Fields of Opportunities

STATE OF IOWA

TERRY E. BRANSTAD, GOVERNOR
KIM REYNOLDS, LT. GOVERNOR

DEPARTMENT OF NATURAL RESOURCES
CHUCK GIPP, DIRECTOR

August 20, 2015

Mr. William Gibson, Environmental Manager
Roquette America, Inc.
P.O. Box 6647
1003 South Fifth Street
Keokuk, IA 52632

RE: Roquette America, Inc. (RAI) Wastewater Treatment Facility Improvement project-DNR Project Number S2013--0183

Subject: Variance Request from 567 IAC 64.2(9)c and Design Standards Section 18B 4.2

Dear Mr.Gibson:

After careful and thorough consideration, the Department has ***approved*** your June 30, 2015 request for a variance from Iowa Administrative Code Subrule 567 IAC 64.2(9)c and Chapter 18B 4.2 of the Iowa Wastewater Facilities Design Standards, which requires the maximum allowed aeration tank organic loading is 40 lbs BOD_5/1,000 cu ft/day, the maximum allowed F/M ratio is 0.5 lb BOD_5/lb of MLVSS and the maximum allowed MLSS is 3000 mg/l.

Based on the documentation presented by your Engineer, it is the determination of this Department that satisfactory justification has been presented to warrant the granting of a variance for the organic loading 52 lbs/day BOD_5/1,000 cu ft, 0.22 lbs BOD_5/day/lb of MLVSS and 6,400 mg/l MLSS. The requested variance is deemed to be reasonable and necessary pursuant to the Iowa Code section 455B.181.

The facts presented for the project present unique circumstances and the variance is therefore justified to provide the narrowest exception possible to the provisions of the rule in accordance with Rule 561 IAC 10.5.

This decision is based on our review of justification presented to support the request. Our concurrence with the request is based on the Department's finding that the resulting project will provide substantially equivalent effectiveness as would be provided by technical compliance with the design standard on this issue.

Please feel free to contact Suresh Kumar at (515) 725-8429 or email suresh.kumar@dnr.Iowa.gov if you have any questions.

Sincerely,

Jon Tack
Water Quality Bureau Chief

cc: Huff & Huff Engineers
DNR FO 6
DNR Sewage File # 6-56-40-101

VARIANCE REQUEST
Iowa Department of Natural Resources

1.	Date:	08/20/15	14a.	Decision:	Appd.
2.	Reviewer/Engr.:	Suresh Kumar		Date:	8/25/15
3.	Date Received:	06/30/15	14b.	Expiration Date (if any):	Permanant
4.	Facility Name:	Roquette America, Inc. (RAI)			
5.	Facility Number:	6-56-40101			
6.	County Number:	56, Lee	15.	Appealed:	
7.	Program Area:	CP (Wastewater)		Date:	
8.	Facility Type:	C O5			
9.	Subject Area:	332, Activated Sludge Organic Loading Rates			
10.	Rule Reference:	567-64.2(9)a			
11.	Design Std. Ref.:	18B.4.2			
12.	Consulting Engr.:	Huff & Huff Engineers			
13.	Variance Rule:	Variance Rule: 567-64.2(9)c			

16. Description of Variance Request:

Description of Variance Request: RAI is a corn wet milling industrial facility located in Keokuk, Iowa. RAI has an activated sludge wastewater treatment system that treats their wastewater that has been upgraded in 2012 with two oxidation ditch aeration basins. RAI is anticipating production increase at their industrial operation that will increase the organic and hydraulic waste loads to their WWTP. Therefore, RAI is requesting a variance from the Design Standard 18B.4.2 to allow higher organic loadings to the aeration tanks instead of the maximum allowed 40 lbsBOD5/day/1,000 cu ft. The higher organic loading increases the food to micro-organism ratio (MLVSS) and mixed liquor suspended solids (MLSS) ratio more than the design standards.

The new aeration system, oxidation ditch, at RAI is a complete mix reactor activated sludge system with in-place anoxic zones. Per the Design Standard Chapter 18B.4.2 the maximum allowed aeration tank organic loading is 40 lbs BOD5/1,000 cu ft/day, the maximum allowed F/M ratio is 0.5 lb BOD5/lb MLVSS and the maximum allowed MLSS is 3000 mg/l. The requested variance is for 52 lbs/day/1,000 cu ft, 0.22 lbs BOD5/day/lb of MLVSS and 6,400 mg/l MLSS.

17. Applicant's/Consulting Engineer's Justification:

2012 WWTP upgrade RAI selected oxidation ditch for the treatment of high strength organic waste. At the time IDNR developed the Design Standards Oxidation ditches were not popular and therefore, the high strength waste reduction utilizing oxidation ditches were not addressed in the design specifications. The organic waste generated at RAI is readily degradable high strength industrial waste. Previously permitted activated sludge WWTP at RAI had higher organic loading, 72 lbs BOD5/day 1,000 cu ft, compared to the requested loading for the expanded new facility, 52 lbs BOD5/day/ 1,000 cu ft. Literature search provided along with the variance request and the RAI WWTP performance data analysis has proven that the current treatment system is capable of consistently achieving the effluent limits.

18. Department's Justification:

Recommend this variance request to be approved.

18B.4.2 capacities and permissible loadings represent typical domestic wastewater. Design standard allows aeration tank sizing based on full scale plant operation experience and rational calculations. The initial variance request was submitted to the department on June 14, 2014 along with the revised facility plan. Department conducted an initial review of the request and suggested RAI to submit a detailed WWTP operational data including plant influent loadings and effluent data. On June 30, 2015 department received detailed field validated data for the WWTP influent loadings and effluent data. The data analysis has proved that the oxidation ditches have performed successfully and achieved effluent limits consistently. The data shows that the WWTP influent ammonia has averaged 128 mg/l with the peak month 225 mg/l and the effluent concentration averaged at 2.2 mg/l and peak month at 8.9 mg/l. The effluent BOD5 averaged at 2,113 lbs/day compared to the permit effluent limit of 5,924 lbs/day. The TSS effluent averaged 1,386

lbs/day compared to the effluent permit limit of 7,138 lbs/day.

The consulting engineer has conducted detailed literature search and provided the information to the department along with the revised variance request submittal. The literature search includes- Industrial Water Pollution Control Book by Eckenfelder published on 1996, Biological Process Design for Wastewater Treatment by Benfield and Randall dated 1980, 1978 USEPA publication on Biological Treatment of Wastes from the Wet Corn Milling Industry, and Biological Wastewater Treatment by Grady, C. P. published on 1999. These publications emphases that well operated oxidation ditches are capable of reducing high strength organic loads in the WWTP.

Therefore, from the data analysis and literature review the department believes that the improved new WWTP with the oxidation ditches at RAI WWTP could treat the proposed higher organic loadings and meet effluent limits consistently.

19. Precedents Used:
None

20. Staff Reviewer: Date: 8/25/15

21. Supervisor: Satya Chennupati Date: 8/25/15

22. Authorized by: Date: 8/25/15

52013-0183

Huff & Huff, incorporated
environmental engineers
and consultants

915 Harger Road, Suite 330
Oak Brook, IL 60523
Phone (630) 684-9100
Fax (630) 684-9120
Website: http://huffnhuff.com

June 25, 2015

Mr. Suresh Kumar
Wastewater Treatment Review Engineer; Industrial
Iowa Department of Natural Resources
502 East 9th Street
Des Moines, IA 50319

Re: Roquette America, Inc.
Performance Summary

Dear Mr. Kumar:

On June 14, 2014, Roquette America, Inc. (Roquette) submitted a Revised Facility Plan to the Iowa DNR. This was followed up with a variance request submitted on August 12, 2014 and supplemented on August 25, 2014. Variances were requested from three specific design requirements contained in Chapter 18B, Activated Sludge Biological Treatment. Specifically, relief from the following were requested:

1. Maximum Aeration Tank Organic Loading in pounds BOD_5 per day per 1,000 cu ft
2. Food to Micro-organism ratio in pounds BOD_5 per pound MLVSS per day
3. Mixed Liquor Suspended Solids (MLSS) operating range concentration

The justifications for these requests were described in detail in both the Revised Facility Plan and the variance request. The purpose of this letter is to summarize performance since the new oxidation ditches came on line.

The three technical design parameters from which Roquette is seeking a variance are all related to the two oxidation ditches/clarifiers installed as part of the expansion. As the DNR is aware, oxidation ditches were not common when the design standards were developed, nor were high-strength wastes included in the development of the design specifications. Oxidation ditches are a form of activated sludge that has become popular over the past decade because of the stability achieved, plus the ability to incorporate denitrification in the process.

With the higher organic-strength waste associated with Roquette's operation, oxidation ditches were selected, have been constructed, and placed into operation over the first half of 2014. The oxidation ditches are designed to achieve the following:

1) Reduce BOD_5
2) Reduce Total Suspended Solids (TSS)
3) Oxidize ammonia to nitrates
4) Denitrify the nitrates to nitrogen gas

In addition, the oxidation ditches provided for a significant increase in both organic loading and hydraulic loading capacity to address both existing loadings and future production growth at the facility. According to the Facility Plan, the expanded treatment plant is designed for the following:

	Flow, mgd	BOD_5, lbs/day	NH_3/N, lbs/day	TSS, lbs,day
AWW	4.89	74,526	5,659	15,482
MWW	7.34	110,533	8,807	74,296

To address the question raised by the Iowa DNR regarding performance of the oxidation ditches, a review of the treatment plant performance for the above parameters, plus effluent nitrates is appropriate. Table 1 presents the influent flow, BOD_5, and TSS loading since 2011. Monthly flows have averaged 4.06 mgd and the maximum monthly average flow was 4.67 mgd. The monthly BOD_5 loading has averaged 50,020 pounds per day with a monthly maximum of 90,385 pounds per day. The TSS loadings have averaged 7,741 pounds per day, and the maximum monthly average loading was 15,901 pounds per day. From these loadings, it is clear that the expanded treatment plant facilities have capacity for future production increases. The influent ammonia concentrations since January 2011 to the treatment plant are presented in Table 2. The influent ammonia has averaged 128 mg/L with the peak month 225 mg/L.

Of course loadings don't equate to performance. Table 3 presents the effluent BOD_5 performance since the oxidation ditches were brought on line. The BOD_5 removal across the expanded treatment plant has been excellent, with the highest 30-day average BOD_5 only 2,113 pounds per day, compared to the permit limit of 5,924 pounds per day. Table 4 presents the TSS effluent results. On a monthly average, the system has averaged only 1,386 pounds per day, compared to the NPDES monthly limit of 7,138 pounds per day. The maximum month discharge was 5,576 pounds per day, still well below the monthly permit limit. Table 5 presents the effluent ammonia results on a monthly average basis. The effluent concentration has averaged 2.2 mg/L, with a maximum monthly average of 8.9 mg/L. Consistent nitrification has been achieved. Finally, Table 6 presents the effluent nitrate results since January 2014, when the

oxidation ditches were started up. Effluent nitrate concentration (as N) has averaged a low 4.0 mg/L since start-up, very impressive compared to the influent ammonia concentration, which has averaged above 100 mg/L.

Based on the incremental MWW BOD_5 loading of 19,593 lbs per day based on the requested design loading to the existing permitted loading, and 5,000,000 gallons of oxidation ditches of aeration capacity, the MWW loading will be 29 lbs per day per 1,000 cu ft, compared to the MWW design of the originally permitted system of 118 lbs BOD_5 per day per 1,000 cu ft.

If the entire aeration system is aggregated, the total BOD_5 loadings are 74,526 lbs per day AWW and 110,533 lbs per day at the MWW. The total aeration capacity available is 10,760,000 gallons. The overall organic loading compared to the existing system is presented below:

Conditions	AWW BOD_5 Loading, lbs/day/1,000 cu ft	MWW BOD_5 Loading, lbs/day/1,000 cu ft
Previously Permitted	**72**	**118**
Requested for Expanded Facilities	**52**	**77**

Roquette's oxidation ditches are designed for an MLVSS of 6,400 to 8,000 mg/L, or an active biomass (MLVSS) in five million gallons of 334,000 pounds of MLVSS. At the design organic loading 74,526 pounds of BOD_5 per day, and ignoring any BOD_5 reduction before the oxidation ditches, the loading on the ditch will be **0.22** pounds BOD_5 per day per pound of MLVSS.

The existing system has demonstrated the ability to achieve the effluent BOD_5 and ammonia effluent limits at the current loadings. The oxidation ditches essentially doubles the aeration capacity and retention time, with the expectation that the expanded system will prove more reliable than the current system. The higher loadings are common for the food industry, which has more readily degradable substrate than domestic sewage. So long as sufficient oxygen is provided, which is the case here, the lower organic loadings will improve performance and reliability.

It should be noted that the BOD_5 loading factor is not used in design of activated sludge systems. The Iowa design standards at Chapter 18B includes a table of "Typical Aeration Tank Loadings and Design Parameters" which indicates the maximum organic loading for Extended Aeration should be 15 pounds of BOD_5 per 1,000 cu ft of aeration capacity per day. There is no theoretical basis for this limit, and it is based on data from domestic sewage, with an influent BOD_5 of less than 200 mg/L. This same Iowa table indicates the Food/Micro-organism ratio (F/M) should be in the range of 0.05 to 0.1 pounds of BOD_5 per pound MLVSS per day, and the MLSS should be

in the range of 3,000 to 5,000 mg/L. None of these guidelines are applicable for high strength, readily degradable wastes. Going back to 1966, Eckenfelder published his Industrial Water Pollution Control book that includes some industrial loadings on a volumetric basis, and more on a MLSS basis. The volumetric design loadings ranged from19 to 475 pounds BOD_5 per day per 1,000 cu ft, all above the Iowa guidelines. In 1978 at the Purdue Industrial Waste Conference, Barrett and Hayden reported on a Brewery activated sludge facility operating at an average 23.8 pounds of BOD_5 per day per 1,000 cu ft and an F/M ratio of 0.15 per day (page 865). Biesinger, et al. at the Purdue Industrial Waste Conference reported that for a Brewery wastewater organic loadings ranged from 15 to 1,180 pounds BOD_5 per day per 1,000 cu ft. (35th Conference proceedings at page 600, 1980.) On a mass basis, the organic loadings range from a low of 0.14 to 3.0 pounds of BOD_5 per day per pound of MLSS. To adjust to per pound of MLVSS, these values would be adjusted upwards by approximately 25 percent. Again, all of them are higher than the upper range in the Iowa DNR "Typical" Loadings.

The reason for including this reference material is to note the inapplicability of municipal loadings for industrial wastewater. In Benefield and Randall's book, Biological Process Design for Wastewater Treatment, (1980), loadings for high rate activated sludge are reported to range from 1.5 to 5.0 pounds BOD_5 per day per pound MLVSS (page 187), over an order of magnitude higher than the Iowa *typical* loadings for municipal wastewater. Koon and Adams reported at the 30th Purdue Industrial Waste Conference on an organic chemical manufacturer operating between 0.23 and 0.43 pounds BOD_5 per day per pound MLVSS, with removal efficiencies ranging from 94.4 and 97.8 percent (Page 911).

In 1978, USEPA published *Biological Treatment of Wastes from the Wet Corn Milling Industry.* This report describes the pilot- and full-scale results for a new activated sludge process, sized for 18,800 pounds per day COD and an aeration capacity of 650,000 gallons. This equates to a COD loading of 216 pounds of COD per day per 1,000 cu ft. Assuming a 1.5:1 ratio of COD to BOD_5, this equates to a BOD_5 loading of **144** pounds per day BOD_5 per 1,000 cu ft, compared to the *typical* Iowa guidelines of 15 pounds of BOD_5 per day per 1,000 cu ft. This wet corn milling facility was sized for 1.16 pounds of COD per day per pound MLSS, or using the same 1.5 ratio, 0.78 pounds of BOD_5 per day per pound of MLSS, or **0.97** pounds of BOD_5 per day per pound of MLVSS. This value is considerably higher than the Iowa *typical* extended aeration loading range of **0.05 to 0.10** pounds per day per pound MLVSS for municipal wastewater.

The point of the above is merely to point out that the Iowa design guidance for activated sludge systems is not appropriate for readily degradable high-strength industrial wastewater. Eckenfelder's long-recognized equation for complete mix aeration tank is simply:

$$\frac{dS}{dt} = \frac{K' X S_e}{S_i}$$

Where:

dS/dt is the substrate utilization rate (mg/L/day)
$K^{'}$ is Eckenfelder's modified model substrate removal rate constant (mg/mg/day)
S_e is the effluent substrate concentration (mg/L)
S_i is the influent substrate concentration (mg/L)
X is the MLVSS concentration (mg/L)

Looking at this equation, the **rate of substrate utilization** (dS/dt) is really the key. If the waste is readily biodegradable, a high degree of removal is possible. In the Iowa guidance, this factor is not considered, resulting in a *one size fits all* approved for design of activated sludge systems, which the above examples clearly show is not how such systems are designed.

The definitive book on designing biological wastewater systems is Grady, C. P., et al, Biological Wastewater Treatment (1999). Grady explains as follows:

> *Activated sludge is applicable to wastewaters with a wide range of concentrations....aerobic suspended growth bioreactors are typically used to treat wastewaters with biodegradable chemical oxygen demand (COD) concentrations up to 4,000 mg/L....Technically, activated sludge can be used to treat wastewaters with biodegradable COD concentrations ranging from about 50 to 10,000 mg/L. The technical constraints derive from sludge settleability and the ability to maintain a suitable Solids Retention Time (SRT).*
>
> *For high-concentration wastewaters, the constraint relates to the ability of the clarifier to consolidate the MLSS for recycle to the bioreactor (page 387).*

Grady goes on then to explain how to design a complete mix activated sludge system, starting on page 419. Nowhere in the design process does the loading per aeration volume enter into the design calculations.

In summary, the expansion with the oxidation ditches has performed successfully, achieving effluent limits on a consistent basis, and overall demonstrating its ability to handle spikes in loadings and flow. Like all biological processes, the oxidation ditch system can be upset from unplanned discharges in the production area, but this would be true no matter what loadings the system was designed to handle. The data presented herein support Roquette's request for a variance, and can be used by the IDNR as evidence that the wastewater treatment system can handle the requested design loadings and consistently achieve its effluent limits.

Signed release:

I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.

Linda L Huff (Signature) 6/25/15 (Date)

Printed or typed name: Linda L. Huff, P.E.
License number 21119
My license renewal date is December 31, 2015.
Pages or sheets covered by this seal:
Variance Request

Please contact William Gibson (319-526-3411) or Huff & Huff, Inc. at 630-684-4444 with any questions.

Sincerely;

Linda L Huff

Linda L. Huff, P.E.
Vice President

William J. Gibson
Environmental Department Manager

TABLE 1
ROQUETTE WASTEWATER TREATMENT PLANT INFLUENT LOADINGS

Month	Influent Flow, MGD		BOD5 Loading, lb/day		TSS Loading, lb/day	
	Mean	Daily Max	Mean	Daily Max	Mean	Daily Max
Jan-11	4.07	4.54	49,103	78,050	8,062	28,089
Feb-11	3.82	4.40	44,913	73,913	8,950	31,375
Mar-11	3.93	4.41	56,318	75,373	6,542	35,240
Apr-11	3.94	4.39	**63,526**	82,928	8,121	21,629
May-11	3.83	4.36	57,634	90,172	12,130	40,710
Jun-11	3.69	4.22	50,821	81,869	9,372	27,259
Jul-11	3.83	4.50	53,474	76,240	7,948	22,308
Aug-11	3.68	4.41	45,826	72,526	12,482	48,566
Sep-11	3.99	4.32	61,586	86,251	10,739	21,578
Oct-11	3.92	4.41	48,519	99,747	7,518	12,233
Nov-11	3.58	4.24	41,523	61,912	6,288	11,290
Dec-11	4.00	4.47	51,774	74,047	6,897	11,776
Jan-12	3.95	4.40	57,915	97,038	7,926	12,768
Feb-12	4.04	4.62	52,548	105,865	4,997	18,587
Mar-12	3.23	4.26	48,556	192,154	2,625	5,329
Apr-12	3.89	4.51	44,129	61,226	5,146	20,912
May-12	3.83	4.42	44,748	68,503	4,277	18,370
Jun-12	3.87	4.39	44,014	57,452	4,322	10,551
Jul-12	3.85	4.46	44,649	72,495	5,373	18,195
Aug-12	3.95	4.40	45,264	78,936	5,709	20,387
Sep-12	3.93	4.46	37,812	60,598	5,799	23,424
Oct-12	3.60	4.38	36,055	68,573	5,505	17,113
Nov-12	4.07	4.57	45,076	64,099	5,438	14,091
Dec-12	4.00	4.87	37,701	60,143	4,486	8,669
Jan-13	3.96	4.47	40,063	66,060	7,244	17,154
Feb-13	4.04	4.64	43,276	67,035	8,410	16,904
Mar-13	4.16	4.73	47,731	68,685	10,369	21,729
Apr-13	4.15	5.04	46,712	64,880	13,086	46,269
May-13	4.06	4.91	41,552	63,933	9,635	30,408
Jun-13	3.95	4.53	49,193	86,105	10,881	30,434
Jul-13	4.16	4.77	40,257	53,669	10,101	32,358
Aug-13	4.14	4.90	45,688	97,444	10,277	33,841
Sep-13	3.86	4.76	42,208	92,331	6,198	19,655
Oct-13	4.37	4.71	46,381	61,860	6,518	15,744
Nov-13	3.79	4.45	37,276	87,401	4,404	10,495
Dec-13	3.79	4.40	37,029	55,475	5,257	20,333
Jan-14	4.01	4.70	43,083	74,391	4,749	7,662
Feb-14	3.95	4.85	67,024	167,905	5,590	14,028
Mar-14	4.27	**5.17**	57,318	91,508	5,636	9,944
Apr-14	4.37	4.87	59,347	88,679	7,667	16,083
May-14	4.38	4.93	**90,385**	131,153	7,429	14,459
Jun-14	4.49	5.44	53,171	72,780	7,466	16,817
Jul-14	4.22	4.97	49,450	90,385	7,839	55,002

TABLE 1
ROQUETTE WASTEWATER TREATMENT PLANT INFLUENT LOADINGS

Month	Influent Flow, MGD		BOD5 Loading, lb/day		TSS Loading, lb/day	
	Mean	Daily Max	Mean	Daily Max	Mean	Daily Max
Aug-14	**4.67**	5.19	44,155	69,757	11,907	71,916
Sep-14	4.31	4.88	49,904	79,614	9,986	68,917
Oct-14	4.63	**9.25**	56,140	117,546	6,595	27,851
Nov-14	4.09	5.15	49,451	73,571	7,291	14,404
Dec-14	4.51	4.93	55,728	71,703	6,355	16,234
Jan-15	4.54	5.61	53,481	74,367	6,709	13,095
Feb-15	4.14	4.92	50,567	80,598	9,382	**98,432**
Mar-15	4.56	5.15	66,220	126,687	8,026	29,052
Apr-15	4.64	5.07	70,432	**276,472**	15,901	54,597
May-15	4.56	4.95	54,371	69,777	12,699	56,828
Mean	**4.06**	**4.77**	**50,020**	**86,073**	**7,741**	**26,058**
Maximum	**4.67**	**9.25**	**90,385**	**276,472**	**15,901**	**98,432**

TABLE 2
INFLUENT AMMONIA CONCENTRATIONS

Month	Average NH3/N, mg/L	Daily Max NH3/N, mg/L
11-Jan	134	292
11-Feb	133	213
11-Mar	140	221
11-Apr	147	262
11-May	134	232
11-Jun	135	204
11-Jul	133	314
11-Aug	182	361
11-Sep	223	346
11-Oct	198	518
11-Nov	154	211
11-Dec	184	229
12-Jan	171	249
12-Feb	138	245
12-Mar	98	192
12-Apr	160	421
12-May	159	253
12-Jun	142	200
12-Jul	174	401
12-Aug	157	232
12-Sep	151	262
12-Oct	124	246
12-Nov	138	209
12-Dec	107	188
13-Jan	115	195
13-Feb	119	232
13-Mar	119	188
13-Apr	142	230
13-May	129	200
13-Jun	126	185
13-Jul	135	314
13-Aug	99	174
13-Sep	108	278
13-Oct	115	174
13-Nov	107	167
13-Dec	101	190
14-Jan	94	137
14-Feb	112	184
14-Mar	92	153
14-Apr	81	175
14-May	57	207
14-Jun	MD	MD
14-Jul	138	470

TABLE 2
INFLUENT AMMONIA CONCENTRATIONS

Month	Average NH3/N, mg/L	Daily Max NH3/N, mg/L
14-Aug	115	1,495
14-Sep	225	1,154
14-Oct	51	575
14-Nov	39	118
14-Dec	54	348
15-Jan	58	416
15-Feb	106	992
Mean	**128**	**315**
Maximum	**225**	**1,495**

MD signifies Missing Data

TABLE 3
ROQUETTE EFFLUENT BOD5

Month	30-day Average, lbs/day
NPDES Permit Limit	**5,924**
Jan-14	207
Feb-14	578
Mar-14	212
Apr-14	244
May-14	2,113
Jun-14	849
Jul-14	436
Aug-14	488
Sep-14	474
Oct-14	430
Nov-14	538
Dec-14	510
Jan-15	573
Feb-15	1,227
Mar-15	262
Apr-15	652
May-15	210
Average	**609**
Maximum	**2,113**

TABLE 4
ROQUETTE EFFLUENT TSS

Month	30-day Average, lbs/day
NPDES Permit Limit	**7,138**
Jan-14	1,412
Feb-14	1,077
Mar-14	765
Apr-14	2,602
May-14	2,357
Jun-14	909
Jul-14	913
Aug-14	620
Sep-14	882
Oct-14	940
Nov-14	867
Dec-14	567
Jan-15	587
Feb-15	5,576
Mar-15	845
Apr-15	1,784
May-15	861
Average	**1,386**
Maximun	**5,576**

TABLE 5
ROQUETTE EFFLUENT AMMONIA AS N

Month	30-day Average, lbs/day	30-day Average, mg/L
Jan-14	22	0.6
Feb-14	247	8.9
Mar-14	41	1.0
Apr-14	10	0.2
May-14	57	1.2
Jun-14	97	2.3
Jul-14	138	3.0
Aug-14	155	3.3
Sep-14	225	5.1
Oct-14	51	0.9
Nov-14	39	0.9
Dec-14	54	1.2
Jan-15	58	1.2
Feb-15	106	2.5
Mar-15	12	0.3
Apr-15	86	1.9
May-15	26	0.6
Average	**87**	**2.2**
Maximum	**247**	**8.9**

TABLE 6

ROQUETTE EFFLUENT NITRATE as N, mg/l

Month	Average, mg/L
Jan-14	2.2
Feb-14	2.9
Mar-14	2.7
Apr-14	15.0
May-14	3.7
Jun-14	9.0
Jul-14	2.8
Aug-14	0.7
Sep-14	-
Oct-14	2.8
Nov-14	-
Dec-14	0.4
Jan-15	-
Feb-15	4.7
Mar-15	<0.10
Apr-15	1.0
May-15	-
Average	**4.0**
Maximum	**15.0**