



Test vs. Control Proof of LLMO Results

Pittsburgh, PA Designs

Test vs. Control Pilot Plants to Verify Sludge Reduction with LLMO S-1

General Environmental Science Corp.....Leadership in Wastewater Biotechnology since 1974

Pittsburgh, PA WWTP Facts

The Pittsburgh, Pennsylvania area WWTP is controlled by ALCOSAN, the regional sanitary authority. The WWTP design is contact stabilization, with primary clarification, but no tertiary treatment. The average daily flow is 180 MGD. Waste Activated Sludge (WAS) is cosettled in the primaries. The sludge is sent to belt presses, and an average cake of about 23% is produced. The sludge cake is either incinerated or sent to landfill. The average sludge produced at ALCOSAN is about 3000 dry tons per month.

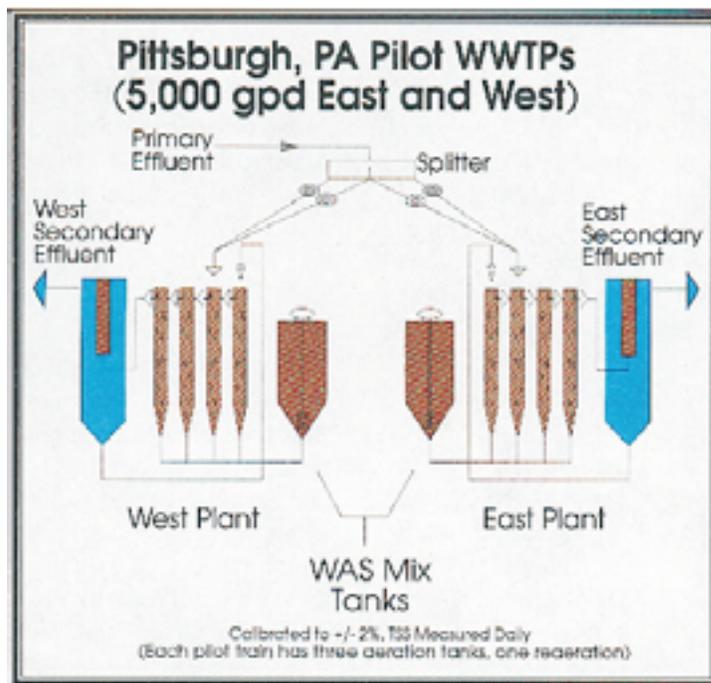
Full Scale LLMO Use

Pittsburgh has been using LLMO S-1 for sludge reduction since June of 1987. An average sludge reduction of about 15% has been achieved. These data have been reported at the national Water Pollution Control Federation conferences in Dallas (1989) and Washington, D.C. (1991).

Construction of Test vs. Control Plants

Prior to awarding GES a long term contract for full plant LLMO use, ALCOSAN decided to evalu-

ate the sludge reduction performance in a quantitative fashion. ALCOSAN constructed parallel, identical pilot plants. The authorities elected to run a test vs. control evaluation, that would allow a more precise quantification of the sludge reduction achieved with the LLMO S-1.



Pilot Plant Design

The ALCOSAN operation staff took great care to design the pilot plants as models of the main plant. Each of the pilot plants was a four stage contact stabilization process. The combined aeration retention time was similar to that of the full plant (about 6 hours). Each aeration pass was equipped with independent air flow

meters. The aeration rate was adjusted similarly for each plant to ensure equal air input.

Valid Test vs Control Conditions

Each plant receives fresh primary effluent from the main plant flow. The primary effluent passes through a splitter box. The two halves of the splitter box were valved such that each side could alternately feed either of the parallel pilot plants. The valves were switched every 8 hours, thus ensuring equal hydraulic loading to each plant. (over)

Each pilot plant was run in the same manner as the main plant. Composite samplers were used to measure effluent SS and BOD. Mixed liquor inventory was maintained at about 2000 mg/l MLSS by varying the wasting rate.

Sludge Measurement Accuracy

Since the main objective was to quantify sludge production, great care was taken to determine the quantity of WAS produced. Waste Activated Sludge was pumped to a calibrated holding tank. The volume was known to within 2%. Combining this sludge volume accuracy with standard SS testing allowed for very precise determination of dry pounds wasted from each pilot plant.

Pilot Plant Start Up

The pilot plants were started up on March 1, 1989. Each parallel plant was operated without LLMO addition through May, 1989. During this start up period, the two plants produced nearly identical amounts of sludge, varying by just 1%. Similarly, each plant exhibited similar BOD and SS removals. The data obtained during the start up period demonstrated the valid test vs. control nature of the plant design and operation.

LLMO Addition to the East Plant

Starting May 9, LLMO products were added to the East pilot plant. Each day 21 ml of LLMO S-1 and 2 ml of LLMO Activator were diluted into 700 ml of tap water. The mixture was aerated for 24 to 48 hours before use. The 700 mls of activated LLMO suspension were added to the East plant, which flowed about 5000 gallons per day.

East Plant Results

The addition of LLMO to the East plant lasted through July 13, 1989. During that period, the LLMO treated East plant showed combined sludge production of 21,000 grams of dry solids, while the control plant (West plant) produced 42,000 grams of dry solids.

LLMO Addition to the West Plant

The ALCOSAN authorities then decided to treat the West plant with LLMO. The pilot plants were both emptied, refilled with mixed liquor from the main plant, and restarted. The plants were again allowed to operate for about 60 days to verify valid test vs. control conditions. Again, the two untreated plants produced nearly identical amounts of sludge and accomplished similar pollutant removals.

West Plant Results

After establishing that the two plants were operating similarly, LLMO addition to the West plant was started. After a 60 day run during January-February 1990, data showed sludge production of 33,000 grams on the treated (West) side, while the control (East) plant showed combined production of 51,000 grams.

Combined LLMO Test Results

Combining the Test/Control evaluation shows a reduction of about 350 grams per day (or about 0.75 lbs) on the treated side. Since 21 mls of LLMO were used per day, this amounts to a proportionate reduction of about 140 lbs of sludge reduction achieved per gallon of LLMO used.

Pilot Plant Verify

Full plant LLMO S-1 Results

The main plant LLMO usage is 220 gallons of LLMO per day. Multiplying the 140 lbs reduced per gallon of LLMO (as demonstrated in the pilot plants) by 220 gallons per day actually used times 30 days per month gives an expected monthly reduction of about 400 to 500 dry tons reduced per month. This figure agrees well with the actual reduction measured during the full plant treatments. Use of the pilot plants by Pittsburgh authorities conclusively demonstrated that LLMO S-1 use causes a 15% sludge reduction at the 180 MDG ALCOSAN WWTP.