UNWANTED LEGACY

Buckley. UVIC PHOTO SERVICES

A UVic engineer is developing an easy way to detect mining's toxic leftovers

by Jody Paterson

Even decades after a mine closes, people in surrounding communities can face serious health risks from drinking contaminated water. Communities in BC's North are particularly at risk of arsenic poisoning due to the legacy of gold and uranium mines, says University of Victoria civil engineer Heather Buckley.

Water is easily contaminated by arsenic and metals that leach out of rock and soil disturbed in the mining process. With no simple, quick or low-cost method for testing water, even short-term measures to address known problems typically end up delayed by weeks or even months until lab results are available.

Buckley is working on a solution. Her research aims to develop a low-cost test strip — along the lines of those used for glucose monitoring — that immediately identifies health-threatening levels of the most common contaminants from mining.

With a goal of creating a simple test strip that sells for a dollar or two, Buckley's work not only envisages giving communities the power to test their water supply at any time and get immediate results, but to have direct access to the data they need to advocate for change or intervention.

"When you dig up rocks for mining the metal extracted accounts for maybe one per cent of that material," explains Buckley, whose research is funded by the Canada Foundation for Innovation. "Then those big piles of rock are out where the dust can blow. Along comes the snow melt, the spring washout, and whatever was in and on those rocks goes straight into the river."

Arsenic occurs naturally in the ground. Rock-crushing spreads it around as a fine dust across the landscape. Mercury, chromium, cadmium and lead are all well-recognized health hazards from mining processes that also affect drinking water. Health effects from such toxins can take years to manifest, at which point the damage has been done.

Buckley's high-tech test strip builds on existing research around molecules specifically designed to capture metals. Such molecules will be used to create a "stickiness" on the test strip for the most problematic metals. She anticipates having a prototype ready for testing within five years, and stresses that keeping them affordable is a critical component of the work.

"I want to make technology that can be viably used in rural Bangladesh," says the "green" engineer and chemist, named a Green Talents Fellow in 2015 by the Fraunhofer Institute for Solar Energy in Freiburg, Germany.

Buckley is hopeful her research will eventually change mining practices. While her current focus is to empower communities to monitor the water supply, she notes that the work also gives companies the tools to show they can do better.

"It creates a space where communities and industries can rebuild trust. It takes away some of the divisiveness," says Buckley. That's an important goal this year, which is the launch of the UN International Decade for Action: Water for Sustainable Development.

A secondary aspect of Buckley's research is to apply the same "stickiness" technology used for the test strips to create a method of extracting valuable metals from mine tailings and boost the amount of ore that mining companies are extracting.

In time, the research could ultimately result in a reduction in mining due to higher returns, and lead to new extraction techniques that don't require the use of additional toxicants like mercury in the extraction process.

UVIC KNOWLEDGE

Research and discovery at the University of Victoria

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Mining is one of four activities that account for the majority of problems around the world related to water quality, according to the United Nations. Other activities on that short list are intensive agriculture, industrial production, and untreated urban runoff and wastewater.

A study that followed up on the 2014 catastrophic collapse of the Mount Polley mine tailing pond in BC found contaminant risks to the drinking water of 33 First Nations and 208 other BC communities, including Smithers, Prince George and Terrace.

Despite a billion-dollar government-funded cleanup at the old Giant Mine on the outskirts of Yellowknife, NWT, a 2016 study of lakes near the mine found that arsenic-contaminated water near the site won't return to its natural state for generations, if ever.

Buckley's research focuses on "green" engineering and chemistry, which is the design of materials, processes and systems that are safer and more sustainable. Identifying environmental contamination is a first step toward safer processes that don't pollute.

Students in the Buckley research group are developing new sensor chemistry in the laboratory and doing field research to pilot new technologies.

UVic's civil engineering researchers are creating a greener, sustainable future for our communities. They're working on green structures and materials; "smart" buildings, infrastructures and cities; industrial ecology; and water sustainability. Info: *uvic.ca/engineering/civil/research*

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