Treating Taste & Odor Compounds In Drinking Water

By Trojan UV

The UV-oxidation system installed at the Neshaminy Falls Water Treatment Plant (WTP), owned and operated by Aqua Pennsylvania, has lead to lower operating costs, a significantly reduced carbon footprint, and an improvement in water quality. The plant serves approximately 100,000 people in Buck and Montgomery Counties in Southeastern Pennsylvania. The source water for the WTP is Neshaminy Creek, which is prone to seasonal algae blooms.

A powdered activated carbon (PAC) system was in place to remove taste and odor, but the system was unable to provide sufficient removal of MIB and geosmin, the compounds responsible for seasonal taste and odor. Further, increasing PAC dose led to high carbon costs and a large increase in residual waste sludge. As part of a comprehensive WTP upgrade, engineers examined alternative taste and odor treatment technologies. The design objective was to determine the most cost-effective taste and odor treatment technology for the Neshaminy Falls WTP. Of PAC, UV-oxidation, and ozone, ozone was ruled out after estimates revealed that the added building footprint costs were prohibitive.

The Solution

Engineers working on the Neshaminy Falls WTP equipment upgrade conducted a comparison of the capital and operation/maintenance costs for PAC and the TrojanUVSwift™ ECT UV- oxidation system for taste and odor. Investigations revealed that while the treatment objective was the same, treatment performance would be significantly different between the two technologies.

Historical data from PAC use illustrates that a PAC dosage of 30 mg/L was only able to achieve a 55% reduction in geosmin concentration. Conversely, the UV-oxidation system provides an 80% reduction at peak flow and a 90% reduction at average flow. This comparison is illustrated in Figure 1.

With respect to treatment cost, the results of an evaluation to remove taste and odor compounds for 90 days per year for 20 years are presented below. On a net present value (NPV) basis, UV-oxidation is a more economical solution than PAC (Figure 2 - see reverse). Further, in addition to providing a higher level of geosmin removal, UV-oxidation also provides a 3-log inactivation of Cryptosporidium and Giardia. Thereby, UV-oxidation gives the WTP the ability to meet current and future disinfection regulations (for example the USEPA Long-Term 2 Enhanced Surface Water Treatment Rule). Other benefits of UV-oxidation include no additional dry solids removal and the elimination of the dust and handling requirements associated with PAC.

Environmental Footprint

In collaboration with the University of Western Ontario, Trojan conducted a life cycle assessment (LCA) of PAC versus UV-oxidation for the Neshaminy Falls WTP. Specifically, the climate change potential of each system was calculated by totaling greenhouse gas emissions associated with each system's manufacture, operation, energy consumption and transportation over a 20-year lifetime.

Results indicate that the installation and operation of UV-oxidation at the Neshaminy Falls WTP would release 74% less carbon dioxide (as measured by carbon dioxide equivalents or CO_2e) versus PAC (Figure 3). This equates to 23,670 less tons of CO_2 being released into the atmosphere, equivalent to the fossil fuel emissions released by driving 4,931 cars for 1 year (12,000 miles per car per year at a fuel economy of 25 miles per US gallon[1]).

The relatively high climate change potential associated with PAC in a WTP is due in part to the energy required, in the

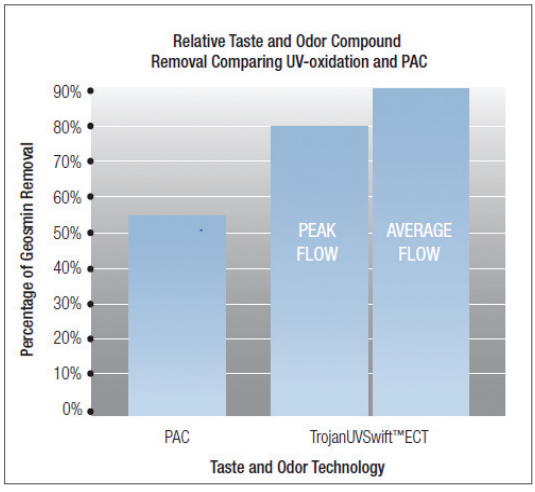

*Figure 1: *Estimates were based on a PAC dose of 30 mg/L and a 90-day taste and odor period.*

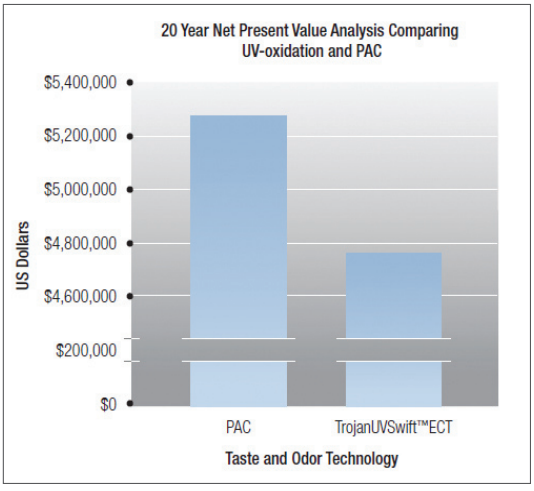

Figure 2: Analysis was based on 90 days of taste and odor operation with a discount factor of 4%. Costs include capital, construction, operation and maintenance (including dry solids removal for spent PAC). The PAC costs were based on $0.95 per pound and $215 per ton of dry solids removal and a dose of 30mg/L.

form of heat and steam, to convert coal into PAC (a process known as 'activation'). Conversely, the climate change potential of UV-oxidation systems is largely derived from the generation of electricity.

Full Scale System

System Design Parameters

- Peak Flow Capacity: 15 million gallons per day (MGD)
- Average Flow: 12 MGD

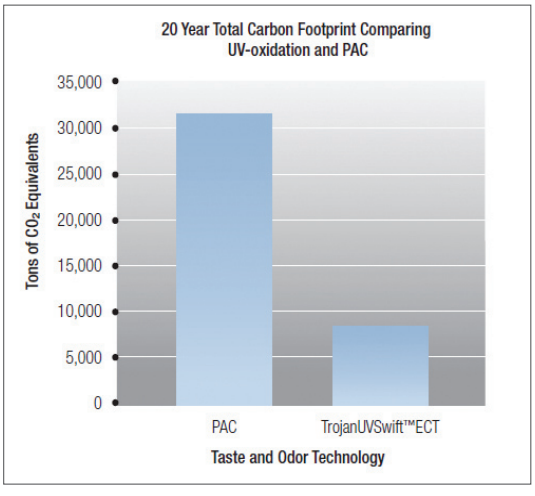

Figure 3: Estimates were based on a PAC dose of 30 mg/L and a 90-day taste and odor period. UV-oxidation was also evaluated over the same 90 day taste and odor period.

- Disinfection Target: 3-loginactivation of Cryptosporidium and Giardia
- Design Geosmin Reduction: 1.0-log (average flow); 0.7 (peak flow)

Advantages Of UV-OX For Seasonal Taste & Odor

- UV-ox removes >90% of geosmin (versus 55% for PAC) at average flow
- UV-ox does not require dry solids removal, drying equipment, or handling of powdered carbon
- UV-ox is cheaper on a 20-year net present value basis when compared to PAC
- Operating a UV-ox system for seasonal taste and odor releases 74% less CO_2e when compared to PAC
- UV-ox requires a very small physical footprint and can often be retrofitted into existing WTP piping

About The Article

This article has been contributed by Technologies. The Company is recognized around the world as the leader in advanced UV water treatment technology. Over the last decade, Trojan has refined and optimized the use of UV technology for the treatment of chemical contaminants in water. website: www.trojanuv.com