onsite disinfection

By Chris McCalib & John Deogracias

Mixed-oxidant solution system reduces plant's chemical usage

The Lakota Wastewater Treatment Plant (WWTP) is the larger of two plants in the Lakehaven Utility District in Washington state. The 10-million-gal-per-day facility serves a mostly residential community between the cities of Seattle and Tacoma, discharging effluent into Puget Sound.

After upgrading to an ultraviolet system for its primary disinfection needs, the plant retained its chlorine system to treat recycled water and serve as a backup contingency. It also used bulk bleach for its odor control system. The rising costs of bulk chlorine and the legal obligations of using the hazardous chemical spurred Lakehaven officials to consider new options.

They chose Parkson's MaximOS onsite water disinfection technology to replace the backup chlorine system at the Lakota plant. Due to superior microbiological efficacy in many applications, Lakehaven managers opted for the mixed-oxidant solution (MOS) using a capital lease program. This allowed the WWTP to maintain an operational and maintenance budget while conserving capital improvement funds.

The Problem Statement

The Lakota WWTP is designed for carbonaceous biochemical oxygen demand removal and does not have nutrient-loading total maximum daily loads on its effluent discharge. As a result, the plant was not designed to include technologies, such as anoxic selectors, that mitigate filamentous organism growth. Without this technology, filamentous bacteria (filamentous) growth was prevalent in the process tanks.

Filamentous growth is a common problem for activated sludge systems because it can interfere with proper settling. Processes downstream are affected as a result. At Lakehaven, clogged filters, clogged piping and foaming were attributed to filamentous. Some varieties of the bacteria thrive in oxygen-deprived environments; others depend on certain nutrient imbalances or high grease and fat loads.

Finding the right treatment method is a matter of identifying the specific type of bacteria and whether it is causing slime, foam, bulking or another settling problem. Chlorine is the most common tool to combat filamentous, and it works by damaging bacteria on the floc surface. Too high a dose, however, damages the floc-forming bacteria that are needed in the system.

Onsite MOS Generation

The MOS is produced by electrolysis of sodium chloride brine in an electrolytic cell that has been optimized for disinfection efficacy. This solution exhibits microbial inactivation properties that are superior to bleach alone. In MOS, free available chlorine (FAC) is the primary analyzable oxidant constituent. The chemical produced from Parkson MOS generators, however, shows demonstrable differences from bleach in both field and laboratory studies, indicating the presence of other oxidant species beyond FAC alone.

Laboratory data using advanced analytical techniques indicate the presence of hydrogen peroxide in MOS. The additional oxidant species in MOS are responsible for enhanced biocidal efficacy—demonstrated on a variety of microorganisms—and enhanced behavior in several chemical processes important in water treatment. Figure 1 shows an example of the biocidal efficacy of MOS compared to sodium hypochlorite/bleach. There are several results published in peer-reviewed literature that have demonstrated this efficacy. Years of compiled field data also show differences.

MaximOS allows for fine dosing adjustments that allowed plant operators to optimize the dose for filamentous kill and control foaming. Filter and pipe clogging in the plant's recycled water system was mitigated. By upgrading to the version with mixed oxidants, Lakehaven has reduced its chemical usage by 30% to 50%, lowering costs and allowing the other biological processes to run optimally. Additionally, the plant has replaced a 12.5% hypochlorite odor air-scrubbing system with the MOS, which has virtually eliminated odor problems.

Finally, the technology continues to fulfill its role as a backup disinfection system. Plant personnel are confident the unit was sized to meet the future needs of the plant. Chemicals can be produced on site and on demand without the safety concerns associated with chlorine gas or the chemical degradation issues common with 12.5% hypochlorite.

Economic & Safety Results

The technology has performed well, achieving the same results as the earlier chlorine system, but doing so with about one-third of the equivalent in chlorine gas. The improved efficiency translated into a savings of about $12,000 a year. Additionally, plant personnel were pleased to replace a hazardous chemical with salt, which is much safer to handle and store on site. WWD

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Figure 1. MaximOS Life-Cycle Costs During (Years 1-4) and After (Years 5-20) Warranty Period

	Chlorine gas system	MaximOS onsite generation system
Chemical costs	$61,000	$0
Annual operations costs	$40,000	$36,333
Total annual costs	**$101,000**	**$36,333**
Savings per year during lease agreement (years 1-4)		$32,438
Projected savings of unit during years 5-20		$1,043,120 ($65k per year)
Projected savings of unit during 20-year equipment life		$1,397,872
Installation costs		($185,000)
Total savings of unit during 20-year equipment life		**$1,212,872**