TROJAN UV

CASE STUDIES

Environmental Contaminant Treatment

Trojan UV Solutions: Treating Taste and Odor Compounds in Drinking Water

On Demand Taste and Odor Treatment **Neshaminy Falls WTP,** Pennsylvania, USA

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 (T&O), but the system was unable to provide sufficient removal of MIB and geosmin, the compounds responsible for seasonal T&O. 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 T&O treatment technologies. The design objective was to determine the most cost-effective T&O-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 TROJAN UV 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 T&O. 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**.

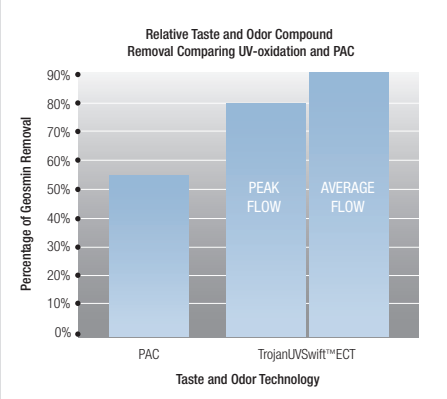

Figure 1: *Estimates were based on a PAC dose of 30 mg/L and a 90-day taste and odor period.

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

CASE STUDIES

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.

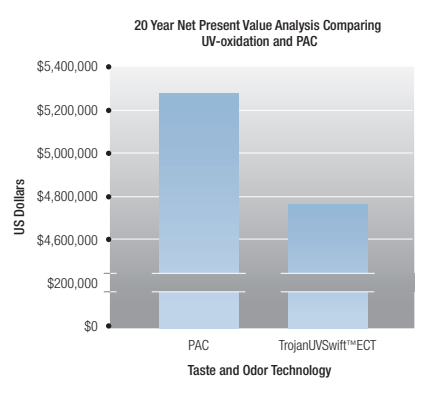

Figure 2: *Analysis was based on 90 days of taste and odor operation with a discount factor of 4%. Costs include capital, construction, operation and maintenance (including dry solids removal for spent PAC). The PAC costs were based on $0.95 per pound and $215 per ton of dry solids removal and a dose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

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 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.

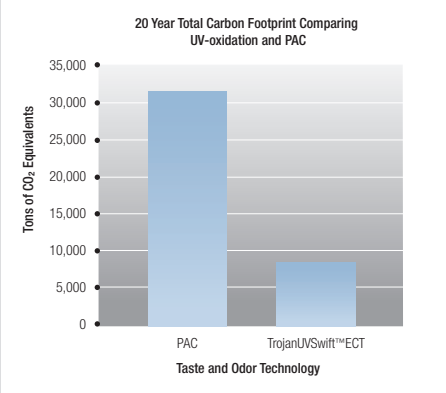

Figure 3: *Estimates were based on a PAC dose of 30 mg/L and a 90-day taste and odor period. UV-oxidation was also evaluated over the same 90 day taste and odor period.

ADVANTAGES OF UV-OX FOR SEASONAL TASTE AND 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

FULL SCALE SYSTEM

SYSTEM DESIGN PARAMETERS

- PEAK FLOW CAPACITY: 15 million gallons per day (MGD)
- AVERAGE FLOW: 12 MGD
- DISINFECTION TARGET: 3-log inactivation of *Cryptosporidium* and *Giardia*
- DESIGN GEOSMIN REDUCTION: 1.0-log (average flow); 0.7 (peak flow)

TESTIMONIALS

"Our Neshaminy WTP facility is space limited. The UV/Peroxide System affords us the ability to install a system that is easy to operate and fits in the space available while producing a superior water quality for our customers. It also provides positive environmental benefits by reducing our carbon footprint."

Marc A. Lucca
Vice President – Production
Aqua Pennsylvania

References:
http://www.epa.gov/oms/climate/420f05001.htm

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