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In-situ techniques for monitoring drinking water quality

Inge Elfferich¹, Elizabeth Bagshaw¹, Rupert Perkins^{1,3}, Peter Kille², Sophie Straiton³, Elena von Benzon¹, and Annalise Sara Hooper¹

¹Earth and Environmental Sciences, Cardiff University, Cardiff, United Kingdom of Great Britain

²Biosciences, Cardiff University, Cardiff, United Kingdom of Great Britain

³Dŵr Cymru Welsh Water, Nelson, United Kingdom of Great Britain

Efficient management of drinking water quality is critical for the water supply, so effective monitoring of supply and storage systems is a priority. This project aims to predict the presence of Taste and Odour (T&O) compounds in drinking water reservoirs, using molecular analyses and smart in-situ monitoring systems. The most common T&O compounds, Geosmin and 2-MIB, are secondary metabolites that can be produced in waterbodies by cyanobacteria and actinomycetes and impact drinking water taste and odour. Although there is no evidence of related health risks, they can be perceived by humans at very low concentrations (5-10 ng/L) and the treatment process to remove them from drinking water is costly. Early assessment of T&O risk is crucial, but currently requires time-consuming and costly sampling as well as laboratory analysis which prevents real-time monitoring and a timely management response.

Cyanobacterial species responsible for T&O production can be monitored with eDNA techniques and potentially provide an early warning of T&O episodes. Moreover, detection of the genes that are responsible for T&O production within the DNA of the freshwater community can help to speed up analysis. We show that qPCR methods can target the Geosmin synthase gene (*geoA*) and that this correlates significantly with Geosmin concentrations >15 ng/L. Alternatively, in-situ sensors that can be deployed remotely and transmit data, can provide real-time monitoring for early warning and potentially predictive capacity. Commercially available sensors do not currently exist for T&O compounds, but they do for many other water quality parameters. We consider the analytes that could be effective for T&O warning systems, using a Welsh reservoir as an exemplar case. Assessment of nutrient dynamics suggests N and P ratios are critical, hence we evaluate the sensors that are available for these compounds and associated environmental controls on their behaviour. We present recommendations for the design of an in-situ monitoring programme and introduce the planned tests that will evaluate it.