MODELING DISINFECTION BYPRODUCTS

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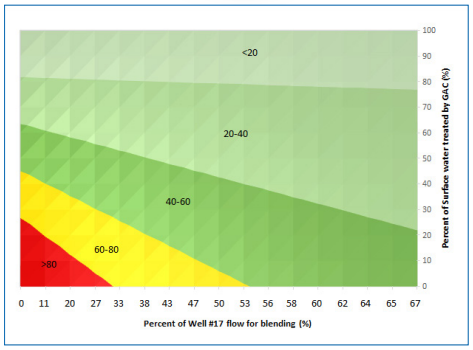
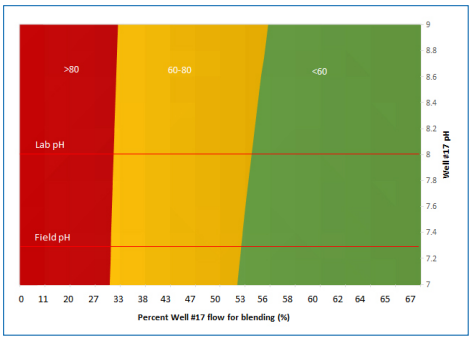
Water Treatment Plant and Distribution System Water Quality Modeling (Part II)

Overview

Using empirical and mechanistic based equations, the Blue Plan-it® Decision Support System estimates natural organic matter (NOM) removal by individual unit processes, disinfectant decay based upon demands exerted by NOM and other constituents, and Disinfection Byproducts (DBP) formation throughout the treatment plant and in the distribution system. This tool determines DBP levels that can be achieved by existing treatment technologies, when the requirements are met for microbiological safety, and disinfectants residual concentration time (CT) compliance. It allows the users to evaluate alternative technologies and operational strategies for enhancing DBP mitigation, and determine the capital and operational costs associated with DBP control. Through a quick sensitivity analysis using the built-in scenario manager, users can gain better understanding of how the design and operation changes affect disinfection and DBP formation.



TTHM levels with partial GAC treatment in the distribution system.

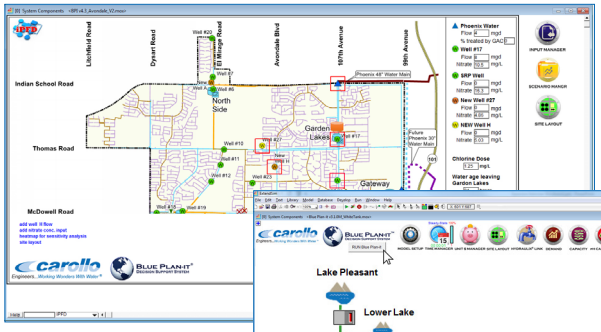


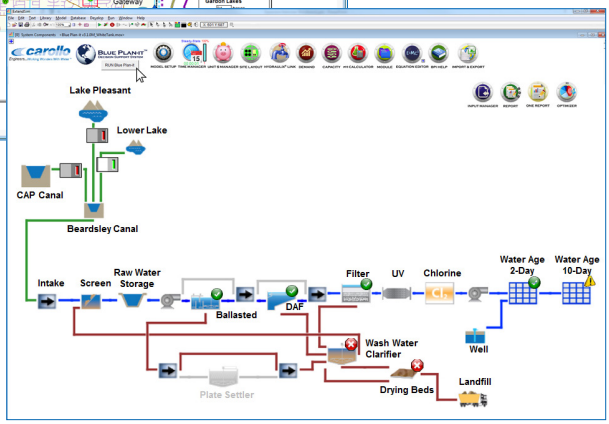
Blending analysis for TTHM formation.

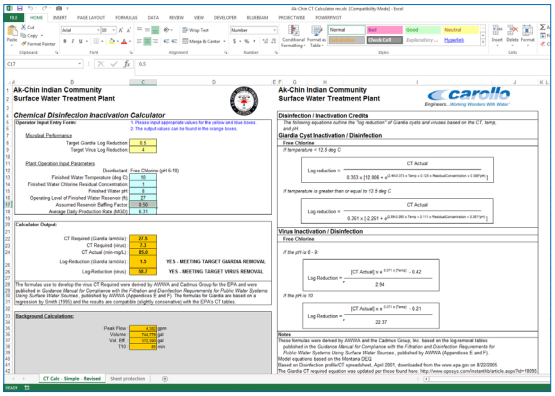
Integrated Proven Algorithms

Integrating algorithms used in the EPA WTP Model, the tool can be used to simulate the performance of various treatment processes (e.g., coagulation, sedimentation, filtration, softening, GAC, membranes, ozone, and bio-treatment) with a list of disinfectant options (e.g., chlorine, chloramines, ozone, and chlorine dioxide). The built-in look up tables and database contains the CT requirements under the Surface Water Treatment Rule for Viruses by free chlorine and for inactivation of Giardia and viruses by chloramines, chlorine dioxide and ozone, as a function of pH and temperature.

The Blue Plan-it® model integrates the algorithms of RTW - Water Chemistry, Process, and Corrosion Control Model and EPA WTP Model to assess the impacts of chemical addition (e.g, coagulant, disinfectant) on pH, alkalinity, etc. and simulates how such changes could affect the disinfection and DBP formation.







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A Flexible and Customizable Tool

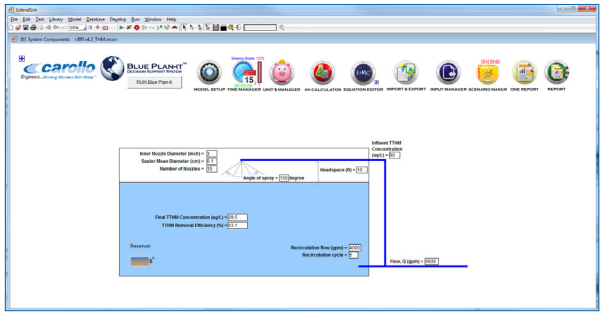
To improve the accuracy of the EPA WTP model, which is largely empirical in nature, the Blue Plan-it® decision support system provides a recommended protocol for performing bench, pilot, and/or full scale testing to calibrate critical parameters and a friendly interface for the user to adjust these parameters based on the testing results and sensitivity analysis.

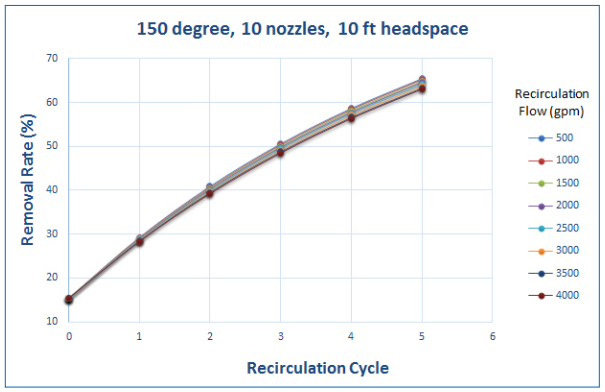
The Blue Plan-it® tool is fully customizable and can be adjusted to model booster chlorination and post-treatment in a distribution system. It models the reduction of volatile DBPs in treated drinking water using aeration technologies based on the equations provided in the AWWA Water Quality and Treatment Handbook. It is used for optimizing the aeration system design (e.g., recirculation rates, number of nuzzles), and predicting TTHM reduction and energy consumption associated with different aeration technologies (e.g., spray aeration and surface aeration). Using its built-in equation editor, users can easily integrate established algorithms for other new processes.

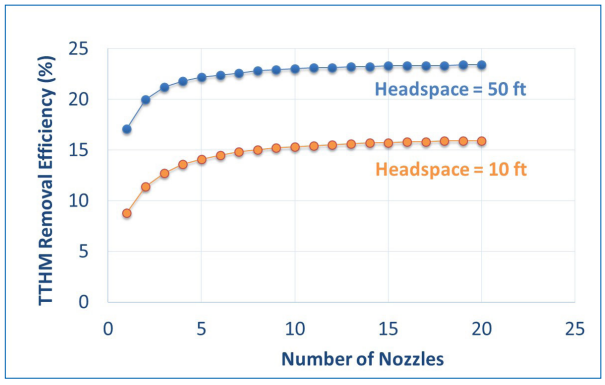
This water quality modeling could be used in conjunction or integrated seamlessly with hydraulic models such as EPA Net, InfoWater, Optimatics, CityWater, etc. The resultant distribution system water quality could be presented using GIS.

Leverage the Full Capacity of Blue Plan-it®

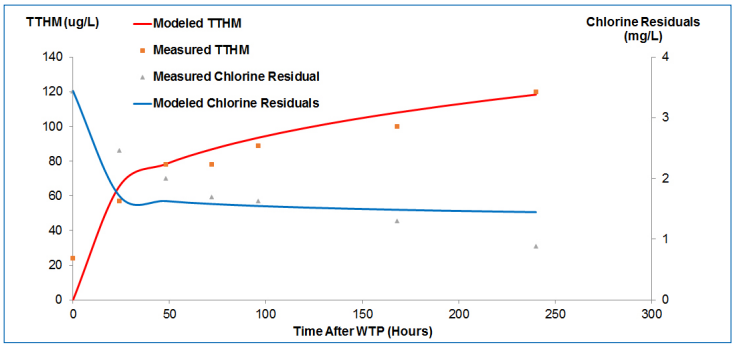
Beyond basic chlorine decay and DBP modeling, the Blue Plan-it® decision support tool supports the user with endless opportunities including what-if analysis, sensitivity analysis, Monte Carlo simulation, multi-objective optimization, cost estimates, and data visualization in one platform. Connecting with Power BI, Tableau, and/or Excel, and the Blue Plan-it® web app, users are provided with a dashboard customized to meet individual needs and preferences. Please refer to other Blue Plan-it® fact sheets for additional information.

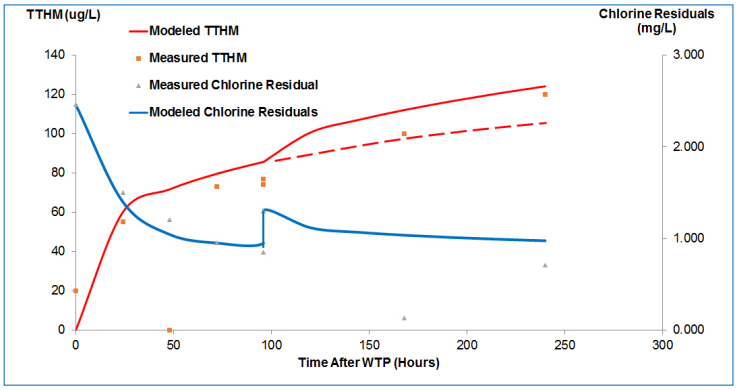






Blue Plan-it® integrates AWWA models for DBP removal by aeration systems to optimize the recirculation rates and nozzle quantity.





Blue Plan-it® models chlorine decay, and DBP formation with and without booster chlorination.