



Jackson

Pipeline Flash Reactor Technology Selected for Castaic Lake Water Agency Expansion

As part of a planned expansion, the Castaic Lake Water Agency (CLWA) has installed pipeline flash reactors (PFR) from the Mazzei Injector Co. LLC in Bakersfield, Calif. CLWA's facilities include the Earl Schmidt Filtration Plant (ESFP) and the Rio Vista Water Treatment Plant (RVWTP). The ESFP ozone system was designed by Black & Veatch. The RVWTP system was a joint design venture by Black & Veatch and Kennedy Jenks Consultants. The plants treat Castaic Lake water supplied from the California State Water Project. Both were recently expanded to increase their capacity.

As part of the RVWTP expansion, the existing 102-in. raw water pipeline was converted to an ozone contactor. The Mazzei PFR was selected for the ozone side stream injection to match a similar installation at the agency's ESFP, and because of its proven high-efficiency operation within a small footprint. The RVWTP expansion is currently under construction.

The 72-in. PFR installed in the contactor uses application-specific nozzles to introduce the water/ozone side stream flow back into the main water flow at high velocities. This causes a section of the system to be a turbulent mixing chamber without the pressure loss of conventional mixing systems. Ozone mass transfer occurs within a few seconds and thoroughly mixes with the main pipe flow. The PFR includes a two-element static mixer just downstream of the nozzles as part of the Black & Veatch design.

INNOVATIVE TECHNOLOGY CREATES SYSTEM EFFICIENCIES

Bubble diffusion. Conventional ozone mixing systems use fine bubble diffusion in the basin or, in some cases, a static mixer. Installation of the PFR moves the gas mixing and transfer out of the basin and into the pipeline.

On new construction, this means plants can have a smaller basin dedicated to providing the contact time needed for microbial inactivation. This reduces the installation footprint and creates space for serpentine-flow basins, which are easier to clean.

On existing plants, installing a PFR increases the time in the existing ozone contacting basin. The volume in the gas mixing zone is not included when calculating contact time, but moving the gas mixing zone out of the basin allows the zone to be included. Additionally, maintenance associated with fine bubble diffusion (gasket and diffusion stone replacement) is eliminated and a system with the potential to provide 95% ozone transfer or better (frequently 98%) is created.

Static mixers. On systems that use a full-flow static mixer as a standalone secondary gas mixing device, the mixing intensity is dependent on plant flow. Providing adequate mixing can be difficult if the plant has a large turndown ratio. For example, if a plant with a maximum-to-minimum flow range of 5:1 is designed

This pipeline flash reactor was installed as part of an expansion to the Castaic Lake (California) Water Agency and uses high-velocity nozzles that ensure optimum gas mixing under all plant flow conditions.



for the maximum flow to provide good gas bubble mixing, there will be very little mixing at the minimum plant flow. Using the same flow range, if a plant is designed for good mixing at the minimum flow, it would experience significant pressure loss during mixing at peak flow. This pressure loss would significantly affect plant pumping costs.

Mazzei's PFR nozzle elements jet a plume of gas bubbles across the main pipeline flow at a constant velocity that is independent of the plant flow. This ensures optimum gas mixing under all plant flow conditions. The nozzle penetrates the interior of the PFR by a few inches, consequently pressure loss at peak plant flows is always < 1 psi and frequently < 1 ft of water.

ONGOING RESEARCH YIELDS ADDITIONAL IMPROVEMENTS

Recent studies at the University of Alberta (Edmonton) resulted in

several discoveries that facilitated improvements in the PFR technology. Using tracer tracking and sophisticated photography, it was determined that the PFR produces effective dispersion of the side stream with the main flow in as little as 1 second. Achieving rapid equilibrium allows the plant to monitor dissolved ozone residuals 1 second from the PFR and to start the clock on accumulating contact time credit for disinfection. Therefore, if the plant pipeline flow rate is 4 fps, disinfection credits can start accumulating 4 ft downstream from the PFR.

Additionally, it was determined that the PFR could be designed with the high-velocity nozzles closer together than they were in the original design. This allowed the stainless-steel PFR spool to be shortened, which helped reduce the footprint and cost of installation, both especially important benefits for small facilities.

Finally, research showed that the side stream injector flow could be reduced if the PFR was designed with minimum nozzle velocity and the nozzles were oriented in a specific configuration. This change allowed much smaller side streams, frequently only 2% of the plant flow, which in turn allowed smaller side stream injection pumps. The PFR designed for the RVWTP resulted in a minimum of 95% transfer at the design condition per side stream train of 875 lb/d at 10% by wt ozone concentration, using a 40-hp pump. Initially two and ultimately four side stream trains will be in operation.

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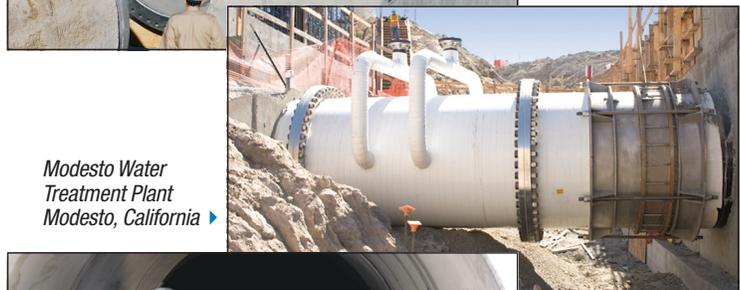
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Rio Vista Water Treatment Plant, Castaic Lake Water Agency, California



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Ozone gas is introduced into the pressurized side stream using patented Mazzei technology

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