

CASE STUDY

MaximOS™

Las Vegas Water Treatment Plant, NM



MaximOS™ improves treatment process and water quality at Las Vegas Plant

Overview

The City of Las Vegas is located in the Sangre de Cristo mountains in north-central New Mexico at an elevation of about 6,500 feet. The potable water supply for the population of 22,000 comes primarily from surface water sources. There are over 100 miles of distribution system piping.

The plant's processes include clarification with 3 stages of mixing, multimedia filtration of the clarifier effluent, and disinfection of the treated water. There are four raw water pumps, each with a 1,500 gpm flow rate. The water plant is designed for 6 MGD capacity, but peak flows are 3 MGD in the summer and 1.8 MGD in the winter due to a water conservation program.

The facility and plant operation have received multiple awards, including the Good Housekeeping Award, the Max Sumerlot Award for operations, a Special Recognition Award from AWWA for Frank Armijo, Plant Manager, and the NMRWA's 2004 Operator of the Year award.

Challenge

Safety Regulations: The Las Vegas Water Treatment Plant stored two (2) one-ton cylinders of chlorine gas on site, exceeding the Risk Management Plan (RMP) limit of 2,500 pounds of chlorine gas. Regulations required expensive plant upgrades in order to be in compliance.

Disinfection By-Product (DBP) Levels: With chlorine gas, Total

Trihalomethanes (TTHMs) at the Las Vegas plant were approximately 80 µg/L, right on the border line for the new Stage 1 DBP limits.

Solution

Las Vegas installed a MIOX disinfection system that generates mixed oxidants (MOS) on site, eliminating the need for a Risk Management Plan. Use of the mixed oxidants in pretreatment caused microfloculation, eliminated severe algae formation, and reduced TTHM formation. Use of mixed oxidants for final disinfection also provides a chlorine residual without the operational dangers of chlorine gas. Lead Operator Larry Francis says, "Even if MIOX had no other effects, the safety aspect alone would be worth it. Chlorine gas is just too dangerous."

Results

Microfloculation – Alum dose was reduced 42% from 10.5 ppm to 7.5 ppm with the addition of mixed oxidants in pretreatment. Sludge production is also reduced.

Turbidity – Average turbidity levels were cut from 0.09 NTU to 0.04 NTU, with an even greater reduction during winter.

Algae Removal – With no pre-oxidant, algae would form 1 to 2 inch thick mats in the clarifiers, peeling off in sheets and overloading the filters. The basins were drained for cleaning on a monthly basis, causing a large water loss and requiring 20 man-hours of maintenance. Even with vigorous scrubbing, it was impossible to fully remove the algae from the mixing

COMPARISON	Gas Chlorine (before)	Mixed Oxidants (after)
Microflocculation	No pre-oxidation due to excessive TTHM formation.	Alum dose reduced 42%. No more KmnO_4 for algae control. Production of sludge decreased.
Turbidity	0.07 NTU average.	0.04 NTU average, 0.019 NTU in winter.
Algae/Biofilm Removal	1" to 2" thick algae growth in clarifiers every 2-3 weeks.	Algae growth eliminated; higher chlorine residual in distribution indicates lack of biofilm.
Filter Backwash	Backwashed every 48 hours.	Backwash cycle doubled to every 96 hours.
Chlorine Dose/Residual	2.0 ppm dose at plant for a 0.3 ppm residual in distribution.	Reducing dose 15% to 30% (to 1.4 to 1.7 ppm) still results in higher residual (0.8 ppm) in distribution.
DBP Reduction	80 $\mu\text{g/L}$ average.	45 $\mu\text{g/L}$ (44% reduction) 3 months after start-up.
Taste & Odor Problems	~200 complaints annually.	Received only 3 complaints in the 6 months since start up; no more chlorine odor at plant.
Maintenance	20 man-hours every 3 weeks for algae removal.	Man-hours reduced to 1/10 previous level; 1-2 hours total per week for equipment operation.
Safety	1-ton gas chlorine cylinders necessitated RMP planning.	No hazardous chemicals; no need to write RMP; no safety equipment required.

paddles. If not washed off, the algae would cause a rash on the operators' hands. Within 2 weeks after the MOS system start-up, the algae was eliminated. Plant operator Ramón Vialpando says, "I wish you could've seen our basins before! It was like a carpet – a shag carpet – with algae. You couldn't hardly get in there without a gas mask."

Filter Backwash Cycle – The decreased algae load permitted the filters to be backwashed every 96 hours instead of every 48 hours.

Chlorine Dose/Residual – The FAC dose as mixed oxidants was reduced 15% to 30% from 2.0 ppm, while the chlorine residual at the end of the distribution system increased from 0.3 ppm to 0.8 ppm.

DBP Reduction – TTHM sampling is done at 10 different points, from the plant to the end of the distribution system. With chlorine gas, TTHMs averaged 80 $\mu\text{g/L}$ in distribution, even with no pre-oxidant addition in the clarifiers. A few months after MOS start-up, TTHMs measured 45 $\mu\text{g/L}$, a 44% reduction. Since the plant was able to increase contact time in the basins without an adverse effect on TTHM formation, they could be ranked as a 4 log removal plant for Giardia and Cryptosporidium.

Taste & Odor Problems – With chlorine gas, the plant received a couple hundred complaints every year, particularly

during algae blooms. After installation of the MOS system, Frank Armijo reported only 3 complaints in 6 months.

Maintenance – Man-hours on basin maintenance were a tenth of those required before MOS disinfection. The brine filters for the MOS system are washed weekly and changed monthly. About fifty bags of salt (~2,500 pounds) are loaded weekly. Las Vegas reported total man-hours for the operation and maintenance of the MOS system at approximately 1-2 hours per week. Although the MOS solution cost more than the cost of chlorine gas on a pound for pound basis, the overall operating costs at the plant were reduced, due to process improvements such as reduced coagulant consumption, reduced sludge disposal, and lower maintenance costs.

Safety – Las Vegas required two (2) one-ton chlorine gas cylinders totaling 4,000 pounds, putting them above the EPA limits for the RMP. Changing out the cylinders required two operators with full gas masks and air tanks and another person outside the chlorine room on stand-by. A fourth person would wait by the phone for a quicker response in the event of an accident. In contrast, the MOS on-site generation involves no hazardous chemicals whatsoever. According to the operators, "The safety aspect alone of MIOX would pretty much sell anybody." ■



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