Emerald Performance Materials

Emerald Performance Materials
1550 County Road 1450 N
Henry, Illinois 61537
309-364-2311

CERTIFIED MAIL: 7010 3090 0003 0728 0020

September 23, 2011

Illinois Environmental Protection Agency
Bureau of Water
Compliance Assurance Section
1021 North Grand Avenue East
Post Office Box 19276
Springfield, Illinois 62794-9276

Re: NPDES Biomonitoring Results- NPDES Permit No. IL0001392-1

Dear Sirs:

In accordance with special condition number 14 of NPDES permit No. IL0001392-1 issued to Emerald Performance Materials and PolyOne Corporation, attached please find the analytical results of the sampling completed in accordance with the letter from Emerald Performance Materials (Mr. Mike Strabley) to your office dated April 16, 2011. Analytical results for the biomonitoring samples scheduled to be collected in October 2011 and January 2012 will be submitted within one week of receipt from the analytical laboratory.

If you have any questions or need addition information, please contact Jim Hastings at (309)364-9479 or myself at (330) 916-6701.

Sincerely,
EMERALD PERFORMANCE MATERIALS, LLC

Brenda Abke

Brenda Abke
Director, HSE&S

Attachments: PDC Laboratories, Inc. Analytical Data Report dated 07/15/11 (sample #1061342-01)
PDC Laboratories, Inc. Analytical Data Report dated 08/31/11 (sample #1072876-01 and 1072876-02)

cc: Jim Hastings, General Foreman, Emerald Performance Materials, Henry IL
Todd Huson, IEPA-Regional Office
John McKinley, PolyOne Corporation, Henry IL

PETITIONER'S HEARING EXHIBIT
AS 19-002
8

PDC Laboratories, Inc.
P.O. Box 9071 • Peoria, IL 61612-9071
(309) 692-9688 • (800) 752-6651 • FAX (309) 692-9689

ACCREDITED IN ACCORDANCE WITH nelac

Emerald Performance Materials
1550 County Rd 1450 N
Henry, IL 61537
Attn: Jim Hastings

Date Received: 06/14/11 8:15
Report Date: 07/15/11
Customer #: 202011
PO#: HE-40014063-UB

Sample No: **1061342-01**
Sample Description: **PLANT**

Collect Date: **06/13/11 17:30**
Matrix: **Waste Water Grab**

Parameters	Result	Qual	Analysis Date	Analyst	Method
Miscellaneous - Environmental Analysis South					
WET Testing Single Dilution - subcontracted	See Attached		06/15/11 00:00	Subco	Subcontracted

1061342

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Emerald Performance Materials
1550 County Rd 1450 N
Henry, IL 61537
Attn: Jim Hastings

Date Received: 06/14/11 8:15
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Customer #: 202011
PO#: HE-40014063-UB

Notes

This report shall not be reproduced, except in full, without the written approval of the laboratory.

PDC Laboratories participates in the following accreditation/certification and proficiency programs at the following locations. Endorsement by Federal or State Governments or their agencies is not implied.

PIA PDC Laboratories - Peoria, IL
NELAC Accreditation for Drinking Water, Wastewater, Hazardous and Solid Wastes Fields of Testing through IL EPA Lab No. 100230
Illinois Department of Public Health Bacteriological Analysis in Drinking Water Approved Laboratory Registry No. 17553
Drinking Water Certifications: Kansas (E-10338); Missouri (870); Wisconsin (998284430); Indiana (C-IL-040); Iowa (240)
Wastewater Certifications: Arkansas (88-0677); Wisconsin (998284430); Iowa (240); Kansas (E-10335)
Hazardous/Solid Waste Certifications; Arkansas (88-0677); Wisconsin (998284430); Iowa (240); Kansas (E-10335)
UST Certification; Iowa (240)
SPM PDC Laboratories - Springfield, MO
EPA DMR-QA Program
STL PDC Laboratories - St. Louis, MO
NELAC Accreditation for Wastewater, Hazardous and Solid Wastes Fields of Testing through KS EPA Lab No. E-10389

Certified by: Kurt C. Stepping, Senior Project Manager

1061342

Electronic Filing: Received, Clerk's Office 04/03/2019 **AS 2019-002**

PDC LABORATORIES, INC.
2231 WEST ALTORFER DRIVE
PEORIA, IL 61615

PHONE # 800-752-6651
FAX # 309-692-9689

State where samples collected ______

CHAIN OF CUSTODY RECORD

ALL HIGHLIGHTED AREAS MUST BE COMPLETED BY CLIENT (PLEASE PRINT) - (SAMPLE ACCEPTANCE POLICY ON REVERSE)

(1) CLIENT: EMERALD PERFORMANCE
ADDRESS: 1550 CR 1450 N
CITY / STATE: HENRY IL
CONTACT PERSON: MIKE STRABLEY

PROJECT NUMBER:
P.O. NUMBER:
MEANS SHIPPED: COURIER
PHONE NUMBER:
FAX NUMBER:
DATE SHIPPED: 6/14/11
SAMPLER: MIKE STRABLEY
(signature, date)

MATRIX TYPES: WW-WASTEWATER, DW-DRINKING WATER, GW-GROUND WATER, WWSL-SLUDGE, NAS-SOLID, LCHT-LEACHATE, OTHER:

(3) ANALYSIS REQUESTED: WET TESTING

(4) (FOR LAB USE ONLY)
LOGIN: 1106342-2
LOGGED BY:
LAB PROJ. #:
TEMPLATE:
PROJ. MGR.:

(2) SAMPLE DESCRIPTION	DATE COLLECTED	TIME COLLECTED	GRAB	COMP	MATRIX TYPE	BOTTLE COUNT	WET TESTING	REMARKS
WET TESTING	6/13	1730	X		WW	2	X	
* Plant	6/13	1						
* River H2O	1	1						

(5) TURNAROUND TIME REQUESTED (PLEASE CIRCLE) NORMAL RUSH DATE RESULTS NEEDED
(RUSH TAT IS SUBJECT TO PDC LABS APPROVAL AND SURCHARGE)
RUSH RESULTS VIA (PLEASE CIRCLE) FAX PHONE E-MAIL
FAX # PHONE # EMAIL ADDRESS

(6) The sample temperature will be measured upon receipt at the lab. By initialing this area you request that the lab notify you, before proceeding with analysis, if the sample temperature is outside of the range of 0.1-6.0°C. By not initialing this area you allow the lab to proceed with analytical testing regardless of the sample temperature.

(7) RELINQUISHED BY: (SIGNATURE) [signature] DATE TIME
RECEIVED BY: (SIGNATURE) [signature] DATE 6/14/11 TIME 230
RELINQUISHED BY: (SIGNATURE) [signature] DATE 6/14/11 TIME 3:15
RECEIVED BY: (SIGNATURE) DATE TIME
RELINQUISHED BY: (SIGNATURE) DATE TIME
RECEIVED AT LAB BY: (SIGNATURE) [signature] DATE 6/14/11 TIME

(8) COMMENTS: (FOR LAB USE ONLY) * Taken from bottles
SAMPLE TEMPERATURE UPON RECEIPT ___ °C
CHILL PROCESS STARTED PRIOR TO RECEIPT Y OR N
SAMPLE(S) RECEIVED ON ICE Y OR N
PROPER BOTTLES RECEIVED IN GOOD CONDITION Y OR N
BOTTLES FILLED WITH ADEQUATE VOLUME Y OR N
SAMPLES RECEIVED WITHIN HOLD TIME(S) Y OR N
(EXCLUDES TYPICAL FIELD PARAMETERS)
DATE AND TIME TAKEN FROM SAMPLE BOTTLE

PAGE ___ OF ___

Copies: white should accompany samples to PDC Labs. Yellow copy to be retained by the client.

EP002842

PDC LABORATORIES, INC.
2231 WEST ALTORFER DRIVE PHONE # 309-692-9688
PEORIA, IL 61615 FAX # 309-692-9589

CHAIN OF CUSTODY RECORD

State where samples collected IL

ALL HIGHLIGHTED AREAS MUST BE COMPLETED BY CLIENT (PLEASE PRINT)

(1) CLIENT: EMERALD MATERIALS
ADDRESS: RR 1 BOX 15
CITY STATE ZIP: HENRY, IL
CONTACT PERSON: JIM HASTINGS

PROJECT NUMBER:
P.O. NUMBER:
MEANS SHIPPED:
PHONE NUMBER: 309/364-8411
FAX NUMBER: 309/364-8414
DATE SHIPPED: 6-16-11
SAMPLER (PLEASE PRINT): Randy Simpson
SAMPLER'S SIGNATURE: [signature]

MATRIX TYPES: WW- WASTEWATER, DW- DRINKING WATER, GW- GROUND WATER, WWSL- SLUDGE, NAS- SOLID, LCHT- LEACHATE, OTHER:

(3) ANALYSIS REQUESTED

(4) (FOR LAB USE ONLY)
LOGIN # 106312-04
LOGGED BY: [initials]
LAB PROJ. #
TEMPLATE: EMRLD_DAY
PROJ. MGR.: EAK

(2) SAMPLE DESCRIPTION AS YOU WANT ON REPORT

Sample Description	Date Collected	Time Collected	Grab	Comp	Matrix Type	Bottle Count	BOD	SS	NH3	Remarks
PRIMARY EFFLUENT	6-16-11	0030	X		WW	1	X			
PLANT EFFLUENT	6-16-11	0030		X	WW	2	X	X	X	
Plant Effluent	6-16-11	0030	X			1				
UPSTream River H2o	6-15	1900				1				

(5) TURNAROUND TIME REQUESTED (PLEASE CIRCLE) NORMAL RUSH
(RUSH TAT IS SUBJECT TO PDC LABS APPROVAL AND SURCHARGE)
RUSH RESULTS VIA (PLEASE CIRCLE) FAX PHONE
FAX # IF DIFFERENT FROM ABOVE:
PHONE # IF DIFFERENT FROM ABOVE:
DATE RESULTS NEEDED:

(6) The sample temperature will be measured upon receipt at the lab. By initialing ___ this area you request that the lab notify you, before proceeding with analysis, if the sample temperature is outside of the range of 0.1-6.0°C. By not initialing ___ this area you allow the lab to proceed with analytical testing regardless of the sample temperature.

(7)

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Date / Time
[signature]	6-16-11 / 0030	[signature]	6/16/11 / 700
		[signature]	6-16-11 / 1245

(8) COMMENTS: (FOR LAB USE ONLY)

SAMPLE TEMPERATURE UPON RECEIPT 2 °C
CHILL PROCESS STARTED PRIOR TO RECEIPT Y OR N
SAMPLE(S) RECEIVED ON ICE Y OR N
PROPER BOTTLES RECEIVED IN GOOD CONDITION Y OR N
BOTTLES FILLED WITH ADEQUATE VOLUME Y OR N
SAMPLES RECEIVED WITHIN HOLD TIME(S) (EXCLUDES TYPICAL FIELD PARAMETERS) Y OR N
DATE AND TIME TAKEN FROM SAMPLE BOTTLE

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EP002843

Environmental Analysis South, Inc.
4000 East Jackson Blvd • Jackson, MO 63755 • 573-204-8817 • Fax 573-204-8818

eas

REPORT OF ACUTE TOXICITY TESTING
City of Emerald, IL
Plant Effluent, AEC = 100%

EAS LOG# 1311712
June 15, 2011 through June19, 2011

Tests performed by:
John P. Clippard / Chemical Analyst at Environmental Analysis South (EAS)
Kelly J. Ray / Biologist at Environmental Analysis South (EAS)
Sara C. Shields / Lab Supervisor - Chemist at Environmental Analysis South (EAS)
David F. Warren / Lab Director - Chemist at Environmental Analysis South (EAS)

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REPORT OF ACUTE TOXICITY TESTING
City of Emerald, IL
Plant Effluent, AEC = 100%

EAS LOG# 1311712
June 15, 2011 through June19, 2011

1. **REPORT SUMMATION:**

1.1. Multiple Dilution Data Summation

Test Solution	*Pimephales promelas* Acute Toxicity Test 96 Hour Survival	*Ceriodaphnia dubia* Acute Toxicity Test 48 Hour Survival
Reconstituted Control (RC)	100%	100%
Upstream Control (UC)	100%	100%
6.25% Effluent	90%	100%
12.5% Effluent	0%*	35%*
25% Effluent	0%*	0%*
50% Effluent	0%*	0%*
100% Effluent	0%*	0%*
Estimated LC_{50} Value	8.50% Effluent	11.27% Effluent

* Indicates a significant difference at alpha = 0.5 between effluent and control survival data.

Conclusion:

Pimephales promelas 96 hour WET results: LC 50 =8.50% using Trimmed Spearman-Karber
NOAEC = 6.25% using Steel's Many-One Rank Test

Ceriodaphnia dubia 48 hour WET results: LC 50 =11.27% using Trimmed Spearman-Karber
NOAEC = 6.25% using Steel's Many-One Rank Test

Approved by ____________________
Sara C. Shields, Chemist

Environmental Analysis South, Inc.

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REPORT OF ACUTE TOXICITY TESTING
City of Emerald, IL
Plant Effluent, AEC = 100%

EAS LOG# 1311712
June 15, 2011 through June19, 2011

2. TEST METHOD SUMMARY

2.1. TEST CONDITIONS AND METHODS:

	Ceriodaphnia dubia:	*Pimephales promelas:*
Test duration:	48 hours	96 hours
Temperature:	24 - 26 degree Celsius	24 - 26 degree Celsius
Light quality:	Ambient laboratory illumination	Ambient laboratory illumination
Photoperiod:	16 hour light, 8 hours dark	16 hour light, 8 hours dark
Control Water:	Moderately Hard Reconstituted Water	Moderately Hard Reconstituted Water
Dilution Water:	Upstream Water - If unavailable or toxic, then control water will be used.	Upstream Water - If unavailable or toxic, then control water will be used.
Size of test vessel:	30 milliliters	250 milliliters
Volume of test solution:	15 milliliters	200 milliliters
Age of test organisms:	<24 hours	1 -14 days (all same age)
Number of organisms/test vessel:	5	10
Number of replicates/concentration:	4	2
Number of organisms/concentration:	20	40 for a single dilution test and 20 for a multiple dilution test
Feeding regime:	None (fed prior to test)	None (fed prior to test)
Aeration:	None	None
Test acceptability criterion:	90% or greater survival in controls	90% or greater survival in controls

The methodology used for the chemistry data was taken from the *Standard Methods for the Examination of Water and Wastewater*, 18th edition (1992). The exception was hardness, which was determined using a Hach EDTA titration test kit. The toxicity tests follow guidelines laid out in the permittee's NPDES permit and were conducted according to EPA approved methods (USEPA 2002).

All test organisms were cultured according to EPA approved methods (USEPA 2002). The *Ceriodaphnia dubia* and the *Pimephales promelas* were obtained from C-K Associates Inc. located in Baton Rouge, Louisiana and shipped overnight for use in the whole effluent toxicity test.

Environmental Analysis South, Inc.
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REPORT OF ACUTE TOXICITY TESTING
City of Emerald, IL
Plant Effluent, AEC = 100%

EAS LOG# 1311712
June 15, 2011 through June19, 2011

2.2. REFERENCE TOXICITY TEST:

Environmental Analysis South performs monthly reference toxicity tests. The most recent reference test was initiated on June 8, 2011 using KCL Lot #41713. Following are the results:

2.2.1. ***P. promelas*** - 48 hr. Acute Test – LC_{50} = 1.071 g/l 95%CI (0.736-1.405 g/l)
EAS %CV = 15.6%
National Warning Limits (75^{th} percentile) = 19%CV
National Control Limits (90^{th} percentile) = 33%CV

2.2.2. ***C. dubia*** - 48 hr. Acute Test – LC_{50} = 0.467 g/l 95%CI (0.303-0.631g/l)
EAS %CV = 17.5%
National Warning Limits (75^{th} percentile) = 29%CV
National Control Limits (90^{th} percentile) = 34%CV

2.3. LITERATURE CITED:

1. APHA. 1992. *Standard methods for the examination of water and wastewater*, 18th Ed. American Public Health Association, Washington, D.C
2. USEPA. 2002. *Methods for measuring the acute toxicity of effluents and receiving waters to freshwater and marine organisms*, 5th Ed. EPA-821-R-02-012
3. USEPA 2000. Understanding and Accounting for Method Variability in Whole Effluent Toxicity Applications under the National Pollutant Discharge Elimination System, (Table B-2). June 2000. EPA 833-R-00-003.

WHOLE EFFLUENT TEST conducted in accordance with US EPA 600/4-90/027
Fifth Edition October 2002

CLIENT NAME:	City of Emerald, IL (Plant)
NPDES NUMBER:	
TYPE OF METHOD:	multiple dilution, 96 hrs PP & 48 CD, AEC=100%
DATE & TIME OF COLLECTION:	06/13/11 1730 hrs
DATE & TIME OF SUBMISSION:	06/15/11 1030 hrs by UPS

Upstream: River
Collected: 06/13/11 1730 hrs

INITIAL OBSERVATIONS	DATE	TIME	ANALYST	QC LOT	QC EXP VALUE	INT EFFL	INT UC	INT RC
LOG NUMBER / ID NUMBER	[redacted]					1311712	1311712A	4014
pH - SU	06/15/11	1045 hrs	SCS	SB114 (8.8-9.2)	9.08	7.68	7.60	7.93
TEMPERATURE °C RECEIVED	06/15/11	1045 hrs	SCS	EAS 106		2	3	24
SPECIFIC CONDUCTANCE umhos	06/15/11	1045 hrs	SCS	ERA P185-506(359-407)	388	12730	546	239
HARDNESS - ppm	06/15/11	1045 hrs	SCS	ERA P170-507(107-134)	120	280	200	80
CHLORINE - ppm	06/15/11	1045 hrs	SCS	tap water	+	<0.04	<0.04	<0.04
DISSOLVED OXYGEN - ppm	06/15/11	1045 hrs	SCS	cal@840		6	7.6	8.3
TOTAL ALKALINITY - ppm	06/15/11	1230 hrs	SCS	ERA P185-506(70.8-83.7)	74.4	406	141	61.7
INITIAL AMMONIA - ppm	06/21/11	1245 hrs	JPC	EAS #1981 (8-12)	10.4	85	0.087	<0.050
TOTAL DISSOLVED SOLIDS -ppm								

0 HOUR OBSERVATIONS	DATE	TIME	ANALYST	QC LOT	QC EXP VALUE	RC	UC	100%	50%	25%	12.50%	6.25%	X %AEC
pH - SU	06/15/11	1100 hrs	SCS	SB114 (8.8-9.2)	9.08	7.96	7.95	7.76	7.83	7.90	7.94	7.96	
TEMPERATURE °C	06/15/11	1100 hrs	SCS	EAS 106		24.4	23.6	23.7	23.6	24.5	24.5	23.6	
SPECIFIC CONDUCTANCE umhos	06/15/11	1100 hrs	SCS	ERA P185-506(359-407)	388	240	546	12340	6260	3690	2090	1326	
DISSOLVED OXYGEN - ppm	06/15/11	1100 hrs	SCS	cal@840		7.7	9.0	7.8	8.7	8.9	9.1	9.0	

24 HOUR OBSERVATIONS - PP	DATE	TIME	ANALYST	QC LOT	QC EXP VALUE	RC	UC	100%	50%	25%	12.50%	6.25%	X %AEC
pH - SU	06/16/11	1100 hrs	SCS	SB114 (8.8-9.2)	9.06	7.66	8.40	8.30	8.37	8.40	8.41	8.42	
TEMPERATURE °C	06/16/11	1100 hrs	SCS	EAS 106		24.4	24.4	24.4	24.4	24.4	24.4	24.4	
SPECIFIC CONDUCTANCE umhos	06/16/11	1100 hrs	SCS	ERA P185-506(359-407)	393	267	549	12070	6590	3670	2100	1312	
DISSOLVED OXYGEN - ppm	06/16/11	1100 hrs	SCS	cal@840		7.6	7.7	7	7.4	7.8	7.8	7.9	

48 HOUR OBSERVATIONS - PP	DATE	TIME	ANALYST	QC LOT	QC EXP VALUE	RC	UC	100%	50%	25%	12.50%	6.25%	X %AEC
pH - SU	06/17/11	1100 hrs	SCS	SB114 (8.8-9.2)	8.95	7.61	8.34	8.52	8.51	8.39	8.41	8.38	
TEMPERATURE °C	06/17/11	1100 hrs	SCS	EAS 106		24.4	24.4	24.4	24.4	24.4	24.4	24.4	
SPECIFIC CONDUCTANCE umhos	06/17/11	1100 hrs	SCS	ERA P185-506(359-407)	371	265	552	12130	6580	3680	2120	1315	
DISSOLVED OXYGEN - ppm	06/17/11	1100 hrs	SCS	cal@840		7.5	7.1	7.1	6.9	6.9	7.1	6.9	
FINAL AMMONIA - ppm													

24 HOUR OBSERVATIONS - CD	DATE	TIME	ANALYST	QC LOT	QC EXP VALUE	RC	UC	100%	50%	25%	12.50%	6.25%	X %AEC
pH - SU	06/16/11	1100 hrs	SCS	SB114 (8.8-9.2)	9.06	8.00	8.53	8.56	8.57	8.57	8.57	8.55	
TEMPERATURE °C	06/16/11	1100 hrs	SCS	EAS 106		24.4	24.4	24.4	24.4	24.4	24.4	24.4	
SPECIFIC CONDUCTANCE umhos	06/16/11	1100 hrs	SCS	ERA P185-506(359-407)	394	253	534	12100	6440	3640	2080	1289	
DISSOLVED OXYGEN - ppm	06/16/11	1100 hrs	SCS	cal@840		7.9	8.1	8.3	8.3	8.3	8.2	8.2	

48 HOUR OBSERVATIONS - CD	DATE	TIME	ANALYST	QC LOT	QC EXP VALUE	RC	UC	100%	50%	25%	12.50%	6.25%	X %AEC
pH - SU	06/17/11	1100 hrs	SCS	SB114 (8.8-9.2)	8.95	8.60	8.52	8.72	8.70	8.64	8.59	8.57	
TEMPERATURE °C	06/17/11	1100 hrs	SCS	EAS 106		24.4	24.4	24.4	24.4	24.4	24.4	24.4	
SPECIFIC CONDUCTANCE umhos	06/17/11	1100 hrs	SCS	ERA P185-506(359-407)	371	268	540	11900	6420	3610	2070	1282	
DISSOLVED OXYGEN - ppm	06/17/11	1100 hrs	SCS	cal@840		7.5	8.1	7.6	7.9	7.8	7.8	8.1	
FINAL AMMONIA - ppm													

Page 9 of 15

Approved by: [signature]

Date: 06/30/2011

WHOLE EFFLUENT TEST conducted in accordance with US EPA 600/4-90/027
Fifth Edition October 2002

CLIENT NAME:	City of Emerald, IL (Plant)
NPDES NUMBER:	
TYPE OF METHOD:	multiple dilution, 96 hrs PP & 48 CD, AEC=100%
DATE & TIME OF COLLECTION:	06/16/11 0030 hrs by City of Emerald
DATE & TIME OF SUBMISSION:	06/17/11 1030 hrs by UPS

Upstream: River
Collected: 06/15/11 1900 hrs by City of Emerald

INITIAL OBSERVATIONS	DATE	TIME	ANALYST	QC LOT	QC EXP VALUE	INT EFFL	INT UC	INT RC
LOG NUMBER / ID NUMBER	[redacted]					1311920	1311920A	RC4014
pH - SU	06/17/11	1045 hrs	JPC	SB114 (8.8-9.2)	8.95	7.61	7.76	7.93
TEMPERATURE °C RECEIVED	06/17/11	1045 hrs	JPC	EAS 106		1	1	24
SPECIFIC CONDUCTANCE umhos	06/17/11	1045 hrs	JPC	ERA P185-506(359-407)	371	13330	624	239
HARDNESS - ppm	06/17/11	1045 hrs	JPC	ERA P170-507(107-134)	120	340	260	80
CHLORINE - ppm	06/17/11	1045 hrs	JPC	tap water	+	<.04	<.04	<0.04
DISSOLVED OXYGEN - ppm	06/17/11	1045 hrs	JPC	cal@840		6.7	7.1	8.3
TOTAL ALKALINITY - ppm	06/22/11	1200 hrs	SCS	Q029-506 (35.4-48.1)	37.6	460	148	52.8
INITIAL AMMONIA - ppm	06/21/11	1245 hrs	JPC	EAS #1981 (8-12)	10.4	88.8	<0.050	<0.050
TOTAL DISSOLVED SOLIDS -ppm								

0 HOUR OBSERVATIONS	DATE	TIME	ANALYST	QC LOT	QC EXP VALUE	RC	UC	100%	50%	25%	12.50%	6.25%	X %AEC
pH - SU	06/17/11	1200 hrs	SCS	SB114 (8.8-9.2)	8.95	8.02	8.06				7.96	8.00	
TEMPERATURE °C	06/17/11	1200 hrs	SCS	EAS 106		24.2	24.2				24.2	24.2	
SPECIFIC CONDUCTANCE umhos	06/17/11	1200 hrs	SCS	ERA P185-506(359-407)	371	263	621				2370	1464	
DISSOLVED OXYGEN - ppm	06/17/11	1200 hrs	SCS	cal@840		7.3	7.9				7.7	7.5	

72 HOUR OBSERVATIONS - PP	DATE	TIME	ANALYST	QC LOT	QC EXP VALUE	RC	UC	100%	50%	25%	12.50%	6.25%	X %AEC
pH - SU	06/18/11	1200 hrs	SCS	SB114 (8.8-9.2)	9.07	7.57	8.06				8.30	8.18	
TEMPERATURE °C	06/18/11	1200 hrs	SCS	EAS 106		24.2	24.2				24.2	24.2	
SPECIFIC CONDUCTANCE umhos	06/18/11	1200 hrs	SCS	ERA P185-506(359-407)	370	255	621				2430	1484	
DISSOLVED OXYGEN - ppm	06/18/11	1200 hrs	SCS	cal@840		7.9	7.9				7.6	7.6	

96 HOUR OBSERVATIONS - PP	DATE	TIME	ANALYST	QC LOT	QC EXP VALUE	RC	UC	100%	50%	25%	12.50%	6.25%	X %AEC
pH - SU	06/19/11	1200 hrs	SCS	SB114 (8.8-9.2)	9.07	7.72	8.31				8.45	8.35	
TEMPERATURE °C	06/19/11	1200 hrs	SCS	EAS 106		24.4	24.4				24.4	24.4	
SPECIFIC CONDUCTANCE umhos	06/19/11	1200 hrs	SCS	ERA P185-506(359-407)	399	261	641				2440	1491	
DISSOLVED OXYGEN - ppm	06/19/11	1200 hrs	SCS	cal@840		7.6	7.6				7.5	7.6	
FINAL AMMONIA - ppm													

Approved by: [signature]

Date: 06/30/2011

WHOLE EFFLUENT TEST conducted in accordance with US EPA 600/4-90/027
Fifth Edition October 2002

City of Emerald, IL (Plant) EAS LOG# 1311712

Date Test Began: June 15, 2011
Time Test Began: 1100 hrs

Date Test Finished: 06/19/11PP&06/17/11CD
Time Test Finished: 1200 hrs

Analyst 1: DFW
Analyst 2: KJR
Analyst 3: SCS

P. promelas (PP) AGE: 5 days HATCH NUMBER: 8636 c-k

	RC	UC	100%	50%	25%	12.50%	6.25%	X% AEC
PERIOD	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE
0 HR-PP	10,10	10,10	10,10	10,10	10,10	10,10	10,10	
24 HR-PP	10,10	10,10	0,0	0,0	0,0	10,10	10,10	
48 HR-PP	10,10	10,10	0,0	0,0	0,0	1,0	10,10	

Ceriodaphnia dubia (CD) AGE: <24 hours HATCH NUMBER: 2338 c-k

	RC	UC	100%	50%	25%	12.50%	6.25%	X% AEC
PERIOD	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE
0 HR-CD	5,5,5,5	5,5,5,5	5,5,5,5	5,5,5,5	5,5,5,5	5,5,5,5	5,5,5,5	
24 HR-CD	5,5,5,5	5,5,5,5	0,0,0,0	0,0,0,0	5,2,5,2	5,5,5,5	5,5,5,5	
48 HR-CD	5,5,5,5	5,5,5,5	0,0,0,0	0,0,0,0	0,0,0,0	3,1,0,3	5,5,5,5	

Approved by: [signature]

Date: 06/30/2011

WHOLE EFFLUENT TEST conducted in accordance with US EPA 600/4-90/027
Fifth Edition October 2002

City of Emerald, IL (Plant) EAS LOG# 1311712

Date Test Began: June 15, 2011
Date Test Finished: 06/19/11PP&06/17/11CD

Time Test Began: 1100 hrs
Time Test Finished: 1200 hrs

Analyst 1: DFW
Analyst 2: KJR
Analyst 3: SCS

P. promelas (PP) AGE: 5 days HATCH NUMBER: 8636 c-k

	RC	UC	100%	50%	25%	12.50%	6.25%	X% AEC
PERIOD	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE
48 HR-PP	10,10	10,10	0,0	0,0	0,0	1,0	10,10	
72 HR-PP	10,10	10,10	0,0	0,0	0,0	1,0	10,10	
96 HR-PP	10,10	10,10	0,0	0,0	0,0	0,0	9,9	

Approved by: [signature]

Date: 06/20/2011

City of Emerald, IL (Plant) EAS#: 1311712

Notes & Comments

Prepared by: [signature]

Date: 06/30/2011

multiple Glenn, IL

11366

SUBCONTRACT ORDER

PDC Laboratories, Inc.

1061342

SENDING LABORATORY:

PDC Laboratories, Inc.
2231 W. Altorfer Drive
Peoria, IL 61615

Project Manager: Kurt C. Stepping
kstepping@pdclab.com Phone: 309-683-1719

RECEIVING LABORATORY:

Environmental Analysis South
4000 East Jackson Blvd
Jackson, MO 63755
Phone :573-204-8817

Sample Origin (State) IL

PO# L 40681

Analysis	Due	Expires	Comments
Sample ID: 1061342-01	**Water**	**Sampled:06/13/11 17:30**	Plant **1311712** temp rec'd = 3°C
01-Wet Single	06/24/11 16:00	06/15/11 17:30	
Sample ID: 1061342-02	**Water**	**Sampled:06/13/11 17:30**	River **1311712** A temp rec'd 3°C
01-Wet Single	06/24/11 16:00	06/15/11 17:30	SS

Relinquished By	Date/Time	Received By	Date/Time
[signature]	6-14-11 10:00		
[signature]		[signature]	6/15/11 1030 UPS

Sample Temperature Upon Receipt	____ C
Sample(s) Received on Ice	Y or N
Proper Bottles Received in Good Condition	Y or N
Bottles Filled with Adequate Volume	Y or N
Samples Received Within Hold Time	Y or N
Date/Time Taken From Sample Bottle	Y or N

reviewed for 1311712

~~SUBCONTRACT ORDER~~

PDC Laboratories, Inc.

1061342

SENDING LABORATORY:	**RECEIVING LABORATORY:**
PDC Laboratories, Inc. 2231 W. Altorfer Drive Peoria, IL 61615 Project Manager: Kurt C. Stepping kstepping@pdclab.com Phone: 309-683-1719	Environmental Analysis South 4000 East Jackson Blvd Jackson, MO 63755 Phone :573-204-8817 Sample Origin (State) IL PO# L40681

Analysis	Due	Expires	Comments
Sample ID: 1061342-01	**Water**	**Sampled:06/13/11 17:30**	Sent 6-14-11
01-Wet Single	06/24/11 16:00	06/15/11 17:30	
Sample ID: 1061342-02	**Water**	**Sampled:06/13/11 17:30**	Sent 6-14-11
01-Wet Single	06/24/11 16:00	06/15/11 17:30	
Sample ID: 1061342-03	**Water**	**Sampled:06/16/11 00:30**	Plant # **1311920** temp rec'd=1°C SCS
01-Wet Single	06/24/11 16:00	06/18/11 00:30	
Sample ID: 1061342-04	**Water**	**Sampled:06/15/11 19:00**	Upstream # **1311920-A** temp rec'd=1°C SCS
01-Wet Single	06/24/11 16:00	06/17/11 19:00	

Relinquished By	Date/Time	Received By	Date/Time
[signature]	6-16-11 13:52		
Relinquished By	Date/Time	Received By	Date/Time
		[signature]	6/17/11 1030 UPS

Sample Temperature Upon Receipt	1.3 C
Sample(s) Received on Ice	(Y) or N
Proper Bottles Received in Good Condition	(Y) or N
Bottles Filled with Adequate Volume	(Y) or N
Samples Received Within Hold Time	(Y) or N
Date/Time Taken From Sample Bottle	(Y) or N

EP002854

PDC Laboratories, Inc.
P.O. Box 9071 • Peoria, IL 61612-9071
(309) 692-9688 • (800) 752-6651 • FAX (309) 692-9689

ACCREDITED IN ACCORDANCE WITH nelac

Emerald Performance Materials
1550 County Rd 1450 N
Henry, IL 61537
Attn: Jim Hastings

Date Received: 07/26/11 11:49
Report Date: 08/31/11
Customer #: 202011
PO#: HE-40014063-UB

Sample No: **1072876-01**
Sample Description: **UPSTREAM**

Collect Date: **07/25/11 16:00**
Matrix: **Waste Water Regular Sample**

Parameters	Result	Qual	Analysis Date	Analyst	Method
Miscellaneous - Environmental Analysis South					
WET Testing Single Dilution - subcontracted	1		07/25/11 00:00	Subco	Subcontracted

Sample No: **1072876-02**
Sample Description: **EFFLUENT**

Collect Date: **07/25/11 16:00**
Matrix: **Waste Water Regular Sample**

Parameters	Result	Qual	Analysis Date	Analyst	Method
Miscellaneous - Environmental Analysis South					
WET Testing Single Dilution - subcontracted	1		07/25/11 00:00	Subco	Subcontracted

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ACCREDITED IN ACCORDANCE WITH nelac

Emerald Performance Materials
1550 County Rd 1450 N
Henry, IL 61537
Attn: Jim Hastings

Date Received: 07/26/11 11:49
Report Date: 08/31/11
Customer #: 202011
PO#: HE-40014063-UB

Notes

This report shall not be reproduced, except in full, without the written approval of the laboratory.

PDC Laboratories participates in the following accreditation/certification and proficiency programs at the following locations. Endorsement by Federal or State Governments or their agencies is not implied.

PIA PDC Laboratories - Peoria, IL
NELAC Accreditation for Drinking Water, Wastewater, Hazardous and Solid Wastes Fields of Testing through IL EPA Lab No. 100230
Illinois Department of Public Health Bacteriological Analysis in Drinking Water Approved Laboratory Registry No. 17553
Drinking Water Certifications: Kansas (E-10338); Missouri (870); Wisconsin (998284430); Indiana (C-IL-040); Iowa (240)
Wastewater Certifications: Arkansas (88-0677); Wisconsin (998284430); Iowa (240); Kansas (E-10335)
Hazardous/Solid Waste Certifications; Arkansas (88-0677); Wisconsin (998284430); Iowa (240); Kansas (E-10335)
UST Certification; Iowa (240)
SPM PDC Laboratories - Springfield, MO
EPA DMR-QA Program
STL PDC Laboratories - St. Louis, MO
NELAC Accreditation for Wastewater, Hazardous and Solid Wastes Fields of Testing through KS EPA Lab No. E-10389

WET analysis subcontracted, report attached.

Certified by: Kurt C. Stepping, Senior Project Manager

1072876

PDC LABORATORIES, INC.
2231 WEST ALTORFER DRIVE
PEORIA, IL 61615

PHONE # 800-752-6651
FAX # 309-692-9689

CHAIN OF CUSTODY RECORD

State where samples collected ____________

ALL HIGHLIGHTED AREAS MUST BE COMPLETED BY CLIENT (PLEASE PRINT) - (SAMPLE ACCEPTANCE POLICY ON REVERSE)

(1) CLIENT: EMERALD
ADDRESS: 1530 CR 1450 N
CITY / STATE / ZIP: HENRY IL
CONTACT PERSON: MIKE STRABLEY

PROJECT NUMBER	P.O. NUMBER	MEANS SHIPPED
		COURIER
PHONE NUMBER	**FAX NUMBER**	**DATE SHIPPED**

SAMPLER (PLEASE PRINT): MIKE STRABLEY
SAMPLER'S SIGNATURE:

MATRIX TYPES:
WW-WASTEWATER
DW-DRINKING WATER
GW-GROUND WATER
WWSL-SLUDGE
NAS-SOLID
LCHT-LEACHATE
OTHER: ________

(3) ANALYSIS REQUESTED: WET TESTING; FECAL

(4) (FOR LAB USE ONLY)
LOGIN: 1072874-2
LOGGED BY: [illegible]
LAB PROJ. #: [illegible]
TEMPLATE: ________
PROJ. MGR.: ________

(2)

[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	MATRIX TYPE	BOTTLE COUNT	WET TESTING	FECAL							REMARKS
WET TESTING		7/25	1600	1	1	WW	2	X								
MONTHLY FECAL TESTING 2		7-26	0600		1	WW	1		X							
upstream	NP															
effluent	NP															

(5) TURNAROUND TIME REQUESTED (PLEASE CIRCLE) NORMAL RUSH DATE RESULTS NEEDED
(RUSH TAT IS SUBJECT TO PDC LABS APPROVAL AND SURCHARGE)
RUSH RESULTS VIA (PLEASE CIRCLE) FAX PHONE E-MAIL
FAX # PHONE # EMAIL ADDRESS

(6) *The sample temperature will be measured upon receipt at the lab. By initialing this area you request that the lab notify you, before proceeding with analysis, if the sample temperature is outside of the range of 0.1-6.0°C. By not initialing this area you allow the lab to proceed with analytical testing regardless of the sample temperature.*

(7)

RELINQUISHED BY: (SIGNATURE)	DATE / TIME	RECEIVED BY: (SIGNATURE)	DATE / TIME
[signature]	7-26 / [illegible]	[signature] Brenda Lane	7-26-19
RELINQUISHED BY: (SIGNATURE)	DATE / TIME	RECEIVED BY: (SIGNATURE)	DATE / TIME
RELINQUISHED BY: (SIGNATURE) Brenda Lane	7-26-19	RECEIVED AT LAB BY: (SIGNATURE) Valerie Benson	7-26-19

(8) COMMENTS: (FOR LAB USE ONLY)

SAMPLE TEMPERATURE UPON RECEIPT ____ °C
CHILL PROCESS STARTED PRIOR TO RECEIPT Y OR N
SAMPLE(S) RECEIVED ON ICE Y OR N
PROPER BOTTLES RECEIVED IN GOOD CONDITION Y OR N
BOTTLES FILLED WITH ADEQUATE VOLUME Y OR N
SAMPLES RECEIVED WITHIN HOLD TIME(S) Y OR N
(EXCLUDES TYPICAL FIELD PARAMETERS)
DATE AND TIME TAKEN FROM SAMPLE BOTTLE ____

PAGE ____ OF ____

Copies: white should accompany samples to PDC Labs. Yellow copy to be retained by the client.

ENVIRONMENTAL ANALYSIS SOUTH, INC.
4000 East Jackson Blvd
Jackson, MO 63755
Phone: (573) 204-8817 Fax: (573) 204-8818

eas

WHOLE EFFLUENT TOXICITY TESTING
CHAIN OF CUSTODY

CLIENT: PDC - Emerald

NPDES PERMIT NUMBER: IL 0001392

EFFLUENT NAME: ____________ (LEGAL NAME) GRAB ☒ 24 HR COMPOSITE ☒

COLLECTION DATA: START DATE: 7/25 START TIME: ~~1600~~ 0000

FINISH DATE: 7/25 FINISH TIME: 1600

UPSTREAM NAME: ILLINOIS RIVER (LEGAL NAME) (GRAB SAMPLE)

COLLECTION DATA: DATE: 7/25/11 TIME: 1600

SAMPLER NAME: MIKE STRABLEY (PRINT NAME) CARRIER: ____________

Disclaimer: Environmental Analysis South, Inc. shall not be held financially liable for invalid whole effluent toxicity test (WET) or shipping charges resulting from the following reasons:

- Sampling & holding time errors (Will results in a setup charge of $100 to the client)
- Commercial carrier delivery problems or errors (Will results in a setup charge of $100 to the client)
- Problems with health or delivery of test organisms by vendor (No setup charge to client)

SAMPLER CHECK LIST

NO HEADSPACE IN BOTTLES ☐
SEND SAMPLES BY NEXT DAY CARRIER OR DELIVER TO LAB ON 7-27-11 ☐
SAMPLES TO BE HAND DELIVERED TO LABORATORY SAME DAY AS TEST SETUP ☐
SUFFICIENT ICE TO COOL SAMPLES TO A RANGE OF 0 - 6° C WHEN SHIPPING OVERNIGHT ☐

RELINQUISHED BY: [signature] DATE: 7-26-11 TIME: [illegible]

LABORATORY USE ONLY

EFFLUENT LOG NUMBER: ____________

RECEIVED TEMPERATURE: ______ °C THERMOMETER ASSIGNED NUMBER: ______

HEADSPACE: YES or NO SAMPLES ICED or DELIVERED SAME DAY AS TEST

UPSTREAM LOG NUMBER: ____________

RECEIVED TEMPERATURE: ______ °C THERMOMETER ASSIGNED NUMBER: ______

HEADSPACE: YES or NO SAMPLES ICED or DELIVERED SAME DAY AS TEST

RECEIVED BY: ____________ DATE: ______ TIME: ______

SHIPPING ORDER

Emerald Performance Materials
1550 County Road 1450 N.
Henry, IL 61537

SHIPPING ORDER NUMBER	P19- 110282
AUTHORIZED BY	Mike Strabley
OUR PURCHASE ORDER NO.	HE-40007840
YOUR INVOICE NO.	
SHIPPED FROM	Henry, IL 61537
YOUR INVOICE DATE	
PURCHASING DEPT. APPROVAL	
SOLD TO	PDC Lab
SHIP TO	PDC Lab
DATE ENTERED	7-26-11
PLANT LOCATION	HENRY
DEPT. NO.	2478
ACCOUNT	6100.1014
DATE SHIPPED	7-26-11
F.O.B.	
SHIP VIA	☐ PREPAID ☐ COLLECT
GROSS WT.	
REQUIRED DELIVERY DATE	
VALUE IF OVER $250	
HAZARDOUS	☐ YES ☒ NO (IF YES, GIVE ADDITIONAL INFORMATION BELOW)
Box No:	
Lab Results:	
BILL OF LADING NUMBER	
D.S.D.& R. REPORT NUMBER	
CHECKED BY	

PLEASE USE THE ABOVE NUMBER WHEN CORRESPONDING

This is to certify that the above named materials are properly classified, described, packaged, marked and labeled, and are in proper condition for transportation according to the applicable regulations of the Department of Transportation.

[signature]

CHECK REASON FOR SHIPMENT

- ☐ REJECTED - RETURNED FOR CREDIT
- ☐ REJECTED - RETURNED FOR REPLACEMENT
- ☐ TO BE PREPARED AND RETURNED TO:
- ☐ CONTAINERS - RETURNED FOR CREDIT
- ☐ SALES OF PROPERTY
- ☐ LOAN OF PROPERTY
- ☒ SAMPLE FOR EVALUATION

DESCRIPTIONS	QUANTITY	SHIPPED UNIT	PRICE	TOTAL
Primary Effluent WET TESTING SAMPLES	2	GALLONS		NCX
Plant Effluent				

INSTRUCTION TO VENDOR:

MATERIAL RECEIVED BY: Name: Date Received:

EP002859

Environmental Analysis South, Inc.
4000 East Jackson Blvd. • Jackson, MO 63755 • 573-204-8817 • Fax 573-204-8818

REPORT OF ACUTE TOXICITY TESTING
City of Emerald, IL
Plant Effluent, AEC = 100%

EAS LOG# 1314124
July 27, 2011 through July 29, 2011

Tests performed by:
John P. Clippard / Chemical Analyst at Environmental Analysis South (EAS)
Kelly J. Ray / Biologist at Environmental Analysis South (EAS)
Sara C. Shields / Lab Supervisor - Chemist at Environmental Analysis South (EAS)
David F. Warren / Lab Director - Chemist at Environmental Analysis South (EAS)

Environmental Analysis South, Inc.
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eas

REPORT OF ACUTE TOXICITY TESTING
City of Emerald, IL
Plant Effluent, AEC = 100%

EAS LOG# 1314124
July 27, 2011 through July 29, 2011

1. REPORT SUMMATION:

1.1. Multiple Dilution Data Summation

Test Solution	*Pimephales promelas* Acute Toxicity Test 48 Hour Survival	*Ceriodaphnia dubia* Acute Toxicity Test 48 Hour Survival
Reconstituted Control (RC)	100%	100%
Reconstituted Control + Sodium Thiosulfate (RCT)	100%	100%
Upstream Control (UC)	100%	100%
6.25% Effluent	95%	100%
12.5% Effluent	0%*	50%*
25% Effluent	0%*	0%*
50% Effluent	0%*	0%*
100% Effluent	0%*	0%*
Estimated LC_{50} Value	8.68% Effluent	12.50% Effluent (10.71% - 14.60%)

* Indicates a significant difference at alpha = 0.5 between effluent and control survival data.

Conclusion:

Pimephales promelas 48 hour WET results:	LC 50 =8.68% using Trimmed Spearman-Karber NOAEC = 6.25% using Steel's Many-One Rank Test
Ceriodaphnia dubia 48 hour WET results:	LC 50 =12.50% using Trimmed Spearman-Karber NOAEC = 6.25% using Steel's Many-One Rank Test

Note: Per the method, test duration for the *Pimephales promelas* should have been 96 hrs. However, due to UPS failure to deliver the renewal effluent, the test was terminated at 48 hours. These results were calculated using the 48 hour data.

Approved by [signature]
Sara C. Shields, Chemist

Environmental Analysis South, Inc.
4000 East Jackson Blvd. • Jackson, MO 63755 • 573-204-8817 • Fax 573-204-8818

REPORT OF ACUTE TOXICITY TESTING
City of Emerald, IL
Plant Effluent, AEC = 100%

EAS LOG# 1314124
July 27, 2011 through July 29, 2011

2. TEST METHOD SUMMARY

2.1. TEST CONDITIONS AND METHODS:

	Ceriodaphnia dubia:	*Pimephales promelas:*
Test duration:	48 hours	48 hours
Temperature:	24 - 26 degree Celsius	24 - 26 degree Celsius
Light quality:	Ambient laboratory illumination	Ambient laboratory illumination
Photoperiod:	16 hour light, 8 hours dark	16 hour light, 8 hours dark
Control Water:	Moderately Hard Reconstituted Water	Moderately Hard Reconstituted Water
Dilution Water:	Upstream Water - If unavailable or toxic, then control water will be used.	Upstream Water - If unavailable or toxic, then control water will be used.
Size of test vessel:	30 milliliters	250 milliliters
Volume of test solution:	15 milliliters	200 milliliters
Age of test organisms:	<24 hours	1 -14 days (all same age)
Number of organisms/test vessel:	5	10
Number of replicates/concentration:	4	2
Number of organisms/concentration:	20	40 for a single dilution test and 20 for a multiple dilution test
Feeding regime:	None (fed prior to test)	None (fed prior to test)
Aeration:	None	None
Test acceptability criterion:	90% or greater survival in controls	90% or greater survival in controls

The methodology used for the chemistry data was taken from the *Standard Methods for the Examination of Water and Wastewater*, 18th edition (1992). The exception was hardness, which was determined using a Hach EDTA titration test kit. The toxicity tests follow guidelines laid out in the permittee's NPDES permit and were conducted according to EPA approved methods (USEPA 2002).

All test organisms were cultured according to EPA approved methods (USEPA 2002). The *Ceriodaphnia dubia* and the *Pimephales promelas* were obtained from C-K Associates Inc. located in Baton Rouge, Louisiana and shipped overnight for use in the whole effluent toxicity test.

Environmental Analysis South, Inc.
4000 East Jackson Blvd. • Jackson, MO 63755 • 573-204-8817 • Fax 573-204-8818

REPORT OF ACUTE TOXICITY TESTING
City of Emerald, IL
Plant Effluent, AEC = 100%

EAS LOG# 1314124
July 27, 2011 through July 29, 2011

2.2. REFERENCE TOXICITY TEST:

Environmental Analysis South performs monthly reference toxicity tests. The most recent reference test was initiated on July 6, 2011 using KCL Lot #41713. Following are the results:

2.2.1. ***P. promelas*** - 48 hr. Acute Test – LC_{50} = 1.068 g/l 95%CI (0.7311-1.405 g/l)
EAS %CV = 15.8%
National Warning Limits (75th percentile) = 19%CV
National Control Limits (90th percentile) = 33%CV

2.2.2. ***C. dubia*** - 48 hr. Acute Test – LC_{50} = 0.463 g/l 95%CI (0.294-0.632g/l)
EAS %CV = 18.3%
National Warning Limits (75th percentile) = 29%CV
National Control Limits (90th percentile) = 34%CV

2.3. LITERATURE CITED:

1. APHA. 1992. *Standard methods for the examination of water and wastewater*, 18th Ed. American Public Health Association, Washington, D.C
2. USEPA. 2002. *Methods for measuring the acute toxicity of effluents and receiving waters to freshwater and marine organisms*, 5th Ed. EPA-821-R-02-012
3. USEPA 2000. Understanding and Accounting for Method Variability in Whole Effluent Toxicity Applications under the National Pollutant Discharge Elimination System, (Table B-2). June 2000. EPA 833-R-00-003.

WHOLE EFFLUENT TEST conducted in accordance with US EPA 600/4-90/027
Fifth Edition October 2002

CLIENT NAME: City of Emerald, IL (Plant)
NPDES NUMBER:
TYPE OF METHOD: multiple dilution, 96 hrs PP & 48 CD, AEC=100%
DATE & TIME OF COLLECTION: 07/27/11 1600 hrs by City of Emerad
DATE & TIME OF SUBMISSION: 07/27/11 1005 hrs by UPS

Upstream: River
Collected: 07/27/11 0710 hrs by Natalie Harris

INITIAL OBSERVATIONS	DATE	TIME	ANALYST	QC LOT	QC EXP VALUE	INT EFFL	INT UC	INT RC
LOG NUMBER / ID NUMBER	[redacted]					1314124	1314124A	4017
pH - SU	07/27/11	1015 hrs	SCS	SB114 (8.8-9.2)	8.98	7.84	8.50	7.94
TEMPERATURE °C RECEIVED	07/27/11	1015 hrs	SCS	EAS 106		2	1	24
SPECIFIC CONDUCTANCE umhos	07/27/11	1015 hrs	SCS	ERA506-010511(401-457)	434	19350	875	247
HARDNESS - ppm	07/27/11	1015 hrs	SCS	ERA P170-507(107-134)	120	320	200	80
CHLORINE - ppm	07/27/11	1015 hrs	SCS	tap water	+	0.72	<0.04	<0.04
DISSOLVED OXYGEN - ppm	07/27/11	1015 hrs	SCS	cal@840		<2	6.2	7.5
TOTAL ALKALINITY - ppm	07/28/11	1500 hrs	SCS	ERA506-010511(60.1-71.9	65.8	949	212	64.7
INITIAL AMMONIA - ppm	08/03/11	1400 hrs	JPC	EAS #1981 (8-12)	10.1	99.9	0.227	<0.05
TOTAL DISSOLVED SOLIDS -ppm								

0 HOUR OBSERVATIONS	DATE	TIME	ANALYST	QC LOT	QC EXP VALUE	RC	UC	100%	50%	25%	12.50%	6.25%	RCT
pH - SU	07/27/11	1100 hrs	SCS	SB114 (8.8-9.2)	8.98	8.22	8.27	8.13	8.19	8.24	8.25	8.22	8.40
TEMPERATURE °C	07/27/11	1100 hrs	SCS	EAS 106		24.1	24.0	24.5	24.5	24.3	24.1	23.9	24.1
SPECIFIC CONDUCTANCE umhos	07/27/11	1100 hrs	SCS	ERA506-010511(401-457)	434	257	843	18340	10090	5500	3150	1948	306
DISSOLVED OXYGEN - ppm	07/27/11	1100 hrs	SCS	cal@840		7.2	8.7	8.4	8.6	8.6	8.7	8.7	7.4

24 HOUR OBSERVATIONS - PP	DATE	TIME	ANALYST	QC LOT	QC EXP VALUE	RC	UC	100%	50%	25%	12.50%	6.25%	RCT
pH - SU	07/28/11	1100 hrs	SCS	SB114 (8.8-9.2)	8.91	7.83	8.17	8.27	8.29	8.26	8.32	8.26	7.93
TEMPERATURE °C	07/28/11	1100 hrs	SCS	EAS 106		25.3	25.3	25.3	25.3	25.3	25.3	25.3	25.3
SPECIFIC CONDUCTANCE umhos	07/28/11	1100 hrs	SCS	ERA506-010511(401-457)	427	267	846	18250	9990	5480	3130	1938	307
DISSOLVED OXYGEN - ppm	07/28/11	1100 hrs	SCS	cal@840		6.5	6.2	3.4	3.4	4.4	6.2	5.8	6.2

48 HOUR OBSERVATIONS - PP	DATE	TIME	ANALYST	QC LOT	QC EXP VALUE	RC	UC	100%	50%	25%	12.50%	6.25%	RCT
pH - SU	07/29/11	1100 hrs	SCS	SB114 (8.8-9.2)	8.93	7.69	8.08	8.33	8.33	8.32	8.35	8.30	8.11
TEMPERATURE °C	07/29/11	1100 hrs	SCS	EAS 106		24.1	24.1	24.1	24.1	24.1	24.1	24.1	24.1
SPECIFIC CONDUCTANCE umhos	07/29/11	1100 hrs	SCS	ERA506-010511(401-457)	424	277	870	18540	10190	5570	3190	1988	326
DISSOLVED OXYGEN - ppm	07/29/11	1100 hrs	SCS	cal@840		6.5	6.5	2.2	3.1	4.1	5.0	5.5	6.8
FINAL AMMONIA - ppm													

24 HOUR OBSERVATIONS - CD	DATE	TIME	ANALYST	QC LOT	QC EXP VALUE	RC	UC	100%	50%	25%	12.50%	6.25%	RCT
pH - SU	07/28/11	1100 hrs	SCS	SB114 (8.8-9.2)	8.91	8.48	8.34	8.31	8.38	8.35	8.41	8.40	8.16
TEMPERATURE °C	07/28/11	1100 hrs	SCS	EAS 106		25.3	25.3	25.3	25.3	25.3	25.3	25.3	25.3
SPECIFIC CONDUCTANCE umhos	07/28/11	1100 hrs	SCS	ERA506-010511(401-457)	427	263	825	17970	9940	5250	3000	1920	280
DISSOLVED OXYGEN - ppm	07/28/11	1100 hrs	SCS	cal@840		7.1	7.0	6.0	6.6	7.0	7.2	7.2	6.9

HOUR OBSERVATIONS - CD	DATE	TIME	ANALYST	QC LOT	QC EXP VALUE	RC	UC	100%	50%	25%	12.50%	6.25%	RCT
pH - SU	07/29/11	1100 hrs	SCS	SB114 (8.8-9.2)	8.93	8.27	8.19	8.26	8.45	8.50	8.48	8.39	8.20
TEMPERATURE °C	07/29/11	1100 hrs	SCS	EAS 106		24.1	24.5	24.5	24.5	24.5	24.5	24.5	24.5
CIFIC CONDUCTANCE umhos	07/29/11	1100 hrs	SCS	ERA506-010511(401-457)	424	255	795	17620	9770	5190	2980	1880	304
DISSOLVED OXYGEN - ppm	07/29/11	1100 hrs	SCS	cal@840		6.8	7.3	7.4	7.5	7.5	7.4	7.4	7.5
FINAL AMMONIA - ppm													

Approved by:

Date: 08/04/2011

WHOLE EFFLUENT TEST conducted in accordance with US EPA 600/4-90/027
Fifth Edition October 2002

CLIENT NAME:
NPDES NUMBER:
TYPE OF METHOD:
DATE & TIME OF COLLECTION:
DATE & TIME OF SUBMISSION: UPS failure to deliver sample

INITIAL OBSERVATIONS	DATE	TIME	ANALYST	QC LOT	QC EXP VALUE	INT EFFL	INT UC	INT RC
LOG NUMBER / ID NUMBER	[redacted]							
pH - SU				SB114 (8.8-9.2)				
TEMPERATURE °C RECEIVED				EAS 106				
SPECIFIC CONDUCTANCE umhos				ERA506-010511(401-457)				
HARDNESS - ppm				ERA P170-507(107-134)				
CHLORINE - ppm				tap water				
DISSOLVED OXYGEN - ppm				cal@840				
TOTAL ALKALINITY - ppm				ERA P173-506(42.8-49.6)				
INITIAL AMMONIA - ppm				EAS #1981 (8-12)				
TOTAL DISSOLVED SOLIDS -ppm								

0 HOUR OBSERVATIONS	DATE	TIME	ANALYST	QC LOT	QC EXP VALUE	RC	UC	100%	50%	25%	12.50%	6.25%	RCT
pH - SU				SB114 (8.8-9.2)									
TEMPERATURE °C				EAS 106									
SPECIFIC CONDUCTANCE umhos				ERA506-010511(401-457)									
DISSOLVED OXYGEN - ppm				cal@840									

72 HOUR OBSERVATIONS - PP	DATE	TIME	ANALYST	QC LOT	QC EXP VALUE	RC	UC	100%	50%	25%	12.50%	6.25%	RCT
pH - SU				SB114 (8.8-9.2)									
TEMPERATURE °C				EAS 106									
SPECIFIC CONDUCTANCE umhos				ERA506-010511(401-457)									
DISSOLVED OXYGEN - ppm				cal@840									

96 HOUR OBSERVATIONS - PP	DATE	TIME	ANALYST	QC LOT	QC EXP VALUE	RC	UC	100%	50%	25%	12.50%	6.25%	RCT
pH - SU				SB114 (8.8-9.2)									
TEMPERATURE °C				EAS 106									
SPECIFIC CONDUCTANCE umhos				ERA506-010511(401-457)									
DISSOLVED OXYGEN - ppm				cal@840									
FINAL AMMONIA - ppm													

Approved by: [signature] Date: 08/04/2011

WHOLE EFFLUENT TEST conducted in accordance with US EPA 600/4-90/027
Fifth Edition October 2002

City of Emerald, IL (Plant) EAS LOG# 1314124

Date Test Began: July 27, 2011 Time Test Began: 1100 hrs

Date Test Finished: July 29, 2011 Time Test Finished: 1100 hrs

Analyst 1: DFW
Analyst 2: KJR
Analyst 3: SCS

P. promelas (PP) AGE: 6 days HATCH NUMBER: 8078 c-k

	RC	UC	100%	50%	25%	12.50%	6.25%	RCT
PERIOD	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE
0 HR-PP	10,10	10,10	10,10	10,10	10,10	10,10	10,10	10,10
24 HR-PP	10,10	10,10	0,0	0,0	0,0	5,9	10,10	10,10
48 HR-PP	10,10	10,10	0,0	0,0	0,0	0,0	10,9	10,10

Ceriodaphnia dubia (CD) AGE: <24 hours HATCH NUMBER: 2357 c-k

	RC	UC	100%	50%	25%	12.50%	6.25%	RCT
PERIOD	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE
0 HR-CD	5,5,5,5	5,5,5,5	5,5,5,5	5,5,5,5	5,5,5,5	5,5,5,5	5,5,5,5	5,5,5,5
24 HR-CD	5,5,5,5	5,5,5,5	0,0,0,0	0,0,0,0	0,1,2,2	5,5,5,5	5,5,5,5	5,5,5,5
48 HR-CD	5,5,5,5	5,5,5,5	0,0,0,0	0,0,0,0	0,0,0,0	2,3,3,2	5,5,5,5	5,5,5,5

Approved by: [signature] Date: 08/04/2011

WHOLE EFFLUENT TEST conducted in accordance with US EPA 600/4-90/027
Fifth Edition October 2002

City of Emerald, IL (Plant) EAS LOG# 1314124

Date Test Began:

Date Test Finished:

Analyst 1: DFW
Analyst 2: KJR
Analyst 3: SCS

P. promelas (PP) AGE: days HATCH NUMBER:

	RC	UC	100%	50%	25%	12.50%	6.25%	RCT
PERIOD	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE
48 HR-PP								
72 HR-PP								
96 HR-PP								

Approved by: [signature]

Date: 08/04/2011

City of Emerald, IL (Plant) EAS#: 1314124

Notes & Comments
Sample aerated prior to test initiation due to low initial DO upon arrival
Sample and reconstituted control treated with sodium thiosulfate prior to test initiation due to presence of chlorine
96 hour PP test was terminated at 48 hours due to UPS failure to deliver the renewal effluent.

Prepared by: [signature]

Date: 08/04/2011

Rehr multiple

114130

SUBCONTRACT ORDER

PDC Laboratories, Inc.

1072876

SENDING LABORATORY:

PDC Laboratories, Inc.
2231 W. Altorfer Drive
Peoria, IL 61615

Project Manager: Kurt C. Stepping
kstepping@pdclab.com Phone: 309-683-1719

RECEIVING LABORATORY:

Environmental Analysis South
4000 East Jackson Blvd
Jackson, MO 63755
Phone :573-204-8817

Sample Origin (State) ______

PO# L-39351

Analysis	Due	Expires	Comments	temp rec'd
Sample ID: 1072876-01	**Water**	**Sampled:07/25/11 16:00**	Emerald Upstream 1314124A	0°C
01-Wet Single	08/05/11 16:00	07/27/11 16:00		SCS
Sample ID: 1072876-02	**Water**	**Sampled:07/25/11 16:00**	Emerald Effluent 1314124	2°C
01-Wet Single	08/05/11 16:00	07/27/11 16:00		

Relinquished By	Date/Time	Received By	Date/Time
Regina M. Peterson	7/26/11 1313		
		Ann Wagoner	7/27/11 1005 UPS

Sample Temperature Upon Receipt	____ C
Sample(s) Received on Ice	Y or N
Proper Bottles Received in Good Condition	Y or N
Bottles Filled with Adequate Volume	Y or N
Samples Received Within Hold Time	Y or N
Date/Time Taken From Sample Bottle	Y or N

CERTIFIED MAIL 7010 3090 0003 0728 0266

Emerald Performance Materials

November 4, 2011

Compliance Assurance Section
Bureau of Water
Illinois EPA
1021 North Grande Avenue East
PO Box 19276
Springfield, IL 62794-9276

Re: NPDES Biomonitoring -- Permit No. IL0001392

Gentlemen:

In a letter to IEPA dated 11 April 2011, Emerald committed to performance of whole effluent toxicity testing of the Henry plant's WWTP effluent by the standards set in Special Condition 14 of the NPDES permit using an amended schedule. The proposed amended schedule was for testing during the 12th, 9th, 6th and 3rd months prior to the expiration date of the current permit. Since no response was received, Emerald assumed that IEPA has no objection to the proposed rescheduling.

Samples were performed on October 10th to satisfy the requirement for testing six months prior to permit expiration. Results were received at the Henry plant on Friday, October 28th. This submission fulfils the permit requirement that IEPA receive a copy of the report within one week following its receipt at the Henry plant.

Sincerely,

Harold Crouch
Environmental Engineer

Emerald Polymer Additives, LLC

1550 County Road 1450 N. / Henry, IL 61537 / Phone: 309-364-2311 / Fax: 309-364-9460
www.emeraldmaterials.com

PDC Laboratories, Inc.
P.O. Box 9071 • Peoria, IL 61612-9071
(309) 692-9688 • (800) 752-6651 • FAX (309) 692-9689

ACCREDITED IN ACCORDANCE WITH nelac

Emerald Performance Materials
1550 County Rd 1450 N
Henry, IL 61537
Attn: Jim Hastings

Date Received: 10/11/11 13:37
Report Date: 10/28/11
Customer #: 202011
PO#: HE-40014063-UB

Sample No: **1101004-01**
Sample Description: **UPSTREAM**
Collect Date: **10/10/11 16:00**
Matrix: **Waste Water Regular Sample**

Parameters	Result	Qual	Analysis Date	Analyst	Method
Miscellaneous - Environmental Analysis South					
WET Testing Single Dilution - subcontracted	SUBCON		10/12/11 00:00		Subcontracted

Sample No: **1101004-02**
Sample Description: **EFFLUENT**
Collect Date: **10/10/11 16:00**
Matrix: **Waste Water**

Parameters	Result	Qual	Analysis Date	Analyst	Method
Miscellaneous - Environmental Analysis South					
WET Testing Single Dilution - subcontracted	SUBCON		10/12/11 00:00		Subcontracted

Sample No: **1101004-03**
Sample Description: **ADDL UP**
Collect Date: **10/12/11 16:00**
Matrix: **Waste Water Regular Sample**

Parameters	Result	Qual	Analysis Date	Analyst	Method
Miscellaneous - Environmental Analysis South					
WET Testing Single Dilution - subcontracted	SUBCON		10/12/11 00:00		Subcontracted

Sample No: **1101004-04**
Sample Description: **ADDL EFF**
Collect Date: **10/12/11 16:00**
Matrix: **Waste Water Regular Sample**

Parameters	Result	Qual	Analysis Date	Analyst	Method
Miscellaneous - Environmental Analysis South					
WET Testing Single Dilution - subcontracted	SUBCON		10/12/11 00:00		Subcontracted

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(309) 692-9688 • (800) 752-6651 • FAX (309) 692-9689

Emerald Performance Materials
1550 County Rd 1450 N
Henry, IL 61537
Attn: Jim Hastings

Date Received: 10/11/11 13:37
Report Date: 10/28/11
Customer #: 202011
PO#: HE-40014063-UB

Notes

This report shall not be reproduced, except in full, without the written approval of the laboratory.

PDC Laboratories participates in the following accreditation/certification and proficiency programs at the following locations. Endorsement by Federal or State Governments or their agencies is not implied.

PIA PDC Laboratories - Peoria, IL
NELAC Accreditation for Drinking Water, Wastewater, Hazardous and Solid Wastes Fields of Testing through IL EPA Lab No. 100230
Illinois Department of Public Health Bacteriological Analysis in Drinking Water Approved Laboratory Registry No. 17553
Drinking Water Certifications: Kansas (E-10338); Missouri (870); Wisconsin (998284430); Indiana (C-IL-040); Iowa (240)
Wastewater Certifications: Arkansas (88-0677); Wisconsin (998284430); Iowa (240); Kansas (E-10335)
Hazardous/Solid Waste Certifications; Arkansas (88-0677); Wisconsin (998284430); Iowa (240); Kansas (E-10335)
UST Certification; Iowa (240)
SPM PDC Laboratories - Springfield, MO
EPA DMR-QA Program
STL PDC Laboratories - St. Louis, MO
NELAC Accreditation for Wastewater, Hazardous and Solid Wastes Fields of Testing through KS EPA Lab No. E-10389

Certified by: Kurt C. Stepping, Senior Project Manager

CHAIN OF CUSTODY RECORD

PDC LABORATORIES, INC.
2231 WEST ALTORFER DRIVE
PEORIA, IL 61615

PHONE # 800-752-6651
FAX # 309-692-9689

State where samples collected ________

ALL HIGHLIGHTED AREAS MUST BE COMPLETED BY CLIENT (PLEASE PRINT) - (SAMPLE ACCEPTANCE POLICY ON REVERSE)

1 CLIENT: Emerald Performance Materials
ADDRESS: 1550 C.R. 1450 N
CITY STATE ZIP: Henry, IL 61537
CONTACT PERSON: Jim Hesting

PROJECT NUMBER:
P.O. NUMBER:
MEANS SHIPPED: courier
PHONE NUMBER:
FAX NUMBER:
DATE SHIPPED: 10/11/11

SAMPLER (PLEASE PRINT): Jim Hesting
SAMPLER'S SIGNATURE: [signature]

MATRIX TYPES:
WW-WASTEWATER
DW-DRINKING WATER
GW-GROUND WATER
WWSL-SLUDGE
NAS-SOLID
LCHT-LEACHATE
OTHER: ________

3 ANALYSIS REQUESTED: WET TESTING

4 (FOR LAB USE ONLY)
LOGIN #: 1100110004-2 MS
LOGGED BY: MS
LAB PROJ. #:
TEMPLATE:
PROJ. MGR.:

2 SAMPLE DESCRIPTION AS YOU WANT ON REPORT	DATE COLLECTED	TIME COLLECTED	SAMPLE TYPE GRAB	SAMPLE TYPE COMP	MATRIX TYPE	BOTTLE COUNT	WET TESTING	REMARKS
WET TESTING	10/10/11	1600	1	1	WW	2	X	

5 TURNAROUND TIME REQUESTED (PLEASE CIRCLE) NORMAL RUSH
(RUSH TAT IS SUBJECT TO PDC LABS APPROVAL AND SURCHARGE)
DATE RESULTS NEEDED
RUSH RESULTS VIA (PLEASE CIRCLE) FAX PHONE E-MAIL
FAX # PHONE # EMAIL ADDRESS

6 *The sample temperature will be measured upon receipt at the lab. By initialing this area you request that the lab notify you, before proceeding with analysis, if the sample temperature is outside of the range of 0.1-6.0°C. By not initialing this area you allow the lab to proceed with analytical testing regardless of the sample temperature.*

7 RELINQUISHED BY: (SIGNATURE)	DATE / TIME	RECEIVED BY: (SIGNATURE)	DATE / TIME
[signature]	10-11-11 / 1530	Brenda Lane	10-11-11 / 1326
Brenda Lane	10-11-11 / 1337	RECEIVED AT LAB BY: Melissa Sibley	10/11/11 / 1337

8 COMMENTS: (FOR LAB USE ONLY)
SAMPLE TEMPERATURE UPON RECEIPT 2 °C
CHILL PROCESS STARTED PRIOR TO RECEIPT Y OR N
SAMPLE(S) RECEIVED ON ICE Y OR N
PROPER BOTTLES RECEIVED IN GOOD CONDITION Y OR N
BOTTLES FILLED WITH ADEQUATE VOLUME Y OR N
SAMPLES RECEIVED WITHIN HOLD TIME(S) (EXCLUDES TYPICAL FIELD PARAMETERS) Y OR N
DATE AND TIME TAKEN FROM SAMPLE BOTTLE ______

PAGE ____ OF ____

Copies: white should accompany samples to PDC Labs. Yellow copy to be retained by the client.

PDC LABORATORIES, INC.
2231 WEST ALTORFER DRIVE
PEORIA, IL 61615
PHONE # 800-752-6651
FAX # 309-692-9689

CHAIN OF CUSTODY RECORD

State where samples collected ______

ALL HIGHLIGHTED AREAS MUST BE COMPLETED BY CLIENT (PLEASE PRINT) (SAMPLE ACCEPTANCE POLICY ON REVERSE)

1. CLIENT: Emerald Performance Materials
ADDRESS: 1550 CR 1450 N
CITY, STATE, ZIP: Henry, IL 61537
CONTACT PERSON: Jim Hartzer

PROJECT NUMBER:
P.O. NUMBER:
MEANS SHIPPED: Courier
PHONE NUMBER:
FAX NUMBER:
DATE SHIPPED: 10/13/11
SAMPLER (PLEASE PRINT): Jim Hartzer
SAMPLER'S SIGNATURE:

MATRIX TYPES: WW-WASTEWATER, DW-DRINKING WATER, GW-GROUND WATER, WWSL-SLUDGE, NAS-SOLID, LCHT-LEACHATE, OTHER:

3. ANALYSIS REQUESTED: WET Testing

4. (FOR LAB USE ONLY)
LOGIN #: 1108844 1004
LOGGED BY:
LAB PROJ. #:
TEMPLATE:
PROJ. MGR.:

2. SAMPLE DESCRIPTION AS YOU WANT ON REPORT	DATE COLLECTED	TIME COLLECTED	SAMPLE TYPE GRAB	SAMPLE TYPE COMP	MATRIX TYPE	BOTTLE COUNT	WET Testing	REMARKS
WET TESTING	10/12/11	1600	1	1	W	2	X	

5. TURNAROUND TIME REQUESTED (PLEASE CIRCLE) NORMAL RUSH
(RUSH TAT IS SUBJECT TO PDC LABS APPROVAL AND SURCHARGE)
DATE RESULTS NEEDED
RUSH RESULTS VIA (PLEASE CIRCLE) FAX PHONE E-MAIL
FAX # PHONE # EMAIL ADDRESS

6. The sample temperature will be measured upon receipt at the lab. By initialing this area you request that the lab notify you, before proceeding with analysis, if the sample temperature is outside of the range of 0.1-6.0°C. By not initialing this area you allow the lab to proceed with analytical testing regardless of the sample temperature.

7. RELINQUISHED BY: (SIGNATURE)	DATE / TIME	RECEIVED BY: (SIGNATURE)	DATE / TIME
[signature]	10-13-11 / 1000	Brenda Lane	10-13-11 / 1000
RELINQUISHED BY: (SIGNATURE)	DATE / TIME	RECEIVED BY: (SIGNATURE)	DATE / TIME
RELINQUISHED BY: (SIGNATURE) Brenda Lane	10-13-11 / 1242	RECEIVED AT LAB BY: (SIGNATURE) Brenda Lane	10-13-11 / 1242

8. COMMENTS: (FOR LAB USE ONLY)
SAMPLE TEMPERATURE UPON RECEIPT 5 °C
CHILL PROCESS STARTED PRIOR TO RECEIPT Y OR N
SAMPLE(S) RECEIVED ON ICE Y OR N
PROPER BOTTLES RECEIVED IN GOOD CONDITION Y OR N
BOTTLES FILLED WITH ADEQUATE VOLUME Y OR N
SAMPLES RECEIVED WITHIN HOLD TIME(S) Y OR N
(EXCLUDES TYPICAL FIELD PARAMETERS)
DATE AND TIME TAKEN FROM SAMPLE BOTTLE ______

PAGE ____ OF ____

Copies: white should accompany samples to PDC Labs. Yellow copy to be retained by the client.

SHIPPING ORDER

Emerald Performance Materials
1550 County Road 1450 N.
Henry, IL 61537

AUTHORIZED BY: Mike Strabley

PURCHASING DEPT. APPROVAL:

DATE ENTERED: 10-13-11

PLANT LOCATION: HENRY

DEPT. NO.: 2478

ACCOUNT: 6100.1014

OUR PURCHASE ORDER NO.: HE-40007640

SHIPPED FROM: Henry, IL 61537

YOUR INVOICE NO.:

YOUR INVOICE DATE:

SHIPPING ORDER NUMBER: P19- 110392

PLEASE USE THE ABOVE NUMBER WHEN CORRESPONDING

BILL OF LADING NUMBER:

O.S.D.& R. REPORT NUMBER:

CHECKED BY:

SOLD TO: PDC Lab

SHIP TO: PDC Lab

DATE SHIPPED: 10-13-11

SHIP VIA:

GROSS WT:

☐ PREPAID ☐ COLLECT

F.O.B.:

REQUIRED DELIVERY DATE:

VALUE IF OVER $250:

This is to certify that the above named materials are properly classified, described, packaged, marked and labeled, and are in proper condition for transportation according to the applicable regulations of the Department of Transportation.

Signature: [signature]

HAZARDOUS ☐ YES ☒ NO (IF YES, GIVE ADDITIONAL INFORMATION BELOW)

Box No: ______ Lab Results: ______

CHECK REASON FOR SHIPMENT:

- ☐ REJECTED - RETURNED FOR CREDIT
- ☐ REJECTED - RETURNED FOR REPLACEMENT
- ☐ TO BE PREPARED AND RETURNED TO:
- ☐ CONTAINERS - RETURNED FOR CREDIT
- ☐ SALES OF PROPERTY
- ☐ LOAN OF PROPERTY
- ☒ SAMPLE FOR EVALUATION

DESCRIPTIONS	QUANTITY	SHIPPED UNIT	PRICE	TOTAL
Primary Effluent				NCX
Plant Effluent	2			

INSTRUCTION TO VENDOR:

MATERIAL RECEIVED BY: Name: Date Received:

Environmental Analysis South, Inc.
4000 East Jackson Blvd. • Jackson, MO 63755 • 573-204-8817 • Fax 573-204-8818

eas

REPORT OF ACUTE TOXICITY TESTING
City of Emerald, IL
Plant Effluent, AEC = 100%

EAS LOG# 1402207
October 12, 2011 through October 16, 2011

Tests performed by:
John P. Clippard / Chemical Analyst at Environmental Analysis South (EAS)
Kelly J. Ray / Biologist at Environmental Analysis South (EAS)
Sara C. Shields / Lab Supervisor - Chemist at Environmental Analysis South (EAS)
David F. Warren / Lab Director - Chemist at Environmental Analysis South (EAS)

Environmental Analysis South, Inc.
4000 East Jackson Blvd. • Jackson, MO 63755 • 573-204-8817 • Fax 573-204-8818
eas

REPORT OF ACUTE TOXICITY TESTING
City of Emerald, IL
Plant Effluent, AEC = 100%

EAS LOG# 1402207
October 12, 2011 through October 16, 2011

1. REPORT SUMMATION:

1.1. Multiple Dilution Data Summation

Test Solution	*Pimephales promelas* Acute Toxicity Test 96 Hour Survival	*Ceriodaphnia dubia* Acute Toxicity Test 48 Hour Survival
Reconstituted Control (RC)	100%	100%
Upstream Control (UC)	100%	100%
6.25% Effluent	95%	100%
12.5% Effluent	85%*	100%
25% Effluent	50%*	70%*
50% Effluent	0%*	15%*
100% Effluent	0%*	0%*
Estimated LC_{50} Value	22.75% Effluent (18.36% - 28.18%)	31.86% Effluent (26.61% - 38.15%)

* Indicates a significant difference at alpha = 0.5 between effluent and control survival data.

Conclusion:

Pimephales promelas 96 hour WET results: LC 50 =22.75% using Trimmed Spearman-Karber
NOAEC = 6.25% using Steel's Many-One Rank Test

Ceriodaphnia dubia 48 hour WET results: LC 50 =31.86% using Trimmed Spearman-Karber
NOAEC = 12.5% using Steel's Many-One Rank Test

Approved by [signature]
Sara C. Shields, Chemist

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eas

REPORT OF ACUTE TOXICITY TESTING
City of Emerald, IL
Plant Effluent, AEC = 100%

EAS LOG# 1402207
October 12, 2011 through October 16, 2011

2. TEST METHOD SUMMARY

2.1. TEST CONDITIONS AND METHODS:

	Ceriodaphnia dubia:	*Pimephales promelas:*
Test duration:	48 hours	96 hours
Temperature:	24 - 26 degree Celsius	24 - 26 degree Celsius
Light quality:	Ambient laboratory illumination	Ambient laboratory illumination
Photoperiod:	16 hour light, 8 hours dark	16 hour light, 8 hours dark
Control Water:	Moderately Hard Reconstituted Water	Moderately Hard Reconstituted Water
Dilution Water:	Upstream Water - If unavailable or toxic, then control water will be used.	Upstream Water - If unavailable or toxic, then control water will be used.
Size of test vessel:	30 milliliters	250 milliliters
Volume of test solution:	15 milliliters	200 milliliters
Age of test organisms:	<24 hours	1 -14 days (all same age)
Number of organisms/test vessel:	5	10
Number of replicates/concentration:	4	2
Number of organisms/concentration:	20	40 for a single dilution test and 20 for a multiple dilution test
Feeding regime:	None (fed prior to test)	None (fed prior to test)
Aeration:	None	None
Test acceptability criterion:	90% or greater survival in controls	90% or greater survival in controls

The methodology used for the chemistry data was taken from the *Standard Methods for the Examination of Water and Wastewater*, 18th edition (1992). The exception was hardness, which was determined using a Hach EDTA titration test kit. The toxicity tests follow guidelines laid out in the permittee's NPDES permit and were conducted according to EPA approved methods (USEPA 2002).

All test organisms were cultured according to EPA approved methods (USEPA 2002). The *Ceriodaphnia dubia* and the *Pimephales promelas* were obtained from C-K Associates Inc. located in Baton Rouge, Louisiana and shipped overnight for use in the whole effluent toxicity test.

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4000 East Jackson Blvd. • Jackson, MO 63755 • 573-204-8817 • Fax 573-204-8818
eas

REPORT OF ACUTE TOXICITY TESTING
City of Emerald, IL
Plant Effluent, AEC = 100%

EAS LOG# 1402207
October 12, 2011 through October 16, 2011

2.2. REFERENCE TOXICITY TEST:

Environmental Analysis South performs monthly reference toxicity tests. The most recent reference test was initiated on October 5, 2011 using KCL Lot #41713. Following are the results:

2.2.1. ***P. promelas*** - 48 hr. Acute Test – LC_{50} = 1.021 g/l 95%CI (0.708-1.334 g/l)
EAS %CV = 15.3%
National Warning Limits (75th percentile) = 19%CV
National Control Limits (90th percentile) = 33%CV

2.2.2. ***C. dubia*** - 48 hr. Acute Test – LC_{50} = 0.460 g/l 95%CI (0.297-0.623g/l)
EAS %CV = 17.7%
National Warning Limits (75th percentile) = 29%CV
National Control Limits (90th percentile) = 34%CV

2.3. LITERATURE CITED:

1. APHA. 1992. *Standard methods for the examination of water and wastewater*, 18th Ed. American Public Health Association, Washington, D.C
2. USEPA. 2002. *Methods for measuring the acute toxicity of effluents and receiving waters to freshwater and marine organisms*, 5th Ed. EPA-821-R-02-012
3. USEPA 2000. Understanding and Accounting for Method Variability in Whole Effluent Toxicity Applications under the National Pollutant Discharge Elimination System, (Table B-2). June 2000. EPA 833-R-00-003.

WHOLE EFFLUENT TEST conducted in accordance with US EPA 600/4-90/027
Fifth Edition October 2002

CLIENT NAME:	City of Emerald, IL (Plant)
NPDES NUMBER:	
TYPE OF METHOD:	multiple dilution, 96 hrs PP & 48 CD, AEC=100%
DATE & TIME OF COLLECTION:	10/10/11 1400 hrs
DATE & TIME OF SUBMISSION:	10/12/11 0940 hrs by UPS

Upstream: River
Collected: 10/10/11 1400 hrs by City of Emerald

INITIAL OBSERVATIONS	DATE	TIME	ANALYST	QC LOT	QC EXP VALUE	INT EFFL	INT UC	INT RC
LOG NUMBER / ID NUMBER	[redacted]					1402207	1402207A	RC4023
pH - SU	10/12/11	1000 hrs	SCS	SB114 (8.8-9.2)	8.93	7.83	8.39	7.80
TEMPERATURE °C RECEIVED	10/12/11	1000 hrs	SCS	EAS 106		3	2	24
SPECIFIC CONDUCTANCE umhos	10/12/11	1000 hrs	SCS	ERA506-010511(401-457)	442	7740	823	277
HARDNESS - ppm	10/12/11	1000 hrs	SCS	ERA P170-507(107-134)	120	420	300	80
CHLORINE - ppm	10/12/11	1000 hrs	SCS	tap water	+	<0.04	<0.04	<0.04
DISSOLVED OXYGEN - ppm	10/12/11	1000 hrs	SCS	cal@840		6.9	7.6	7.3
TOTAL ALKALINITY - ppm	10/12/11	1615 hrs	SCS	ERA506-010511(60.1-71.9)	68.9	168	175	61.9
INITIAL AMMONIA - ppm	10/17/11	1412 hrs	JPC	EAS #1981 (8-12)	9.77	27.1	0.126	<0.05
TOTAL DISSOLVED SOLIDS -ppm								

0 HOUR OBSERVATIONS	DATE	TIME	ANALYST	QC LOT	QC EXP VALUE	RC	UC	100%	50%	25%	12.50%	6.25%	X %AEC
pH - SU	10/12/11	1100 hrs	SCS	SB114 (8.8-9.2)	8.93	8.01	8.20	8.12	8.18	8.33	8.40	8.39	
TEMPERATURE °C	10/12/11	1100 hrs	SCS	EAS 106		23.8	24.4	23.5	23.6	23.7	24.0	24.2	
SPECIFIC CONDUCTANCE umhos	10/12/11	1100 hrs	SCS	ERA506-010511(401-457)	442	235	772	7360	4350	2570	1630	1183	
DISSOLVED OXYGEN - ppm	10/12/11	1100 hrs	SCS	cal@840		7.1	8.4	9.5	9.3	9.3	9.3	8.5	

24 HOUR OBSERVATIONS - PP	DATE	TIME	ANALYST	QC LOT	QC EXP VALUE	RC	UC	100%	50%	25%	12.50%	6.25%	X %AEC
pH - SU	10/13/11	1100 hrs	SCS	SB114 (8.8-9.2)	9.1	7.35	8.12	8.08	8.14	8.17	8.23	8.20	
TEMPERATURE °C	10/13/11	1100 hrs	SCS	EAS 106		25.1	25.1	25.1	25.1	25.1	25.1	25.1	
SPECIFIC CONDUCTANCE umhos	10/13/11	1100 hrs	SCS	ERA506-010511(401-457)	431	252	839	7380	4380	2670	1653	1215	
DISSOLVED OXYGEN - ppm	10/13/11	1100 hrs	SCS	cal@840		6.7	6.6	6.1	6.3	6.3	6.3	6.6	

48 HOUR OBSERVATIONS - PP	DATE	TIME	ANALYST	QC LOT	QC EXP VALUE	RC	UC	100%	50%	25%	12.50%	6.25%	X %AEC
pH - SU	10/14/11	1100 hrs	SCS	SB114 (8.8-9.2)	8.97	7.59	7.99	8.13	8.16	8.17	8.16	8.10	
TEMPERATURE °C	10/14/11	1100 hrs	SCS	EAS 106		24.7	24.7	24.7	24.7	24.7	24.7	24.7	
SPECIFIC CONDUCTANCE umhos	10/14/11	1100 hrs	SCS	ERA506-010511(401-457)	436	280	835	7500	4500	2780	1670	1211	
DISSOLVED OXYGEN - ppm	10/14/11	1100 hrs	SCS	cal@840		6.3	6.6	5.8	6.0	5.9	6.1	6.5	
FINAL AMMONIA - ppm													

24 HOUR OBSERVATIONS - CD	DATE	TIME	ANALYST	QC LOT	QC EXP VALUE	RC	UC	100%	50%	25%	12.50%	6.25%	X %AEC
pH - SU	10/13/11	1100 hrs	SCS	SB114 (8.8-9.2)	9.1	8.00	8.21	8.13	8.25	8.31	8.32	8.27	
TEMPERATURE °C	10/13/11	1100 hrs	SCS	EAS 106		25.1	25.1	25.1	25.1	25.1	25.1	25.1	
SPECIFIC CONDUCTANCE umhos	10/13/11	1100 hrs	SCS	ERA506-010511(401-457)	431	246	797	7180	4250	2560	1636	1216	
DISSOLVED OXYGEN - ppm	10/13/11	1100 hrs	SCS	cal@840		7.1	7.1	7.0	7.0	7.0	7.0	6.9	

48 HOUR OBSERVATIONS - CD	DATE	TIME	ANALYST	QC LOT	QC EXP VALUE	RC	UC	100%	50%	25%	12.50%	6.25%	X %AEC
pH - SU	10/14/11	1100 hrs	SCS	SB114 (8.8-9.2)	8.97	8.09	8.01	8.24	8.28	8.28	8.26	8.16	
TEMPERATURE °C	10/14/11	1100 hrs	SCS	EAS 106		24.7	24.7	24.7	24.7	24.7	24.7	24.7	
SPECIFIC CONDUCTANCE umhos	10/14/11	1100 hrs	SCS	ERA506-010511(401-457)	436	276	780	7060	4210	2530	1616	1190	
DISSOLVED OXYGEN - ppm	10/14/11	1100 hrs	SCS	cal@840		6.8	6.7	6.5	6.4	6.6	6.5	6.3	
FINAL AMMONIA - ppm													

Approved by: [signature]

Date: 10/27/2011

WHOLE EFFLUENT TEST conducted in accordance with US EPA 600/4-90/027
Fifth Edition October 2002

CLIENT NAME:	City of Emerald, IL (Plant)
NPDES NUMBER:	
TYPE OF METHOD:	multiple dilution, 96 hrs PP & 48 CD, AEC=100%
DATE & TIME OF COLLECTION:	10/12/11 1600hrs
DATE & TIME OF SUBMISSION:	10/14/11 1025 hrs UPS

Upstream: River
Collected: 10/12/11 1600 hrs by City of Emerald

INITIAL OBSERVATIONS	DATE	TIME	ANALYST	QC LOT	QC EXP VALUE	INT EFFL	INT UC	INT RC
LOG NUMBER / ID NUMBER	[redacted]					1402417	1402417A	RC4023
pH - SU	10/14/11	1030 hrs	JPC	SB114 (8.8-9.2)	8.97	7.29	7.64	7.80
TEMPERATURE °C RECEIVED	10/14/11	1030 hrs	JPC	EAS 106		3	2	24
SPECIFIC CONDUCTANCE umhos	10/14/11	1030 hrs	JPC	ERA506-010511(401-457)	436	14850	818	277
HARDNESS - ppm	10/14/11	1030 hrs	JPC	ERA P170-507(107-134)	120	600	260	80
CHLORINE - ppm	10/14/11	1030 hrs	JPC	tap water	+	<0.04	<0.04	<0.04
DISSOLVED OXYGEN - ppm	10/14/11	1030 hrs	JPC	cal@840		5.4	7.4	7.3
TOTAL ALKALINITY - ppm	10/19/11	1300 hrs	SCS	ERA506-010511(60.1-71.9)	71.3	86.3	187	61.9
INITIAL AMMONIA - ppm	10/17/11	1412 hrs	JPC	EAS #1981 (8-12)	9.77	59.9	0.174	<0.05
TOTAL DISSOLVED SOLIDS -ppm								

0 HOUR OBSERVATIONS	DATE	TIME	ANALYST	QC LOT	QC EXP VALUE	RC	UC	100%	50%	25%	12.50%	6.25%	X %AEC
pH - SU	10/14/11	1100 hrs	SCS	SB114 (8.8-9.2)	8.97	7.86	7.93	8.01	8.21	8.28	8.26	8.24	
TEMPERATURE °C	10/14/11	1100 hrs	SCS	EAS 106		24.7	24.7	24.7	24.7	24.7	24.7	24.7	
SPECIFIC CONDUCTANCE umhos	10/14/11	1100 hrs	SCS	ERA506-010511(401-457)	436	246	788	14800	8220	4550	2670	1725	
DISSOLVED OXYGEN - ppm	10/14/11	1100 hrs	SCS	cal@840		6.7	10.5	8.0	9.1	9.6	9.6	10.3	

72 HOUR OBSERVATIONS - PP	DATE	TIME	ANALYST	QC LOT	QC EXP VALUE	RC	UC	100%	50%	25%	12.50%	6.25%	X %AEC
pH - SU	10/15/11	1100 hrs	SCS	SB114 (8.8-9.2)	9.01	8.05	8.10	8.05	8.15	8.23	8.27	8.30	
TEMPERATURE °C	10/15/11	1100 hrs	SCS	EAS 106		24.5	24.5	24.5	24.5	24.5	24.5	24.5	
SPECIFIC CONDUCTANCE umhos	10/15/11	1100 hrs	SCS	ERA506-010511(401-457)	431	249	802	14910	8120	4480	2600	1720	
DISSOLVED OXYGEN - ppm	10/15/11	1100 hrs	SCS	cal@840		6.2	6.2	6.4	5.8	5.4	5.51	5.9	

96 HOUR OBSERVATIONS - PP	DATE	TIME	ANALYST	QC LOT	QC EXP VALUE	RC	UC	100%	50%	25%	12.50%	6.25%	X %AEC
pH - SU	10/16/11	1100 hrs	SCS	SB114 (8.8-9.2)	8.94	7.88	8.01	7.97	8.11	8.18	8.15	8.10	
TEMPERATURE °C	10/16/11	1100 hrs	SCS	EAS 106		24.9	24.9	24.9	24.9	24.9	24.9	24.9	
SPECIFIC CONDUCTANCE umhos	10/16/11	1100 hrs	SCS	ERA506-010511(401-457)	437	280	809	15250	8390	4890	2650	1744	
DISSOLVED OXYGEN - ppm	10/16/11	1100 hrs	SCS	cal@840		7.0	7.0	6.8	6.7	6.8	7.2	7.3	
FINAL AMMONIA - ppm													

Approved by: [signature] Date: 10/27/2011

WHOLE EFFLUENT TEST conducted in accordance with US EPA 600/4-90/027
Fifth Edition October 2002

City of Emerald, IL (Plant) EAS LOG# 1402207

Date Test Began: October 12, 2011
Date Test Finished: 10/14/11PP&10/16/11CD

Time Test Began: 1100 hrs
Time Test Finished: 1100 hrs

Analyst 1: DFW
Analyst 2: KJR
Analyst 3: SCS

P. promelas (PP) AGE: 8 days HATCH NUMBER: 8152 c-k

	RC	UC	100%	50%	25%	12.50%	6.25%	X% AEC
PERIOD	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE
0 HR-PP	10,10	10,10	10,10	10,10	10,10	10,10	10,10	
24 HR-PP	10,10	10,10	3,4	10,10	10,10	10,10	10,10	
48 HR-PP	10/17/2011	10,10	0,0	7,4	10,10	10,10	10,10	

Ceriodaphnia dubia (CD) AGE: <24 hours HATCH NUMBER: 2392 c-k

	RC	UC	100%	50%	25%	12.50%	6.25%	X% AEC
PERIOD	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE
0 HR-CD	5,5,5,5	5,5,5,5	5,5,5,5	5,5,5,5	5,5,5,5	5,5,5,5	5,5,5,5	
24 HR-CD	5,5,5,5	5,5,5,5	2,2,0,1	1,3,4,3	5,5,5,5	5,5,5,5	5,5,5,5	
48 HR-CD	5,5,5,5	5,5,5,5	0,0,0,0	0,1,1,1	4,4,3,3	5,5,5,5	5,5,5,5	

Approved by: [signature]

Date: 10/27/2011

WHOLE EFFLUENT TEST conducted in accordance with US EPA 600/4-90/027
Fifth Edition October 2002

City of Emerald, IL (Plant) EAS LOG# 1402207

Date Test Began: October 12, 2011
Date Test Finished: 10/14/11PP&10/16/11CD

Time Test Began: 1200 hrs
Time Test Finished: 1200 hrs

Analyst 1: DFW
Analyst 2: KJR
Analyst 3: SCS

P. promelas (PP)

AGE: 8 days

HATCH NUMBER: 8152 c-k

	RC	UC	100%	50%	25%	12.50%	6.25%	X% AEC
PERIOD	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE
48 HR-PP	10,10	10,10	0,0	7,4	10,10	10,10	10,10	
72 HR-PP	10,10	10,10	0,0	0,0	8,8	9,10	10,10	
96 HR-PP	10/17/2011	10,10	0,0	0,0	6,4	8,9	10,9	

Approved by: [signature]

Date: 10/27/2011

EP002883

City of Emerald, IL (Plant) EAS#: 1402207

Notes & Comments

Prepared by: [signature]

Date: 10/27/2011

multiple Glenn

115064

SUBCONTRACT ORDER

PDC Laboratories, Inc.

1101004

10/11/2011

PDC Laboratories, Inc.
2231 W. Altorfer Drive
Peoria, IL 61615
Project Manager: Kurt C. Stepping
kstepping@pdclab.com Phone: 309-683-1719

Environmental Analysis South
4000 East Jackson Blvd
Jackson, MO 63755
Phone :(573) 204-8817

Sample Origin (State) IL
PO# L 40741

Emerald

Analysis	Due	Expires	Comments
Sample ID: 1101004-01	**Waste Water**		**Sampled: 10/10/11 14:00** Upstream temp rec'd 2 °C 1402207
Wet Testing - Single Dilution	10/21/11 16:00	10/12/11 14:00	
Sample ID: 1101004-02	**Waste Water**		**Sampled: 10/10/11 14:00** Effluent 2 °C 1402207
Wet Testing - Single Dilution	10/21/11 16:00	10/12/11 14:00	

Relinquished By	Date/Time	Received By	Date/Time
[signature]	10-11-11 14:00		
		[signature]	10/12/11 940 UPS

Sample Temperature Upon Receipt	____ C
Sample(s) Received on Ice	Y or N
Proper Bottles Received in Good Condition	Y or N
Bottles Filled with Adequate Volume	Y or N
Samples Received Within Hold Time	Y or N
Date/Time Taken From Sample Bottle	Y or N

renewal for 1402207

SUBCONTRACT ORDER

PDC Laboratories, Inc.

1101004

SENDING LABORATORY:

PDC Laboratories, Inc.
2231 W. Altorfer Drive
Peoria, IL 61615
Phone: 309.692.9688
Fax: 309.692.9689
Project Manager: Kurt C. Stepping

RECEIVING LABORATORY:

Environmental Analysis South
4000 East Jackson Blvd
Jackson, MO 63755
Phone :(573) 204-8817
Fax: (573) 204-8818

Analysis	Due	Expires	Laboratory ID	Comments
Sample ID: 1101004-01	**Water**	**Sampled:10/10/11 16:00**	[redacted]	
01-Wet Single	10/21/11 16:00	10/12/11 16:00		
Containers Supplied:				
Sample ID: 1101004-02	**Water**	**Sampled:10/10/11 16:00**	[redacted]	
01-Wet Single	10/21/11 16:00	10/12/11 16:00		
Containers Supplied:	Emerald, IL		temp rec'd = 2°C SS	
Sample ID: 1101004-03	**Water**	**Sampled:10/12/11 16:00**	[redacted] -A	ADDITIONAL SAMPLE
01-Wet Single	10/21/11 16:00	10/14/11 16:00		
Containers Supplied:			temp rec'd = 3° SS	
Sample ID: 1101004-04	**Water**	**Sampled:10/12/11 16:00**	[redacted] 7	" "
01-Wet Single	10/21/11 16:00	10/14/11 16:00		
Containers Supplied:				

Released By	Date	Received By	Date
[signature]	10-13-11 14:00	[signature]	10/14/11 1025 UPS
Released By	Date	Received By	Date

Emerald Performance Materials

27 February 2012

Illinois Environmental Protection Agency
Division of Water Pollution Control
1021 North Grand Avenue East
PO Box 19276
Springfield IL 62794-9276

Attn: Compliance Assurance Section, MC-19

Certified Mail: 7006 0810 0006 5101 4229

Re: **NPDES Permit No. IL0001392**
Results of WET Testing

Gentlemen:

In January 2012, effluent from Emerald's wastewater treatment facility and dilution water from the Illinois River was submitted to Environmental Analysis South, Inc. for whole effluent toxicity testing, as required by the facility's NPDES permit. Results were received by Emerald on 21 February 2012. Attached is a copy of the results.

If you have any questions, please contact me at harold.crouch@emeraldmaterials.com or 309-364-9472.

Harold Crouch
Environmental Engineer

PDC Laboratories, Inc.
P.O. Box 9071 • Peoria, IL 61612-9071
(309) 692-9688 • (800) 752-6651 • FAX (309) 692-9689

ACCREDITED IN ACCORDANCE WITH nelac

Emerald Performance Materials
1550 County Rd 1450 N
Henry, IL 61537
Attn: Jim Hastings

Date Received: 01/24/12 13:18
Report Date: 02/21/12
Customer #: 202011
PO#: HE-40014063-UB

Laboratory Results

Sample No: 2012627-01
Sample Description: EFFLUENT

Collect Date: 01/23/12 23:59
Matrix: Waste Water

Parameters	Result	Qual	Analysis Date	Analyst	Method
Miscellaneous - Environmental Analysis South					
WET Testing Single Dilution - subcontracted	<				Subcontracted

Sample No: 2012627-02REAM
Sample Description: UPSTREAM

Collect Date: 01/24/12 06:00
Matrix: Waste Water

Parameters	Result	Qual	Analysis Date	Analyst	Method
Miscellaneous - Environmental Analysis South					
WET Testing Single Dilution - subcontracted	<				Subcontracted

PDC Laboratories, Inc.
P.O. Box 9071 • Peoria, IL 61612-9071
(309) 692-9688 • (800) 752-6651 • FAX (309) 692-9689

ACCREDITED IN ACCORDANCE WITH nelac

Emerald Performance Materials
1550 County Rd 1450 N
Henry, IL 61537
Attn: Jim Hastings

Date Received: 01/24/12 13:18
Report Date: 02/21/12
Customer #: 202011
PO#: HE-40014063-UB

Laboratory Results

Notes

This report shall not be reproduced, except in full, without the written approval of the laboratory.

PDC Laboratories participates in the following accreditation/certification and proficiency programs at the following locations. Endorsement by Federal or State Governments or their agencies is not implied.

PIA PDC Laboratories - Peoria, IL
NELAC Accreditation for Drinking Water, Wastewater, Hazardous and Solid Wastes Fields of Testing through IL EPA Lab No. 100230
Illinois Department of Public Health Bacteriological Analysis in Drinking Water Approved Laboratory Registry No. 17553
Drinking Water Certifications: Kansas (E-10338); Missouri (870); Wisconsin (998284430); Indiana (C-IL-040); Iowa (240)
Wastewater Certifications: Arkansas (88-0677); Wisconsin (998284430); Iowa (240); Kansas (E-10335)
Hazardous/Solid Waste Certifications; Arkansas (88-0677); Wisconsin (998284430); Iowa (240); Kansas (E-10335)
UST Certification; Iowa (240)
SPM PDC Laboratories - Springfield, MO
EPA DMR-QA Program
STL PDC Laboratories - St. Louis, MO
NELAC Accreditation for Wastewater, Hazardous and Solid Wastes Fields of Testing through KS EPA Lab No. E-10389

WET Analysis subcontracted, report attached.

Certified by: Kurt C. Stepping, Senior Project Manager

2027-2 M

ENVIRONMENTAL ANALYSIS SOUTH, INC.
4000 East Jackson Blvd
Jackson, MO 63755
Phone: (573) 204-8817 Fax: (573) 204-8818

1/24/12 13:11

WHOLE EFFLUENT TOXICITY TESTING CHAIN OF CUSTODY

CLIENT: Emerald Performance Materials

NPDES PERMIT NUMBER: IL ØØØ1392

EFFLUENT NAME: Outfall ØØ1 (LEGAL NAME) GRAB ☐ 24 HR COMPOSITE ☐

COLLECTION DATA: START DATE: 23 Jan 2Ø12 START TIME: ØØ:Ø1

FINISH DATE: 23 Jan 2Ø12 FINISH TIME: 23:59

UPSTREAM NAME: Illinois River (LEGAL NAME) (GRAB SAMPLE)

COLLECTION DATA: DATE: 24 Jan 2Ø12 TIME: Ø6:4Ø

SAMPLER NAME: Harold Crouch (PRINT NAME) CARRIER: ______

Disclaimer: Environmental Analysis South, Inc. shall not be held financially liable for invalid whole effluent toxicity test (WET) or shipping charges resulting from the following reasons:

- Sampling & holding time errors (Will results in a setup charge of $100 to the client)
- Commercial carrier delivery problems or errors (Will results in a setup charge of $100 to the client)
- Problems with health or delivery of test organisms by vendor (No setup charge to client)

SAMPLER CHECK LIST

NO HEADSPACE IN BOTTLES ✓
SHIP SAMPLES BY NEXT DAY CARRIER OR DELIVER TO LAB ON ___/___/___ ☐
SAMPLES TO BE HAND DELIVERED TO LABORATORY SAME DAY AS TEST SETUP ☐
SUFFICIENT ICE TO COOL SAMPLES TO A RANGE OF 0 - 6° C WHEN SHIPPING OVERNIGHT ☐

RELINQUISHED BY: Harold Crouch DATE: 24 Jan 2Ø12 TIME: Ø7:3Ø

LABORATORY USE ONLY

EFFLUENT LOG NUMBER: 2012027-2 M

RECEIVED TEMPERATURE: 1° °C THERMOMETER ASSIGNED NUMBER: #6

HEADSPACE: YES or (NO) (SAMPLES ICED) or (DELIVERED SAME DAY AS TEST)

UPSTREAM LOG NUMBER: ______

RECEIVED TEMPERATURE: 1° °C THERMOMETER ASSIGNED NUMBER: #6

HEADSPACE: (YES) or (NO) (SAMPLES ICED) or (DELIVERED SAME DAY AS TEST)

RECEIVED BY: [signature] DATE: 1/24/12 TIME: 13:18

Environmental Analysis South, Inc.
4000 East Jackson Blvd. • Jackson, MO 63755 • 573-204-8817 • Fax 573-204-8818

eas

REPORT OF ACUTE TOXICITY TESTING
Emerald Performance Materials
Effluent, AEC = 100%

EAS LOG# 1407821
January 25, 2012 through January 27, 2012

Tests performed by:
John P. Clippard / Chemical Analyst at Environmental Analysis South (EAS)
Kelly J. Ray / Biologist at Environmental Analysis South (EAS)
Sara C. Shields / Lab Supervisor - Chemist at Environmental Analysis South (EAS)
David F. Warren / Lab Director - Chemist at Environmental Analysis South (EAS)

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REPORT OF ACUTE TOXICITY TESTING
Emerald Performance Materials
Effluent, AEC = 100%

EAS LOG# 1407821
January 25, 2012 through January 27, 2012

1. **REPORT SUMMATION:**

1.1. Multiple Dilution Data Summation

Test Solution	*Pimephales promelas* Acute Toxicity Test 96 Hour Survival	*Ceriodaphnia dubia* Acute Toxicity Test 48 Hour Survival
Reconstituted Control (RC)	100%	100%
Upstream Control (UC)	100%	100%
6.25% Effluent	25%*	95%
12.5% Effluent	0%*	15%*
25% Effluent	0%*	0%*
50% Effluent	0%*	0%*
100% Effluent	0%*	0%*
Estimated LC_{50} Value	<6.25% Effluent	9.42% Effluent (8.34% - 10.65%)

* Indicates a significant difference at alpha = 0.5 between effluent and control survival data.

Note: Calculations were performed on the 48 hr Pimepales promelas data rather than 96 hr due to UPS failure to deliver the renewal effluent.

Conclusion:

Pimephales promelas 96 hour WET results:	LC 50 < 6.25% using Trimmed Spearman-Karber NOAEC < 6.25% by the Steel's Many-One Rank Test
Ceriodaphnia dubia 48 hour WET results:	LC 50 = 9.42% using Trimmed Spearman-Karber NOAEC = 6.25% by the Steel's Many-One Rank Test

Approved by ____________________
Sara C. Shields, Chemist

Environmental Analysis South, Inc.
4000 East Jackson Blvd. • Jackson, MO 63755 • 573-204-8817 • Fax 573-204-8818
eas

REPORT OF ACUTE TOXICITY TESTING
Emerald Performance Materials
Effluent, AEC = 100%

EAS LOG# 1407821
January 25, 2012 through January 27, 2012

2. TEST METHOD SUMMARY

2.1. TEST CONDITIONS AND METHODS:

	Ceriodaphnia dubia:	*Pimephales promelas:*
Test duration:	48 hours	48 hours
Temperature:	24 - 26 degree Celsius	24 - 26 degree Celsius
Light quality:	Ambient laboratory illumination	Ambient laboratory illumination
Photoperiod:	16 hour light, 8 hours dark	16 hour light, 8 hours dark
Control Water:	Moderately Hard Reconstituted Water	Moderately Hard Reconstituted Water
Dilution Water:	Upstream Water - If unavailable or toxic, then control water will be used.	Upstream Water - If unavailable or toxic, then control water will be used.
Size of test vessel:	30 milliliters	250 milliliters
Volume of test solution:	15 milliliters	200 milliliters
Age of test organisms:	<24 hours	1 -14 days (all same age)
Number of organisms/test vessel:	5	10
Number of replicates/concentration:	4	2
Number of organisms/concentration:	20	40 for a single dilution test and 20 for a multiple dilution test
Feeding regime:	None (fed prior to test)	None (fed prior to test)
Aeration:	None	None
Test acceptability criterion:	90% or greater survival in controls	90% or greater survival in controls

The methodology used for the chemistry data was taken from the *Standard Methods for the Examination of Water and Wastewater*, 18th edition (1992). The exception was hardness, which was determined using a Hach EDTA titration test kit. The toxicity tests follow guidelines laid out in the permittee's NPDES permit and were conducted according to EPA approved methods (USEPA 2002).

All test organisms were cultured according to EPA approved methods (USEPA 2002). The *Ceriodaphnia dubia* and the *Pimephales promelas* were obtained from C-K Associates Inc. located in Baton Rouge, Louisiana and shipped overnight for use in the whole effluent toxicity test.

Environmental Analysis South, Inc.
4000 East Jackson Blvd. • Jackson, MO 63755 • 573-204-8817 • Fax 573-204-8818

REPORT OF ACUTE TOXICITY TESTING
Emerald Performance Materials
Effluent, AEC = 100%

EAS LOG# 1407821
January 25, 2012 through January 27, 2012

2.2. REFERENCE TOXICITY TEST:

Environmental Analysis South performs monthly reference toxicity tests. The most recent reference test was initiated on January 11, 2012 using KCL Lot #41713. Following are the results:

2.2.1. ***P. promelas*** - 48 hr. Acute Test – LC_{50} = 0.978 g/l 95%CI (0.733 g/l -1.222 g/l)
EAS %CV = 12.5%
National Warning Limits (75th percentile) = 19%CV
National Control Limits (90th percentile) = 33%CV

2.2.2. ***C. dubia*** - 48 hr. Acute Test – LC_{50} = 0.474 g/l 95%CI (0.304 g/l - 0.644g/l)
EAS %CV = 17.9%
National Warning Limits (75th percentile) = 29%CV
National Control Limits (90th percentile) = 34%CV

2.3. LITERATURE CITED:

1. APHA. 1992. *Standard methods for the examination of water and wastewater*, 18th Ed. American Public Health Association, Washington, D.C
2. USEPA. 2002. *Methods for measuring the acute toxicity of effluents and receiving waters to freshwater and marine organisms*, 5th Ed. EPA-821-R-02-012
3. USEPA 2000. Understanding and Accounting for Method Variability in Whole Effluent Toxicity Applications under the National Pollutant Discharge Elimination System, (Table B-2). June 2000. EPA 833-R-00-003.

WHOLE EFFLUENT TEST conducted in accordance with US EPA 600/4-90/027
Fifth Edition October 2002

CLIENT NAME:	Emerald Permance Materials, Effluent,
NPDES NUMBER:	
TYPE OF METHOD:	multiple dilution, 96 hrs PP & 48 CD, AEC=100%
DATE & TIME OF COLLECTION:	01/23/12 2359 hrs by ARH
DATE & TIME OF SUBMISSION:	01/25/12 1030 hrs by UPS

Upstream: River
Collected: 01/24/12 0600 hrs by ARH

INITIAL OBSERVATIONS	DATE	TIME	ANALYST	QC LOT	QC EXP VALUE	INT EFFL	INT UC	INT RC
LOG NUMBER / ID NUMBER						1407821	1407821A	RC4029
pH - SU	01/25/12	1045 hrs	SCS	SB114 (8.8-9.2)	8.95	7.74	7.70	7.99
TEMPERATURE °C RECEIVED	01/25/12	1045 hrs	SCS	EAS 106		3	3	24
SPECIFIC CONDUCTANCE umhos	01/25/12	1045 hrs	SCS	ERA506-0814(452-505)	496	12410	949	242
HARDNESS - ppm	01/25/12	1045 hrs	SCS	ERA P170-507(107-134)	120	380	400	80
CHLORINE - ppm	01/25/12	1045 hrs	SCS	tap water	+	<0.04	<0.04	<0.04
DISSOLVED OXYGEN - ppm	01/25/12	1045 hrs	SCS	cal@840		4.6	7.5	7.4
TOTAL ALKALINITY - ppm	01/26/12	1000 hrs	SCS	ERAP198-506(76.8-91.5)	86.4	610	229	74.8
INITIAL AMMONIA - ppm	01/27/12	1100 hrs	JPC	EAS #2446 (8-12)	9.62	72.2	0.062	<0.05
TOTAL DISSOLVED SOLIDS -ppm								

0 HOUR OBSERVATIONS	DATE	TIME	ANALYST	QC LOT	QC EXP VALUE	RC	UC	100%	50%	25%	12.50%	6.25%	X %AEC
pH - SU	01/25/12	1100 hrs	SCS	SB114 (8.8-9.2)	8.95	8.25	7.84	8.00	8.00	8.00	7.98	7.93	
TEMPERATURE °C	01/25/12	1100 hrs	SCS	EAS 106		24.3	24.6	25.0	24.9	24.9	24.9	24.9	
SPECIFIC CONDUCTANCE umhos	01/25/12	1100 hrs	SCS	ERA506-0814(452-505)	496	282	936	12590	7370	4060	2430	1674	
DISSOLVED OXYGEN - ppm	01/25/12	1100 hrs	SCS	cal@840		8.3	9.6	10.3	10.6	10.7	11.0	11.2	

24 HOUR OBSERVATIONS - PP	DATE	TIME	ANALYST	QC LOT	QC EXP VALUE	RC	UC	100%	50%	25%	12.50%	6.25%	X %AEC
pH - SU	01/26/12	1100 hrs	SCS	SB114 (8.8-9.2)	8.93	7.70	8.26	8.39	8.38	8.37	8.36	8.27	
TEMPERATURE °C	01/26/12	1100 hrs	SCS	EAS 106		25.1	25.1	25.1	25.1	25.1	25.1	25.1	
SPECIFIC CONDUCTANCE umhos	01/26/12	1100 hrs	SCS	ERA506-0814(452-505)	490	315	914	12640	7470	4170	2490	1693	
DISSOLVED OXYGEN - ppm	01/26/12	1100 hrs	SCS	cal@840		7.9	7.7	7	7.4	7.4	7.4	7.5	
48 HOUR OBSERVATIONS - PP	**DATE**	**TIME**	**ANALYST**	**QC LOT**	**QC EXP VALUE**	**RC**	**UC**	**100%**	**50%**	**25%**	**12.50%**	**6.25%**	**X %AEC**
pH - SU	01/27/12	1100 hrs	SCS	SB114 (8.8-9.2)	8.93	8.33	8.06	8.39	8.37	8.33	8.26	8.19	
TEMPERATURE °C	01/27/12	1100 hrs	SCS	EAS 106		24.9	24.9	24.9	24.9	24.9	24.9	24.9	
SPECIFIC CONDUCTANCE umhos	01/27/12	1100 hrs	SCS	ERA506-0814(452-505)	501	390	942	12840	7600	4200	2530	1708	
DISSOLVED OXYGEN - ppm	01/27/12	1100 hrs	SCS	cal@840		7.4	7.2	7.0	6.9	6.8	6.9	7.1	
FINAL AMMONIA - ppm													

24 HOUR OBSERVATIONS - CD	DATE	TIME	ANALYST	QC LOT	QC EXP VALUE	RC	UC	100%	50%	25%	12.50%	6.25%	X %AEC
pH - SU	01/26/12	1100 hrs	SCS	SB114 (8.8-9.2)	8.93	7.99	8.28	8.48	8.52	8.48	8.45	8.44	
TEMPERATURE °C	01/26/12	1100 hrs	SCS	EAS 106		25.1	25.1	25.1	25.1	25.1	25.1	25.1	
SPECIFIC CONDUCTANCE umhos	01/26/12	1100 hrs	SCS	ERA506-0814(452-505)	490	307	893	12370	7160	3960	2450	1627	
DISSOLVED OXYGEN - ppm	01/26/12	1100 hrs	SCS	cal@840		8.4	8.2	8.2	8.2	8.3	8.3	8.3	
8 HOUR OBSERVATIONS - CD	**DATE**	**TIME**	**ANALYST**	**QC LOT**	**QC EXP VALUE**	**RC**	**UC**	**100%**	**50%**	**25%**	**12.50%**	**6.25%**	**X %AEC**
pH - SU	01/27/12	1100 hrs	SCS	SB114 (8.8-9.2)	8.93	1.00	8.25	8.71	8.50	8.51	8.46	8.38	
TEMPERATURE °C	01/27/12	1100 hrs	SCS	EAS 106		25.1	25.1	25.1	25.1	25.1	25.1	25.1	
ECIFIC CONDUCTANCE umhos	01/27/12	1100 hrs	SCS	ERA506-0814(452-505)	501	304	897	12230	7160	4010	2390	1619	
DISSOLVED OXYGEN - ppm	01/27/12	1100 hrs	SCS	cal@840		8.0	8.1	8.0	8.1	8.0	8.1	8.0	
FINAL AMMONIA - ppm													

Page 8 of 13

Approved by: [signature]

Date: 02/02/2012

WHOLE EFFLUENT TEST conducted in accordance with US EPA 600/4-90/027
Fifth Edition October 2002

CLIENT NAME: Emerald Permance Materials, Effluent,
NPDES NUMBER:
TYPE OF METHOD: multiple dilution, 96 hrs PP & 48 CD, AEC=100%
DATE & TIME OF COLLECTION: Renewal was not received due to UPS error--calculations to be made at 48 hours
DATE & TIME OF SUBMISSION:

Upstream: River

INITIAL OBSERVATIONS	DATE	TIME	ANALYST	QC LOT	QC EXP VALUE	INT EFFL	INT UC	INT RC					
LOG NUMBER / ID NUMBER								RC4029					
pH - SU				SB114 (8.8-9.2)				7.99					
TEMPERATURE °C RECEIVED				EAS 106				24					
SPECIFIC CONDUCTANCE umhos				ERA506-0814(452-505)				242					
HARDNESS - ppm				ERA P170-507(107-134)	120			80					
CHLORINE - ppm				tap water				<0.04					
DISSOLVED OXYGEN - ppm				cal@840				7.4					
TOTAL ALKALINITY - ppm				ERA P173-506(42.8-49.6)									
INITIAL AMMONIA - ppm				EAS #1981 (8-12)									
TOTAL DISSOLVED SOLIDS -ppm													
0 HOUR OBSERVATIONS	**DATE**	**TIME**	**ANALYST**	**QC LOT**	**QC EXP VALUE**	**RC**	**UC**	**100%**	**50%**	**25%**	**12.50%**	**6.25%**	**X %AEC**
pH - SU	01/27/12	1100 hrs	SCS	SB114 (8.8-9.2)									
TEMPERATURE °C	01/27/12	1100 hrs	SCS	EAS 106									
SPECIFIC CONDUCTANCE umhos	01/27/12	1100 hrs	SCS	ERA506-0814(452-505)									
DISSOLVED OXYGEN - ppm	01/27/12	1100 hrs	SCS	cal@840									
72 HOUR OBSERVATIONS - PP	**DATE**	**TIME**	**ANALYST**	**QC LOT**	**QC EXP VALUE**	**RC**	**UC**	**100%**	**50%**	**25%**	**12.50%**	**6.25%**	**X %AEC**
pH - SU	01/28/12	1100 hrs	SCS	SB114 (8.8-9.2)									
TEMPERATURE °C	01/28/12	1100 hrs	SCS	EAS 106									
SPECIFIC CONDUCTANCE umhos	01/28/12	1100 hrs	SCS	ERA506-0814(452-505)									
DISSOLVED OXYGEN - ppm	01/28/12	1100 hrs	SCS	cal@840									
96 HOUR OBSERVATIONS - PP	**DATE**	**TIME**	**ANALYST**	**QC LOT**	**QC EXP VALUE**	**RC**	**UC**	**100%**	**50%**	**25%**	**12.50%**	**6.25%**	**X %AEC**
pH - SU	01/29/12	1100 hrs	SCS	SB114 (8.8-9.2)									
TEMPERATURE °C	01/29/12	1100 hrs	SCS	EAS 106									
SPECIFIC CONDUCTANCE umhos	01/29/12	1100 hrs	SCS	ERA506-0814(452-505)									
DISSOLVED OXYGEN - ppm	01/29/12	1100 hrs	SCS	cal@840									
FINAL AMMONIA - ppm													

Approved by: [signature]

Date: 02/02/2012

WHOLE EFFLUENT TEST conducted in accordance with US EPA 600/4-90/027
Fifth Edition October 2002

Emerald Permance Materials, Effluent, EAS LOG# 1407821

Date Test Began: January 25, 2012
Time Test Began: 1100 hrs
Date Test Finished: 11/27/12CD&11/29/12PP
Time Test Finished: 1100 hrs

Analyst 1: DFW
Analyst 2: KJR
Analyst 3: SCS

P. promelas (PP) AGE: 7 days HATCH NUMBER: 8257 c-k

	RC	UC	100%	50%	25%	12.50%	6.25%	X% AEC
PERIOD	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE
0 HR-PP	10,10	10,10	10,10	10,10	10,10	10,10	10,10	
24 HR-PP	10,10	10,10	0,0	0,0	2,1	8,7	8,9	
48 HR-PP	10,10	10,10	0,0	0,0	0,0	0,0	4,1	

Ceriodaphnia dubia (CD) AGE: <24 hours HATCH NUMBER: 2429 c-k

	RC	UC	100%	50%	25%	12.50%	6.25%	X% AEC
PERIOD	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE
0 HR-CD	5,5,5,5	5,5,5,5	5,5,5,5	5,5,5,5	5,5,5,5	5,5,5,5	5,5,5,5	
24 HR-CD	5,5,5,5	5,5,5,5	0,0,0,0	0,0,0,0	2,4,3,5	5,5,5,5	5,5,5,5	
48 HR-CD	5,5,5,5	5,5,5,5	0,0,0,0	0,0,0,0	0,0,0,0	0,0,1,2	5,4,5,5	

Approved by: [signature]

Date: 02/02/2012

WHOLE EFFLUENT TEST conducted in accordance with US EPA 600/4-90/027
Fifth Edition October 2002

Emerald Permance Materials, Effluent, EAS LOG# 1407821

Date Test Began:	January 25, 2012	Time Test Began:	1100 hrs	Analyst 1:	DFW
Date Test Finished:	11/27/12CD&11/29/12PP	Time Test Finished:	1100 hrs	Analyst 2:	KJR
				Analyst 3:	SCS

P. promelas (PP) AGE: 13 days HATCH NUMBER: 052609cd aro

	RC	UC	100%	50%	25%	12.50%	6.25%	X% AEC
PERIOD	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE	ALIVE
48 HR-PP								
72 HR-PP								
96 HR-PP								

Approved by: [signature]

Date: 02/02/2012

WHOLE EFFLUENT TEST conducted in accordance with US EPA 600/4-90/027
Fifth Edition October 2002

Emerald Permance Materials, Effluent, EAS#: 1407821

Notes & Comments
Note #1:Effluent aerated prior to test initiation due low DO upon arrival.
Note #2:Effluent bright orange in color.

Prepared by: [signature]

Date: 02/02/2012

SL-9/oh

116119

SUBCONTRACT ORDER

PDC Laboratories, Inc.

2012627

1/24/2012

PDC Laboratories, Inc.
2231 W. Altorfer Drive
Peoria, IL 61615
Project Manager: Kurt C. Stepping
kstepping@pdclab.com Phone: 309-683-1719

Environmental Analysis South
4000 East Jackson Blvd
Jackson, MO 63755
Phone :(573) 204-8817

Sample Origin (State) IL

PO# L 40833

Emerald

Analysis	Due	Expires	Comments	
Sample ID: 2012627-01 -Effluent Waste Water			Sampled: 01/23/12 23:59	1407821 temp on rec 3°C
Wet Testing - Single Dilution	02/03/12 16:00	01/25/12 23:59		
Sample ID: 2012627-02 -River Waste Water			Sampled: 01/24/12 06:00	1407821-A 3°C
Wet Testing - Single Dilution	02/03/12 16:00	01/26/12 06:00		

SS

Relinquished By	Date/Time	Received By	Date/Time		
[signature]	1-24-12 13:30			Sample Temperature Upon Receipt	____ C
				Sample(s) Received on Ice	Y or N
Relinquished By	Date/Time	Received By	Date/Time	Proper Bottles Received in Good Condition	Y or N
		[signature]	1/25/12 1030 UPS	Bottles Filled with Adequate Volume	Y or N
				Samples Received Within Hold Time	Y or N
				Date/Time Taken From Sample Bottle	Y or N

Emerald Performance Materials

Emerald Performance Materials, LLC
1550 County Road 1450 N
Henry, Illinois 61537
309-364-2311

CERTIFIED MAIL: 7016 1370 0002 2632 2248

November 7, 2017

Illinois Environmental Protection Agency
Bureau of Water
Compliance Assurance Section
1021 North Grand Avenue East
Post Office Box 19276
Springfield, Illinois 62794-9276

Re: NPDES Biomonitoring Results- NPDES Permit No. IL0001392

Dear Sir or Madam:

In accordance with special condition number 14 of NPDES permit No. IL0001392 issued to Emerald Performance Materials, attached please find the analytical results for sampling completed September 27th, 2017. Attached you will also find a letter from Mr. Kurt Stepping, Senior Project Manager from PDC Labs. Mr. Stepping's letter is in explanation of the delayed submission of this report which is outside of the seven (7) day window required under special condition 14 of the above permit. Mr. David Sikes, EHS&S Manager for the Emerald Performance Materials - Henry, IL facility is responsible for reporting all wastewater treatment results to IEPA and the report attached from PDC was not provided to Mr. Sikes until October 1, 2017 due to an automated email oversight by PDC staff. Mr. Sikes and PDC have taken correction actions to ensure that this incident will not happen again. Emerald is requesting that leniency be shown given the cause of the delay is not a result of Emerald negligence or mistake.

If you have any questions or need addition information, please contact David Sikes at (309)364-9472.

Sincerely,
EMERALD PERFORMANCE MATERIALS, LLC

J. David Sikes
EHS&S Manager

Attachments: Letter from Kurt Stepping, Senior Project Manager - PDC Laboratories, Inc.
PDC Laboratories, Inc. Analytical Data Report (Project WO# 7094078)

cc Todd Huson, IEPA-Regional Office
CERTIFIED MAIL: 7016 1370 0002 2632 2255

PDC Laboratories, Inc.
2231 W. Altorfer Drive • Peoria IL 61615
(309) 692-9688 • (800) 752-6651 • FAX (309) 692-9689

November 3, 2017

Mr David Sikes
Emerald Performance Materials
1550 CR 1450 N
Henry, IL 61537

Dear David,

This letter is to document the series of events related to the reporting of your WET testing results for your Henry IL facility.

PDC Laboratories received samples during the week of September 25, 2017.
After all analyses, data entry, and data review were completed PDC Laboratories initially processed a report to Emerald on October 12, 2017. The report was processed through our automated Lab Messenger system and emailed to Emerald.

On November 1, 2017 you informed me that you had never received the report. I immediately regenerated a revised report with a comment on the report as to the reason for the revision and emailed this report to you.

On November 3, 2017 I further investigated the email submittal of the initial report. At this time, I discovered that we used a "project" in our LIMS system from several years past when PDC Labs last was involved with the WET testing for Emerald. The prior Emerald contact person's name was changed to yours. We did not however update a "report options" section of the LIMS that specifically directs the outgoing email from the automated system. This reporting options screen is accessed by clicking through a few more screens. This was an oversight on our end. When the initial report was processed it went to the email addresses at Emerald that are still active from when the project was initiated years ago. This did NOT include you.

I apologize for this oversight on the reporting of the WET testing and any inconvenience this may have caused.

Thank you for your attention to this matter, and please let me know if you have any questions.

Sincerely,

PDC Laboratories Inc.

Kurt C. Stepping
Senior Project Manager

PDC Laboratories, Inc.
PROFESSIONAL DEPENDABLE COMMITTED

November 01, 2017

David Sikes
Emerald Performance Materials
1550 County Rd 1450 N
Henry, IL 61537

Dear David Sikes:

Please find enclosed the **revised** analytical results for the sample(s) the laboratory received on **9/25/17 11:30 am** and logged in under work order **7094078**. All testing is performed according to our current TNI certifications unless otherwise noted. This report cannot be reproduced, except in full, without the written permission of PDC Laboratories, Inc.

If you have any questions regarding your report, please contact your project manager. Quality and timely data is of the utmost importance to us.

PDC Laboratories, Inc. appreciates the opportunity to provide you with analytical expertise. We are always trying to improve our customer service and we welcome you to contact the Vice President, John LaPayne with any feedback you have about your experience with our laboratory.

Sincerely,

Senior Project Manager
(309) 692-9688 x1719
kstepping@pdclab.com

NELAP ACCREDITED TNI LABORATORY

PDC Laboratories, Inc.
2231 West Altorfer Drive
Peoria, IL 61615
(800) 752-6651

REVISED ANALYTICAL RESULTS

Sample:	7094078-01	**Sampled:**	09/25/17 09:00
Name:	EFFLUENT	**Received:**	09/25/17 11:30
Alias:	Pass. Pimephales Promelas LC50 = 3.78%, Ceriodaphnia Dubia LC50 = > 12.5%	**Matrix:**	Waste Water - Composite
		PO #:	HE40080120-UB

Parameter	Result	Unit	Qualifier	Prepared	Analyzed	Analyst	Method
Distilled Nutrients - STL							
Ammonia-N	42	mg/L		09/28/17 10:58	09/28/17 11:10	SCI	EPA 350.1*
General Chemistry - SPMO							
Chlorine - Total Residual	0.14	mg/L	H	09/26/17 16:38	09/26/17 16:38	KB	SM 4500-Cl G*
Conductivity	2900	umhos/cm		09/26/17 12:28	09/26/17 12:28	RRG	SM 2510B
Dissolved Oxygen	8.6	mg/L	H	09/26/17 12:28	09/26/17 12:28	RRG	SM 4500-O G*
pH	8.0	pH Units	H	09/26/17 12:28	09/26/17 12:28	RRG	SM 4500-H B - SW 9040*
General Chemistry - STL							
Alkalinity - total as CaCO3	700	mg/L		09/27/17 09:30	09/27/17 13:30	SCI	SM 2320B*
Total Metals - STL							
Calcium	140	mg/L		09/28/17 11:00	10/02/17 15:06	KLA	EPA 200.7
Hardness	520	mg/L		09/28/17 11:00	10/02/17 15:18	KLA	SM 2340B
Magnesium	39	mg/L		09/28/17 11:00	10/02/17 15:18	KLA	EPA 200.7
WETT - SPMO							
Ceriodaphnia Dubia TUa	< 8.0	units		09/26/17 12:28	09/26/17 12:28	RRG	EPA 2002.0*
Pimephales Promelas TUa	26	units		09/26/17 12:28	09/26/17 12:28	RRG	EPA 2002.0*

Sample:	7094078-02	**Sampled:**	09/25/17 09:00
Name:	UPSTREAM	**Received:**	09/25/17 11:30
Matrix:	Waste Water - Grab	**PO #:**	HE40080120-UB

Parameter	Result	Unit	Qualifier	Prepared	Analyzed	Analyst	Method
Distilled Nutrients - STL							
Ammonia-N	0.48	mg/L		09/28/17 10:58	09/28/17 11:10	SCI	EPA 350.1*
General Chemistry - SPMO							
Chlorine - Total Residual	0.33	mg/L	H	09/26/17 16:38	09/26/17 16:38	KB	SM 4500-Cl G*
Conductivity	700	umhos/cm		09/26/17 12:28	09/26/17 12:28	RRG	SM 2510B
Dissolved Oxygen	8.8	mg/L	H	09/26/17 12:28	09/26/17 12:28	RRG	SM 4500-O G*
pH	8.1	pH Units	H	09/26/17 12:28	09/26/17 12:28	RRG	SM 4500-H B - SW 9040*

PDC Laboratories, Inc.
2231 West Altorfer Drive
Peoria, IL 61615
(800) 752-6651

NOTES

Specific method revisions used for analysis are available upon request.

Memos

Report of Acute Toxicity Testing

Reference Toxicity Test:
PDC Laboratories, INC. conducts a monthly reference toxicant test to demonstrate and obtain consistent, precise results for permit compliance purposes. This demonstration is to ensure satisfactory laboratory performance. The most recent reference test results are as follows:

Date Initiated: September 20, 2017
Date Concluded: September 22, 2017

Reference Toxicant: Potassium Chloride (KCl)
Lot Number: 46345704
Expiration: N/A
Standards ID: SPMO1-22B

Moderately Hard Synthetic Water: 31BC3
Prepared: September 14, 2017
Expiration: September 30, 2017
Analyst: RRG

Pimephales promelas: 48 hour Acute Test - LC50 = 750 mg/L
SPMO %CV = 17.84%
National Limits (75th Percentile) = 17.9% CV
National Control Limit (90th Percentile) = 33% CV
Ceriodaphnia dubia: 48 hour Acute Test - LC50 = 736.8 mg/L
SPMO %CV = 26.44%
National Limits (75th Percentile) = 29%CV
National Control Limit (90th Percentile) = 34%CV

Literature Cited:
1.) APHA. 1992. Standard methods for the examination of water and wastewater, 18th Ed. American Public Health Association, Washington, D.C.
2.) USEPA. 2002. Methods for measuring the acute toxicity of effluents and receiving waters to freshwater and marine organisms, 5th ed. EPA-821-R-02-012
3.) USEPA 2000. Understanding and Accounting for Method Variability in Whole Effluent Toxicity Applications under the National Pollutant Discharge Elimination System, (Table B-2). June 2000. EPA 833-R-00-003

REVISED REPORT: Regenerated 11/1/17 due to original file lost in client email software crash.

PDC Laboratories, Inc.
2231 West Altorfer Drive
Peoria, IL 61615
(800) 752-6651

Certifications

CHI - McHenry, IL
TNI Accreditation for Drinking Water, Wastewater, Hazardous and Solid Wastes Fields of Testing through IL EPA Lab No. 100279
Illinois Department of Public Health Bacteriological Analysis in Drinking Water Approved Laboratory Registry No. 17556

PIA - Peoria, IL
TNI Accreditation for Drinking Water, Wastewater, Hazardous and Solid Wastes Fields of Testing through IL EPA Lab No. 100230
Illinois Department of Public Health Bacteriological Analysis in Drinking Water Approved Laboratory Registry No. 17553
Drinking Water Certifications: Iowa (240); Kansas (E-10338); Missouri (870)
Wastewater Certifications: Arkansas (88-0677); Iowa (240); Kansas (E-10338)
Hazardous/Solid Waste Certifications: Arkansas (88-0677); Iowa (240); Kansas (E-10338)

SPMO - Springfield, MO
USEPA DMR-QA Program

STL - St. Louis, MO
TNI Accreditation for Wastewater, Hazardous and Solid Wastes Fields of Testing through KS Lab No. E-10389
Illinois Department of Public Health Bacteriological Analysis in Drinking Water Approved Laboratory Registry No. 171050
Drinking Water Certifications: Missouri (1050)
Missouri Department of Natural Resources

* Not a TNI accredited analyte

Qualifiers

H Test performed after the expiration of the appropriate regulatory/advisory maximum allowable hold time.

Certified by: Kurt Stepping, Senior Project Manager

SUBCONTRACT ORDER
Transfer Chain of Custody

PDC Laboratories, Inc.

7094078

SENDING LABORATORY

PDC Laboratories, Inc.
2231 W Altorfer Dr
Peoria, IL 61615
(800) 752-6651

RECEIVING LABORATORY

PDC Springfield
1805 W. Sunset
Springfield, MO 65807
(417) 864-8924

Sample: 7094078-01
Name: EFFLUENT

Sampled: 09/25/17 09:00
Matrix: Waste Water
Preservative: Cool <6

Analysis	Due	Expires	Comments
03-WET Multiple	10/05/17 16:00	09/26/17 21:00	

Sample: 7094078-02
Name: UPSTREAM

Sampled: 09/25/17 09:00
Matrix: Waste Water
Preservative: Cool <6

Analysis	Due	Expires	Comments
03-WET Multiple	10/05/17 16:00	09/26/17 21:00	

Please email results to Kurt Stepping at kstepping@pdclab.com

Date Shipped: 9-25-17 Total # of Containers: 9 Sample Origin (State): IL PO #: ______

Turn-Around Time Requested ☑ NORMAL ☐ RUSH Date Results Needed: ______

Relinquished By	Date/Time	Received By	Date/Time
[signature]	9-25-17 1400	[signature]	950 9-26-17

Sample Temperature Upon Receipt	2.9 °C
Sample(s) Received on Ice	(Y) or N
Proper Bottles Received in Good Condition	(Y) or N
Bottles Filled with Adequate Volume	(Y) or N
Samples Received Within Hold Time	(Y) or N
Date/Time Taken From Sample Bottle	(Y) or N

Multiple Dilution WET Test

Client Permit #: IL0001392

Sample # 7094078
Client Emerald Polymer

PP Hatch 091817A
CD Hatch 092617ICA

MHSF 31BC3
Board/Shelf 2;2

Cup	Conc.	Initial	24 hour	48 hour	72 hour	96 hour
P1	6.25	10	8	2	2	1
P2	Lab	10	10	10	9	9
P3	6.25	10	8	3	1	0
P4	12.5	10	0	0	0	0
P5	0.78	10	10	~~10~~ 9	8	7
P6	3.125	10	10	9	7	~~4~~ 5
P7	0.78	10	10	8	8	6
P8	12.5	10	0	0	0	0
P9	1.565	10	10	10	10	9
P10	Lab	10	10	10	9	8
P11	1.565	10	10	9	8	5
P12	Up	10	10	10	8	8
P13 *	3.125	10	10	9	8	6
P14 *	Up	10	10	10	10	9
C1	1.565	5	5	5		
C2	12.5	5	5	5		
C3	Lab	5	5	4		
C4	Lab	5	5	5		
C5	Up	5	5	5		
C6	0.78	5	5	5		
C7	0.78	5	5	5		
C8	6.25	5	5	5		
C9	Lab	5	5	5		
C10	Lab	5	5	5		
C11	12.5	5	5	5		
C12	6.25	5	5	4		
C13	3.125	5	5	5		
C14	1.565	5	5	5		
C15	3.125	5	5	5		
C16	12.5	5	5	5		
C17	Up	5	5	5		
C18	3.125	5	5	5		
C19	1.565	5	5	5		
C20	12.5	5	5	5		
C21	6.25	5	5	5		
C22	0.78	5	5	5		
C23	0.78	5	5	5		
C24	1.565	5	5	5		
C25 *	3.125	5	5	5		
C26 *	Up	5	5	5		
C27 *	Up	5	5	5		
C28 *	6.25	5	5	5		

* These cups only used when upstream samples are provided.

Set Times			
Start Date/Time:	9-26-17 @ 1310		
	Date	Time	Analyst
0 Hour	9-26-17	1310	RRG
24 Hour	9-27-17	1320	RRG
48 Hour	9-28-17	1240	RRG
72 Hour	9-29-17	1307	RRG
96 Hour	9-30-17	1320	KLM
End Date/Time:	~~10-2-17~~ 9-30-17 @ 1320		

Results			
Pimephales promelas			
96 Hour Result		Date	Analyst
LC 50	3.87	10-2-17	RRG
TUa	25.84	10-2-17	RRG
P-Value	0.0038	10-2-17	RRG
Ceriodaphnia Dubia			
48 Hour Result		Date	Analyst
LC 50	>12.5	10-2-17	RRG
TUa	<8	10-2-17	RRG
P-Value	1.0000	10-2-17	RRG
		Date	Analyst
Filtered (Y / N): Y	upstream	9-26-17	RRG
Light Check:	N/A	9-26-17	RRG
PP Fry Age:	8 days	9-26-17	RRG
CD Neonates Age:	<24 hrs	9-26-17	RRG

Comments: PP fry were set in 200 ml of conc. w/in a 250 ml cup .CD were set in 15 ml of conc. w/in a 30 ml cup

Analyst Signature: [signature]
Date: 10-2-17

Read and Understood By: [signature]
Date: 10-10-17

Logbook: 1

Report #: 42

Emerald

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		Date	Time	Analyst	48 hour	Date	Time	Analyst	96 hour			Analyst
4.00	4.01	9-26-17	1102	RRG	4.01	9-28-17	1242	RRG	4.01	9-30-17	1325	KM
7.00	7.00				7.00				7.00			
	10.02				10.02				10.02			
	98				98.2				96.6			

DO (mg/L)	Initial	1 Hour	24 Hour	48 Hour	72 Hour	96 Hour
Date	9-26-17	9-26-17	9-27-17	9-28-17	9-29-17	9-30-17
Time	1114	1409	1316	1241	1305	1325
Analyst	RRG	RRG	RRG	RRG	RRG	KM
Pressure (mmHg)	730	730	733	735	735	736

p	2	7	9	6	1	4	12	8				
						12.50%	*Upstream				Batch	Analyst
pH (EPA 150.1)	7.78	8.11	8.11	8.11	8.08	8.05	8.11	8.07	9-26-17	1228	B717372	RRG
DO mg/L (SM 5010)	8.33	8.57	7.55	8.60	8.59	8.65	8.63	8.65	9 26 17	1228	B717372	RRG

Conductivity (µMohs) (SM 2510B)		Effluent	*Upstream				Analyst
	322	2920	695	9-26 17	1228	B717372	RRG

		Effluent	Upstream *			B	Analyst
Chlorine (mg/L)		0.14	0.33	9-26-17	1638	B717339	~~RRG~~ RRG
Ammonia (mg/L)		42.0	0.48	9-28-17	1130	B717479	SCI
Alkalinity (mg/L)		696		9-27-17	1330	B717367	SCI
	200.7	520		10-2-17	1518	B717482	KM

Comments: Conductivity dup=2940 (RRG 9 26 17)

Conductivity of renewal: upstream=707 Effluent=2980 9-28-17 RRG

**qualifier added to D.O., pH & Chlorine analytes of test due to sample hold time. - RRG 10-2-17

0 Hour		nia Dubia	ate		
Temperature (°C)	24.0	22.8	9-26-17	1310	RRG

1 Hour

Test	MHSF	Effluent	Upstream *	Date		Analyst
DO (mg/L)	7.92	8.45	8.52	9-26-17	140	RRG
	Fathead Minow		Cerodaphnia Dubia	Date		Analyst
Temperature (°C)	24.3		24.0	9-26-17	1410	RRG

24 Hour

Test	MHSF	0.78%	1.57	3.1%	6.25%	12.5%	*Upstream	Date	Time	Analyst
DO (mg/L)	7.31	7.43	7.34	7.51	7.32	7.29	7.49	9-27-17	1326	RRG
	Fathead Minow			Cerodaphnia Dubia				Date	Time	Analyst
Temperature (°C)	25.6			24.7				9-27-17	1326	RRG

48 Hour

Test	MHSF	0.78%	1.57%	3.1%	6.25%	12.5%	*Upstream	Date	Time	Analyst
pH	7.70	8.51	8.51	8.54	8.54	8.56	8.56	9-28-17	1243	RRG
DO (mg/L)	7.34	7.55	7.32	7.68	7.45	7.37	7.43	9-28-17	1243	RRG
	Fathead Minow			Cerodaphnia Dubia				Date	Time	Analyst
Temperature (°C)	25.8			24.8				9-28-17	1243	RRG
	MHSF		Effluent		*Upstream			Date	Time	Analyst
Conductivity (µMohs)	314		2620		1067			9-28-17	1243	RRG
Renewal Period:	Minnows fed @ 1220 on 9-28-17; After 1 hour minnows were transferred to renewed water @ 1355									

72 Hour

Test	MHSF	0.78%	1.57%	3.1%	6.25%	12.5%	*Upstream	Date	Time	Analyst
DO (mg/L)	7.28	6.97	6.78	6.86	6.81	7.14	6.82	9-29-17	1306	RRG
	Fathead Minow							Date	Time	Analyst
Temperature (°C)	26.0							9-29-17	1306	RRG

96 Hour

Test	MHSF	0.78%	1.57%	3.1%	6.25%	12.5%	*Upstream	Date	Time	Analyst
pH	7.87	8.37	8.36	8.44	8.40	8.51	8.38	9.30.17	1330	KM
DO (mg/L)	7.37	6.99	6.66	7.00	6.87	7.37	6.88	9.30.17	1330	KM
	Fathead Minow							Date	Time	Analyst
Temperature (°C)	26.2							9.30.17	~~730~~ 1330 (KM 9.30.17)	KM
	MHSF		Effluent		*Upstream			Date	Time	Analyst
Conductivity (µMohs)	842		1999		1614			9.30.17	1340	KM

* Upstream only performed if supplied by the client

Analyst Signature: [illegible]

Date: 10-2-17

Read and Understood By: [illegible]

Date: 10-10-17

PDC Laboratories, Inc.
2231 W. Altorfer Dr
Peoria, IL 61615

CHAIN OF CUSTODY RECORD

State where samples were collected IL

Phone: (800) 752-6651
Fax: (309) 692-9589
www.pdclab.com

ALL HIGHLIGHTED AREAS MUST BE COMPLETED BY CLIENT (PLEASE PRINT)

(1) CLIENT: EMERALD PERFORMANCE MATERIALS	P.O. NUMBER:	PROJECT NAME: WET	DATE SHIPPED:
ADDRESS: 1550 CO ROAD 1450 NORTH	PHONE: (309) 364-9472	EMAIL: DAVID.SIKES@EMERALDMATERIALS.COM	MEANS SHIPPED:
CITY: HENRY / STATE: IL / ZIP: 61537	SAMPLER (PLEASE PRINT): KURT STEPPING		MATRIX TYPES: WW - WASTE WATER; DW - DRINKING WATER; GW - GROUND WATER; WWSL - SLUDGE; NAS - SOLID; LCHT - LEACHATE; OTHER:
CONTACT PERSON: DAVID SIKES	SAMPLER'S SIGNATURE: [signature]		

(3) ANALYSIS REQUESTED: WET Multiple Dilutions

(4) WORK ORDER (FOR LAB USE ONLY)
LOGIN #: 7095078-2
LOGGED BY: [initials]
PROJECT: Emerald WET
PROJ MGR: KURT

(2) SAMPLE DESCRIPTION AS YOU WANT TO REPORT	DATE COLLECTED	TIME COLLECTED	SAMPLE TYPE GRAB	SAMPLE TYPE COMP	MATRIX TYPE	BOTTLE COUNT	WET Multiple Dilutions	REMARKS
Plant Effluent	9-25-17	0900		X	WW	6	X	
Upstream	9-25-17	0900	X		WW	3	X	

(5) TURNAROUND TIME REQUESTED (RUSH TAT IS SUBJECT TO APPROVAL AND SURCHARGE) ☑ NORMAL ☐ RUSH

DATE RESULTS NEEDED

(6) *The sample temperature will be measured upon receipt at the lab. By initialing this area, you request that we notify you before proceeding with analysis if the sample temperature is outside of the range of 0.1-6.0°C. By not initialing this area, you allow the lab to proceed with analytical testing regardless of the sample temperature.*

RELINQUISHED BY (SIGNATURE)	DATE / TIME	RECEIVED BY (SIGNATURE)	DATE / TIME
(7) [signature]	DATE 9-25-17 TIME 1130		DATE TIME
	DATE TIME		DATE TIME
	DATE TIME	[signature]	DATE 9-25-17 TIME 1130

(8) COMMENTS (FOR LAB USE ONLY)

SAMPLE TEMPERATURE UPON RECEIPT 14 °C
CHILL PROCESS STARTED PRIOR TO RECEIPT Y OR N
SAMPLE(S) RECEIVED ON ICE Y OR N
PROPER BOTTLES RECEIVED IN GOOD CONDITION Y OR N
BOTTLES FILLED WITH ADEQUATE VOLUME Y OR N
SAMPLES RECEIVED WITHIN HOLD TIME(S) (EXCLUDES TYPICAL FIELD PARAMETERS) Y OR N
DATE AND TIME TAKEN FROM SAMPLE BOTTLE

PDC Laboratories, Inc.
2231 W. Altorfer Dr
Peoria, IL 61615

CHAIN OF CUSTODY RECORD

State where samples were collected IL

Phone: (800) 752-6651
Fax: (309) 692-9689
www.pdclab.com

ALL HIGHLIGHTED AREAS MUST BE COMPLETED BY CLIENT (PLEASE PRINT)

(1) CLIENT: EMERALD PERFORMANCE MATERIALS	P.O. NUMBER:	PROJECT NAME: WET	DATE SHIPPED:
ADDRESS: 1550 CO ROAD 1450 NORTH	PHONE: (309) 364-9472	EMAIL: DAVID.SIKES@EMERALDMATERIALS.COM	MEANS SHIPPED:
CITY: HENRY; STATE: IL; ZIP: 61537	SAMPLER (PLEASE PRINT): KURT STEPPING		MATRIX TYPES: WW - WASTE WATER; DW - DRINKING WATER; GW - GROUND WATER; WWSL - SLUDGE; NAS - SOLID; LCHT - LEACHATE; OTHER:
CONTACT PERSON: DAVID SIKES	SAMPLER'S SIGNATURE: [signature]		

(3) ANALYSIS REQUESTED

(4) WORK ORDER (FOR LAB USE ONLY)
LOGIN #: 7094078-3/4
LOGGED BY: [initials]
PROJECT: Emerald WET
PROJ MGR: KURT

(2) SAMPLE DESCRIPTION AS YOU WANT TO REPORT	DATE COLLECTED	TIME COLLECTED	SAMPLE TYPE GRAB	SAMPLE TYPE COMP	MATRIX TYPE	BOTTLE COUNT	WET Multiple Dilutions						REMARKS
Plant Effluent	9-27-17	0900		X	WW	4	X						
Upstream	9-27-17	0845	X		WW	3	X						
													7094078

(5) TURNAROUND TIME REQUESTED (RUSH TAT IS SUBJECT TO APPROVAL AND SURCHARGE) ☑ NORMAL ☐ RUSH

DATE RESULTS NEEDED

(6) *The sample temperature will be measured upon receipt at the lab. By initialing this area, you request that we notify you before proceeding with analysis if the sample temperature is outside of the range of 0.1-6.0°C. By not initialing this area, you allow the lab to proceed with analytical testing regardless of the sample temperature.*

(7) RELINQUISHED BY (SIGNATURE)	DATE / TIME	RECEIVED BY (SIGNATURE)	DATE / TIME
[signature]	DATE 9-27-17 TIME 10:30		DATE TIME
RELINQUISHED BY (SIGNATURE)	DATE TIME	RECEIVED BY (SIGNATURE)	DATE TIME
RELINQUISHED BY (SIGNATURE)	DATE TIME	RECEIVED BY (SIGNATURE) [signature]	DATE 9/27/17 TIME 1030

(8) COMMENTS (FOR LAB USE ONLY)

SAMPLE TEMPERATURE UPON RECEIPT 3 °C
CHILL PROCESS STARTED PRIOR TO RECEIPT (Y) OR N
SAMPLE(S) RECEIVED ON ICE (Y) OR N
PROPER BOTTLES RECEIVED IN GOOD CONDITION (Y) OR N
BOTTLES FILLED WITH ADEQUATE VOLUME (Y) OR N
SAMPLES RECEIVED WITHIN HOLD TIME(S) (EXCLUDES TYPICAL FIELD PARAMETERS) (Y) OR N
DATE AND TIME TAKEN FROM SAMPLE BOTTLE

SUBCONTRACT ORDER
Transfer Chain of Custody

PDC Laboratories, Inc.

7094078

SENDING LABORATORY	RECEIVING LABORATORY
PDC Laboratories, Inc. 2231 W Altorfer Dr Peoria, IL 61615 (800) 752-6651	PDC Laboratories, Inc. - St Louis 3278 N Highway 67 Florissant, MO 63033 (314) 432-0550

Sample: 7094078-01
Name: EFFLUENT
Sampled: 09/25/17 09:00
Matrix: Waste Water
Preservative: Cool <6

Analysis	Due	Expires	Comments
04-Alk	10/05/17 16:00	10/09/17 09:00	
04-Ammonia-N Distill Gallery	10/05/17 16:00	10/23/17 09:00	
04-Ca 200.7 WWTot	10/05/17 16:00	03/24/18 09:00	
04-Mg 200.7 WWTot	10/05/17 16:00	03/24/18 09:00	

Sample: 7094078-02
Name: UPSTREAM
Sampled: 09/25/17 09:00
Matrix: Waste Water
Preservative: H2SO4, cool <6

Analysis	Due	Expires	Comments
04-Ammonia-N Distill Gallery	10/05/17 16:00	10/23/17 09:00	

Please email results to Kurt Stepping at kstepping@pdclab.com

Date Shipped: 9-26-17 Total # of Containers: 5 Sample Origin (State): MO PO #: —

Turn-Around Time Requested [X] NORMAL [ ] RUSH Date Results Needed: —

Relinquished By	Date/Time	Received By	Date/Time
Kavanaugh	9-26-17 1500	R Shell	9/27/17 10:30

Sample Temperature Upon Receipt 3.4 °C
Sample(s) Received on Ice (Y) or N
Proper Bottles Received in Good Condition (Y) or N
Bottles Filled with Adequate Volume (Y) or N
Samples Received Within Hold Time (Y) or N
Date/Time Taken From Sample Bottle (Y) or N

Emerald Performance Materials

April 18, 2019

CERTIFIED MAIL – 9214-8901-0661-5400-0137-2800-05

Todd Huson
Illinois Environmental Protection Agency
Bureau of Water
412 SW Washington Street, Suite D
Peoria, Illinois 61602

Re: 2018 Whole Effluent Toxicity (WET) Test
Emerald Performance Materials, Henry Illinois Plant
NPDES Permit No. IL0001392, Special Condition #14

Dear Mr. Huson:

On March 25, 2019, I called by telephone to inform you that we had missed our required 2018 annual WET Test at the above-referenced facility due to turnover in our on-site Health, Safety, and Environmental department during the third quarter of 2018. We subsequently sent you a letter dated March 27, 2019 to memorialize the details of our missed 2018 WET test. As discussed, we immediately collected samples for WET analysis of both our 24-hour composite effluent and an upstream location (used for the dilutions and background purposes). The enclosed report represents the laboratory WET analyses results from this sampling event.

From review of the report, Lethal Concentrations at 50% mortality (LC50) for both the Ceriodaphnia Dubia (greater than or equal to 12.5%) and Pimephales Promelas (2.6%) where higher than the lowest threshold dilution allowed in our NPDES Permit (2.1% - See Special Condition #14, Item #4). Thus, this numeric limit was satisfied. Furthermore, Ammonia-N was measured at 69 mg/L in the effluent sample, which is less than our permitted daily maximum limit of 140 mg/L.

I trust that this correspondence satisfies the requirements of our annual WET testing program and will conduct another round in August to represent the 2019 WET sampling event. If you have any questions or comments regarding this correspondence, please call Lance Richards at 309-364-9472.

Regards,

Galen Hathcock
Plant Director

Emerald Polymer Additives, LLC

1550 County Road 1450 N. / Henry, IL 61537 / Phone: 309-364-2311 / Fax: 309-364-9460
www.emeraldmaterials.com

PDC Laboratories, Inc.

PROFESSIONAL • DEPENDABLE • COMMITTED

April 18, 2019

Jim Hastings
Emerald Performance Materials
1550 County Rd 1450 N
Henry, IL 61537

Dear Jim Hastings:

Please find enclosed the analytical results for the sample(s) the laboratory received on **3/26/19 8:00 am** and logged in under work order **9034090**. All testing is performed according to our current TNI certifications unless otherwise noted. This report cannot be reproduced, except in full, without the written permission of PDC Laboratories, Inc.

If you have any questions regarding your report, please contact your project manager. Quality and timely data is of the utmost importance to us.

PDC Laboratories, Inc. appreciates the opportunity to provide you with analytical expertise. We are always trying to improve our customer service and we welcome you to contact the Director of Client Services, Lisa Grant with any feedback you have about your experience with our laboratory.

Sincerely,

Kurt Stepping
Senior Project Manager
(309) 692-9688 x1719
kstepping@pdclab.com

NELAP ACCREDITED TNI LABORATORY

PDC Laboratories, Inc.
2231 West Altorfer Drive
Peoria, IL 61615
(800) 752-6651

ANALYTICAL RESULTS

Sample: 9034090-01
Name: EFFLUENT COMP DAY ONE
Alias: C.Dubia LC50= >12.5, P.Promelas LC50= 2.6.

Sampled: 03/26/19 00:00
Received: 03/26/19 08:00
Matrix: Waste Water - Composite
PO #: HE40080120-UB

Parameter	Result	Unit	Qualifier	Prepared	Analyzed	Analyst	Method
General Chemistry - SPMO							
Chlorine - Total Residual	< 0.10	mg/L	H	03/28/19 14:10	03/28/19 14:10	smw	SM 4500-Cl G*
Conductivity	6900	umhos/cm		03/27/19 11:53	03/27/19 11:53	KMR	SM 2510B
Dissolved Oxygen	8.0	mg/L	H	03/27/19 11:53	03/27/19 11:53	KMR	SM 4500-O G*
pH	7.7	pH Units	H	03/27/19 11:53	03/27/19 11:53	KMR	SM 4500-H B - SW 9040*
General Chemistry - STL							
Alkalinity - total as CaCO3	940	mg/L		04/01/19 12:33	04/01/19 12:33	JS	SM 2320B*
Nutrients - SPMO							
Ammonia-N	69	mg/L		03/29/19 15:05	03/29/19 15:05	RRG	EPA 350.1 - QC 10-107-06-1-I & J*
Total Metals - STL							
Calcium	80	mg/L	Q4	04/02/19 09:35	04/03/19 11:17	WPS	EPA 200.7
Hardness	360	mg/L		04/02/19 09:35	04/03/19 11:17	WPS	SM 2340B
Magnesium	40	mg/L	Q4	04/02/19 09:35	04/03/19 11:17	WPS	EPA 200.7
WETT - SPMO							
Ceriodaphnia Dubia TUa	< 1.0	units		03/27/19 12:27	03/27/19 12:27	KMR	EPA 2002.0*
Pimephales Promelas TUa	39	units		03/27/19 12:27	03/27/19 12:27	KMR	EPA 2002.0*

Sample: 9034090-02
Name: UPSTREAM GRAB DAY ONE
Matrix: Surface Water - Grab

Sampled: 03/26/19 00:00
Received: 03/26/19 08:00
PO #: HE40080120-UB

Parameter	Result	Unit	Qualifier	Prepared	Analyzed	Analyst	Method
General Chemistry - SPMO							
Chlorine - Total Residual	< 0.10	mg/L	H	03/28/19 14:10	03/28/19 14:10	smw	SM 4500-Cl G*
Conductivity	790	umhos/cm		03/27/19 11:53	03/27/19 11:53	KMR	SM 2510B
Dissolved Oxygen	9.0	mg/L	H	03/27/19 11:53	03/27/19 11:53	KMR	SM 4500-O G*
pH	8.0	pH Units	H	03/27/19 11:53	03/27/19 11:53	KMR	SM 4500-H B - SW 9040*
Nutrients - SPMO							
Ammonia-N	< 0.10	mg/L		03/29/19 15:05	03/29/19 15:05	RRG	EPA 350.1 - QC 10-107-06-1-I & J*

PDC Laboratories, Inc.
2231 West Altorfer Drive
Peoria, IL 61615
(800) 752-6651

NOTES

Specific method revisions used for analysis are available upon request.

Memos

Report of Acute Toxicity Testing

Reference Toxicity Test:
PDC Laboratories, INC. conducts a monthly reference toxicant test to demonstrate and obtain consistent, precise results for permit compliance purposes. This demonstration is to ensure satisfactory laboratory performance. The most recent reference test results are as follows:

Date Initiated: March 5, 2019
Date Concluded: March 7, 2019

Reference Toxicant: Potassium Chloride (KCl)
Lot Number: 18A195207
Expiration: N/A
Standards ID: SPMO6-22A

Moderately Hard Synthetic Water: 3-3CC3
Prepared: February 27, 2019
Expiration: March 13, 2019
Analyst: KMR

Pimephales promelas: 48 hour Acute Test - LC50 = 750 mg/L
SPMO %CV = 19.60 %
National Limits (75th Percentile) = 17.9% CV
National Control Limit (90th Percentile) = 33% CV
Ceriodaphnia dubia: 48 hour Acute Test - LC50 = 722 mg/L
SPMO %CV = 21.12 %
National Limits (75th Percentile) = 29%CV
National Control Limit (90th Percentile) = 34%CV

Literature Cited:
1.) APHA. 1992. Standard methods for the examination of water and wastewater, 18th Ed. American Public Health Association, Washington, D.C.
2.) USEPA. 2002. Methods for measuring the acute toxicity of effluents and receiving waters to freshwater and marine organisms, 5th ed. EPA-821-R-02-012
3.) USEPA 2000. Understanding and Accounting for Method Variability in Whole Effluent Toxicity Applications under the National Pollutant Discharge Elimination System, (Table B-2), June 2000. EPA 833-R-00-003

PDC Laboratories, Inc.
2231 West Altorfer Drive
Peoria, IL 61615
(800) 752-6651

Certifications

CHI - McHenry, IL
TNI Accreditation for Drinking Water, Wastewater, Hazardous and Solid Wastes Fields of Testing through IL EPA Lab No. 100279
Illinois Department of Public Health Bacteriological Analysis in Drinking Water Approved Laboratory Registry No. 17556

PIA - Peoria, IL
TNI Accreditation for Drinking Water, Wastewater, Hazardous and Solid Wastes Fields of Testing through IL EPA Lab No. 100230
Illinois Department of Public Health Bacteriological Analysis in Drinking Water Approved Laboratory Registry No. 17553
Missouri Department of Natural Resources Certificate of Approval for Microbiological Laboratory Service No. 870
Drinking Water Certifications: Iowa (240); Kansas (E-10338); Missouri (870)
Wastewater Certifications: Arkansas (88-0677); Iowa (240); Kansas (E-10338)
Hazardous/Solid Waste Certifications: Arkansas (88-0677); Iowa (240); Kansas (E-10338)

SPIL - Springfield, IL
NELAP/NELAC accredidation through the Illinois EPA, PAS IL 100323

SPMO - Springfield, MO
USEPA DMR-QA Program

STL - St. Louis, MO
TNI Accreditation for Wastewater, Hazardous and Solid Wastes Fields of Testing through KS Lab No. E-10389
Accreditation of Laboratories for Wastewater, Hazardous, and Solid Waste Analysis through IL EPA No. 200080
Illinois Department of Public Health Bacteriological Analysis in Drinking Water Approved Laboratory Registry No. 171050
Drinking Water Certifications: Missouri (1050)
Missouri Department of Natural Resources

* Not a TNI accredited analyte

Qualifiers

H Test performed after the expiration of the appropriate regulatory/advisory maximum allowable hold time.
Q4 The matrix spike recovery result is unusable since the analyte concentration in the sample is greater than four times the spike level. The associated blank spike was acceptable.

Certified by: Chad Cooper For Kurt Stepping, Senior Project Manager

SHIPPING ORDER

Emerald Performance Materials LLC
1550 County Road 1450 N
Henry, IL 61537

AUTHORIZED BY: Jim Hastings

PURCHASING DEPT APPROVAL

DATE ENTERED

PLANT LOCATION: HENRY, IL 61537

DEPT NO 2476

ACCOUNT 6100 1014

OUR PURCHASE ORDER NO: HE-40016024

YOUR INVOICE NO

SHIPPED FROM

YOUR INVOICE DATE

SOLD TO

SHIP TO: PDC Lab

SHIPPING ORDER NUMBER: P19- 15553

PLEASE USE THE ABOVE NUMBER WHEN CORRESPONDING

BILL OF LADING NUMBER

O S D & R REPORT NUMBER

CHECKED BY

This is to certify that the above named materials are properly classified, described, packaged, marked and labeled for transportation according to the applicable regulations of the Department of Transportation.

CB

DATE SHIPPED: 3-26-19

SHIP VIA: PDC

GROSS WT

F.O.B.

☐ PREPAID

☐ COLLECT

REQUIRED DELIVERY DATE

VALUE IF OVER $250

HAZARDOUS ☐ YES ☒ NO

IF YES GIVE ADDITIONAL INFORMATION BELOW

CHECK REASON FOR SHIPMENT

☐ REJECTED - RETURNED FOR CREDIT

☐ REJECTED - RETURNED FOR REPLACEMENT

☐ TO BE REPAIRED AND RETURNED TO

☐ CONTAINERS - RETURNED FOR CREDIT

☐ SALES OF PROPERTY

☐ LOAN OF PROPERTY

☒ SAMPLES

DESCRIPTIONS	QUANTITY	UNIT	PRICE	TOTAL
~~Primary Effluent~~				
Plant Effluent	4			
Up Stream Grab	2			

WET Testing

INSTRUCTION TO VENDOR

MATERIAL RECEIVED BY

\\Users\HSE\Shipping Orders\Emerald Shipping Order - PDC Lab for Plant & Primary Effluent Samples.xls

PDC Laboratories Inc, SPMO.

EPA Test Methods: 2002.0 & 2000.0

Multiple Dilution WET Test

Sample # ~~9033040-01~~ KMR 9034090-01
Client Emerald

Client Permit # IL-0001392
PP Hatch 031519A
CD Hatch 032719ICB

MHSF 3-4BC2
Board/Shelf 00212

Cup	Conc.	Initial	24 hour	48 hour	72 hour	96 hour
P1	Lab	10	10	10	10	10
P2	1.565	10	10	10	10	9
P3	6.25	10	7	2	2	0
P4	UP	10	10	10	10	9
P5	UP	10	10	10	10	10
P6	12.5	10	2	0	0	0
P7	1.565	10	10	10	10	9
P8	3.125	10	9	5	5	2
P9	0.78	10	10	10	10	10
P10	Lab	10	10	10	10	10
P11	0.78	10	10	9	8	8
P12	6.25	10	10	3	3	0
P13 *	12.5	10	6	0	0	0
P14 *	3.125	10	10	8	7	2
C1	3.125	5	5	5		
C2	1.565	5	5	5		
C3	12.5	5	5	5		
C4	Lab	5	5	5		
C5	UP	5	5	5		
C6	1.565	5	5	5		
C7	12.5	5	5	5		
C8	0.78	5	5	5		
C9	12.5	5	5	5		
C10	0.78	5	5	5		
C11	3.125	5	5	5		
C12	12.5	5	4	4		
C13	UP	5	5	5		
C14	3.125	5	5	5		
C15	1.565	5	5	5		
C16	UP	5	5	5		
C17	6.25	5	5	5		
C18	Lab	5	5	5		
C19	UP	5	5	5		
C20	0.78	5	5	5		
C21	Lab	5	5	5		
C22	Lab	5	5	5		
C23	6.25	5	6	5		
C24	0.78	5	6	5		
C25 *	1.565	5	5	5		
C26 *	6.25	5	5	5		
C27 *	3.125	5	5	5		
C28 *	6.25	5	5	5		

* These cups only used when upstream samples are provided.

Set Times

Start Date/Time: 3.27.19 @ 1227

	Date	Time	Analyst
0 Hour	3.27.19	1227	KMR
24 Hour	3.28.19	1300	KMR
48 Hour	3.29.19	1220	KMR
72 Hour	3.30.19	1215	KLM
96 Hour	3.31.19	1237	RDR

End Date/Time: 3.31.19 @ 1237

Results

Pimephales promelas

96 Hour Result		Date	Analyst
LC 50	2.562	4.1.19	KMR
TUa	39.03	4.1.19	KMR
P-Value	—	—	—

Ceriodaphnia Dubia

48 Hour Result		Date	Analyst
LC 50	>100	4.1.19	KMR
TUa	<1	4.1.19	KMR
P-Value	—	—	—

		Date	Analyst
Filtered (Y / N):	Y	4.1.19	KMR
Light Check:	N/A	4.1.19	KMR
PP Fry Age:	12 days	4.1.19	KMR
CD Neonates Age:	<24hrs	4.1.19	KMR

Comments: PP fry were set in 200 ml of conc. w/in a 250 ml cup. CD were set in 15 ml of conc. w/in a 30 ml cup

Analyst Signature: Krista Rice
Date: 4.1.19

Read and Understood By: [signature]
Date: 4.4.19

Logbook: 3

Report #: 11

EP003244

Routine Chemistries

Sample # ~~9032040-01~~ 9031090-01
Client Permit #: IL-0001392
PP Hatch: 031519A
Client: Emerald
CD Hatch: 03271915A
MHSF: 3-4BC2
Board/Shelf: CK210

Calibration data

pH	Initial	Date	Time	Analyst	48 hour	Date	Time	Analyst	96 hour	Date	Time	Analyst
4.00	4.01	3.27.19	1109	KWL	4.01	3.29.19	1247	KWR	4.01	3-31-19	1233	RRG
7.00	7.00				7.06				7.02			
10.00	10.03				10.03				10.03			
Curve	99.5				99.7				98.8			

DO (mg/L)	Initial	1 Hour	24 Hour	48 Hour	72 Hour	96 Hour
Date	3.27.19	3.27.19	3.28.19	3.29.19	3.30.19	3-31-19
Time	1114	1332	1243	1143	1210	1236
Analyst	KWR	KWR	KWR	KWR	KWR	RRG
Pressure (mmHg)	737	735	732	729	730	

Initial/Received

Cup #	1	9	2	8	3	6	4	13	Date	Time	Batch	Analyst
Concentration	MHSF	0.78%	1.6%	3%	6%	12.5	*Upstream	12.5-DUP				
pH (EPA 150.1)	7.59	7.95	7.97	8.03	8.02	8.00	8.03	8.01	3.27.19	1153	8906384	KWR
DO mg/L (SM 5010)	7.99	8.56	8.66	8.68	8.77	8.73	8.98	8.65	3.27.19	1153	8906384	KWR

Conductivity (µMohs) (SM 2510B)	MHSF	Effluent	*Upstream	Date	Time	Batch	Analyst
	350	6900 (6900)	790	3.27.19	1153	8906381	KWR

	Method	Effluent	Upstream *	Date	Time	Batch	Analyst
Chlorine (mg/L)	4500Cl-G	0.07	0.06	3.28.19	1410	8906315	BMW
Ammonia (mg/L)	EPA 350.1	69.4	0.6644	3.29.19	1505	8906371	RRG
Alkalinity (mg/L)	2320B	944		4.1.19	1233	8906491	JS
Hardness (mg/L)	200.7	300		4.3.19	1117	8906584	WPS

Comments: "H" qualifier added to DO, pH and Chlorine analytes due to sample hold time

0 Hour

	Fathead Minow	Cerodaphnia Dubia	Date	Time	Analyst
Temperature (°C)	24.7	23.2	3.27.19	1227	KWR

1 Hour

Test	MHSF	13%	Upstream *	Date	Time	Analyst
DO (mg/L)	8.00	8.29	8.52	3.27.19	1332	KWR

	Fathead Minow	Cerodaphnia Dubia	Date	Time	Analyst
Temperature (°C)	24.8	23.4	3.27.19	1332	KWR

24 Hour

Test	MHSF	0.78%	1.6%	3%	6%	12.5	*Upstream	Date	Time	Analyst
DO (mg/L)	7.36	7.05	6.94	6.99	7.09	6.86	7.02	3.28.19	1251	KWR

	Fathead Minow	Cerodaphnia Dubia	Date	Time	Analyst
Temperature (°C)	25.7	25.1	3.28.19	1251	KWR

48 Hour

Test	MHSF	0.78%	1.6%	3%	6%	12.5	*Upstream	Date	Time	Analyst
pH	7.73	8.29	8.30	8.35	8.43	8.45	8.37	3.29.19	1152	KWR
DO (mg/L)	7.36	6.99	6.95	6.93	7.08	7.05	7.03	3.29.19	1152	KWR

	Fathead Minow	Cerodaphnia Dubia	Date	Time	Analyst
Temperature (°C)	25.5	23.6	3.29.19	1152	KWR

	MHSF	12.5	*Upstream	Date	Time	Analyst
Conductivity (µMohs)	311	1505	820	3.29.19	1152	KWR
Renewal Period	1230 KWR					

72 Hour

Test	MHSF	0.78%	1.6%	3%	6%	12.5	*Upstream	Date	Time	Analyst
DO (mg/L)	7.14	6.24	6.16	6.70	6.59	7.31	7.02	3.30.19	1210	KWR

	Fathead Minow		Date	Time	Analyst
Temperature (°C)	26.0		3.30.19	1210	KWR

96 Hour

Test	MHSF	0.78%	1.6%	3%	6%	12.5	*Upstream	Date	Time	Analyst
pH	8.02	8.32	8.31	8.39	8.36	8.56	8.46	3-31-19	1237	RRG
DO (mg/L)	7.47	6.94	6.48	6.66	6.31	7.28	7.21	3-31-19	1137	RRG

	Fathead Minow		Date	Time	Analyst
Temperature (°C)	25.5		3-31-19	1237	RRG

	MHSF	12.5	*Upstream	Date	Time	Analyst
Conductivity (µMohs)	331	~~8116~~ 1577 RRG	816	3-31-19	1237	RRG

* Upstream only performed if supplied by the client

Analyst Signature: Krista Rice
Date: 4.1.19

Read and Understood By: [signature]
Date: 4-4-19

	100% EFF	Dup
DO	~~7.99~~ 8.01 KWR	7.87
PH	7.69	7.79

EP003245

PDC Laboratories, Inc.
2231 W. Altorfer Dr
Peoria, IL 61615

WET

CHAIN OF CUSTODY RECORD

State where samples were collected IL

Phone: (800) 752-6651
Fax: (309) 692-9689
www.pdclab.com

1 CLIENT: EMERALD PERFORMANCE MATERIALS	P.O. NUMBER:	PROJECT NAME:	DATE SHIPPED: 3-26-19	4 WORK ORDER (FOR LAB USE ONLY)
ADDRESS: 1550 CO ROAD 1450 NORTH	PHONE: (309) 364-9479	EMAIL: JIM.HASTINGS@EMERALDMATERIALS.COM	MEANS SHIPPED: COURIER	LOGIN #: 9034090-2
CITY: HENRY / STATE: IL / ZIP: 61537	SAMPLER (PLEASE PRINT): Earl Pavlick		MATRIX TYPES: WW - WASTE WATER; DW - DRINKING WATER; GW - GROUND WATER; WWSL - SLUDGE; NAS - SOLID; LCHT - LEACHATE; OTHER	LOGGED BY: [signature]
CONTACT PERSON: JIM HASTINGS	SAMPLER'S SIGNATURE: [signature]			PROJECT: DAILY / PROJ MGR: KURT

3 ANALYSIS REQUESTED

2 SAMPLE DESCRIPTION AS YOU WANT ON REPORT	DATE COLLECTED	TIME COLLECTED	GRAB	COMP	MATRIX TYPE	BOTTLE COUNT	BOD	TSS	NH3	Whole Effluent Toxicity	Concurrent Parameters	REMARKS
~~PRIMARY EFFLUENT~~			~~X~~		~~WW~~	~~1~~	~~X~~					
~~PLANT EFFLUENT~~				~~X~~	~~WW~~	~~2~~	~~X~~	~~X~~	~~X~~			
2.5L PLT EFFluent Day 1 1of2				X						X	X	
2.5L PLT EFFluent Day1 2of2				X						X	X	
200mL PLT EFFluent 1of1				X						X	X	
250mL PLT EFFluent 202				X						X	X	
Upstream Grab 2.5L 1of2			X	~~X~~						X	X	
Upstream Grab 2.5L 2of2			X	~~X~~						X	X	

5 TURNAROUND TIME REQUESTED (RUSH TAT IS SUBJECT TO APPROVAL AND SURCHARGE) [x] NORMAL [ ] RUSH — DATE RESULTS NEEDED:

6 The sample temperature will be measured upon receipt at the lab. By initialing this area you request that we notify you before proceeding with analysis if the sample temperature is outside of the range of 0.1-6.0°C. By not initialing this area you allow the lab to proceed with analytical testing regardless of the sample temperature.

7 RELINQUISHED BY (SIGNATURE)	DATE / TIME	RECEIVED BY (SIGNATURE)	DATE / TIME
[signature]	3-26-19 / 0645	[signature]	3-26-19 / 06:45
[signature]	3-26-19 / 06:49	[signature]	3/26/19 / 649
[signature]	3/26/19 / 800	[signature]	3/26/19 / 800

COMMENTS (FOR LAB USE ONLY)

SAMPLE TEMPERATURE UPON RECEIPT: 6 °C
CHILL PROCESS STARTED PRIOR TO RECEIPT: Y or N
SAMPLE(S) RECEIVED ON ICE: Y or N
PROPER BOTTLES RECEIVED IN GOOD CONDITION: Y or N
BOTTLES FILLED WITH ADEQUATE VOLUME: Y or N
SAMPLES RECEIVED WITHIN HOLD TIME(S) (EXCLUDES TYPICAL FIELD PARAMETERS): Y or N
DATE AND TIME TAKEN FROM SAMPLE BOTTLE

Page 8 of 10

EP003246

SUBCONTRACT ORDER
Transfer Chain of Custody

PDC Laboratories, Inc.

9034090

SENDING LABORATORY

PDC Laboratories, Inc.
2231 W Altorfer Dr
Peoria, IL 61615
(800) 752-6651

RECEIVING LABORATORY

PDC Springfield
1805 W. Sunset
Springfield, MO 65807
(417) 864-8924

Sample: 9034090-01
Name: EFFLUENT COMP DAY ONE

Sampled: 03/26/19 00:00
Matrix: Waste Water
Preservative: Cool <6

Analysis	Due	Expires	Comments
03-WET Multiple	04/05/19 16:00	03/27/19 12:00	

Sample: 9034090-02
Name: UPSTREAM GRAB DAY ONE

Sampled: 03/26/19 00:00
Matrix: Waste Water
Preservative: Cool <6

Analysis	Due	Expires	Comments
03-WET Multiple	04/05/19 16:00	03/27/19 12:00	

Please email results to Kurt Stepping at kstepping@pdclab.com

Date Shipped: 3/26/19 Total # of Containers: 6 Sample Origin (State): IL PO #: —

Turn-Around Time Requested [X] NORMAL [ ] RUSH Date Results Needed: 4/5/19

Relinquished By	Date/Time	Received By	Date/Time
[signature]	3/26/19 14:00	[signature]	0830 3/27/19

Sample Temperature Upon Receipt	2 °C
Sample(s) Received on Ice	(Y) or N
Proper Bottles Received in Good Condition	(Y) or N
Bottles Filled with Adequate Volume	(Y) or N
Samples Received Within Hold Time	(Y) or N
Date/Time Taken From Sample Bottle	(Y) or N

SUBCONTRACT ORDER
Transfer Chain of Custody

PDC Laboratories, Inc.

9034090

SENDING LABORATORY

PDC Laboratories, Inc
2231 W Altorfer Dr
Peoria, IL 61615
(800) 752-6651

RECEIVING LABORATORY

PDC Laboratories, Inc. - St Louis
3278 N Highway 67
Florissant, MO 63033
(314) 432-0550

Sample: 9034090-01
Name: EFFLUENT COMP DAY ONE

Sampled: 03/26/19 00:00
Matrix: Waste Water
Preservative: Cool <6

Analysis	Due	Expires	Comments
04-Alk	04/05/19 16:00	04/09/19 00:00	
04-Ca 6010 Tot	04/05/19 16:00	09/22/19 00:00	
04-Mg 6010 Tot	04/05/19 16:00	09/22/19 00:00	

Please email results to Kurt Stepping at kstepping@pdclab.com

Date Shipped: 3·27·19 Total # of Containers: 2 Sample Origin (State): MO PO #: —

Turn-Around Time Requested [X] NORMAL [ ] RUSH Date Results Needed: —

Relinquished By	Date/Time	Received By	Date/Time		
[signature]	1500 3·27·19	[signature]	3-28-19 12:10	Sample Temperature Upon Receipt	2.2
				Sample(s) Received on Ice	Y or N
				Proper Bottles Received in Good Condition	Y
				Bottles Filled with Adequate Volume	Y
				Samples Received Within Hold Time	Y or N
Relinquished By	Date/Time	Received By	Date/Time	Date/Time Taken From Sample Bottle	Y

Emerald Performance Materials®
Kalama Chemical

October 28, 2019

Certified Mail – 9214 8901 0661 5400 0144 1437 06

Todd Huson
Illinois Environmental Protection Agency
Bureau of Water
412 SW Washington Street, Suite D
Peoria, Illinois 61602

Re: 2019 Whole Effluent Toxicity (WET) Test
Emerald Performance Materials, Henry Illinois Plant
NPDES Permit No. IL0001392, Special Condition #14

Dear Mr. Huson

As noted on April 18, 2019, we had planned to do the 2019 WET test in August. Due to scheduled production outages in August, WET test sampling took place at the beginning of October for the 2019 required WET test. The enclosed report represents the laboratory WET analysis results from this sampling event.

From review of the report, lethal concentrations at 50% mortality (LC50) for both the Ceriodaphnia Dubia (greater than or equal to 12.5%) and Pimephales Promelas (greater than or equal to 12.5%) were higher than the lowest threshold dilution allowed in our NPDES Permit (2.1% - See Special Condition #14, Item #4). Thus, this numeric limit was satisfied.

I trust that this correspondence satisfies the requirements of our annual WET testing program and will return to annual WET testing in 2020. If you have any questions or comments regarding this correspondence, please contact me at 309.364.9487.

Regards,

Galen Hathcock
Plant Director

Attachment: WET Test 10-1-2019

October 14, 2019

Jim Hastings
Emerald Performance Materials
1550 County Rd 1450 N
Henry, IL 61537

RE: WET TESTING

Dear Jim Hastings:

Please find enclosed the analytical results for the **4** sample(s) the laboratory received on **10/1/19 12:08 pm** and logged in under work order **9100130**. All testing is performed according to our current TNI accreditations unless otherwise noted. This report cannot be reproduced, except in full, without the written permission of PDC Laboratories, Inc.

If you have any questions regarding your report, please contact your project manager. Quality and timely data is of the utmost importance to us.

PDC Laboratories, Inc. appreciates the opportunity to provide you with analytical expertise. We are always trying to improve our customer service and we welcome you to contact the Director of Client Services, Lisa Grant, with any feedback you have about your experience with our laboratory at 309-683-1764 or lgrant@pdclab.com.

Sincerely,

Chad Cooper
Laboratory Supervisor
(417) 864-8924
ccooper@pdclab.com

ANALYTICAL RESULTS

Sample: 9100130-01
Name: EFFLUENT COMP DAY ONE
Matrix: Waste Water - Composite

Sampled: 10/01/19 01:00
Received: 10/01/19 12:08
PO #: HE40080120-UB

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
General Chemistry - SPMO									
Chlorine - Total Residual	0.10	mg/L	H	10/02/19 12:00	1	0.10	10/02/19 12:00	CIH	SM 4500-Cl G*
Conductivity	1500	umhos/cm		10/02/19 15:50	1	0.10	10/02/19 15:50	CIH	SM 2510B
Dissolved Oxygen	8.7	mg/L	H	10/02/19 15:45	1	1.0	10/02/19 15:45	CIH	SM 4500-O G*
pH	7.6	pH Units	H	10/02/19 15:50	1		10/02/19 15:50	CIH	SM 4500-H B - SW 9040
Temperature at pH measurement	25	°C		10/02/19 16:10	1		10/02/19 16:10	CIH	SM 4500 H B*
General Chemistry - STL									
Alkalinity - total as CaCO3	320	mg/L		10/09/19 07:21	1	20	10/09/19 07:21	JS	SM 2320B*
Nutrients - SPMO									
Ammonia-N	0.32	mg/L		10/04/19 12:00	1	0.10	10/04/19 12:00	CIH	EPA 350.1 - QC 10-107-06-1-I & J*
Total Metals - STL									
Hardness	360	mg/L		10/04/19 12:16	20	4.7	10/10/19 12:48	WMN	SM 2340B
Calcium	85	mg/L		10/04/19 12:16	20	1.9	10/10/19 12:48	WMN	EPA 200.7
Magnesium	35	mg/L		10/04/19 12:16	20	1.0	10/10/19 12:48	WMN	EPA 200.7
WETT - SPMO									
C. dubia - LC 50	>12.5	%		10/02/19 16:10	1	1.0	10/02/19 16:10	CIH	EPA 2000.0/2002.0*
P. promelas - LC 50	>12.5	%		10/02/19 16:10	1	1.0	10/02/19 16:10	CIH	EPA 2000.0/2002.0*

PDC Laboratories, Inc.

ANALYTICAL RESULTS

Sample: 9100130-02
Name: UPSTREAM GRAB DAY ONE
Matrix: Waste Water - Grab

Sampled: 10/01/19 01:00
Received: 10/01/19 12:08
PO #: HE40080120-UB

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
General Chemistry - SPMO									
Chlorine - Total Residual	< 0.10	mg/L	H	10/02/19 12:00	1	0.10	10/02/19 12:00	CIH	SM 4500-Cl G*
Conductivity	410	umhos/cm		10/02/19 15:50	1	0.10	10/02/19 15:50	CIH	SM 2510B
Dissolved Oxygen	7.5	mg/L	H	10/02/19 15:45	1	1.0	10/02/19 15:45	CIH	SM 4500-O G*
pH	7.5	pH Units	H	10/02/19 15:50	1		10/02/19 15:50	CIH	SM 4500-H B - SW 9040
Temperature at pH measurement	25	°C		10/02/19 16:10	1		10/02/19 16:10	CIH	SM 4500 H B*
Nutrients - SPMO									
Ammonia-N	0.10	mg/L		10/04/19 12:00	1	0.10	10/04/19 12:00	CIH	EPA 350.1 - QC 10-107-06-1-I & J*

NOTES

Specific method revisions used for analysis are available upon request.

* Not a TNI accredited analyte

Memos

Report of Acute Toxicity Testing

Reference Toxicity Test:
PDC Laboratories, INC. conducts a monthly reference toxicant test to demonstrate and obtain consistent, precise results for permit compliance purposes. This demonstration is to ensure satisfactory laboratory performance. The most recent reference test results are as follows:

Date Initiated: September 4, 2019
Date Concluded: September 6, 2019

Reference Toxicant: Potassium Chloride (KCl)
Lot Number: 18A195207
Expiration: N/A
Standards ID: SPMO6-22A

Moderately Hard Synthetic Water: 3-10CC1
Prepared: August 29, 2019
Expiration: September 12, 2019
Analyst: CIH

Pimephales promelas: 48 hour Acute Test - LC50 = 763.2 mg/L
SPMO %CV = 15.15 %
National Limits (75th Percentile) = 17.9% CV
National Control Limit (90th Percentile) = 33% CV
Ceriodaphnia dubia: 48 hour Acute Test - LC50 = 446.4 mg/L
SPMO %CV = 25.20 %
National Limits (75th Percentile) = 29%CV
National Control Limit (90th Percentile) = 34%CV

Literature Cited:

1.) APHA. 1992. Standard methods for the examination of water and wastewater. 18th Ed. American Public Health Association, Washington, D.C.
2.) USEPA. 2002. Methods for measuring the acute toxicity of effluents and receiving waters to freshwater and marine organisms, 5th ed. EPA-821-R-02-012
3.) USEPA 2000. Understanding and Accounting for Method Variability in Whole Effluent Toxicity Applications under the National Pollutant Discharge Elimination System, (Table B-2). June 2000. EPA 833-R-00-003

Certifications

CHI - McHenry, IL - 4314 W Crystal Lake Road A, McHenry, IL 60050
TNI Accreditation for Drinking Water, Wastewater, Fields of Testing through IL EPA Lab No. 100279
Illinois Department of Public Health Bacteriological Analysis in Drinking Water Approved Laboratory Registry No. 17556

PIA - Peoria, IL - 2231 W Altorfer Drive, Peoria, IL 61615
TNI Accreditation for Drinking Water, Wastewater, Hazardous and Solid Wastes Fields of Testing through IL EPA Lab No. 100230
Illinois Department of Public Health Bacteriological Analysis in Drinking Water Approved Laboratory Registry No. 17553
Drinking Water Certifications: Iowa (240); Kansas (E-10338); Missouri (870)
Wastewater Certifications: Arkansas (88-0677); Iowa (240); Kansas (E-10338)
Hazardous/Solid Waste Certifications: Arkansas (88-0677); Iowa (240); Kansas (E-10338)

SPIL - Springfield, IL - 1210 Capitol Airport Drive, Springfield, IL 62707
TNI Accreditation through IL EPA Lab No. 100323

SPMO - Springfield, MO - 1805 W Sunset Street, Springfield, MO 65807
USEPA DMR-QA Program

STL - St. Louis, MO - 3278 N Highway 67, Florissant, MO 63033
TNI Accreditation for Wastewater, Hazardous and Solid Wastes Fields of Testing through KS Lab No. E-10389
TNI Accreditation for Wastewater, Hazardous, and Solid Waste Analysis through IL EPA No. 200080
Illinois Department of Public Health Bacteriological Analysis in Drinking Water Approved Laboratory Registry No. 171050
Missouri Department of Natural Resources
Microbiological Laboratory Service for Drinking Water

Qualifiers

H Test performed after the expiration of the appropriate regulatory/advisory maximum allowable hold time.

Certified by: Chad Cooper, Laboratory Supervisor

PDC Laboratories Inc, SPMO. EPA Test Methods: 2002.0 & 2000.0

Multiple Dilution WET Test

Client Permit #: IL-0001392

Sample # 9101183 130
Client Emerald Performance

PP Hatch SPM07-12E
CD Hatch 092519A

MHSF 3-11CCI
Board/Shelf 002/2

Cup	Conc.	Initial	24 hour	48 hour	72 hour	96 hour
P1	0	10	10	10	10	10
P2	3.125	10	10	10	10	10
P3	6.25	10	10	10	10	10
P4	0	10	10	10	10	10
P5	12.5	10	10	10	10	10
P6	0.78	10	10	10	10	10
P7	12.5	10	10	10	10	10
P8	888	10	10	10	10	10
P9	1.565	10	10	10	10	10
P10	888	10	10	10	10	10
P11	0.78	10	10	10	10	10
P12	3.125	10	10	10	10	10
P13 *	1.565	10	10	10	10	10
P14 *	6.25	10	10	10	10	10
C1	3.125	5	5	5		
C2	0	5	5	5		
C3	6.25	5	5	4		
C4	1.565	5	5	5		
C5	0.78	5	5	5		
C6	1.565	5	5	5		
C7	3.125	5	5	4		
C8	888	5	5	5		
C9	0.78	5	5	5		
C10	888	5	5	4		
C11	6.25	5	4	3		
C12	0.78	5	4	4		
C13	6.25	5	3	2		
C14	3.125	5	5	4		
C15	888	5	5	5		
C16	3.125	5	5	5		
C17	12.5	5	5	4		
C18	0	5	5	5		
C19	12.5	5	4	2		
C20	1.565	5	4	4		
C21	6.25	5	3	2		
C22	888	5	5	5		
C23	0	5	5	5		
C24	0	5	5	5		
C25 *	12.5	5	5	4		
C26 *	0.78	5	5	5		
C27 *	12.5	5	5	5		
C28 *	1.565	5	3	3		

* These cups only used when upstream samples are provided.

Set Times			
Start Date/Time:	10.2.19 / 1610		
	Date	Time	Analyst
0 Hour	10.02.19	1610	CIH
24 Hour	10.3.19	1510	CIH
48 Hour	10.4.19	1400	CIH
72 Hour	10.5.19	1350	NSW
96 Hour	10.6.19	1900	CIH
End Date/Time:	10.6.19 / 1900		

Results			
Pimephales promelas			
96 Hour Result		Date	Analyst
LC 50	~~>100~~ >12.5 CIH	10.11.19	CIH
TUa	<8	10.11.19	CIH
Ceriodaphnia Dubia			
48 Hour Result		Date	Analyst
LC 50	>12.5	10.11.19	CIH
TUa	<8	10.11.19	CIH
		Date	Analyst
Filtered (Y / N):	Y	10.2.19	CIH
Light Check:	—	—	—
PP Fry Age:	7 days	10.2.19	CIH
CD Neonates Age:	<24hrs	10.10.19	CIH

Comments: PP fry were set in 200 ml of conc. w/in a 250 ml cup .CD were set in 15 ml of conc. w/in a 30 ml cup

Analyst Signature: [signature]
Date: 10.10.19

Read and Understood By: [signature]
Date: 10-14-19

Logbook: 3 Report #: 82

PDC Laboratories Inc, SPMO.

EPA Test Methods: 2002.0 & 2000.0

Routine Chemistries

Sample # 91001030
Client Emerald P.
Client Permit #: IL-0001392
PP Hatch SPM07-12E
CD Hatch 092519A
MHSF 3-11CCI
Board/Shelf 002/2

Calibration data

pH	Initial	Date	Time	Analyst	48 hour	Date	Time	Analyst	96 hour	Date	Time	Analyst
4.00	4.01	10.2.19	1227	NSW	4.01	10.4.19	1000	CIH	4.01	10.6.19	1900	CIH
7.00	7.00				7.00				7.00			
10.00	10.01				10.01				10.01			
Curve	98.4				98.9				98.4			

DO (mg/L)	Initial	1 Hour	24 Hour	48 Hour	72 Hour	96 Hour
Date	10.02.19	10.02.19	10.3.19	10.4.19	10.5.19	10.6.19
Time	1517	1712	1453	1330	1316	1900
Analyst	CIH	CIH	CIH	CIH	NSW	CIH
Pressure (mmHg)	729	728	735	736	729	734

Initial/Received

Cup #	10	11	13	12	14	7	4	5	Date	Time	Batch	Analyst
Concentration	MHSF	0.78%	1.565%	3.125%	6.25%	12.5%	*Upstream	12.5%				
pH (EPA 150.1)	7.86	7.64	7.63	7.63	7.60	7.60	7.50	7.61	10.02.19	1550	B9230316	CIH
DO mg/L (SM 5010)	7.49	7.43	7.41	7.51	7.45	7.75	7.44	7.47	10.02.19	1550	B9230316	CIH
DO mg/L Received						8.66	7.54	8.69	10.02.19	1545		CIH

Conductivity (µMohs) (SM 2510B)	MHSF	12.5% Effluent	*Upstream	Date	Time	Batch	Analyst
	332	1410(1416)	411	10.02.19	1550	B9230316	CIH

	Method	Effluent	Upstream *	Date	Time	Batch	Analyst
Chlorine (mg/L)	4500O-G	0.1	0.01	10.2.19	1200	B9224611	CIH
Ammonia (mg/L)	EPA 350.1	0.319	0.0996	10.4.19	1200	B9224497	CIH
Alkalinity (mg/L)	2320B	318		10.9.19	0721	B9232071	JS
Hardness (mg/L)	200.7	366		10.10.19	1248	B9228711	WMW

Comments: H qualifier added due to sample hold time to DO, pH, Ccl.

0 Hour

	Fathead Minow	Cerodaphnia Dubia	Date	Time	Analyst
Temperature (°C)	24.7	24.2	10.02.19	1610 ~~1610~~	CIH

1 Hour

Test	MHSF	12.5% Effluent	Upstream *	Date	Time	Analyst
DO (mg/L)	7.75	7.54	7.46	10.02.19	1710	CIH

	Fathead Minow	Cerodaphnia Dubia	Date	Time	Analyst
Temperature (°C)	24.7	24.2	10.02.19	1710	CIH

24 Hour

Test	MHSF	0.78%	1.565%	3.125%	6.25%	12.5%	*Upstream	Date	Time	Analyst
DO (mg/L)	7.16	6.59	6.48	6.50	6.39	6.22	6.47	10.03.19	1510	CIH

	Fathead Minow	Cerodaphnia Dubia	Date	Time	Analyst
Temperature (°C)	24.7	24.2	10.03.19	1510	CIH

48 Hour

Test	MHSF	0.78%	1.565%	3.125%	6.25%	12.5%	*Upstream	Date	Time	Analyst
pH	7.35	7.67	7.72	7.73	7.78	7.82	7.67	10.4.19	1400	CIH
DO (mg/L)	6.44	6.09	6.19	6.22	6.14	5.89	6.50	10.4.19	1400	CIH

	Fathead Minow	Cerodaphnia Dubia	Date	Time	Analyst
Temperature (°C)	25.6	25.3	10.4.19	1400	CIH

	MHSF	12.5% Effluent	*Upstream	Date	Time	Analyst
Conductivity (µMohs)	342	1445(1480)	415	10.4.19	1400	CIH
Renewal Period						

72 Hour

Test	MHSF	0.78%	1.565%	3.125%	6.25%	12.5%	*Upstream	Date	Time	Analyst
DO (mg/L)	6.61	6.39	6.50	6.42	6.35	6.20	6.52	10.5.19	1350	NSW

	Fathead Minow		Date	Time	Analyst
Temperature (°C)	25.6		10.5.19	1350	NSW

96 Hour

Test	MHSF	0.78%	1.565%	3.125%	6.25%	12.5%	*Upstream	Date	Time	Analyst
pH	~~7.41~~	~~7.79~~	8.17	8.09	8.16	8.17	8.13	10.6.19	1900	CIH
DO (mg/L)	~~6.61~~	~~6.79~~	7.16	7.05	7.07	6.97	7.29	10.6.19	1900	CIH

	Fathead Minow		Date	Time	Analyst
Temperature (°C)	25.6		10.6.19	1900	CIH

	MHSF	12.5% Effluent	*Upstream	Date	Time	Analyst
Conductivity (µMohs)	341	1488(1487)	464	10.6.19	1900	CIH

* Upstream only performed if supplied by the client

	MHSF	0.78/
pH	7.74	8.11
DO	7.46	7.12

Analyst Signature: [signature]
Date: 10.10.19

Read and Understood By: [signature]
Date: 10-14-19

PDC LABORATORIES, INC.
1805 W. SUNSET
SPRINGFIELD, MO 65807

PHONE # 417-864-8924
FAX # 417-864-7081

CHAIN OF CUSTODY RECORD

State where samples collected ______MO_______

ALL HIGHLIGHTED AREAS MUST BE COMPLETED BY CLIENT (PLEASE PRINT)

1 CLIENT: EMERALD PERFORMANCE
ADDRESS: 1550 CR 1450 N
CITY, STATE ZIP: HENRY, IL 61537
CONTACT PERSON: KURT STEPPING

PROJECT NUMBER: MONDAY
P.O. NUMBER:
MEANS SHIPPED:
PHONE NUMBER:
FAX NUMBER:
DATE SHIPPED: 10/1/19
SAMPLER (PLEASE PRINT):
SAMPLER'S SIGNATURE: Hughes

MATRIX TYPES:
WW- WASTEWATER
DW- DRINKING WATER
GW- GROUND WATER
WWSL- SLUDGE
NAS- SOLID
LCHT-LEACHATE
OTHER:

3 ANALYSIS REQUESTED

4 (FOR LAB USE ONLY)
LOGIN # 9100130-02
LOGGED BY: DCW
LAB PROJ. #
TEMPLATE:
PROJ. MGR.: CHAD COOPER

2 SAMPLE DESCRIPTION AS YOU WANT ON REPORT	DATE COLLECTED	TIME COLLECTED	SAMPLE TYPE GRAB	SAMPLE TYPE COMP	MATRIX TYPE	BOTTLE COUNT	WET Test	Shipping						REMARKS
WET TEST EFFLUENT COMPOSITE	10/1/19	0600		X	WW	3	X							
UPSTREAM GRAB (IF AVAILABLE)	↙	↙	X		WW	1	X							

5 TURNAROUND TIME REQUESTED (PLEASE CIRCLE) NORMAL RUSH
(RUSH TAT IS SUBJECT TO PDC LABS APPROVAL AND SURCHARGE)
RUSH RESULTS VIA (PLEASE CIRCLE) FAX PHONE
FAX # IF DIFFERENT FROM ABOVE:
PHONE # IF DIFFERENT FROM ABOVE:
DATE RESULTS NEEDED

6 *The sample temperature will be measured upon receipt at the lab. By initialing this area you request that the lab notify you, before proceeding with analysis, if the sample temperature is outside of the range of 0.1-6.0°C. By not initialing this area you allow the lab to proceed with analytical testing regardless of the sample temperature.* ________

7 RELINQUISHED BY: (SIGNATURE)	DATE / TIME	RECEIVED BY: (SIGNATURE)	DATE / TIME
Hughes	DATE 10/1/19 TIME 0600	Melissa Sibley	DATE 10/1/19 TIME 9:18
	DATE TIME		DATE TIME
Melissa Sibley	DATE 10/1/19 TIME 12:08	D Cw	DATE 10/1/19 TIME 1208

8 COMMENTS: (FOR LAB USE ONLY)

SAMPLE TEMPERATURE UPON RECEIPT 5 °C
CHILL PROCESS STARTED PRIOR TO RECEIPT (Y) OR N
SAMPLE(S) RECEIVED ON ICE (Y) OR N
PROPER BOTTLES RECEIVED IN GOOD CONDITION (Y) OR N
BOTTLES FILLED WITH ADEQUATE VOLUME (Y) OR N
SAMPLES RECEIVED WITHIN HOLD TIME(S) (EXCLUDES TYPICAL FIELD PARAMETERS) (Y) OR N
DATE AND TIME TAKEN FROM SAMPLE BOTTLE ____

EP003495

SUBCONTRACT ORDER
Transfer Chain of Custody

PDC Laboratories, Inc.

9100130

SENDING LABORATORY

PDC Laboratories, Inc.
2231 W Altorfer Dr
Peoria, IL 61615
(800) 752-6651

RECEIVING LABORATORY

PDC Springfield
1805 W. Sunset
Springfield, MO 65807
(417) 864-8924

Sample: 9100130-01
Name: EFFLUENT COMP DAY ONE

Sampled: 10/01/19 01:00
Matrix: Waste Water
Preservative: H2SO4, cool <6

Analysis	Due	Expires	Comments
03-Ammonia-N	10/10/19 16:00	10/29/19 01:00	
03-Chlorine T	10/10/19 16:00	10/01/19 01:14	
03-Conductivity	10/10/19 16:00	10/29/19 01:00	
03-DO	10/10/19 16:00	10/01/19 01:14	
03-pH	10/10/19 16:00	10/01/19 01:14	
03-Shipping	10/10/19 16:00	01/29/20 01:00	
03-Temperature	10/10/19 16:00	10/29/19 01:00	
03-WET Multiple 96 Hour	10/10/19 16:00	10/02/19 13:00	
04-Alk	10/10/19 16:00	10/15/19 01:00	
04-Ca 6010 Tot	10/10/19 16:00	03/29/20 01:00	
04-Mg 6010 Tot	10/10/19 16:00	03/29/20 01:00	

Sample: 9100130-02
Name: UPSTREAM GRAB DAY ONE

Sampled: 10/01/19 01:00
Matrix: Waste Water
Preservative: H2SO4, cool <6

Analysis	Due	Expires	Comments
03-Ammonia-N	10/10/19 16:00	10/29/19 01:00	
03-Chlorine T	10/10/19 16:00	10/01/19 01:14	
03-Conductivity	10/10/19 16:00	10/29/19 01:00	
03-DO	10/10/19 16:00	10/01/19 01:14	
03-pH	10/10/19 16:00	10/01/19 01:14	
03-Temperature	10/10/19 16:00	10/29/19 01:00	

SUBCONTRACT ORDER
Transfer Chain of Custody

PDC Laboratories, Inc.

9100130

Please email results to Kurt Stepping at kstepping@pdclab.com

Date Shipped: 10/01/19 Total # of Containers: 5 Sample Origin (State): IL PO #: ________

Turn-Around Time Requested [✓] NORMAL [ ] RUSH Date Results Needed: ________

Relinquished By	Date/Time	Received By	Date/Time		
[signature]	10/01/19 1310	[signature]	10/2/19 1010	Sample Temperature Upon Receipt	1.8 °C
				Sample(s) Received on Ice	(Y) or N
				Proper Bottles Received in Good Condition	(Y) or N
				Bottles Filled with Adequate Volume	(Y) or N
				Samples Received Within Hold Time	(Y) or N
Relinquished By	Date/Time	Received By	Date/Time	Date/Time Taken From Sample Bottle	(Y) or N

PDC LABORATORIES, INC.
1805 W. SUNSET
SPRINGFIELD, MO 65807

PHONE # 417-864-8924
FAX # 417-864-7081

CHAIN OF CUSTODY RECORD

State where samples collected IL MO

ALL HIGHLIGHTED AREAS MUST BE COMPLETED BY CLIENT (PLEASE PRINT)

(1) CLIENT: EMERALD PERFORMANCE	PROJECT NUMBER: WEDNESDAY	P.O. NUMBER:	MEANS SHIPPED:
ADDRESS: 1550 CR 1450 N	PHONE NUMBER:	FAX NUMBER:	DATE SHIPPED: 10-3-10
CITY/STATE/ZIP: HENRY, IL 61537	SAMPLER (PLEASE PRINT): Mike BROZAK		MATRIX TYPES: WW- WASTEWATER; DW- DRINKING WATER; GW- GROUND WATER; WWSL- SLUDGE; NAS- SOLID; LCHT-LEACHATE; OTHER:
CONTACT PERSON: [redacted]SPRING	SAMPLER'S SIGNATURE: [signature]		

(3) ANALYSIS REQUESTED

(4) (FOR LAB USE ONLY)
LOGIN #: 9100130-4
LOGGED BY: BG
LAB PROJ. #:
TEMPLATE:
PROJ. MGR.: CHAD COOPER

(2) SAMPLE DESCRIPTION AS YOU WANT ON REPORT	DATE COLLECTED	TIME COLLECTED	SAMPLE TYPE GRAB	SAMPLE TYPE COMP	MATRIX TYPE	BOTTLE COUNT	WET Test	Shipping	REMARKS
WET TEST EFFLUENT COMPOSITE	10-3-19	03:00		X	WW	1	X		
UPSTREAM GRAB (IF AVAILABLE)	10-3-19	04:45	X		WW	1	X		

(5) TURNAROUND TIME REQUESTED (PLEASE CIRCLE) NORMAL RUSH
(RUSH TAT IS SUBJECT TO PDC LABS APPROVAL AND SURCHARGE)
RUSH RESULTS VIA (PLEASE CIRCLE) FAX PHONE
FAX # IF DIFFERENT FROM ABOVE: PHONE # IF DIFFERENT FROM ABOVE:
DATE RESULTS NEEDED

(6) *The sample temperature will be measured upon receipt at the lab. By initialing this area you request that the lab notify you, before proceeding with analysis, if the sample temperature is outside of the range of 0.1-6.0°C. By not initialing this area you allow the lab to proceed with analytical testing regardless of the sample temperature.* ______

(7) RELINQUISHED BY: (SIGNATURE)	DATE / TIME	RECEIVED BY: (SIGNATURE)	DATE / TIME
[signature]	DATE 10-3-19 TIME 05:45	Melissa Sibley	DATE 10/3/19 TIME 8:04
	DATE TIME		DATE TIME
Melissa Sibley	DATE 10/8/19 TIME 8:49	[signature]	DATE 10-3-19 TIME 0849

(8) COMMENTS: (FOR LAB USE ONLY)

SAMPLE TEMPERATURE UPON RECEIPT 5 °C
CHILL PROCESS STARTED PRIOR TO RECEIPT (Y) OR N
SAMPLE(S) RECEIVED ON ICE (Y) OR N
PROPER BOTTLES RECEIVED IN GOOD CONDITION (Y) OR N
BOTTLES FILLED WITH ADEQUATE VOLUME (Y) OR N
SAMPLES RECEIVED WITHIN HOLD TIME(S) (EXCLUDES TYPICAL FIELD PARAMETERS) (Y) OR N
DATE AND TIME TAKEN FROM SAMPLE BOTTLE ______

Page 11 of 12
EP003498

SUBCONTRACT ORDER
Transfer Chain of Custody

PDC Laboratories, Inc.

9100130

SENDING LABORATORY

PDC Laboratories, Inc.
2231 W Altorfer Dr
Peoria, IL 61615
(800) 752-6651

RECEIVING LABORATORY

PDC Laboratories, Inc. - St Louis
3278 N Highway 67
Florissant, MO 63033
(314) 432-0550

Sample: 9100130-01
Name: EFFLUENT COMP DAY ONE

Sampled: 10/01/19 01:00
Matrix: Waste Water
Preservative: Cool <6

Analysis	Due	Expires	Comments
04-Alk	10/10/19 16:00	10/15/19 01:00	
04-Ca 6010 Tot	10/10/19 16:00	03/29/20 01:00	
04-Mg 6010 Tot	10/10/19 16.00	03/29/20 01:00	

Please email results to Kurt Stepping at kstepping@pdclab.com

Date Shipped: 10-2-19 Total # of Containers: 2 Sample Origin (State): ~~MO~~ IL PO #: —

Turn-Around Time Requested [X] NORMAL [ ] RUSH Date Results Needed: —

Relinquished By	Date/Time	Received By	Date/Time		
[signature]	10-2-19 1500	[signature]	10/3/19	Sample Temperature Upon Receipt	3.4 °C
				Sample(s) Received on Ice	(Y) or N
				Proper Bottles Received in Good Condition	(Y) or N
				Bottles Filled with Adequate Volume	(Y) or N
				Samples Received Within Hold Time	(Y) or N
Relinquished By	Date/Time	Received By	Date/Time	Date/Time Taken From Sample Bottle	Y or N

EP003499

EMERALD MATERIALS
1550 COUNTY ROAD 1450 N
HENRY, IL 61537-9404

9214 8901 0661 5400 0144 1437 06

RETURN RECEIPT (ELECTRONIC)

WET Test Special Condition 14

TODD HUSON
ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
412 SW WASHINGTON ST STE D
PEORIA, IL 61602-1598

CUT - FOLD HERE

Zone 1

ENVELOPE
CUT / FOLD HERE

CUT / FOLD HERE

CERTIFIED MAIL

Hasler
10/28/2019
US POSTAGE $006.40
ZIP 61537
011E10673344

EMERALD MATERIALS
1550 COUNTY ROAD 1450 N
HENRY, IL 61537-9404

9214 8901 0661 5400 0144 1437 06

RETURN RECEIPT (ELECTRONIC)

WET Test Special Condition 14

TODD HUSON
ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
412 SW WASHINGTON ST STE D
PEORIA, IL 61602-1598

EP003501

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

PETITIONER'S HEARING EXHIBIT
AS 19-002
9

IN THE MATTER OF:	)	
	)	
Petition of Emerald Polymer	)	
	)	AS 19-002
Additives, LLC for an Adjusted	)	
	)	(Adjusted Standard)
Standard from 35 Ill. Adm. Code	)	
	)	
304.122(b)	)	

WRITTEN EXPERT TESTIMONY T. HOUSTON FLIPPIN

I. INTRODUCTION

1. This Expert Written Testimony is submitted to the Illinois Pollution Control Board (Board) in the matter captioned as *In the Matter of: Petition of Emerald Polymer Additives, LLC for an Adjusted Standard from 35 Ill. Adm. Code 122(b)*, AS 19-002, and in accordance with the Hearing Officer's order dated November 25, 2019.

II. QUALIFICATIONS AND EXPERIENCE

2. My name is Thomas Houston Flippin. I am an Executive Engineer in the Industrial Water practice of Brown and Caldwell.

3. I was retained by B.F. Goodrich Company in September 1988 to provide wastewater treatment consulting services and have continued to provide such services at the chemical manufacturing facility located at 1550 County Road 1450 N., in Henry, Illinois (Henry Plant or Emerald Plant) for the last 31 years. During this entire time period, I have served as lead engineer on all Henry Plant matters in which my firm, Brown and Caldwell, has been involved, first for B.F. Goodrich Company and then for its successors-in-interest, including Noveon, Inc. and Emerald Polymer Additives, LLC (Emerald).

4. I received two degrees from Vanderbilt University. I received my Bachelor of Engineering Degree in Civil Engineering in 1982 and my Master of Science Degree in Environmental and Water Resources Engineering in 1984.

5. I immediately went to work for AWARE Incorporated in 1984 and have remained with the same company for the last 35 years in progressively more responsible positions (beginning as a project engineer and eventually being named Executive Engineer) in the area of wastewater engineering. A copy of my resume providing more details on my experience has been marked as Petitioner's Hearing Exhibit 10. My firm has changed names twice. In 1989, we renamed ourselves Eckenfelder Incorporated. In 1998, we were acquired by Brown and Caldwell.

6. During my career, I have personally conducted treatment (treatability) testing of industrial wastewaters and contaminated groundwaters and developed treatment process design criteria from test data. I have provided troubleshooting or optimization services for wastewater treatment facilities (WWTFs), conducted waste minimization studies and developed cost savings for treatment plants. I have also overseen the work described above, designed wastewater and contaminated groundwater treatment processes, assisted in effluent permit negotiations, supported expert testimony preparation and trained treatment plant operators in process operations and troubleshooting.

7. I am a licensed professional engineer in sixteen states, including Illinois. I am also a Board Certified Environmental Engineer with the American Academy of Environmental Engineers.

8. I have published several technical papers, of which more than 10 are directly related to the Henry Plant's issues. My publications are listed on pages 5-7 of my resume. I

have also served as a presenter at numerous conferences, including, most recently, at the 92nd Annual Water Environment Foundation Technical Exhibition and Conference (WEFTEC) in September 2019.

III. EXPERIENCE SPECIFICALLY RELATED TO AMMONIA REDUCTION

9. I have developed the process design for the following biological nitrification facilities. Each of these are operational today and have been historically in compliance with their permits.

- American Cyanamid Superfund Site, Bridgewater, NJ
- BASF (formerly Ciba-Geigy), McIntosh, AL
- Gulf Coast Waste Disposal Authority, Pasadena, TX
- Phillips 66 (formerly ConocoPhillips), Roxana, IL
- Waste Management Services-Woodside Landfill- Walker, LA

10. I have provided optimization assistance for the following biological nitrification facilities. Each of these are operational today and have been historically in compliance with their permits.

- American Cyanamid Superfund Site, Bridgewater, NJ
- Ashland Chemical, Calvert City, KY
- CHS-Laurel, MT
- City of Rochester, MN
- Confidential ammunitions manufacturer, United States
- Gulf Coast Waste Disposal Authority, Pasadena,
- Republic Services-Middle Point Landfill- Murfreesboro, TN
- Valero, Benicia, CA

- Waste Management-Sainte-Sophie, Quebec, Canada

11. I have developed the process design for the following biological nitrification and denitrification facilities.

- Ashland Chemical, Calvert City, KY
- Bush Brothers, Dandridge, TN
- Chesterfield County, VA
- Confidential ammunitions manufacturer, United States
- Dairy Farmers of America, Garden, City, KS
- Dairy Farmers of America, Cass City, MI
- Great Lakes Cheese. Adams, NY
- Lily Del Caribe- Puerto Rico
- Valero-Pembroke, Wales
- Waste Management-Atlantic Waste Disposal, Waverly, VA

12. Lastly, I developed the process design for three breakpoint chlorination facilities: Koch Fertilizer Company, Enid, OK; Republic Services-Middle Point Landfill- Murfreesboro, TN; and Valero, Benicia, CA. The Koch facility was pilot-scale tested and is in final design currently. It treats approximately one-fifth of the effluent ammonia-nitrogen load as the Emerald-Henry Plant. Other treatment alternatives considered for the Koch facility were ozonation, perozonation, alkaline air stripping, steam stripping, precipitation as struvite, electrochemical oxidation, reverse osmosis, suspended growth biological nitrification, and nitrification via artificial wetlands. The breakpoint chlorination system at Republic Services was ultimately replaced with single stage nitrification designed to accommodate a significantly inhibited

nitrification rate. One other option considered for interim treatment at Republic Services was a reported ammonia selective membrane treatment system that proved economically unviable.

IV. HENRY PLANT EXPERIENCE

13. From 1988 to 2004, I provided the following assistance in chronological order listed below.

- Setup, conduct and oversight of treatability testing that was used to develop process design of C-18 wastewater pretreatment system and aeration basin upgrade. Testing was also used to set allowable loading rates of various wastestreams.

- Setup, conduct and oversight of treatability testing that was used to develop conceptual level design criteria for alternative processes for effluent ammonia-nitrogen reduction. Developed conceptual level designs for these alternative processes. Worked with construction cost estimators and venders to develop conceptual level cost estimates of these alternative processes.

- Provided guidance to B.F. Goodrich and Noveon, as requested, regarding WWTF operations and full-scale testing of processes and procedures intended to reduce effluent biochemical oxygen demand (BOD), total suspended solids (TSS) and/or ammonia-nitrogen.

- Authored or reviewed all reports submitted to B.F. Goodrich and Noveon by Brown and Caldwell (formerly AWARE Incorporated and Eckenfelder Inc) during entire period of 1988 through 2004.

- Represented Noveon in discussions with IEPA regarding the Petition for an Adjusted Standard, AS 2002-005, and testified during proceedings before the Illinois Pollution Control Board.

14. From 2005 to 2019, I provided the following assistance in chronological order listed below.

- In August 2012, prepared a letter report to Emerald's counsel regarding ammonia-nitrogen treatment alternatives for the Henry Plant that was identified as Exhibit 13 to Emerald's petition for an adjusted standard in AS 13-002 and advised Emerald in connection with discussions with IEPA.

- Design and oversight of treatability testing that was used to develop conceptual level design criteria for alternative processes for effluent ammonia-nitrogen reduction, including granular activated carbon treatment and river water dilution. Developed conceptual level designs for these alternatives processes. Worked with construction cost estimators and vendors to develop conceptual level cost estimates of these alternative processes. This work is described in more detail in Section VI, below.

- Provide guidance to Emerald, as requested, regarding WWTF operations and full-scale testing of processes and procedures intended to reduce effluent BOD, TSS, and/or ammonia-nitrogen.

- Prepared my expert report for this case, AS 19-002, which has been marked as Petitioner's Hearing Exhibit 12.

- Authored or reviewed all reports submitted to Emerald by Brown and Caldwell during entire period of 2005 through 2019.

V. MISCELLANEOUS TOPICS

15. Pursuant to its discharge permits, the Henry Plant generally collects five samples of wastewater effluent each week and tests the samples for the concentration (mg/L) of ammonia nitrogen. Each concentration is then used with the flow rate to calculate a daily ammonia load (lbs/day), a 30-day average concentration and a 30-day average load. According to the definitions in the standard conditions in Attachment H to the Henry Plant's 2016 NPDES permit, a 30-day average value is calculated as the sum of all measured daily discharges during a calendar month divided by the number of measured values during that month. This produces a large amount of data, which can be unwieldy to analyze unless it is compiled and summarized.

16. Ammonia sample results and flow data from the Henry Plant's annual DMR summary reports, which have been identified as Petitioner's Hearing Exhibit 2, were entered into excel worksheets with one worksheet for each calendar year. I reviewed those worksheets to verify that the data was correctly entered. Additional worksheets were prepared to present certain summary data from the annual worksheets. I checked the formulas for those worksheets to ensure that they accurately presented the data described. The documents marked as Petitioner's Hearing Exhibit 3 provide the following summary data on the ammonia-nitrogen discharged from the Henry Plant from 2013 to June 2019. On EP003097-003099, the second

and third columns show the maximum daily ammonia sample result (mg/L) and the maximum calculated daily load (lb/day), respectively, for each month in each year. The fourth and fifth columns show the 30-day average of daily ammonia samples (mg/L) and calculated daily ammonia load (lb/day), respectively. The shaded values on EP003097-003099 are the highest monthly values during each year. The table at the bottom of EP003099 shows a percentage calculated by dividing the highest monthly value for each year by the corresponding limit in the Henry Plant's 2016 NPDES permit, which is the same as the limit established in AS13-2.

17. In preparation for this case, I reviewed my written testimony submitted to the Board in AS 02-5. In particular, I reviewed the portion of that testimony related to whether the Henry Plant is applying the best available technology economically available (BAT) as identified by USEPA for the Organic Chemical, Plastics, and Synthetic Fibers industrial category. That testimony is still accurate and the Henry Plant does apply BAT.

VI. APRIL 13, 2018 TECHNICAL MEMORANDUM

18. At the request of Emerald and as required by the Board in AS 13-002, Brown and Caldwell studied two treatment alternatives, as reported in our April 13, 2018 Technical Memorandum (the 2018 Technical Memorandum). The two alternatives were: (1) use of granular activated carbon (GAC) treatment on the polymer chemicals (PC) wastewater at the Henry Plant to remove mercaptobenzothiazole (MBT) so that nitrification can occur (GAC treatment); and (2) extracting water from the Illinois River and pumping it uphill to dilute the primary clarifier effluent so that MBT concentrations are reduced enough to allow nitrification to occur (river water dilution). A copy of my 2018 Technical Memorandum is included in Petitioner's Hearing Exhibit 11.

19. The scope of work for these studies consisted of bench scale treatability testing and developing a preliminary design and cost estimate for each option. Laboratory testing was required to evaluate nitrification potential and feasibility.

20. Based on the results from the bench scale tests, preliminary designs and class 5 cost estimates were completed to investigate the economic feasibility of achieving nitrification (biological ammonia-nitrogen removal) through these two methods in comparison to NH3-N removal.

a. Laboratory Testing

21. Fed Batch Reactor (FBR) tests were performed on five combinations of biomass and test waters to investigate the viability of GAC treatment and river water dilution in facilitating nitrification at the Henry Plant. Table 1 to my 2018 Technical Memorandum outlines the five FBR tests run during this investigation. Further description of the pretreatment and testing process for the FBR tests is included in my 2018 Technical Memorandum at pages 3-12.

22. Based on the FBR testing performed, we reached the following conclusions:

- The unpretreated wastewater will continue to cause substantial nitrification inhibition due to high concentrations of MBT.
- Pretreatment of the PC/C-18 wastewater utilizing solids separation and GAC would allow the Henry Plant to nitrify in an uninhibited manner following removal of MBT from the biomass through alkaline washing.
- Diluting the unpretreated clarifier wastewater with water extracted and pumped from the Illinois River requires a dilution percentage in excess of 90% for uninhibited nitrification to occur. At 90% dilution, the nitrification rate observed could be sustainable as long as the MBT concentration in the PC/C-18 wastewater remained within the values used in the FBR testing. The sustainability of the performance of this treatment alternative for NH3-N removal is unlikely due to the inherent variability of the influent MBT concentration (that is, it can vary outside the FBR test range) and the difficulty in maintaining target temperatures in the biological treatment systems while heating a large river water flow (approximately 7 million gallons/day, or MGD).

These conclusions and the basis for them are described further in my 2018 Technical Memorandum at pages 12-13.

b. Conceptual Level Design and Cost Estimates

23. At the conclusion of treatability testing, we developed conceptual designs and Class 5 cost estimates to evaluate additional equipment facility changes needed for each alternative.

24. Class 5 estimates are used to prepare planning level cost scopes or evaluation of alternative schemes, long range capital outlay planning and can also form the base work for the Class 5 Planning Level or Design Technical Feasibility Estimate. As a result, these estimates are intended only for use as aids in conceptual level treatment selection.

25. A complete breakdown of the capital costs associated with each alternative is presented in Attachment A to my 2018 Technical Memorandum. The major annual operating and maintenance costs are summarized in Table 6 and Table 7 to my 2018 Technical Memorandum.

26. The conceptual level design of the GAC treatment alternative is described at pages 13-14 of my 2018 Technical Memorandum. A block flow diagram depicting the GAC treatment alternative is also included in Attachment B to my 2018 Technical Memorandum.

27. The estimated capital cost for the GAC treatment alternative was approximately \$5.3 million. Depending on the source of GAC, this treatment alternative would also increase plant operating costs by \$3.102 to \$4.160 million per year. We calculated a present worth cost for this alternative of \$27 million based on the combination of the capital cost and the increased annual operating costs and assuming a 10-year project duration, zero salvage value, 5% interest and 2% inflation. We concluded that this investment would result in approximately 1.9 million pounds of NH3-N being removed over the course of 10 years resulting in an average cost of

$14/pound of NH3-N removed. More details on these calculations are on pages 13-15 of my 2018 Technical Memorandum.

28. This estimate is 20-fold higher than the costs reported by the publicly owned treatment works serving Decatur, Illinois; Bloomington, Illinois; and Normal, Illinois in 2015 (less than $0.70/pound of NH3-N removed). Further, this estimate is 11-fold higher than the median cost reported by 15 reporting entities in the 2015 survey conducted by the National Association of Clean Water Agencies ($1.33 per pound of NH3-N removed).

29. Based on this comparison, it is my opinion that the removal of NH3-N via GAC treatment at the Emerald plant is not economically reasonable. In addition, the alternative would have other negative environmental side-effects. It would require a significant increase in diesel truck traffic to bring in fresh GAC and haul-out spent GAC for disposal. This would increase greenhouse gas emissions along with being a burden on local roads and residents. Also, the spent GAC is usually taken to an incineration facility, which involves even more emissions of greenhouse gas.

30. The conceptual level design of the river water dilution alternative is described at pages 15-16 of my 2018 Technical Memorandum. A block flow diagram depicting the river water dilution alternative is also included in Attachment B to my 2018 Technical Memorandum.

31. The estimated capital cost for the river water dilution alternative was approximately $23 million excluding the steam generation and supply system. This alternative would also increase operating costs for the Henry Plant by about $4.4 million every year of operation. We calculated a present worth cost of $54 million based on the combination of capital costs and increased annual operating costs and assuming a 10-year project duration, zero salvage value, 5% interest and 2% inflation. We concluded that this investment would result in roughly

1.9 million pounds of NH3-N being removed over the course of 10 years resulting in an average cost of $28 per pound of NH3-N removed. More details on these calculations are on pages 15-16 of my 2018 Technical Memorandum.

32. This estimate is 40-fold higher than the costs reported by the publicly owned treatment works serving Decatur, Illinois; Bloomington, Illinois; and Normal. Illinois in 2015 (<$0.70 per pound of N113-N removed). Further, this estimate is 21-fold higher than the median cost reported by 15 reporting entities in the 2015 survey conducted by the National Association of Clean Water Agencies ($1.33 per pound of NH3-N removed). So, this alternative is roughly twice the cost of the GAC treatment alternative while it would provide no added environmental benefit, probably could not reliably achieve compliance and would have several negative side-effects.

33. In my experience and opinion, the river water dilution alternative for NH3-N removal performance is unlikely to be consistently sustainable due to the inherent variability of the influent MBT concentration and the difficulty in maintaining target temperatures in the biological treatment systems while heating a large river water flow (approximately 7 MGD). In my opinion, although the treatability study for this alternative indicated it can achieve compliance, at plant scale with inherent process variability, it will not achieve compliance all of the time.

34. Emerald estimated in an April 17, 2018 letter to IEPA that is included in Exhibit 11 that the heating equipment required by the river water dilution alternative would emit 38,000 metric tons of CO_2e greenhouse gases, 35 tons of nitrogen oxides and 30 tons of carbon monoxide per year. In my opinion, this is another negative environmental side-effect from this alternative.

35. This alternative would also increase the heat load to the Illinois River 10-fold which would adversely impact localized water quality. It would also greatly complicate utility and treatment plant operations.

VII. OCTOBER 11, 2019 EXPERT REPORT

36. In 2019, under my supervision, Brown and Caldwell updated its analysis of the costs of several alternatives previously considered and added the evaluation of an additional alternative. I was also asked to review the Illinois Environmental Protection Agency's July 19, 2019 Recommendation and express my opinion on some of the positions taken by IEPA. That work resulted in the preparation of my expert report in this matter dated October 11, 2019 (Expert Report). My Expert Report has been marked as Petitioner's Hearing Exhibit 12.

37. As regards IEPA's Recommendation, my Expert Report responds to and rebuts several of the bases upon which the IEPA opposed Emerald's request and also explains why some of the IEPA's suggestions would not help control ammonia-nitrogen in the Henry Plant's discharge.

a. Rebuttal of IEPA Suggestions

38. IEPA objected on Page 16 of the Recommendation to my comparison of unit cost (dollars per pound of ammonia-nitrogen removed) as a means of comparing alternatives and judging economic reasonableness of ammonia-nitrogen removal. IEPA also objected, on this same page, to the use of present worth costs (accounting for both capital and operating costs) instead of capital costs alone when calculating cost of treatment.

39. At a conceptual level, comparing alternatives solely based on estimated capital costs makes no sense. That approach would favor alternatives that have proportionally lower capital costs even if the operating costs were much higher so that total costs of such alternatives

are higher. An example of the error in IEPA's position can be seen in Table 2 of my Expert Report. Breakpoint chlorination has the lowest capital cost of the alternatives considered. If the comparison is limited to capital costs, it appears to be the least costly. But, it has very high operating costs actually making it the second most costly alternative to implement. A comparison based solely on capital costs is incomplete and, in my opinion, deeply flawed.

40. IEPA's objection to considering unit costs is also flawed. Again, the reason can be seen by comparing two alternatives in my Tables 2 and 3. Looking at just the present worth cost, land application appears to be the least expensive alternative. But, that conclusion is wrong because it fails to understand that the land application can, at best, reduce the annual effluent ammonia-nitrogen discharged from the Henry Plant by approximately 22%. Calculating the present worth cost on a \$/lb of NH_3-N removed takes that additional factor into account and shows that land application is actually the second highest cost alternative.

41. In my opinion, comparing alternatives on present worth costs expressed on a unit of pollutant removed basis is the appropriate and best standard for evaluating true treatment costs. The latest cost document provided by the National Association of Clean Water Agencies (NACWA) reports that the median unit cost of ammonia-nitrogen treatment for 12 agencies was \$1.53 per pound of ammonia-nitrogen removed, which is higher than the cost reported by the Greater Peoria Sanitation District (\$0.81 per pound). The basis for these reported costs includes, in all cases, annual operating and maintenance costs. In some cases, these costs may include capitalized present worth cost (amount of money needed today to fund capital and operating costs for a defined project life). The exclusion of capitalized costs by most NACWA members in these reported unit costs is due to the nature of the municipal wastewater treatment plants. Exclusion of capital costs in unit costs by NACWA members is due to several factors. These

include the difficulty in separating capital costs into those required for treatment of flow, biochemical oxygen demand (BOD), total suspended solids (TSS), and ammonia-nitrogen (NH3-N). In municipal plants, the same pieces of equipment contribute to treatment of all four components (flow, BOD, TSS and NH3-N). In the Emerald plant, the costs described herein are focused entirely on NH3-N removal, and therefore, delineation of capitalized present worth costs are straightforward. Contrary to NACWA, IEPA has focused strictly on capital costs of projects that included ammonia-nitrogen removal. Such focus is misguided and results in an incomplete understanding of ammonia-nitrogen removal costs.

42. IEPA's Recommendation also references a number of project capital costs reportedly incurred by public treatment works in the State of Illinois when including ammonia-nitrogen removal in their treatment plant upgrades, including facilities in Geneva, Batavia, Saint Charles, Fox River, Kishwaukee, Newark and Mount Carmel. A discussion of each of these seven "cost examples" is included in Petitioner's Hearing Exhibit 12.

43. The "cost examples" referenced by IEPA all relied upon the lowest cost means of ammonia-nitrogen removal which is single-stage biological nitrification.

44. The Emerald plant provides the same degree of aerobic treatment conditions that allow single-stage nitrification in these IEPA-referenced plants, that is, a solids retention time in excess of 30 days, surplus alkalinity, and available phosphorus. However, the Emerald plant cannot nitrify within a single stage like these other plants due to the presence of MBT in the process wastewater.

45. This compound is foundational to the production processes at the Emerald Plant and has been consistently present in the primary clarifier effluent at 160 mg/L or higher for days at a time (versus a nitrification inhibition threshold of 3 mg/L). To establish reliable single-stage nitrification, MBT removal from the process wastewater would have to exceed 98 percent which has been demonstrated in prior documents as being complex and very costly.

46. Only five of the seven wastewater treatment facilities upgrades referenced by IEPA in its Recommendation had anything to do with ammonia-nitrogen removal. None of these five treatment plant upgrades were implemented solely to accomplish ammonia-nitrogen removal. They were implemented in large part to better accommodate higher flows, greater BOD removal, greater TSS removal, and/or improved disinfection.

47. Consequently, the total costs of these upgrades as reflected in the Recommendation cannot be legitimately used to compare or evaluate costs of ammonia-nitrogen removal at the Emerald plant.

48. IEPA's Recommendation (pages 6 and 27-28) makes reference to the fact that Emerald currently operates one biotreater at its facility and, in the event that the Board grants Emerald's Petition, requests that the Board require Emerald to operate three other biotreaters within four years. The problem with IEPA's position is that it is unsupported by any analysis that operating more biotreaters will reduce ammonia-nitrogen in the effluent.

49. Ammonia-nitrogen removal at the wastewater treatment facility is a function of solids retention time (SRT) and the extent of BOD removal. The maximum amount of ammonia-nitrogen removal will occur at the lowest achievable SRT that ensures sufficient BOD removal.

50. The wastewater treatment plant is already capable of operating at this condition (SRT of 30 to 60 days depending upon production) with only the North Biotreater in service. In fact, I recommended to plant personnel that they only operate the North Biotreater, which is the largest, and shut the others down.

51. In my opinion, operating additional biotreaters will have no impact on effluent ammonia-nitrogen but will make operations more complicated.

52. IEPA has recommended that Emerald implement an in-plant ammonia-nitrogen (NH3-N) monitoring program in hopes of reducing effluent ammonia-nitrogen through at-source detection and control. This strategy might work if effluent ammonia-nitrogen was strongly correlated to influent ammonia-nitrogen.

53. However, this is not the case since influent organic nitrogen (not ammonia nitrogen) is the primary contributor to effluent ammonia-nitrogen.

54. The two primary raw wastewater contributors to the wastewater treatment plant (PVC Tank and PC Tank) were monitored approximately 3 days per week for Total Kjeldahl Nitrogen (TKN) and ammonia-nitrogen (NH3-N) during the period of March 28, 2019 through August 8, 2019. The difference between TKN and NH3-N concentrations represent organic nitrogen. Under normal biological treatment conditions, organic nitrogen is converted to NH3-N. These data are summarized in Figure 1 to Petitioner's Hearing Exhibit 12.

55. The results of the PVC Tank and PC Tank are discussed in detail at pages 4-5 of my Expert Report. The overall findings and conclusions are as follows:

- Only 40 percent of the TKN loading for the PVC tank is comprised of ammonia-nitrogen. This discharge stream includes the nitrogen loading of tertiary filter backwash water and sludge dewatering filtrate which is generated when treating both PVC tank and PC tank wastewaters. Nitrification of this stream alone has been considered in prior evaluations, but does not offer a means of complying with regulatory effluent limits. Recent sampling results continue to demonstrate this finding.
- Only 1 percent of the TKN loading in the PC tank was ammonia-nitrogen.
- Ammonia-nitrogen contributed only 30 percent of the TKN loading discharged by the PVC and PC tank combined. Consequently, in-plant monitoring of ammonia-nitrogen only has the ability to influence 30 percent of the potential final effluent NH3-N load. This finding that the bulk of the final effluent NH3-N loading is due to organic nitrogen present in the raw wastewaters that is converted to ammonia-nitrogen through biological treatment has been documented throughout the years.

56. The Emerald wastewater treatment plant did provide 46 percent removal of influent TKN reducing the effluent ammonia-nitrogen by 344 lbs/day. This removal was associated with nutrient requirements for the BOD removal accomplished by biological treatment within the plant.

57. Any in-plant monitoring would need to focus on TKN monitoring. Unlike NH3-N, there are no direct monitoring probes for TKN in wastewater. Consequently, real-time monitoring and quick response would be impractical.

58. In my opinion, additional sampling of process wastewater sources to determine the origin of effluent ammonia nitrogen is not needed.

b. Updated Conceptual Level Designs and Cost Estimates for Alternatives, including Land Application.

59. Brown & Caldwell was also asked to update its evaluation of the costs of various treatment alternatives previously considered and to evaluate the cost of a land application alternative. Updating costs for every alternative is not necessary because many alternatives are known not to achieve significant effluent ammonia-nitrogen reductions or would have costs in

excess of other more effective alternatives. Costs have been calculated for five alternatives considered most likely to be effective and for land application.

60. The conceptual level cost estimates prepared are the same kind of Class 5 estimates used in evaluating the GAC and river water dilution alternatives in 2018. These estimates were developed by generating equipment costs for each alternative and then applying multiplication factors for direct and indirect costs. The direct costs include freight, tax, purchased equipment installation, installed piping, installed electrical systems, buildings, other structural components, yard improvements, and installed service utilities. Indirect costs include engineering and supervision, construction expenses, legal expenses, and contractor's fee.

61. A contingency multiplication factor is applied to the sum of the direct and indirect costs. The sum of the direct, indirect and contingency results in the fixed capital cost (FCC).

62. The most economical and reliable processes for ammonia-nitrogen removal at the Emerald Plant would consist of further treating the plant final effluent (not plant raw wastewater influent). We updated the design final effluent wasteload information based on 2018 information when the plant was reportedly operating at typical production levels. A summary of the design final effluent wasteload is illustrated in Table 1 to Petitioner's Hearing Exhibit 12.

63. This wasteload was used to update the conceptual level designs and cost estimates for the most economically feasible alternatives, including: (1) ozonation; (2) alkaline stripping; (3) tertiary nitrification; (4) breakpoint chlorination; and (5) ion exchange. Because of IEPA's interest, we also estimated costs for land application even though it will not achieve compliance. The details around each of these cost estimates are included as Attachment A to Petitioner's Hearing Exhibit 12. Initially we had only intended to cost five alternatives in total. When I saw

data on the low levels of MBT in the treatment plant effluent (as opposed to higher levels in the treatment plant influent), I added the re-evaluation of tertiary nitrification.

64. A summary of treatment alternatives performance and costs are shown in Table 2 to Petitioner's Hearing Exhibit 12 and presented as unit costs in Table 3 of that exhibit.

65. These data indicate that tertiary nitrification and ion exchange offer the lowest unit cost for ammonia removal based on annual operations and maintenance costs with ion exchange having a much lower capital cost. On a present worth basis, Emerald would have to commit a minimum of $12 per pound solely for NH3-N removed over the next 10 years, which is approximately 8-fold the median unit costs reported by NACWA.

66. In my opinion, there are no other treatment alternatives for ammonia-nitrogen removal that are worthy of being considered. All other alternatives have been shown to be incapable of achieving reliable compliance or have costs in excess of the alternatives re-evaluated in 2019 as described in my Expert Report.

67. My opinion in this regard also extends to the Algaewheel® technology alternative suggested in IEPA's Recommendation. That technology has similarities to the tertiary nitrification alternative using rotating biological contactors (RBCs) downstream of the secondary clarifier evaluated in my Expert Report. In our alternative, heterotrophic bacteria, which remove BOD, and nitrifying bacteria would grow on fixed film media offered in the RBCs. The bacteria on the RBC media should then be able to nitrify ammonia-nitrogen, if, that is, the level of MBT can be kept low enough in the current plant effluent. The Algaewheel® alternative works in a similar way except that algae replaces the bacteria on the RBCs. As compared to bacteria, use of algae as a nitrifier is a newer technology, which means it is less proven and likely more costly because the technology is still patent-protected.

c. Environmental Impact of Effluent Ammonia-Nitrogen Removal

68. The Illinois River over many years has shown no violations of the acute and chronic water quality standards for ammonia-nitrogen downstream of Emerald's discharge.

69. The results of Whole Effluent Toxicity (WET) testing conducted at the Henry Plant have repeatedly shown no toxic effects from Emerald's effluent outside the approved zone of initial dilution.

70. These results demonstrate that Emerald's construction and continued use of the current wastewater treatment plant, the multi-port diffuser, replacement of the BBTS Wet Scrubber and other actions have produced an effluent that has no material negative effect on the environment. In contrast, every alternative that we have considered has identifiable negative side-effects on the environment.

71. Only one of the six treatment alternatives that we analyzed in 2019 does not require chemical addition to the final effluent. However, this alternative of land application only reduces the annual nitrogen load on the river by 22 percent and requires complexity related to operating and maintaining a river water treatment system, three pumping systems, and an elaborate irrigation system. It also generates hay which has no defined dependable outlet for use.

72. IEPA's further suggestion that the land application alternative be extended to farm land not owned by Emerald is even more implausible. While I am aware of some industrial waste water that is land applied, it is mostly from food processing plants. It is quite rare that the effluent from a chemical plant is land applied. I am also aware of no instance of a chemical plant effluent being land applied onto row crops, such as corn or soybeans, which are dominant crops in Illinois. In addition, corn and soybeans are less salt tolerant than hay (the crop we evaluated

for land application), so to spray the effluent on those crops would require even higher river water dilution than we planned for in our evaluation.

73. The other five alternatives require extensive chemical addition which will appreciably increase the effluent salt load to the Illinois River. These alternatives would either substitute salt for ammonia nitrogen in the Henry Plant's discharge with unknown repercussions for toxicity or require an even more costly fourth level of treatment to reduce the salt.

74. The only two alternatives that can reliably comply with the regulatory limits (breakpoint chlorination and ion exchange) either (a) generate an effluent that may cause failure of the existing effluent aquatic toxicity criterion or (b) generate a liquid waste whose disposal method, destination, and costs are uncertain.

75. In addition, every alternative will indirectly increase greenhouse gas emissions due to increased power consumption and additional diesel truck traffic.

76. The same is true for the GAC and river water dilution alternatives as described above.

77. The collateral negative environmental impact of the treatment alternatives (e.g., greenhouse gas emissions and decreased effluent water quality with respect to higher salt levels) is appreciably more adverse than the current effluent ammonia-nitrogen load.

78. Given that Emerald's effluent has no negative environmental impact and the treatment alternatives have negative collateral environmental effects, implementing any of those alternatives and incurring the estimated costs solely for ammonia-nitrogen removal would be a unique and unreasonable requirement.

79. In my opinion, implementing any of these alternatives is unwise from an environmental standpoint.

T. Houston Flippin, PE, BCEE

Experience Summary

Houston Flippin has 35 years of experience in industrial water management. He is a Board Certified Environmental Engineer who is particularly adept at maximizing treatment process performance. This is due to years of conducting, evaluating, and developing full-scale process design and operating guidelines from bench-, pilot-, and full-scale wastewater treatment studies. These studies have evaluated both biological and physical/chemical processes for treating off-gas, water, groundwater, wastewater, and sludge laden with conventional pollutants, priority pollutants, and aquatic toxicants. Houston has used this experience to develop treatment cost savings (capital and operating), while maintaining reliable effluent and emissions compliance, and negotiate more reasonable limits. His hands-on experience and adept communication skills have made him a frequent workshop lecturer, client staff trainer, and negotiator.

Assignment

Senior Process Design Lead/ Evaluation and Optimization

Education

MS, Environmental and Water Resource Engineering with minor in Chemical Engineering, Vanderbilt University, 1984

BE, Civil and Environmental Engineering, Vanderbilt University, 1982

Registration

Professional Engineer, Alabama (36124), Arkansas (12301), Delaware (15291), Florida (75197), Georgia (031884), Idaho (18867), Illinois (062.053488), Indiana (11100080), Kentucky (21150), Michigan (046604), Mississippi (20817), Ohio (72519), South Carolina (31331), Tennessee (21208), Texas (99149), and Virginia (042268).

Board Certified Environmental Engineer: American Academy of Environmental Engineers (99-20004)

Experience

35 years

Joined Firm

1984

Relevant Expertise

- *Developing site specific operating guidelines and treatment capacities*
- *Developing cost savings for treatment plants*
- *Training client staff in process operations and troubleshooting*

Relevant Chemical Industry Experience

Impact on POTW, American Cyanamid, Barceloneta, Puerto Rico

Lead Engineer. Houston was responsible for developing treatability studies that evaluated the impact of herbicide and pesticide wastestreams on publicly owned treatment works (POTWs). Testing indicated no adverse impact on biochemical oxygen demand (BOD) removal, nitrification, and sludge quality at the desired discharge rates. The test results were used to negotiate the allowed discharges of these wastestreams to the POTW without pretreatment.

Management of Bio-Inhibiting Wastewater, Air Products, Calvert City, Kentucky

Lead Engineer and Project Manager. Houston defined operating guidelines for a wastewater treatment system to allow processing of a bio-inhibiting wastestream component.

Groundwater Treatment Optimization, BASF, Toms River, New Jersey

Lead Engineer. Houston developed strategies to optimize the existing equalization, chemical conditioning system, and filtration of contaminated groundwater with minor modifications.

Treatment Optimization, Borden Chemical Company, Fayetteville, North Carolina and Demopolis, Alabama

Lead Engineer. Houston developed operational and capital upgrades for two wastewater treatment systems to address concerns regarding effluent quality.

Concept Design and Cost Sharing Estimates for Combined Municipal and Industrial Treatment Facility, Calvert City, Kentucky Industrial Complex

Lead Process Engineer. Houston directed treatability testing used to develop the process design for a treatment system capable of meeting direct discharge standards and the Miscellaneous Organic Chemical Manufacturing National Emission Standards for Hazardous Air Pollutants (NESHAP), known as the MON, requirements while treating wastewaters from Calvert City municipal wastewater, Rail Car Services, Sekisui Specialty Chemicals, Wacker Chemical Corporation, and Westlake Chemical as well as leachate from Waste Path Services. The combined treatment facility consisted of wasteload monitoring at each facility, screening, equalization, anaerobic treatment of high-strength wastewaters, activated sludge treatment, chlorination, dechlorination, and post aeration. The process design and 60 percent design were developed, and individual sewer use fees were established to support the facility. The economic payback was longer

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than desired (more than 5 years) for the participating industries to proceed forward with final design of the combined treatment facility.

Treatment Facility Emissions Control, Celanese Chemicals, Calvert City, Kentucky

Technical Director. Houston directed treatability testing used to develop the process design for a treatment system compliant with the MON requirements.

Process Design of New Treatment Facility, Ciba-Geigy Corporation, McIntosh, Alabama

Lead Engineer. Houston was responsible for onsite treatability studies, process design development, and a final report for the treatment of wastewaters discharged from Ciba-Geigy Corporation's largest U.S. organic chemicals manufacturing complex, including pesticides. The project began by evaluating conversion of the existing aerated lagoon system to activated sludge. This conversion was necessary to meet effluent requirements under higher loading conditions and to meet Resource Conservation and Recovery Act (RCRA) closure requirements of onsite surface impoundments. This evaluation involved an activated sludge treatability study evaluating the impact of varying total dissolved solids (TDS) concentrations (0.5 percent to 2.5 percent), temperatures (8°C to 20°C) and RCRA-regulated stream discharge contributions. A process design for the aerated lagoon/activated sludge conversion was developed, presented, and implemented. Houston developed materials for and assisted in the operator training course that preceded startup of the activated sludge plant. A follow-up treatability study was conducted that focused on total Kjeldahl nitrogen, total organic carbon (TOC), acute toxicity, and color reduction through the use of PACT® treatment as compared to tertiary granular activated carbon (GAC) treatment. Special batch treatability testing evaluated alternative source control methods for a highly colored wastestream. A process design was developed to meet revised treatment objectives, a final report was issued, and a new wastewater treatment facility (WWTF) was constructed. Startup assistance and operator training were provided for both WWTFs.

Process Design, Final Design, and Operational Changes of Treatment Facilities, Clariant Corporation, Charlotte, North Carolina and Elgin, South Carolina

Supervising Engineer. Houston directed treatability testing at the Charlotte facility to define operational and capital changes needed in the wastewater treatment system to accommodate new wasteloads. He directed treatability testing at the Elgin facility to develop a process and detailed design of treatment system upgrades required to comply with MON requirements. Houston provided treatment system alternatives analyses in order to select the best process design for advancement into final design.

Treatment Facility Upgrades and Sidestream Management, Cognis Corporation, Charlotte, North Carolina and Cincinnati, Ohio

Lead Engineer. Houston provided treatability testing to develop recommendations for operational and capital upgrades for the Charlotte wastewater treatment system. These upgrades addressed oil/water separation, solids separation, neutralization, high temperature activated sludge treatment, and alternative oxygen transfer systems. He determined beneficial reuse alternatives for select byproduct at the Ohio facility and that the byproduct discharge to the sewer could have compromised compliance with the site's air permit.

Treatment Facility Alternative Upgrades Evaluation, Confidential Organic Chemical Manufacturer, Central United States

Supervising Engineer. This project evaluated process alternatives to meet forecasted production increases. The work included equalization tank modeling to determine flow and loadings, review of possible anaerobic reactor configurations and technologies, modification to the existing activated sludge plant to treat higher loadings and comply with NESHAP regulations, repurposing to use a dissolved air flotation (DAF) for secondary clarification in addition to waste sludge thickening, modifications to the existing secondary clarifiers to improve the inlet distribution tub and flocculating centerwells, and new media and upgrading of the final filter. All projects were evaluated for life cycle costs and justified in terms of economics and process benefits. Overall, the project enabled the client to complete a very complicated process engineering analysis in a short time to ensure detailed design and construction could be accomplished in accordance with the schedule.

Effluent Toxicity Reduction, Confidential Client, Indiana

Lead Engineer and Project Manager. A toxicity identification evaluation (TIE) and toxicity reduction evaluation (TRE) were conducted for a large-volume producer of metal ingots and sheet aluminum. The TIE used Phase I laboratory characterization procedures, single-stream toxicity testing, and resynthesis testing with major wastestreams treated for toxicity removal. Both the water flea (*Ceriodaphnia dubia*) and the fathead minnow were used in acute tests throughout the study. Study results indicated that adsorptive organic compounds associated with an internal waste treatment process were primarily responsible for toxicity. Pure chemical tests with the wastewater treatment polymer used at the site indicated that the polymer might play a role in effluent toxicity. Operational changes were identified that would provide the required effluent toxicity reduction.

Comprehensive Wastewater Management Services Emerald Performance Materials, Inc, Henry, Illinois and Kalama, Washington
Supervising Engineer. Houston provided comprehensive services, including process wastewater permit negotiations and expert testimony, wastewater characterization and minimization, conceptual level alternatives evaluations, treatability studies, process design development, equipment selection, clarifier optimization, operator training, WWTF startup assistance, and WWTF process troubleshooting and optimization. The treatment systems consisted of coagulation, flocculation, sedimentation, peroxidation, aerobic biological treatment, anaerobic biological treatment, and tertiary filtration.

Comprehensive Wastewater Management Services, Henkel Corporation, Kankakee, Illinois
Lead Engineer. Houston provided comprehensive services, including wasteload surveying, waste minimization, water conservation, process design and equipment selection for capital upgrades, and WWTF operating guidelines development. He also prepared upgrades to the existing WWTF to accommodate the addition of a new production line.

Comprehensive Wastewater Management Services, International Specialty Products, Linden, New Jersey; Spartanburg, South Carolina; Winder, Georgia; Huntsville, Alabama; Port Neches, Texas; Texas City, Texas; Calvert City, Kentucky; and San Diego, California
Supervising Engineer. Houston provided comprehensive services, including stormwater and process wastewater permitting, effluent permit negotiations including use of water effects ratio testing wastewater characterization and minimization, conceptual-level alternatives evaluations, treatability studies, process design development, clarifier optimization, operator training, WWTF startup assistance, and WWTF process troubleshooting and optimization.

Comprehensive Wastewater Management Services, Lubrizol Advanced Materials, Inc, Akron, Ohio; Louisville, Kentucky; Calvert City, Kentucky; Charlotte, North Carolina and Gastonia, North Carolina and Spartanburg, South Carolina
Supervising Engineer. Houston provided comprehensive services, including process wastewater permitting, wastewater characterization and minimization, conceptual level alternatives evaluations, treatability studies, process design development, equipment selection, operator training, WWTF startup assistance, and WWTF process troubleshooting and optimization.

Effluent Surfactant Reduction, Marietta Corporation, Courtland, New York
Lead Engineer. Houston evaluated the feasibility of a pretreatment system to meet a 0.5 milligrams per liter (mg/L) methylene blue active substances pretreatment limit. The system consisted of phase separation, ultrafiltration, carbon adsorption, and ozonation.

Pretreatment Alternatives Analyses, Reilly Industries, Lone Star, Texas and Provo, Utah
Lead Engineer and Project Manager. Houston delivered a two-tiered project at these coal tar plants. Treatability studies were conducted, and process designs were developed, for alternative WWTF upgrades to allow the plant to meet more restrictive pretreatment limits. A work plan was developed in cooperation with the Texas Natural Resource Conservation Commission that enabled the POTW to seek permit relief and avoid WWTF upgrades.

Effluent Toxicity Reduction, Rhodia, Mount Pleasant, Tennessee
Lead Engineer. Houston was responsible for treatability studies, process design development, and a final report for the treatment of herbicide wastewaters. The treatments evaluated the impact of photolytic decomposition, carbon adsorption, and macroreticular resins. A solution was implemented that included minor treatment and recycle of waters. The site was converted to a nearly zero discharge operation.

Comprehensive Wastewater Management Services, Rohm and Haas, Bristol, Pennsylvania; Louisville, Kentucky; Knoxville, Tennessee; and Moss Point, Mississippi

Supervising Engineer. Houston provided comprehensive services ranging from process wastewater permit negotiations, wastewater characterization and minimization, conceptual level alternatives evaluations, treatability studies, process design development for nitrification facilities, equipment selection, whitewater treatment alternatives, and WWTF process troubleshooting and optimization.

Treatment Process Troubleshooting and Operator Training, Solvay Advanced Polymers, Marietta, Ohio

Lead Engineer. Houston provided WWTF troubleshooting services and operator training for this facility that included equalization, neutralization, pure oxygen activated sludge treatment, disinfection, and sludge dewatering.

Comprehensive Wastewater Management Services, Solvay Chemicals, Deer Park, Texas

Lead Engineer. Houston provided treatability testing to define WWTF upgrade measures needed to comply with effluent BOD, TOC, and aquatic toxicity limits. He assisted in equipment selection and operator training. Houston developed a compliance plan and schedule. The treatment system consisted of activated sludge treatment with denitrification and DAF for secondary clarification. Provisions were made for effluent GAC treatment.

Process Design of New Treatment Facility , Thiokol Corporation, Brigham City, Utah

Lead Engineer and Project Manager. The project involved TIE followed by TRE as a part of treatability studies for a newly designed WWTF. The new WWTF replaced two existing WWTFs that were abandoned. Acidification, air stripping, alkalinization, chemical reduction with sodium thiosulfate, filtration, GAC, ion exchange (anion and cation), macroreticular resin, and metal complexation with ethylenediaminetetraacetic acid (EDTA), were evaluated as a means of achieving effluent toxicity reduction for a selected wastestream. High salinity was identified as the toxicant. The client decided to blend the selected wastestream with other wastestreams causing a decrease in wastewater salinity and an increase in wastewater BOD. Activated sludge treatment, followed by ozonation as a means of toxicity reduction and disinfection, was determined to provide consistent compliance with effluent BOD and toxicity limits. A process design was provided. The newly designed WWTFs included grit removal, equalization, activated sludge treatment, granular media filtration, and ozonation. The final design for the WWTF was reviewed for consistency with the process design.

Fundamental Different Factor Determination, Union Carbide, Hahnville, Louisiana

Lead Engineer. Houston provided treatability testing to demonstrate that the plant qualified for “fundamentally different factors” in developing effluent limitations. He provided troubleshooting assistance and developed operating procedures to prevent bio-inhibition to activated sludge and viscous sludge bulking.

Process Design, Final Design and Start-Up of New Treatment Facility, Vi-Jon Corporation, Smyrna, Tennessee

Lead Engineer. Houston designed and oversaw treatability testing for three major production area wastewaters (mouthwash, lotion, and shampoo). He developed a process design of the pretreatment facility to treat wastewaters from these production areas. Pretreatment consisted of zinc precipitation, activated sludge with DAF clarification, and sludge dewatering. Houston provided process oversight during detailed design, equipment procurement, and startup.

Management of Bio-Inhibiting Wastewaters, Zeneca Fine Chemicals, Mount Pleasant, Tennessee

Lead Engineer. Houston was responsible for treatability studies that evaluated the impact of various organic chemical, herbicide, and pesticide wastestreams on the site’s biological WWTF. He developed an approach for screening the impact of new wastestreams on the WWTF. Houston prescribed maximum allowable discharge rates of each process wastestream to prevent upset of the WWTF.

Odor Control and Treatment Process Optimization, Chemical Industry and City of Springfield, Massachusetts

Project Engineer. This project included odor identification and control, treatability study and process design of upgrades within existing tankage to accomplish nitrification, denitrification, and good sludge settleability. Houston evaluated the impacts of sludge heat treatment on plant performance.

Treatment Process Optimization, Chemical Industry and Greater Mentor, Ohio

Project Engineer. Houston conducted treatability studies to evaluate the impact of the chemical industry on POTW effluent total suspended solids (TSS) concentrations. He developed operating guidelines that allowed the POTW to accommodate chemical industry discharge while maintaining effluent compliance with both effluent TSS and total phosphorus limits.

Pretreatment for Odor Control, Dalton Utilities, Dalton, Georgia

Senior Consultant. Houston identified threshold odor numbers for a list of chemicals discharged from the chemical industry. This list, coupled with sampling data, identified which chemicals were responsible for sewer odor complaints. Odor control involved selecting pretreatment limits for these targeted compounds.

Process Design and Final Design of New Treatment Facility, Globe Manufacturing, Gastonia, North Carolina

Project Manager and Lead Engineer. Houston managed a wastewater pretreatment project where the industrial discharge was cited as the source of the POTW's effluent aquatic toxicity problem. Treatability tests were conducted which screened the effects of the following treatment processes on effluent toxicity reduction: air stripping, cation exchange resin, activated silica, macroreticular resin, granular activated carbon, and biohydrolysis. Results of these tests and further desktop evaluations indicated the biotoxicant was ethylene diamine and that activated sludge treatment would provide the most cost-effective treatment. Continuous flow treatability studies were used to develop the process design for the selected process. Houston submitted a design basis report for the pretreatment facility, reviewed final design drawings and specifications, and provided startup assistance. The pretreatment facility eliminated all acute and chronic toxicity associated with the wastestream discharge at its flow contribution to the POTW.

Memberships

American Academy of Environmental Engineer

Technical Association of the Pulp and Paper Industry (TAPPI)

Water Environment Federation

Chi Epsilon - National Civil Engineering Honor Society

Publications/Presentations

1. “Introduction of an Integrated Methanogenic Aerobic Single Sludge (IMASS) System”, with Jason Mullen, Si Givens, Everett Gill and Asher Benedict. 92nd Annual Water Environment Foundation Technical Exhibition & Conference (WEFTEC), Chicago, IL, September 2019.
2. “Sludge Reduction Through Uncoupling: Treatability Surprise and Full-Scale Benefits”, Kasey Moraveck, Jonathan Sandhu and Houston Flippin. 92nd Annual Water Environment Foundation Technical Exhibition & Conference (WEFTEC), Chicago, IL, September 2019.
3. “Two Case Studies of Ultrafiltration in Dairy Wastewater”, Membrane Technology Forum, American Dairy Products, Institute, Minneapolis, MN, June 2019.
4. :Anaerobic Reactor Cover Replacement: Interim Operations and Plan”, 49th Annual Food and Beverage Environmental Conference, American Frozen Food Institute, April 2019.
5. “Bioaugmentation and Base Loading: Alternatives for Biodegradation of Acrylonitrile to Low Levels in Publicly Operated Treatment Facilities”, Asher Benedict, Ken Tuck, Houston Flippin, and Everett Gill. 91st Annual Water Environment Foundation Technical Exhibition & Conference (WEFTEC), Chicago, IL, October 2018.
6. “Total Organic Carbon: Dispelling the Myth Around Reuse”. Michael Mecredy, Houston Flippin and Joe Wong, Presented at the 91st Annual Water Environment Foundation Technical Exhibition & Conference (WEFTEC), New Orleans, LA, October 2018.
7. "Magnesium Hydroxide Addition for Odor and Corrosion Control in Conveyance Systems: Product Selection and Dose Optimization," Gayathri Ram Mohan and Houston Flippin, WEFTEC, October 2018.

8. "Taming Temperamental TDS: Total Dissolved Solids Management Strategy for Industrial Wastewaters," Michael Mecredy, Thomas Steinwinder, and Houston Flippin, Water Environment & Technology (WE&T) Magazine, December 2015.
9. "Operator Essentials: What Every Operator Needs to Know about Leachate," Houston Flippin and Kevin Torrens, Water Environment & Technology (WE&T) Magazine, December 2015.
10. "Biological Treatment of Petroleum Refinery Stripped Sour Water Using the Activated Sludge Process," Rion Merlo, Matthew B. Gerhardt, Fran Burlingham, Carla De Las Casas, Everett Gill and Houston Flippin, WEFTEC, October 2010.
11. "Leachate Management," with K. Torrens and R. Menon, South Carolina May 2010 gathering of the Solid Waste Association of North America.
12. "Chlorination for Filament Control: A Refined Approach," with E. Gill, WEF Industrial Water Quality Conference, Baltimore, Maryland, July 2009.
13. "Reducing the Mystery of Micronutrient Addition," with R. Davis (Empirical Laboratories) and D. Kilgour, WEFTEC, Chicago, Illinois, October 2008.
14. "Case Studies in Petroleum Refineries," Tackling Industrial Wastewater Treatment Challenges Workshop, WEFTEC, Chicago, Illinois, October 2008.
15. "Loss of Effluent Mixing Zone Dilution Credits," prepared by Brown and Caldwell for American Petroleum Institute, June 2008.
16. "Theory, Operation, and Design of Selectors for Activated Sludge," Advanced Biological Wastewater Treatment Technologies Workshop-Innovative Solutions to Difficult Problems, Vanderbilt University School of Engineering and Siemens Water Technologies Corporation, Nashville, Tennessee, August 2008.
17. "Beneficial Use of Dairy, Fountain, and Fruit Beverage Wastes in POTWs," with D. Busch (Dean Foods Dairy Group) and P. Bowen and B. Karas (Coca-Cola North America), WEFTEC, San Diego, California, October 2007.
18. "Beneficial Use of Dairy Wastes in POTWs," with D. Busch (Dean Foods Dairy Group) WEF Industrial Water Quality Conference, Providence, Rhode Island, July 2007.
19. "Comprehensive Denitrification Approach," with V.J. Boero, Kentucky/Tennessee 2006 Water Professionals Conference, Chattanooga, Tennessee, July 2006.
20. "Anaerobic Digestion: A potentially Underutilized Resource," with T. Stigers, Kentucky/Tennessee 2006 Water Professionals Conference, Chattanooga, Tennessee, July 2006.
21. "Pretreatment versus POTW Upgrades," poster presentation with Heinz North America at American Frozen Food Industry sponsored Food Industry Environmental Conference, Monterey, California, March 2005.
22. "Biologically Active Aerated Tank Treatment," presentation given in workshop sponsored by City of Fresno, California for industrial dischargers to POTW, October 2004.
23. "A New Approach to Nitrification/Denitrification of Industrial Wastewater," with W. W. Eckenfelder, and V.J. Boero. 10th Annual WEF Industrial Wastes Technical and Regulatory Conference, Philadelphia, Pennsylvania, August 2004.
24. "Enhanced Activated Sludge Treatment of High Strength Bio-inhibitory Industrial Wastewater," with R. Rhoades, 10th Annual WEF Industrial Wastes Technical and Regulatory Conference, Philadelphia, Pennsylvania, August 2004.
25. "Treatment Alternatives for Removing Ammonia Nitrogen from Landfill Leachate," with R.E. Ash and B.N. Card, Annual Tennessee Solid and Hazardous Waste Conference, Gatlinburg, Tennessee, April 2004.
26. "Alternative Considerations in Sizing Aeration Basins," with W. W. Eckenfelder, Design, Performance and Operation of Biological Treatment Processes Pre-Conference Workshop, Vanderbilt University and USEPA Conference, "Industrial Wastewater and Best Available Treatment Technologies: Performance, Reliability, and Economics", Nashville, Tennessee, February 2003.
27. "Modifying Equalization to Provide Pretreatment of High Strength Wastewaters," with D.A. Moye, 19th Annual North Carolina AWWA/WEF Conference Proceedings, Winston-Salem, North Carolina, November 2002.
28. "Benefits of Using Nitrate as Nutrient in Activated Sludge Treatment Systems," with W. W. Eckenfelder and D.A. Moye, 8th Annual WEF Industrial Wastes Technical and Regulatory Conference, Atlantic City, New Jersey, August 2002.
29. "Biological Treatment of High TDS Wastewaters," with W. W. Eckenfelder and V. J. Boero, Water Environment Federation- Industrial Waste Technical and Regulatory Conference, Charleston, South Carolina, August 2001.
30. "Competitive Performance for Water and Wastewater Utilities," with J.L. Pintenich, Nashville Quality Forum, Nashville, Tennessee, October 1999.
31. "Reclaiming POTW Capacity," with M.L. Roeder, American Society of Civil Engineers-Tennessee Section Annual Meeting, Nashville, Tennessee, October 1999.
32. "Batch Activated Sludge Testing to Determine The Impact of Industrial Discharges on POTW Performance", with J.S. Allen, Proceedings of 1998 WEF Industrial Wastes Specialty Conference, Nashville, Tennessee, March 1998.
33. "Economics of Treating Poorly Degradable Wastewaters in the Chemical Industry," with K.D. Torrens, Proceedings of 1998 WEF Industrial Wastes Specialty Conference, Nashville, Tennessee, March 1998.

34. "Effects of Elevated Temperature on the Activated Sludge Process," with W.W. Eckenfelder, Jr., Proceedings of 1994 TAPPI International Environmental Conference, Portland, Oregon, April 1994.
35. "Toxicity Identification and Reduction in the Primary Metals Industry," presented at Spring AIChE Conference, Atlanta, Georgia, April 1994.
36. "Treatability Studies and Process Design for Toxicity Reduction for a Synthetic Fiber Plant," with J.L. Musterman, Water Science Technology, Vol. 29, No. 9 (1994).
37. "Granular Carbon Adsorption of Toxics," technical review of chapter four in Toxicity Reduction in Industrial Effluents, P. W. Lankford and W. W. Eckenfelder, Jr. (Eds), Van Nostrand Reinhold, 1992.
38. "Diagnosing and Solving a Pulp and Paper Mill's Poor Activated Sludge Settleability Problems Through Treatability Studies," with M. A. Bellanca, Proceedings of 1992 TAPPI Environmental Conference, Richmond, Virginia, 1992.
39. "Hydrogen Peroxide Pretreatment of Inhibitory Wastestream – Bench Scale Treatability Testing to Full Scale Implementation: A Case History," with R. L. Linneman, Proceedings of Chemical Oxidation: Technology for 1990's, Vanderbilt University, Nashville, Tennessee, 1991.
40. "Control of Sludge Bulking in a Carbohydrate Wastewater Using a Biosorption Contactor," with W. W. Eckenfelder, Jr. and M. A. Goronszy, Proceedings of the 39th Annual Purdue Industrial Waste Conference, 1984.

Research Topics

1. Biodegradation of PCBs and hexachlorobenzene (HCB), research conducted at Eckenfelder Inc.
2. Volatile Organic Compound Emissions from Activated Sludge Systems, research conducted at Eckenfelder Inc.
3. Performance of Selective Bacteria in Industrial Activated Sludge Systems, research conducted at Vanderbilt University
4. Biosorption for Improved Reactor Capacity, research conducted at Vanderbilt University
5. Control of Activated Sludge Bulking Through the Use of a Biosorption Contactor, research conducted at Vanderbilt University

Emerald Performance Materials®
Kalama Chemical

April 17, 2018

PETITIONER'S HEARING EXHIBIT
AS 19-002
11

CERTIFIED MAIL: 7016 1370 0002 2632 1241

Division of Water Pollution Control
Compliance Assurance Section – Mail Code 19
Illinois Environmental Protection Agency
P. O. Box 19726
Springfield IL 62794-9276

Re: Adjusted Standard 13-2 (NPDES Permit No. IL0001392) – Update Report

To Whom It May Concern:

The Henry, IL Emerald Performance Materials facility is submitting the following report to show continued compliance with the all of requirements of Adjusted Standard 13-2, which are incorporated into NPDES Permit No. IL0001392 Special Condition 16. AS13-2 Conditions 2(c) and (d) require the plant to generally investigate new production methods and technologies that would generate less nitrification inhibitors (i.e., MBT) and new treatment technologies. AS13-2 Condition 2(e) specifically requires the plant to investigate and submit reports evaluating three alternative treatment ideas: granulated activated carbon (GAC), spray irrigation, and river water dilution.

Report as to Conditions 2(c) and (d):

The Henry facility has put together a continuous process improvement project to identify and evaluate potential modifications of the processes and product recipes to recover MBT as well as a few of the key organic nitrogen compounds that serve as the building blocks for most of Emerald's products. The team is comprised of facility personnel, consultants, and process improvement engineers from Emerald corporate services. The approaches taken by this team to evaluate process modifications and alternative treatment options to achieve the final goal of further reducing ammonia in the Emerald WWTF effluent have been unsuccessful since the issuance of AS13-2.

Report as to Condition 2(e):

Granulated Activated Carbon (GAC). The pretreatment of plant wastewater using GAC to remove mercaptobenzothiazole (MBT) was evaluated at a bench scale by Brown & Caldwell.

In the bench scale testing, B&C found that GAC would sufficiently reduce MBT concentrations to allow the microorganisms in the plant wastewater treatment system to achieve adequate nitrification. B&C also evaluated the cost of this alternative and found that its estimated cost is 20x higher than the costs incurred by municipal wastewater treatment facilities in Illinois and 11x higher than the average cost of municipal facilities nationwide. The B&C report is Attachment A. Based on these findings, Emerald does not believe GAC is economically reasonable.

Spray Irrigation/Land Application. Emerald investigated the technical feasibility of a spray irrigation (land application) program. A spray irrigation program is not a technically feasible option for the Henry facility's treated wastewater. There are two principal flaws with this option: a lack of symbiosis between wastewater treatment operations and the agricultural needs for nitrogen amendments; and regulatory restrictions. The regulatory restrictions are paramount.

Condition 2(e) of AS13-2 asks for an evaluation of spray irrigation in accordance with 35 IAC Part 372. Those regulations establish design standards and other standards for low-rate land application of secondary and tertiary treated **domestic** wastewater. Emerald's discharge is industrial wastewater and the Part 372 regulations do not allow low-rate land application of the Henry plant treated effluent. Further, presently the discharge from the plant's wastewater treatment system is not subject to regulation as solid or hazardous waste because of the RCRA exemption for wastewater discharges subject to a NPDES permit under 35 IAC 721.104(a)(2) and its federal equivalent 40 CFR 261.4(a)(2). If a portion of the wastewater stream was diverted to spray irrigation, the diverted portion might be considered land disposal of a solid waste, or possibly a hazardous waste. USEPA considered an analogous circumstance at a landfill in Kentucky in 2007 that wanted to discharge treated leachate that was high in ammonia via spray irrigation. USEPA determined that the proposal – even if it was incorporated into the landfill's NPDES permit – would be prohibited land disposal of a hazardous waste. The USEPA determination is included as Attachment B.

Even if the regulations that restrict the land application of the wastewater were revised; spray irrigation would still not be a technically feasible option because there is a lack of symbiosis between wastewater treatment operations and agricultural needs. The Henry facility continuously discharges treated effluent to the Illinois River. The mass of ammonia discharged is not constant, but rather fluctuates with production. This would require frequent analysis and adjustment of the land application rate in order to meet the nitrogen requirements of the crops. And since the nitrogen is present as dissolved ammonia, the only way to get the nutrient to the crops is via irrigation. Crop irrigation and nitrogen needs do not occur continuously during the growing season and cease altogether outside the growing season.

Land application of biosolids and other soil amendments must follow 40 CFR 503 Subpart B regulations. One of the requirements is that soil amendments must only be applied during the active growing season. In this region of Illinois, the growing season is between 175 and 180 days (at most) in duration. The wastewater effluent would have to be discharged to the Illinois River during the other 185 to 190 days when land application is restricted. Emerald owns 80 acres of land, currently leased to a local farmer, onto which the effluent could be land applied. If the 80 acres were planted with corn, which has a fairly high nitrogen demand of 110 pounds of nitrogen per acre per growing season; 8,800 pounds of nitrogen would be required (assuming 100 bushels per acre). This quantity of nitrogen could be supplied by the wastewater effluent in less than 20 days. Thus, even during the growing season, the available cropland could only receive a small portion of the Henry plant's wastewater. For this additional reason, the spray irrigation option is not technically feasible.

River Water Dilution. Treatment of plant wastewater via river water dilution was evaluated at a bench scale by B&C. In the bench scale testing, B&C found that nitrification could be achieved if the plant wastewater were diluted by 90% with river water. See Attachment A. B&C cautioned, however, that the bench scale results might not be sustainable at plant-scale due to fluctuations in MBT production that would cause inconsistent nitrification and cold weather river water temperatures which would interfere with other wastewater treatment processes that require warm wastewater. B&C also evaluated the cost of this alternative and found that its estimated cost (even without including the capital cost of constructing an additional steam boiler, as discussed below) is 40x higher than the costs incurred by municipal wastewater treatment facilities in Illinois and 21x higher than the average cost of municipal facilities nationwide. Based on the B&C report and Emerald's own evaluation, the river water dilution alternative is not technically feasible or economically reasonable. There are three reasons why this option must be rejected: the option is not likely to achieve the desired ammonia removal; the ancillary environmental impacts outweigh the benefits of any reduction in the mass of ammonia discharged; and the economic cost is prohibitive as demonstrated by B&C.

For the reasons described in the B&C report, Emerald seriously doubts that the river water dilution option can consistently achieve the ammonia reductions that were achieved in the bench scale testing. Also, diluting the facility's wastewater by a factor of almost ten will also dilute the chemicals that the microorganisms metabolize. This may compromise the efficiency of the wastewater treatment plant, hampering the microbial degradation of the other contaminants. Thus, purely from the standpoint of the wastewater discharge, the river water dilution option is not technically feasible.

This alternative would also have significant negative cross-media environmental impacts. Temperature is a critical parameter for the microorganisms that digest the organic chemicals in the wastewater. Steam is injected into the wastewater in order to ensure the temperature is maintained within the optimum range at all times of the year. Since the Illinois River temperature is much colder than the optimal treatment system temperature in late fall, winter and early spring, additional steam would have to be injected to maintain the required temperature range. The volume of river water needed to achieve nitrification on a bench scale is nearly ten times the volume of wastewater the facility typically generates and would require the installation of a 140 million Btu per hour boiler to provide the additional steam. Assuming the boiler ran for seven months of the year, was natural gas-fired, equipped with low-NO_x burners and flue gas recirculation, it could emit as much as 38,000 metric tons of CO_2e greenhouse gases, 35 tons of nitrogen oxides, and 30 tons of carbon monoxide per year to heat the river water. The atmospheric emissions coupled with the additional heat load discharged to the Illinois River would negate any benefit associated with the potential reduction in ammonia concentration in the effluent.

If you have any questions, please contact David Sikes, HS&E Manager via email at david.sikes@emeraldmaterials.com or call at 309.364.9472.

Respectfully,

Galen Hathcock
Plant Manager

ATTACHMENT A

Brown and Caldwell

220 Athens Way, Suite 500
Nashville, TN 37228

T: 615.255.2288
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Technical Memorandum

Prepared for: Emerald Performance Materials

Project Title: Henry Nitrification Evaluation

Project No.: 149470

Technical Memorandum

Subject: Evaluation of Nitrification Alternatives for Emerald-Henry, Illinois Facility

Date: April 13, 2018

To: David Sikes, Environmental, Health and Safety Manager

From: Houston Flippin, P.E., BCEE, Chief Engineer

Copy to: Charlie Gregory, Project Engineer

Prepared by: [signature]
Charlie Gregory, Project Engineer

Reviewed by: [signature] J. Houston Flippin
Houston Flippin, P.E., BCEE, Chief Engineer

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Section 1: Introduction

1.1 Background

The combined wastewater generated at the Emerald Performance Materials - Henry Plant (Emerald) has historically contained high concentrations of Total Kjeldahl Nitrogen (TKN) and ammonia-nitrogen (NH3-N), as well as a known nitrification-inhibiting compound, mercaptobenzothiazole (MBT). This known inhibitor is the compound that serves as the foundational building block of essentially all products at the Emerald Henry Plant.

Both Emerald and Mexichem are co-located at the Henry Plant having at one time been all part of the BF Goodrich Specialty Chemicals plant. Together, these two industries discharge to a shared industrial wastewater treatment facility (IWTF) operated by Emerald (see Figure 1). The wastewaters from Emerald discharge to two equalization tanks: the C-18 Tank and the PC Tank. The wastewaters from Mexichem production discharge to an equalization tank with one Mexichem wastewater (213 Centrate) stream receiving special pretreatment. The wastewaters from the two Emerald tanks, one Mexichem tank, and the Mexichem pretreated wastewater are all discharged to an onsite IWTF. In addition, waters from groundwater recovery, production area stormwater, and utility waters are also treated in the IWTF. The IWTF provides chemical conditioning, primary settling to remove solids, activated sludge treatment to remove biologically degradable materials and tertiary filtration prior to discharge to the Illinois River. The solids from primary settling, Mexichem pretreatment and the waste solids from activated sludge treatment are dewatered using a precoat filter press. The dewatered solids are disposed of off-site. Figure 1 illustrates this wastewater collection and treatment system.

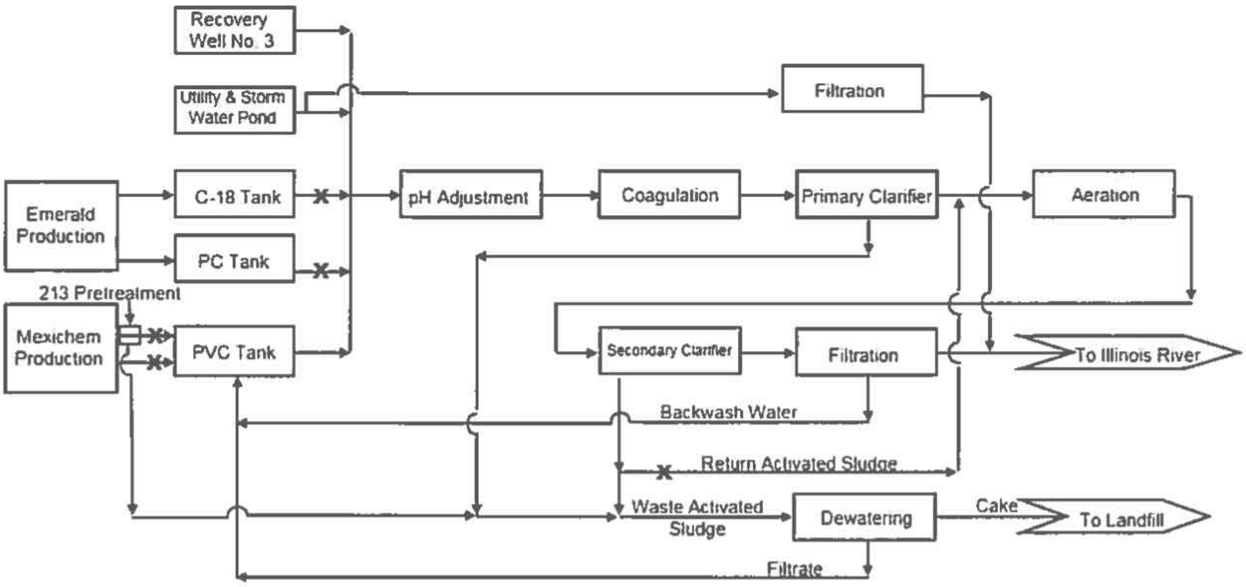

Figure 1: Block Flow Diagram of Wastestream Sources and WWTF

Due to the necessity of MBT use in Emerald's production processes, effluent NH_3-N removal at the Henry Plant is typically low. Brown and Caldwell (BC), at the request of Emerald, has conducted the studies listed below and described herein to satisfy Condition 2 (e) of Adjusted Standard 13-2 issued by the Illinois Pollution Control Board (IPCB), which has been incorporated into Special Condition 15 of the Plant's National Pollution Discharge Elimination system permit (IL0001392) issued by the Illinois Environmental Protection Agency (IEPA):

1. Provide Granular Activated Carbon (GAC) Treatment on the Polymer Chemicals (PC) wastewater to remove MBT so that nitrification can occur.
2. Provide river water dilution to the primary clarifier effluent so that MBT may be diluted and nitrification can occur.

Emerald also requested BC to investigate the technical and economic viability of each.

1.2 Scope of Work

The scope of work for these studies consisted of bench scale treatability testing and developing a preliminary design and cost estimate for each option. Laboratory testing was required to evaluate nitrification potential and feasibility. Based on the results from the bench scale tests, preliminary designs and a class 5 cost estimate were completed to investigate the economic feasibility of achieving nitrification (biological ammonia-nitrogen removal) through these two methods in comparison to NH_3-N removal technologies previously considered. Lastly, these costs were compared to the costs imposed by municipalities on industries to provide NH_3-N removal.

Section 2: Laboratory Testing

Fed Batch Reactor (FBR) testing was performed to investigate the ability for nitrification to occur in pretreated and unpretreated wastewater. During an FBR test, a wastewater is fed to a batch reactor with a fixed biomass population. This configuration allows for the fraction of wastewater in the beaker to increase over time based on a chosen food to mass (F/M) ratio. Thus, the nitrification rate as well as the fraction of wastewater inhibitory to the biomass (generally washed return activated sludge (RAS) from the Henry Plant plus dissolved solids (salt) and pure culture nitrifying bacteria (nitrifiers)) can be ascertained from the results. FBR tests were performed on five combinations of biomass and test waters to investigate the viability of GAC treatment and river water dilution in facilitating nitrification in the IWTF. Table 1 outlines the five FBR tests run during this investigation.

Table 1. FBR Tests Performed

Test	Biomass	Wastewater
FBR 1	Washed RAS + TDS Adjusted Nitrifiers	Unpretreated Primary Clarifier Effluent
FBR 2	Washed RAS + TDS Adjusted Nitrifiers	Primary Clarifier Effluent with PC and C-18 pretreated with GAC
FBR 3 (Control Rd.1)	Washed RAS + TDS Adjusted Nitrifiers	River water with NH4Cl
FBR 4	Washed RAS + River water TDS Adjusted Nitrifiers	10% Unpretreated Primary Clarifier Effluent and 90% River water
FBR 5 (Control Rd. 2)	Washed RAS + River water TDS Adjusted Nitrifiers	River water with NH4Cl

FBR Tests 3 and 5 were run as controls containing the pure culture nitrifiers at different design total dissolved solids (TDS) values. The controls were used to obtain an uninhibited nitrification rate. FBR Test 1 was designed to investigate any possible nitrification experienced with average levels of MBT fed to the current Henry biomass with nitrifying bacteria added. FBR 2 was designed to investigate the ability for nitrification to occur in a test fed GAC treated PC wastewater. FBR Test 4 was performed to investigate if nitrification inhibition would occur if the waste stream remained unpretreated, but heavily diluted with river water.

To simulate the pretreated clarifier effluent, settling tests and GAC tests were performed on combined wastewater collected from the PC and the Cure-Rite® 18 (C-18) equalization tanks. Both these wastewaters are generated through production processes in the Emerald plant. The purpose of these tests was to identify the required solids removal system and to determine the required GAC dose to achieve a target MBT concentration of less than 15 mg/L in the PC wastewater discharge. This settled and GAC treated PC/C-18 wastewater was fed to FBR Test 2.

2.1 Return Activated Sludge (RAS) Washing

The RAS samples provided by Emerald Performance Materials were washed as they arrived at BC's Industrial Treatability Laboratory in Nashville, TN. The RAS samples were washed 8,000-fold at a pH of nine in TDS adjusted river water. After this washing, decant from the RAS was characterized to insure MBT was less than 1 mg/L, pH was adjusted to 7.2, and the decant was re-sampled to ensure MBT was at target concentrations. MBT in both samples was less than 0.04 mg/L.

2.2 Settling Tests and Granular Activated Carbon Testing (GAC)

Prior to FBR testing, settling and GAC tests were performed on the PC/C-18 WW. The settling tests were performed to size a new inclined plate separator prior to GAC treatment. This would aid in the removal of total suspended solids (TSS) prior to carbon treatment. The GAC testing was performed to quantify the GAC dosage necessary so that PC/C-18 WW would not inhibit nitrification.

The PC and C-18 waste streams were blended proportionally to the current average flow of each stream. After being blended, pH was adjusted to 10 using sodium hydroxide (NaOH). While the pH was at 10, settling tests were performed. Table 2 provides the results from the settling tests.

Table 2. Settling Test Results

HRT (gpd/ft2)	TSS (mg/L)
No Settling	127
50	9
300	63
600	65
900	63
1,200	80

The 50 gpd/ft2 test was the only settling test performed that produced a supernatant TSS of 9 mg/L, with a goal of less than 20 mg/L. This was done to mimic the expected TSS quality after treatment with an inclined plate separator. This sample was collected and analyzed for MBT. The resulting MBT is seen in Table 3 as a GAC dosage equal to 0 mg/L.

After settling tests were performed, testing was conducted on the pretreated PC/C-18 WW to determine the concentration of GAC needed to decrease the MBT concentration below 15 mg/L. Table 3 provides the dosages and MBT results from the GAC testing.

Table 3. GAC Test Results	
GAC Dosage (mg/L)	MBT (mg/L)
0	320
1,200	230
5,800	83
10,300	10[a]
14,900	18
19,400	8.4
24,000	0.99

[a] *Suspect data point.*

Results from the GAC tests show that the dosage of GAC to achieve less than 15 mg/L MBT is approximately 17,000 mg/L. In the makeup of the pretreated feed for FBR Test 2, a dosage of 20,000 mg/L was used for pretreatment of the PC/C-18 WW prior to the feed makeup. This dose was selected to provide a margin of safety in achieving adequate MBT removal. The Freundlich isotherm developed from the GAC doses is presented in Figure 2.

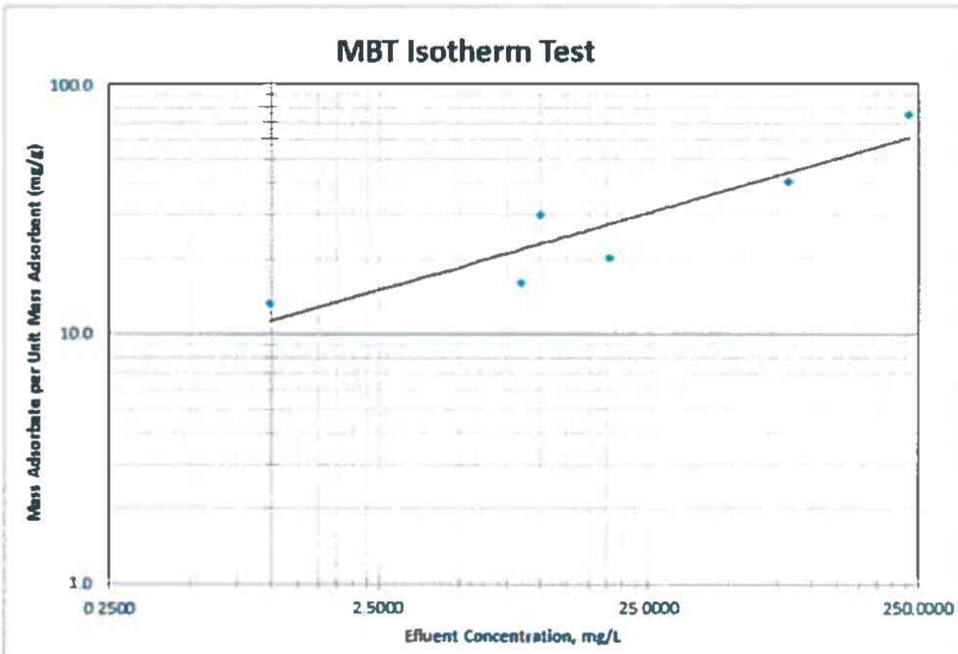

Figure 2. Freundlich Isotherm for MBT removal

Calgon Filtrasorb-300 (F-300), Calgon's most popular GAC media for industrial wastewater applications was deemed adequate and therefore used for the testing performed. Virgin F-300 was chosen for this investigation since it offers good adsorptive properties for a wide range of compounds including MBT.

When MBT is the primary compound being removed by GAC, Calgon Carbon recommends their OLC 12X40 product as being their most efficient product. The OLC 12X40 was recommended by Calgon based on GAC performance with benzotriazole (BTA) removal. BTA is similar in chemical structure to MBT. Calgon believed that removal of BTA through carbon adsorption would be similar to that of MBT. The quantity of MBT removed per mass of GAC (X/M) increase in performance was based on Figure 2 provided by Calgon. The 10 percent improvement in MBT removal assumes that a concentration of 320 mg/L MBT would exist in the PC/C-18 WW. Based on Figure 3, F-300 would have a capacity of approximately three grams of BTA/100 grams carbon. The OLC 12X40 would have an approximate capacity of 3.3 grams of BTA/100 grams carbon. This leads to the assumptions that the OLC 12X40 could potentially have a 10 percent better MBT removal compared to the F-300. In addition, the F-300 is 50 percent costlier. Based on these facts, BC assumed that the lower cost and potentially 10 percent better OLC 12X40 would be used in preparing cost estimates for full-scale application.

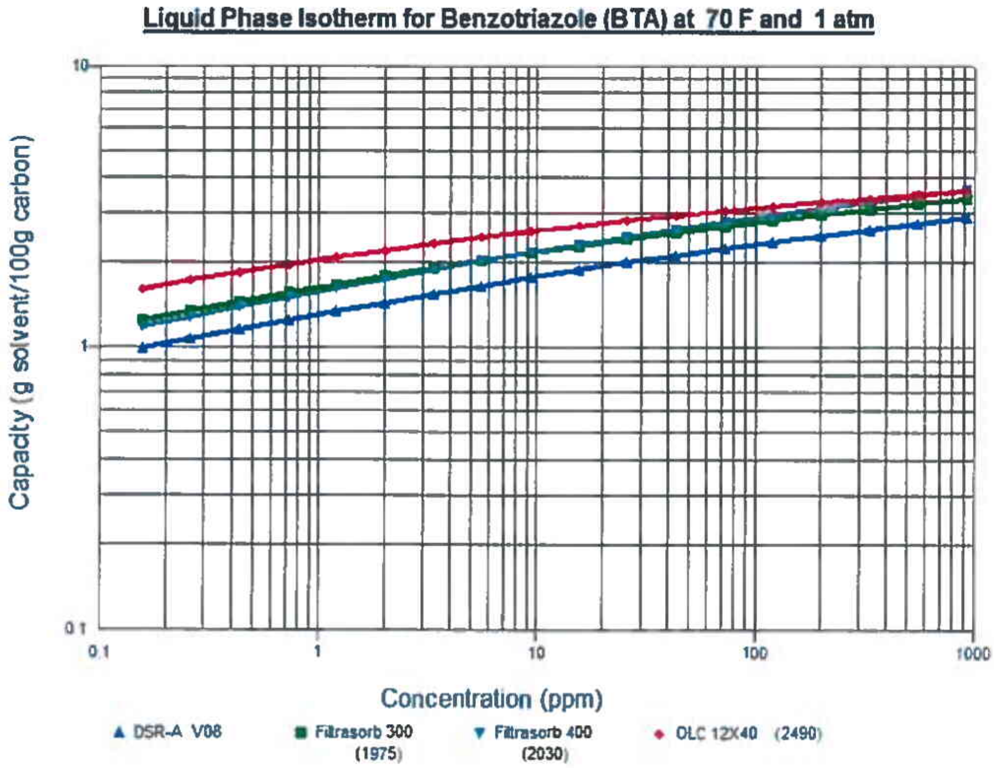

Figure 3. BTA Removal Isotherm

2.3 Feed Characterization

Following pretreatment, feeds were made for each FBR test. The feed makeup for FBR Tests 1 and 2 were based upon the current average waste stream flows experienced at the Henry facility as illustrated in Table 4. PC and C-18 wastewaters have been previously described as wastewaters that originate from Emerald production. Wastewaters from Mexichem polyvinyl chloride production were collected prior to the Polyvinyl Chloride (PVC) tank and termed PVC wastewater. Mexichem makes a product know as 213. The product is centrifuged to remove water. The water removed is discharged to a pretreatment system that consists of chemical conditioning and gravity settling of the solids. The treated water from this process was termed 213 Centrate.

Feed 1 contained the composition of wastewaters illustrated in Table 4 and was subjected to simulated primary treatment and analyzed. This simulation consisting of coagulant addition (using $FeCl_3$), rapid mix, flocculant addition, flocculation and gravity settling at pH 9 as practiced by the plant. Feed 2 was identical to Feed 1 except that the PC and C-18 wastewaters were treated with 20 grams per liter of F-300 GAC. The FBR control tests (Round 1 and Round 2) evaluated feeds composed of tap water, nutrients, alkalinity, and salt. The simulated river water dilution feed was composed of 90% tap water with nutrients, alkalinity, and salt. The other 10% of the feed consisted of Feed 1. The 10:1 dilution was provided in order that the FBR test could operate without nitrification inhibition at least during the beginning of the test. The characteristics of these respective streams are described in Table 5.

Table 4. Henry Waste Stream Composition		
Stream	**Flow (gpm)**	**Percent Makeup (%)**
Emerald PC WW	82	18.6
Emerald C-18	1.8	0.4
Mexichem PVC WW	345	78.3
Mexichem 213 Centrate	11.7	2.7

Table 5. Feed Characterization							
Test	Sample	TKN (mg/L)	NH_3-N (mg/L)	NO_x-N (mg/L)	MBT (mg/L)	cBOD (mg/L)	COD (mg/L)
FBR 1	Feed 1	60	28.1	2.13	50	63.4	890
FBR 2	Feed 2	45.8	28.2	1.68	0.09	<37.5	390
FBR 3	Control Round.1	0	78.2	0	0	NA	0
FBR 4	River Water Dilution Feed	6	108.2	0.21	5	6.3	74
FBR 5	Control Round. 2	0	100.2	0	0	NA	0

Note: TKN test does not detect all forms of organic nitrogen. The average effluent flow and NH_3-N concentration during 2017 were 0.70 million gallons per day (MGD) and 90 mg/L respectively, yielding an average NH_3-N mass of 525 lbs/day.

A Potassium phosphate (KH_2PO_4) buffer containing NaOH was added to the feed of each FBR to provide sufficient alkalinity for complete nitrification. Supplemental NH_3-N was added to FBR Tests 3, 4, and 5 so that nitrification rates could be established for each FBR. Using the KH_2PO_4 buffer also provided sufficient phosphorous for each FBR. A micronutrient broth was also added to each FBR's feed to ensure that micronutrient limitations would not exist in any FBR test. The pH in all tests was maintained between 6.7 and 7.5.

2.4 FBR Testing

Two rounds of FBR testing were performed to investigate both treatment alternatives. The first round consisted of FBR 1, FBR 2, and FBR 3. Round two consisted of FBR 4 and FBR 5. During the FBR testing, wastewater is fed to a batch reactor with a fixed biomass population. This configuration allows for the fraction of wastewater in the beaker to increase over time based on a chosen F/M ratio. Thus, the nitrification rate as well as the fraction of wastewater inhibitory to the biomass can be ascertained from the results.

The FBR tests were designed to be fed based on the F/M currently targeted at the Henry, IL facility of 0.25 day-1. This was altered for FBR Test 2 so that the flow would match the flow experienced at the current facility and not the F/M outlier due to a drop in COD from pretreatment.

All tests were provided with TDS-adjusted, pure-culture nitrifying bacteria. Nitrifiers were TDS adjusted over several days to match the TDS in the feeds. Baseline nitrification rates were generated from the TDS adjusted nitrifiers. The rates developed were:

- active nitrification rate of 1.16 mg N/mg MLVSS/day for nitrifiers at 11,300 mg/L TDS
- active nitrification rate of 0.39 mg N/mg MLVSS/day for nitrifiers at 1,650 mg/L TDS

Based on these rates, 0.27 grams of nitrifiers at a TDS of 11,300 mg/L was added to FBR Tests 1, 2, and 3. For FBR Tests 4 and 5, 2.1 grams of nitrifiers at a TDS of 1,650 mg/L were added. Prior to FBR testing, the temperature of the biomass and the pure culture nitrifiers was slowly increased to 32 °C. The rates of each individual FBR test were compared with the rates measured in the controls (mg NH_3-N removed/mg pure culture nitrifier/day).

The FBR tests progressed in the following manner:

1. The biomass (MLVSS) in each beaker was approximately the same in FBR Tests 1, 2, and 3. This was accomplished by concentrating the biomass via centrifugation to create a slurry of approximately 2.5 percent solids (25,000 mg/L) first. In FBR Tests 4 and 5, the concentration of biomass slurry was approximately 0.5 percent solids (5,000 mg/L).
2. The concentrated biomass slurry was placed in a 2-L beaker along with the nitrifiers, mixed with an overhead mixer and aerated with pure oxygen to maintain dissolved oxygen (DO) greater than 5 mg/L. The 2-L test beakers were then placed in a water bath at 32°C.
3. As the wastewater was fed to the slurry, the volume of the beaker increased. The exposure concentration of the treated wastewater to the biomass (bacteria) increased from zero percent to the target 89 percent wastewater.
4. Samples collected represented effluent samples containing a desired percentage of biologically treated feed wastewater in the presence of the biomass. The sample was centrifuged to remove solids and the biomass were returned to the reactor in order to maintain a consistent mass of biomass in the test reactor. The sample volume was recorded during every sampling event.
5. During testing, samples were collected when treated influent wastewater comprised approximately 13 percent, 26 percent, 48 percent, 72 percent and 89 percent of the collected sample. These samples were then analyzed for indications of nitrification inhibition through NH_3-N reduction and nitrate-nitrogen accumulation. Ideally, these values would be identical. In practice, the nitrification rate was calculated as the average between the ammonia-nitrogen reduction rate and the nitrate-nitrogen accumulation rate.

2.5 Results

Figures 4, 5, 6, and 7 summarize the results of the FBR testing. All tests in Round 1 and Round 2, except the unpretreated feed FBR, experienced consistent removal of NH_3-N through the end. No nitrification was observed between 13% and 60% of the treated wastewater addition for FBR 1, which is consistent with the absence of nitrification in the full-scale facility.

In Round 1, Figures 4 and 5 illustrate that nitrification did not begin until two hours into the test. At this point, 22 percent by volume of treated wastewater was present in the test. This is to be expected since the nitrifiers required some acclimation time after being washed. In a full-scale system, this would not be experienced if a viable colony of nitrifiers existed. Based on the results from NH_3-N removal and NOx-N generation, a relative nitrification rate was developed. The control reactor in Round 1 (FBR 3) had an average active nitrification rate of 1.32 mg N/mg MLVSS active nitrifier/day illustrating that the nitrifiers were uninhibited during testing. The simulated clarifier effluent with GAC pretreatment of PC and C-18 wastewaters exhibited minimal impacts on nitrification where an average active nitrification rate of 1.17 mg N/mg MLVSS/day was calculated for FBR test 2. Both rates were greater compared to the initial baseline proving that GAC treatment of the PC/C-18 wastewater would facilitate nitrification of the combined wastewater at the Henry Plant. These results indicate that without pretreatment to remove or greatly dilute MBT, no nitrification would be observed at the Henry Plant.

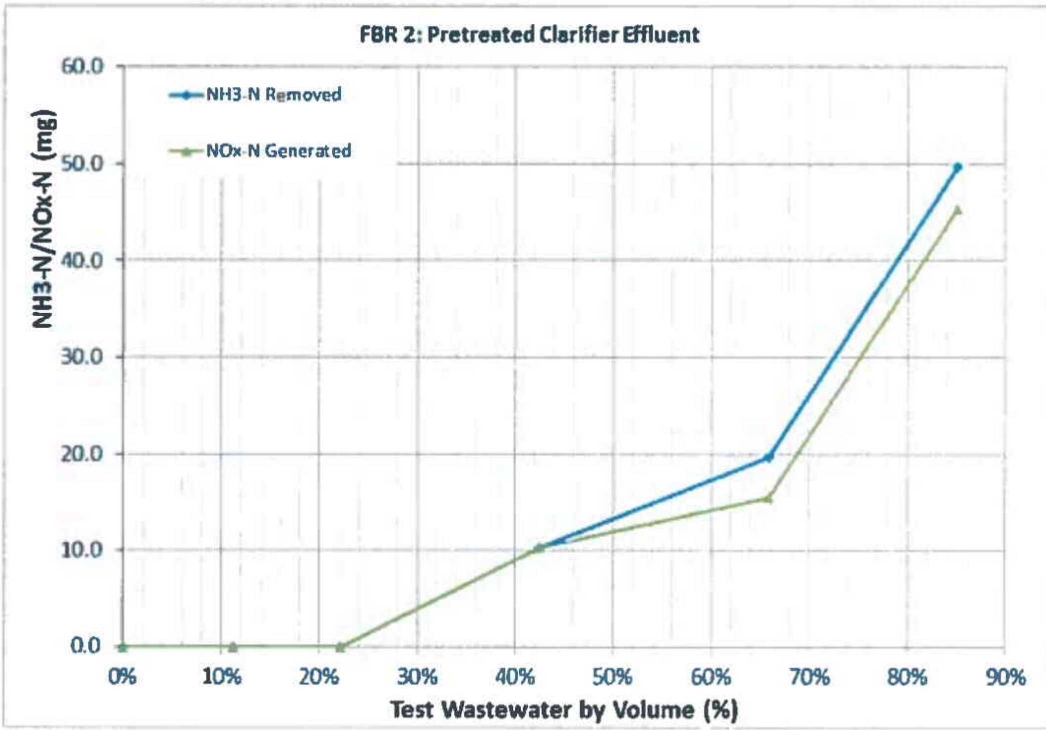

Figure 4. FBR 2 NH_3-N Removal and NO_x-N Generation

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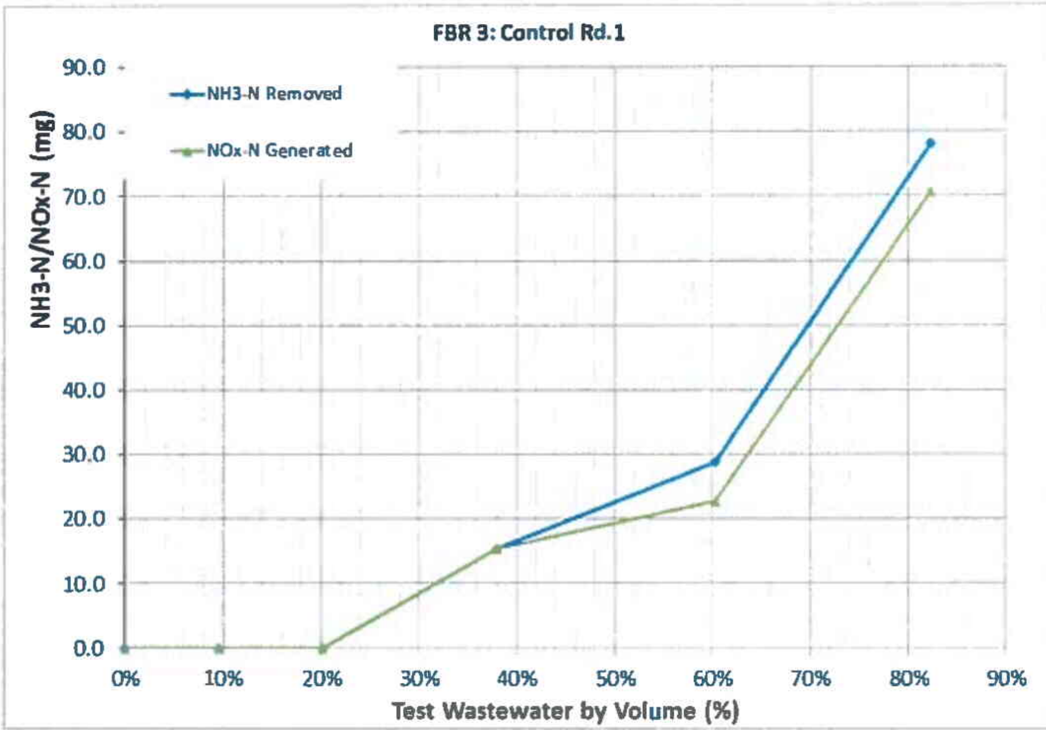


Figure 5. FBR 3 NH_3-N Removal and NOx-N Generation

In Round 2, Figures 6 and 7 depict NH_3-N degrading from the beginning of the test. NH_3-N removal was slower at the beginning of the test as the biomass began to get acclimated to the addition of each feed. In round 2, the control reactor (FBR 5 as illustrated in Figure 7) had an average nitrification rate of 0.37 mg N/mg MLVSS active nitrifier/day with an increasing rate during the tests indicating that the nitrifiers were not inhibited during the control test. Utilizing river water to dilute the unpretreated clarifier effluent (FBR 4 as illustrated in Figure 6) by 90 percent did not completely eliminate nitrification inhibition as evidenced by the 20 percent lower average nitrification rate of 0.29 mg N/mg MLVSS active/day. This inhibition was anticipated since the concentration of MBT exceeded the published nitrification inhibition threshold of 3 mg/L during the second half of the test when the test wastewater exceeded 60 percent in volume.

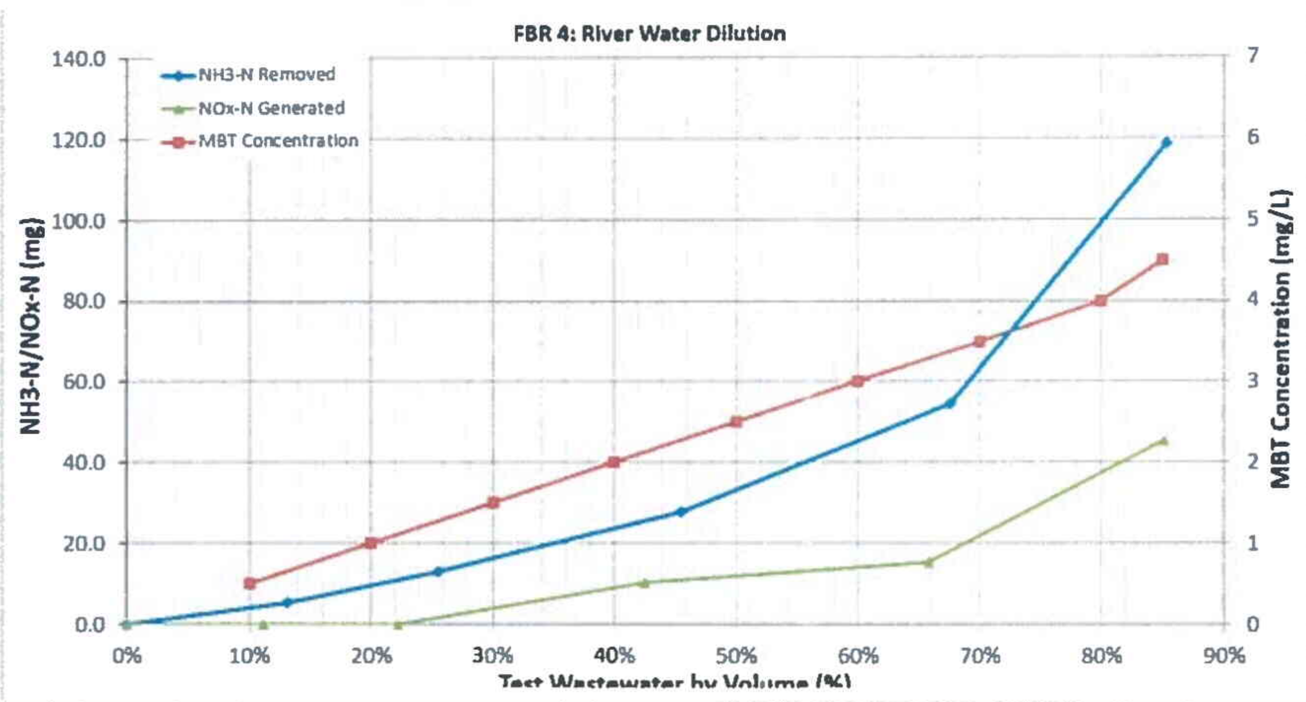


Figure 6. FBR 4 NH_3-N Removal and NOx-N Generation

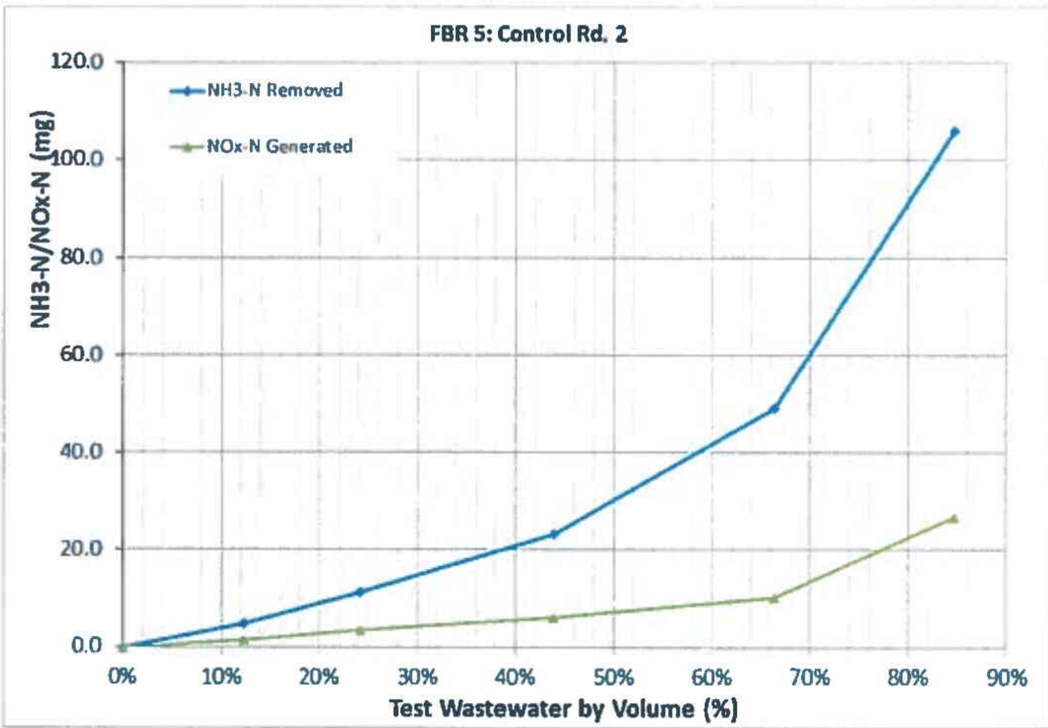


Figure 7. FBR 5 NH_3-N Removal and NOx-N Generation

Figures 6 and 8 illustrate the buildup in MBT concentration during the FBR tests. Based on published literature and previous testing performed by BC, MBT would be expected to cause nitrification inhibition at approximately 3 mg/L[1]. Based on this result, nitrification inhibition did occur at approximately 3.5 mg/L. Minimal concentrations of MBT were observed in the pretreated clarifier effluent allowing the reactor to nitrify uninhibited.

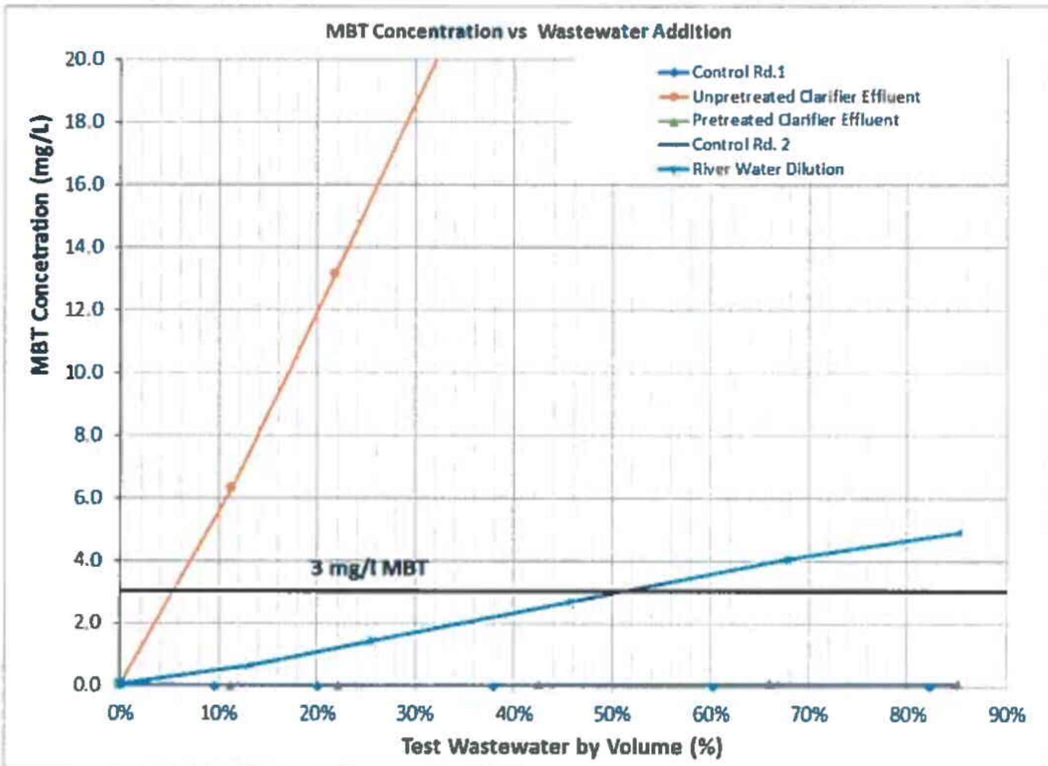


Figure 8. MBT Concentration

2.6 Summary of Treatability Testing

Based on FBR testing performed, the following conclusions were made:

- The unpretreated wastewater will continue to cause substantial nitrification inhibition due to high concentrations of MBT.
- Pretreatment of the PC/C-18 wastewater utilizing solids separation and GAC would allow the Henry Plant to nitrify in an uninhibited matter following removal of MBT from the biomass through alkaline washing.

1 Hockenbury, M.R., and C.P.L. Grady: J. Water Pollut. Control Fed., vol.49, p 768, 1977.

- Diluting the unpretreated clarifier with river water requires a river water percentage in excess of 90% for uninhibited nitrification to occur. At 90% dilution, the nitrification rate observed could be sustainable as long as the MBT concentration in the PC/C-18 wastewater remained within values tested. The sustainability of this treatment alternative, NH_3-N removal, performance is unlikely due to the inherent variability of the influent MBT concentration and the difficulty in maintaining target temperatures in the biological treatment systems while heating a large river water flow (approximately 7 MGD).
- Both the pretreatment option and the river water dilution option would allow biological nitrification. However, neither would be economically reasonable as discussed below.

Section 3: Conceptual Level Design and Cost Estimates

At the conclusion of treatability testing, BC developed conceptual designs and Class 5 cost estimates to evaluate additional equipment facility changes needed for each alternative. A Class 5 estimate is considered to be a conceptual level estimate and is performed when 0 to 2% of the design has been completed. Accuracy for a Class 5 estimate is expected to fall between -50% to +100% of the cost. Class 5 estimates are used to prepare planning level cost scopes or evaluation of alternative schemes, long range capital outlay planning and can also form the base work for the Class 5 Planning Level or Design Technical Feasibility Estimate. As a result, these estimates are intended only for use as aids in conceptual level treatment selection. In order to develop the cost estimates, the major equipment for each option were established and sized. Equipment costs were developed from vendor quotes as well as BC's cost database. The following assumptions were made in the development of the estimates:

- Adequate power is available
- Easy access to equipment installation locations
- No special requirements for electrical equipment (e.g., explosion proof)
- No buildings are included

A complete breakdown of the capital costs associated each alternative is presented in Attachment A. The major annual operating and maintenance (O&M) costs are summarized in Table 6 and Table 7.

3.1 Solids Separation and GAC treatment of PC/C-18 Wastewaters

In this alternative, wastewaters would be discharged to an inclined plate separator (lamella clarifier) sized for an average loading of 50 gpd/sq ft. BC has assumed that current pump conveying the PC/C-18 wastewater is sufficient for future use for conveying wastewater to the clarifier. The sludge from this clarifier would be discharged to the existing plate and frame filter press for dewatering. Effluent from the clarifier will be pumped to a 5,000-gallon poly holding tank that will be pumped to four GAC vessels (containing 40,000 lbs GAC each) operated in series to the existing primary treatment system. The GAC housed in the lead column would be changed approximately every seven days. Sizing of the GAC columns was based on average flow conditions. During peak conditions, the 40,000 lbs GAC vessels would be able to handle additional flow. GAC would need to be replaced more often during increased MBT loads. GAC effluent will flow from the GAC vessels to a 5,000-gallon poly tank. This tank will be used to dampen flow to the primary system, from the surge tank, flow will be pumped to the primary clarifier. A block flow diagram of this system is described in Attachment B.

Based on the new equipment and construction needed for this alternative, the expected total capital cost would be $5,274,000 with a range from $2,637,000 (-50%) to $10,548,000 (+100%). The full capital estimate is described in Attachment A.

The O&M costs only consider the incremental O&M costs associated with the upgraded equipment. If regenerated carbon is used, the X/M will decrease by approximately 30 percent based on estimates provided by Calgon Carbon and the cost of carbon would decrease 50 percent. These prices assume that exhausted carbon will be hauled to Calgon Carbon's regeneration facility in Catlettsburg, Kentucky. BC has assumed that labor costs will not increase in this alternative. Table 6 and Table 7 provides the O&M costs associated with this alternative depending on GAC selection.

Table 6. Virgin GAC (OLC12X40) Treatment O&M Costs

Parameter	Quantity	Unit Cost	Annual Cost, $/yr
Virgin Granular Activated Carbon	5,220 lbs/day	$2.00/lb	$3,811,000
Electricity	60 hp	$0.0495/kwh	$19,400
Maintenance		8% of motorized equipment cost	$33,800
Alkalinity Addition	6000 lbs/day of 50% NaOH	$250/ton	$274,000
Additional Blower Operation	70 hp	$0.0495/kwh	$22,600
Total			$4,160,000

Table 7. Regenerated GAC (DSR-A) Treatment O&M Costs

Parameter	Quantity	Unit Cost	Annual Cost, $/yr
Regenerated Granular Activated Carbon	7,540 lbs/day	$1.00/lb	$2,752,100
Electricity	60 hp	$0.0495/kwh	$19,400
Maintenance		8% of motorized equipment cost	$33,800
Alkalinity Addition	6000 lbs/day of 50% NaOH	$250/ton	$274,000
Additional Blower Operation	70 hp	$0.0495/kwh	$22,600
			$3,102,000

The O&M costs for GAC treatment is driven by the low adsorptive capabilities of MBT by carbon experienced in the bench scale testing.

The capital cost for this option is approximately $5.3 million with a present worth cost of $27 million assuming a 10-year project duration, zero salvage value, 5% interest and 2% inflation. This investment would result in an approximately 1.9 million pounds of NH_3-N being removed over the course of 10 years at an average cost of $14/pound of NH_3-N removed. This is 20-fold higher than the costs reported by the Publicly Owned Treatment Works serving Decatur, Illinois; Bloomington, Illinois and Normal. Illinois in 2015 (less than $0.70/pound of NH_3-N). This is 11-fold higher than the median cost reported by 15 reporting entities in the 2015 survey conducted by the National Association of Clean Water Agencies ($1.33 per pound of NH3-N removed). Based on this comparison, the removal of NH_3-N at the Emerald plant is not economically reasonable.

3.2 River Water Dilution System

In this alternative, all the current waste streams will remain routed as they currently are at the facility. The C-18 wastewater, PC wastewater, and PVC wastewater will all be chemically conditioned and be conveyed to the primary clarifier. From the clarifier, the waste stream will be conveyed to the aeration basin. In addition to the waste stream being routed to the aeration basin, a new lift station will be installed to pump river water from the Illinois River to provide a dilution stream to the waste water. The river water will be pumped to the aeration basin at approximately 7 MGD to dilute MBT. It is assumed that the river water requires no treatment. A steam injection will be installed to ensure that the temperature in the aeration basin will remain at 85 °F year-round. This is the operating temperature to achieve the required Biochemical Oxygen Demand (BOD) removal based on historical performance. The capital cost of the steam generation and supply system was not added to the capital cost estimates due the excessive size needed for this application (a 140 million BTU/hr boiler output would be necessary which is 40-fold greater than the January 2018 consumption by the entire facility). After the aeration basin, a splitter box will be installed to split flow between three clarifiers. Two new 100-foot clarifiers will need to be installed and put into service along with the existing 60-foot clarifier. In additional to the new clarifiers, two new sludge pumps will be needed to convey the mixed liquor back to the aeration basin or to the existing belt filter press. BC has assumed for this evaluation that the current belter filter press will be sufficient for the future needs of the facility.

The supernatant from the clarifiers will also require filtration after clarification, this will require two, new sand filters (each with 1500 ft2 of filtration area). Effluent from the clarifiers will gravity flow to the new sand filter units. The filtered effluent will then be conveyed back to the Illinois River. Piping would need to be upsized throughout the facility to handle the increased flow. No additional changes would be needed for the rest of the treatment system. A block flow diagram of this system is described in Attachment B.

The sustainability of this treatment alternative NH_3-N removal performance is unlikely due to the inherent variability of the influent MBT concentration and the difficulty in maintaining target temperatures in the biological treatment systems while heating a large river water flow (approximately 7 MGD). The addition of river water would be based on percent flow and not MBT concentration. The MBT concentration in the wastewater fluctuates with production. The fluctuation would cause inconsistent nitrification and take several days to remove excess MBT concentrations from the system resulting in several days of low nitrification (high effluent NH_3-N concentrations). In addition to fluctuating MBT, the winter months would also negatively impact the treatment system if river water temperature control were not maintained. This river water (approximately 7 MGD) would have to be heated year-round to a target temperature of 85 °F from an initial temperature that varies by more than 40 °F (below 40°F to 79 °F). Steam injector would be required year-round.

Based on the new equipment and construction needed for this alternative, the expected total capital cost would be $22,600,000 with a range from $11,286,500 (-50%) to $45,146,000 (+100%) excluding the steam supply system. The full capital estimate (excluding steam supply system) is described in Attachment A.

The O&M costs only take into account the new O&M costs associated with the upgraded equipment. BC has assumed that labor costs will not increase in this alternative. Table 8 provides the O&M costs associated with this alternative.

Table 8. River Water Dilution O&M Costs

Parameter	Quantity	Unit Cost	Annual Cost, $/yr
Electricity	260 hp	$0.0495/kwh	$136,000
Maintenance		8% of motorized equipment cost	$288,000
Steam	22,600 therms/day	$0.446/therm	$3,679,000
Alkalinity Addition	6000 lbs/day of 50% NaOH	$250/ton	$274,000
Additional Blower Operation	70 hp	$0.0495/kwh	$22,600
Total			$4,400,000

The capital cost for this option is approximately $23 million (excluding steam supply system) with a present worth cost of $54 million assuming a 10-year project duration, zero salvage value, 5% interest and 2% inflation. This investment would result in an approximately 1.9 million pounds of NH3-N being removed over the course of 10 years at an average cost of $28 per pound of NH3-N removed. This is 41-fold higher than the costs reported by the Publicly Owned Treatment Works serving Decatur, Illinois; Bloomington, Illinois and Normal. Illinois in 2015 (<$0.70 per pound of NH_3-N removed). This is 21-fold higher than the median cost reported by 15 reporting entities in the 2015 survey conducted by the National Association of Clean Water Agencies ($1.33 per pound of NH_3-N removed).

In addition to the economical unreasonableness of this alternative, this alternative would increase the heat load to the Illinois River 10-fold which would adversely impact localized water quality. It would also greatly complicate utility and treatment plant operations.

Attachment A: Capital Cost Estimate

Alternative 1: Solids Separation and GAC Treatment of PC/C-18 Wastewater Class 5 Capital Cost Estimate								
Item	Qty	Unit	Labor $/unit	Materials $/unit	Subs $/unit	Equip $/unit	Total $/unit	Total Net Cost
Div 2- Sitework and Earthwork	3	%	$ 35,438	$ 12,656	$ -	$ 2,531	$ 12,656	$ 12,656
Div 3 - Concrete	8	%	$ 67,500	$ 54,000	$ -	$ 13,500	$ 54,000	$ 54,000
Div 5- Metals	5	%	$ 16,875	$ 63,281	$ -	$ 4,219	$ 63,281	$ 63,281
Div 9- Coating	2	%	$ 16,875	$ 16,875	$ -	$ -	$ 16,875	$ 16,875
Div 11 - Equipment								
Carbon Vessels (40,000 lb, series units)	2	ea	$ 16,000	$ 400,000	$ -	$ 5,000	$ 421,000	$ 842,000
Inclined Plate Separator	1	ea	$ 16,000	$ 190,000	$ -	$ 3,500	$ 209,500	$ 209,500
Inclined Plater Separator Solids Pumps	2	ea	$ 8,000	$ 25,000	$ -	$ 2,500	$ 35,500	$ 71,000
5,000 Gallon Poly Tank	2	ea	$ 8,000	$ 6,000	$ -	$ 1,000	$ 15,000	$ 30,000
GAC Feed Pump	2	ea	$ 8,000	$ 25,000	$ -	$ 2,500	$ 35,500	$ 71,000
GAC Effluent Pump	2	ea	$ 8,000	$ 25,000	$ -	$ 2,500	$ 35,500	$ 71,000
Div 11 Total	-	-	$ 48,000	$ 1,532,000	$ -	$ 33,500	$ -	$ 1,687,500
Div 15- Mechanical (piping, fittings, valves, etc.)	20	%	$ -	$ 337,500	$ -	$ -	$ 337,500	$ 337,500
Div 16- Electrical	25	%	$ -	$ -	$ 421,875	$ -	$ 421,875	$ 421,875
Base Estimate	-	-	$ 253,688	$ 2,877,313	$ 421,875	$ 72,250	$ 1,854,688	$ 2,593,688
Labor Markup	8%							$ 20,295
Material / Process Equipment Markup	8%							$ 230,185.00
Subcontractor Markup	5%							$ 21,093.75
Construction Equipment Markup	8%							$ 5,780
Sales Tax	7.3%							$ 208,605
Material Shipping and Handling	2%							$ 57,546.25
Subtotal								$ 3,137,193
Contractor General Conditions	7%							$ 219,603.49
Subtotal								$ 3,356,796

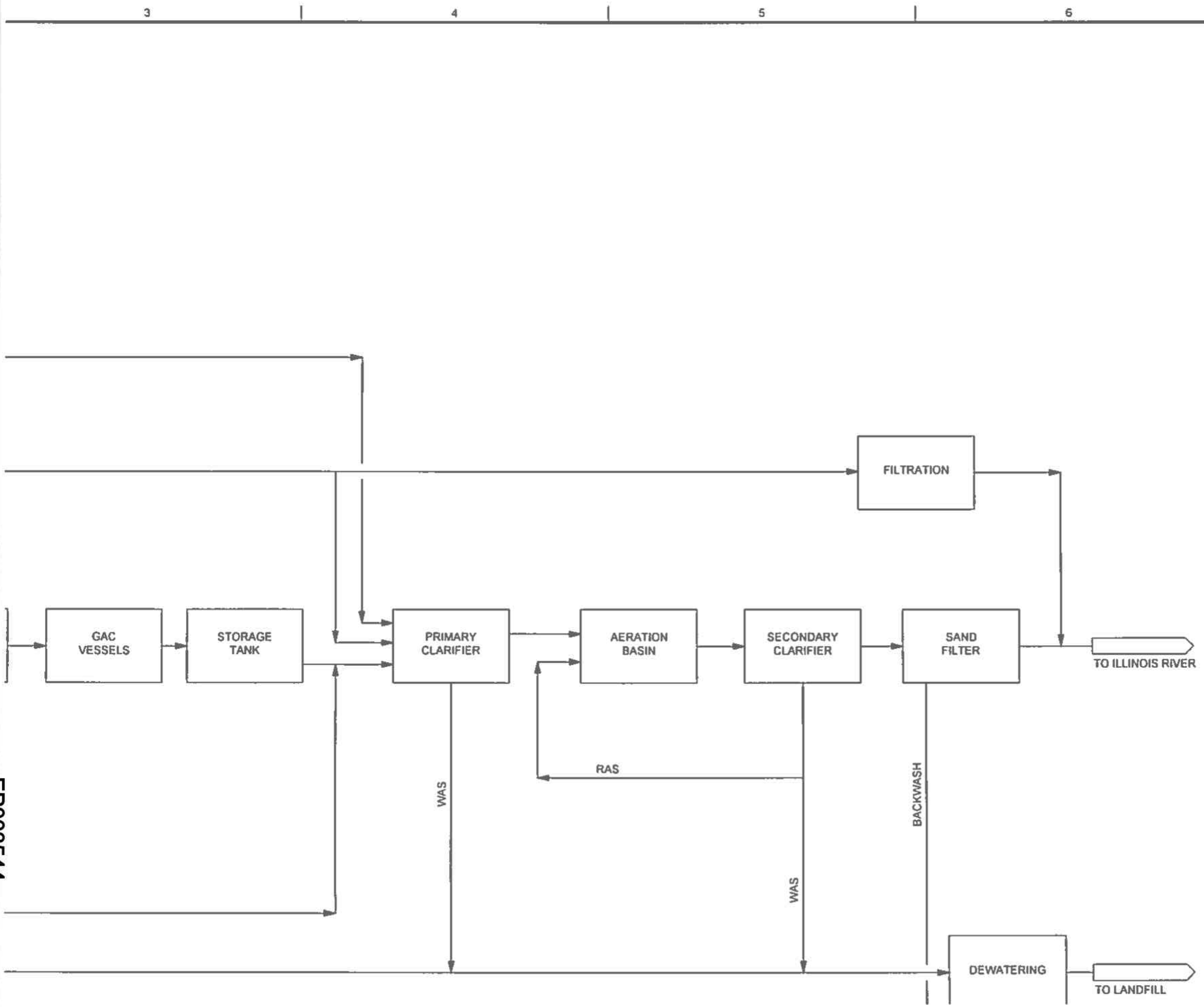
Startup, Training, O&M	1.5%	$	50,351.94
Subtotal		$	3,407,148
Contingency	25%	$	851,787.02
Subtotal		$	4,258,935
Builder's Risk, Liability Auto Insurance	2%	$	85,178.70
Subtotal		$	4,344,114
Bonds	1.5%	$	65,162
Subtotal		$	4,409,276
Engineering (Including Surveying)	15%	$	661,391
Subtotal		$	5,070,667
Project Management	4.0%	$	202,827
Subtotal		$	5,273,494
Grand Total		$	5,274,000
Low Range (-50%)		$	2,637,000
High Range (+100%)		$	10,548,000

Alternative 2: River Water Dilution System Class 5 Capital Cost Estimate

Item	Qty	Unit	Labor $/unit	Materials $/unit	Subs $/unit	Equip $/unit	Total $/unit	Total Net Cost
Div 2- Sitework and Earthwork	10	%	$ 139,073	$ 49,669	$ -	$ 9,934	$ 49,669	$ 49,669
Div 3 - Concrete	15	%	$ 149,006	$ 119,205	$ -	$ 29,801	$ 119,205	$ 119,205
Div 5- Metals	8	%	$ 31,788	$ 119,205	$ -	$ 7,947	$ 119,205	$ 119,205
Div 9- Coating	3	%	$ 29,801	$ 29,801	$ -	$ -	$ 29,801	$ 29,801
Div 11 - Equipment								
Lift Station (Includes Piping and pumps)	1	ea	$ 540,000	$ 2,880,000	$ -	$ 180,000	$ 3,600,000	$ 3,600,000
Clarifier (100' Diameter, Includes sludge pumps)	2	ea	$ 195,000	$ 1,040,000	$ -	$ 65,000	$ 1,300,000	$ 2,600,000
Splitter Box	1	ea	$ 5,000	$ 40,000	$ -	$ 2,000	$ 47,000	$ 47,000
Sand Filter (1500 ft^2 filtration area)	2	ea	$ -	$ -	$ 850,000	$ -	$ 850,000	$ 1,700,000
Clarifier RAS Pump	4	ea	$ 12,000	$ 38,000	$ -	$ 4,000	$ 54,000	$ 216,000
Div 11 Total	-	-	$ 935,000	$ 5,000,000	$ -	$ 312,000	$ -	$ 7,947,000
Div 15- Mechanical (piping, fittings, valves, etc.)	20	%	$ -	$ 1,589,400	$ -	$ -	$ 1,589,400	$ 1,589,400
Div 16- Electrical	25	%	$ -	$ -	$ 1,986,750	$ -	$ 1,986,750	$ 1,986,750
Base Estimate	-	-	$ 2,036,668	$ 10,905,280	$ 2,836,750	$ 610,682	$ 9,745,030	$ 11,841,030
Labor Markup	8%							$ 74,800
Material / Process Equipment Markup	8%							$ 872,422.40
Subcontractor Markup	5%							$ 141,837.50
Construction Equipment Markup	8%							$ 48,854.56
Sales Tax	7.3%							$ 790,633
Material Shipping and Handling	2%							$ 218,105.60
Subtotal								$ 13,987,683
Contractor General Conditions	7%							$ 979,137.80
Subtotal								$ 14,966,821
Startup, Training, O&M	1.5%							$ 224,502.31
Subtotal								$ 15,191,323

Contingency	20%	$ 3,038,264.59
Subtotal		$ 18,229,588
Builder's Risk, Liability Auto Insurance	2%	$ 364,591.75
Subtotal		$ 18,594,179
Bonds	1.5%	$ 278,913
Subtotal		$ 18,873,092
Engineering (Including Surveying)	15%	$ 2,830,964
Subtotal		$ 21,704,056
Project Management	4.0%	$ 868,162
Subtotal		$ 22,572,218
Grand Total		$ 22,573,000
Low Range (-50%)		$ 11,286,500
High Range (+100%)		$ 45,146,000

Attachment B: Block Flow Diagram (BFD)



Brown AND Caldwell

Emerald Performance Materials

HENRY, ILLINOIS

EMERALD PERFORMANCE MATERIALS

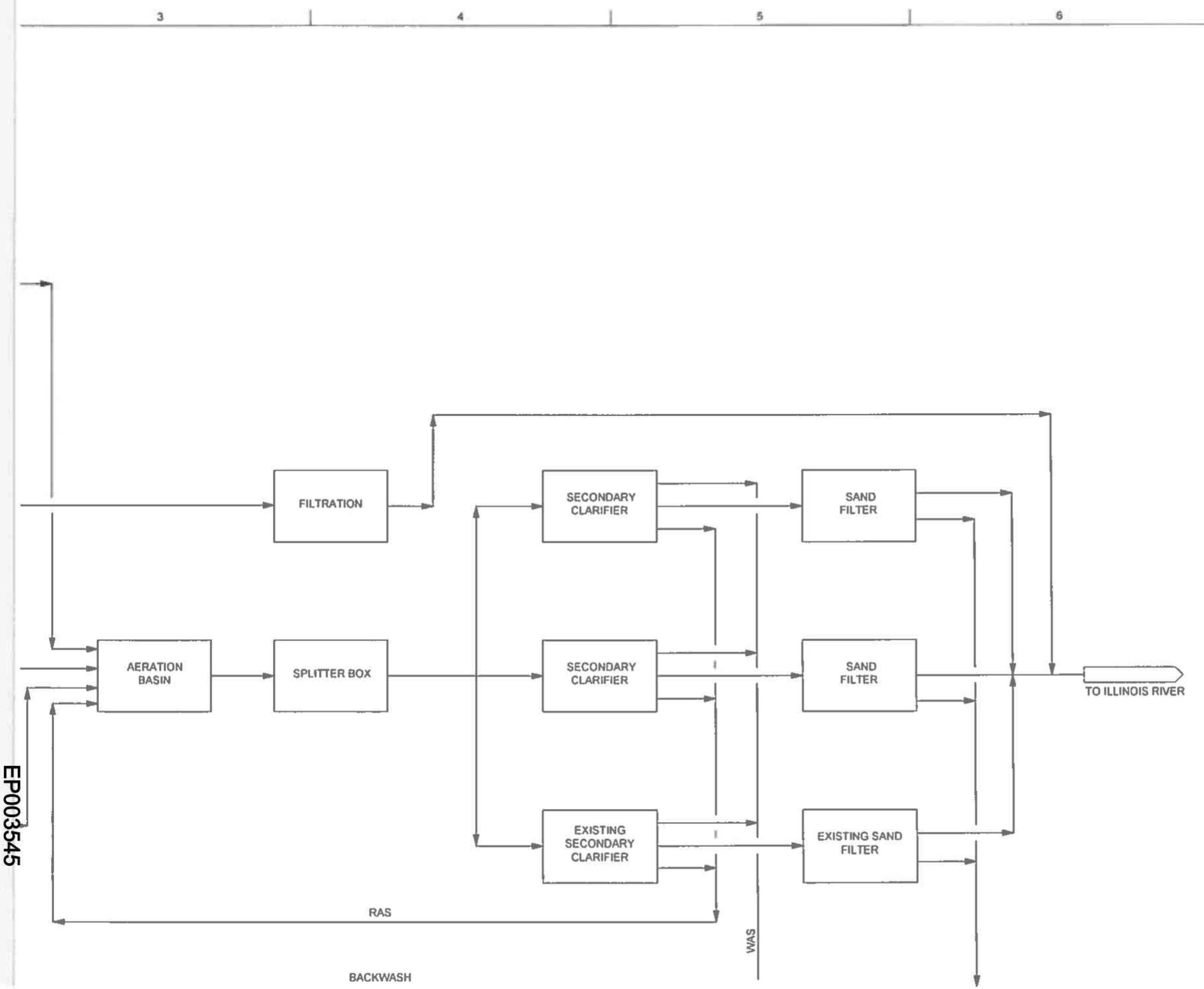
REVISIONS		
REV	DATE	DESCRIPTION

LINE IS 2 INCHES AT FULL SIZE

DESIGNED:

DRAWN:

D
C
B



Brown AND Caldwell

Emerald Performance Materials

HENRY, ILLINOIS

EMERALD PERFORMANCE MATERIALS

REVISIONS

REV	DATE	DESCRIPTION

LINE IS 2 INCHES AT FULL SIZE

DESIGNED:

DRAWN:

EP003545

ATTACHMENT B

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
SOLID WASTE AND EMERGENCY
RESPONSE

JUL 18 2007

Carolyn M. Brown, Esquire
Greenebaum Doll & McDonald PLLC
300 West Vine Street
Suite 1100
Lexington, KY 40507-1665

Dear Ms. Brown:

Thank you for your May 18, 2006 letter, on behalf of Ashland, Inc. (Ashland), in which you request clarification regarding the applicability of the Resource Conservation and Recovery Act (RCRA) regulatory program to a proposed spray irrigation system at Ashland's hazardous waste landfill located in Boyd County, Kentucky. Specifically, you ask that we clarify that the treated effluent permitted under Ashland's state National Pollutant Discharge Elimination System (NPDES) permit would be excluded from being a solid waste under 40 CFR 261.4(a)(2), even if a portion of the treated effluent is managed by spray irrigation to the cap of the hazardous waste landfill. (The regulation at 40 CFR 261.4(a)(2) excludes from the definition of solid waste wastewater discharges that are point source discharges subject to regulation under section 402 of the Clean Water Act (CWA).)

According to your letter, Ashland proposes to use the treated wastewater from the leachate collection system of the landfill for spray irrigation and maintenance of the landfill cap. The landfill leachate is classified as a listed hazardous waste with the hazardous waste code F039.

After reviewing the matter, we have determined that wastewater sprayed onto a landfill cap does not qualify for the Industrial Wastewater Discharge Exclusion under 40 CFR 261.4(a)(2). Although a portion of the effluent will continue to be discharged from Ashland's KPDES-permitted outfall to Chadwick Creek (and thus permitted under Section 402), wastewater that is diverted to land application and is not discharged to waters of the United States is not a point source discharge subject to regulation under the CWA and, therefore, does not qualify for the RCRA exclusion (even if it is part of the KPDES permit). Therefore, the wastewater remains a solid and hazardous waste. Unless it is delisted, the land application of this wastewater will constitute illegal disposal of hazardous waste. We believe a site-specific delisting, if granted, is the most appropriate action for removing the F039 hazardous waste code and allowing the proposed spray irrigation practice to occur.

Thank you for your inquiry regarding RCRA applicability to Ashland's proposed system. All inquiries regarding applicable permit requirements should be directed to Kentucky's Hazardous Waste Program. For other questions on this letter, please contact Jeff Gaines, at (703) 308-8655, or Ross Elliott, at (703) 308-8748.

Sincerely,

Matt Hale

Matt Hale, Director
Office of Solid Waste

cc: April Webb, KDEP
John Jump, KDEP
Bruce Scott, KDEP
Jon Johnston, EPA, Region 4
Kathy Nam, EPA, OGC
Robert Dellinger, EPA, OSW
Robert Hall, EPA, OSW

[redacted]

GREENEBAUM DOLL & McDONALD PLLC

May 18, 2006

Matt Hale
Director, Office of Solid Waste (5301W)
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20460

Re: Applicability of Industrial Wastewater Discharge Exclusion

Dear Mr. Hale:

Our firm represents Ashland Inc. (Ashland) which is the owner/operator and permittee for the Route 3 Landfill in Boyd County, Kentucky. Ashland operated the Route 3 Landfill for disposal of hazardous and nonhazardous wastes from Ashland's Catlettsburg Refinery complex. Closure of the landfill was completed in October 2000. Postclosure monitoring was instituted after completion of closure, and the Kentucky Division of Waste Management issued RCRA Postclosure Permit No. KYD-000-615-898 for the landfill in May 2005. The purpose of this letter is to obtain clarification from your office as to the applicability of the RCRA regulatory program to a proposed spray irrigation system for maintenance of the landfill cap. The spray irrigation system will be covered by the Kentucky Pollutant Discharge Elimination System (KPDES) permit for the landfill as explained in more detail below.

A. <u>Background</u>

The Route 3 Landfill has an extensive leachate collection system including sumps. The collection lines combine and discharge to a concrete wastewater treatment tank (WWTU). The influent from the leachate collection system is classified as F039 multi-source leachate. While in

[redacted]

the tank, this wastewater is treated by sedimentation and aeration. In addition, a granulated activated carbon treatment system is brought on-site to polish the accumulated wastewater prior to periodic discharge to the KPDES-permitted outfall. There is also a separate treatment system for water (precipitation) collected by an underdrainage system. Both wastewater streams are treated and discharged to Chadwick Creek, pursuant to KPDES Permit No. KY0063096.

When the KPDES permit was renewed in 2005, different limitations were imposed. Ashland has discussed with the Divisions of Water and Waste Management possible amendment of the KPDES permit to allow use of the treated wastewater in a spray irrigation system for landfill cap maintenance during appropriate weather conditions while also continuing to allow discharge of the wastewater to Chadwick Creek. Ashland has undertaken extensive analysis of the wastewater as part of its evaluation of spray irrigation as an option. Testing has shown that the treated effluent is typically non-detect for F039 constituents that would be associated with the facility. In fact, ammonia appears to be the constituent that presents the greatest challenge for continued compliance with the KPDES permit -- of course, the ammonia in the effluent also makes it a good choice for cap maintenance. Although this approach would have environmental benefits in terms of reducing discharges to the creek and promoting healthy vegetation on the cap in lieu of fertilizer applications, a question has arisen as to whether the treated wastewater that is pumped from the WWTU and applied to the cap by the spray irrigation equipment may permissibly be considered excluded from the definition of solid (and thus, hazardous) waste pursuant to 40 CFR 261.4(a)(2). At a meeting in April with representatives of the Divisions and Ashland, it was decided that Ashland would submit this request in order to obtain clarification from EPA on the applicability of the exclusion for industrial wastewater discharges in this situation.

B. Regulatory Provisions

The wastewater collected in the WWTU has been classified as multi-source leachate, which is a listed hazardous waste with waste code F039.[1] However, 40 CFR 261.4(a) identifies certain materials which are not classified as a solid wastes and thus would not be hazardous wastes. Pursuant to 40 CFR 261.4(a)(2), the following are not classified as solid waste:

> Industrial wastewater discharges that are point source discharges subject to regulation under section 402 of the Clean Water Act, as amended.
>
> [*Comment*: This exclusion applies only to the actual point source discharge. It does not exclude industrial wastewaters while they are being collected , stored or

[1] Ashland has considered seeking to delist the wastewater based on analyses obtained to date which typically are non-detect for the constituents of concern.

[redacted]

treated before discharge, nor does it excluded sludges that are generated by industrial wastewater treatment.]

The Environmental & Public Protection Cabinet, Division of Water has been delegated authority to implement the National Pollutant Discharge Elimination System (NPDES) permitting program under Section 402 of the Clean Water Act (known as the KPDES permit program in Kentucky). As stated above, Ashland presently holds KPDES Permit No. KY0063096 for discharges of treated wastewater to Chadwick Creek. Ashland intends to seek modification of the KPDES permit to add spray irrigation as a means of managing a portion of the wastewater from the landfill as an alternative to discharge to the creek. The spray irrigation would be strictly controlled to assure that appropriate amounts were applied. The wastewater will not be able to percolate into the closed landfill due to the liner that was part of the final cap design. Ashland requests confirmation from EPA that the wastewater at the point of application from the spray irrigation system would no longer be classified as hazardous waste provided that the spray irrigation is included in the KPDES permit. Having completed closure of the landfill, Ashland obviously wants to avoid inadvertently triggering any additional hazardous waste management requirements as a result of implementation of this proposed wastewater management option.

If you have any questions regarding this letter, please do not hesitate to call. We appreciate your attention to this inquiry.

Sincerely yours,

Carolyn M. Brown

CMB/cab

cc: John G. Horne, Esq., KDEP General Counsel
April Webb, Kentucky Division of Waste Management
Dale Burton, Kentucky Division of Waste Management
Jory Becker, Kentucky Division of Water
Nigel Goulding
Joseph A. French, Esq.

707055_2

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October 11, 2019

PETITIONER'S HEARING EXHIBIT
AS 19-002
12

Brown AND Caldwell

Letter Report
Privileged and Confidential

Mr. Thomas W. Dimond
Ice Miller LLP
200 W. Madison Street, Ste. 3500
Chicago, IL 60606-3417 041514

Subject: Expert Report and Response to Recommendations of Illinois Environmental Protection Agency of July 19, 2019

Dear Mr. Dimond:

Brown and Caldwell (BC) is pleased to respond to part of the comments raised by the Illinois Environmental Protection Agency (IEPA) in the July 19, 2019 Recommendation to Deny Emerald Polymer Additives an Adjusted Standard (AS 19-002). This response specifically addresses comments regarding items listed below.

- Use of present worth costs to express costs of ammonia-nitrogen removal
- Projects and associated capital costs installed by others in the State of Illinois partially related to compliance with ammonia-nitrogen regulatory limits excluding Fox River
- In-plant monitoring of ammonia-nitrogen by Emerald
- Request for updates to conceptual level designs and cost estimates for treatment alternatives to remove ammonia-nitrogen from the Emerald Polymer Additives (Emerald) Plant wastewater treatment plant (WWTP) discharge into the Illinois River[1]
- Request for evaluation of land application for Emerald final effluent
- Impact of biotreater volume on effluent ammonia-nitrogen removal

Cost of Ammonia-Nitrogen Removal

IEPA objected on Page 16 of the Recommendation to BC's comparison of unit cost (dollars per pound of ammonia-nitrogen removed) as a means of judging economic reasonableness of ammonia-nitrogen removal. IEPA also objected, on this same page, to the use of present worth costs (accounting of capital and operating costs) instead of capital costs alone when calculating cost of treatment. BC firmly believes that unit costs and present worth costs are the standard for evaluating true treatment costs. The latest cost document provided by the National Association of Clean Water Agencies (NACWA)[2] reports that the median unit cost of ammonia-nitrogen treatment for 12 agencies was $1.53 per pound of ammonia-nitrogen removed, which is higher than the cost reported

---

[1] Ammonia-Nitrogen Treatment Alternatives for Emerald Performance Materials, LLC submitted by Brown and Caldwell to Drinker, Biddle and Reath, LLP under Privileged and Confidential-Attorney/Client Work Product on July 8, 2013.
[2] 2017 NACWA Financial Survey: A National Survey of Clean Water Agency Financing and Management: Final Report, August 2018.

by the Greater Peoria Sanitation District ($0.81 per pound). The basis for these reported costs includes, in all cases, annual operating and maintenance costs. In some cases, these costs may include capitalized present worth cost (amount of money needed today to fund capital and operating costs for a defined project life). The exclusion of capitalized costs by most NACWA members in these reported unit costs is due to the nature of the municipal wastewater treatment plants. Exclusion of capital costs in unit costs by NACWA members is due to several factors. These include the difficulty in separating capital costs into those required for treatment of flow, biochemical oxygen demand (BOD), total suspended solids (TSS), and ammonia-nitrogen (NH_3-N). In municipal plants, the same pieces of equipment contribute to treatment of all four components (flow, BOD, TSS and NH_3-N). In the Emerald plant, the costs described herein are focused entirely on NH_3-N removal, and therefore, delineation of capitalized present worth costs are straightforward. Contrary to NACWA, IEPA has focused strictly on capital costs of projects that included ammonia-nitrogen removal. Such focus is misguided and results in an incomplete understanding of ammonia-nitrogen removal costs.

IEPA references project capital costs reportedly incurred by others in the State of Illinois when including ammonia-nitrogen removal in their treatment plant upgrades. It should be noted that all of these plants relied upon the lowest cost means of ammonia-nitrogen removal which is single-stage biological nitrification. The Emerald plant provides the same degree of aerobic treatment conditions that allow single-stage nitrification in these IEPA referenced plants (solids retention time in excess of 30 days, surplus alkalinity, and available phosphorus). However, the Emerald plant cannot nitrify within a single stage like these other plants due to the unavoidable presence of a compound in the process wastewater. This compound (mercaptobenzothiazole, MBT) is foundational to the production processes at the Emerald Plant and is consistently present in the primary clarifier effluent at 160 mg/L or higher for days at a time (versus a nitrification inhibition threshold of 3 mg/L[3]). To establish reliable single-stage nitrification, MBT removal from the process wastewater would have to exceed 98 percent which has been demonstrated in prior documents as being complex and cost prohibitive[4]. Each cost example provided by IEPA is discussed below.

1. Geneva, IL (BATES 341 and 353) completed a two-phased project in 2004 for a reported cost of $10.9 million dollars. These costs included multiple upgrades that had nothing to do with ammonia-nitrogen removal including the additions of fine screens, raw sewage pumps, grit tank, primary clarifier, UV disinfection, sludge digestion, sludge dewatering, flood proofing, and remodeling of administration/laboratory facilities. The only upgrades that would be partly linked to ammonia-nitrogen removal would have been addition of aeration tanks, blowers, and a final clarifier. These upgrades also provide increased capacity to treat higher flow, BOD, and TSS (BATES 360 through 369). It is uncertain what portion of these upgrades would be attributed to ammonia-nitrogen removal.
2. Batavia, IL (BATES 437) completed a project in 2001 for a reported cost of $10.8 million. These costs included multiple upgrades that had nothing to do with

[3] M.R. Hockenbury and C.P.L. Grady in Journal of Water Pollution Control Federation, Volume 49, page 768, 1977.

[4] Evaluation of Nitrification Alternatives for Emerald-Henry, Illinois Facility prepared by Brown and Caldwell and submitted to Emerald Performance Materials on April 13, 2018.

ammonia-nitrogen removal including the additions of influent flow measurement, mechanical bar screen, primary clarifier equipment in existing tanks, intermediate pump station pump, UV disinfection, effluent flow meter, and rehabilitation of sludge digestion. The only upgrades that would be partly linked to ammonia-nitrogen removal would have been addition of aeration tanks, blowers, diffusers, and secondary clarifier. These upgrades also provide increased capacity to treat higher flow, BOD, and TSS (BATES 454 through 456 and 460). It is uncertain what portion of these upgrades would be attributed to ammonia-nitrogen removal.

3. Saint Charles, IL (BATES 1365) completed a project in 2002 for a reported cost of $8.4 million. These costs included multiple upgrades that had nothing to do with ammonia-nitrogen removal including the additions of headworks modifications, new scum troughs, existing aeration basin rehabilitation, baffles in existing secondary clarifiers, excess flow pump station and clarifier rehabilitation, new return activated sludge and waste activated sludge pumps, UV disinfection, and piping and electrical system upgrades. The only upgrades that would be partly linked to ammonia-nitrogen removal would have been the addition of aeration tanks and blower building. These upgrades also provide increased capacity to treat higher flow, BOD, and TSS (BATES 1387 through 1389 and 1397). It is uncertain what portion of these upgrades would be attributed to ammonia-nitrogen removal.
4. Fox River, IL (BATES 437) completed a project in 2007 for a reported cost of $2.0 million. This project did not increase the rated capacity of the plant since it did not increase treatment capacity. It only provided for the installation of two flow equalization basins and associated appurtenances. This plant upgrade provided for more stable process control but did not enhance ammonia-nitrogen removal.
5. Kishwaukee, IL (BATES 00015) completed a project in 2017 for a reported cost of $53 million. These costs included multiple upgrades that had nothing to do with ammonia-nitrogen removal including the additions of two primary clarifiers, anaerobic biological phosphorus removal tanks, fermenter, and UV disinfection. The only upgrades that would be partly linked to ammonia-nitrogen removal would have been additions of aeration tanks and secondary clarifiers. These upgrades also provide increased capacity to treat higher flow, BOD, and TSS (BATES 34 through 45). It is uncertain what portion of these upgrades would be attributed to ammonia-nitrogen removal.
6. Newark, IL (BATES 1571-1573) completed a project in 2001 for a reported cost of $3.0 million. These costs included multiple upgrades to a lagoon-based treatment system to achieve improved performance (BOD and TSS removal). These included additions of a bar screen, reconfiguration of cells, installation of insulated covers and baffles. The only upgrade intended to provide ammonia-nitrogen and additional BOD removal was the addition of two polishing reactors. It is uncertain what portion of the polishing reactor cost would be attributed to ammonia-nitrogen removal.
7. Mount Carmel, IL (BATES 1601 and 1603) completed a project in 2018 for a reported cost of $1.6 million. These costs included replacement and relocation of an effluent line and river outfall structure which had nothing to do with ammonia-nitrogen removal. Additionally, the plant replaced an existing mechanical aeration system with a diffused aeration system. It is uncertain if this replacement improved ammonia-nitrogen removal and what portion of this replacement was attributed to ammonia-nitrogen removal.

In summary, only five of the seven wastewater treatment facilities upgrades referenced above had anything to do with ammonia-nitrogen removal. None of these five treatment plant upgrades were implemented solely to accomplish ammonia-nitrogen removal. They were implemented in large part to better accommodate higher flows, greater BOD removal, greater TSS removal, and/or improved disinfection. Consequently, the costs of these upgrades cannot be legitimately used to compare or evaluate costs of ammonia-nitrogen removal at the Emerald plant.

In-Plant Monitoring of Ammonia-Nitrogen

IEPA has recommended that Emerald implement an in-plant ammonia-nitrogen (NH_3-N) monitoring program in hopes of reducing effluent ammonia-nitrogen through at-source detection and control. This strategy would work if effluent ammonia-nitrogen was strongly related to influent ammonia-nitrogen. However, this is not the case since influent organic nitrogen is the primary contributor to effluent ammonia-nitrogen.

The two primary raw wastewater contributors to the wastewater treatment plant (PVC Tank and PC Tank) were monitored approximately 3 days per week for Total Kjeldahl Nitrogen (TKN) and ammonia-nitrogen (NH_3-N) during the period of March 28, 2019 through August 8, 2019. The difference between TKN and NH_3-N concentrations represent organic nitrogen. Under normal biological treatment conditions, organic nitrogen is converted to NH_3-N. These data are summarized in Figure 1 and discussed below.

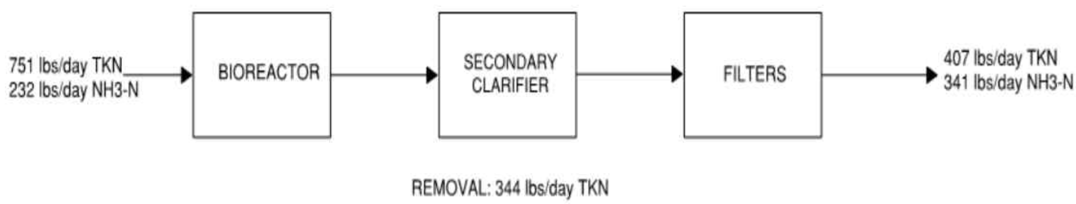

Figure 1. Average TKN Removal Across Emerald WWTP

- The PVC tank discharged on average 524 lbs/day TKN and 230 lbs/day NH_3-N indicating that only 40 percent of the TKN loading was comprised of ammonia-nitrogen. It should be noted that this discharge stream includes the nitrogen loading of tertiary filter backwash water and sludge dewatering filtrate which is generated when treating both PVC tank and PC tank wastewaters. Nitrification of this stream alone has been considered in prior evaluations[5] and does not offer a means of complying with regulatory effluent limits because it would achieve less than 70 percent reduction in effluent ammonia-nitrogen reduction based on prior sampling results. Recent sampling results continue to demonstrate this finding.
- The PC Tank discharged, on average, 227 lbs/day TKN and 2 lbs/day NH_3-N indicating that only 1 percent of the TKN loading was comprised of ammonia-nitrogen.
- Ammonia-nitrogen contributed only 30 percent of the combined TKN loading discharged by the PVC and PC tank (751 lbs/day TKN). Consequently, in-plant monitoring of ammonia-nitrogen only has the ability to influence 30 percent of the

[5] Evaluation of Treatment Alternatives for Reducing Final Effluent Ammonia Load submitted by Brown and Caldwell (formerly Eckenfelder Inc) to Emerald (Formerly BF Goodrich) in February 1997.

potential final effluent NH_3-N load. This finding that the bulk of the final effluent NH_3-N loading is due to organic nitrogen present in the raw wastewaters and converted to ammonia-nitrogen through biological treatment has been documented throughout the years.[1] Additional sampling of raw wastewater sources to determine the origin of effluent ammonia-nitrogen is not needed.

- The Emerald Wastewater Treatment Plant did provide 46 percent removal of influent TKN reducing the effluent ammonia-nitrogen by 344 lbs/day. This removal was associated with nutrient requirements for the BOD removal accomplished by biological treatment within the plant.
- Any in-plant monitoring would need to focus on TKN monitoring. Unlike NH_3-N, there are no direct monitoring probes for TKN in wastewater. Consequently, real-time monitoring and quick response would be impractical.

Updated Conceptual Level Designs and Cost Estimates

IEPA also faulted Emerald for not updating the costs of all compliance alternatives (Recommendation at 15). Updating costs for every alternative is not necessary because many alternatives are known not to achieve significant effluent ammonia-nitrogen reductions or would have costs in excess of other more effective alternatives. Costs have been calculated for five alternatives considered most likely to be effective and for land application.

Conceptual level cost estimates presented herein were developed using an approach recommended by the Association of the Advancement of Cost Estimating (AACE). The estimates are Class 5 estimates with an accuracy of -50 percent to +100 percent. These estimates were developed by generating equipment costs for each alternative and then applying multiplication factors for direct and indirect costs. The direct costs include freight, tax, purchased equipment installation, installed piping, installed electrical systems, buildings, other structural components, yard improvements, and installed service utilities. Indirect costs include engineering and supervision, construction expenses, legal expenses, and contractors fee.

A contingency multiplication factor is applied to the sum of the direct and indirect costs. The sum of the direct, indirect and contingency results in the fixed capital cost (FCC).

The prior 2013 cost estimates were calculated by using the 2002 cost estimates and applying an escalation factor. Due to inflation and other factors, the 2013 estimates underestimated costs and were not as precise as the Class 5 cost estimate contained herein.

The most economical and reliable processes for ammonia-nitrogen removal at the Emerald Plant would consist of further treating the plant final effluent (not plant raw wastewater influent). BC has updated the design final effluent wasteload based on 2018 information when the plant was reportedly operating at typical production levels. A summary of the design final effluent wasteload is illustrated below in Table 1. This wasteload was used to update the conceptual level designs and cost estimates for the most economically feasible alternatives determined in prior work (see footnote 3). The details around these cost estimates is included as Attachment A.

Table 1. Design Final Effluent Wasteload for Emerald Wastewater Treatment Plant			
	Average	Maximum Monthly	Daily Maximum
Flow, gpm	360	412	475
Flow, MGD	0.52	0.59	0.68
TKN, lbs/day	407	508	618
NH_3-N, lbs/day	341	449	553
COD, lbs/day	2,300		
CBOD, lbs/day	47	115	312
TSS, lbs/day	87	220	485
pH, s.u.	7.5	7.7	8.2
Temperature, deg F	77	86	66 to 88 Range
Alkalinity, mg/L	940		
Hardness, mg/L	360		
TDS, mg/L	10,000		
TDFS, mg/L	10,000		
Na, mg/l	3,100		
K, mg/L	3		
Ca, mg/L	42		
Mg, mg/L	14		
Chlorides, mg/L	805		
Sulfate, mg/L	5,460		

Ozonation

Ozonation has been demonstrated to reduce ammonia-nitrogen by 55 percent at an initial pH 11 and final pH 7.6[6]. Consequently, no further ammonia-nitrogen removal was assumed beyond 55 percent. The resulting effluent ammonia-nitrogen concentration would be an order of magnitude higher than the effluent ammonia-nitrogen regulatory limits (3 mg/L monthly average and 6 mg/L daily maximum in 35IAC304.122).

This process oxidizes ammonia-nitrogen to nitrate-nitrogen as does biological nitrification. The difference is that in ozonation only one of three oxygen atoms is used for oxidation while in biological nitrification all oxygen is used for oxidation. Both processes require caustic addition to neutralize the acid formed.

$$4\ O_3 + NH_4^+ \text{ yields } NO_3^- + 2\ H^+ + H_2O + 4\ O_2$$

The process would be installed downstream of the existing sand filter as illustrated in Figure 2 to minimize the oxidant demand associated with effluent TSS.

[6] Treatment of Ammonia Nitrogen Wastewater in Low Concentration by Two-Stage Ozonization, Xianping Luo,et al., International Journal of Environmental Research and Public Health, 2015, Volume 12, pages 11975 through 11987

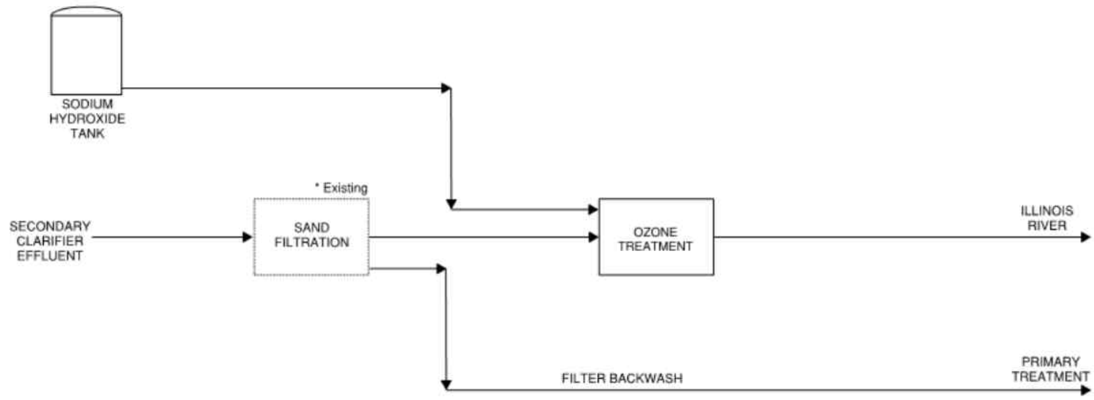

Figure 2. Ozone Treatment Block Flow Drawing

Alkaline Stripping

Alkaline stripping can practically provide up to 95 percent removal of effluent ammonia-nitrogen. However, this degree of removal is inadequate to comply with the regulatory effluent limits.

In this treatment, caustic would be used to raise the filtered effluent to pH 11.5 and passed through an air stripping column packed with media. The column effluent would be lowered to pH 8.5 using sulfuric acid and discharge through the existing outfall as illustrated in Figure 3. The off-gas from the column would pass through an acid scrubber. The acid scrubber would produce a liquid waste (ammonium sulfate) that essentially concentrates the ammonia-nitrogen from one stream (final effluent) into a smaller liquid stream requiring off-site disposal. It is uncertain where this acid scrubber waste (approximately 4,500 gallons per day of 0.9 percent by weight nitrogen) could be disposed making this treatment alternative questionably viable. For purposes of costing this alternative, it was assumed that the waste could be hauled to Greater Peoria Sanitation District for disposal.

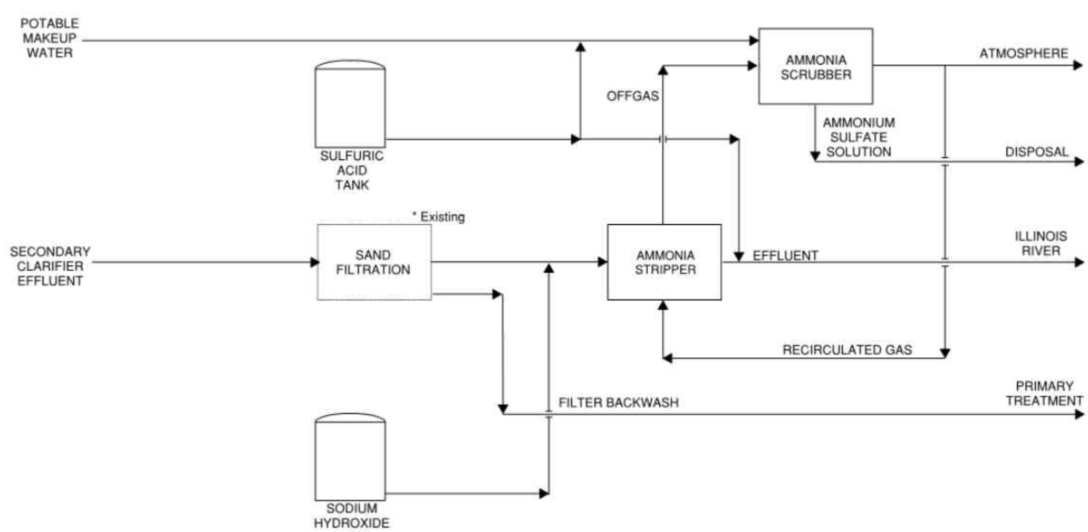

Figure 3. Alkaline Stripping Block Flow Diagram

Tertiary Nitrification

Under normal operating conditions, the secondary clarifier reportedly discharges less than 3 mg/L mercaptobenzothiazole (the reported concentration at which nitrification is significantly inhibited). Under these conditions, tertiary nitrification should be capable of achieving compliance with proposed effluent ammonia-nitrogen limits. It is uncertain how often upstream biological treatment and secondary clarifier upsets would disrupt the performance of tertiary nitrification. The Emerald plant is subject to these upsets periodically due to the poorly degradable nature of the compounds present in the process wastewater and the heavy reliance upon chemical conditioning for secondary clarifier effluent quality control. Pilot-scale demonstration work would be required to demonstrate the reliability of this treatment process.

The process would consist of adding rotating biological contactors (RBCs) downstream of the secondary clarifier as illustrated in Figure 4. Sodium hydroxide would be added to satisfy the alkalinity demand. Heterotrophic bacteria (BOD removing bacteria) and nitrifying bacteria would grow on the fixed film media offered in the RBCs. Excess bacteria would slough off the fixed film and be caught by downstream rotary disk filters. The smaller particles exiting the rotary disk filters would be captured by the existing downstream tertiary filters. The captured solids from both filters would be discharged to the primary treatment system during filter backwashes.

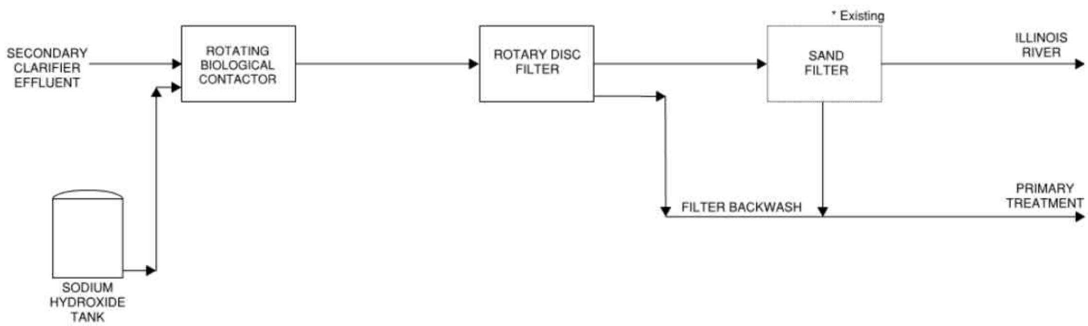

Figure 4. Tertiary Nitrification Block Flow Diagram

Breakpoint Chlorination

Breakpoint chlorination can discharge an effluent in compliance with the effluent ammonia-nitrogen regulatory limits. However, the quantity of treatment chemical addition required increases the effluent salt load by more than 70 percent. Additionally, it is uncertain if this treatment process would form chlorination byproducts which could adversely impact the effluent aquatic toxicity and jeopardize compliance with the effluent acute toxicity criterion (<2.1 percent effluent lethal concentration that results in 50 percent mortality). Further testing would be required to address this uncertainty. In this process, ammonia is oxidized to nitrogen gas using chlorine while producing acid. The process is non-selective in its oxidation and would consume some residual biochemical oxygen demand (BOD) and chemical oxygen demand (COD) as well as some organic nitrogen. Consequently, the dose of chlorine would be approximately 12 pounds chlorine applied per pound of ammonia-nitrogen oxidized and the alkalinity requirement would be approximately 14 pounds of alkalinity applied per pound of ammonia-nitrogen oxidized.

The process would be installed downstream of the existing tertiary filter as illustrated Figure 5. This location would minimize the required chlorine demand.

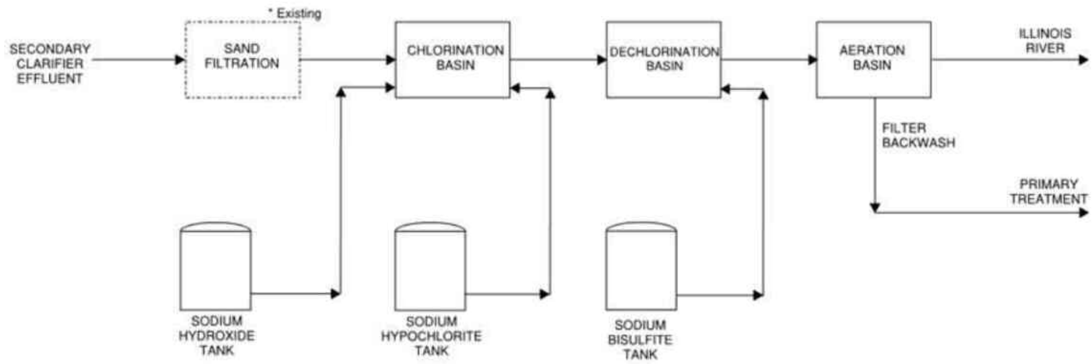

Figure 5. Breakpoint Chlorination Block Flow Diagram

Ion Exchange

Ion exchange can discharge an effluent in compliance with the effluent ammonia-nitrogen regulatory limits. Purolite recommended a hydrogen-based cation exchange resin for this treatment which will remove ammonia (NH_4^+) and other cations as well from the wastewater. Caustic will be used to maintain a minimum effluent pH 6.5. Hydrochloric acid will be used to regenerate the resin. In essence, this treatment concentrates the ammonia-nitrogen in one stream (the final effluent) into a smaller stream requiring off-site disposal. It is uncertain where this spent regenerant (ammonium chloride at approximately 4,500 gpd of 0.90 percent by weight nitrogen) could be disposed making this alternative questionably viable. For purposes of costing this alternative, it was assumed that the waste could be hauled to Greater Peoria Sanitation District for disposal.

The process would be installed downstream of the existing sand filter to prevent solids fouling of the ion exchange column as illustrated in Figure 6.

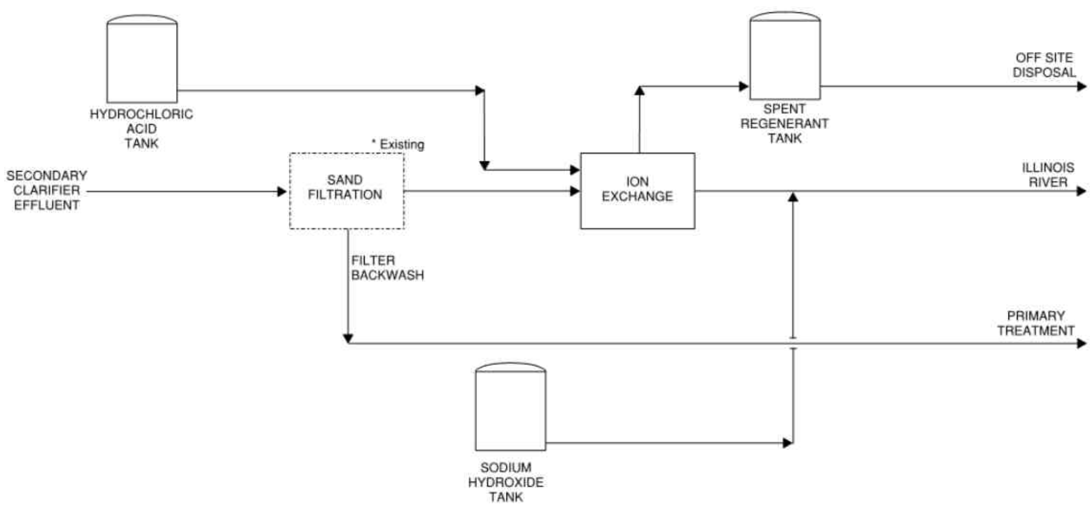

Figure 6. Ion Exchange Block Flow Diagram

Land Application

The Emerald Plant owns 80 acres on land adjacent to the plant that could be used to grow a salt tolerant, high nitrogen uptake hay (e.g., Bermuda grass) which would exert a nitrogen uptake of approximately 350 pounds per acre per year. This nitrogen uptake would support an average of 160,000 gpd (30 percent of the average final effluent flow) over the course of approximately 9 months per year when the ground is thawed. This effluent would be diluted with 360,000 gpd of clarified river water prior to irrigation to minimize salt impacts on plant growth and associated nitrogen uptake. An average root zone TDS of less than 3800 mg/L was targeted. The water not used for plant growth would discharge as groundwater into the Illinois River. Unlike the Akzo Nobel land application system, dilution water addition is required to mitigate salt impacts on the proposed crops. Tiling of this acreage would not be provided, like at Akzo Nobel, since it would not allow collection of the treated water. At the Emerald site, the normal groundwater level is deeper than tiles are installed (greater than 10 feet) and the soil is highly permeable.

The viability of this process would be contingent on being granted a river water withdrawal permit, being granted a permit that allows the river water clarifier to discharge solids removed back to the river, and finding an entity willing to cut and remove the hay at no cost to Emerald. Currently, the acreage is used to grow profitable crops (corn and soybeans). These crops offer a significantly lower nitrogen uptake and salt tolerance.

Combined the process illustrated in Figure 7 would only treat 22 percent of the annual nitrogen load. Furthermore, operation of this system would be complex.

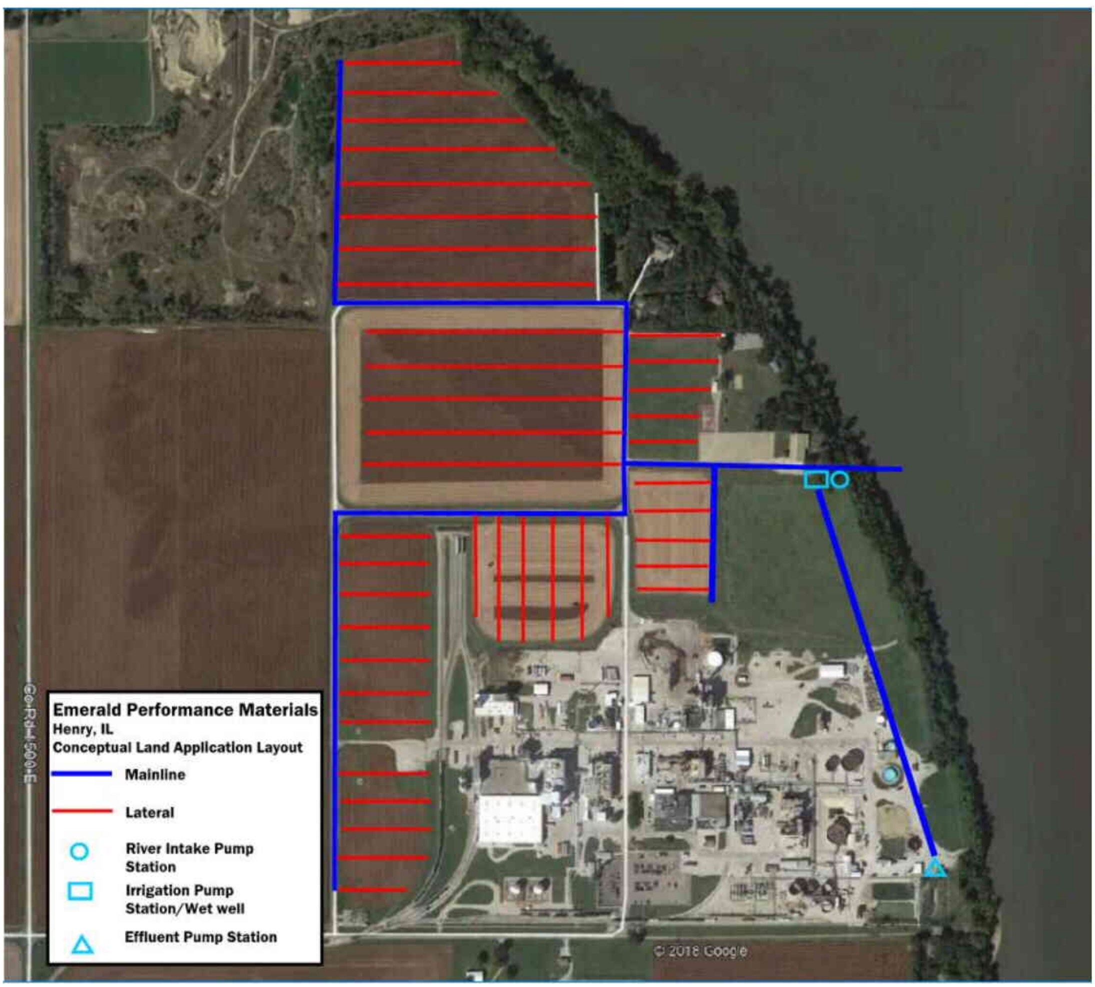

Figure 7. Land Application Layout Drawing

Summary of Treatment Alternatives Performance and Associated Costs

A summary of treatment alternatives performance and associated costs are shown in Table 2. These costs are presented as unit costs in Table 3. These data indicate that tertiary nitrification and ion exchange offer the lowest unit cost for ammonia removal based on annual operations and maintenance costs with ion exchange having a much lower capital cost. These costs, even on an annual operations and maintenance basis, are 4-fold greater than the median unit costs reported by NACWA for others providing ammonia-nitrogen removal. On a present worth basis, Emerald would have to commit a minimum of $12 per pound of NH_3-N removed over the next 10 years (approximately 8-fold the median unit costs reported by NACWA.

Table 2. Treatment Alternatives and Associated Costs

Alternative	Achieve Regulatory Limits?	Average NH_3-N Removal (lbs/day)	Capital Costs ($ million)	Annual O/M[a] Costs ($ million)	Present Worth[b] ($ million)
Ozonation	No	188	22	0.96	30
Alkaline Stripping	No[d]	324	7.3	1.4	19
Tertiary Nitrification	Uncertain	$\leq$331	10	0.74	17
Breakpoint Chlorination	Yes[c]	331	4.1	2.5	24
Ion Exchange	Yes[d]	331	6.0	1.0	14
Land Application	No	77	6.0	0.39[e]	9.2

[a] Annual operations and maintenance costs.

[b] Based on 10 years at 4 percent interest and no salvage value. Present worth of annual O/M costs is annual costs times 8.1 Total present worth is present worth of both the annual O/M and capital costs.

[c] Uncertain if treatment process would adversely impact compliance with effluent aquatic toxicity criterion.

[d] Uncertainty regarding spent regenerant disposal makes treatment alternative questionably viable.

[e] Excludes loss of income from current farming of 80 acres.

Table 3. Unit Costs of Treatment Alternatives

Alternative	O/M Costs ($/pound NH_3-N removed)	Present Worth ($/pound of NH_3-N removed)
Ozonation	14	44
Alkaline Stripping	12	16
Tertiary Nitrification	>6.3	>14
Breakpoint Chlorination	21	20
Ion Exchange	8.5	12
Land Application	14	33

Environmental Impact of Effluent Ammonia-Nitrogen Removal

This section describes the current water quality status of the Illinois River and the sensitivity of Emerald's ammonia-nitrogen discharge on water quality as well as the negative collateral impacts to the environment that removing Emerald's ammonia-nitrogen would create.

As reflected In Emerald's petition for an adjusted standard, the Illinois River over many years has shown no violations of the acute and chronic water quality standards for ammonia-nitrogen downstream of Emerald's discharge. The petition also presents the results of Whole Effluent Toxicity (WET) testing that have repeatedly shown no toxic effects from Emerald's effluent outside the approved zone of initial dilution. These results demonstrate that Emerald's construction and continued use of the current wastewater treatment plant, the multi-port diffuser, replacement of the BBTS Wet Scrubber and other actions have produced an effluent that has no material negative effect on the environment. Additionally, the wastewater treatment plant operated by Emerald is considered by USEPA to provide the best degree of treatment economically achievable (BAT) for these type wastewaters[7].

As described herein, only one of the six treatment alternatives does not require chemical addition to the final effluent. However, this alternative of land application only reduces the annual nitrogen load on the river by 22 percent and requires complexity related to operating and maintaining a river water treatment system, three pumping systems, and an elaborate irrigation system. It also generates hay which has no defined dependable outlet for use. The other five alternatives require extensive chemical addition which will appreciably increase the effluent salt load to the Illinois River. The only two alternatives that can reliably comply with the regulatory limits (breakpoint chlorination and ion exchange) either a) generate an effluent that may cause failure of the existing effluent aquatic toxicity criterion or b) generate a liquid waste whose disposal method, destination, and costs are uncertain. In addition, every alternative will indirectly increase greenhouse gas emissions due to increased power consumption and additional diesel truck traffic. The collateral negative environmental impact of the treatment alternatives (e.g., greenhouse gas emissions and decreased effluent water quality with respect to higher salt levels) is appreciably more adverse than the current effluent ammonia-nitrogen load.

Given that Emerald's effluent has no negative environmental impact and the treatment alternatives have possible negative collateral environmental effects, implementing any of those alternatives and incurring the estimated costs solely for ammonia-nitrogen removal would be a unique and unreasonable requirement.

Operation of Additional Biotreaters

Ammonia-nitrogen removal at the wastewater treatment facility is a function of solids retention time (SRT) and the extent of BOD removal. The maximum amount of ammonia-nitrogen removal will occur at the lowest achievable SRT that ensures sufficient BOD removal. The wastewater treatment plant is already capable of operating at this condition (SRT of 30 to 60 days depending upon production) with only the North Biotreater in service. Operating additional biotreaters will have no impact on effluent ammonia-nitrogen but will make operations more complicated.

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[7] Code of Federal Register, Title 40, Subpart 414 Organic Chemical, Plastics and Synthetic Fibers.

We appreciate this opportunity to be of service to ICE Miller and Emerald. Please call Houston Flippin at 615.250.1220 if you have any questions or need additional information.

Very truly yours,

Brown and Caldwell

T. Houston Flippin, P.E., BCEE
Industrial Wastewater Process Leader

Si Givens
Vice President

THF:na

cc: Charlie Gregory, Brown and Caldwell

Limitations:

The information contained in this proposal is proprietary and contains confidential information that is of significant economic value to Brown and Caldwell. It is intended to be used only for evaluation of our qualifications to provide services. It should not be duplicated, used, or disclosed, in whole or in part, for any purpose other than to evaluate this proposal. Further, Client is cautioned that electronic files may be compromised by media degradation, file corruption,

Attachment A: Capital and Annual Cost Tables for Treatment Alternatives

	Ion Exchange		Tertiary Nitrification		Alkaline Stripping		Ozonation		Breakpoint Chlorination		Land Application	
	Selected Percentage	Cost	Selected Percentage	Cost	Selected Percentage	Cost	Selected Percentage	Cost	Selected Percentage	Cost	Selected Percentage	Cost
Direct Costs												
Purchased Equipment Delivered		$ 1,256,445		$ 2,583,927		$ 1,817,733		$ 4,781,859		$ 855,271		$ 1,265,210
Freight	3%	$ 38,000	3%	$ 78,000	3%	$ 55,000	3%	$ 143,000	3%	$ 26,000	3%	$ 38,000
Tax	6%	$ 79,000	6%	$ 161,000	6%	$ 114,000	6%	$ 299,000	6%	$ 53,000	6%	$ 79,000
Purchased Equipment Installation	6%	$ 75,000	6%	$ 155,000	6%	$ 109,000	6%	$ 287,000	6%	$ 51,000	6%	$ 76,000
Instrumentation and Controls (Installed)	18%	$ 226,000	18%	$ 465,000	18%	$ 327,000	18%	$ 861,000	18%	$ 154,000	18%	$ 228,000
Piping (Installed)	16%	$ 201,000	16%	$ 413,000	16%	$ 291,000	16%	$ 765,000	16%	$ 137,000	16%	$ 202,000
Electrical Systems (Installed)	10%	$ 126,000	10%	$ 258,000	10%	$ 182,000	10%	$ 478,000	10%	$ 86,000	10%	$ 127,000
Buildings		$ 80,000		$ 80,000		$ 80,000		$ 160,000		$ 80,000		$ 80,000
Structural	18%	$ 226,000	18%	$ 465,000	18%	$ 327,000	18%	$ 861,000	18%	$ 154,000	18%	$ 228,000
Yard Improvements	10%	$ 126,000	10%	$ 258,000	10%	$ 182,000	10%	$ 478,000	10%	$ 86,000	10%	$ 127,000
Service Utilities (Installed)	30%	$ 377,000	30%	$ 775,000	30%	$ 545,000	30%	$ 1,435,000	30%	$ 257,000	30%	$ 380,000
Direct Cost Subtotal		**$ 2,810,445**		**$ 5,691,927**		**$ 4,029,733**		**$ 10,548,859**		**$ 1,939,271**		**$ 2,830,210**
Indirect Costs												
Engineering and Supervision	10%	$ 281,000	10%	$ 569,000	10%	$ 403,000	10%	$ 1,055,000	10%	$ 194,000	10%	$ 283,000
Construction Expenses	34%	$ 956,000	34%	$ 1,935,000	34%	$ 1,370,000	34%	$ 3,587,000	34%	$ 659,000	34%	$ 962,000
Legal Expenses	4%	$ 112,000	4%	$ 228,000	4%	$ 161,000	4%	$ 422,000	4%	$ 78,000	4%	$ 113,000
Contractor's Fee	15%	$ 422,000	15%	$ 854,000	15%	$ 604,000	15%	$ 1,582,000	15%	$ 291,000	15%	$ 425,000
Indirect Cost Subtotal		**$ 1,771,000**		**$ 3,586,000**		**$ 2,538,000**		**$ 6,646,000**		**$ 1,222,000**		**$ 1,783,000**
Contingency	30%	$ 1,374,000	30%	$ 1,076,000	30%	$ 761,000	30%	$ 5,158,000	30%	$ 948,000	30%	$ 1,384,000
Fixed-Capital Cost (FCC)		**$ 6,000,000**		**$ 10,400,000**		**$ 7,300,000**		**$ 22,400,000**		**$ 4,100,000**		**$ 6,000,000**
Annual O&M Costs												
Energy/Power	$ 2,675		$ 5,314		$ 68,480		$ 55,884		$ 6,420		$ 43,870	
Power Cost ($/kwh)	$ 0.0657		$ 0.0657		$ 0.0657		$ 0.0657		$ 0.0657		$ 0.0657	
Chemical	$ 300,048		$ 193,489		$ 593,339		$ 164,670		$ 2,116,655		$ -	
Equipment Maintenance	$ 108,956		$ 229,130		$ 169,270		$ 422,388		$ 66,708		$ 37,108	
Labor ($/year)	$ 312,000		$ 312,000		$ 312,000		$ 312,000		$ 312,000		$ 312,000	
Labor Rate ($/hr)	$ 50		$ 50		$ 50		$ 50		$ 50		$ 50	
Number of Operators	3		3		3		3		3		3	
Hours per Operator	8		8		8		8		8		8	
Days	5		5		5		5		5		5	
Weeks per year	52		52		52		52		52		52	
Ion Exchange Media	$ 20,000		$ -		$ -		$ -		$ -		$ -	
Hauling Disposal	$ 282,072		$ -		$ 282,072		$ -		$ -		$ -	
Contingency (%)	$ -		$ -		$ -		$ -		$ -		$ -	
Total Annual O&M Cost, $	$ 1,026,000		$ 740,000		$ 1,425,000		$ 955,000		$ 2,502,000		$ 393,000	
Total Present Worth of Annual O&M Costs $/yr	$ 8,400,000		$ 6,100,000		$ 11,600,000		$ 7,800,000		$ 20,300,000		$ 3,200,000	
Capital Cost, $:	$ 6,000,000		$ 10,400,000		$ 7,300,000		$ 22,400,000		$ 4,100,000		$ 6,000,000	
Total Present Worth Cost, $:	$ 14,400,000		$ 16,500,000		$ 18,900,000		$ 30,200,000		$ 24,400,000		$ 9,200,000	
Average Ammonia Removed , %	97%		95%		95%		55%		97%		22%	
Average Amount of Ammonia Removed, lb /day	331		324		324		188		331		77	
O&M Costs, $/ lb of Ammonia Removed	$ 8.50		$ 6.26		$ 12.05		$ 13.95		$ 20.72		$ 13.98	
Total Present Worth Cost, $/lb Ammonia Removed	**$ 11.93**		**$ 13.95**		**$ 15.98**		**$ 44.12**		**$ 20.21**		**$ 32.73**	