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MATERIALS AND METHODS FOR WATER TREATMENT AT CONTAMINATED SITES IN ANTARCTICA

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Water treatment at contaminated sites in Antarctica involves many scientific and engineering challenges. Our experience has been that existing technologies for temperate climates must be adapted, or new technologies devised, for implementation in the Antarctic environment. Australia has focussed on two main areas of water treatment research: pump-and-treat and permeable reactive barriers (PRBs).

A pump-and-treat methodology suitable for Antarctic conditions was developed for the remediation of an abandoned rubbish dump at Old Casey Station. The water treatment plant was designed to remove both suspended and dissolved heavy metals from subsurface water. Particle separation was achieved by dosing with ferric chloride coagulant, whilst an iminodiacetic acid cationic exchange resin was used to remove dissolved heavy metals. The most important aspects of the research were: 1) The kinetics of nucleation and flocculation of colloids at low temperature, 2) the impact of salinity on water treatment, and 3) control of floc density and settling characteristics.

Permeable reactive barrier technology is also being developed as a passive alternative to pump-and-treat methods. We have investigated the use of zeolites for removal of heavy metals and hydrocarbons from ground water in Antarctica. Thus far research has shown that freezing and thawing is one of the greatest constraints on PRB performance and larger zeolite grain size is important to minimize clogging of the barrier. Low temperatures and salinity both have a significant impact on the efficiency of heavy metals exchange onto zeolites.

For hydrocarbon contamination, PRBs serve two purposes –retardation of hydrocarbon plume migration, and delivery of nutrients to stimulate the activity of hydrocarbon degrading micro-organisms. The current focus of this research is the development of a controlled nutrient release system for PRBs. This work will be crucial to the success of bioremediation of subsurface water in Antarctica, as previous studies have shown that a precise delivery of nutrients is especially important in the remediation of polar soils.