Tennessee Valley Authority, 1499 Steam Plant Road, Gallatin, Tennessee 37066-8714

January 9, 2012

Mr. Patrick Cromer
Division of Water Pollution Control
Enforcement and Compliance Section
6th Floor, L&C Annex
401 Church Street
Nashville, Tennessee 37243-1534

Dear Mr. Cromer:

Enclosed are certified copies of the TVA - Gallatin Fossil Plant Discharge Monitoring Reports (DMRs) for February 2012. Also included are the annual toxicity testing results for the ash pond discharge (Outfall 001) as prescribed in Part III E of the NPDES permit for Gallatin Fossil Plant. A computer disk that contains the DMR data is attached.

If you have any questions concerning these reports or if additional information is required, please contact Michael T. Gray, Program Administrator(Environmental),615-230-4066, or Ronnie Wyatt, Acting Manager (Engineering), 615-230-2638.

*I certify under penalty of law that I have personally examined and am familiar with the information submitted in the attached document; and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.*

Sincerely,

Scott A. Hadfield
Plant Manager

Enclosures

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

*Document Type: NPDES Permit Compliance Records*

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Sincerely,

Scott A. Hadfield
Plant Manager

Enclosures

MTG/ksl

cc: (Enclosures):
M. T. Gray, Gallatin
S. W. Hixson, BR 4A-C
C. Smith, MCT 1A-CCK
K. Ward, EDMS, BR 4A-C

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

PERMITTEE NAME/ADDRESS *(Include Facility Name/Location if Different)*

Name: TVA - Gallatin Fossil Plant
Address: Plant Manager
1499 Steam Plant Road
Gallatin TN 37066
Facility: TVA-Gallatin Fossil
Location: Sumner Co. (NEAC)

Attn: M. T. Gray, Program Administrator (Env.)

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM *(NPDES)*
**DISCHARGE MONITORING REPORT** *(DMR)*

| (2-16) | (17-19) |
|---|---|
| TN0005428 | 001 G |
| PERMIT NUMBER | DISCHARGE NUMBER |

MONITORING PERIOD

| | YEAR | MO | DAY | | YEAR | MO | DAY |
|---|---|---|---|---|---|---|---|
| From | 12 | 02 | 01 | To | 12 | 02 | 29 |
| | (20-21) | (22-23) | (24-25) | | (26-27) | (28-29) | (30-31) |

MAJOR
(SUBR 04)
F - FINAL
ASH POND DISCHARGE
Effluent

*** NO DISCHARGE [ ] ***

Form Approved.
OMB No. 2040-0004
Approval expires 05-31-98

NOTE: Read instructions before completing this form.

| PARAMETER (32-37) | | (3 Card Only) QUANTITY OR LOADING (46-53) AVERAGE | (54-61) MAXIMUM | UNITS | (4 Card Only) QUALITY OR CONCENTRATION (38-45) MINIMUM | (46-53) AVERAGE | (54-61) MAXIMUM | UNITS | NO. EX (62-63) | FREQUENCY OF ANALYSIS (64-68) | SAMPLE TYPE (69-70) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PH | SAMPLE MEASUREMENT | ******** | ******** | ** | 7.6 | ******** | 8.4 | 12 | 0 | 10 / 29 | GRAB |
| 00400 1 0 0 EFFLUENT GROSS VALUE | PERMIT REQUIREMENT | ******** | ******** | **** | 6.0 MINIMUM | ******** | 9.0 MAXIMUM | SU | | WEEKLY | GRAB |
| SOLIDS, TOTAL SUSPENDED | SAMPLE MEASUREMENT | ******** | ******** | ** | ******** | 10.0 | 10.0 | 19 | 0 | 1 / 29 | GRAB |
| 00530 1 0 0 EFFLUENT GROSS VALUE | PERMIT REQUIREMENT | ******** | ******** | **** | ******** | 28 MO AVG | 92.7 MAXIMUM | MG/L | | ONCE/ MONTH | GRAB |
| OIL AND GREASE | SAMPLE MEASUREMENT | ******** | ******** | ** | ******** | <5.0 | <5.0 | 19 | 0 | 1 / 29 | GRAB |
| 00556 1 0 0 EFFLUENT GROSS VALUE | PERMIT REQUIREMENT | ******** | ******** | **** | ******** | 14 MO AVG | 18 MAXIMUM | MG/L | | ONCE/ MONTH | GRAB |
| FLOW, IN CONDUIT OR THRU TREATMENT PLANT | SAMPLE MEASUREMENT | 29.97 | 31.13 | 03 | ******** | ******** | ******** | ** | 0 | 4 / 29 | WEIR |
| 50050 1 0 0 EFFLUENT GROSS VALUE | PERMIT REQUIREMENT | REPORT MO AVG | REPORT DAILY MX | MGD | ******** | ******** | ******** | **** | | WEEKLY | INSTAN |
| | SAMPLE MEASUREMENT | | | | | | | | | | |
| | PERMIT REQUIREMENT | | | | | | | | | | |
| | SAMPLE MEASUREMENT | | | | | | | | | | |
| | PERMIT REQUIREMENT | | | | | | | | | | |
| | SAMPLE MEASUREMENT | | | | | | | | | | |
| | PERMIT REQUIREMENT | | | | | | | | | | |

| NAME/TITLE PRINCIPAL EXECUTIVE OFFICER | | | TELEPHONE | | DATE | | |
|---|---|---|---|---|---|---|---|
| Dennis R. Spencer<br>Vice President - Coal Operations, FPG | I CERTIFY UNDER PENALTY OF LAW THAT I HAVE PERSONALLY EXAMINED AND AM FAMILIAR WITH THE INFORMATION SUBMITTED HEREIN; AND BASED ON MY INQUIRY OF THOSE INDIVIDUALS IMMEDIATELY RESPONSIBLE FOR OBTAINING THE INFORMATION, I BELIEVE THE SUBMITTED INFORMATION IS TRUE, ACCURATE AND COMPLETE. I AM AWARE THAT THERE ARE SIGNIFICANT PENALTIES FOR SUBMITTING FALSE INFORMATION, INCLUDING THE POSSIBILITY OF FINE AND IMPRISONMENT. SEE 18 U.S.C. §1001 AND 33 U.S.C. §1319. (Penalties under these statutes may include fines up to $10,000 and or maximum imprisonment of between 6 months and 5 years.) | Plant Manager<br>SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT | 615 | 230-4091 | 12 | 03 | 09 |
| TYPED OR PRINTED | | | AREA CODE | NUMBER | YEAR | MO | DAY |

COMMENTS AND EXPLANATION OF ANY VIOLATIONS *(Reference all attachments here)*

PERMITTEE NAME/ADDRESS *(Include Facility Name/Location if Different)*

Name: TVA - Gallatin Fossil Plant
Address: Plant Manager
1499 Steam Plant Road
Gallatin TN 37066
Facility: TVA-Gallatin Fossil
Location: Sumner Co. (NEAC)

Attn: M. T. Gray, Program Administrator (Env.)

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM *(NPDES)*
**DISCHARGE MONITORING REPORT** *(DMR)*

| (2-16) PERMIT NUMBER | (17-19) DISCHARGE NUMBER |
|---|---|
| TN0005428 | 001 T |

MONITORING PERIOD

| | YEAR | MO | DAY | | YEAR | MO | DAY |
|---|---|---|---|---|---|---|---|
| From | 12 | 02 | 01 | To | 12 | 02 | 29 |
| | (20-21) | (22-23) | (24-25) | | (26-27) | (28-29) | (30-31) |

MAJOR
(SUBR 04)
F - FINAL
ASH POND DISCHARGE
Effluent

*** NO DISCHARGE ***

Form Approved.
OMB No. 2040-0004
Approval expires 05-31-98

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| PARAMETER (32-37) | | (3 Card Only) QUANTITY OR LOADING (46-53) AVERAGE | (54-61) MAXIMUM | UNITS | (4 Card Only) QUALITY OR CONCENTRATION (38-45) MINIMUM | (46-53) AVERAGE | (54-61) MAXIMUM | UNITS | NO. EX (62-63) | FREQUENCY OF ANALYSIS (64-68) | SAMPLE TYPE (69-70) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| IC25 STATRE 7DAY CHR CERIODAPHNIA | SAMPLE MEASUREMENT | ******** | ******** | ** | >20.4 | ******** | ******** | 23 | 0 | 1 / 365 | |
| TRP3B 1 0 0 EFFLUENT GROSS VALUE | PERMIT REQUIREMENT | ******** | ******** | **** | REPORT MINIMUM | ******** | ******** | PERCENT | | ANNUAL | COMPOS |
| IC25 STATRE 7DAY CHR PIMEPHALES | SAMPLE MEASUREMENT | ******** | ******** | ** | >20.4 | ******** | ******** | 23 | 0 | 1 / 365 | |
| TRP6C 1 0 0 EFFLUENT GROSS VALUE | PERMIT REQUIREMENT | ******** | ******** | **** | REPORT MINIMUM | ******** | ******** | PERCENT | | ANNUAL | COMPOS |
| | SAMPLE MEASUREMENT | | | | | | | | | | |
| | PERMIT REQUIREMENT | | | | | | | | | | |
| | SAMPLE MEASUREMENT | | | | | | | | | | |
| | PERMIT REQUIREMENT | | | | | | | | | | |
| | SAMPLE MEASUREMENT | | | | | | | | | | |
| | PERMIT REQUIREMENT | | | | | | | | | | |
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| | PERMIT REQUIREMENT | | | | | | | | | | |

| NAME/TITLE PRINCIPAL EXECUTIVE OFFICER | | | TELEPHONE | | DATE | | |
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COMMENTS AND EXPLANATION OF ANY VIOLATIONS *(Reference all attachments here)*

Composite sampling method utilized for toxicity tests.

PERMITTEE NAME/ADDRESS *(Include Facility Name/Location if Different)*

Name: TVA - Gallatin Fossil Plant
Address: Plant Manager
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Gallatin TN 37066
Facility: TVA-Gallatin Fossil
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Attn: M. T. Gray, Program Administrator (Env.)

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM *(NPDES)*
**DISCHARGE MONITORING REPORT** *(DMR)*

(2-16) TN0005428 — PERMIT NUMBER
(17-19) 002 G — DISCHARGE NUMBER

MONITORING PERIOD

| | YEAR | MO | DAY | | YEAR | MO | DAY |
|---|---|---|---|---|---|---|---|
| From | 12 | 02 | 01 | To | 12 | 02 | 29 |
| | (20-21) | (22-23) | (24-25) | | (26-27) | (28-29) | (30-31) |

MAJOR
(SUBR 04)
F - FINAL
COOLING WATER, STORM WATER
Effluent

*** NO DISCHARGE ***

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|---|---|---|---|---|---|---|---|---|---|---|---|
| TEMPERATURE, WATER DEG. CENTIGRADE | SAMPLE MEASUREMENT | ******** | ******** | ** | ******** | ******** | 9.7 | 04 | 0 | 29 / 29 | RCORDR |
| 00010 0 0 0 INTAKE | PERMIT REQUIREMENT | ******** | ******** | **** | ******** | ******** | REPORT DAILY MX | DEG. C. | | CONTIN UOUS | RCORDR |
| TEMPERATURE, WATER DEG. CENTIGRADE | SAMPLE MEASUREMENT | ******** | ******** | ** | ******** | ******** | 17.3 | 04 | 0 | 29 / 29 | CALCTD |
| 00010 1 0 0 EFFLUENT GROSS VALUE | PERMIT REQUIREMENT | ******** | ******** | **** | ******** | ******** | 32.8 DAILY MX | DEG. C. | | DAILY | CALCTD |
| OXIDANTS, TOTAL RESIDUAL | SAMPLE MEASUREMENT | ******** | ******** | ** | ******** | Monitoring Not Required | Monitoring Not Required | 19 | | | |
| 34044 1 0 0 EFFLUENT GROSS VALUE | PERMIT REQUIREMENT | ******** | ******** | **** | ******** | 0.011 MO AVG | 0.019 DAILY MX | MG/L | | WEEKLY | CALCTD |
| FLOW, IN CONDUIT OR THRU TREATMENT PLANT | SAMPLE MEASUREMENT | 932.46 | 932.46 | 03 | ******** | ******** | ******** | ** | 0 | 29 / 29 | ESTIMA |
| 50050 1 0 0 EFFLUENT GROSS VALUE | PERMIT REQUIREMENT | REPORT MO AVG | REPORT DAILY MX | MGD | ******** | ******** | ******** | **** | | DAILY | ESTIMA |
| CHLORINATION DURATION | SAMPLE MEASUREMENT | ******** | ******** | ** | ******** | ******** | Monitoring Not Required | 14 | | | |
| 78739 1 0 0 EFFLUENT GROSS VALUE | PERMIT REQUIREMENT | ******** | ******** | **** | ******** | ******** | 120 DAILY MX | MIN/DAY | | DAILY | RCORDR |
| | SAMPLE MEASUREMENT | | | | | | | | | | |
| | PERMIT REQUIREMENT | | | | | | | | | | |
| | SAMPLE MEASUREMENT | | | | | | | | | | |
| | PERMIT REQUIREMENT | | | | | | | | | | |

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| TYPED OR PRINTED | | | AREA CODE | NUMBER | YEAR | MO | DAY |

COMMENTS AND EXPLANATION OF ANY VIOLATIONS *(Reference all attachments here)*

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Gallatin TN 37066
Facility TVA-Gallatin Fossil
Location Sumner Co. (NEAC)

Attn: M. T. Gray, Program Administrator (Env.)

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM *(NPDES)*
**DISCHARGE MONITORING REPORT** *(DMR)*

(2-16) TN0005428 PERMIT NUMBER
(17-19) 002 T DISCHARGE NUMBER

MONITORING PERIOD

| | YEAR | MO | DAY | | YEAR | MO | DAY |
|---|---|---|---|---|---|---|---|
| From | 12 | 02 | 01 | To | 12 | 02 | 29 |
| | (20-21) | (22-23) | (24-25) | | (26-27) | (28-29) | (30-31) |

MAJOR
(SUBR 04)
F - FINAL
COOLING WATER, STORM WATER
Effluent

*** NO DISCHARGE ***

Form Approved.
OMB No. 2040-0004
Approval expires 05-31-98

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|---|---|---|---|---|---|---|---|---|---|---|---|
| IC25 STATRE 7DAY CHR CERIODAPHNIA | SAMPLE MEASUREMENT | ******** | ******** | ** | Monitoring Not Required | ******** | ******** | 23 | | | |
| TRP3B 1 0 0 EFFLUENT GROSS VALUE | PERMIT REQUIREMENT | ******** | ******** | **** | 100 MINIMUM | ******** | ******** | PERCENT | | QTRLY | COMPOS |
| IC25 STATRE 7DAY CHR PIMEPHALES | SAMPLE MEASUREMENT | ******** | ******** | ** | Monitoring Not Required | ******** | ******** | 23 | | | |
| TRP6C 1 0 0 EFFLUENT GROSS VALUE | PERMIT REQUIREMENT | ******** | ******** | **** | 100 MINIMUM | ******** | ******** | PERCENT | | QTRLY | COMPOS |
| | SAMPLE MEASUREMENT | | | | | | | | | | |
| | PERMIT REQUIREMENT | | | | | | | | | | |
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| | SAMPLE MEASUREMENT | | | | | | | | | | |
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COMMENTS AND EXPLANATION OF ANY VIOLATIONS *(Reference all attachments here)*

Not Chlorinating.

PERMITTEE NAME/ADDRESS *(Include Facility Name/Location if Different)*

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Address: Plant Manager
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Gallatin TN 37066
Facility: TVA-Gallatin Fossil
Location: Sumner Co. (NEAC)

Attn: M. T. Gray, Program Administrator (Env.)

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM *(NPDES)*
**DISCHARGE MONITORING REPORT** *(DMR)*

(2-16) TN0005428 — PERMIT NUMBER
(17-19) 005 G — DISCHARGE NUMBER

MONITORING PERIOD
From YEAR 12 (20-21) MO 02 (22-23) DAY 01 (24-25) To YEAR 12 (26-27) MO 02 (28-29) DAY 29 (30-31)

MAJOR
(SUBR 04)
F - FINAL
CLEANING WASTEWATER
Effluent

*** NO DISCHARGE XX ***

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|---|---|---|---|---|---|---|---|---|---|---|---|
| COPPER, TOTAL (AS CU) | SAMPLE MEASUREMENT | ******** | ******** | ** | ******** | | | 19 | | | |
| 01042 1 0 0 EFFLUENT GROSS VALUE | PERMIT REQUIREMENT | ******** | ******** | **** | ******** | 1.0 MO AVG | 1.0 MAXIMUM | MG/L | | ONCE/ BATCH | GRAB |
| IRON, TOTAL (AS FE) | SAMPLE MEASUREMENT | ******** | ******** | ** | ******** | | | 19 | | | |
| 01045 1 0 0 EFFLUENT GROSS VALUE | PERMIT REQUIREMENT | ******** | ******** | **** | ******** | 1.0 MO AVG | 1.0 MAXIMUM | MG/L | | ONCE/ BATCH | GRAB |
| FLOW, IN CONDUIT OR THRU TREATMENT PLANT | SAMPLE MEASUREMENT | | | 03 | ******** | ******** | ******** | ** | | | |
| 50050 1 0 0 EFFLUENT GROSS VALUE | PERMIT REQUIREMENT | REPORT MO AVG | REPORT DAILY MX | MGD | ******** | ******** | ******** | **** | | ONCE/ BATCH | ESTIMA |
| | SAMPLE MEASUREMENT | | | | | | | | | | |
| | PERMIT REQUIREMENT | | | | | | | | | | |
| | SAMPLE MEASUREMENT | | | | | | | | | | |
| | PERMIT REQUIREMENT | | | | | | | | | | |
| | SAMPLE MEASUREMENT | | | | | | | | | | |
| | PERMIT REQUIREMENT | | | | | | | | | | |
| | SAMPLE MEASUREMENT | | | | | | | | | | |
| | PERMIT REQUIREMENT | | | | | | | | | | |

NAME/TITLE PRINCIPAL EXECUTIVE OFFICER
Dennis R. Spencer
Vice President - Coal Operations, FPG
TYPED OR PRINTED

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Plant Manager
SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT

| TELEPHONE | | DATE | | |
|---|---|---|---|---|
| 615 | 230-4091 | 12 | 03 | 09 |
| AREA CODE | NUMBER | YEAR | MO | DAY |

COMMENTS AND EXPLANATION OF ANY VIOLATIONS *(Reference all attachments here)*
No Discharge this Period

**TENNESSEE VALLEY AUTHORITY**
**TOXICITY TEST REPORT**

## INTRODUCTION / EXECUTIVE SUMMARY

Report Date: February 28, 2012

1. Facility / Discharger: Gallatin Fossil Plant / TVA
2. County / State: Sumner / Tennessee
3. NPDES Permit #: TN 0005428
4. Type of Facility: Fossil-fueled steam electric generating plant
5. Design Flow (MGD): 27.9
6. Receiving Stream: Cumberland River
7. 1Q10 (MGD): 552.1
8. Outfall Tested: 001
9. Dates Sampled: February 05 – 10, 2012
10. Average Flow on Days Sampled (MGD): 32.32, 29.09, 30.16
11. Pertinent Site Conditions: No unusual conditions reported. (Production / operation data will be provided upon request).
12. Test Dates: February 07 – 14, 2012
13. Test Type: Short-term Chronic Definitive
14. Test Species: Fathead Minnows (*Pimephales promelas*)
    Daphnids (*Ceriodaphnia dubia*)
15. Concentrations Tested (%): Outfall 001: 1.3, 2.6, 5.1, 10.2, 20.4
    Intake: 100
16. Permit Limit Endpoint (%): Outfall 001: $IC_{25} = 5.1$
17. Test Results: Outfall 001: *Pimephales promelas:* $IC_{25} > 20.4$
    *Ceriodaphnia dubia:* $IC_{25} > 20.4$

18. Facility Contact: Michael Gray
Phone #: (615) 230-4066

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

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

21. TVA Contact: Donald W. Snodgrass
Phone #: (256) 386-2787

22. Notes: Outfall 001 samples collected February 05 – 10, 2012 showed no toxic effects to fathead minnows or daphnids. The resulting $IC_{25}$ values, for both species, were > 20.4 percent.

Exposure of daphnids and minnows to intake samples resulted in no significant difference from control during this study period.

## METHODS SUMMARY

Samples:

1. Sampling Point: Outfall 001, Intake

2. Sample Type: Composite

3. Sample Information:

| Sample ID | Date (MM-DD-YY) Time (CT) Collected | Date (MM-DD-YY) Time (ET) Received | Arrival Temp. (°C) | Initial TRC* (mg/L) | Date (MM-DD-YY) Time (ET) First Used |
|---|---|---|---|---|---|
| 001 | 02-05-12 0900 to 02-06-12 0800 | 02-07-12 0825 | 0.5 | <0.10 | 02-07-12 1026<br>02-08-12 0928 |
| Intake | 02-05-12 0945 to 02-06-12 0845 | 02-07-12 0825 | 0.8 | <0.10 | 02-07-12 1026<br>02-08-12 0928 |
| 001 | 02-07-12 0920 to 02-08-12 0820 | 02-08-12 1610 | 0.3 | <0.10 | 02-09-12 0927<br>02-10-12 0938 |
| Intake | 02-07-12 1005 to 02-08-12 0905 | 02-08-12 1610 | 0.6 | <0.10 | 02-09-12 0927<br>02-10-12 0938 |
| 001 | 02-09-12 0710 to 02-10-12 0610 | 02-10-12 1440 | 0.1, 0.1† | <0.10 | 02-11-12 1000<br>02-12-12 0928<br>02-13-12 0930 |
| Intake | 02-09-12 0755 to 02-10-12 0655 | 02-10-12 1440 | 0.1 | <0.10 | 02-11-12 1000<br>02-12-12 0928<br>02-13-12 0930 |

*TRC = Total Residual Chlorine
† Samples were collected in two 2.5 gallon cubitainers. Temperature was measured in each cubitainer upon arrival.

4. Sample Manipulation: Samples collected from Outfall 001 and intake were warmed to test temperature (25.0 ± 1.0°C) in a warm water bath.

| | *Pimephales promelas* | *Ceriodaphnia dubia* |
|---|---|---|
| Test Organisms: | | |
| 1. Source: | Aquatox, Inc. | In-house Cultures |
| 2. Age: | 20.5 hours old | < 24-hours old |
| Test Method Summary: | | |
| 1. Test Conditions: | Static, Renewal | Static, Renewal |
| 2. Test Duration: | 7 days | Until at least 60% of control females have 3 broods |
| 3. Control / Dilution Water: | Moderately Hard Synthetic | Moderately Hard Synthetic |
| 4. Number of Replicates: | 4 | 10 |
| 5. Organisms per Replicate: | 10 | 1 |
| 6. Test Initiation: Outfall 001: (Date/Time) | 02-07-12 1230 ET | 02-07-12 1026 ET |
| 7. Test Termination: Outfall 001: (Date/Time) | 02-14-12 1140 ET | 02-14-12 0948 ET |
| 8. Test Temperature: Outfall 001: | Mean = 24.8°C (24.2 – 25.1°C) | Mean = 24.9°C (24.7 - 25.3°C) |

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

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

**TOXICITY TEST RESULTS** (see Appendix B for Bench Sheets)

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

Conducted February 07 – 14, 2012 using effluent collected from Outfall 001.

| Test Solutions (% Effluent) | Percent Surviving (time interval used – days) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Control | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 1.3% | 100 | 100 | 100 | 100 | 98 | 98 | 98 |
| 2.6% | 100 | 100 | 100 | 100 | 98 | 98 | 98 |
| 5.1% | 100 | 100 | 100 | 100 | 98 | 95 | 95 |
| 10.2% | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 20.4% | 100 | 100 | 100 | 100 | 98 | 98 | 98 |
| Intake | 100 | 100 | 100 | 100 | 100 | 100 | 95 |

| Test Solutions (% Effluent) | Mean Dry Weight (mg) (replicate number) | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | Mean |
| Control | 0.619 | 0.604 | 0.660 | 0.672 | 0.639 |
| 1.3% | 0.687 | 0.581 | 0.569 | 0.641 | 0.620 |
| 2.6% | 0.702 | 0.669 | 0.652 | 0.691 | 0.679 |
| 5.1% | 0.626 | 0.679 | 0.657 | 0.637 | 0.650 |
| 10.2% | 0.675 | 0.701 | 0.729 | 0.763 | 0.717 |
| 20.4% | 0.528 | 0.775 | 0.674 | 0.753 | 0.683 |
| Intake | 0.462 | 0.647 | 0.668 | 0.506 | 0.571 |

| | |
|---|---|
| $IC_{25}$ Value: > 20.4%<br>Permit Limit: 5.1%<br><br>95% Confidence Limits:<br>Upper Limit: NA<br>Lower Limit: NA | Calculated TU Estimates: < 4.9 TUc*<br><br>Permit Limit: 19.6 TUc |

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

TOXICITY TEST RESULTS (see Appendix B for Bench Sheets)

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

Conducted February 07 – 14, 2012 using effluent from Outfall 001.

| Test Solutions (% Effluent) | Percent Surviving (time interval used – days) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Control | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 1.3% | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 2.6% | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 5.1% | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 10.2% | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 20.4% | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

| Test Solutions (% Effluent) | Reproduction (#young/female/7 days) Data (replicate number) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Mean |
| Control | 31 | 32 | 33 | 31 | 28 | 30 | 33 | 33 | 31 | 31 | 31.3 |
| 1.3% | 33 | 33 | 30 | 32 | 33 | 30 | 32 | 34 | 30 | 34 | 32.1 |
| 2.6% | 35 | 33 | 34 | 32 | 30 | 31 | 34 | 33 | 29 | 34 | 32.5 |
| 5.1% | 33 | 34 | 34 | 34 | 32 | 33 | 30 | 29 | 30 | 34 | 32.3 |
| 10.2% | 36 | 31 | 32 | 36 | 32 | 36 | 34 | 36 | 32 | 32 | 33.7 |
| 20.4% | 37 | 33 | 35 | 37 | 35 | 33 | 33 | 36 | 35 | 37 | 35.1 |

| | |
|---|---|
| $IC_{25}$ Value: > 20.4%<br>Permit Limit: 5.1%<br><br>95% Confidence Limits:<br>Upper Limit: NA<br>Lower Limit: NA | Calculated TU Estimates: < 4.9 TUc*<br><br>Permit Limit: 19.6 TUc |

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

TOXICITY TEST RESULTS (see Appendix B for Bench Sheets)

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

Conducted February 07 – 14, 2012 using water from Intake

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

| Test Solutions (% Effluent) | Reproduction (#young/female/7 days) Data (replicate number) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Mean |
| Control | 29 | 27 | 29 | 29 | 32 | 32 | 31 | 32 | 32 | 30 | 30.3 |
| Intake | 37 | 36 | 35 | 38 | 36 | 36 | 38 | 35 | 38 | 37 | 36.6 |

| | |
|---|---|
| $IC_{25}$ Value: ≥ 100%<br>Permit Limit: N/A<br><br>95% Confidence Limits:<br>Upper Limit: NA<br>Lower Limit: NA | Calculated TU Estimates: < 1.0 TUc*<br><br>Permit Limit: N/A |

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

REFERENCE TOXICANT TEST RESULTS (see Appendix A and C)

| Species | Date | Time | Duration | Toxicant | Results ($IC_{25}$) |
|---|---|---|---|---|---|
| *Pimephales promelas* | February 07 – 14, 2012 | 1243 | 7-days | KCl | 0.77 g/L |
| *Ceriodaphnia dubia* | February 07 – 14, 2012 | 1000 | 7-days | NaCl | 1.08 g/L |

**PHYSICAL/CHEMICAL SUMMARY**

Water Chemistry Mean Values and Ranges for *Pimephales promelas* and *Ceriodaphnia dubia* Tests, Gallatin Fossil Plant (GAF) Outfall 001 and Intake
February 07-14, 2012

| Test | Sample ID | Temperature (°C) | | Dissolved Oxygen (mg/L) | | pH (S.U.) | | Conductance | Alkalinity | Hardness | Total Residual |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Initial | Final | Initial | Final | Initial | Final | (µmhos/cm) | (mg/L $CaCO_3$) | (mg/L $CaCO_3$) | Chlorine (mg/L) |
| *Pimephales promelas* | Control | 24.8<br>24.7 - 24.9 | 24.6<br>24.5 - 24.8 | 7.7<br>7.6 - 7.9 | 7.9<br>7.7 - 8.1 | 7.95<br>7.89 - 8.02 | 7.79<br>7.68 - 7.87 | 312<br>306 - 320 | 62<br>61 - 64 | 90<br>87 - 91 | -<br>- - |
| | 1.3% | 24.9<br>24.8 - 25.0 | 24.6<br>24.5 - 24.8 | 7.8<br>7.6 - 8.0 | 7.7<br>7.1 - 8.0 | 7.95<br>7.91 - 8.02 | 7.79<br>7.68 - 7.87 | 309<br>304 - 315 | -<br>- - | -<br>- - | -<br>- - |
| | 2.6% | 24.9<br>24.8 - 25.0 | 24.6<br>24.4 - 24.8 | 7.7<br>7.6 - 8.0 | 7.7<br>7.1 - 8.1 | 7.96<br>7.93 - 8.00 | 7.80<br>7.68 - 7.89 | 311<br>306 - 318 | -<br>- - | -<br>- - | -<br>- - |
| | 5.1% | 24.9<br>24.8 - 25.0 | 24.6<br>24.4 - 24.8 | 7.8<br>7.6 - 8.1 | 7.7<br>7.0 - 8.0 | 7.97<br>7.94 - 8.00 | 7.79<br>7.64 - 7.90 | 312<br>306 - 323 | -<br>- - | -<br>- - | -<br>- - |
| | 10.2% | 24.9<br>24.8 - 25.0 | 24.6<br>24.2 - 24.8 | 7.8<br>7.6 - 8.1 | 7.7<br>7.0 - 8.0 | 7.98<br>7.95 - 7.99 | 7.84<br>7.75 - 7.95 | 314<br>308 - 324 | -<br>- - | -<br>- - | -<br>- - |
| | 20.4% | 24.9<br>24.8 - 25.0 | 24.6<br>24.2 - 24.7 | 7.9<br>7.6 - 8.1 | 7.8<br>7.0 - 8.1 | 8.00<br>7.97 - 8.04 | 7.84<br>7.75 - 7.96 | 319<br>313 - 327 | -<br>- - | -<br>- - | -<br>- - |
| | 100% | 25.1<br>25.0 - 25.2 | -<br>- - | 8.2<br>8.2 - 8.2 | -<br>- - | 7.95<br>7.87 - 8.09 | -<br>- - | 362<br>355 - 368 | 126<br>121 - 129 | 171<br>166 - 178 | < 0.10<br>< 0.10 - < 0.10 |
| | Intake | 25.0<br>24.8 - 25.1 | 24.6<br>24.3 - 24.8 | 8.1<br>7.7 - 8.3 | 7.7<br>7.0 - 8.0 | 7.89<br>7.83 - 7.96 | 7.79<br>7.68 - 7.91 | 190<br>182 - 198 | 69<br>67 - 71 | 86<br>85 - 89 | < 0.10<br>< 0.10 - < 0.10 |
| *Ceriodaphnia dubia* | Control | 24.8<br>24.7 - 24.9 | 25.0<br>24.7 - 25.3 | 7.7<br>7.6 - 7.9 | 7.9<br>7.7 - 8.1 | 7.95<br>7.89 - 8.02 | 7.94<br>7.91 - 7.98 | 312<br>306 - 320 | 62<br>61 - 64 | 90<br>87 - 91 | -<br>- - |
| | 1.3% | 24.9<br>24.8 - 24.9 | 25.0<br>24.8 - 25.3 | 7.8<br>7.6 - 8.0 | 7.9<br>7.7 - 8.1 | 7.95<br>7.91 - 8.02 | 7.93<br>7.90 - 7.96 | 309<br>304 - 315 | -<br>- - | -<br>- - | -<br>- - |
| | 2.6% | 24.9<br>24.8 - 24.9 | 25.0<br>24.8 - 25.3 | 7.7<br>7.6 - 8.0 | 7.9<br>7.7 - 8.1 | 7.96<br>7.93 - 8.00 | 7.93<br>7.90 - 7.96 | 311<br>306 - 318 | -<br>- - | -<br>- - | -<br>- - |
| | 5.1% | 24.8<br>24.8 - 24.9 | 25.0<br>24.8 - 25.2 | 7.8<br>7.6 - 8.1 | 7.8<br>7.6 - 8.0 | 7.97<br>7.94 - 8.00 | 7.94<br>7.90 - 7.98 | 312<br>306 - 323 | -<br>- - | -<br>- - | -<br>- - |
| | 10.2% | 24.9<br>24.8 - 25.0 | 25.0<br>24.8 - 25.2 | 7.8<br>7.6 - 8.1 | 7.8<br>7.6 - 8.0 | 7.98<br>7.95 - 7.99 | 7.95<br>7.91 - 7.99 | 314<br>308 - 324 | -<br>- - | -<br>- - | -<br>- - |
| | 20.4% | 24.9<br>24.8 - 25.0 | 25.0<br>24.8 - 25.2 | 7.9<br>7.6 - 8.1 | 7.9<br>7.6 - 8.0 | 8.00<br>7.97 - 8.04 | 8.00<br>7.97 - 8.03 | 319<br>313 - 327 | -<br>- - | -<br>- - | -<br>- - |
| | 100% | 25.1<br>25.0 - 25.2 | -<br>- - | 8.2<br>8.2 - 8.2 | -<br>- - | 7.95<br>7.87 - 8.09 | -<br>- - | 362<br>355 - 368 | 126<br>121 - 129 | 171<br>166 - 178 | < 0.10<br>< 0.10 - < 0.10 |
| | Intake | 25.0<br>24.8 - 25.2 | 25.0<br>24.7 - 25.2 | 8.1<br>7.7 - 8.3 | 8.0<br>7.8 - 8.2 | 7.89<br>7.83 - 7.96 | 7.95<br>7.91 - 7.98 | 190<br>182 - 198 | 69<br>67 - 71 | 86<br>85 - 89 | < 0.10<br>< 0.10 - < 0.10 |

| Overall temperature (°C) | Average | Minimum | Maximum |
|---|---|---|---|
| *Pimephales promelas* | 24.8 | 24.2 | 25.1 |
| *Ceriodaphnia dubia* | 24.9 | 24.7 | 25.3 |

## SUMMARY / CONCLUSIONS

Outfall 001 samples collected February 07 – 14, 2012 showed no toxic effects to fathead minnows or daphnids. The resulting $IC_{25}$ values, for both species, were > 20.4 percent.

Exposure of daphnids and minnows to intake samples resulted in no significant difference from control during this study period.

## Appendix A

## ADDITIONAL TOXICITY TEST INFORMATION

### SUMMARY OF METHODS

1. *Pimephales promelas*

   Tests were conducted according to EPA-821-R-02-013 (October 2002) using four replicates, each containing ten test organisms, per treatment. Test vessels consisted of 500-mL plastic disposable cups, each containing 250-mL of test solution.

2. *Ceriodaphnia dubia*

   Tests were conducted according to EPA-821-R-02-013 (October 2002) using ten replicates, each containing one test organism, per treatment. Test vessels consisted of 30-mL polypropylene cups, each containing 15-mL of test solution.

### DEVIATIONS / MODIFICATIONS TO TEST PROTOCOL

1. *Pimephales promelas*

   None

2. *Ceriodaphnia dubia*

   None

### DEVIATIONS / MODIFICATIONS TO PRETEST CULTURE OR HOLDING OF TEST ORGANISMS

1. *Pimephales promelas*

   None

2. *Ceriodaphnia dubia*

   None

## PHYSICAL AND CHEMICAL METHODS

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

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

3. Temperature was measured by SM 2550 B.

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

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

6. Conductance was measured by SM 2510 B.

7. Alkalinity was measured by SM 2320 B.

8. Total hardness was measured by SM 2340 C.

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

## QUALITY ASSURANCE

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

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

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

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

3. Dilution Water Used: Moderately hard synthetic water.

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

REFERENCES


1. NPDES Permit No. TN0005428.

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

3. Standard Methods for the Examination of Water and Wastewater, 21st Edition, 2005.

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

Gallatin Fossil Plant Biomonitoring
February 07 – 14, 2012

Appendix B

Chain of Custody Records and
Toxicity Test Bench Sheets

# TVA BIOMONITORING CHAIN OF CUSTODY RECORD Page 1 of 1

Page 1 of 1

Client: TVA

Project Name: Gallatin Fossil Plant

P.O. Number: N/A

Facility Sampled: Gallatin Fossil Plant

NPDES Number: TN0005428

Collected By: Ray Duncan Tim Stephens Steven Keenan

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

Delivered By (Circle One):
FedEx UPS Bus Client
Other (specify): X courier

General Comments: Dissolved metals samples were collected and remained on ice until the toxicity results are known. Thalimedes malfunctioned; therefore, flow was taken from staff gauge @ the beginning & End of Sample Event

| Field Identification / Sample Description | Grab/Comp. | Collection Date/Time(CT) Start | End | Container Number & Volume Collected | Flow (MGD) | Rain Event? (Mark as Appropriate) Yes | If Yes, Inches | No | Trace | Laboratory Use (project # 76064) ETS Log Number | Arrival Temp. (°C) | By | Time ET | Appearance |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Outfall 001-1 | Comp | 02/05/2012 0900 | 02/06/2012 0800 | 1 (2.5 gal) | 32.32 | | | X | | 120207-01 | 0.5°C | J | 0825 | * |
| Intake-1 | Comp | 02/05/2012 0945 | 02/06/2012 0845 | 1 (1 gal) | N/A | | | X | | 120207-02 | 0.8°C | J | 0825 | * |

* Custody seals intact. Samples received in good condition. TRC absent in all samples. Jm

Sample Custody – Fill In From Top Down

| Relinquished By (Signature): | Date/Time | Received By (Signature): | Date/Time |
|---|---|---|---|
| TVA | 02/06/12 1100 (CT) | ~~FedEx~~ TAS DC Expedite | 2-6-12 1100 (CT) |
| ~~FedEx~~ TAS DC Expedite | 02-07-12 0825 (ET) | ETS | 02-07-12 0825 (ET) |

Instructions: Clients should fill in all areas except those in the "Laboratory Use" block. Biomonitoring samples are preserved by storing them at 6°C and shipping them in ice. The hold time for each sample is 36 hours from the time of collection. Therefore, please collect and ship in such a way that the laboratory will receive the samples with ample time to initiate testing within that time frame. Samples shipped overnight on Friday via FedEx or UPS must be marked for Saturday delivery or they will not arrive until the following Monday.

ETS
Environmental Testing Solutions, Inc.



# Whole Effluent Toxicity Sample Receipt Log

*Sample temperature performed using Sample Receiving Thermometer: SN 6338.

| Date received | Time received | Received by | Received from | Sample temperature (°C)* | Project number | Sample | Sample name and description | State | Comments |
|---|---|---|---|---|---|---|---|---|---|
| 02-07-12 | 0825 | J. Sumner | TVA Courier | 0.5 | 7666 | 120207.01 | TVA - Gallatin Fossil Plant - Outfall 001 - 1 | TN | |
| 02-07-12 | 0825 | J. Sumner | TVA Courier | 0.8 | 7666 | 120207.02 | TVA - Gallatin Fossil Plant - Intake - 1 | TN | |
| 02-07-12 | 0950 | K. Keenan | Fed - Ex | 2.8 | 7667 | 120207.03 | City of Chattanooga - Moccasin Bend WWTP | TN | |
| 02-07-12 | 0950 | K. Keenan | Fed - Ex | 2.5 | 7668 | 120207.04 | CORR ERI - McQuay International | AL | |
| 02-07-12 | 0950 | K. Keenan | Fed - Ex | 1.0 | 7669 | 120207.05 | Wilson WWTP | NC | |
| 02-07-12 | 0950 | K. Keenan | Fed - Ex | 2.8 | 7670 | 120207.06 | PCS Phosphate, Inc. - Outfall 007 | NC | |
| 02-07-12 | 0950 | K. Keenan | Fed - Ex | 3.0 | 7671 | 120207.07 | Progress Energy Carolinas - Sutton Plant | NC | |
| 02-07-12 | 1037 | K. Keenan | T. McMinn | 0.3 | 7672 | 120207.08 | Trevco - Ridgeview Acres MHP | NC | |
| 02-07-12 | 1121 | K. Keenan | S. Byers | 2.3 | 7673 | 120207.09 | Byers Environmental - Marshall WWTP | NC | |
| 02-07-12 | 1310 | J. Sumner | J. Kennedy | 1.1 | 7674 | 120207.10 | Waynesville WWTP | NC | |
| 02-07-12 | 1310 | J. Sumner | J. Kennedy | 2.3 | 7675 | 120207.11 | WQL - Jefferson WWTP | NC | |
| 02-07-12 | 1310 | J. Sumner | J. Kennedy | 2.3 | 7676 | 120207.12 | WQL - Unimin Corporation | NC | |
| 02-07-12 | 1311 | J. Sumner | L. Ballard | 2.2 | 7677 | 120207.13 | Marion - Corpening Creek WWTP | NC | |
| 02-07-12 | 1320 | J. Sumner | M. Ringgenberg | 3.3 | 7678 | 120207.14 | COA - Mills River | NC | |

# BIOMONITORING CHAIN OF CUSTODY RECORD

Page 1 of 1

Client: TVA

Project Name: Gallatin Fossil Plant

P.O. Number: N/A

Facility Sampled: Gallatin Fossil Plant

NPDES Number: TN0005428

Collected By: Tim Stephens Steven Keenum Ray Duncan Ray Duncan

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

Delivered By (Circle One):
FedEx UPS Bus Client
Other (specify): X courier

General Comments: Dissolved metals samples were collected and remained on ice until the toxicity results are known.

| Field Identification / Sample Description | Grab/Comp. | Collection Date/Time(CT) Start | Collection Date/Time(CT) End | Container Number & Volume Collected | Flow (MGD) | Rain Event? (Mark as Appropriate) Yes | If Yes, Inches | No | Trace | Laboratory Use: ETS Log Number | Arrival Temp. (°C) | By | Time ET | Appearance |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Outfall 001-2 | Comp | 02/07/2012 0920 | 02/08/2012 0820 | 1 (2.5 gal) | 29.09 | X | | | X | 120208-26 | 0.3°C | JH | 1610 | * |
| Intake-2 | Comp | 02/07/2012 1005 | 02/08/2012 0905 | 1 (1 gal) | N/A | X | | | X | 120208-27 | 0.6°C | JH | 1610 | * |

Project # 7666

* CUSTODY SEALS INTACT. SAMPLES RECEIVED IN GOOD CONDITION. TRC ABSENT IN ALL SAMPLES. Jim/unme

Sample Custody – Fill In From Top Down

| Relinquished By (Signature): | Date/Time | Received By (Signature): | Date/Time |
|---|---|---|---|
| [signature] | 02/08/2012 1037 (CT) | Don Capelenel ~~FedEx~~ TA Service DC Expedite 02-08-12 | 2-8-12 10:37 (CT) |
| Don Capelenel ~~FedEx~~ TA DC Expedite | 02-08-12 1200 CT ~~(ET)~~ 02-08-12 | Mike Capel DC Expedite | 02-08-12 1200 CT ~~(ET)~~ 02-08-12 |

Instructions: Clients should fill in all areas except those in the "Laboratory Use" block. Biomonitoring samples are preserved by storing them at 6°C and shipping them in ice. The hold time for each sample is 36 hours from the time of collection. Therefore, please collect and ship in such a way that the laboratory will receive the samples with ample time to initiate testing within that time frame. Samples shipped overnight on Friday via FedEx or UPS must be marked for Saturday delivery or they will not arrive until the following Monday.

Mike Capel DC Expedite 02-08-12 ~~1600~~ 1610 ET 02-08-12 → Jim/unme ETS 02-08-12 ~~1600~~ 1610 ET 02-08-12

ETS
Environmental Testing Solutions, Inc.



# Whole Effluent Toxicity Sample Receipt Log

*Sample temperature performed using Sample Receiving Thermometer; SN 6338.

| Date received | Time received | Received by | Received from | Sample temperature (°C)* | Project number | Sample | Sample name and description | State | Comments |
|---|---|---|---|---|---|---|---|---|---|
| 02-08-12 | 0950 | K. Keenan | Fed - Ex | 0.5 | 7679 | 120208.01 | CORR ERI - AAF McQuay International | NC | |
| 02-08-12 | 0950 | K. Keenan | Fed - Ex | 2.6 | 7680 | 120208.02 | ALCOA - Outfall 005 | NC | |
| 02-08-12 | 0950 | K. Keenan | Fed - Ex | 2.6 | 7680 | 120208.03 | ALCOA - Outfall 012 | NC | |
| 02-08-12 | 0950 | K. Keenan | Fed - Ex | 1.2 | 7681 | 120208.04 | Duke Energy Corporation - Belews Creek Steam Station | NC | |
| 02-08-12 | 0950 | K. Keenan | Fed - Ex | 1.0 | 7682 | 120208.05 | Bladenboro WWTP | NC | |
| 02-08-12 | 0950 | K. Keenan | Fed - Ex | 0.6 | 7683 | 120208.06 | City of Gastonia - Dallas WWTP | NC | |
| 02-08-12 | 0950 | K. Keenan | Fed - Ex | 1.2 | 7684 | 120208.07 | United Water - Enfield WWTP | NC | |
| 02-08-12 | 0950 | K. Keenan | Fed - Ex | 0.4 | 7685 | 120208.08 | Duke Energy Corporation -Marshall Steam Station | NC | |
| 02-08-12 | 0950 | K. Keenan | Fed - Ex | 0.5 | 7686 | 120208.09 | Ammons Resource Group - Raleigh CC | NC | |
| 02-08-12 | 0950 | K. Keenan | Fed - Ex | 1.2 | 7687 | 120208.10 | United Water - Scotland Neck WWTP | NC | |
| 02-08-12 | 0950 | K. Keenan | Fed - Ex | 0.8 | 7688 | 120208.11 | Wilson WWTP | NC | |
| 02-08-12 | 0950 | K. Keenan | Fed - Ex | 0.9 | 7689 | 120208.12 | Elementis | NC | |
| 02-08-12 | 0950 | K. Keenan | Fed - Ex | 2.6 | 7680 | 120208.13 | ALCOA - Outfall 002 | NC | |
| 02-08-12 | 0950 | K. Keenan | Fed - Ex | 2.6 | 7680 | 120208.14 | ALCOA - Outfall 013 | NC | |
| 02-08-12 | 0950 | K. Keenan | Fed - Ex | 1.0 | 7690 | 120208.15 | Progress Energy Carolinas - Mayo Steam Electric Plant | NC | |
| 02-08-12 | 0950 | K. Keenan | UPS | 0.4 | 7691 | 120208.16 | TVA - Shawnee Fossil Plant - Outfall 001 AA | KY | |
| 02-08-12 | 0950 | K. Keenan | UPS | 0.3 | 7691 | 120208.17 | TVA - Shawnee Fossil Plant - Intake AA | KY | |
| 02-08-12 | 0950 | K. Keenan | UPS | 0.4 | 7691 | 120208.18 | TVA - Shawnee Fossil Plant - Outfall 001 AP | KY | |
| 02-08-12 | 0950 | K. Keenan | UPS | 0.3 | 7691 | 120208.19 | TVA - Shawnee Fossil Plant - Intake AP | KY | |
| 02-08-12 | 0950 | K. Keenan | Fed - Ex | 0.5 | 7692 | 120808.20 | Carolina Beach WWTP | NC | |
| 02-08-12 | 0950 | K. Keenan | UPS | 1.0 | 7693 | 120208.21 | Microbac Environmental - Roseboro WWTP | NC | |
| 02-08-12 | 0950 | K. Keenan | UPS | 0.5 | 7694 | 120208.22 | South Cary WWTP | NC | |
| 02-08-12 | 0950 | K. Keenan | UPS | 1.0 | 7695 | 120208.23 | Microbac Environmental - J.P. Stevens - Wagram WWTP | NC | |
| 02-08-12 | 0950 | K. Keenan | UPS | 0.4 | 7696 | 120208.24 | Enviro Chemists - Manteo WWTP | NC | |
| 02-08-12 | 1028 | J. Sumner | Dash Courier | 1.0 | 7697 | 120208.25 | OWASA - Mason Farms | NC | |
| 02-08-12 | 1610 | J. Sumner | TVA Courier | 0.3 | 7666 | 120208.26 | TVA - Gallatin Fossil Plant - Outfall 001 - 2 | TN | |
| 02-08-12 | 1610 | J. Sumner | TVA Courier | 0.6 | 7666 | 120208.27 | TVA - Gallatin Fossil Plant - Intake - 2 | TN | |

# BIOMONITORING CHAIN OF CUSTODY RECORD

Page 1 of 1

Client: TVA

Project Name: Gallatin Fossil Plant

P.O. Number: N/A

Facility Sampled: Gallatin Fossil Plant

NPDES Number: TN0005428

Collected By: Ray Duncan Steven Keenum Tim Sleppe
Ray Duncan Steven Keenum Tim Sleppe

Environmental Testing Solution, Inc.
Asheville Fed-EX Location.
628 Patton Ave.
Asheville, NC 28801
Phone: 828-350-9364
Fax: 828-350-9368

Delivered By (Circle One):
FedEx UPS Bus Client
Other (specify): X Courier

General Comments: Dissolved metals samples were collected and remained on ice until the toxicity results are

| Field Identification / Sample Description | Grab/Comp. | Collection Date/Time (CT) Start | End | Container Number & Volume Collected | Flow (MGD) | Rain Event? (Mark as Appropriate) Yes | If Yes, Inches | No | Trace | Laboratory Use: ETS Log Number | Arrival Temp. (°C) | By | Time ET | Appearance |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Outfall 001-3 | Comp | 02/09/2012 0710 | 02/10/2012 0610 | 2 (2.5 gal) | 30.16 | | | X | | 1202101[illegible] | 0.1-0.1 °C | JL | 1440 | * |
| Intake-3 | Comp | 02/09/2012 0755 | 02/10/2012 0655 | 1 (2.5 gal) | N/A | | | X | | 1202101[illegible] | 0.1 °C | JL | 1440 | * |

project # 7666

* CUSTODY SEALS INTACT. SAMPLES RECEIVED IN GOOD CONDITION. TRC ABSENT IN ALL SAMPLES

Sample Custody – Fill In From Top Down

| Relinquished By (Signature): | Date/Time | Received By (Signature): | Date/Time |
|---|---|---|---|
| Tim A. Sleppe TVA | 02/10/12 0846 (CT) | Mike Capel ~~FedEx~~ TAS DC EXPEDITE | 2-10-12 0846 (CT) |
| Mike Capel ~~FedEx~~ TAS DC EXPEDITE | 02-10-12 1440 (ET) | Jim [illegible] ETS | 02-10-12 1440 (ET) |

Instructions: Clients should fill in all areas except those in the "Laboratory Use" block. Biomonitoring samples are preserved by storing them at 6°C and shipping them in ice. The hold time for each sample is 36 hours from the time of collection. Therefore, please collect and ship in such a way that the laboratory will receive the samples with ample time to initiate testing within that time frame. Samples shipped overnight on Friday via FedEx or UPS must be marked for Saturday delivery or they will not arrive until the following Monday.

ETS
Environmental Testing Solutions, Inc.



# Whole Effluent Toxicity Sample Receipt Log

*Sample temperature performed using Sample Receiving Thermometer: SN 6338.

| Date received | Time received | Received by | Received from | Sample temperature (°C)* | Project number | Sample | Sample name and description | State | Comments |
|---|---|---|---|---|---|---|---|---|---|
| 02-10-12 | 0939 | K. Keenan | Fed - Ex | 1.0 | 7680 | 120210.01 | ALCOA - Outfall 005 | NC | |
| 02-10-12 | 0939 | K. Keenan | Fed - Ex | 1.0 | 7680 | 120210.02 | ALCOA - Outfall 012 | NC | |
| 02-10-12 | 0939 | K. Keenan | Fed - Ex | 1.2 | 7681 | 120210.03 | Duke Energy Corporation - Belews Creek Steam Station | NC | |
| 02-10-12 | 0939 | K. Keenan | Fed - Ex | 0.4 | 7682 | 120210.04 | Bladenboro WWTP | NC | |
| 02-10-12 | 0939 | K. Keenan | Fed - Ex | 1.0 | 7683 | 120210.05 | City of Gastonia - Dallas WWTP | NC | |
| 02-10-12 | 0939 | K. Keenan | Fed - Ex | 0.5 | 7684 | 120210.06 | United Water - Enfield WWTP | NC | |
| 02-10-12 | 0939 | K. Keenan | Fed - Ex | 1.1 | 7685 | 120210.07 | Duke Energy Corporation -Marshall Steam Station | NC | |
| 02-10-12 | 0939 | K. Keenan | Fed - Ex | 0.5 | 7686 | 120210.08 | Ammons Resource Group - Raleigh CC | NC | |
| 02-10-12 | 0939 | K. Keenan | Fed - Ex | 0.5 | 7687 | 120210.09 | United Water - Scotland Neck WWTP | NC | |
| 02-10-12 | 0939 | K. Keenan | Fed - Ex | 0.3 | 7688 | 120210.10 | Wilson WWTP | NC | |
| 02-10-12 | 0939 | K. Keenan | Fed - Ex | 0.6 | 7689 | 120210.11 | Elementis | NC | |
| 02-10-12 | 0945 | K. Keenan | UPS | 0.5 | 7693 | 120210.12 | Microbac Environmental - Roseboro WWTP | NC | |
| 02-10-12 | 0945 | K. Keenan | UPS | 0.6 | 7694 | 120210.13 | South Cary WWTP | NC | |
| 02-10-12 | 0945 | K. Keenan | UPS | 0.5 | 7695 | 120210.14 | Microbac Environmental - J.P. Stevens - Wagram WWTP | NC | |
| 02-10-12 | 1110 | J. Sumner | Dash Courier | 1.2 | 7697 | 120210.15 | OWASA - Mason Farms | NC | |
| 02-10-12 | 1440 | J. Sumner | TVA Courier | 0.1, 0.1 | 7666 | 120210.16 | TVA - Gallatin Fossil Plant - Outfall 001 - 3 | TN | |
| 02-10-12 | 1440 | J. Sumner | TVA Courier | 0.1 | 7666 | 120210.17 | TVA - Gallatin Fossil Plant - Intake - 3 | TN | |

ETS
Environmental Testing Solutions, Inc.

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

**Species:** ***Pimephales promelas***

**Client:** Tennessee Valley Authority
**Facility:** Gallatin Fossil Plant
**NPDES #:** TN0005428
**Project #:** 76666

**County:** ~~Summer~~ SUMNER
**Outfall:** 001

| *Dilution preparation information:* | | | | | | *Comments:* |
|---|---|---|---|---|---|---|
| Dilution prep (%) | 1.3 | 2.6 | 5.1 | 10.2 | 20.4 | |
| Effluent volume (mL) | 19.5 | 39 | 76.5 | 153 | 306 | |
| Diluent volume (mL) | 1480.5 | 1461 | 1423.5 | 1347 | 1194 | |
| Total volume (mL) | 1500 | 1500 | 1500 | 1500 | 1500 | |

| *Test organism information:* | | *Test information:* | |
|---|---|---|---|
| Organism age: | 20.50 HOURS OLD | Randomizing template: | BLUE |
| Date and times organisms were born between: | 02-06-12 1600 | Incubator number and shelf location: | 3B |
| Organism source: | ATOX BATCH 02-06-12 | *Artemia* CHM number: | CHM593 |
| | | ***Drying information for weight determination:*** | |
| Transfer bowl information: | pH = 7.65 S.U.<br>Temperature = 24.6°C | Date / Time in oven: | 02-14-12 1205 |
| | | Initial oven temperature: | 60°C |
| Average transfer volume: | 0.1776 mL | Date / Time out of oven: | 02-15-12 1210 |
| | | Final oven temperature: | 60°C |
| | | Total drying time: | 24.1 HOURS |

***Daily feeding and renewal information:***

| Day | Date | Morning feeding | | Afternoon feeding | | Test initiation, renewal, or termination | | Sample numbers used | | MHSW batch used |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Time | Analyst | Time | Analyst | Time | Analyst | Outfall 001 | Intake | |
| 0 | 02-07-12 | | | 1500 | JH | 1230 | JH | 120207.01 | 120207.02 | 02-01-12 |
| 1 | 02-08-12 | 0750 | JH | 1350 | JH | 1134 | JH | 120207.01 | 120207.02 | 02-02-12 |
| 2 | 02-09-12 | 0730 | JH | (1345) 1330 | JH | 1130 | JH | 120208.26 | 120208.27 | 02-02-12 |
| 3 | 02-10-12 | 0700 | JH | 1300 | JH | 1133 | JH | 120208.26 | 120208.27 | 02-08-12 |
| 4 | 02-11-12 | 0720 | JH | 1320 | JH | 1137 | JH | 120210.16 | 120210.17 | 02-08-12 |
| 5 | 02-12-12 | 0750 | JH | 1350 | JH | 1132 | JH | 120210.16 | 120210.17 | 02-10-12 |
| 6 | 02-13-12 | 0800 | JH | 1400 | JH | 1130 | JH | 120210.16 | 120210.17 | 02-10-12 |
| 7 | 02-14-12 | | | | | 1140 | JH | | | |

| *Control information:* | | Acceptance criteria |
|---|---|---|
| % Mortality: | 0% | ≤ 20% |
| Average weight per initial larvae: | 0.639 | |
| Average weight per surviving larvae: | 0.639 | ≥ 0.25mg/larvae |

| *Summary of test endpoints:* | |
|---|---|
| 7-day $LC_{50}$ | >20.4% |
| NOEC | 20.4% |
| LOEC | >20.4% |
| ChV | >20.4% |
| $IC_{25}$ | >20.4% |

Independent Review by Kelley E. Cawvey

ETS
Environmental Testing Solutions, Inc.

**Species:** ***Pimephales promelas***
**Client:** **TVA / Gallatin Fossil Plant, Outfall 001** **Date:** 02-07-12

***Survival and Growth Data***

| Day | CONTROL | | | | 1.3% | | | | 2.6% | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 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 | 9 1d | 10 | 10 | 10 | 9 1d | 10 | 10 |
| 6 | 10 | 10 | 10 | 10 | 10 | 9 | 10 | 10 | 10 | 9 | 10 | 10 |
| 7 | 10 | 10 | 10 | 10 | 10 | 9 | 10 | 10 | 10 | 9 | 10 | 10 |
| A = Pan weight (mg)<br>Tray color code:: Light Pink<br>Analyst: MHF<br>Date: 01-31-12 | 01-31-12 MF ~~14.44~~ 14.47 | 13.12 | 14.10 | 13.72 | 13.49 | 13.77 | 14.34 | 14.09 | 14.28 | 13.79 | 14.22 | 13.42 |
| B = Pan + Larvae weight (mg)<br>Analyst: MHF<br>Date: 02-16-12 | 20.66 | 19.16 | 20.70 | 20.44 | 20.36 | 19.58 | 20.03 | 20.50 | 21.30 | 20.48 | 20.74 | 20.33 |
| C = Larvae weight (mg) = B – A<br>Hand calculated.<br>Analyst: | 6.19 | 6.04 | 6.60 | 6.72 | 6.87 | 5.81 | 5.69 | 6.41 | 7.02 | 6.69 | 6.52 | 6.91 |
| Weight per initial number of larvae (mg) = C / Initial number of larvae<br>Hand calculated.<br>Analyst: | 0.619 | 0.604 | 0.660 | 0.672 | 0.687 | 0.581 | 0.569 | 0.641 | 0.702 | 0.669 | 0.652 | 0.691 |
| Average weight per initial number of larvae (mg) | 0.639 | | | | 0.620 | | | | 0.679 | | | |
| Percent reduction from control (%) | | | | | 3.07. | | | | -6.27. | | | |

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

Calculations and data reviewed:

***Comments:***

Independent Review by Kelley E. Reeves Initials:

ETS
Environmental Testing Solutions, Inc.

**Species:** ***Pimephales promelas***
**Client:** **TVA / Gallatin Fossil Plant, Outfall 001** **Date:** 02-07-12

***Survival and Growth Data***

| Day | 5.1% | | | | 10.2% | | | | 20.4% | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 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 | 9'd | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 9'd | 10 | 10 | 10 |
| 6 | 9 | 10 | 9'd | 10 | 10 | 10 | 10 | 10 | 9 | 10 | 10 | 10 |
| 7 | 9 | 10 | 9 | 10 | 10 | 10 | 10 | 10 | 9 | 10 | 10 | 10 |
| A = Pan weight (mg)<br>Tray color code:: Light Pink<br>Analyst: MHF<br>Date: 01-31-12 | 14.69 | 14.85 | 14.41 | 12.99 | 14.17 | 15.44 | 13.83 | 14.16 | 14.19 | 13.51 | 15.60 | 14.32 |
| B = Pan + Larvae weight (mg)<br>Analyst: MHF<br>Date: 02-16-12 | 20.95 | 21.64 | 20.98 | 19.36 | 20.92 | 22.45 | 21.12 | 21.79 | 19.47 | 21.26 | 22.34 | 21.85 |
| C = Larvae weight (mg) = B – A<br>Hand calculated.<br>Analyst: [illegible] | 6.26 | 6.79 | 6.57 | 6.37 | 6.75 | 7.01 | 7.29 | 7.63 | 5.28 | 7.75 | 6.74 | 7.53 |
| Weight per initial number of larvae (mg) = C / Initial number of larvae<br>Hand calculated.<br>Analyst: [illegible] | 0.626 | 0.679 | 0.657 | 0.637 | 0.675 | 0.701 | 0.729 | 0.763 | 0.528 | 0.775 | 0.674 | 0.753 |
| Average weight per initial number of larvae (mg) / Percent reduction from control (%) | 0.650 | | -1.7% | | 0.717 | | -12.3% | | 0.683 | | -6.8% | |

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

Calculations and data reviewed: [illegible]

***Comments:***

ETS
Environmental Testing Solutions, Inc.

**Species:** ***Pimephales promelas***
**Client:** **TVA / Gallatin Fossil Plant, Outfall 001** **Date:** 02-07-12

***Survival and Growth Data***

| Day | 100% Intake | | | | [redacted] | | | |
|---|---|---|---|---|---|---|---|---|
| | Y | Z | AA | BB | [redacted] | | | |
| 0 | 10 | 10 | 10 | 10 | [redacted] | | | |
| 1 | 10 | 10 | 10 | 10 | [redacted] | | | |
| 2 | 10 | 10 | 10 | 10 | [redacted] | | | |
| 3 | 10 | 10 | 10 | 10 | [redacted] | | | |
| 4 | 10 | 10 | 10 | 10 | [redacted] | | | |
| 5 | 10 | 10 | 10 | 10 | [redacted] | | | |
| 6 | 10 | 10 | 10 | 10 | [redacted] | | | |
| 7 | 9 1d sm | 10 | 10 | 9 1d | [redacted] | | | |
| A = Pan weight (mg)<br>Tray color code:: Light Pink<br>Analyst: MRF<br>Date: 01-31-12 | 14.11 | 13.78 | 13.58 | 12.91 | [redacted] | | | |
| B = Pan + Larvae weight (mg)<br>Analyst: MRF<br>Date: 02-16-12 | 18.73 | 20.25 | 20.26 | 17.97 | [redacted] | | | |
| C = Larvae weight (mg) = B – A<br>Hand calculated.<br>Analyst: JL | 4.62 | 6.47 | 6.68 | 5.06 | [redacted] | | | |
| Weight per initial number of larvae (mg) = C / Initial number of larvae<br>Hand calculated.<br>Analyst: JL | 0.462 | 0.647 | 0.668 | 0.506 | [redacted] | | | |
| Average weight per initial number of larvae (mg) / Percent reduction from control (%) | 0.571 | | 10.67. | | [redacted] | | | |

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

Calculations and data reviewed: JL

***Comments:***

Independent Review by Kelley E. Keene Initials: KK

# TVA / Gallatin Fossil Plant, Outfall 001
## February 07-14, 2012

ETS
Environmental Testing Solutions, Inc.

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

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

Project number: 7666

| Concentration (%) | Replicate | Initial number of larvae | Final number of larvae | A = Pan weight (mg) | B = Pan + Larvae weight (mg) | Larvae weight (mg) = A - B | Not for Compliance Assessment, Internal Laboratory QC: Weight / Surviving number of larvae (mg) | Mean weight / Surviving number of larvae (mg) | Coefficient of variation (Mean weight per surviving number of larvae) (%) | Weight / Initial number of larvae (mg) | Mean survival (%) | Mean weight / Initial number of larvae (mg) | Coefficient of variation (Mean weight per initial number of larvae) (%) | Percent reduction from control (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Control | A | 10 | 10 | 14.47 | 20.66 | 6.19 | 0.619 | 0.639 | 5.1 | 0.619 | 100.0 | 0.639 | 5.1 | Not applicable |
| | B | 10 | 10 | 13.12 | 19.16 | 6.04 | 0.604 | | | 0.604 | | | | |
| | C | 10 | 10 | 14.10 | 20.70 | 6.60 | 0.660 | | | 0.660 | | | | |
| | D | 10 | 10 | 13.72 | 20.44 | 6.72 | 0.672 | | | 0.672 | | | | |
| 1.3% | E | 10 | 10 | 13.49 | 20.36 | 6.87 | 0.687 | 0.636 | 7.7 | 0.687 | 97.5 | 0.620 | 8.9 | 3.0 |
| | F | 10 | 9 | 13.77 | 19.58 | 5.81 | 0.646 | | | 0.581 | | | | |
| | G | 10 | 10 | 14.34 | 20.03 | 5.69 | 0.569 | | | 0.569 | | | | |
| | H | 10 | 10 | 14.09 | 20.50 | 6.41 | 0.641 | | | 0.641 | | | | |
| 2.6% | I | 10 | 10 | 14.28 | 21.30 | 7.02 | 0.702 | 0.697 | 5.4 | 0.702 | 97.5 | 0.679 | 3.3 | -6.2 |
| | J | 10 | 9 | 13.79 | 20.48 | 6.69 | 0.743 | | | 0.669 | | | | |
| | K | 10 | 10 | 14.22 | 20.74 | 6.52 | 0.652 | | | 0.652 | | | | |
| | L | 10 | 10 | 13.42 | 20.33 | 6.91 | 0.691 | | | 0.691 | | | | |
| 5.1% | M | 10 | 9 | 14.69 | 20.95 | 6.26 | 0.696 | 0.685 | 5.6 | 0.626 | 95.0 | 0.650 | 3.6 | -1.7 |
| | N | 10 | 10 | 14.85 | 21.64 | 6.79 | 0.679 | | | 0.679 | | | | |
| | O | 10 | 9 | 14.41 | 20.98 | 6.57 | 0.730 | | | 0.657 | | | | |
| | P | 10 | 10 | 12.99 | 19.36 | 6.37 | 0.637 | | | 0.637 | | | | |
| 10.2% | Q | 10 | 10 | 14.17 | 20.92 | 6.75 | 0.675 | 0.717 | 5.3 | 0.675 | 100.0 | 0.717 | 5.3 | -12.3 |
| | R | 10 | 10 | 15.44 | 22.45 | 7.01 | 0.701 | | | 0.701 | | | | |
| | S | 10 | 10 | 13.83 | 21.12 | 7.29 | 0.729 | | | 0.729 | | | | |
| | T | 10 | 10 | 14.16 | 21.79 | 7.63 | 0.763 | | | 0.763 | | | | |
| 20.4% | U | 10 | 9 | 14.19 | 19.47 | 5.28 | 0.587 | 0.697 | 12.3 | 0.528 | 97.5 | 0.683 | 16.4 | -6.8 |
| | V | 10 | 10 | 13.51 | 21.26 | 7.75 | 0.775 | | | 0.775 | | | | |
| | W | 10 | 10 | 15.60 | 22.34 | 6.74 | 0.674 | | | 0.674 | | | | |
| | X | 10 | 10 | 14.32 | 21.85 | 7.53 | 0.753 | | | 0.753 | | | | |
| 100% Intake | Y | 10 | 9 | 14.11 | 18.73 | 4.62 | 0.513 | 0.598 | 12.1 | 0.462 | 95.0 | 0.571 | 17.9 | 10.6 |
| | Z | 10 | 10 | 13.78 | 20.25 | 6.47 | 0.647 | | | 0.647 | | | | |
| | AA | 10 | 10 | 13.58 | 20.26 | 6.68 | 0.668 | | | 0.668 | | | | |
| | BB | 10 | 9 | 12.91 | 17.97 | 5.06 | 0.562 | | | 0.506 | | | | |

**Outfall 101:**
**Dunnett's MSD value:** 0.0960
**PMSD:** 15.0

**Intake:**
**Dunnett's MSD value:** 0.1041
**PMSD:** 16.3

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

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

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

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

File: gaf001_020712data.xlsx
Entered by: J. Sumner
Reviewed by: _____

# TVA / Gallatin Fossil Plant, Outfall 001
## February 07-14, 2012

ETS Environmental Testing Solutions, Inc.

Statistical Analyses

**Larval Fish Growth and Survival Test-7 Day Growth**

| | | | | | |
|---|---|---|---|---|---|
| Start Date: | 2/7/2012 | Test ID: | PpFRCR | Sample ID: | TVA / Gallatin Fossil Plant, Outfall 001 |
| End Date: | 2/14/2012 | Lab ID: | ETS-Envir. Testing Sol. | Sample Type: | DMR-Discharge Monitoring Report |
| Sample Date: | | Protocol: | FWCHR-EPA-821-R-02-013 | Test Species: | PP-Pimephales promelas |
| Comments: | | | | | |

| Conc-% | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| D-Control | 0.6190 | 0.6040 | 0.6600 | 0.6720 |
| 1.3 | 0.6870 | 0.5610 | 0.5690 | 0.6410 |
| 2.6 | 0.7020 | 0.6690 | 0.6520 | 0.6910 |
| 5.1 | 0.6260 | 0.6790 | 0.6570 | 0.6370 |
| 10.2 | 0.6750 | 0.7010 | 0.7290 | 0.7630 |
| 20.4 | 0.5280 | 0.7750 | 0.6740 | 0.7530 |
| Intake | 0.4620 | 0.6470 | 0.6680 | 0.5060 |

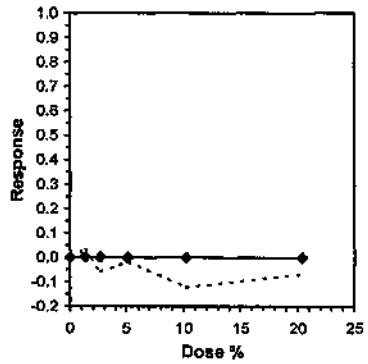
| | | | Transform: Untransformed | | | | | 1-Tailed | | | Isotonic | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conc-% | Mean | N-Mean | Mean | Min | Max | CV% | N | t-Stat | Critical | MSD | Mean | N-Mean |
| D-Control | 0.6388 | 1.0000 | 0.6388 | 0.6040 | 0.6720 | 5.077 | 4 | | | | 0.6643 | 1.0000 |
| 1.3 | 0.6195 | 0.9699 | 0.6195 | 0.5690 | 0.6870 | 8.866 | 4 | 0.483 | 2.410 | 0.0960 | 0.6643 | 1.0000 |
| 2.6 | 0.6785 | 1.0622 | 0.6785 | 0.6520 | 0.7020 | 3.297 | 4 | -0.996 | 2.410 | 0.0960 | 0.6643 | 1.0000 |
| 5.1 | 0.6498 | 1.0172 | 0.6498 | 0.6260 | 0.6790 | 3.593 | 4 | -0.276 | 2.410 | 0.0960 | 0.6643 | 1.0000 |
| 10.2 | 0.7170 | 1.1225 | 0.7170 | 0.6750 | 0.7630 | 5.268 | 4 | -1.965 | 2.410 | 0.0960 | 0.6643 | 1.0000 |
| 20.4 | 0.6825 | 1.0685 | 0.6825 | 0.5280 | 0.7750 | 16.375 | 4 | -1.099 | 2.410 | 0.0960 | 0.6643 | 1.0000 |
| Intake | 0.5708 | 0.8935 | 0.5708 | 0.4620 | 0.6680 | 17.894 | 4 | | | | | |

| Auxiliary Tests | Statistic | Critical | Skew | Kurt |
|---|---|---|---|---|
| Shapiro-Wilk's Test indicates normal distribution (p > 0.01) | 0.92928 | 0.884 | -0.9175 | 3.07177 |
| Bartlett's Test indicates equal variances (p = 0.05) | 11.1286 | 15.0863 | | |

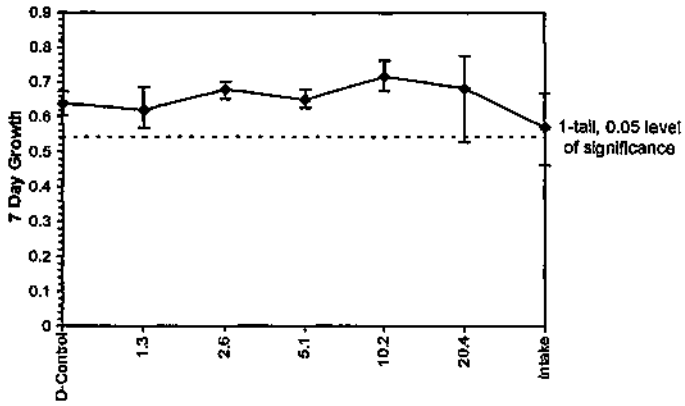
| Hypothesis Test (1-tail, 0.05) | NOEC | LOEC | ChV | TU | MSDu | MSDp | MSB | MSE | F-Prob | df |
|---|---|---|---|---|---|---|---|---|---|---|
| Dunnett's Test | 20.4 | >20.4 | | 4.90196 | 0.09597 | 0.15025 | 0.00495 | 0.00317 | 0.22177 | 5, 18 |
| Treatments vs D-Control | | | | | | | | | | |

**Linear Interpolation (200 Resamples)**

| Point | % | SD | 95% CL(Exp) | Skew |
|---|---|---|---|---|
| IC05 | >20.4 | | | |
| IC10 | >20.4 | | | |
| IC15 | >20.4 | | | |
| IC20 | >20.4 | | | |
| IC25 | >20.4 | | | |
| IC40 | >20.4 | | | |
| IC50 | >20.4 | | | |




**Dose-Response Plot**




Independent Review by Kelley E. Kemp Initials:



File: gaf001_020712data.xlsx
Entered by: J. Surgner
Reviewed by: _____

# TVA / Gallatin Fossil Plant, Intake
# February 07-14, 2012

ETS Environmental Testing Solutions, Inc.

## Statistical Analyses

**Larval Fish Growth and Survival Test-7 Day Growth**

| | | | | | |
|---|---|---|---|---|---|
| Start Date: | 2/7/2012 | Test ID: | PpFRCR | Sample ID: | TVA / Gallatin Fossil Plant, Intake |
| End Date: | 2/14/2012 | Lab ID: | ETS-Envir. Testing Sol. | Sample Type: | DMR-Discharge Monitoring Report |
| Sample Date: | | Protocol: | FWCHR-EPA-821-R-02-013 | Test Species: | PP-Pimephales promelas |
| Comments: | | | | | |

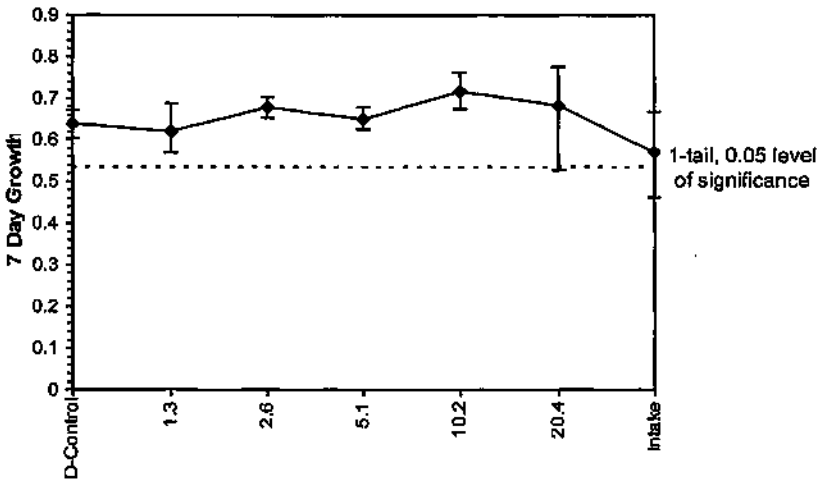
| Conc-% | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| D-Control | 0.6190 | 0.6040 | 0.6600 | 0.6720 |
| 1.3 | 0.6870 | 0.5810 | 0.5690 | 0.6410 |
| 2.6 | 0.7020 | 0.6690 | 0.6520 | 0.6910 |
| 5.1 | 0.6260 | 0.6790 | 0.6570 | 0.6370 |
| 10.2 | 0.6750 | 0.7010 | 0.7290 | 0.7630 |
| 20.4 | 0.5280 | 0.7750 | 0.6740 | 0.7530 |
| Intake | 0.4620 | 0.6470 | 0.6680 | 0.5060 |

| | | | Transform: Untransformed | | | | | | 1-Tailed | |
|---|---|---|---|---|---|---|---|---|---|---|
| Conc-% | Mean | N-Mean | Mean | Min | Max | CV% | N | t-Stat | Critical | MSD |
| D-Control | 0.6388 | 1.0000 | 0.6388 | 0.6040 | 0.6720 | 5.077 | 4 | | | |
| 1.3 | 0.6195 | 0.9699 | 0.6195 | 0.5690 | 0.6870 | 8.866 | 4 | | | |
| 2.6 | 0.6785 | 1.0622 | 0.6785 | 0.6520 | 0.7020 | 3.297 | 4 | | | |
| 5.1 | 0.6498 | 1.0172 | 0.6498 | 0.6260 | 0.6790 | 3.593 | 4 | | | |
| 10.2 | 0.7170 | 1.1225 | 0.7170 | 0.6750 | 0.7630 | 5.268 | 4 | | | |
| 20.4 | 0.6825 | 1.0685 | 0.6825 | 0.5280 | 0.7750 | 16.375 | 4 | | | |
| Intake | 0.5708 | 0.8935 | 0.5708 | 0.4620 | 0.6680 | 17.894 | 4 | 1.269 | 1.943 | 0.1041 |

| Auxiliary Tests | Statistic | Critical | Skew | Kurt |
|---|---|---|---|---|
| Shapiro-Wilk's Test indicates normal distribution (p > 0.01) | 0.97687 | 0.749 | -0.1092 | -0.8826 |
| F-Test indicates equal variances (p = 0.09) | 9.91861 | 47.4683 | | |

| Hypothesis Test (1-tail, 0.05) | MSDu | MSDp | MSB | MSE | F-Prob | df |
|---|---|---|---|---|---|---|
| Homoscedastic t Test indicates no significant differences Treatments vs D-Control | 0.10411 | 0.16299 | 0.00925 | 0.00574 | 0.25138 | 1, 6 |

**Dose-Response Plot**






File: gaf001_020712data.xlsx
Entered by: J. Sumner
Reviewed by: ____

ETS
Environmental Testing Solutions, Inc.

# TVA / Gallatin Fossil Plant, Outfall 001
## February 07-14, 2012
*Pimephales promelas* Chronic Whole Effluent Toxicity Test
EPA-821-R-02-013, Method 1000.0

### Daily Chemical Analyses

Project number: 7666

| Concentration | Parameter | Day 0 | | Day 1 | | Day 2 | | Day 3 | | Day 4 | | Day 5 | | Day 6 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Initial | Final | Initial | Final | Initial | Final | Initial | Final | Initial | Final | Initial | Final | Initial | Final |
| Control | pH (SU) | 7.93 | 7.86 | 7.89 | 7.71 | 7.96 | 7.78 | 7.89 | 7.80 | 7.98 | 7.68 | 8.02 | 7.83 | 7.99 | 7.87 |
| | DO (mg/L) | 7.6 | 8.0 | 7.6 | 8.1 | 7.7 | 7.7 | 7.6 | 7.7 | 7.7 | 7.7 | 7.7 | 7.8 | 7.9 | 8.0 |
| | Conductivity (µmhos/cm) | 312 | | 320 | | 307 | | 318 | | 313 | | 306 | | 310 | |
| | Alkalinity (mg/L $CaCO_3$) | 62 | | 64 | | | | 62 | | | | 61 | | | |
| | Hardness (mg/L $CaCO_3$) | 91 | | 91 | | | | 87 | | | | 89 | | | |
| | Temperature (°C) | 24.8 | 24.5 | 24.9 | 24.6 | 24.9 | 24.8 | 24.9 | 24.7 | 24.7 | 24.7 | 24.8 | 24.5 | 24.7 | 24.5 |
| 1.3% | pH (SU) | 8.02 | 7.86 | 7.91 | 7.68 | 7.94 | 7.77 | 7.95 | 7.78 | 7.92 | 7.73 | 7.96 | 7.81 | 7.95 | 7.87 |
| | DO (mg/L) | 8.0 | 8.0 | 7.7 | 7.9 | 7.8 | 7.6 | 7.8 | 7.7 | 7.7 | 7.1 | 7.8 | 7.7 | 7.6 | 8.0 |
| | Conductivity (µmhos/cm) | 305 | | 310 | | 308 | | 314 | | 309 | | 304 | | 315 | |
| | Temperature (°C) | 24.8 | 24.8 | 25.0 | 24.6 | 24.9 | 24.5 | 24.9 | 24.5 | 24.9 | 24.6 | 24.9 | 24.8 | 24.8 | 24.5 |
| 2.6% | pH (SU) | 8.00 | 7.82 | 7.93 | 7.68 | 7.97 | 7.80 | 7.97 | 7.82 | 7.94 | 7.73 | 7.97 | 7.86 | 7.97 | 7.89 |
| | DO (mg/L) | 8.0 | 7.9 | 7.6 | 7.8 | 7.8 | 7.6 | 7.8 | 7.8 | 7.7 | 7.1 | 7.6 | 7.7 | 7.6 | 8.1 |
| | Conductivity (µmhos/cm) | 306 | | 312 | | 310 | | 318 | | 310 | | 306 | | 315 | |
| | Temperature (°C) | 24.8 | 24.6 | 25.0 | 24.5 | 24.9 | 24.5 | 24.9 | 24.8 | 24.9 | 24.6 | 24.9 | 24.6 | 24.9 | 24.4 |
| 5.1% | pH (SU) | 8.00 | 7.81 | 7.94 | 7.64 | 7.99 | 7.79 | 7.97 | 7.79 | 7.96 | 7.74 | 7.98 | 7.85 | 7.98 | 7.90 |
| | DO (mg/L) | 8.1 | 7.9 | 7.7 | 7.8 | 7.8 | 7.7 | 7.9 | 7.8 | 7.7 | 7.0 | 7.7 | 7.8 | 7.6 | 8.0 |
| | Conductivity (µmhos/cm) | 306 | | 313 | | 310 | | 323 | | 311 | | 308 | | 316 | |
| | Temperature (°C) | 24.8 | 24.8 | 25.0 | 24.7 | 24.9 | 24.7 | 24.9 | 24.7 | 24.9 | 24.6 | 24.9 | 24.6 | 24.9 | 24.4 |
| 10.2% | pH (SU) | 7.99 | 7.82 | 7.95 | 7.75 | 7.99 | 7.84 | 7.98 | 7.81 | 7.98 | 7.80 | 7.99 | 7.89 | 7.99 | 7.95 |
| | DO (mg/L) | 8.1 | 7.9 | 7.8 | 7.7 | 7.8 | 7.8 | 8.0 | 7.8 | 7.8 | 7.0 | 7.6 | 7.7 | 7.6 | 8.0 |
| | Conductivity (µmhos/cm) | 310 | | 317 | | 309 | | 324 | | 313 | | 308 | | 319 | |
| | Temperature (°C) | 24.8 | 24.8 | 25.0 | 24.7 | 24.9 | 24.7 | 24.9 | 24.7 | 24.9 | 24.8 | 24.9 | 24.6 | 24.9 | 24.2 |
| 20.4% | pH (SU) | 7.98 | 7.83 | 7.99 | 7.76 | 7.97 | 7.84 | 8.02 | 7.86 | 8.00 | 7.75 | 8.02 | 7.86 | 8.04 | 7.96 |
| | DO (mg/L) | 8.1 | 7.9 | 7.9 | 7.8 | 7.9 | 7.9 | 8.0 | 7.8 | 7.8 | 7.0 | 7.6 | 7.9 | 7.7 | 8.1 |
| | Conductivity (µmhos/cm) | 313 | | 318 | | 314 | | 327 | | 320 | | 313 | | 325 | |
| | Temperature (°C) | 24.8 | 24.7 | 25.0 | 24.7 | 24.9 | 24.6 | 25.0 | 24.7 | 24.9 | 24.5 | 24.9 | 24.5 | 24.9 | 24.2 |
| 100% | pH (SU) | 7.88 | | | | 7.87 | | | | 8.09 | | | | | |
| | DO (mg/L) | 8.2 | | | | 8.2 | | | | 8.2 | | | | | |
| | Conductivity (µmhos/cm) | 355 | | | | 363 | | | | 368 | | | | | |
| | Alkalinity (mg/L $CaCO_3$) | 129 | | | | 129 | | | | 121 | | | | | |
| | Hardness (mg/L $CaCO_3$) | 178 | | | | 170 | | | | 166 | | | | | |
| | Total Residual Chlorine (mg/L) | <0.10 | | | | <0.10 | | | | <0.10 | | | | | |
| | Temperature (°C) | 25.0 | | | | 25.2 | | | | 25.0 | | | | | |
| 100% Intake | pH (SU) | 7.88 | 7.79 | 7.94 | 7.68 | 7.83 | 7.76 | 7.96 | 7.80 | 7.85 | 7.72 | 7.84 | 7.85 | 7.96 | 7.91 |
| | DO (mg/L) | 8.3 | 7.8 | 7.9 | 7.7 | 8.2 | 7.8 | 8.3 | 7.7 | 8.2 | 7.0 | 7.7 | 7.9 | 7.9 | 8.0 |
| | Conductivity (µmhos/cm) | 190 | | 191 | | 188 | | 198 | | 186 | | 182 | | 194 | |
| | Alkalinity (mg/L $CaCO_3$) | 71 | | | | 69 | | | | 67 | | | | | |
| | Hardness (mg/L $CaCO_3$) | 85 | | | | 89 | | | | 85 | | | | | |
| | Total Residual Chlorine (mg/L) | <0.10 | | | | <0.10 | | | | <0.10 | | | | | |
| | Temperature (°C) | 25.1 | 24.7 | 25.1 | 24.6 | 25.0 | 24.8 | 25.0 | 24.8 | 25.0 | 24.5 | 24.8 | 24.3 | 24.9 | 24.3 |

File: gaf001_020712chem.xls
Entered by: J. Sumner
Reviewed by: JH

ETS
Environmental Testing Solutions, Inc.

**Species:** ***Pimephales promelas*** **Date:** 07-02-12
**Client:** **TVA / Gallatin Fossil Plant, Outfall 001**
***Daily Chemistry:***

| | | Day | | | | | |
|---|---|---|---|---|---|---|---|
| | | 0 | | 1 | | 2 | |
| | *Analyst* | CDJ | CDJ | CDJ | CDJ | CDJ | CDJ |
| **Concentration** | **Parameter** | | | | | | |
| CONTROL | pH (S.U.) | 7.93 | 7.86 | 7.89 | 7.71 | 7.96 | 7.78 |
| | DO (mg/L) | 7.6 | 8.0 | 7.6 | 8.1 | 7.7 | 7.7 |
| | Conductivity (µmhos/cm) | 312 | | 320 | | 307 | |
| | Alkalinity (mg $CaCO_3$/L) | 62 | | 64 | | 07-02-12 | |
| | Hardness (mg $CaCO_3$/L) | 91 | | 91 | | | |
| | Temperature (°C) | 24.8 | 24.5 | 24.9 | 24.6 | 24.9 | 24.8 |
| 1.3% | pH (S.U.) | 8.02 | 7.86 | 7.91 | 7.68 | 7.94 | 7.77 |
| | DO (mg/L) | 8.0 | 8.0 | 7.7 | 7.9 | 7.9 | 7.6 |
| | Conductivity (µmhos/cm) | 305 | | 310 | | 308 | |
| | Temperature (°C) | 24.8 | 24.8 | 25.0 | 24.6 | 24.9 | 24.5 |
| 2.6% | pH (S.U.) | 8.00 | 7.82 | 7.93 | 7.68 | 7.97 | 7.80 |
| | DO (mg/L) | 8.0 | 7.9 | 7.6 | 7.8 | 7.8 | 7.6 |
| | Conductivity (µmhos/cm) | 306 | | 312 | | 310 | |
| | Temperature (°C) | 24.8 | 24.6 | 25.0 | 24.5 | 24.9 | 24.5 |
| 5.1% | pH (S.U.) | 8.00 | 7.81 | 7.94 | 7.64 | 7.99 | 7.79 |
| | DO (mg/L) | 8.1 | 7.9 | 7.7 | 7.8 | 7.8 | 7.7 |
| | Conductivity (µmhos/cm) | 306 | | 313 | | 310 | |
| | Temperature (°C) | 24.8 | 24.8 | 25.0 | 24.7 | 24.9 | 24.7 |
| 10.2% | pH (S.U.) | 7.99 | 7.82 | 7.95 | 7.75 | 7.99 | 7.84 |
| | DO (mg/L) | 8.1 | 7.9 | 7.9 | 7.7 | 7.8 | 7.8 |
| | Conductivity (µmhos/cm) | 310 | | 317 | | 309 | |
| | Temperature (°C) | 24.8 | 24.8 | 25.0 | 24.7 | 24.9 | 24.7 |
| 20.4% | pH (S.U.) | 7.98 | 7.83 | 7.99 | 7.76 | 7.97 | 7.84 |
| | DO (mg/L) | 8.1 | 7.9 | 7.9 | 7.8 | 7.9 | 7.9 |
| | Conductivity (µmhos/cm) | 313 | | 318 | | 314 | |
| | Temperature (°C) | 24.8 | 24.7 | 25.0 | 24.7 | 24.9 | 24.6 |
| 100% Outfall | pH (S.U.) | 7.88 | | | | 7.87 | |
| | DO (mg/L) | 8.2 | | | | 8.2 | |
| | Conductivity (µmhos/cm) | 355 | | | | 363 | |
| | Alkalinity (mg $CaCO_3$/L) | 129 | | | | 129 | |
| | Hardness (mg $CaCO_3$/L) | 178 | | | | 170 | |
| | TR chlorine (mg/L) | <0.10 | | | | <0.10 | |
| | Temperature (°C) | 25.0 | | | | 25.2 | |
| | | Initial | Final | Initial | Final | Initial | Final |

Independent Review by Kelley E. Brenner Initials: KB

ETS
Environmental Testing Solutions, Inc.

**Species:** *Pimephales promelas*
**Client:** TVA / Gallatin Fossil Plant, Outfall 001 **Date:** 02-07-12

| | | Day | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 3 | | 4 | | 5 | | 6 | |
| | *Analyst* | CDJ | JCB | JCB | JCB | JCB | CDJ | CDJ | CDJ |
| Concen-tration | Parameter | | | | | | | | |
| CONTROL | pH (S.U.) | 7.89 | 7.80 | 7.98 | 7.68 | 8.02 | 7.83 | 7.99 | 7.87 |
| | DO (mg/L) | 7.6 | 7.7 | 7.7 | 7.1 | 7.7 | 7.8 | 7.9 | 8.0 |
| | Conductivity (µmhos/cm) | 318 | | 313 | | 306 | | 310 | |
| | Alkalinity (mg $CaCO_3$/L) | 62 | | ~~[illegible]~~ | | 61 | | ~~[illegible]~~ | |
| | Hardness (mg $CaCO_3$/L) | 87 | | | | 89 | | | |
| | Temperature (°C) | 24.9 | 24.7 | 24.7 | 24.7 | 24.8 | 24.5 | 24.7 | 24.5 |
| 1.3% | pH (S.U.) | 7.95 | 7.78 | 7.92 | 7.73 | 7.96 | 7.81 | 7.95 | 7.87 |
| | DO (mg/L) | 7.8 | 7.7 | 7.7 | 7.1 | 7.8 | 7.7 | 7.6 | 8.0 |
| | Conductivity (µmhos/cm) | 314 | | 309 | | 304 | | 315 | |
| | Temperature (°C) | 24.9 | 24.5 | 24.9 | 24.6 | 24.9 | 24.8 | 24.8 | 24.5 |
| 2.6% | pH (S.U.) | 7.97 | 7.82 | 7.94 | 7.73 | 7.97 | 7.86 | 7.97 | 7.89 |
| | DO (mg/L) | 7.8 | 7.8 | 7.7 | 7.1 | 7.6 | 7.7 | 7.6 | 8.1 |
| | Conductivity (µmhos/cm) | 318 | | 310 | | 306 | | 315 | |
| | Temperature (°C) | 24.9 | 24.8 | 24.9 | 24.6 | 24.9 | 24.6 | 24.9 | 24.4 |
| 5.1% | pH (S.U.) | 7.97 | 7.79 | 7.96 | 7.74 | 7.98 | 7.85 | 7.98 | 7.90 |
| | DO (mg/L) | 7.9 | 7.8 | 7.7 | 7.0 | 7.7 | 7.8 | 7.6 | 8.0 |
| | Conductivity (µmhos/cm) | 323 | | 311 | | 308 | | 316 | |
| | Temperature (°C) | 24.9 | 24.7 | 24.9 | 24.6 | 24.9 | 24.6 | 24.9 | 24.4 |
| 10.2% | pH (S.U.) | 7.98 | 7.81 | 7.98 | 7.80 | 7.99 | 7.89 | 7.99 | 7.95 |
| | DO (mg/L) | 8.0 | 7.8 | 7.8 | 7.0 | 7.6 | 7.7 | 7.6 | 8.0 |
| | Conductivity (µmhos/cm) | 324 | | 313 | | 308 | | 319 | |
| | Temperature (°C) | 24.9 | 24.7 | 24.9 | 24.8 | 24.9 | 24.6 | 24.9 | 24.2 |
| 20.4% | pH (S.U.) | 8.02 | 7.86 | 8.00 | 7.75 | 8.02 | 7.86 | 8.04 | 7.96 |
| | DO (mg/L) | 8.0 | 7.8 | 7.8 | 7.0 | 7.6 | 7.9 | 7.7 | 8.1 |
| | Conductivity (µmhos/cm) | 327 | | 320 | | 313 | | 325 | |
| | Temperature (°C) | 25.0 | 24.7 | 24.9 | 24.5 | 24.9 | 24.5 | 24.9 | 24.2 |
| 100% Outfall | pH (S.U.) | | | 8.09 | | | | | |
| | DO (mg/L) | | | 8.2 | | | | | |
| | Conductivity (µmhos/cm) | | | 368 | | | | | |
| | Alkalinity (mg $CaCO_3$/L) | | | 121 | | | | | |
| | Hardness (mg $CaCO_3$/L) | | | 166 | | | | | |
| | TR chlorine (mg/L) | | | <0.10 | | | | | |
| | Temperature (°C) | | | 25.0 | | | | | |
| | | Initial | Final | Initial | Final | Initial | Final | Initial | Final |

Independent Review by Kelley E. Ferrell

ETS
Environmental Testing Solutions, Inc.

**Species:** ***Pimephales promelas***
**Client:** **TVA / Gallatin Fossil Plant, Outfall 001** **Date:** 02-07-12

***Daily Chemistry:***

| | | Day | | | | | |
|---|---|---|---|---|---|---|---|
| | | 0 | | 1 | | 2 | |
| | *Analyst* | CDJ | CDJ | CDJ | CDJ | CDJ | CDJ |
| **Concentration** | **Parameter** | | | | | | |
| 100% Intake | pH (S.U.) | 7.88 | 7.79 | 7.94 | 7.68 | 7.83 | 7.76 |
| | DO (mg/L) | 8.3 | 7.8 | 7.9 | 7.7 | 8.2 | 7.8 |
| | Conductivity (µmhos/cm) | 190 | | 191 | | 188 | |
| | Alkalinity (mg $CaCO_3$/L) | 71 | | | | 69 | |
| | Hardness (mg $CaCO_3$/L) | 85 | | | | 89 | |
| | TR chlorine (mg/L) | <0.10 | | | | <0.10 | |
| | Temperature (°C) | 25.1 | 24.7 | 25.1 | 24.6 | 25.0 | 24.8 |
| | | Initial | Final | Initial | Final | Initial | Final |

| | | Day | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 3 | | 4 | | 5 | | 6 | |
| | *Analyst* | CDJ | JLB | JLB | JLB | JLB | CDJ | CDJ | CDJ |
| **Concen-tration** | **Parameter** | | | | | | | | |
| 100% Intake | pH (S.U.) | 7.96 | 7.80 | 7.85 | 7.72 | 7.84 | 7.85 | 7.96 | 7.91 |
| | DO (mg/L) | 8.3 | 7.7 | 8.2 | 7.6 | 7.7 | 7.9 | 7.9 | 8.0 |
| | Conductivity (µmhos/cm) | 198 | | 186 | | 182 | | 194 | |
| | Alkalinity (mg $CaCO_3$/L) | | | 67 | | | | | |
| | Hardness (mg $CaCO_3$/L) | | | 85 | | | | | |
| | TR chlorine (mg/L) | | | <0.10 | | | | | |
| | Temperature (°C) | 25.0 | 24.8 | 25.0 | 24.5 | 24.8 | 24.3 | 24.9 | 24.3 |
| | | Initial | Final | Initial | Final | Initial | Final | Initial | Final |

Independent Review by Kelley E. Kiernan Initials: KK

ETS
Environmental Testing Solutions, Inc.

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

**Client:** Tennessee Valley Authority
**Facility:** Gallatin Fossil Plant
**NPDES #:** TN0005428
**Project #:** 7666

**County:** ~~Summer~~ SUMNER
**Outfall:** 001

| *Dilution preparation information:* | | | | | | *Comments:* |
|---|---|---|---|---|---|---|
| Dilution prep (%) | 1.3 | 2.6 | 5.1 | 10.2 | 20.4 | |
| Effluent volume (mL) | 19.5 | 39 | 76.5 | 153 | 306 | |
| Diluent volume (mL) | 1480.5 | 1461 | 1423.5 | 1347 | 1194 | |
| Total volume (mL) | 1500 | 1500 | 1500 | 1500 | 1500 | |

| *Test organism source information:* | | | | | | | | | | | *Test information:* | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Organism age: | < 24-hours old | | | | | | | | | | Randomizing template color: | GOLD |
| Date and times organisms were born between: | 02-07-12 0713 TO 0947 | | | | | | | | | | Incubator number and shelf location: | 2C1 |
| Culture board: | 01-31-12 B | | | 01-31-12 B | | | | | | | | |
| Replicate number: | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | YWT batch: | 01-05-12 |
| Culture board cup number: | 31 | 32 | 35 | 2 | 3 | 4 | 12 | 13 | 21 | 32 | | |
| Transfer vessel information: | pH = 7.90 S.U. Temperature = 24.9 °C | | | | | | | | | | *Selenastrum* batch: | 01-30-12 |
| Average transfer volume (mL): | 0.0415 mL | | | | | | | | | | | |

### *Daily renewal information:*

| Day | Date | Test initiation and feeding, renewal and feeding, or termination time | MHSW batch used | Sample numbers used Outfall 001 | Sample numbers used Intake | Analyst |
|---|---|---|---|---|---|---|
| 0 | 02-07-12 | 1076 | 02-01-12 | 120207.01 | 120207.02 | JH |
| 1 | 02-08-12 | 0928 | 02-02-12 | 120207.01 | 120207.02 | JH |
| 2 | 02-09-12 | 0927 | 02-02-12 | 120208.26 | 120208.27 | JH |
| 3 | 02-10-12 | 0938 | 02-08-12 | 120208.26 | 120208.27 | JH |
| 4 | 02-11-12 | 1000 | 02-08-12 | 120210.16 | 120210.17 | JH |
| 5 | 02-12-12 | 0928 | 02-10-12 | 120210.16 | 120210.17 | JH |
| 6 | 02-13-12 | 0930 | 02-10-12 | 120210.16 | 120210.17 | JH |
| 7 | 02-14-12 | 0948 | | | | JH |

| *Control information:* | Control-1 | Control-2 | Acceptance criteria | *Summary of test endpoints:* | |
|---|---|---|---|---|---|
| % of Male Adults: | 0% | 0% | ≤ 20% | 7-day $LC_{50}$ | > 20.47% |
| % Adults having 3rd Broods: | 100% | 100% | ≥ 80% | NOEC | 20.47% |
| % Mortality: | 0% | 0% | ≤ 20% | LOEC | > 20.47% |
| Mean Offspring/Female: | 31.3 | 30.3 | ≥ 15.0 offspring/female | ChV | > 20.47% |
| % CV: | 5.0% | 5.8% | < 40.0 % | $IC_{25}$ | > 20.47% |

Independent Review by Kelley E. Keene Initials: KK

ETS Environmental Testing Solutions, Inc.

Species: *Ceriodaphnia dubia*
Client: TVA / Gallatin Fossil Plant, Outfall 001 Date: 02-07-12

**CONTROL-1** *Survival and Reproduction Data*

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

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

| *Concentration:* | |
|---|---|
| % Mortality: | 0% |
| Mean Offspring/Female: | 31.3 |

CONC: 1.3% *Survival and Reproduction Data*

| Day | | Replicate number 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Young produced | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 2 | Young produced | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 3 | Young produced | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 4 | Young produced | 5 | 4 | 4 | 4 | 5 | 4 | 5 | 4 | 5 | 5 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 5 | Young produced | 13 | 12 | 12 | 11 | 12 | 12 | 13 | 12 | 10 | 12 |
| | 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 | 15 | 17 | 14 | 17 | 16 | 14 | 14 | 18 | 15 | 17 |
| Total young produced | | 33 | 33 | 30 | 32 | 33 | 30 | 32 | 34 | 30 | 34 |
| Final Adult Mortality | | L | L | L | L | L | L | L | L | L | L |

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

| *Concentration:* | |
|---|---|
| % Mortality: | 0% |
| Mean Offspring/Female: | 32.1 |
| % Reduction from Control-1: | -2.6% |

Independent Review by Kelley E. Keen Initials: KK

ETS Environmental Testing Solutions, Inc.

**Species:** *Ceriodaphnia dubia*
**Client:** TVA / Gallatin Fossil Plant, Outfall 001 **Date:** 02-07-12

CONC: **2.6%** ***Survival and Reproduction Data***

| Day | | Replicate number 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Young produced | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 2 | Young produced | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 3 | Young produced | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 4 | Young produced | 5 | 4 | 6 | 4 | 4 | 5 | 4 | 4 | 4 | 4 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 5 | Young produced | 12 | 13 | 12 | 12 | 11 | 13 | 13 | 12 | 11 | 12 |
| | 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 | 18 | 16 | 16 | 16 | 15 | 13 | 17 | 17 | 14 | 18 |
| Total young produced | | 35 | 33 | 34 | 32 | 30 | 31 | 34 | 33 | 29 | 34 |
| Final Adult Mortality | | L | L | L | L | L | L | L | L | L | L |

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

| *Concentration:* | |
|---|---|
| % Mortality: | 0% |
| Mean Offspring/Female: | 32.5 |
| % Reduction from Control-1: | -3.8% |

CONC: **5.1%** ***Survival and Reproduction Data***

| Day | | Replicate number 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Young produced | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 2 | Young produced | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 3 | Young produced | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 4 | Young produced | 4 | 5 | 5 | 4 | 5 | 5 | 5 | 4 | 4 | 4 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 5 | Young produced | 12 | 12 | 11 | 13 | 13 | 13 | 12 | 10 | 11 | 11 |
| | 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 | 17 | 17 | 18 | 17 | 14 | 15 | 13 | 15 | 15 | 19 |
| Total young produced | | 33 | 34 | 34 | 34 | 32 | 33 | 30 | 29 | 30 | 34 |
| Final Adult Mortality | | L | L | L | L | L | L | L | L | L | L |

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

| *Concentration:* | |
|---|---|
| % Mortality: | 0% |
| Mean Offspring/Female: | 32.3 |
| % Reduction from Control-1: | -3.2% |

Independent Review by Kelley E. Keene Initials: KK

ETS Environmental Testing Solutions, Inc.

**Species:** *Ceriodaphnia dubia*
**Client:** TVA / Gallatin Fossil Plant, Outfall 001 **Date:** 02-07-12

CONC: **10.2%** ***Survival and Reproduction Data***

| Day | | Replicate number 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Young produced | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 2 | Young produced | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 3 | Young produced | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 4 | Young produced | 4 | 4 | 5 | 4 | 4 | 6 | 4 | 5 | 5 | 6 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 5 | Young produced | 13 | 12 | 12 | 14 | 12 | 12 | 13 | 13 | 12 | 12 |
| | 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 | 19 | 15 | 15 | 18 | 16 | 18 | 17 | 18 | 15 | 14 |
| Total young produced | | 36 | 31 | 32 | 36 | 32 | 36 | 34 | 36 | 32 | 32 |
| Final Adult Mortality | | L | L | L | L | L | L | L | L | L | L |

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

| *Concentration:* | |
|---|---|
| % Mortality: | 0% |
| Mean Offspring/Female: | 33.7 |
| % Reduction from Control-1: | -7.7% |

CONC: **20.4%** ***Survival and Reproduction Data***

| Day | | Replicate number 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Young produced | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 2 | Young produced | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 3 | Young produced | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 4 | Young produced | 5 | 4 | 5 | 5 | 6 | 4 | 4 | 4 | 5 | 5 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 5 | Young produced | 13 | 12 | 12 | 14 | 11 | 13 | 13 | 13 | 12 | 13 |
| | 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 | 19 | 17 | 18 | 18 | 18 | 16 | 16 | 19 | 18 | 19 |
| Total young produced | | 37 | 33 | 35 | 37 | 35 | 33 | 33 | 36 | 35 | 37 |
| Final Adult Mortality | | L | L | L | L | L | L | L | L | L | L |

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

| *Concentration:* | |
|---|---|
| % Mortality: | 0% |
| Mean Offspring/Female: | 35.1 |
| % Reduction from Control-1: | -12.1% |

Independent Review by Kelley E. Kreman Initials: K

ETS Environmental Testing Solutions, Inc.

Species: *Ceriodaphnia dubia*
Client: TVA / Gallatin Fossil Plant, Outfall 001 Date: 07-07-12

**CONTROL-2** *Survival and Reproduction Data*

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

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

| *Concentration:* | |
|---|---|
| % Mortality: | 0% |
| Mean Offspring/Female: | 30.3 |

CONC: **100% Intake** *Survival and Reproduction Data*

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

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

| *Concentration:* | |
|---|---|
| % Mortality: | 0% |
| Mean Offspring/Female: | 36.6 |
| % Reduction from Control-2: | -20.8% |

Independent Review by Kelley E. Keenan (Initials: KK)

# TVA / Gallatin Fossil Plant, Outfall 001
## February 07-14, 2012

ETS
Environmental Testing Solutions, Inc.

## Verification of *Ceriodaphnia* Reproduction Totals

### Control-1

| Day | Replicate number 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 6 | 4 | 4 | 43 |
| 5 | 12 | 12 | 13 | 12 | 10 | 10 | 13 | 11 | 12 | 12 | 117 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 14 | 16 | 16 | 15 | 14 | 16 | 16 | 16 | 15 | 15 | 153 |
| Total | 31 | 32 | 33 | 31 | 28 | 30 | 33 | 33 | 31 | 31 | 313 |

### 1.3%

| Day | Replicate number 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 5 | 4 | 4 | 4 | 5 | 4 | 5 | 4 | 5 | 5 | 45 |
| 5 | 13 | 12 | 12 | 11 | 12 | 12 | 13 | 12 | 10 | 12 | 119 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 15 | 17 | 14 | 17 | 16 | 14 | 14 | 18 | 15 | 17 | 157 |
| Total | 33 | 33 | 30 | 32 | 33 | 30 | 32 | 34 | 30 | 34 | 321 |

### 2.6%

| Day | Replicate number 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 5 | 4 | 6 | 4 | 4 | 5 | 4 | 4 | 4 | 4 | 44 |
| 5 | 12 | 13 | 12 | 12 | 11 | 13 | 13 | 12 | 11 | 12 | 121 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 18 | 16 | 16 | 16 | 15 | 13 | 17 | 17 | 14 | 18 | 160 |
| Total | 35 | 33 | 34 | 32 | 30 | 31 | 34 | 33 | 29 | 34 | 325 |

### 5.1%

| Day | Replicate number 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 4 | 5 | 5 | 4 | 5 | 5 | 5 | 4 | 4 | 4 | 45 |
| 5 | 12 | 12 | 11 | 13 | 13 | 13 | 12 | 10 | 11 | 11 | 118 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 17 | 17 | 18 | 17 | 14 | 15 | 13 | 15 | 15 | 19 | 160 |
| Total | 33 | 34 | 34 | 34 | 32 | 33 | 30 | 29 | 30 | 34 | 323 |

### 10.2%

| Day | Replicate number 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 4 | 4 | 5 | 4 | 4 | 6 | 4 | 5 | 5 | 6 | 47 |
| 5 | 13 | 12 | 12 | 14 | 12 | 12 | 13 | 13 | 12 | 12 | 125 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 19 | 15 | 15 | 18 | 16 | 18 | 17 | 18 | 15 | 14 | 165 |
| Total | 36 | 31 | 32 | 36 | 32 | 36 | 34 | 36 | 32 | 32 | 337 |

### 20.4%

| Day | Replicate number 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 5 | 4 | 5 | 5 | 6 | 4 | 4 | 4 | 5 | 5 | 47 |
| 5 | 13 | 12 | 12 | 14 | 11 | 13 | 13 | 13 | 12 | 13 | 126 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 19 | 17 | 18 | 18 | 18 | 16 | 16 | 19 | 18 | 19 | 178 |
| Total | 37 | 33 | 35 | 37 | 35 | 33 | 33 | 36 | 35 | 37 | 351 |

### Control-2

| Day | Replicate number 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 3 | 3 | 4 | 4 | 4 | 5 | 4 | 4 | 4 | 4 | 39 |
| 5 | 12 | 10 | 11 | 12 | 12 | 12 | 11 | 12 | 12 | 13 | 117 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 14 | 14 | 14 | 13 | 16 | 15 | 16 | 16 | 16 | 13 | 147 |
| Total | 29 | 27 | 29 | 29 | 32 | 32 | 31 | 32 | 32 | 30 | 303 |

### 100% Intake

| Day | Replicate number 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 5 | 5 | 4 | 5 | 5 | 5 | 6 | 5 | 4 | 6 | 50 |
| 5 | 13 | 12 | 12 | 13 | 14 | 12 | 14 | 12 | 13 | 13 | 128 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 19 | 19 | 19 | 20 | 17 | 19 | 18 | 18 | 21 | 18 | 188 |
| Total | 37 | 36 | 35 | 38 | 36 | 36 | 38 | 35 | 38 | 37 | 366 |

File: gaf001_020712data.xlsx
Entered by: J. Sumner
Reviewed by:

# TVA / Gallatin Fossil Plant, Outfall 001
# February 07-14, 2012

ETS
Environmental Testing Solutions, Inc.

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

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

Project number: 7666

| 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 - 1 | 31 | 32 | 33 | 31 | 28 | 30 | 33 | 33 | 31 | 31 | 100 | 31.3 | 5.0 | Not applicable |
| 1.3% | 33 | 33 | 30 | 32 | 33 | 30 | 32 | 34 | 30 | 34 | 100 | 32.1 | 5.0 | -2.6 |
| 2.6% | 35 | 33 | 34 | 32 | 30 | 31 | 34 | 33 | 29 | 34 | 100 | 32.5 | 6.0 | -3.8 |
| 5.1% | 33 | 34 | 34 | 34 | 32 | 33 | 30 | 29 | 30 | 34 | 100 | 32.3 | 6.0 | -3.2 |
| 10.2% | 36 | 31 | 32 | 36 | 32 | 36 | 34 | 36 | 32 | 32 | 100 | 33.7 | 6.3 | -7.7 |
| 20.4% | 37 | 33 | 35 | 37 | 35 | 33 | 33 | 36 | 35 | 37 | 100 | 35.1 | 4.7 | -12.1 |
| Control - 2 | 29 | 27 | 29 | 29 | 32 | 32 | 31 | 32 | 32 | 30 | 100 | 30.3 | 5.8 | Not applicable |
| 100% Intake | 37 | 36 | 35 | 38 | 36 | 36 | 38 | 35 | 38 | 37 | 100 | 36.6 | 3.2 | -20.8 |

**Outfall 001:**
**Dunnett's MSD value:** 1.860
**PMSD:** 5.9

**Intake:**
**Dunnett's MSD value:** 1.163
**PMSD:** 3.8

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

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

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

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

File: gaf001_020712data.xlsx
Table populated from associated "Verification of Ceriodaphnia Reproduction Totals" spreadsheet.
Spreadsheet entered by: J. Sumner
Reviewed by: JS

# TVA / Gallatin Fossil Plant, Outfall 001
## February 07-14, 2012

ETS Environmental Testing Solutions, Inc.

Statistical Analyses

**Ceriodaphnia Survival and Reproduction Test-Reproduction**

| | | | | | |
|---|---|---|---|---|---|
| Start Date: | 2/7/2012 | Test ID: | CdFRCR | Sample ID: | TVA / Gallatin Fossil Plant, Outfall 001 |
| End Date: | 2/14/2012 | Lab ID: | ETS-Envir. Testing Sol. | Sample Type: | DMR-Discharge Monitoring Report |
| Sample Date: | | Protocol: | FWCHR-EPA-821-R-02-013 | Test Species: | CD-Ceriodaphnia dubia |
| Comments: | | | | | |

| Conc-% | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Control-1 | 31.000 | 32.000 | 33.000 | 31.000 | 28.000 | 30.000 | 33.000 | 33.000 | 31.000 | 31.000 |
| Control-2 | 29.000 | 27.000 | 29.000 | 29.000 | 32.000 | 32.000 | 31.000 | 32.000 | 32.000 | 30.000 |
| 1.3 | 33.000 | 33.000 | 30.000 | 32.000 | 33.000 | 30.000 | 32.000 | 34.000 | 30.000 | 34.000 |
| 2.6 | 35.000 | 33.000 | 34.000 | 32.000 | 30.000 | 31.000 | 34.000 | 33.000 | 29.000 | 34.000 |
| 5.1 | 33.000 | 34.000 | 34.000 | 34.000 | 32.000 | 33.000 | 30.000 | 29.000 | 30.000 | 34.000 |
| 10.2 | 36.000 | 31.000 | 32.000 | 36.000 | 32.000 | 36.000 | 34.000 | 38.000 | 32.000 | 32.000 |
| 20.4 | 37.000 | 33.000 | 35.000 | 37.000 | 35.000 | 33.000 | 33.000 | 38.000 | 35.000 | 37.000 |
| Intake | 37.000 | 36.000 | 35.000 | 38.000 | 36.000 | 36.000 | 38.000 | 35.000 | 38.000 | 37.000 |

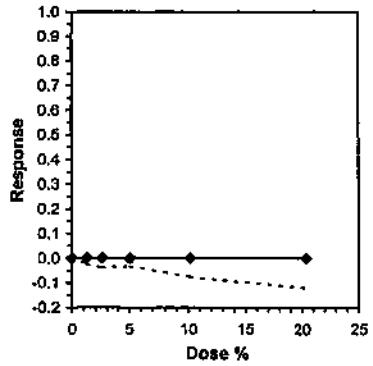
| | | | Transform: Untransformed | | | | | Rank | 1-Tailed | Isotonic | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Conc-% | Mean | N-Mean | Mean | Min | Max | CV% | N | Sum | Critical | Mean | N-Mean |
| Control-1 | 31.300 | 1.0330 | 31.300 | 28.000 | 33.000 | 5.006 | 10 | * | | 32.833 | 1.0000 |
| Control-2 | 30.300 | 1.0000 | 30.300 | 27.000 | 32.000 | 5.832 | 10 | | | | |
| 1.3 | 32.100 | 1.0594 | 32.100 | 30.000 | 34.000 | 4.969 | 10 | 118.00 | 75.00 | 32.833 | 1.0000 |
| 2.6 | 32.500 | 1.0726 | 32.500 | 29.000 | 35.000 | 6.024 | 10 | 125.00 | 75.00 | 32.833 | 1.0000 |
| 5.1 | 32.300 | 1.0660 | 32.300 | 29.000 | 34.000 | 6.026 | 10 | 122.50 | 75.00 | 32.833 | 1.0000 |
| 10.2 | 33.700 | 1.1122 | 33.700 | 31.000 | 36.000 | 6.264 | 10 | 135.00 | 75.00 | 32.833 | 1.0000 |
| 20.4 | 35.100 | 1.1584 | 35.100 | 33.000 | 37.000 | 4.739 | 10 | 150.50 | 75.00 | 32.833 | 1.0000 |
| Intake | 36.600 | 1.2079 | 36.600 | 35.000 | 38.000 | 3.207 | 10 | | | | |

| Auxiliary Tests | Statistic | Critical | Skew | Kurt |
|---|---|---|---|---|
| Kolmogorov D Test indicates non-normal distribution (p <= 0.01) | 1.09077 | 1.035 | -0.3599 | -1.1381 |
| Bartlett's Test indicates equal variances (p = 0.93) | 1.35551 | 15.0863 | | |
| The control means are not significantly different (p = 0.20) | 1.33897 | 2.10092 | | |

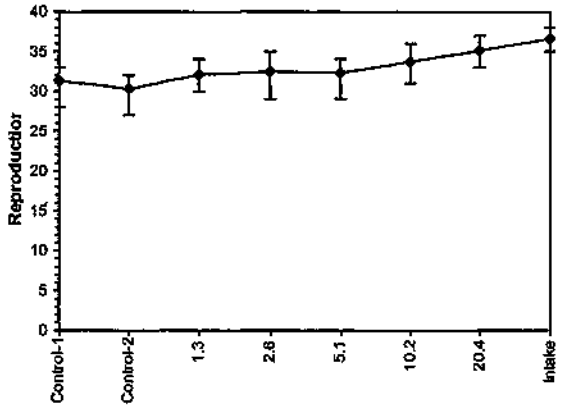
| Hypothesis Test (1-tail, 0.05) | NOEC | LOEC | ChV | TU |
|---|---|---|---|---|
| Steel's Many-One Rank Test | 20.4 | >20.4 | | 4.90196 |
| Treatments vs Control-1 | | | | |

**Linear Interpolation (200 Resamples)**

| Point | % | SD | 95% CL | Skew |
|---|---|---|---|---|
| IC05 | >20.4 | | | |
| IC10 | >20.4 | | | |
| IC15 | >20.4 | | | |
| IC20 | >20.4 | | | |
| IC25 | >20.4 | | | |
| IC40 | >20.4 | | | |
| IC50 | >20.4 | | | |




**Dose-Response Plot**




Independent Review by Kelley E. Kemmerer (initials) KK



File: gal001_020712data.xlsx
Entered by: J. Sumner
Reviewed by: _____

# TVA / Gallatin Fossil Plant, Outfall 001
# February 07-14, 2012

ETS
Environmental Testing Solutions, Inc.

## Statistical Analyses

**Used for PMSD calculation only. Ceriodaphnia Survival and Reproduction Test-Reproduction**

| | | | | | |
|---|---|---|---|---|---|
| Start Date: | 2/7/2012 | Test ID: | CdFRCR | Sample ID: | TVA / Gallatin Fossil Plant, Outfall 001 |
| End Date: | 2/14/2012 | Lab ID: | ETS-Envir. Testing Sol. | Sample Type: | DMR-Discharge Monitoring Report |
| Sample Date: | | Protocol: | FWCHR-EPA-821-R-02-013 | Test Species: | CD-Ceriodaphnia dubia |
| Comments: | | | | | |

| Conc-% | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Control-1 | 31.000 | 32.000 | 33.000 | 31.000 | 28.000 | 30.000 | 33.000 | 33.000 | 31.000 | 31.000 |
| Control-2 | 29.000 | 27.000 | 29.000 | 29.000 | 32.000 | 32.000 | 31.000 | 32.000 | 32.000 | 30.000 |
| 1.3 | 33.000 | 33.000 | 30.000 | 32.000 | 33.000 | 30.000 | 32.000 | 34.000 | 30.000 | 34.000 |
| 2.6 | 35.000 | 33.000 | 34.000 | 32.000 | 30.000 | 31.000 | 34.000 | 33.000 | 29.000 | 34.000 |
| 5.1 | 33.000 | 34.000 | 34.000 | 34.000 | 32.000 | 33.000 | 30.000 | 29.000 | 30.000 | 34.000 |
| 10.2 | 36.000 | 31.000 | 32.000 | 36.000 | 32.000 | 36.000 | 34.000 | 36.000 | 32.000 | 32.000 |
| 20.4 | 37.000 | 33.000 | 35.000 | 37.000 | 35.000 | 33.000 | 33.000 | 36.000 | 35.000 | 37.000 |
| Intake | 37.000 | 36.000 | 35.000 | 38.000 | 36.000 | 36.000 | 38.000 | 35.000 | 38.000 | 37.000 |

| | | | Transform: Untransformed | | | | | | 1-Tailed | |
|---|---|---|---|---|---|---|---|---|---|---|
| Conc-% | Mean | N-Mean | Mean | Min | Max | CV% | N | t-Stat | Critical | MSD |
| Control-1 | 31.300 | 1.0330 | 31.300 | 28.000 | 33.000 | 5.006 | 10 | * | | |
| Control-2 | 30.300 | 1.0000 | 30.300 | 27.000 | 32.000 | 5.832 | 10 | | | |
| 1.3 | 32.100 | 1.0594 | 32.100 | 30.000 | 34.000 | 4.969 | 10 | -0.984 | 2.287 | 1.860 |
| 2.6 | 32.500 | 1.0726 | 32.500 | 29.000 | 35.000 | 6.024 | 10 | -1.475 | 2.287 | 1.860 |
| 5.1 | 32.300 | 1.0660 | 32.300 | 29.000 | 34.000 | 6.026 | 10 | -1.230 | 2.287 | 1.860 |
| 10.2 | 33.700 | 1.1122 | 33.700 | 31.000 | 36.000 | 6.264 | 10 | -2.951 | 2.287 | 1.860 |
| 20.4 | 35.100 | 1.1584 | 35.100 | 33.000 | 37.000 | 4.739 | 10 | -4.672 | 2.287 | 1.860 |
| Intake | 36.600 | 1.2079 | 36.600 | 35.000 | 38.000 | 3.207 | 10 | | | |

| Auxiliary Tests | Statistic | Critical | Skew | Kurt |
|---|---|---|---|---|
| Kolmogorov D Test indicates non-normal distribution (p <= 0.01) | 1.09077 | 1.035 | -0.3599 | -1.1381 |
| Bartlett's Test indicates equal variances (p = 0.93) | 1.35551 | 15.0863 | | |
| The control means are not significantly different (p = 0.20) | 1.33897 | 2.10092 | | |

| Hypothesis Test (1-tail, 0.05) | NOEC | LOEC | ChV | TU | MSDu | MSDp | MSB | MSE | F-Prob | df |
|---|---|---|---|---|---|---|---|---|---|---|
| Dunnett's Test | 20.4 | >20.4 | | 4.90196 | 1.85978 | 0.05942 | 18.3467 | 3.30741 | 3.4E-04 | 5, 54 |
| Treatments vs Control-1 | | | | | | | | | | |

Independent Review by Kelley E. Kennedy Initials: KK



File: gaf001_020712data.xlsx
Entered by: J. Sumner
Reviewed by: _____

# TVA / Gallatin Fossil Plant, Intake
# February 07-14, 2012

ETS Environmental Testing Solutions, Inc.

Statistical Analyses

**Ceriodaphnia Survival and Reproduction Test-Reproduction**

| | | | | | |
|---|---|---|---|---|---|
| Start Date: | 2/7/2012 | Test ID: | CdFRCR | Sample ID: | TVA / Gallatin Fossil Plant, Intake |
| End Date: | 2/14/2012 | Lab ID: | ETS-Envir. Testing Sol. | Sample Type: | DMR-Discharge Monitoring Report |
| Sample Date: | | Protocol: | FWCHR-EPA-821-R-02-013 | Test Species: | CD-Ceriodaphnia dubia |
| Comments: | | | | | |

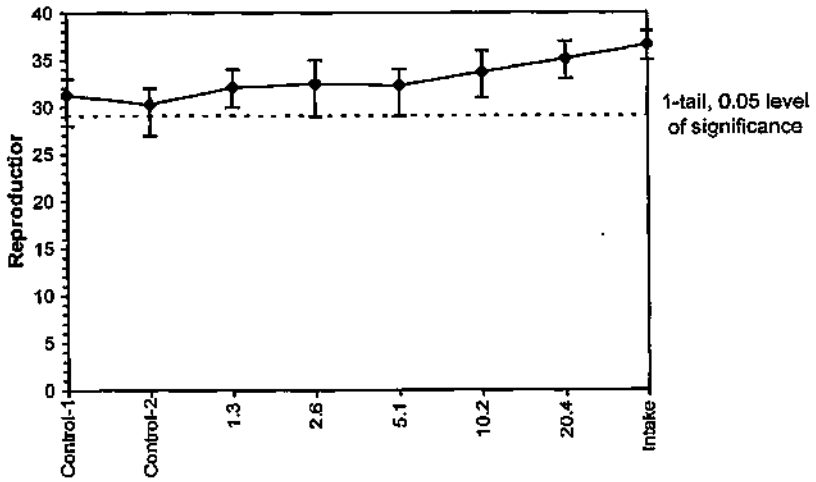
| Conc-% | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Control-1 | 31.000 | 32.000 | 33.000 | 31.000 | 28.000 | 30.000 | 33.000 | 33.000 | 31.000 | 31.000 |
| Control-2 | 29.000 | 27.000 | 29.000 | 29.000 | 32.000 | 32.000 | 31.000 | 32.000 | 32.000 | 30.000 |
| 1.3 | 33.000 | 33.000 | 30.000 | 32.000 | 33.000 | 30.000 | 32.000 | 34.000 | 30.000 | 34.000 |
| 2.6 | 35.000 | 33.000 | 34.000 | 32.000 | 30.000 | 31.000 | 34.000 | 33.000 | 29.000 | 34.000 |
| 5.1 | 33.000 | 34.000 | 34.000 | 34.000 | 32.000 | 33.000 | 30.000 | 29.000 | 30.000 | 34.000 |
| 10.2 | 36.000 | 31.000 | 32.000 | 36.000 | 32.000 | 36.000 | 34.000 | 36.000 | 32.000 | 32.000 |
| 20.4 | 37.000 | 33.000 | 35.000 | 37.000 | 35.000 | 33.000 | 33.000 | 36.000 | 35.000 | 37.000 |
| Intake | 37.000 | 36.000 | 35.000 | 38.000 | 36.000 | 36.000 | 38.000 | 35.000 | 38.000 | 37.000 |

| | | | Transform: Untransformed | | | | | | 1-Tailed | |
|---|---|---|---|---|---|---|---|---|---|---|
| Conc-% | Mean | N-Mean | Mean | Min | Max | CV% | N | t-Stat | Critical | MSD |
| Control-1 | 31.300 | 1.0330 | 31.300 | 28.000 | 33.000 | 5.006 | 10 | | | |
| Control-2 | 30.300 | 1.0000 | 30.300 | 27.000 | 32.000 | 5.832 | 10 | * | | |
| 1.3 | 32.100 | 1.0594 | 32.100 | 30.000 | 34.000 | 4.969 | 10 | | | |
| 2.6 | 32.500 | 1.0726 | 32.500 | 29.000 | 35.000 | 6.024 | 10 | | | |
| 5.1 | 32.300 | 1.0660 | 32.300 | 29.000 | 34.000 | 6.026 | 10 | | | |
| 10.2 | 33.700 | 1.1122 | 33.700 | 31.000 | 36.000 | 6.264 | 10 | | | |
| 20.4 | 35.100 | 1.1584 | 35.100 | 33.000 | 37.000 | 4.739 | 10 | | | |
| Intake | 36.600 | 1.2079 | 36.600 | 35.000 | 38.000 | 3.207 | 10 | -9.391 | 1.734 | 1.163 |

| Auxiliary Tests | Statistic | Critical | Skew | Kurt |
|---|---|---|---|---|
| Shapiro-Wilk's Test indicates normal distribution (p > 0.01) | 0.90706 | 0.868 | -0.4329 | -0.5838 |
| F-Test indicates equal variances (p = 0.24) | 2.26613 | 6.54109 | | |
| The control means are not significantly different (p = 0.20) | 1.33897 | 2.10092 | | |

| Hypothesis Test (1-tail, 0.05) | MSDu | MSDp | MSB | MSE | F-Prob | df |
|---|---|---|---|---|---|---|
| Homoscedastic t Test indicates no significant differences Treatments vs Control-2 | 1.16324 | 0.03839 | 198.45 | 2.25 | 2.3E-08 | 1, 18 |

**Dose-Response Plot**




Independent Review by Kelley E. Kenna Initials:



File: gaf001_020712data.xlsx
Entered by: J. Sumner
Reviewed by:

# TVA / Gallatin Fossil Plant, Outfall 001
## February 07-14, 2012

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

ETS
Environmental Testing Solutions, Inc.



### Daily Chemical Analyses

Project number: 7666

| Concentration | Parameter | Day 0 | | Day 1 | | Day 2 | | Day 3 | | Day 4 | | Day 5 | | Day 6 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Initial | Final | Initial | Final | Initial | Final | Initial | Final | Initial | Final | Initial | Final | Initial | Final |
| CONTROL | pH (SU) | 7.93 | 7.91 | 7.89 | 7.91 | 7.96 | 7.97 | 7.89 | 7.93 | 7.98 | 7.91 | 8.02 | 7.96 | 7.99 | 7.98 |
| | DO (mg/L) | 7.6 | 7.9 | 7.6 | 8.1 | 7.7 | 7.7 | 7.6 | 7.9 | 7.7 | 8.0 | 7.7 | 7.9 | 7.9 | 8.0 |
| | Conductivity (µmhos/cm) | 312 | | 320 | | 307 | | 318 | | 313 | | 306 | | 310 | |
| | Alkalinity (mg/L $CaCO_3$) | 62 | | 64 | | | | 62 | | | | 61 | | | |
| | Hardness (mg/L $CaCO_3$) | 91 | | 91 | | | | 87 | | | | 89 | | | |
| | Temperature (°C) | 24.7 | 24.9 | 24.7 | 24.7 | 24.8 | 25.3 | 24.8 | 24.9 | 24.8 | 24.9 | 24.9 | 25.1 | 24.8 | 25.0 |
| 1.3% | pH (SU) | 8.02 | 7.90 | 7.91 | 7.93 | 7.94 | 7.96 | 7.95 | 7.94 | 7.92 | 7.92 | 7.96 | 7.94 | 7.95 | 7.93 |
| | DO (mg/L) | 8.0 | 7.8 | 7.7 | 8.1 | 7.8 | 7.7 | 7.8 | 7.9 | 7.7 | 7.8 | 7.8 | 7.9 | 7.6 | 8.0 |
| | Conductivity (µmhos/cm) | 305 | | 310 | | 308 | | 314 | | 309 | | 304 | | 315 | |
| | Temperature (°C) | 24.9 | 24.8 | 24.8 | 24.8 | 24.9 | 25.0 | 24.9 | 25.1 | 24.8 | 25.3 | 24.9 | 25.1 | 24.8 | 24.9 |
| 2.6% | pH (SU) | 8.00 | 7.90 | 7.93 | 7.93 | 7.97 | 7.96 | 7.97 | 7.94 | 7.94 | 7.92 | 7.97 | 7.94 | 7.97 | 7.92 |
| | DO (mg/L) | 8.0 | 7.8 | 7.6 | 8.1 | 7.8 | 7.7 | 7.8 | 7.9 | 7.7 | 7.7 | 7.6 | 7.8 | 7.6 | 8.0 |
| | Conductivity (µmhos/cm) | 306 | | 312 | | 310 | | 318 | | 310 | | 306 | | 315 | |
| | Temperature (°C) | 24.9 | 24.9 | 24.8 | 24.8 | 24.9 | 25.2 | 24.9 | 25.1 | 24.8 | 25.1 | 24.9 | 25.3 | 24.8 | 24.9 |
| 5.1% | pH (SU) | 8.00 | 7.90 | 7.94 | 7.98 | 7.99 | 7.95 | 7.97 | 7.95 | 7.96 | 7.94 | 7.98 | 7.94 | 7.98 | 7.91 |
| | DO (mg/L) | 8.1 | 7.9 | 7.7 | 8.0 | 7.8 | 7.7 | 7.9 | 7.9 | 7.7 | 7.6 | 7.7 | 7.8 | 7.6 | 8.0 |
| | Conductivity (µmhos/cm) | 306 | | 313 | | 310 | | 323 | | 311 | | 308 | | 316 | |
| | Temperature (°C) | 24.9 | 24.9 | 24.8 | 24.8 | 24.9 | 25.2 | 24.9 | 24.8 | 24.8 | 25.1 | 24.8 | 25.2 | 24.8 | 24.9 |
| 10.2% | pH (SU) | 7.99 | 7.91 | 7.95 | 7.99 | 7.99 | 7.94 | 7.98 | 7.97 | 7.98 | 7.98 | 7.99 | 7.94 | 7.99 | 7.92 |
| | DO (mg/L) | 8.1 | 7.9 | 7.8 | 8.0 | 7.8 | 7.7 | 8.0 | 7.9 | 7.8 | 7.6 | 7.6 | 7.8 | 7.6 | 7.9 |
| | Conductivity (µmhos/cm) | 310 | | 317 | | 309 | | 324 | | 313 | | 308 | | 319 | |
| | Temperature (°C) | 24.9 | 24.8 | 24.8 | 24.8 | 24.9 | 25.2 | 25.0 | 25.0 | 24.8 | 25.0 | 24.8 | 25.2 | 24.8 | 25.1 |
| 20.4% | pH (SU) | 7.98 | 7.97 | 7.99 | 8.03 | 7.97 | 7.99 | 8.02 | 8.01 | 8.00 | 7.99 | 8.02 | 8.01 | 8.04 | 7.98 |
| | DO (mg/L) | 8.1 | 7.9 | 7.9 | 8.0 | 7.9 | 7.8 | 8.0 | 8.0 | 7.8 | 7.6 | 7.6 | 7.9 | 7.7 | 8.0 |
| | Conductivity (µmhos/cm) | 313 | | 318 | | 314 | | 327 | | 320 | | 313 | | 325 | |
| | Temperature (°C) | 24.9 | 24.8 | 24.9 | 25.0 | 25.0 | 25.0 | 25.0 | 25.0 | 24.8 | 25.2 | 24.8 | 25.2 | 24.9 | 25.1 |
| 100% | pH (SU) | 7.88 | | | | 7.87 | | | | 8.09 | | | | | |
| | DO (mg/L) | 8.2 | | | | 8.2 | | | | 8.2 | | | | | |
| | Conductivity (µmhos/cm) | 355 | | | | 363 | | | | 368 | | | | | |
| | Alkalinity (mg/L $CaCO_3$) | 129 | | | | 129 | | | | 121 | | | | | |
| | Hardness (mg/L $CaCO_3$) | 178 | | | | 170 | | | | 166 | | | | | |
| | Total Residual Chlorine (mg/L) | <0.10 | | | | <0.10 | | | | <0.10 | | | | | |
| | Temperature (°C) | 25.0 | | | | 25.2 | | | | 25.0 | | | | | |
| 100% Intake | pH (SU) | 7.88 | 7.92 | 7.94 | 7.98 | 7.83 | 7.91 | 7.96 | 7.94 | 7.85 | 7.96 | 7.84 | 7.97 | 7.96 | 7.95 |
| | DO (mg/L) | 8.3 | 8.0 | 7.9 | 8.2 | 8.2 | 7.8 | 8.3 | 7.9 | 8.2 | 7.9 | 7.7 | 8.0 | 7.9 | 8.1 |
| | Conductivity (µmhos/cm) | 190 | | 191 | | 188 | | 198 | | 186 | | 182 | | 194 | |
| | Alkalinity (mg/L $CaCO_3$) | 71 | | | | 69 | | | | 67 | | | | | |
| | Hardness (mg/L $CaCO_3$) | 85 | | | | 89 | | | | 85 | | | | | |
| | Total Residual Chlorine (mg/L) | <0.10 | | | | <0.10 | | | | <0.10 | | | | | |
| | Temperature (°C) | 25.2 | 24.8 | 25.0 | 24.7 | 24.9 | 25.1 | 24.9 | 24.8 | 25.0 | 25.1 | 24.8 | 25.0 | 24.9 | 25.2 |

File: gaf001_020712chem.xls
Entered by: J. Sumner
Reviewed by: _____

ETS Environmental Testing Solutions, Inc.

Species: *Ceriodaphnia dubia* Date: 02-07-12

Client: TVA / Gallatin Fossil Plant, Outfall 001

*Daily Chemistry:*

| | | Day | | | | | |
|---|---|---|---|---|---|---|---|
| | | 0 | | 1 | | 2 | |
| | Analyst | CDJ | CDJ | CDJ | CDJ | CDJ | CDJ |
| Concentration | Parameter | | | | | | |
| CONTROL | pH (S.U.) | 7.93 | 7.91 | 7.89 | 7.91 | 7.96 | 7.97 |
| | DO (mg/L) | 7.6 | 7.9 | 7.6 | 8.1 | 7.7 | 7.7 |
| | Conductivity (µmhos/cm) | 312 | | 320 | | 307 | |
| | Alkalinity (mg $CaCO_3$/L) | 62 | | 64 | | 02-07-12 | |
| | Hardness (mg $CaCO_3$/L) | 91 | | 91 | | | |
| | Temperature (°C) | 24.7 | 24.9 | 24.7 | 24.7 | 24.8 | 25.3 |
| 1.3% | pH (S.U.) | 8.02 | 7.90 | 7.91 | 7.93 | 7.94 | 7.96 |
| | DO (mg/L) | 8.0 | 7.8 | 7.7 | 8.1 | 7.8 | 7.7 |
| | Conductivity (µmhos/cm) | 305 | | 310 | | *308 (308) | |
| | Temperature (°C) | 24.9 | 24.8 | 24.8 | 24.8 | 24.9 | 25.0 |
| 2.6% | pH (S.U.) | 8.00 | 7.90 | 7.93 | 7.93 | 7.97 | 7.96 |
| | DO (mg/L) | 8.0 | 7.8 | 7.6 | 8.1 | 7.8 | 7.7 |
| | Conductivity (µmhos/cm) | 306 | | 312 | | 310 | |
| | Temperature (°C) | 24.9 | 24.9 | 24.8 | 24.8 | 24.9 | 25.2 |
| 5.1% | pH (S.U.) | 8.00 | 7.90 | 7.94 | 7.98 | 7.99 | 7.95 |
| | DO (mg/L) | 8.1 | 7.9 | 7.7 | 8.0 | 7.8 | 7.7 |
| | Conductivity (µmhos/cm) | 306 | | 313 | | 310 | |
| | Temperature (°C) | 24.9 | 24.9 | 24.8 | 24.8 | 24.9 | 25.2 |
| 10.2% | pH (S.U.) | 7.99 | 7.91 | 7.95 | 7.99 | 7.99 | 7.94 |
| | DO (mg/L) | 8.1 | 7.9 | 7.8 | 8.0 | 7.8 | 7.7 |
| | Conductivity (µmhos/cm) | 310 | | 317 | | 309 | |
| | Temperature (°C) | 24.9 | 24.8 | 24.8 | 24.8 | 24.9 | 25.2 |
| 20.4% | pH (S.U.) | 7.98 | 7.97 | 7.99 | 8.03 | 7.97 | 7.99 |
| | DO (mg/L) | 8.1 | 7.9 | 7.9 | 8.0 | 7.9 | 7.8 |
| | Conductivity (µmhos/cm) | 313 | | 318 | | 314 | |
| | Temperature (°C) | 24.9 | 24.8 | 24.9 | 25.0 | 25.0 | 25.0 |
| 100% Outfall | pH (S.U.) | 7.88 | | | | 7.87 | |
| | DO (mg/L) | 8.2 | | | | 8.2 | |
| | Conductivity (µmhos/cm) | 355 | | | | 363 | |
| | Alkalinity (mg $CaCO_3$/L) | 129 | | | | 129 | |
| | Hardness (mg $CaCO_3$/L) | 178 | | | | 170 | |
| | TR chlorine (mg/L) | <0.10 | | | | <0.10 | |
| | Temperature (°C) | 25.0 | | | | 25.2 | |
| | | Initial | Final | Initial | Final | Initial | Final |

*02-07-12 CDJ

Independent Review by Kelley E. Kerr Initials

ETS Environmental Testing Solutions Inc.

**Species:** *Ceriodaphnia dubia*
**Client:** TVA / Gallatin Fossil Plant, Outfall 001 **Date:** 02-07-12

| | | Day | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 3 | | 4 | | 5 | | 6 | |
| | Analyst | CDJ | JLB | JLB | JLB | JLB | CDJ | CDJ | CDJ |
| Concentration | Parameter | | | | | | | | |
| CONTROL | pH (S.U.) | 7.89 | 7.93 | 7.98 | 7.91 | 8.02 | 7.94 | 7.99 | 7.98 |
| | DO (mg/L) | 7.6 | 7.9 | 7.7 | 8.1 | 7.7 | 7.9 | 7.9 | 8.0 |
| | Conductivity (µmhos/cm) | 318 | | 313 | | 306 | | 310 | |
| | Alkalinity (mg $CaCO_3$/L) | 62 | | 02-11-12 | | 61 | | 02-13-12 | |
| | Hardness (mg $CaCO_3$/L) | 87 | | | | 89 | | | |
| | Temperature (°C) | 24.8 | 24.9 | 24.8 | 24.9 | 24.9 | 25.1 | 24.8 | 25.0 |
| 1.3% | pH (S.U.) | 7.95 | 7.94 | 7.92 | 7.92 | 7.96 | 7.94 | 7.95 | 7.93 |
| | DO (mg/L) | 7.8 | 7.9 | 7.7 | 7.8 | 7.8 | 7.9 | 7.6 | 8.0 |
| | Conductivity (µmhos/cm) | 314 | | 309 | | 304 | | 315 | |
| | Temperature (°C) | 24.9 | 25.1 | 24.8 | 25.3 | 24.9 | 25.1 | 24.8 | 24.9 |
| 2.6% | pH (S.U.) | 7.97 | 7.94 | 7.94 | 7.92 | 7.97 | 7.94 | 7.97 | 7.92 |
| | DO (mg/L) | 7.8 | 7.9 | 7.7 | 7.7 | 7.6 | 7.8 | 7.6 | 8.0 |
| | Conductivity (µmhos/cm) | 318 | | 310 | | 306 | | 315 | |
| | Temperature (°C) | 24.9 | 25.1 | 24.8 | 25.1 | 24.9 | 25.3 | 24.8 | 24.9 |
| 5.1% | pH (S.U.) | 7.97 | 7.95 | 7.96 | 7.94 | 7.98 | 7.94 | 7.98 | 7.91 |
| | DO (mg/L) | 7.9 | 7.9 | 7.7 | 7.6 | 7.7 | 7.8 | 7.6 | 8.0 |
| | Conductivity (µmhos/cm) | 323 | | 311 | | 308 | | 316 | |
| | Temperature (°C) | 24.9 | 24.8 | 24.8 | 25.1 | 24.8 | 25.2 | 24.8 | 24.9 |
| 10.2% | pH (S.U.) | 7.98 | 7.97 | 7.98 | 7.98 | 7.99 | 7.94 | 7.99 | 7.92 |
| | DO (mg/L) | 8.0 | 7.9 | 7.8 | 7.6 | 7.6 | 7.8 | 7.6 | 7.9 |
| | Conductivity (µmhos/cm) | 324 | | 313 | | 308 | | 319 | |
| | Temperature (°C) | 25.0 | 25.0 | 24.8 | 25.0 | 24.8 | 25.2 | 24.8 | 25.1 |
| 20.4% | pH (S.U.) | 8.02 | 8.01 | 8.00 | 7.99 | 8.02 | 8.01 | 8.04 | 7.98 |
| | DO (mg/L) | 8.0 | 8.0 | 7.8 | 7.6 | 7.6 | 7.9 | 7.7 | 8.0 |
| | Conductivity (µmhos/cm) | 327 | | 320 | | 313 | | 325 | |
| | Temperature (°C) | 25.0 | 25.0 | 24.8 | 25.2 | 24.8 | 25.2 | 24.9 | 25.1 |
| 100% Outfall | pH (S.U.) | | | 8.09 | | | | | |
| | DO (mg/L) | | | 8.2 | | | | | |
| | Conductivity (µmhos/cm) | | | 368 | | | | | |
| | Alkalinity (mg $CaCO_3$/L) | | | 121 | | | | | |
| | Hardness (mg $CaCO_3$/L) | | | 166 | | | | | |
| | TR chlorine (mg/L) | | | <0.10 | | | | | |
| | Temperature (°C) | | | 25.0 | | | | | |
| | | Initial | Final | Initial | Final | Initial | Final | Initial | Final |

Independent Review by Kelley B. Tennant Initials: KT

ETS
Environmental Testing Solutions, Inc.

Species: *Ceriodaphnia dubia*
Client: TVA / Gallatin Fossil Plant, Outfall 001

Date: 02-07-12

***Daily Chemistry:***

| | | Day 0 | | Day 1 | | Day 2 | |
|---|---|---|---|---|---|---|---|
| | *Analyst* | CDJ | CDJ | CDJ | CDJ | CDJ | CDJ |
| Concentration | Parameter | | | | | | |
| 100% Intake | pH (S.U.) | 7.88 | 7.92 | 7.94 | 7.98 | 7.83 | 7.91 |
| | DO (mg/L) | 8.3 | 8.0 | 7.9 | 8.2 | 8.2 | 7.8 |
| | Conductivity (µmhos/cm) | 190 | | 191 | | 188 | |
| | Alkalinity (mg $CaCO_3$/L) | 71 | | | | 69 | |
| | Hardness (mg $CaCO_3$/L) | 85 | | | | 89 | |
| | TR chlorine (mg/L) | <0.10 | | | | <0.10 | |
| | Temperature (°C) | 25.2 | 24.8 | 25.0 | 24.7 | 24.9 | 25.1 |
| | | Initial | Final | Initial | Final | Initial | Final |

| | | Day 3 | | Day 4 | | Day 5 | | Day 6 | |
|---|---|---|---|---|---|---|---|---|---|
| | *Analyst* | CDJ | JLB | JLB | JLB | JLB | CDJ | CDJ | CDJ |
| Concen-tration | Parameter | | | | | | | | |
| 100% Intake | pH (S.U.) | 7.96 | 7.94 | 7.85 | 7.96 | 7.84 | 7.97 | 7.96 | 7.95 |
| | DO (mg/L) | 8.3 | 7.9 | 8.2 | 7.9 | 7.7 | 8.0 | 7.9 | 8.1 |
| | Conductivity (µmhos/cm) | 198 | | 186 | | 182 | | 194 | |
| | Alkalinity (mg $CaCO_3$/L) | | | 67 | | | | | |
| | Hardness (mg $CaCO_3$/L) | | | 85 | | | | | |
| | TR chlorine (mg/L) | | | <0.10 | | | | | |
| | Temperature (°C) | 24.9 | 24.8 | 25.0 | 25.1 | 24.8 | 25.0 | 24.9 | 25.2 |
| | | Initial | Final | Initial | Final | Initial | Final | Initial | Final |

Independent Review by Kelley E. Keenan Initials: KK

ETS
Environmental Testing Solutions, Inc.

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

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

| | | | |
|---|---|---|---|
| Analyst | MHF | Iodide reagent: | INR507 |
| Date analyzed | 02-07-12 | Acid reagent: | INR490 |

***Calibration:***

| | 0.10 mg/L | 1.00 mg/L | Slope |
|---|---|---|---|
| Reference standard number | INS5921 | INS5921 | -48.1% |

*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%) |
|---|---|---|---|
| INS5921 | 0.50 | 0.534 | 106.8% |

***Duplicate sample precision:***

| Sample number | Sample ID | Sample characteristics | Residual chlorine (mg/L) | %RPD = {(S - D) /[(S+D)/2]} x 100 (acceptable range = ± 10%) |
|---|---|---|---|---|
| 120207.05 | WILSON | clear, particles, no color | S <0.0000637 | |
| ↓ | Duplicate | | D <0.0000556 | ← MF |

***Sample measurements:***

| Sample number | Sample ID | Sample characteristics | Residual chlorine (mg/L) |
|---|---|---|---|
| | Reagent Blank | | <0.00773 |
| 120207.03 | CHATTANOOSA | clear, particles, tan | <0.000111 |
| 120207.04 | CORR | clear, particles, no color | 0.000378 |
| 120207.01 | GAF 001 | clear, particles, no color | <0.000502 |
| 120207.02 | ↓ INTAKE | clear, particles, no color | 0.00247 |
| 120207.06 | ~~PSS~~ MF 02-07-12 PCS PHOSPHATE | clear, ~~particles~~ 02-07-12 MF, pale tan | <0.000872 |
| 120207.07 | SUTTON | clear, particles, pale tan | <0.000653 |
| 120206.01 | McGUIRE 0 mg/L | | 0.369 |
| | 0.2 mg/L | MF 02-07-12 | 0.447 |
| | 1.6 mg/L | | 1.23 |
| | 4 mg/L | | 3.25 |

*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%) |
|---|---|---|---|
| INS5921 | 0.50 | 0.470 | 94.0% |

| | |
|---|---|
| Reviewed by | JL |
| Date reviewed | 02-07-12 |

ETS
Environmental Testing Solutions, Inc.

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

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

| | | | |
|---|---|---|---|
| Analyst | JLB | Iodide reagent: | INR 507 |
| Date analyzed | 02.09.12 | Acid reagent: | INR 490 |

***Calibration:***

| | 0.10 mg/L | 1.00 mg/L | Slope |
|---|---|---|---|
| Reference standard number | INSS 921 | INSS 921 | -50.7% |

*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%) |
|---|---|---|---|
| INSS921 | 0.50 | 0.503 | 100.6% |

***Duplicate sample precision:***

| Sample number | Sample ID | Sample characteristics | Residual chlorine (mg/L) | %RPD = {(S - D) /[(S+D)/2]} x 100 (acceptable range = ± 10%) |
|---|---|---|---|---|
| 120209.03 | WILSON | no color, clear, no particles | S <0.000572 | |
| ↓ | Duplicate | | D <0.000443 | JLB 02.09.12 |

***Sample measurements:***

| Sample number | Sample ID | Sample characteristics | Residual chlorine (mg/L) |
|---|---|---|---|
| | Reagent Blank | | <0.00363 |
| 120209.01 | CHATTANOOGA | yellow, cloudy, particles | <0.000137 |
| 120209.02 | CORR | no color, cloudy, particles | 0.000783 |
| 120208.26 | TVA / GAF 001 | no color, cloudy, no particles | <0.000352 |
| 120208.27 | ↓ INTAKE | no color, cloudy, no particles | 0.00306 |
| 120209.04 | WASHINGTON | no color, clear, no particles | <0.000525 |
| 120209.05 | CFPU - LOUGHLIN | pale yellow, clear, no particles | 0.000113 |
| | | | |
| | | | |
| | | | JLB 02.09.12 |

*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%) |
|---|---|---|---|
| INSS921 | 0.50 | 0.500 | 100.0% |

| | |
|---|---|
| Reviewed by | H |
| Date reviewed | 02.09.12 |

ETS
Environmental Testing Solutions, Inc.

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

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

Analyst: MKF
Date analyzed: 02-11-12

Iodide reagent: INR507
Acid reagent: INR490

***Calibration:***

| | 0.10 mg/L | 1.00 mg/L | Slope |
|---|---|---|---|
| Reference standard number | INSS921 | INSS921 | -46.9% |

*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%) |
|---|---|---|---|
| INSS921 | 0.50 | 0.543 | 108.6% |

***Duplicate sample precision:***

| Sample number | Sample ID | Sample characteristics | Residual chlorine (mg/L) | %RPD = {(S - D) /[(S+D)/2]} x 100 (acceptable range = ± 10%) |
|---|---|---|---|---|
| 120211.01 | CHATTANOOGA | clear, particles, tan | S <0.000291 | |
| ↓ | Duplicate | | D <0.000136 | 02-11-12 MF |

***Sample measurements:***

| Sample number | Sample ID | Sample characteristics | Residual chlorine (mg/L) |
|---|---|---|---|
| | Reagent Blank | | <0.0161 |
| 120211.02 | CORR | cloudy, particles, pale tan | 0.00164 |
| 120210.16 | GAF 001 | clear, particles, no color | <0.00148 |
| 120210.17 | ↓ INTAKE | clear, particles, pale tan | 0.00295 |
| 120211.03 | WILSON | clear, particles, pale tan | <0.000244 |
| | | MF 02-11-12 | |

*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%) |
|---|---|---|---|
| INSS921 | 0.50 | 0.472 | 94.4% |

Reviewed by: JI
Date reviewed: 02-11-12

ETS Environmental Testing Solutions, Inc.

# Alkalinity (SM 2320 B)

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

Analyst: JCB

Date analyzed: 02.12.12

**Titrate samples to pH = 4.5 S.U.**

Time initiated: 1630

Time completed: 1233

*Titrant normality and multiplier determination:*

| pH of Deionized water = 4.5 S.U. | Titrant reference number | Normality check standard number | Begin ml | End ml | Total ml (E) | Normality (N) of $H_2SO_4$ = (5 ml $Na_2CO_3$ x 0.05)/E = 0.25/E (acceptable range = 0.0180 - 0.0220) | pH Factor or Multiplier = (N x 50000)/ 100 ml sample = N x 500 |
|---|---|---|---|---|---|---|---|
| 5.3 | INR 484 | INSS 1018 | 0.1 | 12.2 | 12.1 | 0.0207 | 10.4 |

blk correction: 0.0 - 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%) |
|---|---|---|---|---|---|---|---|---|
| INSS 959 | 100 | 100 | 12.2 | 21.6 | 9.4 | 10.4 | 98 | 98.0% |

*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%) |
|---|---|---|---|---|---|---|---|---|
| 02-01-12 | SSW | 100 | 21.6 | 24.8 | 3.2 | 10.4 | S 33 | |
| ↓ | Duplicate (B) | ↓ | 24.8 | 28.1 | 3.3 | ↓ | D 34 | 3.0% |

*Matrix spike recovery:*

| Reference standard number | Spike value (SV) (mg $CaCO_3$/L) | Sample volume (ml) | Begin ml | End ml | Total ml | Multiplier | Spike alkalinity (A) (mg $CaCO_3$/L) |
|---|---|---|---|---|---|---|---|
| INSS 959 | 50 | 100 | 24.8 | 32.7 | 7.9 | 10.4 | 82 |

| Sample alkalinity (B) (mg $CaCO_3$/L) | Measured spike value (MV) MV = A - B (mg $CaCO_3$/L) | % R = MV / SV x 100 (acceptable range = 75 to 125%) |
|---|---|---|
| 34 | 48 | 96.0% |

*Sample measurements:*

| Sample number | Sample ID | Sample volume (ml) | Begin ml | End ml | Total ml | Multiplier | Alkalinity (mg $CaCO_3$/L) |
|---|---|---|---|---|---|---|---|
| 02-08-12 | MHSW | 100 | 32.7 | 38.7 | 6.0 | 10.4 | 62 |
| 02-10-12 | ↓ | ↓ | 38.7 | 44.6 | 5.9 | ↓ | 61 |
| 01-29-12 | ↓ | ↓ | 0.0 | 6.1 | 6.1 | ↓ | 63 |
| 02-01-12 | ↓ | ↓ | 6.1 | 12.1 | 6.0 | ↓ | 62 |
| 02-02-12 | ↓ | ↓ | 12.1 | 18.3 | 6.2 | ↓ | 64 |
| 02-06-12 | ↓ | ↓ | 18.3 | 24.3 | 6.0 | ↓ | 62 |
| 02-06-12 | SandSW | ↓ | 24.3 | 33.2 | 8.9 | ↓ 021312 | ~~92~~ 93 |
| 02-11-12 | ↓ | ↓ | 33.2 | 41.1 | 7.9 | ↓ | 82 |
| 120207.05 | Wilson 1 | ↓ | 41.1 | 48.8 | 7.7 | ↓ | 80 |

Reviewed by: [illegible]

Date reviewed: 02-13-12

ETS Environmental Testing Solutions, Inc.

# Alkalinity (SM 2320 B)

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

| | | | |
|---|---|---|---|
| Analyst | JJB | Time initiated | |
| Date analyzed | 02.12.12 | Time completed | 021312 |

**Titrate samples to pH = 4.5 S.U.**

*Titrant normality and multiplier determination:*

| pH of Deionized water = 4.5 S.U. | Titrant reference number | Normality check standard number | Begin ml | End ml | Total ml (E) | Normality (N) of $H_2SO_4$ = (5 ml $Na_2CO_3$ x 0.05)/E = 0.25/E (acceptable range = 0.0180 - 0.0220) | pH Factor or Multiplier = (N x 50000)/ 100 ml sample = N x 500 |
|---|---|---|---|---|---|---|---|
| | | | | | | | 021312 |

*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%) |
|---|---|---|---|---|---|---|---|---|
| INSS 959 | 100 | 100 | 0.0 | 9.4 | 9.4 | 10.4 | 98 | 98.0% |

*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%) |
|---|---|---|---|---|---|---|---|---|
| 120209.03 | Wilson 2 | 100 | 9.4 | 16.7 | 7.3 | 10.4 | S 76 | |
| ↓ | Duplicate (B) | ↓ | 16.7 | 24.0 | 7.3 | ↓ | D 76 | 02.13.12 JJB |

*Matrix spike recovery:*

| Reference standard number | Spike value (SV) (mg $CaCO_3$/L) | Sample volume (ml) | Begin ml | End ml | Total ml | Multiplier | Spike alkalinity (A) (mg $CaCO_3$/L) |
|---|---|---|---|---|---|---|---|
| INSS 959 | 50 | 100 | 16.7 | 28.7 | 12.0 | 10.4 | 120 |

| Sample alkalinity (B) (mg $CaCO_3$/L) | Measured spike value (MV) MV = A - B (mg $CaCO_3$/L) | % R = MV / SV x 100 (acceptable range = 75 to 125%) |
|---|---|---|
| 76 | 44 | 88.0% |

*Sample measurements:*

| Sample number | Sample ID | Sample volume (ml) | Begin ml | End ml | Total ml | Multiplier | Alkalinity (mg $CaCO_3$/L) |
|---|---|---|---|---|---|---|---|
| 120211.03 | Wilson 3 | 100 | 28.7 | 36.0 | 7.3 | 10.4 | 76 |
| 120207.03 | Chattanooga 1 | 25 | 36.0 | 40.5 | 4.5 | 19 | 190 |
| 120209.01 | ↓ 2 | ↓ | 40.5 | 45.2 | 4.7 | ↓ | 200 |
| 120211.01 | ↓ 3 | ↓ | 0.0 | 6.1 | 6.1 | ↓ | 250 |
| 120207.04 | Oak Ar 1 | ↓ | 6.1 | 10.7 | 4.6 | ↓ | 190 |
| 120209.02 | ↓ 2 | ↓ | 10.7 | 15.1 | 4.4 | ↓ | 180 |
| 120211.02 | ↓ 3 | ↓ | 15.1 | 19.5 | 4.4 | ↓ | 180 |
| 120207.01 | TVA GAF 001 1 | ↓ | 19.5 | 22.6 | 3.1 | ↓ | 130 - 129 |
| 120208.26 | ↓ 2 | ↓ | 22.6 | 25.7 | 3.1 | ↓ | 130 - 129 |

Reviewed by: MGM Date reviewed: 021312

ETS Environmental Testing Solutions, Inc.

# Alkalinity (SM 2320 B)

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

| | | | |
|---|---|---|---|
| Analyst | JSB | Time initiated | |
| Date analyzed | 02.12.12 | Time completed | 021312 |

**Titrate samples to pH = 4.5 S.U.**

*Titrant normality and multiplier determination:*

| pH of Deionized water = 4.5 S.U. | Titrant reference number | Normality check standard number | Begin ml | End ml | Total ml (E) | Normality (N) of $H_2SO_4$ = (5 ml $Na_2CO_3$ x 0.05)/E = 0.25/E (acceptable range = 0.0180 - 0.0220) | pH Factor or Multiplier = (N x 50000)/ 100 ml sample = N x 500 |
|---|---|---|---|---|---|---|---|
| | | | | | | | 021312 |

*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%) |
|---|---|---|---|---|---|---|---|---|
| IN55959 | 100 | 100 | 25.7 | 35.1 | 9.4 | 10.4 | 98 | 98.0% |

*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%) |
|---|---|---|---|---|---|---|---|---|
| 120210.16 | TVAGAF001 3 | 25 | 35.1 | 38.0 | 2.9 | (4) 10.4 | S 120-121 | |
| ↓ | Duplicate (B) | ↓ | 38.0 | 41.0 | 3.0 | ↓ | D 120-125 | JSB |

*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) |
|---|---|---|---|---|---|---|---|
| IN55959 | 200 | 25 | 38.0 | 45.7 | 7.7 | (4) 10.4 | 320 |

| Sample alkalinity (B) (mg $CaCO_3$/L) | Measured spike value (MV) MV = A - B (mg $CaCO_3$/L) | % R = MV / SV x 100 (acceptable range = 75 to 125%) |
|---|---|---|
| 120 | 200 | 100.0% |

*Sample measurements:*

| Sample number | Sample ID | Sample volume (ml) | Begin ml | End ml | Total ml | Multiplier | Alkalinity (mg $CaCO_3$/L) |
|---|---|---|---|---|---|---|---|
| 120207.02 | TVAGAF INT 1 | 50 | 0.0 | 3.4 | 3.4 | (2) 10.4 | 71 |
| 120208.23 | 2 | ↓ | 3.4 | 6.7 | 3.3 | ↓ | 69 |
| 120210.17 | 3 | ↓ | 6.7 | 9.9 | 3.2 | 021312 | ~~66~~ 67 |
| 120208.16 | TVA SHF AA | ↓ | 9.9 | 13.2 | 3.3 | ↓ | 69 |
| 120208.17 | AA INT | ↓ | 13.2 | 16.4 | 3.2 | 021312 | ~~66~~ 67 |
| 120208.18 | AP | ↓ | 16.2 | 19.6 | ~~3.2~~ 3.4 | 021312 | ~~66~~ 71 |
| 120208.19 | AP INT | ↓ | 19.6 | 22.9 | 3.3 | ↓ | 69 |
| | | | | | | | |
| | | | | | | 02-12-12 | JSB |

Reviewed by: KLM Date reviewed: 021312

ETS Environmental Testing Solutions, Inc.

# Total Hardness (SM 2340 C)

RL = 1.0 mg $CaCO_3$/L

| | | | |
|---|---|---|---|
| Analyst | JB | Time initiated | 1230 |
| Date analyzed | 02.11.12 | Time completed | 1358 |

***Titrant normality and multiplier determination:***

| Titrant reference number | Normality check standard number | Begin ml | End ml | Total ml (E) | Normality (N) of EDTA = 0.2/E (acceptable range = 0.0180 - 0.0220) | pH Factor or Multiplier = (N x 50000)/ 50 ml sample = N x 1000 |
|---|---|---|---|---|---|---|
| INR 488 | INSS 898 | 0.0 | 9.9 | 9.9 | 0.0202 | 20.2 |

***Laboratory control standard:***

| Reference standard number | True value (TV) (mg $CaCO_3$/L) | Sample volume (ml) | Begin ml | End ml | Total ml | Multiplier | Hardness (MV) (mg $CaCO_3$/L) | % RS = MV / TV x 100 (acceptable range = 90 to 110%) |
|---|---|---|---|---|---|---|---|---|
| INSS 919 | 40 | 50 | 9.9 | 11.9 | 2.0 | 20.2 | 40 | 100.0% |

***Duplicate sample precision:***

| Sample number | Sample ID | Sample volume (ml) | Begin ml | End ml | Total ml | Multiplier | Hardness (mg $CaCO_3$/L) | %RPD = {(S - D) /[(S+D)/2]} x 100 |
|---|---|---|---|---|---|---|---|---|
| 02.01.12 | SSW | 50 | 11.9 | 14.0 | 2.1 | 20.2 | S 42 | |
| ↓ | Duplicate (B) | ↓ | 14.0 | 16.1 | 2.1 | ↓ | D 42 | 02.11.12 JB |

***Matrix spike recovery:***

| Reference standard number | Spike value (SV) (mg $CaCO_3$/L) | Sample volume (ml) | Begin ml | End ml | Total ml | Multiplier | Spike hardness (A) (mg $CaCO_3$/L) |
|---|---|---|---|---|---|---|---|
| INSS 919 | 40 | 50 | 14.0 | 18.0 | 4.0 | 20.2 | 81 |

| 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%) |
|---|---|---|
| 42 | 39 | 97.5% |

***Sample measurements:***

| Sample number | Sample ID | Sample volume (ml) | Begin ml | End ml | Total ml | Multiplier | Hardness (mg $CaCO_3$/L) |
|---|---|---|---|---|---|---|---|
| TV = ND | Blank (should be = 0 mg $CaCO_3$/L) | 50 | 0.0 | 0.0 | 0.0 | 20.2 | ND |
| 02.08.12 | MHSW | 50 | 18.0 | 22.3 | 4.3 | | 87 |
| 02.10.12 | | | 22.3 | 26.7 | 4.4 | | 89 |
| 01.29.12 | | | 26.7 | 31.3 | 4.6 | | 93 |
| 02.01.12 | | | 31.3 | 35.8 | 4.5 | | 91 |
| 02.02.12 | | | 35.8 | 40.3 | 4.5 | | 91 |
| 02.06.12 | ↓ | | 40.3 | 44.7 | 4.4 | | 89 |
| 120207.05 | Wilson 1 | | 0.0 | 2.9 | 2.9 | | 02.13.12 ~~58~~ 59 |
| 120209.03 | 2 | | 2.9 | 5.8 | 2.9 | | 02.13.12 ~~58~~ 59 |
| 120211.03 | ↓ 3 | ↓ | 5.8 | 8.8 | 3.0 | ↓ | 61 |



Note: If 1 ml of titrant is used, sample must be diluted. Reviewed by: KLA Date reviewed: 02.13.12

ETS Environmental Testing Solutions, Inc.

# Total Hardness (SM 2340 C)

RL = 1.0 mg $CaCO_3$/L

| | | | |
|---|---|---|---|
| Analyst | JCB | Time initiated | 02-13-12 |
| Date analyzed | 02.11.12 | Time completed | |

*Titrant normality and multiplier determination:*

| Titrant reference number | Normality check standard number | Begin ml | End ml | Total ml (E) | Normality (N) of EDTA = 0.2/E (acceptable range = 0.0180 - 0.0220) | pH Factor or Multiplier = (N x 50000)/ 50 ml sample = N x 1000 |
|---|---|---|---|---|---|---|
| | | | | | | 02-13-12 |

*Laboratory control standard:*

| Reference standard number | True value (TV) (mg $CaCO_3$/L) | Sample volume (ml) | Begin ml | End ml | Total ml | Multiplier | Hardness (MV) (mg $CaCO_3$/L) | % RS = MV / TV x 100 (acceptable range = 90 to 110%) |
|---|---|---|---|---|---|---|---|---|
| INSS 919 | 40 | 50 | 8.8 | 10.7 | 1.9 | 20.2 | 38 | 95.0% |

*Duplicate sample precision:*

| Sample number | Sample ID | Sample volume (ml) | Begin ml | End ml | Total ml | Multiplier | Hardness (mg $CaCO_3$/L) 02-13-12 | %RPD = ((S - D) /[(S+D)/2]) x 100 |
|---|---|---|---|---|---|---|---|---|
| 120207.03 | Chattanooga 1 | 25 | 10.7 | 14.8 | 4.1 | (2) 20.2 | S 160* 170 | |
| ↓ | Duplicate (B) | ↓ | 14.8 | 19.0 | 4.2 | ↓ ↓ | D 170 | ~~6.1%~~ 02-13-12 |

*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) |
|---|---|---|---|---|---|---|---|
| INSS919 | 80 | 25 | 19.0 | 24.9 | 5.9 | (2) 20.2 | 240 |

| 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%) |
|---|---|---|
| 170 | 70 | 87.5% |

*Sample measurements:*

| Sample number | Sample ID | Sample volume (ml) | Begin ml | End ml | Total ml | Multiplier | Hardness (mg $CaCO_3$/L) |
|---|---|---|---|---|---|---|---|
| TV = ND | Blank (should be = 0 mg $CaCO_3$/L) | | | | | | 02-13-12 |
| 120209.01 | Chattanooga 2 | 25 | 24.9 | 29.4 | 4.5 | (2) 20.2 | 180 |
| 120211.01 | ↓ 3 | ↓ | 29.4 | 34.3 | 4.9 | ↓ | 200 |
| 120207.04 | Cork-AL 1 | | 34.3 | 39.0 | 4.7 | | 190 |
| 120209.02 | ↓ 2 | | 39.0 | 43.6 | 9.6 | 02-13-12 | ~~180~~* 190 |
| 120211.02 | ↓ 3 | | 43.6 | 48.3 | 4.7 | | 190 |
| 120207.01 | NA GAFDI 1 | | 0.0 | 4.4 | 4.4 | | 190 = 170 |
| 120208.26 | ↓ 2 | | 4.4 | 8.6 | 4.2 | | 170 |
| 120210.16 | ↓ 3 | | 8.6 | 12.7 | 4.1 | 02-13-12 | 160* 170 = 160 |
| 120207.02 | NA GAF INT 1 | ↓ | 12.7 | 14.8 | 2.1 | ↓ ↓ | 85 |



If titrant is used, sample must be diluted. Reviewed by: KLM Date reviewed 02-13-12

ETS Environmental Testing Solutions, Inc.

# Total Hardness (SM 2340 C)

RL = 1.0 mg $CaCO_3$/L

| | |
|---|---|
| Analyst | JJB |
| Date analyzed | 02.11.12 |

| | |
|---|---|
| Time initiated | |
| Time completed | 021412 |

*Titrant normality and multiplier determination:*

| Titrant reference number | Normality check standard number | Begin ml | End ml | Total ml (E) | Normality (N) of EDTA 0.2/E (acceptable range = 0.0180 - 0.0220) | pH Factor or Multiplier = (N x 50000)/ 50 ml sample = N x 1000 |
|---|---|---|---|---|---|---|
| | | | | | | 021312 |

*Laboratory control standard:*

| Reference standard number | True value (TV) (mg $CaCO_3$/L) | Sample volume (ml) | Begin ml | End ml | Total ml | Multiplier | Hardness (MV) (mg $CaCO_3$/L) | % RS = MV / TV x 100 (acceptable range = 90 to 110%) |
|---|---|---|---|---|---|---|---|---|
| INSS 919 | 40 | 50 | 14.8 | 16.8 | 2.0 | 20.2 | 40 | 100.0% |

*Duplicate sample precision:*

| Sample number | Sample ID | Sample volume (ml) | Begin ml | End ml | Total ml | Multiplier | Hardness (mg $CaCO_3$/L) | %RPD = {(S - D) /[(S+D)/2]} x 100 |
|---|---|---|---|---|---|---|---|---|
| 120208.27 | TVAGAFINT 2 | 25 | 16.8 | 19.0 | 2.2 | (1) 20.2 | S 89 | |
| ↓ | Duplicate (B) | ↓ | 19.0 | 21.2 | 2.2 | ↓ ↓ | D 89 | JJB |

*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) 021312 |
|---|---|---|---|---|---|---|---|
| INSS 919 | 80 | 25 | 19.0 | 23.1 | 4.1 | (1) 20.2 | ~~160*~~ 170 |

| 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%) |
|---|---|---|
| 89 | 021312 ~~71*~~ 81 | ~~88.8%~~ 021312 101.2% |

*Sample measurements:*

| Sample number | Sample ID | Sample volume (ml) | Begin ml | End ml | Total ml | Multiplier | Hardness (mg $CaCO_3$/L) |
|---|---|---|---|---|---|---|---|
| TV = ND | Blank (should be = 0 mg $CaCO_3$/L) | | | | | | 021312 |
| 120210.17 | TVAGAFINT 3 | 25 | 23.1 | 25.2 | 2.1 | (1) 20.2 | 85 |
| 120208.16 | TVASHF AA | 25 | 25.2 | 27.3 | 2.1 | (1) | 85 |
| 120208.17 | INT AA | 50 | 27.3 | 31.4 | 4.1 | | 82 |
| 120208.18 | AP | 25 | 31.4 | 33.4 | 2.0 | (1) | 81 |
| 120208.19 | INT AP | 50 | 33.4 | 37.4 | 4.0 | | 81 |
| | | | | | | | 02.12.12 JJB |

*Note: If 5.0 mL of titrant is used, sample must be diluted.* Reviewed by: MCM Date reviewed: 021312

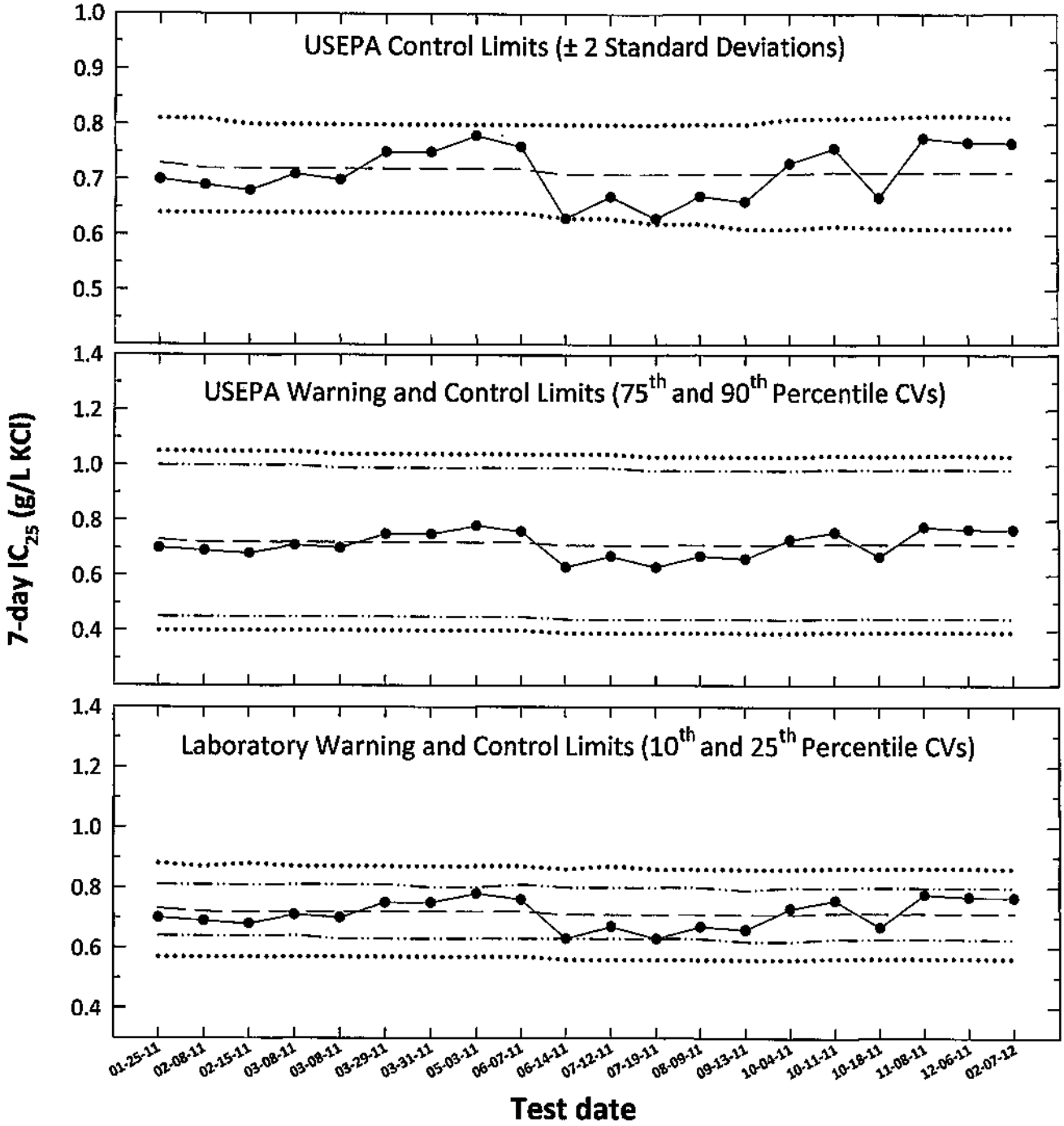
Gallatin Fossil Plant Biomonitoring
February 07 – 14, 2012

Appendix C

Reference Toxicant Test and
Control Chart

Environmental Testing Solutions, Inc.

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




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

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

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

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

Graphs generated from associated excel spreadsheet.
Excel spreadsheet entered by: J. Sumner
Reviewed by: _____

ETS
Environmental Testing Solutions, Inc.

# *Pimephales promelas*
## Chronic Reference Toxicant Control Chart

| Test number | Test date | 7-day $IC_{25}$ (g/L KCl) | CT (g/L KCl) | S | State and USEPA Control Limits CT - 2S | State and USEPA Control Limits CT + 2S | $S_{A.10}$ | Laboratory Warning Limits $CT - S_{A.10}$ | Laboratory Warning Limits $CT + S_{A.10}$ | $S_{A.25}$ | Laboratory Control Limits $CT - S_{A.25}$ | Laboratory Control Limits $CT + S_{A.25}$ | $S_{A.75}$ | USEPA Warning Limits $CT - S_{A.75}$ | USEPA Warning Limits $CT + S_{A.75}$ | $S_{A.90}$ | USEPA Control Limits $CT - S_{A.90}$ | USEPA Control Limits $CT + S_{A.90}$ | CV |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 01-25-11 | 0.70 | 0.73 | 0.04 | 0.64 | 0.81 | 0.09 | 0.64 | 0.81 | 0.15 | 0.57 | 0.88 | 0.28 | 0.45 | 1.00 | 0.33 | 0.40 | 1.05 | 0.06 |
| 2 | 02-08-11 | 0.69 | 0.72 | 0.04 | 0.64 | 0.81 | 0.09 | 0.64 | 0.81 | 0.15 | 0.57 | 0.87 | 0.27 | 0.45 | 1.00 | 0.33 | 0.40 | 1.05 | 0.06 |
| 3 | 02-15-11 | 0.68 | 0.72 | 0.04 | 0.64 | 0.80 | 0.09 | 0.64 | 0.81 | 0.15 | 0.57 | 0.88 | 0.27 | 0.45 | 1.00 | 0.33 | 0.40 | 1.05 | 0.06 |
| 4 | 03-08-11 | 0.71 | 0.72 | 0.04 | 0.64 | 0.80 | 0.09 | 0.64 | 0.81 | 0.15 | 0.57 | 0.87 | 0.27 | 0.45 | 1.00 | 0.33 | 0.40 | 1.05 | 0.06 |
| 5 | 03-08-11 | 0.70 | 0.72 | 0.04 | 0.64 | 0.80 | 0.09 | 0.63 | 0.81 | 0.15 | 0.57 | 0.87 | 0.27 | 0.45 | 0.99 | 0.32 | 0.40 | 1.04 | 0.05 |
| 6 | 03-29-11 | 0.75 | 0.72 | 0.04 | 0.64 | 0.80 | 0.09 | 0.63 | 0.81 | 0.15 | 0.57 | 0.87 | 0.27 | 0.45 | 0.99 | 0.32 | 0.40 | 1.04 | 0.05 |
| 7 | 03-31-11 | 0.75 | 0.72 | 0.04 | 0.64 | 0.80 | 0.09 | 0.63 | 0.80 | 0.15 | 0.57 | 0.87 | 0.27 | 0.45 | 0.99 | 0.32 | 0.40 | 1.04 | 0.05 |
| 8 | 05-03-11 | 0.78 | 0.72 | 0.04 | 0.64 | 0.80 | 0.09 | 0.63 | 0.80 | 0.15 | 0.57 | 0.87 | 0.27 | 0.45 | 0.99 | 0.32 | 0.40 | 1.04 | 0.05 |
| 9 | 06-07-11 | 0.76 | 0.72 | 0.04 | 0.64 | 0.80 | 0.09 | 0.63 | 0.81 | 0.15 | 0.57 | 0.87 | 0.27 | 0.45 | 0.99 | 0.32 | 0.40 | 1.04 | 0.05 |
| 10 | 06-14-11 | 0.63 | 0.71 | 0.04 | 0.63 | 0.80 | 0.09 | 0.63 | 0.80 | 0.15 | 0.56 | 0.86 | 0.27 | 0.44 | 0.99 | 0.32 | 0.39 | 1.04 | 0.06 |
| 11 | 07-12-11 | 0.67 | 0.71 | 0.04 | 0.63 | 0.80 | 0.09 | 0.63 | 0.80 | 0.15 | 0.56 | 0.87 | 0.27 | 0.44 | 0.99 | 0.32 | 0.39 | 1.04 | 0.06 |
| 12 | 07-19-11 | 0.63 | 0.71 | 0.05 | 0.62 | 0.80 | 0.09 | 0.63 | 0.80 | 0.15 | 0.56 | 0.86 | 0.27 | 0.44 | 0.98 | 0.32 | 0.39 | 1.03 | 0.06 |
| 13 | 08-09-11 | 0.67 | 0.71 | 0.05 | 0.62 | 0.80 | 0.09 | 0.63 | 0.80 | 0.15 | 0.56 | 0.86 | 0.27 | 0.44 | 0.98 | 0.32 | 0.39 | 1.03 | 0.07 |
| 14 | 09-13-11 | 0.66 | 0.71 | 0.05 | 0.61 | 0.80 | 0.08 | 0.62 | 0.79 | 0.15 | 0.56 | 0.86 | 0.27 | 0.44 | 0.98 | 0.32 | 0.39 | 1.03 | 0.07 |
| 15 | 10-04-11 | 0.73 | 0.71 | 0.05 | 0.61 | 0.81 | 0.09 | 0.62 | 0.80 | 0.15 | 0.56 | 0.86 | 0.27 | 0.44 | 0.98 | 0.32 | 0.39 | 1.03 | 0.07 |
| 16 | 10-11-11 | 0.76 | 0.71 | 0.05 | 0.62 | 0.81 | 0.09 | 0.63 | 0.80 | 0.15 | 0.56 | 0.86 | 0.27 | 0.44 | 0.99 | 0.32 | 0.39 | 1.03 | 0.07 |
| 17 | 10-18-11 | 0.67 | 0.71 | 0.05 | 0.61 | 0.81 | 0.09 | 0.63 | 0.80 | 0.15 | 0.56 | 0.86 | 0.27 | 0.44 | 0.98 | 0.32 | 0.39 | 1.03 | 0.07 |
| 18 | 11-08-11 | 0.78 | 0.71 | 0.05 | 0.61 | 0.82 | 0.09 | 0.63 | 0.80 | 0.15 | 0.56 | 0.86 | 0.27 | 0.44 | 0.98 | 0.32 | 0.39 | 1.03 | 0.07 |
| 19 | 12-06-11 | 0.77 | 0.71 | 0.05 | 0.61 | 0.82 | 0.09 | 0.63 | 0.80 | 0.15 | 0.56 | 0.86 | 0.27 | 0.44 | 0.98 | 0.32 | 0.39 | 1.03 | 0.07 |
| 20 | 02-07-12 | 0.77 | 0.71 | 0.05 | 0.61 | 0.81 | 0.09 | 0.63 | 0.80 | 0.15 | 0.56 | 0.86 | 0.27 | 0.44 | 0.98 | 0.32 | 0.39 | 1.03 | 0.07 |

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

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

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

**Laboratory Control and Warning Limits**

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

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

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

**USEPA Control and Warning Limits**

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

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

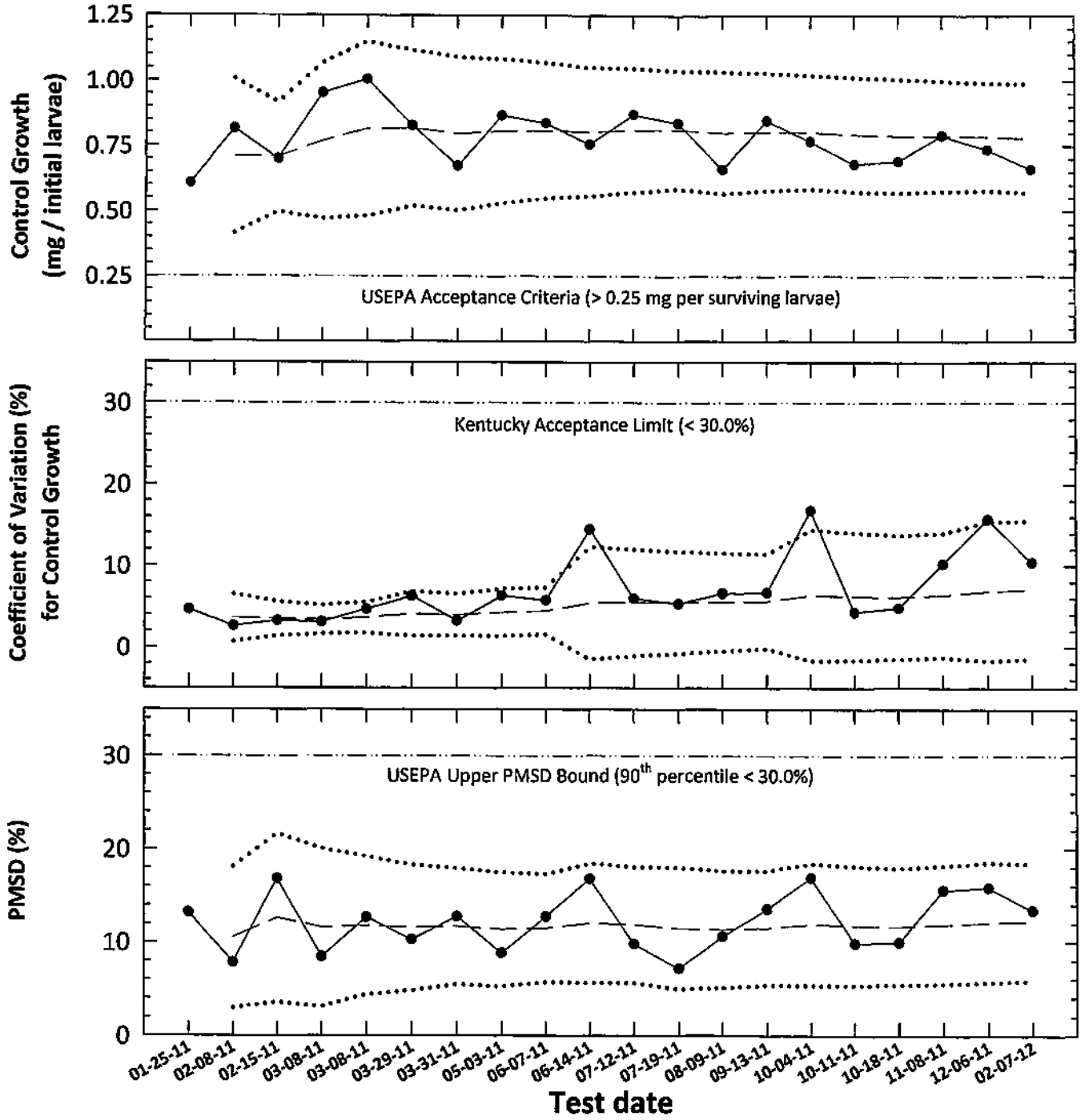
CV = Coefficient of variation of the $IC_{25}$ values.

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

File: ppkclcr_020712.xlsx
Entered by: J. Sumner
Reviewed by: _____

Environmental Testing Solutions, Inc.

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




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

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

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

Independent Review by Kelley K. Kemp Initials: KK



Graphs generated from associated excel spreadsheet.
Excel spreadsheet entered by: J. Sumner
Reviewed by: _____

ETS Environmental Testing Solutions, Inc.

# Precision of Endpoint Measurements

## *Pimephales promelas*
## Chronic Reference Toxicant Data

| Test number | Test date | Control Survival (%) | Control Mean Growth (mg/larvae) | CT for Control Growth (mg/larvae) | CV (%) | CT for Control Growth CV (%) | MSD | PMSD (%) | CT for PMSD (%) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 01-25-11 | 100 | 0.608 | | 4.6 | | 0.08 | 13.2 | |
| 2 | 02-08-11 | 100 | 0.817 | 0.712 | 2.6 | 3.6 | 0.06 | 7.8 | 10.5 |
| 3 | 02-15-11 | 100 | 0.701 | 0.708 | 3.3 | 3.5 | 0.12 | 16.8 | 12.6 |
| 4 | 03-08-11 | 100 | 0.953 | 0.770 | 3.1 | 3.4 | 0.08 | 8.4 | 11.6 |
| 5 | 03-08-11 | 100 | 1.006 | 0.817 | 4.7 | 3.6 | 0.13 | 12.7 | 11.8 |
| 6 | 03-29-11 | 100 | 0.829 | 0.819 | 6.3 | 4.1 | 0.09 | 10.3 | 11.5 |
| 7 | 03-31-11 | 100 | 0.675 | 0.798 | 3.2 | 4.0 | 0.09 | 12.8 | 11.7 |
| 8 | 05-03-11 | 100 | 0.867 | 0.807 | 6.3 | 4.3 | 0.08 | 8.8 | 11.3 |
| 9 | 06-07-11 | 97.5 | 0.839 | 0.810 | 5.8 | 4.4 | 0.11 | 12.7 | 11.5 |
| 10 | 06-14-11 | 100 | 0.758 | 0.805 | 14.5 | 5.4 | 0.13 | 16.8 | 12.0 |
| 11 | 07-12-11 | 97.5 | 0.872 | 0.811 | 6.0 | 5.5 | 0.09 | 9.8 | 11.8 |
| 12 | 07-19-11 | 100 | 0.839 | 0.814 | 5.4 | 5.5 | 0.06 | 7.2 | 11.4 |
| 13 | 08-09-11 | 100 | 0.662 | 0.802 | 6.6 | 5.6 | 0.07 | 10.6 | 11.4 |
| 14 | 09-13-11 | 100 | 0.848 | 0.805 | 6.7 | 5.6 | 0.12 | 13.6 | 11.5 |
| 15 | 10-04-11 | 100 | 0.768 | 0.803 | 16.8 | 6.4 | 0.13 | 16.9 | 11.9 |
| 16 | 10-11-11 | 100 | 0.681 | 0.795 | 4.3 | 6.3 | 0.07 | 9.9 | 11.8 |
| 17 | 10-18-11 | 100 | 0.693 | 0.789 | 4.8 | 6.2 | 0.07 | 10.0 | 11.7 |
| 18 | 11-08-11 | 100 | 0.792 | 0.789 | 10.3 | 6.4 | 0.12 | 15.6 | 11.9 |
| 19 | 12-06-11 | 100 | 0.738 | 0.786 | 15.7 | 6.9 | 0.12 | 15.9 | 12.1 |
| 20 | 02-07-12 | 100 | 0.662 | 0.780 | 10.5 | 7.1 | 0.09 | 13.4 | 12.2 |

*Note:*

**CV** = Coefficient of variation for control growth.
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.
Lower PMSD bound determined by USEPA (10th percentile) = 12%.
Upper PMSD bound determined by USEPA (90th percentile) = 30%.

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

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

Independent Review by Kelley E. Kingston Inc.



File: ppkcler_020712.xlsx
Entered by: J. Sumner
Reviewed by: ____

ETS
Environmental Testing Solutions, Inc.

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

PpKClCR Test Number: 243

| *Dilution preparation information:* | | | | | | *Comments:* |
|---|---|---|---|---|---|---|
| KCl Stock INSS number: | INSS 1004 | | | | | |
| Stock preparation: | 50 g KCl/L: Dissolve 50 g KCl in 1-L Milli-Q water. | | | | | |
| Dilution prep (mg/L) | 450 | 600 | 750 | 900 | 1050 | |
| Stock volume (mL) | 9 | 12 | 15 | 18 | 21 | |
| Diluent volume (mL) | 991 | 988 | 985 | 982 | 979 | |
| Total volume (mL) | 1000 | 1000 | 1000 | 1000 | 1000 | |

| *Test organism information:* | | *Test information:* | |
|---|---|---|---|
| Organism age: | 20.72 HOURS OLD | Randomizing template: | RED |
| Date and times organisms were born between: | 02-06-12 1600 | Incubator number and shelf location: | 3F |
| Organism source: | ATOX BATCH Pp 02-06-12 | *Artemia* CHM number: | CHM593 |
| | | *Drying information for weight determination:* | |
| Transfer vessel information: | pH = 7.65 S.U.<br>Temperature = 24.6 °C | Date / Time in oven: | 02-14-12 1205 |
| | | Initial oven temperature: | 60°C |
| Average transfer volume: | 0.1776 mL | Date / Time out of oven: | 02-15-12 1210 |
| | | Final oven temperature: | 60°C |
| | | Total drying time: | 24 HOURS |

*Daily feeding and renewal information:*

| Day | Date | Morning feeding | | Afternoon feeding | | Test initiation, renewal, or termination | | MHSW batch used |
|---|---|---|---|---|---|---|---|---|
| | | Time | Analyst | Time | Analyst | Time | Analyst | |
| 0 | 02-07-12 | — | — | 1500 | JH | 1243 | JH | 02-01-12 |
| 1 | 02-08-12 | 0750 | JH | 1350 | JH | 1145 | JH | 02-02-12 |
| 2 | 02-09-12 | 0730 | JH | 1330 | JH | 1143 | JH | 02-02-12 |
| 3 | 02-10-12 | 0700 | JH | 1300 | JH | 1145 | JH | 02-08-12 |
| 4 | 02-11-12 | 0720 | JH | 1320 | JH | 1150 | JH | 02-08-12 |
| 5 | 02-12-12 | 0750 | JH | 1350 | JH | 1148 | JH | 02-10-12 |
| 6 | 02-13-12 | 0800 | JH | 1400 | JH | 1144 | JH | 02-10-12 |
| 7 | 02-14-12 | | | | | 1200 | JH | |

| *Control information:* | | Acceptance criteria | *Summary of test endpoints:* | |
|---|---|---|---|---|
| % Mortality: | 0% | ≤ 20% | 7-day $LC_{50}$ | 798.9 |
| Average weight per initial larvae: | 0.662 | | NOEC | 600 |
| Average weight per surviving larvae: | 0.662 | ≥ 0.25 mg/larvae | LOEC | 750 |
| | | | ChV | 670.8 |
| | | | $IC_{25}$ | 765.9 |

Independent Review by Kelley C. Kemp Initials: KC

ETS
Environmental Testing Solutions, Inc.

**Species:** ***Pimephales promelas*** PpKClCR Test Number: 243

***Survival and Growth Data***

| Day | Control | | | | 450 mg KCl/L | | | | 600 mg KCl/L | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | I | J | K | L |
| 0 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 1 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 2 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 3 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 4 | 10 | 10 | 10 | 10 | 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 | 9 1d | 10 | 10 | 10 | 10 | 10 | 10 |
| 7 | 1SM 10 | 10 | 10 | 10 | 10 | 9 | 10 | 10 | 10 | 10 | 10 | 10 |
| A = Pan weight (mg)<br>Tray color code:: Orange<br>Analyst: MHF<br>Date: 02-31-12 | 14.57 | 13.64 | 12.97 | 14.06 | 13.90 | 14.68 | 14.24 | 13.94 | 13.38 | 12.10 | 14.14 | 12.22 |
| B = Pan + Larvae weight (mg)<br>Analyst: MHF<br>Date: 02-15-12 | 20.20 | 20.91 | 19.83 | 20.79 | 20.93 | 21.00 | 21.40 | 21.93 | 20.31 | 18.53 | 20.87 | 19.08 |
| C = Larvae weight (mg) = B – A<br>Hand calculated.<br>Analyst: JM | 5.63 | 7.24 | 6.86 | 6.73 | 7.03 | 6.32 | 7.16 | 7.99 | 6.93 | 6.43 | 6.73 | 6.86 |
| Weight per initial number of larvae (mg) = C / Initial number of larvae<br>Hand calculated.<br>Analyst: JM | 0.563 | 0.724 | 0.686 | 0.673 | 0.703 | 0.632 | 0.716 | 0.799 | 0.693 | 0.643 | 0.673 | 0.686 |
| Average weight per initial number of larvae (mg) / Percent reduction from control (%) | 0.662 | | | | 0.713 | | -7.7% | | 0.674 | | -1.9% | |

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

| *Comments:* |
|---|
| |
| |
| |

Independent Review by Kelley E. Keenan

ETS
Environmental Testing Solutions, Inc.

**Species:** ***Pimephales promelas*** PpKClCR Test Number: 243

***Survival and Growth Data***

| Day | 750 mg KCl/L | | | | 900 mg KCl/L | | | | 1050 mg KCl/L | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | M | N | O | P | Q | R | S | T | U | V | W | X |
| 0 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 1 | 10 | 10 | 10 | 9 1d | 7 3d | 7 3d | 7 3d | 8 1d | 6 4d | 6 4d | 6 4d | 4 6d |
| 2 | 9 1d | 10 | 8 2d | 9 | 7 | 7 | 6 1d | 7 1d | 4 2d | 3 3d | 4 1d | 4 |
| 3 | 9 | 10 | 8 | 9 | 5 2d | 7 | 5 1d | 5 2d | 3 1d | 2 1d | 4 | 4 |
| 4 | 8 1d | 9 1d | 7 1d | 9 | 4 1d | 5 2d | 3 2d | 3 2d | 1 2d | 2 | 3 1d | 3 1d |
| 5 | 7 1d | 6 3d | 6 1d | 8 1d | 2 2d | 3 2d | 3 | 3 | 1 | 1 1d | 2 1d | 2 1d |
| 6 | 7 | 6 | 5 1d | 8 | 2 | 3 | 2 1d | 2 1d | 1 | 1 | 2 | 2 |
| 7 | 7 1LG | 6 | 5 | 8 1LG | 2 SM | 3 | 2 1LG | 2 | 1 | 1 | 1 1d | 1 1d 1LG |
| A = Pan weight (mg)<br>Tray color code:: Orange<br>Analyst: MHF<br>Date: 01-31-12 | 13.88 | 14.60 | 15.93 | 13.92 | 13.87 | 13.73 | 14.60 | 13.14 | 13.65 | 14.15 | 14.05 | 13.68 |
| B = Pan + Larvae weight (mg)<br>Analyst: MHF<br>Date: 02-15-12 | 20.47 | 19.14 | 19.79 | 21.20 | 14.94 | 16.05 | 16.49 | 14.42 | 14.44 | 14.96 | 14.71 | 14.72 |
| C = Larvae weight (mg) = B – A<br>Hand calculated.<br>Analyst: [illegible] | 6.59 | 4.54 | 3.86 | 7.28 | 1.07 | 2.32 | 1.89 | 1.28 | 0.79 | 0.81 | 0.66 | 1.04 |
| Weight per initial number of larvae (mg) = C / Initial number of larvae<br>Hand calculated.<br>Analyst: [illegible] | 0.659 | 0.454 | 0.386 | 0.728 | 0.107 | 0.232 | 0.189 | 0.128 | 0.079 | 0.081 | 0.066 | 0.104 |
| Average weight per initial number of larvae (mg) | 0.557 | | | | 0.164 | | | | 0.083 | | | |
| Percent reduction from control (%) | | | 15.8% | | | | 75.2% | | | | 87.5% | |

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

***Comments:***

Independent Review by Kelley E. Keene Initials: [illegible]

Independent Review by Kelly S. Dorman Initials: JK

ETS
Environmental Testing Solutions, Inc.

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

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

Test number: 243
Test dates: February 07-14, 2012

| Concentration (mg/L KCl) | Replicate | Initial number of larvae | Final number of larvae | A = Pan weight (mg) | B = Pan + Larvae weight (mg) | Larvae weight (mg) = A - B | Weight / Surviving number of larvae (mg) | Mean weight/ Surviving number of larvae (mg) | Coefficient of variation (Mean weight per surviving number of larvae) (%) | Weight / Initial number of larvae (mg) | Mean survival (%) | Mean weight/ Initial number of larvae (mg) | Coefficient of variation (%) | Percent reduction from control (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Control | A | 10 | 10 | 14.57 | 20.20 | 5.63 | 0.563 | 0.662 | 10.5 | 0.563 | 100.0 | 0.662 | 10.5 | Not applicable |
| | B | 10 | 10 | 13.67 | 20.91 | 7.24 | 0.724 | | | 0.724 | | | | |
| | C | 10 | 10 | 12.97 | 19.83 | 6.86 | 0.686 | | | 0.686 | | | | |
| | D | 10 | 10 | 14.06 | 20.79 | 6.73 | 0.673 | | | 0.673 | | | | |
| 450 | E | 10 | 10 | 13.90 | 20.93 | 7.03 | 0.703 | 0.730 | 6.4 | 0.703 | 97.5 | 0.713 | 9.6 | -7.7 |
| | F | 10 | 9 | 14.68 | 21.00 | 6.32 | 0.702 | | | 0.632 | | | | |
| | G | 10 | 10 | 14.24 | 21.40 | 7.16 | 0.716 | | | 0.716 | | | | |
| | H | 10 | 10 | 13.94 | 21.93 | 7.99 | 0.799 | | | 0.799 | | | | |
| 600 | I | 10 | 10 | 13.38 | 20.31 | 6.93 | 0.693 | 0.674 | 3.3 | 0.693 | 100.0 | 0.674 | 3.3 | -1.9 |
| | J | 10 | 10 | 12.10 | 18.53 | 6.43 | 0.643 | | | 0.643 | | | | |
| | K | 10 | 10 | 14.14 | 20.87 | 6.73 | 0.673 | | | 0.673 | | | | |
| | L | 10 | 10 | 12.22 | 19.08 | 6.86 | 0.686 | | | 0.686 | | | | |
| 750 | M | 10 | 7 | 13.88 | 20.47 | 6.59 | 0.941 | 0.845 | 11.2 | 0.659 | 65.0 | 0.557 | 29.2 | 15.8 |
| | N | 10 | 6 | 14.60 | 19.14 | 4.54 | 0.757 | | | 0.454 | | | | |
| | O | 10 | 5 | 15.93 | 19.79 | 3.86 | 0.772 | | | 0.386 | | | | |
| | P | 10 | 8 | 13.92 | 21.20 | 7.28 | 0.910 | | | 0.728 | | | | |
| 900 | Q | 10 | 2 | 13.87 | 14.94 | 1.07 | 0.535 | 0.723 | 24.5 | 0.107 | 22.5 | 0.164 | 34.8 | 75.2 |
| | R | 10 | 3 | 13.73 | 16.05 | 2.32 | 0.773 | | | 0.232 | | | | |
| | S | 10 | 2 | 14.60 | 16.49 | 1.89 | 0.945 | | | 0.189 | | | | |
| | T | 10 | 2 | 13.14 | 14.42 | 1.28 | 0.640 | | | 0.128 | | | | |
| 1050 | U | 10 | 1 | 13.65 | 14.44 | 0.79 | 0.790 | 0.825 | 19.2 | 0.079 | 10.0 | 0.083 | 19.2 | 87.5 |
| | V | 10 | 1 | 14.15 | 14.96 | 0.81 | 0.810 | | | 0.081 | | | | |
| | W | 10 | 1 | 14.05 | 14.71 | 0.66 | 0.660 | | | 0.066 | | | | |
| | X | 10 | 1 | 13.68 | 14.72 | 1.04 | 1.040 | | | 0.104 | | | | |

Dunnett's MSD value: 0.0888
PMSD: 13.4

MSD = Minimum Significant Difference
PMSD = Percent Minimum Significant Difference

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

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

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

File: ppkclor_020712.xlsx
Entered by: J. Sumner
Reviewed by: JK

ETS Environmental Testing Solutions, Inc.

# Statistical Analyses

## Larval Fish Growth and Survival Test-7 Day Survival

| | | | | | |
|---|---|---|---|---|---|
| Start Date: | 2/7/2012 | Test ID: | PpKClCR | Sample ID: | REF-Ref Toxicant |
| End Date: | 2/14/2012 | Lab ID: | ETS-Envir. Testing Sol. | Sample Type: | KCL-Potassium chloride |
| Sample Date: | | Protocol: | FWCHR-EPA-821-R-02-013 | Test Species: | PP-Pimephales promelas |
| Comments: | | | | | |

| Conc-mg/L | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| D-Control | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 450 | 1.0000 | 0.9000 | 1.0000 | 1.0000 |
| 600 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 750 | 0.7000 | 0.6000 | 0.5000 | 0.8000 |
| 900 | 0.2000 | 0.3000 | 0.2000 | 0.2000 |
| 1050 | 0.1000 | 0.1000 | 0.1000 | 0.1000 |

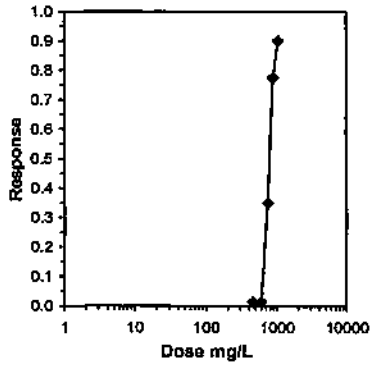
| | | | Transform: Arcsin Square Root | | | | | Rank | 1-Tailed | Number | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Conc-mg/L | Mean | N-Mean | Mean | Min | Max | CV% | N | Sum | Critical | Resp | Number |
| D-Control | 1.0000 | 1.0000 | 1.4120 | 1.4120 | 1.4120 | 0.000 | 4 | | | 0 | 40 |
| 450 | 0.9750 | 0.9750 | 1.3713 | 1.2490 | 1.4120 | 5.942 | 4 | 18.00 | 10.00 | 1 | 40 |
| 600 | 1.0000 | 1.0000 | 1.4120 | 1.4120 | 1.4120 | 0.000 | 4 | 18.00 | 10.00 | 0 | 40 |
| *750 | 0.6500 | 0.6500 | 0.9424 | 0.7854 | 1.1071 | 14.670 | 4 | 10.00 | 10.00 | 14 | 40 |
| *900 | 0.2250 | 0.2250 | 0.4926 | 0.4636 | 0.5796 | 11.772 | 4 | 10.00 | 10.00 | 31 | 40 |
| *1050 | 0.1000 | 0.1000 | 0.3218 | 0.3218 | 0.3218 | 0.000 | 4 | 10.00 | 10.00 | 36 | 40 |

| Auxiliary Tests | Statistic | Critical | Skew | Kurt |
|---|---|---|---|---|
| Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01) | 0.9615 | 0.884 | -0.1027 | 3.0272 |
| Equality of variance cannot be confirmed | | | | |

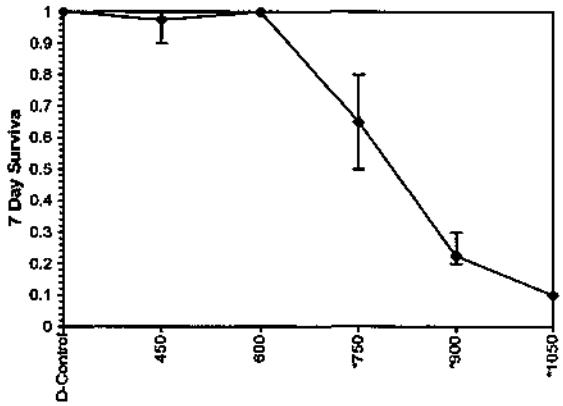
| Hypothesis Test (1-tail, 0.05) | NOEC | LOEC | ChV | TU |
|---|---|---|---|---|
| Steel's Many-One Rank Test | 600 | 750 | 670.82 | |
| Treatments vs D-Control | | | | |

### Trimmed Spearman-Karber

| Trim Level | EC50 | 95% CL | |
|---|---|---|---|
| 0.0% | | | |
| 5.0% | | | |
| 10.0% | 798.88 | 762.13 | 837.39 |
| 20.0% | 798.71 | 758.03 | 837.38 |
| Auto-10.0% | 798.88 | 762.13 | 837.39 |




### Dose-Response Plot




Independent Review by Jeffrey E. Kenna



File: ppkclcr_020712.xlsx
Entered by: J. Sumner
Reviewed by: _____

ETS Environmental Testing Solutions, Inc.

# Statistical Analyses

## Larval Fish Growth and Survival Test-7 Day Growth

| | | | | | |
|---|---|---|---|---|---|
| Start Date: | 2/7/2012 | Test ID: | PpKClCR | Sample ID: | REF-Ref Toxicant |
| End Date: | 2/14/2012 | Lab ID: | ETS-Envir. Testing Sol. | Sample Type: | KCL-Potassium chloride |
| Sample Date: | | Protocol: | FWCHR-EPA-821-R-02-013 | Test Species: | PP-Pimephales promelas |
| Comments: | | | | | |

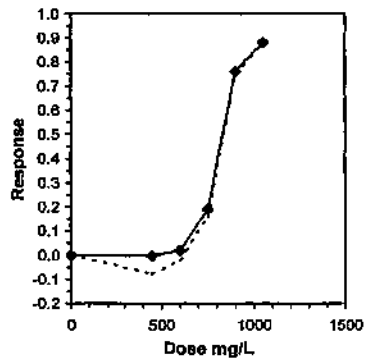
| Conc-mg/L | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| D-Control | 0.5630 | 0.7240 | 0.6860 | 0.6730 |
| 450 | 0.7030 | 0.6320 | 0.7160 | 0.7990 |
| 600 | 0.6930 | 0.6430 | 0.6730 | 0.6860 |
| 750 | 0.6590 | 0.4540 | 0.3860 | 0.7280 |
| 900 | 0.1070 | 0.2320 | 0.1890 | 0.1280 |
| 1050 | 0.0790 | 0.0810 | 0.0660 | 0.1040 |

| | | | Transform: Untransformed | | | | | 1-Tailed | | | Isotonic | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conc-mg/L | Mean | N-Mean | Mean | Min | Max | CV% | N | t-Stat | Critical | MSD | Mean | N-Mean |
| D-Control | 0.6815 | 1.0000 | 0.6815 | 0.5630 | 0.7240 | 10.452 | 4 | | | | 0.6870 | 1.0000 |
| 450 | 0.7125 | 1.0771 | 0.7125 | 0.6320 | 0.7990 | 9.610 | 4 | -1.252 | 2.180 | 0.0888 | 0.6870 | 1.0000 |
| 600 | 0.6738 | 1.0185 | 0.6738 | 0.6430 | 0.6930 | 3.282 | 4 | -0.301 | 2.180 | 0.0888 | 0.6738 | 0.9807 |
| 750 | 0.5568 | 0.8416 | 0.5568 | 0.3860 | 0.7280 | 29.236 | 4 | | | | 0.5568 | 0.8104 |
| 900 | 0.1640 | 0.2479 | 0.1640 | 0.1070 | 0.2320 | 34.840 | 4 | | | | 0.1640 | 0.2387 |
| 1050 | 0.0825 | 0.1247 | 0.0825 | 0.0660 | 0.1040 | 19.153 | 4 | | | | 0.0825 | 0.1201 |

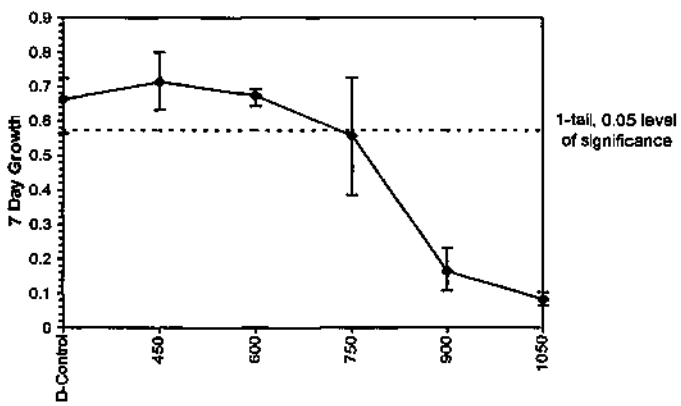
| Auxiliary Tests | | | | | Statistic | | Critical | | Skew | Kurt |
|---|---|---|---|---|---|---|---|---|---|---|
| Shapiro-Wilk's Test indicates normal distribution (p > 0.01) | | | | | 0.94259 | | 0.805 | | -0.4553 | 0.42812 |
| Bartlett's Test indicates equal variances (p = 0.21) | | | | | 3.14892 | | 9.21035 | | | |
| **Hypothesis Test (1-tail, 0.05)** | **NOEC** | **LOEC** | **ChV** | **TU** | **MSDu** | **MSDp** | **MSB** | **MSE** | **F-Prob** | **df** |
| Dunnett's Test | 600 | >600 | | | 0.06881 | 0.13425 | 0.00284 | 0.00332 | 0.45746 | 2, 9 |
| Treatments vs D-Control | | | | | | | | | | |

### Linear Interpolation (200 Resamples)

| Point | mg/L | SD | 95% CL(Exp) | | Skew |
|---|---|---|---|---|---|
| IC05 | 627.05 | 63.12 | 465.08 | 839.35 | 0.0563 |
| IC10 | 671.09 | 48.60 | 588.66 | 828.51 | 0.5772 |
| IC15 | 715.13 | 42.11 | 612.14 | 818.15 | -0.0683 |
| IC20 | 752.73 | 34.60 | 620.94 | 811.34 | -0.6059 |
| IC25 | 785.85 | 28.43 | 645.47 | 819.21 | -0.9334 |
| IC40 | 805.21 | 19.11 | 726.15 | 843.96 | -1.0156 |
| IC50 | 831.44 | 14.73 | 766.81 | 881.83 | -0.9611 |




### Dose-Response Plot




Independent Review by Kelley E. Keenan Date: 7/2/12



File: ppkclcr_020712.xlsx
Entered by: J. Sumner
Reviewed by: ____

ETS Environmental Testing Solutions, Inc.

**Species:** ***Pimephales promelas*** PpKClCR Test Number: 243

***Daily Chemistry:***

| | | Day | | | | | |
|---|---|---|---|---|---|---|---|
| | | 0 | | 1 | | 2 | |
| | Analyst | CDJ | CDJ | CDJ | CDJ | CDJ | CDJ |
| Concentration | Parameter | | | | | | |
| CONTROL | pH (S.U.) | 7.93 | 7.81 | 7.89 | 7.70 | 7.96 | 7.75 |
| | DO (mg/L) | 7.6 | 7.7 | 7.6 | 7.6 | 7.7 | 8.0 |
| | Conductivity (µmhos/cm) | 312 | | 320 | | 307 | |
| | Alkalinity (mg $CaCO_3$/L) | 62 | | 64 | | | |
| | Hardness (mg $CaCO_3$/L) | 91 | | 91 | | 02-04-12 | |
| | Temperature (°C) | 24.9 | 24.6 | 24.9 | 24.5 | 24.8 | 24.7 |
| 450 mg KCl/L | pH (S.U.) | 7.91 | 7.82 | 7.90 | 7.66 | 7.99 | 7.73 |
| | DO (mg/L) | 7.6 | 7.6 | 7.6 | 7.4 | 7.6 | 7.9 |
| | Conductivity (µmhos/cm) | 1090 | | 1090 | | 1090 | |
| | Temperature (°C) | 25.1 | 24.7 | 24.9 | 24.5 | 24.8 | 24.5 |
| 600 mg KCl/L | pH (S.U.) | 7.94 | 7.82 | 7.93 | 7.70 | 8.01 | 7.80 |
| | DO (mg/L) | 7.6 | 7.6 | 7.6 | 7.5 | 7.6 | 7.9 |
| | Conductivity (µmhos/cm) | 1360 | | 1360 | | 1350 | |
| | Temperature (°C) | 25.1 | 24.7 | 24.9 | 24.6 | 24.8 | 24.5 |
| 750 mg KCl/L | pH (S.U.) | 7.94 | 7.78 | 7.93 | 7.66 | 8.01 | 7.74 |
| | DO (mg/L) | 7.6 | 7.6 | 7.7 | 7.5 | 7.6 | 8.0 |
| | Conductivity (µmhos/cm) | 1590 | | 1610 | | 1600 | |
| | Temperature (°C) | 25.0 | 24.7 | 24.9 | 24.6 | 24.8 | 24.8 |
| 900 mg KCl/L | pH (S.U.) | 7.95 | 7.80 | 7.93 | 7.68 | 8.01 | 7.78 |
| | DO (mg/L) | 7.6 | 7.6 | 7.7 | 7.5 | 7.6 | 8.0 |
| | Conductivity (µmhos/cm) | 1860 | | 1880 | | 1830 | |
| | Temperature (°C) | 24.8 | 24.5 | 24.9 | 24.3 | 24.8 | 24.9 |
| 1050 mg KCl/L | pH (S.U.) | 7.95 | 7.80 | 7.94 | 7.67 | 8.02 | 7.76 |
| | DO (mg/L) | 7.7 | 7.6 | 7.8 | 7.6 | 7.7 | 8.0 |
| | Conductivity (µmhos/cm) | 2110 | | 2110 | | 2100 | |
| | Temperature (°C) | 24.8 | 24.8 | 24.9 | 24.4 | 24.8 | 24.7 |
| STOCK | Conductivity (µmhos/cm) | 69100 | | | | | |
| | | Initial | Final | Initial | Final | Initial | Final |

Independent Review by Kelley E. Kemp Initials: KK

ETS
Environmental Testing Solutions, Inc.

**Species:** ***Pimephales promelas*** PpKClCR Test Number: 243

| | | Day | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 3 | | 4 | | 5 | | 6 | |
| | Analyst | CDJ | JRS | JRS | JRS | JRS | CDJ | CDJ | CDJ |
| Concentration | Parameter | | | | | | | | |
| CONTROL | pH (S.U.) | 7.89 | 7.64 | 7.98 | 7.67 | 8.02 | 7.76 | 7.99 | ~~7.93~~ 7.77 |
| | DO (mg/L) | 7.6 | 7.6 | 7.7 | 7.4 | 7.7 | 7.6 | 7.9 | 7.7 |
| | Conductivity (µmhos/cm) | 318 | | 313 | | 306 | | 310 | |
| | Alkalinity (mg $CaCO_3$/L) | 62 | | | | 61 | | | |
| | Hardness (mg $CaCO_3$/L) | 87 | | | | 89 | | | |
| | Temperature (°C) | 24.8 | 24.7 | 24.8 | 24.4 | 24.7 | 24.2 | 24.8 | 24.5 |
| 450 mg KCl/L | pH (S.U.) | 7.95 | 7.72 | 7.96 | 7.68 | 7.98 | 7.82 | 8.00 | ~~7.94~~ 7.81 |
| | DO (mg/L) | 7.6 | 7.4 | 7.7 | 7.4 | 8.2 | 7.6 | 7.8 | 7.8 |
| | Conductivity (µmhos/cm) | 1110 | | 1060 | | 1090 | | 1090 | |
| | Temperature (°C) | 24.8 | 24.5 | 25.0 | 24.3 | 24.7 | 24.6 | 24.7 | 24.5 |
| 600 mg KCl/L | pH (S.U.) | 7.97 | 7.74 | 7.99 | 7.62 | 7.98 | 7.79 | 8.01 | ~~7.95~~ 7.81 |
| | DO (mg/L) | 7.6 | 7.4 | 7.8 | 7.5 | 8.2 | 7.7 | 7.9 | 7.8 |
| | Conductivity (µmhos/cm) | 1390 | | 1340 | | 1350 | | 1350 | |
| | Temperature (°C) | 24.8 | 24.5 | 24.8 | 24.3 | 24.7 | 24.3 | 24.7 | 24.4 |
| 750 mg KCl/L | pH (S.U.) | 7.97 | 7.71 | 7.98 | 7.69 | 7.99 | 7.80 | 8.02 | ~~7.95~~ 7.85 |
| | DO (mg/L) | 7.6 | 7.4 | 7.8 | 7.4 | 8.0 | 7.7 | 7.9 | 8.0 |
| | Conductivity (µmhos/cm) | 1650 | | 1590 | | 1550 | | 1600 | |
| | Temperature (°C) | 24.9 | 24.6 | 24.8 | 24.6 | 24.7 | 24.3 | 24.7 | 24.4 |
| 900 mg KCl/L | pH (S.U.) | 7.97 | 7.70 | 7.99 | 7.66 | 7.99 | 7.80 | 8.02 | ~~7.96~~ 7.84 |
| | DO (mg/L) | 7.7 | 7.4 | 7.9 | 7.3 | 8.0 | 7.9 | 7.9 | 7.9 |
| | Conductivity (µmhos/cm) | 1890 | | 1810 | | 1740 | | 1860 | |
| | Temperature (°C) | 24.9 | 24.4 | 24.8 | 24.5 | 24.7 | 24.3 | 24.7 | 24.6 |
| 1050 mg KCl/L | pH (S.U.) | 7.97 | 7.76 | 7.99 | 7.62 | 8.00 | 7.83 | 8.02 | ~~7.91~~ 7.84 |
| | DO (mg/L) | 7.8 | 7.4 | 7.9 | 7.4 | 8.0 | 7.8 | 8.0 | 7.9 |
| | Conductivity (µmhos/cm) | 2150 | | 2100 | | 2090 | | 2130 | |
| | Temperature (°C) | 24.8 | 24.4 | 24.9 | 24.5 | 24.7 | 24.4 | 24.7 | 24.2 |
| | | Initial | Final | Initial | Final | Initial | Final | Initial | Final |

* pH VALUES REANALYZ & CONFIRMED

Independent Review by Kelley E. Keenan Date: 02-14-12

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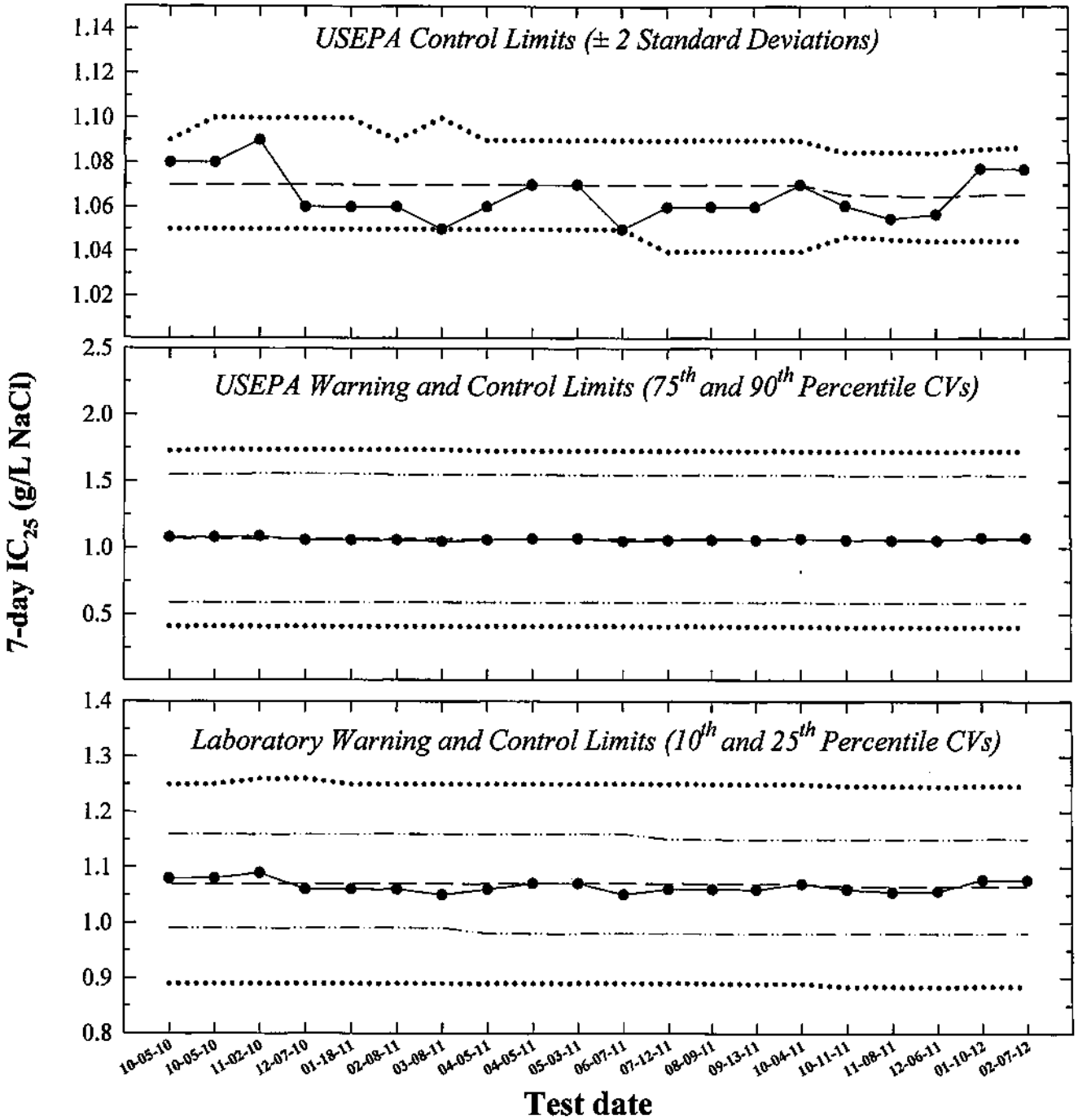
# *Ceriodaphnia dubia*
# Chronic Reference Toxicant Control Chart




- **7-day $IC_{25}$** = 25% inhibition concentration. An estimation of the concentration of sodium chloride that would cause a 25% reduction in *Ceriodaphnia* reproduction for the test population.
- **Central Tendency** (mean $IC_{25}$)
- **Warning Limits** (mean $IC_{25} \pm S_{A.10}$ or $S_{A.75}$)
- **Control Limits** (mean $IC_{25} \pm S_{A.25}$, $S_{A.90}$, or 2 Standard Deviations)

Independent Review by Kelley E. Carnegie



Graphs generated from associated excel spreadsheet.
Excel spreadsheet entered by: J. Sumner
Reviewed by:

ETS
Environmental Testing Solutions, Inc.

# *Ceriodaphnia dubia*
## Chronic Reference Toxicant Control Chart

| Test number | Test date | 7-day $IC_{25}$ (g/L NaCl) | CT (g/L NaCl) | S | State and USEPA Control Limits CT - 2S | CT + 2S | $S_{A.10}$ | Laboratory Warning Limits CT - $S_{A.10}$ | CT + $S_{A.10}$ | $S_{A.25}$ | Laboratory Control Limits CT - $S_{A.25}$ | CT + $S_{A.25}$ | $S_{A.75}$ | USEPA Warning Limits CT - $S_{A.75}$ | CT + $S_{A.75}$ | $S_{A.90}$ | USEPA Control Limits CT - $S_{A.90}$ | CT + $S_{A.90}$ | CV |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 10-05-10 | 1.08 | 1.07 | 0.01 | 1.05 | 1.09 | 0.09 | 0.99 | 1.16 | 0.18 | 0.89 | 1.25 | 0.48 | 0.59 | 1.55 | 0.66 | 0.41 | 1.73 | 0.01 |
| 2 | 10-05-10 | 1.08 | 1.07 | 0.01 | 1.05 | 1.10 | 0.09 | 0.99 | 1.16 | 0.18 | 0.89 | 1.25 | 0.48 | 0.59 | 1.55 | 0.66 | 0.41 | 1.74 | 0.01 |
| 3 | 11-02-10 | 1.09 | 1.07 | 0.01 | 1.05 | 1.10 | 0.09 | 0.99 | 1.16 | 0.18 | 0.89 | 1.26 | 0.48 | 0.59 | 1.56 | 0.67 | 0.41 | 1.74 | 0.01 |
| 4 | 12-07-10 | 1.06 | 1.07 | 0.01 | 1.05 | 1.10 | 0.09 | 0.99 | 1.16 | 0.18 | 0.89 | 1.26 | 0.48 | 0.59 | 1.56 | 0.67 | 0.41 | 1.74 | 0.01 |
| 5 | 01-18-11 | 1.06 | 1.07 | 0.01 | 1.05 | 1.10 | 0.09 | 0.99 | 1.16 | 0.18 | 0.89 | 1.25 | 0.48 | 0.59 | 1.56 | 0.66 | 0.41 | 1.74 | 0.01 |
| 6 | 02-08-11 | 1.06 | 1.07 | 0.01 | 1.05 | 1.09 | 0.09 | 0.99 | 1.16 | 0.18 | 0.89 | 1.25 | 0.48 | 0.59 | 1.55 | 0.66 | 0.41 | 1.74 | 0.01 |
| 7 | 03-08-11 | 1.05 | 1.07 | 0.01 | 1.05 | 1.10 | 0.09 | 0.99 | 1.16 | 0.18 | 0.89 | 1.25 | 0.48 | 0.59 | 1.55 | 0.66 | 0.41 | 1.74 | 0.01 |
| 8 | 04-05-11 | 1.06 | 1.07 | 0.01 | 1.05 | 1.09 | 0.09 | 0.98 | 1.16 | 0.18 | 0.89 | 1.25 | 0.48 | 0.59 | 1.55 | 0.66 | 0.41 | 1.73 | 0.01 |
| 9 | 04-05-11 | 1.07 | 1.07 | 0.01 | 1.05 | 1.09 | 0.09 | 0.98 | 1.16 | 0.18 | 0.89 | 1.25 | 0.48 | 0.59 | 1.55 | 0.66 | 0.41 | 1.73 | 0.01 |
| 10 | 05-03-11 | 1.07 | 1.07 | 0.01 | 1.05 | 1.09 | 0.09 | 0.98 | 1.16 | 0.18 | 0.89 | 1.25 | 0.48 | 0.59 | 1.55 | 0.66 | 0.41 | 1.73 | 0.01 |
| 11 | 06-07-11 | 1.05 | 1.07 | 0.01 | 1.05 | 1.09 | 0.09 | 0.98 | 1.16 | 0.18 | 0.89 | 1.25 | 0.48 | 0.59 | 1.55 | 0.66 | 0.41 | 1.73 | 0.01 |
| 12 | 07-12-11 | 1.06 | 1.07 | 0.01 | 1.04 | 1.09 | 0.09 | 0.98 | 1.15 | 0.18 | 0.89 | 1.25 | 0.48 | 0.59 | 1.55 | 0.66 | 0.41 | 1.73 | 0.01 |
| 13 | 08-09-11 | 1.06 | 1.07 | 0.01 | 1.04 | 1.09 | 0.09 | 0.98 | 1.15 | 0.18 | 0.89 | 1.25 | 0.48 | 0.59 | 1.55 | 0.66 | 0.41 | 1.73 | 0.01 |
| 14 | 09-13-11 | 1.06 | 1.07 | 0.01 | 1.04 | 1.09 | 0.09 | 0.98 | 1.15 | 0.18 | 0.89 | 1.25 | 0.48 | 0.59 | 1.55 | 0.66 | 0.41 | 1.73 | 0.01 |
| 15 | 10-04-11 | 1.07 | 1.07 | 0.01 | 1.04 | 1.09 | 0.09 | 0.98 | 1.15 | 0.18 | 0.89 | 1.25 | 0.48 | 0.59 | 1.55 | 0.66 | 0.41 | 1.73 | 0.01 |
| 16 | 10-11-11 | 1.06 | 1.07 | 0.01 | 1.05 | 1.08 | 0.09 | 0.98 | 1.15 | 0.18 | 0.88 | 1.25 | 0.48 | 0.59 | 1.55 | 0.66 | 0.40 | 1.73 | 0.01 |
| 17 | 11-08-11 | 1.05 | 1.07 | 0.01 | 1.05 | 1.08 | 0.09 | 0.98 | 1.15 | 0.18 | 0.88 | 1.25 | 0.48 | 0.59 | 1.54 | 0.66 | 0.40 | 1.73 | 0.01 |
| 18 | 12-06-11 | 1.06 | 1.06 | 0.01 | 1.04 | 1.08 | 0.09 | 0.98 | 1.15 | 0.18 | 0.88 | 1.25 | 0.48 | 0.59 | 1.54 | 0.66 | 0.40 | 1.72 | 0.01 |
| 19 | 01-10-12 | 1.08 | 1.07 | 0.01 | 1.04 | 1.09 | 0.09 | 0.98 | 1.15 | 0.18 | 0.88 | 1.25 | 0.48 | 0.59 | 1.54 | 0.66 | 0.40 | 1.73 | 0.01 |
| 20 | 02-07-12 | 1.08 | 1.07 | 0.01 | 1.04 | 1.09 | 0.09 | 0.98 | 1.15 | 0.18 | 0.88 | 1.25 | 0.48 | 0.59 | 1.55 | 0.66 | 0.40 | 1.73 | 0.01 |

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

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

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

**Laboratory Control and Warning Limits**

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

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

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

**USEPA Control and Warning Limits**

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

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

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

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

File: CdNaClCR_020712.xlsx
Entered by: J. Sumner
Reviewed by: _____

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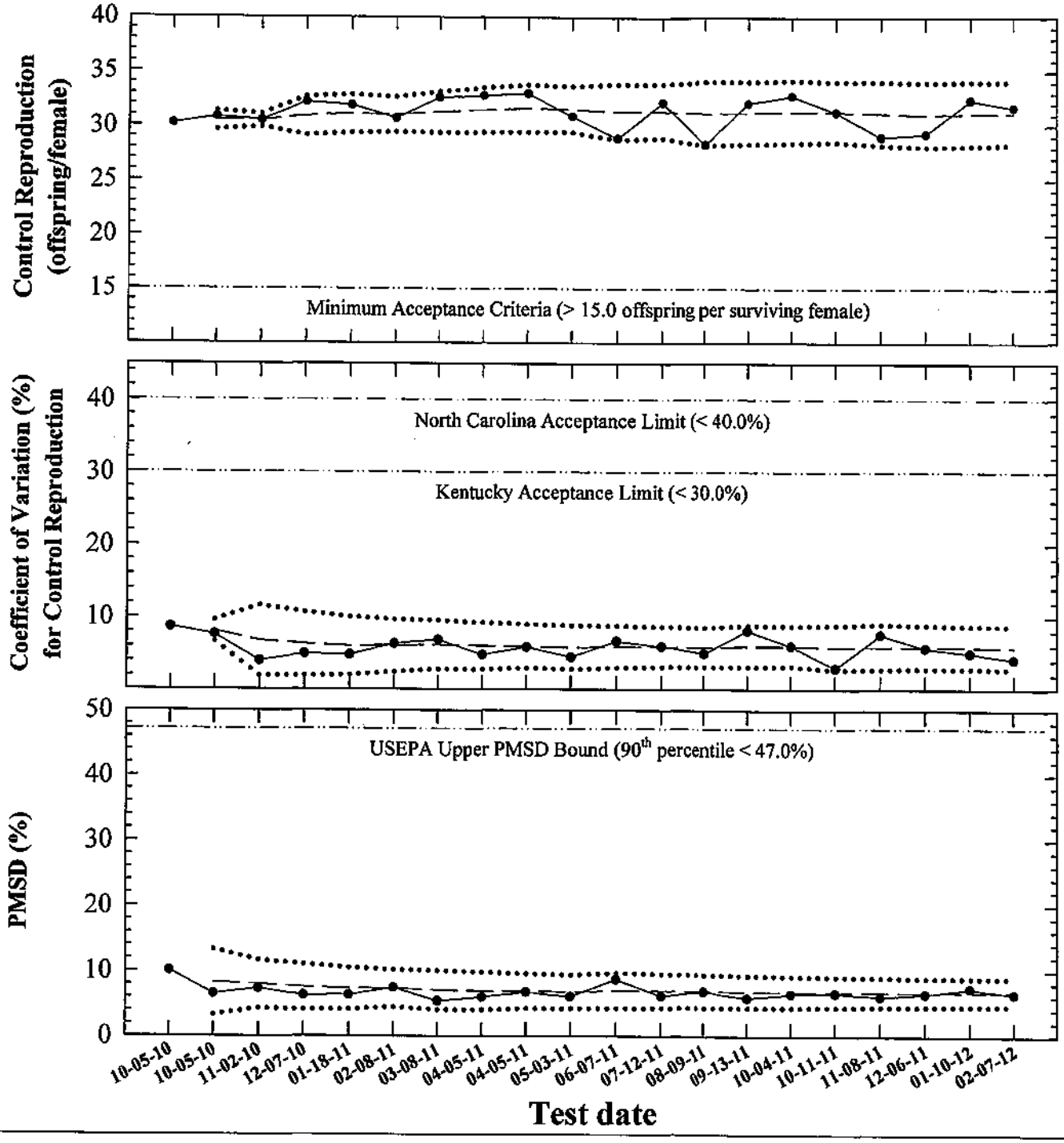
# *Ceriodaphnia dubia*
# Chronic Reference Toxicant Control Chart
# Precision of Endpoint Measurements




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

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

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

Independent Review by Kelley Engineering



Graphs generated from associated excel spreadsheet.
Excel spreadsheet entered by: J. Sumner
Reviewed by:

Environmental Testing Solutions, Inc.

# Precision of Endpoint Measurements

## *Ceriodaphnia dubia*
## Chronic Reference Toxicant Data

| Test number | Test date | Control Survival (%) | Control Mean Reproduction (offspring/female) | CT for Control Mean Reproduction (offspring/female) | CV (%) | CT for Control Reproduction CV (%) | MSD | PMSD (%) | CT for PMSD (%) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 10-05-10 | 100 | 30.2 | | 8.7 | | 3.0 | 10.0 | |
| 2 | 10-05-10 | 100 | 30.8 | 30.5 | 7.6 | 8.1 | 2.0 | 6.5 | 8.3 |
| 3 | 11-02-10 | 100 | 30.5 | 30.5 | 4.0 | 6.8 | 2.2 | 7.3 | 7.9 |
| 4 | 12-07-10 | 100 | 32.2 | 30.9 | 4.9 | 6.3 | 2.0 | 6.2 | 7.5 |
| 5 | 01-18-11 | 100 | 31.9 | 31.1 | 4.8 | 6.0 | 2.0 | 6.3 | 7.3 |
| 6 | 02-08-11 | 100 | 30.7 | 31.1 | 6.3 | 6.1 | 2.3 | 7.4 | 7.3 |
| 7 | 03-08-11 | 100 | 32.6 | 31.3 | 6.9 | 6.2 | 1.8 | 5.4 | 7.0 |
| 8 | 04-05-11 | 100 | 32.8 | 31.5 | 4.8 | 6.0 | 2.0 | 6.0 | 6.9 |
| 9 | 04-05-11 | 100 | 33.0 | 31.6 | 5.9 | 6.0 | 2.2 | 6.7 | 6.9 |
| 10 | 05-03-11 | 100 | 30.9 | 31.6 | 4.5 | 5.8 | 1.9 | 6.1 | 6.8 |
| 11 | 06-07-11 | 100 | 28.9 | 31.3 | 6.7 | 5.9 | 2.5 | 8.7 | 7.0 |
| 12 | 07-12-11 | 100 | 32.2 | 31.4 | 6.0 | 5.9 | 2.0 | 6.2 | 6.9 |
| 13 | 08-09-11 | 100 | 28.3 | 31.2 | 5.0 | 5.9 | 1.9 | 6.8 | 6.9 |
| 14 | 09-13-11 | 100 | 32.1 | 31.2 | 8.2 | 6.0 | 1.9 | 5.8 | 6.8 |
| 15 | 10-04-11 | 100 | 32.8 | 31.3 | 6.1 | 6.0 | 2.1 | 6.5 | 6.8 |
| 16 | 10-11-11 | 100 | 31.3 | 31.3 | 3.0 | 5.8 | 2.1 | 6.6 | 6.8 |
| 17 | 11-08-11 | 100 | 29.0 | 31.2 | 7.6 | 5.9 | 1.8 | 6.1 | 6.7 |
| 18 | 12-06-11 | 100 | 29.3 | 31.1 | 5.8 | 5.9 | 1.9 | 6.5 | 6.7 |
| 19 | 01-10-12 | 100 | 32.4 | 31.2 | 5.1 | 5.9 | 2.4 | 7.4 | 6.8 |
| 20 | 02-07-12 | 100 | 31.7 | 31.2 | 4.2 | 5.8 | 2.1 | 6.5 | 6.7 |

*Note:*

**CV** = Coefficient of variation for control reproduction.
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.
Lower PMSD bound determined by USEPA (10th percentile) = 13%.
Upper PMSD bound determined by USEPA (90th percentile) = 47%.

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

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

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

Independent Review by Kelley G. Kannan



File: CdNaClCR_020712.xlsx
Entered by: J. Sumner
Reviewed by: _____

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

CdNaClCR #: 129

| *Dilution preparation information:* | | | | | | *Comments:* |
|---|---|---|---|---|---|---|
| NaCl Stock INSS number: | INSS 1003 | | | | | |
| Stock preparation: | 100 g NaCl/L: Dissolve 50 g NaCl in 500 mL Milli-Q water. | | | | | |
| Dilution prep (mg/L) | 600 | 800 | 1000 | 1200 | 1400 | |
| Stock volume (mL) | 9 | 12 | 15 | 18 | 21 | |
| Diluent volume (mL) | 1491 | 1488 | 1485 | 1482 | 1479 | |
| Total volume (mL) | 1500 | 1500 | 1500 | 1500 | 1500 | |

| *Test organism source information:* | | | | | | | | | | | *Test information:* | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Organism age: | < 24-hours old | | | | | | | | | | Randomizing template color: | GREEN |
| Date and times organisms were born between: | 02-07-12 0713 TO 0947 | | | | | | | | | | Incubator number and shelf location: | 2B1 |
| Culture board: | 01-31-12 A | | | | | | | | | | | |
| Replicate number: | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | YWT batch: | 01-05-12 |
| Culture board cup number: | 2 | 4 | 5 | 6 | 11 | 12 | 13 | 14 | 18 | 20 | | |
| Transfer vessel information: | pH = 7.90 S.U. Temperature = 24.9 °C | | | | | | | | | | *Selenastrum* batch: | 01-30-12 |
| Average transfer volume (mL): | 0.0415 mL | | | | | | | | | | | |

*Daily renewal information:*

| Day | Date | Test initiation and feeding, renewal and feeding, or termination time | MHSW batch used | Analyst |
|---|---|---|---|---|
| 0 | 02-07-12 | 1000 | 02-01-12 | JH |
| 1 | 02-08-12 | 0900 | 02-02-12 | JH |
| 2 | 02-09-12 | 0905 | 02-02-12 | JH |
| 3 | 02-10-12 | 0910 | 02-08-12 | JH |
| 4 | 02-11-12 | 0930 | 02-08-12 | JH |
| 5 | 02-12-12 | 0900 | 02-10-12 | JH |
| 6 | 02-13-12 | 0900 | 02-10-12 | JH |
| 7 | 02-14-~~0~~12 | 0903 | [redacted] | JH |

| *Control information:* | | Acceptance criteria | *Summary of test endpoints:* | |
|---|---|---|---|---|
| % of Male Adults: | 0% | ≤ 20% | 7-day $LC_{50}$ | >1400 |
| % Adults having 3rd Broods: | 100% | ≥ 80% | NOEC | 1000 |
| % Mortality: | 0% | ≤ 20% | LOEC | 1200 |
| Mean Offspring/Female: | 31.7 | ≥ 15.0 offspring/female | ChV | 1095.5 |
| % CV: | 4.27% | < 40.0 % | $IC_{25}$ | 1076.9 |

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**Species:** ***Ceriodaphnia dubia*** CdNaClCR #: 129

**CONTROL** ***Survival and Reproduction Data***

| Day | | Replicate number 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Young produced | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 2 | Young produced | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 3 | Young produced | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 4 | Young produced | 4 | 4 | 4 | 5 | 5 | 4 | 4 | 5 | 4 | 5 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 5 | Young produced | 10 | 12 | 13 | 12 | 12 | 11 | 11 | 10 | 12 | 10 |
| | 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 | 16 | 17 | 14 | 16 | 16 | 15 | 15 | 18 | 16 | 17 |
| Total young produced | | 30 | 33 | 31 | 33 | 33 | 30 | 30 | 33 | 32 | 32 |
| Final Adult Mortality | | L | L | L | L | L | L | L | L | L | L |
| X for 3rd Broods | | X | X | X | X | X | X | X | X | X | X |

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

| *Concentration:* | |
|---|---|
| % Mortality: | 0% |
| Mean Offspring/Female: | 31.7 |

**600 mg NaCl/L** ***Survival and Reproduction Data***

| Day | | Replicate number 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Young produced | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 2 | Young produced | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 3 | Young produced | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 4 | Young produced | 4 | 6 | 5 | 4 | 4 | 5 | 4 | 4 | 4 | 4 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 5 | Young produced | 11 | 11 | 13 | 12 | 12 | 12 | 10 | 11 | 11 | 13 |
| | 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 | 18 | 15 | 15 | 19 | 17 | 17 | 17 | 15 | 16 | 16 |
| Total young produced | | 33 | 32 | 33 | 35 | 33 | 34 | 31 | 30 | 31 | 33 |
| Final Adult Mortality | | L | L | L | L | L | L | L | L | L | L |

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

| *Concentration:* | |
|---|---|
| % Mortality: | 0% |
| Mean Offspring/Female: | 32.5 |
| % Reduction from Control: | -2.5% |

Independent Review by Kelley E. Kn... Inits. K

**Species:** ***Ceriodaphnia dubia*** CdNaClCR #: 129

**800 mg NaCl/L** ***Survival and Reproduction Data***

| Day | | Replicate number 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Young produced | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 2 | Young produced | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 3 | Young produced | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 4 | Young produced | 5 | 5 | 4 | 4 | 5 | 4 | 4 | 4 | 4 | 5 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 5 | Young produced | 13 | 13 | 10 | 12 | 11 | 12 | 10 | 10 | 13 | 10 |
| | 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 | 16 | 16 | 19 | 16 | 16 | 18 | 15 | 17 | 15 | 15 |
| Total young produced | | 34 | 34 | 33 | 32 | 32 | 34 | 29 | 31 | 32 | 30 |
| Final Adult Mortality | | L | L | L | L | L | L | L | L | L | L |

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

| *Concentration:* | |
|---|---|
| % Mortality: | 0% |
| Mean Offspring/Female: | 32.1 |
| % Reduction from Control: | -1.3% |

**1000 mg NaCl/L** ***Survival and Reproduction Data***

| Day | | Replicate number 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Young produced | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 2 | Young produced | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 3 | Young produced | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 4 | Young produced | 4 | 6 | 4 | 4 | 4 | 4 | 4 | 5 | 4 | 4 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 5 | Young produced | 10 | 10 | 10 | 12 | 10 | 11 | 11 | 10 | 10 | 12 |
| | 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 | 17 | 15 | 14 | 16 | 15 | 18 | 15 | 16 | 14 | 14 |
| Total young produced | | 31 | 31 | 28 | 32 | 29 | 33 | 30 | 31 | 28 | 30 |
| Final Adult Mortality | | L | L | L | L | L | L | L | L | L | L |

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

| *Concentration:* | |
|---|---|
| % Mortality: | 0% |
| Mean Offspring/Female: | 30.3 |
| % Reduction from Control: | 4.4% |

**Species:** ***Ceriodaphnia dubia*** CdNaClCR #: 129

**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 | 2 | 3 | 3 | 2 | 4 | 4 | 2 | 2 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 5 | Young produced | 6 | 0 | 5 | 8 | 5 | 7 | 9 | 6 | 6 | 8 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 6 | Young produced | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 7 | Young produced | 9 | 0 | 6 | 6 | 5 | 8 | 4 | 5 | 3 | 5 |
| Total young produced | | 17 | 6 | 13 | 17 | 13 | 17 | 17 | 15 | 11 | 15 |
| Final Adult Mortality | | L | L | L | L | L | L | L | L | L | L |

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

| *Concentration:* | |
|---|---|
| % Mortality: | 0% |
| Mean Offspring/Female: | 14.1 |
| % Reduction from Control: | 55.5% |

**1400 mg NaCl/L** ***Survival and Reproduction Data***

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

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

| *Concentration:* | |
|---|---|
| % Mortality: | 0% |
| Mean Offspring/Female: | 4.4 |
| % Reduction from Control: | 86.1% |

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# Verification of *Ceriodaphnia* Reproduction Totals

## Control

| Day | Replicate number | | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 4 | 4 | 4 | 5 | 5 | 4 | 4 | 5 | 4 | 5 | 44 |
| 5 | 10 | 12 | 13 | 12 | 12 | 11 | 11 | 10 | 12 | 10 | 113 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 16 | 17 | 14 | 16 | 16 | 15 | 15 | 18 | 16 | 17 | 160 |
| Total | 30 | 33 | 31 | 33 | 33 | 30 | 30 | 33 | 32 | 32 | 317 |

## 1000 mg NaCl/L

| Day | Replicate number | | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 4 | 6 | 4 | 4 | 4 | 4 | 4 | 5 | 4 | 4 | 43 |
| 5 | 10 | 10 | 10 | 12 | 10 | 11 | 11 | 10 | 10 | 12 | 106 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 17 | 15 | 14 | 16 | 15 | 18 | 15 | 16 | 14 | 14 | 154 |
| Total | 31 | 31 | 28 | 32 | 29 | 33 | 30 | 31 | 28 | 30 | 303 |

## 600 mg NaCl/L

| Day | Replicate number | | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 4 | 6 | 5 | 4 | 4 | 5 | 4 | 4 | 4 | 4 | 44 |
| 5 | 11 | 11 | 13 | 12 | 12 | 12 | 10 | 11 | 11 | 13 | 116 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 18 | 15 | 15 | 19 | 17 | 17 | 17 | 15 | 16 | 16 | 165 |
| Total | 33 | 32 | 33 | 35 | 33 | 34 | 31 | 30 | 31 | 33 | 325 |

## 1200 mg NaCl/L

| Day | Replicate number | | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 2 | 3 | 2 | 3 | 3 | 2 | 4 | 4 | 2 | 2 | 27 |
| 5 | 6 | 0 | 5 | 8 | 5 | 7 | 9 | 6 | 6 | 8 | 60 |
| 6 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| 7 | 9 | 0 | 6 | 6 | 5 | 8 | 4 | 5 | 3 | 5 | 51 |
| Total | 17 | 6 | 13 | 17 | 13 | 17 | 17 | 15 | 11 | 15 | 141 |

## 800 mg NaCl/L

| Day | Replicate number | | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 5 | 5 | 4 | 4 | 5 | 4 | 4 | 4 | 4 | 5 | 44 |
| 5 | 13 | 13 | 10 | 12 | 11 | 12 | 10 | 10 | 13 | 10 | 114 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 16 | 16 | 19 | 16 | 16 | 18 | 15 | 17 | 15 | 15 | 163 |
| Total | 34 | 34 | 33 | 32 | 32 | 34 | 29 | 31 | 32 | 30 | 321 |

## 1400 mg NaCl/L

| Day | Replicate number | | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 1 | 2 | 2 | 1 | 2 | 0 | 3 | 3 | 0 | 1 | 15 |
| 5 | 2 | 0 | 3 | 2 | 2 | 3 | 0 | 0 | 1 | 2 | 15 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 3 | 2 | 0 | 2 | 0 | 0 | 1 | 4 | 2 | 0 | 14 |
| Total | 6 | 4 | 5 | 5 | 4 | 3 | 4 | 7 | 3 | 3 | 44 |

File: CdNaClCR_020712.xlsx
Entered by: J. Sumner
Reviewed by: JS

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Environmental Testing Solutions, Inc.

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

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

**Test number:** CdNaClCR #130
**Test dates:** February 07-14, 2012

| 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 | 30 | 33 | 31 | 33 | 33 | 30 | 30 | 33 | 32 | 32 | 100 | 31.7 | 4.2 | Not applicable |
| 600 | 33 | 32 | 33 | 35 | 33 | 34 | 31 | 30 | 31 | 33 | 100 | 32.5 | 4.6 | -2.5 |
| 800 | 34 | 34 | 33 | 32 | 32 | 34 | 29 | 31 | 32 | 30 | 100 | 32.1 | 5.4 | -1.3 |
| 1000 | 31 | 31 | 28 | 32 | 29 | 33 | 30 | 31 | 28 | 30 | 100 | 30.3 | 5.4 | 4.4 |
| 1200 | 17 | 6 | 13 | 17 | 13 | 17 | 17 | 15 | 11 | 15 | 100 | 14.1 | 25.1 | 55.5 |
| 1400 | 6 | 4 | 5 | 5 | 4 | 3 | 4 | 7 | 3 | 3 | 100 | 4.4 | 30.7 | 86.1 |

**Dunnett's MSD value:** 2.050
**PMSD:** 6.5

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

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

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

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

File: CdNaClCR_020712.xlsx
Table populated from associated "Verification of *Ceriodaphnia* Reproduction Totals" spreadsheet.
Spreadsheet entered by: J. Sumner
Reviewed by: _____

ETS Environmental Testing Solutions, Inc.

# Statistical Analyses

**Ceriodaphnia Survival and Reproduction Test-Reproduction**

| | | | | | |
|---|---|---|---|---|---|
| Start Date: | 2/7/2012 | Test ID: | CdNaClCR | Sample ID: | REF-Ref Toxicant |
| End Date: | 2/14/2012 | Lab ID: | ETS-Envir. Testing Sol. | Sample Type: | NACL-Sodium chloride |
| Sample Date: | | Protocol: | FWCHR-EPA-821-R-02-013 | Test Species: | CD-Ceriodaphnia dubia |
| Comments: | | | | | |

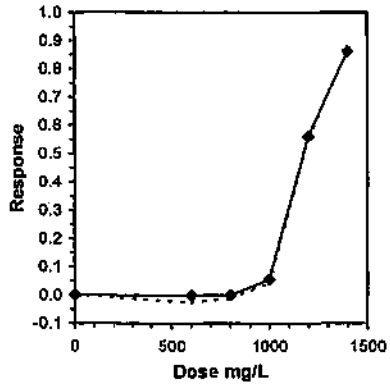
| Conc-mg/L | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| D-Control | 30.000 | 33.000 | 31.000 | 33.000 | 33.000 | 30.000 | 30.000 | 33.000 | 32.000 | 32.000 |
| 600 | 33.000 | 32.000 | 33.000 | 35.000 | 33.000 | 34.000 | 31.000 | 30.000 | 31.000 | 33.000 |
| 800 | 34.000 | 34.000 | 33.000 | 32.000 | 32.000 | 34.000 | 29.000 | 31.000 | 32.000 | 30.000 |
| 1000 | 31.000 | 31.000 | 28.000 | 32.000 | 29.000 | 33.000 | 30.000 | 31.000 | 28.000 | 30.000 |
| 1200 | 17.000 | 6.000 | 13.000 | 17.000 | 13.000 | 17.000 | 17.000 | 15.000 | 11.000 | 15.000 |
| 1400 | 6.000 | 4.000 | 5.000 | 5.000 | 4.000 | 3.000 | 4.000 | 7.000 | 3.000 | 3.000 |

| | | | Transform: Untransformed | | | | | | 1-Tailed | | Isotonic | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conc-mg/L | Mean | N-Mean | Mean | Min | Max | CV% | N | t-Stat | Critical | MSD | Mean | N-Mean |
| D-Control | 31.700 | 1.0000 | 31.700 | 30.000 | 33.000 | 4.219 | 10 | | | | 32.100 | 1.0000 |
| 600 | 32.500 | 1.0252 | 32.500 | 30.000 | 35.000 | 4.644 | 10 | -0.893 | 2.287 | 2.050 | 32.100 | 1.0000 |
| 800 | 32.100 | 1.0126 | 32.100 | 29.000 | 34.000 | 5.386 | 10 | -0.446 | 2.287 | 2.050 | 32.100 | 1.0000 |
| 1000 | 30.300 | 0.9558 | 30.300 | 28.000 | 33.000 | 5.401 | 10 | 1.562 | 2.287 | 2.050 | 30.300 | 0.9439 |
| *1200 | 14.100 | 0.4448 | 14.100 | 6.000 | 17.000 | 25.119 | 10 | 19.637 | 2.287 | 2.050 | 14.100 | 0.4393 |
| *1400 | 4.400 | 0.1388 | 4.400 | 3.000 | 7.000 | 30.679 | 10 | 30.459 | 2.287 | 2.050 | 4.400 | 0.1371 |

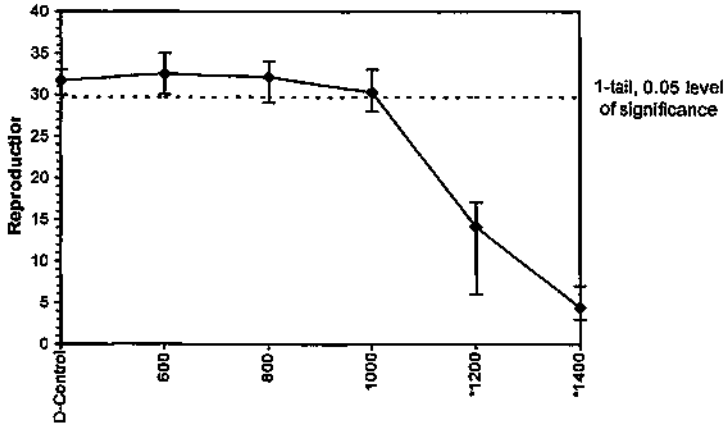
| Auxiliary Tests | | | | | Statistic | | Critical | | Skew | Kurt |
|---|---|---|---|---|---|---|---|---|---|---|
| Kolmogorov D Test indicates normal distribution (p > 0.01) | | | | | 0.6763 | | 1.035 | | -1.1952 | 3.99518 |
| Bartlett's Test indicates equal variances (p = 0.01) | | | | | 14.9138 | | 15.0863 | | | |
| **Hypothesis Test (1-tail, 0.05)** | NOEC | LOEC | ChV | TU | MSDu | MSDp | MSB | MSE | F-Prob | df |
| Dunnett's Test | 1000 | 1200 | 1095.45 | | 2.04951 | 0.06465 | 1437.62 | 4.01667 | 4.3E-40 | 5, 54 |
| Treatments vs D-Control | | | | | | | | | | |

**Linear Interpolation (200 Resamples)**

| Point | mg/L | SD | 95% CL | | Skew |
|---|---|---|---|---|---|
| IC05 | 978.333 | 39.8936 | 880.992 | 1008.25 | -0.7055 |
| IC10 | 1017.41 | 6.72401 | 1002.93 | 1027.47 | -0.5458 |
| IC15 | 1037.22 | 6.33581 | 1024.11 | 1047.91 | -0.1198 |
| IC20 | 1057.04 | 6.45695 | 1041.92 | 1068.4 | -0.0539 |
| IC25 | 1076.85 | 6.84842 | 1061.99 | 1089.18 | -0.0460 |
| IC40 | 1136.3 | 9.19137 | 1118.24 | 1151.54 | -0.1418 |
| IC50 | 1175.93 | 11.3119 | 1152.96 | 1195.15 | -0.1697 |




**Dose-Response Plot**




File: CdNaClCR_020712.xlsx
Entered by: J. Sumner
Reviewed by: _____

Independent Review by Kelley E. Keen Initials: KK

Species: *Ceriodaphnia dubia* CdNaClCR #: 129

***Daily Chemistry:***

| | | Day | | | | | |
|---|---|---|---|---|---|---|---|
| | | 0 | | 1 | | 2 | |
| | Analyst | CDJ | CDJ | CDJ | CDJ | CDJ | CDJ |
| Concentration | Parameter | | | | | | |
| CONTROL | pH (S.U.) | 7.93 | 7.94 | 7.89 | 8.00 | 7.96 | 8.00 |
| | DO (mg/L) | 7.6 | 8.0 | 7.6 | 8.0 | 7.7 | 8.1 |
| | Conductivity (µmhos/cm) | 312 | | 320 | | 307 | |
| | Alkalinity (mg $CaCO_3$/L) | 62 | | 64 | | 01-09-12 | |
| | Hardness (mg $CaCO_3$/L) | 91 | | 91 | | | |
| | Temperature (°C) | 24.9 | 24.8 | 24.8 | 25.1 | 24.8 | 25.2 |
| 600 mg NaCl/L | pH (S.U.) | 7.94 | 7.89 | 7.92 | 7.97 | 7.95 | 7.95 |
| | DO (mg/L) | 7.7 | 8.0 | 7.8 | 8.0 | 7.9 | 8.1 |
| | Conductivity (µmhos/cm) | 1400 | | 1400 | | 1350 | |
| | Temperature (°C) | 24.9 | 24.9 | 24.8 | 25.0 | 24.7 | 25.0 |
| 800 mg NaCl/L | pH (S.U.) | 7.93 | 7.88 | 7.91 | 7.98 | 7.98 | 7.94 |
| | DO (mg/L) | 7.6 | 7.9 | 7.8 | 8.1 | 7.9 | 8.1 |
| | Conductivity (µmhos/cm) | 1760 | | 1770 | | 1730 | |
| | Temperature (°C) | 25.0 | 25.1 | 24.8 | 25.2 | 24.7 | 25.0 |
| 1000 mg NaCl/L | pH (S.U.) | 7.91 | 7.88 | 7.91 | 7.97 | 7.99 | 7.94 |
| | DO (mg/L) | 7.6 | 7.9 | 7.8 | 8.0 | 7.9 | 8.1 |
| | Conductivity (µmhos/cm) | 2080 | | 2090 | | 2120 | |
| | Temperature (°C) | 25.0 | 25.1 | 24.8 | 25.2 | 24.7 | 25.1 |
| 1200 mg NaCl/L | pH (S.U.) | 7.92 | 7.87 | 7.91 | 7.98 | 7.98 | 7.94 |
| | DO (mg/L) | 7.7 | 7.8 | 7.8 | 8.0 | 7.9 | 8.2 |
| | Conductivity (µmhos/cm) | 2480 | | 2470 | | 2640 | |
| | Temperature (°C) | 25.0 | 25.1 | 24.9 | 25.2 | 24.7 | 25.3 |
| 1400 mg NaCl/L | pH (S.U.) | 7.92 | 7.86 | 7.91 | 7.98 | 7.99 | 7.93 |
| | DO (mg/L) | 7.7 | 7.8 | 7.9 | 8.1 | 8.0 | 8.2 |
| | Conductivity (µmhos/cm) | 2820 | | 2820 | | 2970 ~~2840~~ 01-09-12 | |
| | Temperature (°C) | 25.0 | 25.1 | 24.9 | 25.2 | 24.7 | 25.0 |
| STOCK | Conductivity (µmhos/cm) | 105000 | | | | | |
| | | Initial | Final | Initial | Final | Initial | Final |

Independent Review by Kelley E. Kemp Initials: KK

ETS Environmental Testing Solutions, Inc.

**Species:** ***Ceriodaphnia dubia*** CdNaClCR #: 129

| | | Day | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 3 | | 4 | | 5 | | 6 | |
| | Analyst | CDJ | JLB | JLB | JLB | JLB | CDJ | CDJ | CDJ |
| Concentration | Parameter | | | | | | | | |
| CONTROL | pH (S.U.) | 7.89 | 7.98 | 7.98 | 7.97 | 8.02 | 7.99 | 7.99 | 7.84 |
| | DO (mg/L) | 7.6 | 7.6 | 7.7 | 7.7 | 7.7 | 7.8 | 7.9 | 8.0 |
| | Conductivity (µmhos/cm) | 318 | | 313 | | 306 | | 310 | |
| | Alkalinity (mg $CaCO_3$/L) | 62 | | | | 61 | | | |
| | Hardness (mg $CaCO_3$/L) | 87 | | | | 89 | | | |
| | Temperature (°C) | 24.9 | 25.1 | 24.9 | 25.2 | 24.7 | 25.3 | 24.8 | 25.2 |
| 600 mg NaCl/L | pH (S.U.) | 7.95 | 7.98 | 7.98 | 7.97 | 7.99 | 7.99 | 8.02 | 7.86 |
| | DO (mg/L) | 7.9 | 7.8 | 7.7 | 7.6 | 7.6 | 7.7 | 8.2 | 7.8 |
| | Conductivity (µmhos/cm) | 1400 | | 1380 | | 1350 | | 1410 | |
| | Temperature (°C) | 25.0 | 25.3 | 25.1 | 25.0 | 24.6 | 25.1 | 24.6 | 25.2 |
| 800 mg NaCl/L | pH (S.U.) | 7.95 | 7.98 | 8.00 | 8.00 | 8.04 | 7.99 | 8.05 | 7.92 |
| | DO (mg/L) | 8.0 | 7.8 | 7.8 | 7.6 | 7.7 | 7.7 | 8.2 | 7.9 |
| | Conductivity (µmhos/cm) | 1800 | | 1740 | | 1770 | | 1810 | |
| | Temperature (°C) | 25.0 | 25.0 | 24.9 | 25.0 | 24.6 | 25.1 | 24.6 | 25.4 |
| 1000 mg NaCl/L | pH (S.U.) | 7.94 | 7.98 | 8.00 | 7.98 | 8.03 | 7.98 | 8.04 | 7.91 |
| | DO (mg/L) | 8.0 | 8.0 | 7.8 | 7.7 | 7.8 | 7.7 | 8.2 | 8.0 |
| | Conductivity (µmhos/cm) | 2160 | | 2120 | | 2100 | | 2130 | |
| | Temperature (°C) | 25.0 | 25.0 | 24.9 | 25.0 | 24.7 | 25.2 | 24.6 | 25.1 |
| 1200 mg NaCl/L | pH (S.U.) | 7.95 | 7.98 | 8.00 | 8.00 | 8.02 | 7.99 | 8.05 | 7.92 |
| | DO (mg/L) | 8.0 | 7.9 | 7.8 | 7.7 | 7.8 | 7.8 | 8.2 | 8.0 |
| | Conductivity (µmhos/cm) | 2540 | | 2490 | | 2450 | | 2520 | |
| | Temperature (°C) | 25.0 | 25.0 | 24.9 | 24.8 | 24.6 | 25.0 | 24.6 | 25.0 |
| 1400 mg NaCl/L | pH (S.U.) | 7.94 | 7.98 | 8.00 | 7.99 | 8.02 | 7.98 | 8.03 | 7.92 |
| | DO (mg/L) | 8.0 | 7.9 | 7.8 | 7.7 | 7.9 | 7.9 | 8.2 | 8.0 |
| | Conductivity (µmhos/cm) | 2850 | | 2830 | | 2810 | | 2860 | |
| | Temperature (°C) | 25.0 | 25.0 | 24.9 | 24.8 | 24.6 | 25.0 | 24.6 | 25.3 |
| | | Initial | Final | Initial | Final | Initial | Final | Initial | Final |

Independent Review by Kelley E. Keen