

## Permeable Bio-Reactive Barriers to Tackle Petroleum Hydrocarbon Contamination in the Sub-Antarctic

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**Abstract :** Increasing transportation and storage of petroleum hydrocarbons in Antarctic and sub-Antarctic regions have resulted in frequent accidental spills. Migrating petroleum hydrocarbon spills can have a significant impact on terrestrial and marine ecosystems in cold regions, as harsh environmental conditions result in heightened sensitivity to pollution. This migration of contaminants has led to the development of Permeable Reactive Barriers (PRB) for application in cold regions. PRB's are one of the most practical technologies for on-site or in-situ groundwater remediation in cold regions due to their minimal energy, monitoring and maintenance requirements. The Main Power House site has been used as a fuel storage and power generation area for the Macquarie Island research station since at least 1960. Soil analysis at the site has revealed Total Petroleum Hydrocarbon (TPH) (C9-C28) concentrations as high as 19,000 mg/kg soil. Groundwater TPH concentrations at this site can exceed 350 mg/L TPH. Ongoing migration of petroleum hydrocarbons into the neighbouring marine ecosystem resulted in the installation of a 'funnel and gate' PRB in November 2014. The 'funnel and gate' design successfully intercepted contaminated groundwater and analysis of TPH retention and biodegradation on PRB media are currently underway. Installation of the PRB facilitates research aimed at better understanding the contribution of particle attached biofilms to the remediation of groundwater systems. Bench-scale PRB system analysis at The University of Melbourne is currently examining the role biofilms play in petroleum hydrocarbon degradation, and how controlled release nutrient media can heighten the metabolic activity of biofilms in cold regions in the presence of low temperatures and low nutrient groundwater.

**Keywords :** groundwater, petroleum, Macquarie island, funnel and gate

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