MOLEAER®
ADVANCING NANOBUBBLE TECHNOLOGY

GOLETA SANITARY
Water Resource Recovery District

SELECTIVE OXIDATION OF INHIBITORY COMPOUNDS TO IMPROVE WRRF EFFICIENCY

Surfactants, FOG, QACs and Tensioactif

Client Case Study: Goleta Sanitary District, Goleta, CA, USA

Install Date:	Treatment Plant Metrics:	Unit:	Results:
May 2022	• **Design Flow: 9.5 MGD (1,498 m³/hr)** • **Current AADWF: 4.2 MGD (662 m³/hr)**	**2600 GPM (590 m³/hr)** **NBG 6 nanobubble generator**	• **43% reduction in aeration energy usage** • **44% total decrease in Chlorine demand** • **10% increase in TSS removal efficiency**

The Problem for Goleta Sanitary District

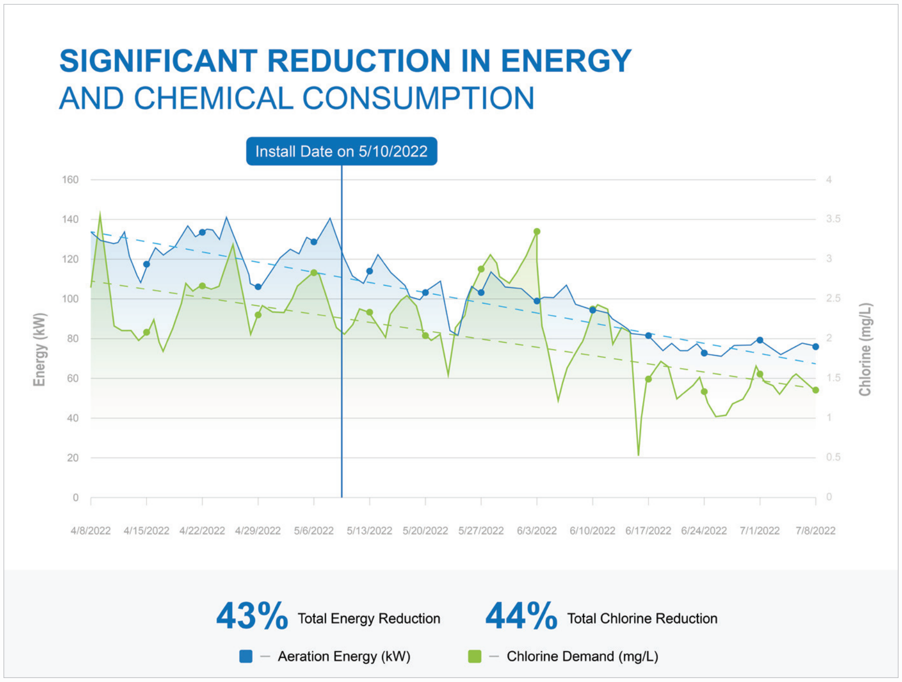
Goleta Sanitary District (GSD) in Goleta, California, faced significant challenges with their plant's efficiency as they were nearing design BOD/TSS loading. Due to drought and extreme water conservation in California, their influent concentrations were very high. Even though they eliminated contributions from industrial users in 2016 when they became aware of the impacts of surfactants, the 2020 pandemic increased surfactant loading on the facility.

Surfactants, such as laundry and dishwasher detergents, personal care products, cleaning chemicals and disinfectants, are persistent in municipal and industrial waste streams. Surfactants pose a significant challenge for wastewater treatment plants because they:

- Inhibit the Activated Sludge Process
- Reduce oxygen transfer efficiency
- Lower oxygen transfer in the biomass
- Reduce biomass kinetics
- Inhibit solids separation and dewaterability of the sludge
- Continue to the effluent polluting the receiving body
- Accumulate in the environment

Additionally, the increased use of surfactant-containing products (attributed to more liquid products and the pandemic) and the reduction in water use per person due to drought, water conservation and high-efficiency appliances have led to greater challenges for wastewater treatment facilities.

In May 2022, GSD began a trial with Moleaer, installing a 2700 GPM nanobubble generator at post-screening and grit removal before the primary clarification as pretreatment.



Temporary installation at GSD for the trial period.

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How Nanobubbles Helped Goleta Sanitary District

Reduced Aeration Energy:

- 43% reduction in aeration energy (kW)
- Improved Oxygen Transfer Rate (OTR) due to the removal of surfactants
- Improved Oxygen Uptake Rate (OUR) due to more efficient biology that was less inhibited

Reduction in Chlorine Demand:

- 44% total decrease in Chlorine demand
- Less demand for soluble organics in effluent

Primary Clarifier: Improved Liquids/Solids Separation:

- Clear supernatant down to the sludge blanket

- More compact sludge
- No evidence of denitrification or fermentation
- Allowed for multiple primary clarifiers to be online without the risk of septicity due to long hydraulic retention times
- Significant odor reduction

Primary Effluent Equalization Basin:

- Reduced odor
- Reduced visual evidence of surfactant foam

Improvement in Final Effluent Quality:

- BOD went from being greater than TSS to equal after nanobubbles suggesting all soluble BOD was converted in the biological process

Costs Savings for GSD:

- 9% of the plant's electricity budget
- 10.7% in plant chemical costs
- 4.7% of operations and maintenance budget
- Eliminated bio-augmentation

Based on the success of the pilot, GSD signed a Nanobubble-as-a-Service (NaaS) contract with Moleaer, which allows them to implement the most advanced nanobubble technology over the life of the contract.

"Moleaer's nanobubble system applied as a pretreatment helped our plant with a variety of metrics that ultimately enabled us to reduce O&M inputs and produce better-quality effluent. This translated to around $87,000* per year in avoided operating costs and could save several million dollars in future capital costs associated with plant expansion to meet impending nutrient regulations," states a Goleta Sanitary District representative. "What started as a pilot project may become a permanent installation in our wastewater facility. We'd recommend other facilities consider the use of nanobubbles to help improve their treatment processes."

Savings were based on 2022 baseline costs.

Moleaer's Nanobubble Solution

Moleaer's nanobubble technology produces bubbles 70-120 nanometers in diameter, the size of a virus. Due to their small size, they have unique chemical and physical properties. Nanobubbles lack the buoyancy to float to the surface and pop like larger (micro) bubbles, and they stay suspended in liquid solutions moving in random motion. In wastewater treatment, nanobubbles act more like chemistry to remove inhibitory compounds.

Nanobubbles provide distinct benefits that remove inhibitory compounds from wastewater:

1. **Oxidation:** When nanobubbles collapse, they produce a Reactive Oxidative Species (ROS). This strong oxidative effect weakens the molecular bonds in the surfactant.
2. **Effect of Charge:** Nanobubbles have a strong negative charge. Surfactant molecules, which are polar, interact with nanobubbles and dispersed ions driven by the respective electrical charges.
3. **Turbulence/Mixing:** Due to the charge neutralization and collapse of the alkyl chain of surfactants, floc is formed.

To learn more about Moleaer's technology for improved wastewater treatment capacity while reducing costs, visit our website at www.moleaer.com/industries/wastewater