Silver (or lead) linings? Innovative technologies to beneficially re-use legacy contaminated marine sediments.

Hazel M Vandeleur[1], **Craig Styan[2]**

[1]University College London (Australia), 220 Victoria Square, Adelaide SA 5000
[2]University College London (Australia), 220 Victoria Square, Adelaide SA 5000

Phone: +61-(0)-407-106531
E-mail: h.vandeleur@ucl.ac.uk

Introduction: Many coastal locations around Australia have a long history of industrial activities, some of which have released contaminants such as heavy metals into the marine environment. Such contaminants can be important environmentally as many of these metals are toxic and have long-term persistence. Often, contaminants bind quickly to the sediments thereby reducing their bioavailability, but the sediment/water interface still provides potential for uptake by some organisms and human activities like dredging and anchor disturbance can easily increase contaminant availability.

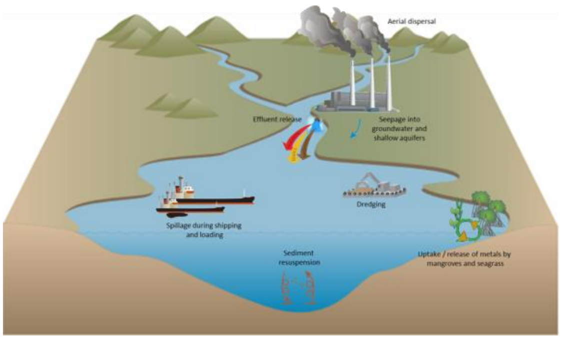

Fig. 1: Conceptual diagram of metal contamination sources into the Port Pirie marine system.

Port Pirie is located on the eastern shore of the Upper Spencer Gulf, South Australia and the site of one of the world's largest lead smelters, which has been in constant operation for more than 120 years. Historically, heavy metal pollution from the smelter has entered the environment through emissions from smoke stacks, dust blown from the site, the spillage of concentrates during the loading of ships, and effluent discharged to the Pirie River and First Creek. Silt has been dredged from the Port Pirie harbour area and dumped in Germein Bay, also contributing to metal contamination of the gulf.

Previous studies have demonstrated extremely elevated levels of a variety of metals in areas around Port Pirie in both water and sediment samples including zinc, lead, arsenic, manganese and copper with many values being above ANZECC/ARMCANZ water and/or sediment quality trigger values. Remobilisation of these sediments by both natural (such as wave and tidal action) and anthropogenic activities (such as dredging and anchoring) may result in these contaminants becoming bioavailable, making their way into the food chain, disrupting the Gulf ecosystem and potentially creating health risks associated with eating seafood.

Usually, remediation associated with dredging contaminated sediments is viewed simply in terms of the costs associated with different disposal options but, depending on which remediation methods are used, the value of metals that can be recovered might also be considered. Many different options exist for the remediation of sediments including pyrometallurgy, sludge stabilisation methods, thermal processes to lyse and release metals, liquid extraction of critical elements, electrokinetic extraction and phytoremediation. Similarly, while smelters are an obvious cause of contamination, the use of such facilities in remediation activities is rarely considered. Whether such options are economically viable for the remediation of legacy sediments such as those at Port Pirie has not been explored.

Methods: A data collation and review of all sediment, seston and water quality information was undertaken along with a cost-benefit analysis of remediation options and technologies.

Results: Preliminary results are presented including an analysis of metal contamination through time correlated with changes to the lead and zinc smelter technologies and upgrades.

Discussion: The potential for asset recovery in parallel to remediation of metal contaminated sediments is discussed both in a Port Pirie context and in a wider 'closing the loop' context in relation to contaminated soils and sediments more widely.