

ACUTE TOXICITY TEST

Pimephales promelas

DELAWARE RIVER BASIN COMMISSION

AAT JOB # 123-01-17

WHITE CLAY CREEK

REPORT PREPARED BY:

AMERICAN AQUATIC TESTING, INC.

890 NORTH GRAHAM STREET

ALLENTOWN, PA 18109

BIOMONITORING REPORT FORM: ACUTE TOXICITY

NJPDES #: N/A White Clay Creek / Flowback

FACILITY NAME: Delaware River Basin Commission
25 State Police Drive, P.O. Box 7360

FACILITY LOCATION: West Trenton, N.J. 08628-0360

LABORATORY: American Aquatic Testing, Inc.

ACUTE TOXICITY CERTIFICATION NUMBER: PA682

TEST SPECIFICATIONS:

EFFLUENT TYPE: Flowback
TEST TYPE: Static Daily Renewal

TEST RESULTS:

Test start date: 07/17/12 Test completion date: 07/21/12

Test endpoint (check one): LC₅₀ NMAT EC₅₀

LC ₅₀ / EC ₅₀ :	0.97%
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Highest % mortality in any test concentration (if applicable): 100%

Test concentration: 2%

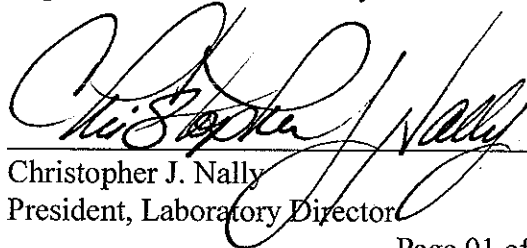
Test organism: *Pimephales promelas* Fathead minnow
(scientific name) (common name)

QUALITY CONTROL SUMMARY:

Control mortality: 0%
Temperature maintained at 20 + / 2 ° C? Yes
Dissolved O₂ levels always > than 40 % saturation? Yes
Two or more concentrations exhibit a trend deviation? No
Were there any deviations from specified methodologies? No

CERTIFICATION:

Report certified for accuracy:


Christopher J. Nally
President, Laboratory Director

08/01/12
Date

TEST ORGANISM DATA:

Test organism source:

Cultured: _____ Commercial hatchery: X
(ABS, Inc.)

TEST ORGANISM ACCLIMATION

Is the culture water and test dilution water the same and are the culture water temp and dilution water temp the same? No
If yes, proceed to Test Design Section

Fish and Grass shrimp

INITIAL NUMBER OF ORGANISMS: 300
TOTAL ACCLIMATION PERIOD: 0 DAYS 0 HOURS
ACCLIMATION PERIOD TO 100% DILUTION WATER AT SPECIFIED TEST TEMPERATURE (HRS): N/A
OF MORTALITIES (48 HRS PRIOR TO TEST): N/A
TEST ORGANISM AGE AT START OF TEST (DAYS): 9

Mysids and Daphnids

INITIAL NUMBER OF ORGANISMS: N/A
TEST ORGANISM AGE AT START OF TEST (DAYS): N/A
CULTURE WATER SOURCE: N/A
CULTURE WATER SALINITY: N/A
CULTURE WATER TEMPERATURE: N/A
DILUTION WATER SOURCE: N/A
DILUTION WATER SALINITY UPON COLLECTION: N/A
OF MORTALITIES: N/A

TEST DESIGN:

OF EFFLUENT CONCENTRATIONS: 05
OF REPLICATES / CONCENTRATION: 02
OF TEST ORGANISMS / REPLICATE: 10
VOLUME OF TEST CHAMBERS (LITERS): 1.0
FLOW-THROUGH BIOASSAY EXCHANGE RATE; #/DAY: N/A

EFFLUENT SAMPLING:

PLANT SAMPLING LOCATION: Flowback water from natural gas drilling operation
EFFLUENT TYPE: untreated
DISCHARGE (check one): Continuous ___ Intermittent ___
EFFLUENT SAMPLE TYPE: grab sample
MAXIMUM HOLDING TIME: N/A
TESTING LOCATION: On-site ___ Remote laboratory X

Beginning Date & Time	Ending Date & Time	Dissolved Oxygen (ppm)	pH (Std. Units)	Use Date	Time
07/16/12 1045	07/16/12 1045	N/A	4.9	07/17-20/12	1900

EFFLUENT SAMPLE ADJUSTMENTS

ARE SALINITY ADJUSTMENTS ANTICIPATED? No
IF YES, SPECIFY SOURCE OF SALT, BRINE OR WATER USED: N/A

WERE ANY pH ADJUSTMENTS MADE? No
IF YES, SPECIFY REAGENT USED AND AMOUNT: N/A
THE pH LEVEL UPON SAMPLE COLLECTION (INITIAL pH): N/A
THE pH LEVEL AFTER THE ADDITION OF SEA SALTS (DRIFTED pH): N/A
THE ADJUSTED pH LEVEL: N/A

SAMPLE FILTERED: NO IF YES, MESH SIZE (MM): N/A

WERE ANY ADJUSTMENTS TO THE CHLORINE LEVELS MADE? No
IF YES, SPECIFY REAGENT TO BE USED AND THE AMOUNT: N/A
WAS AN ADDITIONAL CONTROL INCLUDED IN THE TEST
CONTAINING THE REAGENT? N/A

DILUTION WATER:

EFFLUENT RECEIVING WATER: White Clay Creek
DILUTION WATER SOURCE: N/A
IF SUBSTITUTE DILUTION WATER WAS USED, HAS ITS USE
BEEN APPROVED BY THE NJDEP IN THE METH. QUESTIONNAIRE? N/A
COLLECTION LOCATION: N/A
COLLECTION DATES: 07/15/12

BIOASSAY RESULTS:

Time	24 hour	48 hour	72 hour	96 hour
LC ₅₀ /EC ₅₀ (% effluent)				0.97% x

CALCULATION METHOD: PROBIT METHOD X
GRAPHICAL INTERPOLATION —
VISUAL INSPECTION —
TRIMMED SPARMAN-KARBER —

NOTE: Attach the statistical printouts used to determine the LC₅₀/EC₅₀ value and the mortality data sheets

Is the calculated LC₅₀/EC₅₀ valid according to the specifications of the method used? Yes

MISCELLANEOUS:

Were any exposure chambers aerated during the test? No

If yes, specify conc., duration, & lowest % saturation reached prior to aeration & the time: N/A

Were test organisms observed for appearance & behavior at least daily? Yes

NOTE: Attach a copy of the acute toxicity test bench sheets with coded observations for each day.

NOTE: Attach a copy of the raw data sheets for physical-chemical measurements taken during the test during to the report form.

Acute Test

American Aquatic Testing, Inc.

Job #: 123-01-17
 Species: P. promelas
 Hatch Date: 7-9-12

Start Date & Time: 7-17-12 1900
 End Date & Time: 7-21-12 1900
 Dilution Water: White Clay Creek

WHITE CLAY

Concentration %	Rep.	Live Count					Appearance & Behavior				
		0 hr.	24 hr.	48 hr.	72 hr.	96 hr.	0 hr.	24 hr.	48 hr.	72 hr.	96 hr.
Control	A	10	10	10	10	10					
	B	10	10	10	10	10					
0.25	A	10	10	10	10	9					
	B	10	10	10	9	9					
0.5	A	10	10	10	8 ²	8					
	B	10	10	10	9	7 ²				3	3,2
1.0	A	10	10	9	8	6 ²				3	3,2
	B	10	10	10	8 ²	8				3	3,2
2.0	A	10	10	7 ³	3 ⁴	2 ¹				3	3,2
	B	10	10	5 ⁵	1 ⁴	1				3	3,2
4.0	A	10	0 ¹⁰	-	-	-				3	3,2
	B	8	1 ⁹	0	-	-				-	-
Initials											
Date											

Observation Key: 1-Normal, 2-Inactive, 3-Irritated, 4-Surfacing, 5-Abnormal body orientation, 6-Abnormal skin color, 7-Abnormal skin condition, 8-Abnormal respiration

Weight and Length Data			
Length in Millimeters		Weight in Grams	
1	7	11	6
2	10	12	7
3	7	13	7
4	8	14	8
5	8	15	8
6	8	16	7
7	9	17	8
8	7	18	6
9	10	19	7
10	7	20	7
1	0.00508	11	0.00149
2	0.00209	12	0.00250
3	0.00505	13	0.00204
4	0.00319	14	0.00171
5	0.00146	15	0.00216
6	0.00175	16	0.00255
7	0.00349	17	0.00152
8	0.00246	18	0.00189
9	0.00548	19	0.00173
10	0.0061	20	0.00219
Initials		MMP	
Date		7-21	

Loss 97%

Chamber Volume (L): 0.5 Average Weight (g): 0.00257 Standard Dev.: 0.00026
 Loading Factor (g/L): 0.0514
 Length of Shortest Fish (mm): 6 Length of Longest Fish (mm): 10
 Mean Length (mm): 7.6 Standard Deviation: 1.095

Freshwater Acute Test

Job #: 123-01-17

American Aquatic Testing, Inc.

Start Date & Time: 7-17-12 1100

Species: P. promelas

End Date & Time: 7-21-12 1900

Dilution Water: White Clay Creek

Test Type: 96 hr. SDR

Concentration %	Rep.	Dissolved Oxygen (mg/L)					Temperature (C)				
		0 hr.	24 hr.	48 hr.	72 hr.	96 hr.	0 hr.	24 hr.	48 hr.	72 hr.	96 hr.
Control	A	10.3	8.6	8.3	8.6	8.3	20.5	21.0	21.0	21.0	20.0
	B	10.3	8.6	8.3	8.6	8.3	20.5	21.0	21.0	21.0	20.0
0.25	A	10.2	8.6	8.3	8.6	8.2	20.5	21.0	21.0	21.0	20.0
	B	10.2	8.6	8.3	8.7	8.2	20.5	21.0	21.0	21.0	20.0
0.5	A	10.1	8.6	8.3	8.7	8.3	20.5	21.5	21.0	21.0	20.0
	B	10.1	8.6	8.3	8.8	8.2	20.5	21.5	21.0	21.0	20.0
1.0	A	10.1	8.6	8.4	8.8	8.1	20.5	21.5	21.0	21.0	20.0
	B	10.1	8.6	8.4	8.8	8.0	20.5	21.5	21.0	21.0	20.0
2.0	A	10.1	8.5	8.4	8.7	8.1	20.5	21.5	21.0	21.0	20.0
	B	10.1	8.6	8.4	8.7	8.0	20.5	21.5	21.0	21.0	20.0
4.0	A	10.1	8.4	-	-	-	20.5	21.0	-	-	-
	B	10.1	8.7	7.7	-	-	20.5	21.5	21.0	-	-
Initials		JTAP	MTF	JMTF	MTF	MP	JTAP	MTF	JMTF	MTF	MP
Date		7/17	7-18	7/19	7-20	7-21	7/17	7-18	7/19	7-20	7-21

Concentration %	pH (std units)					Conductivity (umhos)				
	0 hr.	24 hr.	48 hr.	72 hr.	96 hr.	0 hr.	24 hr.	48 hr.	72 hr.	96 hr.
Control	7.7	7.8	7.9	7.9	8.0	192	196	194	193	190
0.25	7.6	7.7	7.7	7.9	7.9	896	1190	968	961	913
0.5	7.6	7.5	7.7	7.7	7.8	2045	2577	1903	1902	1822
1.0	7.5	7.4	7.6	7.6	7.8	3369	4785	3468	3511	3416
2.0	7.4	7.3	7.5	7.5	7.6	6430	8960	6510	6580	6360
4.0	7.2	7.1	7.4	-	-	12350	17070	16980	-	-
Initials	JTAP	MTF	JMTF	MTF	MP	JTAP	MTF	JMTF	MTF	MP
Date	7/17	7-18	7/19	7-20	7-21	7/17	7-18	7/19	7-20	7-21

Concentration	Alkalinity (mg/L)					Hardness (mg/L)				
	0 hr.	24 hr.	48 hr.	72 hr.	96 hr.	0 hr.	24 hr.	48 hr.	72 hr.	96 hr.
Control	80					90				
100%	80					2490				
Initials	JKAK					JKAK				
Date	7/17					7/17				

Concentration	Chlorine (mg/L)			
	Sample 1	Sample 2	Sample 3	Sample 4
Control	0.00			
100%	0.02			
Initials	JKAK			
Date	7/17			

Observations: ① Readings done for total alkalinity at 7-18-12

Acute Fish Test-96 Hr Survival

Start Date: 7/17/2012	Test ID: 1230117ppw	Sample ID: White Clay & Flowback
End Date: 7/21/2012	Lab ID: AAT, INC.	Sample Type: GRAB
Sample Date:	Protocol: EPAA 91-EPA/600/4-90/027F	Test Species: PP-Pimephales promelas

Comments:

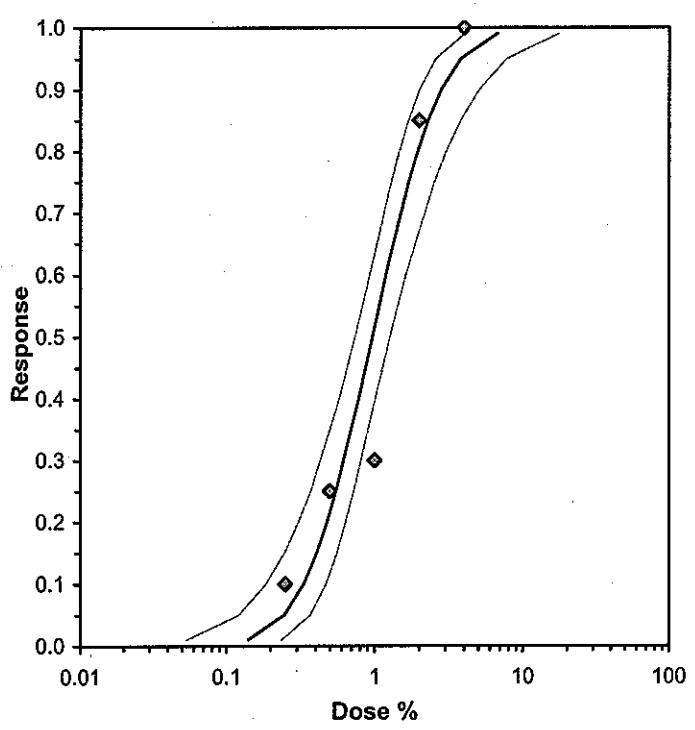
Conc-%	1	2
White Clay	1.0000	1.0000
0.25	0.9000	0.9000
0.5	0.8000	0.7000
1	0.6000	0.8000
2	0.2000	0.1000
4	0.0000	0.0000

Conc-%	Mean	N-Mean	Transform: Arcsin Square Root					N	Number Resp	Total Number
			Mean	Min	Max	CV%				
White Clay	1.0000	1.0000	1.4120	1.4120	1.4120	0.000	2	0	20	
0.25	0.9000	0.9000	1.2490	1.2490	1.2490	0.000	2	2	20	
0.5	0.7500	0.7500	1.0492	0.9912	1.1071	7.818	2	5	20	
1	0.7000	0.7000	0.9966	0.8861	1.1071	15.685	2	6	20	
2	0.1500	0.1500	0.3927	0.3218	0.4636	25.550	2	17	20	
4	0.0000	0.0000	0.1588	0.1588	0.1588	0.000	2	20	20	

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Normality of the data set cannot be confirmed				
Equality of variance cannot be confirmed				

Parameter	Value	SE	95% Fiducial Limits		Maximum Likelihood-Probit						
			Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter		
Slope	2.7629	0.44896	1.88295	3.64285	0	5.94683	7.81472	0.11	-0.0129	0.36194	3
Intercept	5.03577	0.15581	4.73037	5.34116							

Point	Probits	%	95% Fiducial Limits	
EC01	2.674	0.13966	0.05344	0.2351
EC05	3.355	0.24644	0.12072	0.36843
EC10	3.718	0.33359	0.18524	0.47106
EC15	3.964	0.40919	0.24619	0.55848
EC20	4.158	0.48133	0.30745	0.64187
EC25	4.326	0.55326	0.37062	0.726
EC40	4.747	0.78588	0.57966	1.01381
EC50	5.000	0.97063	0.74137	1.2682
EC60	5.253	1.19881	0.92899	1.61922
EC75	5.674	1.70286	1.30001	2.52721
EC80	5.842	1.95736	1.47119	3.04481
EC85	6.036	2.3024	1.69162	3.8007
EC90	6.282	2.82421	2.00637	5.04918
EC95	6.645	3.82288	2.56626	7.74473
EC99	7.326	6.74606	4.02305	17.4887



ACUTE TOXICITY TEST

Ceriodaphnia dubia

DELAWARE RIVER BASIN COMMISSION
AAT JOB # 123-01-17

WHITE CLAY CREEK

REPORT PREPARED BY:

AMERICAN AQUATIC TESTING, INC.
890 NORTH GRAHAM STREET
ALLENTOWN, PA 18109

BIOMONITORING REPORT FORM: ACUTE TOXICITY

NJPDES #: N/A White Clay Creek / Flowback

FACILITY NAME: Delaware River Basin Commission
25 State Police Drive, P.O. Box 7360

FACILITY LOCATION: West Trenton, N.J. 08628-0360

LABORATORY: American Aquatic Testing, Inc.

ACUTE TOXICITY CERTIFICATION NUMBER: PA682

TEST SPECIFICATIONS:

EFFLUENT TYPE: Flowback
TEST TYPE: Static Daily Renewal

TEST RESULTS:

Test start date: 07/17/12 Test completion date: 07/19/12

Test endpoint (check one): LC₅₀ X NMAT EC₅₀

LC ₅₀ :	1.0%
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Highest % mortality in any test concentration (if applicable): 100%

Test concentration: 2.0, 4.0%

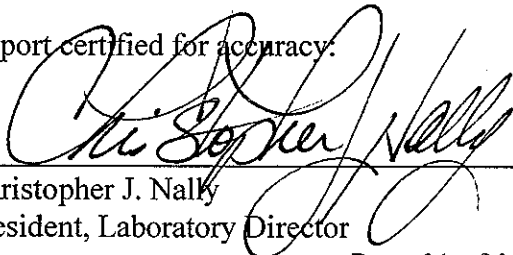
Test organism: Ceriodaphnia dubia Water flea
(scientific name) (common name)

QUALITY CONTROL SUMMARY:

Control mortality: 00%
Temperature maintained at 20 + / 2 ° C? Yes
Dissolved O₂ levels always > than 40 % saturation? Yes
Two or more concentrations exhibit a trend deviation? No
Were there any deviations from specified test methodologies? No

CERTIFICATION:

Report certified for accuracy:



Christopher J. Nally
President, Laboratory Director

08/01/12

Date

TEST ORGANISM DATA:

Test organism source:

Cultured: Commercial hatchery:
(specify)

TEST ORGANISM ACCLIMATION

Is the culture water and test dilution water the same and are the culture water temp and dilution water temp the same? No

If yes, proceed to Test Design Section

Fish and Grass shrimp

INITIAL NUMBER OF ORGANISMS: N/A
TOTAL ACCLIMATION PERIOD: N/A
ACCLIMATION PERIOD TO 100% DILUTION WATER
AT SPECIFIED TEST TEMPERATURE (HRS): N/A
OF MORTALITIES (48 HRS PRIOR TO TEST): N/A
TEST ORGANISM AGE AT START OF TEST (DAYS): N/A

Mysids and Daphnids

INITIAL NUMBER OF ORGANISMS: 300
TEST ORGANISM AGE AT START OF TEST (HOURS): <24
CULTURE WATER SOURCE: Moderately hard recon water
CULTURE WATER SALINITY: N/A
CULTURE WATER TEMPERATURE: 20.0
DILUTION WATER SOURCE: White Clay Creek
DILUTION WATER SALINITY UPON COLLECTION: N/A
OF MORTALITIES: N/A

TEST DESIGN:

OF EFFLUENT CONCENTRATIONS: 05
OF REPLICATES / CONCENTRATION: 02
OF TEST ORGANISMS / REPLICATE: 10
VOLUME OF TEST CHAMBERS (LITERS): 0.25
FLOW-THROUGH BIOASSAY EXCHANGE RATE; #/DAY: N/A

EFFLUENT SAMPLING:

PLANT SAMPLING LOCATION: Flowback water from natural gas drilling operation
EFFLUENT TYPE: untreated
DISCHARGE (check one): Continuous ___ Intermittent ___
EFFLUENT SAMPLE TYPE: grab sample
MAXIMUM HOLDING TIME: N/A
TESTING LOCATION: On-site ___ Remote laboratory X

Beginning Date & Time	Ending Date & Time	Dissolved Oxygen (ppm)	pH (Std. Units)	Use Date	Time
07/16/12 1045	07/16/12 1045	N/A	4.9	07/17-18/12	1800

EFFLUENT SAMPLE ADJUSTMENTS

ARE SALINITY ADJUSTMENTS ANTICIPATED? No
 IF YES, SPECIFY SOURCE OF SALT, BRINE OR WATER USED: N/A

WERE ANY pH ADJUSTMENTS MADE? No
 IF YES, SPECIFY REAGENT USED AND AMOUNT: N/A
 THE pH LEVEL UPON SAMPLE COLLECTION (INITIAL pH): N/A
 THE pH LEVEL AFTER THE ADDITION OF SEA SALTS (DRIFTED pH): N/A
 THE ADJUSTED pH LEVEL: N/A

SAMPLE FILTERED: NO IF YES, MESH SIZE (MM): N/A

WERE ANY ADJUSTMENTS TO THE CHLORINE LEVELS MADE? No
 IF YES, SPECIFY REAGENT TO BE USED AND THE AMOUNT: N/A
 WAS AN ADDITIONAL CONTROL INCLUDED IN THE TEST
 CONTAINING THE REAGENT? N/A

DILUTION WATER:

EFFLUENT RECEIVING WATER: White Clay Creek
 DILUTION WATER SOURCE: N/A
 IF SUBSTITUTE DILUTION WATER WAS USED, HAS ITS USE
 BEEN APPROVED BY THE NJDEP IN THE METH. QUESTIONNAIRE? N/A

COLLECTION LOCATION: N/A

COLLECTION DATES: 07/15/12

BIOASSAY RESULTS:

Time	24 hour	48 hour	72 hour	96 hour
LC ₅₀ (% effluent)		1.0 x		

CALCULATION METHOD: PROBIT METHOD —
 GRAPHICAL —
 SPEARMAN-KARBER X
 TRIMMED SPEARMAN-KARBER —
 VISUAL —

NOTE: Attach the statistical printouts used to determine the LC₅₀/EC₅₀ value and the mortality data sheets

Is the calculated LC₅₀/EC₅₀ valid according to the specifications of the method used? Yes

MISCELLANEOUS:

Were any exposure chambers aerated during the test? No

If yes, specify conc., duration & the time: N/A

Were test organisms observed for appearance & behavior at least daily? Yes

NOTE: Attach a copy of the acute toxicity test bench sheets with coded observations for each day.

NOTE: Attach a copy of the raw data sheets for physical-chemical measurements taken during the test to the report form.

Acute Test

American Aquatic Testing, Inc.

Job #: 123-01-17
 Species: C. dubia
 Hatch Date: 7-17-12

WHITE
CLAY

Start Date & Time: 7-17-12 1800
 End Date & Time: 7-19-12 1700
 Dilution Water: White Clay Creek

Concentration %	Rep.	Live Count					Appearance & Behavior				
		0 hr.	24 hr.	48 hr.	72 hr.	96 hr.	0 hr.	24 hr.	48 hr.	72 hr.	96 hr.
Control	A	10	10	10			1	1	1		
	B	10	10	10			1	1	1		
0.25	A	10	10	10			1	1	1		
	B	10	10	10			1	1	1		
0.5	A	10	10	10			1	1	1		
	B	10	10	10			1	1	1		
1.0	A	10	6 ⁴	5 ¹			1	3	3		
	B	10	6 ⁴	5 ¹			1	3	3		
2.0	A	10	0 ⁰	-			1	-	-		
	B	10	0 ⁰	-			1	-	-		
4.0	A	10	0 ⁰	-			1	-	-		
	B	10	0 ⁰	-			1	-	-		
Initials		<u>WOK</u>	<u>MMF</u>	<u>MMF</u>			<u>WOK</u>	<u>MMF</u>	<u>MMF</u>		
Date		<u>7-17</u>	<u>7-18</u>	<u>7-19</u>			<u>7-17</u>	<u>7-18</u>	<u>7-19</u>		

Observation Key: 1-Normal, 2-Inactive, 3-Irritated, 4-Surfacing, 5-Abnormal body orientation, 6-Abnormal skin color, 7-Abnormal skin condition, 8-Abnormal respiration

Weight and Length Data			
Length in Millimeters		Weight in Grams	
1	_____	11	_____
2	_____	12	_____
3	_____	13	_____
4	_____	14	_____
5	_____	15	_____
6	_____	16	_____
7	_____	17	_____
8	_____	18	_____
9	_____	19	_____
10	_____	20	_____

Initials _____
 Date _____

1.0
 LC50 86%

Chamber Volume (L): _____ Average Weight (g): _____ Standard Dev.: _____
 Loading Factor (g/L): _____
 Length of Shortest Fish (mm): _____ Length of Longest Fish (mm): _____
 Mean Length (mm): _____ Standard Deviation: _____

Freshwater Acute Test

American Aquatic Testing, Inc.

Job #: 123-01-17

Time
Start Date: 7-17-12 1800

Species: C. dubia

End Date
Start Time: 7-19-12 1700

Dilution Water: White Clay Creek

Test Type: 48 hr. SNR

Concentration <i>0%</i>	Rep.	Dissolved Oxygen (mg/L)			Temperature (C)			Live Count			
		0 hr.	24 hr.	48 hr.	0 hr.	24 hr.	48 hr.	0 hr.	24 hr.	48 hr.	
Control	A	10.3	8.9	8.7	20.5	20.0	20.5	/			
	B										
0.25	A	10.2	8.9	8.6	20.5	20.0	20.5				
	B										
0.5	A	10.1	8.8	8.6	20.5	20.0	20.5				
	B										
1.0	A	10.1	8.7	8.6	20.5	20.0	20.5				
	B										
2.0	A	10.1	8.80	-	20.5	20.00	-				
	B										
4.0	A	10.1	8.90	-	20.5	20.00	-				
	B										
Initials		JTAP	MTF	WML	JTAP	MTF	WML				
Date		7/17	7-18	7/19	7/17	7-18	7/19				

Concentration	Alkalinity (mg/L)			Hardness (mg/L)			Chlorine (mg/L)
	0 hr.	24 hr.	48 hr.	0 hr.	24 hr.	48 hr.	Sample 1
Control	80			90			0.00
100%	80			2490			0.02
Initials	JTAP			JTAP			KAK
Date	7/17			7/17			7/17

Concentration <i>0%</i>	pH (std units)			Conductivity (umhos)		
	0 hr.	24 hr.	48 hr.	0 hr.	24 hr.	48 hr.
Control	7.7	8.1	8.2	192	194	239
0.25	7.6	8.0	8.0	896	894	905
0.5	7.6	7.9	8.0	2045	2049	2074
1.0	7.5	7.8	8.0	3369	3385	3437
2.0	7.4	7.70	-	6430	64700	-
4.0	7.2	7.50	-	12350	124300	-
Initials	JTAP	MTF	WML	JTAP	MTF	WML
Date	7/17	7-18	7/19	7/17	7-18	7/19

Observations: ① Readings done due to total alkalinity - MTF 7-18

Acute Fish Test-48 Hr Survival

Start Date: 7/17/2012 Test ID: 1230117cdw Sample ID: White Clay & Flowback
 End Date: 7/19/2012 Lab ID: AAT, INC. Sample Type: GRAB
 Sample Date: Protocol: EPAA 91-EPA/600/4-90/027F Test Species: Ceriodaphnia dubia

Comments:

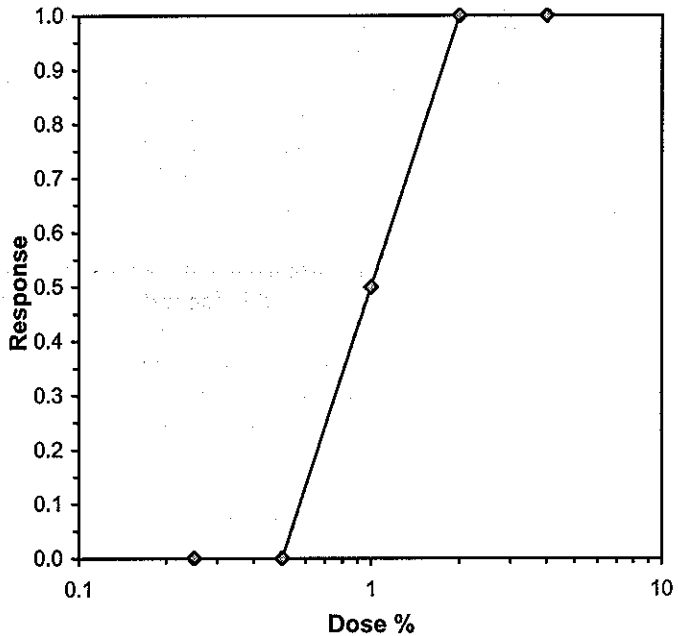
Conc-%	1	2
White Clay	1.0000	1.0000
0.25	1.0000	1.0000
0.5	1.0000	1.0000
1	0.5000	0.5000
2	0.0000	0.0000
4	0.0000	0.0000

Conc-%	Mean	N-Mean	Transform: Arcsin Square Root					N	Number Resp	Total Number
			Mean	Min	Max	CV%				
White Clay	1.0000	1.0000	1.4120	1.4120	1.4120	0.000	2	0	20	
0.25	1.0000	1.0000	1.4120	1.4120	1.4120	0.000	2	0	20	
0.5	1.0000	1.0000	1.4120	1.4120	1.4120	0.000	2	0	20	
1	0.5000	0.5000	0.7854	0.7854	0.7854	0.000	2	10	20	
2	0.0000	0.0000	0.1588	0.1588	0.1588	0.000	2	20	20	
4	0.0000	0.0000	0.1588	0.1588	0.1588	0.000	2	20	20	

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Normality of the data set cannot be confirmed				
Equality of variance cannot be confirmed				

Trimmed Spearman-Kärber

Trim Level	EC50	95% CL	
0.0%	1.0000	0.8564	1.1676
5.0%	1.0000	0.8418	1.1879
10.0%	1.0000	0.8239	1.2138
20.0%	1.0000	0.7723	1.2948
Auto-0.0%	1.0000	0.8564	1.1676



**NJPDES BIOMONITORING REPORT FORM
FRESHWATER CHRONIC TOXICITY TEST**

NJPDES #: N/A White Clay Creek / Flowback
FACILITY NAME: Delaware River Basin Commission
25 State Police Drive, P.O. Box 7360
FACILITY LOCATION: West Trenton, N.J. 08628-0360
LABORATORY: American Aquatic Testing, Inc.
ACUTE TOXICITY CERTIFICATION NUMBER: PA682

SRT INFORMATION	DATE:	July 17, 2012	IC ₂₅ :	554.8 ppm
	CONTROL CHART		UCL:	638.0 ppm
	MEAN:	588.7 ppm	LCL:	539.4 ppm

TEST START DATE: July 24, 2012 TEST END DATE: July 31, 2012

TEST TYPE AND RESULTS (Check applicable test, circle applicable endpoint and fill in NOEC &/or IC₂₅)

X Fathead minnow, NOEC 0.062% (growth) IC₂₅ 0.08%
PMSD 16.4%

Method 1000.0 (*Pimephales promelas* 7 day Larval Survival and Growth Test)


 Cladoceran, (CN/CD) NOEL , IC₂₅

Method 1002.0 (*Ceriodaphnia dubia* 3 brood Survival and Reproduction Test)

CONTROL MORTALITY: 5%

Did the test meet the acceptability criteria for the test species as specified in Part III of the Chronic Methods Document? YES

ACCURACY OF REPORT CERTIFIED BY:



Christopher J. Nally
President, Laboratory Director

08/01/12
Date

TEST DESIGN

NUMBER OF CONCENTRATIONS: 05
 NUMBER OF REPLICATES / CONCENTRATION: 04
 NUMBER OF TEST ORGANISMS / REPLICATE: 10
 DILUTION SERIES: 0.5
 TEST VESSEL SIZE: 1.0 L
 TEST SOLUTION VOLUME: 500 mL
 EXPLAIN ANY DEVIATIONS FROM SPECIFIED METHODS; N/A

EFFLUENT SAMPLING

SAMPLE LOCATION: Flowback water from natural gas drilling operation
 EFFLUENT TYPE: untreated
 DISCHARGE: N/A
 RETENTION TIME: N/A
 SAMPLE TYPE: composite _____ Other x ,
 (Grab)

Sample Collection		Sample Data taken upon arrival at laboratory		Use in Toxicity Test	
Beginning Date & Time	Ending Date & Time	Dissolved Oxygen (ppm)	pH (Std. Units)	Date(s)	Time(s)
07/16/12, 1045	07/16/12, 1045	N/A	4.9	07/17-22/12	1630+/- 1 hr

Maximum holding time for any effluent sample: N/A

Describe any pretreatment of the effluent: N/A

TESTING LOCATION

REMOTE LABORATORY X
 ON-SITE LABORATORY
 ON-SITE COMMERCIAL LABORATORY

DILUTION WATER

EFFLUENT RECEIVING WATER: N/A
 DILUTION WATER: White Clay Creek
 DESCRIBE ANY ADJUSTMENT TO THE DILUTION WATER: N/A
 IF RECEIVING WATER IS USED AS DILUTION SOURCE, DESCRIBE COLLECTION LOCATION AND DATES OF COLLECTION: 07/15/12

Client/Toxicant: 123
 Project Number: 01-17R
 Species: P. promelas

White
Clay Creek

Beginning Date & Time: 7-29-12 1630
 Ending Date & Time: 7/31/12 1530
 Hatch Date: 7-23-12

Chronic Test
American Aquatic Testing, Inc.
Live Count

Conc.	Rep	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Control	A	10	10	10	10	9	9	9	9
	B	10	10	10	10	10	10	10	10
	C	10	10	10	9	9	9	9	9
	D	10	10	10	10	10	10	10	10
0.015%	A	10	10	10	10	10	10	10	10
	B	10	10	10	10	10	10	10	10
	C	10	10	10	10	10	10	10	10
	D	10	10	10	10	10	10	10	10
0.031%	A	10	10	10	10	10	10	10	10
	B	10	10	10	10	10	10	10	10
	C	10	10	10	10	10	10	10	10
	D	10	10	10	10	10	10	10	10
0.062%	A	10	10	10	10	10	10	10	10
	B	10	9	9	9	9	9	9	9
	C	10	10	9	9	9	9	9	9
	D	10	10	10	10	10	10	9	9
0.125%	A	10	10	9	9	5	5	5	5
	B	10	10	9	9	7	6	4	4
	C	10	10	10	10	8	7	5	3
	D	10	10	10	9	5	3	2	2
0.250%	A	10	10	8	6	3	1	1	1
	B	10	10	9	5	3	2	2	2
	C	10	10	8	6	3	0	1	1
	D	10	10	6	5	1	0	1	1
	A								
	B								
	C								
	D								
Initials	MMK	MMK	MMK	MMK	MMK	MMK	MMK	MMK	MMK
Date	7-29	7-29	7-29	7-30	7-30	7-30	7-31	7-31	7-31

Observations: 0.0829

Client/Toxicant: 123
 Project Number: 01-17R
 Species: P. promelas

White Clay
Creek

Beginning Date & Time: 7-24-12 1630
 Ending Date & Time: 7/31/12 1530
 Hatch Date: 7-23-12

Chronic Test
 American Aquatic Testing, Inc.
 Weight Data

QC
0.01305

% Conc.	Rep	Pan #	A weight of boat (g)	B weight of boat & fish (g)	(B-A)*1000=C dry weight of fish (mg)	D # of surviving fish	C/D mean dry weight (mg)	C/E IC ₂₅ & NOEC calc. weight (mg)
Control	A	1	0.01196	0.01626	4.30	9	0.478	0.430
	B	2	0.01319	0.01769	4.50	10	0.450	0.450
	C	3	0.01373	0.01781	4.08	9	0.453	0.408
	D	4	0.01394	0.01800	4.06	10	0.406	0.406
0.015	A	5	0.01313	0.01764	4.51	10		0.451
	B	6	0.01247	0.01658	4.11	10		0.411
	C	7	0.01409	0.01819	4.10	10		0.410
	D	8	0.01390	0.01771	3.81	9		0.381
0.031	A	9	0.01192	0.01544	3.52	10		0.352
	B	10	0.01317	0.01820	5.03	10		0.503
	C	11	0.01434	0.01818	3.84	10		0.384
	D	12	0.01379	0.01784	4.05	10		0.405
0.062	A	13	0.01272	0.01679	3.87	10		0.407
	B	14	0.01296	0.01683	3.87	9		0.387
	C	15	0.01337	0.01762	4.25	9		0.425
	D	16	0.01318	0.01715	3.97	9		0.397
0.125	A	17	0.01092	0.01279	1.87	5		0.187
	B	18	0.01238	0.01410	1.72	4		0.172
	C	19	0.01270	0.01417	1.47	5		0.147
	D	20	0.01256	0.01326	0.70	2		0.070
0.250	A	21	0.01123	0.01174	0.51	1		0.051
	B	22	0.01137	0.01214	0.77	2		0.077
	C	—	—	—	—	—	—	—
	D	—	—	—	—	—	—	—
/	A							
	B							
	C							
	D							
Initials		thd	thd	thd	thd	thd	thd	thd
Date		7/31/12	8/1/12	8/1/12	8/1/12	8/1/12	8/1/12	8/1/12

QC
0.01301

QC
0.0

E = Original number of organisms at test initiation, adjusted for losses.

Observations: ① 4.07

Date/Time In: 7/31/12 1530
Temp: 110°

Date/Time Out: 8/1/12 5:00
Temp: 104°

Client/Toxicant: 123
 Job Number: 01-17R
 Species: P. promelas

White Clay Creek

Beginning Date & Time: 7-24-12 1630
 Ending Date & Time: 7/31/12 1530

Freshwater Chronic Test
 American Aquatic Testing, Inc.,
 Physical / Chemical Parameters
 Initial Readings

Parameter	Concentration	Day							
		1	2	3	4	5	6	7	8
Dissolved Oxygen (mg/L)	Control	77	7.7	78	77	83	78	75	
	0.015%	77	7.7	78	77	83	78	7.5	
	0.031%	77	7.8	77	77	83	78	7.5	
	0.062%	77	7.8	77	77	82	78	7.5	
	0.125%	77	7.8	77	77	82	78	7.5	
	0.250%	77	7.8	77	77	82	78	7.5	
pH	Control	77	7.6	78	77	77	78	7.8	
	0.015%	77	7.6	7.6	7.6	77	77	7.8	
	0.031%	77	7.6	7.5	7.6	7.6	77	7.8	
	0.062%	77	7.6	7.5	7.6	7.6	77	7.8	
	0.125%	77	7.6	7.4	7.5	7.6	7.6	7.8	
	0.250%	76	7.5	7.4	7.4	7.5	7.5	7.7	
Initials		WV	MVF	WV	WV	WV	WV	TAP	
Date		7/24	7/25	7/26	7/27	7/28	7/29	7/30	

Final Readings

Parameter	Concentration	Day							
		1	2	3	4	5	6	7	8
Temp °C	Control	24.5	25.0	25.0	25.5	25.0	25.0	25.5	
	0.015%	24.5	25.0	25.0	25.5	25.5	25.0	25.5	
	0.031%	24.5	25.0	25.0	25.5	25.5	25.0	25.5	
	0.062%	25.0	25.0	25.0	25.5	25.5	25.0	25.5	
	0.125%	25.0	25.0	25.0	25.5	25.5	25.0	25.5	
	0.250%	25.0	25.0	25.0	25.5	25.5	25.0	25.5	
Dissolved Oxygen (mg/L)	Control	7.2	7.2	7.2	7.0	7.2	7.1	6.9	
	0.015%	7.1	7.3	7.2	6.9	7.9	7.0	7.0	
	0.031%	7.1	7.3	7.2	6.8	7.1	7.0	6.8	
	0.062%	7.3	7.2	7.1	6.9	7.0	6.9	6.8	
	0.125%	7.0	7.2	7.0	7.1	7.0	7.0	6.5	
	0.250%	7.0	7.2	6.9	7.0	7.2	7.3	6.7	
pH	Control	8.0	8.0	7.9	7.9	7.9	7.9	7.9	
	0.015%	7.9	8.0	7.7	7.9	7.9	7.9	7.9	
	0.031%	7.9	7.9	7.7	7.8	7.8	7.9	7.8	
	0.062%	7.9	7.9	7.6	7.8	7.8	7.9	7.8	
	0.125%	7.8	7.9	7.5	7.7	7.7	7.9	7.7	
	0.250%	7.8	7.8	7.5	7.6	7.7	7.9	7.7	
Initials		WV	MVF	WV	KAK	KAK	TAP	MFP	
Date		7/25	7/26	7/27	7/28	7/29	7/30	7/31	

Conductivity (umhos/cm)		
Date	Control	100%
7/24	224	1170
Initials	WV	WV

Alkalinity (mg/L as CaCO ₃)		
Date	Control	100%
Initials		

Hardness (mg/L as CaCO ₃)		
Date	Control	100%
Initials		

Ammonia / Chlorine		
Date	NH ₃	Res Cl ₂
Initials		

Observations:

Larval Fish Growth and Survival Test-7 Day Survival

Start Date: 7/24/2012	Test ID: 1230117pwR	Sample ID: WHITE CLAY
End Date: 7/31/2012	Lab ID: AAT, INC.	Sample Type: GRAB
Sample Date:	Protocol: EPAF 94-EPA/600/4-91/002	Test Species: PP-Pimephales promelas

Comments:

Conc-%	1	2	3	4
White Clay	0.9000	1.0000	0.9000	1.0000
0.015	1.0000	1.0000	1.0000	0.9000
0.031	1.0000	1.0000	1.0000	1.0000
0.062	1.0000	0.9000	0.9000	0.9000
0.125	0.5000	0.4000	0.5000	0.2000
0.25	0.1000	0.2000	0.0000	0.0000

Conc-%	Mean	N-Mean	Transform: Arcsin Square Root				N	t-Stat	1-Tailed Critical	MSD	Isotonic	
			Mean	Min	Max	CV%					Mean	N-Mean
White Clay	0.9500	1.0000	1.3305	1.2490	1.4120	7.072	4				0.9750	1.0000
0.015	0.9750	1.0263	1.3713	1.2490	1.4120	5.942	4	-0.546	2.410	0.1797	0.9750	1.0000
0.031	1.0000	1.0526	1.4120	1.4120	1.4120	0.000	4	-1.093	2.410	0.1797	0.9750	1.0000
0.062	0.9250	0.9737	1.2898	1.2490	1.4120	6.318	4	0.546	2.410	0.1797	0.9250	0.9487
*0.125	0.4000	0.4211	0.6798	0.4636	0.7854	22.317	4	8.726	2.410	0.1797	0.4000	0.4103
*0.25	0.0750	0.0789	0.2757	0.1588	0.4636	53.294	4	14.143	2.410	0.1797	0.0750	0.0769

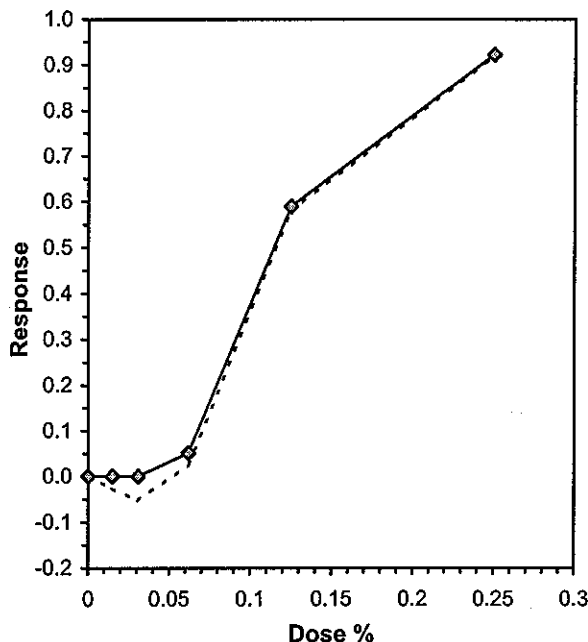
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.98211	0.884	-0.2458	0.06365

Equality of variance cannot be confirmed

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	0.062	0.125	0.08803	1612.9	0.10964	0.11622	0.88514	0.01112	1.2E-11	5, 18

Treatments vs White Clay

Point	%	SD	Linear Interpolation (200 Resamples)		
			95% CL(Exp)	Skew	
IC05	0.0612	0.0066	0.0377	0.0711	-0.2938
IC10	0.0677	0.0028	0.0586	0.0765	0.3869
IC15	0.0736	0.0028	0.0657	0.0823	0.4082
IC20	0.0794	0.0030	0.0706	0.0891	0.3349
IC25	0.0853	0.0033	0.0755	0.0957	0.2486
IC40	0.1028	0.0048	0.0898	0.1170	0.1690
IC50	0.1145	0.0062	0.0983	0.1355	0.2964



Larval Fish Growth and Survival Test-7 Day Biomass

Start Date: 7/24/2012	Test ID: 1230117pwR	Sample ID: WHITE CLAY
End Date: 7/31/2012	Lab ID: AAT, INC.	Sample Type: GRAB
Sample Date:	Protocol: EPAF 94-EPA/600/4-91/002	Test Species: PP-Pimephales promelas

Comments:

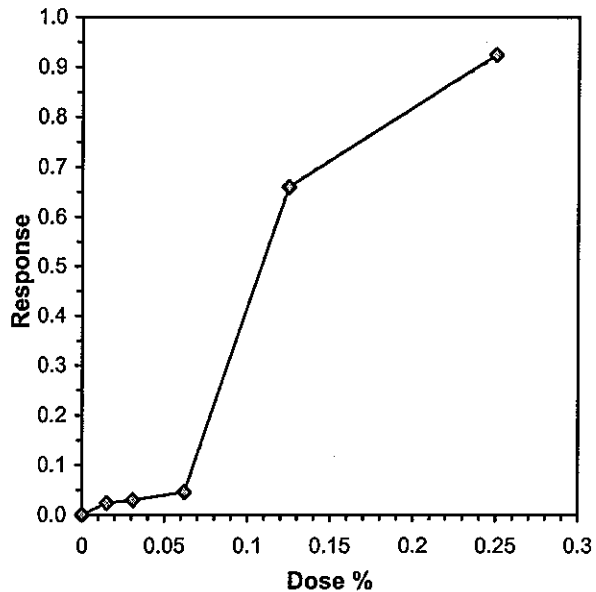
Conc-%	1	2	3	4
White Clay	0.4300	0.4500	0.4080	0.4060
0.015	0.4510	0.4110	0.4100	0.3810
0.031	0.3520	0.5030	0.3840	0.4050
0.062	0.4070	0.3870	0.4250	0.3970
0.125	0.1870	0.1720	0.1470	0.0700
0.25	0.0510	0.0770	0.0000	0.0000

Conc-%	Mean	N-Mean	Transform: Untransformed				N	t-Stat	1-Tailed Critical	MSD	Isotonic	
			Mean	Min	Max	CV%					Mean	N-Mean
White Clay	0.4235	1.0000	0.4235	0.4060	0.4500	4.898	4				0.4235	1.0000
0.015	0.4133	0.9758	0.4133	0.3810	0.4510	6.959	4	0.356	2.410	0.0694	0.4133	0.9758
0.031	0.4110	0.9705	0.4110	0.3520	0.5030	15.837	4	0.434	2.410	0.0694	0.4110	0.9705
0.062	0.4040	0.9540	0.4040	0.3870	0.4250	4.012	4	0.678	2.410	0.0694	0.4040	0.9540
*0.125	0.1440	0.3400	0.1440	0.0700	0.1870	36.124	4	9.711	2.410	0.0694	0.1440	0.3400
*0.25	0.0320	0.0756	0.0320	0.0000	0.0770	120.140	4	13.602	2.410	0.0694	0.0320	0.0756

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.97842	0.884	0.32119	0.88681
Bartlett's Test indicates equal variances (p = 0.23)	6.82359	15.0863		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test Treatments vs White Clay	0.062	0.125	0.08803	1612.9	0.06936	0.16379	0.1178	0.00166	3.2E-11	5, 18

Point	%	SD	Linear Interpolation (200 Resamples)		
			95% CL(Exp)	Skew	
IC05	0.0624	0.0192	0.0000	0.0672	-0.2708
IC10	0.0675	0.0091	0.0059	0.0715	-3.3331
IC15	0.0727	0.0024	0.0632	0.0771	-0.1040
IC20	0.0778	0.0024	0.0689	0.0828	-0.0748
IC25	0.0829	0.0025	0.0743	0.0885	-0.0638
IC40	0.0983	0.0032	0.0883	0.1067	-0.0872
IC50	0.1086	0.0040	0.0972	0.1192	-0.0936



NJPDES BIOMONITORING REPORT FORM
FRESHWATER CHRONIC TOXICITY TEST

NJPDES #: N/A

White Clay Creek / Flowback

FACILITY NAME: Delaware River Basin Commission
25 State Police Drive, P.O. Box 7360

FACILITY LOCATION: West Trenton, N.J. 08628-0360

LABORATORY: American Aquatic Testing, Inc.

ACUTE TOXICITY CERTIFICATION NUMBER: PA682

SRT INFORMATION	DATE:	June 27, 2012	IC ₂₅ :	264.0 ppm
	CONTROL CHART		UCL:	397.8 ppm
	MEAN:	319.2 ppm	LCL:	240.5 ppm

TEST START DATE: July 17, 2012 TEST END DATE: July 23, 2012

TEST TYPE AND RESULTS (Check applicable test, circle applicable endpoint and fill in NOEC &/or IC₂₅)

 Fathead minnow, (CN/FM) NOEL , IC₂₅

Method 1000.0 (*Pimephales promelas* 7 day Larval Survival and Growth Test)

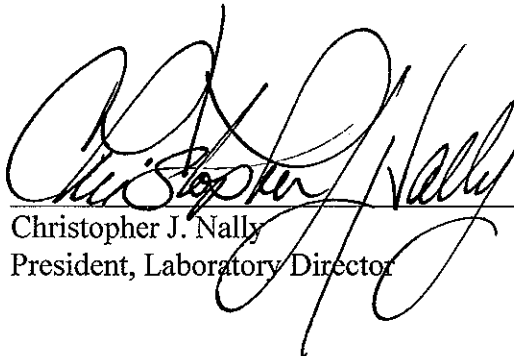
 X Cladoceran, (CN/CD) NOEC 0.25% (Reproduction) IC₂₅ 0.55%
PMSD 14.5%

Method 1002.0 (*Ceriodaphnia dubia* 3 brood Survival and Reproduction Test)

CONTROL MORTALITY: 00%

Did the test meet the acceptability criteria for the test species as specified in Part III of the Chronic Methods Document? YES

ACCURACY OF REPORT CERTIFIED BY:



Christopher J. Nally
President, Laboratory Director

08/01/12
Date

TEST DESIGN

NUMBER OF CONCENTRATIONS: 05
 NUMBER OF REPLICATES / CONCENTRATION: 10
 NUMBER OF TEST ORGANISMS / REPLICATE: 01
 DILUTION SERIES: 0.5
 TEST VESSEL SIZE: 30 mL
 TEST SOLUTION VOLUME: 15 mL
 EXPLAIN ANY DEVIATIONS FROM SPECIFIED METHODS; N/A

EFFLUENT SAMPLING

SAMPLE LOCATION: Flowback water from natural gas drilling operation
 EFFLUENT TYPE: untreated
 DISCHARGE: N/A
 RETENTION TIME: N/A
 SAMPLE TYPE: Composite ___ Other x,
 (Grab)

Sample Collection		Sample Data taken upon arrival at laboratory		Use in Toxicity Test	
Beginning Date & Time	Ending Date & Time	Dissolved Oxygen (ppm)	pH (Std. Units)	Date(s)	Time(s)
07/16/12, 1045	07/16/12, 1045	N/A	4.9	07/17-22/12	1600+/- 1 hr

Maximum holding time for any effluent sample: N/A

Describe any pretreatment of the effluent: N/A

TESTING LOCATION

REMOTE LABORATORY
 ON-SITE LABORATORY X
 ON-SITE COMMERCIAL LABORATORY

DILUTION WATER

EFFLUENT RECEIVING WATER: N/A
 DILUTION WATER: White Clay Creek
 DESCRIBE ANY ADJUSTMENT TO THE DILUTION WATER: N/A
 IF RECEIVING WATER IS USED AS DILUTION SOURCE, DESCRIBE COLLECTION LOCATION AND DATES OF COLLECTION: 07/15/12

**SUMMARY SHEET FOR THE CLADOCERAN
CERIODAPHNIA DUBIA TEST**

Percent Effluent	Mean Percent Survival	Mean Number of Young per Surviving Female	Percent of Females with Third Brood
Control – White Clay Creek	100	32.8	100
0.125	100	31.6	100
0.25	100	31.5	100
0.50	100	26.7	90
1.0	60	3.3	00
2.0	00	0.0	00

Organism source: X cultured stock, commercial supplier

Name of supplier: N/A

Age of organisms (hours): < 24

Test organisms all released within an 08 hour period? Yes

Neonates obtained from: mass culture, X individually cultured organisms

Was the test terminated when 60 % of the surviving females in the controls had produced their third brood? Yes

Within how many hours after test termination were the organisms counted? Immediately

NUMBER OF MALES / EPHIPPIA

Percent Effluent	Number of Males	Number of Ehippia
Control	00	00
0.125	00	00
0.25	00	00
0.50	00	00
1.0	00	00
2.0	00	00

Did the number of males in the controls and/or the test concentrations influence the determination of the NOEC/IC₂₅? No

Project Number: 123-01-17 WHITE CLAY

Beginning Date & Time: 7-17-12 1600
 Ending Date & Time: 7-23-12 1545

Ceriodaphnia dubia, Survival and Reproduction Test

American Aquatic Testing, Inc.,

Survival / Reproduction Data

Day	Conc.		Replicate										Initials										
			1	2	3	4	5	6	7	8	9	10											
1	N	B	0	0	0	0	0	0	0	0	0	0	0	MPD									
2	N	B	0	0	0	0	0	0	0	0	0	0	0	TRD									
3	N	B	6	1	4	1	4	1	6	1	4	1	3	1	4	1	6	1	4	1	TRD		
4	N	B	14	2	14	2	12	2	8	2	14	2	14	2	9	2	12	2	16	2	12	2	MPD
5	N	B	0	0	0	0	10	3	10	3	18	3	18	3	14	3	0	0	10	3	MPD		
6	N	B	20	3	20	3	20	3	0	0	0	0	0	0	0	18	3	0	0	TRD			
7	N	B																					
8	N	B																					
Tot N		Tot B	40	3	38	3	36	3	24	3	28	3	36	3	30	3	30	3	40	3	26	3	Tot A
																						10	

Average Neonates per Female = 32.8 % Females with 3rd Brood = 100

Day	Conc.		Replicate										Initials										
			1	2	3	4	5	6	7	8	9	10											
1	N	B	0	0	0	0	0	0	0	0	0	0	0	MPD									
2	N	B	0	0	0	0	0	0	0	0	0	0	0	TRD									
3	N	B	6	1	4	1	4	1	4	1	4	1	6	1	2	1	4	1	6	1	TRD		
4	N	B	12	2	14	2	10	2	12	2	8	2	14	2	12	2	12	2	14	2	8	2	MPD
5	N	B	0	0	0	0	0	0	0	14	3	0	14	3	0	0	0	0	0	MPD			
6	N	B	20	3	18	3	12	3	18	3	12	3	0	10	3	0	20	3	16	3	TRD		
7	N	B																					
8	N	B																					
Tot N		Tot B	38	3	36	3	26	3	34	3	24	3	32	3	28	3	30	3	38	3	30	3	Tot A
																						10	

Average Neonates per Female = 31.6 % Females with 3rd Brood = 100

Day	Conc.		Replicate										Initials										
			1	2	3	4	5	6	7	8	9	10											
1	N	B	0	0	0	0	0	0	0	0	0	0	0	MPD									
2	N	B	0	0	0	0	0	0	0	0	0	0	0	TRD									
3	N	B	4	1	4	1	6	1	5	1	4	1	2	1	4	1	4	1	6	1	4	1	TRD
4	N	B	12	2	12	2	12	2	11	2	12	2	14	2	10	2	10	2	10	2	10	2	MPD
5	N	B	14	3	0	0	0	0	0	14	3	14	3	14	3	0	0	0	0	MPD			
6	N	B	0	16	3	20	3	20	3	19	3	0	0	0	0	20	3	8	3	TRD			
7	N	B																					
8	N	B																					
Tot N		Tot B	30	3	32	3	38	3	36	3	35	3	30	3	28	3	28	3	36	3	22	3	Tot A
																						10	

Average Neonates per Female = 31.5 % Females with 3rd Brood = 100

(N=Neonates, B=Broods, A=Alive)

Observations:

Project Number: 123-01-17 WHITE CLAY

Beginning Date & Time: 7-17-12 1600
 Ending Date & Time: 7-23-12 1545

Ceriodaphnia dubia, Survival and Reproduction Test

American Aquatic Testing, Inc.,

Survival / Reproduction Data

Day	Conc.		Replicate										Initials	
			1	2	3	4	5	6	7	8	9	10		
1	N	B	0	0	0	0	0	0	0	0	0	0	0	MP
2	N	B	0	0	0	0	0	0	0	0	0	0	0	MP
3	N	B	41	41	21	41	41	41	0	41	51	41		MP
4	N	B	82	102	62	102	102	102	81	122	92	122		MP
5	N	B	0	0	0	143	0	163	142	163	0	0		MP
6	N	B	183	143	203	0	83	0	0	0	113	83		MP
7	N	B												
8	N	B												
Tot N		Tot B	283	283	283	283	223	303	222	323	253	243		Tot A
													10	

Average Neonates per Female = 26.7 % Females with 3rd Brood = 90

Day	Conc.		Replicate										Initials	
			1	2	3	4	5	6	7	8	9	10		
1	N	B	0	0	0	0	0	0	0	0	0	0	0	MP
2	N	B	0	0	0	0	0	0	0	0	0	0	0	MP
3	N	B	0	0	0	0	0	0	0	0	0	0	0	MP
4	N	B	21	21	41	0	0	41	0	21	0	41		MP
5	N	B	0	D-	0	0	D-	102	0	0	D-	0		MP
6	N	B	D-	-	22	0	-	0	0	0	-	32		MP
7	N	B												
8	N	B												
Tot N		Tot B	21	21	62	0	0	142	0	2	0	72		Tot A
													6	

Average Neonates per Female = 3.3 % Females with 3rd Brood = 0

Day	Conc.		Replicate										Initials	
			1	2	3	4	5	6	7	8	9	10		
1	N	B	0	0	0	0	0	0	D-	0	0	D-		MP
2	N	B	D-	D-	D-	D-	D-	D-	-	D-	D-	-		MP
3	N	B												
4	N	B												
5	N	B												
6	N	B												
7	N	B												
8	N	B												
Tot N		Tot B	0	0	0	0	0	0	0	0	0	0	0	Tot A
													0	

Average Neonates per Female = 0 % Females with 3rd Brood = 0
 (N=Neonates, B=Broods, A=Alive)

Observations:

Client/Toxicant: 123
 Job Number: 01-17
 Species: Ceriodia

White Clay Creek

Beginning Date & Time: 7-17-12 1600
 Ending Date & Time: 7-23-12 1545

Freshwater Chronic Test
 American Aquatic Testing, Inc.,
 Physical / Chemical Parameters
 Initial Readings

Parameter	Concentration	Day							
		1	2	3	4	5	6	7	8
Dissolved Oxygen (mg/L)	Control	9.5	8.2	7.9	8.0	8.2	7.4		
	0.125	9.5	8.2	7.9	8.0	8.2	7.4		
	0.25	9.5	8.2	8.0	8.0	8.2	7.4		
	0.50	9.4	8.2	8.0	8.0	8.2	7.4		
	1.0	9.4	8.2	8.0	8.0	8.2	7.4		
	2.0	9.4	8.2	8.0	-	-			
pH	Control	7.8	7.8	7.6	7.6	7.5	7.5		
	0.125	7.6	7.7	7.6	7.5	7.5	7.5		
	0.25	7.6	7.6	7.5	7.5	7.5	7.4		
	0.5	7.6	7.5	7.5	7.5	7.4	7.4		
	1.0	7.5	7.4	7.4	7.4	7.4	7.4		
	2.0	7.4	7.3	7.3	-	-			
Initials		TAP	TAP	TAP	TAP	MP	MP		
Date		7/17	7/18	7/19	7/20	7/21	7/22		

Conductivity (µmhos/cm)		
Date	Control	100%
7/17	212	7110
Initials	TAP	TAP
Alkalinity (mg/L as CaCO ₃)		
Date	Control	100%
7/17		
Initials		
Hardness (mg/L as CaCO ₃)		
Date	Control	100%
7/17		
Initials		

Final Readings

Parameter	Concentration	Day							
		1	2	3	4	5	6	7	8
Temperature (°C)	Control	25.0	25.0	25.5	25.5	25.5	25.5		
	0.125	25.0	25.0	25.5	25.5	25.5	25.5		
	0.25	25.0	25.0	25.5	25.5	25.5	25.5		
	0.5	25.0	25.0	25.5	25.5	25.5	25.5		
	1.0	25.0	25.0	25.5	25.5	25.5	25.5		
	2.0	25.0	25.0	-	-	-	-		
Dissolved Oxygen (mg/L)	Control	8.0	7.7	8.1	8.0	7.8	8.3		
	0.125	8.0	7.6	8.1	8.0	7.9	8.1		
	0.25	8.0	7.5	8.1	8.0	7.9	8.2		
	0.5	8.0	7.4	8.1	8.0	7.8	8.0		
	1.0	8.0	7.4	8.1	8.0	7.8	8.1		
	2.0	7.7	7.4	-	-	-	-		
pH	Control	8.2	8.1	8.0	8.2	8.2	8.2		
	0.125	8.1	8.0	8.0	8.2	8.2	8.1		
	0.25	8.1	8.0	8.0	8.2	8.2	8.1		
	0.5	8.1	7.9	7.9	8.1	8.1	8.0		
	1.0	8.0	7.9	7.9	8.0	8.1	8.0		
	2.0	7.8	7.8	-	-	-	-		
Initials		MP	JMF	TAP	MP	MP	JMF		
Date		7/18	7/19	7/20	7/21	7/22	7/23		

Ammonia / Chlorine		
Date	NH ₃	Res Cl ₂
Initials		

Observations:

Ceriodaphnia Survival and Reproduction Test-7 Day Survival

Start Date: 7/17/2012 Test ID: 1230117cwc Sample ID: White Clay & Flowback
 End Date: 7/24/2012 Lab ID: AAT, INC Sample Type: Grab
 Sample Date: Protocol: EPAF 94-EPA/600/4-91/002 Test Species: CD-Ceriodaphnia dubia

Comments:

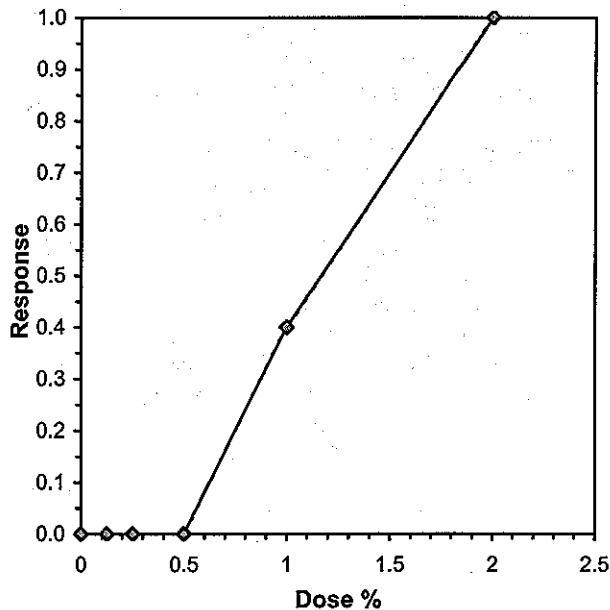
Conc-%	1	2	3	4	5	6	7	8	9	10
White Clay	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
0.125	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
0.25	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
0.5	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1	0.0000	0.0000	1.0000	1.0000	0.0000	1.0000	1.0000	1.0000	0.0000	1.0000
2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Conc-%	Mean	N-Mean	Resp	Not Resp	Total	N	Fisher's Exact P	1-Tailed Critical	Isotonic Mean	N-Mean
White Clay	1.0000	1.0000	0	10	10	10			1.0000	1.0000
0.125	1.0000	1.0000	0	10	10	10	1.0000	0.0500	1.0000	1.0000
0.25	1.0000	1.0000	0	10	10	10	1.0000	0.0500	1.0000	1.0000
0.5	1.0000	1.0000	0	10	10	10	1.0000	0.0500	1.0000	1.0000
*1	0.6000	0.6000	4	6	10	10	0.0433	0.0500	0.6000	0.6000
2	0.0000	0.0000	10	0	10	10			0.0000	0.0000

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Fisher's Exact Test	0.5	1	0.70711	200
Treatments vs White Clay				

Linear Interpolation (200 Resamples)

Point	%	SD	95% CL	Skew	
IC05	0.5625	0.0499	0.5357	0.7500	2.4302
IC10	0.6250	0.0997	0.5714	1.0000	2.4302
IC15	0.6875	0.1116	0.6071	1.0556	1.6514
IC20	0.7500	0.1273	0.6429	1.1111	1.1827
<u>IC25</u>	<u>0.8125</u>	0.1338	0.6786	1.1667	0.9016
IC40	1.0000	0.1554	0.7857	1.3333	0.3282
IC50	1.1667	0.1707	0.8571	1.4444	-0.1379



0.8125% = 8125 ppm

Ceriodaphnia Survival and Reproduction Test-Reproduction

Start Date: 7/17/2012 Test ID: 1230117cwc Sample ID: White Clay & Flowback
 End Date: 7/24/2012 Lab ID: AAT, INC Sample Type: Grab
 Sample Date: Protocol: EPAF 94-EPA/600/4-91/002 Test Species: CD-Ceriodaphnia dubia
 Comments:

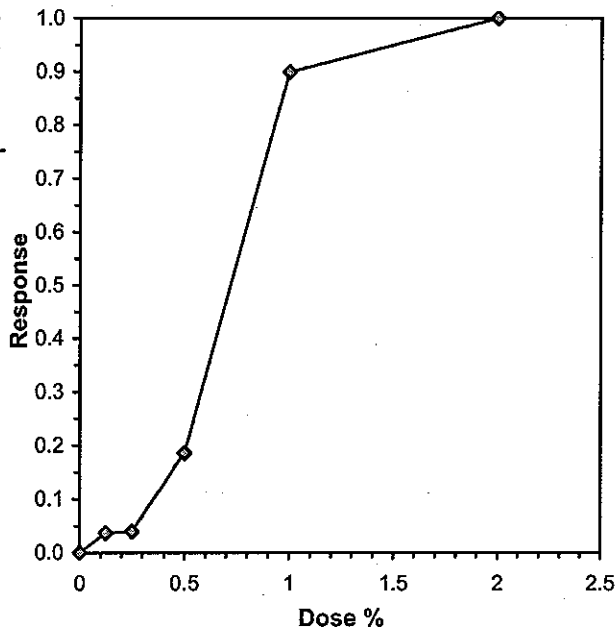
Conc-%	1	2	3	4	5	6	7	8	9	10
White Clay	40.000	38.000	36.000	24.000	28.000	36.000	30.000	30.000	40.000	26.000
0.125	38.000	36.000	26.000	34.000	24.000	32.000	28.000	30.000	38.000	30.000
0.25	30.000	32.000	38.000	36.000	35.000	30.000	28.000	28.000	36.000	22.000
0.5	28.000	28.000	28.000	28.000	22.000	30.000	22.000	32.000	25.000	24.000
1	2.000	2.000	6.000	0.000	0.000	14.000	0.000	2.000	0.000	7.000
2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Conc-%	Mean	N-Mean	Transform: Untransformed					t-Stat	1-Tailed Critical	MSD	Isotonic	
			Mean	Min	Max	CV%	N				Mean	N-Mean
White Clay	32.800	1.0000	32.800	24.000	40.000	17.997	10				32.800	1.0000
0.125	31.600	0.9634	31.600	24.000	38.000	15.446	10	0.562	2.223	4.749	31.600	0.9634
0.25	31.500	0.9604	31.500	22.000	38.000	15.498	10	0.609	2.223	4.749	31.500	0.9604
*0.5	26.700	0.8140	26.700	22.000	32.000	12.491	10	2.856	2.223	4.749	26.700	0.8140
*1	3.300	0.1006	3.300	0.000	14.000	137.054	10	13.810	2.223	4.749	3.300	0.1006
2	0.000	0.0000	0.000	0.000	0.000	0.000	10				0.000	0.0000

Auxiliary Tests	Statistic	Critical	Skew	Kurt						
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.97379	0.93	0.09144	-0.5464						
Bartlett's Test indicates equal variances (p = 0.60)	2.73518	13.2767								
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test Treatments vs White Clay	0.25	0.5	0.35355	400	4.74936	0.1448	1550.67	22.8156	1.7E-18	4, 45

Linear Interpolation (200 Resamples)

Point	%	SD	95% CL	Skew
IC05	0.2677	0.1070	0.0458 0.3605	-0.1356
IC10	0.3531	0.1099	0.0916 0.4838	-0.5021
IC15	0.4385	0.0919	0.1678 0.5281	-0.9213
IC20	0.5098	0.0662	0.3197 0.5596	-1.6534
IC25	<u>0.5449</u>	0.0348	0.4390 0.5919	-0.9280
IC40	0.6500	0.0249	0.5977 0.6940	-0.1122
IC50	0.7201	0.0231	0.6756 0.7593	0.0536



0.5449% = 5449 ppm

NJPDES BIOMONITORING REPORT FORM
FRESHWATER CHRONIC TOXICITY TEST

NJPDES #: N/A

White Clay Creek / Flowback

FACILITY NAME: Delaware River Basin Commission
25 State Police Drive, P.O. Box 7360

FACILITY LOCATION: West Trenton, N.J. 08628-0360

LABORATORY: American Aquatic Testing, Inc.

ACUTE TOXICITY CERTIFICATION NUMBER: PA682

SRT INFORMATION	DATE:	July 19, 2012	IC ₂₅ :	2307.7 ppm
	CONTROL CHART		UCL:	3479.3 ppm
	MEAN:	2124.8 ppm	LCL:	902.8 ppm

TEST START DATE: July 17, 2012

TEST END DATE: July 21, 2012

TEST TYPE AND RESULTS (Check applicable test, circle applicable endpoint and fill in NOEC &/or IC₂₅)

X *Selenastrum capricornutum*, NOEC <0.125% IC₂₅ 0.06%
PMSD 5.08%

Method 1003.0 (Green Alga *Selenastrum capricornutum*, Growth Test)

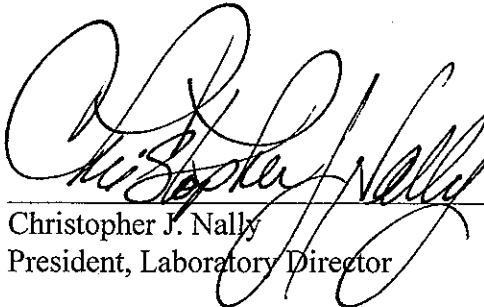
Cladoceran, (CN/CD) NOEL , IC₂₅

Method 1001.0 (*Ceriodaphnia dubia* 3 brood Survival and Reproduction Test)

CONTROL GROWTH: 4.536 x 10⁶ cells/mL

Did the test meet the acceptability criteria for the test species as specified in Part III of the Chronic Methods Document? YES

ACCURACY OF REPORT CERTIFIED BY



Christopher J. Nally
President, Laboratory Director

08/01/12
Date

TEST DESIGN

NUMBER OF CONCENTRATIONS: 5
 NUMBER OF REPLICATES / CONCENTRATION: 4
 NUMBER OF TEST ORGANISMS / REPLICATE: 10,000 cells/mL
 DILUTION SERIES: 0.5
 TEST VESSEL SIZE: 125 mL
 TEST SOLUTION VOLUME: 25 mL
 EXPLAIN ANY DEVIATIONS FROM SPECIFIED METHODS; N/A

EFFLUENT SAMPLING

SAMPLE LOCATION: Flowback water from natural gas drilling operation
 EFFLUENT TYPE: untreated
 DISCHARGE: N/A
 RETENTION TIME: N/A
 SAMPLE TYPE: composite Other (grab)

Sample Collection		Sample Data taken upon arrival at laboratory		Use in Toxicity Test	
Beginning Date & Time	Ending Date & Time	Dissolved Oxygen (ppm)	pH (Std. Units)	Use Date	Time
07/16/12 1045	07/16/12 1045	N/A	4.9	07/17-20/12	1900

Maximum holding time for any effluent sample: N/A

Describe any pretreatment of the effluent: N/A

TESTING LOCATION

REMOTE LABORATORY
 ON-SITE LABORATORY
 ON-SITE COMMERCIAL LABORATORY

DILUTION WATER

EFFLUENT RECEIVING WATER: N/A
 DILUTION WATER: White Clay Creek
 DESCRIBE ANY ADJUSTMENT TO THE DILUTION WATER: N/A
 IF RECEIVING WATER IS USED AS DILUTION SOURCE, DESCRIBE COLLECTION LOCATION AND DATES OF COLLECTION: 07/15/12

Freshwater Algae Test

American Aquatic Testing, Inc.

Job #: 123-01-17

Time
Start Date: 7-19-12 1745

Species: S. capricornutum

End Date
Start Time: 07/23/12 110

Dilution Water: White Clay Creek

Test Type: 96 hr. SNR

Concentration %	pH (standard units)					Temperature (C)				
	0 hr.	24 hr.	48 hr.	72 hr.	96 hr.	0 hr.	24 hr.	48 hr.	72 hr.	96 hr.
Control	7.6	8.4	8.7	8.8	9.2	26.0	26.5	25.5	25.5	26.6
0.125	7.6	8.4	8.6	8.7	8.8	26.0	26.6	25.5	25.5	26.6
0.25	7.5	8.3	8.5	8.6	8.4	26.0	26.6	25.5	25.5	26.6
0.5	7.5	8.3	8.3	8.4	8.2	26.0	26.6	25.5	25.5	26.6
1.0	7.4	8.2	8.2	8.3	8.1	26.0	26.6	25.5	25.5	26.6
2.0	7.3	8.1	8.1	8.1	8.1	25.0	26.6	25.5	25.5	26.6
Initials	TAP	MP	MP	MP	MP	MP	MP	MP	MP	MP
Date	7/19	07/20	7/21	7/22	07/23	07/19	07/20	7/21	7/22	07/23

Concentration %	Conductivity (umhos)	Alkalinity (mg/l)	Hardness (mg/l)
Control	210		
0.125	714		
0.5	2078		
2.0	7000		
Initials	TAP		
Date	7/19		

Reading Date	Light Intensity (ft-c)
7/19	407
07/20	376
7/21	409
7/22	423
07/23	411
Initials	TAP

Concentration %	Cell Density (1 x 10 cells/ml)					Mean Density (1 x 10 cells/ml)	Comments
	Replicate						
	1	2	3	4	5		
Control	4.769	4.687	4.229	4.557		4.536	
0.125	2.478	2.170	2.301	2.038		2.247	
0.25	0.886	1.076	0.851	0.805		0.921	
0.5	0.443	0.455	0.515	0.393		0.467	
1.0	0.363	0.419	0.462	0.351		0.394	
2.0	0.400	0.488	0.355	0.336		0.395	
Initials	MP	MP	MP	MP		MP	
Date	07/23	07/23	07/23	07/23		07/24	

Observations: _____

1026 0.0619%

Phytoplankton Test-Growth-Cell Density

Start Date: 7/19/2012	Test ID: 1230117wsc	Sample ID: White Clay & Flowback
End Date: 7/23/2012	Lab ID: AAT, INC	Sample Type: GRAB
Sample Date:	Protocol: EPAF 94-EPA/600/4-91/002	Test Species: SC-Selenastrum capricornutum

Comments:

Conc-%	1	2	3	4
ite Clay Creek	4769000	4587000	4229000	4557000
EPA Soft	4576000	4366000	4687000	4264000
0.125	2478000	2170000	2301000	2038000
0.25	886000	1075000	857000	865000
0.5	443000	455000	575000	393000
1	353000	419000	452000	351000
2	400000	488000	355000	336000

Conc-%	Mean	N-Mean	Transform: Untransformed				N	t-Stat	1-Tailed Critical	MSD	Isotonic	
			Mean	Min	Max	CV%					Mean	N-Mean
ite Clay Creek	4535500	1.0139	4535500	4229000	4769000	4.956	4	*		4535500	1.0000	
EPA Soft	4473250	1.0000	4473250	4264000	4687000	4.310	4					
*0.125	2246750	0.5023	2246750	2038000	2478000	8.362	4	23.950	2.410	230310	2246750	0.4954
*0.25	920750	0.2058	920750	857000	1075000	11.247	4	37.825	2.410	230310	920750	0.2030
*0.5	466500	0.1043	466500	393000	575000	16.539	4	42.579	2.410	230310	466500	0.1029
*1	393750	0.0880	393750	351000	452000	12.714	4	43.340	2.410	230310	394250	0.0869
*2	394750	0.0882	394750	336000	488000	17.153	4	43.329	2.410	230310	394250	0.0869

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.93987	0.884	-0.2293	1.39459
Bartlett's Test indicates equal variances (p = 0.11)	8.88536	15.0863		
The control means are not significantly different (p = 0.69)	0.4204	2.44691		

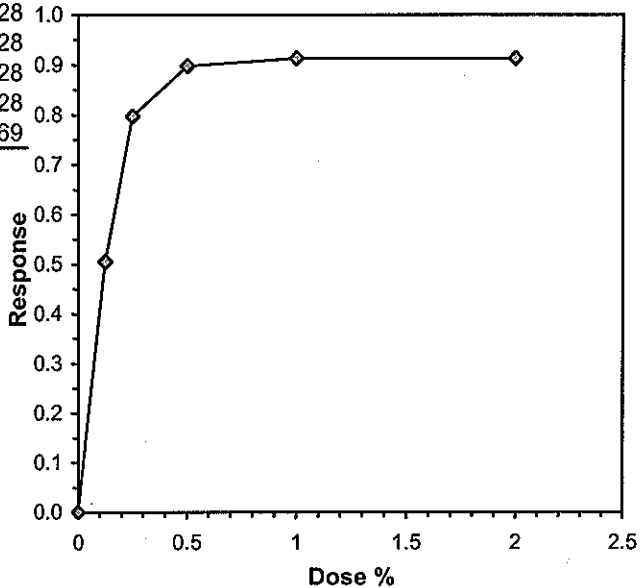
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	<0.125	0.125			230310	0.05078	1.1E+13	1.8E+10	2.5E-19	5, 18

Treatments vs White Clay Creek

Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)		Skew
IC05*	0.0124	0.0005	0.0109	0.0137	0.0028
IC10*	0.0248	0.0009	0.0218	0.0274	0.0028
IC15*	0.0372	0.0014	0.0327	0.0411	0.0028
IC20*	0.0495	0.0019	0.0435	0.0547	0.0028
<u>IC25*</u>	<u>0.0619</u>	0.0024	0.0544	0.0684	0.0028
IC40*	0.0991	0.0038	0.0871	0.1095	0.0028
IC50*	0.1239	0.0056	0.1089	0.1426	0.4069

* indicates IC estimate less than the lowest concentration



0.0619% = 619 ppm

TEST ENDED EARLY – EXCESSIVE MORTALITY

NJPDES BIOMONITORING REPORT FORM FRESHWATER CHRONIC TOXICITY TEST

NJPDES #: N/A White Clay Creek / Flowback

FACILITY NAME: Delaware River Basin Commission
25 State Police Drive, P.O. Box 7360

FACILITY LOCATION: West Trenton, N.J. 08628-0360

LABORATORY: American Aquatic Testing, Inc.

ACUTE TOXICITY CERTIFICATION NUMBER: PA682

SRT INFORMATION	DATE:	July 17, 2012	IC ₂₅ :	554.8 ppm
	CONTROL CHART		UCL:	638.0 ppm
	MEAN:	588.7 ppm	LCL:	539.4 ppm

TEST START DATE: July 17, 2012 TEST END DATE: July 23, 2012

TEST TYPE AND RESULTS (Check applicable test, circle applicable endpoint and fill in NOEC &/or IC₂₅)

X Fathead minnow, NOEC <0.125% (Survival) IC₂₅ 0.07% (estimate)
PMSD 29.3%

Method 1000.0 (*Pimephales promelas* 7 day Larval Survival and Growth Test)

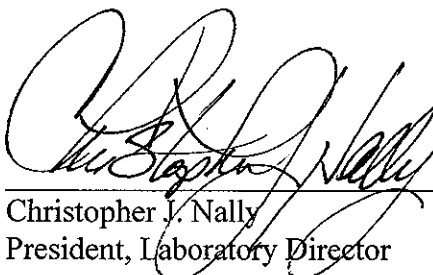
 Cladoceran, (CN/CD) NOEL , IC₂₅

Method 1002.0 (*Ceriodaphnia dubia* 3 brood Survival and Reproduction Test)

CONTROL MORTALITY: 00 %

Did the test meet the acceptability criteria for the test species as specified in Part III of the Chronic Methods Document? YES

ACCURACY OF REPORT CERTIFIED BY:



Christopher J. Nally
President, Laboratory Director

08/01/12

Date

Client/Toxicant: 123
 Project Number: 01-17
 Species: P. promelas

WHITE
CLAY

Beginning Date & Time: 7-17-12 1800
 Ending Date & Time: 07/23/12 1200
 Hatch Date: 7-16-12

Chronic Test
 American Aquatic Testing, Inc.
 Live Count ①

Conc.	Rep	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Control	A	10	10	10	8 ²	8	8	8	
	B	10	10	10	10	10	10	10	
	C	10	10	10	10	10	10	10	
	D	10	10	10	9 ¹	6 ³	6	6	
0.125	A	10	10	10	10	10	8 ²	5 ³	
	B	10	10	10	10	9 ¹	7 ²	7	
	C	10	10	10	8 ²	8	6 ²	3 ³	
	D	10	10	10	8 ²	7 ¹	4 ³	4	
0.25	A	10	10	10	4 ⁶	3 ¹	1 ²	0 ¹	
	B	10	10	10	3 ¹	3	1 ²	0 ¹	
	C	10	10	9 ¹	4 ⁶	3 ¹	0 ³	-	
	D	10	10	10	4 ⁶	2 ²	1 ¹	0 ¹	
0.5	A	10	10	9 ¹	4 ⁵	1 ³	0 ¹	-	
	B	10	10	10	4 ⁶	0 ⁴	-	-	
	C	10	10	7 ³	2 ⁵	0 ²	-	-	
	D	10	10	9 ¹	2 ²	0 ²	-	-	
1.0	A	10	10	9 ¹	2 ¹	0 ²	-	-	
	B	10	10	10	3 ¹	0 ³	-	-	
	C	10	10	9 ¹	2 ¹	1 ¹	0 ¹	-	
	D	10	10	10	4 ⁶	1 ³	0 ¹	-	
2.0	A	10	10	10	0 ¹⁰	-	-	-	
	B	10	9 ¹	9	0 ⁹	-	-	-	
	C	10	10	10	0 ¹⁰	-	-	-	
	D	10	9 ¹	9	0 ⁹	-	-	-	
	A								
	B								
	C								
	D								
Initials									
Date	07/17	07/18	07/19	7-20	7-21	7-22	7-23		

Observations:
 ① EXCHANGES STOPPED @ DAY 3 07/20/12 JF

S 0.0708%

Client/Toxicant: 123
 Job Number: 01-17
 Species: P. promelas

(White Clay)

Beginning Date & Time: 7-17-12 1800
 Ending Date & Time: 07/23/12 1200

Freshwater Chronic Test
 American Aquatic Testing, Inc.,
 Physical / Chemical Parameters
 Initial Readings

Parameter	Concentration	Day							
		1	2	3	4	5	6	7	8
Dissolved Oxygen (mg/L)	Control	9.5	8.2	7.9	8.0				
	0.125	9.5	8.2	7.9	8.0				
	0.25	9.5	8.2	8.0	8.0				
	0.50	9.4	8.2	8.0	8.0				
	1.0	9.4	8.2	8.0	8.0				
	2.0	9.4	8.2	8.0	-				
pH	Control	7.8	7.7	7.6	7.6				
	0.125	7.6	7.7	7.6	7.5				
	0.25	7.6	7.6	7.5	7.5				
	0.5	7.6	7.5	7.5	7.5				
	1.0	7.5	7.4	7.4	7.4				
	2.0	7.4	7.3	7.3	-				
Initials		JAK	TP	TP	TP				
Date		7/17	7/18	7/19	7/20				

Conductivity (µmhos/cm)		
Date	Control	100%
7/17	212	7110
Initials	TR	JAK/TP
Alkalinity (mg/L as CaCO ₃)		
Date	Control	100%
Initials		
Hardness (mg/L as CaCO ₃)		
Date	Control	100%
Initials		

Final Readings

Parameter	Concentration	Day							
		1	2	3	4	5	6	7	8
Temperature (°C)	Control	25.5	25.0	25.0	25.0	25.0	25.5		
	0.125	25.5	25.0	25.0	25.0	25.0	25.5		
	0.25	25.5	25.0	25.0	25.0	25.0	25.5		
	0.5	25.5	25.0	25.0	25.0	25.0	-		
	1.0	25.5	25.0	25.0	25.0	25.0	-		
	2.0	25.5	25.0	25.0	-	-	-		
Dissolved Oxygen (mg/L)	Control	7.6	7.0	7.1	7.4	7.9	6.6		
	0.125	7.5	7.1	7.4	7.7	6.6	6.6		
	0.25	7.6	6.5	7.4	7.7	6.6	6.6		
	0.5	7.5	6.8	7.3	7.6	6.7	-		
	1.0	7.2	6.9	7.0	7.5	6.6	-		
	2.0	7.0	6.8	7.1	-	-	-		
pH	Control	7.9	8.0	7.8	7.9	7.9	7.8		
	0.125	7.9	8.0	7.9	7.9	7.8	7.8		
	0.25	7.8	7.8	7.9	7.9	7.8	7.8		
	0.5	7.8	7.8	7.8	7.8	7.8	-		
	1.0	7.7	7.7	7.7	7.8	7.7	-		
	2.0	7.6	7.7	7.7	-	-	-		
Initials		MMP	STAP	CP	MMP	MMP	MMP		
Date		7/18	7/19	7/20	7/21	7/22	7/23		

Ammonia / Chlorine		
Date	NH ₃	Res Cl ₂
Initials		

Observations:
 ① 6.7 MP 7/22

Larval Fish Growth and Survival Test-7 Day Survival

Start Date: 7/19/2012	Test ID: 1230117pwc	Sample ID: White Clay & Flowback
End Date: 7/23/2012	Lab ID: AAT, INC	Sample Type: GRAB
Sample Date:	Protocol: EPAF 94-EPA/600/4-91/002	Test Species: PP-Pimephales promelas

Comments:

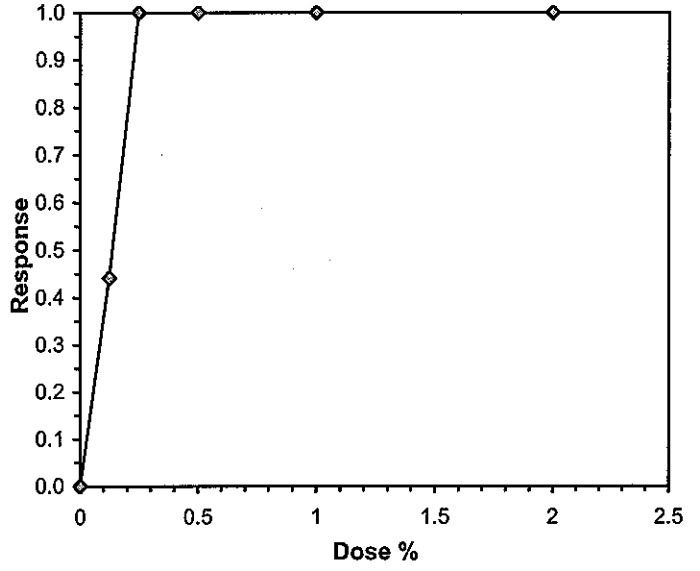
Conc-%	1	2	3	4
White Clay	0.8000	1.0000	1.0000	0.6000
0.125	0.5000	0.7000	0.3000	0.4000
0.25	0.0000	0.0000	0.0000	0.0000
0.5	0.0000	0.0000	0.0000	0.0000
1	0.0000	0.0000	0.0000	0.0000
2	0.0000	0.0000	0.0000	0.0000

Conc-%	Mean	N-Mean	Transform: Arcsin Square Root				N	t-Stat	1-Tailed Critical	MSD	Isotonic	
			Mean	Min	Max	CV%					Mean	N-Mean
White Clay	0.8500	1.0000	1.2043	0.8861	1.4120	21.278	4	2.860	1.943	0.3017	0.8500	1.0000
*0.125	0.4750	0.5588	0.7602	0.5796	0.9912	23.069	4				0.4750	0.5588
0.25	0.0000	0.0000	0.1588	0.1588	0.1588	0.000	4				0.0000	0.0000
0.5	0.0000	0.0000	0.1588	0.1588	0.1588	0.000	4				0.0000	0.0000
1	0.0000	0.0000	0.1588	0.1588	0.1588	0.000	4				0.0000	0.0000
2	0.0000	0.0000	0.1588	0.1588	0.1588	0.000	4				0.0000	0.0000

Auxiliary Tests	Statistic	Critical	Skew	Kurt		
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.9133	0.749	-0.209	-1.2845		
F-Test indicates equal variances (p = 0.55)	2.13488	47.4683				
Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates significant differences Treatments vs White Clay	0.25545	0.29308	0.39442	0.04821	0.02879	1, 6

Point	%	SD	95% CL(Exp)		Skew
IC05*	0.0142	0.0093	0.0080	0.0345	9.9056
IC10*	0.0283	0.0116	0.0160	0.0689	4.9289
IC15*	0.0425	0.0148	0.0241	0.1034	2.9930
IC20*	0.0567	0.0175	0.0321	0.1378	2.0109
IC25*	0.0708 0.0708	0.0197	0.0401	0.1620	1.4347
IC40*	0.1133	0.0200	0.0641	0.1756	0.3048
IC50	0.1382	0.0181	0.0823	0.1867	-0.0268

* indicates IC estimate less than the lowest concentration



0.078% = 708 ppm