

Speciation of vanadium in the Hazeltine Creek catchment following the 2014 Mount Polley tailings dam spill, Canada

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Vanadium (V) is a redox-sensitive transition metal that can exist in oxidation states from -1 to +5. The tailings dam breach at the Mount Polley gold and copper mine on August 4th, 2014, in British Columbia, Canada, resulted in the release of 10 million m³ of water and 4.5 million m³ of tailings (range 106-289 mg/kg V) into the Hazeltine Creek catchment and Quesnel Lake. To understand the controls on V cycling following the spill and subsequent remediation actions, electron microprobe and automated mineralogical analysis, and X-ray absorption spectroscopy of tailings, spill-affected soils and secondary ochres, combined with PHREEQC modeling of stream, pore and seep water data, have been used to determine the solid- and aqueous-phase speciation of V. The results suggests that weathering and oxidation of primary vanadium(III)-bearing minerals in the tailings (e.g., magnetite and titanite) may contribute to the formation of V(V)-bearing waters. Vanadium(V)-bearing secondary iron oxides form at the outflows of seeps, and these may play a significant role in attenuating V in downstream stream waters.