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QUANTIFYING AND INCREASING THE ROBUSTNESS OF DRINKING WATER SYSTEMS IN THE FACE OF EXTREME RAW WATER QUALITY DEGRADATIONS

DOCENA I POPRAWA NIEZAWODNOŚCI SYSTEMÓW ZAOPATRZENIA W WODĘ W PRZYPADKU SZCZEGÓLNIE NISKIEJ JAKOŚCI WÓD UJMOWANYCH

For municipalities using surface water as their potable water source, several types of events can trigger extreme raw water quality changes that may overwhelm a treatment plant. Extreme weather events, upstream spills and blooms of cyanobacteria that produce cyanotoxins are three types of such events. Although the impacts of each of these may be different, there are also common features. In terms of increasing their robustness, treatment plants need to develop short-term operational responses and potentially consider long-term process modifications that may require significant capital expenditures. The presentation describes research being undertaken to examine both of these aspects.

Extreme weather events have the potential to overwhelm a treatment train which has been designed based on historical raw water quality. To mention only two potential issues, specific problems could include turbidity that exceeds a plant's capability, and increased total organic carbon (TOC) concentration that creates an excessive coagulant demand, interferes with disinfection and/or UV inactivation, increases membrane fouling or leads to unacceptable levels of disinfection by-products.

A spill upstream of a plant's intake could occur by inadvertent discharge from an industrial facility, an accident with a tanker truck, or a rupture of a pipeline. A spill would normally involve a specific chemical. Blooms of cyanobacteria, which are being experienced more frequently in recent years, can lead to levels of raw water cyanotoxins that would exceed a plant's ability to cope.

For these reasons, it is essential that plants have the capability to deal with extreme events. Their frequency is only expected to increase because of climate change.

Although the specific contaminants in each of these situations may be different, in principle, a plant would have several avenues of response. The first involves operational changes that could be implemented relatively quickly with little or no capital expenditure. Defining and optimizing these responses are one focus of the research being undertaken. The optimum solution may involve a combination of responses, and will be different for each plant.

Long-term solutions involving significant capital expenditures may also be required. In terms of longer-term planning, there are two important aspects. The first is the need to evolve/modify a treatment plant and/or water system to better cope with recurrences of the extreme events discussed above, when simple operational modifications would not be adequate. The second aspect is potential long-term changes in baseline water quality. These might occur over several decades. An additional challenge could be tightening regulations with respect to specific parameters. Although these are difficult to predict for the longer term, reasonable "what if" scenarios could be constructed and investigated.

This research aims to develop a robust tool for identifying the most promising options for a partner to successfully manage long-term water quality changes and recurring periods of shorter-term adverse water quality.