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VIABILITY OF INDICATORS AND SURROGATES TO ASSESS REMOVAL OF ORGANIC MICROPOLLUTANTS DURING INDIRECT POTABLE REUSE

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ABSTRACT: Currently there is a lack of properly chosen and universally accepted water quality parameters for monitoring removal of unregulated trace organics in indirect potable reuse applications. The purpose of this study was to develop a framework of surrogates and indicator compounds that can be used to monitor the removal of a broad range of wastewater-derived chemical contaminants during conventional and advanced treatment of wastewater or water sources with wastewater contributions. Parallel efforts were directed to monitor a wide range of different bulk parameters (such as TOC, conductivity, biodegradable TOC, etc.) to identify viable surrogates, which could be used in lieu of or along with indicator compounds, to assess the removal of organic contaminants during various treatment processes. The objectives of this research were (a) to select potential indicators and surrogates for wastewater-derived chemical contaminants in systems where indirect potable reuse occurs; (b) to identify and assess the performance of analytical methods for the chosen surrogates and indicators; and (c) to validate the ability of chosen surrogates and indicators to predict the removal of organic contaminants in potable water reuse systems. Treatment processes for the removal of trace organics considered in this study rely on six removal mechanisms that determine their fate through individual unit operations or processes. These mechanisms are biodegradation, chemical and UV oxidation, photolysis, adsorption, physical separation, and volatilization. The proposed framework sorted the identified compounds with relevant high occurrence compounds into classifications of good (>70%), intermediate (<70% to >30%) and poor (<30%) removal for each mechanism. Several indicators for each treatment process and respective removal categories were identified to allow for potential variations in occurrence, mechanistic diversity, and a broad range of physico-chemical properties within an indicator group. Indicator compounds were quantified utilizing different analytical methods (GC-MS; GC/MS-MS; LC-MS/MS). Monitoring efforts were conducted at ten full-scale facilities. Findings of this study support that the developed framework is a functional tool that can be used to monitor wastewater-derived chemical contaminants in systems where indirect potable reuse occurs.

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