Characterising pathogen contamination in urban groundwater in Kabwe, Zambia: a comparative study using multiple pollution indicators and contributing risk factors

J. SORENSEN[1], S. PEDLEY[2], D. READ[3], M. CHIBESA[4], M. CHIRWA[5], R. BELL[1], D. NKHUWA[5], M. LIEMISA[4], M. STUART[1], D.J. LAPWORTH[1]

[1]: British Geological Survey, Maclean Building, Wallingford, OX10 8BB, UK : djla@bgs.ac.uk
[2]: University of Surrey, Guildford, GU2 7XH, UK
[3]: Centre of Ecology and Hydrology, Maclean Building, Wallingford, OX10 8BB, UK
[4]: Lukanga Water and Sewerage Company, Kabwe, Zambia
[5]: University of Zambia, Great East Road Campus, Lusaka, Zambia

Résumé/*Abstract*

Low income urban communities across Africa depend on the use of shallow, often polluted, groundwater sources for drinking and domestic use. The factors influencing microbiological contamination in groundwater are complex and require multiple assessment approaches. Microbial contamination is often predicted using sanitary risk assessments and characterised using thermotolerant coliforms and faecal streptococci as indicators. This paper evaluates this approach against molecular pathogen broad screening, in-situ optical fluorescence for tryptophan (a protein marker associated with waste water) and inorganic chemistry, in groundwater across Kabwe, Zambia. Thermotolerant coliforms are assessed against risk factors obtained from sanitary surveys and wider hazard assessments. Groundwater samples were obtained from both deeper boreholes and shallow hand-dug wells located in a range of housing densities and land uses. Sampling was repeated in both the dry and wet seasons to investigate temporal differences. Preliminary results show that thermtolerant coliforms were generally absent in the deep boreholes and high in the shallow wells (10^2-10^4 CFU/100 mL). In shallow wells in the dry season, the median values were 112 cfu/100mL, which increased to 1025 cfu/100mL in the wet season. Tryptophan concentrations were much lower in the deeper boreholes, but higher in both deep and shallow supplies in the wet season and showed a good correlation with risk factor scores. Provisional molecular screening results have revealed the presence of multiple pathogens including *Vibrio cholera* and *Salmonella enterica* within the shallow wells.