ENVIRONMENTAL DOCUMENT TYPE:
KIF NPDES Permit Compliance Records
(2008 Annual Toxicity Testing
Outfall 002)

August 25, 2008

Ronald C. Hall, KFP 1A-KST

KINGSTON FOSSIL (KIF) PLANT NPDES PERMIT TN0005452: TOXICITY TESTING OF OUTFALL 002 - AUGUST, 2008

Attached are two copies of the toxicity report. Chronic testing of fathead minnows (*Pimephales promelas*) and daphnids (*Ceriodaphnia dubia*), using KIF discharge samples collected August 3-8, showed no toxicity to test organisms. IC_{25} values for both species were > 100 percent effluent. The results for both species exposed to intake samples were not significantly different from control results.

Please call me at (256) 386-2755 if you have comments or questions following your review.

Cynthia L. Russell
Biologist
Environmental Engineering Services-West
CTR 2L-M

CLR Attachment
cc (Attachments)
C. W. McCowan , KFP 1A-KST
L. P. Johnson, LP 5D-C
R. M. Sherrard, PSC 1X-C
Files, RSO&E-EDMS-Muscle Shoals

KIF August 2008M

TENNESSEE VALLEY AUTHORITY
TOXICITY TEST REPORT

INTRODUCTION / EXECUTIVE SUMMARY

Report Date: August 25, 2008

1. Facility / Discharger: Kingston Fossil Plant / TVA
2. County / State: Roane / Tennessee
3. NPDES Permit #: TN0005452
4. Type of Facility: Fossil-Fueled Steam Electric Generating Plant
5. Receiving Stream: Clinch River
6. 1Q10: 156
7. Sample Tested: 002
8. Dates Sampled: August 3-8, 2008
9. Average Flow on Days Sampled (MGD): 1351.2, 1357.1, 1357.1
10. Pertinent Site Conditions: No unusual conditions reported. (Production / operation data will be provided upon request).
11. Test Dates: August 5-12, 2008
12. Test Type: Short-term Chronic Definitive
13. Test Species: Fathead Minnows (*Pimephales promelas*)
    Daphnids (*Ceriodaphnia dubia*)
14. Concentrations Tested (%):
    Pimephales promelas: Outfall 002: 6.25, 12.5, 25, 50, 100
    Intake: 100

    Ceriodaphnia dubia: Outfall 002: 6.25, 12.5, 25, 50, 100
    Intake: 100

15. Permit Limit Endpoint (%): Outfall 002: $IC_{25} = 100\%$

16. Test Results: Outfall 002: *Pimephales promelas:* $IC_{25} > 100\%$
Ceriodaphnia dubia: $IC_{25} > 100\%$

17. Facility Contact: Cynthia W. McCowan Phone #: (865) 717-2180

18. Consulting / Testing Lab: Environmental Testing Solutions, Inc.

19. Lab Contact: Jim Sumner Phone #: (828) 350-9364

20. TVA Contact: Cynthia L. Russell Phone #: (256) 386-2755

21. Notes: Outfall 002 samples collected August 3-8, 2008, showed no toxic effects to fathead minnows or daphnids. The resulting IC_{25} values, for both species, were > 100 percent. Exposure of fathead minnows and daphnids to intake samples resulted in no significant differences for growth or reproduction from controls based on Homoscedastic t-Tests.

METHODS SUMMARY

Samples:

1. Sampling Point: Outfall 002, Intake

2. Sample Type: Outfall 002: Composite
   Intake: Composite

3. Sample Information:

ID	Date/Time* Collected (MM-DD-YY/Time‡)	Date/Time Received (MM-DD-YY/Time)	Arrival Temp. (°C)	Initial TRC† (mg/L)	Date/Time Of Last Use (MM-DD-YY/Time)
002	08-03-08 / 0900 08-04-08 / 0800	08-04-08 / 1400	1.4	< 0.10	08-05-08 / 1215 08-06-08 / 1124
Intake	08-03-08 / 0900 08-04-08 / 0800	08-04-08 / 1400	2.0	< 0.10	08-05-08 / 1215 08-06-08 / 1124
002	08-05-08 / 0900 08-06-08 / 0800	08-06-08 / 1415	1.9	< 0.10	08-07-08 / 1121 08-08-08 / 1120
Intake	08-05-08 / 0900 08-06-08 / 0800	08-06-08 / 1415	2.4	< 0.10	08-07-08 / 1121 08-08-08 / 1120
002	08-07-08 / 0900 08-08-08 / 0800	08-08-08 / 1420	0.8	< 0.10	08-09-08 / 1117 08-10-08 / 1120 08-11-08 / 1123
Intake	08-07-08 / 0900 08-08-08 / 0800	08-08-08 / 1420	0.7	< 0.10	08-09-08 / 1117 08-10-08 / 1120 08-11-08 / 1123

* Represents the period of time during which the 24-hourly aliquots were collected.
‡ All times listed are in ET.
†Total residual chlorine.

4. Sample Manipulation: Samples from Outfall 002 and intake were warmed to test temperature (25.0 ± 1.0°C) in a warm water bath.

Test Organisms:	*Pimephales promelas*	*Ceriodaphnia dubia*
1. Source:	Aquatox, Inc.	In-house Cultures
2. Age:	19 hours old	<24-hours old
Test Method Summary:		
1. Test Conditions:	Static, Renewal	Static, Renewal
2. Test Duration:	7 days	Until at least 60% of control females have 3 broods
3. Control / Dilution Water:	Moderately Hard Synthetic	Moderately Hard Synthetic
4. Number of Replicates:	4	10
5. Organisms per Replicate:	10	1
6. Test Initiation: (Date/Time):	08-05-08/ 1100 ET	08-05-08 / 1215 ET
7. Test Termination: (Date/Time):	08-12-08 / 1000 ET	08-12-08 / 1153 ET
8. Test Temperature:	Mean = 24.6°C (24.1 - 25.0°C)	Mean = 24.8°C (24.5 - 25.3°C)

9. Physical / Chemical Measurements: Alkalinity, hardness, total residual chlorine, and conductivity were measured at the laboratory in each 100% sample. Daily temperatures were measured in one replicate for each test concentration. Pre- and post-exposure test solutions were analyzed daily for pH and dissolved oxygen.

10. Statistics: Statistics were performed according to methods prescribed by EPA using ToxCalc version 5.0 statistical software (Tidepool Scientific Software, McKinneyville, CA).

TOXICITY TEST RESULTS (see Appendix B for Bench Sheets)

1. Results of a *Pimephales promelas* Chronic/ 7-day Toxicity Test.
(Genus species) (Type / Duration)

Conducted August 5-12, 2008 using effluent from Outfall 002.

Test Solutions (% Effluent)	Percent Surviving (time interval used – days)						
	1	2	3	4	5	6	7
Control	100	100	100	100	100	100	100
6.25%	100	100	100	100	100	100	100
12.5%	100	100	100	100	100	100	100
25%	100	100	100	100	100	100	100
50%	100	100	100	98	98	98	98
100%	100	100	100	100	100	100	100
Intake	100	100	100	100	100	100	100

Test Solutions (% Effluent)	Mean Dry Weight (mg) (replicate number)				
	1	2	3	4	Mean
Control	0.938	0.829	0.781	0.688	0.809
6.25%	0.908	0.854	0.828	0.731	0.830
12.5%	0.831	0.753	0.705	0.833	0.781
25%	0.824	0.702	0.713	0.668	0.727
50%	0.809	0.861	0.714	0.745	0.782
100%	0.778	0.752	0.823	0.780	0.783
Intake	0.667	0.816	0.716	0.824	0.756

IC_{25} Value: > 100% Permit Limit: 100% 95% Confidence Limits: Upper Limit: NA Lower Limit: NA	Calculated TU Estimates: < 1.0 TUc* Permit Limit: 1.0 TUc

*TUa = $100/LC_{50}$: TUc = $100/ IC_{25}$

TOXICITY TEST RESULTS (see Appendix B for Bench Sheets)

2. Results of a *Ceriodaphnia dubia* (Genus species) Chronic/ 7-day Toxicity Test. (Type / Duration)

Conducted August 5-12, 2008 using effluent from Outfall 002.

Test Solutions (% Effluent)	Percent Surviving (time interval used – days)						
	1	2	3	4	5	6	7
Control	100	100	100	100	100	100	100
6.25%	100	100	100	100	100	100	100
12.5%	100	100	100	100	100	100	100
25%	100	100	100	100	100	100	100
50%	100	100	100	100	100	100	100
100%	100	100	100	100	100	100	100

Test Solutions (% Effluent)	Reproduction (#young/female/7 days) Data (replicate number)										
	1	2	3	4	5	6	7	8	9	10	Mean
Control	27	28	29	29	30	29	30	29	31	32	29.4
6.25%	28	33	32	33	32	30	30	33	29	32	31.2
12.5%	33	33	34	35	35	36	32	33	34	33	33.8
25%	35	38	33	33	35	34	34	34	34	34	34.4
50%	37	37	38	34	39	32	29	36	35	35	35.2
100%	33	40	38	42	34	41	37	36	34	39	37.4

IC_{25} Value: ≥ 100% Permit Limit: 100% 95% Confidence Limits: Upper Limit: NA Lower Limit: NA	Calculated TU Estimates: < 1.0 TUc* Permit Limit: 1.0 TUc

*TUa = $100/LC_{50}$: TUc = $100/ IC_{25}$

TOXICITY TEST RESULTS (see Appendix B for Bench Sheets)

2. Results of a *Ceriodaphnia dubia* Chronic/ 7-day Toxicity Test.
(Genus species) (Type / Duration)

Conducted August 5-12, 2008 using water from Intake

Test Solutions (% Effluent)	Percent Surviving (time interval used – days)						
	1	2	3	4	5	6	7
Control	100	100	100	100	100	100	100
Intake	100	100	100	100	100	100	100

Test Solutions (% Effluent)	Reproduction (#young/female/7 days) Data (replicate number)										
	1	2	3	4	5	6	7	8	9	10	Mean
Control	27	29	28	30	31	30	28	30	27	32	29.2
Intake	39	40	33	36	35	34	35	37	38	36	36.3

IC_{25} Value: ≥ 100% Permit Limit: NA 95% Confidence Limits: Upper Limit: NA Lower Limit: NA	Calculated TU Estimates: ≤ 1.0 TUc* Permit Limit: NA

*TUa = $100/LC_{50}$: TUc = $100/ IC_{25}$

REFERENCE TOXICANT TEST RESULTS (See Appendices A and C)

Species	Date	Time	Duration	Toxicant	Results (LC_{50}/IC_{25})
Pimephales promelas	08-05-08	1130	7 days	KCl	0.69 g/L (IC_{25})
Ceriodaphnia dubia	08-05-08	1200	7 days	NaCl	1.09 g/L (IC_{25})

PHYSICAL/CHEMICAL SUMMARY

Water Chemistry Mean Values and Ranges for *Pimephales promelas* and *Ceriodaphnia dubia* Tests of TVA / Kingston Fossil Plant - Outfall 002 performed August 5-12, 2008.

Test	Sample ID	Temperature (°C)		Dissolved Oxygen (mg/L)		pH (S.U.)		Conductance (µmhos/cm)	Alkalinity (mg/L $CaCO_3$)	Hardness (mg/L $CaCO_3$)	Total Residual Chlorine (mg/L)
		Initial	Final	Initial	Final	Initial	Final				
Pimephales promelas	Control	24.7 24.6 - 24.8	24.2 24.1 - 24.5	7.7 7.5 - 8.0	7.5 6.6 - 7.9	7.62 7.43 - 7.87	7.38 7.16 - 7.54	307 290 - 324	62 59 - 63	91 86 - 94	- - -
	6.25%	24.7 24.6 - 24.9	24.4 24.1 - 24.7	7.8 7.6 - 8.2	7.5 6.5 - 7.9	7.51 7.32 - 7.61	7.37 7.14 - 7.52	302 292 - 312	- - -	- - -	- - -
	12.5%	24.8 24.7 - 24.9	24.4 24.2 - 24.6	7.8 7.6 - 8.2	7.5 6.5 - 7.9	7.50 7.32 - 7.59	7.39 7.16 - 7.55	303 295 - 319	- - -	- - -	- - -
	25%	24.8 24.7 - 24.9	24.4 24.2 - 24.6	7.8 7.6 - 8.1	7.5 6.5 - 7.9	7.50 7.29 - 7.60	7.42 7.27 - 7.58	299 294 - 314	- - -	- - -	- - -
	50%	24.8 24.7 - 24.9	24.3 24.1 - 24.5	7.9 7.7 - 8.1	7.5 6.7 - 7.9	7.52 7.25 - 7.62	7.46 7.32 - 7.58	297 293 - 312	- - -	- - -	- - -
	100%	24.8 24.7 - 24.9	24.4 24.3 - 24.5	7.9 7.8 - 8.1	7.5 6.8 - 7.9	7.53 7.17 - 7.63	7.58 7.43 - 7.72	295 288 - 304	115 111 - 118	137 131 - 146	< 0.10 < 0.10 - < 0.10
	Intake	24.8 24.6 - 25.0	24.3 24.1 - 24.5	8.0 7.8 - 8.2	7.6 6.9 - 8.1	7.40 7.18 - 7.59	7.49 7.23 - 7.64	220 203 - 234	81 72 - 89	98 95 - 99	< 0.10 < 0.10 - < 0.10
Ceriodaphnia dubia	Control	24.7 24.6 - 24.9	25.0 24.7 - 25.2	7.7 7.5 - 8.0	7.9 7.8 - 8.2	7.62 7.43 - 7.87	7.50 7.32 - 7.66	307 290 - 324	62 59 - 63	91 86 - 94	- - -
	6.25%	24.8 24.7 - 24.9	25.0 24.6 - 25.2	7.8 7.6 - 8.2	7.9 7.8 - 8.1	7.51 7.32 - 7.61	7.50 7.32 - 7.65	302 292 - 312	- - -	- - -	- - -
	12.5%	24.8 24.7 - 24.9	24.9 24.7 - 25.1	7.8 7.6 - 8.2	7.8 7.7 - 8.0	7.50 7.32 - 7.59	7.51 7.33 - 7.65	303 295 - 319	- - -	- - -	- - -
	25%	24.8 24.7 - 24.9	24.9 24.7 - 25.3	7.8 7.6 - 8.1	7.9 7.7 - 8.0	7.50 7.29 - 7.60	7.52 7.37 - 7.65	299 294 - 314	- - -	- - -	- - -
	50%	24.8 24.7 - 24.9	24.8 24.6 - 25.2	7.9 7.7 - 8.1	7.9 7.7 - 8.0	7.52 7.25 - 7.62	7.58 7.43 - 7.74	297 293 - 312	- - -	- - -	- - -
	100%	24.9 24.7 - 25.0	24.8 24.6 - 25.2	7.9 7.8 - 8.1	7.9 7.8 - 8.0	7.53 7.17 - 7.63	7.69 7.54 - 7.85	295 288 - 304	115 111 - 118	137 131 - 146	< 0.10 < 0.10 - < 0.10
	Intake	24.8 24.5 - 25.0	24.9 24.6 - 25.2	8.0 7.8 - 8.2	7.8 7.7 - 8.2	7.40 7.18 - 7.59	7.58 7.44 - 7.69	220 203 - 234	81 72 - 89	98 95 - 99	< 0.10 < 0.10 - < 0.10

Overall temperature (°C)	Average	Minimum	Maximum
Pimephales promelas	24.6	24.1	25.0
Ceriodaphnia dubia	24.8	24.5	25.3

SUMMARY/CONCLUSIONS

Outfall 002 samples collected August 3-8, 2008, showed no toxic effects to fathead minnows or daphnids. The resulting IC_{25} values, for both species, were > 100 percent. Exposure of fathead minnows and daphnids to intake samples resulted in no significant differences for growth or reproduction from controls based on Homoscedastic t-Tests.

Appendix A

ADDITIONAL TOXICITY TEST INFORMATION

SUMMARY OF METHODS

1. *Pimephales promelas*

   Tests were conducted according to EPA-821-R-02-013 using four replicates, each containing ten test organisms, per treatment. Test vessels consisted of 500-mL plastic disposable cups, each containing 250-mL of test solution.

2. *Ceriodaphnia dubia*

   Tests were conducted according to EPA-821-R-02-013 using ten replicates, each containing one test organism, per treatment. Test vessels consisted of 30-mL polypropylene cups, each containing 15-mL of test solution.

DEVIATIONS / MODIFICATIONS TO TEST PROTOCOL

1. *Pimephales promelas*

   None

2. *Ceriodaphnia dubia*

   None

DEVIATIONS / MODIFICATIONS TO PRETEST CULTURE OR HOLDING OF TEST ORGANISMS

1. *Pimephales promelas*

   None

2. *Ceriodaphnia dubia*

   None

PHYSICAL AND CHEMICAL METHODS

1. Reagents, Titrants, Buffers, etc.: All chemicals were certified products used before expiration dates (where applicable).

2. Instruments: All identification, service, and calibration information pertaining to laboratory instruments is recorded in calibration and maintenance logbooks.

3. Temperature was measured by SM 2550 B.

4. Dissolved oxygen was measured by SM 4500 O G.

5. The pH was measured by SM 4500 H+ B.

6. Conductance was measured by SM 2510 B.

7. Alkalinity was measured by SM 2320 B.

8. Total hardness was measured by SM 2340 C.

9. Total residual chlorine was measured by ORION Electrode Method 97-70.

QUALITY ASSURANCE

Toxicity Test Methods: All phases of the study including, but not limited to, sample collection, handling and storage, glassware preparation, test organism culturing/acquisition and acclimation, test organism handling during test, and maintaining appropriate test conditions were conducted according to the protocol as described in this report and EPA-821-R-02-013. Any known deviations were noted during the study and are reported herein.

REFERENCE TOXICANT TESTS (See Appendix C for control chart information)

1. Test Type: 7-day chronic tests with results expressed as IC_{25} values in g/L KCl or NaCl.

2. Standard Toxicant: Potassium Chloride (KCl crystalline) for *Pimephales promelas*.
   Sodium Chloride (NaCl crystalline) for *Ceriodaphnia dubia*.

3. Dilution Water Used: Moderately hard synthetic water.

4. Statistics: ToxCalc software Version 5.0 was used for statistical analyses.

REFERENCES

1. NPDES Permit No. TN0005452.

2. USEPA. Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, EPA-821-R-02-013 (October 2002).

3. Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998.

4. Quality Assurance Program: Standard Operating Procedures, Environmental Testing Solutions, Inc (most current version).

Kingston Fossil Plant Biomonitoring
August 5-12, 2008

Appendix B

Chain of Custody Records and
Toxicity Test Bench Sheets

BIOMONITORING CHAIN OF CUSTODY RECORD

Page 1 of 1

Client: TVA

Project Name: Kingston Fossil Plant

P.O. Number: N/A

Facility Sampled: KIF

NPDES Number: TN0005452

Collected By: Larry Shelton

Larry Shelton

Environmental Testing Solution, Inc.
351 Depot Street.
Asheville, NC
28801
Phone: 828-350-9364
Fax: 828-350-9368

Delivered By (Circle One):

FedEx UPS Bus Client

Other (specify): Courier Service

General Comments:
Note: Diss. Mtls. Bottles filtered & collected onsite during each sampling event @ each sample location. Diss. Metls. are then stored at TVA 4200 Greenway Dr.
Samples are collected and shipped on ice to the contract laboratory.
All times are Eastern.

Field Identification / Sample Description	Grab/Comp.	Collection Date/Time		Container Number & Volume Collected	Flow (MGD)	Rain Event? (Mark as Appropriate)				Laboratory Use (project #3992)				
		Date	Time			Yes	If Yes, Inches	No	Trace	ETS Log Number	Arrival Temp. (°C)	By	Time	Appearance
KIF - Outfall 002	Comp	08/04/08	0840 am	(1) 2.5 GCT	1351.2					080804.01	1.4°C	JS	1400	*
KIF - Intake	Comp	08/04/08	0945 am	(1) 1 GCT						080804.02	2.0°C	JS	1400	*
										* Custody seals intact. Samples received in good condition.				
Outfall 001 Start:		08/03/08	0900 am											
Outfall 001 Finish:		08/04/08	0800 am											
Intake Start:		08/03/08	0900 am											
Intake Finish:		08/04/08	0800 am											

Sample Custody – Fill In From Top Down

Relinquished By (Signature):	Date/Time	Received By (Signature):	Date/Time
Larry Shelton	8/4/08 1045 EDT	Lee Garland	8/4/08 10:45
Lee Garland	8/4/08 1400	Jm/umm	08-04-08 1400

Instructions: Clients should fill in all areas except those in the "Laboratory Use" block. Biomonitoring samples are preserved by storing them at 4°C and shipping them in ice. The hold time for each sample is 36 hours from the time of collection. Therefore, please collect and ship in such a way that the laboratory will receive the samples with ample time to initiate testing within that time frame. Samples shipped overnight on Friday via FedEx or UPS must be marked for Saturday delivery or they will not arrive until the following Monday.

BIOMONITORING CHAIN OF CUSTODY RECORD

Page 1 of 1

Client: TVA

Project Name: Kingston Fossil Plant

P.O. Number: N/A

Facility Sampled: KIF

NPDES Number: TN0005452

Collected By: Larry Shelton

Larry Shelton

Environmental Testing Solution, Inc.
351 Depot Street.
Asheville, NC
28801
Phone: 828-350-9364
Fax: 828-350-9368

Delivered By (Circle One):

FedEx UPS Bus Client

Other (specify): Courier Service

General Comments:
Note: Diss. Mtls. Bottles filtered & collected onsite during each sampling event @ each sample location. Diss. Metls. are then stored at TVA 4200 Greenway Dr.
Samples are collected and shipped on ice to the contract laboratory.
All times are Eastern.

Field Identification / Sample Description	Grab/Comp.	Collection Date/Time		Container Number & Volume Collected	Flow (MGD)	Rain Event? (Mark as Appropriate)			
		Date	Time			Yes	If Yes, Inches	No	Trace
KIF - Outfall 001	Comp	08/06/08	0820 am	(1) 2.5 GCT	1357.1				
KIF - Intake	Comp	08/06/08	0955 am	(1) 1 GCT					
Outfall 001 Start:		08/05/08	0900 am						
Outfall 001 Finish:		08/06/08	0800 am						
Intake Start:		08/05/08	0900 am						
Intake Finish:		08/06/08	0800 am						

Project # 3992

Laboratory Use

ETS Log Number	Arrival Temp. (°C)	By	Time	Appearance
08080820	1.9°C	JH	1415	*
08080821	2.4°C	JH	1415	*

* Custody seals intact. Samples received in good condition.

Sample Custody – Fill In From Top Down

Relinquished By (Signature):	Date/Time	Received By (Signature):	Date/Time
Larry Shelton	8/6/08 1100 EDT	Ken Garland	8/6/08 11:50 EDT
Ken Garland	08-06-08 1415	Jim Junner ETS	08-06-08 1415

Instructions: Clients should fill in all areas except those in the "Laboratory Use" block. Biomonitoring samples are preserved by storing them at 4°C and shipping them in ice. The hold time for each sample is 36 hours from the time of collection. Therefore, please collect and ship in such a way that the laboratory will receive the samples with ample time to initiate testing within that time frame. Samples shipped overnight on Friday via FedEx or UPS must be marked for Saturday delivery or they will not arrive until the following Monday.

Security Seals in place when picked up by courier.

BIOMONITORING CHAIN OF CUSTODY RECORD

Client: TVA

Project Name: Kingston Fossil Plant

P.O. Number: N/A

Facility Sampled: KIF

NPDES Number: TN0005452

Collected By: Larry Shelton

Environmental Testing Solution, Inc.
351 Depot Street.
Asheville, NC
28801
Phone: 828-350-9364
Fax: 828-350-9368

Delivered By (Circle One):

FedEx UPS Bus Client

Other (specify): Courier Service

General Comments:
Note: Diss. Mtls. Bottles filtered & collected onsite during each sampling event @ each sample location. Diss. Metls. are then stored at TVA 4200 Greenway Dr.
Samples are collected and shipped on ice to the contract laboratory.
All times are Eastern.

Page 16 of 76

Field Identification / Sample Description	Grab/Comp.	Collection Date/Time		Container Number & Volume Collected	Flow (MGD)	Rain Event? (Mark as Appropriate)				Laboratory Use				
		Date	Time			Yes	If Yes, Inches	No	Trace	ETS Log Number	Arrival Temp. (°C)	By	Time	Appearance
KIF - Outfall 002	Comp	08/08/08	0835 am	(1) 5 GCT	1357.1		0.11			080808 Q6	0.8°C	JS	1420	*
KIF - Intake	Comp	08/08/08	0945 am	(1) 2.5 GCT						080808.07	0.7°C	JS	1420	*
Outfall 001 Start:		08/07/08	0900 am							* Custody seals intact. Samples received in good condition. Yvonne				
Outfall 001 Finish:		08/08/08	0800 am											
Intake Start:		08/07/08	0900 am											
Intake Finish:		08/08/08	0800 am											

Project #3992

Sample Custody – Fill In From Top Down

Relinquished By (Signature):	Date/Time	Received By (Signature):	Date/Time
Larry Shelton	8/8/08 1100 EDT	Jim Garland	08/08/08 1100
Jim Garland	08-08-08 1420	Jm/umm ETS	08-08-08 1420

Instructions: Clients should fill in all areas except those in the "Laboratory Use" block. Biomonitoring samples are preserved by storing them at 4°C and shipping them in ice. The hold time for each sample is 36 hours from the time of collection. Therefore, please collect and ship in such a way that the laboratory will receive the samples with ample time to initiate testing within that time frame. Samples shipped overnight on Friday via FedEx or UPS must be marked for Saturday delivery or they will not arrive until the following Monday.

ETS Environmental Testing Solutions, Inc.

Chronic Whole Effluent Toxicity Test (EPA-821-R-02-013 Method 1000.0)

Species: *Pimephales promelas*

Client: TVA
Facility: Kingston Fossil Plant
NPDES #: TN 0005452
Project #: 3992

County: Roane
Treatment: Non-treated
Outfall: 002

Dilution preparation information:						*Comments:*
Dilution prep (%)	6.25	12.5	25	50	100	
Effluent volume (mL)	156.25	312.5	625	1250	2500	
Diluent volume (mL)	2343.75	2187.5	1875	1250	0	
Total volume (mL)	2500	2500	2500	2500	2500	

Test organism information:		*Test information:*	
Organism age:	19 HOURS OLD	Randomizing template:	BLUE
Date and times organisms were born between:	08-04-08 1600	Incubator number:	3B
Organism source:	ATOX BATCH Pp 08-04-08	*Artemia* lot number:	BG1004W
Transfer bowl information:	pH = 7.66 Temperature = 25.3 °C	Total drying time:	24-HOURS
		Date / Time in: 08-12-08	1035
Average transfer volume:	0.1384 mL	Date / Time out: 08-13-08	1040
		Oven temperature:	60°C

Daily feeding and renewal information:

Day	Date	Morning feeding time	Afternoon feeding time	Test initiation, renewal, or termination time	Control water batch used MHSW	Sample numbers used	Analyst
0	08-05-08	——dl	1550	1100	07-30-08B	080804.01 + 02	dl
1	08-06-08	0800	1400	1003	07-30-08B	080804.01 + 02	dl
2	08-07-08	0800	1410	1005	08-04-08A	080806.20 + 21	dl
3	08-08-08	0800	1413	1007	08-04-08A	080806.20 + 21	dl
4	08-09-08	0750	1400	1009	08-04-08B	080808.06 + 07	dl
5	08-10-08	0745	1400	1003	08-04-08B	080808.06 + 07	dl
6	08-11-08	0730	1335	1002	08-04-08B	080808.06 + 07	dl
7	08-12-08			1000			dl

Control information:		Acceptance criteria	*Summary of test endpoints:*	
% Mortality:	0%	≤ 20%	7-day LC_{50}	>100%
Average weight per initial larvae:	0.809		NOEC	100%
Average weight per surviving larvae:	0.809	≥ 0.25 mg/larvae	LOEC	>100%
			ChV	>100%
			IC_{25}	>100%

Species: *Pimephales promelas* Date: 08-05-08

Client: TVA / Kingston Fossil Plant - Non-treated

Survival and Growth Data

Day	CONTROL				6.25%				12.5%			
	A	B	C	D	E	F	G	H	I	J	K	L
0	10	10	10	10	10	10	10	10	10	10	10	10
1	10	10	10	10	10	10	10	10	10	10	10	10
2	10	10	10	10	10	10	10	10	10	10	10	10
3	10	10	10	10	10	10	10	10	10	10	10	10
4	10	10	10	10	10	10	10	10	10	10	10	10
5	10	10	10	10	10	10	10	10	10	10	10	10
6	10	10	10	10	10	10	10	10	10	10	10	10
7	10 lg	10	10	10 sm	10 lg	10	10	10 sm	10	10	10 sm	10
A = Pan weight (mg) Tray color code:: lt blue Analyst: MM	13.44	14.78	15.12	14.05	13.23	15.75	15.39	14.41	13.71	14.60	14.48	14.45
B = Pan + Larvae weight (mg) Analyst: BSL	22.82	23.07	22.93	20.93	22.31	24.29	23.67	21.72	22.02	22.13	21.53	22.78
Larvae weight (mg) = A – B	9.38	8.29	7.81	6.88	9.08	8.54	8.28	7.31	8.31	7.53	7.05	8.33
Weight per initial number of larvae (mg) = C / Initial number of larvae	0.938	0.829	0.781	0.688	0.908	0.854	0.828	0.731	0.831	0.753	0.705	0.833
Average weight per initial number of larvae (mg)	0.809				0.830				0.781			
Percent reduction from control (%)					- 2.67.				3.57.			

Comment codes: c = clear, d = dead, fg = fungus, k = killed, m = missing, sk = sick, sm = unusually small, lg = unusually large, d&r = decanted and returned, w = wounded.

Calculations and data reviewed:

Comments:

Species: *Pimephales promelas*

Client: TVA / Kingston Fossil Plant - Non-treated Date: 08-05-08

Survival and Growth Data

Day	25%				50%				100%			
	M	N	O	P	Q	R	S	T	U	V	W	X
0	10	10	10	10	10	10	10	10	10	10	10	10
1	10	10	10	10	10	10	10	10	10	10	10	10
2	10	10	10	10	10	10	10	10	10	10	10	10
3	10	10	10	10	10	10	10	10	10	10	10	10
4	10	10	10	10	10	10	9 sk	10	10	10	10	10
5	10	10	10	10	10	10	9	10	10	10	10	10
6	10	10	10	10	10	10	9	10	10	10	10	10
7	10	10 ISM	10 ISM	10 ISM	10	10	9	10	10	10	10	10
A = Pan weight (mg) Tray color code:: lt. blue Analyst: NM	14.59	14.21	13.41	14.81	14.46	13.10	15.86	13.88	15.62	14.95	13.38	12.92
B = Pan + Larvae weight (mg) Analyst: BSC	22.83	21.23	20.54	21.49	22.55	21.71	23.00	21.33	23.40	22.47	21.61	20.72
Larvae weight (mg) = A – B	8.24	7.02	7.13	6.68	8.09	8.61	7.14	7.45	7.78	7.52	8.23	7.80
Weight per initial number of larvae (mg) = C / Initial number of larvae	0.824	0.702	0.713	0.668	0.809	0.861	0.714	0.745	0.778	0.752	0.823	0.780
Average weight per initial number of larvae (mg)	0.727		10.2%		0.782		3.3%		0.783		3.2%	
Percent reduction from control (%)												

Comment codes: c = clear, d = dead, fg = fungus, k = killed, m = missing, sk = sick, sm = unusually small, lg = unusually large, d&r = decanted and returned, w = wounded.

Calculations and data reviewed: JH

Comments:

ETS
Environmental Testing Solutions, Inc.

Species: *Pimephales promelas*

Client: TVA / Kingston Fossil Plant - Non-treated **Date:** 08-05-08

Survival and Growth Data

Day	100% Intake			
	Y	Z	AA	BB
0	10	10	10	10
1	10	10	10	10
2	10	10	10	10
3	10	10	10	10
4	10	10	10	10
5	10	10	10	10
6	10	10	10	10
7	10 ISM	10	10 ISM	10
A = Pan weight (mg) Tray color code:: lt. blue Analyst: MM	14.61	14.41	14.37	14.28
B = Pan + Larvae weight (mg) Analyst: BSC	21.28	22.57	21.53	22.52
Larvae weight (mg) = A – B	6.67	8.16	7.16	8.24
Weight per initial number of larvae (mg) = C / Initial number of larvae	0.667	0.816	0.716	0.824
Average weight per initial number of larvae (mg)	0.756			
Percent reduction from control (%)	6.67			

Comment codes: c = clear, d = dead, fg = fungus, k = killed, m = missing, sk = sick, sm = unusually small, lg = unusually large, d&r = decanted and returned, w = wounded.

Calculations and data reviewed: JL

Comments:

TVA / Kingston Fossil Plant, Outfall 002
August 05-12, 2008

Environmental Testing Solutions, Inc.

***Pimephales promelas* Chronic Whole Effluent Toxicity Test**
EPA-821-R-02-013, Method 1000.0

Quality Control
Verification of Data Entry, Calculations, and Statistical Analyses

Project number: 3992

Reveiwed by:

							Not for Compliance Assessment, Internal Laboratory QC							
Concentration (%)	Replicate	Initial number of larvae	Final number of larvae	A = Pan weight (mg)	B = Pan + Larvae weight (mg)	Larvae weight (mg) = A - B	Weight / Surviving number of larvae (mg)	Mean weight / Surviving number of larvae (mg)	Coefficient of variation (Mean weight per surviving number of larvae) (%)	Weight / Initial number of larvae (mg)	Mean survival (%)	Mean weight / Initial number of larvae (mg)	Coefficient of variation (Mean weight per initial number of larvae) (%)	Percent reduction from control (%)
Control	A	10	10	13.44	22.82	9.38	0.938	0.809	12.9	0.938	100.0	0.809	12.9	Not applicable
	B	10	10	14.78	23.07	8.29	0.829			0.829				
	C	10	10	15.12	22.93	7.81	0.781			0.781				
	D	10	10	14.05	20.93	6.88	0.688			0.688				
6.25%	E	10	10	13.23	22.31	9.08	0.908	0.830	8.9	0.908	100.0	0.830	8.9	-2.6
	F	10	10	15.75	24.29	8.54	0.854			0.854				
	G	10	10	15.39	23.67	8.28	0.828			0.828				
	H	10	10	14.41	21.72	7.31	0.731			0.731				
12.5%	I	10	10	13.71	22.02	8.31	0.831	0.781	8.0	0.831	100.0	0.781	8.0	3.5
	J	10	10	14.60	22.13	7.53	0.753			0.753				
	K	10	10	14.48	21.53	7.05	0.705			0.705				
	L	10	10	14.45	22.78	8.33	0.833			0.833				
25%	M	10	10	14.59	22.83	8.24	0.824	0.727	9.3	0.824	100.0	0.727	9.3	10.2
	N	10	10	14.21	21.23	7.02	0.702			0.702				
	O	10	10	13.41	20.54	7.13	0.713			0.713				
	P	10	10	14.81	21.49	6.68	0.668			0.668				
50%	Q	10	10	14.46	22.55	8.09	0.809	0.802	6.0	0.809	97.5	0.782	8.4	3.3
	R	10	10	13.10	21.71	8.61	0.861			0.861				
	S	10	9	15.86	23.00	7.14	0.793			0.714				
	T	10	10	13.88	21.33	7.45	0.745			0.745				
100%	U	10	10	15.62	23.40	7.78	0.778	0.783	3.8	0.778	100.0	0.783	3.8	3.2
	V	10	10	14.95	22.47	7.52	0.752			0.752				
	W	10	10	13.38	21.61	8.23	0.823			0.823				
	X	10	10	12.92	20.72	7.80	0.780			0.780				
100% Intake	Y	10	10	14.61	21.28	6.67	0.667	0.756	10.2	0.667	100.0	0.756	10.2	6.6
	Z	10	10	14.41	22.57	8.16	0.816			0.816				
	AA	10	10	14.37	21.53	7.16	0.716			0.716				
	BB	10	10	14.28	22.52	8.24	0.824			0.824				

Outfall 002:
Dunnett's MSD value: 0.1205
PMSD: 14.9

Intake:
Dunnett's MSD value: 0.1257
PMSD: 15.5

MSD = Minimum Significant Difference
PMSD = Percent Minimum Significant Difference
PMSD is a measure of test precision. The PMSD is the minimum percent difference between the control and treatment that can be declared statistically significant in a whole effluent toxicity test.

Lower PMSD bound determined by USEPA (10th percentile) = 12%.
Upper PMSD bound determined by USEPA (90th percentile) = 30%.

Lower and upper PMSD bounds were determined from the 10th and 90th percentile, respectively, of PMSD data from EPA's WET Interlaboratory Variability Study (USEPA, 2001a; USEPA, 2001b).

USEPA. 2001a, 2001b. Final Report: Interlaboratory Variability Study of EPA Short-term Chronic and Acute Whole Effluent Toxicity Test Methods, Volumes 1 and 2-Appendix. EPA-821-B-01-004 and EPA-821-B-01-005. US Environmental Protection Agency, Cincinnati, OH.

TVA / Kingston Fossil Plant, Outfall 002
August 05-12, 2008
Statistical Analyses

Environmental Testing Solutions, Inc.

Larval Fish Growth and Survival Test-7 Day Growth

Start Date:	8/5/2008	Test ID:	PpFRCR	Sample ID:	TVA / Kingston Fossil Plant, Outfall 002
End Date:	8/12/2008	Lab ID:	ETS-Envir. Testing Sol.	Sample Type:	DMR-Discharge Monitoring Report
Sample Date:		Protocol:	FWCHR-EPA-821-R-02-013	Test Species:	PP-Pimephales promelas
Comments:	Non-treated				

Conc-%	1	2	3	4
D-Control	0.9380	0.8290	0.7810	0.6880
6.25	0.9080	0.8540	0.8280	0.7310
12.5	0.8310	0.7530	0.7050	0.8330
25	0.8240	0.7020	0.7130	0.6680
50	0.8090	0.8610	0.7140	0.7450
100	0.7780	0.7520	0.8230	0.7800

			Transform: Untransformed					1-Tailed			Isotonic	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.8090	1.0000	0.8090	0.6880	0.9380	12.859	4				0.8196	1.0000
6.25	0.8303	1.0263	0.8303	0.7310	0.9080	8.923	4	-0.425	2.410	0.1205	0.8196	1.0000
12.5	0.7805	0.9648	0.7805	0.7050	0.8330	8.023	4	0.570	2.410	0.1205	0.7805	0.9523
25	0.7268	0.8983	0.7268	0.6680	0.8240	9.302	4	1.645	2.410	0.1205	0.7641	0.9322
50	0.7823	0.9669	0.7823	0.7140	0.8610	8.403	4	0.535	2.410	0.1205	0.7641	0.9322
100	0.7833	0.9682	0.7833	0.7520	0.8230	3.755	4	0.515	2.410	0.1205	0.7641	0.9322

Auxiliary Tests					Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)					0.98911625		0.884		0.10828099	-0.3313661
Bartlett's Test indicates equal variances (p = 0.60)					3.62678957		15.0862722			
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	100	>100		1	0.12047456	0.14891788	0.00483747	0.00499789	0.46326116	5, 18
Treatments vs D-Control										

Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)	Skew
IC05	13.913			
IC10	>100			
IC15	>100			
IC20	>100			
IC25	>100			
IC40	>100			
IC50	>100			

kif002_08-05-08data

TVA / Kingston Fossil Plant, Intake
August 05-12, 2008
Statistical Analyses

Environmental Testing Solutions, Inc.

Larval Fish Growth and Survival Test-7 Day Growth

Start Date:	8/5/2008	Test ID:	PpFRCR	Sample ID:	TVA / Kingston Fossil Plant, Intake
End Date:	8/12/2008	Lab ID:	ETS-Envir. Testing Sol.	Sample Type:	DMR-Discharge Monitoring Report
Sample Date:		Protocol:	FWCHR-EPA-821-R-02-013	Test Species:	PP-Pimephales promelas
Comments:	Non-treated				

Conc-%	1	2	3	4
D-Control	0.9380	0.8290	0.7810	0.6880
100	0.6670	0.8160	0.7160	0.8240

			Transform: Untransformed					1-Tailed			Isotonic	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.8090	1.0000	0.8090	0.6880	0.9380	12.859	4				0.8090	1.0000
100	0.7558	0.9342	0.7558	0.6670	0.8240	10.176	4	0.823	1.943	0.1257	0.7558	0.9342

Auxiliary Tests	Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.97357935		0.749		0.04262499	-0.9586298
F-Test indicates equal variances (p = 0.63)	1.82961154		47.4672279			
Hypothesis Test (1-tail, 0.05)	**MSDu**	**MSDp**	**MSB**	**MSE**	**F-Prob**	**df**
Homoscedastic t Test indicates no significant differences Treatments vs D-Control	0.12569582	0.15537184	0.00567112	0.00836846	0.44187054	1, 6

Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)	Skew
IC05*	75.962			
IC10	>100			
IC15	>100			
IC20	>100			
IC25	>100			
IC40	>100			
IC50	>100			

* indicates IC estimate less than the lowest concentration

kif002_08-05-08data

TVA / Kingston Fossil Plant, Outfall 002
August 05-12, 2008

ETS Environmental Testing Solutions, Inc.

Pimephales promelas Chronic Whole Effluent Toxicity Test
EPA-821-R-02-013, Method 1000.0

Daily Chemical Analyses

Project number: 3992

Reviewed by:

Concentration	Parameter	Day 0		Day 1		Day 2		Day 3		Day 4		Day 5		Day 6	
		Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final
Control	pH (SU)	7.43	7.37	7.82	7.26	7.53	7.39	7.72	7.54	7.87	7.50	7.43	7.45	7.53	7.16
	DO (mg/L)	7.6	7.7	7.7	7.4	7.6	7.5	7.6	7.8	7.5	7.9	8.0	7.6	7.6	6.6
	Conductivity (µmhos/cm)	310		324		305		312		308		302		290	
	Alkalinity (mg/L $CaCO_3$)	59				63				63					
	Hardness (mg/L $CaCO_3$)	92				94				86					
	Temperature (°C)	24.7	24.3	24.6	24.2	24.7	24.1	24.7	24.1	24.8	24.2	24.6	24.2	24.8	24.5
6.25%	pH (SU)	7.48	7.36	7.43	7.27	7.32	7.39	7.59	7.52	7.61	7.50	7.57	7.44	7.55	7.14
	DO (mg/L)	7.6	7.6	7.7	7.4	7.7	7.6	7.7	7.7	8.0	7.9	8.2	7.5	7.6	6.5
	Conductivity (µmhos/cm)	300		312		302		307		304		292		300	
	Temperature (°C)	24.7	24.6	24.6	24.2	24.8	24.5	24.7	24.2	24.8	24.1	24.7	24.5	24.9	24.7
12.5%	pH (SU)	7.46	7.36	7.45	7.29	7.32	7.39	7.56	7.55	7.59	7.51	7.57	7.45	7.54	7.16
	DO (mg/L)	7.6	7.6	7.7	7.4	7.7	7.6	7.7	7.8	8.0	7.9	8.2	7.5	7.7	6.5
	Conductivity (µmhos/cm)	300		319		302		307		296		295		300	
	Temperature (°C)	24.7	24.5	24.7	24.5	24.8	24.3	24.8	24.2	24.8	24.3	24.7	24.6	24.9	24.3
25%	pH (SU)	7.47	7.38	7.46	7.29	7.29	7.39	7.56	7.58	7.60	7.53	7.58	7.50	7.55	7.27
	DO (mg/L)	7.6	7.6	7.7	7.4	7.7	7.6	7.8	7.8	8.0	7.9	8.1	7.6	7.8	6.5
	Conductivity (µmhos/cm)	294		314		298		302		295		294		298	
	Temperature (°C)	24.8	24.5	24.7	24.4	24.8	24.5	24.8	24.4	24.8	24.2	24.7	24.3	24.9	24.6
50%	pH (SU)	7.50	7.39	7.52	7.32	7.25	7.48	7.60	7.58	7.59	7.58	7.62	7.52	7.58	7.32
	DO (mg/L)	7.7	7.7	7.7	7.5	7.8	7.6	7.9	7.7	8.0	7.9	8.1	7.6	7.8	6.7
	Conductivity (µmhos/cm)	293		312		295		300		293		293		294	
	Temperature (°C)	24.8	24.5	24.7	24.4	24.8	24.4	24.8	24.1	24.9	24.2	24.7	24.5	24.9	24.3
100%	pH (SU)	7.54	7.53	7.58	7.43	7.17	7.58	7.63	7.72	7.59	7.68	7.58	7.64	7.59	7.48
	DO (mg/L)	7.8	7.6	7.9	7.5	7.9	7.7	7.9	7.7	8.0	7.9	8.1	7.6	7.8	6.8
	Conductivity (µmhos/cm)	292		304		294		296		288		294		294	
	Alkalinity (mg/L $CaCO_3$)	111				118				116					
	Hardness (mg/L $CaCO_3$)	131				135				146					
	Total Residual Chlorine (mg/L)	<0.10				<0.10				<0.10					
	Temperature (°C)	24.8	24.4	24.7	24.3	24.8	24.5	24.7	24.3	24.9	24.5	24.7	24.4	24.9	24.3
100% Intake	pH (SU)	7.42	7.52	7.49	7.48	7.18	7.64	7.59	7.58	7.36	7.50	7.33	7.47	7.40	7.23
	DO (mg/L)	7.8	7.6	8.0	7.5	8.0	7.4	7.9	7.8	8.1	8.1	8.2	7.6	7.9	6.9
	Conductivity (µmhos/cm)	226		234		234		233		203		206		206	
	Alkalinity (mg/L $CaCO_3$)	83				89				72					
	Hardness (mg/L $CaCO_3$)	99				99				95					
	Total Residual Chlorine (mg/L)	<0.10				<0.10				<0.10					
	Temperature (°C)	24.8	24.4	24.7	24.5	24.9	24.5	24.8	24.2	24.7	24.1	24.6	24.4	25.0	24.3

Species: *Pimephales promelas*
Client: TVA / Kingston Fossil Plant – Non-treated

Date: 08-05-08

Daily Chemistry:

		Day					
		0		1		2	
	Analyst	JH	MW	MW	JL	JH	JL
Concentration	Parameter						
CONTROL	pH (S.U.)	7.43	~~7.43~~ 7.37	7.82	7.26	7.53	7.39
	DO (mg/L)	7.6	7.7	7.7	7.4	7.6	7.5
	Conductivity (µmhos/cm)	310		324		305	
	Alkalinity (mg $CaCO_3$/L)	59				63	
	Hardness (mg $CaCO_3$/L)	92				94	
	Temperature (°C)	24.7	24.3	24.6	24.2	24.7	24.1
6.25%	pH (S.U.)	7.48	7.36	7.43	7.27	7.32	7.39
	DO (mg/L)	7.6	7.6	7.7	7.4	7.7	7.6
	Conductivity (µmhos/cm)	300		312		302	
	Temperature (°C)	24.7	24.6	24.6	24.2	24.8	24.5
12.5%	pH (S.U.)	7.46	7.36	7.45	7.29	7.32	7.39
	DO (mg/L)	7.6	7.6	7.7	7.4	7.7	7.6
	Conductivity (µmhos/cm)	300		319		302	
	Temperature (°C)	24.7	24.5	24.7	24.5	24.8	24.3
25%	pH (S.U.)	7.47	7.38	7.46	7.29	7.29	7.39
	DO (mg/L)	7.6	7.6	7.7	7.4	7.7	7.6
	Conductivity (µmhos/cm)	294		314		298	
	Temperature (°C)	24.8	24.5	24.7	24.4	24.8	24.5
50%	pH (S.U.)	7.50	7.39	7.52	7.32	7.25	7.48
	DO (mg/L)	7.7	7.7	7.7	7.5	7.8	7.6
	Conductivity (µmhos/cm)	293		312		295	
	Temperature (°C)	24.8	24.5	24.7	24.4	24.8	24.4
100%	pH (S.U.)	7.54	7.53	7.58	7.43	7.17	7.58
	DO (mg/L)	7.8	7.6	7.9	7.5	7.9	7.7
	Conductivity (µmhos/cm)	292		304		294	
	Alkalinity (mg $CaCO_3$/L)	111				118	
	Hardness (mg $CaCO_3$/L)	131				135	
	TR chlorine (mg/L)	<0.10				<0.10	
	Temperature (°C)	24.8	24.4	24.7	24.3	24.8	24.5
100% Intake	pH (S.U.)	7.42	7.52	7.49	7.48	7.18	7.64
	DO (mg/L)	7.8	7.6	8.0	7.5	8.0	7.4
	Conductivity (µmhos/cm)	226		234		234	
	Alkalinity (mg $CaCO_3$/L)	83				89	
	Hardness (mg $CaCO_3$/L)	99				99	
	TR chlorine (mg/L)	<0.10				<0.10	
	Temperature (°C)	24.8	24.4	24.7	24.5	24.9	24.5
		Initial	Final	Initial	Final	Initial	Final

Species: *Pimephales promelas* Date: 08-05-08

Client: TVA / Kingston Fossil Plant – Non-treated

		Day							
		3		4		5		6	
	Analyst	JH	UAB	UAB	JH/BSC	JH/BSC	JH	JH	KEG
Concentration	Parameter								
CONTROL	pH (S.U.)	7.72	7.54	7.87	7.50	7.43	7.45	7.53	7.16
	DO (mg/L)	7.6	7.8	7.5	7.9	8.0	7.6	7.6	6.6
	Conductivity (µmhos/cm)	312		308		302		290	
	Alkalinity (mg $CaCO_3$/L)			63					
	Hardness (mg $CaCO_3$/L)			86					
	Temperature (°C)	24.7	24.1	24.8	24.2	24.6	24.2	24.8	24.5
6.25%	pH (S.U.)	7.59	7.52	7.61	7.50	7.57	7.44	7.55	7.14
	DO (mg/L)	7.7	7.7	8.0	7.9	8.2	7.5	7.6	6.5
	Conductivity (µmhos/cm)	307		304		292		300	
	Temperature (°C)	24.7	24.2	24.8	24.1	24.7	24.5	24.9	24.7
12.5%	pH (S.U.)	7.56	7.55	7.59	7.51	7.57	7.45	7.54	7.16
	DO (mg/L)	7.7	7.8	8.0	7.9	8.2	7.5	7.7	6.5
	Conductivity (µmhos/cm)	307		296		295		300	
	Temperature (°C)	24.8	24.2	24.8	24.3	24.7	24.6	24.9	24.3
25%	pH (S.U.)	7.56	7.58	7.60	7.53	7.58	7.50	7.55	7.27
	DO (mg/L)	7.8	7.8	8.0	7.9	8.1	7.6	7.8	6.5
	Conductivity (µmhos/cm)	302		295		294 ~~296~~ BSC		298	
	Temperature (°C)	24.8	24.4	24.8	24.2	24.7	24.3	24.9	24.6
50%	pH (S.U.)	7.60	7.58	7.59	7.58	7.62	7.52	7.58	7.32
	DO (mg/L)	7.9	7.7	8.0	7.9	8.1	7.6	7.8	6.7
	Conductivity (µmhos/cm)	300		293		293		294	
	Temperature (°C)	24.8	24.1	24.9	24.2	24.7	24.5	24.9	24.3
100%	pH (S.U.)	7.63	7.72	7.59	7.68	7.58	7.64	7.59	7.48
	DO (mg/L)	7.9	7.7	8.0	7.9	8.1	7.6	7.8	6.8
	Conductivity (µmhos/cm)	296		288		294		294	
	Alkalinity (mg $CaCO_3$/L)			116					
	Hardness (mg $CaCO_3$/L)			146					
	TR chlorine (mg/L)			<0.10					
	Temperature (°C)	24.7	24.3	24.9	24.5	24.7	24.4	24.9	24.3
100% Intake	pH (S.U.)	7.59	7.58	7.36	7.50	7.33	7.47	7.40	7.23
	DO (mg/L)	7.9	7.8	8.1	8.1	8.2	7.6	7.9	6.9
	Conductivity (µmhos/cm)	233		203		206		206	
	Alkalinity (mg $CaCO_3$/L)			72					
	Hardness (mg $CaCO_3$/L)			95					
	TR chlorine (mg/L)			<0.10					
	Temperature (°C)	24.8	24.2	24.7	24.1	24.6	24.4	25.0	24.3
		Initial	Final	Initial	Final	Initial	Final	Initial	Final

ETS
Environmental Testing Solutions, Inc.

Chronic Whole Effluent Toxicity Test (EPA-821-R-02-013 Method 1002.0)
Species: *Ceriodaphnia dubia*

Client: TVA
Facility: Kingston Fossil Plant
NPDES #: TN 0005452
Project #: 3992

County: Roane
Treatment: Non-treated
Outfall: 002

Dilution preparation information:						*Comments:*
Dilution prep (%)	6.25	12.5	25	50	100	
Effluent volume (mL)	156.25	312.5	625	1250	2500	
Diluent volume (mL)	2343.75	2187.5	1875	1250	0	
Total volume (mL)	2500	2500	2500	2500	2500	

Test organism source information:											*Test information:*	
Organism age:	< 24-hours old										Randomizing template color:	GREEN
Date and times organisms were born between:	08-05-08 0800 TO 1050										Incubator number and shelf location:	2B2
Culture board:	07-29-08 B											
Replicate number:	1	2	3	4	5	6	7	8	9	10	YWT batch:	07-07-08
Culture board cup number:	2	5	6	9	11	12	15	16	17	21		
Transfer bowl information:	pH = 7.70 SU Temperature = 24.9 °C										*Selenastrum* batch:	07-25-08

Daily renewal information:

Day	Date	Test initiation, renewal, or termination time	Control water batch used MHSW	Sample numbers used	Analyst
0	08-05-08	1215	07-30-08 B	080804.01 & 02	JH
1	08-06-08	1124	07-30-08 B	080804.01 & 02	JH
2	08-07-08	1121	08-04-08 A	080806.20 & 21	JH
3	08-08-08	1120	08-04-08 A	080806.20 & 21	JH
4	08-09-08	1117	08-04-08 B	080808.06 & 07	JH
5	08-10-08	1120	08-04-08 B	080808.06 & 07	JH
6	08-11-08	1123	08-04-08 B	080808.06 & 07	JH
7	08-12-08	1153			JH

Control information:	1	2	Acceptance criteria	*Summary of test endpoints:*	
% of Male Adults:	0%	0%	≤ 20%	7-day LC50	>100%
% Adults having 3rd Broods:	100%	100%	≥ 80%	NOEC	100%
% Mortality:	0%	0%	≤ 20%	LOEC	>100%
Mean Offspring/Female:	29.4	29.2	≥ 15.0 offspring/female	ChV	>100%
% CV:	4.9%	5.8%	< 40.0 %	IC25	>100%

Species: *Ceriodaphnia dubia*
Client: Kingston Fossil Plant - Non-treated Date: 08-05-08

CONTROL *Survival and Reproduction Data*

Day		Replicate number 1	2	3	4	5	6	7	8	9	10
1	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
2	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
3	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
4	Young produced	3	3	4	3	4	3	3	3	3	4
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	0	0	0	0	0	11	0	11	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	10	10	10	10	13	0	10	0	12	12
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	14	15	15	16	13	15	17	15	16	16
Total young produced		27	28	29	29	30	29	30	29	31	32
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L
X for 3rd Broods		X	X	X	X	X	X	X	X	X	X

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	29.4

CONC: 6.25% *Survival and Reproduction Data*

Day		Replicate number 1	2	3	4	5	6	7	8	9	10
1	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
2	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
3	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
4	Young produced	4	3	3	5	3	4	4	3	3	3
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	0	13	12	10	0	11	11	13	0	13
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	10	0	0	0	12	0	0	0	12	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	14	17	17	18	17	15	15	17	14	16
Total young produced		28	33	32	33	32	30	30	33	29	32
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	31.2
% Reduction from Control:	-6.17%

Species: *Ceriodaphnia dubia*
Client: Kingston Fossil Plant - Non-treated
Date: 08-05-08

CONC: 12.5%

Survival and Reproduction Data

Day		Replicate number 1	2	3	4	5	6	7	8	9	10
1	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
2	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
3	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
4	Young produced	5	4	4	3	5	3	3	4	4	4
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	0	0	12	13	13	0	11	13	11	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	12	10	0	0	0	12	0	0	0	12
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	16	19	18	19	17	21	18	16	19	17
Total young produced		33	33	34	35	35	36	32	33	34	33
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	33.8
% Reduction from Control:	-15.07%

CONC: 25%

Survival and Reproduction Data

Day		Replicate number 1	2	3	4	5	6	7	8	9	10
1	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
2	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
3	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
4	Young produced	4	4	3	3	5	4	4	3	3	4
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	12	14	0	12	0	11	14	11	0	13
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	0	0	10	0	12	0	0	0	13	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	19	20	20	18	18	19	16	20	18	17
Total young produced		35	38	33	33	35	34	34	34	34	34
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	34.4
% Reduction from Control:	-17.07%

Species: *Ceriodaphnia dubia*
Client: Kingston Fossil Plant - Non-treated Date: 08-05-08

CONC: 50% *Survival and Reproduction Data*

Day		Replicate number									
		1	2	3	4	5	6	7	8	9	10
1	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
2	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
3	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
4	Young produced	5	3	3	4	4	3	4	4	5	4
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	0	14	14	13	14	12	0	12	12	14
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	12	0	0	0	0	0	10	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	20	20	19	17	21	17	15	20	18	17
Total young produced		37	37	38	34	39	32	29	36	35	35
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	35.2
% Reduction from Control:	-19.7%

CONC: 100% *Survival and Reproduction Data*

Day		Replicate number									
		1	2	3	4	5	6	7	8	9	10
1	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
2	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
3	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
4	Young produced	4	5	4	6	4	5	4	4	3	5
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	0	15	13	16	0	14	15	12	0	13
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	11	0	0	0	13	0	0	0	11	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	18	20	21	20	17	22	18	20	20	21
Total young produced		33	40	38	42	34	41	37	36	34	39
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	37.4
% Reduction from Control:	-27.2%

Species: *Ceriodaphnia dubia*
Client: Kingston Fossil Plant - Non-treated Date: 08-05-08

CONTROL *Survival and Reproduction Data*

Day		Replicate number 1	2	3	4	5	6	7	8	9	10
1	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
2	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
3	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
4	Young produced	3	3	4	3	5	3	3	3	4	4
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	0	0	0	0	0	12	0	10	0	11
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	11	10	10	13	12	0	11	0	10	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	13	16	14	14	14	15	14	17	13	17
Total young produced		27	29	28	30	31	30	28	30	27	32
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	29.2

CONC: 100% Intake *Survival and Reproduction Data*

Day		Replicate number 1	2	3	4	5	6	7	8	9	10
1	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
2	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
3	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
4	Young produced	4	5	4	3	4	3	3	5	3	3
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	0	16	0	12	12	0	11	13	13	15
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	15	0	12	0	0	13	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	20	19	17	21	19	18	21	19	22	18
Total young produced		39	40	33	36	35	34	35	37	38	36
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	36.3
% Reduction from Control:	-24.3%

ETS
Environmental Testing Solutions, Inc.

TVA / Kingston Fossil Plant, Outfall 002
August 05-12, 2008

Verification of *Ceriodaphnia* Reproduction Totals

Control-1

Day	Replicate number										Total
	1	2	3	4	5	6	7	8	9	10	
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0
4	3	3	4	3	4	3	3	3	3	4	33
5	0	0	0	0	0	11	0	11	0	0	22
6	10	10	10	10	13	0	10	0	12	12	87
7	14	15	15	16	13	15	17	15	16	16	152
Total	27	28	29	29	30	29	30	29	31	32	294

6.25%

Day	Replicate number										Total
	1	2	3	4	5	6	7	8	9	10	
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0
4	4	3	3	5	3	4	4	3	3	3	35
5	0	13	12	10	0	11	11	13	0	13	83
6	10	0	0	0	12	0	0	0	12	0	34
7	14	17	17	18	17	15	15	17	14	16	160
Total	28	33	32	33	32	30	30	33	29	32	312

12.5%

Day	Replicate number										Total
	1	2	3	4	5	6	7	8	9	10	
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0
4	5	4	4	3	5	3	3	4	4	4	39
5	0	0	12	13	13	0	11	13	11	0	73
6	12	10	0	0	0	12	0	0	0	12	46
7	16	19	18	19	17	21	18	16	19	17	180
Total	33	33	34	35	35	36	32	33	34	33	338

25%

Day	Replicate number										Total
	1	2	3	4	5	6	7	8	9	10	
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0
4	4	4	3	3	5	4	4	3	3	4	37
5	12	14	0	12	0	11	14	11	0	13	87
6	0	0	10	0	12	0	0	0	13	0	35
7	19	20	20	18	18	19	16	20	18	17	185
Total	35	38	33	33	35	34	34	34	34	34	344

50%

Day	Replicate number										Total
	1	2	3	4	5	6	7	8	9	10	
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0
4	5	3	5	4	4	3	4	4	5	4	41
5	0	14	14	13	14	12	0	12	12	14	105
6	12	0	0	0	0	0	10	0	0	0	22
7	20	20	19	17	21	17	15	20	18	17	184
Total	37	37	38	34	39	32	29	36	35	35	352

100%

Day	Replicate number										Total
	1	2	3	4	5	6	7	8	9	10	
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0
4	4	5	4	6	4	5	4	4	3	5	44
5	0	15	13	16	0	14	15	12	0	13	98
6	11	0	0	0	13	0	0	0	11	0	35
7	18	20	21	20	17	22	18	20	20	21	197
Total	33	40	38	42	34	41	37	36	34	39	374

Control-2

Day	Replicate number										Total
	1	2	3	4	5	6	7	8	9	10	
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0
4	3	3	4	3	5	3	3	3	4	4	35
5	0	0	0	0	0	12	0	10	0	11	33
6	11	10	10	13	12	0	11	0	10	0	77
7	13	16	14	14	14	15	14	17	13	17	147
Total	27	29	28	30	31	30	28	30	27	32	292

100% Intake

Day	Replicate number										Total
	1	2	3	4	5	6	7	8	9	10	
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0
4	4	5	4	3	4	3	3	5	3	3	37
5	0	16	0	12	12	0	11	13	13	15	92
6	15	0	12	0	0	13	0	0	0	0	40
7	20	19	17	21	19	18	21	19	22	18	194
Total	39	40	33	36	35	34	35	37	38	36	363

TVA / Kingston Fossil Plant, Outfall 002
August 05-12, 2008

Environmental Testing Solutions, Inc.

Ceriodaphnia dubia Chronic Whole Effluent Toxicity Test
EPA-821-R-02-013, Method 1002.0

Quality Control
Verification of Data Entry, Calculations, and Statistical Analyses

Project number: 3992

Reveiwed by:

Concentration (%)	Replicate number										Survival (%)	Average reproduction (offspring/female)	Coefficient of variation (%)	Percent reduction from pooled controls (%)
	1	2	3	4	5	6	7	8	9	10				
Control - 1	27	28	29	29	30	29	30	29	31	32	100	29.4	4.9	Not applicable
6.25%	28	33	32	33	32	30	30	33	29	32	100	31.2	5.8	-6.1
12.5%	33	33	34	35	35	36	32	33	34	33	100	33.8	3.6	-15.0
25%	35	38	33	33	35	34	34	34	34	34	100	34.4	4.2	-17.0
50%	37	37	38	34	39	32	29	36	35	35	100	35.2	8.4	-19.7
100%	33	40	38	42	34	41	37	36	34	39	100	37.4	8.4	-27.2
Control - 2	27	29	28	30	31	30	28	30	27	32	100	29.2	5.8	Not applicable
100% Intake	39	40	33	36	35	34	35	37	38	36	100	36.3	6.1	-24.3

Outfall 002:
Dunnett's MSD value: 2.192
PMSD: 7.5

Intake:
Dunnett's MSD value: 1.526
PMSD: 5.2

MSD = Minimum Significant Difference
PMSD = Percent Minimum Significant Difference
PMSD is a measure of test precision. The PMSD is the minimum percent difference between the control and treatment that can be declared statistically significant in a whole effluent toxicity test.

Lower PMSD bound determined by USEPA (10^{th} percentile) = 13%.
Upper PMSD bound determined by USEPA (90^{th} percentile) = 47%.
Lower and upper PMSD bounds were determined from the 10th and 90th percentile, respectively, of PMSD data from EPA's WET Interlaboratory Variability Study (USEPA, 2001a; USEPA, 2001b).

USEPA. 2000. Understanding and Accounting for Method Variability in Whole Effluent Toxicity Applications Under the National Pollutant Discharge Elimination Program. EPA-833-R-00-003. US Environmental Protection Agency, Cincinnati, OH.

USEPA. 2001a, 2001b. Final Report: Interlaboratory Variability Study of EPA Short-term Chronic and Acute Whole Effluent Toxicity Test Methods, Volumes 1 and 2-Appendix. EPA-821-B-01-004 and EPA-821-B-01-005. US Environmental Protection Agency, Cincinnati, OH.

TVA / Kingston Fossil Plant, Outfall 002
August 05-12, 2008
Statistical Analyses

Environmental Testing Solutions, Inc.

Ceriodaphnia Survival and Reproduction Test-Reproduction

Start Date:	8/5/2008	Test ID:	CdFRCR	Sample ID:	TVA / Kingston Fossil Plant, Outfall 002
End Date:	8/12/2008	Lab ID:	ETS-Envir. Testing Sol.	Sample Type:	DMR-Discharge Monitoring Report
Sample Date:		Protocol:	FWCHR-EPA-821-R-02-013	Test Species:	CD-Ceriodaphnia dubia
Comments:					

Conc-%	1	2	3	4	5	6	7	8	9	10
D-Control	27.000	28.000	29.000	29.000	30.000	29.000	30.000	29.000	31.000	32.000
6.25	28.000	33.000	32.000	33.000	32.000	30.000	30.000	33.000	29.000	32.000
12.5	33.000	33.000	34.000	35.000	35.000	36.000	32.000	33.000	34.000	33.000
25	35.000	38.000	33.000	33.000	35.000	34.000	34.000	34.000	34.000	34.000
50	37.000	37.000	38.000	34.000	39.000	32.000	29.000	36.000	35.000	35.000
100	33.000	40.000	38.000	42.000	34.000	41.000	37.000	36.000	34.000	39.000

			Transform: Untransformed					1-Tailed			Isotonic	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	29.400	1.0000	29.400	27.000	32.000	4.863	10				33.567	1.0000
6.25	31.200	1.0612	31.200	28.000	33.000	5.813	10	-1.878	2.287	2.192	33.567	1.0000
12.5	33.800	1.1497	33.800	32.000	36.000	3.637	10	-4.591	2.287	2.192	33.567	1.0000
25	34.400	1.1701	34.400	33.000	38.000	4.157	10	-5.217	2.287	2.192	33.567	1.0000
50	35.200	1.1973	35.200	29.000	39.000	8.449	10	-6.052	2.287	2.192	33.567	1.0000
100	37.400	1.2721	37.400	33.000	42.000	8.380	10	-8.347	2.287	2.192	33.567	1.0000

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Kolmogorov D Test indicates normal distribution (p > 0.01)	0.76377356	1.035	-0.3247167	0.72868278
Bartlett's Test indicates equal variances (p = 0.01)	14.2226963	15.0862722		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test Treatments vs D-Control	100	>100		1	2.19152693	0.07454173	82.1466667	4.59259259	2.0E-10	5, 54

Linear Interpolation (200 Resamples)

Point	%	SD	95% CL	Skew
IC05	>100			
IC10	>100			
IC15	>100			
IC20	>100			
IC25	>100			
IC40	>100			
IC50	>100			

kif002_08-05-08data

TVA / Kingston Fossil Plant, Intake
August 05-12, 2008
Statistical Analyses

Environmental Testing Solutions, Inc.

Ceriodaphnia Survival and Reproduction Test-Reproduction

Start Date:	8/5/2008	Test ID:	CdFRCR	Sample ID:	TVA / Kingston Fossil Plant, Intake
End Date:	8/12/2008	Lab ID:	ETS-Envir. Testing Sol.	Sample Type:	DMR-Discharge Monitoring Report
Sample Date:		Protocol:	FWCHR-EPA-821-R-02-013	Test Species:	CD-Ceriodaphnia dubia
Comments:					

Conc-%	1	2	3	4	5	6	7	8	9	10
D-Control	27.000	29.000	28.000	30.000	31.000	30.000	28.000	30.000	27.000	32.000
100	39.000	40.000	33.000	36.000	35.000	34.000	35.000	37.000	38.000	36.000

			Transform: Untransformed						1-Tailed		Isotonic	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	29.200	1.0000	29.200	27.000	32.000	5.776	10				32.750	1.0000
100	36.300	1.2432	36.300	33.000	40.000	6.098	10	-8.068	1.734	1.526	32.750	1.0000

Auxiliary Tests	Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.96861571		0.868		0.22971757	-0.7175098
F-Test indicates equal variances (p = 0.43)	1.72265625		6.54108953			
Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates no significant differences Treatments vs D-Control	1.52601978	0.05226095	252.05	3.87222222	2.2E-07	1, 18

Linear Interpolation (200 Resamples)

Point	%	SD	95% CL	Skew
IC05	>100			
IC10	>100			
IC15	>100			
IC20	>100			
IC25	>100			
IC40	>100			
IC50	>100			

kif002_08-05-08data

TVA / Kingston Fossil Plant, Outfall 002
August 05-12, 2008

ETS Environmental Testing Solutions, Inc.

Ceriodaphnia dubia Chronic Whole Effluent Toxicity Test
EPA-821-R-02-013, Method 1002.0

Daily Chemical Analyses

Project number: 3992

Reviewed by:

Concentration	Parameter	Day 0		Day 1		Day 2		Day 3		Day 4		Day 5		Day 6	
		Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final
Control	pH (SU)	7.43	7.45	7.82	7.32	7.53	7.48	7.72	7.57	7.87	7.59	7.43	7.45	7.53	7.66
	DO (mg/L)	7.6	7.8	7.7	7.8	7.6	7.8	7.6	7.9	7.5	8.2	8.0	7.9	7.6	7.9
	Conductivity (µmhos/cm)	310		324		305		312		308		302		290	
	Alkalinity (mg/L $CaCO_3$)	59				63				63					
	Hardness (mg/L $CaCO_3$)	92				94				86					
	Temperature (°C)	24.7	24.9	24.6	24.8	24.7	25.2	24.6	24.9	24.8	25.2	24.8	25.1	24.9	24.7
6.25%	pH (SU)	7.48	7.47	7.43	7.32	7.32	7.47	7.59	7.57	7.61	7.59	7.57	7.44	7.55	7.65
	DO (mg/L)	7.6	7.8	7.7	7.8	7.7	7.8	7.7	7.8	8.0	8.1	8.2	7.8	7.6	7.9
	Conductivity (µmhos/cm)	300		312		302		307		304		292		300	
	Temperature (°C)	24.7	24.9	24.8	24.6	24.7	25.0	24.7	24.9	24.8	25.2	24.7	25.1	24.9	25.2
12.5%	pH (SU)	7.46	7.49	7.45	7.33	7.32	7.47	7.56	7.57	7.59	7.59	7.57	7.44	7.54	7.65
	DO (mg/L)	7.6	7.8	7.7	7.7	7.7	7.9	7.7	7.8	8.0	8.0	8.2	7.8	7.7	7.9
	Conductivity (µmhos/cm)	300		319		302		307		296		295		300	
	Temperature (°C)	24.8	24.8	24.8	24.9	24.7	25.1	24.7	24.7	24.8	24.8	24.7	25.0	24.9	25.0
25%	pH (SU)	7.47	7.49	7.46	7.37	7.29	7.48	7.56	7.60	7.60	7.60	7.58	7.47	7.55	7.65
	DO (mg/L)	7.6	7.9	7.7	7.7	7.7	7.9	7.8	7.8	8.0	8.0	8.1	7.8	7.8	7.9
	Conductivity (µmhos/cm)	294		314		298		302		295		294		298	
	Temperature (°C)	24.8	24.8	24.8	24.7	24.8	25.3	24.7	24.8	24.9	24.7	24.7	25.0	24.9	24.9
50%	pH (SU)	7.50	7.52	7.52	7.43	7.25	7.53	7.60	7.66	7.59	7.66	7.62	7.53	7.58	7.74
	DO (mg/L)	7.7	7.9	7.7	7.7	7.8	7.9	7.9	7.9	8.0	8.0	8.1	7.8	7.8	7.9
	Conductivity (µmhos/cm)	293		312		295		300		293		293		294	
	Temperature (°C)	24.8	24.6	24.8	24.7	24.8	25.2	24.7	25.0	24.9	24.8	24.7	24.7	24.9	24.9
100%	pH (SU)	7.54	7.57	7.58	7.54	7.17	7.65	7.63	7.78	7.59	7.74	7.58	7.67	7.59	7.85
	DO (mg/L)	7.8	7.9	7.9	7.8	7.9	7.9	7.9	7.9	8.0	8.0	8.1	7.9	7.8	7.8
	Conductivity (µmhos/cm)	292		304		294		296		288		294		294	
	Alkalinity (mg/L $CaCO_3$)	111				118				116					
	Hardness (mg/L $CaCO_3$)	131				135				146					
	Total Residual Chlorine (mg/L)	<0.10				<0.10				<0.10					
	Temperature (°C)	24.9	24.9	24.9	24.7	24.8	25.2	24.7	24.9	25.0	24.6	24.7	24.9	25.0	24.7
100% Intake	pH (SU)	7.42	7.55	7.49	7.53	7.18	7.69	7.59	7.67	7.36	7.55	7.33	7.44	7.40	7.64
	DO (mg/L)	7.8	7.8	8.0	7.7	8.0	7.7	7.9	7.7	8.1	8.2	8.2	8.0	7.9	7.8
	Conductivity (µmhos/cm)	226		234		234		233		203		206		206	
	Alkalinity (mg/L $CaCO_3$)	83				89				72					
	Hardness (mg/L $CaCO_3$)	99				99				95					
	Total Residual Chlorine (mg/L)	<0.10				<0.10				<0.10					
	Temperature (°C)	24.8	24.9	24.9	24.6	24.9	25.2	24.7	24.9	24.8	24.9	24.5	24.9	25.0	24.9

Species: *Ceriodaphnia dubia* Date: 08-05-08

Client: Kingston Fossil Plant - Non-treated

Daily Chemistry:

		Day					
		0		1		2	
	Analyst	JH	MDL	MDL	JH	JH	JH
Concentration	Parameter						
CONTROL	pH (S.U.)	7.43	7.45	7.82	7.32	7.53	7.48
	DO (mg/L)	7.6	7.8	7.7	7.8	7.6	7.8
	Conductivity (µmhos/cm)	310		324		305	
	Alkalinity (mg $CaCO_3$/L)	59				63	
	Hardness (mg $CaCO_3$/L)	92				94	
	Temperature (°C)	24.7	24.9	24.6	24.8	24.7	25.2
6.25%	pH (S.U.)	7.48	7.47	7.43	7.32	7.32	7.47
	DO (mg/L)	7.6	7.8	7.7	7.8	7.7	7.8
	Conductivity (µmhos/cm)	300		312		302	
	Temperature (°C)	24.7	24.9	24.8	24.6	24.7	25.0
12.5%	pH (S.U.)	7.46	7.49	7.45	7.33	7.32	7.47
	DO (mg/L)	7.6	7.8	7.7	7.7	7.7	7.9
	Conductivity (µmhos/cm)	300		319		302	
	Temperature (°C)	24.8	24.8	24.8	24.9	24.7	25.1
25%	pH (S.U.)	7.47	7.49	7.46	7.37	7.29	7.48
	DO (mg/L)	7.6	7.9	7.7	7.7	7.7	7.9
	Conductivity (µmhos/cm)	294		314		298	
	Temperature (°C)	24.8	24.8	24.8	24.7	24.8	25.3
50%	pH (S.U.)	7.50	7.52	7.52	7.43	7.25	7.53
	DO (mg/L)	7.7	7.9	7.7	7.7	7.8	7.9
	Conductivity (µmhos/cm)	293		312		295	
	Temperature (°C)	24.8	24.6	24.8	24.7	24.8	25.2
100%	pH (S.U.)	7.54	7.57	7.58	7.54	7.17	7.65
	DO (mg/L)	7.8	7.9	7.9	7.8	7.9	7.9
	Conductivity (µmhos/cm)	292		304		294	
	Alkalinity (mg $CaCO_3$/L)	111				118	
	Hardness (mg $CaCO_3$/L)	131				135	
	TR chlorine (mg/L)	<0.10				<0.10	
	Temperature (°C)	24.9	24.9	24.9	24.7	24.8	25.2
100% Intake	pH (S.U.)	7.42	~~7.65~~ 7.55	7.49	7.53	7.18	7.69
	DO (mg/L)	7.8	7.8	8.0	7.7	8.0	7.7
	Conductivity (µmhos/cm)	226		284		284	
	Alkalinity (mg $CaCO_3$/L)	83				89	
	Hardness (mg $CaCO_3$/L)	99				99	
	TR chlorine (mg/L)	<0.10				<0.10	
	Temperature (°C)	24.8	24.9	24.9	24.6	24.9	25.2
		Initial	Final	Initial	Final	Initial	Final

Species: *Ceriodaphnia dubia*
Client: Kingston Fossil Plant - Non-treated

Date: 08-05-08

		Day							
		3		4		5		6	
Analyst		JL	LAB	LAB	JL/BSC	JL/BSC	JL	JL	KBC
Concentration	Parameter								
CONTROL	pH (S.U.)	7.72	7.57	7.87	7.59	7.43	7.45	7.53	7.66
	DO (mg/L)	7.6	7.9	7.5	8.2	8.0	7.9	7.6	7.9
	Conductivity (µmhos/cm)	312		308		302		290	
	Alkalinity (mg $CaCO_3$/L)			63					
	Hardness (mg $CaCO_3$/L)			86					
	Temperature (°C)	24.6	24.9	24.8	25.2	24.8	25.1	24.9	24.7
6.25%	pH (S.U.)	7.59	7.57	7.61	7.59	7.57	7.44	7.55	7.65
	DO (mg/L)	7.7	7.8	8.0	8.1	8.2	7.8	7.6	7.9
	Conductivity (µmhos/cm)	307		304		292		300	
	Temperature (°C)	24.7	24.9	24.8	25.2	24.7	25.1	24.9	25.2
12.5%	pH (S.U.)	7.56	7.57	7.59	7.59	7.57	7.44	7.54	7.65
	DO (mg/L)	7.7	7.8	8.0	8.0	8.2	7.8	7.7	7.9
	Conductivity (µmhos/cm)	307		296		295		300	
	Temperature (°C)	24.7	24.7	24.8	24.8	24.7	25.0	24.9	25.0
25%	pH (S.U.)	7.56	7.60	7.60	7.60	7.58	7.47	7.55	7.65
	DO (mg/L)	7.8	7.8	8.0	8.0	8.1	7.8	7.8	7.9
	Conductivity (µmhos/cm)	302		295		294		298	
	Temperature (°C)	24.7	24.8	24.9	24.7	24.7	25.0	24.9	24.9
50%	pH (S.U.)	7.60	7.66	7.59	7.66	7.62	7.53	7.58	7.74
	DO (mg/L)	7.9	7.9	8.0	8.0	8.1	7.8	7.8	7.9
	Conductivity (µmhos/cm)	300		293		293		294	
	Temperature (°C)	24.7	25.0	24.9	24.8	24.7	24.7	24.9	24.9
100%	pH (S.U.)	7.63	7.78	7.59	7.74	7.58	7.47	7.59	7.85
	DO (mg/L)	7.9	7.9	8.0	8.0	8.1	7.9	7.8	7.8
	Conductivity (µmhos/cm)	296		288		294		294	
	Alkalinity (mg $CaCO_3$/L)			116					
	Hardness (mg $CaCO_3$/L)			146					
	TR chlorine (mg/L)			<0.10					
	Temperature (°C)	24.7	24.9	25.0	24.6	24.7	24.9	25.0	24.7
100% Intake	pH (S.U.)	7.59	7.67	7.36	7.55	7.33	7.44	7.40	7.64
	DO (mg/L)	7.9	7.7	8.1	8.2	8.2	8.0	7.9	7.8
	Conductivity (µmhos/cm)	233		203		206		206	
	Alkalinity (mg $CaCO_3$/L)			72					
	Hardness (mg $CaCO_3$/L)			95					
	TR chlorine (mg/L)			<0.10					
	Temperature (°C)	24.7	24.9	24.8	24.9	24.5	24.9	25.0	24.9
		Initial	Final	Initial	Final	Initial	Final	Initial	Final

Environmental Testing Solutions, Inc.

Total Residual Chlorine
(Orion Electrode Method, Orion 97-70)

Matrix: Water, RL = 0.10 mg/L
Meter: Accumet Model AR25 pH/Ion Meter

Analyst	LMB	Iodide reagent:	IN R310
Date analyzed	08-05-08	Acid reagent:	IN R3010

Calibration:

	0.10 mg/L	1.00 mg/L
Reference standard number	IN55579	IN55579

Note: For samples with a residual chlorine of > 1.0 mg/L, the calibration range must be adjusted to bracket the chlorine levels of the samples.

Laboratory control standard:

Reference standard number	True value (TV) (mg/L)	Measured value (MV) (mg/L)	% RS = MV / TV x 100 (acceptable range = 90 to 110%)
IN55579	0.50	0.502	100.4%

Duplicate sample precision:

Sample number	Sample ID	Sample characteristics	Residual chlorine (mg/L)	%RPD = {(S - D) /[(S+D)/2]} x 100 (acceptable range = ± 10%)
080805.07	Cape Fear-up/INT	cloudy/particles/tan	S <0.0190	
	Duplicate		D 0.0666	LB

Sample measurements:

Sample number	Sample ID	Sample characteristics	Residual chlorine (mg/L)
	Blank (should be = < 0.10 mg/L)		<0.00886
080805.06	Cape Fear-out 007	slightly cloudy w/part, pale tan	<0.0117
080805.03	Sutton Plant	clear w/particles, pale tan	<0.00197
080805.02	Chattanooga	cloudy w/particles, gold	<0.000113
080805.04	PCS-out 007	clear w/few particles, NO color	<0.000740
080805.05	↓ out 100	clear w/part., NO color	<0.000404
080805.08	ONWASA	clear, NO color	<0.000620
080805.01	Foxwood Hills	clear, NO color	<0.0000284
080804.02	KIF INTAKE LMB	LIGHT TAN, CLEAR	<0.000712
080804.01	KIF OUTFALL 002	LIGHT TAN, CLEAR	<0.000583

Note: All samples were analyzed in excess of EPA recommended holding time (15 minutes) unless otherwise noted.

Laboratory control standard:

Reference standard number	True value (TV) (mg/L)	Measured value (MV) (mg/L)	% RS = MV / TV x 100 (acceptable range = 90 to 110%)
IN55579	0.50	0.477	95.4%

Reviewed by
Date reviewed 08-05-08

ETS Environmental Testing Solutions, Inc.

Total Residual Chlorine
(Orion Electrode Method, Orion 97-70)

Matrix: Water, RL = 0.10 mg/L
Meter: Accumet Model AR25 pH/Ion Meter

Analyst	KLH	Iodide reagent:	INR310
Date analyzed	08.07.08	Acid reagent:	INR300

Calibration:

	0.10 mg/L	1.00 mg/L
Reference standard number	INSS579	INSS579

Note: For samples with a residual chlorine of > 1.0 mg/L, the calibration range must be adjusted to bracket the chlorine levels of the samples.

Laboratory control standard:

Reference standard number	True value (TV) (mg/L)	Measured value (MV) (mg/L)	% RS = MV / TV x 100 (acceptable range = 90 to 110%)
INSS579	0.50	0.505	101.0%

Duplicate sample precision:

Sample number	Sample ID	Sample characteristics	Residual chlorine (mg/L)	%RPD = {(S - D) /[(S+D)/2]} x 100 (acceptable range = ± 10%)
080807.01	Forward Hills	paleton, clear	S <0.00326	
↓	Duplicate		D <0.00512	—

Sample measurements:

Sample number	Sample ID	Sample characteristics	Residual chlorine (mg/L)
	Blank (should be = < 0.10 mg/L)		<0.00059
080807.02	Chattanooga	yellow-brown, slightly cloudy	<0.00307
080807.03	Washington	no color, clear	<0.000134
080807.04			
080806.20	TVA-KIF-002	paleton, clear	<0.000306
080806.21	↓ INTake	no color, clear	<0.000331
080806.19	Marshall WWTP	no color, clear	0.000328
		N/A	

Note: All samples were analyzed in excess of EPA recommended holding time (15 minutes) unless otherwise noted.

Laboratory control standard:

Reference standard number	True value (TV) (mg/L)	Measured value (MV) (mg/L)	% RS = MV / TV x 100 (acceptable range = 90 to 110%)
INSS579	0.50	0.515	103.0%

Reviewed by: JT
Date reviewed: 08-07-08

ETS
Environmental Testing Solutions, Inc.

Total Residual Chlorine
(Orion Electrode Method, Orion 97-70)

Matrix: Water, RL = 0.10 mg/L
Meter: Accumet Model AR25 pH/Ion Meter

Analyst	LAB	Iodide reagent:	IN2310
Date analyzed	08-09-08	Acid reagent:	IN2306

Calibration:

	0.10 mg/L	1.00 mg/L
Reference standard number	INSS579	INSS579

Note: For samples with a residual chlorine of > 1.0 mg/L, the calibration range must be adjusted to bracket the chlorine levels of the samples.

Laboratory control standard:

Reference standard number	True value (TV) (mg/L)	Measured value (MV) (mg/L)	% RS = MV / TV x 100 (acceptable range = 90 to 110%)
INSS579	0.50	0.498	99.6%

Duplicate sample precision:

Sample number	Sample ID	Sample characteristics	Residual chlorine (mg/L)	%RPD = {(S - D) /[(S+D)/2]} x 100 (acceptable range = ± 10%)
080809.05	AAF McQuay	slightly cloudy w/ particles, ~~pale~~ tan	S <0.000193	
↓	Duplicate		D <0.000127	LB

Sample measurements:

Sample number	Sample ID	Sample characteristics	Residual chlorine (mg/L)
	Blank (should be = < 0.10 mg/L)		<0.00837
080809.06	Belews Creek	clear, NO color	0.00250
080809.10	Wilson WWTP	clear, pale tan	<0.000735
080809.02	Southcary WWTP	clear, pale tan	0.000303
080809.03	Foxwood Hills	clear, pale tan	<0.000121
080809.01	Scarlett Acres	cloudy w/part., pale grey	0.000792
080809.17	JP Stevens	opaque w/part, orange	0.000936
080809.16	Roseboro WWTP	clear, no color	0.00719
080809.15	Rockingham WWTP	slightly cloudy w/part. pale yellow	<0.00109
080809.08	Marshall SS	clear, NO color	0.0445

Note: All samples were analyzed in excess of EPA recommended holding time (15 minutes) unless otherwise noted.

Laboratory control standard:

Reference standard number	True value (TV) (mg/L)	Measured value (MV) (mg/L)	% RS = MV / TV x 100 (acceptable range = 90 to 110%)
	0.50		LB

Reviewed by
Date reviewed 08-09-08

Environmental Testing Solutions, Inc.

Total Residual Chlorine
(Orion Electrode Method, Orion 97-70)

Matrix: Water, RL = 0.10 mg/L
Meter: Accumet Model AR25 pH/Ion Meter

Analyst	LMB
Date analyzed	08-09-08

Iodide reagent:	
Acid reagent:	LB

Calibration:

	0.10 mg/L	1.00 mg/L
Reference standard number		LB

Note: For samples with a residual chlorine of > 1.0 mg/L, the calibration range must be adjusted to bracket the chlorine levels of the samples.

Laboratory control standard:

Reference standard number	True value (TV) (mg/L)	Measured value (MV) (mg/L)	% RS = MV / TV x 100 (acceptable range = 90 to 110%)
IN55579	0.50	0.474	94.8%

Duplicate sample precision:

Sample number	Sample ID	Sample characteristics	Residual chlorine (mg/L)	%RPD = {(S - D) /[(S+D)/2]} x 100 (acceptable range = ± 10%)
080809.12	Elementis	NO COLOR clear w/part	S <0.000593	
↓	Duplicate		D <0.000198	LB

Sample measurements:

Sample number	Sample ID	Sample characteristics	Residual chlorine (mg/L)
	Blank (should be = < 0.10 mg/L)		LB
080809.14	Hercules	cloudy w/particles, tan	<0.000859
080809.07	Bladenboro WWTP	cloudy w/particles, tan	0.0408
080809.09	Raleigh CC	clear w/particles, no color	<0.00394
080808.04	Waynesville WWTP	slightly cloudy w/part., tan	<0.000128
080808.03	Cape Fear up/INT	cloudy w/part, tan	0.0520
080808.02	Cape Fear out CO7	slightly cloudy w/part, tan	<0.0208
080808.05	Gnasa	clear, no color	<0.00144
080809.13	Lincoln CT	clear w/particles, no color	0.0141
080809.11	Craven Co. Wood	clear, no color	<0.00130

Note: All samples were analyzed in excess of EPA recommended holding time (15 minutes) unless otherwise noted.

Laboratory control standard:

Reference standard number	True value (TV) (mg/L)	Measured value (MV) (mg/L)	% RS = MV / TV x 100 (acceptable range = 90 to 110%)
IN55579	0.50		LB

Reviewed by	
Date reviewed	08-09-08

ETS
Environmental Testing Solutions, Inc.

Total Residual Chlorine
(Orion Electrode Method, Orion 97-70)

Matrix: Water, RL = 0.10 mg/L
Meter: Accumet Model AR25 pH/Ion Meter

Analyst	LAB
Date analyzed	08-09-08

Iodide reagent:	
Acid reagent:	LB

Calibration:

	0.10 mg/L	1.00 mg/L
Reference standard number		LB

Note: For samples with a residual chlorine of > 1.0 mg/L, the calibration range must be adjusted to bracket the chlorine levels of the samples.

Laboratory control standard:

Reference standard number	True value (TV) (mg/L)	Measured value (MV) (mg/L)	% RS = MV / TV x 100 (acceptable range = 90 to 110%)
IN55579	0.50	0.474	94.8%

Duplicate sample precision:

Sample number	Sample ID	Sample characteristics	Residual chlorine (mg/L)	%RPD = {(S - D) /[(S+D)/2]} x 100 (acceptable range = ± 10%)
080809.04	Chattanooga	cloudy w/particles, orange	S <0.00107	
↓	Duplicate		D <0.000481	LB

Sample measurements:

Sample number	Sample ID	Sample characteristics	Residual chlorine (mg/L)
	Blank (should be = < 0.10 mg/L)		LB
080808.07	TVA-Kingston-Int.	clear, NO color	<0.0141
080808.06	TVA-Kingston-Out 002	clear w/particles, NO color	<0.00464
			LB

Note: All samples were analyzed in excess of EPA recommended holding time (15 minutes) unless otherwise noted.

Laboratory control standard:

Reference standard number	True value (TV) (mg/L)	Measured value (MV) (mg/L)	% RS = MV / TV x 100 (acceptable range = 90 to 110%)
IN55579	0.50	0.481	96.2%

Reviewed by	JL
Date reviewed	08-09-08

Environmental Testing Solutions, Inc.

Alkalinity
(SM 2320 B)

Matrix: Water, RL = 1.0 mg $CaCO_3$/L

Analyst: BSC
Date analyzed: 03-05-03

Titrate samples to pH = 4.50 S.U.

Time initiated: 1043
Time completed: 1121

Titrant normality and multiplier determination:

pH of Deionized water = 4.5 S.U.	Titrant reference number	Normality check standard number	Begin ml	End ml	Total ml (E)	Normality (N) of H_2SO_4 = (5 ml Na_2CO_3 x 0.05)/E = 0.25/E (acceptable range = 0.0180 - 0.0220)	pH Factor or Multiplier = (N x 50000)/ 100 ml sample = N x 500
6.5	INR301	INSS569	~~0.0~~ 0.2	12.0	11.8	0.0212	10.6

Blk Correction 0.0 - ~~0.2~~ 0.2 = ~~0.2~~ 0.2 mL

Laboratory control standard:

Reference standard number	True value (TV) (mg $CaCO_3$/L)	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Alkalinity (MV) (mg $CaCO_3$/L)	% RS = MV / TV x 100 (acceptable range = 90 to 110%)
INSS535	100	100	12.0	21.2	9.2	10.6	97.5	97.5%

Duplicate sample precision:

Sample number	Sample ID	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Alkalinity (mg $CaCO_3$/L)	%RPD = {(S - D) /[(S+D)/2]} x 100 (acceptable range = ± 10%)
07-30-00A	MHS H2O	100	~~21.2~~ 11.5 BSC	26.8	56	10.6	S 59	
↓	Duplicate (B)	↓	26.8	32.4	56	↓	D 59	——— BSC

Matrix spike recovery:

Reference standard number	Spike value (SV) (mg $CaCO_3$/L)	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Spike alkalinity (A) (mg $CaCO_3$/L)
INSS 535	~~50~~ K 100	100	~~32.4~~ 26.8	41.9	~~9.5~~ 15.1	10.6	161 K 160

Sample alkalinity (B) (mg $CaCO_3$/L)	Measured spike value (MV) MV = A - B (mg $CaCO_3$/L)	% R = MV / SV x 100 (acceptable range = 75 to 125%)
59	~~101 - 59 = 42~~ K 160 - 59 = 101	~~84~~ K 101.0%

Sample measurements:

Sample number	Sample ID	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Alkalinity (mg $CaCO_3$/L)
07-30-00B	MHS H2O	100	41.9	47.5	56	10.6	59
50533	EES# 070844	↓	0.0	2.2	2.2	↓	23
50534	070845		2.2	4.4	2.2		23
50535	070846	↓	4.4	4.8	0.4	↓	4.2

Reviewed by: [ ] Date reviewed: [ ]

Environmental Testing Solutions, Inc.

Alkalinity
(SM 2320 B)

Matrix: Water, RL = 1.0 mg $CaCO_3$/L

Analyst	RSC	Time initiated	1244
Date analyzed	08-10-08	Time completed	1245

Titrate samples to pH = 4.50 S.U.

Titrant normality and multiplier determination:

pH of Deionized water = 4.5 S.U.	Titrant reference number	Normality check standard number	Begin ml	End ml	Total ml (E)	Normality (N) of H_2SO_4 = (5 ml Na_2CO_3 x 0.05)/E = 0.25/E (acceptable range = 0.0180 - 0.0220)	pH Factor or Multiplier = (N x 50000)/ 100 ml sample = N x 500
4.98	INR201	INSS607	~~0.1~~ 0.0	11.6	11.5	0.0217	10.9

Blk. Correction 0.0 → 0.1

Laboratory control standard:

Reference standard number	True value (TV) (mg $CaCO_3$/L)	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Alkalinity (MV) (mg $CaCO_3$/L)	% RS = MV / TV x 100 (acceptable range = 90 to 110%)
INSS607	100	100	11.5	20.6	9.1	10.9	99.2	99.2%

Duplicate sample precision:

Sample number	Sample ID	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Alkalinity (mg $CaCO_3$/L)	%RPD = {(S - D) /[(S+D)/2]} x 100 (acceptable range = ± 10%)
08-0400B	MHS H_2O	100	20.6	26.4	5.8	10.9	S 63	
↓	Duplicate (B)	↓	26.4	32.3	5.9	↓	D 64	1.6%

Matrix spike recovery:

Reference standard number	Spike value (SV) (mg $CaCO_3$/L)	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Spike alkalinity (A) (mg $CaCO_3$/L)
INSS607	100	100	26.4	41.9	15.5	10.9	169 = 170

Sample alkalinity (B) (mg $CaCO_3$/L)	Measured spike value (MV) MV = A - B (mg $CaCO_3$/L)	% R = MV / SV x 100 (acceptable range = 75 to 125%)
64	~~105~~ 106	~~105~~ 106%

Sample measurements:

Sample number	Sample ID	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Alkalinity (mg $CaCO_3$/L)
08-0700	MHS H_2O	~~41.7~~ 100	~~47~~ 41.9	47.5	5.6	10.9	61
08-0900	↓		~~47.5~~ 0.0	5.7	5.7		62
08-0700	SSW H_2O		5.7	8.6	2.9		32
08-0400A	MHS H_2O		~~8.6~~ 5.1	20.9	5.8		63
08-0400A	SAT SW		20.9	30.9	10.0		110
08-0400B	↓		30.9	41.3	10.4		110
08-0900	↓		30	10.7	10.7		120
~~Page 445 of 576~~	Washington		10.7	30.0	19.3		210
50631	EES# 080801	↓	30.0	32.5	2.5	↓	27

Reviewed by: [illegible] Date reviewed: 08.11.08

ETS
Environmental Testing Solutions, Inc.

Alkalinity
(SM 2320 B)

Matrix: Water, RL = 1.0 mg $CaCO_3$/L

Analyst: BSL
Date analyzed: 08-10-08

Titrate samples to pH = 4.50 S.U.

Time initiated: 1244
Time completed: 1:15

Titrant normality and multiplier determination:

pH of Deionized water = 4.5 S.U.	Titrant reference number	Normality check standard number	Begin ml	End ml	Total ml (E)	Normality (N) of H_2SO_4 = (5 ml Na_2CO_3 x 0.05)/E = 0.25/E (acceptable range = 0.0180 - 0.0220)	pH Factor or Multiplier = (N x 50000)/ 100 ml sample = N x 500
							BSL

Laboratory control standard:

Reference standard number	True value (TV) (mg $CaCO_3$/L)	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Alkalinity (MV) (mg $CaCO_3$/L)	% RS = MV / TV x 100 (acceptable range = 90 to 110%)
JNSS 607	100	100	32.5	42.2	9.7	10.9	106	106%

Duplicate sample precision:

Sample number	Sample ID	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Alkalinity (mg $CaCO_3$/L)	%RPD = {(S - D) /[(S+D)/2]} x 100 (acceptable range = ± 10%)
50632	EES # 080802	100	42.2	44.5	2.3	10.9	S 25	
50632	Duplicate (B)	⊥	0.0	2.1	2.1	⊥	D 23	~~9.1%~~ 8.3%

Matrix spike recovery:

Reference standard number	Spike value (SV) (mg $CaCO_3$/L)	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Spike alkalinity (A) (mg $CaCO_3$/L)
JNSS 607	100	100	~~2.3~~ 0.0	12.2	12.2	10.9	133 = 130

Sample alkalinity (B) (mg $CaCO_3$/L)	Measured spike value (MV) MV = A - B (mg $CaCO_3$/L)	% R = MV / SV x 100 (acceptable range = 75 to 125%)
23	~~110~~ 107	~~110%~~ 107%

Sample measurements:

Sample number	Sample ID	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Alkalinity (mg $CaCO_3$/L)
50633	EES # 080803	~~12.2~~ 100	~~13.9~~ 12.2	~~17~~ 13.9	1.7	10.9	~~19~~ 18
080805.01	Fokwood 1	⊥	13.9	22.0	8.1	⊥	88
080807.01	↓ 2	⊥	22.0	29.1	7.1	⊥	77
080809.03	↓ 3	⊥	29.1	37.3	8.2	⊥	89
080805.02	Chattanaga 1	25	37.3	46.2	8.9	(4)	390
080807.02	↓ 2	↓	0.0	10.0	10.0	↓	~~110~~ 440
080809.04	↓ 3	↓	10.0	20.6	10.6	↓	460
[illegible] Page 46 of 76	TVA KIF002 1	50	20.6	25.7	5.1	(2)	110 = 111
080806.20	↓ 2	↓	25.7	31.1	5.4	↓	120 = 118

Reviewed by: Km Date reviewed: 08.11.08

ETS Environmental Testing Solutions, Inc.

Alkalinity
(SM 2320 B)

Matrix: Water, RL = 1.0 mg $CaCO_3$/L

Analyst: BSC

Date analyzed: 08.10.08

Titrate samples to pH = 4.50 S.U.

Time initiated: 1244

Time completed: ~~1345~~ BSC 1445

Titrant normality and multiplier determination:

pH of Deionized water = 4.5 S.U.	Titrant reference number	Normality check standard number	Begin ml	End ml	Total ml (E)	Normality (N) of H_2SO_4 = (5 ml Na_2CO_3 x 0.05)/E = 0.25/E (acceptable range = 0.0180 - 0.0220)	pH Factor or Multiplier = (N x 50000)/ 100 ml sample = N x 500
							BSC

Laboratory control standard:

Reference standard number	True value (TV) (mg $CaCO_3$/L)	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Alkalinity (MV) (mg $CaCO_3$/L)	% RS = MV / TV x 100 (acceptable range = 90 to 110%)
INS607	100	100	31.1	~~24.5~~	9.4	10.9	102	102%

Duplicate sample precision:

Sample number	Sample ID	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Alkalinity (mg $CaCO_3$/L)	%RPD = {(S - D) /[(S+D)/2]} x 100 (acceptable range = ± 10%)
080808.06	TVA KIF 002 3	50	0.0	5.3	5.3	(2) 10.9	S ~~116~~ BSC 116	
↓	Duplicate (B)	50	5.3	10.7	5.4	↓ ↓	D 118	1.7%

Matrix spike recovery:

Reference standard number	Spike value (SV) (mg $CaCO_3$/L)	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Spike alkalinity (A) (mg $CaCO_3$/L)
INS607	~~200~~ 300 BSC	50	5.3	~~21.2~~ 30.7 BSC	~~15.7~~ 15.4 BSC	(2) 10.9	~~317~~ BSC 336 = 340

Sample alkalinity (B) (mg $CaCO_3$/L)	Measured spike value (MV) MV = A - B (mg $CaCO_3$/L)	% R = MV / SV x 100 (acceptable range = 75 to 125%)
118	218	109%

Sample measurements:

Sample number	Sample ID	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Alkalinity (mg $CaCO_3$/L)
080804.02	TVA KIF INT 1	50	20.7	24.5	3.8	(2) 10.9	83
080806.21	↓ 2	↓	24.5	28.6	4.1	↓ ↓	~~82~~ BSC 89
080808.07	↓ 3	↓	28.6	31.9	3.3	↓ ↓	72

Reviewed by: [illegible] Date reviewed: 10/11/08

ETS Environmental Testing Solutions, Inc.

Total Hardness (SM 2340 C)

RL = 1.0 mg $CaCO_3$/L

Analyst	BSC	Time initiated	0948
Date analyzed	08·03·08	Time completed	1035

Titrant normality and multiplier determination:

Titrant reference number	Normality check standard number	Begin ml	End ml	Total ml (E)	Normality (*N*) of EDTA = 0.2/E (acceptable range = 0.0180 - 0.0220)	pH Factor or Multiplier = (*N* x 50000)/ 50 ml sample = *N* x 1000
INA308	INSS 513	0.0	10.0	10.0	0.020	20.0

Laboratory control standard:

Reference standard number	True value (TV) (mg $CaCO_3$/L)	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Hardness (MV) (mg $CaCO_3$/L)	% RS = MV / TV x 100 (acceptable range = 90 to 110%)
INSS 566	40	50	10.0	12.1	2.1	20.0	42	105%

Duplicate sample precision:

Sample number	Sample ID	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Hardness (mg $CaCO_3$/L)	%RPD = {(S - D) /[(S+D)/2]} x 100
07·30·08A	MHSH2O	50	12.1	16.6	4.5	20.0	S 90 BSC	
1	Duplicate (B)	1	16.6	21.1	4.5	1	D 90	100% ~~100%~~ BSC

Matrix spike recovery:

Reference standard number	Spike value (SV) (mg $CaCO_3$/L)	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Spike hardness (A) (mg $CaCO_3$/L)
INSS566	40	50	~~16.6~~ 21.1 BSC	23.1	6.5	20.0	130

Sample hardness (B) (mg $CaCO_3$/L)	Measured spike value (MV) MV = A - B (mg $CaCO_3$/L)	% R = MV / SV x 100 (acceptable range = 75 to 125%)
90	130 - 90 = 40	100%

Sample measurements:

Sample number	Sample ID	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Hardness (mg $CaCO_3$/L)
TV = ND	Blank (should be = 0 mg $CaCO_3$/L)	50	23.1	23.2	0.1	~~20.0~~ 20.0 BSC	2.0
07·30·08B	MHS H2O	1	23.2	~~28.7~~ 27.8 BSC	~~5.5~~ 4.6 BSC	1	~~110~~ BSC 92
							BSC

Note: If >15ml of titrant is used, sample must be diluted. Reviewed by: [ ] Date: [ ]

ETS Environmental Testing Solutions, Inc.

Total Hardness (SM 2340 C)

RL = 1.0 mg $CaCO_3$/L

Analyst	BSC
Date analyzed	08-10-08

Time initiated	0933
Time completed	~~1117~~ 1020

Titrant normality and multiplier determination:

Titrant reference number	Normality check standard number	Begin ml	End ml	Total ml (E)	Normality (*N*) of EDTA = 0.2/E (acceptable range = 0.0180 - 0.0220)	pH Factor or Multiplier = (*N* x 50000)/ 50 ml sample = *N* x 1000
INR308	INSS 513	0.0	9.8	9.8	0.0204	20.4

Laboratory control standard:

Reference standard number	True value (TV) (mg $CaCO_3$/L)	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Hardness (MV) (mg $CaCO_3$/L)	% RS = MV / TV x 100 (acceptable range = 90 to 110%)
INSS 566	40	50	9.8	11.5	2.0	20.4	40.8 = 41	~~102%~~ (025)

Duplicate sample precision:

Sample number	Sample ID	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Hardness (mg $CaCO_3$/L)	%RPD = {(S - D) /[(S+D)/2]} x 100
08-0408B	MHS H2O	50	11.3	16.0	4.2	20.4	S 86	
↓	Duplicate (B)	↓	16.0	20.4	4.4	20.4	D 90	4.5%

Matrix spike recovery:

Reference standard number	Spike value (SV) (mg $CaCO_3$/L)	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Spike hardness (A) (mg $CaCO_3$/L)
INSS 566	40	50	~~20.4~~ 16.0	22.3	6.3	20.4	128 = (130)

Sample hardness (B) (mg $CaCO_3$/L)	Measured spike value (MV) MV = A - B (mg $CaCO_3$/L)	% R = MV / SV x 100 (acceptable range = 75 to 125%)
~~80~~ (90)	40	100%

Sample measurements:

Sample number	Sample ID	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Hardness (mg $CaCO_3$/L)
TV = ND	Blank (should be = 0 mg $CaCO_3$/L)	50	0.0	0.1	0.1	20.4	2.0
08-0708	MHS H2O		0.1	4.1	4.0		82
08-0908	↓		4.1	8.6	4.5		92
08-0708	SSW H2O		8.6	10.7	2.1		43
08-0408A	MHS H2O		10.7	15.3	4.6		94
080805.01	Foxwood 1		15.3	17.8	2.5		51
080807.01	↓ 2		17.8	21.7	3.9		80
080809.03	↓ 3		21.7	24.8	3.1		63
080811.03	Washington		24.8	29.9	5.1		100
	Waynesville	↓	29.9	45.2	15.3	↓	310 *

Date reviewed 08-11-08

ETS
Environmental Testing Solutions, Inc.

Total Hardness (SM 2340 C)

RL = 1.0 mg $CaCO_3$/L

Analyst	BSL		Time initiated	~~0933~~ 1020
Date analyzed	08-10-08		Time completed	1115

Titrant normality and multiplier determination:

Titrant reference number	Normality check standard number	Begin ml	End ml	Total ml (E)	Normality (N) of EDTA = 0.2/E (acceptable range = 0.0180 - 0.0220)	pH Factor or Multiplier = (N x 50000)/ 50 ml sample = N x 1000
INR308	INSS 513	0.1	10.2	10.1	0.0198	19.8

Laboratory control standard:

Reference standard number	True value (TV) (mg $CaCO_3$/L)	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Hardness (MV) (mg $CaCO_3$/L)	% RS = MV / TV x 100 (acceptable range = 90 to 110%)
INSS ~~560~~ 566 BSL	40	50	~~10.2~~ 10.2 BSL	12.2	2.0	19.8	~~41~~ BSL 39.6 (40)	~~99%~~ (100.0%)

Duplicate sample precision:

Sample number	Sample ID	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Hardness (mg $CaCO_3$/L)	%RPD = {(S - D) /[(S+D)/2]} x 100
080805.02	Chattanooga 1	25	12.2	16.8	4.6	(2) 19.8	S 182 (180)	
↓	Duplicate (B)	25	16.8	21.5	4.7	↓	D 186 = (190)	~~2.2%~~ (5.4%)

Matrix spike recovery: * I accidently dumped out sample before spiking

	Reference standard number	Spike value (SV) (mg $CaCO_3$/L)	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Spike hardness (A) (mg $CaCO_3$/L)
*	INSS 566	~~90~~ BSL 80	50	21.5	28.5	7.0	(2) ~~(2)~~ 19.8	~~277~~ BSL 277 ~~138~~ BSL = (280)

Sample hardness (B) (mg $CaCO_3$/L)	Measured spike value (MV) MV = A - B (mg $CaCO_3$/L)	% R = MV / SV x 100 (acceptable range = 75 to 125%)
(190) ~~184 138 138/2 = 93~~ BSL	(90) ~~138 - 93 = 45~~ BSL 94	(90%) ~~113%~~ BSL ~~114%~~

Sample measurements:

Sample number	Sample ID	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Hardness (mg $CaCO_3$/L)
TV = ND	Blank (should be = 0 mg $CaCO_3$/L)						
080807.02	Chattanooga 2	25	28.5	33.7	5.2	(2) 19.8	210
080809.04	↓ 3	↓	33.7	37.7	4.0	↓	160
080804.01	TVA-KIF002 1	50	37.7	44.3	6.6		130 = 131
080806.20	↓ 2		44.3	51.1	6.8		140 = 135
080808.06	↓ 3		6.7	14.1	7.4		150 = 146
080804.02	INT 1		14.1	19.1	5.0		100 = 99
080806.21	↓ 2		19.1	24.1	5.0		100 = 99
	↓ 3	↓	24.1	28.9	4.8	↓	95

Note: If >15ml of titrant is used, sample must be diluted. Reviewed by: [illegible] Date reviewed: 08-11-08

Page 50 of 76

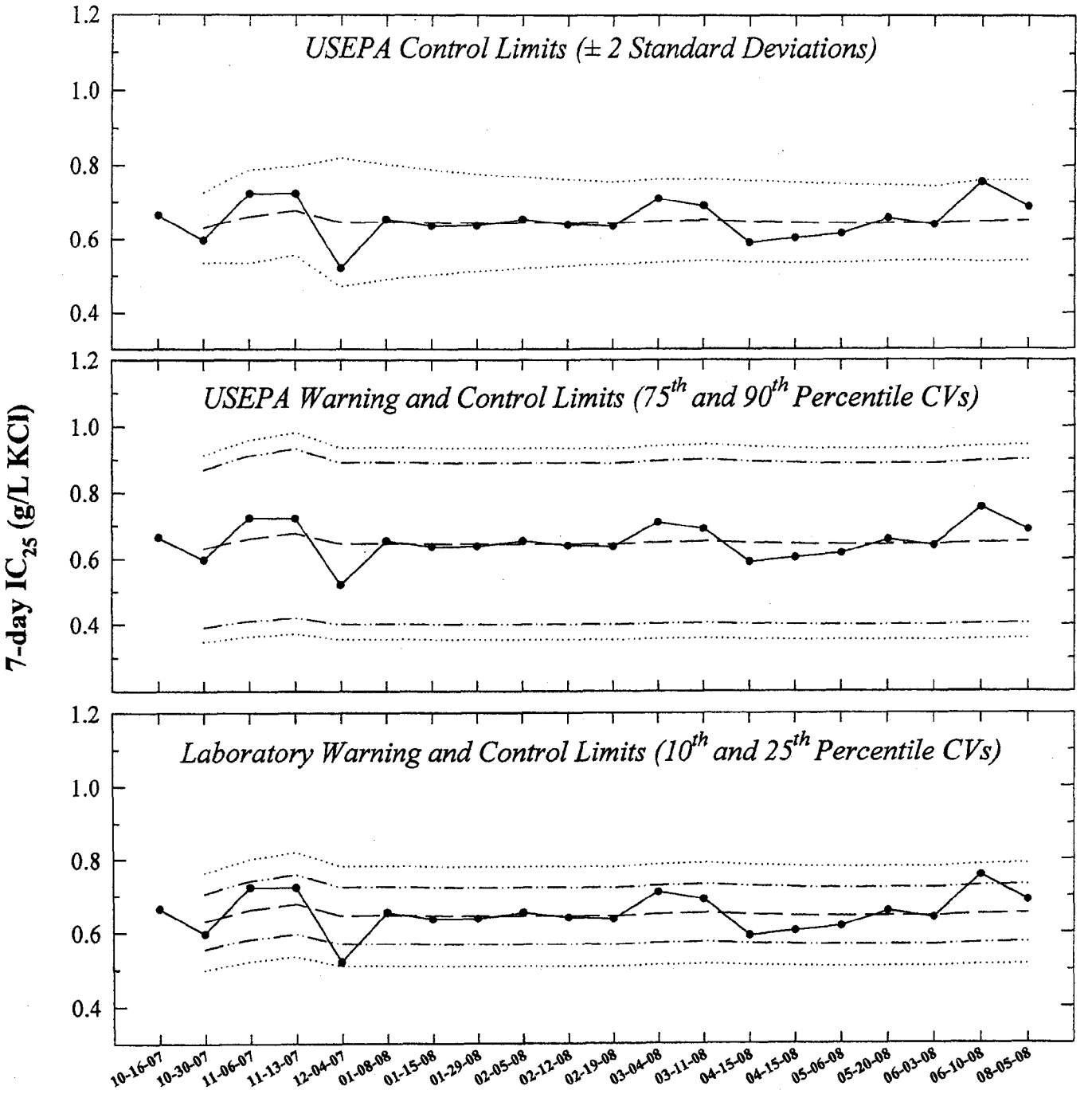
Kingston Fossil Plant Biomonitoring
August 5-12, 2008

Appendix C

Reference Toxicant Test and
Control Chart

Environmental Testing Solutions, Inc.

Pimephales promelas
Chronic Reference Toxicant Control Chart
Organism Source: Aquatox, Inc.



Test date

——•—— **7-day IC_{25}** = 25% inhibition concentration. An estimation of the concentration of potassium chloride that would cause a 25% reduction in *Pimephales* growth for the test population.

— — — **Central Tendency** (mean IC_{25})

—·—·— **Warning Limits** (mean $IC_{25} \pm S_{A.10}$ or $S_{A.75}$)

..... **Control Limits** (mean $IC_{25} \pm S_{A.25}$, $S_{A.90}$, or 2 Standard Deviations)

Environmental Testing Solutions, Inc.

Pimephales promelas
Chronic Reference Toxicant Control Chart

Test number	Test date	7-day IC_{25} (g/L KCl)	CT (g/L KCl)	S	State and USEPA Control Limits CT - 2S	CT + 2S	$S_{A.10}$	Laboratory Warning Limits CT - $S_{A.10}$	CT + $S_{A.10}$	$S_{A.25}$	Laboratory Control Limits CT - $S_{A.25}$	CT + $S_{A.25}$	$S_{A.75}$	USEPA Warning Limits CT - $S_{A.75}$	CT + $S_{A.75}$	$S_{A.90}$	USEPA Control Limits CT - $S_{A.90}$	CT + $S_{A.90}$	CV
1	10-16-07	0.66																	
2	10-30-07	0.60	0.63	0.05	0.54	0.73	0.08	0.56	0.71	0.13	0.50	0.76	0.24	0.39	0.87	0.28	0.35	0.91	0.08
3	11-06-07	0.72	0.66	0.06	0.53	0.79	0.08	0.58	0.74	0.14	0.52	0.80	0.25	0.41	0.91	0.30	0.36	0.96	0.10
4	11-13-07	0.72	0.68	0.06	0.56	0.80	0.08	0.60	0.76	0.14	0.54	0.82	0.26	0.42	0.93	0.30	0.37	0.98	0.09
5	12-04-07	0.52	0.65	0.09	0.47	0.82	0.08	0.57	0.72	0.14	0.51	0.78	0.25	0.40	0.89	0.29	0.36	0.94	0.14
6	01-08-08	0.65	0.65	0.08	0.49	0.80	0.08	0.57	0.73	0.14	0.51	0.78	0.25	0.40	0.89	0.29	0.36	0.94	0.12
7	01-15-08	0.64	0.65	0.07	0.50	0.79	0.08	0.57	0.72	0.14	0.51	0.78	0.25	0.40	0.89	0.29	0.36	0.94	0.11
8	01-29-08	0.64	0.64	0.07	0.51	0.78	0.08	0.57	0.72	0.14	0.51	0.78	0.25	0.40	0.89	0.29	0.35	0.93	0.10
9	02-05-08	0.65	0.65	0.06	0.52	0.77	0.08	0.57	0.72	0.14	0.51	0.78	0.25	0.40	0.89	0.29	0.36	0.94	0.10
10	02-12-08	0.64	0.65	0.06	0.53	0.76	0.08	0.57	0.72	0.14	0.51	0.78	0.25	0.40	0.89	0.29	0.35	0.94	0.09
11	02-19-08	0.64	0.64	0.06	0.53	0.76	0.08	0.57	0.72	0.14	0.51	0.78	0.24	0.40	0.89	0.29	0.35	0.93	0.09
12	03-04-08	0.71	0.65	0.06	0.54	0.76	0.08	0.57	0.73	0.14	0.51	0.79	0.25	0.40	0.90	0.29	0.36	0.94	0.09
13	03-11-08	0.69	0.65	0.06	0.54	0.76	0.08	0.57	0.73	0.14	0.52	0.79	0.25	0.40	0.90	0.29	0.36	0.95	0.08
14	04-15-08	0.59	0.65	0.06	0.54	0.76	0.08	0.57	0.73	0.14	0.51	0.78	0.25	0.40	0.90	0.29	0.36	0.94	0.09
15	04-15-08	0.60	0.65	0.05	0.54	0.75	0.08	0.57	0.72	0.14	0.51	0.78	0.25	0.40	0.89	0.29	0.36	0.94	0.08
16	05-06-08	0.62	0.64	0.05	0.54	0.75	0.08	0.57	0.72	0.14	0.51	0.78	0.24	0.40	0.89	0.29	0.35	0.93	0.08
17	05-20-08	0.66	0.64	0.05	0.54	0.75	0.08	0.57	0.72	0.14	0.51	0.78	0.24	0.40	0.89	0.29	0.35	0.93	0.08
18	06-03-08	0.64	0.64	0.05	0.54	0.74	0.08	0.57	0.72	0.14	0.51	0.78	0.24	0.40	0.89	0.29	0.35	0.93	0.08
19	06-10-08	0.76	0.65	0.06	0.54	0.76	0.08	0.57	0.73	0.14	0.51	0.79	0.25	0.40	0.90	0.29	0.36	0.94	0.08
20	08-05-08	0.69	0.65	0.05	0.54	0.76	0.08	0.57	0.73	0.14	0.52	0.79	0.25	0.40	0.90	0.29	0.36	0.95	0.08

Note: 7-d IC_{25} = 7-day 25% inhibition concentration. An estimation of the concentration of potassium chloride that would cause a 25% reduction in Pimephales growth for the test population.

CT = Central tendency (mean IC_{25}).

S = Standard deviation of the IC_{25} values.

Laboratory Control and Warning Limits

Laboratory control and warning limits were established using the standard deviation of the IC_{25} values corresponding to the 10th and 25th percentile CVs. These ranges are more stringent than the control and warning limits recommended by USEPA for the test method and endpoint.

$S_{A.10}$ = Standard deviation corresponding to the 10th percentile CV. ($S_{A.10}$ = 0.12)

$S_{A.25}$ = Standard deviation corresponding to the 25th percentile CV. ($S_{A.25}$ = 0.21)

USEPA Control and Warning Limits

$S_{A.75}$ = Standard deviation corresponding to the 75th percentile CV. ($S_{A.75}$ = 0.38)

$S_{A.90}$ = Standard deviation corresponding to the 90th percentile CV. ($S_{A.90}$ = 0.45)

CV = Coefficient of variation of the IC_{25} values.

USEPA. 2000. Understanding and Accounting for Method Variability in Whole Effluent Toxicity Applications Under the National Pollutant Discharge Elimination Program. EPA-833-R-00-003. US Environmental Protection Agency, Cincinnati, OH.

Organisms obtained from Aquatox, Inc.

atox08-05-08

ETS Environmental Testing Solutions, Inc.

Precision of Endpoint Measurements

Pimephales promelas
Chronic Reference Toxicant Data

Test number	Test date	Control Survival (%)	Control Mean Growth (mg/larvae)	CT for Control Growth (mg/larvae)	CV (%)	CT for Control Growth CV (%)	MSD	PMSD (%)	CT for PMSD (%)
1	10-16-07	100	0.662		13.6		0.08	12.8	
2	10-30-07	100	0.771	0.716	12.0	12.8	0.16	20.1	16.5
3	11-06-07	100	0.624	0.685	6.4	10.7	0.09	14.7	15.9
4	11-13-07	100	0.603	0.665	14.2	11.6	0.10	16.8	16.1
5	12-04-07	100	0.756	0.683	7.9	10.8	0.11	14.5	15.8
6	01-08-08	100	0.821	0.706	2.7	9.5	0.03	3.4	13.7
7	01-15-08	100	0.842	0.725	10.5	9.6	0.14	17.0	14.2
8	01-29-08	97.5	0.728	0.726	5.4	9.1	0.07	9.0	13.5
9	02-05-08	100	0.818	0.736	7.2	8.9	0.07	9.1	13.0
10	02-12-08	100	0.709	0.733	2.4	8.2	0.05	6.8	12.4
11	02-19-08	100	0.833	0.742	6.1	8.0	0.13	15.5	12.7
12	03-04-08	100	0.731	0.741	6.0	7.9	0.07	9.0	12.4
13	03-11-08	97.5	0.695	0.738	5.1	7.7	0.07	10.5	12.2
14	04-15-08	100	0.999	0.756	9.0	7.8	0.11	11.1	12.2
15	04-15-08	100	0.898	0.766	9.1	7.8	0.08	9.1	11.9
16	05-06-08	100	0.857	0.772	4.4	7.6	0.16	18.2	12.3
17	05-20-08	100	0.844	0.776	19.2	8.3	0.16	18.8	12.7
18	06-03-08	100	0.918	0.784	6.1	8.2	0.09	9.4	12.5
19	06-10-08	97.5	0.724	0.781	10.9	8.3	0.11	15.7	12.7
20	08-05-08	100	0.854	0.784	15.3	8.7	0.13	15.0	12.8

Note:

CV = Coefficient of variation for control growth.
Lower CV bound determined by USEPA (10^{th} percentile) = 3.5%.
Upper CV bound determined by USEPA (90^{th} percentile) = 20%

MSD = Minimum Significant Difference

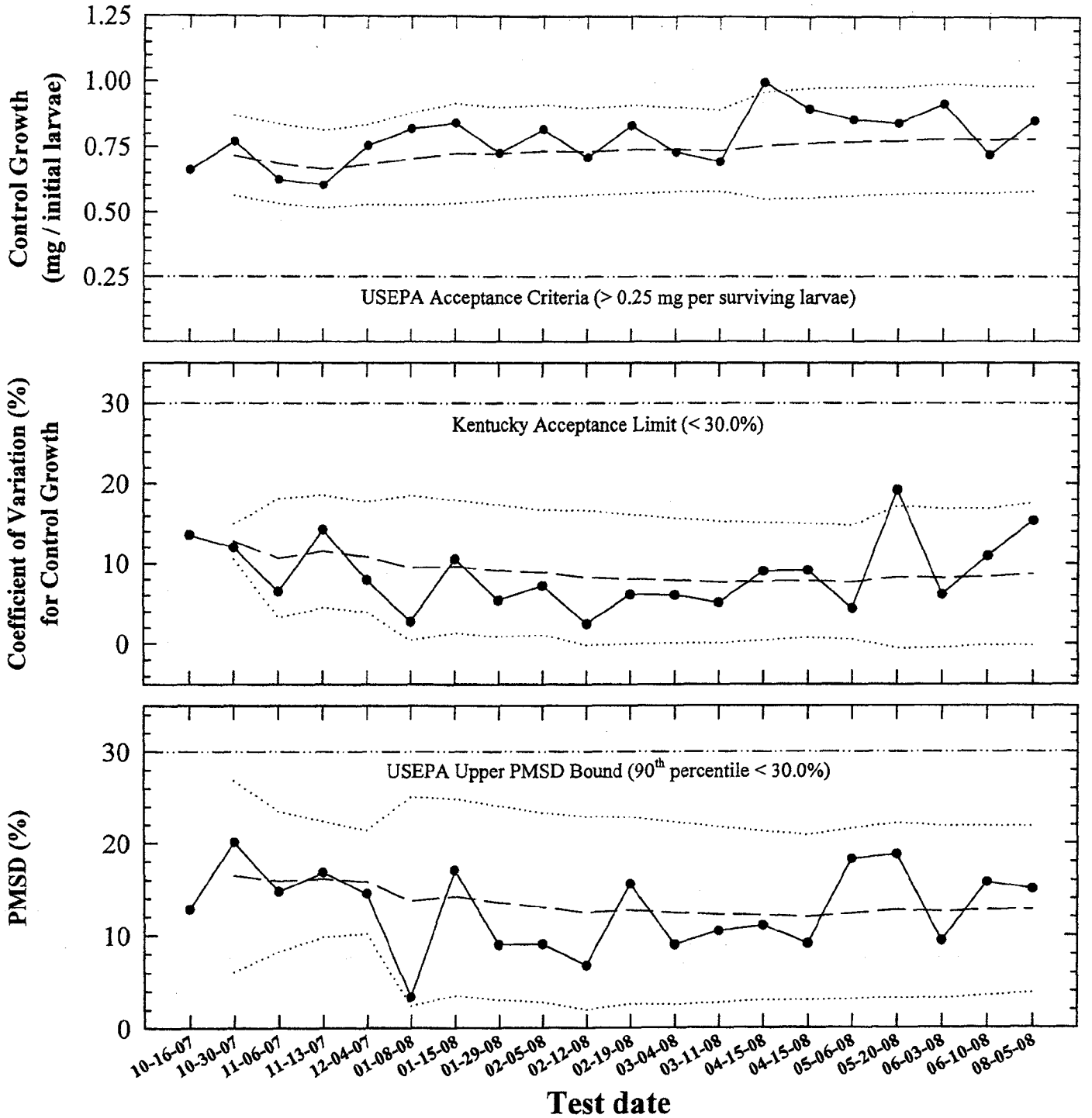
PMSD = Percent Minimum Significant Difference
PMSD is a measure of test precision. The PMSD is the minimum percent difference between the control and treatment that can be declared statistically significant in a whole effluent toxicity test.
Lower PMSD bound determined by USEPA (10^{th} percentile) = 12%.
Upper PMSD bound determined by USEPA (90^{th} percentile) = 30%.

CT = Central Tendancy (mean Control Growth, CV, or PMSD)

USEPA. 2000. Understanding and Accounting for Method Variability in Whole Effluent Toxicity Applications Under the National Pollutant Discharge Elimination Program. EPA-833-R-00-003. US Environmental Protection Agency, Cincinnati, OH.
USEPA. 2001a, 2001b. Final Report: Interlaboratory Variability Study of EPA Short-term Chronic and Acute Whole Effluent Toxicity Test Methods, Volumes 1 and 2 Appendix. EPA-821-B-01-004 and EPA-821-B-01-005. US Environmental Protection Agency, Cincinnati, OH.

ETS
Environmental Testing Solutions, Inc.

Pimephales promelas
Chronic Reference Toxicant Control Chart
Precision of Endpoint Measurements
Organism Source: Aquatox, Inc.



—●— **Control Reproduction, Coefficient of Variation (CV), or Percent Minimum Significant Difference (PMSD)** PMSD is the minimum significant difference between the control and treatment that can be declared statistically significant.

— — — **Central Tendency** (mean Control Growth, CV, or PMSD)

····· **Control Limits** (mean Control Growth, CV, or PMSD ± 2 Standard Deviations)

ETS
Environmental Testing Solutions, Inc.

Potassium Chloride Chronic Reference Toxicant Test
(EPA-821-R-02-013 Method 1000.0)
Species: *Pimephales promelas*

PpKClCR Test Number: 156

Dilution preparation information:						*Comments:*
KCl CHM number:		CHM 349				
Stock preparation:		50 g KCl/L: Dissolve 50 g KCl in 1-L Deionized water				
Dilution prep (mg/L)	450	600	750	900	1050	
Stock volume (mL)	9	12	15	18	21	
Diluent volume (mL)	991	988	985	982	979	
Total volume (mL)	1000	1000	1000	1000	1000	

Test organism information:		*Test information:*	
Organism age:	19.5 HOURS OLD	Randomizing template:	GREEN
Date and times organisms were born between:	08-04-08 1600	Incubator number and shelf location:	3D
Organism source:	ATOX BATCH Pp 08-04-08	*Artemia* lot number:	BG 100HU
Transfer bowl information:	pH = 7.66 SU Temperature = 25.3 °C	Total drying time:	24-HOURS
		Date / Time in: 08-12-08	1035
Average transfer volume:	0.1384 mL	Date / Time out: 08-13-08	1040
		Oven temperature:	60°C

Daily feeding and renewal information:

Day	Date	Morning feeding time	Afternoon feeding time	Test initiation, renewal, or termination time	MHS batch used	Analyst
0	08-05-08	—	1550	1130	07-30-08 B	JH
1	08-06-08	0800	1400	1032	07-30-08 B	JH
2	08-07-08	0860	1410	1033	08-04-08 A	JH
3	08-08-08	0800	1413	1031	08-04-08 A	JH
4	08-09-08	0750	1400	1035	08-04-08 B	JH
5	08-10-08	0745	1400	1040	08-04-08 B	JH
6	08-11-08	0730	1335	1038	08-04-08 B	BDH
7	08-12-08			1033		JH

Control information:		Acceptance criteria
% Mortality:	0%	≤ 20%
Average weight per initial larvae:	0.854	
Average weight per surviving larvae:	0.854	≥ 0.25 mg/larvae

Summary of test endpoints:	
7-day LC_{50}	772.9
NOEC	600
LOEC	750
ChV	670.8
IC_{25}	687.6

ETS
Environmental Testing Solutions, Inc.

Species: *Pimephales promelas*

PpKClCR Test Number: 156

Survival and Growth Data

Day	Control				450 mg KCl/L				600 mg KCl/L			
	A	B	C	D	E	F	G	H	I	J	K	L
0	10	10	10	10	10	10	10	10	10	10	10	10
1	10	10	10	10	10	10	10	10	10	10	10	10
2	10	10	10	10	10	10	10	10	10	10	10	10
3	10	10	10	10	10	10	10	10	10	10	10	10
4	10	10	10	10	9 sk	10	10	10	10	10	10	10
5	10	10	10	10	9	10	10	10	10	10	10	10
6	10	10	10	10	9	10	10	10	10	10	10	10
7	10 2SM	10	10	10 1LG	9 1LG	10 1LG	10	10	10	10	10 1SM	10
A = Pan weight (mg) Tray color code:: red Analyst: MM	14.60	15.86	14.44	14.57	13.90	14.91	14.79	14.80	12.74	14.14	14.06	13.52
B = Pan + Larvae weight (mg) Analyst: BSC	21.54	24.57	22.81	24.70	22.77	24.44	23.53	23.71	21.01	22.63	21.87	22.49
C = Larvae weight (mg) = A – B	6.94	8.71	8.37	10.13	8.87	9.53	8.74	8.91	8.27	8.49	7.81	8.97
Weight per initial number of larvae (mg) = C / Initial number of larvae	0.694	0.871	0.837	1.013	0.887	0.953	0.871	0.891	0.827	0.849	0.781	0.897
Average weight per initial number of larvae (mg)	0.854				0.901		-5.6%		0.839		1.8%	
Percent reduction from control (%)												

Comment codes: c = clear, d = dead, fg = fungus, k = killed, m = missing, sk = sick, sm = unusually small, lg = unusually large, d&r = decanted and returned, w = wounded.

Calculations and data reviewed: JL

Comments:

Environmental Testing Solutions, Inc.

Species: *Pimephales promelas*

PpKClCR Test Number: 156

Survival and Growth Data

Day	750 mg KCl/L				900 mg KCl/L				1050 mg KCl/L			
	M	N	O	P	Q	R	S	T	U	V	W	X
0	10	10	10	10	10	10	10	10	10	10	10	10
1	8 2d	7 3d	8 2d	7 3d	3 7d	6 4d	4 6d	4 6d	3 7d	2 8d	2 8d	3 7d
2	8	7	8	7	3	6	4	4	3	2	1 1d	2 1d
3	8	7	8	7	3	6	4	4	3	2	1	2
4	7 1d	6 1d	8	7	2 1d	4 2d	3 1d	3 1d	1 2d	2	0 1d	0 2d
5	6 1d	6	8	6 1d	1 1d	2 2d	2 1d	1 2d	0 1d	0 2d	0	0
6	6	6	8	6	1	2	2	1	0	0	0	0
7	6	6	7 1d	6 1SM	1 1Lg	1 1d	1 1d SM	1 1Lg	0	0	0	0
A = Pan weight (mg) Tray color code:: red Analyst: MM	13.88 14.13	14.13 14.11	14.28	13.99	14.09	14.58	13.75	13.64	14.13	15.21	15.76	14.47
B = Pan + Larvae weight (mg) Analyst: BSC	19.51	19.10	20.58	18.51	15.08	15.44	14.47	14.72				
C = Larvae weight (mg) = A – B	5.38	4.99	6.30	4.52	0.99	0.86	0.72	1.08				
Weight per initial number of larvae (mg) = C / Initial number of larvae	0.538	0.499	0.630	0.452	0.099	0.086	0.072	0.108	0	0	0	0
Average weight per initial number of larvae (mg)	0.530				0.091				0			
Percent reduction from control (%)	38.0%				89.3%				100%			

Comment codes: c = clear, d = dead, fg = fungus, k = killed, m = missing, sk = sick, sm = unusually small, lg = unusually large, d&r = decanted and returned, w = wounded.

Calculations and data reviewed: JH

Comments:

Environmental Testing Solutions, Inc.

Pimephales promelas Chronic Reference Toxicant Test
EPA-821-R-02-013, Method 1000.0

Quality Control
Verification of Data Entry, Calculations, and Statistical Analyses

Test number: PpKClCR #156
Test dates: August 05-12, 2008
Reveiwed by:

Concentration (mg/L KCl)	Replicate	Initial number of larvae	Final number of larvae	A = Pan weight (mg)	B = Pan + Larvae weight (mg)	Larvae weight (mg) = A - B	Weight / Surviving number of larvae (mg)	Mean weight/ Surviving number of larvae (mg)	Coefficient of variation (Mean weight per surviving number of larvae) (%)	Weight / Initial number of larvae (mg)	Mean survival (%)	Mean weight/ Initial number of larvae (mg)	Coefficient of variation (%)	Percent reduction from control (%)
Control	A	10	10	14.60	21.54	6.94	0.694	0.854	15.3	0.694	100.0	0.854	15.3	Not applicable
	B	10	10	15.86	24.57	8.71	0.871			0.871				
	C	10	10	14.44	22.81	8.37	0.837			0.837				
	D	10	10	14.57	24.70	10.13	1.013			1.013				
450	E	10	9	13.90	22.77	8.87	0.986	0.926	5.6	0.887	97.5	0.901	3.9	-5.6
	F	10	10	14.91	24.44	9.53	0.953			0.953				
	G	10	10	14.79	23.53	8.74	0.874			0.874				
	H	10	10	14.80	23.71	8.91	0.891			0.891				
600	I	10	10	12.74	21.01	8.27	0.827	0.839	5.7	0.827	100.0	0.839	5.7	1.8
	J	10	10	14.14	22.63	8.49	0.849			0.849				
	K	10	10	14.06	21.87	7.81	0.781			0.781				
	L	10	10	13.52	22.49	8.97	0.897			0.897				
750	M	10	6	14.13	19.51	5.38	0.897	0.845	8.2	0.538	62.5	0.530	14.3	38.0
	N	10	6	14.11	19.10	4.99	0.832			0.499				
	O	10	7	14.28	20.58	6.30	0.900			0.630				
	P	10	6	13.99	18.51	4.52	0.753			0.452				
900	Q	10	1	14.09	15.08	0.99	0.990	0.913	17.2	0.099	10.0	0.091	17.2	89.3
	R	10	1	14.58	15.44	0.86	0.860			0.086				
	S	10	1	13.75	14.47	0.72	0.720			0.072				
	T	10	1	13.64	14.72	1.08	1.080			0.108				
1050	U	10	0	0.00	0.00	0.00	0.000	0.000	0.0	0.000	0.0	0.000	#DIV/0!	100.0
	V	10	0	0.00	0.00	0.00	0.000			0.000				
	W	10	0	0.00	0.00	0.00	0.000			0.000				
	X	10	0	0.00	0.00	0.00	0.000			0.000				

Dunnett's MSD value: 0.1281 MSD = Minimum Significant Difference
PMSD: 15.0 PMSD = Percent Minimum Significant Difference

PMSD is a measure of test precision. The PMSD is the minimum percent difference between the control and treatment that can be declared statistically significant in a whole effluent toxicity test.
Lower PMSD bound determined by USEPA (10th percentile) = 12%.
Upper PMSD bound determined by USEPA (90th percentile) = 30%.

Lower and upper PMSD bounds were determined from the 10th and 90th percentile, respectively, of PMSD data from EPA's WET Interlaboratory Variability Study (USEPA, 2001a; USEPA, 2001b).

USEPA. 2001a, 2001b. Final Report: Interlaboratory Variability Study of EPA Short-term Chronic and Acute Whole Effluent Toxicity Test Methods, Volumes 1 and 2-Appendix. EPA-821-B-01-004 and EPA-821-B-01-005. US Environmental Protection Agency, Cincinnati, OH.

Organisms obtained from Aquatox, Inc.

ETS
Environmental Testing Solutions, Inc.

Statistical Analyses

Larval Fish Growth and Survival Test-7 Day Survival

Start Date:	8/5/2008	Test ID:	PpKClCR	Sample ID:	REF-Ref Toxicant
End Date:	8/12/2008	Lab ID:	ETS-Envir. Testing Sol.	Sample Type:	KCL-Potassium chloride
Sample Date:		Protocol:	FWCHR-EPA-821-R-02-013	Test Species:	PP-Pimephales promelas
Comments:					

Conc-mg/L	1	2	3	4
D-Control	1.0000	1.0000	1.0000	1.0000
450	0.9000	1.0000	1.0000	1.0000
600	1.0000	1.0000	1.0000	1.0000
750	0.6000	0.6000	0.7000	0.6000
900	0.1000	0.1000	0.1000	0.1000
1050	0.0000	0.0000	0.0000	0.0000

			Transform: Arcsin Square Root					Rank	1-Tailed	Number	Total
Conc-mg/L	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical	Resp	Number
D-Control	1.0000	1.0000	1.4120	1.4120	1.4120	0.000	4			0	40
450	0.9750	0.9750	1.3713	1.2490	1.4120	5.942	4	16.00	10.00	1	40
600	1.0000	1.0000	1.4120	1.4120	1.4120	0.000	4	18.00	10.00	0	40
*750	0.6250	0.6250	0.9123	0.8861	0.9912	5.759	4	10.00	10.00	15	40
*900	0.1000	0.1000	0.3218	0.3218	0.3218	0.000	4	10.00	10.00	36	40
1050	0.0000	0.0000	0.1588	0.1588	0.1588	0.000	4			40	40

Auxiliary Tests					Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)					0.77513826	0.868	-1.2150016	5.36244191
Equality of variance cannot be confirmed								
Hypothesis Test (1-tail, 0.05)		NOEC	LOEC	ChV	TU			
Steel's Many-One Rank Test		600	750	670.820393				
Treatments vs D-Control								

Trimmed Spearman-Karber

Trim Level	EC50	95% CL	
0.0%			
5.0%	772.32	743.62	802.13
10.0%	773.40	741.91	806.23
20.0%	777.93	733.16	825.44
Auto-1.3%	772.86	745.55	801.16

Organisms obtained from Aquatox, Inc.

atox08-05-08

ETS
Environmental Testing Solutions, Inc.

Statistical Analyses

Larval Fish Growth and Survival Test-7 Day Growth

Start Date:	8/5/2008	Test ID:	PpKClCR	Sample ID:	REF-Ref Toxicant
End Date:	8/12/2008	Lab ID:	ETS-Envir. Testing Sol.	Sample Type:	KCL-Potassium chloride
Sample Date:		Protocol:	FWCHR-EPA-821-R-02-013	Test Species:	PP-Pimephales promelas
Comments:					

Conc-mg/L	1	2	3	4
D-Control	0.6940	0.8710	0.8370	1.0130
450	0.8870	0.9530	0.8740	0.8910
600	0.8270	0.8490	0.7810	0.8970
750	0.5380	0.4990	0.6300	0.4520
900	0.0990	0.0860	0.0720	0.1080
1050	0.0000	0.0000	0.0000	0.0000

			Transform: Untransformed					1-Tailed			Isotonic	
Conc-mg/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.8538	1.0000	0.8538	0.6940	1.0130	15.340	4				0.8775	1.0000
450	0.9013	1.0556	0.9013	0.8740	0.9530	3.912	4	-0.808	2.180	0.1281	0.8775	1.0000
600	0.8385	0.9821	0.8385	0.7810	0.8970	5.749	4	0.260	2.180	0.1281	0.8385	0.9556
750	0.5298	0.6205	0.5298	0.4520	0.6300	14.255	4				0.5298	0.6037
900	0.0913	0.1069	0.0913	0.0720	0.1080	17.197	4				0.0913	0.1040
1050	0.0000	0.0000	0.0000	0.0000	0.0000	0.000	4				0.0000	0.0000

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.92262149	0.805	0.02218568	2.50557331
Bartlett's Test indicates equal variances (p = 0.08)	4.95044184	9.2103405		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test Treatments vs D-Control	600	>600			0.12810631	0.15005131	0.00428425	0.0069065	0.55926651	2, 9

Linear Interpolation (200 Resamples)

Point	mg/L	SD	95% CL(Exp)		Skew
IC05	602.37	66.80	246.83	633.13	-2.0022
IC10	623.68	27.61	481.66	655.87	-2.3788
IC15	645.00	17.06	584.71	679.82	-0.9129
IC20	666.32	16.08	610.64	704.72	-0.3976
IC25	687.63	16.22	634.67	729.38	-0.1771
IC40	751.11	14.52	695.32	782.62	-0.4658
IC50	781.13	10.77	736.87	807.17	-0.4379

Organisms obtained from Aquatox, Inc.

atox08-05-08

Species: *Pimephales promelas*

PpKClCR Test Number: 156

Daily Chemistry:

		Day					
		0		1		2	
	Analyst	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Concentration	Parameter						
CONTROL	pH (S.U.)	7.43	7.68	7.82	7.57	7.53	7.43
	DO (mg/L)	7.6	7.6	7.7	7.5	7.6	7.6
	Conductivity (µmhos/cm)	310		324		305	
	Alkalinity (mg $CaCO_3$/L)	59				63	
	Hardness (mg $CaCO_3$/L)	92				94	
	Temperature (°C)	24.3	24.7	24.6	24.3	24.5	24.2
450 mg KCl/L	pH (S.U.)	7.57	7.68	7.83	7.51	7.63	7.53
	DO (mg/L)	7.6	7.6	7.8	7.5	7.6	7.6
	Conductivity (µmhos/cm)	1070		1110		1070	
	Temperature (°C)	24.5	24.7	24.5	24.6	24.5	24.2
600 mg KCl/L	pH (S.U.)	7.61	7.64	7.83	7.43	7.64	7.52
	DO (mg/L)	7.6	7.6	7.8	7.4	7.7	7.5
	Conductivity (µmhos/cm)	1330		1410		1320	
	Temperature (°C)	24.4	24.6	24.5	24.3	24.6	24.3
750 mg KCl/L	pH (S.U.)	7.62	7.64	7.82	7.44	7.65	7.53
	DO (mg/L)	7.7	7.6	7.7	7.4	7.7	7.5
	Conductivity (µmhos/cm)	1580		1650		1560	
	Temperature (°C)	24.4	24.6	24.5	24.4	24.5	24.1
900 mg KCl/L	pH (S.U.)	7.65	7.65	7.82	7.47	7.66	7.53
	DO (mg/L)	7.7	7.5	7.7	7.5	7.7	7.5
	Conductivity (µmhos/cm)	1850		1900		1800	
	Temperature (°C)	24.5	24.5	24.5	24.5	24.5	24.1
1050 mg KCl/L	pH (S.U.)	7.64	7.65	7.80	7.50	7.65	7.62
	DO (mg/L)	7.7	7.6	7.7	7.4	7.7	7.6
	Conductivity (µmhos/cm)	2100		2160		2070	
	Temperature (°C)	24.5	24.7	24.5	24.5	24.5	24.3
STOCK	Conductivity (µmhos/cm)	70700		—x		—x	
		Initial	Final	Initial	Final	Initial	Final

Environmental Testing Solutions, Inc.

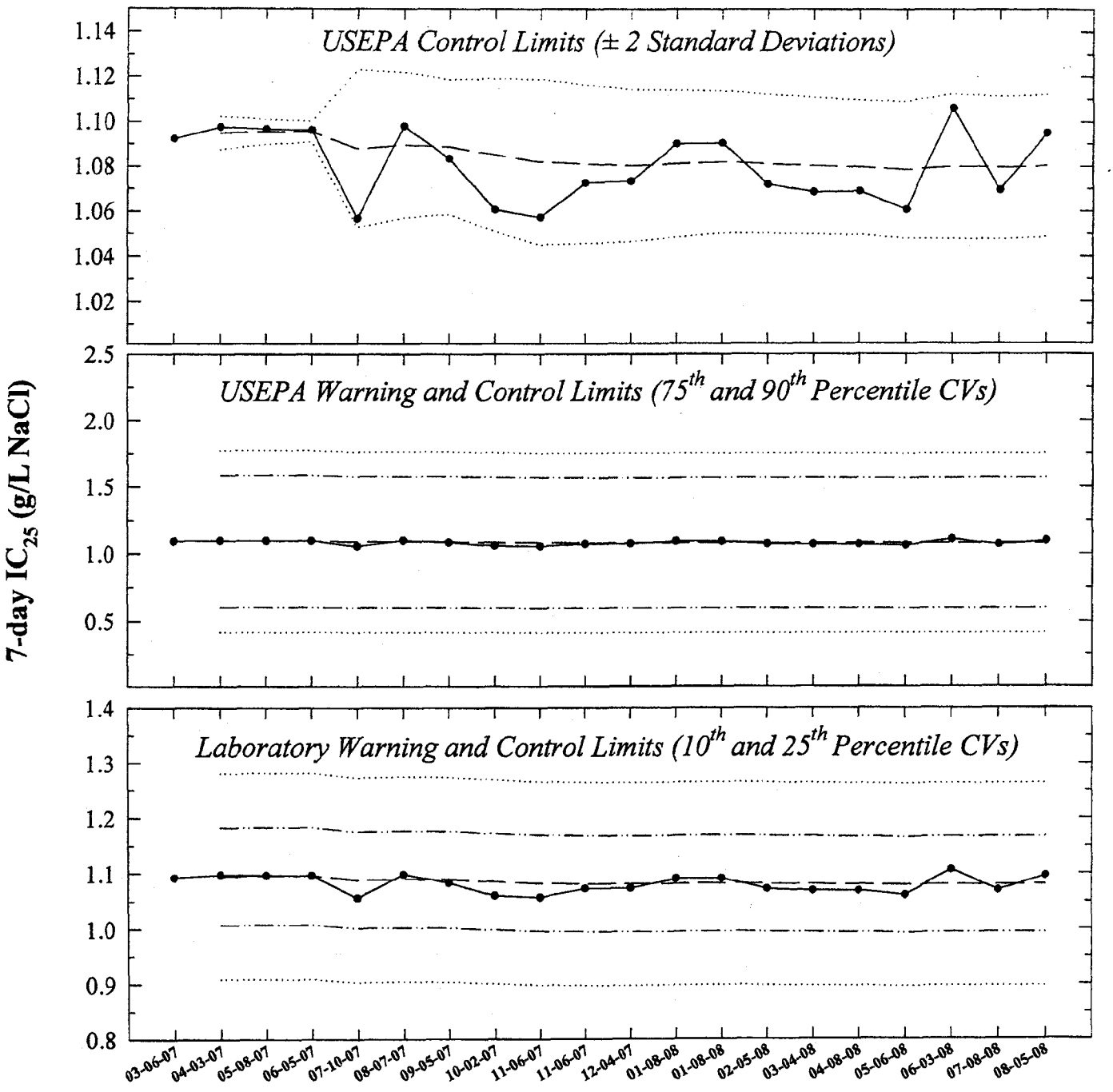
Species: *Pimephales promelas*

PpKClCR Test Number: 156

		Day							
		3		4		5		6	
	Analyst	JH	LAB	LAB	JL/BS	JL/BS	JH	JH	MEK
Concentration	Parameter								
CONTROL	pH (S.U.)	7.72	7.60	7.87	7.48	7.43	7.58	7.53	7.39
	DO (mg/L)	7.6	7.7	7.5	7.7	8.0	7.4	7.6	6.5
	Conductivity (µmhos/cm)	312		308		302		290	
	Alkalinity (mg $CaCO_3$/L)			63					
	Hardness (mg $CaCO_3$/L)			86					
	Temperature (°C)	24.5	24.7	24.8	24.2	24.6	24.5	24.8	24.1
450 mg KCl/L	pH (S.U.)	7.80	7.60	7.90	7.55	7.61	7.61	7.68	7.36
	DO (mg/L)	7.6	7.5	7.5	7.8	7.9	7.4	7.6	6.2
	Conductivity (µmhos/cm)	1090		1080		1060		1060	
	Temperature (°C)	24.5	24.3	24.8	24.2	24.5	24.4	24.9	24.2
600 mg KCl/L	pH (S.U.)	7.81	7.64	7.90	7.60	7.65	7.61	7.70	7.39
	DO (mg/L)	7.7	7.6	7.6	7.7	8.0	7.4	7.6	6.2
	Conductivity (µmhos/cm)	1340		1300		1330		1310	
	Temperature (°C)	24.5	24.2	24.8	24.1	24.5	24.4	24.9	24.2
750 mg KCl/L	pH (S.U.)	7.82	7.64	7.90	7.60	7.65	7.61	7.71	7.38
	DO (mg/L)	7.7	7.7	7.7	7.7	8.0	7.5	7.6	6.3
	Conductivity (µmhos/cm)	1590		1560		1570		1550	
	Temperature (°C)	24.6	24.2	24.8	24.1	24.5	24.2	24.9	24.3
900 mg KCl/L	pH (S.U.)	7.82	7.63	7.90	7.60	7.68	7.61	7.72	7.47
	DO (mg/L)	7.7	7.6	7.7	7.8	8.0	7.4	7.6	6.3
	Conductivity (µmhos/cm)	1830		1800		1820		1790	
	Temperature (°C)	24.6	24.5	24.8	24.2	24.6	24.3 24.8	24.8	24.3
1050 mg KCl/L	pH (S.U.)	7.82	7.70	7.91	7.61	7.70			
	DO (mg/L)	7.7	7.8	7.9	7.7	7.9			
	Conductivity (µmhos/cm)	2100		2060		2060			
	Temperature (°C)	24.6	24.4	24.8	24.0	24.5	24.3	24.8	
STOCK	Conductivity (µmhos/cm)								
		Initial	Final	Initial	Final	Initial	Final	Initial	Final

ETS
Environmental Testing Solutions, Inc.

Ceriodaphnia dubia
Chronic Reference Toxicant Control Chart



—●— **7-day IC_{25}** = 25% inhibition concentration. An estimation of the concentration of sodium chloride that would cause a 25% reduction in *Ceriodaphnia* reproduction for the test population.

— — **Central Tendency** (mean IC_{25})

-·-·- **Warning Limits** (mean $IC_{25} \pm S_{A.10}$ or $S_{A.75}$)

····· **Control Limits** (mean $IC_{25} \pm S_{A.25}$, $S_{A.90}$, or 2 Standard Deviations)

ETS

Environmental Testing Solutions, Inc.

Ceriodaphnia dubia
Chronic Reference Toxicant Control Chart

Test number	Test date	7-day IC_{25} (g/L NaCl)	CT (g/L NaCl)	S	State and USEPA Control Limits CT - 2S	CT + 2S	$S_{A.10}$	Laboratory Warning Limits CT - $S_{A.10}$	CT + $S_{A.10}$	$S_{A.25}$	Laboratory Control Limits CT - $S_{A.25}$	CT + $S_{A.25}$	$S_{A.75}$	USEPA Warning Limits CT - $S_{A.75}$	CT + $S_{A.75}$	$S_{A.90}$	USEPA Control Limits CT - $S_{A.90}$	CT + $S_{A.90}$	CV
1	03-06-07	1.09																	
2	04-03-07	1.10	1.09	0.00	1.09	1.10	0.09	1.01	1.18	0.19	0.91	1.28	0.49	0.60	1.59	0.68	0.42	1.77	0.00
3	05-08-07	1.10	1.10	0.00	1.09	1.10	0.09	1.01	1.18	0.19	0.91	1.28	0.49	0.60	1.59	0.68	0.42	1.77	0.00
4	06-05-07	1.10	1.10	0.00	1.09	1.10	0.09	1.01	1.18	0.19	0.91	1.28	0.49	0.60	1.59	0.68	0.42	1.77	0.00
5	07-10-07	1.06	1.09	0.02	1.05	1.12	0.09	1.00	1.17	0.18	0.90	1.27	0.49	0.60	1.58	0.67	0.41	1.76	0.02
6	08-07-07	1.10	1.09	0.02	1.06	1.12	0.09	1.00	1.18	0.19	0.90	1.27	0.49	0.60	1.58	0.68	0.41	1.76	0.01
7	09-05-07	1.08	1.09	0.02	1.06	1.12	0.09	1.00	1.18	0.19	0.90	1.27	0.49	0.60	1.58	0.67	0.41	1.76	0.01
8	10-02-07	1.06	1.09	0.02	1.05	1.12	0.09	1.00	1.17	0.18	0.90	1.27	0.49	0.60	1.57	0.67	0.41	1.76	0.02
9	11-06-07	1.06	1.08	0.02	1.05	1.12	0.09	1.00	1.17	0.18	0.90	1.27	0.49	0.60	1.57	0.67	0.41	1.75	0.02
10	11-06-07	1.07	1.08	0.02	1.05	1.12	0.09	0.99	1.17	0.18	0.90	1.26	0.49	0.59	1.57	0.67	0.41	1.75	0.02
11	12-04-07	1.07	1.08	0.02	1.05	1.11	0.09	0.99	1.17	0.18	0.90	1.26	0.49	0.59	1.57	0.67	0.41	1.75	0.02
12	01-08-08	1.09	1.08	0.02	1.05	1.11	0.09	0.99	1.17	0.18	0.90	1.26	0.49	0.59	1.57	0.67	0.41	1.75	0.02
13	01-08-08	1.09	1.08	0.02	1.05	1.11	0.09	1.00	1.17	0.18	0.90	1.27	0.49	0.60	1.57	0.67	0.41	1.75	0.01
14	02-05-08	1.07	1.08	0.02	1.05	1.11	0.09	0.99	1.17	0.18	0.90	1.26	0.49	0.59	1.57	0.67	0.41	1.75	0.01
15	03-04-08	1.07	1.08	0.02	1.05	1.11	0.09	0.99	1.17	0.18	0.90	1.26	0.49	0.59	1.57	0.67	0.41	1.75	0.01
16	04-08-08	1.07	1.08	0.02	1.05	1.11	0.09	0.99	1.17	0.18	0.90	1.26	0.49	0.59	1.57	0.67	0.41	1.75	0.01
17	05-06-08	1.06	1.08	0.02	1.05	1.11	0.09	0.99	1.16	0.18	0.90	1.26	0.49	0.59	1.56	0.67	0.41	1.75	0.01
18	06-03-08	1.11	1.08	0.02	1.05	1.11	0.09	0.99	1.17	0.18	0.90	1.26	0.49	0.59	1.57	0.67	0.41	1.75	0.01
19	07-08-08	1.07	1.08	0.02	1.05	1.11	0.09	0.99	1.17	0.18	0.90	1.26	0.49	0.59	1.57	0.67	0.41	1.75	0.01
20	08-05-08	1.09	1.08	0.02	1.05	1.11	0.09	0.99	1.17	0.18	0.90	1.26	0.49	0.59	1.57	0.67	0.41	1.75	0.01

Note: **7-d IC_{25}** = 7-day 25% inhibition concentration. An estimation of the concentration of sodium chloride that would cause a 25% reduction in *Ceriodaphnia* reproduction for the test population.

CT = Central tendency (mean IC_{25}).

S = Standard deviation of the IC_{25} values.

Laboratory Control and Warning Limits

Laboratory control and warning limits were established using the standard deviation of the IC_{25} values corresponding to the 10th and 25th percentile CVs. These ranges are more stringent than the control and warning limits recommended by USEPA for the test method and endpoint.

$S_{A.10}$ = Standard deviation corresponding to the 10th percentile CV. ($S_{A.10} = 0.08$)

$S_{A.25}$ = Standard deviation corresponding to the 25th percentile CV. ($S_{A.25} = 0.17$)

USEPA Control and Warning Limits

$S_{A.75}$ = Standard deviation corresponding to the 75th percentile CV. ($S_{A.75} = 0.45$)

$S_{A.90}$ = Standard deviation corresponding to the 90th percentile CV. ($S_{A.90} = 0.62$)

CV = Coefficient of variation of the IC_{25} values.

USEPA. 2000. Understanding and Accounting for Method Variability in Whole Effluent Toxicity Applications Under the National Pollutant Discharge Elimination Program. EPA-833-R-00-003. US Environmental Protection Agency, Cincinnati, OH.

ETS
Environmental Testing Solutions, Inc.

Precision of Endpoint Measurements

Ceriodaphnia dubia
Chronic Reference Toxicant Data

Test number	Test date	Control Survival (%)	Control Mean Reproduction (offspring/female)	CT for Control Mean Reproduction (offspring/female)	CV (%)	CT for Control Reproduction CV (%)	MSD	PMSD (%)	CT for PMSD (%)
1	03-06-07	100	30.1		6.0		2.6	8.7	
2	04-03-07	100	33.1	31.6	4.4	5.2	2.2	6.6	7.7
3	05-08-07	100	32.0	31.7	8.5	6.3	2.7	8.4	7.9
4	06-05-07	100	28.4	30.9	7.5	6.6	2.5	8.7	8.1
5	07-10-07	100	29.3	30.6	6.0	6.5	2.5	8.5	8.2
6	08-07-07	100	28.7	30.3	7.5	6.6	2.9	10.0	8.5
7	09-05-07	100	29.7	30.2	5.7	6.5	2.5	8.4	8.5
8	10-02-07	100	29.5	30.1	9.4	6.9	2.4	8.2	8.4
9	11-06-07	100	28.0	29.9	6.1	6.8	2.5	8.8	8.5
10	11-06-07	100	30.4	29.9	5.6	6.7	2.2	7.2	8.4
11	12-04-07	100	31.8	30.1	5.5	6.6	2.5	7.9	8.3
12	01-08-08	100	30.3	30.1	6.6	6.6	2.2	7.3	8.2
13	01-08-08	100	31.8	30.2	4.9	6.4	2.4	7.7	8.2
14	02-05-08	100	31.3	30.3	6.4	6.4	2.8	9.1	8.2
15	03-04-08	100	31.5	30.4	8.0	6.5	2.7	8.5	8.3
16	04-08-08	100	29.6	30.3	7.7	6.6	2.6	8.8	8.3
17	05-06-08	100	32.1	30.4	6.3	6.6	2.5	7.9	8.3
18	06-03-08	100	30.5	30.5	7.9	6.7	3.0	9.9	8.4
19	07-08-08	100	30.9	30.5	6.7	6.7	2.4	7.7	8.3
20	08-05-08	100	29.4	30.4	7.9	6.7	2.2	7.6	8.3

Note:

CV = Coefficient of variation for control reproduction.
Lower CV bound determined by USEPA (10^{th} percentile) = 8.9%.
Upper CV bound determined by USEPA (90^{th} percentile) = 42%

MSD = Minimum Significant Difference

PMSD = Percent Minimum Significant Difference
PMSD is a measure of test precision. The PMSD is the minimum percent difference between the control and treatment that can be declared statistically significant in a whole effluent toxicity test.
Lower PMSD bound determined by USEPA (10^{th} percentile) = 13%.
Upper PMSD bound determined by USEPA (90^{th} percentile) = 47%.

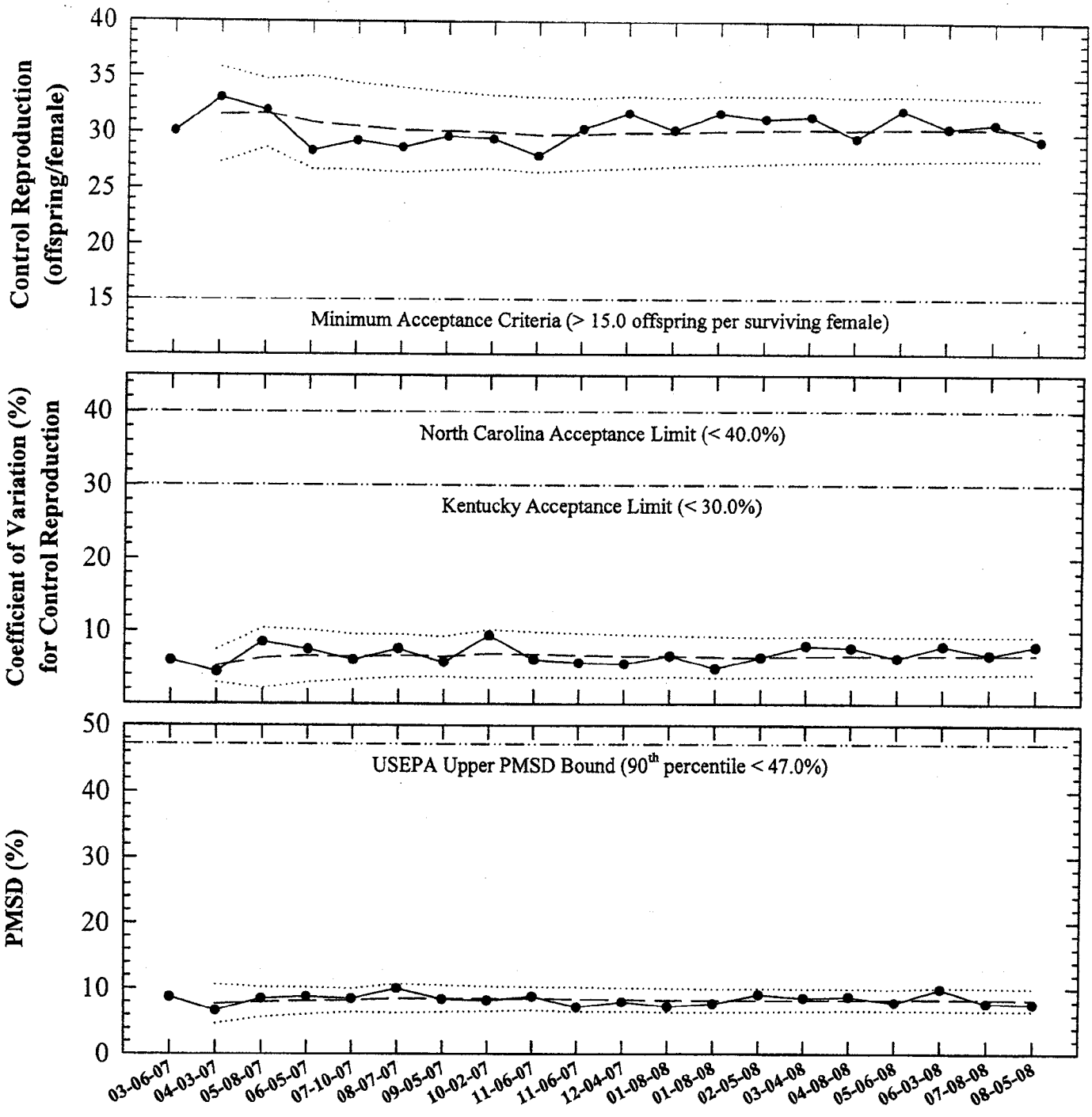
CT = Central Tendancy (Mean Control Reproduction, CV, or PMSD)

USEPA. 2000. Understanding and Accounting for Method Variability in Whole Effluent Toxicity Applications Under the National Pollutant Discharge Elimination Program. EPA-833-R-00-003. US Environmental Protection Agency, Cincinnati, OH.

USEPA. 2001a, 2001b. Final Report: Interlaboratory Variability Study of EPA Short-term Chronic and Acute Whole Effluent Toxicity Test Methods, Volumes 1 and 2-Appendix. EPA-821-B-01-004 and EPA-821-B-01-005. US Environmental Protection Agency, Cincinnati, OH.

ETS
Environmental Testing Solutions, Inc.

Ceriodaphnia dubia
Chronic Reference Toxicant Control Chart
Precision of Endpoint Measurements



—•— **Control Reproduction, Coefficient of Variation (CV), or Percent Minimum Significant Difference (PMSD)** PMSD is the minimum significant difference between the control and treatment that can be declared statistically significant.

— — **Central Tendency** (mean Control Reproduction, CV, or PMSD)

····· **Control Limits** (mean Control Reproduction, CV, or PMSD ± 2 Standard Deviations)

ETS Environmental Testing Solutions, Inc.

Sodium Chloride Chronic Reference Toxicant Test
(EPA-821-R-02-013 Method 1002.0)
Species: *Ceriodaphnia dubia*

CdNaCLCR #: 78

Dilution preparation information:						*Comments:*
NaCl CHM number:	CHM120					
Stock preparation:	100 g NaCl/l (dissolve 50 g NaCl in 500 ml deionized water)					
Dilution prep (mg/L)	600	800	1000	1200	1400	
Stock volume (mL)	9	12	15	18	21	
Diluent volume (mL)	1491	1488	1485	1482	1479	
Total volume (mL)	1500	1500	1500	1500	1500	

Test organism source information:											*Test information:*	
Organism age:	< 24-hours old										Randomizing template color:	Blue
Date and times organisms were born between:	08-05-08 0800 TO 1050										Incubator number and shelf location:	2B1
Culture board:	07-29-08 A											
Replicate number:	1	2	3	4	5	6	7	8	9	10	YWT batch:	07-07-08
Culture board cup number:	1	3	5	15	16	17	18	19	21	24		
Transfer bowl information:	pH = 7.70 SU			Temperature = 24.9 °C							*Selenastrum* batch:	07-25-08

Daily renewal information:

Day	Date	Test initiation and feeding, renewal and feeding, or termination time	MHSW batch used	Analyst
0	08-05-08	1200	07-30-08 B	dl
1	08-06-08	1105	07-30-08 B	dl
2	08-07-08	1101	08-04-08 A	dl
3	08-08-08	1100	08-04-08 A	dl
4	08-09-08	1100	08-04-08 B	dl
5	08-10-08	1103	08-04-08 B	dl
6	08-11-08	1105	08-04-08 B	dl
7	08-12-08	1109		dl

Control information:		Acceptance criteria	*Summary of test endpoints:*	
% of Male Adults:	0%	≤ 20%	7-day LC_{50}	>1400
% Adults having 3rd Broods:	100%	≥ 80%	NOEC	1000
% Mortality:	0%	≤ 20%	LOEC	1200
Mean Offspring/Female:	29.4	≥ 15.0 offspring/female	ChV	1095.4
% CV:	7.99%	< 40.0 %	IC_{25}	1094.9

Species: *Ceriodaphnia dubia* CdNaCLCR #: 78

CONTROL *Survival and Reproduction Data*

Day		Replicate number									
		1	2	3	4	5	6	7	8	9	10
1	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
2	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
3	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
4	Young produced	3	3	3	3	5	4	4	3	4	3
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	0	0	12	11	0	13	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	10	10	0	0	13	0	10	10	12	10
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	14	17	15	14	14	16	13	17	15	13
Total young produced		27	30	30	28 29	32	33	27	30	31	26
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L
X for 3rd Broods		X	X	X	X	X	X	X	X	X	X

Note: Adult mortality (L = live, D = dead), SB = split brood (single brood split between two days), CO = carry over (offspring carried over with adult during transfer).

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	29.4

600 mg NaCl/L *Survival and Reproduction Data*

Day		Replicate number									
		1	2	3	4	5	6	7	8	9	10
1	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
2	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
3	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
4	Young produced	4	3	5	4	4	3	3	3	4	4
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	0	0	12	0	0	0	0	11	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	11	11	0	12	10	10	10	0	13	11
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	14	14	17	13	16	16	14	13	15	13
Total young produced		29	28	34	29	30	29	27	27	32	28
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Note: Adult mortality (L = live, D = dead), SB = split brood (single brood split between two days), CO = carry over (offspring carried over with adult during transfer).

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	29.3
% Reduction from Control:	0.3%

Species: *Ceriodaphnia dubia* CdNaCLCR #: 78

800 mg NaCl/L *Survival and Reproduction Data*

Day		Replicate number									
		1	2	3	4	5	6	7	8	9	10
1	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
2	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
3	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
4	Young produced	4	3	4	3	3	3	3	4	4	4
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	0	0	12	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	14	11	0	10	10	11	12	10	13	12
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	13	14	16	15	17	13	14	14	14	16
Total young produced		31	28	32	28	30	27	29	28	31	32
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Note: Adult mortality (L = live, D = dead), SB = split brood (single brood split between two days), CO = carry over (offspring carried over with adult during transfer).

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	29.6
% Reduction from Control:	-0.7%

1000 mg NaCl/L *Survival and Reproduction Data*

Day		Replicate number									
		1	2	3	4	5	6	7	8	9	10
1	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
2	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
3	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
4	Young produced	4	3	5	4	4	3	3	4	4	3
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	0	0	10	0	0	10	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	13	12	0	10	10	0	9	11	12	10
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	14	14	15	12	16	13	14	13	15	11
Total young produced		31	29	30	26	30	26	26	28	31	24
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Note: Adult mortality (L = live, D = dead), SB = split brood (single brood split between two days), CO = carry over (offspring carried over with adult during transfer).

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	28.1
% Reduction from Control:	4.4%

Species: *Ceriodaphnia dubia* CdNaCLCR #: 78

1200 mg NaCl/L *Survival and Reproduction Data*

Day		Replicate number									
		1	2	3	4	5	6	7	8	9	10
1	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
2	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
3	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
4	Young produced	3	2	4	3	3	1	4	3	3	3
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	0	0	0	6	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	8	5	7	0	6	9	5	5	10	4
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	5	10	3	9	9	0	6	11	0	7
Total young produced		17/16	17	14	18	18	10	15	19	13	14
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Note: Adult mortality (L = live, D = dead), SB = split brood (single brood split between two days), CO = carry over (offspring carried over with adult during transfer).

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	15.4
% Reduction from Control:	47.6%

1400 mg NaCl/L *Survival and Reproduction Data*

Day		Replicate number									
		1	2	3	4	5	6	7	8	9	10
1	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
2	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
3	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
4	Young produced	1	1	0	3	0	2	0	0	3	1
	Adult mortality	L	L	L	D	L	L	L	L	L	L
5	Young produced	0	0	0		3	0	0	2	0	0
	Adult mortality	L	L	L		L	L	L	L	L	L
6	Young produced	0	0	0		0	0	0	0	0	0
	Adult mortality	L	L	L		L	L	L	L	L	L
7	Young produced	3	2	2	↓	0	0	5	0	0	4
Total young produced		4	3	2	3	3	2	5	2	3	5
Final Adult Mortality		L	L	L	D	L	L	L	L	L	L

Note: Adult mortality (L = live, D = dead), SB = split brood (single brood split between two days), CO = carry over (offspring carried over with adult during transfer).

Concentration:	
% Mortality:	10%
Mean Offspring/Female:	3.2
% Reduction from Control:	89.1%

ETS
Environmental Testing Solutions, Inc.

Page 276 of 276

Verification of *Ceriodaphnia* Reproduction Totals

Control

Day	Replicate number										Total
	1	2	3	4	5	6	7	8	9	10	
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0
4	3	3	3	3	5	4	4	3	4	3	35
5	0	0	12	11	0	13	0	0	0	0	36
6	10	10	0	0	13	0	10	10	12	10	75
7	14	17	15	14	14	16	13	17	15	13	148
Total	27	30	30	28	32	33	27	30	31	26	294

1000 mg NaCl/L

Day	Replicate number										Total
	1	2	3	4	5	6	7	8	9	10	
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0
4	4	3	5	4	4	3	3	4	4	3	37
5	0	0	10	0	0	10	0	0	0	0	20
6	13	12	0	10	10	0	9	11	12	10	87
7	14	14	15	12	16	13	14	13	15	11	137
Total	31	29	30	26	30	26	26	28	31	24	281

600 mg NaCl/L

Day	Replicate number										Total
	1	2	3	4	5	6	7	8	9	10	
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0
4	4	3	5	4	4	3	3	3	4	4	37
5	0	0	12	0	0	0	0	11	0	0	23
6	11	11	0	12	10	10	10	0	13	11	88
7	14	14	17	13	16	16	14	13	15	13	145
Total	29	28	34	29	30	29	27	27	32	28	293

1200 mg NaCl/L

Day	Replicate number										Total
	1	2	3	4	5	6	7	8	9	10	
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0
4	3	2	4	3	3	1	4	3	3	3	29
5	0	0	0	6	0	0	0	0	0	0	6
6	8	5	7	0	6	9	5	5	10	4	59
7	5	10	3	9	9	0	6	11	0	7	60
Total	16	17	14	18	18	10	15	19	13	14	154

800 mg NaCl/L

Day	Replicate number										Total
	1	2	3	4	5	6	7	8	9	10	
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0
4	4	3	4	3	3	3	3	4	4	4	35
5	0	0	12	0	0	0	0	0	0	0	12
6	14	11	0	10	10	11	12	10	13	12	103
7	13	14	16	15	17	13	14	14	14	16	146
Total	31	28	32	28	30	27	29	28	31	32	296

1400 mg NaCl/L

Day	Replicate number										Total
	1	2	3	4	5	6	7	8	9	10	
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0
4	1	1	0	3	0	2	0	0	3	1	11
5	0	0	0	0	3	0	0	2	0	0	5
6	0	0	0	0	0	0	0	0	0	0	0
7	3	2	2	0	0	0	5	0	0	4	16
Total	4	3	2	3	3	2	5	2	3	5	32

ETS
Environmental Testing Solutions, Inc.

Ceriodaphnia dubia Chronic Reference Toxicant Test
EPA-821-R-02-013, Method 1002.0

Quality Control
Verification of Data Entry, Calculations, and Statistical Analyses

Test number: CdNaClCR #78
Test dates: August 05-12, 2008
Reveiwed by:

Concentration (mg/L NaCl)	Replicate number										Survival (%)	Average reproduction (offspring/female)	Coefficient of variation (%)	Percent reduction from control (%)
	1	2	3	4	5	6	7	8	9	10				
Control	27	30	30	28	32	33	27	30	31	26	100	29.4	7.9	Not applicable
600	29	28	34	29	30	29	27	27	32	28	100	29.3	7.6	0.3
800	31	28	32	28	30	27	29	28	31	32	100	29.6	6.2	-0.7
1000	31	29	30	26	30	26	26	28	31	24	100	28.1	8.8	4.4
1200	16	17	14	18	18	10	15	19	13	14	100	15.4	17.9	47.6
1400	4	3	2	3	3	2	5	2	3	5	90	3.2	35.5	89.1

Dunnett's MSD value: 2.234
PMSD: 7.6

MSD = Minimum Significant Difference
PMSD = Percent Minimum Significant Difference

PMSD is a measure of test precision. The PMSD is the minimum percent difference between the control and treatment that can be declared statistically significant in a whole effluent toxicity test.

Lower PMSD bound determined by USEPA (10^{th} percentile) = 13%.

Upper PMSD bound determined by USEPA (90^{th} percentile) = 47%.

Lower and upper PMSD bounds were determined from the 10th and 90th percentile, respectively, of PMSD data from EPA's WET Interlaboratory Variability Study (USEPA, 2001a; USEPA, 2001b).

USEPA. 2001a, 2001b. Final Report: Interlaboratory Variability Study of EPA Short-term Chronic and Acute Whole Effluent Toxicity Test Methods, Volumes 1 and 2-Appendix. EPA-821-B-01-004 and EPA-821-B-01-005. US Environmental Protection Agency, Cincinnati, OH.

ETS
Environmental Testing Solutions, Inc.

Statistical Analyses

Ceriodaphnia Survival and Reproduction Test-Reproduction

Start Date:	8/5/2008	Test ID:	CdNaClCR	Sample ID:	REF-Ref Toxicant
End Date:	8/12/2008	Lab ID:	ETS-Envir. Testing Sol.	Sample Type:	NACL-Sodium chloride
Sample Date:		Protocol:	FWCHR-EPA-821-R-02-013	Test Species:	CD-Ceriodaphnia dubia
Comments:					

Conc-mg/L	1	2	3	4	5	6	7	8	9	10
D-Control	27.000	30.000	30.000	28.000	32.000	33.000	27.000	30.000	31.000	26.000
600	29.000	28.000	34.000	29.000	30.000	29.000	27.000	27.000	32.000	28.000
800	31.000	28.000	32.000	28.000	30.000	27.000	29.000	28.000	31.000	32.000
1000	31.000	29.000	30.000	26.000	30.000	26.000	26.000	28.000	31.000	24.000
1200	16.000	17.000	14.000	18.000	18.000	10.000	15.000	19.000	13.000	14.000
1400	4.000	3.000	2.000	3.000	3.000	2.000	5.000	2.000	3.000	5.000

			Transform: Untransformed					1-Tailed			Isotonic	
Conc-mg/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	29.400	1.0000	29.400	26.000	33.000	7.888	10				29.433	1.0000
600	29.300	0.9966	29.300	27.000	34.000	7.555	10	0.102	2.287	2.234	29.433	1.0000
800	29.600	1.0068	29.600	27.000	32.000	6.209	10	-0.205	2.287	2.234	29.433	1.0000
1000	28.100	0.9558	28.100	24.000	31.000	8.789	10	1.330	2.287	2.234	28.100	0.9547
*1200	15.400	0.5238	15.400	10.000	19.000	17.901	10	14.327	2.287	2.234	15.400	0.5232
*1400	3.200	0.1088	3.200	2.000	5.000	35.478	10	26.813	2.287	2.234	3.200	0.1087

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Kolmogorov D Test indicates normal distribution (p > 0.01)	0.78750116	1.035	-0.0380093	-0.3470141
Bartlett's Test indicates equal variances (p = 0.23)	6.90396881	15.0862722		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test Treatments vs D-Control	1000	1200	1095.44512		2.23440775	0.07600026	1197.04	4.77407407	4.5E-36	5, 54

Linear Interpolation (200 Resamples)

Point	mg/L	SD	95% CL		Skew
IC05	1002.17848	77.7461456	779.434641	1020.05615	-2.6984
IC10	1025.35433	14.2887789	991.731061	1041.35951	-1.6852
IC15	1048.53018	10.7345501	1024.74818	1063.03383	-0.2233
IC20	1071.70604	10.0921623	1048.62094	1086.08067	-0.1967
IC25	1094.88189	9.88843252	1072.93237	1108.70826	-0.1481
IC40	1164.40945	11.8919414	1140.70124	1187.71569	0.1217
IC50	1211.20219	12.8831181	1183.9923	1232.85271	-0.1732

08-05-08

Species: *Ceriodaphnia dubia* CdNaCLCR #: 78

Daily Chemistry:

		Day					
		0		1		2	
	Analyst	JH	KDL	KDL	JH	JH	JH
Concentration	Parameter						
CONTROL	pH (S.U.)	7.43	7.67	7.82	7.51	7.53	7.48
	DO (mg/L)	7.6	7.8	7.7	7.7	7.6	7.6
	Conductivity (µmhos/cm)	310		324		305	
	Alkalinity (mg $CaCO_3$/L)	59				63	
	Hardness (mg $CaCO_3$/L)	92				94	
	Temperature (°C)	24.6	24.9	24.7	24.7	24.6	24.9
600 mg NaCl/L	pH (S.U.)	7.61	7.60	7.71	7.51	7.62	7.51
	DO (mg/L)	7.6	7.8	7.8	7.7	7.7	7.7
	Conductivity (µmhos/cm)	1380		1430		1390	
	Temperature (°C)	24.6	24.9	24.7	24.6	24.5	25.1
800 mg NaCl/L	pH (S.U.)	7.59	7.60	7.70	7.53	7.61	7.53
	DO (mg/L)	7.7	7.8	7.8	7.7	7.7	7.6
	Conductivity (µmhos/cm)	1730		1800		1750	
	Temperature (°C)	24.6	24.9	24.7	24.8	24.5	25.0
1000 mg NaCl/L	pH (S.U.)	7.59	7.59	7.68	7.52	7.61	7.54
	DO (mg/L)	7.7	7.7	7.8	7.7	7.7	7.7
	Conductivity (µmhos/cm)	2090		2160		2110	
	Temperature (°C)	24.6	24.9	24.6	24.9	24.7	25.0
1200 mg NaCl/L	pH (S.U.)	7.59	7.59	7.68	7.51	7.61	7.56
	DO (mg/L)	7.7	7.7	7.7	7.7	7.8	7.8
	Conductivity (µmhos/cm)	2420		2490		2420	
	Temperature (°C)	24.7	24.9	24.6	24.9	24.7	25.2
1400 mg NaCl/L	pH (S.U.)	7.62	7.59	7.67	7.52	7.60	7.56
	DO (mg/L)	7.7	7.7	7.7	7.7	7.8	7.8
	Conductivity (µmhos/cm)	2770		2830		2770	
	Temperature (°C)	24.7	24.8	24.6	24.9	24.6	25.1
STOCK	Conductivity (µmhos/cm)	121000		—		—	
		Initial	Final	Initial	Final	Initial	Final

Species: *Ceriodaphnia dubia* CdNaCLCR #: 78

		Day							
		3		4		5		6	
	Analyst	JH	VAB	VAB	JH/BSC	JH/BSC	JH	JH	VAB
Concentration	Parameter								
CONTROL	pH (S.U.)	7.72	~~7.72~~	7.81	7.51	7.43	7.46	7.53	7.68
	DO (mg/L)	7.6	8.1	7.5	8.2	8.0	7.8	7.6	7.7
	Conductivity (µmhos/cm)	312		308		302		290	
	Alkalinity (mg $CaCO_3$/L)			63					
	Hardness (mg $CaCO_3$/L)			86					
	Temperature (°C)	24.5	24.9	24.7	25.0	24.6	24.7	24.9	25.1
600 mg NaCl/L	pH (S.U.)	7.78	~~7.70~~	7.75	7.55	7.58	7.50	7.67	7.69
	DO (mg/L)	7.7	7.9 (7.46)	8.1	8.0	8.0	7.7	7.6	7.7
	Conductivity (µmhos/cm)	1390		1370		1360		1410	
	Temperature (°C)	24.7	25.0	24.9	24.7	24.6	24.9	24.8	24.7
800 mg NaCl/L	pH (S.U.)	7.76	7.66	7.74	7.59	7.60	7.50	7.67	7.72
	DO (mg/L)	7.9	7.8	~~7.69~~ (8.0)	8.6	8.1	7.7	7.6	7.7
	Conductivity (µmhos/cm)	1760		1750		1750		1820	
	Temperature (°C)	24.5	25.0	24.8	25.1	24.5	24.8	24.8	24.6
1000 mg NaCl/L	pH (S.U.)	7.75	7.66	7.74	7.60	7.61	7.53	7.66	7.73
	DO (mg/L)	7.9	7.8	~~7.69~~ (8.1)	8.0	8.1	7.7	7.7	7.7
	Conductivity (µmhos/cm)	2070		2090		2080		2130	
	Temperature (°C)	24.6	24.8	24.8	25.2	24.5	24.8	24.9	24.6
1200 mg NaCl/L	pH (S.U.)	7.74	7.66	7.73	7.59	7.61	7.52	7.66	7.72
	DO (mg/L)	7.9	7.8	~~7.69~~ (8.1)	7.9	8.1	7.7	7.8	7.8
	Conductivity (µmhos/cm)	2360		2410		2420		2460	
	Temperature (°C)	24.6	25.0	24.8	24.8	24.8	24.9	24.9	24.9
1400 mg NaCl/L	pH (S.U.)	7.74	7.68	7.74	7.58	7.61	7.53	7.66	7.72
	DO (mg/L)	7.9	7.9	~~7.70~~ (8.2)	8.0	8.3	7.7	7.8	7.7
	Conductivity (µmhos/cm)	2760		2740		2750		2800	
	Temperature (°C)	24.6	25.0	24.9	24.8	24.7	25.1	24.9	24.9
STOCK	Conductivity (µmhos/cm)	— JH		— VAB		— JH		— JH	
		Initial	Final	Initial	Final	Initial	Final	Initial	Final