Mazzei®

CASE STUDY

Improving the Quality of Tertiary Effluent for Indirect Potable Reuse

Membrane Filtration/Ozonation Demonstration Facility

Clark County Water Reclamation District, Las Vegas, Nevada, USA

The Problem: The Clark County Water Reclamation District (CCWRD), which serves the unincorporated residential areas surrounding Las Vegas, has augmented an existing Advanced Water Treatment (AWT) Facility with a demonstration facility incorporating membrane filtration and ozonation to improve the quality of tertiary effluent for indirect potable reuse (IPR). The 4,700 m3/h (30 mgd) demonstration facility is essentially a full-scale pilot that will allow CCWRD to evaluate the membrane/ozonation (M/O) treatment train for future expansion and upgrade of tertiary treatment.

The AWT Facility treats secondary effluent from the Central Plant (CP)—CCWRD's main wastewater treatment facility—prior to discharge into the Las Vegas Wash, which ultimately flows into Lake Mead, the region's source for potable water. The existing AWT train consists of chemical clarification using aluminum sulfate, granular media filtration, and UV disinfection. The M/O demonstration facility treatment train consists of drum screens, ultrafiltration (UF) membranes, and ozone disinfection (FIGURE 1).

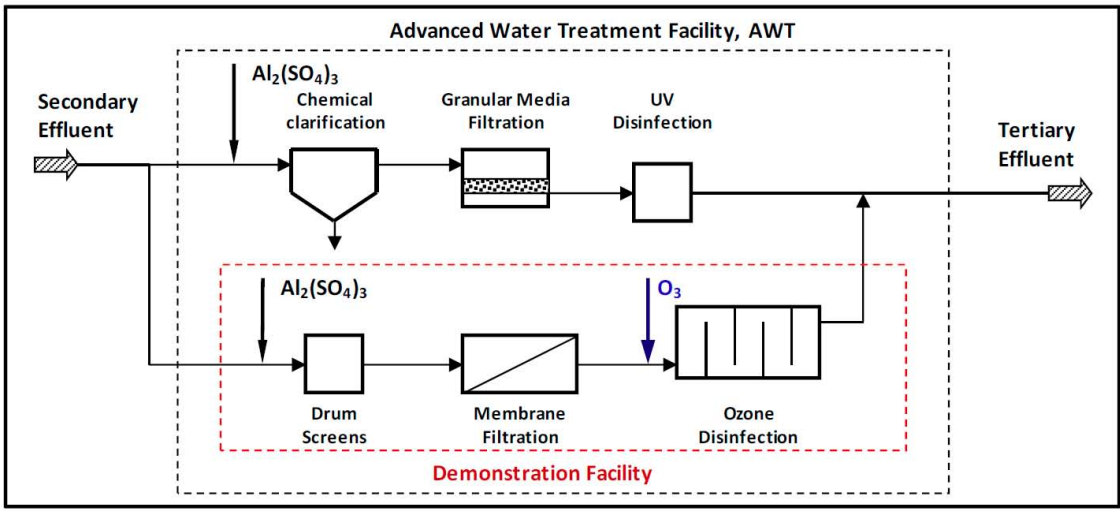

FIGURE 1: Simplied process flow diagram of the AWT Facility

The goal of the M/O facility is to exceed the requirements of the National Pollution Discharge Elimination System (NPDES) permit, meet the California Code of Regulations (CCR) Title 22 requirements, and achieve reduction in additional contaminants, such as nutrients and microconstituents—including endocrine disrupting chemicals (EDCs), pharmaceuticals and personal care products (PPCPs), synthetic organic compounds (SOCs), and other trace organic contaminants which have been found in the region's water supply from Lake Mead.

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The Solution: The initial ozone contacting design consisted of two fine bubble diffusion (FBD) systems with traditional over/under baffled concrete tanks. However, native soils in the area were identified during the design phase as "critically expansive and highly compressible." After having to demolish previous structures at the AWT Facility and CP due to structural damage caused by the soil, all new concrete structures, including the proposed FBD ozone contactor(s), were required to be supported by drilled concrete piers, which made conventional bubble diffusion an expensive alternative.

Because of the high cost of using FBD ozone contactors, other ozone contacting alternatives were evaluated. The Sidestream Venturi Injection (SVI) – Pipeline Flash Reactor™ (PFR) system was ultimately selected since it eliminated the need for a deep contactor and allowed flexibility in basin design to meet site constraints. The SVI - PFR system consists of two sidestreams, each with a 1,100 gpm injection pump producing 45 psi of pressure through a 6 inch stainless steel injector. The two injectors feed into the 48 inch diameter by 70 inch long PFR which is installed in-line immediately upstream of the ozone contactor (eliminating the contactor volume that would have been required for fine bubble diffusion use). One of the sidestream pumps is variable speed to allow plant operators to dial in the optimum working pressure and flow for the injector to provide an energy efficient transfer of ozone during periods when low ozone dosage is required. The needed power for the SVI – PFR system at the design condition of 1,650 lb/d ozone applied at a concentration of 10% wt is 29 kW. This translates to an energy requirement of 0.42 kW·h/lb of ozone applied.

The main advantages of the SVI - PFR system in comparison with the FBD system include:

- Flexible contactor design;
- Simplified operation and maintenance;
- High transfer efficiency in a 12 foot side water depth.

The Results: The Mazzei Sidestream Venturi Injection – Pipeline Flash Reactor System provides a feasible alternative for dissolution of ozone at the CCWRD AWT M/O Facility by eliminating the geometric constraints on the ozone contactor. This allowed the contactor design to be based on improved hydraulic characteristics for rapid ozone dissolution within the site constraints imposed on the basin dimensions, and, in this case, reduced the footprint and weight of the structure by eliminating the diffusion grids and decreasing the side water depth.

The CCWRD AWT Ozone System started up in December 2014, and, with the exception of some gasket failures due to poor material selection, the operation has been uneventful. Although designed to be able to apply a peak ozone dosage of 8.0 mg/l utilizing 2 sidestream injectors, the plant typically operates a single injector at an applied ozone dosage of 3 mg/l. Ozone transfer efficiency has ranged from 96% – 98%.

To get a better understanding about how a Mazzei Sidestream Venturi Injector-Pipeline Flash Reactor 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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