OPTIMIZING ADSORPTION AND ION EXCHANGE

WATER
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Adsorption and Ion Exchange Process Model Using Blue Plan-it®

Benefits and Applications

Carollo's powerful water system simulation platform, Blue Plan-it® (BPI) Decision Support System, now features an advanced process modeling module for adsorption and ion exchange that can be effectively applied to the design and operation of treatment facilities. This tool incorporates both empirical and mechanism-based algorithms to simulate how various adsorbents and resins remove contaminants.

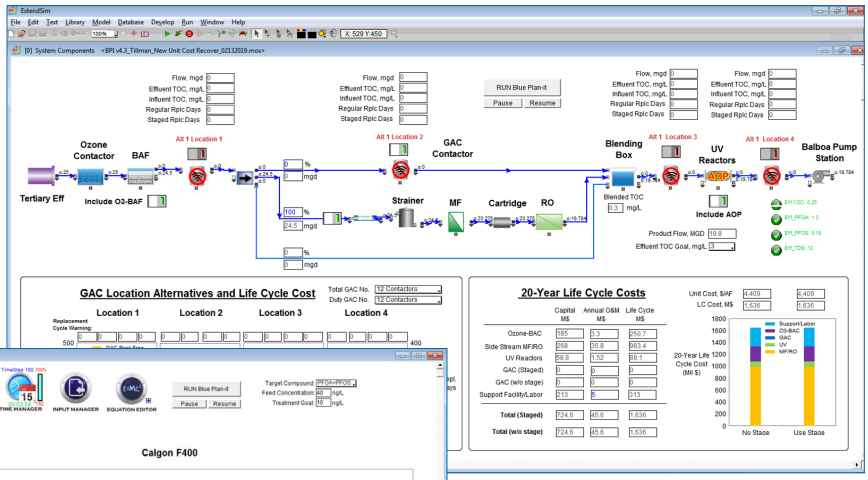
BPI is typically used when simulating the following processes:

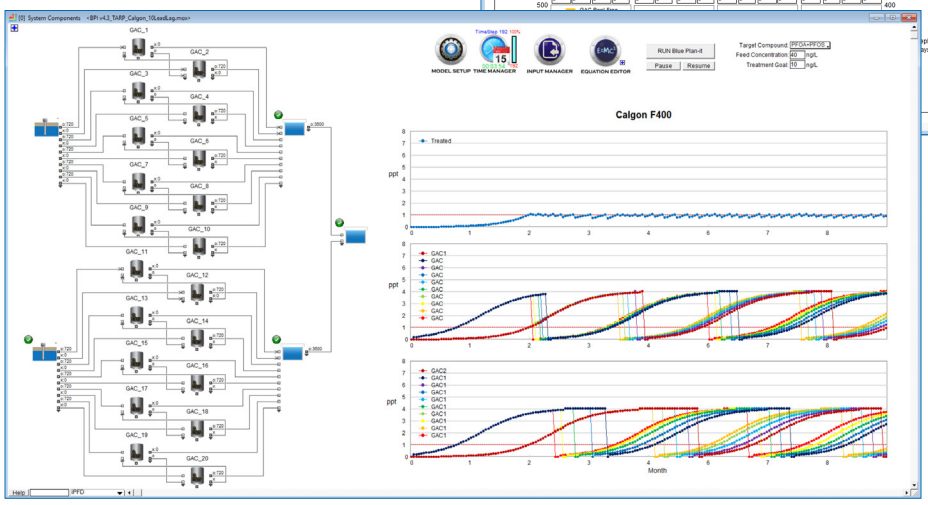
- Removal of natural organic matters (NOM) and reduction of total trihalomethanes (TTHMs) using granular activated carbon (GAC).
- Arsenic removal by activated alumina (AA) or granular iron hydroxide (GFH) media.
- Removal of perfluorinated compounds (PFAS) using GAC and ion exchange.
- Hardness removal using cation exchange resins.

Default model algorithms can be calibrated using site-specific bench testing results (e.g., isotherm testing or a Rapid Small Scale Column Test [RSSCT]) and pilot or full-scale operations data. The breakthrough curve is modeled using exponential, logarithmic, or polynomial equations based on either feed concentrations or the solid phase mass load. Algorithms to account for biological activities on the media are integrated.

Models can be used to support a wide range of design and operation decisions, such as the following:

- Determining the required number of contactors in parallel or series to meet a target product water quality.
- Giving operation guidance to operators when determining the frequency of media replacement or regeneration.
- Evaluating alternative configurations (e.g., batch operation, lead-lag operation, or staged parallel operation).
- Optimizing performance to lower capital, O&M, and life-cycle costs.





The BPI adsorption model was used to optimize the GAC usage and treatment configuration for large direct potable reuse (DPR) projects.

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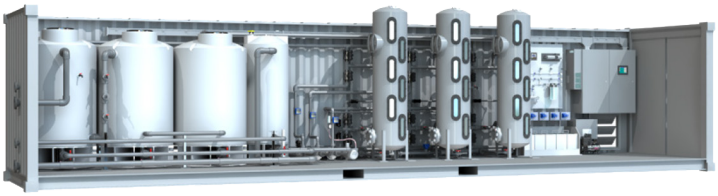
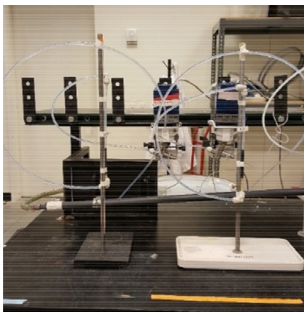
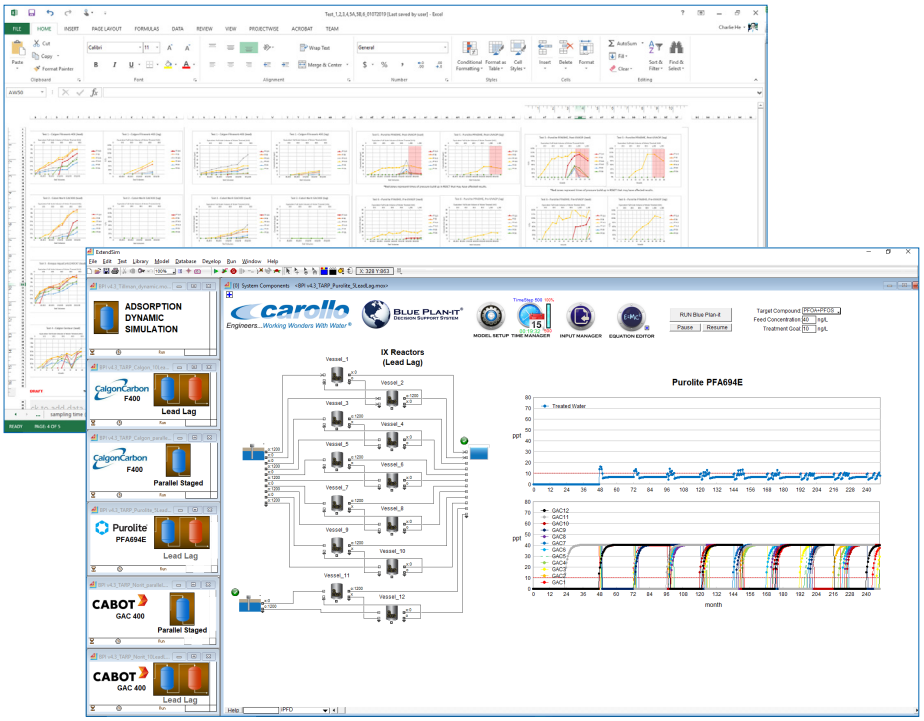
Testing and Modeling for Treatment of Perfluorinated Compounds (PFAS)

BPI has been used to simulate and optimize the design and operations of perfluorinated compounds treatment processes for over 15 different water sources and blends in the United States. This experience has resulted in a database with over 40 sets of RSSCT results for both short- and long-chain compounds with concentrations of PFAS ranging from 0 to 3,000 ng/L.

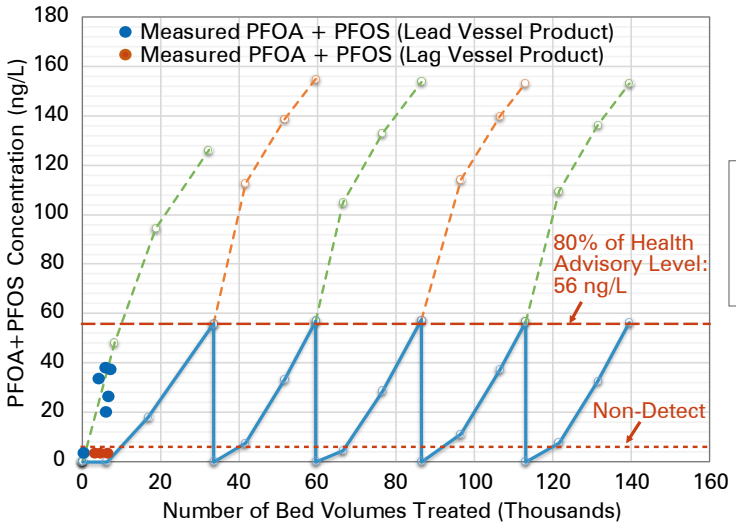




Carollo, in collaboration with Arizona State University, conducted bench-scale and demonstration-scale testing on GAC, ion exchange, reverse osmosis, and UV advanced oxidation process to fill in critical data gaps on PFAS treatability within the industry.



BPI PFAS treatability model allows users to enter the flow and water quality of a new source, select a treatment goal, media, preferred configuration, and simulate the effluent quality, media replacement frequency, capital and O&M costs to compare multiple alternatives side-by-side.



Model-predicted results were validated using available full-scale results and vendors' projected media replacement frequency.