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Impacts of Membrane Process Residuals on Wastewater Treatment

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Objectives:

- Identification of the concentrations at which constituents of concern can adversely impact wastewater treatment or treatment plant facilities or their permits.
- Recommendations for estimating the adverse impacts of membrane process residuals on wastewater treatment and for planning new membrane projects with respect to discharging residuals to wastewater collection and treatment systems.
- Development of models for water and wastewater utilities to assess the impacts of residuals disposal not only on current facilities, but also on future projects.
- Development of a guidance manual for reference to all of this material.

Summary of Findings:

Based on the literature review and the utility surveys, the operation of membrane systems appears to results in a range of adverse impacts caused by spent backwash water, chemical cleaning, and concentrate streams including the following:

- Corrosion by sulfides and chloride.
- Deflocculation by various cations.
- Inhibition of biological treatment by salts metals and specific organic chemicals.
- Partitioning of metals and organic chemicals to biomass.
- Inhibition of anaerobic digestion by salts metals and specific organic chemicals.
- Effluent toxicity of salts, metals and specific organic chemicals.

This project provides utilities with two types of models for predicting the impacts of membrane concentrate loadings on the collection system and the WWTP. Point source impacts reflect the discharge of concentrates from a variety of sources (RO concentrates, backwash water, etc.) to the wastewater collection system which are evaluated with models provided in Excel.

Recommendations:

This research project provides practical guidance to utilities concerning the effects of membrane process residuals on wastewater treatment (including treatment processes, effluent quality, and water reuse and residuals management options). The impacts of system-wide concentrate discharges are evaluated with an Excel mass balance model. The systemwide mass balance allows almost any wastewater treatment system to be modeled. The model is a water mass balance including water losses through leaks in the distribution system, water sold outside the wastewater service area, water reuse from both a satellite plant and an effluent reuse facility, and evaporation. The mass balance tracks a variety of conservative and non-conservative pollutants. The conservative pollutants are never destroyed while the non-conservative pollutants are partially destroyed or converted into another physical form. The model includes many inputs which makes it very flexible when meeting a specific utility's needs. This model is flexible and allows "what if" scenarios to be run to determine if future projects produce conditions that could impact system performance and thus require attention. As a planning tool it enables the utility to look ahead and determine how future projects which incorporate membrane residuals will impact the wastewater collection system (corrosion) or produce an effluent too high in a particular pollutant.