TRIAL TREATMENT REPORT

Ammonia Reduction using a Biocatalyst

Woodridge-Green Valley Wastewater Treatment Plant
DuPage County, Illinois

August 7, 1997

(and Supplement August 26,1997)

Prepared By:
Stuart H. Russell, P.E.
25W665 Elmwood Dr.
Wheaton, Illinois 60187
(630) 752-8706

TRIAL TREATMENT REPORT
Ammonia Reduction
Wood ridge - Green Valley Wastewater Treatment Plant
DuPage County, Illinois

Introduction
This document is a report of the ammonia reduction trial treatment at the Woodridge Green Valley (WGV) Wastewater Treatment Plant owned and operated by the DuPage County Department of Public Works, located in Woodridge, Illinois (suburban Chicago). The plant has a capacity of 12MGD and utilizes an activated sludge process. Secondary effluent is treated for ammonia with two, fixed-film media nitrification towers. In 1990, a two-phase (acid phase/methane phase) anaerobic digestion process was added to the plant. In addition, waste activated sludge from another smaller treatment plant (Knollwood) is brought to the WGV plant for digestion during nighttime hours and final disposal. The WGV plant also incorporates a 1,500 kW cogeneration facility utilizing a reciprocating engine-generator fired by digester gas, natural gas and diesel fuel. A Flow Pattern Diagram and Site Plan for the plant copied from the operating manual are attached to this report.

The objective of this trial treatment was to attempt to reduce the high levels of ammonia (stated as 1,800 mg/L avg., with a range of up to 3,000 mg/L) in the filtrate from the sludge filter presses by adding a bio-catalyst to the feed sludge. The high levels of ammonia may be one cause of periodic problems with meeting effluent discharge limits for NB) based on a composite daily sample. The ammonia odor is also a nuisance for workers in the plant, especially in the filter press room. Reducing the filtrate ammonia concentration to 500 mg/L or less was established as the objective of the trial treatment.

Previous treatment trials conducted at the Point Loma wastewater treatment plant in San Diego, California; and at a plant in Las Vegas, Nevada showed that ammonia odors were successfully eliminated from sludge dewatering systems using this technology. Both of these other plants utilize anaerobic digestion systems.

Sludge Treatment Facilities
Located in the Sludge Treatment Building (no. 9 on the Site Plan) are two Ashbrook-Simon-Hartley "Klampress" type filter presses with belts of2.2 meters in width, and one Petkus filter press with belts of 1.8 meters in width. The filter presses are operated 8 hours per day, 5 days per week. Sludge is fed to the presses by two, 200 gpm rated progressing cavity type sludge pumps (Netzsch Model NE-90A) at a rate of 80 to 100 gpm drawing sludge at an average of 3.4% total solids from the 500,000-gallon secondary digester. Polymer flocculent (Cytec Excel 100) is added to the sludge prior to the filter presses at an average rate of 110 lb. per dry ton of sludge. Dewatered sludge filter cake ranges from 15% to 20% total solids and is hauled away by truck for land application. The filtrate (avg. flow of 52,000 gal. per day) is held in a 70,000-gallon under-floor tank located in the Tertiary Filtration Facilities Building (no. 6 on the Site Plan), then trickled continuously back into the plant head works. See Figure 1 for a schematic arrangement of the sludge treatment facilities.

Trial Treatment Setup
The trial treatment apparatus was set up on August 6, 1997. The trial treatment plan called for the EcoSystem Plus (ESP) bio-catalytic product manufactured by Neozyme, International, Inc. to be diluted with water and metered into the suction side of the sludge feed pump supplying one of the filter presses. This injection point allows about two to three minutes of contact time with the sludge prior to the filtrate sampling point at the filter press. The plan was to meter the ESP at a rate to achieve approximately 150 mg/L concentration of ESP in the sludge.

To achieve this dilution and to control the flow of the ESP solution, the County provided a Stranco PolyBlend model M1800 polymer-mixing device. The mechanical mixing impeller in the mixing chamber was disconnected to avoid possible foaming. The metering pump was calibrated to achieve the desired concentration of ESP (38 mg per min. based on an assumed feed sludge rate flow of 80 gpm). Dilution water was set at a rate of 5 gpm to form a 0.2% solution of ESP prior to metering into the sludge line (the dilution water flow was taken into account in calculating the target ESP concentration). The trial treatment plan also called for compressed air to be injected into the mixing and metering device to maximize aeration, however, because the Stranco device was not set up for air injection, no air was injected during the trial.

Trial Treatment Operation
The trial took place on August 7, 1997. The trial treatment plan called for one of the other two filter presses to be used as an untreated control during the 8-hour trial treatment period. However, because of operational problems, only one filter press was in operation on the day of the trial.

The ESP injection was started at 9: 10 AM and samples of the filtrate were taken at the filter press at 10:lOAM and 11:15 AM. Samples of the feed sludge and sludge filter cake were also taken at 11: 15 AM. A mechanical problem forced the shutdown of the filter press at 11:45 AM, and the ESP injection was stopped at 11:50 AM. The press was re-started at 1:00 PM, and an untreated sample of the filtrate was collected at 1:30 PM. The ESP injection was re-started at 1:35 PM, and filtrate samples were taken at the filter press at 2: 15 PM and 2:45 PM. The filter press stopped operation for the day at 2:50 PM. Additional samples of the filtrate were taken at the storage tank at 3:10 PM and at 6:30 AM on August 8. Total ESP usage was approximately 4.5 gallons over the trial period.

Trial Treatment Results
Samples of the filtrate, feed sludge and sludge filter cake were analyzed in the WGV in house laboratory for ammonia concentration in the filtrate samples, and % total solids and % volatile solids in the sludge samples. Table 1 presents the results of the laboratory analysis for the filtrate samples, and Table 2 gives the results of the sludge samples.

TABLE 1 - Filtrate Samples

Sample	Description	pH	NH_3 Concentration (ppm)
1	Untreated (taken at 1.30pm)	8.06	2,840
2	Morning trial (t = 60 min)	8.11	970
3	Morning trial (t = 120 min)	8.29	1,520
4	Afternoon trial (t = 40 min)	8.2	1,570
5	Afternoon trial (t = 70 min)	8.2	1,520
6	Holding Tank (taken at 3.10pm)	8.3	1,480
7	Holding Tank (taken at 6.30am 8/8/97)	8.2	1,400

TABLE 2 - Sludge Samples

Samples Description	pH	% Total Solids	% Volatile Solids
Feed Sludge (taken at 11.15am)	7.7	3.3	65.4
Sludge Filter Cake (taken at 11.15am)	8.3	15.8	60.5

Analysis of Results

The laboratory results show that the ammonia concentration in the filtrate was reduced 45% to 66% from its untreated level after a contact time with the ESP solution of between 2 and 3 minutes. The filter press operator stated that during the trial, the ammonia odor from the filter press was significantly reduced. An additional ammonia reduction occurred in the filtrate holding tank during the additional 6 to 20 hours of holding time. Figure 2 is a graphic presentation of these results.

An examination of the Process Control Data for July and August indicates that the normal pattern of rising ammonia levels in the Process Raw water and the Final Effluent from Monday through Friday was interrupted during the week of the trial. This change may indicate that the reduction in the filtrate ammonia level resulting from the trial treatment stopped the build-up of ammonia in the treatment process. If so, the ESP treatment will help prevent ammonia excursions above effluent permit limits that generally happen late in the week.

The trial treatment did not reach the target concentration of 500 mg/L; however, the following factors may have limited the treatment effectiveness:

I. The ammonia concentration in the untreated filtrate was significantly higher than expected (2,840 mg/L instead of the expected 1,800 mg/L, or 58% higher).
2. The injection of air into the ESP solution or the sludge was not possible during the trial.
3. The addition of air into the holding tank was not done during the trial.

Recommendations for Further Testing

The results of this one-day trial indicate that the ESP product will accomplish significant reduction of ammonia in the WGV process. A longer-term test is recommended to allow for variation in certain parameters and the addition of air to attempt to optimize the ESP treatment effectiveness. A one-week trial will allow enough time to determine a reasonable estimate of full-scale product effectiveness and cost. This trial would treat the entire sludge flow from both sludge pumps.

There are four parameters to be varied and monitored during the one-week trial. They are:

ESP Dilution Ratio
ESP Concentration and Injection Point
Polymer Flow
Air Injection

ESP Dilution Ratio
Reducing the ratio of dilution water to ESP prior to injection into the sludge may increase effectiveness. For example, dilution ratios of 0.5%, 1%,5%, and 10% could be produced at a constant total ESP concentration while monitoring filtrate ammonia concentration and filter cake properties. The dilution ratios could be varied again when the polymer feed is varied to obtain maximum polymer reduction.

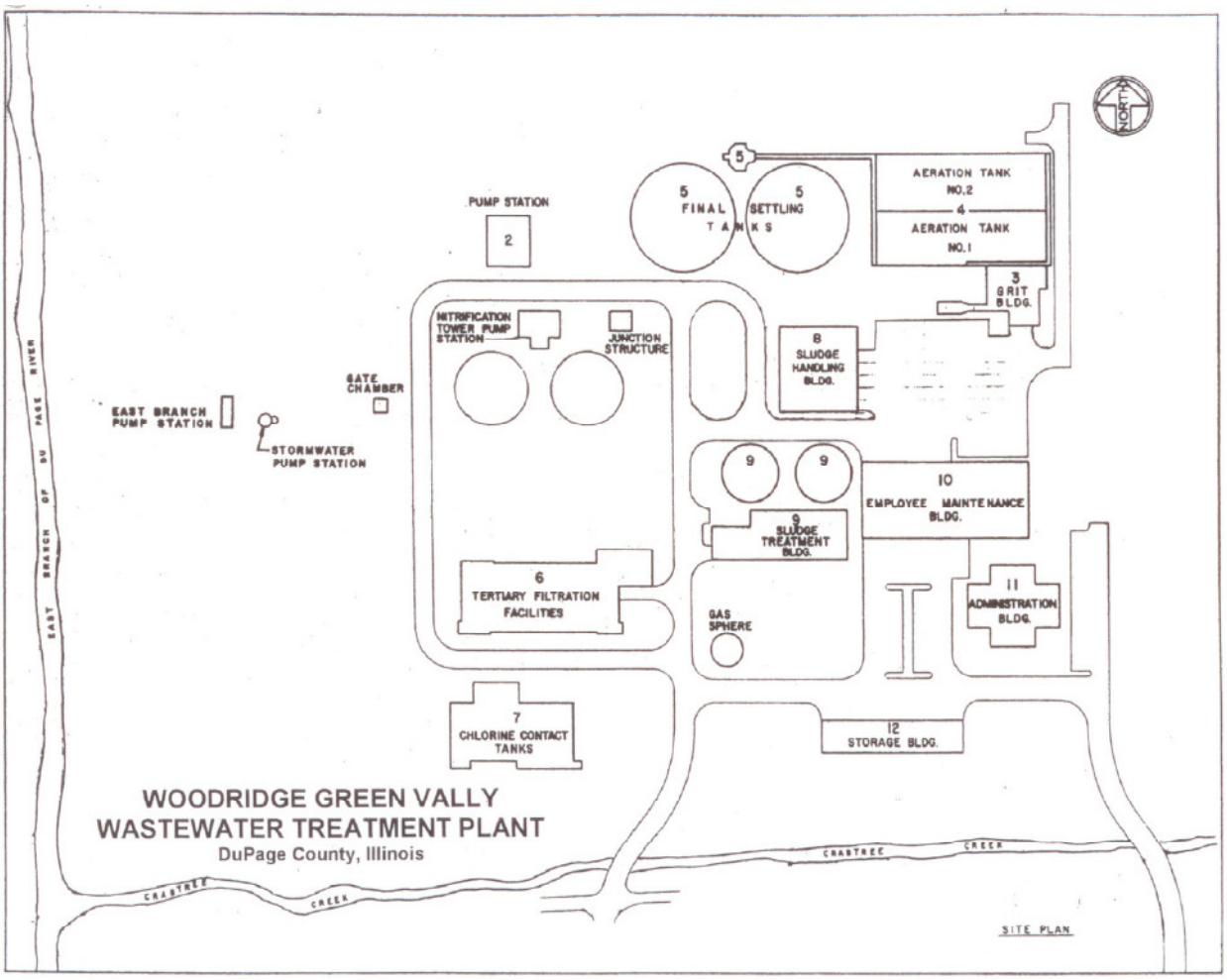
ESP Concentration and Injection Point
Variation in the total ESP concentration and splitting ESP injections between the sludge feed and filtrate tank may be more effective than the approach used in the one-day trial. Based upon tests in other applications, a time-staged injection of ESP has proven to be more effective in cases involving high concentrations of pollutants. For example, the one week trial may vary the total concentration and split between injection points as follows to determine which combination results in the most total ammonia reduction (ESP concentration in mg/L):

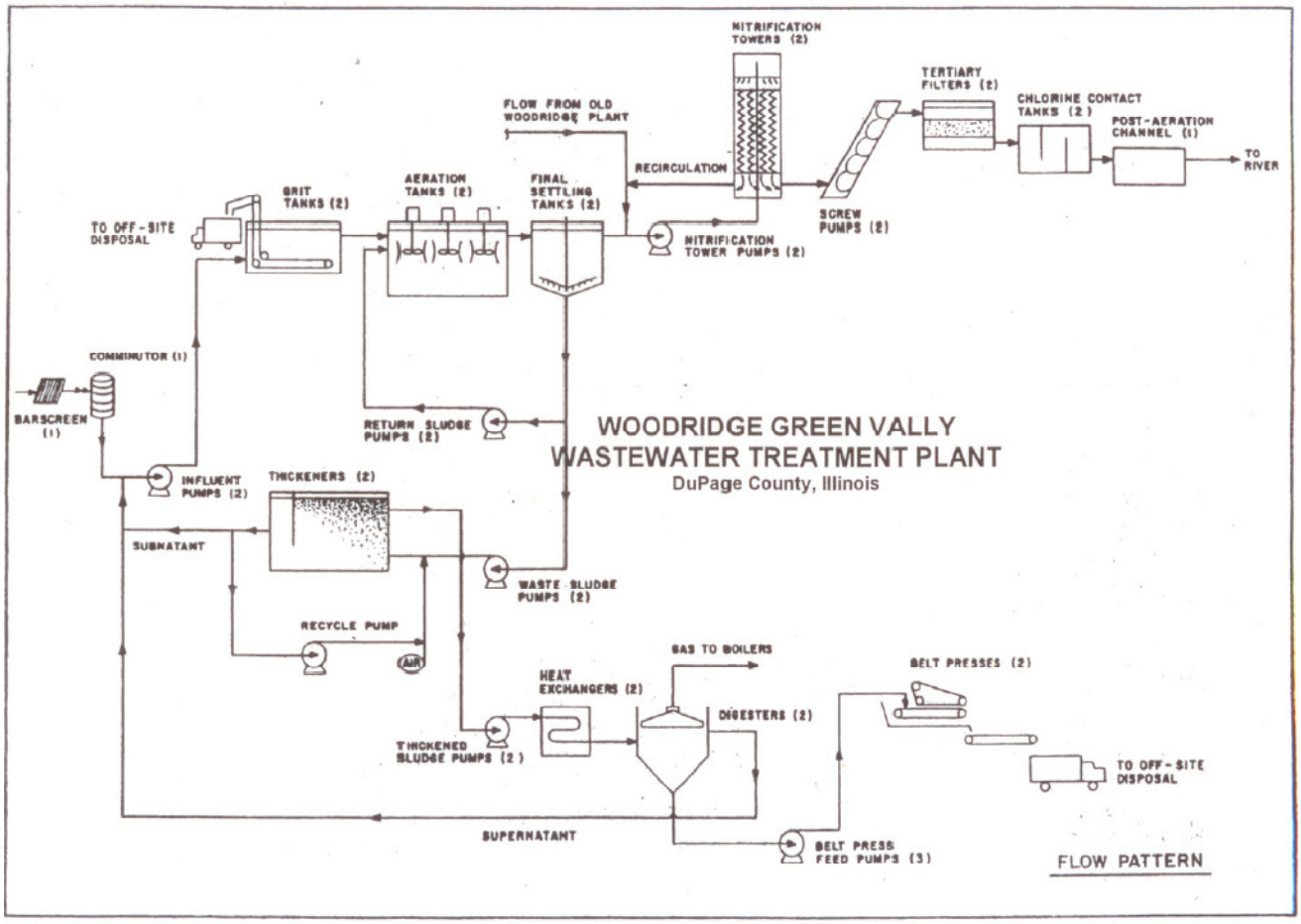
Sludge Injection	Filtrate Tank	Total
150	0	150
120	30	150
120	60	180
150	30	180
90	60	150

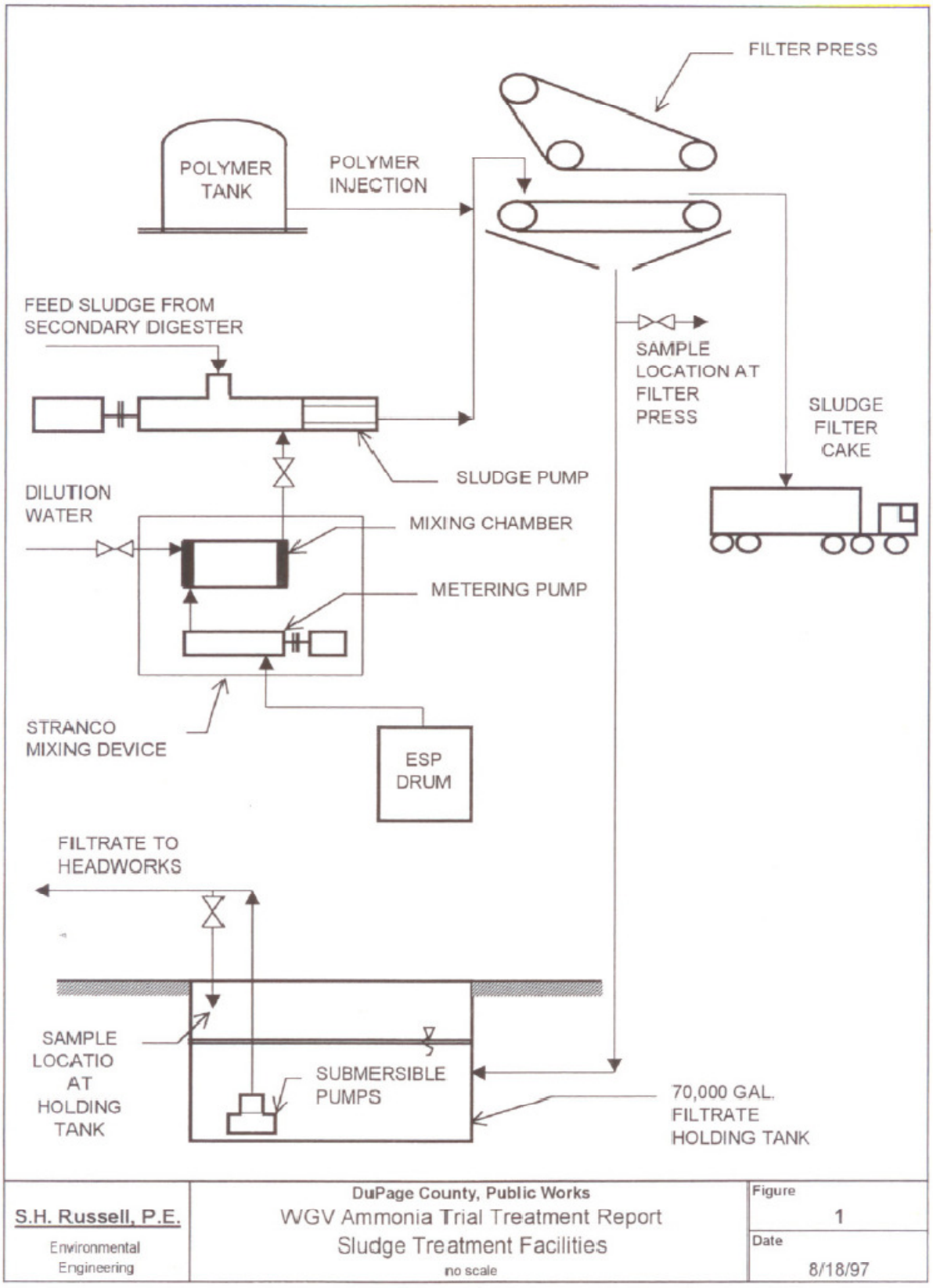
Each combination will require a full day to effectively evaluate the total ammonia reductions in the filtrate tank.

Polymer Flow
In other trials ESP has shown the ability to create drier sludge filter cake. In order to demonstrate this effect in the WGV plant, polymer flow can be reduced in incremental adjustments established by the system operators. The object is to ascertain the amount of polymer reduction available when the ESP product is used while maintaining acceptable percent solids in the sludge filter cake.

Air Injection
Based upon other trials, the injection of air can enhance the effectiveness of the ESP product. Air injection both in the ESP solution and in the filtrate holding tank will maximize ammonia reduction effectiveness. A fine-bubble ceramic diffuser supplied by compressed air will be the best device to use in the filtrate tank.







WGV Ammonia Trial Treatment