

ChemScan[®] Process Analyzer

Side by Side Evaluation

ChemScan vs Hach
at the
Blue Plains Wastewater Treatment Plant

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Project Summary

During late 1998 and early 1999 a side by side demonstration project was conducted at the Blue Plains Wastewater Treatment Plant, serving the Washington, DC metropolitan area. The Herndon, VA office of CH2M-Hill supervised the demonstration project.

Two sample points were selected for the demonstration. One point was the influent to the nitrification/ denitrification tanks. This influent has already passed through several treatment steps including bar screens, aerated grit chambers, primary sedimentation, secondary treatment using high rate activated sludge and secondary sedimentation. The other sample point was at the third stage of a five-stage nitrification/denitrification process. Under normal conditions, this sample point is the final aerated stage, with the remaining two stages being anoxic. Methanol for denitrification is fed to the final two stages.

The demonstration included a Hach APA 6000™ analyzer for nitrate and ammonia, including a 5 gpm pump and a centrifugal filter system. The ChemScan equipment included a UV-4100 Analyzer for analysis of nitrate, ammonia, phosphate and percent transmittance. A ChemScan cross flow ultra filter and a 3hp Penn Valley pump were also included.

This study was the subject of a technical paper presented at the 72nd Annual Water Environment Federation Conference & Exposition in New Orleans, Louisiana during October 1999. A synopsis of this presentation is included as an attachment to this report.

Comparative Results and Comments

The results from this demonstration included the following comparisons and quotations:

Hach

“The Hach APA 6000™ ion-selective electrode was subject to interference at lower concentrations of ammonia-N (less than 1 mg/L) and to occasional unexplained data scatter.”

“The instrument readings and the laboratory nitrate-N concentrations... in general followed the calibration line...There were occasional instrument readings with considerable scatter, as demonstrated by a low R² of 0.56.”

“In it's current form, the analyzer may be unsuitable for configuration into an algorithm for feedback or feed forward control...unless electronic filters are employed.”

“After switching the sample stream to the nitrification influent, the Hach instrument stopped functioning properly.”

ChemScan

“Once the instrument was properly calibrated, the ChemScan®...process analyzer was capable of reporting reliable concentration values at both the low end and high end of the data range.”

“Once properly calibrated, the ChemScan® instrument followed laboratory nitrate-N concentration closely...with an R² of 0.98...”

“The instrument possessed considerable resolution to show diurnal variations and was able to produce reliable data outputs consistently in both Stage 3 and the nitrification influent.”

Other conclusions

Most of the trend analysis used in the CH2M-Hill study at Blue Plains was obtained using the ChemScan Process Analyzer.

Major conclusions reached by CH2M-Hill include the following:

- At this plant there was not a substantial deviation between flow and ammonia concentration variations in the nitrification influent. This is a very large plant (370mgd) with a considerable hydraulic capacity within the sewer system and treatment process prior to nitrification.
- Some ammonia fluctuation occurs during storm events. Cost savings could be anticipated using on-line instrumentation during a storm.
- Several opportunities exist for the use of on-line analyzers to improve process control. The application of on-line instrumentation include:
 - methanol addition rate control for denitrification
 - aeration rate control to achieve nitrification
 - metal salt addition rate control for phosphorous removal
- It was estimated by CH2M-Hill that on-line analysis may result in substantial savings at this plant from reductions in chemical addition (principally iron salts and methanol.) CH2M-Hill estimates that the cost of the ChemScan analyzer system may be recovered from the first year of operation.

Errata and comments

The CH2M-Hill study erroneously identifies the ChemScan analyzer as the "UV-6100" when the UV-4100 was the model used in the study.

The study frequently mentions that the ChemScan calibration process was "lengthy and manual" but fails to mention that this was a service initially performed by factory personnel during set up of the system and was not performed by site personnel during the study.

The study mentions that ChemScan reagents required "precise measurement and mixing by laboratory personnel." This was true in late 1998 at the Blue Plains site, but premixed reagents for phosphate analysis are now available. No reagents are required for nitrate analysis. Bleach is the main reagent for ammonia analysis.

ChemScan filter maintenance at this site was affected by the lack of a flooded suction location for the ChemScan sample pump and a constant draw of sample from the ChemScan sample line by the Hach system. Neither condition would exist for a permanent installation.