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November 30, 2018

VDH - Environmental Health

ATTN: Marcia Degen, P.E., Ph.D. - Technical Services Engineer Supervisor

Civic Mall 2nd Floor

1502 Williamson Road, SE.

Roanoke VA 24012

Phone: 804-387-1883

RE: Orenco Systems Evaluation

Orenco Systems Inc. Evaluation:

I was contracted by Orenco Systems to conduct a review of the Pennsylvania Onlot Technology Verification Program (TVP) and assess if the requirements and protocols of the TVP meet the requirements set forth in GMP #2016-03.

In preparation for this report I reviewed the requirements of GMP #2016-03, the Pennsylvania Onlot Technology Verification Program, which was overseen by NSF International, and the 2005 Rural Engineering Services Report (which detailed the initial testing of the AX20 in Virginia). At the conclusion of the TVP, NSF International issued a thorough report detailing all aspects of the testing program including but not limited to: testing protocols, QA/QC procedures, site selection, roles and responsibilities, and data analysis (including outlier removal justification and statistical analysis). In reviewing this report, I can certify that the field testing carried out in Pennsylvania is compliant with the requirements set forth in GMP #2016-03 and with the previous testing in VA. For ease of communication I have listed the requirements of GMP #2016-03 and noted how the TVP meets the said requirements.

1. Site selection is described in the report, installation was per manufacturer's requirements and geographical location of systems is described. All systems were Mode 3 AdvanTex AX20's.
2. O&M logs were maintained by NSF International. NSF International wrote a letter confirming that O&M was carried per manufacturer's instructions and no special maintenance was performed.
3. NSF International maintains all of the Chain of Custody forms and has written a letter to that effect to the VDH.

4. All key participants are clearly identified in the report.
5. All sampling methods and analytical methods are described in detail in the report.
6. All testing results and analyses were reviewed and are consistent with the requirements of GMP #2016-03. The data presented in the TVP report is consistent with the data presented in the 2005 report authored by Rural Engineering Services.
7. All outliers and associated justifications are present in the PA TVP report.

The Orenco AdvanTex AX20 (Mode 3) was installed and tested at eleven sites across the State of Pennsylvania. Field sites were selected based on the intended use of the technology. Each site was tested for a minimum of twelve months (with nine of the eleven sites being tested for two to three years) to evaluate the variations in the effluent quality that are likely to occur based on the influent sewage strength, flow rate and temperature. Effluent samples were collected monthly and analyzed for specific parameters outlined in the quality assurance project plan (QAPP), including the typical wastewater measurements (CBOD₅, TSS, turbidity, alkalinity, nitrogen species, fecal coliform, pH and temperature).

Influent samples were collected weekly for four weeks prior to effluent sampling to establish a baseline influent waste strength concentration. Following the effluent sampling, influent waste strength was also monitored for four weeks to establish a baseline. The site selection and year-long test period served to capture variations in the effluent quality that may occur based on sewage strength, flow rate and seasonal temperature fluctuations.

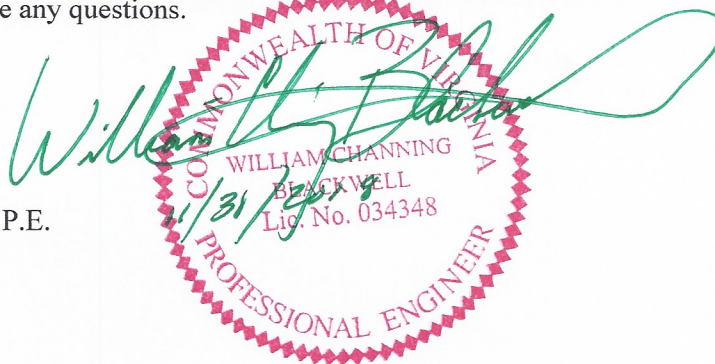
Over the course of the field evaluation the mean effluent CBOD₅ was 6 mg/L and the mean effluent total suspended solids was 10 mg/L. The mean influent total nitrogen was 44 mg/L and the mean effluent total nitrogen was 17 mg/L, representing a 61% reduction. The median effluent CBOD₅ was 4 mg/L and the median effluent total suspended solids was 5 mg/L. The median effluent total nitrogen was 16 mg/L. These values do not account for the VDH "clean data" procedure for values below the detection limit, thus values for Virginia will be different.

After reviewing Orenco Systems Inc, Operation and Maintenance Manual, Installation Manual, Technical Data Sheet for AX20, the 2005 Rural Engineering Services Report, the NSF International report on the TVP and the GMP #2016-03, I conclude that the TVP meets the requirements of GMP#2016-03.

It is my understanding that Orenco Systems Inc has supplied the VDH with the letter from NSF discussing the O&M and chain of custody forms and the NSF International Report on the TVP. Please let me know if you have any questions.

Sincerely yours,

William Blackwell, P.E.





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February 15, 2019

VDH - Environmental Technical Services Manager
ATTN: Marcia Degen, P.E, Ph.D. – Technical Services Engineer Supervisor
Civic Mall 2nd Floor
1502 Williamson Road, SE.
Roanoke VA 24012
Phone: 804-387-1883

RE: Orenco Systems Inc. Evaluation

This letter is to serve as an addendum to my previously submitted evaluation of the Orenco Systems Inc. compliance with GMP #2016-03.

1. In both the 2005 Rural Engineering Services Report and the Pennsylvania Onlot Technology Verification Program (TVP) the AdvanTex AX20 (AX20) met the BOD/TSS requirements of TL3 (10/10 mg/L). It should be noted that in the TVP the mean cBOD was reported as 5.8 mg/L and the median was reported as 4mg/L. The TSS value(s) reported are a mean of 10mg/L and a median of 5mg/L. Both values meet the TL3 requirement.
2. The O&M manuals have been submitted and reviewed. In my professional opinion, the manufacturer's maintenance schedule accurately reflects the servicing and maintenance requirements of the AX20 and AX20RT.
3. The drawings on the VDH website are accurate and up to date.
4. All models currently approved under TL3 are to be included in this approval.
5. All systems were operated and tested in mode 3, except for two months where influent data was collected. In order to accurately collect influent concentrations, the systems had to operate in mode 1. The periods during which the system was operated in mode 1 and were clearly identified in the report. My evaluation was based solely on mode 3 performance. All site evaluated met the required number of samples in mode 3 operation.
6. Sample dates have been added and an updated spreadsheet has been sent to the VDH.

7. All of the raw data has been sent to VDH.
8. Orenco has supplied this information via a letter and records supplied by NSF.
9. In conclusion, through combination of data collected in Virginia from 14 mode 3 AdvanTex systems and 10 mode 3 AdvanTex sites in the TVP the AdvanTex wastewater treatment meet the requirements set forth in GMP #2016-03. The BOD/TSS and TN concentrations were very similar in the two studies I reviewed. The O&M carried out in both studies was equivalent and followed the manufacturer's recommendations.

Sincerely yours,

William Blackwell , P.E.



November 15, 2018

Ms. Marcia J. Degen, Ph.D., P.E.
Virginia Department of Health
Environmental Technical Services Manager
Civic Mall 2nd Floor
1502 Williamson Road, SE.
Roanoke VA 24012

Re: Orenco AdvanTex AX20N - PENNSYLVANIA EXPERIMENTAL ONLOT
TECHNOLOGY VERIFICATION PROGRAM

Dear Ms. Degen,

I am writing on behalf of Orenco Systems, Inc. to confirm the chain of custody and maintenance procedures used during the Pennsylvania Experimental Onlot Technology Verification Program.

NSF managed the complete PA Experimental Onlot Technology Verification Program for the Orenco AdvanTex AX20N, from 2005 to 2008. This included the testing of 12 sites across the state of Pennsylvania. The analytical testing was done using Benchmark Analytics, located in Center Valley, PA. The entire project was documented in a comprehensive QAPP, Quality Assurance Protection Plan. This included project overview, testing personnel, test locations, sampling location, test methods, frequency, full analytical quality control, data validation, sampling procedures, chain of custody and sample tracing/discard.

The chain of custody procedure is documented in the attached, Appendix Q – SOP: How to fill out a chain of custody. NSF does have all of the actual data sheets, including the completed chain of custodies for all of the analytical work. These files are all separated by site and contain several hundred pages of data, quality assurance results and chain of custodies.

The Orenco Systems were newly installed units, they were started and operated in accordance with the manufacturer supplied O&M Manual. Orenco provided regular operation and maintenance at the 6th month, then annually following the first visit, and continued to perform this service during the verification testing. Samples were taken during week 1-4, and weeks 8, 12, 16, 20, 24, 28, 32, 36, 40, 44, 48, 52, 53, 54, 55 and 56.

If you have any questions, please contact me directly.

Sincerely,

A handwritten signature in black ink that reads "Sharon Steiner".

Sharon Steiner
Business Unit Manager
Wastewater Treatment Unit Program

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cc: product specs (0B980)