

# **Applying in-situ fluorescence and molecular screening techniques to understand contamination and contributing risk factors in shallow urban groundwaters in sub-Saharan Africa**

D.J. LAPWORTH<sup>1</sup>, J. SORENSEN<sup>1</sup>, S. PEDLEY<sup>2</sup>, D.C.W. NKHUWA<sup>5</sup>, D. READ<sup>3</sup>, M. CHIBESA<sup>4</sup>, M. CHIRWA<sup>5</sup>,  
R. BELL<sup>1</sup>, M. LIEMISA<sup>4</sup>, M. STUART<sup>1</sup>, J. KABIKA<sup>5</sup>

<sup>1</sup>: British Geological Survey, Maclean Building, Wallingford, OX10 8BB, UK : djla@bgs.ac.uk

<sup>2</sup>: University of Surrey, Guildford, GU2 7XH, UK

<sup>3</sup>: Centre of Ecology and Hydrology, Maclean Building, Wallingford, OX10 8BB, UK

<sup>4</sup>: Lukanga Water and Sewerage Company, Kabwe, Zambia

<sup>5</sup>: University of Zambia, Great East Road Campus, Lusaka, Zambia

Shallow hand dug wells and boreholes are particularly important as local sources of water in sub-Saharan Africa. They are also potentially most at risk from anthropogenic contamination. As such, mapping groundwater contamination and understanding the key risk factors remains a priority. The risk of microbial contamination is often evaluated using sanitary risk assessments and characterised using thermotolerant coliforms and faecal streptococci as indicators. This paper evaluates this approach along with novel techniques including molecular pathogen screening and in-situ optical fluorescence for tryptophan (a protein waste water marker), as well as traditional chemical indicators. Groundwater quality sampling and characterisation were done during the wet and dry seasons at 50 sites (including hand dug wells and boreholes) across Kabwe, Zambia. Kabwe is a former mining town in Central province with a history of contamination and a population of around 200,000, which is largely dependent on groundwater for water supply.

Thermotolerant coliforms are assessed against risk factors obtained from sanitary surveys and wider hazard assessments. Preliminary results show that thermotolerant 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 (>20 m), but higher in both deep and shallow supplies in the wet season and showed a good correlation with sanitary risk factor scores. Provisional molecular screening results have revealed the presence of multiple pathogens including *Vibrio cholera* and *Salmonella enterica* within the shallow wells. These novel techniques show good potential for complementing traditional culture techniques, enabling rapid field assessments/screening and more detailed source tracking studies to be undertaken.

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