Pure Water. Clean Air. Better World. CalgonCarbon®

Granular Activated Carbon: A long-term solution for meeting DPB compliance

Cobb County, GA

Granular Activated Carbon: A long-term solution for meeting DPB compliance

Cobb County, GA

DBP DILEMMA

When the Cobb County-Marietta Water Authority (CCMWA) anticipated the need to upgrade the Hugh A. Wyckoff water treatment plant, they turned to granular activated carbon (GAC) technology after vetting several alternatives. The plant, a wholesaler in a two-plant system, processes up to 72 million gallons per day and serves about 350,000 people. Comprising of Wyckoff and the James E. Quarles treatment plant, CCMWA is the second largest water provider in Georgia.

The Wyckoff plant draws its water from Allatoona Lake. Because of the plant's location and setup, water treated there can remain in transit for up to 10 days, leading to higher disinfection byproduct (DBP) levels. CCMWA needed to upgrade its plant to comply with the U.S. EPA's Stage 2 regulations for DBPs. While the plant was scheduled to come into compliance with the Stage 2 regulations in 2012, they were given until August 2013 to do so because of ongoing construction work.

Back in 2002, the CCMWA began piloting different technologies, testing ozone-biofiltration, continuous ion exchange, carbon adsorption and nanofiltration. In 2009, the plan to pursue activated carbon technology was set in place, and the CCMWA, along with CH2M HILL Engineers, began the final design work.

Calgon Carbon's Filtrasorb 300 GAC, contained in 28 Model 12-40 pressure vessels, was judged as the best solution to serve the plant's needs. The installation of the 28 vessels made it the largest installation of GAC pressure vessels at a single plant.

CHOOSING A SOLUTION

To keep DBPs low and to prepare the plant for the future, the CCMWA looked at several options when deciding on a technology. The five guiding criteria in the selection process were: 1) Effectiveness for lowering DBPs, 2) operational fit of the technology to the plant, 3) flexibility of operations, 4) capital costs and operation and maintenance (O&M) costs, and 5) limitation of wastewater discharges. Of all available technologies, Filtrasorb GAC best met the criteria and was encompassing enough to address some of the future DBP regulations in discussion.

Before its decision, CCMWA investigated continuous ion exchange technology, which removes specific molecular weight organics. It removes natural organic matter (measured as total organic carbon, or TOC) but not pharmaceutical and personal care products (PPCPs), which the CCMWA felt would likely be regulated in the future. Wastewater disposal from this process would be an issue at Wyckoff given the small capacity of the local wastewater plant. Continuous ion exchange also requires a large footprint at the head of the water

treatment plant, which was unavailable at Wyckoff. In addition, the continuous ion exchange tested by CCMWA uses a resin that, globally, is only manufactured in one plant, causing supply/cost concerns, said Patrick Pherson, project engineer for the CCMWA.

Ozone and biofiltration gave only a marginal improvement in the TOC reduction. The capital and O&M costs would be high for the incremental improvement in water quality, Pherson said. Additionally, existing multimedia filters would need to be replaced with deeper beds to accommodate biofiltration media, which would be difficult given the hydraulics of the plant.

CCMWA then examined nanofiltration. Though plant operators said removals were excellent, the membranes were fouled quickly and the process generated a waste stream with high TOC content. The flow from this waste stream was estimated to amount to approximately 3 MGD for the CCMWA. The plant judged this would be too much to be sent to the local wastewater treatment plant, or to be easily treated on site. Nanofiltration was therefore deemed to not be a feasible technology for this site.

Despite the accepted use of chloramines in neighboring states, Georgia discourages their use. Chloramines may eliminate regulated DBPs, but they also can create their own set of DBPs, which are currently unregulated but may be in the future. The CCMWA stated it felt chloramines could only be a short-term solution.

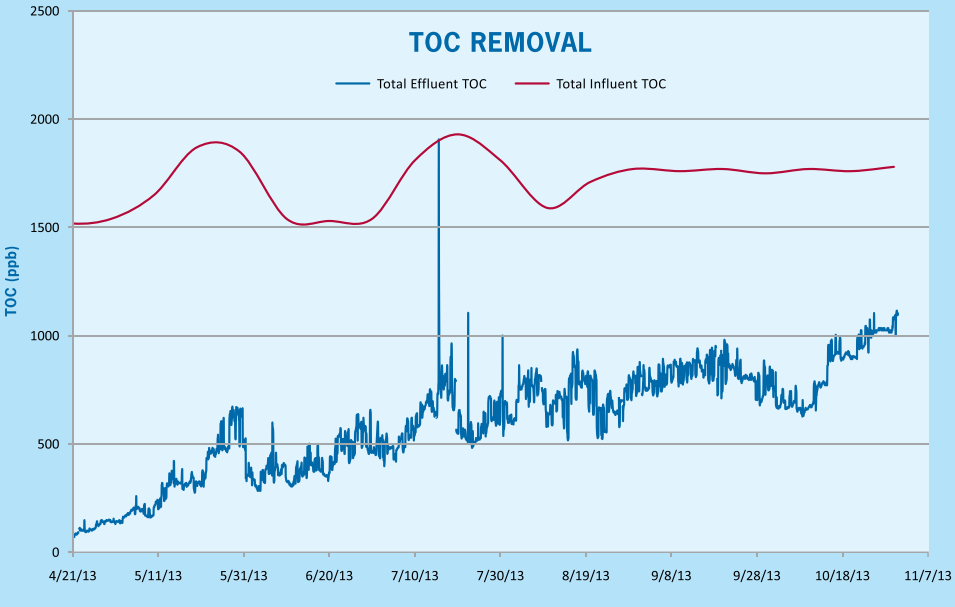
After eliminating these options, the CCMWA decided activated carbon technology best fit the plant's needs because it provides solutions to current and future regulations, has operational flexibility, is maintainable within the Wyckoff context, and does not produce too much wastewater. Operation of GAC filters was anticipated to be relatively easy for the plant to accommodate, as the plant already has traditional multimedia filters in place and GAC filtration is very similar in terms of operation.

"We are anticipating that over the next 20 years there will be more regulations on contaminants that come from pharmaceutical and personal care products," said Pherson. "We will already have a technology that will take many of these emerging contaminants out. This installation was not only designed with current regulations in mind, but with an eye to the future ones also."

The CCMWA chose to competitively bid the pressure vessels and the Filtrasorb GAC separately. Calgon Carbon won both. "They were present through the design and competitive bid process, and their winning both bids shows that they are economical and they have good technology," Pherson said. Calgon Carbon also was chosen for the reactivation supply contract based on its experience with potable reactivation and experience working with CCMWA on the design and supply of the GAC facility. A three-year contract with optional renewal was signed.

MEETING REGULATIONS IN A COST-EFFECTIVE WAY

CCMWA operates GAC filters seasonally from May to October to remain under DBP limits; this limited operation extends the life of the GAC beds.



WHAT ARE DBPS AND WHY ARE THEY REGULATED?

Disinfecting water through chemical agents such as chlorine is an essential part of public health, because it protects consumers from disease-carrying microorganisms. But disinfectants react with naturally-occurring matter (NOM) in the water to form compounds called "disinfectant by-products" (DBPs). DBPs have been linked to a number of human health concerns and have been regulated by the U.S. EPA.

Some disinfectants, such as chloramines and ozonation, do reduce these DBPs, but create new, currently unregulated, and toxic DBPs. This is why many municipal water providers are taking the step of removing NOM from water before adding disinfectant chemicals. This allows water providers to disinfect the water and negate known DBPs without creating new DBPs. Activated carbon is one of the most commonly applied technologies used to remove NOM from water.

THE MODEL 12-40 VESSEL

Calgon Carbon's Model 12-40 vessels comprise an adsorption system that uses granular activated carbon (GAC) to remove dissolved organic contaminants, such as DBPs and NOM, from liquids. These vessels can hold up to 40,000 lbs. of GAC, providing the additional contact time to remove either compounds at low concentrations or poorly adsorbing compounds.

Provided with two GAC discharge lines positioned to extract 20,000 lbs. of spent carbon each, the system minimizes the time required for GAC exchanges by eliminating guesswork when removing spent carbon from the vessels. In addition,

The GAC filters are able to treat partial flow of the plant, and its treated water is blended back with filtered water. This reduces the amount of flow to GAC vessels and extends the life of the GAC.

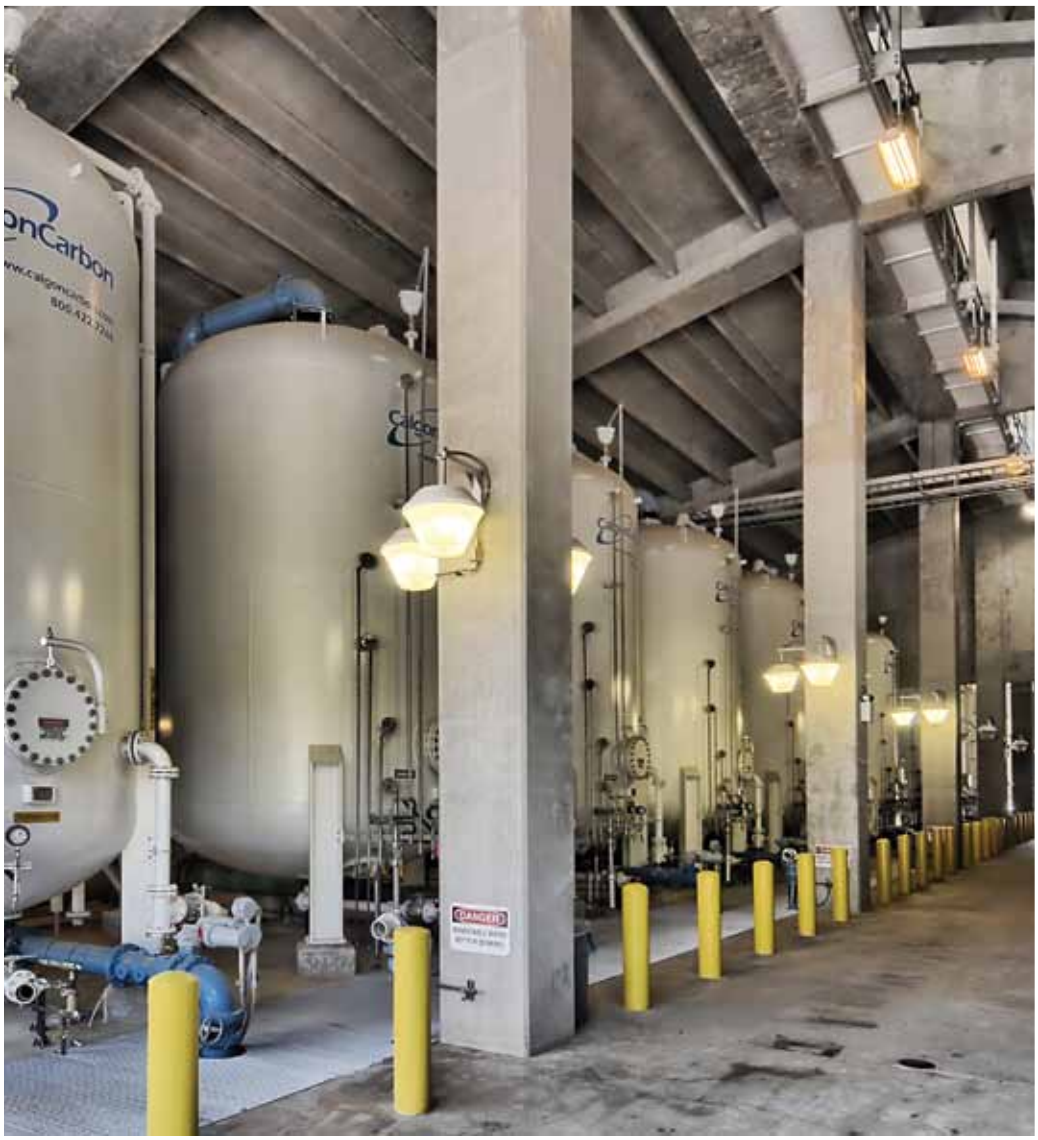
Continuous monitoring on the GAC facility effluent ensures they are optimizing the GAC usage. Monitoring points on each GAC filter, sampled weekly, determine when each filter is approaching exhaustion. CCMWA tracks how much TOC the carbon is able to process. Once the carbon runs down to 30 percent removal of the TOC coming through the plant, it is sent back for regeneration.

Usually, Pherson says, the carbon becomes exhausted at the end of the five-month season when the GAC normally operates, and must only be reactivated once per year. Calgon Carbon's vessels can be turned on and shut down individually, which gives the plant flexibility as to how much carbon it uses in the summertime.

"This installation was not only designed with current regulations in mind, but with an eye to the future ones also."

— Patrick Pherson, Cobb County-Maretta Water Authority

For its exchanges, CCMWA uses custom municipal reactivated (CMR) carbon. During this process, spent activated carbon is removed from the filters and transported to one of Calgon Carbon's NSF-certified, exclusively potable reactivation facilities, where it is reactivated thermally at high temperature. The reactivated carbon, along with a small amount of virgin makeup GAC, is then returned to CCMWA for reuse at its Wyckoff facility. Carbon exchanges and all virgin activated carbon makeup are supplied and performed by Calgon Carbon. Custom reactivation, in comparison to yearly replacement with virgin GAC, saves CCMWA about 30 percent of the cost of using activated carbon.



three nozzles along the straight side of the vessel can be fitted with in-bed sample assemblies to allow the operator to monitor the progress of the adsorbate as it flows through the bed.

The standard design for the Model 12-40 consists of two vessels combined with a centralized pipe manifold to allow for series or parallel operation, but it also can come as a single vessel if preferred

CUSTOM REACTIVATION: WHERE, HOW AND WHY IT HAPPENS

Calgon Carbon not only sells carbon and carbon technology for municipal water providers but also reactivates the GAC after it is exhausted. The company has a dedicated NSF-approved reactivation plant in North Tonawanda, NY, that serves customers east of the Mississippi River.

This facility is used for potable custom reactivation, meaning specific customers' carbon is processed separately from other customers' carbon. During the reactivation process, organic compounds that have been captured by GAC are destroyed when subjected to high temperatures that, at the same time, restore the GAC to a usable state. This results in a cost savings for the customer over the use of virgin carbon. The reactivation/recycling process also is better for the environment, with a reduced CO_2 footprint as compared to the manufacture of virgin activated carbon. The custom reactivation process employed at the plant reduces both the cost of using virgin GAC and the carbon footprint associated with GAC utilization.