

(NPDES Permit Compliance Records)

April 1, 2002

Robert L. Rehberg, KFP 1A-KST

KINGSTON FOSSIL (KIF) PLANT NPDES PERMIT TN0005452:
COMPLIANCE TOXICITY TESTING OF OUTFALL 002 – FEBRUARY 2002

Attached are two copies of the subject report as required by the State. This annual, routine toxicity testing was scheduled to coincide with testing of NoxTech technology designed to reduce nitrous oxides (NO_x) in plant air emissions. This type of NO_x control involves injection of ammonia and natural gas directly into the boilers. Since there is potential for the presence of ammonia in wastewater during operation of the system, toxicity testing was conducted during the NoxTech demonstration to show continued compliance with NPDES whole effluent toxicity (WET) limits.

No ammonia was measured in Outfall 002 samples at the time of first use in the toxicity tests. Measurements of ammonia made following the corresponding 24-hour exposure periods were within the normal range for controls (i.e. no ammonia added) observed in previous ammonia related tests conducted by TVA. This presence of ammonia in old samples, prior to test renewal, is due to natural biological processes involving test organism metabolism and the breakdown of wastes and excess food.

Chronic testing of fathead minnows and daphnids using Outfall 002 samples collected February 11-16, showed no toxicity to test organisms. IC₂₅ values for both species were > 100 percent effluent. Exposure of test organisms to intake samples resulted in no significant reductions in fathead minnow survival, although variability of survival among replicates was very high, ranging from 40 percent to 100 percent among the four replicates. Growth was significantly reduced from controls, based on Homoscedastic t-Tests. Daphnids demonstrated no significant differences from control for survival or reproduction when exposed to intake samples.

Fathead minnows were also exposed to UV treated Outfall 002 and intake samples since fish pathogens present in intake water have been the suspected cause of interference (anomalous dose response and high variability among replicates, as demonstrated by untreated intake samples in this test) in previous WET testing at Kingston. Outfall 002 and intake samples treated by two minutes exposure to UV light prior to introduction of test organisms produced no significant reductions in

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fathead minnow survival or growth. These results indicate that fish pathogen interference is very likely the cause of historic problems with WET tests for this effluent since the anomalous survival response observed in intake samples was removed by UV treatment.

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

Cynthia L. Russell
Biologist
Environmental Engineering Services-West
CEB 3A-M

CLR

Attachment

cc L. F. Campbell, KFP 1A-KST (Attachment)
H. Hemmati-Aras, LP 2G-C
L. K. Printz, LP 5D-C (Attachment)
J. R. Quinn, HB 2A-C
H. N. Taylor, HB 2A-C
D. E. Thomas, CEB 3A-M
EDMS, CEB 1B-M (Attachment)

**TENNESSEE VALLEY AUTHORITY
TOXICITY TEST REPORT**

INTRODUCTION/EXECUTIVE SUMMARY

- 1) Facility/Discharger: Kingston Fossil Plant/TVA Report Date: April 1, 2002
- 2) County/State: Roane/Tennessee 3) NPDES Permit #: TN0005452
- 4) Type of Facility: Fossil-fueled steam electric generating plant
- 5) Design Flow (MGD): 1400
- 6) Receiving Stream: Clinch River 7) 1Q-20 (MGD): 187
- 8) Outfall Tested: 002 9) Dates Sampled: February 11-16, 2002
- 10) Flow on day(s) sampled (MGD): 1402
- 11) Pertinent site conditions: No unusual conditions reported.
- 12) Test Dates: February 13-20, 2002
- 13) Test Type: Short-term Chronic-definitive
- 14) Test Species: Fathead Minnows (*Pimephales promelas*)
Daphnids (*Ceriodaphnia dubia*)
- 15) Concentrations Tested (%): Outfall 002: 6.25, 12.5, 25, 50, 100
Raw Water Intake: 100
Pimephales promelas: UV-Treated Outfall 002: 6.25, 12.5, 25, 50, 100
UV-Treated Intake: 100
- 16) Permit Limit Endpoint (%): IC₂₅ = 100
- 17) Test Results (%): Outfall 002: *Pimephales promelas*: IC₂₅ > 100
Ceriodaphnia dubia: IC₂₅ > 100
UV treated Outfall 002: *Pimephales promelas*: IC₂₅ > 100
- 18) Facility Contact: Linda F. Campbell 9) Phone #: (865) 717-2157
- 20) Consultant/Testing Laboratory Name: Environmental Testing Solutions, LLC
- 21) Lab Contact: Jim Sumner 22) Phone #: (828) 862-8193
TVA Contact: Cynthia L. Russell Phone #: (256) 386-2755

23) Notes:

This annual, routine toxicity testing was scheduled to coincide with testing of NoxTech technology designed to reduce nitrous oxides (NOx) in plant air emissions. This type of NOx control involves injection of ammonia and natural gas directly into the boilers. Since there is potential for the presence of ammonia in wastewater during operation of the system, toxicity testing was conducted during the NoxTech demonstration to show continued compliance with NPDES whole effluent toxicity (WET) limits.

No ammonia was measured in Outfall 002 samples at the time of first use in the toxicity tests. Measurements of ammonia made following the corresponding 24-hour exposure periods were within the normal range for controls (i.e. no ammonia added) observed in previous ammonia related tests conducted by TVA. The presence of ammonia in old samples, prior to test renewal, is due to natural biological processes involving test organism metabolism and the breakdown of wastes and excess food. A summary of ammonia concentrations from the tests are provided on pages 10-11.

Chronic testing of fathead minnows and daphnids using Outfall 002 samples collected February 11-16, showed no toxicity to test organisms. IC₂₅ values for both species were > 100 percent effluent. Exposure of test organisms to intake samples resulted in no significant reductions in fathead minnow survival, although variability of survival among replicates was very high, ranging from 40 percent to 100 percent among the four replicates. Growth was significantly reduced from controls, based on Homoscedastic t-Tests. Daphnids demonstrated no significant differences from control for survival or reproduction when exposed to intake samples.

Fathead minnows were also exposed to UV treated Outfall 002 and intake samples since fish pathogens present in intake water have been the suspected cause of interference (anomalous dose response and high variability among replicates, as demonstrated by untreated intake samples in this test) in previous WET testing at Kingston. Outfall 002 and intake samples treated by two minutes exposure to UV light prior to introduction of test organisms produced no significant reductions in fathead minnow survival or growth. These results indicate that fish pathogen interference is very likely the cause of historic problems with WET tests for this effluent since the anomalous survival response in intake samples was removed by UV treatment.

METHODS SUMMARY

Samples

- 1) Sampling Point: Final 002 discharge at end of pipe
- 2) Sample Type: 24-h composite
- 3) Sample Information:

Sample ID	Date/Time Collected (MM-DD-YY/Time)	Date/Time Received (MM-DD-YY/Time)	Arrival Temp. (°C)	Initial TRC* (mg/L)	Date/Time Used (MM-DD-YY/Time)
002	02-11-02/1500 02-12-02/1400	02-13-02/1316	3.1	<0.10	02-13-02/1602 02-14-02/1613
Intake	02-11-02/1400 02-12-02/1300	02-13-02/1316	3.1	<0.10	02-13-02/1602 02-14-02/1613
002	02-13-02/1300 02-14-02/1200	02-15-02/1120	0.5	<0.10	02-15-02/1617 02-16-02/1553
Intake	02-13-02/1200 02-14-02/1100	02-15-02/1120	0.5	<0.10	02-15-02/1617 02-16-02/1553
002	02-15-02/1100 02-16-02/1000	02-17-02/1032	2.3 [†]	<0.10	02-17-02/1600 02-18-02/1608 02-19-02/1600
Intake	02-15-02/1000 02-16-02/0900	02-17-02/1032	2.3 [†]	<0.10	02-17-02/1600 02-18-02/1608 02-19-02/1600

*Total residual chlorine.

[†]Collected in two 2.5-gallon cubitainers. Temperature was measured in each cubitainer upon arrival.

4) Sample manipulation:

Samples for routine compliance tests were warmed to test temperature ($25 \pm 1^\circ\text{C}$) in a warm water bath.

Aliquots of Outfall 002 and intake samples used for side by side UV treated test were warmed to 24°C in a warm water bath and held in 40Watt Rainbow Lifeguard UV Sterilizer for 2 minutes prior to exposure of test organisms.

Test Organisms

1) Source:	<i>Pimephales promelas</i> <u>Aquatic Biosystems, Inc.</u>	<i>Ceriodaphnia dubia</i> <u>In-house culture</u>
2) Age:	<u>24 hours</u>	<u>< 24 hours</u>

Test Method Summary (See Appendix A for additional information)

1) Test Conditions	<i>Pimephales promelas</i> <u>Static, renewal</u>	<i>Ceriodaphnia dubia</i> <u>Static, renewal</u>
2) Test Duration	<u>7 days</u>	<u>Until at least 60% of control females have 3 broods</u>
3) Dilution/Control Water	<u>Moderately Hard Synthetic Water</u>	<u>Moderately Hard Synthetic Water</u>
4) Number Replicates	<u>4</u>	<u>10</u>
5) Animals per Replicate	<u>10</u>	<u>1</u>
6) Test Initiation: (Date/Time)		
UV Treated	<u>02/13/02-1528 EST</u> <u>02/13/02-1528 EST</u>	<u>02/13/02-1602 EST</u>
7) Test Termination: (Date/Time)		
UV Treated	<u>02/20/02-1536 EST</u> <u>02/20/02-1514 EST</u>	<u>02/20/02-1631 EST</u>
8) Test Temperature:	<u>Mean = 24.6°C</u> <u>(24.3°C-25.6°C)</u>	<u>Mean = 24.6°C</u> <u>(24.2°C-25.5°C)</u>
	UV Treated <u>Mean = 24.6°C</u> <u>(24.1°C-25.5°C)</u>	
9) Physical/Chemical Measurements: Hardness, alkalinity, total residual chlorine, and conductivity were measured at the laboratory in each 100 percent 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
(Genus) (Species)

Chronic 7-d Toxicity Test
(Type/Duration)

Conducted 02/13/02 - 02/20/02
(mm/dd/yy) (mm/dd/yy)

Using Effluent From Outfall 002.
(number)

Test Solutions	Percent Surviving (time intervals used - days)						
	1	2	3	4	5	6	7
Control	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>
6.25% Effluent	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>
12.5% Effluent	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>
25% Effluent	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>
50% Effluent	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>
100% Effluent	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>
100% Intake	<u>100</u>	<u>100</u>	<u>98</u>	<u>93</u>	<u>75</u>	<u>73</u>	<u>70</u>

Test Solutions	IC ₂₅ Mean Dry Weight (mg) (Replication)					Mean
	1	2	3	4		
Control	<u>0.646</u>	<u>0.743</u>	<u>0.658</u>	<u>0.703</u>		<u>0.688</u>
6.25% Effluent	<u>0.644</u>	<u>0.628</u>	<u>0.752</u>	<u>0.790</u>		<u>0.704</u>
12.5% Effluent	<u>0.736</u>	<u>0.670</u>	<u>0.666</u>	<u>0.789</u>		<u>0.715</u>
25% Effluent	<u>0.622</u>	<u>0.579</u>	<u>0.700</u>	<u>0.692</u>		<u>0.648</u>
50% Effluent	<u>0.492</u>	<u>0.599</u>	<u>0.628</u>	<u>0.750</u>		<u>0.617</u>
100% Effluent	<u>0.691</u>	<u>0.687</u>	<u>0.618</u>	<u>0.632</u>		<u>0.657</u>
100% Intake	<u>0.575</u>	<u>0.335</u>	<u>0.212</u>	<u>0.559</u>		<u>0.420[†]</u>
IC ₂₅ Value: = >100%		Calculated TU Estimates *: IC ₂₅ = <1.0 TU _c				
95% Confidence Limits		Permit Limit: <u>1.0 TU_c</u>				
Upper Limit: N/A						
Lower Limit: N/A						

*NOTE: TU_c = 100/ IC₂₅

[†]Significantly less than control.

TOXICITY TEST RESULTS: continued

2) Results of a *Ceriodaphnia dubia*
(Genus) (Species)

Chronic 3-brood/7-days Toxicity Test
(Type/Duration)

Conducted 02/13/02 - 02/20/02
(mm/dd/yy) (mm/dd/yy)

Using Effluent From Outfall 002.
(number)

Test Solutions	Percent Surviving (time intervals used - days)						
	1	2	3	4	5	6	7
Control	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>
6.25% Effluent	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>
12.5% Effluent	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>
25% Effluent	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>
50% Effluent	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>
100% Effluent	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>
Intake	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>

Test Solutions	Reproduction (#young/female/7 days) Data										Mean
	Replicates										
	1	2	3	4	5	6	7	8	9	10	
Control	<u>25</u>	<u>28</u>	<u>21</u>	<u>25</u>	<u>22</u>	<u>25</u>	<u>21</u>	<u>25</u>	<u>25</u>	<u>25</u>	<u>24.2</u>
6.25% Effluent	<u>27</u>	<u>25</u>	<u>24</u>	<u>27</u>	<u>23</u>	<u>22</u>	<u>27</u>	<u>24</u>	<u>27</u>	<u>28</u>	<u>25.4</u>
12.5% Effluent	<u>25</u>	<u>26</u>	<u>27</u>	<u>26</u>	<u>29</u>	<u>24</u>	<u>27</u>	<u>26</u>	<u>25</u>	<u>26</u>	<u>26.1</u>
25.0% Effluent	<u>27</u>	<u>28</u>	<u>26</u>	<u>25</u>	<u>28</u>	<u>28</u>	<u>26</u>	<u>25</u>	<u>26</u>	<u>27</u>	<u>26.6</u>
50.0% Effluent	<u>29</u>	<u>27</u>	<u>25</u>	<u>28</u>	<u>28</u>	<u>29</u>	<u>24</u>	<u>25</u>	<u>26</u>	<u>22</u>	<u>26.3</u>
100% Effluent	<u>27</u>	<u>31</u>	<u>24</u>	<u>29</u>	<u>26</u>	<u>27</u>	<u>26</u>	<u>27</u>	<u>26</u>	<u>26</u>	<u>26.9</u>
Intake	<u>26</u>	<u>25</u>	<u>25</u>	<u>31</u>	<u>24</u>	<u>27</u>	<u>25</u>	<u>25</u>	<u>24</u>	<u>24</u>	<u>25.6</u>
IC ₂₅ Value: > 100%		Calculated TU Estimates *: IC ₂₅ : < 1.0 TU _c									
95% Confidence Limits Upper Limit = N/A Lower Limit = N/A		Permit Limit: 1.0 TU _c									

*NOTE: TU_c = 100/ IC₂₅

REFERENCE TOXICANT TEST RESULTS (See Appendices A and C)

Species	Date	Time	Duration	Toxicant	Results (IC ₂₅)
<i>Pimephales promelas</i>	02/13/02	1632	7 days	KCl	649.6 mg/L (IC ₂₅)
<i>Ceriodaphnia dubia</i>	02/05/02	1337	7 days	NaCl	1072.5 mg/L (IC ₂₅)

TOXICITY TEST RESULTS UV TREATED (See Appendix B for Bench Sheets)

1) Results of a *Pimephales promelas* Chronic 7-d Toxicity Test
 (Genus) (Species) (Type/Duration)
 Conducted 02/13/02 - 02/20/02 Using Effluent From Outfall 002.
 (mm/dd/yy) (mm/dd/yy) (number)

Test Solutions	Percent Surviving (time intervals used - days)						
	1	2	3	4	5	6	7
	Control	<u>100</u>	<u>100</u>	<u>100</u>	<u>98</u>	<u>98</u>	<u>98</u>
6.25% Effluent	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>
12.5% Effluent	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>
25% Effluent	<u>100</u>	<u>100</u>	<u>100</u>	<u>98</u>	<u>98</u>	<u>98</u>	<u>98</u>
50% Effluent	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>
100% Effluent	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>
100% Intake	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>

Test Solutions	IC ₂₅ Mean Dry Weight (mg) (Replication)					Mean
	1	2	3	4		
Control	<u>0.537</u>	<u>0.482</u>	<u>0.610</u>	<u>0.652</u>	<u>0.570</u>	
6.25% Effluent	<u>0.506</u>	<u>0.545</u>	<u>0.658</u>	<u>0.582</u>	<u>0.573</u>	
12.5% Effluent	<u>0.581</u>	<u>0.607</u>	<u>0.691</u>	<u>0.595</u>	<u>0.618</u>	
25% Effluent	<u>0.615</u>	<u>0.619</u>	<u>0.546</u>	<u>0.677</u>	<u>0.614</u>	
50% Effluent	<u>0.629</u>	<u>0.690</u>	<u>0.531</u>	<u>0.671</u>	<u>0.630</u>	
100% Effluent	<u>0.667</u>	<u>0.730</u>	<u>0.701</u>	<u>0.675</u>	<u>0.693</u>	
100% Intake	<u>0.679</u>	<u>0.603</u>	<u>0.707</u>	<u>0.656</u>	<u>0.661</u>	
IC ₂₅ Value: = >100%		Calculated TU Estimates *: IC ₂₅ = <1.0 TU _c				
95% Confidence Limits		Permit Limit: <u>1.0 TU_c</u>				
Upper Limit: <u>N/A</u>						
Lower Limit: <u>N/A</u>						

*NOTE: TU_c = 100/ IC₂₅

PHYSICAL/CHEMICAL SUMMARY

Water Chemistry Mean Values and Ranges for Fathead Minnow and Daphnid Tests, Kingston Fossil Plant (KIF), Untreated Outfall 002, February 13-20, 2002

Test/ Sample ID	Temperature		Dissolved Oxygen		pH		Conductance Initial (µmhos)	Alkalinity Initial mg/L CaCO ₃	Hardness Initial mg/L CaCO ₃	Total Residual Chlorine (mg/L)
	Initial (°C)	Final (°C)	Initial (mg/L)	Final (mg/L)	Initial	Final S.U.				
Fathead/ Control	24.5 (24.3-24.7)	24.4 (24.3-24.6)	7.9 (7.6-8.0)	7.5 (7.2-7.7)	8.08 (8.06-8.13)	7.76 (7.65-7.99)	314 (297-322)	70 (69-70)	90 (86-94)	-
Fathead/ 6.25%	24.6 (24.3-24.8)	24.4 (24.3-24.5)	8.0 (7.8-8.2)	7.5 (7.2-7.8)	8.08 (8.06-8.12)	7.75 (7.58-7.98)	304 (295-310)	-	-	-
Fathead/ 12.5%	24.8 (24.5-25.0)	24.4 (24.3-24.6)	8.1 (7.9-8.4)	7.5 (7.0-7.7)	8.07 (8.03-8.11)	7.68 (7.52-7.93)	294 (287-306)	-	-	-
Fathead/ 25%	24.8 (24.4-25.0)	24.4 (24.3-24.6)	8.2 (7.9-8.6)	7.5 (7.0-7.7)	8.03 (7.99-8.06)	7.66 (7.46-7.90)	270 (259-287)	-	-	-
Fathead/ 50%	24.9 (24.4-25.3)	24.4 (24.3-24.6)	8.3 (8.0-8.6)	7.5 (7.0-8.0)	7.92 (7.83-8.03)	7.57 (7.26-7.90)	223 (201-251)	-	-	-
Fathead/ 100%	25.1 (24.5-25.5)	24.4 (24.3-24.6)	8.5 (8.2-8.8)	7.6 (7.0-8.0)	7.55 (7.26-7.92)	7.32 (6.86-7.77)	120 (82-173)	28 (14-54)	43 (30-66)	<0.10 (<0.10-<0.10)
Fathead/ Intake	24.8 (24.3-25.6)	24.4 (24.3-24.6)	8.5 (8.2-8.7)	7.6 (7.0-8.0)	7.44 (7.21-7.76)	7.22 (6.81-7.66)	106 (75-144)	23 (14-40)	39 (24-62)	<0.10 (<0.10-<0.10)
Daphnid/ Control	24.4 (24.2-24.7)	24.5 (24.3-24.6)	7.9 (7.6-8.0)	8.0 (7.9-8.3)	8.08 (8.06-8.13)	8.11 (8.03-8.23)	314 (297-322)	70 (69-70)	90 (86-94)	-
Daphnid/ 6.25	24.5 (24.4-24.8)	24.5 (24.3-24.6)	8.0 (7.8-8.2)	8.1 (7.9-8.4)	8.08 (8.06-8.12)	8.11 (8.03-8.22)	304 (295-310)	-	-	-
Daphnid/ 12.5 %	24.6 (24.4-24.9)	24.5 (24.3-24.6)	8.1 (7.9-8.4)	8.1 (7.9-8.3)	8.07 (8.03-8.11)	8.07 (7.97-8.19)	294 (287-306)	-	-	-
Daphnid/ 25.0 %	24.7 (24.4-25.1)	24.5 (24.3-24.6)	8.2 (7.9-8.6)	8.1 (7.9-8.3)	8.03 (7.99-8.06)	8.08 (7.97-8.21)	270 (259-287)	-	-	-
Daphnid/ 50.0 %	24.8 (24.5-25.3)	24.5 (24.3-24.6)	8.3 (8.0-8.6)	8.2 (8.0-8.4)	7.92 (7.83-8.03)	7.94 (7.75-8.13)	223 (201-251)	-	-	-
Daphnid/ 100.0 %	24.9 (24.5-25.5)	24.5 (24.3-24.6)	8.5 (8.2-8.8)	8.1 (8.0-8.4)	7.55 (7.26-7.92)	7.65 (7.31-8.11)	120 (82-173)	28 (14-54)	43 (30-66)	<0.10 (<0.10-<0.10)
Daphnid/ Intake	24.6 (24.4-25.3)	24.5 (24.3-24.6)	8.5 (8.2-8.7)	8.1 (7.8-8.5)	7.44 (7.21-7.76)	7.55 (7.28-7.91)	106 (75-144)	23 (14-40)	39 (24-62)	<0.10 (<0.10-<0.10)

PHYSICAL/CHEMICAL SUMMARY (continued)

Water Chemistry Mean Values and Ranges for Fathead Minnow, Kingston Fossil Plant (KIF), UV Treated, February 13-20, 2002.

Test/ Sample ID	Temperature		Dissolved Oxygen		pH		Conductance Initial (µmhos)	Alkalinity mg/L CaCO ₃	Hardness mg/L CaCO ₃	Total Residual Chlorine (mg/L)
	Initial (°C)	Final (°C)	Initial (mg/L)	Final (mg/L)	Initial S.U.	Final S.U.				
Fathead/ Control	24.6 (24.4-24.8)	24.5 (24.2-24.7)	8.0 (8.0-8.0)	7.6 (7.3-7.9)	7.99 (7.92-8.04)	7.73 (7.63-7.89)	310 (298-318)	70 (69-70)	90 (86-94)	-
Fathead/ 6.25%	24.6 (24.3-24.8)	24.4 (24.2-24.6)	8.0 (8.0-8.1)	7.5 (7.3-7.8)	8.02 (7.96-8.06)	7.76 (7.66-7.88)	301 (292-310)	-	-	-
Fathead/ 12.5%	24.7 (24.3-24.8)	24.4 (24.2-24.6)	8.1 (8.0-8.2)	7.6 (7.4-7.8)	8.02 (7.96-8.05)	7.71 (7.57-7.81)	290 (278-297)	-	-	-
Fathead/ 25%	24.8 (24.4-25.0)	24.4 (24.1-24.6)	8.2 (8.0-8.2)	7.6 (7.4-7.9)	7.99 (7.91-8.04)	7.67 (7.55-7.84)	267 (251-281)	-	-	-
Fathead/ 50%	24.9 (24.3-25.3)	24.4 (24.1-24.6)	8.2 (8.1-8.4)	7.6 (7.2-8.0)	7.90 (7.80-8.00)	7.57 (7.31-7.87)	220 (195-243)	-	-	-
Fathead/ 100%	25.0 (24.4-25.5)	24.5 (24.2-24.7)	8.3 (8.1-8.6)	7.6 (7.1-8.0)	7.54 (7.26-7.88)	7.29 (6.91-7.75)	119 (82-167)	28 (14-54)	43 (30-66)	<0.10 (<0.10- <0.10)
Fathead/ Intake	24.7 (24.3-25.4)	24.4 (24.2-24.6)	8.3 (8.0-8.5)	7.6 (7.4-8.1)	7.46 (7.12-7.80)	7.27 (6.92-7.69)	105 (72-145)	23 (14-40)	39 (24-62)	<0.10 (<0.10- <0.10)

Kingston Fossil Plant (KIF) Condenser Cooling Water, Ammonia Concentrations for *P. promelas*, February 13-20, 2002

Total Ammonia (mg/L N)									
Measured Ammonia Concentrations									
Sample ID	Initial					Final			
	Day 0	Day 2	Day 5	Day 6	Mean	Day 1	Day 3	Day 6	Mean
Synthetic Water Outfall 002 Intake	< 0.01	Untreated < 0.01	< 0.01	< 0.01	< 0.01	0.38	0.46	0.81	0.55
	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.43	0.49	1.10	0.67
	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.38	0.46	0.87	0.57
Synthetic Water Outfall 002 Intake	< 0.01	UV Treated < 0.01	< 0.01	< 0.01	< 0.01	0.29	0.35	0.78	0.47
	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.22	0.34	0.84	0.47
	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.23	0.41	0.95	0.53

Calculated Un-ionized Ammonia (mg/L N)									
Measured Ammonia Concentrations									
Sample ID	Initial					Final			
	Day 0	Day 2	Day 5	Day 6	Mean	Day 1	Day 3	Day 6	Mean
Synthetic Water Outfall 002 Intake	< 0.001	Untreated < 0.001	< 0.001	< 0.001	< 0.001	0.021	0.015	0.026	0.021
	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.007	0.003	0.035	0.015
	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.005	0.003	0.018	0.009
Synthetic Water Outfall 002 Intake	< 0.001	UV Treated < 0.001	< 0.001	< 0.001	< 0.001	0.012	0.014	0.032	0.019
	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.001	0.002	0.027	0.010
	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.001	0.003	0.020	0.008

Kingston Fossil Plant (KIF) Condenser Cooling Water, Ammonia Concentrations for *C. dubia*, February 13-20, 2002

Total Ammonia (mg/L N)									
Measured Ammonia Concentrations									
Sample ID	Initial					Final			
	Day 0	Day 2	Day 5	Day 6	Mean	Day 1	Day 3	Day 6	Mean
Synthetic Water	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Outfall 002	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.01	< 0.01	< 0.01	0.01
Intake	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-	0.01	0.02	0.02

Calculated Un-ionized Ammonia (mg/L N)									
Measured Ammonia Concentrations									
Sample ID	Initial					Final			
	Day 0	Day 2	Day 5	Day 6	Mean	Day 1	Day 3	Day 6	Mean
Synthetic Water	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Outfall 002	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.001	< 0.001	< 0.001	0.001
Intake	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	-	< 0.001	0.001	0.001

SUMMARY/CONCLUSIONS

Chronic testing of fathead minnows and daphnids using Outfall 002 samples collected February 11-16, showed no toxicity to test organisms. IC_{25} values for both species were > 100 percent effluent. Exposure of test organisms to intake samples resulted in no significant reductions in fathead minnow survival, although variability of survival among replicates was very high, ranging from 40 percent to 100 percent among the four replicates. Growth was significantly reduced from controls, based on Homoscedastic t-Tests. Daphnids demonstrated no significant differences from control for survival or reproduction when exposed to intake samples.

Fathead minnows were also exposed to UV treated Outfall 002 and intake samples since fish pathogens present in intake water have been the suspected cause of interference (anomalous dose response and high variability among replicates, as demonstrated by untreated intake samples in this test) in previous WET testing at Kingston. Outfall 002 and intake samples were treated by two minutes exposure to UV light prior to introduction of test organisms produced no significant reductions in fathead minnow survival or growth.

Appendix A

ADDITIONAL TOXICITY TEST INFORMATION

SUMMARY OF METHODS

1) *Pimephales promelas*

Tests were conducted according to EPA/600/4-91/002 (July 1994) using four replicates, each containing ten test organisms, per treatment. Test vessels consisted of 400-mL polypropylene beakers, each containing 250-mL of test solution.

2) *Ceriodaphnia dubia*

Tests were conducted according to EPA/600/4-91/002 (July 1994) 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 using EPA Method 170.1.
- 4) Dissolved oxygen was measured using EPA Method 360.1.
- 5) The pH was measured EPA Method 150.1.
- 6) Conductance was measured EPA 120.1.
- 7) Alkalinity was measured using EPA 310.1.
- 8) Hardness was measured EPA Method 130.2.
- 9) Total residual chlorine was measured using EPA 330.5.

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/600/4-91/002. 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 IC₂₅ values in g KCl.
- 2) Standard Toxicant: Potassium Chloride (KCl crystalline).
- 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) Lewis, P. A., D. J. Klemm, J. M. Lazorchak, T. J. Norberg-King, W. H. Peltier, M. A. Heber. Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, EPA/600/4-91/002 (July 1994).
- 3) Methods for Chemical Analysis of Water and Wastes, EPA/600/4-79/020 (March 1983).

Kingston Fossil Plant Biomonitoring
February 13-20, 2002

Appendix B

Chain of Custody Records and
Toxicity Test Bench Sheets

TENNESSEE VALLEY AUTHORITY WATER MANAGEMENT
ENVIRONMENTAL CHEMISTRY ANALYSIS REQUEST AND CUSTODY RECORD

FORM CONTROL # 15085

PROJECT ID KIF-Toxicity

REFERENCE: WORKPLAN OTHER
ACCT NO.

DATE REQUIRED

RESULTS TO

JENNIFER MOSES

TVA-252-386-2518

JMOSES@tva.gov

DATE RECEIVED

PROJECT LEADER

DAYS DUE

NO. TESTS

LAB USE ONLY	LAB ID	FIELD ID	SAMPLE DESCRIPTION	SAMPLE MATRIX	DATE/TIME COLLECTED	NO. OF BOTTLES	ADDITIONAL IDCS
	KIF-PI-2B		KINGSTON Fossil - PLANT INTAKE - 2B	W.H.P.	2/13/02 1200	1-2.5"	260/020215:01
	KIF-002-2B		KINGSTON - Fossil - DSN002 - 2B	W.H.P.	2/13/02 1300 2/14/02 1200	1-2.5 gal 1-1 gal	260/020215:02

FIELD COMMENTS Samples Collected Using ISCO Samplers. Samples Composites over 24 hr. period @ the internal All samples Iced During Collection & shipment. KIF-002-2A Flow-Weighted Composite. Samples Shipped FASTER overnight on 2/14/02 All times EST

ANALYSIS REQUESTED Toxicity

SUBMITTED BY [Signature]

DATE/TIME 2/14/02 1334

LABORATORY COMMENTS Custody seals intact. Samples received in good condition.

RECEIVED BY [Signature]

DATE/TIME 02-15-02 1120

DISTRIBUTION OF COPIES

1 - LABORATORY

2 - RETURN TO REQUESTOR

3 - RETAINED BY REQUESTOR

Tempo S/C

TVA 30488 (RG-WM 3-94)

Sample Receipt Log

Date Received	Time Received	Received By	Received From	Sample Temperature (°C)	Project Number	Sample Number	Sample Name and Description	State	Comments
02-07-02	1156	KEKEENAN	FEDEX	0.6°C	243	020207.01	CORR ERI - McQUAY INT. ^{END OF SWALE}	AL	
02-07-02	1156	KEKEENAN	FEDEX	0.6°C	243	020207.02	CORR ERI - McQUAY INT. ^{START OF SWALE}	AL	
02-07-02	1157	KEKEENAN	FEDEX	0.7°C	252	020207.03	ALCOA ENGINEERED PRODUCTS	NC	
02-07-02	1159	KEKEENAN	FEDEX	0.9°C	245	020207.04	TVA BULL RUN OUTFALL 001	TN	
02-07-02	1159	KEKEENAN	FEDEX	0.8°C	245	020207.05	TVA BULL RUN INTAKE	TN	
02-08-02	0814	J Sumner	D. TRAMMEL	0.3°C	253	020208.01	TEST AMERICA SILVERLINE PLASTICS - 001	NC	
02-09-02	1102	KEKEENAN	Asheville Courier	1.1°C	246	020209.01	SPRUCE PINE WWTP	NC	
02-09-02	1102	KEKEENAN	GREYHOUND	0.8°C	247	020209.02	WAYNESVILLE WWTP	NC	
02-09-02	1103	KEKEENAN	FEDEX	0.7°C	243	020209.03	CORR ERI - McQUAY INT. ^{END OF SWALE}	AL	
02-09-02	1103	KEKEENAN	FEDEX	0.8°C	243	020209.04	CORR ERI - McQUAY INT. ^{START OF SWALE}	AL	
02-09-02	1104	KEKEENAN	FEDEX	1.2°C	245	020209.05	TVA BULL RUN OUTFALL 001	TN	
02-09-02	1104	KEKEENAN	FEDEX	0.9°C	245	020209.06	TVA BULL RUN INTAKE	TN	
02-12-02	1520	KEKEENAN	D. WIRE	1.1°C	204	020212.01	ENSURE HOUSTON WWTP	NC	
02-13-02	0810	KEKEENAN	GREYHOUND	0.7°C	254	020213.01	Precise Analytical - Fieldcrest Mills	NC	
02-13-02	0810	KEKEENAN	Asheville Courier	0.7°C	255	020213.02	COMH SCOPE, INC.	NC	
02-13-02	0811	KEKEENAN	D. TRAMMEL	0.5°C	256	020213.03	TEST AMERICA EARTH ENV. - ANDREWS WWTP	NC	
02-13-02	1015	J Sumner	UPS	1.4°C	257	020213.04	TRITEST CAPITAL HARRIS EYE CENTER	NC	
02-13-02	1015	J Sumner	UPS	1.4°C	258	020213.05	TRITEST CAPITAL SHNPP	NC	
02-13-02	1315	KEKEENAN	FEDEX	3.3°C	259	020213.06	ENFIELD WWTP	NC	
02-13-02	1316	KEKEENAN	FEDEX	3.1°C	260	020213.07	TVA KINGSTON INTAKE	TN	
02-13-02	1316	KEKEENAN	FEDEX	3.1°C	260	020213.08	TVA KINGSTON OUTFALL 002	TN	
02-13-02	1514	J Sumner	R. VESS	1.9°C	261	020213.09	BAXTER HEALTHCARE CORP.	NC	

Sample Receipt Log

Date Received	Time Received	Received By	Received From	Sample Temperature (°C)	Project Number	Sample Number	Sample Name and Description	State	Comments
02-14-02	0946	Juma	D. TRAMMEL	2.1°C	262	020214.01	TEST AMERICA EARTH ENV. - MARSHALL WWTP	NC	
02-14-02	1130	KEKEENAN	Fedex	1.0°C	263	020214.02	GEORGETOWN STEEL - DRI PLANT	SC	
02-15-02	1120	KEKEENAN	Fedex	0.5°C	260	020215.01	TVA KINGSTON INTAKE	TN	
02-15-02	1120	KEKEENAN	Fedex	0.5°C	260	020215.02	TVA KINGSTON OUTFALL 002	TN	
02-15-02	1317	Juma	R. VESS	1.2°C	261	020215.03	BAXTER HEALTHCARE CORP.	NC	
02-15-02	1322	Juma	R. PATR	1.9°C	264	020215.04	EMS - THE MOUNTAIN WWTP	NC	
02-16-02	1114	KEKEENAN	Fedex	0.8°C	259	020216.01	ENFIELD WWTP	NC	
02-16-02	1114	KEKEENAN	GREYHOUND	2.0°C	254	020216.02	PRECISE ANALYTICAL - FIELDSREST HILLS	NC	
02-16-02	1115	KEKEENAN	ASHVILLE COURIER	0.7°C	255	020216.03	COMM SCOPE, INC.	NC	
02-16-02	1115	KEKEENAN	D. TRAMMEL	0.4°C	256	020216.04	TEST AMERICA EARTH ENV. - ANDREWS WWTP	NC	
02-17-02	1032	KEKEENAN	D. THOMAS	2.3°C	260	020217.01	TVA KINGSTON INTAKE	TN	
02-17-02	1032	KEKEENAN	D. THOMAS	2.3°C	260	020217.02	TVA KINGSTON OUTFALL 002	TN	
02-19-02	1106	Juma	Fedex	0.8°C	265	020219.01	DUKE ENERGY - MCGUIRE 002	NC	
02-20-02	1038	Juma	Fedex	1.1°C	266	020220.01 020220.01	DUKE ENERGY - MCGUIRE 001	NC	
02-20-02	1038	Juma	Fedex	1.7°C	267	020220.02	DUKE ENERGY - BELEWS CREEK	NC	
02-20-02	1038	Juma	Fedex	0.9°C	268	020220.03	DUKE ENERGY - MARSHALL	NC	
02-23-02	1122	Juma	Fedex	1.0°C	267	020223.01 020223.01	DUKE ENERGY - BELEWS CREEK	NC	
02-23-02	1122	Juma	Fedex	1.3°C	268	020223.02	DUKE ENERGY - MARSHALL	NC	

Chronic Whole Effluent Toxicity Test (EPA/600/4-91/002 Method 1000.0)
Species: *Pimephales promelas*

Client: TVA
 Facility: KINGSTON FOSSIL PLANT
 NPDES #: TN-0005452
NOT TREATED

Dilution preparation information:					Comments:	
MHS batch:	02-12-02 / 02-18-02					
Dilution prep (%)	6.25	12.5	25	50		100
Effluent volume (mL)	93.75	187.5	375	750		1500
Diluent volume (mL)	1406.25	1312.5	1125	750	0	

Test organism information:		Test information:	
Organism age:	24-HOURS OLD	Randomizing template:	Yellow
Date and times organisms were born between:	02-12-02 1330 TO 1500 MST 1530 to 1700 EST	Incubator number:	2
Organism source:	ABS BATCH 02-12-02	Artemia lot number:	860207P
Transfer bowl information:	pH = 7.91 Temperature = 24.4°C	Oven temperature:	60°C
		Drying time:	24-HOURS

Daily feeding and renewal information:

Day	Date	Morning feeding time	Afternoon feeding time	Test initiation, renewal, or termination time	Analyst
0	02-13-02	— dl	1644	1528	KEK
1	02-14-02	1036	1645	1521	dl
2	02-15-02	1030	1654	1534	dl
3	02-16-02	1141	1748	1542	KEK
4	02-17-02	1032	1637	1549	KEK
5	02-18-02	1035	1638	1527	dl
6	02-19-02	1039	1640	1524	dl
7	02-20-02	—	— dl	1536	dl

Control information:		Acceptance criteria	Summary of test endpoints:	
% Mortality:	0%	≤ 20%	7-day LC50	> 100%
Average weight per larvae:	0.6876	≥ 0.25 mg/larvae	NOEC	100%
			LOEC	> 100%
			ChV	7100%
			IC25	> 160%

Species: *Pimephales promelas*

Client: TVA KINGSTON

NONTREATED

Date: 02-13-02

Day	Survival and Growth Data											
	CONTROL				6.25%				125%			
	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	10	10	10	10	10	10	10	10	10	10	10
A = Pan weight (mg)	15.91	17.802	14.207	14.966	14.628	14.990	14.622	14.591	14.815	14.710	15.007	14.709
B = Pan + Larvae weight (mg)	21.65	22.23	20.87	22.00	21.06	21.27	22.14	22.49	22.17	21.48	21.66	22.60
Larvae weight (mg) = A - B	6.459	7.428	6.583	7.034	6.442	6.280	7.518	7.899	7.355	6.704	6.656	7.891

Calculations and data reviewed: *[Signature]*

Comments:

Species: *Pimephales promelas*


Client: TVA KINNSTON

NONTREATED

Date: 02-13-02

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	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	10	10	10	10	10	10	10	10	10	10	10
A = Pan weight (mg)	15.006	14.703	14.900	14.630	15.324	15.161	15.542	14.674	14.940	14.813	15.050	15.208
B = Pan + Larvae weight (mg)	21.23	20.49	21.90	21.56	20.24	21.15	20.87	22.17	21.85	21.69	21.23	21.53
Larvae weight (mg) = A - B	6.224	5.787	7.000	6.924	4.916	5.989	6.278	7.496	6.910	6.873	6.180	6.322

Calculations and data reviewed: 

Comments:


Species: *Pimephales promelas*

Client: TVA KINGSTON
 NONTREATED

Date: 02-13-02

Survival and Growth Data

Day	100% INTAKE				CC	DD	EE	FF	GG	HH	II	JJ
	Y	Z	AA	BB								
0	10	10	10	10								
1	10	10	10	10								
2	10	10	10	10								
3	10	9 ^{1d}	10	10								
4	10	7 ^{2d}	10	10								
5	10	5 ^{2d}	5 ^{5d}	10								
6	10	5	4 ^{1d}	10								
7	10	5	4	9 ^{1d}								
A = Pan weight (mg)	14.032	15.114	14.035	14.034								
B = Pan + Larvae weight (mg)	20.38	18.46	16.95	20.42								
Larvae weight (mg) = A - B	5.748	3.346	2.115	5.586								

Calculations and data reviewed: 

Comments:

Environmental Testing Solutions, LLC

Chronic Whole Effluent Toxicity Test (EPA/600/4-91/002, Method 1000.0)

Species: *Pimephales promelas*

Quality Control

Verification of Data Entry, Calculations, and Statistical Analyses

Client: TVA Kingston Fossil Plant - Non-Treated
 Test dates: February 13-20, 2002
 Project number: 260

Reviewed by: *J. Umad*

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 / Initial number of larvae (mg)	Mean survival (%)	Mean weight (mg)	Coefficient of variation (%)	Percent reduction from control (%)
Control	A	10	10	15.191	21.650	6.459	0.6459	100.0	0.6876	6.4	Not applicable
	B	10	10	14.802	22.230	7.428	0.7428				
	C	10	10	14.287	20.870	6.583	0.6583				
	D	10	10	14.966	22.000	7.034	0.7034				
6.25%	E	10	10	14.618	21.060	6.442	0.6442	100.0	0.7035	11.3	-2.3
	F	10	10	14.990	21.270	6.280	0.6280				
	G	10	10	14.622	22.140	7.518	0.7518				
	H	10	10	14.591	22.490	7.899	0.7899				
12.5%	I	10	10	14.815	22.170	7.355	0.7355	100.0	0.7152	8.2	-4.0
	J	10	10	14.776	21.480	6.704	0.6704				
	K	10	10	15.004	21.660	6.656	0.6656				
	L	10	10	14.709	22.600	7.891	0.7891				
25%	M	10	10	15.006	21.230	6.224	0.6224	100.0	0.6484	9.0	5.7
	N	10	10	14.703	20.490	5.787	0.5787				
	O	10	10	14.900	21.900	7.000	0.7000				
	P	10	10	14.636	21.560	6.924	0.6924				
50%	Q	10	10	15.324	20.240	4.916	0.4916	100.0	0.6170	17.2	10.3
	R	10	10	15.161	21.150	5.989	0.5989				
	S	10	10	14.592	20.870	6.278	0.6278				
	T	10	10	14.674	22.170	7.496	0.7496				
100%	U	10	10	14.940	21.850	6.910	0.6910	100.0	0.6571	5.7	4.4
	V	10	10	14.817	21.690	6.873	0.6873				
	W	10	10	15.050	21.230	6.180	0.6180				
	X	10	10	15.208	21.530	6.322	0.6322				
100% Intake	Y	10	10	14.632	20.380	5.748	0.5748	70.0	0.4199	42.1	38.9
	Z	10	5	15.114	18.460	3.346	0.3346				
	AA	10	4	14.835	16.950	2.115	0.2115				
	BB	10	9	14.834	20.420	5.586	0.5586				

MSD = Minimum Significant Difference
 PMSD = Percent Minimum Significant Difference

Outfall 002:
 Duannett's MSD value: 0.116
 PMSD: 16.9

Intake:
 Duannett's MSD value: 0.1772
 PMSD: 25.8

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. On average, a significant difference occurs for Environmental Testing Solutions, LLC chronic toxicity tests when a toxicant reduces Pimephales growth by 19.1% from the control (determined Lower PMSD bound determined by USEPA (10th percentile) = 9.4%
 Upper PMSD bound determined by USEPA (90th percentile) = 35%
 The lower and upper bounds were calculated by the USEPA using 205 tests conducted from 19 laboratories for Pimephales growth in chronic reference toxicant tests.

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.

Environmental Testing Solutions, LLC

Statistical Analyses

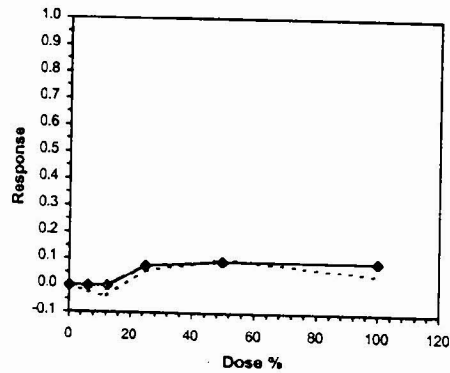
Larval Fish Growth and Survival Test-7 Day Growth					
Start Date:	2/13/02	Test ID:	PpFRCR	Sample ID:	TVA Kingston Fossil Plant, Non-Treated (260)
End Date:	2/20/02	Lab ID:	BTS-Env. Testing Solutions	Sample Type:	DMR-Discharge Monitoring Report
Sample Date:		Protocol:	EPAF 91-EPA Freshwater	Test Species:	PP-Pimephales promelas
Comments:					

Conc-%	1	2	3	4
D-Control	0.6459	0.7428	0.6583	0.7034
6.25	0.6442	0.6280	0.7518	0.7899
12.5	0.7355	0.6704	0.6656	0.7891
25	0.6224	0.5787	0.7000	0.6924
50	0.4916	0.5989	0.6278	0.7496
100	0.6910	0.6873	0.6180	0.6322

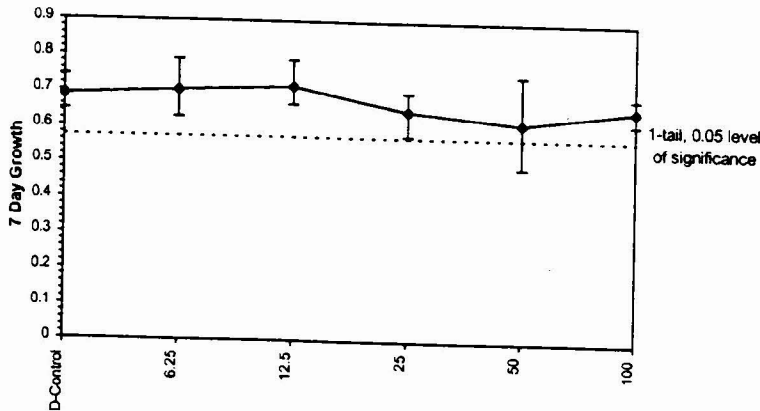
Conc-%	Mean	N-Mean	Transform: Untransformed				N	t-Stat	1-Tailed Critical	MSD	Isotonic	
			Mean	Min	Max	CV%					Mean	N-Mean
D-Control	0.6876	1.0000	0.6876	0.6459	0.7428	6.446	4				0.7021	1.0000
6.25	0.7035	1.0231	0.7035	0.6280	0.7899	11.317	4	-0.330	2.410	0.1160	0.7021	1.0000
12.5	0.7152	1.0401	0.7152	0.6656	0.7891	8.209	4	-0.573	2.410	0.1160	0.7021	1.0000
25	0.6484	0.9430	0.6484	0.5787	0.7000	8.963	4	0.815	2.410	0.1160	0.6484	0.9235
50	0.6170	0.8973	0.6170	0.4916	0.7496	17.192	4	1.468	2.410	0.1160	0.6371	0.9074
100	0.6571	0.9537	0.6571	0.6180	0.6910	5.701	4	0.633	2.410	0.1160	0.6371	0.9074

Auxiliary Tests					
Shapiro-Wilk's Test indicates normal distribution ($p > 0.01$)		Statistic	Critical	Skew	Kurt
Bartlett's Test indicates equal variances ($p = 0.57$)		0.983322442	0.884	0.133016156	-0.185797786
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	Chv	TU	MSDu
Dunnnett's Test	100	>100		1	0.115958618
					MSDp
					MSB
					MSE
					F-Prob
					df
					15.08631706
					0.00552104
					0.004630223
					0.351866215
					5, 18

Point	%	SD	95% CL(Exp)	Linear Interpolation (80 Resamples)
IC05	20.671			Skew
IC10	>100			
IC15	>100			
IC20	>100			
IC25	>100			
IC40	>100			
IC50	>100			



Dose-Response Plot



Environmental Testing Solutions, LLC

Statistical Analyses

Larval Fish Growth and Survival Test-7 Day Survival					
Start Date:	2/13/02	Test ID:	PpFRCR	Sample ID:	TVA Kingston Fossil Plant, Intake, Non-Treated (260)
End Date:	2/20/02	Lab ID:	ETS-Env. Testing Solutions	Sample Type:	DMR-Discharge Monitoring Report
Sample Date:		Protocol:	EPAF 91-EPA Freshwater	Test Species:	PP-Fimephales promelas
Comments:					

Conc-%	1	2	3	4
D-Control	1.0000	1.0000	1.0000	1.0000
100	1.0000	0.5000	0.4000	0.9000

Conc-%	Mean	N-Mean	Transform: Arcsin Square Root				N	t-Stat	1-Tailed	
			Mean	Min	Max	CV%			Critical	MSD
D-Control	1.0000	1.0000	1.4120	1.4120	1.4120	0.000	4	2.151	2.353	0.4149
100	0.7000	0.7000	1.0328	0.6847	1.4120	34.138	4			

Auxiliary Tests				
	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution ($p > 0.01$)	0.923492134	0.749	0.113609697	0.087904734
Equality of variance cannot be confirmed				
Hypothesis Test (1-tail, 0.05)				
Heteroscedastic t Test indicates no significant differences				

Environmental Testing Solutions, LLC

Statistical Analyses

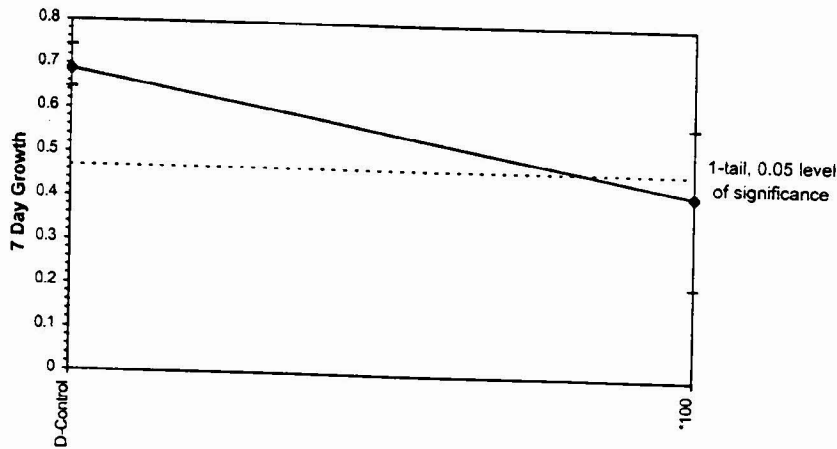
Larval Fish Growth and Survival Test-7 Day Growth					
Start Date:	2/13/02	Test ID:	PpFRCR	Sample ID:	TVA Kingston Fossil Plant, Intake, Non-Treated (260)
End Date:	2/20/02	Lab ID:	ETS-Env. Testing Solutions	Sample Type:	DMR-Discharge Monitoring Report
Sample Date:		Protocol:	EPAF 91-EPA Freshwater	Test Species:	PP-Pimephales promelas
Comments:					

Conc-%	1	2	3	4
D-Control	0.6459	0.7428	0.6583	0.7034
100	0.5748	0.3346	0.2115	0.5586

Conc-%	Mean	N-Mean	Transform: Untransformed				N	t-Stat	1-Tailed Critical	MSD
			Mean	Min	Max	CV%				
D-Control	0.6876	1.0000	0.6876	0.6459	0.7428	6.446	4			
*100	0.4199	0.6106	0.4199	0.2115	0.5748	42.144	4	2.935	1.943	0.1772

Auxiliary Tests				
Shapiro-Wilk's Test indicates normal distribution ($p > 0.01$)	Statistic	Critical	Skew	Kurt
F-Test indicates equal variances ($p = 0.05$)	0.963622987	0.749	-0.358446666	-0.015445846
Hypothesis Test (1-tail, 0.05)	15.93779945	47.46834564		
Homoscedastic t Test indicates significant differences				

Dose-Response Plot



Chronic Whole Effluent Toxicity Test (EPA/600/4-91/002 Method 1002.0)
Species: *Ceriodaphnia dubia*

	Date	Time	Analyst
Test start	02-13-02	1602	JP
Test end	02-20-02	1631	JP

Client: TVA
 Facility: KINGSTON FOSSIL PLANT
 NPDES #: TN-000545Z NON TREATED

Dilution preparation information:					Comments:
MHS batch:	02-12-02 / 02-18-02				
Dilution prep (%)	6.25	12.5	25	50	100
Effluent volume (mL)	93.75	187.5	375	750	1500
Diluent volume (mL)	1406.25	1312.5	1125	750	0

Test organism information:		Test information:	
Organism age:	< 24 HOURS OLD	Randomizing template:	GREEN
Date and times organisms were born between:	02-12-02 1648 TO 1851	Incubator number:	2
Organism source:	02-05-02 A+B	YCT batch:	ABS 01-23-02
Transfer bowl information:	pH = 8.11 Temperature = 24.3	Selenastrum batch:	ABS 01-23-02

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	3	4	0	3	3	4	3	3	3	4
	Adult mortality	L	L	L	L	L	L	L	L	L	L
4	Young produced	9	0	4	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	0	10	6	8	7	8	6	10	8	7
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	13	14	10	14	12	0	12	12	2	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	0	0	1	0	0	13	0	0	12	14
Total young produced		25	28	21	25	22	25	21	25	25	25
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L
X for 3 rd Broods		X	X	X	X	X	X	X	X	X	X

Calculations and data reviewed: JP

Test Renewal, Feeding, and Incubator Location Information							
Date	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Time	02-18 1608	02-19 1600	02-23 1602	02-14 1613	02-15 1617	02-16 1553	02-17 1600
Analyst	JP	JP	JP	JP	JP	JP	JP
Shelf	C1	C1	C1	C1	C1	C1	C1
Location							

Control information:		Acceptance criteria	Summary of test endpoints:	
% of Male Adults:	0%	≤ 20%	7-day LC50	> 100%
% Adults having 3 rd Broods:	100%	≥ 80%	NOEC	100%
% Mortality:	0%	≤ 20%	LOEC	> 100%
Mean Offspring/Female:	24.2	≥ 15.0 offspring/female	ChV	> 100%
% CV:	9.1%	< 40.0 %	IC25	> 100%

Species: *Ceriodaphnia dubia*

Client: TVA KINSTON NONTREATED

Date: 02-13-02

CONCENTRATION: 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	3	3	3	3	3	4	3	3	0	4
	Adult mortality	L	L	L	L	L	L	L	L	L	L
4	Young produced	10	9	0	0	0	0	0	0	4	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	0	0	9	12	8	8	10	7	10	10
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	14	13	12	12	12	10	0	14	3	14
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	0	0	0	0	0	0	14	0	10	0
Total young produced		27	25	24	27	23	22	27	24	27	28
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	25.4
% Reduction from Control:	-5.0%

Calculations and data reviewed: *JS*

CONCENTRATION: 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	4	3	3	3	0	3	4	4	3	3
	Adult mortality	L	L	L	L	L	L	L	L	L	L
4	Young produced	8	9	0	0	4	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	0	0	10	7	11	6	10	10	7	9
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	13	14	4	1	0	3	13	12	15	14
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	0	0	10	15	14	12	0	0	0	0
Total young produced		25	26	27	26	29	24	27	26	25	26
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	26.1
% Reduction from Control:	-7.9%

Calculations and data reviewed: *JS*

Species: *Ceriodaphnia dubia*

Client: TVA KINGSTON NONTREATED

Date: 02-13-02

CONCENTRATION: 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	3	4	3	3	0	3	4	4	4	3
	Adult mortality	L	L	L	L	L	L	L	L	L	L
4	Young produced	9	8	0	0	4	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	0	0	8	9	8	11	6	8	7	10
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	15	16	0	13	16	14	16	13	15	14
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	0	0	15	0	0	0	0	0	0	0
Total young produced		27	28	26	25	28	28	26	25	26	27
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	26.6
% Reduction from Control:	-9.9%

Calculations and data reviewed: *JL*

CONCENTRATION: 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	3	4	4	0	3	3	3	3	4	3
	Adult mortality	L	L	L	L	L	L	L	L	L	L
4	Young produced	0	10	0	5	0	0	0	0	9	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	10	0	7	8	10	10	7	8	0	6
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	0	13	14	0	15	16	14	14	13	13
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	16	0	0	15	0	0	0	0	0	0
Total young produced		29	27	25	28	28	29	24	25	26	22
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	26.3
% Reduction from Control:	-8.7%

Calculations and data reviewed: *JL*

Species: *Ceriodaphnia dubia*

Client: TVA KINGSTON NONTREATED

Date: 02-13-02

CONCENTRATION: 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	3	3	0	4	3	3	4	3	3
	Adult mortality	L	L	L	L	L	L	L	L	L	L
4	Young produced	4	0	0	4	0	0	0	8	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	8	12	7	10	9	8	10	0	8	9
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	15	16	14	0	0	16	13	15	15	14
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	0	0	0	15	13	0	0	0	0	0
Total young produced		27	31	24	29	26	27	26	27	26	26
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	26.9
% Reduction from Control:	-11.2%

Calculations and data reviewed: *JH*

CONCENTRATION: 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	3	3	0	3	4	0	3	4	3
	Adult mortality	L	L	L	L	L	L	L	L	L	L
4	Young produced	4	0	0	3	0	0	4	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	8	10	8	12	8	8	9	10	7	8
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	24	12	0	0	3	2	3	12	10	13
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	10	12	14	16	10	13	9	0	3	0
Total young produced		26	25	25	31	24	27	25	25	24	24
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	25.6
% Reduction from Control:	-5.8%

Calculations and data reviewed: *JH*

Environmental Testing Solutions, LLC

Chronic Whole Effluent Toxicity Test (EPA/600/4-91/002, Method 1002.0)

Species: *Ceriodaphnia dubia*

Quality Control

Verification of Data Entry, Calculations, and Statistical Analyses

Client: TVA Kingston Fossil Plant - Non-Treated

Test dates: February 13-20, 2002

Project number: 260

Reviewed by: *J. J. J.*

Concentration (%)	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	25	28	21	25	22	25	21	25	25	25	100	24.2	9.1	Not applicable
6.25%	27	25	24	27	23	22	27	24	27	28	100	25.4	8.1	-5.0
12.5%	25	26	27	26	29	24	27	26	25	26	100	26.1	5.3	-7.9
25%	27	28	26	25	28	28	26	25	26	27	100	26.6	4.4	-9.9
50%	29	27	25	28	28	29	24	25	26	22	100	26.3	8.8	-8.7
100%	27	31	24	29	26	27	26	27	26	26	100	26.9	7.1	-11.2
100% Intake	26	25	25	31	24	27	25	25	24	24	100	25.6	8.3	-5.8

Outfall 002:

Dunnett's MSD value: 1.930
 PMSD: 8.0

Intake:

Dunnett's MSD value: 1.675
 PMSD: 6.9

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. On average, a significant difference occurs for Environmental Testing Solutions, LLC chronic toxicity tests when a toxicant reduces *Ceriodaphnia* reproduction by 13.0% from the control.

Lower PMSD bound determined by USEPA (10th percentile) = 11%.

Upper PMSD bound determined by USEPA (90th percentile) = 37%.

The lower and upper bounds were calculated by the USEPA using 393 tests conducted from 33 laboratories for *Ceriodaphnia* reproduction in chronic reference toxicant tests.

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.

Statistical Analyses

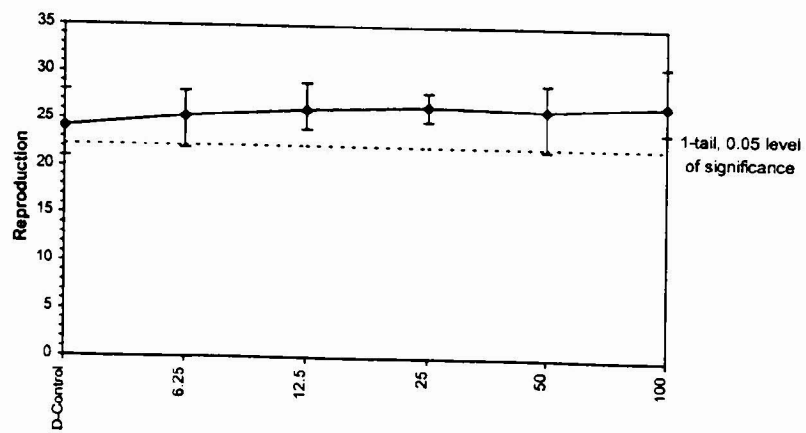
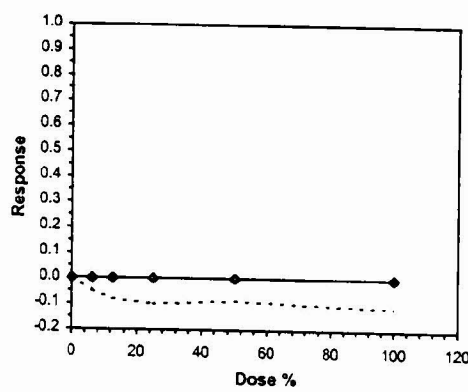
Daphnia Survival and Reproduction Test-Reproduction					
Start Date:	2/13/02	Test ID:	CdFRCR	Sample ID:	TVA Kingston Fossil Plant, Non-Treated
End Date:	2/20/02	Lab ID:	ETS-Env. Testing Solutions	Sample Type:	DMR-Discharge Monitoring Report
Sample Date:		Protocol:	EPAF 91-EPA Freshwater	Test Species:	CD-Ceriodaphnia dubia
Comments:					

Conc-%	1	2	3	4	5	6	7	8	9	10
D-Control	25.000	28.000	21.000	25.000	22.000	25.000	21.000	25.000	25.000	25.000
6.25	27.000	25.000	24.000	27.000	23.000	22.000	27.000	24.000	27.000	28.000
12.5	25.000	26.000	27.000	26.000	29.000	24.000	27.000	26.000	25.000	26.000
25	27.000	28.000	26.000	25.000	28.000	28.000	26.000	25.000	26.000	27.000
50	29.000	27.000	25.000	28.000	28.000	29.000	24.000	25.000	26.000	22.000
100	27.000	31.000	24.000	29.000	26.000	27.000	26.000	27.000	26.000	26.000

Conc-%	Mean	N-Mean	Transform: Untransformed				CV%	N	t-Stat	1-Tailed Critical	MSD	Isotonic	
			Mean	Min	Max	Mean						N-Mean	
D-Control	24.200	1.0000	24.200	21.000	28.000	9.095	10				25.917	1.0000	
6.25	25.400	1.0496	25.400	22.000	28.000	8.132	10	-1.422	2.287	1.930	25.917	1.0000	
12.5	26.100	1.0785	26.100	24.000	29.000	5.250	10	-2.251	2.287	1.930	25.917	1.0000	
25	26.600	1.0992	26.600	25.000	28.000	4.413	10	-2.844	2.287	1.930	25.917	1.0000	
50	26.300	1.0868	26.300	22.000	29.000	8.790	10	-2.488	2.287	1.930	25.917	1.0000	
100	26.900	1.1116	26.900	24.000	31.000	7.108	10	-3.199	2.287	1.930	25.917	1.0000	

Auxiliary Tests											
Kolmogorov D Test indicates normal distribution (p > 0.01)								Statistic	Critical	Skew	Kurt
Bartlett's Test indicates equal variances (p = 0.33)								0.558318555	1.035	-0.075089788	-0.183902637
Hypothesis Test (1-tail, 0.05)								5.770777702	15.08631706		
Dunnnett's Test											
	NOEC	LOEC	ChV	TU	MSDn	MSDp	MSB	MSE	F-Prob	df	
	100	>100		1	1.929792501	0.079743492	9.656666667	3.561111111	0.029432544	5, 54	

Point	%	SD	95% CL	Linear Interpolation (80 Resamples)
IC05	>100			Skew
IC10	>100			
IC15	>100			
IC20	>100			
IC25	>100			
IC40	>100			
IC50	>100			



Environmental Testing Solutions, LLC

Statistical Analyses

Ceriodaphnia Survival and Reproduction Test-Reproduction									
Start Date:	2/13/02	Test ID:	CdFRCR	Sample ID:	TVA Kingston Fossil Plant, Intake, Non-Treated				
End Date:	2/20/02	Lab ID:	ETS-Env. Testing Solutions	Sample Type:	DMR-Discharge Monitoring Report				
Sample Date:		Protocol:	EPAF 91-EPA Freshwater	Test Species:	CD-Ceriodaphnia dubia				
Comments:									

Conc-%	1	2	3	4	5	6	7	8	9	10
D-Control	25.000	28.000	21.000	25.000	22.000	25.000	21.000	25.000	25.000	25.000
100	26.000	25.000	25.000	31.000	24.000	27.000	25.000	25.000	24.000	24.000

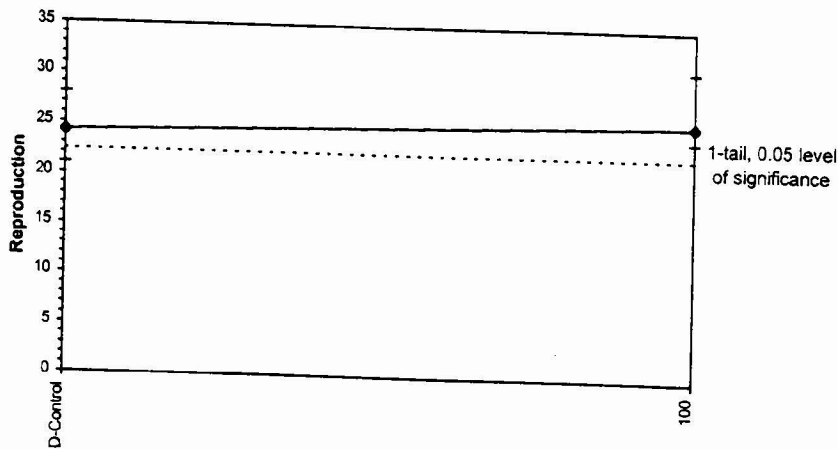
Conc-%	Mean	N-Mean	Transform: Untransformed					N	t-Stat	I-Tailed Critical	MSD
			Mean	Min	Max	CV%					
D-Control	24.200	1.0000	24.200	21.000	28.000	9.095	10	-1.449	1.734	1.675	
100	25.600	1.0579	25.600	24.000	31.000	8.276	10				

Auxiliary Tests

Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution ($p > 0.01$)	0.91813302	0.868	0.810776009
F-Test indicates equal variances ($p = 0.91$)	1.079207897	6.54108572	1.33372549
Hypothesis Test (1-tail, 0.05)			

Homoscedastic t Test indicates no significant differences

Dose-Response Plot



Chronic Whole Effluent Toxicity Test (EPA/600/4-91/002 Method 1000.0)
Species: *Pimephales promelas*

Client: TVA
 Facility: KINGSTON FOSSIL PLANT
 NPDES #: TN-0005452
 UV TREATED

Dilution preparation information:						Comments:
MHS batch:	02-12-02 / 02-18-02					
Dilution prep (%)	6.25	12.5	25	50	100	
Effluent volume (mL)	93.75	187.5	375	750	1500	
Diluent volume (mL)	1406.25	1312.5	1125	750	0	

Test organism information:		Test information:	
Organism age:	24-HOURS OLD	Randomizing template:	BLUE
Date and times organisms were born between:	02-12-02 1330 TO 1500 MST 1530 to 1700 EST	Incubator number:	2
Organism source:	ABS BATCH 02-12-02	Artemia lot number:	050201P
Transfer bowl information:	pH = 7.91 Temperature = 24.4°C	Oven temperature:	60°C
		Drying time:	24-HOURS

Daily feeding and renewal information:

Day	Date	Morning feeding time	Afternoon feeding time	Test initiation, renewal, or termination time	Analyst
0	02-13-02	—	1644	1528	JH
1	02-14-02	1036	1645	1506	JH
2	02-15-02	1030	1654	1519	JH
3	02-16-02	1141	1748	1527	KEK
4	02-17-02	1032	1637	1530	KEK
5	02-18-02	1035	1638	1509	JH
6	02-19-02	1039	1640	1510	JH
7	02-20-02	—	—	1514	JH

KEK

Control information:		Acceptance criteria	Summary of test endpoints:	
% Mortality:	0% 2.5%	≤ 20%	7-day LC50	> 100%
Average weight per larvae:	0.5702	≥ 0.25 mg/larvae	NOEC	100%
			LOEC	> 100%
			ChV	> 100%
			IC25	> 100%

Species: *Pimephales promelas*

Client: TVA KINGSTON

Date: 02-13-02

UV 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	9 ^{1d}	10	10	10	10	10	10	10	10	10	10
5	10	9	10	10	10	10	10	10	10	10	10	10
6	10	9	10	10	10	10	10	10	10	10	10	10
7	10	9	10	10	10	10	10	10	10	10	10	10
A = Pan weight (mg)	14.910	14.995	14.617	14.960	15.003	15.055	14.947	14.613	14.975	14.609	14.708	14.653
B = Pan + Larvae weight (mg)	20.28	19.81	20.72	21.48	20.06	20.48	21.53	20.43	20.78	20.74	21.62	20.60
Larvae weight (mg) = A - B	5.370	4.815	6.103	6.520	5.057	5.445	6.583	5.817	5.805	6.071	6.912	5.947

Calculations and data reviewed: *[Signature]*

Comments:

Species: *Pimephales promelas*

Client: TVA KINGSTON

Date: 02-13-02

UV TREATED

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	9 ^h	10	10	10	10	10	10	10	10	10
5	10	10	9	10	10	10	10	10	10	10	10	10
6	10	10	9	10	10	10	10	10	10	10	10	10
7	10	10	9	10	10	10	10	10	10	10	10	10
A = Pan weight (mg)	14.719	14.950	15.043	14.988	14.783	14.913	14.755	14.632	15.089	15.130	14.967	14.623
B = Pan + Larvae weight (mg)	20.87	21.15	20.50	21.73	21.07	21.81	20.66	21.34	21.73	22.44	21.88	21.43
Larvae weight (mg) = A - B	6.151	6.194	5.457	6.772	6.287	6.897	5.305	6.708	6.671	7.304	7.013	6.745

Calculations and data reviewed: *[Signature]*

Comments:

Species: *Pimephales promelas*

Client: TVA KINGSTON

Date: 02-13-02

UV TREATED

Survival and Growth Data

Day	100% INTAKE				CC	DD	EE	FF	GG	HH	II	JJ
	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	10	10	10								
A = Pan weight (mg)	14.938	14.715	14.684	15.020								
B = Pan + Larvae weight (mg)	21.73	20.74	21.65	21.59								
Larvae weight (mg) = A - B	6.792	6.025	7.066	6.560								

Calculations and data reviewed: *[Signature]*

Comments:

Environmental Testing Solutions, LLC

Chronic Whole Effluent Toxicity Test (EPA/600/4-91/002, Method 1000.0)

Species: *Pimephales promelas*

Quality Control

Verification of Data Entry, Calculations, and Statistical Analyses

Client: TVA Kingston Fossil Plant - UV Treated
 Test dates: February 13-20, 2002
 Project number: 260

Reviewed by: *J. Jume*

Concentration (%)	Replicate	Initial number of larvae	Final number of larvae	A = Paa weight (mg)	B = Paa + Larvae weight (mg)	Larvae weight (mg) = A - B	Weight/initial number of larvae (mg)	Mean survival (%)	Mean weight (mg)	Coefficient of variation (%)	Percent reduction from control (%)
Control	A	10	10	14.910	20.280	5.370	0.5370	97.5	0.5702	13.3	Not applicable
	B	10	9	14.995	19.810	4.815	0.4815				
	C	10	10	14.617	20.720	6.103	0.6103				
	D	10	10	14.960	21.480	6.520	0.6520				
6.25%	E	10	10	15.003	20.060	5.057	0.5057	100.0	0.5726	11.4	-0.4
	F	10	10	15.035	20.480	5.445	0.5445				
	G	10	10	14.947	21.530	6.583	0.6583				
	H	10	10	14.613	20.430	5.817	0.5817				
12.5%	I	10	10	14.975	20.780	5.805	0.5805	100.0	0.6184	8.0	-0.4
	J	10	10	14.669	20.740	6.071	0.6071				
	K	10	10	14.708	21.620	6.912	0.6912				
	L	10	10	14.653	20.600	5.947	0.5947				
25%	M	10	10	14.719	20.870	6.151	0.6151	97.5	0.6144	8.8	-7.7
	N	10	10	14.956	21.150	6.194	0.6194				
	O	10	9	15.043	20.500	5.457	0.5457				
	P	10	10	14.958	21.730	6.772	0.6772				
50%	Q	10	10	14.783	21.070	6.287	0.6287	100.0	0.6299	11.3	-10.5
	R	10	10	14.913	21.810	6.897	0.6897				
	S	10	10	14.755	20.060	5.305	0.5305				
	T	10	10	14.632	21.340	6.708	0.6708				
100%	U	10	10	15.059	21.730	6.671	0.6671	100.0	0.6933	4.1	-21.6
	V	10	10	15.136	22.440	7.304	0.7304				
	W	10	10	14.867	21.880	7.013	0.7013				
	X	10	10	14.685	21.430	6.745	0.6745				
100% Intake	Y	10	10	14.938	21.730	6.792	0.6792	100.0	0.6611	6.7	-15.9
	Z	10	10	14.715	20.740	6.025	0.6025				
	AA	10	10	14.584	21.650	7.066	0.7066				
	BB	10	10	15.030	21.590	6.560	0.6560				

Outfall 002:
 Dunnett's MSD value: 0.1014
 PMSD: 17.8

Intake:
 Dunnett's MSD value: 0.0853
 PMSD: 15.0

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. On average, a significant difference occurs for Environmental Testing Solutions, LLC chronic toxicity tests when a toxicant reduces Pimephales growth by 19.1% from the control (determined through Lower PMSD bound determined by USEPA (10th percentile) = 9.4%
 Upper PMSD bound determined by USEPA (90th percentile) = 35%
 The lower and upper bounds were calculated by the USEPA using 205 tests conducted from 19 laboratories for Pimephales growth in chronic reference toxicant tests.

Environmental Testing Solutions, LLC

Statistical Analyses

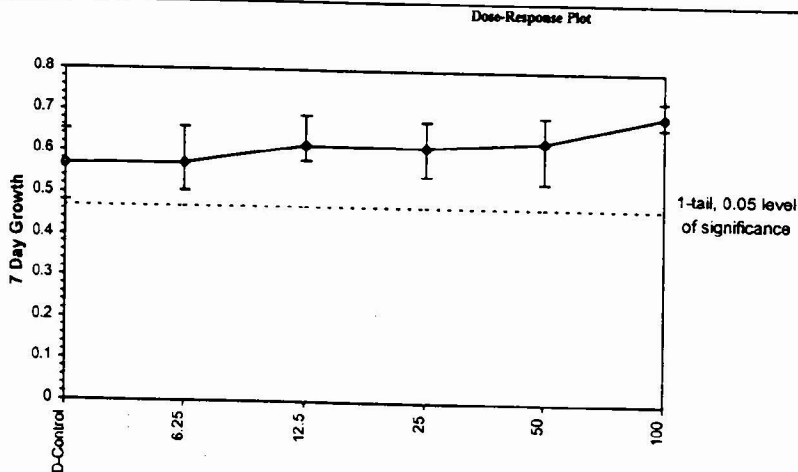
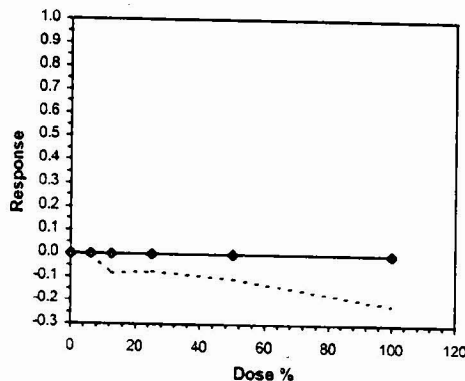
Larval Fish Growth and Survival Test-7 Day Growth					
Start Date:	2/13/02	Test ID:	PpFRCR	Sample ID:	TVA Kingston Fossil Plant, UV Treated (260)
End Date:	2/20/02	Lab ID:	ETS-Env. Testing Solutions	Sample Type:	DMR-Discharge Monitoring Report
Sample Date:		Protocol:	EPAF 91-EPA Freshwater	Test Species:	PP-Pimephales promelas
Comments:					

Conc-%	1	2	3	4
D-Control	0.5370	0.4815	0.6103	0.6520
6.25	0.5057	0.5445	0.6583	0.5817
12.5	0.5805	0.6071	0.6912	0.5947
25	0.6151	0.6194	0.5457	0.6772
50	0.6287	0.6897	0.5305	0.6708
100	0.6671	0.7304	0.7013	0.6745

Conc-%	Mean	N-Mean	Transform: Untransformed				N	t-Stat	1-Tailed Critical	MSD	Isotonic	
			Mean	Min	Max	CV%					Mean	N-Mean
D-Control	0.5702	1.0000	0.5702	0.4815	0.6520	13.306	4				0.6165	1.0000
6.25	0.5726	1.0041	0.5726	0.5057	0.6583	11.361	4	-0.056	2.410	0.1014	0.6165	1.0000
12.5	0.6184	1.0845	0.6184	0.5805	0.6912	8.046	4	-1.145	2.410	0.1014	0.6165	1.0000
25	0.6144	1.0774	0.6144	0.5457	0.6772	8.760	4	-1.050	2.410	0.1014	0.6165	1.0000
50	0.6299	1.1047	0.6299	0.5305	0.6897	11.274	4	-1.420	2.410	0.1014	0.6165	1.0000
100	0.6933	1.2159	0.6933	0.6671	0.7304	4.147	4	-2.927	2.410	0.1014	0.6165	1.0000

Auxiliary Tests				
Shapiro-Wilk's Test indicates normal distribution ($p > 0.01$)	Statistic		Critical	
Bartlett's Test indicates equal variances ($p = 0.76$)	0.966592133		0.884	
Hypothesis Test (1-tail, 0.05)	2.63269186		15.08631706	
Dunnnett's Test	NOEC	LOEC	ChV	TU
	100	>100		1
			MSDu	MSDp
			0.101365951	0.177772625
			MSB	MSE
			0.008132583	0.003538181
			F-Prob	df
			0.088182129	5, 18

Point	%	SD	Linear Interpolation (80 Resamples)	
			95% CL(Exp)	Skew
IC05	>100			
IC10	>100			
IC15	>100			
IC20	>100			
IC25	>100			
IC40	>100			
IC50	>100			



Environmental Testing Solutions, LLC

Statistical Analyses

Larval Fish Growth and Survival Test-7 Day Growth

Start Date: 2/13/02	Test ID: PpFRCR	Sample ID: TVA Kingston Fossil Plant, Intake, UV Treated (260)
End Date: 2/20/02	Lab ID: ETS-Env. Testing Solutions	Sample Type: DMR-Discharge Monitoring Report
Sample Date:	Protocol: EPAF 91-EPA Freshwater	Test Species: PP-Pimephales promelas

Conc-%	1	2	3	4
D-Control	0.5370	0.4815	0.6103	0.6520
100	0.6792	0.6025	0.7066	0.6560

Transform: Untransformed

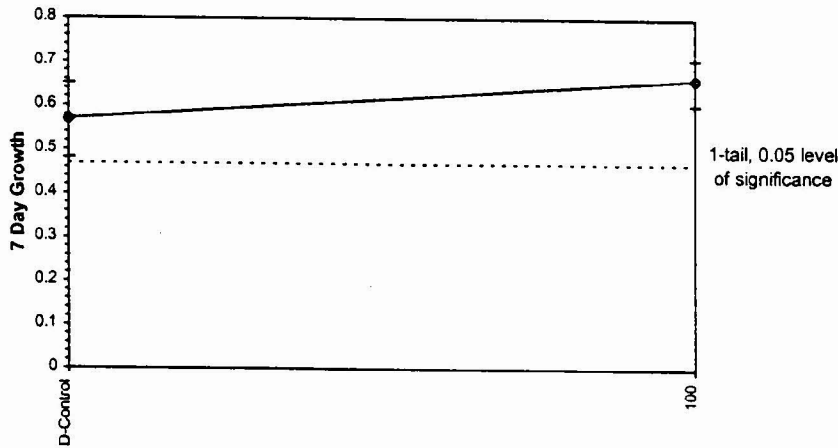
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	1-Tailed Critical	MSD
D-Control	0.5702	1.0000	0.5702	0.4815	0.6520	13.306	4			
100	0.6611	1.1594	0.6611	0.6025	0.7066	6.684	4	-2.070	1.943	0.0853

Auxiliary Tests

Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.975504756	0.749	-0.224105339
F-Test indicates equal variances (p = 0.40)	2.948051929	47.46834564	
Hypothesis Test (1-tail, 0.05)			

Homoscedastic t Test indicates no significant differences

Dose-Response Plot



Species: *Ceriodaphnia dubia* and *Pimephales promelas*
 Environmental Testing Solutions, LLC
 Summary of Chemical Analyses

Client: TVA Kingston Fossil Plant
 Test dates: February 13-20, 2002
 Project number: 260

Reviewed by: *SKK*

Pimephales promelas *Ceriodaphnia dubia*

Concentration	Parameter	Initial				Final							
		Minimum	Maximum	Mean	S	Minimum	Maximum	Mean	S				
Control	pH (SU)	8.06	8.13	8.08	0.03	7.65	7.99	7.76	0.14	8.03	8.23	8.11	0.07
	DO (mg/L)	7.6	8.0	7.9	0.0	7.2	7.7	7.5	0.2	7.9	8.3	8.0	0.1
	Conductivity (µmhos/cm)	297	322	314	9								
	Alkalinity (mg/L CaCO ₃)	69	70	70	1								
	Hardness (mg/L CaCO ₃)	86	94	90	6								
	Initial Temperature (°C)					24.3	24.7	24.5	0.1	24.2	24.7	24.4	0.2
6.25%	Final Temperature (°C)					24.3	24.6	24.4	0.1	24.3	24.6	24.5	0.1
	pH (SU)	8.06	8.12	8.08	0.02	7.58	7.86	7.75	0.15	8.03	8.22	8.11	0.08
	DO (mg/L)	7.8	8.2	8.0	0.1	7.2	7.8	7.5	0.2	7.9	8.4	8.1	0.2
	Conductivity (µmhos/cm)	295	310	304	7								
	Initial Temperature (°C)					24.3	24.8	24.6	0.2	24.4	24.8	24.5	0.2
	Final Temperature (°C)					24.3	24.5	24.4	0.1	24.3	24.6	24.5	0.1
12.5%	pH (SU)	8.03	8.11	8.07	0.03	7.52	7.93	7.68	0.17	7.97	8.19	8.07	0.08
	DO (mg/L)	7.9	8.4	8.1	0.2	7.0	7.8	7.5	0.2	7.9	8.3	8.1	0.1
	Conductivity (µmhos/cm)	287	306	294	6								
	Initial Temperature (°C)					24.5	25.0	24.7	0.2	24.4	24.9	24.6	0.2
	Final Temperature (°C)					24.3	24.6	24.4	0.1	24.3	24.6	24.5	0.1
	DO (mg/L)	7.99	8.06	8.03	0.03	7.46	7.90	7.66	0.17	7.97	8.21	8.08	0.09
25%	Conductivity (µmhos/cm)	259	287	270	9								
	Initial Temperature (°C)					24.4	25.0	24.8	0.2	24.4	24.9	24.6	0.2
	Final Temperature (°C)					24.3	24.6	24.4	0.1	24.3	24.6	24.5	0.1
	pH (SU)	7.83	8.03	7.92	0.07	7.26	7.90	7.57	0.26	7.75	8.13	7.94	0.14
	DO (mg/L)	8.0	8.6	8.3	0.2	7.0	8.0	7.5	0.3	8.0	8.4	8.2	0.2
	Conductivity (µmhos/cm)	201	251	223	19								
50%	Initial Temperature (°C)					24.4	25.3	24.9	0.3	24.5	25.3	24.8	0.3
	Final Temperature (°C)					24.3	24.6	24.4	0.1	24.3	24.6	24.5	0.1
	pH (SU)	7.26	7.92	7.55	0.28	6.86	7.77	7.32	0.35	7.31	8.11	7.65	0.33
	DO (mg/L)	8.2	8.8	8.5	0.2	7.0	8.0	7.6	0.4	8.0	8.4	8.1	0.2
	Conductivity (µmhos/cm)	82	173	120	44								
	Alkalinity (mg/L CaCO ₃)	14	54	28	23								
100%	Hardness (mg/L CaCO ₃)	30	66	43	20								
	Total Residual Chlorine (mg/L)	<0.10	<0.10	<0.10	0								
	Initial Temperature (°C)					24.5	25.5	25.1	0.4	24.5	25.5	24.9	0.3
	Final Temperature (°C)					24.3	24.6	24.4	0.1	24.3	24.6	24.5	0.1
	pH (SU)	7.21	7.76	7.44	0.21	6.81	7.66	7.22	0.35	7.28	7.91	7.55	0.29
	DO (mg/L)	8.2	8.7	8.5	0.2	7.0	8.0	7.6	0.3	7.8	8.5	8.1	0.2
100% Intake	Conductivity (µmhos/cm)	75	144	106	34								
	Alkalinity (mg/L CaCO ₃)	14	40	23	14								
	Hardness (mg/L CaCO ₃)	24	62	39	20								
	Total Residual Chlorine (mg/L)	<0.10	<0.10	<0.10	0								
	Initial Temperature (°C)					24.3	25.6	24.8	0.5	24.4	25.3	24.6	0.3
	Final Temperature (°C)					24.3	24.6	24.4	0.1	24.3	24.6	24.5	0.1

Overall Temperature (°C)
 (including all concentrations for initial and final temperatures)

24.3 25.6 24.6 0.2 24.2 25.5 24.6 0.2

Environmental Testing Solutions, LLC

Chronic Whole Effluent Toxicity Test (EPA/600/4-91/002, Method 1000.0)
 Species: *Pimephales promelas*

Daily Chemical Analyses

Client: TVA Kingston Fossil Plant - Non-Treated
 Test dates: February 13-20, 2002
 Project number: 260

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)	8.09	7.99	8.06	7.67	8.13	7.66	8.06	7.65	8.06	7.68	8.06	7.93	8.07	7.73
	DO (mg/L)	8.0	7.7	7.8	7.5	8.0	7.4	7.9	7.2	7.9	7.7	7.6	7.4	7.8	7.5
	Conductivity (µmhos/cm)	317		322		317		319		297		306		319	
	Alkalinity (mg/L CaCO ₃)	70													
	Hardness (mg/L CaCO ₃)	94													
6.25%	Temperature (°C)	24.4	24.6	24.3	24.4	24.5	24.5	24.3	24.4	24.4	24.7	24.4	24.5	24.5	24.3
	pH (SU)	8.09	7.98	8.06	7.60	8.12	7.66	8.07	7.58	8.07	7.76	8.06	7.91	8.07	7.79
	DO (mg/L)	8.0	7.8	7.8	7.5	8.0	7.4	7.9	7.2	7.7	7.7	8.2	7.4	8.0	7.6
	Conductivity (µmhos/cm)	299		310		306		310		295		297		310	
	Temperature (°C)	24.6	24.5	24.3	24.4	24.6	24.5	24.4	24.4	24.8	24.3	24.7	24.5	24.6	24.3
12.5%	pH (SU)	8.07	7.93	8.03	7.52	8.11	7.60	8.04	7.52	8.07	7.63	8.07	7.84	8.08	7.73
	DO (mg/L)	8.1	7.7	7.9	7.6	8.2	7.4	7.9	7.0	7.9	7.5	8.4	7.5	8.0	7.6
	Conductivity (µmhos/cm)	287		295		294		297		289		291		306	
	Temperature (°C)	24.7	24.5	24.5	24.4	24.7	24.5	24.5	24.4	24.8	24.3	25.0	24.6	24.6	24.3
	pH (SU)	8.03	7.90	7.99	7.46	8.06	7.54	7.99	7.51	8.05	7.70	8.05	7.83	8.06	7.71
25%	DO (mg/L)	8.3	7.7	8.0	7.5	8.3	7.3	7.9	7.0	7.9	7.7	8.6	7.4	8.1	7.6
	Conductivity (µmhos/cm)	259		268		265		269		270		274		287	
	Temperature (°C)	24.7	24.5	24.7	24.4	25.0	24.4	24.4	24.4	24.8	24.3	25.0	24.6	24.8	24.3
	pH (SU)	7.90	7.82	7.87	7.26	7.91	7.35	7.83	7.29	7.94	7.69	7.99	7.90	8.03	7.68
	Conductivity (µmhos/cm)	201		212		208		212		238		240		251	
50%	Temperature (°C)	25.0	24.5	24.7	24.4	25.3	24.5	24.4	24.4	25.0	24.3	25.3	24.6	24.8	24.3
	pH (SU)	7.35	7.30	7.33	6.86	7.36	7.03	7.26	7.04	7.75	7.60	7.86	7.77	7.92	7.63
	DO (mg/L)	8.5	8.0	8.2	7.6	8.6	7.3	8.2	7.0	8.4	8.0	8.8	7.6	8.5	7.5
	Conductivity (µmhos/cm)	82		86		83		85		164		164		173	
	Alkalinity (mg/L CaCO ₃)	14		15		15		15		54		54		54	
100%	Hardness (mg/L CaCO ₃)	30		32		32		32		66		66		66	
	Total Residual Chlorine (mg/L)	<0.10		<0.10		<0.10		<0.10		<0.10		<0.10		<0.10	
	Temperature (°C)	25.1	24.6	24.9	24.4	25.5	24.5	24.5	24.4	24.4	24.3	25.5	24.4	24.8	24.3
	pH (SU)	7.30	7.23	7.29	6.90	7.32	6.91	7.21	6.81	7.66	7.51	7.76	7.66	7.56	7.52
	DO (mg/L)	8.5	8.0	8.2	7.5	8.7	7.4	8.4	7.0	8.3	7.8	8.7	7.7	8.6	7.6
100% Intake	Conductivity (µmhos/cm)	75		80		80		81		141		142		144	
	Alkalinity (mg/L CaCO ₃)	14		16		16		16		40		40		40	
	Hardness (mg/L CaCO ₃)	30		24		24		24		62		62		62	
	Total Residual Chlorine (mg/L)	<0.10		<0.10		<0.10		<0.10		<0.10		<0.10		<0.10	
	Temperature (°C)	25.1	24.6	24.7	24.4	25.1	24.5	24.3	24.4	24.6	24.3	25.6	24.6	24.3	24.3

Species: *Pimephales promelas*

Client: TVA KINGSTON - OUTFALL 002
 NONTREATED

Date: 02-13-02

Full-strength Chemistry:

Parameter	Sample Number:			Control Batch:		
	1	2	3	02-12-02	02-18-02	
pH (S.U.)	7.35	7.36	7.75	8.09	8.07	/
DO (mg/L)	8.5	8.6	8.4	8.0	7.8	
Conductivity (umhos/cm)	75	83	164	317	319	
Alkalinity (mg CaCO ₃ /L)	14	15	54	70	69	
Hardness (mg CaCO ₃ /L)	30	32	66	94	86	
Chlorine (mg/L)	<0.10	<0.10	<0.10			
Collection start date	02-11-02	02-13-02	02-15-02			
Collection end time	1400	1200	1000			
Grab or Composite (duration)	23-HOUR COMPOSITE	23-HOUR COMPOSITE	23-HOUR COMPOSITE			
Temperature (°C) upon receipt	3.1°C	0.5°C	2.3°C			
Physical characteristics	CLEAR NO COLOR	CLEAR NO COLOR	CLEAR NO COLOR			
Dates sample used	02-13-02 02-14-02	02-15-02 02-16-02	02-17-02 02-18-02 02-19-02			
ETS Project and Sample numbers	260 020213.0A	020215.02	020217.02			

Species: *Pimephales promelas*

Client: TVA KINGSTON - INTAKE
NONTREATED

Date: 02-13-02

Full-strength Chemistry:

Parameter:	Sample Number:			Control Batch:			
	1	2	3	02-12-02	02-14-02		
pH (S.U.)	7.30	7.32	7.66	8.09	8.07	/	
DO (mg/L)	8.5	8.7	8.3	8.0	7.8		
Conductivity (µmhos/cm)	75	80	141	317	319		
Alkalinity (mg CaCO ₃ /L)	14	16	40	70	69		
Hardness (mg CaCO ₃ /L)	30	24	62	94	86		
Chlorine (mg/L)	<0.10	<0.10	<0.10				
Collection start date	02-11-02	02-13-02	02-15-02				
Collection end time	1300	1100	0900				
Grab or Composite (duration)	23 HOUR COMPOSITE	23 HOUR COMPOSITE	23 HOUR COMPOSITE				
Temperature (°C) upon receipt	3.1°C	0.5°C	2.3°C				
Physical characteristics	CLEAR NO COLOR	CLEAR NO COLOR	PALE YELLOW CLEAR FLOATING PARTICLES				
Dates sample used	02-13-02 02-14-02	02-15-02 02-16-02	02-17-02 02-18-02 02-19-02				
ETS Project and Sample numbers	260 020213.01	020215.01	020217.01				

Species: *Pimephales promelas*

Client: TVA KINGSTON

Date: 02-13-02

NONTREATED

Daily Chemistry:

Concentration	Parameter	Day					
		0		1		2	
CONTROL	pH (S.U.)	8.09	7.99	8.06	7.67	8.13	7.66
	DO (mg/L)	8.0	7.7	7.8	7.5	8.0	7.4
	Conductivity (µmhos/cm)	317		322		317	
	Temperature (°C)	24.4	24.6	24.3	24.4	24.5	24.5
6.25%	pH (S.U.)	8.09	7.98	8.06	7.60	8.12	7.66
	DO (mg/L)	8.0	7.8	7.8	7.5	8.0	7.4
	Conductivity (µmhos/cm)	299		310		300	
	Temperature (°C)	24.6	24.5	24.3	24.4	24.6	24.5
12.5%	pH (S.U.)	8.07	7.93	8.03	7.52	8.11	7.60
	DO (mg/L)	8.1	7.7	7.9	7.6	8.2	7.4
	Conductivity (µmhos/cm)	287		295		294	
	Temperature (°C)	24.7	24.5	24.5	24.4	24.7	24.5
25%	pH (S.U.)	8.03	7.90	7.99	7.46	8.06	7.54
	DO (mg/L)	8.3	7.7	8.0	7.5	8.3	7.3
	Conductivity (µmhos/cm)	259		268		265	
	Temperature (°C)	24.7	24.5	24.7	24.4	25.0	24.4
50%	pH (S.U.)	7.90	7.82	7.87	7.26	7.91	7.35
	DO (mg/L)	8.4	8.0	8.1	7.6	8.5	7.2
	Conductivity (µmhos/cm)	201		212		200	
	Temperature (°C)	25.0	24.5	24.7	24.4	25.3	24.5
100%	pH (S.U.)	7.35	7.30	7.33	6.86	7.36	7.03
	DO (mg/L)	8.5	8.0	8.2	7.6	8.6	7.3
	Conductivity (µmhos/cm)	82		86		83	
	Temperature (°C)	25.1	24.6	24.9	24.4	25.5	24.5
100% INTAKE	pH (S.U.)	7.30	7.23	7.29	6.90	7.32	6.91
	DO (mg/L)	8.5	8.0	8.2	7.5	8.7	7.4
	Conductivity (µmhos/cm)	75		78		80	
	Temperature (°C)	25.1	24.6	24.7	24.4	25.1	24.5
		Initial	Final	Initial	Final	Initial	Final

Species: *Pimephales promelas*

Client: TVA KINGSTON
NONTREATED

Date: 02-13-02

Concentration	Parameter	Day							
		3		4		5		6	
CONTROL	pH (S.U.)	8.06	7.65	8.06	7.68	8.06	7.93	8.07	7.73
	DO (mg/L)	7.9	7.2	7.9	7.7	7.6	7.4	7.8	7.5
MHS	Conductivity (µmhos/cm)	319		297		306		39	
	Temperature (°C)	24.3	24.4	24.7	24.4	24.5	24.5	24.5	24.3
6.25%	pH (S.U.)	8.07	7.58	8.07	7.76	8.06	7.91	8.07	7.79
	DO (mg/L)	7.9	7.2	7.9	7.7	8.2	7.4	8.0	7.6
	Conductivity (µmhos/cm)	310		295		297		310	
	Temperature (°C)	24.4	24.4	24.8	24.3	24.7	24.5	24.6	24.3
12.5%	pH (S.U.)	8.04	7.52	8.07	7.63	8.07	7.84	8.00	7.73
	DO (mg/L)	7.9	7.0	7.9	7.5	8.4	7.5	8.0	7.6
	Conductivity (µmhos/cm)	297		289		291		306	
	Temperature (°C)	24.5	24.4	24.8	24.3	25.0	24.6	24.6	24.3
25%	pH (S.U.)	7.99	7.51	8.05	7.70	8.05	7.83	8.06	7.71
	DO (mg/L)	7.9	7.0	7.9	7.7	8.6	7.4	8.1	7.6
	Conductivity (µmhos/cm)	269		270		274		287	
	Temperature (°C)	24.4	24.4	24.8	24.3	25.0	24.6	24.8	24.3
50%	pH (S.U.)	7.83	7.29	7.94	7.69	7.99	7.90	8.03	7.68
	DO (mg/L)	8.0	7.0	8.1	7.8	8.6	7.6	8.2	7.6
	Conductivity (µmhos/cm)	212		238		240		251	
	Temperature (°C)	24.4	24.4	25.0	24.3	25.3	24.6	24.8	24.3
100%	pH (S.U.)	7.26	7.04	7.75	7.60	7.86	7.77	7.92	7.63
	DO (mg/L)	8.2	7.0	8.4	8.0	8.8	7.6	8.5	7.5
	Conductivity (µmhos/cm)	85		164		164		173	
	Temperature (°C)	24.5	24.4	25.1	24.3	25.5	24.4	24.8	24.3
100% INTAKE	pH (S.U.)	7.21	6.81	7.66	7.51	7.70	7.66	7.56	7.52
	DO (mg/L)	8.4	7.0	8.3	7.8	8.7	7.7	8.6	7.6
	Conductivity (µmhos/cm)	81		141		142		144	
	Temperature (°C)	24.3	24.4	24.6	24.3	25.6	24.6	24.3	24.3
		Initial	Final	Initial	Final	Initial	Final	Initial	Final

Chronic Whole Effluent Toxicity Test (EPA/600/4-91/002, Method 1002.0)

Species: *Ceriodaphnia dubia*

Daily Chemical Analyses

Client: TVA Kingston Fossil Plant - Non-Treated
 Test dates: February 13-20, 2002
 Project number: 260

Reviewed by: XEN

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)	8.09	8.07	8.06	8.11	8.13	8.05	8.06	8.11	8.06	8.15	8.06	8.23	8.07	8.03	
	DO (mg/L)	8.0	8.0	7.8	8.0	8.0	8.0	7.9	8.0	7.9	8.3	7.6	8.0	7.8	7.9	
	Conductivity (µmhos/cm)	317		322		317		319		319	297	306		319		
	Alkalinity (mg/L CaCO ₃)	70														
	Hardness (mg/L CaCO ₃)	94														
6.25%	Temperature (°C)	24.4	24.6	24.2	24.5	24.5	24.4	24.4	24.3	24.6	24.7	24.5	24.5	24.5	24.4	
	pH (SU)	8.09	8.03	8.06	8.16	8.12	8.04	8.07	8.16	8.16	8.12	8.06	8.22	8.07	8.03	
	DO (mg/L)	8.0	8.1	7.8	8.0	8.0	8.1	7.9	8.1	8.1	8.4	8.2	8.0	8.1	7.9	
	Conductivity (µmhos/cm)	299		310		306		310		297	295	297		310		
	Temperature (°C)	24.5	24.6	24.4	24.5	24.5	24.4	24.4	24.6	24.6	24.7	24.8	24.6	24.5	24.4	
12.5%	pH (SU)	8.07	8.02	8.03	8.14	8.11	7.97	8.04	8.12	8.12	8.05	8.07	8.19	8.08	8.02	
	DO (mg/L)	8.1	8.1	7.9	8.1	8.2	8.1	7.9	8.1	8.1	8.3	8.4	8.1	8.0	7.9	
	Conductivity (µmhos/cm)	287		295		294		297		297	289	291		306		
	Temperature (°C)	24.5	24.6	24.4	24.5	24.6	24.6	24.4	24.6	24.6	24.8	24.9	24.6	24.6	24.4	
	pH (SU)	8.03	7.98	7.99	8.13	8.06	7.97	7.99	8.09	8.09	8.05	8.05	8.21	8.06	8.04	
25%	DO (mg/L)	8.3	8.1	8.0	8.1	8.3	8.1	8.1	8.2	8.2	8.3	8.6	8.1	8.1	7.9	
	Conductivity (µmhos/cm)	259		268		265		269		274	270	274		287		
	Temperature (°C)	24.6	24.6	24.5	24.5	24.7	24.6	24.4	24.6	24.6	24.3	24.9	24.6	24.6	24.4	
	pH (SU)	7.90	7.82	7.87	7.91	7.91	7.75	7.83	7.89	7.89	7.94	7.99	8.13	8.03	7.95	
	DO (mg/L)	8.4	8.1	8.1	8.1	8.5	8.0	8.0	8.2	8.2	8.1	8.6	8.3	8.2	8.0	
50%	Conductivity (µmhos/cm)	201		212		208		212		238	238	240		251		
	Temperature (°C)	24.8	24.6	24.7	24.4	24.9	24.6	24.6	24.6	24.6	24.8	25.3	24.6	24.5	24.4	
	pH (SU)	7.35	7.43	7.33	7.38	7.36	7.31	7.26	7.45	7.45	7.75	7.86	8.00	7.92	7.86	
	DO (mg/L)	8.5	8.2	8.2	8.0	8.6	8.0	8.2	8.1	8.1	8.4	8.8	8.3	8.5	8.0	
	Conductivity (µmhos/cm)	82		86		83		85		164	164	164		173		
100%	Alkalinity (mg/L CaCO ₃)	14				15		15		54	54					
	Hardness (mg/L CaCO ₃)	30				32		32		66	66					
	Total Residual Chlorine (mg/L)	<0.10				<0.10		<0.10		<0.10	<0.10					
	Temperature (°C)	24.8	24.6	24.8	24.5	25.2	24.4	24.5	24.6	24.6	24.8	25.5	24.6	24.6	24.4	
	pH (SU)	7.30	7.32	7.29	7.33	7.32	7.28	7.21	7.37	7.37	7.66	7.76	7.91	7.56	7.75	
100% Intake	DO (mg/L)	8.5	8.1	8.2	8.1	8.7	8.0	8.4	8.2	8.2	8.5	8.7	8.2	8.6	7.8	
	Conductivity (µmhos/cm)	75		78		80		81		141	141	142		144		
	Alkalinity (mg/L CaCO ₃)	14				16		16		40	40					
	Hardness (mg/L CaCO ₃)	30				24		24		62	62					
	Total Residual Chlorine (mg/L)	<0.10				<0.10		<0.10		<0.10	<0.10					
Temperature (°C)	24.6	24.6	24.4	24.4	24.8	24.5	24.4	24.6	24.6	24.6	25.3	24.6	24.4	24.4		

Species: *Ceriodaphnia dubia*

Client: TVA KINGSTON NONTREATED
OUTFALL 002

Date: 02-13-02

Full-strength Chemistry:

Parameter	Sample Number:			Control Batch:		
	1	2	3	02-12-02	02-14-02	
pH (S.U.)	7.35	7.36	7.75	8.09	8.07	
DO (mg/L)	8.5	8.6	8.4	8.0	7.8	
Conductivity (µmhos/cm)	75	83	164	317	319	
Alkalinity (mg CaCO ₃ /L)	14	15	54	70	69	
Hardness (mg CaCO ₃ /L)	30	32	66	94	86	
Chlorine (mg/L)	<0.10	<0.10	<0.10			
Collection start date	02-11-02	02-13-02	02-15-02			
Collection end time	1400	1200	1000			
Grab or Composite (duration)	23-HOUR COMPOSITE	23-HOUR COMPOSITE	23-HOUR COMPOSITE			
Temperature (°C) upon receipt	3.1°C	0.5°C	2.3°C			
Physical characteristics	CLEAR NO COLOR	CLEAR NO COLOR	CLEAR NO COLOR			
Dates sample used	02-13-02 02-14-02	02-15-02 02-16-02	02-17-02 02-18-02 02-19-02			
ETS Project and Sample numbers	260 020213.08	020215.02	020217.02			

Species: *Ceriodaphnia dubia*

Client: TVA KINGSTON NONTREATED
INTAKE

Date: 02-13-02

Full-strength Chemistry:

Parameter	Sample Number:			Control Batch:		
	1	2	3	02-12-02	02-15-02	
pH (S.U.)	7.30	7.32	7.66	8.09	8.07	
DO (mg/L)	8.5	8.7	8.3	8.0	7.8	
Conductivity (µmhos/cm)	75	80	141	317	319	
Alkalinity (mg CaCO ₃ /L)	14	16	40	70	69	
Hardness (mg CaCO ₃ /L)	30	24	62	94	86	
Chlorine (mg/L)	<0.10	<0.10	<0.10			
Collection start date	02-11-02	02-13-02	02-15-02			
Collection end time	1300	1100	0900			
Grab or Composite (duration)	23 HOUR COMPOSITE	23-HOUR COMPOSITE	23-HOUR COMPOSITE			
Temperature (°C) upon receipt	3.1°C	0.5°C	2.3°C			
Physical characteristics	CLEAR NO COLOR	CLEAR NO COLOR	PALE YELLOW CLEAR FLOATING PARTICLES			
Dates sample used	02-13-02 02-14-02	02-15-02 02-16-02	02-17-02 02-18-02 02-19-02			
ETS Project and Sample numbers	260 020213.07	020215.01	020217.01			

Species: *Ceriodaphnia dubia*

Client: TVA KINGSTON
 NONTREATED

Date: 02-13-02

Daily Chemistry:

Concentration	Parameter	Day					
		0		1		2	
CONTROL	pH (S.U.)	8.09	8.07	8.06	8.11	8.13	8.05
	DO (mg/L)	8.0	8.0	7.8	8.0	8.0	8.0
	Conductivity (µmhos/cm)	317		322		317	
	Temperature (°C)	24.4	24.6	24.2	24.5	24.5	24.4
6.25%	pH (S.U.)	8.09	8.03	8.06	8.16	8.12	8.04
	DO (mg/L)	8.0	8.1	7.8	8.0	8.0	8.1
	Conductivity (µmhos/cm)	299		310		306	
	Temperature (°C)	24.5	24.6	24.4	24.5	24.5	24.4
12.5%	pH (S.U.)	8.07	8.02	8.03	8.14	8.11	7.97
	DO (mg/L)	8.1	8.1	7.9	8.1	8.2	8.1
	Conductivity (µmhos/cm)	287		295		294	
	Temperature (°C)	24.5	24.6	24.4	24.5	24.6	24.6
25%	pH (S.U.)	8.03	7.98	7.99	8.13	8.06	7.97
	DO (mg/L)	8.3	8.1	8.0	8.1	8.3	8.1
	Conductivity (µmhos/cm)	259		268		265	
	Temperature (°C)	24.6	24.6	24.5	24.5	24.7	24.6
50%	pH (S.U.)	7.90	7.82	7.87	7.91	7.91	7.75
	DO (mg/L)	8.4	8.1	8.1	8.1	8.5	8.0
	Conductivity (µmhos/cm)	201		212		208	
	Temperature (°C)	24.8	24.6	24.7	24.4	24.9	24.6
100%	pH (S.U.)	7.35	7.43	7.33	7.38	7.36	7.31
	DO (mg/L)	8.5	8.2	8.2	8.0	8.6	8.0
	Conductivity (µmhos/cm)	82		84		83	
	Temperature (°C)	24.8	24.6	24.8	24.5	25.2	24.4
100% INTAKE	pH (S.U.)	7.30	7.32	7.29	7.33	7.32	7.28
	DO (mg/L)	8.5	8.1	8.2	8.1	8.7	8.0
	Conductivity (µmhos/cm)	75		78		80	
	Temperature (°C)	24.6	24.6	24.4	24.4	24.8	24.5
		Initial	Final	Initial	Final	Initial	Final

Species: *Ceriodaphnia dubia*

Client: TVA KINGSTON
NON TREATED

Date: 02-13-02

Concentration	Parameter	Day							
		3		4		5		6	
CONTROL	pH (S.U.)	8.06	8.11	8.06	8.15	8.06	8.23	8.07	8.03
	DO (mg/L)	7.9	8.0	7.9	8.3	7.6	8.0	7.8	7.9
	Conductivity (µmhos/cm)	319		297		306		319	
	Temperature (°C)	24.3	24.6	24.7	24.3	24.5	24.5	24.5	24.4
6.25%	pH (S.U.)	8.07	8.16	8.07	8.12	8.06	8.22	8.07	8.03
	DO (mg/L)	7.9	8.1	7.9	8.4	8.2	8.0	8.1	7.9
	Conductivity (µmhos/cm)	310		295		297		310	
	Temperature (°C)	24.4	24.6	24.7	24.3	24.8	24.6	24.5	24.4
12.5%	pH (S.U.)	8.04	8.12	8.07	8.05	8.07	8.19	8.08	8.02
	DO (mg/L)	7.9	8.1	7.9	8.3	8.4	8.1	8.0	7.9
	Conductivity (µmhos/cm)	297		289		291		306	
	Temperature (°C)	24.4	24.6	24.8	24.3	24.9	24.6	24.6	24.4
25%	pH (S.U.)	7.99	8.09	8.05	8.11	8.05	8.21	8.06	8.04
	DO (mg/L)	7.9	8.2	7.9	8.3	8.6	8.1	8.1	7.9
	Conductivity (µmhos/cm)	269		270		274		287	
	Temperature (°C)	24.4	24.6	24.8	24.3	25.1	24.6	24.6	24.4
50%	pH (S.U.)	7.83	7.89	7.94	8.10	7.99	8.13	8.03	7.95
	DO (mg/L)	8.0	8.2	8.1	8.4	8.6	8.3	8.2	8.0
	Conductivity (µmhos/cm)	212		238		240		251	
	Temperature (°C)	24.5	24.6	24.8	24.3	25.3	24.6	24.5	24.4
100%	pH (S.U.)	7.26	7.45	7.75	8.11	7.86	8.00	7.92	7.86
	DO (mg/L)	8.2	8.1	8.4	8.4	8.8	8.3	8.5	8.0
	Conductivity (µmhos/cm)	85		164		164		173	
	Temperature (°C)	24.5	24.6	24.8	24.3	25.5	24.6	24.6	24.4
100% INTAKE	pH (S.U.)	7.21	7.37	7.66	7.90	7.76	7.91	7.56	7.75
	DO (mg/L)	8.4	8.2	8.3	8.5	8.7	8.2	8.6	7.8
	Conductivity (µmhos/cm)	81		141		142		144	
	Temperature (°C)	24.4	24.6	24.6	24.3	25.3	24.6	24.4	24.4
		Initial	Final	Initial	Final	Initial	Final	Initial	Final

Summary of Chemical Analyses

Client: TVA Kingston Fossil Plant
 Test dates: February 13-16, 2002
 Project number: 240

Reviewed by: *JCN*

Pimphales promelas

Concentration	Parameter	Initial		Final		S	Final			
		Minimum	Maximum	Mean	S		Minimum	Maximum	Mean	
Control	pH (SU)	7.92	8.04	7.99	8.05	0.05	7.63	7.89	7.72	0.09
	DO (mg/L)	8.0	8.0	8.0	8.0	0.0	7.3	7.9	7.6	0.2
	Conductivity (umhos/cm)	298	318	310	310	6				
	Alkalinity (mg/L CaCO ₃)	69	70	70	70	1				
	Hardness (mg/L CaCO ₃)	85	94	90	90	6				
	Initial Temperature (°C)						24.4	24.8	24.6	0.1
	Final Temperature (°C)						24.2	24.7	24.5	0.2
6.25%	pH (SU)	7.96	8.06	8.02	8.04	0.04	7.66	7.88	7.76	0.07
	DO (mg/L)	8.0	8.1	8.0	8.1	0.1	7.3	7.8	7.5	0.2
	Conductivity (umhos/cm)	292	310	301	301	6				
	Initial Temperature (°C)						24.3	24.8	24.6	0.2
	Final Temperature (°C)						24.2	24.6	24.4	0.1
	pH (SU)	7.96	8.05	8.02	8.03	0.03	7.57	7.81	7.71	0.09
	DO (mg/L)	8.0	8.2	8.1	8.1	0.1	7.4	7.8	7.6	0.1
12.5%	Conductivity (umhos/cm)	278	297	290	290	7				
	Initial Temperature (°C)						24.3	24.8	24.7	0.2
	Final Temperature (°C)						24.2	24.6	24.4	0.1
	pH (SU)	7.91	8.04	7.99	8.05	0.05	7.55	7.84	7.67	0.10
	DO (mg/L)	8.0	8.2	8.2	8.2	0.1	7.4	7.9	7.8	0.2
	Conductivity (umhos/cm)	251	281	267	267	11				
	Initial Temperature (°C)						24.4	25.0	24.8	0.2
25%	Final Temperature (°C)						24.1	24.6	24.4	0.2
	pH (SU)	7.80	8.00	7.90	8.08	0.08	7.31	7.87	7.57	0.20
	DO (mg/L)	8.1	8.4	8.2	8.2	0.1	7.2	8.0	7.6	0.2
	Conductivity (umhos/cm)	195	241	220	220	20				
	Initial Temperature (°C)						24.3	25.3	24.9	0.4
	Final Temperature (°C)						24.1	24.6	24.4	0.2
	pH (SU)	7.26	7.88	7.54	8.26	0.26	6.91	7.75	7.29	0.36
100%	DO (mg/L)	8.1	8.6	8.3	8.2	0.2	7.1	8.0	7.6	0.3
	Conductivity (umhos/cm)	82	163	119	119	44				
	Alkalinity (mg/L CaCO ₃)	14	34	28	23	23				
	Hardness (mg/L CaCO ₃)	30	66	43	20	20				
	Total Residual Chlorine (mg/L)	< 0.10	< 0.10	< 0.10	< 0.10	0				
	Initial Temperature (°C)						24.4	25.5	25.0	0.5
	Final Temperature (°C)						24.2	24.7	24.5	0.2
100% Isolate	pH (SU)	7.12	7.80	7.46	8.29	0.29	6.92	7.89	7.27	0.33
	DO (mg/L)	8.0	8.5	8.3	8.2	0.2	7.4	8.1	7.6	0.3
	Conductivity (umhos/cm)	72	145	105	36	36				
	Alkalinity (mg/L CaCO ₃)	14	40	21	14	14				
	Hardness (mg/L CaCO ₃)	24	62	39	20	20				
	Total Residual Chlorine (mg/L)	< 0.10	< 0.10	< 0.10	< 0.10	0				
	Initial Temperature (°C)						24.3	25.4	24.7	0.4
Final Temperature (°C)						24.2	24.6	24.4	0.1	

Overall Temperature (°C)
 (including all concentrations for initial and final temperatures)

24.1 25.5 24.6 0.2

Environmental Testing Solutions, LLC

Chronic Whole Effluent Toxicity Test (EPA/600/4-91/002, Method 1000.0)

Species: *Pimephales promelas*

Daily Chemical Analyses

Reviewed by: *SKA*

Client: TVA Kingston Fossil Plant

Test dates: February 13-20, 2002

Project number: 260

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)	8.04	7.70	7.92	7.64	7.93	7.70	8.03	7.63	7.77	7.97	7.89	8.02	7.81	7.81
	DO (mg/L)	8.0	7.9	8.0	7.5	8.0	7.7	8.0	7.3	8.0	7.7	8.0	7.5	8.0	7.6
	Conductivity (µmhos/cm)	310		306		318		313		298		308		314	
	Alkalinity (mg/L CaCO ₃)	70													
	Hardness (mg/L CaCO ₃)	94													
6.25%	Temperature (°C)	24.5	24.7	24.4	24.5	24.6	24.4	24.4	24.4	24.4	24.5	24.5	24.5	24.6	24.2
	pH (SU)	8.06	7.76	7.96	7.66	7.98	7.72	8.03	7.69	8.04	7.80	8.01	7.88	8.03	7.78
	DO (mg/L)	8.1	7.8	8.0	7.4	8.0	7.5	8.0	7.3	8.1	7.6	8.1	7.5	8.0	7.6
	Conductivity (µmhos/cm)	300		292		307		310		296		299		305	
	Temperature (°C)	24.7	24.6	24.6	24.5	24.6	24.4	24.3	24.4	24.4	24.5	24.8	24.5	24.6	24.2
12.5%	pH (SU)	8.05	7.76	7.96	7.57	7.99	7.69	8.02	7.62	8.03	7.71	8.04	7.81	8.04	7.78
	DO (mg/L)	8.1	7.8	8.1	7.4	8.0	7.5	8.1	7.4	8.2	7.6	8.2	7.6	8.0	7.6
	Conductivity (µmhos/cm)	284		278		294		296		288		293		297	
	Temperature (°C)	24.8	24.6	24.6	24.5	24.8	24.4	24.3	24.4	24.4	24.5	24.8	24.5	24.5	24.2
	pH (SU)	8.01	7.69	7.91	7.55	7.97	7.66	7.96	7.58	8.01	7.67	8.03	7.84	8.04	7.73
25%	DO (mg/L)	8.2	7.9	8.2	7.4	8.0	7.5	8.2	7.4	8.2	7.6	8.2	7.6	8.2	7.6
	Conductivity (µmhos/cm)	255		251		266		270		270		276		281	
	Temperature (°C)	24.8	24.6	24.8	24.5	24.8	24.4	24.4	24.4	24.4	24.5	24.9	24.5	24.6	24.1
	pH (SU)	7.87	7.47	7.80	7.31	7.84	7.54	7.82	7.37	7.96	7.66	7.99	7.87	8.00	7.74
	DO (mg/L)	8.3	8.0	8.2	7.5	8.1	7.6	8.2	7.2	8.2	7.7	8.4	7.7	8.3	7.7
50%	Conductivity (µmhos/cm)	201		195		209		214		238		240		243	
	Temperature (°C)	25.2	24.6	24.8	24.5	25.0	24.4	24.3	24.4	25.2	24.5	25.3	24.5	24.5	24.1
	pH (SU)	7.34	7.01	7.26	6.91	7.37	7.06	7.36	7.06	7.83	7.60	7.88	7.75	7.74	7.65
	DO (mg/L)	8.3	8.0	8.4	7.5	8.2	7.5	8.1	7.1	8.2	7.8	8.6	7.7	8.3	7.7
	Conductivity (µmhos/cm)	84		82		84		80		167		164		167	
100%	Alkalinity (mg/L CaCO ₃)	14		15		32		66		54		66		66	
	Hardness (mg/L CaCO ₃)	30		<0.10		<0.10		<0.10		<0.10		<0.10		<0.10	
	Total Residual Chlorine (mg/L)	<0.10		<0.10		<0.10		<0.10		<0.10		<0.10		<0.10	
	Temperature (°C)	25.4	24.7	24.9	24.5	25.2	24.4	24.4	24.4	25.3	24.5	25.5	24.5	24.4	24.2
	pH (SU)	7.27	7.03	7.12	6.92	7.29	7.04	7.27	7.04	7.71	7.59	7.80	7.69	7.78	7.57
100% Intake	DO (mg/L)	8.2	8.1	8.3	7.4	8.0	7.4	8.0	7.4	8.3	7.8	8.5	7.5	8.5	7.7
	Conductivity (µmhos/cm)	72		73		81		80		142		144		145	
	Alkalinity (mg/L CaCO ₃)	14		16		24		40		62		62		62	
	Hardness (mg/L CaCO ₃)	30		<0.10		<0.10		<0.10		<0.10		<0.10		<0.10	
	Total Residual Chlorine (mg/L)	<0.10		<0.10		<0.10		<0.10		<0.10		<0.10		<0.10	
Temperature (°C)	25.0	24.6	24.5	24.5	24.7	24.4	24.4	24.4	24.4	24.9	25.4	24.5	24.3	24.2	

Species: *Pimephales promelas*

Client: TVA KINGSTON OUTFALL 002
UV TREATED

Date: 02-13-02

Full-strength Chemistry:

Parameter	Sample Number:			Control Batch:		
	1	2	3	02-12-02	02-18-02	
pH (S.U.)	7.34	7.37	7.83	8.04	8.02	
DO (mg/L)	8.3	8.2	8.2	8.0	8.0	
Conductivity (µmhos/cm)	84	84	167	310	314	df
Alkalinity (mg CaCO ₃ /L)	14	15	54	70	69	
Hardness (mg CaCO ₃ /L)	30	32	66	94	86	
Chlorine (mg/L)	<0.10	<0.10	<0.10			
Collection start date	02-11-02	02-13-02	02-15-02			
Collection end time	1400	1200	1000			
Grab or Composite (duration)	23 HOUR COMPOSITE	23-HOUR COMPOSITE	23-HOUR COMPOSITE			
Temperature (°C) upon receipt	3.1°C	0.5°C	2.3°C			
Physical characteristics	CLEAR NO COLOR	CLEAR NO COLOR	CLEAR NO COLOR			
Dates sample used	02-13-02 02-14-02	02-15-02 02-16-02	02-17-02 02-18-02 02-19-02			
ETS Project and Sample numbers	260 020213.08	020215.02	020217.02			

Species: *Pimephales promelas*

Client: TVA KINGSTON - INTAKE
UV TREATED

Date: 02-13-02

Full-strength Chemistry:

Parameter	Sample Number:			Control Batch:		
	1	2	3	02-12-02	02-18-02	
pH (S.U.)	7.27	7.29	7.71	8.04	8.02	<div style="font-size: 2em; font-weight: bold;">X</div>
DO (mg/L)	8.2	8.0	8.3	8.0	8.0	
Conductivity (µmhos/cm)	72	81	142	310	314	
Alkalinity (mg CaCO ₃ /L)	¹⁴ 44	¹⁶ 15	⁴⁰ 54 ♂	70	69	
Hardness (mg CaCO ₃ /L)	³⁰ 30	²⁴ 32	⁶² 66 ♂	94	86	
Chlorine (mg/L)	<0.10	<0.10	<0.10			
Collection start date	02-11-02	02-13-02	02-14-02			
Collection end time	1300	1100	0900			
Grab or Composite (duration)	23 HOUR COMPOSITE	23-HOUR COMPOSITE	23-HOUR COMPOSITE			
Temperature (°C) upon receipt	3.1°C	0.5°C	2.3°C			
Physical characteristics	CLEAR NO COLOR	CLEAR NO COLOR	PALE YELLOW CLEAR FLOATING PARTICLES			
Dates sample used	02-13-02 02-14-02	02-15-02 02-16-02	02-17-02 02-18-02 02-19-02			
ETS Project and Sample numbers	260 020213.07	020215.01	020217.01			

Species: *Pimephales promelas*

Client: TVA KINGSTON

Date: 02-13-02

UV TREATED

Daily Chemistry:

Concentration	Parameter	Day					
		0		1		2	
CONTROL	pH (S.U.)	8.04	7.70	7.92	7.64	7.93	7.70
	DO (mg/L)	8.0	7.9	8.0	7.5	8.0	7.7
	Conductivity (µmhos/cm)	310		306		318	
	Temperature (°C)	24.5	24.7	24.4	24.5	24.6	24.4
MHS	pH (S.U.)	8.06	7.76	7.96	7.66	7.98	7.72
	DO (mg/L)	8.1	7.8	8.0	7.4	8.0	7.5
	Conductivity (µmhos/cm)	300		292		307	
	Temperature (°C)	24.7	24.6	24.6	24.5	24.6	24.4
6.25%	pH (S.U.)	8.05	7.76	7.96	7.57	7.99	7.69
	DO (mg/L)	8.1	7.8	8.1	7.4	8.0	7.5
	Conductivity (µmhos/cm)	284		278		294	
	Temperature (°C)	24.8	24.6	24.6	24.5	24.8	24.4
12.5%	pH (S.U.)	8.01	7.69	7.91	7.55	7.97	7.66
	DO (mg/L)	8.2	7.9	8.2	7.4	8.0	7.5
	Conductivity (µmhos/cm)	255		251		266	
	Temperature (°C)	24.8	24.6	24.8	24.5	24.8	24.4
25%	pH (S.U.)	7.87	7.47	7.80	7.31	7.84	7.54
	DO (mg/L)	8.3	8.0	8.2	7.5	8.1	7.6
	Conductivity (µmhos/cm)	201		195		209	
	Temperature (°C)	25.2	24.6	24.8	24.5	25.0	24.4
50%	pH (S.U.)	7.34	7.01	7.26	6.91	7.37	7.06
	DO (mg/L)	8.3	8.0	8.4	7.5	8.2	7.5
	Conductivity (µmhos/cm)	84		82		84	
	Temperature (°C)	25.4	24.7	24.9	24.5	25.2	24.4
100%	pH (S.U.)	7.27	7.03	7.12	6.92	7.29	7.04
	DO (mg/L)	8.2	8.1	8.3	7.4	8.0	7.4
	Conductivity (µmhos/cm)	72		73		81	
	Temperature (°C)	25.0	24.6	24.5	24.5	24.7	24.4
100% INTAKE	pH (S.U.)						
	DO (mg/L)						
	Conductivity (µmhos/cm)						
	Temperature (°C)						
		Initial	Final	Initial	Final	Initial	Final

Species: *Pimephales promelas*

Client: TVA KINGSTON

Date: 02-13-02

UV TREATED

Concentration	Parameter	Day							
		3		4		5		6	
CONTROL	pH (S.U.)	8.03	7.63	8.02	7.77	7.97	7.87	8.02	7.81
	DO (mg/L)	8.0	7.3	8.0	7.7	8.0	7.5	8.0	7.6
	Conductivity (µmhos/cm)	319 315		298		308		314	
	Temperature (°C)	24.4	24.4	24.8	24.5	24.6	24.5	24.6	24.2
6.25%	pH (S.U.)	8.03	7.69	8.04	7.80	8.01	7.88	8.03	7.78
	DO (mg/L)	8.0	7.3	8.1	7.6	8.1	7.5	8.0	7.6
	Conductivity (µmhos/cm)	310 310		296		299		365	
	Temperature (°C)	24.3	24.4	24.8	24.5	24.8	24.5	24.6	24.2
12.5%	pH (S.U.)	8.02	7.62	8.03	7.71	8.04	7.81	8.04	7.78
	DO (mg/L)	8.1	7.4	8.2	7.6	8.2	7.6	8.0	7.6
	Conductivity (µmhos/cm)	297 296		288		293		297	
	Temperature (°C)	24.3	24.4	24.8	24.5	24.8	24.5	24.5	24.2
25%	pH (S.U.)	7.96	7.58	8.01	7.67	8.03	7.84	8.04	7.73
	DO (mg/L)	8.2	7.4	8.2	7.6	8.2	7.6	8.2	7.6
	Conductivity (µmhos/cm)	268 270		270		276		281	
	Temperature (°C)	24.4	24.4	25.0	24.5	24.9	24.5	24.6	24.1
50%	pH (S.U.)	7.82	7.37	7.96	7.66	7.99	7.87	8.00	7.74
	DO (mg/L)	8.2	7.2	8.2	7.7	8.4	7.7	8.3	7.7
	Conductivity (µmhos/cm)	212 214		238		240		243	
	Temperature (°C)	24.3	24.4	25.2	24.5	25.3	24.5	24.5	24.1
100%	pH (S.U.)	7.36	7.06	7.83	7.60	7.88	7.75	7.65 7.65	7.65
	DO (mg/L)	8.1	7.1	8.2	7.8	8.6	7.7	7.74 8.3	7.7
	Conductivity (µmhos/cm)	85 86		167		164		167	
	Temperature (°C)	24.4	24.4	25.3	24.5	25.5	24.5	24.4	24.2
100% INTAKE	pH (S.U.)	8.0 7.27	7.04	7.71	7.59	7.80	7.69	7.78	7.57
	DO (mg/L)	8.0	7.4	8.3	7.8	8.5	7.5	8.5	7.7
	Conductivity (µmhos/cm)	80 81 85		142		144		145	
	Temperature (°C)	24.4	24.4	24.9	24.5	25.4	24.5	24.3	24.2
		Initial	Final	Initial	Final	Initial	Final	Initial	Final

Total Residual Chlorine
(EPA Method 330.5)
 Matrix: Water, MDL = 0.10 mg/L
 Meter: Accumet Model 25 pH/Ion Meter

Analyst KWA
 Date analyzed 02-13-02

Iodide reagent: INR041
 Acid reagent: INR023
 Slope: 26.7

Calibration:

	0.10 mg/L	1.00 mg/L
Reference standard number	<u>INSS005</u>	<u>INSS005</u>

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%)
<u>INSS005</u>	<u>0.50</u>	<u>0.530</u>	<u>106%</u>

Duplicate sample precision:

Sample number	Sample ID	Sample characteristics	Residual chlorine (mg/L)	%RPD = $\frac{(S - D)}{((S+D)/2)} \times 100$ (acceptable range = ± 10%)
<u>020213.03</u>	<u>T. Amer</u>	<u>Septic shell floating particles</u>	<u>S 20.00170</u>	
	<u>Duplicate</u>		<u>D 20.00167</u>	<u>-</u>

Sample measurements:

Sample number	Sample ID	Sample characteristics	Residual chlorine (mg/L)
	<u>Blank (should be = < 0.10 mg/L)</u>		<u>20.00003</u>
<u>020213.09</u>	<u>Baxter</u>	<u>no color, clear</u>	<u>20.00150</u>
<u>020213.02</u>	<u>Omm-Sage</u>	<u>pale yellow, clear</u>	<u>20.00001</u>
<u>020213.06</u>	<u>Enfield</u>	<u>no color, clear</u>	<u>20.00005</u>
<u>020213.01</u>	<u>Prosser - Gilderest Mills</u>	<u>pale yellow, daphnia present</u>	<u>0.00033</u>
<u>020212.01</u>	<u>The mt.</u>	<u>pale yellow</u>	<u>20.00009</u>
<u>020213.05</u>	<u>Tritest, cnc shaver, h-2000</u>	<u>pale yellow, slightly cloudy, floating particles</u>	<u>20.00160</u>
<u>020213.04</u>	<u>↓ Hanover</u>	<u>no color, slightly cloudy</u>	<u>20.00001</u>
<u>020213.07</u>	<u>TVA-KIP Intake</u>	<u>no color, clear</u>	<u>20.00373</u>
<u>020213.08</u>	<u>TVA-KIP 002</u>	<u>no color, clear</u>	<u>20.00006</u>

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%)
<u>INSS005</u>	<u>0.50</u>	<u>0.540</u>	<u>108%</u>

Reviewed by [Signature]
 Date reviewed 02-18-02

Total Residual Chlorine
(EPA Method 330.5)
Matrix: Water, MDL = 0.10 mg/L
Meter: Accumet Model 25 pH/Ion Meter

Analyst Ker
Date analyzed 02-15-02

Iodide reagent: INRO41
Acid reagent: INRO23
Slope: -27.9

Calibration:

	0.10 mg/L	1.00 mg/L
Reference standard number	<u>IN55005</u>	<u>IN55005</u>

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%)
<u>IN55005</u>	<u>0.50</u>	<u>0.513</u>	<u>102.60%</u>

Duplicate sample precision:

Sample number	Sample ID	Sample characteristics	Residual chlorine (mg/L)	%RPD = $\frac{(S - D)}{((S+D)/2)} \times 100$ (acceptable range = ± 10%)
<u>020215.01</u>	<u>KIP Intake</u>	<u>no color, clear</u>	<u>S 40.00747</u>	
<u>↓</u>	<u>Duplicate</u>		<u>D 40.00646</u>	<u>—</u>

Sample measurements:

Sample number	Sample ID	Sample characteristics	Residual chlorine (mg/L)
	<u>Blank (should be = < 0.10 mg/L)</u>		<u>40.00074</u>
<u>020215.02</u>	<u>KIP Outfall 002</u>	<u>no color, clear</u>	<u>40.00422</u>

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%)
<u>IN55005</u>	<u>0.50</u>	<u>0.511</u>	<u>102.2%</u>

Reviewed by JKL
Date reviewed 02-18-02

Total Residual Chlorine
(EPA Method 330.5)
Matrix: Water, MDL = 0.10 mg/L
Meter: Accumet Model 25 pH/Ion Meter

Analyst KET
Date analyzed 02.17.02

Iodide reagent: INR04
Acid reagent: INR023
Slope: 26.2

Calibration:

	0.10 mg/L	1.00 mg/L
Reference standard number	<u>1N55005</u>	<u>1N55005</u>

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%)
<u>1N55005</u>	<u>0.50</u>	<u>0.510</u>	<u>102%</u>

Duplicate sample precision:

Sample number	Sample ID	Sample characteristics	Residual chlorine (mg/L)	%RPD = $\frac{ S - D }{(S+D)/2} \times 100$ (acceptable range = ± 10%)
<u>020217.01</u>	<u>KIP-INTAKE</u>	<u>no color, clear</u>	<u>S 10.00710</u>	
<u>↓</u>	<u>Duplicate</u>		<u>D 10.00659</u>	<u>—</u>

Sample measurements:

Sample number	Sample ID	Sample characteristics	Residual chlorine (mg/L)
	<u>Blank (should be = < 0.10 mg/L)</u>		
<u>020217.02</u>	<u>KIP-002</u>	<u>pale yellow, clear, floating particles</u>	<u>10.00509</u>
			<u>0.0112</u>

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%)
<u>1N55005</u>	<u>0.50</u>	<u>0.530</u>	<u>106%</u>

Reviewed by [Signature]
Date reviewed 02.18.02

Alkalinity
(EPA Method 310.1)

Matrix: Water, MDL = 1.0 mg CaCO₃/L

Analyst: KEL
Date analyzed: 02-21-02

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 ₂ SO ₄ = (5 ml Na ₂ CO ₃ x 0.05)/E = 0.25/E (acceptable range = 0.018 - 0.022)	pH Factor or Multiplier = (N x 50000) / 100 ml sample = N x 500
6.5	1NR038	1N55078	0.2	12.2	12.0	0.0208	10.4

BVL collection 00-0.1 - 0.1 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%)
1N55079	100	100	12.2	22.1	9.9	10.4	103	103%

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%)
02-19-02	SSW	100	22.1	25.2	3.1	10.4	^S 32	3.2%
02-19-02	Duplicate	100	25.2	28.2	3.0	10.4	^D 31	

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)
1N55079	60	100	25.2	53.7	8.0	10.4	93

Sample alkalinity (B) (mg CaCO ₃ /L)	Measured spike value (MV) (mg CaCO ₃ /L) MV = A - B	% R = MV / SV x 100 (acceptable range = 75 to 125%)
31	52	104%

Sample measurements:

Sample number	Sample ID	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Alkalinity (mg CaCO ₃ /L)
02-12-02	SSW	100	33.2	36.6	3.4	10.4	35
02-12-02A	MITS		36.7	43.4	6.7		70
02-12-02B			1.5	8.3	6.8		70
02-15-02			8.4	14.9	6.5		60
02-18-02A			14.9	21.5	6.6		69
02-18-02B			21.5	28.1	6.6		69
020213.02	KIP-002	1	28.1	26.0	1.3		14
020215.02		2	34.2	35.0	1.4		15
020217.02		3	35.0	40.0	5.2		54

Reviewed by: [Signature]

Date reviewed: 02-25-02

**Alkalinity
(EPA Method 310.1)**

Matrix: Water, MDL = 1.0 mg CaCO₃/L

Analyst KEH
Date analyzed 02-21-02

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 ₂ SO ₄ = (5 ml Na ₂ CO ₃ x 0.05)/E = 0.25/E (acceptable range = 0.018 - 0.022)	pH Factor or Multiplier = (N x 50000)/ 100 ml sample = N x 500

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%)
1NSS079	100	100	15.0	24.0	9.0	10.4	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 = $\frac{ S - D }{(S+D /2)} \times 100$ (acceptable range = ± 10%)
020215.01	KIP INTAKE 2	100	24.0	26.3	1.5	10.4	^S 14	
020215.01	Duplicate	100	26.4	27.8	1.4	10.4	^D 15	6.4

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)
1NSS079	50	100	26.4	32.6	6.2	10.4	64

Sample alkalinity (B) (mg CaCO ₃ /L)	Measured spike value (MV) (mg CaCO ₃ /L) MV = A - B	% R = MV / SV x 100 (acceptable range = 75 to 125%)
15	49	98%

Sample measurements:

Sample number	Sample ID	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Alkalinity (mg CaCO ₃ /L)
020213.08	KIP INTAKE 1	100	47.2	36.4	1.3	10.4	14
020217.01	↓ 3	↓	32.6	36.4	3.8	↓	40
020214.02	G.Town DRI	75	36.4	47.2	10.8	9	220

Reviewed by: KEH

Date reviewed: 02-25-02

**Total Hardness
(EPA Method 130.2)**

Matrix: Water, MDL = 1.0 mg CaCO₃/L

Analyst KEL
Date analyzed 02-21-02

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 = 0.018 - 0.022)	pH Factor or Multiplier = (N x 50000) / 50 ml sample = N x 1000
INR011	INR009	0.1	10.1	10.0	0.020	20

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%)
1NS000	40	50	10.1	12.1	2.0	20	40	100%

Duplicate sample precision:

Sample number	Sample ID	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Hardness (mg CaCO ₃ /L)	%RPD = $\frac{ S - D }{ (S+D)/2 } \times 100$ (acceptable range = ± 10%)
02-12-02	SSW	50	12.3	14.6	2.3	20	^S 46	0.3%
02-12-02	Duplicate	50	14.6	17.1	2.5	20	^D 50	

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)
1NS000	40	50	14.6	19.0	4.4	20	88

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%)
50	38	95%

Sample measurements:

Sample number	Sample ID	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Hardness (mg CaCO ₃ /L)
	Blank (should be = 0 mg CaCO ₃ /L)	50	0.1	0.1	0.0	20	ND
02-19-02	SSW		19.0	21.1	2.1		42
02-12-02 A	MITS		21.1	25.8	4.7		94
02-12-02 B			25.8	30.1	4.3		86
02-15-02			30.1	34.5	4.4		88
02-18-02 A			34.5	38.8	4.3		96
02-18-02 B	↓		38.8	43.1	4.3		86
020213.00	KIP 002	1	0.0	1.5	1.5		30
020215.02	↓	2	1.0	3.2	1.0		32
020217.02	↓	3	3.2	6.5	3.3		66

Note: If >15ml of titrant is used, sample must be diluted.

Reviewed by: [Signature]

Date reviewed 02-25-02

**Total Hardness
(EPA Method 130.2)**

Matrix: Water, MDL = 1.0 mg CaCO₃/L

Analyst KEL
Date analyzed 02.21.02

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 = 0.018 - 0.022)	pH Factor or Multiplier = (N x 50000) / 50 ml sample = N x 1000

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%)
1N5500B	40	50	6.5	9.5	2.0	20	40	100%

Duplicate sample precision:

Sample number	Sample ID	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Hardness (mg CaCO ₃ /L)	%RPD = $\frac{ (S - D) }{((S + D)/2)} \times 100$ (acceptable range = ± 10%)
020213.0B	KIP Intake 1	50	8.5	10.0	1.5	20	^S 30	
020213.0B	Duplicate	50	10.0	11.5	1.5	20	^D 30	

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)
1N5500B	40	50	10.0	13.5	3.5	20	70

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%)
30	40	100%

Sample measurements:

Sample number	Sample ID	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Hardness (mg CaCO ₃ /L)
	Blank (should be = 0 mg CaCO ₃ /L)						
020215.01	KIP Intake 2	50	13.5	14.7	1.2	20	24
020217.01	↓ 3	50	14.7	17.0	3.1	↓	62
020214.02	G. Town - DR1	25	17.0	23.1	5.3 (2)	↓	210

Note: If >15ml of titrant is used, sample must be diluted.

Reviewed by: JF

Date reviewed 02.25.02

**Kingston Fossil Plant Biomonitoring
February 13-20, 2002**

Appendix C

**Reference Toxicant Test and
Control Chart Information**

Environmental Testing Solutions, LLC

Potassium Chloride Chronic Reference Toxicant Control Chart for *Pimephales promelas* using Moderately Hard Synthetic Water

Test number	Test date	7-day IC25 (g KCl/L)	CT (g/L KCl)	S	S _{A.75}	S _{A.90}	CV
1	03-07-00	0.58					
2	03-17-00	0.68	0.63	0.06	0.24	0.28	0.10
3	05-23-00	0.69	0.65	0.06	0.25	0.29	0.09
4	06-13-00	0.72	0.67	0.06	0.25	0.30	0.09
5	06-13-00	0.70	0.67	0.05	0.26	0.30	0.08
6	09-19-00	0.66	0.67	0.05	0.26	0.30	0.07
7	10-24-00	0.77	0.69	0.06	0.26	0.31	0.08
8	11-07-00	0.65	0.68	0.05	0.26	0.31	0.08
9	03-13-01	0.69	0.68	0.05	0.26	0.31	0.07
10	06-26-01	0.53	0.67	0.07	0.25	0.30	0.10
11	07-17-01	0.74	0.67	0.07	0.26	0.30	0.10
12	08-21-01	0.62	0.67	0.07	0.25	0.30	0.10
13	09-25-01	0.60	0.66	0.07	0.25	0.30	0.10
14	11-01-01	0.71	0.67	0.07	0.25	0.30	0.10
15	11-06-01	0.66	0.67	0.06	0.25	0.30	0.09
16	11-27-01	0.57	0.66	0.06	0.25	0.30	0.10
17	12-12-01	0.63	0.66	0.06	0.25	0.30	0.10
18	01-04-02	0.49	0.65	0.07	0.25	0.29	0.11
19	02-05-02	0.61	0.65	0.07	0.25	0.29	0.11
20	02-13-02	0.65	0.65	0.07	0.25	0.29	0.11

Note: 7-d IC25 = 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 IC25).

S = Standard deviation of the IC25 values.

S_{A.75} = Standard deviation corresponding to the the 75th percentile CV.

S_{A.75} = 0.38, as determined by USEPA for the method and endpoint.

S_{A.90} = Standard deviation corresponding to the the 90th percentile CV.

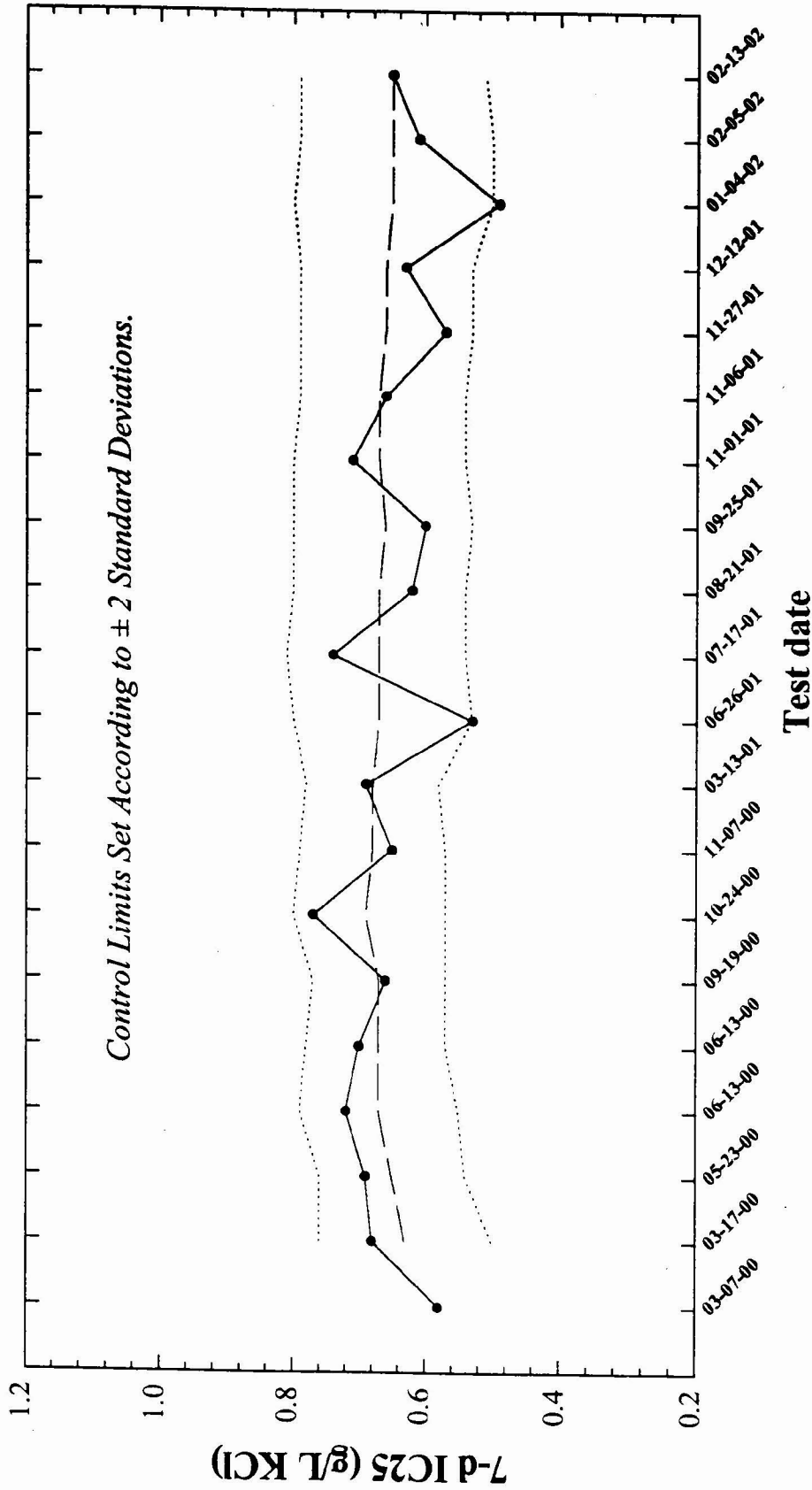
S_{A.90} = 0.45, as determined by the USEPA for the method and endpoint.

CV = Coefficient of variation of the IC25 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.

Environmental Testing Solutions, LLC

Potassium Chloride Chronic Reference Toxicant Control Chart for *Pimephales promelas* using Moderately Hard Synthetic Water



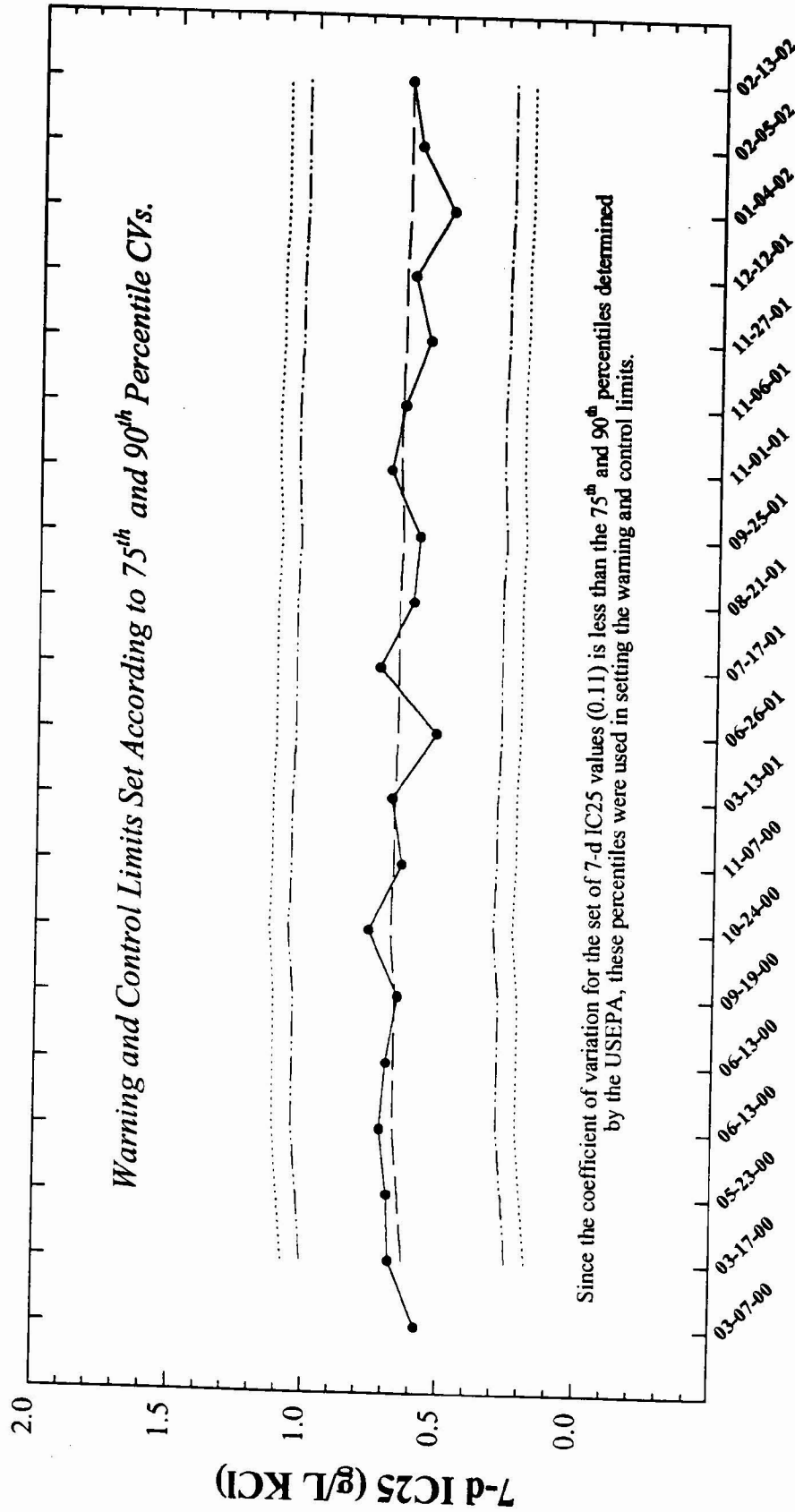
● 7-day IC25 = 25% inhibition concentration. An estimation of the concentration of potassium chloride that would cause a 25% reduction in *Pimephales* growth for the test population.

--- Central Tendency (mean IC25)

..... Control Limits (mean IC25 ± 2 Standard Deviations)

Environmental Testing Solutions, LLC

Potassium Chloride Chronic Reference Toxicant Control Chart for *Pimephales promelas* using Moderately Hard Synthetic Water



Test date

- 7-day IC25 = 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 IC25)
- Warning Limits (mean IC25 ± S_{A,75}, S_{A,75} = 0.38, as determined by USEPA for the method and endpoint)
- Control Limits (mean IC25 ± S_{A,90}, S_{A,90} = 0.45, as determined by USEPA for the method and endpoint)

Environmental Testing Solutions, LLC

Precision of Endpoint Measurements

Potassium Chloride Chronic Reference Toxicant Data for *Pimephales promelas* using Moderately Hard Synthetic Water

Test number	Test date	Control Survival (%)	Control Mean Growth (mg/larvae)	CV (%)	CT for Control Growth CV (%)	MSD	PMSD (%)	CT for PMSD (%)
1	03-07-00	100	0.67	4.9		0.05	7.6	
2	03-17-00	97.5	0.40	7.5	6.2	0.06	15.7	11.7
3	05-23-00	100	0.31	3.6	5.3	0.07	21.2	14.8
4	06-13-00	100	0.45	10.1	6.5	0.10	22.2	16.7
5	06-13-00	100	0.58	13.2	7.9	0.12	20.0	17.3
6	09-19-00	100	0.67	5.3	7.4	0.07	11.2	16.3
7	10-24-00	97.5	0.83	13.3	8.3	0.22	26.9	17.8
8	11-07-00	97.5	0.67	10.5	8.6	0.13	19.3	18.0
9	03-13-01	92.5	0.34	6.5	8.3	0.08	22.8	18.5
10	06-26-01	100	0.63	9.8	8.5	0.19	30.6	19.7
11	07-17-01	100	0.52	9.1	8.5	0.07	13.8	19.2
12	08-21-01	100	0.89	8.3	8.5	0.13	15.1	18.9
13	09-25-01	100	0.85	4.9	8.2	0.09	10.4	18.2
14	11-01-01	100	0.54	2.5	7.8	0.10	18.6	18.2
15	11-06-01	100	1.00	7.4	7.8	0.17	16.9	18.2
16	11-27-01	97.5	0.70	22.8	8.7	0.18	26.1	18.7
17	12-12-01	95	0.82	16.6	9.2	0.19	23.5	18.9
18	01-04-02	95	0.80	10.1	9.2	0.18	22.0	19.1
19	02-05-02	97.5	0.95	6.9	9.1	0.21	22.2	19.3
20	02-13-02	100	0.65	8.0	9.1	0.10	15.5	19.1

Note: CV = Coefficient of variation for control survival.
On average, the CV for control growth is 9.1% in Environmental Testing Solutions, LLC *Pimephales* chronic toxicity tests.
Lower CV bound determined by USEPA (10th percentile) = 3.5%.
Upper CV bound determined by USEPA (90th 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. On average, a significant difference occurs for Environmental Testing Solutions, LLC chronic toxicity tests when a toxicant reduces *Pimephales* growth by 19.1% from the control.
Lower PMSD bound determined by USEPA (10th percentile) = 9.4%.
Upper PMSD bound determined by USEPA (90th percentile) = 35%.

CT = Central Tendency (mean Control Growth CV or mean PMSD)

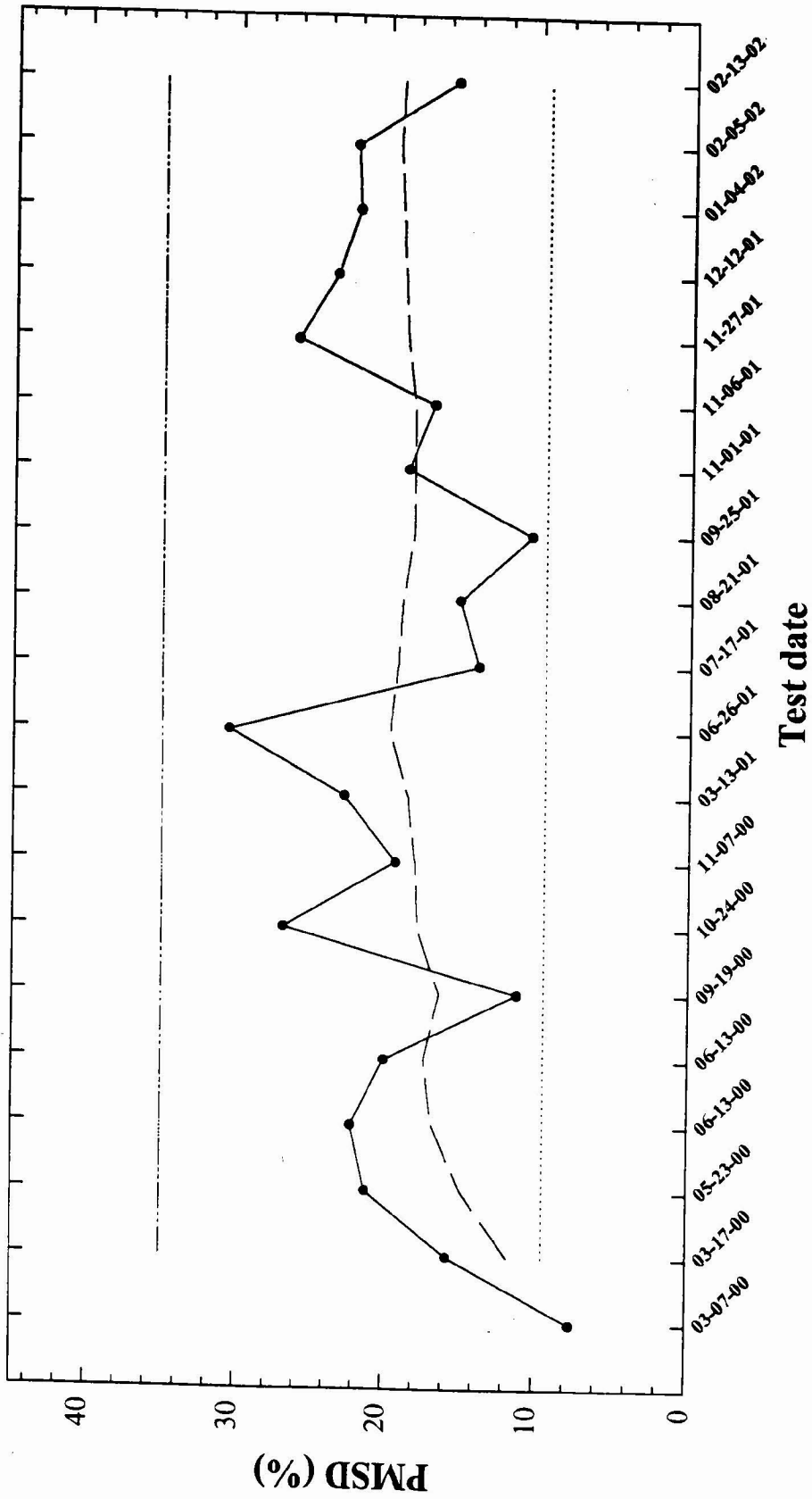
The lower and upper bounds were calculated by the USEPA using 205 tests conducted from 19 laboratories for *Pimephales* growth in chronic reference toxicant tests.

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.

Environmental Testing Solutions, LLC

Precision of Endpoint Measurements

Potassium Chloride Chronic Reference Toxicant Control Chart
for *Pimephales promelas*
using Moderately Hard Synthetic Water



● PMSD = percent minimum significant difference. PMSD is the minimum significant difference between the control and treatment that can be declared statistically significant.
- - Central Tendency (mean PMSD)
..... Lower and Upper PMSD Bounds
Lower PMSD Bound (10th percentile) = 9.4%, Upper PMSD Bound (90th percentile) = 35%
(Lower and upper PMSD bounds were determined by USEPA for the method and endpoint.)

**Potassium Chloride Chronic Reference Toxicant Test
(EPA/600/4-91/002 Method 1000.0)
Species: *Pimephales promelas***

PpKCICR Test Number: 12

<i>Dilution preparation information:</i>						<i>Comments:</i>
KCl CHM number:		CHM 067				
Stock preparation:		50 g KCl/L: Dissolve 50 g KCl in 1-L Deionized water				
Dilution prep (mg/L)	300	450	600	750	900	
Stock volume (mL)	6	9	12	15	18	
Diluent volume (mL)	994	991	988	985	982	

<i>Test organism information:</i>		<i>Test information:</i>	
Organism age:	24-HOURS OLD	Randomizing template:	GREEN
Date and times organisms were born between:	02-12-02 1330 TO 1500 MST	Incubator number:	2
Organism source:	ABS BATCH 02-12-02	Artemia lot number:	BG-0207P
Transfer bowl information:	pH = 7.91 Temperature = 24.6°C	Oven temperature:	60°C
		Drying time:	24-HOURS

Daily feeding and renewal information:

Day	Date	Morning feeding time	Afternoon feeding time	Test initiation, renewal, or termination time	Analyst
0	02-13-02	_____ <i>df</i>	1644	1632	<i>df</i> KEK
1	02-14-02	1036	1645	1630	<i>df</i>
2	02-15-02	1030	1654	1646	<i>df</i>
3	02-16-02	1141	1748	1620	KEK
4	02-17-02	1032	1637	1629	KEK
5	02-18-02	1035	1638	1630	<i>df</i>
6	02-19-02	1039	1640	1636	<i>df</i>
7	02-20-02	_____	_____ <i>df</i>	1611	<i>df</i> /KEK

<i>Control information:</i>		Acceptance criteria	<i>Summary of test endpoints:</i>	
% Mortality:	0%	≤ 20%	7-day LC50	776.6
Average weight per larvae:	0.64P3	≥ 0.25 mg/larvae	NOEC	600
			LOEC	750
			ChV	670.8
			IC25	649.6

PpKCICR Test Number: 12

Survival and Growth Data

Day	CONTROL				300 mg KCl/L				450 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	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	10	10	10	9 ^d	10	10	10	10	10	10	10
A = Pan weight (mg)	14.720	14.680	14.654	15.053	14.663	14.812	15.112	14.631	15.146	14.954	14.702	16.058
B = Pan + Larvae weight (mg)	21.30	20.41	21.56	21.75	20.57	21.50	21.59	21.00	21.51	20.88	20.31	20.72
Larvae weight (mg) = A - B	7.980	6.720	6.904	6.717	5.907	6.688	6.478	6.369	6.364	5.926	5.608	5.662

Calculations and data reviewed: *df*

Comments:

PpKICR Test Number: 12

Survival and Growth Data

Day	600 mg KCl/L				750 mg KCl/L				900 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	10	10	10	10	10	10	10	10	9 ^{1d}	9 ^{1d}	10	10
2	10	10	10	9 ^{1d}	10	10	8 ^{2d}	9 ^{1d}	7 ^{2d}	9	7 ^{3d}	6 ^{4d}
3	10	10	10	9	10	9 ^{1d}	8	9	6 ^{1d}	9	7	5 ^{1d}
4	10	10	9 ^{1d}	8 ^{1d}	8 ^{2d}	9	8	9	6	9	5 ^{2d}	5
5	10	10	9	8	6 ^{2d}	9	8	9	6	6 ^{3d}	4 ^{1d}	3 ^{2d}
6	10	10	9	8	4 ^{2d}	8 ^{1d}	7 ^{1d}	5 ^{4d}	3 ^{3d}	3 ^{2d}	4	2 ^{1d}
7	10	10	9	8	4	3 ^{2d}	7	5	3	3	3 ^{1d}	2
A = Pan weight (mg)	11.710	11.693	11.500	11.055	11.779	11.021	11.709	11.025	11.931	11.001	11.025	11.783
B = Pan + Larvae weight (mg)	21.36	20.96	19.13	19.93	17.73	17.05	20.44	17.72	16.63	16.55	16.70	15.80
Larvae weight (mg) = A - B	6.644	6.267	4.950	4.875	2.953	2.016	5.731	2.905	1.699	1.549	1.675	1.017

Calculations and data reviewed: *JL*

Comments:

Environmental Testing Solutions, LLC

Chronic Whole Effluent Toxicity Test (EPA/600/4-91/002, Method 1000.0)
Species: *Pimephales promelas*

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

Test number: PpKCCR # 12
Test dates: February 13-20, 2002

Reviewed by: 

Concentration (mg/L KCl)	Replicate	Initial number of larvae	Final number of larvae	A = Paas weight (mg)	B = Paas + Larvae weight (mg)	Larvae weight (mg) - A - B	Weight/Initial number of larvae (mg)	Mean survival (%)	Mean weight (mg)	Coefficient of variation (%)	Percent reduction from control (%)
Control	A	10	10	14.720	21.300	6.580	0.6580	100.0	0.6483	8.0	Not applicable
	B	10	10	14.680	20.410	5.730	0.5730				
	C	10	10	14.656	21.560	6.904	0.6904				
	D	10	10	15.033	21.750	6.717	0.6717				
300	E	10	9	14.663	20.570	5.907	0.5907	97.5	0.6361	5.2	1.9
	F	10	10	14.812	21.500	6.688	0.6688				
	G	10	10	15.112	21.590	6.478	0.6478				
	H	10	10	14.631	21.000	6.369	0.6369				
450	I	10	10	15.146	21.510	6.364	0.6364	100.0	0.5890	5.9	9.1
	J	10	10	14.954	20.880	5.926	0.5926				
	K	10	10	14.702	20.310	5.608	0.5608				
	L	10	10	15.058	20.720	5.662	0.5662				
600	M	10	10	14.716	21.360	6.644	0.6644	92.5	0.5584	18.4	13.9
	N	10	10	14.693	20.960	6.267	0.6267				
	O	10	9	14.580	19.130	4.550	0.4550				
	P	10	8	15.055	19.930	4.875	0.4875				
750	Q	10	4	14.777	17.730	2.953	0.2953	47.5	0.3401	47.4	47.5
	R	10	3	15.034	17.050	2.016	0.2016				
	S	10	7	14.709	20.440	5.731	0.5731				
	T	10	5	14.815	17.720	2.905	0.2905				
900	U	10	3	14.931	16.630	1.699	0.1699	27.5	0.1485	21.5	77.1
	V	10	3	15.001	16.550	1.549	0.1549				
	W	10	3	15.025	16.700	1.675	0.1675				
	X	10	2	14.783	15.800	1.017	0.1017				

Dunnnett's MSD value: $\frac{0.1008}{15.5}$
PMSD:

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. On average, a significant difference occurs for Environmental Testing Solutions, LLC chronic toxicity tests when a toxicant reduces Pimephales growth by 19.1% from the control (determined Lower PMSD bound determined by USEPA (10th percentile) = 9.4%, Upper PMSD bound determined by USEPA (90th percentile) = 35%). The lower and upper bounds were calculated by the USEPA using 205 tests conducted from 19 laboratories for Pimephales growth in chronic reference toxicant tests.

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 Aquatic BioSystems, Inc.

Environmental Testing Solutions, LLC

Statistical Analyses

Larval Fish Growth and Survival Test-7 Day Survival					
Start Date:	2/13/02	Test ID:	PpKCCR	Sample ID:	REF-Ref Toxicant
End Date:	2/20/02	Lab ID:	ETS-Bav. Testing Solutions	Sample Type:	KCL-Potassium chloride
Sample Date:		Protocol:	EPAF 91-EPA Freshwater	Test Species:	PP-Pimephales promelas
Comments:					

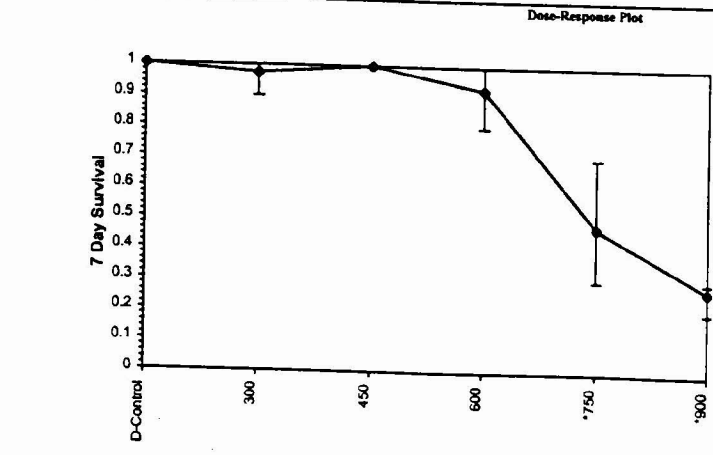
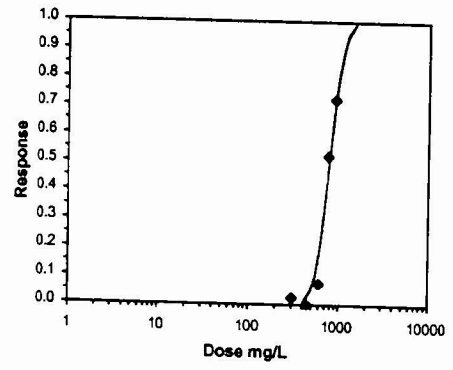
Conc-mg/L	1	2	3	4
D-Control	1.0000	1.0000	1.0000	1.0000
300	0.9000	1.0000	1.0000	1.0000
450	1.0000	1.0000	1.0000	1.0000
600	1.0000	1.0000	0.9000	0.8000
750	0.4000	0.3000	0.7000	0.5000
900	0.3000	0.3000	0.3000	0.2000

Conc-mg/L	Mean	N-Mean	Transform: Arcsin Square Root				Rank Sum	I-Tailed Critical	Number Resp	Total Number
			Mean	Min	Max	CV%				
D-Control	1.0000	1.0000	1.4120	1.4120	1.4120	0.000				
300	0.9750	0.9750	1.3713	1.2490	1.4120	5.942	16.00	10.00	0	
450	1.0000	1.0000	1.4120	1.4120	1.4120	0.000	18.00	10.00	1	
600	0.9250	0.9250	1.2951	1.1071	1.4120	11.347	14.00	10.00	0	
*750	0.4750	0.4750	0.7602	0.5796	0.9912	23.069	10.00	10.00	3	
*900	0.2750	0.2750	0.5506	0.4636	0.5796	10.532	10.00	10.00	21	
									29	

Auxiliary Tests				
Shapiro-Wilk's Test indicates normal distribution ($p > 0.01$)	Statistic	Critical	Skew	Kurt
Equality of variance cannot be confirmed	0.912003458	0.884	0.01746614	1.563854793
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	600	750	670.8203932	

Parameter	Value	SE	95% Fiducial Limits		Maximum Likelihood-Probit						
			Control	Chl-Sq	Critical	P-value	Mu	Sigma	Iter		
Slope	8.156307252	6.13730153	-11.375344	27.68795852	0	69.4112817	7.814724922	5.7E-15	2.89020729	0.122604503	5
Intercept	-18.5734187	17.53962358	-74.3923822	37.24554482							

Point	Probits	mg/L	95% Fiducial Limits
EC01	2.674	402.704574	
EC05	3.355	488.1359875	
EC10	3.718	540.85805	
EC15	3.964	579.6100317	
EC20	4.158	612.3796342	
EC25	4.326	641.9656769	
EC40	4.747	723.0124827	
EC50	5.000	776.6177126	
EC60	5.253	834.1973259	
EC75	5.674	939.5129494	
EC80	5.842	984.9038764	
EC85	6.036	1040.587732	
EC90	6.282	1115.144805	
EC95	6.645	1235.588163	
EC99	7.326	1497.711139	



Organisms obtained from Aquatic BioSystems, Inc.

Environmental Testing Solutions, LLC

Statistical Analyses

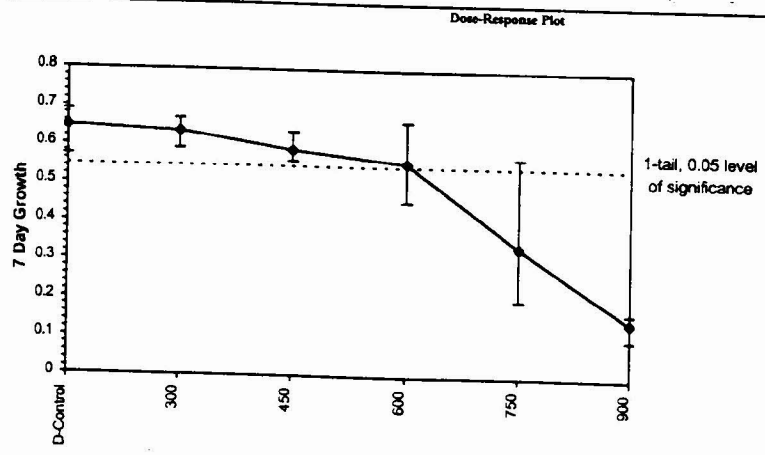
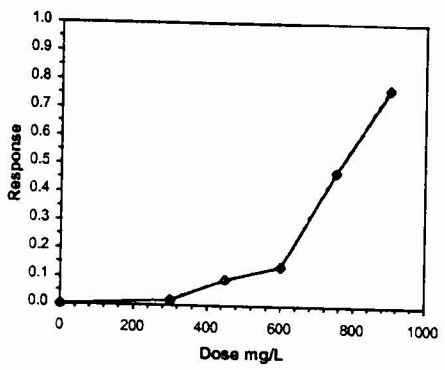
Larval Fish Growth and Survival Test-7 Day Growth					
Start Date:	2/13/02	Test ID:	PpkCICR	Sample ID:	REF-Ref Toxicant
End Date:	2/20/02	Lab ID:	ETS-Env. Testing Solutions	Sample Type:	KCL-Potassium chloride
Sample Date:		Protocol:	EPAF 91-EPA Freshwater	Test Species:	PP-Pimephales promelas
Comments:					

Conc-mg/L	1	2	3	4
D-Control	0.6380	0.5730	0.6904	0.6717
300	0.5907	0.6688	0.6478	0.6369
450	0.6364	0.5926	0.5608	0.5662
600	0.6644	0.6267	0.4550	0.4875
750	0.2953	0.2016	0.5731	0.2905
900	0.1699	0.1549	0.1675	0.1017

Conc-mg/L	Mean	N-Mean	Transform: Untransformed					N	t-Stat	1-Tailed Critical	MSD	Isotonic	
			Mean	Min	Max	CV%	Mean					N-Mean	
D-Control	0.6483	1.0000	0.6483	0.5730	0.6904	8.008	4				0.6483	1.0000	
300	0.6361	0.9811	0.6361	0.5907	0.6688	5.189	4	0.278	2.290	0.1008	0.6361	0.9811	
450	0.5890	0.9086	0.5890	0.5608	0.6364	5.861	4	1.346	2.290	0.1008	0.5890	0.9086	
600	0.5584	0.8614	0.5584	0.4550	0.6644	18.385	4	2.041	2.290	0.1008	0.5584	0.8614	
750	0.3401	0.5247	0.3401	0.2016	0.5731	47.389	4				0.3401	0.5247	
900	0.1485	0.2291	0.1485	0.1017	0.1699	21.472	4				0.1485	0.2291	

Auxiliary Tests					
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)		Statistic	0.985034227	Critical	0.844
Bartlett's Test indicates equal variances (p = 0.19)		Statistic	4.78058672	Critical	11.34488201
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	
Dunnnett's Test	600	>600			
			MSDu	MSDp	MSB
			0.100849062	0.15556525	0.006973359
				MSE	F-Prob
				0.003878848	0.201162338
					df
					3, 12

Point	mg/L	SD	Linear Interpolation (80 Resamples)		
			95% CL(Exp)	Skew	
IC05	364.36	102.98	51.71	742.68	-0.0372
IC10	477.22	95.82	261.25	708.87	-0.0042
IC15	605.06	57.13	392.76	672.49	-0.7218
IC20	627.34	35.79	502.31	698.40	-0.8815
IC25	649.61	35.34	571.57	802.00	0.5916
IC40	716.44	37.36	645.42	838.29	0.3033
IC50	762.51	36.30	670.12	858.53	-0.1525



PpKCICR Test Number: 12

MHS Control Chemistry:

Parameter	Control Batch:		
	02-12-02	02-18-02	
pH (S.U.)	8.09	8.07	/
DO (mg/L)	8.0	7.8	
Conductivity (µmhos/cm)	317	319	
Alkalinity (mg CaCO ₃ /L)	70	69	
Hardness (mg CaCO ₃ /L)	94	86	

Acceptance Criteria for Daily Chemistry:

Concentration	Acceptance Criteria (dilutions must be remade if the conductivity falls outside the acceptable range)
CONTROL	280 - 360
300 mg KCl/L	840 - 890
450 mg KCl/L	1100 - 1180
600 mg KCl/L	1390 - 1460
750 mg KCl/L	1660 - 1710
900 mg KCl/L	1890 - 1950
KCl Stock (25 g KCl/L)	67000 - 76000

PpKCICR Test Number: 12

Daily Chemistry:

Concentration	Parameter	Day					
		0		1		2	
CONTROL	pH (S.U.)	8.09	8.02	8.06	7.75	8.13	7.88
	DO (mg/L)	8.0	7.8	7.8	7.5	8.07	7.6
	Conductivity (µmhos/cm)	317		322		317	
	Temperature (°C)	24.5	24.5	24.2	24.5	24.6	24.3
300 mg KCl/L	pH (S.U.)	8.10	8.03	8.10	7.82	8.14	7.84
	DO (mg/L)	8.1	7.9	8.0	7.6	7.9	7.6
	Conductivity (µmhos/cm)	877		912		917	
	Temperature (°C)	24.4	24.5	24.2	24.4	24.6	24.2
450 mg KCl/L	pH (S.U.)	8.16	8.05	8.12	7.82	8.14	7.83
	DO (mg/L)	8.2	7.9	8.1	7.6	8.0	7.5
	Conductivity (µmhos/cm)	1160		1191		1207	
	Temperature (°C)	24.4	24.5	24.2	24.4	24.6	24.3
600 mg KCl/L	pH (S.U.)	8.18	8.00	8.13	7.80	8.18	7.90
	DO (mg/L)	8.2	7.8	8.1	7.6	8.0	7.5
	Conductivity (µmhos/cm)	1446		1473		1490	
	Temperature (°C)	24.5	24.5	24.2	24.4	24.6	24.3
750 mg KCl/L	pH (S.U.)	8.19	8.09	8.14	7.85	8.10	7.90
	DO (mg/L)	8.3	7.9	8.2	7.5	8.0	7.5
	Conductivity (µmhos/cm)	1693		1732		1764	
	Temperature (°C)	24.5	24.5	24.2	24.4	24.6	24.2
900 mg KCl/L	pH (S.U.)	8.20	8.07	8.14	7.84	8.10	7.93
	DO (mg/L)	8.3	7.9	8.3	7.6	8.1	7.5
	Conductivity (µmhos/cm)	1919		1948		1981	
	Temperature (°C)	24.5	24.5	24.2	24.4	24.6	24.2
		Initial	Final	Initial	Final	Initial	Final

STOCK
CONDUCTIVITY

71000

73200

60100

PpKCICR Test Number: 12

Concentration	Parameter	Day							
		3		4		5		6	
CONTROL	pH (S.U.)	8.06	7.82	8.06	7.69	8.06	7.78	8.07	7.79
	DO (mg/L)	7.9	7.8	7.9	7.3	7.6	7.7	7.8	7.6
	Conductivity (µmhos/cm)	319		297		306		319	
	Temperature (°C)	24.3	24.5	24.7	24.3	24.6	24.5	24.5	24.4
300 mg KCl/L	pH (S.U.)	8.11	7.87	8.12	7.80	8.10	7.87	8.14	7.75
	DO (mg/L)	8.2	7.8	8.1	7.6	7.7	7.7	8.1	7.6
	Conductivity (µmhos/cm)	895		878		852		938	
	Temperature (°C)	24.3	24.5	24.7	24.3	24.6	24.4	24.5	24.4
450 mg KCl/L	pH (S.U.)	8.13	7.82	8.16	7.78	8.15	7.77	8.17	7.90
	DO (mg/L)	8.2	7.8	8.2	7.7	7.7	7.8	8.2	7.5
	Conductivity (µmhos/cm)	1180		1150		1126		1212	
	Temperature (°C)	24.4	24.5	24.7	24.3	24.6	24.4	24.5	24.4
600 mg KCl/L	pH (S.U.)	8.14	7.77	8.16	7.70	8.16	7.85	8.17	7.90
	DO (mg/L)	8.1	7.2	8.2	7.4	7.7	7.6	8.2	7.5
	Conductivity (µmhos/cm)	1473		1431		1415		1488	
	Temperature (°C)	24.4	24.5	24.7	24.3	24.5	24.4	24.5	24.4
750 mg KCl/L	pH (S.U.)	8.15	7.84	8.17	7.81	8.16	7.92	8.17	7.90
	DO (mg/L)	8.2	7.8	8.4	7.6	8.2	7.7	8.3	7.6
	Conductivity (µmhos/cm)	1704		1697		1650		1784	
	Temperature (°C)	24.3	24.5	24.7	24.3	24.5	24.4	24.5	24.4
900 mg KCl/L	pH (S.U.)	8.15	7.87	8.19	7.82	8.17	7.95	8.18	7.94
	DO (mg/L)	8.2	8.0	8.4	7.7	8.5	7.8	8.3	7.6
	Conductivity (µmhos/cm)	1931		1897		1878		1998	
	Temperature (°C)	24.3	24.5	24.7	24.3	24.6	24.4	24.5	24.4
		Initial	Final	Initial	Final	Initial	Final	Initial	Final

69300

69300

70300

71700

Environmental Testing Solutions, LLC

Sodium Chloride Chronic Reference Toxicant Control Chart for *Ceriodaphnia dubia* using Moderately Hard Synthetic Water

Test number	Test date	7-d IC25 (g/L NaCl)	CT (g/L NaCl)	S	S _{A.75}	S _{A.90}	CV
1	12-13-00	0.88					
2	12-17-00	0.91	0.89	0.02	0.40	0.55	0.02
3	12-17-00	0.89	0.89	0.01	0.40	0.55	0.01
4	12-19-00	1.01	0.92	0.06	0.41	0.57	0.06
5	12-19-00	0.97	0.93	0.06	0.42	0.58	0.06
6	01-09-01	0.95	0.93	0.05	0.42	0.58	0.05
7	02-06-01	1.11	0.96	0.08	0.43	0.59	0.08
8	03-07-01	1.04	0.97	0.08	0.44	0.60	0.08
9	04-04-01	1.02	0.98	0.08	0.44	0.60	0.08
10	05-09-01	1.10	0.99	0.08	0.44	0.61	0.08
11	06-06-01	1.07	1.00	0.08	0.45	0.62	0.08
12	07-10-01	1.05	1.00	0.08	0.45	0.62	0.08
13	08-08-01	1.02	1.00	0.08	0.45	0.62	0.08
14	09-12-01	1.02	1.00	0.07	0.45	0.62	0.07
15	10-10-01	1.03	1.01	0.07	0.45	0.62	0.07
16	11-01-01	1.00	1.00	0.07	0.45	0.62	0.07
17	12-05-01	1.05	1.01	0.07	0.45	0.62	0.07
18	01-09-02	0.91	1.00	0.07	0.45	0.62	0.07
19	02-05-02	1.07	1.01	0.07	0.45	0.62	0.07

Note: **7-d IC25** = 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 IC25).

S = Standard deviation of the IC25 values.

S_{A.75} = Standard deviation corresponding to the the 75th percentile CV.

S_{A.75} = 0.45, as determined by USEPA for the method and endpoint.

S_{A.90} = Standard deviation corresponding to the the 90th percentile CV.

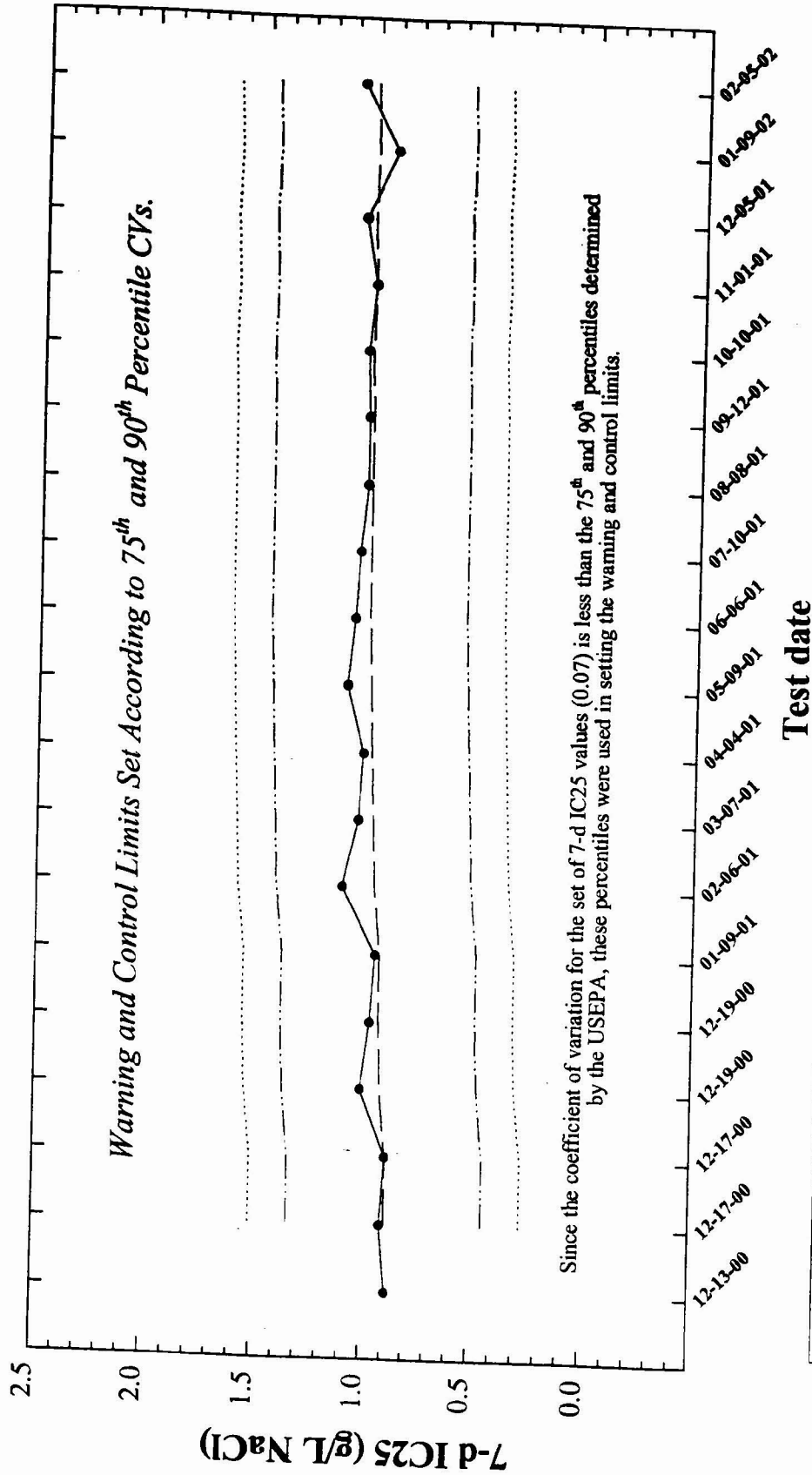
S_{A.90} = 0.62, as determined by the USEPA for the method and endpoint.

CV = Coefficient of variation of the IC25 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.

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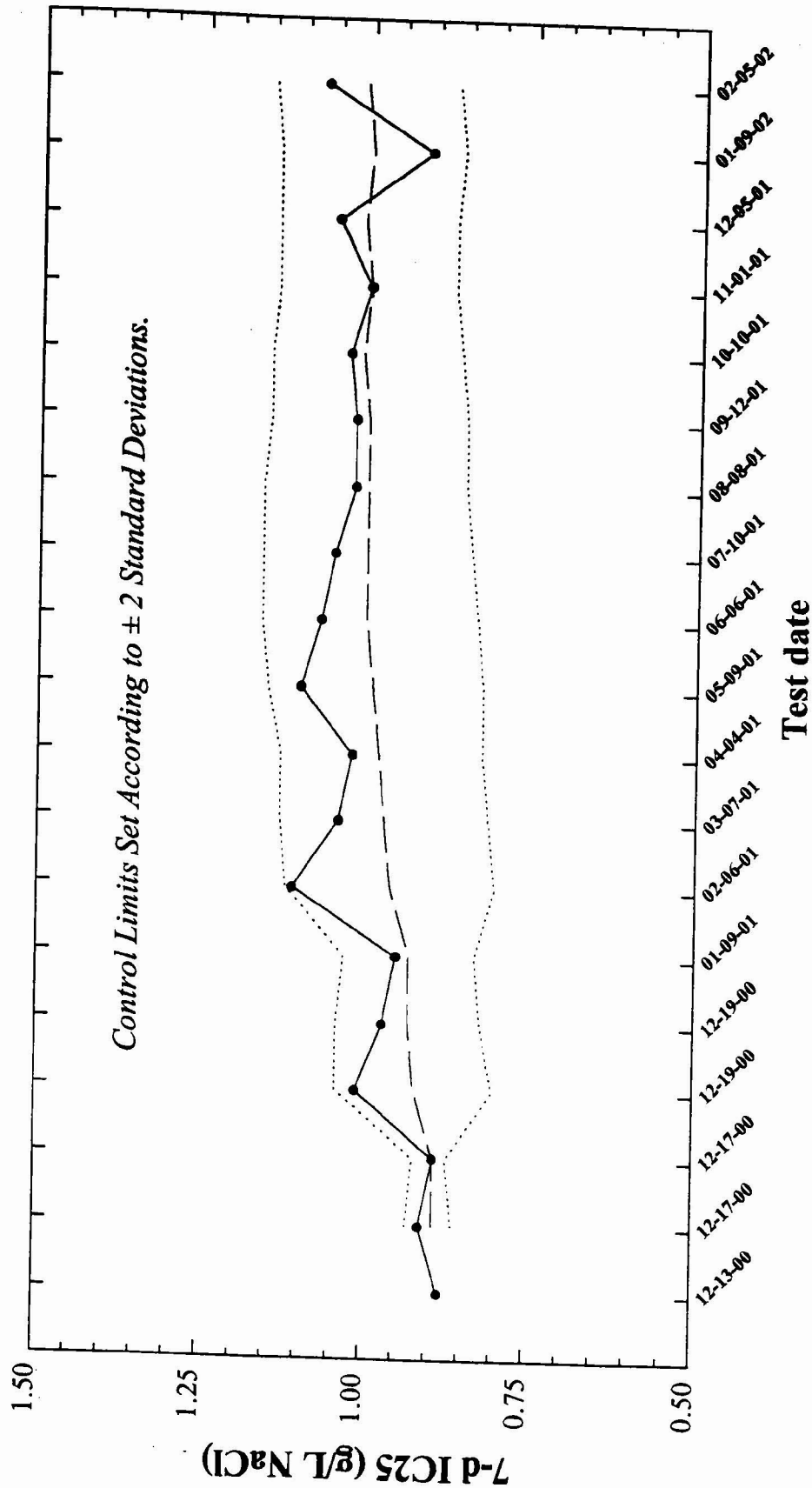
Sodium Chloride Chronic Reference Toxicant Control Chart for *Ceriodaphnia dubia* using Moderately Hard Synthetic Water



- 7-day IC25 = 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 IC25)
- - - Warning Limits (mean IC25 ± S_{A,75}, S_{A,75} = 0.45, as determined by USEPA for the method and endpoint)
- Control Limits (mean IC25 ± S_{A,90}, S_{A,90} = 0.62, as determined by USEPA for the method and endpoint)

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Sodium Chloride Chronic Reference Toxicant Control Chart for *Ceriodaphnia dubia* using Moderately Hard Synthetic Water



—●— 7-day IC25 = 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 IC25)

..... Control Limits (mean IC25 ± 2 Standard Deviations)

Environmental Testing Solutions, LLC

Precision of Endpoint Measurements

Sodium Chloride Chronic Reference Toxicant Data for *Ceriodaphnia dubia* using Moderately Hard Synthetic Water

Test number	Test date	Control Survival (%)	Control Mean Reproduction (offspring/female)	CV (%)	CT for Control Reproduction CV (%)	MSD (%)	PMSD (%)	CT for PMSD (%)
1	12-13-00	100	21.8	11.6		2.6	11.8	
2	12-17-00	100	24.0	16.0	13.8	3.5	14.6	13.2
3	12-17-00	100	25.6	4.6	10.7	3.3	12.9	13.1
4	12-19-00	100	24.8	9.5	10.4	4.6	18.4	14.4
5	12-19-00	100	25.1	19.2	12.2	5.0	19.8	15.5
6	01-09-01	100	28.0	8.4	11.6	3.5	12.4	15.0
7	02-06-01	100	22.1	10.1	11.3	3.1	14.2	14.9
8	03-07-01	100	24.0	8.3	11.0	2.4	10.1	14.3
9	04-04-01	100	25.0	10.0	10.9	2.9	11.8	14.0
10	05-09-01	100	27.9	8.9	10.7	3.1	11.0	13.7
11	06-06-01	100	27.8	5.8	10.2	3.5	12.5	13.6
12	07-10-01	100	25.0	9.4	10.1	2.8	11.2	13.4
13	08-08-01	100	30.9	2.4	9.6	2.7	8.7	13.0
14	09-12-01	100	28.6	6.6	9.3	2.7	9.4	12.8
15	10-10-01	100	24.9	8.8	9.3	2.5	9.9	12.6
16	11-01-01	100	27.0	6.5	9.1	3.1	11.6	12.5
17	12-05-01	100	24.8	9.1	9.1	4.8	19.5	12.9
18	01-09-02	100	27.5	7.5	9.0	4.5	16.3	13.1
19	02-05-02	100	23.1	10.1	9.1	2.6	11.1	13.0

Note: CV = Coefficient of variation for control reproduction.
 On average, the CV for control reproduction is 9.1% in Environmental Testing Solutions, LLC
 Lower CV bound determined by USEPA (10th percentile) = 8.9%.
 Upper CV bound determined by USEPA (90th 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. On average, a significant difference occurs for Environmental Testing Solutions, LLC chronic toxicity tests when a toxicant reduces *Ceriodaphnia* reproduction by 13.0% from the control.

Lower PMSD bound determined by USEPA (10th percentile) = 11%.
 Upper PMSD bound determined by USEPA (90th percentile) = 37%.

CT = Central Tendency (mean Control Reproduction CV or mean PMSD)

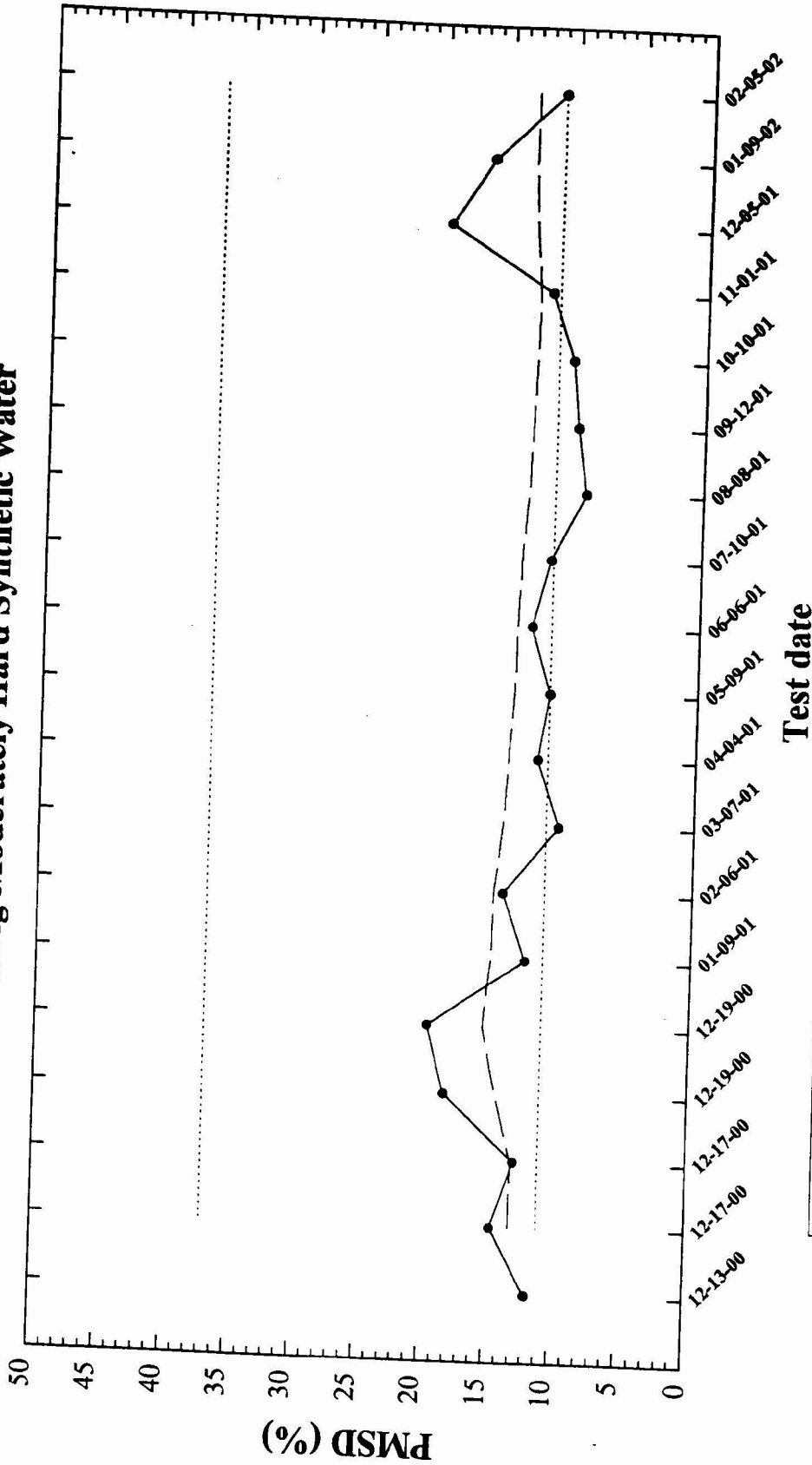
The lower and upper bounds were calculated by the USEPA using 393 tests conducted from 33 laboratories for *Ceriodaphnia* reproduction in chronic reference toxicant tests.

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.

Environmental Testing Solutions, LLC

Precision of Endpoint Measurements

Sodium Chloride Chronic Reference Toxicant Control Chart
for *Ceriodaphnia dubia*
using Moderately Hard Synthetic Water



Test date

● PMSD = percent minimum significant difference. PMSD is the minimum significant difference between the control and treatment that can be declared statistically significant.
— Central Tendency (mean PMSD)
- - - Lower and Upper PMSD Bounds
Lower PMSD Bound (10th percentile) = 11%, Upper PMSD Bound (90th percentile) = 37%
(Lower and upper PMSD bounds were determined by USEPA for the method and endpoint.)

Sodium Chloride Chronic Reference Toxicant Test
(EPA/600/4-91/002 Method 1002.0)

Species: *Ceriodaphnia dubia*

Date	Time	Analyst
02-05-02	1337	JL
02-12-02	1340	JL

CdNaClCR Test Number: 19

Dilution preparation information:						Comments:
NaCl CHM number:	CHM 060					
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	

Test organism information:		Test information:	
Organism age:	24-HOURS OLD	Randomizing template:	YELLOW
Date and times organisms were born between:	02-04-02 1538 TO 1801	Incubator number:	2
Organism source:	D1-29-02 A+B	YCT batch:	ABS 01-23-02
Transfer bowl information:	pH = 8.08 Temperature (°C) = 24.6	Selenastrum batch:	ABS 01-23-02

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	4	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
4	Young produced	4	0	3	3	4	4	5	6	5	5
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	6	7	6	6	8	7	8	8	8	7
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	0	13	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	12	0	12	10	10	13	12	11	14	10
Total young produced		22	24	21	19	22	24	25	25	27	22
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L
X for 3 rd Broods		X	X	X	X	X	X	X	X	X	X

Calculations and data reviewed: JL

Test Renewal, Feeding, and Randomization Record Label

	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Date	02-11	02-05	02-06	02-07	02-08	02-09	02-10
Time	1310	1331	1342	1342	1328	1322	1300
Analyst	JL	JL	JL	JL	JL	JL	JL
Shelf	C3	C3	C3	C3	C3	C3	C3
Location							

Control information:	Acceptance criteria	Summary of test endpoints (mg NaCl/L):	
% of Male Adults:	≤ 20%	7-day LC50	> 1400
% Adults having 3 rd Broods:	≥ 80%	NOEC	800
% Mortality:	≤ 20%	LOEC	1000
Mean Offspring/Female:	≥ 15.0 offspring/female	ChV	894.4
% CV:	< 40.0 %	IC25	1072.5

CdNaCICR Test Number: 19

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	3	0	4	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
4	Young produced	1	3	0	4	3	4	5	4	6	5
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	8	7	8	6	6	9	7	8	6	9
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	12	0	0	0	0	0	0	0	1	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	0	13	10	10	11	12	12	10	13	11
Total young produced		24	23	22	20	20	25	24	22	25	25
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	23.08
% Reduction from Control:	0.4%

23.1
0%

Calculations and data reviewed: st

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	4	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
4	Young produced	4	3	0	4	4	4	4	5	3	4
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	6	6	8	7	7	6	10	6	7	8
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	3	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	12	10	10	14	12	9	11	10	14	12
Total young produced		25	19	22	25	23	19	25	21	24	24
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	22.7
% Reduction from Control:	1.7%

Calculations and data reviewed: st

CdNaClCR Test Number: 19

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	3	3	3	2	3	4	3	5	2	3
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	8	6	9	7	9	7	6	6	7	7
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	11	8	10	10	11	9	10	10	9	8
Total young produced		22	17	22	19	23	20	19	21	18	18
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	19.9
% Reduction from Control:	13.9%

Calculations and data reviewed: dl

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	2	3	3	1	2	3	2	2	2	3
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	8	6	5	6	6	4	4	1	7	6
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	0	0	2	0	4	0	0	0	6	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	6	0	0	11	0	8	9	5	1	0
Total young produced		16	9	10	18	12	15	15	8	16	9
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	12.8
% Reduction from Control:	44.6%

Calculations and data reviewed: dl

CdNaClCR Test Number: 19

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	0	1	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	4	3	2	4	1	3	1	3	4	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	0	0	0	0	0	0	0	0	2	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	1	3	0	0	4	3	6	4	0	0
Total young produced		5	7	2	4	5	6	7	7	6	0
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	4.9
% Reduction from Control:	78.8%

Calculations and data reviewed: JA

Environmental Testing Solutions, LLC

Statistical Analyses

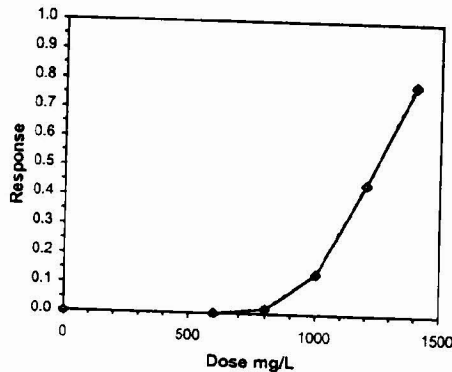
Ceriodaphnia Survival and Reproduction Test-Reproduction										
Start Date:	2/5/02	Test ID:	CdNaClCR	Sample ID:	REF-Ref Toxicant					
End Date:	2/12/02	Lab ID:	ETS-Env. Testing Solutions	Sample Type:	NaCl-Sodium chloride					
Sample Date:		Protocol:	EPAF 91-EPA Freshwater	Test Species:	CD-Ceriodaphnia dubia					
Comments:										

Cono-mg/L	1	2	3	4	5	6	7	8	9	10
D-Control	22.000	24.000	21.000	19.000	22.000	24.000	25.000	25.000	27.000	22.000
600	24.000	23.000	22.000	20.000	20.000	25.000	24.000	22.000	26.000	23.000
800	25.000	19.000	22.000	23.000	23.000	19.000	25.000	21.000	24.000	24.000
1000	22.000	17.000	22.000	19.000	23.000	20.000	19.000	21.000	18.000	18.000
1200	16.000	9.000	10.000	18.000	12.000	15.000	15.000	8.000	16.000	9.000
1400	5.000	7.000	2.000	4.000	5.000	6.000	7.000	7.000	6.000	0.000

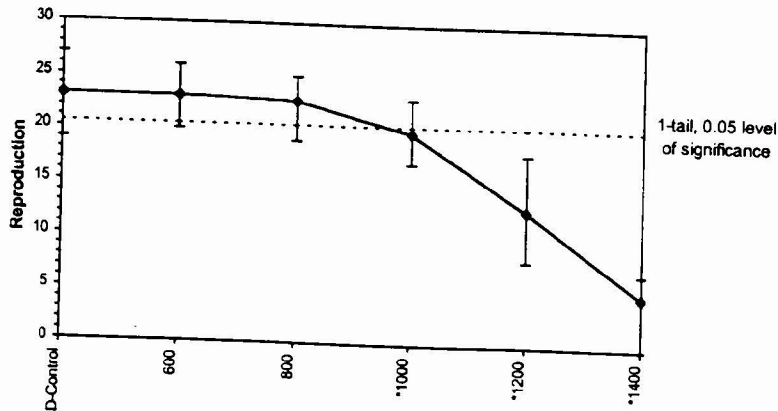
Cono-mg/L	Mean	N-Mean	Transformed Untransformed						t-Stat	1-Tailed Critical	MSD	Isotonic	
			Mean	Min	Max	CV%	N	Mean				N-Mean	
D-Control	23.100	1.0000	23.100	19.000	27.000	10.091	10				23.100	1.0000	
600	23.100	1.0000	23.100	20.000	26.000	9.000	10	0.000	2.287	2.571	23.100	1.0000	
800	22.700	0.9827	22.700	19.000	25.000	10.394	10	0.356	2.287	2.571	22.700	0.9827	
*1000	19.900	0.8615	19.900	17.000	23.000	10.175	10	2.846	2.287	2.571	19.900	0.8615	
*1200	12.800	0.5541	12.800	8.000	18.000	28.241	10	9.161	2.287	2.571	12.800	0.5541	
*1400	4.900	0.2121	4.900	0.000	7.000	47.570	10	16.188	2.287	2.571	4.900	0.2121	

Auxiliary Tests							
Kolmogorov D Test indicates normal distribution (p > 0.01)				Statistic	Critical	Skew	Kurt
Bartlett's Test indicates equal variances (p = 0.49)				1.013699293	1.035	-0.269182039	-0.769287695
Hypothesis Test (1-tail, 0.05)				NOEC	LOEC	ChV	TU
Dunnnett's Test				800	1000	894.427191	
				MSDa	MSDp	MSB	MSE
				2.570923277	0.11129538	551.99	6.32037037
				F-Prob	df		
				1.3E-24	5, 54		

Point	mg/L	SD	Linear Interpolation (80 Resamples)			
			95% CL		Skew	
IC05	853.9285714	124.9585875	406.5833333	897.604249	-1.9012	
IC10	936.4285714	55.25304671	788.8666667	1003.449466	-0.7789	
IC15	1007.464789	37.55514641	890.1826923	1033.676681	-1.2226	
IC20	1040	20.52487717	984.5714286	1066.136275	-0.3918	
IC25	1072.535211	19.23479909	1030.745614	1100.905816	0.0937	
IC40	1170.140845	25.77623754	1123.013068	1213.401099	0.3315	
IC50	1231.64557	24.33635566	1176.598681	1265.472561	-0.1609	



Dose-Response Plot



Environmental Testing Solutions, LLC

Chronic Whole Effluent Toxicity Test (EPA/600/4-91/002, Method 1002.0)

Species: *Ceriodaphnia dubia*

Quality Control

Verification of Data Entry, Calculations, and Statistical Analyses

Test number: CdNaClCR #19

Test dates: February 5-12, 2002

Reviewed by: *J. J. J.*

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	22	24	21	19	22	24	25	25	27	22	100	23.1	10.1	Not applicable
600	24	23	22	20	20	25	24	22	26	25	100	23.1	9.0	0.0
800	25	19	22	25	23	19	25	21	24	24	100	22.7	10.4	1.7
1000	22	17	22	19	23	20	19	21	18	18	100	19.9	10.2	13.9
1200	16	9	10	18	12	15	15	8	16	9	100	12.8	28.2	44.6
1400	5	7	2	4	5	6	7	7	6	0	100	4.9	47.6	78.8

Dunnnett's MSD value: 2.571
PMSD: 11.1

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. On average, a significant difference occurs for Environmental Testing Solutions, LLC chronic toxicity tests when a toxicant reduces *Ceriodaphnia* reproduction by 13.0% from the control.

Lower PMSD bound determined by USEPA (10th percentile) = 11%.

Upper PMSD bound determined by USEPA (90th percentile) = 37%.

The lower and upper bounds were calculated by the USEPA using 393 tests conducted from 33 laboratories for *Ceriodaphnia* reproduction in chronic reference toxicant tests.

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.

CdNaClCR Test Number: 19

MHS Control Chemistry:

Parameter	Control Batch:		
	02-04-02	02-07-02	
pH (S.U.)	8.10	8.09	
DO (mg/L)	7.9	7.7	<i>OK</i>
Conductivity (µmhos/cm)	306	324	
Alkalinity (mg CaCO ₃ /L)	64	66	
Hardness (mg CaCO ₃ /L)	88	90	

Acceptance Criteria for Daily Chemistry:

Concentration	<i>OK</i> Acceptance Criteria (dilutions must be remade if the conductivity falls outside the acceptable range)
CONTROL	280 - 360
600 mg NaCl/L	1390 - 1590
800 mg NaCl/L	1780 - 1970
1000 mg NaCl/L	2190 - 2370
1200 mg NaCl/L	2550 - 2740
1400 mg NaCl/L	2910 - 3160
NaCl Stock	110500 - 116300

Recalculating acceptable ranges - range for guidance only.

CdNaCICR Test Number: 19

Daily Chemistry:

Concentration	Parameter	Day					
		0		1		2	
CONTROL	pH (S.U.)	8.10	8.10	8.08	8.08	8.04	8.04
	DO (mg/L)	7.9	8.1	7.8	8.2	7.8	8.1
	Conductivity (µmhos/cm)	300 337		309		319	
	Temperature (°C)	24.8	24.2	24.2	24.5	24.5	24.3
600 mg NaCl/L	pH (S.U.)	8.14	8.12	8.12	8.09	8.13	8.09
	DO (mg/L)	8.0	8.0	7.8	8.1	8.0	8.2
	Conductivity (µmhos/cm)	1580		1458 1422		1494	
	Temperature (°C)	24.8	24.2	24.3	24.5	24.6	24.3
800 mg NaCl/L	pH (S.U.)	8.15	8.17	8.14	8.08	8.12	8.10
	DO (mg/L)	8.0	8.0	7.8	8.2	8.1	8.2
	Conductivity (µmhos/cm)	1901		1827		1828	
	Temperature (°C)	24.8	24.2	24.3	24.5	24.5	24.3
1000 mg NaCl/L	pH (S.U.)	8.14	8.12	8.14	8.08	8.12	8.11
	DO (mg/L)	8.0	8.1	7.8	8.2	8.1	8.2
	Conductivity (µmhos/cm)	2330		2193		2193	
	Temperature (°C)	24.8	24.2	24.2	24.5	24.5	24.3
1200 mg NaCl/L	pH (S.U.)	8.14	8.12	8.14	8.08	8.12	8.10
	DO (mg/L)	8.0	8.0	7.9	8.2	8.1	8.3
	Conductivity (µmhos/cm)	2710		2560		2570	
	Temperature (°C)	24.8	24.2	24.2	24.5	24.5	24.3
1400 mg NaCl/L	pH (S.U.)	8.14	8.14	8.15	8.07	8.12	8.09
	DO (mg/L)	8.1	8.0	8.0	8.2	8.1	8.3
	Conductivity (µmhos/cm)	3080		2930		2896	
	Temperature (°C)	24.8	24.2	24.3	24.5	24.5	24.3
		Initial	Final	Initial	Final	Initial	Final

Stock Conductivity 116300

111400

110900

CdNaClCR Test Number: 19

Concentration	Parameter	Day							
		3		4		5		6	
CONTROL	pH (S.U.)	8.09	8.23	8.10	8.10	8.09	8.17	8.10	8.16
	DO (mg/L)	7.7	8.2	8.0	8.0	7.8	8.0	7.8	7.8
	Conductivity (µmhos/cm)	324		324		316		311	
	Temperature (°C)	24.2	24.4	24.4	24.3	24.3	24.5	24.3	24.6
600 mg NaCl/L	pH (S.U.)	8.13	8.23	8.14	8.08	8.16	8.15	8.17	8.14
	DO (mg/L)	8.0	8.3	8.0	8.0	7.9	8.0	8.0	7.8
	Conductivity (µmhos/cm)	1500		1462		1496		1576	
	Temperature (°C)	24.2	24.4	24.4	24.3	24.3	24.5	24.3	24.6
800 mg NaCl/L	pH (S.U.)	8.12	8.23	8.14	8.10	8.16	8.14	8.16	8.14
	DO (mg/L)	8.3	8.2	8.1	8.0	7.9	8.0	8.0	7.8
	Conductivity (µmhos/cm)	1870		1824		1866		1906	
	Temperature (°C)	24.2	24.3	24.4	24.3	24.3	24.4	24.3	24.6
1000 mg NaCl/L	pH (S.U.)	8.12	8.24	8.15	8.16	8.17	8.14	8.15	8.14
	DO (mg/L)	8.3	8.1	8.1	8.0	7.9	8.0	8.2	7.8
	Conductivity (µmhos/cm)	2250		2203		2267		2380	
	Temperature (°C)	24.2	24.4	24.4	24.3	24.3	24.5	24.3	24.6
1200 mg NaCl/L	pH (S.U.)	8.13	8.23	8.16	8.11	8.16	8.14	8.15	8.14
	DO (mg/L)	8.4	8.2	8.3	8.0	8.0	8.0	8.3	7.8
	Conductivity (µmhos/cm)	2226		2250		2621		2740	
	Temperature (°C)	24.2	24.4	24.4	24.3	24.3	24.5	24.3	24.6
1400 mg NaCl/L	pH (S.U.)	8.13	8.23	8.16	8.13	8.16	8.13	8.15	8.15
	DO (mg/L)	8.4	8.2	8.4	8.0	8.0	8.0	8.3	7.9
	Conductivity (µmhos/cm)	2987		2887		2964		3150	
	Temperature (°C)	24.2	24.4	24.4	24.3	24.3	24.5	24.3	24.6
		Initial	Final	Initial	Final	Initial	Final	Initial	Final

111700

110200

109700

111000