Case Study

CalgonCarbon
A Kuraray Company

Shelby Talladega WTP: Installing Granular Activated Carbon Today to Prevent Regulatory Issues in the Future

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In 2010, Shelby County Water Services (SCWS) was planning for the future. With new regulations on the horizon, SCWS determined that the Talladega/Shelby water treatment plant in Shelby County, AL, needed more effective removal of disinfection byproducts (DBPs). Specifically, the treatment plant needed help complying with the U.S. EPA's new Stage 2 Disinfection Byproduct Rule (DBPR).

SCWS serves both retail and wholesale customers. The active wholesale customers, Alabaster, Pelham, and Sterrett-Vandiver, sell significant amounts of water from SCWS to their customers. The number of SCWS retail customers, primarily located in Westover, Chelsea and the subdivisions of Eagle Point, Greystone, Forrest Park, Forrest Lakes, Mt. Laurel, Regent Park, Villas Belvedere and Highland Village, grew from about 3,200 in 2001 to more than 10,500 in 2010. Part of that increase was attributed to the acquisition of customers from

the former Westover Water Authority, which merged with SCWS in 2007.

SCWS gets water from Lay Lake on the Coosa River and treats the water in two facilities: Talladega/Shelby Water Treatment Plant and Shelby County South Water Treatment Plant. The Shelby County South water treatment plant near Wilsonville is owned and operated by Shelby County. The South Plant began production of drinking water treated with granular activated carbon (GAC) for DBP removal in 2008.

Over the course of the following year, SCWS considered GAC and ion exchange for use at the Talladega/Shelby plant to ensure compliance with Stage 2 DBPR regulations. Based on its analysis, the County concluded that the cost and performance of a GAC system would be similar to the other options, assuming the carbon lasted at least one year before requiring reactivation.

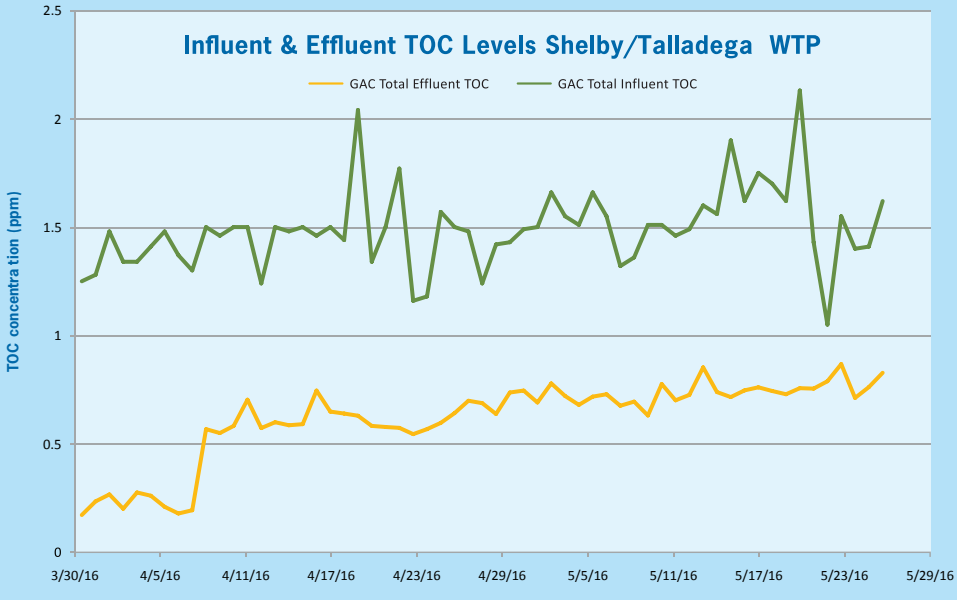
Another consideration in the analysis was the location of the Talladega/Shelby plant: the remote location and lack of septic sewers favored a technology that resulted in minimal waste. Waste from the plant flows through a series of settlement lagoons and eventually is discharged into the Coosa River. These waste lagoons were not designed to treat high levels of color, total dissolved solids or salt, which can be typical of ion exchange waste. Furthermore, the Alabama Department of Environmental Management indicated a concentrated waste discharge would require special permits and significant testing for compliance. For these reasons, SCWS was drawn toward the GAC system, which characteristically results in very little waste.

The County's cost analysis showed that the GAC filters needed to effectively remove DBPs for a full year before requiring reactivation. Calgon Carbon proposed its newest and largest GAC adsorption system, the Model-14. This system, equipped with two vessels that hold 60,000 lb of GAC each, was developed as SCWS evaluated how best to upgrade the plant. Birmingham-based Municipal Consultants Inc., who played a large role in the design process for the plant, took notice of the new system.

"When Calgon Carbon released the 60,000-lb vessels, we were able to reduce the number of vessels we needed down to four," said Chris Cousins, president of Municipal Consultants. "This saves money because with the larger size, we only have to reactivate two of them every fiscal year."

In the end, the plant installed four of the 14-ft diameter Model-14 pressure vessels over a 10-month period. Filtered water is pumped through the GAC to remove the natural organic matter (NOM) from the source of water before disinfection, preventing the formation of DBPs. The system is designed to allow plant operators to pump either all or part of the filtered water through the vessels in either parallel or series operation. As of 2016, the Talladega/Shelby water treatment plant is the only plant currently operating the large 60,000-lb vessels.

The county sends the spent GAC from two vessels, approximately every year, to Calgon Carbon for custom reactivation. The spent GAC is transported to one of Calgon Carbon's custom reactivation facilities, where it is thermally reactivated to remove adsorbed contaminants and restore its adsorption capacity. Calgon



WHAT ARE DBPs AND WHY ARE THEY REGULATED?

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

Some alternative disinfectants, such as chloramines and ozonation, do reduce the level of regulated DBPs, but result in new, currently unregulated and still toxic DBPs. Many municipal water providers are taking the step of removing NOM from water before adding disinfectant chemicals, preventing the formation of both regulated and unregulated DBPs. Granular activated carbon (GAC) is one of the most commonly applied technologies used to remove NOM from water.

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 custom municipal reactivation, meaning every customer's carbon is segregated

Carbon returns and installs the reactivated carbon (including a small amount of virgin GAC to make up for losses in reactivation) into the Talladega/Shelby vessels. The entire reactivation process is performed according to the latest NSF and AWWA standards governing the reactivation of GAC used for drinking water treatment. All of Calgon Carbon's custom reactivation facilities are exclusively dedicated to the reactivation of potable-grade carbons.

Ultimately, GAC was a wise selection of the treatment options that were considered because it is an effective removal technology that accomplishes more than just DBP compliance. GAC not only removes targeted contaminants of concern, such as NOM and DBPs, but it also acts as a defense barrier against accidental contamination by unregulated compounds like perfluorinated compounds (PFCs), pesticides, and a number of other contaminants listed on the U.S. EPA's Contaminant Candidate List 4 (CCL4).

"This was supplied as a complete system: carbon, vessels, pipes, pressure vessels and all. It has proven to be the right choice."

— Michael Cain, Shelby County Water Services

Since the installation of the Model-14 vessels with GAC at the Talladega/Shelby plant, DBP levels throughout the distribution system have remained in compliance. Installation of the GAC systems pre-empted the impact of the Stage 2 DBPR, ensuring Shelby County's water was in continuous compliance during the transition from Stage 1 to the more stringent Stage 2.

The affordability of Calgon Carbon's proposed solution, the availability of custom reactivation services, and the large vessel design were all factors in SCWS's choice to work with Calgon Carbon, according to Michael Cain, manager of water services for Shelby County. "This was supplied as a complete system: Carbon, vessels, pipes, pressure vessels and all," said Cain. "Calgon Carbon has proven to be the right choice."

and 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 near-virgin state. This resulting reactivated product results in a cost savings. The reactivation/recycling process also is better for the environment, with a reduced CO_2 footprint compared to the manufacture of virgin activated carbon.

MODEL 14 VESSELS

Calgon Carbon's Model 14 adsorption system uses granular activated carbon (GAC) to remove dissolved organic contaminants, such as DBPs and NOM, from liquids. These vessels can hold up to 60,000 lbs. of GAC providing the additional contact time to remove either compounds at low concentrations or poorly adsorbing compounds.

The Model 14 is designed with one GAC fill line and three GAC discharge lines positioned to extract 20,000 lbs. of spent carbon each. The arrangement of the discharge lines facilitates efficient GAC exchanges in three easily removed increments. In addition, three nozzles along the straight side of the vessel can be fitted with in-bed sample assemblies to allow the operator to monitor the mass transfer zone of the adsorbate through the bed.

The standard Model 14 system is a single vessel. Typical designs include several single vessels operated in parallel. However, two vessel systems can also be provided for lead-lag operation.