

Applications of synchrotron-based techniques in mine waste and tailings managements.

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Canada is the second largest producer of uranium in the world, producing roughly 13% of the total global output. The majority of uranium mined and milled in Canada is in Athabasca Basin region of North Saskatchewan. Uranium ores mined in Northern Saskatchewan are often associated with large amounts (10-20 wt%) of other harmful elements, such as arsenic. For over 10 years, researchers in the Industrial Science Group at the Canadian Light Source (Saskatoon, Canada) have used synchrotron-based techniques to better understand geochemistry of the mine tailings in Northern Saskatchewan and ensure that the environment is protected from harmful elements. Presented here is an overview of the techniques that are available at the Canadian Light Source and how they are beneficial to the Canadian mining industry. X-ray absorption spectroscopy (XAS) has been used to gain a better understanding of the arsenic and iron mineral species present in uranium mine tailings and how that speciation has evolved over time. Synchrotron-based powder X-ray diffraction (PXRD) techniques are also complimentary to XAS in analyzing mine tailings, providing greater sensitivity to minor crystalline and amorphous species compared to traditional laboratory PXRD. The potential of synchrotron-based computed tomography (CT) imaging techniques in the mining industry will also be discussed.