# Drinking Water Quality Preservation in a Southern California Reservoir

# **Case Study**



Aerial photo of the Silverwood Lake (Google 2014)

# Project Overview

Location: San Bernardino County, California
Silverwood Lake: 965 surface acres, 73,000 acre foot capacity
Project Objective: Control taste and odor compound (geosmin) by targeting the in lake source, cyanobacteria.
Solution: Application of PAK®27 Algaecide
Results: Immediate and sustained reduction in geosmin and cyanobacteria concentrations following the application of PAK 27.

# **The Problem**

Silverwood Lake State Recreation Area is a part of the California State Water Project located in San Bernadino County. Silverwood lake is the first storage lake off the Eastern California Aqueduct. Water is delivered from this lake to Metropolitan Water District (MWD) of Southern California providing domestic water for an estimated 3 million residents

in the Los Angeles region. In addition, this lake is a popular recreational resource for boating, swimming and fishing. The California Department of Water Resources (DWR) contacted SePRO Corporation in late June 2014 as the MWD was experiencing taste and odor (T&O) issues with the lake water. Cyanobacteria (*Anabaena* sp.), at low but widely distributed cell counts, was identified by MWD as the culprit.

# The Solution

DWR and Metropolitan Water District of Southern California (MWD) routinely monitor water quality throughout the regions lakes and water conveyance systems to assure high quality drinking water is available to their customers. As part of this effort, they routinely monitor cyanobacteria and the associated taste and odor (T&O) compounds geosmin and 2-methylisoborneal. When cyanobacteria and T&O levels reach action thresholds, these agencies work to implement various management practices including treatment of cyanobacteria in the supply lakes.

As geosmin levels began to increase in Silverwood Lake in June 2014, DWR collaborated with SePRO Corporation and to assess, prescribe and implement a treatment program.

With over a decade of successful use in drinking water systems around the US and targeted efficacy toward nuisance cyanobacteria, PAK 27 algaecide (NSF/ANSI Standard 60 Certified, OMRI listed, US EPA registration number 68660-9-67690) was selected for managing this source of the taste and odor compounds in Silverwood Lake.

On July 1 and 2, 2014, PAK 27 algaecide was applied by AquaTechnex (*a professional lake management and application company*), targeting

cyanobacteria in the upper 4 feet of the water column (*Figure 1*). Geographic Information System (GIS) mapping software was used to confirm the surface acreage of the lake and the 8 treatment zones designed to assure precision application and dosing of the prescribed concentration of product (*Figure 2*).



Figure 1. PAK 27 application trail in Silverwood Lake.



Figure 2. Silverwood Lake treatment zones.



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#### Monitoring

Secchi disc (water clarity) measurements and water samples (2 feet below the surface) were collected pre-application from in all 8 zones in the lake. Samples were collected 1 day after treatment (DAT) in zones 1, 2 and 3 and 7 DAT from all 8 zones. Samples were shipped to SePRO Research and Technology Campus laboratory (ISO/IEC 17025:2005 certified) for algae identification/enumeration and chlorophyll a

Silverwood Lake Cyanobacteria

analysis. Additional water samples from the lake were collected by DWR and analysis completed by the MWD laboratory to document geosmin concentrations and algae identification/ enumeration.

### The Results

PAK 27 algaecide had a significant and positive impact on water quality as a result of controlling cyanobacteria in Silverwood Lake. Secchi depths prior to treatment in all zones averaged 13.5 feet. By 1 DAT, secchi measurements the treated zones (1, 2, 3) had a substantially increased to an average depth of 18 feet. Field observations noted improved water clarity following the PAK 27 application. Cyanobacteria (primarily Anabaena sp.) was significantly and rapidly controlled with the PAK 27 treatment. SRTC data documented an immediate (1 DAT) and sustained decrease (> 90%) of cyanobacteria 14 DAT, the last date of sample analysis for cyanobacteria lakewide (Figure 3). The additional samples collected by DWR and analyzed by MWD laboratory relayed similar results documenting a 92% decrease in Anabaena sp. post-treatment. Despite low initial chlorophyll a levels (average 1.5 µg/L), all 1 DAT samples were below detection limit of  $1 \mu q/L$ . By 7 DAT, only 3 of 10 samples had detectable chlorophyll a levels (those 3 sites averaged 1.3  $\mu$ g/L), though this is likely due to the green alga, Sphaerocystis found in the samples. Geosmin levels 7 DAT decreased 56% and 98% at 21 DAT compared to pre-treatment conditions. By 28 DAT, geosmin was non-detectable in the lake (Figure 4).





Figure 3: Cyanobacteria cell densities from Silverwood Lake samples. Only site 1 - 3 were sampled 1 DAT. Detection limit was 40 cells/mL, this value was used graphically if cells were detected. All cyanobacteria was comprised of Anabaena spp. with exception of some Microcystis sp. in the site 8, 7 DAT sample.

#### Silverwood Lake Geosmin



Figure 4: Geosmin concentrations from Silverwood Lake samples through time. Not all stations were sampled at each sampling event.

## Conclusion

PAK 27 algaecide had a significant and positive impact on water guality, taste and odor, by effectively controlling the cyanobacteria in Silverwood Lake. This proactive management strategy (treating when established action threshold levels are reached) is a viable option for controlling taste and odor producing cyanobacteria in source water lakes/reservoirs. Better water coming into the water treatment facility equals better water out. DWR and MWD continue routine monitoring to assess water quality and be prepared to proactively address taste and odor producing cyanobacteria.

At the time of this writing, August 22, 2014, action threshold levels cyanobacteria and T&O compounds had remained below action threshold levels since the successful July 1 - 2, 2014 PAK 27 treatment.



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#### August 2014