

The role of groundwater dissolved organic matter on arsenic mobilisation in a shallow alluvial aquifer in the Namoi Valley, NSW, Australia

Nur Syahiza Zainuddin¹, Dr Martin Andersen², Prof Andy Baker², Dr Richard Crane², Associate Professor Denis O'Carroll³, Dr Chris Marjo⁴, Dr Helen Rutledge^{2,4}.

1. University of New South Wales

2. Connected Waters Initiative Research Centre, UNSW Australia, Sydney, Australia

3. Department of Civil and Environmental Engineering, University of Western Ontario, London, ON, Canada.

4. Mark Wainwright Analytical Centre, University of New South Wales, Kensington, NSW, Australia 2052

The aim of this study is to gain a better understanding of the environmental fate and mobility of arsenic by correlating to DOM reactivity in floodplain aquifers. Water samples were collected from the river, groundwater and hyporheic zone at the Bellevue Farm on the Namoi River upstream of, Narrabri, NSW, Australia. Since arsenic is redox sensitive, and its mobility is reliant upon its redox state, As(III) and As(V) were separated *in situ* by using an As(V) specific zeolite absorbent. Organic matter fluorescence analysis was also performed using a Horiba Aqualog scanning spectrophotometer to determine the fluorescent organic matter constituents and quality. The water chemistry was depleted in dissolved oxygen and a weak correlation was found between dissolved Fe(II) and dissolved As(III). A set of 44 excitation emission matrix (EEM) measurements of water samples from the surface and alluvial environment were decomposed into three fluorescent components; humic- (C1), fulvic- (C2) and protein-like (C3) substances. High DOM fluorescence intensity (range 315-760) was observed from surface water and shallow (<0.6 m) hyporheic zone pore water samples. In contrast, groundwater DOM fluorescence intensity was mostly low and constant (range 9-76). The fact that groundwater DOM fluorescence is constant while dissolved Fe increases, indicates that DOM from the river alone cannot explain the increase in dissolved groundwater Fe(II). The groundwater chemistry results suggest that degradation of dissolved organic matter from the river is not the only process controlling the release of Fe(II) by reductive iron-oxide dissolution and associated arsenic release. Sedimentary organic matter must also play a significant role in these processes. This study highlights the important to understand the biogeochemistry of surface water groundwater interactions to predict the release and mobility of arsenic in riparian zones in order to assess potential health implications for portable groundwater abstraction.