39 parts per million.
- Health Canada's recommended safe level for soil and drinking water is 0.10 parts per million.

	Bark	Sapwood	Heartwood	PPM of As
Spruce Sample #1		✓		0.93
Spruce Sample #2	~	✓		0.47
Spruce Sample #3	✓	~		0.09
Spruce Sample #4	✓			0.08
Birch Sample #1			~	—
Birch Sample #2				—

✓ - Arsenic present  
~ - Slight arsenic presence

Table 1: Overview of arsenic location in their respective tree core samples.

## Acknowledgements

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All research took place on the University of Saskatchewan's main campus, which is situated on Treaty 6 Territory and the Homeland of the Métis.

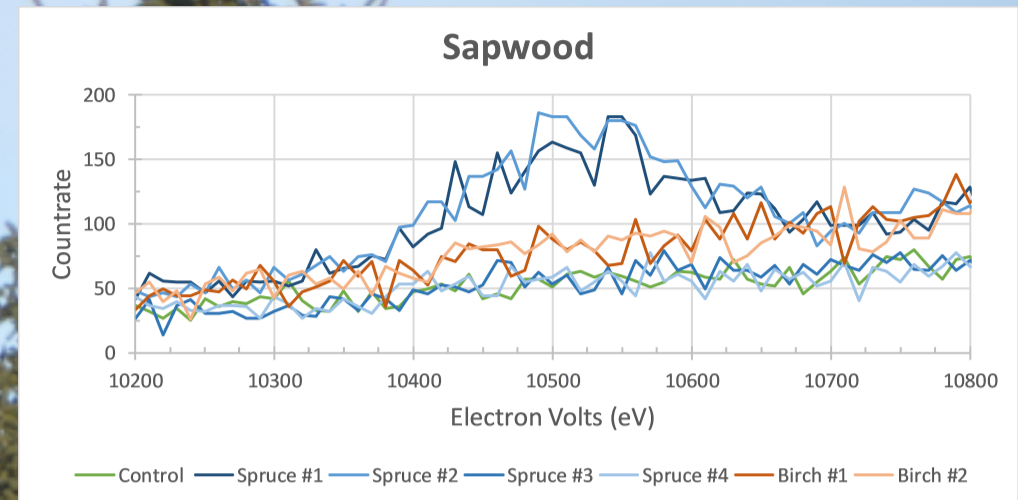


Figure 1: White spruce contained the highest average measure of arsenic in sapwood. (Arsenic peak at approximately 10500 eV)

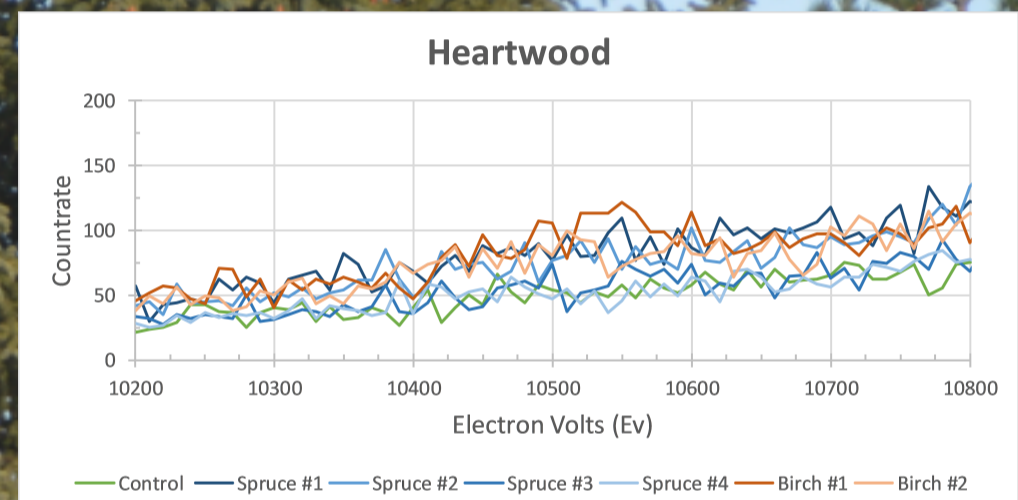


Figure 2: White birch contained the highest average measure of arsenic in heartwood. (Arsenic peak at approximately 10500 eV)



Group at CLS discussing our analytical procedure with the IDEAS Beamline.

## References

1. <http://www.hss.gov.nt.ca/sites/www.hss.gov.nt.ca/files/resources/map-arsenic-concentrations-measured-water-bodies-yellowknife-area.pdf>