

**To:** David Williams, Executive Director  
Bay Area Clean Water Agencies

**From:** Sheba Hafiz, AECOM

**Date:** February 27, 2017

## **Memo: Aerobic Granular Sludge (AGS) Nereda® Technology for Nutrient Removal.**

### **Full Scale Demonstration Project**

Bay Area regulations are expected to impose stringent effluent nitrogen and phosphorus limits in the future. We understand Bay Area POTWs are concerned about the impending costs of meeting stricter nutrient standards and are working in collaboration with other agencies in an effort to address the challenges of significant regulatory changes.

Nutrient removal requires a considerable expansion of treatment volume using conventional treatment approaches. Space at many Bay Area plants is at a premium and retrofits in this context may be prohibitively expensive. Nereda® AGS is an innovative treatment technology that can achieve nutrient removal in a small footprint with significant energy savings over conventional activated sludge processes. There are over 30 full scale installations of Nereda® worldwide that have successfully demonstrated meeting performance objectives for nutrient removal in sustained full scale operation. This technology was commercially developed in Europe, with installations now spanning the globe; however, as of now, there are no installations in the United States.

Aerobic Granular Sludge is an evolution of Conventional Activated Sludge technology (CAS) whereby microorganisms form large dense granules instead of fluffy flocs. These granules are stratified, surface-to-core, with layered biomass that enables respective roles of nitrification and denitrification, so that these processes occur in-situ and simultaneously, avoiding the need for dedicated reactor zones and recycle streams. Granules are formed by



enforcing strict feast-famine feeding regimes in Sequencing Batch Reactors (SBRs) ensuring selection of phosphate-accumulating organisms (PAOs), thereby removing phosphorus as

well as nitrogen. These dense granules increase reactor capacity by increasing mixed liquor suspended solids (MLSS) concentrations to 6000-8000 mg/l, and by achieving rapid settling due to the high granule density and size.

Use of a sequencing batch approach negates the need for a secondary clarifier, further saving space and conserving energy. Nereda® has reportedly been shown to use approximately 30-40% less energy than conventional flow-through CAS, in part due to the absence of recycle pumping for Internal Mixed Liquor Recycle (IMLR) and Return Activated Sludge (RAS).

AECOM is proposing a full scale demonstration of this technology in the US. An important component of this demonstration is to show that a conventional flow-through, continuous CAS process can be cost-effectively adapted/retrofitted to a quasi-SBR (step-wise continuous) process. In the last two years, a retrofit of continuous, flow-through CAS has been successfully demonstrated at the Frielas wastewater treatment plant (WWTP) outside of Lisbon Portugal. A similar demonstration in the U.S. would not be a "first"; however, a retrofit of a Bay area CAS basin into an AGS quasi-SBR in a well-documented study would pave the way for acceptance by Bay area regulators. The study would provide evaluation and design criteria for Bay area consortium members and accelerate the adoption of this revolutionary wastewater treatment technology in the U.S.

AECOM has had an expression of interest from BACWA members, Fairfield-Suisun Sewer District (FSSD), to host a Nereda AGS demonstration at their 12 MGD wastewater treatment facility and from Central Contra Costa Sanitary District (CCCSD) to participate in the project. Our pre-proposal for research funding to support this project was accepted by the AWWA Water Research Foundation (WRF) which provides matching funds up to \$100,000 for innovative technology demonstrations, through subscribing utilities. Our intent is to build a consortium that in aggregate will generate contributions matching the \$100,000 grant from WRF.

A member of the prospective consortium would have the opportunity to participate in the design of the demonstration project, receive periodic progress reports, participate in workshops to review findings, and provide input to operations in order to create relevant findings that would inform their future nutrient removal decisions.

AECOM would appreciate an opportunity to present the details and benefits of this project to the BACWA Executive Board.