



Faculty of Engineering and Applied Science Chemical Engineering Seminar Series



The risks to fish of oil spills in rivers - Hyporheic flows and oil contamination of spawning shoals



Dr. Peter V. Hodson/Queen's University

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Dupuis Hall, Room 215

ABSTRACT

The expanding shipment of oil via pipeline and rail in Canada has increased the risk of spills to freshwater ecosystems. However, the fate of oil in freshwater is not well understood, particularly in west coast rivers where salmonids reproduce. These rivers are shallow and turbulent, with a high gradient, variable flow rates, and porous bed sediments derived from glacial till. In-stream pressure gradients generate hyporheic flows through bed sediments between zones of down-welling and up-welling. Salmonids spawn in these zones because continuous flows of fresh water promote egg development until hatch (6-7 months). Hydraulic modelling demonstrates that hyporheic flows could entrain oil droplets into bed sediments, and model sediment columns readily trap oil between sediment particles. Water passing through columns of contaminated sediment contains measurable concentrations of hydrocarbons that decline over weeks as the oil weathers by water washing. We assessed the potential exposure of salmonid embryos to oil in interstitial waters by measuring the bioavailability of dissolved hydrocarbons to juvenile trout exposed to effluents from columns of oiled sediments. The bioavailability of oil to trout, as indicated by induction of liver detoxification enzymes, increased with oil loading by up to 50-fold that of trout in effluent from non-oiled columns. Induction persisted for several weeks, indicating that oil trapped in bed sediments may pose a prolonged risk to the survival and development of salmonid eggs.