Shupe & Associates, Inc.

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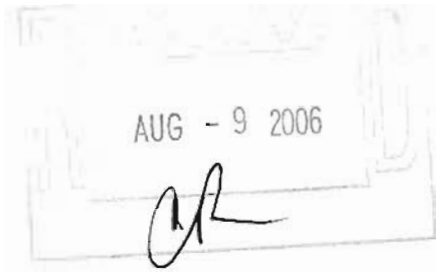
August 9, 2006

FAX: 501/682-0910

Arkansas Dept. of Environmental Quality
8001 National Drive
Little Rock, AR 72209



ATTENTION: Parviz Mokhtari

REFERENCE: Mt. View Envirex Orbal Approval

Dear Parviz:

Byron Hicks, P.E. is out of pocket today and asked me to get this directly to you. Attached is a letter from George Smith, Director of Biological Development for Envirex. Please note that this plant was designed in 1988 for 1 MGD with a peak of 4.0 MGD, BOD loading of 1168 lbs/day and ammonia of 200 lbs/day.

Please note that in 2005 the plant produced excellent results with an average plant flow of 1.081 MGD and a cBOD loading of 1858 lbs/day and a TSS of 313 mg/L or 2820 lbs/day.

As you can see from George Smiths attached letter, the 2005 average effluent data was less than 1 mg/L on BOD and approximately 1 mg/L on TSS with a NH3 of 0.235 mg/L, phosphorus of 0.167 mg/L and a NO3 of 3.79 mg/L.

George Smith has been involved in designing hundreds of Orbal systems, many of which are in the 10 state area for approximately 30 years. As you are probably aware, Envirex is located in Waukesha, WI and is used to dealing with cold weather and ammonia.

We are very confident that the existing plant design will produce a quality effluent for the people of Mt. View and the State of Arkansas. We respectfully request approval of the current Orbal design for Mt. View.

Sincerely,

Phil Shupe, P.E.

PS:ac

USFilter
A Siemens Business

ENVIREX PRODUCTS
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August 9, 2006

MOUNTAIN VIEW, ARKANSAS
ORBAL AERATION DESIGN PARAMETERS

AUG - 9 2006

The proposed 21 lb/1000 cf BOD loading rate for Mountain View is justified and should remain unchanged. Changing the design to a loading rate of 15 lbs/1000 cf BOD will have negative consequences on process performance during underload conditions. Optimum process performance of the Orbal process is based upon maintaining a sludge age in the range of 10-20 days with a MLSS not less than 2000 mg/l. Excess volume during underload conditions will result in overly long sludge ages and inferior sludge settling characteristics.

The comments concerning the Hillsboro, Ohio plant are not accurate. Hillsboro had operating problems many years ago under old plant management. These problems had no relationship with BOD loading (as an example, we can point to numerous plants that had operating problems with loading rates less than 5 lbs/1000 cf BOD loading). The problems at Hillsboro were corrected many years ago. It presently is one of the best operating plants in Ohio. Effluent results for 2005 Y are as follows:

Flow:	1.08 mgd	(1.775 mgd max. month)
BOD:	0.48 mg/l	(0.9 mg/l mm)
SS:	0.975 mg/l	(4 mg/l mm)
NH3:	0.235 mg/l	(0.59 mg/l mm)
P:	0.167 mg/l	(0.47 mg/l mm)
NO3	3.79 mg/l	(4.97 mg/l mm)

It should be noted that the highest effluent ammonia values were in the months of May and June – not the winter months.

I spoke today with one of the plant operators at Hillsboro. He said the plant had excellent performance in all areas. They operate their MLSS in the 2600 – 2800 mg/l range during the winter. This corresponds to an F/M ratio of 1.9 lb BOD/d/lbMLVSS. This is considerably higher than what we have proposed in the design of Mountain View – but not higher than what we would recommend in actual operation.

With over 30 years of designing Orbal type systems - many with ultra stringent effluent requirements – we have no hesitation at all in guaranteeing the process performance at Mountain View with the proposed BOD loading of 21 lbs/1000 cf. Considering the warmer weather conditions of Arkansas, we would have no hesitation of providing a process warranty is Mountain View was designed for a 25 lbs/1000 cf BOD loading.

We do not provide these process warranties lightly. All designs are thoroughly reviewed and scrutinized before being approved. We have provided a warranty for an Orbal system where effluent P levels of 0.1 mg/l and ammonia levels of 0.5 mg/l had to be met – while operating with only an 8 day sludge age! (This plant, McMinnville, OR, is one of the most successful operating BNR plant in the country)

The design for Mountain View has a sludge age of 12 - 14 days. We do not consider the process warranty for Mountain View to be difficult in any way to meet. Possibly the hardest period for the warranty will be low-load conditions when sufficient turndown capability is needed. Of course, adding more volume to the design will only make this period more risky.

In summary, the Orbal basin proposed for Mountain View is not small and is completely adequate in size for the process conditions. Based upon these factors, we would appreciate your approval of the 21 lb loading condition.

Sincerely,

George Smith
Director Biological Development

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June 28, 2006

MOUNTAIN VIEW, ARKANSAS
ORBAL AERATION DESIGN PARAMETERS

The purpose of this letter is to address the design parameters used in the Orbal Aeration Process for Mountain View's new wastewater treatment plant. The proposed BOD loading of the Orbal Process for Mountain View is 24.6 lbs/1000 cf. This exceeds the 15 lbs/1000 cf provision used in the Ten States Standards guidelines for plants with nitrification requirements.

We have numerous Orbal and VLR aeration systems that have been designed in States that follow the Ten State Standards where exceptions to the 15 lbs/1000 cf BOD loading were allowed. But all of these designs were approved based upon supporting calculations verifying that full nitrification would be achieved during cold weather.

Some of the projects approved, along with the BOD loading used in the design, follows:

- Greencastle, IN ... 2.8 mgd @ 26 lbs/1000 cf
- Peru, IN ... 8.0 mgd @ 26 lbs/1000 cf
- Little Lower Miami, Warren County, OH ... 7.2 mgd @ 28 lbs//1000 cf
- Chambersburg, PA ... 7.0 mgd @ 30 lbs/1000 cf
- Hillsboro, OH ... 1.0 mgd A 20 lbs/1000 cf
- Fort Dodge, Iowa ... 5 mgd @ 30 lbs/1000 cf

The design for Mountain View is based upon a MLSS of 4000 mg/l, a sludge yield of 0.85 and a sludge age of 12 days. For cold weather operation, the system would have a 4500 mg/l MLSS, a sludge yield of 0.81 and a sludge age of 14 days.

It is well documented that a sludge age of 14 days is sufficiently adequate to achieve complete nitrification under cold weather conditions. Support information on this was published as recent as the May 2006 WE&T article, *"The Versatility of Oxidation Ditches"*, by Dr. Larry W. Moore of the University of Memphis. In this article, Dr. Moore states, "At mixed liquor temperatures as low as 50°F (10°C), a design solids retention time of 14 days should be adequate to achieve excellent nitrification".

Most Orbal and VLR plants have achieved excellent nitrification (and denitrification) in cold weather areas with sludge ages lower than 10 days. Two plants achieving this type of performance with low sludge age are Chalfont-New Britain, PA (required to nitrify and denitrify and operates with sludge age in the 8-10 day range) and Hillsboro, OH (nitrifies in cold weather with 20 lb/1000 cf BOD loading). EPA data from Hillsboro is attached.

The Orbal and VLR systems described have at least three reactors in series – as does the Orbal system proposed for Mountain View. Reactors in series allow operating flexibility – with process safeguards for operating at higher MLSS concentrations. Operating at higher MLSS concentrations provides more solids inventory; thus a longer sludge age is achieved at reduced tank volume.

The Orbal system proposed for Mountain View has the capability to divert wastewater flow to the inner channels while still keeping RAS to the first channel. This allows a systems to operate at higher MLSS levels than normal (5000 mg/l to 7000 mg/l) without worry about clarifier solids washout during storm flow. As an example, during high stormflows, the diversion of the wastewater to the inner channel will result in immediate reduction of solids sent to the clarifiers.

Here are the results of a three channel system operating at 6200 mg/l MLSS that had a 4Q stormflow.

Plant: Brookfield, Ohio (design BOD loading @ 22 lbs/1000 cf)

1.2 mgd flow @ 6200/6200/6200 MLSS across three channels

Eff. BOD/SS/ammonia ... 1.5/1.3/0.14 mg/l

4.8 mgd stormflow @ 7600/7600/1800 MLSS across three channels

Eff. BOD/SS/ammonia ... 5/5/1.1 mg/l

This is why multi-reactor systems can be designed with elevated MLSS concentrations ... and reduced basin volumes.

The attached article, *"Nitrification Made Easy"*, shows why the multi-reactor design is more important to good nitrification than the selected BOD loading. Reactors in series easily are better for achieving high nitrification performance over single reactor systems. The article discusses a plant in Ohio (Carey) that did not meet their 1.5 mg/l effluent ammonia limit. The article presents performance data on during an evaluation phase when three of their five tanks were operated in series and the remaining two were left to operate in parallel. The side by side results gave this comparison on effluent ammonia:

Two tanks in parallel: 1.72 mg/l
Three tanks in series: 0.03 mg/l

Reactors in series are better for nitrification.

The Orbal design for Mountain View is based upon three reactors in series. We will be providing a process guarantee on effluent performance, including nitrification (and denitrification). The selected BOD loading for Mountain View was part of our process guarantee analysis. We prefer to keep operating sludge ages at 10 – 14 day for best effluent performance.

Systems with extended sludge ages (which can occur because of excessive tank volume) tend to have sludge that does not settle as well. The excess tank volume also can result in more difficulty in achieving full denitrification during under loaded periods.

For all of the above reasons, we would request that the design BOD of 24.5 lbs/1000 cf selected for Mountain View's Orbal design be approved. If there are questions concerning the points made in this letter, or if additional information is needed, please do not hesitate to contact us.

Sincerely,

George Smith
Director Biological Development

HILLSBORO, OH VLR DATA FROM EPA WEBSITE

DJB
3/29/2001

	INFLUENT FLOW MGD	FLOW M3/D	BOD MG/L	TSS MG/L	ORGANIC LOAD LB/1000 FT3/D	ORGANIC LOAD KG/M3/D
Sep-00	1.14	4334	185.00	236	20.8	0.33
Aug-00	1.08	4107	252.00	161	26.8	0.43
Jul-00	0.96	3630	283.00	294	26.6	0.43
Jun-00	0.86	3269	199.00	413	16.8	0.27
May-00	0.95	3597	215.00	174	20.0	0.32
Apr-00	1.16	4404	105.00	194	12.0	0.19
Mar-00	1.09	4108	142.00	153	15.1	0.24
Feb-00	1.65	6246	147.00	171	23.8	0.38
Average	1.11	4212	191	225	20.2	0.32

	EFFLUENT BOD MG/L	TSS MG/L	NH3 MG/L	NO2/NO3 MG/L	TP MG/L
Sep-00	1.67	1.33	0.462	5.12	0.25
Aug-00		0.31	0.099	3.27	0.28
Jul-00	3.38	0.31	0.149	3.19	0.31
Jun-00	4.58	0.50	0.504	4.16	0.67
May-00	2.60	0.20	0.935	3.41	0.44
Apr-00	1.42	0.75	0.222		0.42
Mar-00	0.62	0.54	0.298	2.50	0.45
Feb-00	5.50	14.83	0.302	6.02	0.93
Average	2.82	2.35	0.371	3.95	0.47

FIFTH ANNUAL *OPERATIONS FORUM*

By converting from parallel operation to operation in series of its aeration tanks, the Village of Carey, Ohio, produces a better effluent at minimal cost

PROBLEM SOLVING CONTEST

Nitrification Made Easy

Doug Keller and Micheal Schlack

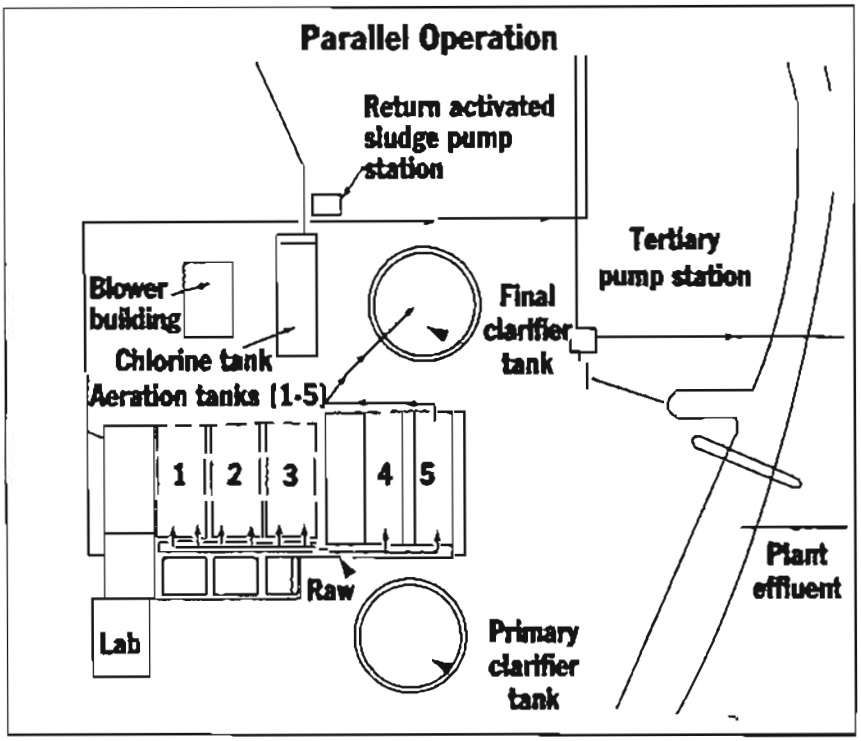
Over the past several years, the Village of Carey, Ohio, faced a battle to achieve ammonia limits in its National Pollutant Discharge Elimination System permit. The permit monthly average limit for ammonia is 2 mg/L, and the weekly average limit is 4 mg/L.

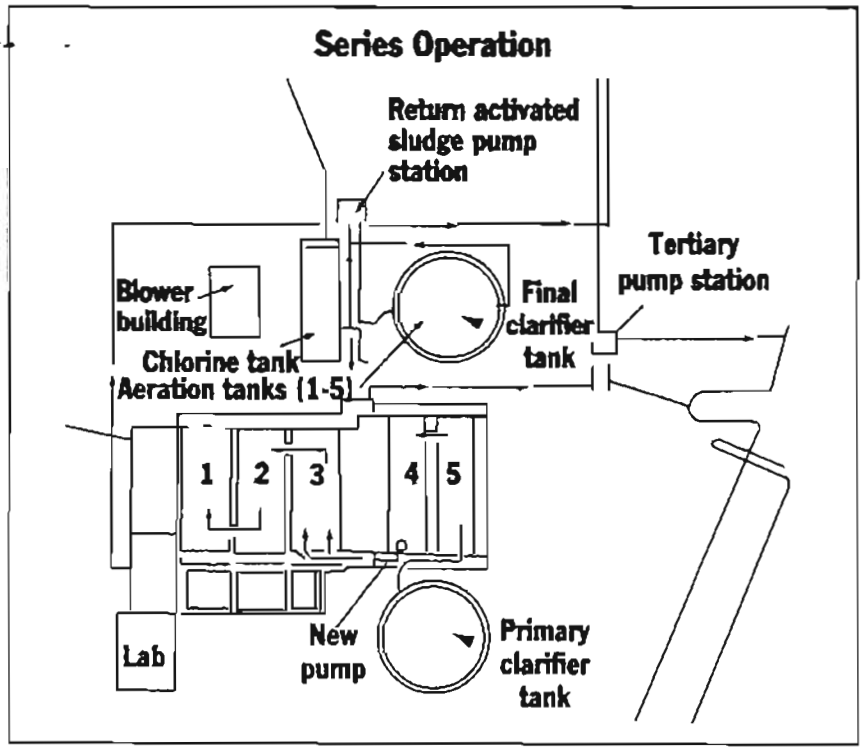
The war on ammonia was started at the source through a pretreatment ordinance that limits sewer use and the quantity and type of pollutants permitted for discharge. Next, the village's director of water and wastewater identified industries that did not comply with the ordinance. The village helped these industries reach compliance by supplying them with nitrifying bacteria that reduced ammonia levels to achieve a treatable influent containing 100 mg/L of biochemical oxygen demand, 15 Mg/L of ammonia, and 5 mg/L of total phosphorus. But these improvements were minor victories.

Further investigation revealed that the biomass in aeration tanks needed more contact time to achieve nitrification. The tanks were operated in parallel — influent entered a channel and was split equally among five tanks — but the detention time did not allow nitrification on a continuous basis (see figure, *Parallel Operation*, p. 28). Operators determined that if the aeration tanks were operated in series, detention time would increase significantly.

In a pilot project, tanks 1, 2, and 3 were connected in a series. Flow traveled from tank to tank through 4-in. (100-mm) holes that remained in tank walls after old air lines were removed. Although the holes were 4 in. (100 mm) above the normal water level, resulting in significant head loss, the project allowed workers to test series operation. Midway through the project, ammonia levels dipped to 0.06 mg/L (from the original 3.7 mg/L) in the tanks operating in a series. In contrast, ammonia levels reached 1.8 mg/L in the tanks that continued to operate in par-

PROBLEM SOLVING CONTEST





allel (tanks 4 and 5) and 1.0 mg/L in the final clarifier. At the end of the project, ammonia levels averaged 0.03 mg/L in the series section, 1.76 mg/L in the parallel section, and 1.3 mg/L in the final clarifier. These results demonstrated that series operation was worth a try.

The entire plant would begin series operation on July 30, 1998, but first, minor revisions were made. Electrical lines and piping were purchased, and holes were made in the walls between tanks 1, 2, and 3 and between tanks 4 and 5 using an 18-in.-bit (46-cm-bit) drill to permit more flow. A 1.5-mgd (5678-m^3/d) submersible pump, which was sized according to the maximum daily flow plus return activated sludge, was installed in Tank 4 to pump flows to Tank 3. All flow now enters Tank 5 and works its way to Tank 1, not unlike a plug-flow system (see figure, *Series Operation*, left). The modification has increased detention time roughly fivefold. In addition, the plant's two polishing lagoons for tertiary treatment no longer are a source of ammonia due to improved nitrification in the aeration tanks.

Difference in the Results

In the figure on page 29, *Effluent Ammonia Comparison*, the vertical black line marks when series operation began. Results in March and April are from the first series test, and the full pilot project was initiated in late July. The results so far look promising, and an expected permanent construction would include installing a channel connecting tanks 3 and 4. The channel would eliminate the need for the submersible pump and turn the aeration cell into a gravity-feed system to eliminate the possibility of mechanical failure. While carbonaceous biochemical