



City of Yankton Water Purification Facility

Venturi In-line Aeration System (Air Injection Skids & PFR)

THE PROBLEM: As the city of Yankton, South Dakota, grew, the demand for water increased as well. In addition, the city's water supply was experiencing problems with trihalomethanes (THMs) during a few months of the year. Surface water from the Missouri River was being used as the water treatment plant's source water, and during spring flooding events, a greater abundance of organic matter was present in this water supply. When mixed with chlorine compounds that are used to disinfect water, THMs formed. THM levels are regulated by the federal government, so keeping them in check is always a concern.

The city faced an additional challenge beyond just the technical demands of water treatment. The plant is located in an existing city park on a beautiful stretch of the Missouri River, so it was important to have a facility that could seamlessly blend in with both the park and the surrounding downtown area.

THE SOLUTION: The proactive City Commission began looking into an expansion before a crisis arose. They approved a new water purification facility that would now be supplied with well water rather than surface water from the river. This new facility would use reverse osmosis (RO) technology to achieve high-quality drinking water, and was

designed to treat groundwater flow rates up to 10 million gallons per day (mgd). Since there was a significant iron concentration in the water, to reduce chemical costs and lighten the load on the RO membranes, the raw water would first need an aeration step, retention tank, and multimedia filtration.

When evaluating aeration equipment, it became apparent that there was no convenient location to install a large draft aerator. The only possible location would have required the replacement of an aesthetically pleasing clock tower with a large, unsightly draft aerator on top of the building which the city determined would be an eyesore.

HDR, serving as design engineer, was familiar with Mazzei Injector Company's in-line gas contacting systems used for ozone applications, and was happy to hear that the same equipment could be effectively used for aeration systems.

With the help of Vessco, Inc., Mazzei provided aeration equipment consisting of two air injection skids and a 24-inch Pipeline Flash Reactor™ (PFR) which was conveniently installed out of sight in the building's basement. Each injection skid includes a skid-mounted booster pump which draws a sidestream from the mainline flow and pumps it through the skid-mounted venturi injector, which uses the

flow of the water to create a vacuum that draws atmospheric air into the sidestream. The water/gas mixture is then blended back into the mainline through a stainless steel PFR that employs high velocity mixing nozzles to aggressively mix and uniformly transfer the oxygen into solution.

THE RESULT: The Mazzei venturi in-line aeration system is able to sufficiently aerate the raw water to oxidize up to 2 mg/l of iron that is subsequently removed by multimedia filters. This aeration system proved to be the ideal fit for the newly expanded Yankton water treatment facility for a number of reasons:

- The PFR does not contain any static mixing elements or any moving parts, so zero maintenance is required and there is almost no mainline pressure loss across the unit.
- The use of a venturi eliminates the need for a blower, compressor, or any type of diffuser that is likely to foul over time.
- The system's compact footprint provided the engineer with the necessary flexibility to design a plant with an elevated level of architecture without sacrificing function.



Air Injection Skid



Pipeline Flash Reactor

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