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Rec'd 2-6-85

February 5, 1986 LR85-5844

Ms. Elsa Potts, Engineer
Construction Grants Branch
Arkansas Department of Pollution
Control and Ecology
8001 National Drive
Little Rock, Arkansas 72207

Dear Ms. Potts:

Re: Harrisburg Facility Plan Amendment

Please consider this letter as a supplement to the Harrisburg Facility Plan Amendment dated January 20, 1986. Items discussed below refer to Sections and page numbers of the Amendment.

1. Section 1, page 2.
   We now understand that the May through October effluent limits will be 10/15/6/2, rather than 15/15/6/5 as shown.

2. Section 3, page 5.
   Same comment as Item 1.

3. Section 6, page 8.
   Same comment as Item 1.

4. Section 6, page 10.
   The aerated/facultative lagoons will be designed with an overall removal efficiency of approximately 88 percent with a combined detention time of approximately 59 days.

5. Section 11, page 39.

A revised calculation sheet for the aerated/facultative lagoon design is attached. These calculations are based on assumed BOD removal rate coefficients as shown for the first cell with a 15 percent reduction through each successive cell. This procedure predicts the BOD removal of each cell; however, since the actual removal rate coefficients may vary somewhat from the assumed values, the actual removals that occur in the four cells may vary from the figures shown. The overall lagoon system is designed for a theoretical soluble BOD in the effluent of 5 mg/l. The lagoon effluent TSS can be expected to be up to 60 mg/l or perhaps higher at times, depending on the algae growth during warm weather. Because of the variability of effluent solids, it is difficult to accurately predict the total BOD of the lagoon system, but it is expected to be approximately 30 mg/l winter and summer.

6. Section 11, page 40.

Replace the third paragraph with the following:

These filters will remove solids to less than 15 mg/l as required by the proposed new permit. The total BOD of the lagoon system will be reduced from approximately 30 mg/l to 10 mg/l or less by the filters. This BOD reduction results from solids removal by the filters with the aid of chemical addition.

7. Section 11, page 40.

As stated in Item 1 above, the May through October DO requirement will be 2 mg/l rather than 5 mg/l as shown.

8. Section 11, page 41.

EPA Studies

Ammonia data from two EPA studies of aerated/facultative lagoon systems is attached. Some basic information and conclusions from these two studies follow:

a. Orange Grove, Mississippi

EPA-600/2-80-006, March 1980; "Performance Evaluation of the Aerated Lagoon System at North Gulfport, Mississippi."

2 cell lagoon
0.50 MGD design flow
1125 lb/day design BOD loading
25.8 days total detention at design flow
Annual average flow during study = 0.766 MGD
Average BOD loading during study = 1520 lb/day

Table 21 shows monthly average ammonia data. The lowest ammonia removal rate occurred in October and November 1976. The removal rate for those two months was 52 percent. The average ammonia rate for the remaining 10 months was 71 percent.

b. Pawnee, Illinois

EPA-600/2-79-043, July 1979, "Performance Evaluation of the Three-Lagoon Wastewater Treatment Plant at Pawnee, Illinois."

3 cell lagoon
0.50 MGD design flow
850 lb/day design BOD loading
60 days total detention time at design flow
Annual average flow during study = 0.208 MGD
Average BOD loading during study = 804 lb/day

Table 5 shows the influent ammonia concentration during the study. The effluent values shown in Table 5 refer to the effluent of intermittent sand filters following the lagoons. Table 7 shows lagoon effluent ammonia values. The lowest ammonia removal rate occurred in March 1977 (66 percent). The next lowest ammonia removal was 85 percent in February 1977. The average ammonia removal rate for the remaining 9 months was over 97 percent.

Monticello Data

Results of recent ammonia analyses on the effluent from the treatment system for the City of Monticello is attached. This system consists basically of two parallel trains with one aerated/facultative lagoon and one polishing pond in each train. The ammonia concentrations of the effluents of the two polishing ponds are shown in mg/l.

Dumas Data

One additional sample from the Dumas aerated/facultative lagoon system has been analyzed with the results attached.

Harrisburg Data

A sheet presenting available ammonia data from the existing oxidation ponds at Harrisburg is attached. The seven influent samples were all taken during periods of dry weather. The average flow during the January 1986 sampling period was 0.159 MGD. The average influent ammonia concentration is approximately 25 mg/l. Based on the present ammonia loading and projected flows (domestic and I/I) for the design year, the average influent ammonia concentration at design flow is expected to be in the range of 12 to 15 mg/l.

During dry weather periods when ammonia concentrations are expected to be in the 20 to 30 mg/l range, total detention time in the lagoon system would be approximately 100 days as opposed to 59 days at the design flow of 0.466 MGD.

Conclusions

Based on the referenced EPA studies and the data collected from the Dumas and Monticello aerated/facultative lagoon systems and the Harrisburg oxidation pond, it is expected that the effluent from the proposed 4 cell aerated/facultative lagoon system will meet the proposed ammonia limitation of 6 mg/l May through October and 10 mg/l November through April.

Some ammonia reduction may occur in the filter through removal of biomass; but this is not expected to be significant.

9. Appendix D

The attached copy of the City's Resolution of Intent should replace the one included in the Facility Plan Amendment, as that one was not signed by the City Clerk.

I hope you find this additional information satisfactory. Please call me if you need anything else.

Very truly yours,

McCLELLAND CONSULTING ENGINEERS, INC.

Charles H. McLaughlin, P.E.

CHM:kmp

cc: Honorable Tommy McGee
Mayor, City of Harrisburg

CITY OF HARRISBURG, ARKANSAS
FOUR CELL AERATED/FACULTATIVE LAGOON DESIGN
JANUARY 1986

new flow

FLOW (MGD)	0.466	
INFLUENT BOD (MG/L)	250	→ 250 × 8.34 × .403 = 840 #/day
Ke @ 5 DEG C	0.14	* (WINTER)
Ke @ 25 DEG C	0.35	* (SUMMER)

* CELL NO. 1 VALUE; REDUCED BY 15% THROUGH EACH SUCCESSIVE CELL

CELL NO.	LENGTH (FT)	WIDTH (FT)	AREA (SF)	DEPTH (FT)	VOLUME (MG)	DET. TIME (DAYS)	REMOVAL EFFICIENCY SUMMER	WINTER
1	360	265	95400	8	5.71	12.3	81.1%	63.2%
2	500	240	120000	8	7.18	15.4	82.1%	64.7%
3	520	240	124800	8	7.47	16.0	80.2%	61.8%
4	500	240	120000	8	7.18	15.4	76.8%	57.0%
TOTALS			460200		27.54	59.1		
TOTAL REMOVAL EFFICIENCY BASED ON TOTAL BOD							88.0%	88.0%

SUMMER

CELL NO.	INFLUENT BOD (LB/DAY)	(MG/L)	BOD REMOVED (LB/DAY)	(MG/L)	SOLUBLE EFFLUENT BOD** (LB/DAY)	(MG/L)	ESTIMATED CELL 4 EFFLUENT TOTAL BOD (LB/DAY)	(MG/L)
1	972	250	788	203	184	47		
2	184	47	151	39	33	8		
3	33	8	26	7	19	5		
4	19	5	15	4	19	5	117	30

WINTER

CELL NO.	INFLUENT BOD (LB/DAY)	(MG/L)	BOD REMOVED (LB/DAY)	(MG/L)	SOLUBLE EFFLUENT BOD (LB/DAY)	(MG/L)	ESTIMATED CELL 4 EFFLUENT TOTAL BOD (LB/DAY)	(MG/L)
1	972	250	614	158	358	92		
2	358	92	232	60	126	32		
3	126	32	78	20	48	12		
4	48	12	27	7	21	5	117	30

** CALCULATED EFFLUENT BOD'S LESS THAN 5 MG/L ARE SHOWN AS 5 MG/L

Ammonia Nitrogen (NH_3-N)

Tables 21 and 22 tabulate respectively average monthly total and soluble ammonia concentrations observed at sampling locations during the study period. Results are also graphically illustrated in Figures 9 and 10.

The total ammonia influent concentration ranged from a high of 20.0 mg/l in November (low flow) to a low of 11.6 mg/l during July (high flow period) with a yearly weighed mean of 15.0 mg/l. The soluble NH_3-N content represented approximately 92% of the total concentrations at all sample locations. Consequently, complete removal of solids would not result in significant additional ammonia reductions. As shown by Figures 9 and 10 very high removals were affected within the first cell during summer months (June through August). NH_3-N assimilation by the biomass during this time was greatest due to temperature influence on metabolic rates. During the summer total NH_3-N removal averaged 79% with an average residual of 2.7 mg/l. Increases in total and soluble NH_3-N levels, however, were noted following both the second aeration cell and settling basin for the months of June through November. This may be attributable to the higher temperatures increasing benthic decomposition rates of settled sludge solids and algae cells with subsequent feedback of ammonia to the overlying waters. Chlorination following sampling location L3 may have resulted in algae cell death with release of NH_3-N into solution.

TABLE 21. MONTHLY AVERAGE TOTAL AMMONIA NITROGEN (NH_3-N) CONCENTRATION OF THE WASTEWATER INFLUENT AND EFFLUENT FROM EACH CELL IN THE ORANGE GROVE AERATED LAGOON SYSTEM

	Total ammonia nitrogen (mg/l) - monthly average			
MONTH	INFLUENT	CELL A1	CELL A2	EFFLUENT
December '75	19.0	11.6	7.6	7.5
January	16.5	11.5	7.0	7.3
February	14.0	12.4	0.5	3.1
March	15.2	12.7	3.4	0.9
April	15.1	11.3	2.8	3.1
May	19.3	15.0	6.3	5.8
June	13.8	1.8	3.1	4.1
July	11.6	3.2	4.5	5.0
August	16.8	1.4	3.4	4.8
September	14.2	6.2	6.4	6.1
October	13.5	0.7	6.5	9.9
November '76	20.0	7.5	9.7	9.4
YEARLY MEAN	15.0	8.0	5.1	5.5

AMMONIA DATA - AERATED/FACULTATIVE LAGOON
CITY OF DUMAS, ARKANSAS

SAMPLE DATE	NH3-N INFLUENT (MG/L)	NH3-N EFFFLUENT (MG/L)
4/23/84	-	0.456
5/4/84	-	0.431
5/21/84	-	2.017
6/11/84	20.2	0.519
6/27/84	-	3.125
7/5/84	-	0.541
7/11/84	-	0.334
1/16/86 *	-	0.97

* CELL NO. 4 TEMPERATURE = 7 DEG. C.

AMMONIA DATA - OXIDATION POND
CITY OF HARRISBURG, ARKANSAS

SAMPLE DATE	NH3-N INFLUENT (MG/L)	NH3-N EFFFLUENT (MG/L)
8/1/79	19.7	6.2
8/2/79	28.6	5.6
1/21/86	19.8	-
1/23/86	23.0	-
1/24/86	26.8	-
1/25/86	30.8	-
2/3/86 *	28.9	7.8

* POND TEMPERATURE NEAR EFFLUENT = 9 DEG. C.

$\frac{28.9 - 7.8}{28.9} = 73\%$

$\frac{19.7 - 6.2}{19.7} = 68.5\%$

$\frac{28.6 - 5.6}{28.6} = 80.4$

Ammonia Data - Aerated/Facultative Lagoons
City of Monticello, Arkansas
NPDES Permit No. AR0021831

Sample Date		Discharge 001	Discharge 002
1985			
April	10	5.57	8.60
	17	6.329	6.266
	24	7.78	5.57
May	1	6.33	6.14
	8	3.49	6.39
	15	0.310	3.494
	22	1.829	1.597
	29	2.959	1.165
June	5	2.154	0.283
	12	7.003	0.170
	19	2.985	0.214
	26	2.63	0.280
July	2	1.78	0.622
	10	*	*
	17	1.64	0.431
	24	1.69	0.355
	31	1.287	0.179
Aug.	8	0.506	0.194
	14	1.464	0.179
	21	1.99	0.219
	28	*	*
Sept.	3	2.84	0.91
	4	3.03	0.26
	5	2.58	0.33
	10	1.99	0.23
	11	4.04	0.29
	12	5.25	0.27
	17	2.79	0.30
	18	2.58	0.45
	19	2.28	2.15
	24	3.41	0.11
	25	4.22	0.42
	26	0.49	3.34
Oct.	1	0.92	0.19
	2	2.19	0.33
	3	1.96	0.45
	8	1.27	1.65
	9	7.8	0.54
	10	1.15	0.52
Oct.	15	2.51	0.57
	16	2.20	0.52
	17	2.91	0.52
	22	3.92	0.57
	23	4.2	0.14
	24	4.94	0.64
	29	3.41	0.50
	30	5.85	0.5
	31	5.78	0.54
Nov.	5	7.84	0.21
	6	7.6	0.35
	7	8.00	0.20
	12	7.32	0.49
	13	6.98	0.49
	14	7.43	0.49
	19	8.84	0.49
	20	9.19	0.49
	21	9.05	0.5
	25	9.3	0.4
	26	9.7	0.4
Dec.	3	9.8	0.84
	4	9.06	1.23
	5	9.68	0.97
	10	10.6	1.43
	11	8.28	1.61
	12	9.62	1.91
	17	9.68	3.5
	18	9.96	3.82
	19	9.96	*
	23	*	5.02
	27	9.00	10.14
	31	8.39	6.05
1986			
Jan.	2	8.28	6.60
	7	7.36	7.36
	8	8.01	7.45
	9	7.36	7.15
	14	6.60	6.85
	15	6.50	6.40
	16	6.50	6.07

* Invalid samples (not preserved)

Pawnee, Illinois

TABLE 7. POND III EFFLUENTS

(average concentrations in mg/l)

Year/Month	Nitrites		Nitrates		Ammonia Nitrogen	
	No. of Samples	Avg. Conc.	No. of Samples	Avg. Conc.	No. of Samples	Avg. Conc.
1976						
March	--	--	--	--	--	--
April	(24)	0.049	(25)	1.5	(25)	0.90
May	(7)	0.020	(7)	1.0	(7)	0.40
June	(7)	0.021	(7)	0.8	(7)	0.60
July	(31)	0.552	(31)	0.9	(31)	0.73
August	(7)	0.035	(7)	0.27	(7)	0.57
September	(7)	0.021	(7)	0.15	(7)	0.48
October	(29)	0.046	(29)	0.23	(29)	0.39
November	(7)	0.378	(7)	0.95	(7)	0.38
December	(7)	0.121	(7)	0.90	(7)	0.49
1977						
January	--	--	--	--	--	--
February	(7)	0.039	(7)	0.97	(7)	4.4
March	(24)	0.157	(24)	1.18	(24)	6.1
Annual Average	(157)	0.177	(158)	0.87	(158)	1.4

Pawnee, Illinois

TABLE 5. (continued)

	Samples Analyzed	Nitrogen, NH_3		
		Inf*	Eff*	% Removal
1976				
March	(7)	12	1.4	88.3
April	(27)	13	0.2	98.6
May	(7)	20	0.4	98.0
June	(7)**	31	0.7	97.7
July	(19)**	24	0.6	97.5
August	(7)	26	0.5	97.9
September	(7)	36	0.5	98.5
October	(25)**	35	0.4	98.9
November	(6)**	37	0.5	98.7
December	(7)	34	0.5	98.5
1977				
February	(7)	29	4.2	85.5
March	(24)	18	5.5	69.4
12-month average		26	1.3	93.9

(continued)

*In mg/l
**Effluent samples analyzed totaled 6 in June, 31 in July, 29 in October and 7 in November