Mazzei®

CASE STUDY

Expansion and Upgrade of WWTP Ozone Disinfection System

Ozone Gas Contacting System

Springfield, Missouri

The Problem: The City of Springfield, Missouri's Southwest Wastewater Treatment Plant (SWWTP), recently renamed Southwest Clean Water Plant, has continuously used ozone to disinfect secondary wastewater since 1978. The ozone system installed in 1978 utilized an oxygen plant to feed plate ozone generators that discharged ozone gas into the head space of the plant's three contactors. Head space ozone gas was mixed into the shallow water using three turbine mixers at each contactor (FIGURE 1). Ozone off gas was not destroyed by an ozone destruct module, but instead was collected, re-compressed and sent to an activated sludge basin.

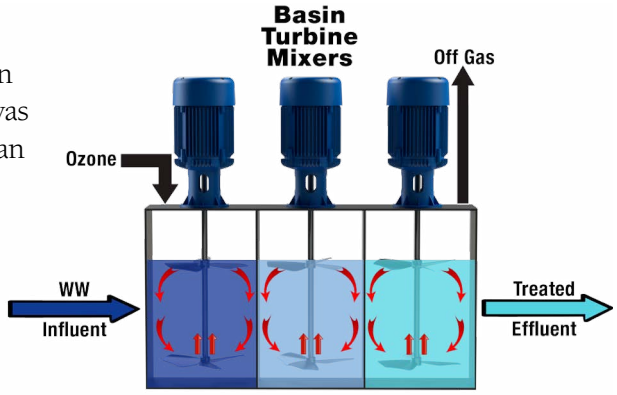

FIGURE 1. Ozone Gas Contacting System 1978

The plate ozone generators were replaced in 1988 with Emery ozone generators. The replacement ozone generators allowed the plant to continue to meet its disinfection goals, but by 2008 the annual ozone maintenance costs began approaching $100,000 for labor, materials and downtime. The financial cost to maintain the ozone equipment and increasing scarcity of generator replacement parts motivated the utility to upgrade their ozone system.

The Solution: The expansion and upgrade of the ozone system required a review of plant operations and a reevaluation of the wastewater's ozone demand. Bench scale tests determined the wastewater's ozone demand at the plant's peak monthly flow to both satisfy demand and ensure the plant met its disinfection goals. Early in the design stage, the decision was made to replace the high energy turbine mixers with a lower energy, more efficient sidestream ozone injection system which utilized sidestream Venturi injectors (SVI) for primary ozone contacting, followed by basin nozzle manifolds (BNM) for secondary gas contacting into the basins' bulk wastewater flow. The final retrofit design included a structural modification of the basin inlets to allow the SVI-BNM retrofit to contact all of the basin's wastewater flow. The dual inlet gates at the front of each contactor are enclosed in a concrete structure that funnels entering wastewater into a narrow tunnel to allow confined space gas mixing (FIGURE 2).

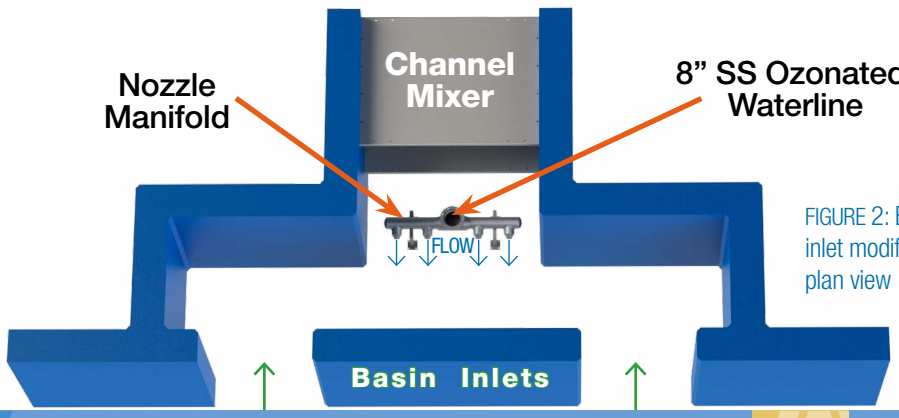

FIGURE 2: Basin inlet modification, plan view

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The BNM countercurrent nozzle jets that aggressively mix and transfer ozone into the channeled wastewater flow are followed by static mixing elements that provide a final mixing of the bulk water flow prior to discharge into the larger downstream cells. To ensure even distribution of ozone into the bulk wastewater flow, Computational Fluid Dynamics (CFD) was used to direct the design and placement of the channels' basin nozzle manifolds and static mixing elements (FIGURE 3). Each BNM receives ozone gas from 1 or 2 duty SVI which are installed on top of the basin. The mixed flow of the injectors enters the nozzle manifold through a common, vertical 8" line (FIGURE 4). Ozone production is provided by a single ozone generator to treat the peak monthly flow of 64 MGD. A fully redundant generator allows the plant to disinfect during storm water flows up to 100 MGD.

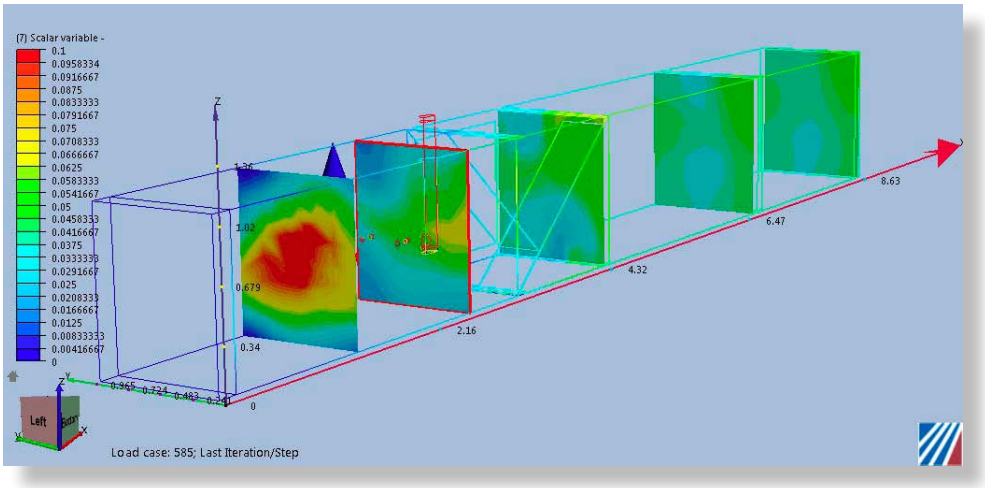

FIGURE 3: Cross sections of (O3) concentration in channel and its discharge plume.

The Results: Plant data comparing the energy cost of the SVI-BNM ozone dissolution system with the turbine mixing design showed the retrofit design reduced the energy cost of ozone contacting by an average of 69.2% under all plant flow conditions. Performance data taken during a Mazzei site visit on April 16, 2014 showed an ozone transfer efficiency of 92.1% was achieved using an applied ozone dosage of 2.5 mg/l of 6 % wt. ozone.

FIGURE 4:
Contactor Number 3
ozone injectors

To get a better understanding about how a Mazzei Sidestream Venturi Injector-Basin Nozzle Manifold system works, take a look at this animation.

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For additional information on how Mazzei can assist with your water treatment goals, contact us at:

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