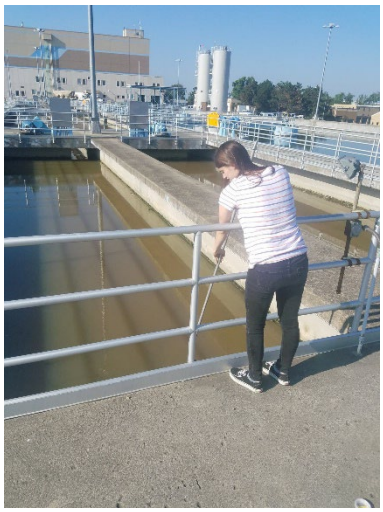
Dr. Natalie Hull and Dr. Zuzana Bohrerova of the Department of Civil, Environmental, and Geodetic Engineering at The Ohio State University completed a project funded by the Ohio Water Resources Center via the Ohio Water Development Authority subaward. This project, titled "**Impact of filter upset during conventional surface water treatment on UV disinfection efficacy,"** aimed to evaluate the effectiveness and predictability of UV disinfection of drinking water in case of filter malfunction.



Graduate student Judith Straathof sampling flocculated unsettled water for experiments

Water treatment plants do not receive UV disinfection credit for *Cryptosporidium* and *Giardia* pathogens when combined filter effluent turbidity exceeds 0.3 NTU (95th percentile) or 1 NTU (maximum) due to particle shielding and scattering of the inactivating UV light. In this project, UV disinfection of indigenous aerobic bacterial endospores (a surrogate for *Cryptosporidium* and *Giardia*) in unsettled flocculated water was investigated to simulate the worst-case high-turbidity scenario for UV disinfection. The impact of turbidity on UV disinfection was also measured in drinking water plant influent water (raw) and in unsettled softened water (soft). Due to an increasing number of extreme weather events accompanying climate change and the impacts of aging infrastructure , high turbidity events may occur more frequently.

As can be seen in Figure 1, the bacterial endospores showed lower inactivation rates in unsettled flocculated water compared to unsettled softened water and raw river water. When comparing different water quality characteristics, the decreased inactivation of flocculated water was not correlated with turbidity, total suspended solids, or absorbance, but rather with the threshold quantity of flocculated particles of 20 or more microns in size.

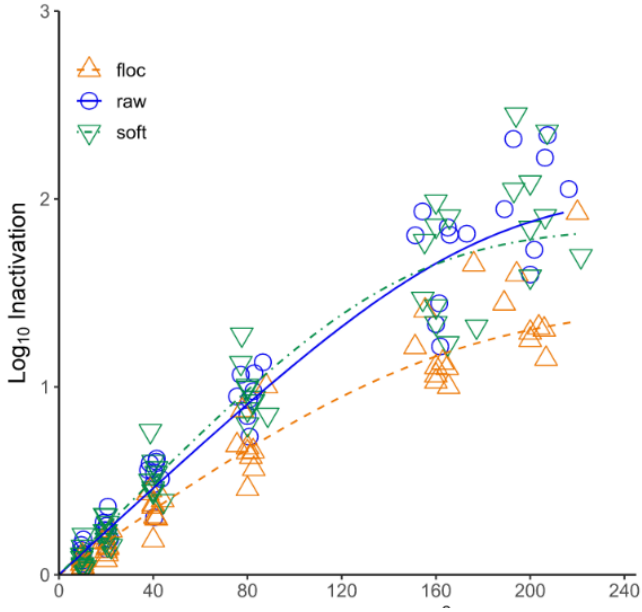


Figure 1. Dose response for indigenous, aerobic spores in samples of raw river water, unsettled flocculated water, and unsettled softened water with Geeraerd-tail biological models.

These results show evidence for predictable UV disinfection under widely varied water quality conditions. This predictability of UV disinfection during filter upset supports the need for a new evidence-based approach for awarding partial credit to UV disinfection during filter malfunction conditions. This will especially benefit small water utilities, where various capacity issues lead to greater challenges with problems such as filter upset.

<u>Researcher Profile:</u> Dr. Natalie Hull is an Assistant Professor of Civil Environmental and Geodetic Engineering at the Ohio State University. Her research centers on sustainably engineered safe water, utilizing her background in engineering and microbiology. Dr. Zuzana Bohrerova is a Research Specialist in the Department of Civil, Environmental and Geodetic Engineering at OSU, focusing on water treatment and other water issues in the state of Ohio. Judith Straathof is an environmental engineering master's student in Dr. Hull's lab with a focus on water treatment.