



Tennessee Valley Authority, Post Office Box 2000, Soddy Daisy, Tennessee 37384-2000

September 10, 2015

Ms. Christina Morgan
Tennessee Department of Environment
and Conservation
Division of Water Resources
William R. Snodgrass Tennessee Tower
312 Rosa L. Parks Avenue, 11th Floor
Nashville, Tennessee 37243

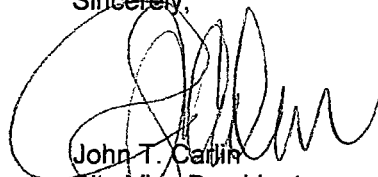
Dear Ms. Morgan:

TENNESSEE VALLEY AUTHORITY (TVA) - SEQUOYAH NUCLEAR PLANT (SQN) - NPDES
PERMIT NO. TN0026450 - DISCHARGE MONITORING REPORT (DMR) FOR August 2015

Enclosed is the June 2015 Discharge Monitoring Report for Sequoyah Nuclear Plant. Toxicity at outfall 101 was sampled August 9 - 14, 2015. The toxicity report is enclosed. There were no exceedances during the monitoring period. If you have any questions or need additional information, please contact Millicent Garland by email at mrmoore@tva.gov or by phone at (423) 843-6714.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Sincerely,



John T. Carlin
Site Vice President
Sequoyah Nuclear Plant

Enclosures

cc (Enclosures):

Chattanooga Environmental Field Office
Division of Water Pollution Control
State Office Building, Suite 550
540 McCallie Avenue
Chattanooga, Tennessee 37402-2013

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

IE25
NRK

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

Name **TVA - SEQUOYAH NUCLEAR PLANT**
 Address **P.O. BOX 2000**
(INTEROFFICE OPS-5N-SQN)
SODDY - DAISY, TN 37384
 Facility **TVA - SEQUOYAH NUCLEAR PLANT**
 Location **HAMILTON COUNTY**

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

MAJOR
 (SUBR 01)

Form Approved.
 OMB No. 2040-0004

TN0026450

101 G

PERMIT NUMBER

DISCHARGE NUMBER

MONITORING PERIOD

From **15 08 01** To **15 08 31**

F - FINAL
 DIFFUSER DISCHARGE
 EFFLUENT

*** NO DISCHARGE ☐ ***

NOTE: Read instructions before completing this form.

| PARAMETER | | QUANTITY OR LOADING | | | QUALITY OR CONCENTRATION | | | | NO. EX | FREQUENCY OF ANALYSIS | SAMPLE TYPE |
|--|--------------------|---------------------|---------------------|----------|--------------------------|------------|---------------------|---------|--------|-----------------------|-------------|
| | | AVERAGE | MAXIMUM | UNITS | MINIMUM | AVERAGE | MAXIMUM | UNITS | | | |
| TEMPERATURE, WATER DEG. CENTIGRADE | SAMPLE MEASUREMENT | ***** | ***** | ** | ***** | ***** | 41.9 | 04 | 0 | 31 / 31 | RCORDR |
| 00010 1 0 | PERMIT REQUIREMENT | ***** | ***** | **** | ***** | ***** | Req. Mon. DAILY MAX | DEG. C. | | CONTI NUOUS | CALCTD |
| EFFLUENT GROSS | | | | | | | | | | | |
| TEMPERATURE, WATER DEG. CENTIGRADE | SAMPLE MEASUREMENT | ***** | ***** | ** | ***** | ***** | 29.6 | 04 | 0 | 31 / 31 | MODELD |
| 00010 Z 0 | PERMIT REQUIREMENT | ***** | ***** | **** | ***** | ***** | 30.5 DAILY MX | DEG. C. | | CONTI NUOUS | CALCTD |
| INSTREAM MONITORING | | | | | | | | | | | |
| TEMP. DIFF. BETWEEN SAMP. & UPSTRM DEG.C | SAMPLE MEASUREMENT | ***** | ***** | ** | ***** | ***** | 2.4 | 04 | 0 | 31 / 31 | CALCTD |
| 00016 1 S | PERMIT REQUIREMENT | ***** | ***** | **** | ***** | ***** | 3.0 DAILY MX | DEG. C. | | CONTI NUOUS | CALCTD |
| EFFLUENT GROSS | | | | | | | | | | | |
| FLOW, IN CONDUIT OR THRU TREATMENT PLANT | SAMPLE MEASUREMENT | ***** | 1800 | 03 | ***** | ***** | ***** | ** | 0 | 31 / 31 | RCORDR |
| 50050 1 0 | PERMIT REQUIREMENT | ***** | Req. Mon. DAILY MAX | MGD | ***** | ***** | ***** | **** | | CONTI NUOUS | RCORDR |
| EFFLUENT GROSS | | | | | | | | | | | |
| CHLORINE, TOTAL RESIDUAL | SAMPLE MEASUREMENT | ***** | ***** | ** | ***** | 0.018 | 0.028 | 19 | 0 | 23 / 31 | GRAB |
| 50060 1 0 | PERMIT REQUIREMENT | ***** | ***** | **** | ***** | 0.1 MO AVG | 0.1 DAILY MAX | MG/L | | FIVE PER WEEK | CALCTD |
| EFFLUENT GROSS | | | | | | | | | | | |
| TEMPERATURE - C, RATE OF CHANGE | SAMPLE MEASUREMENT | ***** | 0.4 | 62 | ***** | ***** | | ** | 0 | 31 / 31 | CALCTD |
| 82234 1 0 | PERMIT REQUIREMENT | ***** | 2.0 DAILY MX | DEG C/HR | ***** | ***** | ***** | **** | | CONTI NUOUS | CALCTD |
| EFFLUENT GROSS | | | | | | | | | | | |
| | SAMPLE MEASUREMENT | | | | | | | | | | |
| | PERMIT REQUIREMENT | | | | | | | | | | |

| | | | | | | |
|--|---|--|----------|------|----|-----|
| NAME/TITLE PRINCIPAL EXECUTIVE OFFICER | I Certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. | TELEPHONE | | DATE | | |
| John T. Carlin | | 423 | 843-7001 | 15 | 09 | 09 |
| Site Vice President | | AREA CODE | NUMBER | YEAR | MO | DAY |
| TYPED OR PRINTED | | SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT | | | | |

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

No closed mode operation. The following injections occurred: Flogard MS6236 (max calc. conc. 0.03 mg/L - limit 0.2 mg/L), Spectrus CT 1300 (max calc. conc. 0.03 mg/L - limit 0.05 mg/L)

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

Name **TVA - SEQUOYAH NUCLEAR PLANT**
 Address **P.O. BOX 2000**
(INTEROFFICE OPS-5N-SQN)
SODDY - DAISY, TN 37384
 Facility **TVA - SEQUOYAH NUCLEAR PLANT**
 Location **HAMILTON COUNTY**

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

MAJOR
 (SUBR 01)

Form Approved.
 OMB No. 2040-0004

TN0026450 **101 T**
PERMIT NUMBER **DISCHARGE NUMBER**

F - FINAL
 BIOMONITORING FOR OUTFALL 101
 EFFLUENT

| MONITORING PERIOD | | | | | |
|-------------------|-----------|-----------|--------------|-----------|-----------|
| YEAR | MO | DAY | YEAR | MO | DAY |
| From 15 | 08 | 01 | To 15 | 08 | 31 |

*** NO DISCHARGE ☐ ***

NOTE: Read instructions before completing this form.

| PARAMETER | | QUANTITY OR LOADING | | | QUALITY OR CONCENTRATION | | | | NO. EX | FREQUENCY OF ANALYSIS | SAMPLE TYPE |
|-----------------------------------|--------------------|---------------------|---------|-------|--------------------------|---------|---------|---------|--------|-----------------------|-------------|
| | | AVERAGE | MAXIMUM | UNITS | MINIMUM | AVERAGE | MAXIMUM | UNITS | | | |
| IC25 STATRE 7DAY CHR CERIODAPHNIA | SAMPLE MEASUREMENT | ***** | ***** | ** | >100.0 | ***** | ***** | 23 | 0 | 1 / 180 | COMPOS |
| TRP3B 1 0 | PERMIT REQUIREMENT | ***** | ***** | **** | 42.8 | ***** | ***** | PERCENT | | SEMI ANNUAL | COMPOS |
| EFFLUENT GROSS | | | | | MINIMUM | | | | | | |
| IC25 STATRE 7DAY CHR PIMEPHALES | SAMPLE MEASUREMENT | ***** | ***** | ** | >100.0 | ***** | ***** | 23 | 0 | 1 / 180 | COMPOS |
| TRP6C 1 0 | PERMIT REQUIREMENT | ***** | ***** | **** | 42.8 | ***** | ***** | PERCENT | | SEMI ANNUAL | COMPOS |
| EFFLUENT GROSS | | | | | MINIMUM | | | | | | |
| | SAMPLE MEASUREMENT | | | | | | | | | | |
| | PERMIT REQUIREMENT | | | | | | | | | | |
| | SAMPLE MEASUREMENT | | | | | | | | | | |
| | PERMIT REQUIREMENT | | | | | | | | | | |
| | SAMPLE MEASUREMENT | | | | | | | | | | |
| | PERMIT REQUIREMENT | | | | | | | | | | |
| | SAMPLE MEASUREMENT | | | | | | | | | | |
| | PERMIT REQUIREMENT | | | | | | | | | | |
| | SAMPLE MEASUREMENT | | | | | | | | | | |
| | PERMIT REQUIREMENT | | | | | | | | | | |

| | | | | | | |
|--|---|-----------|----------|------|----|-----|
| NAME/TITLE PRINCIPAL EXECUTIVE OFFICER | I Certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. | TELEPHONE | | DATE | | |
| John T. Carlin | | 423 | 843-7001 | 15 | 09 | 09 |
| Site Vice President | | | | | | |
| TYPED OR PRINTED | SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT | AREA CODE | NUMBER | YEAR | MO | DAY |

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

Toxicity was sampled August 9-14, 2015.

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

Name **TVA - SEQUOYAH NUCLEAR PLANT**
 Address **P.O. BOX 2000**
(INTEROFFICE OPS-5N-SQN)
SODDY - DAISY, TN 37384
 Facility **TVA - SEQUOYAH NUCLEAR PLANT**
 Location **HAMILTON COUNTY**

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

MAJOR
 (SUBR 01)

Form Approved.
 OMB No. 2040-0004

TN0026450 **103 G**
PERMIT NUMBER **DISCHARGE NUMBER**

F - FINAL
 LOW VOL. WASTE TREATMENT POND
 EFFLUENT

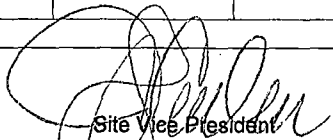
| MONITORING PERIOD | | | | | |
|-------------------|----|-----|------|----|-----|
| YEAR | MO | DAY | YEAR | MO | DAY |
| 15 | 08 | 01 | 15 | 08 | 31 |

From To

*** NO DISCHARGE ☐ ***

NOTE: Read instructions before completing this form.

| PARAMETER | | QUANTITY OR LOADING | | | QUALITY OR CONCENTRATION | | | | NO. EX | FREQUENCY OF ANALYSIS | SAMPLE TYPE |
|---|--------------------|---------------------|----------------------|-------|--------------------------|----------------|-------------------|-------|--------|-----------------------|-------------|
| | | AVERAGE | MAXIMUM | UNITS | MINIMUM | AVERAGE | MAXIMUM | UNITS | | | |
| PH 00400 1 0 EFFLUENT GROSS | SAMPLE MEASUREMENT | ***** | ***** | ** | 7.4 | ***** | 7.9 | 12 | 0 | 5 / 31 | GRAB |
| | PERMIT REQUIREMENT | ***** | ***** | ** | 6.0 MINIMUM | ***** | 9.0 MAXIMUM | SU | | ONCE/ WEEK | GRAB |
| SOLIDS, TOTAL SUSPENDED 00530 1 0 EFFLUENT GROSS | SAMPLE MEASUREMENT | ***** | ***** | ** | ***** | 8.0 | 8.0 | 19 | 0 | 1 / 31 | GRAB |
| | PERMIT REQUIREMENT | ***** | ***** | ** | ***** | 30.0 MO AVG | 100.0 DAILY MX | MG/L | | ONCE/ MONTH | GRAB |
| OIL AND GREASE 00556 1 0 EFFLUENT GROSS | SAMPLE MEASUREMENT | ***** | ***** | ** | ***** | <5.0 | <5.0 | 19 | 0 | 1 / 31 | GRAB |
| | PERMIT REQUIREMENT | ***** | ***** | ** | ***** | 15.0 MO AVG | 20.0 DAILY MX | MG/L | | ONCE/ MONTH | GRAB |
| FLOW, IN CONDUIT OR THRU TREATMENT PLANT 50050 1 0 EFFLUENT GROSS | SAMPLE MEASUREMENT | 1.254 | 1.288 | 03 | ***** | ***** | ***** | ** | 0 | 5 / 31 | INSTAN |
| | PERMIT REQUIREMENT | Req. Mon. MO AVG | Req. Mon DAILY MX | MGD | ***** | ***** | ***** | ** | | ONCE/ WEEK | INSTAN |
| | SAMPLE MEASUREMENT | | | | | | | | | | |
| | PERMIT REQUIREMENT | | | | | | | | | | |
| | SAMPLE MEASUREMENT | | | | | | | | | | |
| | PERMIT REQUIREMENT | | | | | | | | | | |
| | SAMPLE MEASUREMENT | | | | | | | | | | |
| | PERMIT REQUIREMENT | | | | | | | | | | |

| | | | | | | | |
|---|---|--|-----------|----------|------|----|-----|
| NAME/TITLE PRINCIPAL EXECUTIVE OFFICER John T. Carlin Site Vice President TYPED OR PRINTED | I Certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. |  Site Vice President SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT | TELEPHONE | | DATE | | |
| | | | 423 | 843-7001 | 15 | 09 | 09 |
| | | | 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 - SEQUOYAH NUCLEAR PLANT**
 Address **P.O. BOX 2000**
(INTEROFFICE OPS-6N-SQN)
SODDY - DAISY, TN 37384
 Facility **TVA - SEQUOYAH NUCLEAR PLANT**
 Location **HAMILTON COUNTY**

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

MAJOR
 (SUBR 01)

Form Approved.
 OMB No. 2040-0004

TN0026450
PERMIT NUMBER

110 G
DISCHARGE NUMBER

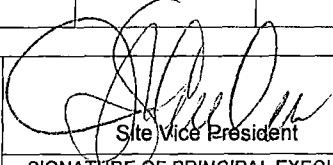
F - FINAL
 RECYCLED COOLING WATER
 EFFLUENT

| MONITORING PERIOD | | | | | |
|-------------------|-----------|-----------|--------------|-----------|-----------|
| YEAR | MO | DAY | YEAR | MO | DAY |
| From 15 | 08 | 01 | To 15 | 08 | 31 |

*** NO DISCHARGE ☒ ***

NOTE: Read instructions before completing this form.

| PARAMETER | | QUANTITY OR LOADING | | | QUALITY OR CONCENTRATION | | | | NO. EX | FREQUENCY OF ANALYSIS | SAMPLE TYPE |
|---|--------------------|---------------------|---------------------------|-------|--------------------------|-------------------|------------------------|-------|--------|-----------------------|-------------|
| | | AVERAGE | MAXIMUM | UNITS | MINIMUM | AVERAGE | MAXIMUM | UNITS | | | |
| TEMPERATURE, WATER DEG. CENTIGRADE 00010 1 0 EFFLUENT GROSS VALUE | SAMPLE MEASUREMENT | ***** | ***** | ** | ***** | ***** | | 04 | | | |
| | PERMIT REQUIREMENT | ***** | ***** | ** | ***** | ***** | REPORT DAILY MX | DEG C | | CONTINUOUS | CALC'D |
| TEMPERATURE, WATER DEG. CENTIGRADE 00010 Z 0 INSTREAM MONITORING | SAMPLE MEASUREMENT | ***** | ***** | ** | ***** | ***** | | 04 | | | |
| | PERMIT REQUIREMENT | ***** | ***** | ** | ***** | ***** | 30.5 DAILY MX | DEG C | | CONTINUOUS | CALC'D |
| TEMP. DIFF. BETWEEN SAMP. & UPSTRM DEG.C 00016 1 0 EFFLUENT GROSS VALUE | SAMPLE MEASUREMENT | ***** | ***** | ** | ***** | ***** | | 04 | | | |
| | PERMIT REQUIREMENT | ***** | ***** | ** | ***** | ***** | 5 DAILY MX | DEG C | | CONTINUOUS | CALC'D |
| FLOW, IN CONDUIT OR THRU TREATMENT PLANT 50050 1 0 EFFLUENT GROSS VALUE | SAMPLE MEASUREMENT | ***** | | 03 | ***** | ***** | ***** | ** | | | |
| | PERMIT REQUIREMENT | ***** | Req. Mon. DAILY MX | MGD | ***** | ***** | ***** | ** | | CONTINUOUS | RCORDR |
| CHLORINE, TOTAL RESIDUAL 50060 1 0 EFFLUENT GROSS VALUE | SAMPLE MEASUREMENT | ***** | ***** | ** | ***** | | | 19 | | | |
| | PERMIT REQUIREMENT | ***** | ***** | ** | ***** | 0.1 MO AVG | 0.1 DAILY MX | MG/L | | Five per Week | CALC'D |
| TEMPERATURE - C, RATE OF CHANGE 82234 1 0 EFFLUENT GROSS VALUE | SAMPLE MEASUREMENT | ***** | | 04 | ***** | ***** | ***** | ** | | | |
| | PERMIT REQUIREMENT | ***** | 2 DAILY MX | DEG C | ***** | ***** | ***** | ** | | CONTINUOUS | CALC'D |
| | SAMPLE MEASUREMENT | | | | | | | | | | |
| | PERMIT REQUIREMENT | | | | | | | | | | |

| | | | | | | | |
|---|---|--|-----------|----------|------|----|-----|
| NAME/TITLE PRINCIPAL EXECUTIVE OFFICER John T. Carlin Site Vice President TYPED OR PRINTED | I Certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. |  Site Vice President SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT | TELEPHONE | | DATE | | |
| | | | 423 | 843-7001 | 15 | 09 | 09 |
| | | | AREA CODE | NUMBER | YEAR | MO | DAY |

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

No Discharge this Period

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

Name **TVA - SEQUOYAH NUCLEAR PLANT**
 Address **P.O. BOX 2000**
(INTEROFFICE OPS-5N-SQN)
SODDY - DAISY, TN 37384
 Facility **TVA - SEQUOYAH NUCLEAR PLANT**
 Location **HAMILTON COUNTY**

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

MAJOR
 (SUBR 01)

Form Approved.
 OMB No. 2040-0004

TN0026450 **110 T**
PERMIT NUMBER **DISCHARGE NUMBER**

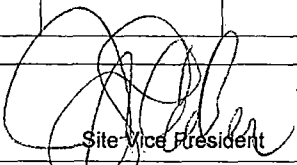
F - FINAL
 RECYCLED COOLING WATER
 EFFLUENT

MONITORING PERIOD
 From **15 08 01** To **15 08 31**

*** NO DISCHARGE ☒ ***

NOTE: Read instructions before completing this form.

| PARAMETER | | QUANTITY OR LOADING | | | QUALITY OR CONCENTRATION | | | | NO. EX | FREQUENCY OF ANALYSIS | SAMPLE TYPE |
|--|--------------------|---------------------|---------|-------|--------------------------|---------|---------|---------|--------|-----------------------|-------------|
| | | AVERAGE | MAXIMUM | UNITS | MINIMUM | AVERAGE | MAXIMUM | UNITS | | | |
| IC25 STATRE 7DAY CHR CERIODAPHNIA TRP3B 1 0 0 EFFLUENT GROSS VALUE | SAMPLE MEASUREMENT | ***** | ***** | ** | | ***** | ***** | 23 | | | |
| | PERMIT REQUIREMENT | ***** | ***** | **** | 42.8 MINIMUM | ***** | ***** | PERCENT | | SEMI ANNUAL | COMPOS |
| IC25 STATRE 7DAY CHR PIMEPHALES TRP6C 1 0 0 EFFLUENT GROSS VALUE | SAMPLE MEASUREMENT | ***** | ***** | ** | | ***** | ***** | 23 | | | |
| | PERMIT REQUIREMENT | ***** | ***** | **** | 42.8 MINIMUM | ***** | ***** | PERCENT | | SEMI ANNUAL | COMPOS |
| | SAMPLE MEASUREMENT | | | | | | | | | | |
| | PERMIT REQUIREMENT | | | | | | | | | | |
| | SAMPLE MEASUREMENT | | | | | | | | | | |
| | PERMIT REQUIREMENT | | | | | | | | | | |
| | SAMPLE MEASUREMENT | | | | | | | | | | |
| | PERMIT REQUIREMENT | | | | | | | | | | |
| | SAMPLE MEASUREMENT | | | | | | | | | | |
| | PERMIT REQUIREMENT | | | | | | | | | | |
| | SAMPLE MEASUREMENT | | | | | | | | | | |
| | PERMIT REQUIREMENT | | | | | | | | | | |
| | SAMPLE MEASUREMENT | | | | | | | | | | |
| | PERMIT REQUIREMENT | | | | | | | | | | |

| | | | | | | | |
|---|---|--|-----------|----------|------|----|-----|
| NAME/TITLE PRINCIPAL EXECUTIVE OFFICER John T. Carlin Site Vice President TYPED OR PRINTED | I Certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. |  Site Vice President SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT | TELEPHONE | | DATE | | |
| | | | 423 | 843-7001 | 15 | 09 | 09 |
| | | | AREA CODE | NUMBER | YEAR | MO | DAY |

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

No Discharge this Period

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

Name **TVA - SEQUOYAH NUCLEAR PLANT**
 Address **P.O. BOX 2000**
(INTEROFFICE OPS-5N-SQN)
SODDY - DAISY, TN 37384
 Facility **TVA - SEQUOYAH NUCLEAR PLANT**
 Location **HAMILTON COUNTY**

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

MAJOR
 (SUBR 01)

Form Approved.
 OMB No. 2040-0004

TN0026450 **118 G**
 PERMIT NUMBER DISCHARGE NUMBER

F - FINAL
 WASTEWATER & STORM WATER
 EFFLUENT

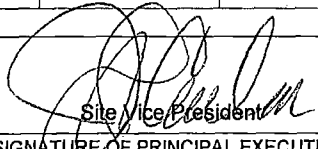
| MONITORING PERIOD | | | | | |
|-------------------|----|-----|------|----|-----|
| YEAR | MO | DAY | YEAR | MO | DAY |
| 15 | 08 | 01 | 15 | 08 | 31 |

From To

*** NO DISCHARGE ☒ ***

NOTE: Read instructions before completing this form.

| PARAMETER | | QUANTITY OR LOADING | | | QUALITY OR CONCENTRATION | | | | NO. EX | FREQUENCY OF ANALYSIS | SAMPLE TYPE |
|--|--------------------|---------------------|-----------------------|-------|--------------------------|---------|-----------------|-------|--------|-----------------------|-------------|
| | | AVERAGE | MAXIMUM | UNITS | MINIMUM | AVERAGE | MAXIMUM | UNITS | | | |
| OXYGEN, DISSOLVED (DO) 00300 1 0 EFFLUENT GROSS | SAMPLE MEASUREMENT | ***** | ***** | ** | | ***** | ***** | 19 | | | |
| | PERMIT REQUIREMENT | ***** | ***** | **** | 2 MINIMUM | ***** | ***** | MG/L | | TWICE/ WEEK | GRAB |
| SOLIDS, TOTAL SUSPENDED 00530 1 0 EFFLUENT GROSS | SAMPLE MEASUREMENT | ***** | ***** | ** | ***** | ***** | | 19 | | | |
| | PERMIT REQUIREMENT | ***** | ***** | **** | ***** | ***** | 100 DAILY MX | MG/L | | TWICE/ WEEK | GRAB |
| SOLIDS, SETTLEABLE 00545 1 0 EFFLUENT GROSS | SAMPLE MEASUREMENT | ***** | ***** | ** | ***** | ***** | | 25 | | | |
| | PERMIT REQUIREMENT | ***** | ***** | **** | ***** | ***** | 1 DAILY MX | ML/L | | ONCE/ MONTH | GRAB |
| FLOW, IN CONDUIT OR THRU TREATMENT PLANT 50050 1 0 EFFLUENT GROSS | SAMPLE MEASUREMENT | | | 03 | ***** | ***** | ***** | ** | | | |
| | PERMIT REQUIREMENT | Req. Mon. MO AVG | Req. Mon. DAILY MX | MGD | ***** | ***** | ***** | * | | ONCE/ BATCH | ESTIMA |
| | SAMPLE MEASUREMENT | | | | | | | | | | |
| | PERMIT REQUIREMENT | | | | | | | | | | |
| | SAMPLE MEASUREMENT | | | | | | | | | | |
| | PERMIT REQUIREMENT | | | | | | | | | | |
| | SAMPLE MEASUREMENT | | | | | | | | | | |
| | PERMIT REQUIREMENT | | | | | | | | | | |

| | | | | | | | |
|---|---|--|-----------|----------|------|----|-----|
| NAME/TITLE PRINCIPAL EXECUTIVE OFFICER John T. Carlin Site Vice President TYPED OR PRINTED | I Certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. |  Site Vice President SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT | TELEPHONE | | DATE | | |
| | | | 423 | 843-7001 | 15 | 09 | 09 |
| | | | AREA CODE | NUMBER | YEAR | MO | DAY |

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

During this reporting period, there has been no flow from the Dredge Pond other than that resulting from rainfall. No Discharge this Period

**TENNESSEE VALLEY AUTHORITY
TOXICITY TEST REPORT**

INTRODUCTION / EXECUTIVE SUMMARY

Report Date: September 03, 2015

1. Facility / Discharger: Sequoyah Nuclear Plant / TVA
2. County / State: Hamilton / Tennessee
3. NPDES Permit #: TN0026450
4. Type of Facility: Nuclear-Fueled Electric Generating Plant
5. Design Flow (MGD): 1,579
6. Receiving Stream: Tennessee River (TRM 483.6)
7. 1Q10: 3,491
8. Outfall Tested: 101
9. Dates Sampled: August 09 – 14, 2015
10. Average Flow on Days Sampled (MGD): 1793, 1776, 1780
11. Pertinent Site Conditions: Production / operation data will be provided upon request.
12. Test Dates: August 11 – 18, 2015
13. Test Type: Short-term Chronic Definitive
14. Test Species: Fathead Minnows (*Pimephales promelas*)
Daphnids (*Ceriodaphnia dubia*)
15. Concentrations Tested (%): Outfall 101: 10.7, 21.4, 42.8, 85.6, 100
Intake: 100
Pimephales promelas: UV treated Outfall 101: 10.7, 21.4, 42.8, 85.6, 100
UV treated Intake: 100
16. Permit Limit Endpoint (%): Outfall 101: IC₂₅ = 42.8%
17. Test Results: Outfall 101: *Pimephales promelas*: IC₂₅ > 100%
Ceriodaphnia dubia: IC₂₅ > 100%
UV treated Outfall 101: *Pimephales promelas*: IC₂₅ > 100%

18. Facility Contact: Millicent Garland Phone #: (423) 843-6714

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: Exposures to samples collected August 09 – 14, 2015 from Outfall 101 resulted in no toxic effects to fathead minnows or daphnids. The resulting IC₂₅ values, for both species, were > 100 percent. Exposure daphnids to intake samples resulted in no significant difference from the control during this study period. Growth was significantly reduced in minnows exposed to intake samples.

Fathead minnows were also exposed to UV treated Outfall 101 and intake samples since fish pathogens present in intake water have been the suspected cause of interference (anomalous dose response and high variability among replicates) in previous toxicity testing at Sequoyah. At the time this study was conducted, insignificant mortality occurred in minnows exposed to non-treated and UV treated samples.

METHODS SUMMARY

Samples:

1. Sampling Point: Outfall 101, Intake
2. Sample Type: Composite
3. Sample Information:

| Sample ID | Date (MM-DD-YY) Time (ET) Collected | Date (MM-DD-YY) Time (ET) Received | Arrival Temp. (°C) | Initial TRC* (mg/L) | Date (MM-DD-YY) Time (ET) Last Used By |
|-----------|---|--|-----------------------|------------------------|---|
| 101 | 08-09-15 0700 to 08-10-15 0600 | 08-10-15 1205 | 1.8, 1.3 [†] | <0.10 | 08-11-15 1121 08-12-15 1022 |
| Intake | 08-09-15 0720 to 08-10-15 0620 | 08-10-15 1205 | 1.7 | <0.10 | 08-11-15 1121 08-12-15 1022 |
| 101 | 08-11-15 0700 to 08-12-15 0600 | 08-12-15 1300 | 1.5, 1.3 [†] | <0.10 | 08-13-15 1021 08-14-15 1022 |
| Intake | 08-11-15 0722 to 08-12-15 0622 | 08-12-15 1300 | 1.2 | <0.10 | 08-13-15 1021 08-14-15 1022 |
| 101 | 08-13-15 0700 to 08-14-15 0600 | 08-14-15 1306 | 1.7, 0.7 [†] | <0.10 | 08-15-15 1028 08-16-15 1025 08-17-15 1021 |
| Intake | 08-13-15 0718 to 08-14-15 0618 | 08-14-15 1306 | 1.9 | <0.10 | 08-15-15 1028 08-16-15 1025 08-17-15 1021 |

*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 from Outfall 101 and intake were warmed to test temperature (25.0 ± 1.0°C) in a warm water bath.

Aliquots of Outfall 101 and Intake samples were UV-treated through a 40-watt Smart® UV Sterilizer (manufactured by Emperor Aquatics, Inc.) for 2 minutes.

Pimephales promelas

Ceriodaphnia dubia

Test Organisms:

- | | | |
|------------|--------------------------------|--------------------------|
| 1. Source: | <u>Aquatox, Inc.</u> | <u>In-house Cultures</u> |
| 2. Age: | <u>18.17 – 19.35 hours old</u> | <u>< 24-hours old</u> |

Test Method Summary:

- | | | |
|-----------------------------------|--|--|
| 1. Test Conditions: | <u>Static, Renewal</u> | <u>Static, Renewal</u> |
| 2. Test Duration: | <u>7 days</u> | <u>Until at least 60% of control females have 3 broods</u> |
| 3. Control / Dilution Water: | <u>Moderately Hard Synthetic</u> | <u>Moderately Hard Synthetic</u> |
| 4. Number of Replicates: | <u>4</u> | <u>10</u> |
| 5. Organisms per Replicate: | <u>10</u> | <u>1</u> |
| 6. Test Initiation: (Date/Time) | | |
| Outfall 101 | <u>08-11-15 1121 ET</u> | <u>08-11-15 0900 ET</u> |
| UV Treated Outfall 101 | <u>08-11-15 1110 ET</u> | |
| 7. Test Termination: (Date/Time) | | |
| Outfall 101 | <u>08-18-15 1035 ET</u> | <u>08-18-15 0803 ET</u> |
| UV Treated Outfall 101 | <u>08-18-15 1017 ET</u> | |
| 8. Test Temperature: Outfall 101: | <u>Mean = 24.7°C</u> <u>(24.2 – 25.2°C)</u> | <u>Mean = 24.9°C</u> <u>(24.7 – 25.3°C)</u> |

Test Temperature: UV-Treated Outfall 101: Mean = 24.8°C
(24.3 – 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 C for Bench Sheets)

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

Conducted August 11 – 18, 2015 using effluent from Outfall 101.

| Test Solutions (% Effluent) | Percent Surviving (time interval used – days) | | | | | | |
|--------------------------------|--|-----|-----|-----|-----|-----|-----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Control | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 10.7% | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 21.4% | 100 | 100 | 98 | 98 | 98 | 98 | 98 |
| 42.8% | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 85.6% | 100 | 100 | 100 | 100 | 98 | 98 | 98 |
| 100.0% | 100 | 100 | 98 | 98 | 95 | 95 | 95 |
| Intake | 100 | 100 | 100 | 100 | 100 | 88 | 88 |

| Test Solutions (% Effluent) | Mean Dry Weight (mg) (replicate number) | | | | |
|--------------------------------|--|-------|-------|-------|-------|
| | 1 | 2 | 3 | 4 | Mean |
| Control | 0.714 | 0.568 | 0.752 | 0.738 | 0.693 |
| 10.7% | 0.655 | 0.742 | 0.691 | 0.707 | 0.699 |
| 21.4% | 0.671 | 0.708 | 0.596 | 0.678 | 0.663 |
| 42.8% | 0.607 | 0.659 | 0.660 | 0.790 | 0.679 |
| 85.6% | 0.614 | 0.716 | 0.728 | 0.662 | 0.680 |
| 100.0% | 0.762 | 0.644 | 0.707 | 0.662 | 0.694 |
| Intake | 0.527 | 0.576 | 0.545 | 0.635 | 0.571 |

IC₂₅ Value: ≥ 100%

Permit Limit: 42.8%

95% Confidence Limits:

Upper Limit: NA

Lower Limit: NA

Calculated TU Estimates: < 1.0 TUc*

Permit Limit: 2.3 TUc

*TUa = 100/LC₅₀; TUc = 100/ IC₂₅

TOXICITY TEST RESULTS (see Appendix C for Bench Sheets)

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

Conducted August 11 – 18, 2015 using effluent from Outfall 101.

| Test Solutions (% Effluent) | Percent Surviving (time interval used – days) | | | | | | |
|--------------------------------|--|-----|-----|-----|-----|-----|-----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Control | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 10.7% | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 21.4% | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 42.8% | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 85.6% | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 100.0% | 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 | 30 | 30 | 29 | 28 | 29 | 30 | 33 | 31 | 30 | 31 | 30.1 |
| 10.7% | 33 | 30 | 32 | 33 | 30 | 31 | 32 | 30 | 31 | 30 | 31.2 |
| 21.4% | 34 | 33 | 32 | 31 | 32 | 31 | 30 | 32 | 31 | 33 | 31.9 |
| 42.8% | 34 | 33 | 35 | 30 | 31 | 32 | 31 | 33 | 31 | 31 | 32.1 |
| 85.6% | 35 | 34 | 35 | 34 | 35 | 33 | 37 | 34 | 34 | 35 | 34.6 |
| 100.0% | 35 | 36 | 35 | 35 | 35 | 36 | 35 | 37 | 36 | 35 | 35.5 |
| IC ₂₅ Value: <u>≥ 100%</u> Permit Limit: <u>42.8%</u> 95% Confidence Limits: Upper Limit: <u>NA</u> Lower Limit: <u>NA</u> | | | | | | Calculated TU Estimates: <u>< 1.0 TUc*</u> Permit Limit: <u>2.3 TUc</u> | | | | | |

*TUa = 100/LC₅₀; TUc = 100/ IC₂₅

TOXICITY TEST RESULTS (see Appendix C for Bench Sheets)

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

Conducted August 11 – 18, 2015 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 | 30 | 28 | 29 | 28 | 30 | 29 | 30 | 30 | 30 | 27 | 29.1 |
| Intake | 34 | 37 | 38 | 36 | 36 | 35 | 38 | 33 | 32 | 34 | 35.3 |
| IC ₂₅ Value: <u>> 100%</u> Permit Limit: <u>N/A</u> 95% Confidence Limits: Upper Limit: <u>NA</u> Lower Limit: <u>NA</u> | | | | Calculated TU Estimates: <u>< 1.0 TU_c*</u> Permit Limit: <u>N/A</u> | | | | | | | |

*TU_a = 100/LC₅₀; TU_c = 100/IC₂₅

TOXICITY TEST RESULTS, UV-TREATED (see Appendix C for Bench Sheets)

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

Conducted August 11 – 18, 2015 using effluent from UV Treated Outfall 101.

| Test Solutions (% Effluent) | Percent Surviving (time interval used – days) | | | | | | |
|--------------------------------|--|-----|-----|-----|-----|-----|-----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Control | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 10.7% | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 21.4% | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 42.8% | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 85.6% | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 100.0% | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Intake | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

| Test Solutions (% Effluent) | Mean Dry Weight (mg) (replicate number) | | | | |
|--|--|-------|---|-------|-------|
| | 1 | 2 | 3 | 4 | Mean |
| Control | 0.785 | 0.659 | 0.655 | 0.747 | 0.712 |
| 10.7% | 0.648 | 0.588 | 0.726 | 0.724 | 0.672 |
| 21.4% | 0.712 | 0.767 | 0.619 | 0.824 | 0.731 |
| 42.8% | 0.655 | 0.738 | 0.747 | 0.753 | 0.723 |
| 85.6% | 0.811 | 0.803 | 0.815 | 0.715 | 0.786 |
| 100.0% | 0.737 | 0.713 | 0.869 | 0.809 | 0.782 |
| Intake | 0.694 | 0.743 | 0.689 | 0.670 | 0.699 |
| IC ₂₅ Value: <u>> 100%</u> | | | Calculated TU Estimates: <u>< 1.0 TUc*</u> | | |
| 95% Confidence Limits: | | | | | |
| Upper Limit: <u>NA</u> Lower Limit: <u>NA</u> | | | | | |

*TUa = 100/LC₅₀; TUc = 100/ IC₂₅

REFERENCE TOXICANT TEST RESULTS (see Appendix A and D)

| Species | Date | Time | Duration | Toxicant | Results (IC ₂₅) |
|----------------------------|----------------------|------|----------|----------|-----------------------------|
| <i>Pimephales promelas</i> | August 11 – 18, 2015 | 1100 | 7-days | KCl | 0.81 g/L |
| <i>Ceriodaphnia dubia</i> | August 04 – 11, 2015 | 0935 | 7-days | NaCl | 1.06 g/L |

PHYSICAL/CHEMICAL SUMMARY

Water Chemistry Mean Values and Ranges for *Pimephales promelas* and *Ceriodaphnia dubia* Tests, Non-treated Sequoyah Nuclear Plant (SQN) Outfall 101 performed August 11-18, 2015.

| Test | Sample ID | Temperature (°C) | | Dissolved Oxygen (mg/L) | | pH (S.U.) | | Conductance (µmhos/cm) | Alkalinity (mg/L CaCO ₃) | Hardness (mg/L CaCO ₃) | Total Residual Chlorine (mg/L) |
|----------------------------|-------------|------------------|-------------|-------------------------|-------------|-------------|-------------|---------------------------|---|---------------------------------------|-----------------------------------|
| | | Initial | Final | Initial | Final | Initial | Final | | | | |
| <i>Pimephales promelas</i> | Control | 24.8 | 24.5 | 7.8 | 7.7 | 7.75 | 7.52 | 318 | 60 | 86 | |
| | | 24.7 - 24.9 | 24.3 - 24.7 | 7.6 - 7.9 | 7.0 - 8.0 | 7.63 - 7.98 | 7.39 - 7.68 | 305 - 327 | 59 - 61 | 84 - 88 | |
| | 10.8% | 24.8 | 24.4 | 7.8 | 7.7 | 7.74 | 7.48 | 301 | | | |
| | | 24.8 - 25.0 | 24.2 - 24.6 | 7.7 - 7.9 | 6.9 - 8.0 | 7.67 - 7.79 | 7.35 - 7.67 | 291 - 315 | | | |
| | 21.6% | 24.9 | 24.5 | 7.9 | 7.7 | 7.74 | 7.46 | 287 | | | |
| | | 24.8 - 25.0 | 24.3 - 24.7 | 7.8 - 8.0 | 6.9 - 8.0 | 7.68 - 7.78 | 7.32 - 7.65 | 280 - 301 | | | |
| | 43.2% | 24.9 | 24.5 | 7.9 | 7.8 | 7.74 | 7.47 | 258 | | | |
| | | 24.8 - 25.0 | 24.3 - 24.6 | 7.8 - 8.0 | 7.0 - 8.1 | 7.68 - 7.80 | 7.29 - 7.65 | 253 - 263 | | | |
| | 86.4% | 24.9 | 24.5 | 7.9 | 7.8 | 7.73 | 7.45 | 206 | | | |
| | | 24.8 - 25.0 | 24.3 - 24.7 | 7.8 - 8.1 | 6.9 - 8.1 | 7.67 - 7.79 | 7.23 - 7.68 | 200 - 209 | | | |
| 100.0% | 24.9 | 24.6 | 7.9 | 7.7 | 7.73 | 7.46 | 187 | 70 | 73 | < 0.10 | |
| | 24.8 - 25.1 | 24.3 - 24.7 | 7.8 - 8.1 | 6.5 - 8.1 | 7.67 - 7.80 | 7.20 - 7.69 | 181 - 192 | 67 - 73 | 72 - 76 | < 0.10 - < 0.10 | |
| Intake | 24.9 | 24.5 | 8.0 | 7.8 | 7.73 | 7.55 | 189 | 69 | 72 | < 0.10 | |
| | 24.7 - 25.2 | 24.3 - 24.6 | 7.8 - 8.1 | 6.9 - 8.1 | 7.67 - 7.79 | 7.41 - 7.70 | 184 - 191 | 65 - 73 | 72 - 72 | < 0.10 - < 0.10 | |
| <i>Ceriodaphnia dubia</i> | Control | 24.8 | 25.0 | 7.8 | 7.9 | 7.75 | 7.67 | 318 | 60 | 86 | |
| | | 24.7 - 24.9 | 24.8 - 25.2 | 7.6 - 7.9 | 7.6 - 8.1 | 7.63 - 7.98 | 7.54 - 7.77 | 305 - 327 | 59 - 61 | 84 - 88 | |
| | 10.8% | 24.8 | 25.0 | 7.8 | 7.9 | 7.74 | 7.69 | 301 | | | |
| | | 24.7 - 24.9 | 24.8 - 25.1 | 7.7 - 7.9 | 7.6 - 8.1 | 7.67 - 7.79 | 7.62 - 7.76 | 291 - 315 | | | |
| | 21.6% | 24.9 | 25.0 | 7.9 | 7.9 | 7.74 | 7.69 | 287 | | | |
| | | 24.7 - 25.0 | 24.8 - 25.2 | 7.8 - 8.0 | 7.6 - 8.1 | 7.68 - 7.78 | 7.63 - 7.76 | 280 - 301 | | | |
| | 43.2% | 24.9 | 25.0 | 7.9 | 7.9 | 7.74 | 7.69 | 258 | | | |
| | | 24.8 - 25.0 | 24.8 - 25.3 | 7.8 - 8.0 | 7.7 - 8.1 | 7.68 - 7.80 | 7.63 - 7.80 | 253 - 263 | | | |
| | 86.4% | 24.9 | 24.9 | 7.9 | 7.9 | 7.73 | 7.70 | 206 | | | |
| | | 24.8 - 25.0 | 24.8 - 25.0 | 7.8 - 8.1 | 7.8 - 8.1 | 7.67 - 7.79 | 7.63 - 7.81 | 200 - 209 | | | |
| 100.0% | 24.9 | 25.0 | 7.9 | 7.9 | 7.73 | 7.70 | 187 | 70 | 73 | < 0.10 | |
| | 24.8 - 25.0 | 24.8 - 25.1 | 7.8 - 8.1 | 7.8 - 8.1 | 7.67 - 7.80 | 7.63 - 7.83 | 181 - 192 | 67 - 73 | 72 - 76 | < 0.10 - < 0.10 | |
| Intake | 24.9 | 25.0 | 8.0 | 8.0 | 7.73 | 7.72 | 189 | 69 | 72 | < 0.10 | |
| | 24.8 - 25.0 | 24.9 - 25.1 | 7.8 - 8.1 | 7.8 - 8.1 | 7.67 - 7.79 | 7.44 - 7.83 | 184 - 191 | 65 - 73 | 72 - 72 | < 0.10 - < 0.10 | |

| Overall temperature (°C) | Average | Minimum | Maximum |
|----------------------------|---------|---------|---------|
| <i>Pimephales promelas</i> | 24.7 | 24.2 | 25.2 |
| <i>Ceriodaphnia dubia</i> | 24.9 | 24.7 | 25.3 |

PHYSICAL/CHEMICAL SUMMARY

Water Chemistry Mean Values and Ranges for *Pimephales promelas* Test, UV-treated Sequoyah Nuclear Plant (SQN) Outfall 101
performed August 11-18, 2015.

| Test | Sample ID | Temperature (°C) | | Dissolved Oxygen (mg/L) | | pH (S.U.) | | Conductance (µmhos/cm) | Alkalinity (mg/L CaCO ₃) | Hardness (mg/L CaCO ₃) | *Total Residual Chlorine (mg/L) |
|----------------------------|-----------|------------------|-------------|-------------------------|-----------|-------------|-------------|---------------------------|---|---------------------------------------|------------------------------------|
| | | Initial | Final | Initial | Final | Initial | Final | | | | |
| <i>Pimephales promelas</i> | Control | 24.9 | 24.5 | 7.8 | 7.7 | 7.74 | 7.57 | 316 | 60 | 84 | |
| | | 24.8 - 24.9 | 24.3 - 24.7 | 7.7 - 8.0 | 6.9 - 8.0 | 7.68 - 7.80 | 7.33 - 7.71 | 307 - 327 | 59 - 60 | 82 - 86 | |
| | 10.8% | 24.9 | 24.5 | 7.9 | 7.7 | 7.74 | 7.53 | 304 | | | |
| | | 24.8 - 25.0 | 24.4 - 24.7 | 7.8 - 8.0 | 6.9 - 8.1 | 7.59 - 7.84 | 7.32 - 7.71 | 294 - 316 | | | |
| | 21.6% | 25.0 | 24.6 | 7.9 | 7.7 | 7.76 | 7.53 | 292 | | | |
| | | 24.8 - 25.0 | 24.4 - 24.7 | 7.8 - 8.0 | 6.9 - 8.1 | 7.68 - 7.85 | 7.37 - 7.71 | 283 - 304 | | | |
| | 43.2% | 25.0 | 24.5 | 7.9 | 7.7 | 7.77 | 7.51 | 262 | | | |
| | | 24.8 - 25.1 | 24.3 - 24.7 | 7.8 - 8.0 | 7.0 - 8.1 | 7.68 - 7.86 | 7.27 - 7.71 | 255 - 269 | | | |
| | 86.4% | 25.0 | 24.6 | 7.9 | 7.7 | 7.77 | 7.51 | 209 | | | |
| | | 24.8 - 25.1 | 24.3 - 24.7 | 7.8 - 8.1 | 7.0 - 8.1 | 7.69 - 7.87 | 7.28 - 7.71 | 202 - 217 | | | |
| | 100.0% | 25.1 | 24.4 | 7.9 | 7.7 | 7.78 | 7.50 | 191 | 69 | 73 | < 0.10 |
| | | 24.9 - 25.3 | 24.3 - 24.6 | 7.8 - 8.1 | 6.9 - 8.1 | 7.70 - 7.88 | 7.28 - 7.71 | 183 - 198 | 67 - 71 | 72 - 76 | < 0.10 - < 0.10 |
| | Intake | 25.1 | 24.5 | 8.0 | 7.7 | 7.79 | 7.56 | 191 | 69 | 72 | < 0.10 |
| | | 25.0 - 25.2 | 24.4 - 24.6 | 7.8 - 8.1 | 6.6 - 8.1 | 7.70 - 7.88 | 7.39 - 7.71 | 183 - 203 | 67 - 71 | 72 - 72 | < 0.10 - < 0.10 |

*Note: Total residual chlorine was performed on non-treated Outfall 101 and Intake samples.

| Overall temperature (°C) | Average | Minimum | Maximum |
|----------------------------|---------|---------|---------|
| <i>Pimephales promelas</i> | 24.8 | 24.3 | 25.3 |

SUMMARY / CONCLUSIONS

Exposures to samples collected August 09 – 14, 2015 from Outfall 101 resulted in no toxic effects to fathead minnows or daphnids. The resulting IC₂₅ values, for both species, were > 100 percent. Exposure daphnids to intake samples resulted in no significant difference from the control during this study period. Growth was significantly reduced in minnows exposed to intake samples.

Fathead minnows were also exposed to UV treated Outfall 101 and intake samples since fish pathogens present in intake water have been the suspected cause of interference (anomalous dose response and high variability among replicates) in previous toxicity testing at Sequoyah. At the time this study was conducted, insignificant mortality occurred in minnows exposed to non-treated and UV treated samples.

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-2000.
4. Dissolved oxygen was measured by SM 4500-O G-2001.
5. The pH was measured by SM 4500-H+ B-2000.
6. Conductance was measured by SM 2510 B-1997.
7. Alkalinity was measured by SM 2320 B-1997.
8. Total hardness was measured by SM 2340 C-1997.
9. Total residual chlorine was measured by ORION 97-70-1977.

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 D for control chart information)

1. Test Type: 7-day chronic tests with results expressed as IC₂₅ 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. TN0026450.
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, 22nd Edition, 2012.
4. Quality Assurance Program: Standard Operating Procedures, Environmental Testing Solutions, Inc (most current version).

Sequoyah Nuclear Plant Biomonitoring
August 11 – 18, 2015

Appendix B

Diffuser Discharge Concentrations of Total Residual Chlorine,
Diffuser Discharge Concentrations of Chemicals Used to
Control Microbiologically Induced Corrosion and Mollusks
During Toxicity Test Sampling

Table B-1. Sequoyah Nuclear Plant Outfall 101
Diffuser Discharge Concentrations of Chemicals Used to Control Microbiologically
Induced Corrosion and Mollusks, During Toxicity Test Sampling,
February 6, 2005 – August 14, 2015

| Date | Sodium Hypochlorite mg/L TRC | Towerbrom mg/L TRC | PCL-222 mg/L Phosphate | PCL-401 mg/L Copolymer | CL-363 mg/L DMAD | Cuprostat-PF mg/L Azole | H-130M mg/L Quat | Nalco 73551 mg/L EO/PO | H-150M mg/L Quat |
|------------|---------------------------------------|--------------------------|------------------------------|------------------------------|------------------------|-------------------------------|------------------------|---------------------------------|------------------------|
| 02/06/2005 | - | <0.0042 | 0.028 | 0.010 | - | - | - | - | - |
| 02/07/2005 | - | <0.0116 | 0.028 | 0.010 | - | - | - | 0.007 | - |
| 02/08/2005 | - | <0.0080 | 0.028 | 0.010 | - | - | - | - | - |
| 02/09/2005 | - | 0.0199 | 0.028 | 0.010 | - | - | - | - | - |
| 02/10/2005 | - | <0.0042 | 0.028 | 0.010 | - | - | - | - | - |
| 02/11/2005 | - | 0.0155 | 0.028 | 0.010 | - | - | - | 0.007 | - |
| 06/05/2005 | - | 0.0063 | - | - | - | - | - | - | - |
| 06/06/2005 | - | 0.0043 | - | - | - | - | - | - | 0.037 |
| 06/07/2005 | - | 0.0103 | - | - | - | - | - | - | 0.037 |
| 06/08/2005 | - | 0.0295 | - | - | - | - | - | - | 0.037 |
| 06/09/2005 | - | 0.0129 | - | - | - | - | - | - | - |
| 06/10/2005 | - | 0.0184 | - | - | - | - | - | - | - |
| 07/17/2005 | - | 0.0109 | 0.026 | 0.009 | - | - | - | - | - |
| 07/18/2005 | - | 0.0150 | 0.026 | 0.009 | - | - | - | - | 0.036 |
| 07/19/2005 | - | 0.0163 | 0.026 | 0.009 | - | - | - | - | 0.036 |
| 07/20/2005 | - | 0.0209 | 0.026 | 0.009 | - | - | - | 0.014 | 0.036 |
| 07/21/2005 | - | 0.0242 | 0.026 | 0.009 | - | - | - | - | - |
| 07/22/2005 | - | 0.0238 | 0.054 | 0.018 | - | - | - | 0.014 | - |
| 10/30/2005 | - | 0.0068 | - | - | - | - | - | - | - |
| 10/31/2005 | - | 0.0112 | - | - | - | - | - | - | - |
| 11/01/2005 | - | 0.0104 | - | - | - | - | - | - | 0.035 |
| 11/02/2005 | - | 0.0104 | - | - | - | - | - | - | 0.036 |
| 11/03/2005 | - | 0.0117 | - | - | - | - | - | - | 0.036 |
| 11/04/2005 | - | 0.0165 | - | - | - | - | - | - | 0.035 |
| 11/14/2005 | - | 0.0274 | - | - | - | - | - | - | - |
| 11/15/2005 | - | 0.0256 | - | - | - | - | - | - | - |
| 11/16/2005 | - | 0.0234 | - | - | - | - | - | - | - |
| 11/17/2005 | - | 0.0231 | - | - | - | - | - | - | - |
| 11/18/2005 | - | 0.0200 | - | - | - | - | - | - | - |
| 11/19/2005 | - | 0.0116 | - | - | - | - | - | - | - |

Table B-1. Sequoyah Nuclear Plant Outfall 101
Diffuser Discharge Concentrations of Chemicals Used to Control Microbiologically
Induced Corrosion and Mollusks, During Toxicity Test Sampling,
February 6, 2005 – August 14, 2015

| Date | Sodium Hypochlorite mg/L TRC | Towerbrom mg/L TRC | PCL-222 mg/L Phosphate | PCL-401 mg/L Copolymer | CL-363 mg/L DMAD | Cuprostat-PF mg/L Azole | H-130M mg/L Quat | Nalco 73551 mg/L EO/PO | H-150M mg/L Quat | MSW 101 mg/L Phosphate |
|------------|---------------------------------------|--------------------------|------------------------------|------------------------------|------------------------|-------------------------------|------------------------|---------------------------------|------------------------|---------------------------------|
| 11/12/2006 | - | 0.0055 | - | - | - | - | - | - | - | - |
| 11/13/2006 | - | 0.0068 | - | - | - | - | - | - | 0.037 | - |
| 11/14/2006 | - | 0.0143 | - | - | - | - | - | - | 0.037 | - |
| 11/15/2006 | - | 0.0068 | - | - | - | - | - | - | 0.037 | - |
| 11/16/2006 | - | 0.0267 | - | - | - | - | - | - | 0.037 | - |
| 11/17/2006 | - | 0.0222 | - | - | - | - | - | - | - | - |
| 11/26/2006 | - | 0.0188 | - | - | - | - | - | - | - | - |
| 11/27/2006 | - | 0.0138 | - | - | - | - | - | - | - | - |
| 11/28/2006 | - | 0.0120 | - | - | - | - | - | - | - | - |
| 11/29/2006 | - | 0.0288 | - | - | - | - | - | - | - | - |
| 11/30/2006 | - | 0.0376 | - | - | - | - | - | - | - | - |
| 12/01/2006 | - | 0.0187 | - | - | - | - | - | - | - | - |
| 05/28/07 | - | - | - | - | - | - | - | - | - | 0.015 |
| 05/29/07 | - | - | - | - | - | - | - | - | 0.036 | 0.015 |
| 05/30/07 | - | 0.0084 | - | - | - | - | - | 0.017 | 0.036 | 0.015 |
| 05/31/07 | - | 0.0103 | - | - | - | - | - | - | 0.036 | 0.015 |
| 06/01/07 | - | 0.0164 | - | - | - | - | - | 0.017 | 0.036 | 0.015 |
| 06/02/07 | - | 0.0305 | - | - | - | - | - | - | - | 0.015 |
| 12/02/07 | - | 0.0241 | - | - | - | - | - | - | - | - |
| 12/03/07 | - | 0.0128 | - | - | - | - | - | - | - | - |
| 12/04/07 | - | 0.0238 | - | - | - | - | - | - | - | - |
| 12/05/07 | - | 0.0158 | - | - | - | - | - | - | - | - |
| 12/06/07 | - | 0.0162 | - | - | - | - | - | - | - | - |
| 12/07/07 | - | 0.0175 | - | - | - | - | - | - | - | - |
| 04/13/08 | - | 0.0039 | - | - | - | - | - | - | - | - |
| 04/14/08 | - | 0.0124 | - | - | - | - | - | - | - | - |
| 04/15/08 | - | 0.0229 | - | - | - | - | - | - | - | - |
| 04/16/08 | - | 0.0143 | - | - | - | - | - | - | - | - |
| 04/17/08 | - | 0.0120 | - | - | - | - | - | - | - | - |
| 04/18/08 | - | 0.0149 | - | - | - | - | - | - | - | - |
| 10/26/08 | - | 0.0260 | - | - | - | - | - | - | - | - |
| 10/27/08 | - | 0.0151 | - | - | - | - | - | 0.017 | - | - |
| 10/28/08 | - | 0.0172 | - | - | - | - | - | - | 0.041 | - |
| 10/29/08 | - | 0.0154 | - | - | - | - | - | 0.018 | 0.041 | 0.030 |
| 10/30/08 | - | - | - | - | - | - | - | - | 0.041 | 0.030 |
| 10/31/08 | - | 0.0086 | - | - | - | - | - | - | 0.041 | 0.030 |

Table B-1. Sequoyah Nuclear Plant Outfall 101
Diffuser Discharge Concentrations of Chemicals Used to Control Microbiologically
Induced Corrosion and Mollusks, During Toxicity Test Sampling,
February 6, 2005 – August 14, 2015

| Date | Sodium Hypochlorite mg/L TRC | Towerbrom mg/L TRC | PCL-222 mg/L Phosphate | PCL-401 mg/L Copolymer | CL-363 mg/L DMAD | Cuprostat -PF mg/L Azole | H-130M mg/L Quat | Nalco 73551 mg/L EO/PO | Spectrus CT1300 mg/L Quat | H-150M mg/L Quat | MSW 101 mg/L Phosphate |
|----------|------------------------------|--------------------|------------------------|------------------------|------------------|--------------------------|------------------|------------------------|---------------------------|------------------|------------------------|
| 02/08/09 | - | 0.0197 | - | - | - | - | - | 0.017 | - | - | - |
| 02/09/09 | - | 0.0237 | - | - | - | - | - | 0.017 | - | - | - |
| 02/10/09 | - | 0.0104 | - | - | - | - | - | 0.021 | - | - | - |
| 02/11/09 | - | 0.0155 | - | - | - | - | - | 0.017 | - | - | - |
| 02/12/09 | - | 0.0106 | - | - | - | - | - | 0.017 | - | - | - |
| 02/13/09 | - | - | - | - | - | - | - | - | - | - | - |
| 05/10/09 | - | 0.0129 | - | - | - | - | - | - | - | - | - |
| 05/11/09 | - | 0.0415 | - | - | - | - | - | - | - | 0.0446 | - |
| 05/12/09 | - | 0.0053 | - | - | - | - | - | - | - | 0.0396 | - |
| 05/13/09 | - | 0.0049 | - | - | - | - | - | - | - | 0.0396 | - |
| 05/14/09 | - | <0.0141 | - | - | - | - | - | - | - | 0.0397 | - |
| 05/15/09 | - | <0.0160 | - | - | - | - | - | - | - | - | - |
| 11/15/09 | - | 0.025 | - | - | - | - | - | - | - | - | - |
| 11/16/09 | - | 0.0152 | - | - | - | - | - | - | - | - | - |
| 11/17/09 | - | 0.0255 | - | - | - | - | - | - | - | - | - |
| 11/18/09 | - | 0.0306 | - | - | - | - | - | - | - | - | - |
| 11/19/09 | - | 0.0204 | - | - | - | - | - | - | - | - | - |
| 11/20/09 | - | 0.0093 | - | - | - | - | - | - | - | - | - |
| 05/09/10 | - | 0.0192 | - | - | - | - | - | - | - | - | - |
| 05/10/10 | - | 0.0055 | - | - | - | - | - | - | - | - | - |
| 05/11/10 | - | 0.0100 | - | - | - | - | - | - | 0.039 | - | - |
| 05/12/10 | - | 0.0171 | - | - | - | - | - | - | 0.039 | - | - |
| 05/13/10 | - | 0.0041 | - | - | - | - | - | - | 0.039 | - | - |
| 05/14/10 | - | 0.0099 | - | - | - | - | - | - | 0.039 | - | - |

Table B-1. Sequoyah Nuclear Plant Outfall 101
Diffuser Discharge Concentrations of Chemicals Used to Control Microbiologically
Induced Corrosion and Mollusks, During Toxicity Test Sampling,
February 6, 2005 – August 14, 2015

| Date | Sodium Hypo-chlorite mg/L TRC | Towerbrom mg/L TRC | PCL-222 mg/L Phos-phate | PCL-401 mg/L Copoly-mer | CL-363 mg/L DMAD | Cuprostat -PF mg/L Azole | H-130M mg/L Quat | Nalco 73551 mg/L EO/PO | Spectrus CT1300 mg/L Quat | H-150M mg/L Quat | MSW 101 mg/L Phos-phate | Floguard MS6236 mg/L Phosphate |
|------------|-------------------------------|--------------------|-------------------------|-------------------------|------------------|--------------------------|------------------|------------------------|---------------------------|------------------|-------------------------|--------------------------------|
| 10/31/10 | - | - | - | - | - | - | - | - | - | - | - | - |
| 11/01/10 | - | 0.0122 | - | - | - | - | - | - | - | - | - | - |
| 11/02/10 | - | 0.0112 | - | - | - | - | - | - | - | - | - | - |
| 11/03/10 | - | 0.0163 | - | - | - | - | - | - | - | - | - | - |
| 11/04/10 | - | 0.0107 | - | - | - | - | - | - | - | - | - | - |
| 11/05/10 | - | 0.0132 | - | - | - | - | - | - | - | - | - | - |
| 05/01/2011 | - | - | - | - | - | - | - | - | - | - | - | - |
| 05/02/2011 | - | - | - | - | - | - | - | - | 0.04 | - | - | - |
| 05/03/2011 | - | - | - | - | - | - | - | - | 0.04 | - | - | - |
| 05/04/2011 | - | 0.0155 | - | - | - | - | - | - | 0.04 | - | - | - |
| 05/05/2011 | - | 0.0179 | - | - | - | - | - | - | 0.04 | - | - | - |
| 05/06/2011 | - | 0.0089 | - | - | - | - | - | - | - | - | - | - |
| 11/06/2011 | - | 0.0168 | - | - | - | - | - | - | - | - | - | - |
| 11/07/2011 | - | 0.0225 | - | - | - | - | - | - | - | - | - | - |
| 11/08/2011 | - | 0.0141 | - | - | - | - | - | - | - | - | - | - |
| 11/09/2011 | - | 0.0239 | - | - | - | - | - | - | - | - | - | - |
| 11/10/2011 | - | 0.0242 | - | - | - | - | - | - | - | - | - | - |
| 11/11/2011 | - | 0.0231 | - | - | - | - | - | - | - | - | - | - |
| 05/06/2012 | - | - | - | - | - | - | - | - | - | - | - | - |
| 05/07/2012 | - | - | - | - | - | - | - | - | - | - | - | - |
| 05/08/2012 | - | - | - | - | - | - | - | - | 0.041 | - | - | - |
| 05/09/2012 | - | 0.0145 | - | - | - | - | - | - | 0.041 | - | - | - |
| 05/10/2012 | - | 0.0298 | - | - | - | - | - | - | 0.041 | - | - | - |
| 05/11/2012 | - | 0.0174 | - | - | - | - | - | - | - | - | - | - |
| 08/12/2012 | - | - | - | - | - | - | - | - | - | - | - | 0.029 |
| 08/13/2012 | - | 0.0256 | - | - | - | - | - | 0.028 | 0.037 | - | - | 0.029 |
| 08/14/2012 | - | 0.0209 | - | - | - | - | - | - | 0.037 | - | - | 0.029 |
| 08/15/2012 | - | 0.0279 | - | - | - | - | - | 0.028 | - | - | - | 0.029 |
| 08/16/2012 | - | 0.0076 | - | - | - | - | - | - | - | - | - | 0.029 |
| 08/17/2012 | - | 0.0446 | - | - | - | - | - | - | - | - | - | 0.032 |
| 05/12/2013 | - | 0.0099 | - | - | - | - | - | - | - | - | - | - |
| 05/13/2013 | - | - | - | - | - | - | - | - | - | - | - | 0.064 |
| 05/14/2013 | - | 0.0091 | - | - | - | - | - | 0.039 | - | - | - | 0.064 |
| 05/15/2013 | - | 0.0096 | - | - | - | - | - | 0.039 | - | - | - | 0.064 |
| 05/16/2013 | - | 0.0229 | - | - | - | - | - | - | - | - | - | 0.032 |
| 05/17/2013 | - | 0.0063 | - | - | - | - | - | - | - | - | - | 0.032 |
| 09/15/2013 | - | - | - | - | - | - | - | - | - | - | - | 0.03 |
| 09/16/2013 | - | 0.0072 | - | - | - | - | - | - | 0.0379 | - | - | 0.03 |
| 09/17/2013 | - | 0.0107 | - | - | - | - | - | 0.036 | 0.0379 | - | - | 0.03 |
| 09/18/2013 | - | 0.0217 | - | - | - | - | - | 0.036 | 0.0379 | - | - | 0.03 |
| 09/19/2013 | - | 0.0172 | - | - | - | - | - | - | - | - | - | 0.03 |
| 09/20/2013 | - | 0.0173 | - | - | - | - | - | - | - | - | - | 0.03 |

Table B-1. Sequoyah Nuclear Plant Outfall 101
Diffuser Discharge Concentrations of Chemicals Used to Control Microbiologically
Induced Corrosion and Mollusks, During Toxicity Test Sampling,
February 6, 2005 – August 14, 2015

| Date | Sodium Hypo- chlorite mg/L TRC | Towerbrom mg/L TRC | PCL- 222 mg/L Phos- phate | PCL-401 mg/L Copoly- mer | CL-363 mg/L DMAD | Cuprostat -PF mg/L Azole | H-130M mg/L Quat | Nalco 73551 mg/L EO/PO | Spectrus CT1300 mg/L Quat | H-150M mg/L Quat | MSW 101 mg/L Phos- phate | Floguard MS6236 mg/L Phosphate |
|------------|--|--------------------------|---------------------------------------|-----------------------------------|------------------------|--------------------------------|------------------------|---------------------------------|------------------------------------|------------------------|--------------------------------------|---|
| 05/04/2014 | - | 0.0118 | - | - | - | - | - | - | - | - | - | - |
| 05/05/2014 | - | 0.0112 | - | - | - | - | - | - | - | - | - | - |
| 05/06/2014 | - | 0.0096 | - | - | - | - | - | - | - | - | - | - |
| 05/07/2014 | - | 0.0164 | - | - | - | - | - | - | - | - | - | - |
| 05/08/2014 | - | 0.0235 | - | - | - | - | - | - | - | - | - | - |
| 05/09/2014 | - | 0.0110 | - | - | - | - | - | - | - | - | - | - |
| 09/07/2014 | - | - | - | - | - | - | - | - | - | - | - | - |
| 09/08/2014 | - | - | - | - | - | - | - | - | 0.04 | - | - | - |
| 09/09/2014 | - | - | - | - | - | - | - | - | 0.04 | - | - | - |
| 09/10/2014 | - | - | - | - | - | - | - | - | 0.04 | - | - | - |
| 09/11/2014 | - | 0.0070 | - | - | - | - | - | - | - | - | - | - |
| 09/12/2014 | - | 0.0074 | - | - | - | - | - | - | - | - | - | - |
| 08/09/2015 | | - | | | | | | | - | | | - |
| 08/10/2015 | | 0.0195 | | | | | | | 0.03 | | | - |
| 08/11/2015 | | 0.0275 | | | | | | | 0.03 | | | - |
| 08/12/2015 | | 0.0213 | | | | | | | - | | | 0.03 |
| 08/13/2015 | | 0.0192 | | | | | | | - | | | 0.03 |
| 08/14/2015 | | 0.0182 | | | | | | | - | | | 0.03 |

Sequoyah Nuclear Plant Biomonitoring
August 11 – 18, 2015

Appendix C

Chain of Custody Records and
Toxicity Test Bench Sheets

BIOMONITORING CHAIN OF CUSTODY RECORD

Page 1 of 1

Client: TVA

Project Name: Sequoyah NP Toxicity

O. Number: N/A

Facility Sampled: Sequoyah NP

NPDES Number: TN0026450

Collected By: *Amy Parker, Marcus Moore*

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): Sonic Delivery

General Comments:

Took samples from 101 sampler @ 0655
Took sample from Intake sampler @ 0720

* 101 Backup sample was shipped to Environmental Testing Solution

* Diss. Metals were collected & kept on site

| Field Identification / Sample Description | Grab/Comp | Collection Date/Time | | Container Number & Volume Collected | Flow (MGD) | Rain Event? (Mark as Appropriate) | | | | Laboratory Use | | | | |
|---|-----------|----------------------|----------------------|-------------------------------------|------------|-----------------------------------|----------------|----|-------|----------------|--------------------|----|---------|------------|
| | | Start | End | | | Yes | If Yes, Inches | No | Trace | ETS Log Number | Arrival Temp. (°C) | By | Time ET | Appearance |
| SQN-101-TOX | Comp | 8-9-15 0700 Est | 8-10-15 0600 EST | 2 (2.5gal) | 1793.314 | | | X | | 150810.01 | 1.8/1.3C | X | 1205 | * |
| SQN-INT-TOX | Comp | 8-9-15 0720 Est | 8-10-15 0620 Est. | 1 (2.5 gal) | NA | | | X | | 150810.02 | 1.7C | X | 1205 | * |

Sample Custody - Fill In From Top Down

* CUSTODY SEALS INTACT. SAMPLES RECEIVED

| Relinquished By (Signature): | Date/Time | Received By (Signature): | IN GOOD CONDITION TREC PRESENT IN ALL SAMPLES |
|------------------------------|-------------------|--------------------------|---|
| <i>W.D.W. / TVA</i> | 8-10-15 / 0816 ET | <i>Bobby R. Shuler</i> | 8-10-15 08:16 ET |
| <i>Bobby R. Shuler</i> SONIC | 8-10-15 12:05 ET | <i>JWH</i> ETS | 08-10-15 1205 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.



Whole Effluent Sample Receipt Log

Page 90

*Sample temperature performed using Sample Receiving Thermometer: SN 130580151

| Date Received | Time Received | Received by | Received from | *Sample Temp. (°C) | Project number | Sample number | Sample name and description | State | Comments |
|---------------|---------------|-------------|---------------|--------------------|----------------|---------------|---------------------------------------|-------|----------|
| 08-10-15 | 1205 | J. Sumner | TVA Courier | 1.8/1.3 | 10842 | 150810 .01 | TVA - Sequoyah Nuclear Plant - 101 | TN | |
| 08-10-15 | 1205 | J. Sumner | TVA Courier | 1.7 | 10842 | 150810 .02 | TVA - Sequoyah Nuclear Plant - Intake | TN | |

BIOMONITORING CHAIN OF CUSTODY RECORD

Page 1 of 1

Client: TVA

Project Name: Sequoyah NP Toxicity

P.O. Number: N/A

Facility Sampled: Sequoyah NP

NPDES Number: TN0026450

Collected By: *Obie Moore, Andy Pank*

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): Sonic Delivery

General Comments:

*Took samples from 101 sampler @ 0626
Took sample from Intake sampler @ 0703*** 101 Backup sample was shipped to Environmental
Testing Solution*** Diss. Metals were collected + kept on site*

| Field Identification / Sample Description | Grab/Comp | Collection Date/Time | | Container Number & Volume Collected | Flow (MGD) | Rain Event? (Mark as Appropriate) | | | | Project # 10042 Laboratory Use | | | | |
|--|-----------|----------------------|---------------------|--|---------------|--------------------------------------|-------------------|----|-------|-----------------------------------|-----------------------|----|------|------------|
| | | Start | End | | | Yes | If Yes, Inches | No | Trace | ETS Log Number | Arrival Temp. (°C) | By | Time | Appearance |
| SQN-101-TOX | Comp | 8-11-15 0700 Est | 8-12-15 0600 Est | 2 (2.5gal) | 1776.43 | X | 0.31 | | | 15002.11 | 15.13 C | JL | 1300 | + |
| SQN-INT-TOX | Comp | 8-11-15 0722 Est | 8-12-15 0622 Est | 1 (2.5 gal) | NA | X | 0.31 | | | 15002.12 | 1.2 C | JL | 1300 | X |

Sample Custody - Fill In From Top Down

* CUSTODY SEALS INTACT. SAMPLES RECEIVED IN

| Relinquished By (Signature): | Date/Time | Received By (Signature): | GOOD CONDITION. TIRC ABSENT IN ALL SAMPLES |
|------------------------------|-----------------|--------------------------|--|
| <i>Obie Moore / TVA</i> | 8-12-15/0830 ET | <i>BR Skiles</i> SONIC | 8-12-15 8:30 ET |
| <i>BR Skiles</i> SONIC | 8-12-15 1:00 ET | <i>Jim</i> ETS | 08-12-15 1300 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.



Whole Effluent Sample Receipt Log

Page 92

*Sample temperature performed using Sample Receiving Thermometer: SN 130580151

| Date Received | Time Received | Received by | Received from | *Sample Temp. (°C) | Project number | Sample number | Sample name and description | State | Comments |
|---------------|---------------|-------------|---------------|--------------------|----------------|---------------|---------------------------------------|-------|----------|
| 08-12-15 | 1002 | K. Keenan | Fed - Ex | 0.5 | 10848 | 150812 .01 | ALCOA - 005 | NC | |
| 08-12-15 | 1002 | K. Keenan | Fed - Ex | 0.6 | 10849 | 150812 .02 | Apex WRF | NC | |
| 08-12-15 | 1002 | K. Keenan | Fed - Ex | 2.7 | 10850 | 150812 .03 | Daikin Applied Americas, Inc. | NC | |
| 08-12-15 | 1002 | K. Keenan | Fed - Ex | 0.7 | 10851 | 150812 .04 | Dallas WWTP | NC | |
| 08-12-15 | 1002 | K. Keenan | Fed - Ex | 0.5 | 10852 | 150812 .05 | McGuire NS - 005 | NC | |
| 08-12-15 | 1002 | K. Keenan | Fed - Ex | 0.4 | 10853 | 150812 .06 | Craven County Wood Energy | NC | |
| 08-12-15 | 1002 | K. Keenan | Fed - Ex | 0.7 | 10854 | 150812 .07 | Elementis | NC | |
| 08-12-15 | 1002 | K. Keenan | Fed - Ex | 1.1 | 10855 | 150812 .08 | Woodlake Yacht Club | NC | |
| 08-12-15 | 1002 | K. Keenan | Fed - Ex | 0.7 | 10856 | 150812 .09 | McGuire NS - 001 | NC | |
| 08-12-15 | 1002 | K. Keenan | Fed - Ex | 1.7 | 10857 | 150812 .10 | McGuire NS - 002 | NC | |
| 08-12-15 | 1300 | J. Sumner | TVA Courier | 1.5/1.3 | 10842 | 150812 .11 | TVA - Sequoyah Nuclear Plant - 101 | TN | |
| 08-12-15 | 1300 | J. Sumner | TVA Courier | 1.2 | 10842 | 150812 .12 | TVA - Sequoyah Nuclear Plant - Intake | TN | |

BIOMONITORING CHAIN OF CUSTODY RECORD

Page 1 of 1

| | | |
|---|---|--|
| Client: TVA | 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 |
| Project Name: Sequoyah NP Toxicity | | Other (specify): <u>Sonic Delivery</u> |
| O. Number: N/A | | General Comments: |
| Facility Sampled: Sequoyah NP | | Took samples from 101 sampler @ 0628 Took samples from Intake sampler @ 0717 * 101 Backup sample was shipped to Environmental Testing Solution * Diss. Metals were collected + kept on site |
| NPDES Number: TN0026450 | | |
| Collected By: <u>Marcus O. Moore</u> <u>Andy Panter</u> | | |

| Field Identification / Sample Description | Grab/Comp | Collection Date/Time | | Container Number & Volume Collected | Flow (MGD) | Rain Event? (Mark as Appropriate) | | | | Laboratory Use | | | | |
|---|-----------|----------------------|---------------------|-------------------------------------|------------|-----------------------------------|----------------|----|-------|----------------|--------------------|----|---------|------------|
| | | Start | End | | | Yes | If Yes, Inches | No | Trace | ETS Log Number | Arrival Temp. (°C) | By | Time ET | Appearance |
| SQN-101-TOX | Comp | 8-13-15 0700 Est | 8-14-15 0600 Est | 2 (2.5 gal) | 1779.543 | | | X | | 15004.08 | 1.7/0.7 C | J | 1306 | * |
| SQN-INT-TOX | Comp | 8-13-15 0718 Est | 8-14-15 0618 Est | 1 (2.5 gal) | NA | | | X | | 15004.09 | 1.9 C | J | 1306 | * |

Sample Custody - Fill In From Top Down

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

| Relinquished By (Signature): | Date/Time | Received By (Signature): | | Date/Time |
|------------------------------|-------------------|--------------------------|-------|-------------------|
| <u>M. O. Moore</u> / TVA | 8-14-15 / 0821 ET | <u>Bobby R. Shales</u> | SONIC | 8-14-15 - 8:21 ET |
| <u>Bobby R. Shales</u> SONIC | 8-14-15 1:06 ET | <u>Jma/u</u> | ETS | 08-14-15 1306 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.



Whole Effluent Sample Receipt Log

*Sample temperature performed using Sample Receiving Thermometer: SN 130580151

| Date Received | Time Received | Received by | Received from | *Sample Temp. (°C) | Project number | Sample number | Sample name and description | State | Comments |
|---------------|---------------|-------------|---------------|--------------------|----------------|---------------|---------------------------------------|-------|----------|
| 08-14-15 | 0950 | K. Keenan | Fed - Ex | 0.5 | 10848 | 150814 .01 | ALCOA - 005 | NC | |
| 08-14-15 | 0950 | K. Keenan | Fed - Ex | 1.6 | 10849 | 150814 .02 | Apex WRF | NC | |
| 08-14-15 | 0950 | K. Keenan | Fed - Ex | 1.1 | 10850 | 150814 .03 | Daikin Applied Americas, Inc. | NC | |
| 08-14-15 | 0950 | K. Keenan | Fed - Ex | 1.0 | 10851 | 150814 .04 | Dallas WWTP | NC | |
| 08-14-15 | 0950 | K. Keenan | Fed - Ex | 0.7 | 10852 | 150814 .05 | McGuire NS - 005 | NC | |
| 08-14-15 | 0950 | K. Keenan | Fed - Ex | 1.0 | 10853 | 150814 .06 | Craven County Wood Energy | NC | |
| 08-14-15 | 0950 | K. Keenan | Fed - Ex | 2.0 | 10854 | 150814 .07 | Elementis | NC | |
| 08-14-15 | 1306 | J. Sumner | TVA Courier | 1.7/0.7 | 10842 | 150814 .08 | TVA - Sequoyah Nuclear Plant - 101 | TN | |
| 08-14-15 | 1306 | J. Sumner | TVA Courier | 1.9 | 10842 | 150814 .09 | TVA - Sequoyah Nuclear Plant - Intake | TN | |

Chronic Whole Effluent Toxicity Test (EPA-821-R-02-013 Method 1000.0)
Species: Pimephales promelas

Client: Tennessee Valley Authority
Facility: Sequoyah Nuclear Plant
NPDES #: TN0026450
Project #: 10842

County: Hamilton
Outfall: 101

| Dilution preparation information: | | | | | | Comments: |
|-----------------------------------|--------|------|------|------|------|-----------|
| Dilution prep (%) | 10.7 | 21.4 | 42.8 | 85.6 | 100 | |
| Effluent volume (mL) | 267.5 | 535 | 1070 | 2140 | 2500 | |
| Diluent volume (mL) | 2232.5 | 1965 | 1430 | 360 | 0 | |
| Total volume (mL) | 2500 | 2500 | 2500 | 2500 | 2500 | |

| Test organism information: | | Test information: | |
|---|--------------------------|--|--------------------|
| Organism age: | 18-35 to 19-35 Hours old | Randomizing template: | GREEN |
| Date and times organisms were born between: | 08-10-15 1500-1700 | Incubator number and shelf location: | 3D |
| Organism source: | ATOX Batch Pp: 08-10-15 | Artemia CHM number: | CHM836 |
| Transfer bowl information: | | Drying information for weight determination: | |
| pH = 7.63 S.U. Temperature = 24.9 °C | | Date / Time in oven: | 08-15-15 1030 1040 |
| Average transfer volume: | | Initial oven temperature: | 60 °C |
| | | Date / Time out of oven: | 08-14-15 1030 1040 |
| | | 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 | | Sample numbers used | | MHSW batch used |
|-----|----------|-----------------|---------|-------------------|---------|--|---------|---------------------|-----------|-----------------|
| | | Time | Analyst | Time | Analyst | Time | Analyst | Outfall 101 | Intake | |
| 0 | 08-11-15 | 0730 | JL | 1530 | JL | 1121 | JL | 150810.01 | 150810.02 | 08-09-15 |
| 1 | 08-12-15 | 0730 | JL | 1330 | JL | 1022 | JL | 150810.01 | 150810.02 | 08-09-15 |
| 2 | 08-13-15 | 0730 | JL | 1330 | JL | 1021 | JL | 150812.11 | 150812.12 | 08-10-15A |
| 3 | 08-14-15 | 0715 | JL | 1315 | JL | 1022 | JL | 150812.11 | 150812.12 | 08-10-15A |
| 4 | 08-15-15 | 0803 | JL | 1405 | JL | 1026 | JL | 150814.08 | 150814.09 | 08-10-15B |
| 5 | 08-16-15 | 0805 | JL | 1405 | JL | 1025 | JL | 150814.08 | 150814.09 | 08-10-15B |
| 6 | 08-17-15 | 0745 | JL | 1345 | JL | 1021 | JL | 150814.08 | 150814.09 | 08-10-15B |
| 7 | 08-18-15 | | | | | 1035 | JL | | | |

| Control information: | | Acceptance criteria | Summary of test endpoints: | |
|--------------------------------------|-------|---------------------|----------------------------|---------|
| % Mortality: | 0% | ≤ 20% | 7-day LC ₅₀ | > 1007. |
| Average weight per initial larvae: | 0.693 | | NOEC | 1007. |
| Average weight per surviving larvae: | 0.693 | ≥ 0.25mg/larvae | LOEC | > 1007. |
| | | | ChV | > 1007. |
| | | | IC ₂₅ | > 1007. |



Species: *Pimephales promelas*
 Client: TVA / Sequoyah Nuclear Plant, Outfall 101, NON-treated
 Date: 08-11-15

Survival and Growth Data

| Day | CONTROL | | | | | | | | | | 10.7% | | 21.4% | |
|---|---------|----|----|----|----|----|----|----|----|----|-------|----|-------|--|
| | A | B | C | D | E | F | G | H | I | J | K | L | | |
| 0 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | | |
| 1 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | | |
| 2 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | | |
| 3 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | | |
| 4 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | | |
| 5 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | | |
| 6 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | | |
| 7 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | | |
| A = Pan weight (mg) Tray color code: N6 Date: 08-03-15 Analyst: Magera B = Pan + Larvae weight (mg) Date: 08-19-15 Analyst: Magera C = Larvae weight (mg) = B - A Hand calculated. Weight per initial number of larvae (mg) = C / Initial number of larvae Hand calculated. Analyst: Magera | | | | | | | | | | | | | | |
| Average weight per initial number of larvae (mg) Percent reduction from control (%) | | | | | | | | | | | | | | |
| 0.693 0.714 0.568 0.734 0.655 0.742 0.691 0.707 0.671 0.708 0.596 0.678 4.37 | | | | | | | | | | | | | | |

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

Comments:



Species: *Pimephales promelas*

Client: TVA / Sequoyah Nuclear Plant, Outfall 101, NON-treated

Date: 08-11-15

Survival and Growth Data

| Day | 42.8% | | | | 85.6% | | | | 100% | | | |
|---|-------|----|----|----|-----------------|----|----|----|-------|----|-----------------|-----------------|
| | M | N | O | P | Q | R | S | T | U | V | W | X |
| 0 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 1 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 2 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 3 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 9 ^{fg} |
| 4 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 9 |
| 5 | 10 | 10 | 10 | 10 | 9 ^{fg} | 10 | 10 | 10 | 10 | 10 | 9 ^{fg} | 9 |
| 6 | 10 | 10 | 10 | 10 | 9 | 10 | 10 | 10 | 10 | 10 | 9 | 9 |
| 7 | 10 | 10 | 10 | 10 | 9 | 10 | 10 | 10 | 10 | 10 | 9 | 9 |
| A = Pan weight (mg) Tray color code: <u>Magenta</u> Analyst: <u>N6</u> Date: <u>08-03-15</u> | | | | | | | | | | | | |
| B = Pan + Larvae weight (mg) Analyst: <u>A1</u> Date: <u>08-19-15</u> | | | | | | | | | | | | |
| C = Larvae weight (mg) = B - A Hand calculated. Analyst: <u>[Signature]</u> | | | | | | | | | | | | |
| Weight per initial number of larvae (mg) = C / Initial number of larvae Hand calculated. Analyst: <u>[Signature]</u> | | | | | | | | | | | | |
| Average weight per initial number of larvae (mg) | 0.679 | | | | 0.680 | | | | 0.694 | | | |
| Percent reduction from control (%) | 2.07. | | | | 1.97. | | | | -0.17 | | | |

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:



Species: *Pimephales promelas*
 Client: TVA / Sequoyah Nuclear Plant, Outfall 101, NON-treated
 Date: 08-11-15

Survival and Growth Data

| Day | 100% Intake | | | | | | | |
|--|-------------|----|----|----|-------------------------|----|----|----|
| | BB | AA | Z | Y | BB | AA | Z | Y |
| 0 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 1 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 2 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 3 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 4 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 5 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 6 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 7 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| | | | | | | | | |
| A = Pan weight (mg) | | | | | 15.80 15.19 14.32 16.09 | | | |
| Tray color code: Magenta | | | | | | | | |
| Date: 08-03-15 | | | | | | | | |
| Analyst: M | | | | | | | | |
| B = Pan + Larvae weight (mg) | | | | | 21.07 20.95 19.77 22.44 | | | |
| Date: 08-19-15 | | | | | | | | |
| Analyst: M | | | | | | | | |
| C = Larvae weight (mg) = B - A | | | | | 5.27 5.76 5.45 6.35 | | | |
| Hand calculated: | | | | | | | | |
| Analyst: M | | | | | | | | |
| Weight per initial number of larvae (mg) | | | | | | | | |
| = C / Initial number of larvae | | | | | | | | |
| Hand calculated: | | | | | | | | |
| Analyst: M | | | | | | | | |
| Average weight per initial number of larvae (mg) | | | | | | | | |
| Percent reduction from control (%) | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |



ETS

Environmental Testing Solutions, Inc.

TVA / Sequoyah Nuclear Plant, Outfall 101
Non-treated
August 11-18, 2015

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: 10842

| Not for Compliance Assessment, Internal Laboratory QC | | | | | | | | | | | | | | | |
|---|-----------|--------------------------|------------------------|---------------------|------------------------------|----------------------------|--|---|---|--|-------------------|---|---|------------------------------------|--|
| Concentration (%) | Replicate | Initial number of larvae | Final number of larvae | A = Pan weight (mg) | B = Pan + Larvae weight (mg) | Larvae weight (mg) = A - B | Weight / Surviving number of larvae (mg) | Mean weight / Surviving number of larvae (mg) | Coefficient of variation (Mean weight per surviving number of larvae) (%) | Weight / Initial number of larvae (mg) | Mean survival (%) | Mean weight / Initial number of larvae (mg) | Coefficient of variation (Mean weight per initial number of larvae) (%) | Percent reduction from control (%) | |
| Control | A | 10 | 10 | 16.10 | 23.24 | 7.14 | 0.714 | 0.693 | 12.2 | 0.714 | 100.0 | 0.693 | 12.2 | Not applicable | |
| | B | 10 | 10 | 16.08 | 21.76 | 5.68 | 0.568 | | | 0.568 | | | | | |
| | C | 10 | 10 | 15.75 | 23.27 | 7.52 | 0.752 | | | 0.752 | | | | | |
| | D | 10 | 10 | 16.19 | 23.57 | 7.38 | 0.738 | | | 0.738 | | | | | |
| 10.7% | E | 10 | 10 | 12.92 | 19.47 | 6.55 | 0.655 | 0.699 | 5.2 | 0.655 | 100.0 | 0.699 | 5.2 | -0.8 | |
| | F | 10 | 10 | 16.84 | 24.26 | 7.42 | 0.742 | | | 0.742 | | | | | |
| | G | 10 | 10 | 16.11 | 23.02 | 6.91 | 0.691 | | | 0.691 | | | | | |
| | H | 10 | 10 | 16.42 | 23.49 | 7.07 | 0.707 | | | 0.707 | | | | | |
| 21.4% | I | 10 | 10 | 16.16 | 22.87 | 6.71 | 0.671 | 0.683 | 11.5 | 0.671 | 97.5 | 0.663 | 7.2 | 4.3 | |
| | J | 10 | 9 | 15.12 | 22.20 | 7.08 | 0.787 | | | 0.708 | | | | | |
| | K | 10 | 10 | 16.06 | 22.02 | 5.96 | 0.596 | | | 0.596 | | | | | |
| | L | 10 | 10 | 15.44 | 22.22 | 6.78 | 0.678 | | | 0.678 | | | | | |
| 42.8% | M | 10 | 10 | 16.45 | 22.52 | 6.07 | 0.607 | 0.679 | 11.5 | 0.607 | 100.0 | 0.679 | 11.5 | 2.0 | |
| | N | 10 | 10 | 15.92 | 22.51 | 6.59 | 0.659 | | | 0.659 | | | | | |
| | O | 10 | 10 | 15.65 | 22.25 | 6.60 | 0.660 | | | 0.660 | | | | | |
| | P | 10 | 10 | 16.10 | 24.00 | 7.90 | 0.790 | | | 0.790 | | | | | |
| 85.6% | Q | 10 | 9 | 15.14 | 21.28 | 6.14 | 0.682 | 0.697 | 4.4 | 0.614 | 97.5 | 0.680 | 7.7 | 1.9 | |
| | R | 10 | 10 | 15.58 | 22.74 | 7.16 | 0.716 | | | 0.716 | | | | | |
| | S | 10 | 10 | 15.17 | 22.45 | 7.28 | 0.728 | | | 0.728 | | | | | |
| | T | 10 | 10 | 15.15 | 21.77 | 6.62 | 0.662 | | | 0.662 | | | | | |
| 100% | U | 10 | 10 | 14.95 | 22.57 | 7.62 | 0.762 | 0.732 | 8.5 | 0.762 | 95.0 | 0.694 | 7.6 | -0.1 | |
| | V | 10 | 10 | 15.85 | 22.29 | 6.44 | 0.644 | | | 0.644 | | | | | |
| | W | 10 | 9 | 14.94 | 22.01 | 7.07 | 0.786 | | | 0.707 | | | | | |
| | X | 10 | 9 | 15.81 | 22.43 | 6.62 | 0.736 | | | 0.662 | | | | | |
| 100% Intake | Y | 10 | 7 | 15.80 | 21.07 | 5.27 | 0.753 | 0.658 | 9.8 | 0.527 | 87.5 | 0.571 | 8.3 | 17.6 | |
| | Z | 10 | 9 | 15.19 | 20.95 | 5.76 | 0.640 | | | 0.576 | | | | | |
| | AA | 10 | 9 | 14.32 | 19.77 | 5.45 | 0.606 | | | 0.545 | | | | | |
| | BB | 10 | 10 | 16.09 | 22.44 | 6.35 | 0.635 | | | 0.635 | | | | | |

Outfall 101:

Dunnnett's MSD value: 0.1041
 PMSD: 15.0

MSD =
 PMSD =

Minimum Significant Difference
 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.

Intake:

Dunnnett's MSD value: 0.0944
 PMSD: 13.6

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: sqn101_081115data.xlsx
 Entered by: J. Sumner
 Reviewed by:

TVA / Sequoyah Nuclear Plant, Outfall 101

Non-treated

August 11-18, 2015



Statistical Analyses

Larval Fish Growth and Survival Test-7 Day Growth

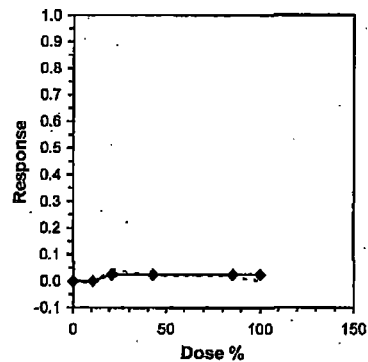
Start Date: 8/11/15 Test ID: PpFRCR Sample ID: TVA / SQN, Outfall 101
 End Date: 8/18/15 Lab ID: ETS-Envir. Testing Sol. Sample Type: DMR-Discharge Monitoring Report
 Sample Date: August 2015 Protocol: FWCHR-EPA-821-R-02-013 Test Species: PP-Pimephales promelas
 Comments: Non-treated

| Conc.-% | 1 | 2 | 3 | 4 |
|-----------|--------|--------|--------|--------|
| D-Control | 0.7140 | 0.5680 | 0.7520 | 0.7380 |
| 10.7 | 0.8550 | 0.7420 | 0.6910 | 0.7070 |
| 21.4 | 0.8710 | 0.7080 | 0.5960 | 0.6780 |
| 42.8 | 0.6070 | 0.6590 | 0.8600 | 0.7900 |
| 85.6 | 0.6140 | 0.7160 | 0.7280 | 0.6620 |
| 100 | 0.7620 | 0.6440 | 0.7070 | 0.6620 |
| Intake | 0.5270 | 0.5760 | 0.5450 | 0.6350 |

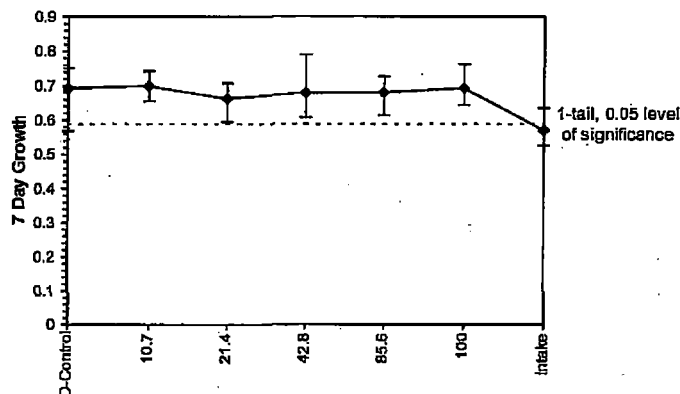
| Conc.-% | Mean | N-Mean | Transform: Untransformed | | | | N | t-Stat | 1-Tailed | | Isotonic | |
|-----------|--------|--------|--------------------------|--------|--------|--------|---|--------|----------|--------|----------|--------|
| | | | Mean | Min | Max | CV% | | | Critical | MSD | Mean | N-Mean |
| D-Control | 0.6930 | 1.0000 | 0.6930 | 0.6580 | 0.7520 | 12.236 | 4 | | | | 0.6959 | 1.0000 |
| 10.7 | 0.6988 | 1.0083 | 0.6988 | 0.6550 | 0.7420 | 5.168 | 4 | -0.133 | 2.410 | 0.1041 | 0.6959 | 1.0000 |
| 21.4 | 0.6633 | 0.9571 | 0.6633 | 0.5960 | 0.7080 | 7.180 | 4 | 0.689 | 2.410 | 0.1041 | 0.6790 | 0.9757 |
| 42.8 | 0.6790 | 0.9798 | 0.6790 | 0.6070 | 0.7900 | 11.492 | 4 | 0.324 | 2.410 | 0.1041 | 0.6790 | 0.9757 |
| 85.6 | 0.6800 | 0.9812 | 0.6800 | 0.6140 | 0.7280 | 7.726 | 4 | 0.301 | 2.410 | 0.1041 | 0.6790 | 0.9757 |
| 100 | 0.6938 | 1.0011 | 0.6938 | 0.6440 | 0.7620 | 7.590 | 4 | -0.017 | 2.410 | 0.1041 | 0.6790 | 0.9757 |
| Intake | 0.5708 | 0.8236 | 0.5708 | 0.5270 | 0.6350 | 8.300 | 4 | | | | | |

| Auxiliary Tests | | | | Statistic | Critical | Skew | Kurt |
|--|--|--|--|-----------|----------|---------|---------|
| Shapiro-Wilk's Test indicates normal distribution ($p > 0.01$) | | | | 0.88441 | 0.884 | -0.2583 | 0.05031 |
| Bartlett's Test indicates equal variances ($p = 0.75$) | | | | 2.65818 | 15.0863 | | |
| Hypothesis Test (1-tail, 0.05) | | | | NOEC | LOEC | ChV | TU |
| Dunnnett's Test | | | | 100 | >100 | | 1 |
| Treatments vs D-Control | | | | MSDu | MSDp | MSB | MSE |
| | | | | 0.10408 | 0.1502 | 0.00069 | 0.00373 |
| | | | | F-Prob | df | | |
| | | | | 0.96457 | 5, 18 | | |

| Linear Interpolation (200 Resamples) | | | | |
|--------------------------------------|------|----|-------------|------|
| Point | % | SD | 95% CL(Exp) | Skew |
| IC05 | >100 | | | |
| IC10 | >100 | | | |
| IC15 | >100 | | | |
| IC20 | >100 | | | |
| IC25 | >100 | | | |
| IC40 | >100 | | | |
| IC50 | >100 | | | |



Dose-Response Plot



TVA / Sequoyah Nuclear Plant, Outfall 101 - Intake

Non-treated

August 11-18, 2015



Environmental Testing Solutions, Inc.

Statistical Analyses

Larval Fish Growth and Survival Test-7 Day Growth

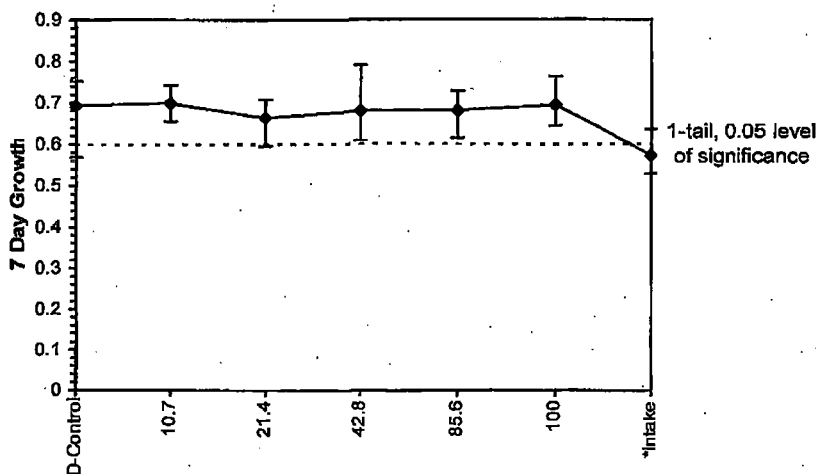
Start Date: 8/11/15 Test ID: PpFRCR Sample ID: TVA / SQN, Outfall 101 - Intake
End Date: 8/18/15 Lab ID: ETS-Envir. Testing Sol. Sample Type: DMR-Discharge Monitoring Report
Sample Date: August 2015 Protocol: FWCHR-EPA-821-R-02-013 Test Species: PP-Pimephales promelas
Comments: Non-treated

| Conc-% | 1 | 2 | 3 | 4 |
|-----------|--------|--------|--------|--------|
| D-Control | 0.7140 | 0.5680 | 0.7520 | 0.7380 |
| 10.7 | 0.6550 | 0.7420 | 0.6910 | 0.7070 |
| 21.4 | 0.6710 | 0.7080 | 0.5960 | 0.6780 |
| 42.8 | 0.6070 | 0.6590 | 0.6600 | 0.7900 |
| 85.6 | 0.6140 | 0.7160 | 0.7280 | 0.6620 |
| 100 | 0.7620 | 0.6440 | 0.7070 | 0.6620 |
| Intake | 0.5270 | 0.5760 | 0.5450 | 0.6350 |

| Conc-% | Mean | N-Mean | Transform: Untransformed | | | | N | t-Stat | 1-Tailed | |
|-----------|--------|--------|--------------------------|--------|--------|--------|---|--------|----------|--------|
| | | | Mean | Min | Max | CV% | | | Critical | MSD |
| D-Control | 0.6930 | 1.0000 | 0.6930 | 0.5680 | 0.7520 | 12.236 | 4 | | | |
| 10.7 | 0.6988 | 1.0083 | 0.6988 | 0.6550 | 0.7420 | 5.168 | 4 | | | |
| 21.4 | 0.6633 | 0.9571 | 0.6633 | 0.5960 | 0.7080 | 7.180 | 4 | | | |
| 42.8 | 0.6790 | 0.9798 | 0.6790 | 0.6070 | 0.7900 | 11.492 | 4 | | | |
| 85.6 | 0.6800 | 0.9812 | 0.6800 | 0.6140 | 0.7280 | 7.726 | 4 | | | |
| 100 | 0.6938 | 1.0011 | 0.6938 | 0.6440 | 0.7620 | 7.590 | 4 | | | |
| *Intake | 0.5708 | 0.8236 | 0.5708 | 0.5270 | 0.6350 | 8.300 | 4 | 2.517 | 1.943 | 0.0944 |

| Auxiliary Tests | Statistic | Critical | Skew | Kurt | | |
|---|-----------|----------|---------|---------|---------|------|
| Shapiro-Wilk's Test indicates normal distribution ($p > 0.01$) | 0.90738 | 0.749 | -1.0985 | 1.0071 | | |
| F-Test indicates equal variances ($p = 0.36$) | 3.20404 | 47.4683 | | | | |
| Hypothesis Test (1-tail, 0.05) | MSDu | MSDp | MSB | MSE | F-Prob | df |
| Homoscedastic t Test indicates significant differences Treatments vs D-Control | 0.09437 | 0.13618 | 0.02989 | 0.00472 | 0.04546 | 1, 6 |

Dose-Response Plot



TVA / Sequoyah Nuclear Plant, Outfall 101 - Intake

Non-treated
August 11-18, 2015



Statistical Analyses

Larval Fish Growth and Survival Test-7 Day Survival

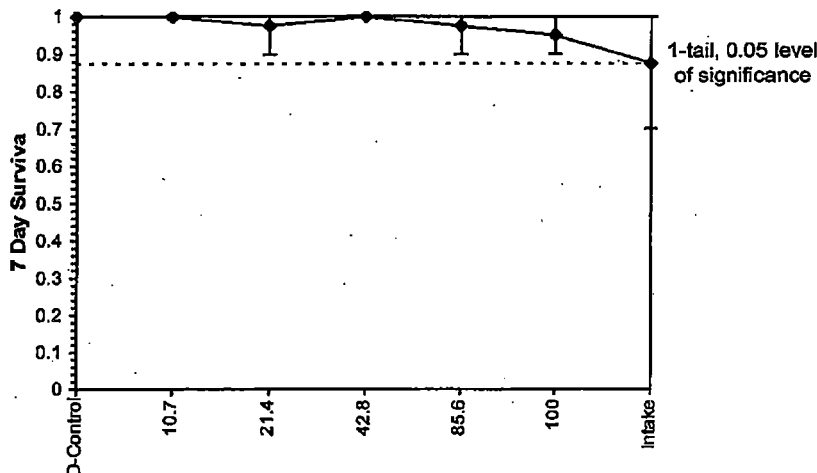
Start Date: 8/11/15 Test ID: PpFRCR Sample ID: TVA / SQN, Outfall 101 - Intake
End Date: 8/18/15 Lab ID: ETS-Envir. Testing Sol. Sample Type: DMR-Discharge Monitoring Report
Sample Date: August 2015 Protocol: FWCHR-EPA-821-R-02-013 Test Species: PP-Pimephales promelas
Comments: Non-treated

| Conc-% | 1 | 2 | 3 | 4 |
|-----------|--------|--------|--------|--------|
| D-Control | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 10.7 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 21.4 | 1.0000 | 0.9000 | 1.0000 | 1.0000 |
| 42.8 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 85.6 | 0.9000 | 1.0000 | 1.0000 | 1.0000 |
| 100 | 1.0000 | 1.0000 | 0.9000 | 0.9000 |
| Intake | 0.7000 | 0.9000 | 0.9000 | 1.0000 |

| Conc-% | Mean | N-Mean | Transform: Arcsin Square Root | | | | N | t-Stat | 1-Tailed Critical | MSD |
|-----------|--------|--------|-------------------------------|--------|--------|--------|---|--------|-------------------|--------|
| | | | Mean | Min | Max | CV% | | | | |
| D-Control | 1.0000 | 1.0000 | 1.4120 | 1.4120 | 1.4120 | 0.000 | 4 | | | |
| 10.7 | 1.0000 | 1.0000 | 1.4120 | 1.4120 | 1.4120 | 0.000 | 4 | | | |
| 21.4 | 0.9750 | 0.9750 | 1.3713 | 1.2490 | 1.4120 | 5.942 | 4 | | | |
| 42.8 | 1.0000 | 1.0000 | 1.4120 | 1.4120 | 1.4120 | 0.000 | 4 | | | |
| 85.6 | 0.9750 | 0.9750 | 1.3713 | 1.2490 | 1.4120 | 5.942 | 4 | | | |
| 100 | 0.9500 | 0.9500 | 1.3305 | 1.2490 | 1.4120 | 7.072 | 4 | | | |
| Intake | 0.8750 | 0.8750 | 1.2253 | 0.9912 | 1.4120 | 14.199 | 4 | 2.146 | 2.353 | 0.2047 |

| Auxiliary Tests | Statistic | Critical | Skew | Kurt | | |
|--|-----------|----------|---------|---------|---------|------|
| Shapiro-Wilk's Test indicates normal distribution (p > 0.01) | 0.78118 | 0.749 | -0.8127 | 3.70059 | | |
| Equality of variance cannot be confirmed | | | | | | |
| Hypothesis Test (1-tail, 0.05) | MSDu | MSDp | MSB | MSE | F-Prob | df |
| Heteroscedastic t Test indicates no significant differences | 0.10142 | 0.10402 | 0.06971 | 0.01514 | 0.07551 | 1, 6 |
| Treatments vs D-Control | | | | | | |

Dose-Response Plot



Species: *Pimephales promelas*

Date: 08-11-15

Client: TVA / Sequoyah Nuclear Plant, Outfall 101, NON-treated

Daily Chemistry:

| Analyst | | Day (Analyst identified for each day, performed pH, D.O. and conductivity measurements only.) | | | | | |
|------------------------|---------------------------------------|--|-------|---------------|-------|---------|-------|
| | | 0 | | 1 | | 2 | |
| | | AI | N6 | N6 | N6 | N6 | N |
| Concentration | Parameter | | | | | | |
| CONTROL NON-treated | pH (S.U.) | 7.77 | 7.62 | 7.63 | 7.60 | 7.70 | 7.39 |
| | DO (mg/L) | 7.8 | 7.9 | 7.9 | 8.0 | 7.8 | 7.0 |
| | Conductivity (µmhos/cm) | 323 | | 307 | | 305 | |
| | *Alkalinity (mg CaCO ₃ /L) | 59 | | 61 | | 61 | |
| | *Hardness (mg CaCO ₃ /L) | 86 | | 84 | | 84 | |
| | *Temperature (°C) | 24.9 | 24.6 | 24.8 | 24.6 | 24.7 | 24.3 |
| | | | | | | | |
| 10.7% | pH (S.U.) | 7.67 | 7.63 | 7.74 | 7.52 | 7.73 | 7.35 |
| | DO (mg/L) | 7.8 | 7.9 | 7.9 | 8.0 | 7.9 | 6.9 |
| | Conductivity (µmhos/cm) | 307 | | 300 | | 301 | |
| | *Temperature (°C) | 25.0 | 24.4 | 24.8 | 24.3 | 24.8 | 24.6 |
| 21.4% | pH (S.U.) | 7.68 | 7.59 | 7.78 | 7.51 | 7.73 | 7.33 |
| | DO (mg/L) | 7.8 | 8.0 | 7.9 | 8.0 | 7.9 | 6.9 |
| | Conductivity (µmhos/cm) | 292 | | 283 | | 288 | |
| | *Temperature (°C) | 25.0 | 24.3 | 24.8 | 24.3 | 24.9 | 24.6 |
| 42.8% | pH (S.U.) | 7.68 | 7.60 | 7.78 | 7.51 | 7.71 | 7.29 |
| | DO (mg/L) | 7.9 | 8.0 | 8.0 | 8.0 | 7.9 | 7.0 |
| | Conductivity (µmhos/cm) | 261 | | 256 | | 256 | |
| | *Temperature (°C) | 25.0 | 24.6 | 24.8 | 24.5 | 24.9 | 24.4 |
| 85.6% | pH (S.U.) | 7.68 | 7.60 | 7.78 | 7.51 | 7.71 | 7.23 |
| | DO (mg/L) | 7.9 | 8.0 | 8.0 | 8.0 | 7.9 | 6.9 |
| | Conductivity (µmhos/cm) | 206 | | 205 | | 203 | |
| | *Temperature (°C) | 25.0 | 24.5 | 24.8 | 24.5 | 24.9 | 24.4 |
| 100% | pH (S.U.) | 7.68 | 7.60 | 7.79 | 7.52 | 7.71 | 7.20 |
| | DO (mg/L) | 8.0 | 8.1 | 8.0 | 8.1 | 7.9 | 6.5 |
| | Conductivity (µmhos/cm) | 189 | | 186 | | 186 | |
| | *Alkalinity (mg CaCO ₃ /L) | 69 | | | | 67 | |
| | *Hardness (mg CaCO ₃ /L) | 76 | | | | 72 | |
| | *TR chlorine (mg/L) | <0.10 | | | | <0.10 | |
| | *Temperature (°C) | 25.1 | 24.5 | 24.8 | 24.5 | 24.9 | 24.7 |
| 100% Intake | pH (S.U.) | 7.69 | 7.61 | 7.79 | 7.59 | 7.72 | 7.41 |
| | DO (mg/L) | 8.0 | 8.1 | 8.0 | 8.1 | 8.0 | 6.9 |
| | Conductivity (µmhos/cm) | 189 | | 185 | | 189 | |
| | *Alkalinity (mg CaCO ₃ /L) | 65 | | | | 69 | |
| | *Hardness (mg CaCO ₃ /L) | 72 | | | | 72 | |
| | *TR chlorine (mg/L) | <0.10 | | | | <0.10 | |
| | *Temperature (°C) | 25.2 | 24.5 | 24.9 | 24.4 | 24.9 | 24.5 |
| | | Initial | Final | Initial | Final | Initial | Final |

Temperatures performed at the time of test initiation, renewal or termination by the analyst identified in the Daily Renewal Information table located on Page 1.
Alkalinity, hardness and total residual chlorine performed by the analyst identified on the bench sheet specific for each analysis and transcribed to this bench sheet
by: JA. Total residual chlorine was performed on non-treated Outfall 101 and Intake samples.

Species: *Pimephales promelas*

Client: TVA / Sequoyah Nuclear Plant, Outfall 101, NON-treated

Date: 08-11-15

| Analyst | | Day (Analyst identified for each day, performed pH, D.O. and conductivity measurements only.) | | | | | | | |
|------------------------|---------------------------------------|--|-------|---------|-------|----------------|-------|----------------|-------|
| | | 3 | | 4 | | 5 | | 6 | |
| | | N | N6 | N6 | N6 | N6 | N6 | N6 | A1 |
| Concentration | Parameter | | | | | | | | |
| CONTROL NON-treated | pH (S.U.) | 7.98 | 7.42 | 7.68 | 7.49 | 7.71 | 7.68 | 7.75 | 7.410 |
| | DO (mg/L) | 7.10 | 7.9 | 7.8 | 8.0 | 7.9 | 7.8 | 7.7 | 7.3 |
| | Conductivity (µmhos/cm) | 317 | | 326 | | 327 | | 319 | |
| | *Alkalinity (mg CaCO ₃ /L) | 317 | | 61 | | 327 | | 319 | |
| | *Hardness (mg CaCO ₃ /L) | 317 | | 88 | | 327 | | 319 | |
| | *Temperature (°C) | 24.8 | 24.7 | 24.8 | 24.6 | 24.8 | 24.4 | 24.8 | 24.4 |
| | | | | | | | | | |
| 10.7% | pH (S.U.) | 7.74 | 7.39 | 7.71 | 7.48 | 7.78 | 7.67 | 7.79 | 7.35 |
| | DO (mg/L) | 7.7 | 7.9 | 7.8 | 8.0 | 7.9 | 7.8 | 7.8 | 7.3 |
| | Conductivity (µmhos/cm) | 294 | | 315 | | 291 | | 302 | |
| | *Temperature (°C) | 24.9 | 24.5 | 24.8 | 24.5 | 24.8 | 24.5 | 24.8 | 24.2 |
| 21.4% | pH (S.U.) | 7.75 | 7.32 | 7.70 | 7.46 | 7.78 | 7.65 | 7.77 | 7.38 |
| | DO (mg/L) | 7.8 | 8.0 | 7.8 | 8.0 | 8.0 | 7.8 | 7.8 | 7.2 |
| | Conductivity (µmhos/cm) | 280 | | 301 | | 280 | | 287 | |
| | *Temperature (°C) | 24.9 | 24.5 | 24.8 | 24.5 | 24.8 | 24.7 | 24.8 | 24.4 |
| 42.8% | pH (S.U.) | 7.73 | 7.36 | 7.70 | 7.46 | 7.80 | 7.65 | 7.77 | 7.45 |
| | DO (mg/L) | 7.8 | 8.1 | 7.8 | 8.0 | 8.0 | 7.8 | 7.8 | 7.4 |
| | Conductivity (µmhos/cm) | 253 | | 263 | | 256 | | 261 | |
| | *Temperature (°C) | 24.9 | 24.5 | 24.8 | 24.5 | 24.9 | 24.3 | 24.9 | 24.5 |
| 85.6% | pH (S.U.) | 7.70 | 7.36 | 7.67 | 7.36 | 7.79 | 7.68 | 7.77 | 7.40 |
| | DO (mg/L) | 7.9 | 8.1 | 7.9 | 8.0 | 8.1 | 7.8 | 7.8 | 7.5 |
| | Conductivity (µmhos/cm) | 200 | | 209 | | 209 | | 209 | |
| | *Temperature (°C) | 24.9 | 24.6 | 24.8 | 24.7 | 24.9 | 24.3 | 24.9 | 24.3 |
| 100% | pH (S.U.) | 7.70 | 7.37 | 7.67 | 7.42 | 7.80 | 7.69 | 7.78 | 7.40 |
| | DO (mg/L) | 7.9 | 8.1 | 7.9 | 8.0 | 8.1 | 7.8 | 7.8 | 7.4 |
| | Conductivity (µmhos/cm) | 181 | | 192 | | 197 | | 189 | |
| | *Alkalinity (mg CaCO ₃ /L) | | | 73 | | | | | |
| | *Hardness (mg CaCO ₃ /L) | | | 72 | | | | | |
| | *TR chlorine (mg/L) | | | <0.10 | | | | | |
| | *Temperature (°C) | 25.0 | 24.6 | 24.8 | 24.7 | 24.9 | 24.6 | 24.9 | 24.3 |
| 100% Intake | pH (S.U.) | 7.71 | 7.46 | 7.67 | 7.53 | 7.77 | 7.70 | 7.79 | 7.54 |
| | DO (mg/L) | 7.9 | 8.1 | 7.9 | 8.0 | 8.1 | 7.8 | 7.8 | 7.4 |
| | Conductivity (µmhos/cm) | 184 | | 191 | | 191 | | 191 | |
| | *Alkalinity (mg CaCO ₃ /L) | | | 73 | | | | | |
| | *Hardness (mg CaCO ₃ /L) | | | 72 | | | | | |
| | *TR chlorine (mg/L) | | | <0.10 | | | | | |
| | *Temperature (°C) | 25.0 | 24.6 | 24.9 | 24.6 | 24.8 | 24.5 | 24.7 | 24.3 |
| | | Initial | Final | Initial | Final | Initial | Final | Initial | Final |

Independent
Review by
Nancy E. Knepp

Temperatures performed at the time of test initiation, renewal or termination by the analyst identified in the Daily Renewal Information table located on Page 1.
Alkalinity, hardness and total residual chlorine performed by the analyst identified on the bench sheet specific for each analysis and transcribed to this bench sheet.
Total residual chlorine was performed on non-treated Outfall 101 and Intake samples.

TVA / Sequoyah Nuclear Plant, Outfall 101 - Non-treated

August 11-18, 2015

Pimephales promelas Chronic Whole Effluent Toxicity Test

EPA-821-R-02-013, Method 1000.0

Daily Chemical Analyses

Project number: 10842

Page 38 of 95



ETS

Environmental Testing Solutions, Inc.

| 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) | 7.77 | 7.62 | 7.63 | 7.60 | 7.70 | 7.39 | 7.98 | 7.42 | 7.68 | 7.48 | 7.71 | 7.68 | 7.75 | 7.46 |
| | DO (mg/L) | 7.8 | 7.9 | 7.9 | 8.0 | 7.8 | 7.0 | 7.6 | 7.9 | 7.8 | 8.0 | 7.9 | 7.8 | 7.7 | 7.3 |
| | Conductivity (µmhos/cm) | 323 | | 307 | | 305 | | 317 | | 326 | | 327 | | 318 | |
| | Alkalinity (mg/L CaCO ₃) | 59 | | | | 61 | | | | 61 | | | | | |
| | Hardness (mg/L CaCO ₃) | 86 | | | | 84 | | | | 88 | | | | | |
| | Temperature (°C) | 24.9 | 24.6 | 24.8 | 24.6 | 24.7 | 24.3 | 24.8 | 24.7 | 24.8 | 24.6 | 24.8 | 24.4 | 24.8 | 24.4 |
| 10.7% | pH (SU) | 7.67 | 7.63 | 7.74 | 7.52 | 7.73 | 7.35 | 7.74 | 7.39 | 7.71 | 7.48 | 7.78 | 7.67 | 7.79 | 7.35 |
| | DO (mg/L) | 7.8 | 7.9 | 7.9 | 8.0 | 7.9 | 6.9 | 7.7 | 7.9 | 7.8 | 8.0 | 7.9 | 7.8 | 7.8 | 7.3 |
| | Conductivity (µmhos/cm) | 307 | | 300 | | 301 | | 294 | | 315 | | 291 | | 302 | |
| | Temperature (°C) | 25.0 | 24.4 | 24.8 | 24.3 | 24.8 | 24.6 | 24.9 | 24.5 | 24.8 | 24.5 | 24.8 | 24.5 | 24.8 | 24.2 |
| 21.4% | pH (SU) | 7.68 | 7.59 | 7.78 | 7.51 | 7.73 | 7.33 | 7.75 | 7.32 | 7.70 | 7.46 | 7.78 | 7.65 | 7.77 | 7.38 |
| | DO (mg/L) | 7.8 | 8.0 | 7.9 | 8.0 | 7.9 | 6.9 | 7.8 | 8.0 | 7.8 | 8.0 | 8.0 | 7.8 | 7.8 | 7.2 |
| | Conductivity (µmhos/cm) | 292 | | 283 | | 288 | | 280 | | 301 | | 280 | | 287 | |
| | Temperature (°C) | 25.0 | 24.3 | 24.8 | 24.3 | 24.9 | 24.6 | 24.9 | 24.5 | 24.8 | 24.5 | 24.8 | 24.7 | 24.8 | 24.4 |
| 42.8% | pH (SU) | 7.68 | 7.60 | 7.78 | 7.51 | 7.71 | 7.29 | 7.73 | 7.36 | 7.70 | 7.46 | 7.80 | 7.65 | 7.77 | 7.45 |
| | DO (mg/L) | 7.9 | 8.0 | 8.0 | 8.0 | 7.9 | 7.0 | 7.8 | 8.1 | 7.8 | 8.0 | 8.0 | 7.8 | 7.8 | 7.4 |
| | Conductivity (µmhos/cm) | 261 | | 256 | | 256 | | 253 | | 263 | | 256 | | 261 | |
| | Temperature (°C) | 25.0 | 24.6 | 24.8 | 24.5 | 24.9 | 24.4 | 24.9 | 24.5 | 24.8 | 24.5 | 24.9 | 24.3 | 24.9 | 24.5 |
| 85.6% | pH (SU) | 7.68 | 7.60 | 7.78 | 7.51 | 7.71 | 7.23 | 7.70 | 7.36 | 7.67 | 7.36 | 7.79 | 7.68 | 7.77 | 7.40 |
| | DO (mg/L) | 7.9 | 8.0 | 8.0 | 8.0 | 7.9 | 6.9 | 7.9 | 8.1 | 7.9 | 8.0 | 8.1 | 7.8 | 7.8 | 7.5 |
| | Conductivity (µmhos/cm) | 206 | | 205 | | 203 | | 200 | | 209 | | 209 | | 209 | |
| | Temperature (°C) | 25.0 | 24.5 | 24.8 | 24.5 | 24.9 | 24.4 | 24.9 | 24.6 | 24.8 | 24.7 | 24.9 | 24.3 | 24.9 | 24.3 |
| 100% | pH (SU) | 7.68 | 7.60 | 7.79 | 7.52 | 7.71 | 7.20 | 7.70 | 7.37 | 7.67 | 7.42 | 7.80 | 7.69 | 7.78 | 7.40 |
| | DO (mg/L) | 8.0 | 8.1 | 8.0 | 8.1 | 7.9 | 6.5 | 7.9 | 8.1 | 7.9 | 8.0 | 8.1 | 7.8 | 7.8 | 7.4 |
| | Conductivity (µmhos/cm) | 189 | | 186 | | 186 | | 181 | | 192 | | 187 | | 189 | |
| | Alkalinity (mg/L CaCO ₃) | 69 | | | | 67 | | | | 73 | | | | | |
| | Hardness (mg/L CaCO ₃) | 76 | | | | 72 | | | | 72 | | | | | |
| | Total Residual Chlorine (mg/L) | <0.10 | | | | <0.10 | | | | <0.10 | | | | | |
| 100% Intake | Temperature (°C) | 25.1 | 24.5 | 24.8 | 24.5 | 24.9 | 24.7 | 25.0 | 24.6 | 24.8 | 24.7 | 24.9 | 24.6 | 24.9 | 24.3 |
| | pH (SU) | 7.69 | 7.61 | 7.79 | 7.59 | 7.72 | 7.41 | 7.71 | 7.46 | 7.67 | 7.53 | 7.77 | 7.70 | 7.79 | 7.54 |
| | DO (mg/L) | 8.0 | 8.1 | 8.0 | 8.1 | 8.0 | 6.9 | 7.9 | 8.1 | 7.9 | 8.0 | 8.1 | 7.8 | 7.8 | 7.4 |
| | Conductivity (µmhos/cm) | 189 | | 185 | | 189 | | 184 | | 191 | | 191 | | 191 | |
| | Alkalinity (mg/L CaCO ₃) | 65 | | | | 69 | | | | 73 | | | | | |
| | Hardness (mg/L CaCO ₃) | 72 | | | | 72 | | | | 72 | | | | | |
| | Total Residual Chlorine (mg/L) | <0.10 | | | | <0.10 | | | | <0.10 | | | | | |
| 100% Intake | Temperature (°C) | 25.2 | 24.5 | 24.9 | 24.4 | 24.9 | 24.5 | 25.0 | 24.6 | 24.9 | 24.6 | 24.8 | 24.5 | 24.7 | 24.3 |

File: sqn101_081115chem.xlsx

Entered by: J. Sumner

Reviewed by:

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

Client: Tennessee Valley Authority
Facility: Sequoyah Nuclear Plant
NPDES #: TN0026450
Project #: 10842

County: Hamilton
Outfall: 101

| Dilution preparation information: | | | | | | Comments: |
|-----------------------------------|--------|------|------|------|------|-----------|
| Dilution prep (%) | 10.7 | 21.4 | 42.8 | 85.6 | 100 | |
| Effluent volume (mL) | 267.5 | 535 | 1070 | 2140 | 2500 | |
| Diluent volume (mL) | 2232.5 | 1965 | 1430 | 360 | 0 | |
| Total volume (mL) | 2500 | 2500 | 2500 | 2500 | 2500 | |

| Test organism source information: | | | | | | Test information: |
|---|---|----------|------------------------------|-----------|-----------|---|
| Organism age: | | | < 24-hours old | | | Randomizing template color: <u>RED</u> |
| Date and times organisms were born between: | | | <u>08-11-15 0610 TO 0850</u> | | | Incubator number and shelf location: <u>2B1</u> |
| Culture board: | | | <u>08-04-15 A</u> | | | YWT batch: <u>07-28-15</u> |
| Replicate number: | 1 | 2 | 3 | 4 | 5 | Selenastrum batch: <u>07-22-15</u> |
| Culture board cup number: | <u>7</u> | <u>9</u> | <u>10</u> | <u>17</u> | <u>22</u> | |
| Transfer vessel information: | pH = <u>7.86</u> S.U. Temperature = <u>24.9°C</u> | | | | | |
| Average transfer volume (mL): | <u>0.0121 mL</u> | | | | | |

Daily renewal information:

| Day | Date | Test initiation and feeding, renewal and feeding, or termination time | MHSW batch used | Sample numbers used Outfall 101 | Intake | Analyst |
|-----|----------|---|-------------------|---------------------------------|------------------|-----------|
| 0 | 08-11-15 | <u>0900</u> | <u>08-09-15</u> | <u>150810.01</u> | <u>150810.02</u> | <u>JK</u> |
| 1 | 08-12-15 | <u>0800</u> | <u>08-09-15</u> | <u>150810.01</u> | <u>150810.02</u> | <u>JK</u> |
| 2 | 08-13-15 | <u>0800</u> | <u>08-10-15 A</u> | <u>150812.11</u> | <u>150812.12</u> | <u>JK</u> |
| 3 | 08-14-15 | <u>0800</u> | <u>08-10-15 A</u> | <u>150812.11</u> | <u>150812.12</u> | <u>JK</u> |
| 4 | 08-15-15 | <u>0820</u> | <u>08-10-15 B</u> | <u>150814.08</u> | <u>150814.09</u> | <u>JK</u> |
| 5 | 08-16-15 | <u>0819</u> | <u>08-10-15 B</u> | <u>150814.08</u> | <u>150814.09</u> | <u>JK</u> |
| 6 | 08-17-15 | <u>0800</u> | <u>08-10-15 B</u> | <u>150814.08</u> | <u>150814.09</u> | <u>JK</u> |
| 7 | 08-18-15 | <u>0803</u> | | | | <u>JK</u> |

| Control information: | | | | Summary of test endpoints: | |
|---|--------------|--------------|-------------------------|----------------------------|------------------|
| | Control-1 | Control-2 | Acceptance criteria | | |
| % of Male Adults: | <u>07.</u> | <u>07.</u> | ≤ 20% | 7-day LC ₅₀ | <u>>1007.</u> |
| % Adults having 3 rd Broods: | <u>1007.</u> | <u>1007.</u> | ≥ 80% | NOEC | <u>1007.</u> |
| % Mortality: | <u>07.</u> | <u>07.</u> | ≤ 20% | LOEC | <u>>1007.</u> |
| Mean Offspring/Female: | <u>30.1</u> | <u>29.1</u> | ≥ 15.0 offspring/female | ChV | <u>>1007.</u> |
| % CV: | <u>4.67.</u> | <u>3.87.</u> | < 40.0 % | IC ₂₅ | <u>>1007.</u> |



Species: Ceriodaphnia dubia

Client: TVA / Sequoyah Nuclear Plant, Outfall 101

Date: 08-11-15

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 | 3 | 3 | 4 | 3 | 4 | 4 | 4 | 3 | 3 | 4 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 5 | Young produced | 13 | 11 | 10 | 12 | 10 | 12 | 12 | 13 | 10 | 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 | 14 | 16 | 15 | 13 | 15 | 14 | 17 | 15 | 17 | 16 |
| Total young produced | | 30 | 30 | 29 | 28 | 29 | 30 | 33 | 31 | 30 | 31 |
| Final Adult Mortality | | L | L | L | L | L | L | L | L | L | L |
| X for 3 rd Broods | | X | X | X | X | X | X | X | X | X | X |

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: | 07. |
| Mean Offspring/Female: | 30.1 |

CONC: 10.7%

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 | 3 | 3 | 4 | 3 | 3 | 4 | 3 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 5 | Young produced | 12 | 11 | 13 | 12 | 12 | 11 | 12 | 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 | 15 | 18 | 15 | 16 | 17 | 17 | 17 | 15 |
| Total young produced | | 33 | 30 | 32 | 33 | 30 | 31 | 32 | 30 | 31 | 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: | 07. |
| Mean Offspring/Female: | 31.2 |
| % Reduction from Control-1: | 3.77. |



Species: *Ceriodaphnia dubia*

Client: TVA / Sequoyah Nuclear Plant, Outfall 101

Date: 08-11-15

CONC: 21.4%

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 | 4 | 3 | 4 | 4 | 5 | 4 | 4 | 4 | 3 | 4 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 5 | Young produced | 13 | 12 | 13 | 10 | 10 | 11 | 12 | 12 | 13 | 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 | 18 | 15 | 17 | 17 | 16 | 14 | 16 | 15 | 17 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| Total young produced | | 34 | 33 | 32 | 34 | 32 | 31 | 30 | 32 | 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: | 07. |
| Mean Offspring/Female: | 31.9 |
| % Reduction from Control-1: | -6.07. |

CONC: 42.8%

Survival and Reproduction Data

| Day | | Replicate number | | | | | | | | | |
|-----------------------|-----------------|------------------|----|----|----|----|----|----|----|----|----|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1 | Young produced | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 2 | Young produced | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 3 | Young produced | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 4 | Young produced | 5 | 4 | 4 | 3 | 4 | 4 | 3 | 5 | 5 | 4 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 5 | Young produced | 12 | 12 | 12 | 12 | 11 | 13 | 10 | 13 | 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 | 17 | 17 | 19 | 15 | 16 | 15 | 18 | 15 | 15 | 15 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| Total young produced | | 34 | 33 | 35 | 30 | 31 | 32 | 31 | 33 | 31 | 31 |
| 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: | 07. |
| Mean Offspring/Female: | 32.1 |
| % Reduction from Control-1: | -6.67. |



Species: *Ceriodaphnia dubia*

Client: TVA / Sequoyah Nuclear Plant, Outfall 101

Date: 08-11-15

CONC: 85.6%

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 | 4 | 5 | 5 | 5 | 4 | 4 | 5 | 6 | 4 | 4 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 5 | Young produced | 13 | 13 | 12 | 14 | 12 | 12 | 13 | 13 | 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 | 18 | 16 | 18 | 15 | 19 | 17 | 19 | 15 | 17 | 18 |
| Total young produced | | 35 | 34 | 35 | 34 | 35 | 33 | 37 | 34 | 34 | 35 |
| 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: | 07. |
| Mean Offspring/Female: | 34.6 |
| % Reduction from Control-1: | -15.07. |

CONC: 100%

Survival and Reproduction Data

| Day | | Replicate number | | | | | | | | | |
|-----------------------|-----------------|------------------|----|----|----|----|----|----|----|----|----|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1 | Young produced | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 2 | Young produced | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 3 | Young produced | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 4 | Young produced | 6 | 4 | 4 | 5 | 5 | 5 | 4 | 4 | 5 | 4 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 5 | Young produced | 12 | 14 | 14 | 13 | 14 | 14 | 12 | 14 | 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 | 17 | 18 | 17 | 17 | 16 | 17 | 19 | 19 | 19 | 18 |
| Total young produced | | 35 | 36 | 35 | 35 | 35 | 36 | 35 | 37 | 36 | 35 |
| 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: | 07. |
| Mean Offspring/Female: | 35.5 |
| % Reduction from Control-1: | -17.97. |



Species: *Ceriodaphnia dubia*

Client: TVA / Sequoyah Nuclear Plant, Outfall 101

Date: 08-11-15

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 | 3 | 3 | 4 | 3 | 4 | 4 | 4 | 3 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 5 | Young produced | 11 | 11 | 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 | 14 | 16 | 13 | 15 | 14 | 16 | 16 | 13 | 14 |
| Total young produced | | 30 | 28 | 29 | 28 | 30 | 29 | 30 | 30 | 30 | 27 |
| Final Adult Mortality | | L | L | L | L | L | L | L | L | L | L |
| X for 3 rd Broods | | X | X | X | X | X | X | X | X | X | X |

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: | 07. |
| Mean Offspring/Female: | 29.1 |

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 | 6 | 5 | 4 | 4 | 3 | 5 | 4 | 4 | 5 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 5 | Young produced | 12 | 13 | 13 | 14 | 13 | 14 | 14 | 12 | 13 | 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 | 18 | 20 | 18 | 19 | 16 | 19 | 17 | 15 | 17 |
| Total young produced | | 34 | 37 | 38 | 36 | 36 | 35 | 38 | 33 | 32 | 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: | 07. |
| Mean Offspring/Female: | 35.3 |
| % Reduction from Control-2: | -21.37 |



TVA / Sequoyah Nuclear Plant, Outfall 101 - Non-treated

August 11-18, 2015

Verification of *Ceriodaphnia* Reproduction Totals

Control-1

| Day | Replicate number | | | | | | | | | | Total |
|-------|------------------|----|----|----|----|----|----|----|----|----|-------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 3 | 3 | 4 | 3 | 4 | 4 | 4 | 3 | 3 | 4 | 35 |
| 5 | 13 | 11 | 10 | 12 | 10 | 12 | 12 | 13 | 10 | 11 | 114 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 14 | 16 | 15 | 13 | 15 | 14 | 17 | 15 | 17 | 16 | 152 |
| Total | 30 | 30 | 29 | 28 | 29 | 30 | 33 | 31 | 30 | 31 | 301 |

10.7%

| 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 | 3 | 3 | 4 | 3 | 3 | 4 | 3 | 35 |
| 5 | 12 | 11 | 13 | 12 | 12 | 11 | 12 | 10 | 10 | 12 | 115 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 17 | 15 | 15 | 18 | 15 | 16 | 17 | 17 | 17 | 15 | 162 |
| Total | 33 | 30 | 32 | 33 | 30 | 31 | 32 | 30 | 31 | 30 | 312 |

21.4%

| Day | Replicate number | | | | | | | | | | Total |
|-------|------------------|----|----|----|----|----|----|----|----|----|-------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 4 | 3 | 4 | 4 | 5 | 4 | 4 | 4 | 3 | 4 | 39 |
| 5 | 13 | 12 | 13 | 10 | 10 | 11 | 12 | 12 | 13 | 12 | 118 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 17 | 18 | 15 | 17 | 17 | 16 | 14 | 16 | 15 | 17 | 162 |
| Total | 34 | 33 | 32 | 31 | 32 | 31 | 30 | 32 | 31 | 33 | 319 |

42.8%

| Day | Replicate number | | | | | | | | | | Total |
|-------|------------------|----|----|----|----|----|----|----|----|----|-------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 5 | 4 | 4 | 3 | 4 | 4 | 3 | 5 | 5 | 4 | 41 |
| 5 | 12 | 12 | 12 | 12 | 11 | 13 | 10 | 13 | 11 | 12 | 118 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 17 | 17 | 19 | 15 | 16 | 15 | 18 | 15 | 15 | 15 | 162 |
| Total | 34 | 33 | 35 | 30 | 31 | 32 | 31 | 33 | 31 | 31 | 321 |

85.6%

| Day | Replicate number | | | | | | | | | | Total |
|-------|------------------|----|----|----|----|----|----|----|----|----|-------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 4 | 5 | 5 | 5 | 4 | 4 | 5 | 6 | 4 | 4 | 46 |
| 5 | 13 | 13 | 12 | 14 | 12 | 12 | 13 | 13 | 13 | 13 | 128 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 18 | 16 | 18 | 15 | 19 | 17 | 19 | 15 | 17 | 18 | 172 |
| Total | 35 | 34 | 35 | 34 | 35 | 33 | 37 | 34 | 34 | 35 | 346 |

100%

| Day | Replicate number | | | | | | | | | | Total |
|-------|------------------|----|----|----|----|----|----|----|----|----|-------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 6 | 4 | 4 | 5 | 5 | 5 | 4 | 4 | 5 | 4 | 46 |
| 5 | 12 | 14 | 14 | 13 | 14 | 14 | 12 | 14 | 12 | 13 | 132 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 17 | 18 | 17 | 17 | 16 | 17 | 19 | 19 | 19 | 18 | 177 |
| Total | 35 | 36 | 35 | 35 | 35 | 36 | 35 | 37 | 36 | 35 | 355 |

Control-2

| Day | Replicate number | | | | | | | | | | Total |
|-------|------------------|----|----|----|----|----|----|----|----|----|-------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 3 | 3 | 3 | 3 | 4 | 3 | 4 | 4 | 4 | 3 | 34 |
| 5 | 11 | 11 | 10 | 12 | 11 | 12 | 10 | 10 | 13 | 10 | 110 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 16 | 14 | 16 | 13 | 15 | 14 | 16 | 16 | 13 | 14 | 147 |
| Total | 30 | 28 | 29 | 28 | 30 | 29 | 30 | 30 | 30 | 27 | 291 |

100% Intake

| Day | Replicate number | | | | | | | | | | Total |
|-------|------------------|----|----|----|----|----|----|----|----|----|-------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 5 | 6 | 5 | 4 | 4 | 5 | 5 | 4 | 4 | 6 | 48 |
| 5 | 12 | 13 | 13 | 14 | 13 | 14 | 14 | 12 | 13 | 11 | 129 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 17 | 18 | 20 | 18 | 19 | 16 | 19 | 17 | 15 | 17 | 176 |
| Total | 34 | 37 | 38 | 36 | 36 | 35 | 38 | 33 | 32 | 34 | 353 |

File: sqn101_081115data.xlsx

Entered by: J. Sumner

Reviewed by:



TVA / Sequoyah Nuclear Plant, Outfall 101
Non-treated
August 11-18, 2015

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: 10842

| 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 | 30 | 30 | 29 | 28 | 29 | 30 | 33 | 31 | 30 | 31 | 100 | 30.1 | 4.6 | Not applicable |
| 10.7% | 33 | 30 | 32 | 33 | 30 | 31 | 32 | 30 | 31 | 30 | 100 | 31.2 | 3.9 | -3.7 |
| 21.4% | 34 | 33 | 32 | 31 | 32 | 31 | 30 | 32 | 31 | 33 | 100 | 31.9 | 3.8 | -6.0 |
| 42.8% | 34 | 33 | 35 | 30 | 31 | 32 | 31 | 33 | 31 | 31 | 100 | 32.1 | 5.0 | -6.6 |
| 85.6% | 35 | 34 | 35 | 34 | 35 | 33 | 37 | 34 | 34 | 35 | 100 | 34.6 | 3.1 | -15.0 |
| 100% | 35 | 36 | 35 | 35 | 35 | 36 | 35 | 37 | 36 | 35 | 100 | 35.5 | 2.0 | -17.9 |
| Control - 2 | 30 | 28 | 29 | 28 | 30 | 29 | 30 | 30 | 30 | 27 | 100 | 29.1 | 3.8 | Not applicable |
| 100% Intake | 34 | 37 | 38 | 36 | 36 | 35 | 38 | 33 | 32 | 34 | 100 | 35.3 | 5.8 | -21.3 |

Outfall 101:

Dunnnett's MSD value: 1.254

PMSD: 4.2

MSD = Minimum Significant Difference

PMSD = Percent Minimum Significant Difference

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

Intake:

Dunnnett's MSD value: 1.280

PMSD: 4.4

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.

TVA / Sequoyah Nuclear Plant, Outfall 101

Non-treated

August 11-18, 2015



Statistical Analyses

Ceriodaphnia Survival and Reproduction Test-Reproduction

Start Date: 8/11/2015 Test ID: CdFRCR Sample ID: TVA / SQN, Outfall 101
 End Date: 8/18/2015 Lab ID: ETS-Envir. Testing Sol. Sample Type: DMR-Discharge Monitoring Report
 Sample Date: August 2015 Protocol: FWCHR-EPA-821-R-02-013 Test Species: CD-Ceriodaphnia dubia
 Comments: Non-treated

| Conc-% | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|-----------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Control-1 | 30.000 | 30.000 | 29.000 | 28.000 | 28.000 | 30.000 | 33.000 | 31.000 | 30.000 | 31.000 |
| Control-2 | 30.000 | 28.000 | 29.000 | 28.000 | 30.000 | 29.000 | 30.000 | 30.000 | 30.000 | 27.000 |
| 10.7 | 33.000 | 30.000 | 32.000 | 33.000 | 30.000 | 31.000 | 32.000 | 30.000 | 31.000 | 30.000 |
| 21.4 | 34.000 | 33.000 | 32.000 | 31.000 | 32.000 | 31.000 | 30.000 | 32.000 | 31.000 | 33.000 |
| 42.8 | 34.000 | 33.000 | 35.000 | 30.000 | 31.000 | 32.000 | 31.000 | 33.000 | 31.000 | 31.000 |
| 85.6 | 35.000 | 34.000 | 35.000 | 34.000 | 35.000 | 33.000 | 37.000 | 34.000 | 34.000 | 35.000 |
| 100 | 35.000 | 36.000 | 35.000 | 35.000 | 35.000 | 36.000 | 35.000 | 37.000 | 36.000 | 35.000 |
| Intake | 34.000 | 37.000 | 38.000 | 36.000 | 36.000 | 35.000 | 38.000 | 33.000 | 32.000 | 34.000 |

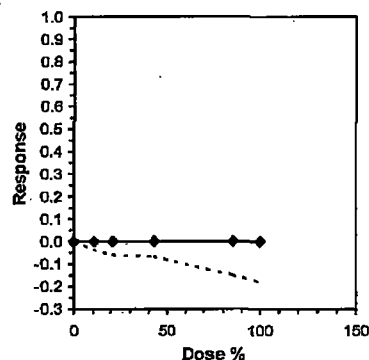
| Conc-% | Mean | N-Mean | Transform: Untransformed | | | | N | t-Stat | 1-Tailed Critical | MSD | Isotonic | |
|-----------|--------|--------|--------------------------|--------|--------|-------|----|--------|-------------------|-------|----------|--------|
| | | | Mean | Min | Max | CV% | | | | | Mean | N-Mean |
| Control-1 | 30.100 | 1.0344 | 30.100 | 28.000 | 33.000 | 4.553 | 10 | | * | | 32.567 | 1.0000 |
| Control-2 | 29.100 | 1.0000 | 29.100 | 27.000 | 30.000 | 3.782 | 10 | | | | | |
| 10.7 | 31.200 | 1.0722 | 31.200 | 30.000 | 33.000 | 3.940 | 10 | -2.006 | 2.287 | 1.254 | 32.567 | 1.0000 |
| 21.4 | 31.900 | 1.0862 | 31.900 | 30.000 | 34.000 | 3.753 | 10 | -3.282 | 2.287 | 1.254 | 32.567 | 1.0000 |
| 42.8 | 32.100 | 1.1031 | 32.100 | 30.000 | 35.000 | 4.969 | 10 | -3.647 | 2.287 | 1.254 | 32.567 | 1.0000 |
| 85.6 | 34.600 | 1.1890 | 34.600 | 33.000 | 37.000 | 3.107 | 10 | -8.206 | 2.287 | 1.254 | 32.567 | 1.0000 |
| 100 | 35.500 | 1.2199 | 35.500 | 35.000 | 37.000 | 1.992 | 10 | -9.847 | 2.287 | 1.254 | 32.567 | 1.0000 |
| Intake | 35.300 | 1.2131 | 35.300 | 32.000 | 38.000 | 5.829 | 10 | | | | | |

| Auxiliary Tests | | | | | | | Statistic | Critical | Skew | Kurt | | | | | | |
|--|--|--|--|--|--|--|-----------|----------|---------|--------|-------|---------|---------|--------|---------|-------|
| Kolmogorov D Test indicates normal distribution ($p > 0.01$) | | | | | | | 0.90242 | 1.035 | 0.57339 | -0.006 | | | | | | |
| Bartlett's Test Indicates equal variances ($p = 0.34$) | | | | | | | 5.68796 | 15.0863 | | | | | | | | |
| The control means are not significantly different ($p = 0.09$) | | | | | | | 1.79928 | 2.10092 | | | | | | | | |
| Hypothesis Test (1-tail, 0.05) | | | | | | | NOEC | LOEC | ChV | TU | MSDu | MSDp | MSB | MSE | F-Prob | df |
| Dunnnett's Test | | | | | | | 100 | >100 | | 1 | 1.254 | 0.04166 | 42.7087 | 1.5037 | 5.4E-14 | 5, 54 |
| Treatments vs Control-1 | | | | | | | | | | | | | | | | |

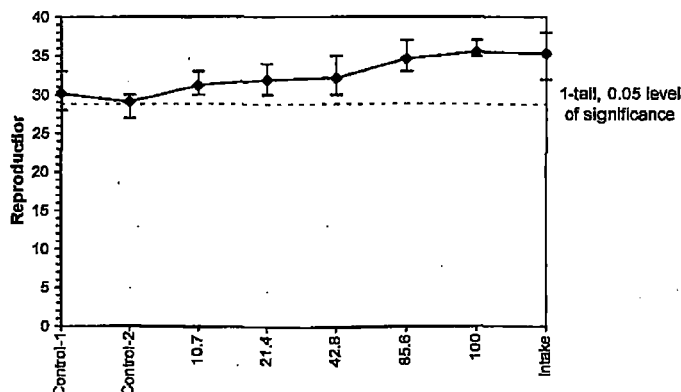
Treatments vs Control-1

Linear Interpolation (200 Resamples)

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



Dose-Response Plot



TVA / Sequoyah Nuclear Plant, Outfall 101 - Intake
Non-treated
August 11-18, 2015



Statistical Analyses

Ceriodaphnia Survival and Reproduction Test-Reproduction

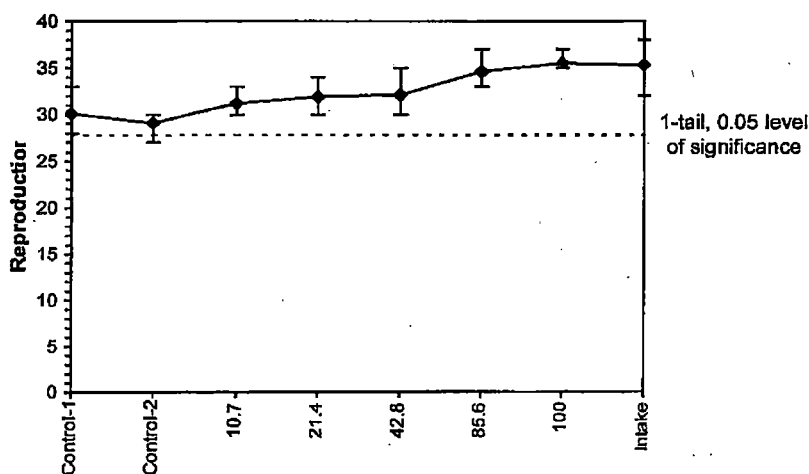
| | | |
|--------------------------|----------------------------------|--|
| Start Date: 8/11/2015 | Test ID: CdFRCR | Sample ID: TVA / SQN, Outfall 101 - Intake |
| End Date: 8/18/2015 | Lab ID: ETS-Envir. Testing Sol. | Sample Type: DMR-Discharge Monitoring Report |
| Sample Date: August 2015 | Protocol: FWCHR-EPA-821-R-02-013 | Test Species: CD-Ceriodaphnia dubia |
| Comments: Non-treated | | |

| Conc-% | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|-----------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Control-1 | 30.000 | 30.000 | 29.000 | 28.000 | 29.000 | 30.000 | 33.000 | 31.000 | 30.000 | 31.000 |
| Control-2 | 30.000 | 28.000 | 29.000 | 28.000 | 30.000 | 29.000 | 30.000 | 30.000 | 30.000 | 27.000 |
| 10.7 | 33.000 | 30.000 | 32.000 | 33.000 | 30.000 | 31.000 | 32.000 | 30.000 | 31.000 | 30.000 |
| 21.4 | 34.000 | 33.000 | 32.000 | 31.000 | 32.000 | 31.000 | 30.000 | 32.000 | 31.000 | 33.000 |
| 42.8 | 34.000 | 33.000 | 35.000 | 30.000 | 31.000 | 32.000 | 31.000 | 33.000 | 31.000 | 31.000 |
| 85.6 | 35.000 | 34.000 | 35.000 | 34.000 | 35.000 | 33.000 | 37.000 | 34.000 | 34.000 | 35.000 |
| 100 | 35.000 | 36.000 | 35.000 | 35.000 | 35.000 | 36.000 | 35.000 | 37.000 | 36.000 | 35.000 |
| Intake | 34.000 | 37.000 | 38.000 | 36.000 | 36.000 | 35.000 | 38.000 | 33.000 | 32.000 | 34.000 |

| Conc-% | Transform: Untransformed | | | | | | N | 1-Tailed | | |
|-----------|--------------------------|--------|--------|--------|--------|-------|----|----------|----------|-------|
| | Mean | N-Mean | Mean | Min | Max | CV% | | t-Stat | Critical | MSD |
| Control-1 | 30.100 | 1.0344 | 30.100 | 28.000 | 33.000 | 4.553 | 10 | | | |
| Control-2 | 29.100 | 1.0000 | 29.100 | 27.000 | 30.000 | 3.782 | 10 | | | |
| 10.7 | 31.200 | 1.0722 | 31.200 | 30.000 | 33.000 | 3.940 | 10 | | | |
| 21.4 | 31.900 | 1.0962 | 31.900 | 30.000 | 34.000 | 3.753 | 10 | | | |
| 42.8 | 32.100 | 1.1031 | 32.100 | 30.000 | 36.000 | 4.969 | 10 | | | |
| 85.6 | 34.600 | 1.1890 | 34.600 | 33.000 | 37.000 | 3.107 | 10 | | | |
| 100 | 35.500 | 1.2199 | 35.500 | 35.000 | 37.000 | 1.992 | 10 | | | |
| Intake | 35.300 | 1.2131 | 35.300 | 32.000 | 38.000 | 5.829 | 10 | -8.403 | 1.734 | 1.280 |

| Auxiliary Tests | Statistic | Critical | Skew | Kurt | | |
|--|-----------|----------|---------|---------|---------|-------|
| Shapiro-Wilk's Test indicates normal distribution (p > 0.01) | 0.95757 | 0.868 | -0.2237 | -0.356 | | |
| F-Test indicates equal variances (p = 0.08) | 3.49541 | 6.54109 | | | | |
| The control means are not significantly different (p = 0.09) | 1.79928 | 2.10092 | | | | |
| Hypothesis Test (1-tail, 0.05) | MSDu | MSDp | MSB | MSE | F-Prob | df |
| Homoscedastic t Test indicates no significant differences | 1.2795 | 0.04397 | 192.2 | 2.72222 | 1.2E-07 | 1, 18 |
| Treatments vs Control-2 | | | | | | |

Dose-Response Plot



Species: *Ceriodaphnia dubia*

Date: 08-11-15

Client: TVA / Sequoyah Nuclear Plant, Outfall 101

Daily Chemistry:

| Concentration | | Day (Analyst identified for each day, performed pH, D.O. and conductivity measurements only.) | | | | | |
|---------------|---------------------------------------|--|-------|---------------|-------|---------|-------|
| | | 0 | | 1 | | 2 | |
| | | AN | N6 | N6 | N6 | NO | N |
| Parameter | Analyst | | | | | | |
| CONTROL | pH (S.U.) | 7.77 | 7.74 | 7.63 | 7.65 | 7.70 | 7.66 |
| | DO (mg/L) | 7.8 | 7.8 | 7.9 | 8.0 | 7.8 | 7.6 |
| | Conductivity (µmhos/cm) | 323 | | 307 | | 305 | |
| | *Alkalinity (mg CaCO ₃ /L) | 59 | | 45 | | 61 | |
| | *Hardness (mg CaCO ₃ /L) | 86 | | 84 | | 84 | |
| | *Temperature (°C) | 24.7 | 24.9 | 24.8 | 25.1 | 24.8 | 24.9 |
| 10.7% | pH (S.U.) | 7.67 | 7.76 | 7.74 | 7.68 | 7.73 | 7.68 |
| | DO (mg/L) | 7.8 | 7.8 | 7.9 | 8.0 | 7.9 | 7.6 |
| | Conductivity (µmhos/cm) | 307 | | 300 | | 301 | |
| | *Temperature (°C) | 24.7 | 25.1 | 24.8 | 24.8 | 24.9 | 25.1 |
| 21.4% | pH (S.U.) | 7.68 | 7.76 | 7.78 | 7.69 | 7.73 | 7.67 |
| | DO (mg/L) | 7.8 | 7.8 | 7.9 | 8.0 | 7.9 | 7.6 |
| | Conductivity (µmhos/cm) | 292 | | 283 | | 288 | |
| | *Temperature (°C) | 24.7 | 25.1 | 24.9 | 24.8 | 24.9 | 25.1 |
| 42.8% | pH (S.U.) | 7.68 | 7.80 | 7.78 | 7.70 | 7.71 | 7.65 |
| | DO (mg/L) | 7.9 | 7.8 | 8.0 | 8.0 | 7.9 | 7.7 |
| | Conductivity (µmhos/cm) | 261 | | 256 | | 256 | |
| | *Temperature (°C) | 24.8 | 25.0 | 24.9 | 24.9 | 24.9 | 25.3 |
| 85.6% | pH (S.U.) | 7.68 | 7.81 | 7.78 | 7.72 | 7.71 | 7.65 |
| | DO (mg/L) | 7.9 | 7.9 | 8.0 | 8.0 | 7.9 | 7.8 |
| | Conductivity (µmhos/cm) | 206 | | 205 | | 203 | |
| | *Temperature (°C) | 24.8 | 24.8 | 24.9 | 24.9 | 24.9 | 25.0 |
| 100% | pH (S.U.) | 7.68 | 7.83 | 7.79 | 7.72 | 7.71 | 7.63 |
| | DO (mg/L) | 8.0 | 7.9 | 8.0 | 8.0 | 7.9 | 7.8 |
| | Conductivity (µmhos/cm) | 189 | | 186 | | 186 | |
| | *Alkalinity (mg CaCO ₃ /L) | 69 | | | | 67 | |
| | *Hardness (mg CaCO ₃ /L) | 76 | | | | 72 | |
| | *TR chlorine (mg/L) | <0.10 | | | | <0.10 | |
| | *Temperature (°C) | 25.0 | 25.1 | 24.9 | 24.9 | 25.0 | 24.8 |
| | | | | | | | |
| 100% Intake | pH (S.U.) | 7.69 | 7.83 | 7.79 | 7.75 | 7.72 | 7.65 |
| | DO (mg/L) | 8.0 | 7.9 | 8.0 | 8.0 | 8.0 | 7.8 |
| | Conductivity (µmhos/cm) | 189 | | 185 | | 189 | |
| | *Alkalinity (mg CaCO ₃ /L) | 65 | | | | 69 | |
| | *Hardness (mg CaCO ₃ /L) | 72 | | | | 72 | |
| | *TR chlorine (mg/L) | <0.10 | | | | <0.10 | |
| | *Temperature (°C) | 25.0 | 25.1 | 24.9 | 25.1 | 24.9 | 25.1 |
| | | Initial | Final | Initial | Final | Initial | Final |

*Temperatures performed at the time of test initiation, renewal or termination by the analyst identified in the Daily Renewal Information table located on Page 1. Alkalinity, hardness and total residual chlorine performed by the analyst identified on the bench sheet specific for each analysis and transcribed to this bench sheet by: 81



Species: *Ceriodaphnia dubia*

Client: TVA / Sequoyah Nuclear Plant, Outfall 101

Date: 08-11-15

| Analyst | | Day (Analyst identified for each day, performed pH, D.O. and conductivity measurements only.) | | | | | | | |
|----------------------------|--|--|-------|---------|-------|----------------|-------|----------------|-------|
| | | 3 | | 4 | | 5 | | 6 | |
| | | N | NO | N6 | N6 | N6 | N6 | N6 | A1 |
| Concen- tration | Parameter | | | | | | | | |
| CONTROL | pH (S.U.) | 7.63 | 7.63 | 7.63 | 7.71 | 7.71 | 7.54 | 7.75 | 7.77 |
| | DO (mg/L) | 7.6 | 8.0 | 7.8 | 8.1 | 7.9 | 7.9 | 7.7 | 7.7 |
| | Conductivity (µmhos/cm) | 317 | | 326 | | 327 | | 318 | |
| | *Alkalinity (mg CaCO ₃ /L) | 317 | | 61 | | 327 | | 318 | |
| | *Hardness (mg CaCO ₃ /L) | 317 | | 88 | | 327 | | 318 | |
| | *Temperature (°C) | 24.8 | 24.8 | 24.8 | 25.2 | 24.8 | 25.0 | 24.9 | 25.2 |
| | 10.7% | pH (S.U.) | 7.74 | 7.62 | 7.71 | 7.72 | 7.78 | 7.63 | 7.79 |
| DO (mg/L) | | 7.7 | 8.0 | 7.8 | 8.1 | 7.9 | 7.9 | 7.8 | 7.7 |
| Conductivity (µmhos/cm) | | 294 | | 315 | | 291 | | 302 | |
| *Temperature (°C) | | 24.9 | 24.9 | 24.9 | 25.0 | 24.7 | 24.8 | 24.9 | 25.0 |
| 21.4% | pH (S.U.) | 7.75 | 7.63 | 7.70 | 7.73 | 7.78 | 7.64 | 7.77 | 7.71 |
| | DO (mg/L) | 7.8 | 8.0 | 7.8 | 8.1 | 8.0 | 7.9 | 7.9 | 7.7 |
| | Conductivity (µmhos/cm) | 280 | | 301 | | 280 | | 287 | |
| | *Temperature (°C) | 24.9 | 24.9 | 24.9 | 24.9 | 24.7 | 24.8 | 25.0 | 25.2 |
| 42.8% | pH (S.U.) | 7.73 | 7.63 | 7.70 | 7.73 | 7.80 | 7.64 | 7.77 | 7.71 |
| | DO (mg/L) | 7.8 | 8.0 | 7.8 | 8.1 | 8.0 | 7.9 | 7.8 | 7.8 |
| | Conductivity (µmhos/cm) | 253 | | 263 | | 256 | | 261 | |
| | *Temperature (°C) | 24.9 | 25.0 | 24.9 | 24.9 | 24.8 | 24.8 | 25.0 | 24.9 |
| 85.6% | pH (S.U.) | 7.70 | 7.63 | 7.67 | 7.73 | 7.79 | 7.66 | 7.77 | 7.70 |
| | DO (mg/L) | 7.9 | 8.0 | 7.9 | 8.1 | 8.1 | 7.9 | 7.8 | 7.8 |
| | Conductivity (µmhos/cm) | 200 | | 209 | | 209 | | 209 | |
| | *Temperature (°C) | 24.9 | 24.9 | 24.9 | 24.9 | 24.8 | 24.8 | 25.0 | 24.9 |
| 100% | pH (S.U.) | 7.70 | 7.63 | 7.67 | 7.74 | 7.80 | 7.64 | 7.78 | 7.71 |
| | DO (mg/L) | 7.9 | 8.0 | 7.9 | 8.1 | 8.1 | 7.9 | 7.8 | 7.9 |
| | Conductivity (µmhos/cm) | 181 | | 192 | | 187 | | 189 | |
| | *Alkalinity (mg CaCO ₃ /L) | | | 73 | | | | | |
| | *Hardness (mg CaCO ₃ /L) | | | 72 | | | | | |
| | *TR chlorine (mg/L) | | | <0.10 | | | | | |
| | *Temperature (°C) | 24.9 | 25.1 | 25.0 | 25.1 | 24.8 | 25.1 | 25.0 | 24.9 |
| 100% Intake | pH (S.U.) | 7.71 | 7.44 | 7.67 | 7.80 | 7.77 | 7.81 | 7.79 | 7.74 |
| | DO (mg/L) | 7.9 | 8.0 | 7.9 | 8.1 | 8.1 | 8.0 | 7.8 | 8.0 |
| | Conductivity (µmhos/cm) | 184 | | 191 | | 191 | | 191 | |
| | *Alkalinity (mg CaCO ₃ /L) | | | 73 | | | | | |
| | *Hardness (mg CaCO ₃ /L) | | | 72 | | | | | |
| | *TR chlorine (mg/L) | | | <0.10 | | | | | |
| | *Temperature (°C) | 25.0 | 25.0 | 25.0 | 24.9 | 25.0 | 24.9 | 24.8 | 25.1 |
| | | Initial | Final | Initial | Final | Initial | Final | Initial | Final |

Independent Review by
Kellie E. Kennon
K

*Temperatures performed at the time of test initiation, renewal or termination by the analyst identified in the Daily Renewal Information table located on Page 1. Alkalinity, hardness and total residual chlorine performed by the analyst identified on the bench sheet specific for each analysis and transcribed to this bench sheet by: *K*



ETS

Environmental Testing Solutions, Inc.

TVA / Sequoyah Nuclear Plant, Outfall 101 - Non-treated August 11-18, 2015

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

Daily Chemical Analyses

Project number: 10842

| 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) | 7.77 | 7.74 | 7.63 | 7.65 | 7.70 | 7.66 | 7.98 | 7.63 | 7.68 | 7.71 | 7.71 | 7.54 | 7.75 | 7.77 |
| | DO (mg/L) | 7.8 | 7.8 | 7.9 | 8.0 | 7.8 | 7.6 | 7.6 | 8.0 | 7.8 | 8.1 | 7.9 | 7.9 | 7.7 | 7.7 |
| | Conductivity (µmhos/cm) | 323 | | 307 | | 305 | | 317 | | 326 | | 327 | | 318 | |
| | Alkalinity (mg/L CaCO ₃) | 59 | | | | 61 | | | | 61 | | | | | |
| | Hardness (mg/L CaCO ₃) | 86 | | | | 84 | | | | 88 | | | | | |
| | Temperature (°C) | 24.7 | 24.9 | 24.8 | 25.1 | 24.8 | 24.9 | 24.8 | 24.8 | 24.8 | 25.2 | 24.8 | 25.0 | 24.9 | 25.2 |
| 10.7% | pH (SU) | 7.67 | 7.76 | 7.74 | 7.68 | 7.73 | 7.68 | 7.74 | 7.62 | 7.71 | 7.72 | 7.78 | 7.63 | 7.79 | 7.72 |
| | DO (mg/L) | 7.8 | 7.8 | 7.9 | 8.0 | 7.9 | 7.6 | 7.7 | 8.0 | 7.8 | 8.1 | 7.9 | 7.9 | 7.8 | 7.7 |
| | Conductivity (µmhos/cm) | 307 | | 300 | | 301 | | 294 | | 315 | | 291 | | 302 | |
| | Temperature (°C) | 24.7 | 25.1 | 24.8 | 24.8 | 24.9 | 25.1 | 24.9 | 24.9 | 24.9 | 25.0 | 24.7 | 24.8 | 24.9 | 25.0 |
| 21.4% | pH (SU) | 7.68 | 7.76 | 7.78 | 7.69 | 7.73 | 7.67 | 7.75 | 7.63 | 7.70 | 7.73 | 7.78 | 7.64 | 7.77 | 7.71 |
| | DO (mg/L) | 7.8 | 7.8 | 7.9 | 8.0 | 7.9 | 7.6 | 7.8 | 8.0 | 7.8 | 8.1 | 8.0 | 7.9 | 7.8 | 7.7 |
| | Conductivity (µmhos/cm) | 292 | | 283 | | 288 | | 280 | | 301 | | 280 | | 287 | |
| | Temperature (°C) | 24.7 | 25.1 | 24.9 | 24.8 | 24.9 | 25.1 | 24.9 | 24.9 | 24.9 | 24.9 | 24.7 | 24.8 | 25.0 | 25.2 |
| 42.8% | pH (SU) | 7.68 | 7.80 | 7.78 | 7.70 | 7.71 | 7.65 | 7.73 | 7.63 | 7.70 | 7.73 | 7.80 | 7.64 | 7.77 | 7.71 |
| | DO (mg/L) | 7.9 | 7.8 | 8.0 | 8.0 | 7.9 | 7.7 | 7.8 | 8.0 | 7.8 | 8.1 | 8.0 | 7.9 | 7.8 | 7.8 |
| | Conductivity (µmhos/cm) | 261 | | 256 | | 256 | | 253 | | 263 | | 256 | | 261 | |
| | Temperature (°C) | 24.8 | 25.0 | 24.9 | 24.9 | 24.9 | 25.3 | 24.9 | 25.0 | 24.9 | 24.9 | 24.8 | 24.8 | 25.0 | 24.9 |
| 85.6% | pH (SU) | 7.68 | 7.81 | 7.78 | 7.72 | 7.71 | 7.65 | 7.70 | 7.63 | 7.67 | 7.73 | 7.79 | 7.66 | 7.77 | 7.70 |
| | DO (mg/L) | 7.9 | 7.9 | 8.0 | 8.0 | 7.9 | 7.8 | 7.9 | 8.0 | 7.9 | 8.1 | 8.1 | 7.9 | 7.8 | 7.8 |
| | Conductivity (µmhos/cm) | 206 | | 205 | | 203 | | 200 | | 209 | | 209 | | 209 | |
| | Temperature (°C) | 24.8 | 24.8 | 24.9 | 24.9 | 24.9 | 25.0 | 24.9 | 24.9 | 24.9 | 24.9 | 24.8 | 24.8 | 25.0 | 24.9 |
| 100% | pH (SU) | 7.68 | 7.83 | 7.79 | 7.72 | 7.71 | 7.63 | 7.70 | 7.63 | 7.67 | 7.74 | 7.80 | 7.64 | 7.78 | 7.71 |
| | DO (mg/L) | 8.0 | 7.9 | 8.0 | 8.0 | 7.9 | 7.8 | 7.9 | 8.0 | 7.9 | 8.1 | 8.1 | 7.9 | 7.8 | 7.9 |
| | Conductivity (µmhos/cm) | 189 | | 186 | | 186 | | 181 | | 192 | | 187 | | 189 | |
| | Alkalinity (mg/L CaCO ₃) | 69 | | | | 67 | | | | 73 | | | | | |
| | Hardness (mg/L CaCO ₃) | 76 | | | | 72 | | | | 72 | | | | | |
| | Total Residual Chlorine (mg/L) | <0.10 | | | | <0.10 | | | | <0.10 | | | | | |
| | Temperature (°C) | 25.0 | 25.1 | 24.9 | 24.9 | 25.0 | 24.8 | 24.9 | 25.1 | 25.0 | 25.1 | 24.8 | 25.1 | 25.0 | 24.9 |
| 100% Intake | pH (SU) | 7.69 | 7.83 | 7.79 | 7.75 | 7.72 | 7.65 | 7.71 | 7.44 | 7.67 | 7.80 | 7.77 | 7.81 | 7.79 | 7.74 |
| | DO (mg/L) | 8.0 | 7.9 | 8.0 | 8.0 | 8.0 | 7.8 | 7.9 | 8.0 | 7.9 | 8.1 | 8.1 | 8.0 | 7.8 | 8.0 |
| | Conductivity (µmhos/cm) | 189 | | 185 | | 189 | | 184 | | 191 | | 191 | | 191 | |
| | Alkalinity (mg/L CaCO ₃) | 65 | | | | 69 | | | | 73 | | | | | |
| | Hardness (mg/L CaCO ₃) | 72 | | | | 72 | | | | 72 | | | | | |
| | Total Residual Chlorine (mg/L) | <0.10 | | | | <0.10 | | | | <0.10 | | | | | |
| | Temperature (°C) | 25.0 | 25.1 | 24.9 | 25.1 | 24.9 | 25.1 | 25.0 | 25.0 | 25.0 | 24.9 | 25.0 | 24.9 | 24.8 | 25.1 |

File: sqn101_081115chem.xlsx
Entered by: J. Sumner
Reviewed by:

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

Species: *Pimephales promelas*

Client: Tennessee Valley Authority

County: Hamilton

Facility: Sequoyah Nuclear Plant

Outfall: 101

NPDES #: TN0026450

Project #: 10842

| Dilution preparation information: | | | | | | Comments: |
|-----------------------------------|--------|------|------|------|------|---|
| Dilution prep (%) | 10.7 | 21.4 | 42.8 | 85.6 | 100 | Each concentration was UV-treated for 2 minutes to remove pathogenic Interferences. |
| Effluent volume (mL) | 267.5 | 535 | 1070 | 2140 | 2500 | |
| Diluent volume (mL) | 2232.5 | 1965 | 1430 | 360 | 0 | |
| Total volume (mL) | 2500 | 2500 | 2500 | 2500 | 2500 | |

| Test organism information: | | | Test information: | |
|---|--------------------------|--------------------|--|----------|
| Organism age: | 18.17 to 19.17 HOURS OLD | | Randomizing template: | Yellow |
| Date and times organisms were born between: | 08-10-15 1800-1700 | | Incubator number and shelf location: | 3C |
| Organism source: | ATOX Batch Pp: 08-10-15 | | Artemia CHM number: | CHM836 |
| Transfer bowl information: | pH = 7.63 S.U. | | Drying information for weight determination: | |
| | Temperature = 24.9 °C | | Date / Time in oven: | 08-18-15 |
| Average transfer volume: | 0.1749 mL | | Initial oven temperature: | 60 °C |
| | | | Date / Time out of oven: | 08-19-15 |
| | | | 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 | | Sample numbers used | | MHSW batch used |
|-----|----------|-----------------|---------|-------------------|---------|--|---------|---------------------|-----------|-----------------|
| | | Time | Analyst | Time | Analyst | Time | Analyst | Outfall 101 | Intake | |
| 0 | 08-11-15 | 0730 | JL | 1530 | JL | 1110 | JL | 150810.01 | 150810.02 | 08-09-15 |
| 1 | 08-12-15 | 0730 | JL | 1330 | JL | 1010 | JL | 150810.01 | 150810.02 | 08-09-15 |
| 2 | 08-13-15 | 0730 | JL | 1330 | JL | 1010 | JL | 150812.11 | 150812.12 | 08-10-15A |
| 3 | 08-14-15 | 0715 | JL | 1315 | JL | 1011 | JL | 150812.11 | 150812.12 | 08-10-15A |
| 4 | 08-15-15 | 0805 | JL | 1405 | JL | 1038 | JL | 150814.08 | 150814.09 | 08-10-15B |
| 5 | 08-16-15 | 0805 | JL | 1405 | JL | 1015 | JL | 150814.08 | 150814.09 | 08-10-15B |
| 6 | 08-17-15 | 0745 | JL | 1345 | JL | 1010 | JL | 150814.08 | 150814.09 | 08-10-15B |
| 7 | 08-18-15 | | | | | 1017 | JL | | | |

| Control information: | | Acceptance criteria | Summary of test endpoints: | |
|--------------------------------------|-------|---------------------|----------------------------|---------|
| % Mortality: | 07 | ≤ 20% | 7-day LC ₅₀ | > 1007. |
| Average weight per initial larvae: | 0.712 | | NOEC | 1007. |
| Average weight per surviving larvae: | 0.712 | ≥ 0.25mg/larvae | LOEC | > 1007. |
| | | | ChV | > 1007. |
| | | | IC ₂₅ | > 1007. |



Species: Pimephales promelas

Client: TVA / Sequoyah Nuclear Plant, Outfall 101, UV-treated

Date: 08-11-15

Survival and Growth Data

| Day | CONTROL | | | | 10.7% | | | | 21.4% | | | |
|---|---------|----|----|----|-------|----|----|----|-------|----|----|----|
| | A | B | C | D | E | F | G | H | I | J | K | L |
| 0 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 1 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 2 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 3 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 4 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 5 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 6 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 7 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| A = Pan weight (mg) Tray color code: <u>Forest Green</u> Analyst: <u>MB</u> Date: <u>08-03-15</u> | | | | | | | | | | | | |
| B = Pan + Larvae weight (mg) Analyst: <u>AM</u> Date: <u>08-19-15</u> | | | | | | | | | | | | |
| C = Larvae weight (mg) = B - A Hand calculated. Analyst: <u>[Signature]</u> | | | | | | | | | | | | |
| Weight per initial number of larvae (mg) = C / Initial number of larvae Hand calculated. Analyst: <u>[Signature]</u> | | | | | | | | | | | | |
| Average weight per initial number of larvae (mg) | 0.712 | | | | 0.672 | | | | 0.731 | | | |
| Percent reduction from control (%) | | | | | -5.67 | | | | -2.77 | | | |

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:

| |
|--|
| |
| |
| |
| |



Species: *Pimephales promelas*

Client: TVA / Sequoyah Nuclear Plant, Outfall 101, UV-treated

Date: 08-11-15

Survival and Growth Data

| Day | 42.8% | | | | 85.6% | | | | 100% | | | |
|---|-------|----|----|----|-------|----|----|----|------|----|----|----|
| | M | N | O | P | Q | R | S | T | U | V | W | X |
| 0 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 1 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 2 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 3 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 4 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 5 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 6 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 7 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| A = Pan weight (mg) Tray color code: <u>Forest Green</u> Analyst: <u>N6</u> Date: <u>08-03-15</u> | | | | | | | | | | | | |
| B = Pan + Larvae weight (mg) Analyst: <u>AI</u> Date: <u>08-19-15</u> | | | | | | | | | | | | |
| C = Larvae weight (mg) = B - A Hand calculated. Analyst: <u>[Signature]</u> | | | | | | | | | | | | |
| Weight per initial number of larvae (mg) = C / Initial number of larvae Hand calculated. Analyst: <u>[Signature]</u> | | | | | | | | | | | | |
| Average weight per initial number of larvae (mg) Percent reduction from control (%) | | | | | | | | | | | | |
| 0.723 -1.77 0.786 -10.57 0.782 -9.97 | | | | | | | | | | | | |

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

Species: *Pimephales promelas*

Client: TVA / Sequoyah Nuclear Plant, Outfall 101, UV-treated

Date: 08-11-15

Survival and Growth Data

| Day | 100% Intake | | | |
|---|-------------|-------|-------|-------|
| | Y | Z | AA | BB |
| 0 | 10 | 10 | 10 | 10 |
| 1 | 10 | 10 | 10 | 10 |
| 2 | 10 | 10 | 10 | 10 |
| 3 | 10 | 10 | 10 | 10 |
| 4 | 10 | 10 | 10 | 10 |
| 5 | 10 | 10 | 10 | 10 |
| 6 | 10 | 10 | 10 | 10 |
| 7 | 10 | 10 | 10 | 10 |
| A = Pan weight (mg) Tray color code: <u>Forest Green</u> Analyst: <u>MG</u> Date: <u>08-03-15</u> | | | | |
| | 16.07 | 16.40 | 15.00 | 15.93 |
| B = Pan + Larvae weight (mg) Analyst: <u>AI</u> Date: <u>08-19-15</u> | | | | |
| | 23.01 | 23.83 | 21.89 | 22.63 |
| C = Larvae weight (mg) = B - A Hand calculated. Analyst: <u>[Signature]</u> | | | | |
| | 6.94 | 7.43 | 6.89 | 6.70 |
| Weight per initial number of larvae (mg) = C / Initial number of larvae Hand calculated. Analyst: <u>[Signature]</u> | | | | |
| | 0.694 | 0.743 | 0.689 | 0.670 |
| Average weight per initial number of larvae (mg) | 0.699 | | 1.87. | |
| Percent reduction from control (%) | | | | |

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

Comments:

| |
|--|
| |
| |
| |
| |





ETS

Environmental Testing Solutions, Inc.

TVA / Sequoyah Nuclear Plant, Outfall 101
UV-treated
August 11-18, 2015

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: 10842

| Project number: 1008 | | | | | | | | | | | | | | | |
|----------------------|-----------|--------------------------|------------------------|---------------------|------------------------------|----------------------------|---|---|--|--|-------------------|---|--|------------------------------------|--|
| 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 / Initial number of larvae (mg) | Mean survival (%) | Mean weight / Initial number of larvae (mg) | Coefficient of variation (Stdev weight per initial number of larvae) (%) | Percent reduction from control (%) | |
| | | | | | | | Weight / Surviving number of larvae (mg) | Mean weight / Surviving number of larvae (mg) | Coefficient of variation (Stdev weight per surviving number of larvae) (%) | | | | | | |
| Control | A | 10 | 10 | 14.13 | 21.98 | 7.85 | 0.785 | 0.712 | 9.1 | 0.785 | 100.0 | 0.712 | 9.1 | Not applicable | |
| | B | 10 | 10 | 16.14 | 22.73 | 6.59 | 0.659 | | | 0.659 | | | | | |
| | C | 10 | 10 | 15.85 | 22.40 | 6.55 | 0.655 | | | 0.655 | | | | | |
| | D | 10 | 10 | 14.95 | 22.42 | 7.47 | 0.747 | | | 0.747 | | | | | |
| 10.7% | E | 10 | 10 | 15.59 | 22.07 | 6.48 | 0.648 | 0.672 | 9.9 | 0.648 | 100.0 | 0.672 | 9.9 | 5.6 | |
| | F | 10 | 10 | 16.75 | 22.63 | 5.88 | 0.588 | | | 0.588 | | | | | |
| | G | 10 | 10 | 16.41 | 23.67 | 7.26 | 0.726 | | | 0.726 | | | | | |
| | H | 10 | 10 | 15.53 | 22.77 | 7.24 | 0.724 | | | 0.724 | | | | | |
| 21.4% | I | 10 | 10 | 16.43 | 23.55 | 7.12 | 0.712 | 0.731 | 11.9 | 0.712 | 100.0 | 0.731 | 11.9 | -2.7 | |
| | J | 10 | 10 | 16.37 | 24.04 | 7.67 | 0.767 | | | 0.767 | | | | | |
| | K | 10 | 10 | 16.57 | 22.76 | 6.19 | 0.619 | | | 0.619 | | | | | |
| | L | 10 | 10 | 16.36 | 24.60 | 8.24 | 0.824 | | | 0.824 | | | | | |
| 42.8% | M | 10 | 10 | 16.04 | 22.59 | 6.55 | 0.655 | 0.723 | 6.3 | 0.655 | 100.0 | 0.723 | 6.3 | -1.7 | |
| | N | 10 | 10 | 15.27 | 22.65 | 7.38 | 0.738 | | | 0.738 | | | | | |
| | O | 10 | 10 | 15.85 | 23.32 | 7.47 | 0.747 | | | 0.747 | | | | | |
| | P | 10 | 10 | 15.97 | 23.50 | 7.53 | 0.753 | | | 0.753 | | | | | |
| 85.6% | Q | 10 | 10 | 15.97 | 24.08 | 8.11 | 0.811 | 0.786 | 6.1 | 0.811 | 100.0 | 0.786 | 6.1 | -10.5 | |
| | R | 10 | 10 | 13.84 | 21.87 | 8.03 | 0.803 | | | 0.803 | | | | | |
| | S | 10 | 10 | 16.35 | 24.50 | 8.15 | 0.815 | | | 0.815 | | | | | |
| | T | 10 | 10 | 14.40 | 21.55 | 7.15 | 0.715 | | | 0.715 | | | | | |
| 100% | U | 10 | 10 | 13.61 | 20.98 | 7.37 | 0.737 | 0.782 | 9.1 | 0.737 | 100.0 | 0.782 | 9.1 | -9.9 | |
| | V | 10 | 10 | 15.09 | 22.22 | 7.13 | 0.713 | | | 0.713 | | | | | |
| | W | 10 | 10 | 16.40 | 25.09 | 8.69 | 0.869 | | | 0.869 | | | | | |
| | X | 10 | 10 | 15.94 | 24.03 | 8.09 | 0.809 | | | 0.809 | | | | | |
| 100% Intake | Y | 10 | 10 | 16.07 | 23.01 | 6.94 | 0.694 | 0.699 | 4.4 | 0.694 | 100.0 | 0.699 | 4.4 | 1.8 | |
| | Z | 10 | 10 | 16.40 | 23.83 | 7.43 | 0.743 | | | 0.743 | | | | | |
| | AA | 10 | 10 | 15.00 | 21.89 | 6.89 | 0.689 | | | 0.689 | | | | | |
| | BB | 10 | 10 | 15.93 | 22.63 | 6.70 | 0.670 | | | 0.670 | | | | | |

Outfall 101:

Dunnett's MSD value: 0.1114

PMDS: 15.7

MSD =
PMDS =

Minimum Significant Difference
 Percent Minimum Significant Difference

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

Intake:

Dunnett's MSD value: 0.0699

PMDS: 9.8

Lower PMDS bound determined by USEPA (10th percentile) = 12%.

Upper PMDS bound determined by USEPA (90th percentile) = 30%.

Lower and upper PMDS bounds were determined from the 10th and 90th percentile, respectively, of PMDS 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: sqn101_081115data-uv.xlsx

Entered by: J. Supner

Reviewed by:

TVA / Sequoyah Nuclear Plant, Outfall 101

UV-treated

August 11-18, 2015



Statistical Analyses

Larval Fish Growth and Survival Test-7 Day Growth

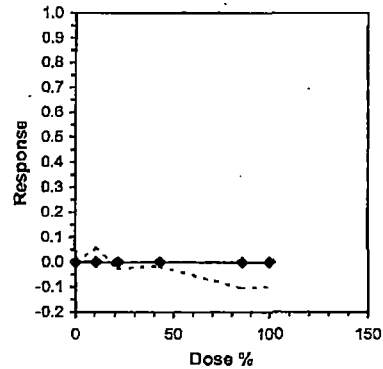
Start Date: 8/11/15 Test ID: PpFRCR Sample ID: TVA / SQN, Outfall 101
 End Date: 8/18/15 Lab ID: ETS-Envir. Testing Sol. Sample Type: DMR-Discharge Monitoring Report
 Sample Date: August 2015 Protocol: FWCHR-EPA-821-R-02-013 Test Species: PP-Pimephales promelas
 Comments: UV-treated

| Conc-% | 1 | 2 | 3 | 4 |
|-----------|--------|--------|--------|--------|
| D-Control | 0.7850 | 0.6590 | 0.6550 | 0.7470 |
| 10.7 | 0.6480 | 0.5880 | 0.7260 | 0.7240 |
| 21.4 | 0.7120 | 0.7670 | 0.8190 | 0.8240 |
| 42.8 | 0.6550 | 0.7380 | 0.7470 | 0.7530 |
| 85.6 | 0.8110 | 0.8030 | 0.8150 | 0.7150 |
| 100 | 0.7370 | 0.7130 | 0.8690 | 0.8090 |
| Intake | 0.6940 | 0.7430 | 0.6890 | 0.6700 |

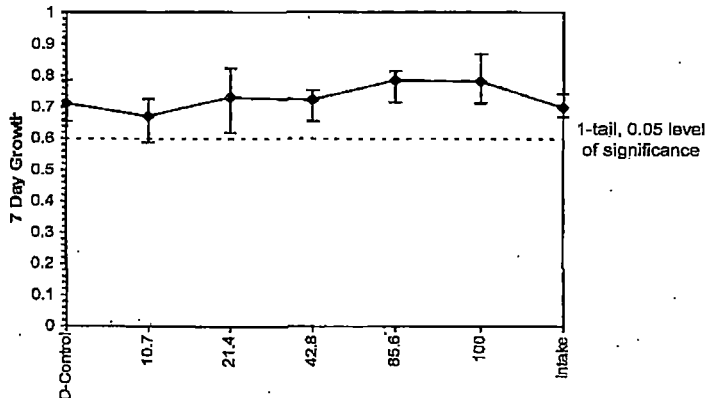
| Conc-% | Mean | N-Mean | Transform: Untransformed | | | | N | t-Stat | 1-Tailed Critical | MSD | Isotonic | |
|-----------|--------|--------|--------------------------|--------|--------|--------|---|--------|-------------------|--------|----------|--------|
| | | | Mean | Min | Max | CV% | | | | | Mean | N-Mean |
| D-Control | 0.7115 | 1.0000 | 0.7115 | 0.6550 | 0.7850 | 9.113 | 4 | | | | 0.7341 | 1.0000 |
| 10.7 | 0.6715 | 0.9438 | 0.6715 | 0.5880 | 0.7260 | 9.897 | 4 | 0.885 | 2.410 | 0.1114 | 0.7341 | 1.0000 |
| 21.4 | 0.7305 | 1.0267 | 0.7305 | 0.6190 | 0.8240 | 11.947 | 4 | -0.411 | 2.410 | 0.1114 | 0.7341 | 1.0000 |
| 42.8 | 0.7233 | 1.0165 | 0.7233 | 0.6550 | 0.7530 | 6.349 | 4 | -0.254 | 2.410 | 0.1114 | 0.7341 | 1.0000 |
| 85.6 | 0.7860 | 1.1047 | 0.7860 | 0.7150 | 0.8150 | 6.055 | 4 | -1.612 | 2.410 | 0.1114 | 0.7341 | 1.0000 |
| 100 | 0.7820 | 1.0991 | 0.7820 | 0.7130 | 0.8690 | 9.068 | 4 | -1.525 | 2.410 | 0.1114 | 0.7341 | 1.0000 |
| Intake | 0.6990 | 0.9824 | 0.6990 | 0.6700 | 0.7430 | 4.449 | 4 | | | | | |

| Auxiliary Tests | | | | | Statistic | | Critical | | Skew | Kurt | | | | |
|--|--|--|--|--|-----------|------|----------|----|---------|---------|---------|---------|---------|-------|
| Shapiro-Wilk's Test indicates normal distribution ($p > 0.01$) | | | | | 0.94413 | | 0.884 | | -0.2521 | -1.0075 | | | | |
| Bartlett's Test indicates equal variances ($p = 0.91$) | | | | | 1.5502 | | 15.0863 | | | | | | | |
| Hypothesis Test (1-tail, 0.05) | | | | | NOEC | LOEC | Chv | TU | MSDu | MSDp | MSB | MSE | F-Prob | df |
| Dunnett's Test | | | | | 100 | >100 | | 1 | 0.1114 | 0.15657 | 0.00784 | 0.00427 | 0.16624 | 5, 18 |
| Treatments vs D-Control | | | | | | | | | | | | | | |

| Linear Interpolation (200 Resamples) | | | | |
|--------------------------------------|------|----|-------------|------|
| Point | % | SD | 95% CL(Exp) | Skew |
| IC05 | >100 | | | |
| IC10 | >100 | | | |
| IC15 | >100 | | | |
| IC20 | >100 | | | |
| IC25 | >100 | | | |
| IC40 | >100 | | | |
| IC50 | >100 | | | |



Dose-Response Plot



File: sqn101_081115data-uv.xlsx
 Entered by: J. Sumner
 Reviewed by:

TVA / Sequoyah Nuclear Plant, Outfall 101 - Intake
UV-treated
August 11-18, 2015



Statistical Analyses

Larval Fish Growth and Survival Test-7 Day Growth

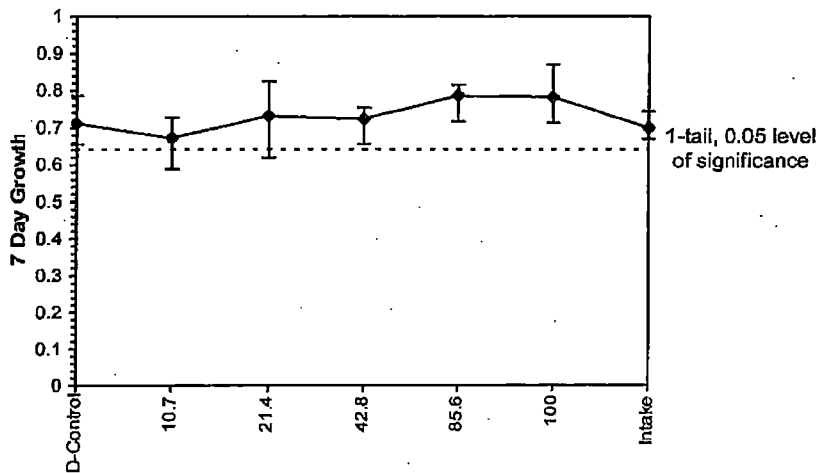
| | | |
|--------------------------|----------------------------------|--|
| Start Date: 8/11/15 | Test ID: PpFRCR | Sample ID: TVA / SQN, Outfall 101 - Intake |
| End Date: 8/18/15 | Lab ID: ETS-Envir. Testing Sol. | Sample Type: DMR-Discharge Monitoring Report |
| Sample Date: August 2015 | Protocol: FWCHR-EPA-821-R-02-013 | Test Species: PP-Pimephales promelas |
| Comments: Non-treated | | |

| Conc-% | 1 | 2 | 3 | 4 |
|-----------|--------|--------|--------|--------|
| D-Control | 0.7850 | 0.6590 | 0.6550 | 0.7470 |
| 10.7 | 0.6480 | 0.5880 | 0.7260 | 0.7240 |
| 21.4 | 0.7120 | 0.7670 | 0.6190 | 0.8240 |
| 42.8 | 0.6550 | 0.7380 | 0.7470 | 0.7530 |
| 85.6 | 0.8110 | 0.8030 | 0.8150 | 0.7150 |
| 100 | 0.7370 | 0.7130 | 0.8690 | 0.8090 |
| Intake | 0.6940 | 0.7430 | 0.6890 | 0.6700 |

| Conc-% | Transform: Untransformed | | | | | | N | t-Stat | 1-Tailed Critical | MSD |
|-----------|--------------------------|--------|--------|--------|--------|--------|---|--------|-------------------|--------|
| | Mean | N-Mean | Mean | Min | Max | CV% | | | | |
| D-Control | 0.7115 | 1.0000 | 0.7115 | 0.6550 | 0.7850 | 9.113 | 4 | | | |
| 10.7 | 0.6715 | 0.9438 | 0.6715 | 0.5880 | 0.7260 | 9.897 | 4 | | | |
| 21.4 | 0.7305 | 1.0267 | 0.7305 | 0.6190 | 0.8240 | 11.947 | 4 | | | |
| 42.8 | 0.7233 | 1.0165 | 0.7233 | 0.6550 | 0.7530 | 6.349 | 4 | | | |
| 85.6 | 0.7860 | 1.1047 | 0.7860 | 0.7150 | 0.8150 | 6.055 | 4 | | | |
| 100 | 0.7820 | 1.0991 | 0.7820 | 0.7130 | 0.8690 | 9.068 | 4 | | | |
| Intake | 0.6990 | 0.9824 | 0.6990 | 0.6700 | 0.7430 | 4.449 | 4 | 0.348 | 1.943 | 0.0699 |

| Auxiliary Tests | Statistic | Critical | Skew | Kurt | | |
|--|-----------|----------|---------|---------|---------|------|
| Shapiro-Wilk's Test indicates normal distribution (p > 0.01) | 0.9396 | 0.749 | 0.32208 | -1.1983 | | |
| F-Test indicates equal variances (p = 0.26) | 4.34562 | 47.4683 | | | | |
| Hypothesis Test (1-tail, 0.05) | MSDu | MSDp | MSB | MSE | F-Prob | df |
| Homoscedastic t Test indicates no significant differences | 0.06987 | 0.0982 | 0.00031 | 0.00259 | 0.73997 | 1, 6 |
| Treatments vs D-Control | | | | | | |

Dose-Response Plot



File: sqn101_081115data-uv.xlsx
 Entered by: J. Sumner
 Reviewed by:

Species: *Pimephales promelas*

Date: 08-11-15

Client: TVA / Sequoyah Nuclear Plant, Outfall 101, UV-treated

Daily Chemistry:

| Analyst | | Day (Analyst identified for each day, performed pH, D.O. and conductivity measurements only.) | | | | | |
|-----------------------|---------------------------------------|--|-------|-----------------|-------|---------|-------|
| | | 0 | | 1 | | 2 | |
| | | 41 | N6 | N6 | N6 | N6 | 2 |
| Concentration | Parameter | | | | | | |
| CONTROL UV-treated | pH (S.U.) | 7.71 | 7.66 | 7.50 | 7.60 | 7.76 | 7.33 |
| | DO (mg/L) | 7.8 | 7.8 | 8.0 | 7.9 | 7.8 | 6.9 |
| | Conductivity (µmhos/cm) | 325 | | 310 | | 313 | |
| | *Alkalinity (mg CaCO ₃ /L) | 60 | | 58 | | 59 | |
| | *Hardness (mg CaCO ₃ /L) | 28 | | 28 | | 84 | |
| | *Temperature (°C) | 24.8 | 24.6 | 24.9 | 24.4 | 24.8 | 24.6 |
| 10.7% | pH (S.U.) | 7.70 | 7.68 | 7.84 | 7.61 | 7.80 | 7.32 |
| | DO (mg/L) | 7.8 | 7.8 | 8.0 | 7.9 | 7.8 | 6.9 |
| | Conductivity (µmhos/cm) | 310 | | 300 | | 300 | |
| | *Temperature (°C) | 24.8 | 24.5 | 25.0 | 24.6 | 24.9 | 24.7 |
| 21.4% | pH (S.U.) | 7.69 | 7.63 | 7.85 | 7.60 | 7.80 | 7.37 |
| | DO (mg/L) | 7.8 | 7.9 | 8.0 | 7.9 | 7.9 | 6.9 |
| | Conductivity (µmhos/cm) | 293 | | 297 | | 289 | |
| | *Temperature (°C) | 24.8 | 24.7 | 25.0 | 24.6 | 25.0 | 24.5 |
| 42.8% | pH (S.U.) | 7.68 | 7.66 | 7.86 | 7.55 | 7.80 | 7.27 |
| | DO (mg/L) | 7.8 | 7.9 | 8.0 | 7.9 | 7.8 | 7.0 |
| | Conductivity (µmhos/cm) | 267 | | 258 | | 259 | |
| | *Temperature (°C) | 24.8 | 24.4 | 25.0 | 24.3 | 25.0 | 24.7 |
| 85.6% | pH (S.U.) | 7.69 | 7.66 | 7.87 | 7.60 | 7.81 | 7.28 |
| | DO (mg/L) | 7.8 | 7.9 | 8.1 | 7.9 | 7.8 | 7.0 |
| | Conductivity (µmhos/cm) | 213 | | 206 | | 204 | |
| | *Temperature (°C) | 24.8 | 24.4 | 25.0 | 24.6 | 25.0 | 24.7 |
| 100% | pH (S.U.) | 7.70 | 7.66 | 7.88 | 7.59 | 7.81 | 7.28 |
| | DO (mg/L) | 7.9 | 8.0 | 8.1 | 7.9 | 7.8 | 6.9 |
| | Conductivity (µmhos/cm) | 198 | | 187 | | 186 | |
| | *Alkalinity (mg CaCO ₃ /L) | 69 | | | | 67 | |
| | *Hardness (mg CaCO ₃ /L) | 76 | | | | 72 | |
| | *TR chlorine (mg/L) | <0.10 | | | | <0.10 | |
| | *Temperature (°C) | 24.9 | 24.6 | 25.1 | 24.5 | 25.1 | 24.4 |
| 100% Intake | pH (S.U.) | 7.70 | 7.66 | 7.89 | 7.61 | 7.81 | 7.39 |
| | DO (mg/L) | 8.0 | 8.0 | 8.1 | 7.9 | 7.8 | 6.9 |
| | Conductivity (µmhos/cm) | 203 | | 186 | | 185 | |
| | *Alkalinity (mg CaCO ₃ /L) | 67 | | | | 69 | |
| | *Hardness (mg CaCO ₃ /L) | 72 | | | | 72 | |
| | *TR chlorine (mg/L) | <0.10 | | | | <0.10 | |
| | *Temperature (°C) | 25.0 | 24.5 | 25.0 | 24.5 | 25.0 | 24.6 |
| | | Initial | Final | Initial | Final | Initial | Final |

*Temperatures performed at the time of test initiation, renewal or termination by the analyst identified in the Daily Renewal Information table located on Page 1.
 *Alkalinity, hardness and total residual chlorine performed by the analyst identified on the bench sheet specific for each analysis and transcribed to this bench sheet.
 *Total residual chlorine was performed on non-treated Outfall 101 and Intake samples.

Species: *Pimephales promelas*

Client: TVA / Sequoyah Nuclear Plant, Outfall 101, UV-treated

Date: 08-11-15

| Analyst | | Day (Analyst identified for each day, performed pH, D.O. and conductivity measurements only.) | | | | | | | |
|-----------------------|---------------------------------------|--|-------|---------|-------|-----------------------|-------|---------------|-------|
| | | 3 | | 4 | | 5 | | 6 | |
| | | W | NO | 16 | NO | NO | NO | NO | 28 |
| Concentration | Parameter | | | | | | | | |
| CONTROL UV-treated | pH (S.U.) | 7.69 | 7.70 | 7.62 | 7.51 | 7.74 11.00 | 7.71 | 7.77 | 7.51 |
| | DO (mg/L) | 7.8 | 7.9 | 7.8 | 8.0 | 7.4 (8.0) | 7.9 | 7.7 | 7.2 |
| | Conductivity (µmhos/cm) | 307 | | 317 | | 313 | | 327 | |
| | *Alkalinity (mg CaCO ₃ /L) | 60 | | 60 | | 60 | | 60 | |
| | *Hardness (mg CaCO ₃ /L) | 86 | | 86 | | 86 | | 86 | |
| | *Temperature (°C) | 24.9 | 24.7 | 24.9 | 24.3 | 24.9 | 24.6 | 24.9 | 24.6 |
| 10.7% | pH (S.U.) | 7.69 | 7.44 | 7.59 | 7.50 | 7.77 | 7.71 | 7.81 | 7.45 |
| | DO (mg/L) | 7.8 | 7.9 | 7.9 | 8.1 | 8.6 | 7.9 | 7.8 | 7.2 |
| | Conductivity (µmhos/cm) | 294 | | 301 | | 306 | | 316 | |
| | *Temperature (°C) | 25.0 | 24.4 | 24.9 | 24.6 | 25.0 | 24.4 | 24.9 | 24.5 |
| 21.4% | pH (S.U.) | 7.68 | 7.43 | 7.68 | 7.51 | 7.79 | 7.71 | 7.82 | 7.44 |
| | DO (mg/L) | 7.9 | 8.0 | 7.9 | 8.1 | 8.0 | 7.9 | 7.8 | 7.2 |
| | Conductivity (µmhos/cm) | 283 | | 304 | | 290 | | 297 | |
| | *Temperature (°C) | 25.0 | 24.4 | 24.9 | 24.7 | 25.0 | 24.6 | 25.0 | 24.6 |
| 42.8% | pH (S.U.) | 7.68 | 7.44 | 7.69 | 7.51 | 7.82 | 7.71 | 7.83 | 7.45 |
| | DO (mg/L) | 7.9 | 8.0 | 7.9 | 8.1 | 8.0 | 9.0 | 7.8 | 7.2 |
| | Conductivity (µmhos/cm) | 255 | | 269 | | 263 | | 264 | |
| | *Temperature (°C) | 25.1 | 24.4 | 24.9 | 24.5 | 25.0 | 24.6 | 25.0 | 24.6 |
| 85.6% | pH (S.U.) | 7.70 | 7.40 | 7.76 | 7.50 | 7.82 | 7.71 | 7.83 | 7.44 |
| | DO (mg/L) | 8.0 | 8.0 | 7.9 | 8.1 | 8.0 | 8.0 | 7.8 | 7.2 |
| | Conductivity (µmhos/cm) | 202 | | 217 | | 211 | | 208 | |
| | *Temperature (°C) | 25.1 | 24.6 | 25.0 | 24.7 | 25.0 | 24.3 | 25.1 | 24.6 |
| 100% | pH (S.U.) | 7.71 | 7.37 | 7.71 | 7.46 | 7.83 | 7.71 | 7.84 | 7.40 |
| | DO (mg/L) | 8.0 | 8.0 | 7.9 | 8.1 | 8.0 | 8.0 | 7.9 | 7.2 |
| | Conductivity (µmhos/cm) | 183 | | 193 | | 194 | | 197 | |
| | *Alkalinity (mg CaCO ₃ /L) | | | 71 | | | | | |
| | *Hardness (mg CaCO ₃ /L) | | | 72 | | | | | |
| | *TR chlorine (mg/L) | | | <0.10 | | | | | |
| | *Temperature (°C) | 25.3 | 24.3 | 25.2 | 24.4 | 25.0 | 24.5 | 25.2 | 24.3 |
| 100% Intake | pH (S.U.) | 7.71 | 7.49 | 7.71 | 7.53 | 7.85 | 7.71 | 7.84 | 7.55 |
| | DO (mg/L) | 8.1 | 8.0 | 7.9 | 8.1 | 8.0 | 8.1 | 7.9 | 7.2 |
| | Conductivity (µmhos/cm) | 183 | | 193 | | 190 | | 198 | |
| | *Alkalinity (mg CaCO ₃ /L) | | | 71 | | | | | |
| | *Hardness (mg CaCO ₃ /L) | | | 72 | | | | | |
| | *TR chlorine (mg/L) | | | <0.10 | | | | | |
| | *Temperature (°C) | 25.2 | 24.6 | 25.1 | 24.4 | 25.1 | 24.4 | 25.1 | 24.6 |
| | | Initial | Final | Initial | Final | Initial | Final | Initial | Final |

Independent Review by: *[Signature]*
 Temperatures performed at the time of test initiation, renewal or termination by the analyst identified in the Daily Renewal Information table located on Page 1.
 Alkalinity, hardness and total residual chlorine performed by the analyst identified on the bench sheet specific for each analysis and transcribed to this bench sheet.
 Total residual chlorine was performed on non-treated Outfall 101 and Intake samples.



ETS

Environmental Testing Solutions, Inc.

TVA / Sequoyah Nuclear Plant, Outfall 101 - UV-treated August 11-18, 2015

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

Daily Chemical Analyses

Project number: 10842

| 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) | 7.71 | 7.66 | 7.80 | 7.60 | 7.76 | 7.33 | 7.69 | 7.70 | 7.68 | 7.51 | 7.74 | 7.71 | 7.77 | 7.51 |
| | DO (mg/L) | 7.8 | 7.8 | 8.0 | 7.9 | 7.8 | 6.9 | 7.8 | 7.9 | 7.8 | 8.0 | 8.0 | 7.9 | 7.7 | 7.2 |
| | Conductivity (µmhos/cm) | 325 | | 310 | | 313 | | 307 | | 317 | | 313 | | 327 | |
| | Alkalinity (mg/L CaCO ₃) | 60 | | | | 59 | | | | 60 | | | | | |
| | Hardness (mg/L CaCO ₃) | 82 | | | | 84 | | | | 86 | | | | | |
| | Temperature (°C) | 24.8 | 24.6 | 24.9 | 24.4 | 24.8 | 24.6 | 24.9 | 24.7 | 24.9 | 24.3 | 24.9 | 24.6 | 24.9 | 24.6 |
| 10.7% | pH (SU) | 7.70 | 7.68 | 7.84 | 7.61 | 7.80 | 7.32 | 7.69 | 7.44 | 7.59 | 7.50 | 7.77 | 7.71 | 7.81 | 7.45 |
| | DO (mg/L) | 7.8 | 7.8 | 8.0 | 7.9 | 7.8 | 6.9 | 7.8 | 7.9 | 7.9 | 8.1 | 8.0 | 7.9 | 7.8 | 7.2 |
| | Conductivity (µmhos/cm) | 310 | | 300 | | 300 | | 294 | | 301 | | 306 | | 316 | |
| | Temperature (°C) | 24.8 | 24.5 | 25.0 | 24.6 | 24.9 | 24.7 | 25.0 | 24.4 | 24.9 | 24.6 | 25.0 | 24.4 | 24.9 | 24.5 |
| 21.4% | pH (SU) | 7.69 | 7.63 | 7.85 | 7.60 | 7.80 | 7.37 | 7.68 | 7.43 | 7.68 | 7.51 | 7.78 | 7.71 | 7.82 | 7.44 |
| | DO (mg/L) | 7.8 | 7.9 | 8.0 | 7.9 | 7.8 | 6.9 | 7.9 | 8.0 | 7.9 | 8.1 | 8.0 | 7.9 | 7.8 | 7.2 |
| | Conductivity (µmhos/cm) | 293 | | 287 | | 289 | | 283 | | 304 | | 290 | | 297 | |
| | Temperature (°C) | 24.8 | 24.7 | 25.0 | 24.6 | 25.0 | 24.5 | 25.0 | 24.4 | 24.9 | 24.7 | 25.0 | 24.6 | 25.0 | 24.6 |
| 42.8% | pH (SU) | 7.68 | 7.66 | 7.86 | 7.55 | 7.80 | 7.27 | 7.68 | 7.44 | 7.69 | 7.51 | 7.82 | 7.71 | 7.83 | 7.45 |
| | DO (mg/L) | 7.8 | 7.9 | 8.0 | 7.9 | 7.8 | 7.0 | 7.9 | 8.0 | 7.9 | 8.1 | 8.0 | 8.0 | 7.8 | 7.2 |
| | Conductivity (µmhos/cm) | 267 | | 258 | | 259 | | 255 | | 269 | | 263 | | 264 | |
| | Temperature (°C) | 24.8 | 24.4 | 25.0 | 24.3 | 25.0 | 24.7 | 25.1 | 24.4 | 24.9 | 24.5 | 25.0 | 24.6 | 25.0 | 24.6 |
| 85.6% | pH (SU) | 7.69 | 7.66 | 7.87 | 7.60 | 7.81 | 7.28 | 7.70 | 7.40 | 7.70 | 7.50 | 7.82 | 7.71 | 7.83 | 7.44 |
| | DO (mg/L) | 7.8 | 7.9 | 8.1 | 7.9 | 7.8 | 7.0 | 8.0 | 8.0 | 7.9 | 8.1 | 8.0 | 8.0 | 7.8 | 7.2 |
| | Conductivity (µmhos/cm) | 213 | | 206 | | 204 | | 202 | | 217 | | 211 | | 208 | |
| | Temperature (°C) | 24.8 | 24.4 | 25.0 | 24.6 | 25.0 | 24.7 | 25.1 | 24.6 | 25.0 | 24.7 | 25.0 | 24.3 | 25.1 | 24.6 |
| 100% | pH (SU) | 7.70 | 7.66 | 7.88 | 7.59 | 7.81 | 7.28 | 7.71 | 7.37 | 7.71 | 7.46 | 7.83 | 7.71 | 7.84 | 7.40 |
| | DO (mg/L) | 7.9 | 8.0 | 8.1 | 7.9 | 7.8 | 6.9 | 8.0 | 8.0 | 7.9 | 8.1 | 8.0 | 8.0 | 7.9 | 7.2 |
| | Conductivity (µmhos/cm) | 198 | | 187 | | 186 | | 183 | | 193 | | 194 | | 197 | |
| | Alkalinity (mg/L CaCO ₃) | 69 | | | | 67 | | | | 71 | | | | | |
| | Hardness (mg/L CaCO ₃) | 76 | | | | 72 | | | | 72 | | | | | |
| | *Total Residual Chlorine (mg/L) | <0.10 | | | | <0.10 | | | | <0.10 | | | | | |
| | Temperature (°C) | 24.9 | 24.6 | 25.1 | 24.5 | 25.1 | 24.4 | 25.3 | 24.3 | 25.2 | 24.4 | 25.0 | 24.5 | 25.2 | 24.3 |
| 100% Intake | pH (SU) | 7.70 | 7.66 | 7.88 | 7.61 | 7.81 | 7.39 | 7.71 | 7.49 | 7.71 | 7.53 | 7.85 | 7.71 | 7.84 | 7.55 |
| | DO (mg/L) | 8.0 | 8.0 | 8.1 | 7.9 | 7.8 | 6.6 | 8.1 | 8.0 | 7.9 | 8.1 | 8.0 | 8.1 | 7.9 | 7.2 |
| | Conductivity (µmhos/cm) | 203 | | 186 | | 185 | | 183 | | 193 | | 190 | | 198 | |
| | Alkalinity (mg/L CaCO ₃) | 67 | | | | 69 | | | | 71 | | | | | |
| | Hardness (mg/L CaCO ₃) | 72 | | | | 72 | | | | 72 | | | | | |
| | *Total Residual Chlorine (mg/L) | <0.10 | | | | <0.10 | | | | <0.10 | | | | | |
| | Temperature (°C) | 25.0 | 24.5 | 25.0 | 24.5 | 25.0 | 24.6 | 25.2 | 24.6 | 25.1 | 24.4 | 25.1 | 24.4 | 25.1 | 24.6 |

*Note: Total residual chlorine was performed on non-treated Outfall 101 and Intake samples.

File: sqn101_081115chem-UV.xlsx
Entered by: J. Sumner
Reviewed by:

Alkalinity (SM 2320 B-1997)
Matrix: Water, RL = 1.0 mg CaCO₃/L

Analyst K
Date analyzed 08-10-15

Time initiated 0930
Time completed 0920

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 ₂ SO ₄ = (5 ml Na ₂ CO 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 | 1N0149 | 1NSS1302 | 0.1 | 12.3 | 12.2 | 0.0205 | 10.2 |

Bill 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%) |
|------------------------------|---|--------------------------|-------------|-----------|-------------|------------|--|--|
| 1NSS1304 | 100 | 100 | 12.3 | 21.5 | 9.2 | 10.2 | 94 | 94.07 |

Duplicate sample precision:

| Sample number | Sample ID | Sample volume (ml) | Begin ml | End ml | Total ml | Multiplier | Alkalinity (mg CaCO ₃ /L) | %RPD = {(S - D) / ((S+D)/2)} x 100 (acceptable range = ± 10%) |
|------------------|---------------|--------------------------|-------------|-----------|-------------|------------|---|---|
| 08-12-15 | MHSW | 100 | 21.0 | 27.4 | 5.8 | 10.2 | S 69 | |
| J | Duplicate (B) | J | 27.4 | 33.2 | 5.8 | J | D 59 | -2001415 |

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) |
|------------------------------|--|--------------------------|-------------|-----------|-------------|------------|---|
| 1NSS1304 | 50 | 100 | 27.4 | 38.0 | 10.4 | 10.2 | 110 |

| Sample alkalinity (B) (mg CaCO ₃ /L) | Measured spike value (MV) MV = A - B (mg CaCO ₃ /L) | % R = MV / SV x 100 (acceptable range = 75 to 125%) |
|--|--|---|
| 59 | 51 | 102.07 |

Sample measurements:

| Sample number | Sample ID | Sample volume (ml) | Begin ml | End ml | Total ml | Multiplier | Alkalinity (mg CaCO ₃ /L) |
|---------------|--------------|-----------------------|-------------|-----------|-------------|------------|---|
| 08-14-15 | MHSW | 100 | 38.0 | 43.9 | 5.9 | 10.2 | 60 |
| 08-09-15 | J | | 0.0 | 38.0 | 5.8 | | 59 |
| 08-10-15A | J | | 5.8 | 43.8 | 6.0 | | 61 |
| 08-10-15B | J | | 11.8 | 47.0 | 6.0 | | 61 |
| 08-09-15 | MHSW WU 1 | | 17.0 | 23.7 | 5.9 | | 60 |
| 08-10-15A | J 2 | | 23.7 | 29.5 | 5.8 | | 59 |
| 08-10-15B | J 3 | | 29.5 | 35.4 | 5.9 | | 60 |
| 150810.02 | TVA SQNINT 1 | 50 | 35.4 | 38.4 | 3.2 | (2) | 65 |
| 150812.12 | J 2 | J | 38.0 | 42.0 | 3.4 | J | 69 |

Reviewed by: K

Date reviewed: 08-10-15

Alkalinity (SM 2320 B-1997)

Matrix: Water, RL = 1.0 mg CaCO₃/L

Analyst W
Date analyzed 08/10/15

Time initiated 08/10/15
Time completed 08/10/15

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 ₂ SO ₄ = (5 ml Na ₂ CO 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 |
|---|--------------------------------|--|-------------|-----------|--------------------|--|--|
| | | | | | | | <u>10.2</u> |

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%) |
|------------------------------|---|--------------------------|-------------|------------|-------------|-------------|--|--|
| <u>INSS1304</u> | <u>100</u> | <u>100</u> | <u>0.0</u> | <u>9.5</u> | <u>9.5</u> | <u>10.2</u> | <u>97</u> | <u>97.07</u> |

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%) |
|------------------|----------------------|--------------------------|-------------|-------------|-------------|-----------------|---|---|
| <u>150814.09</u> | <u>TVA SQN INT 3</u> | <u>50</u> | <u>9.5</u> | <u>13.1</u> | <u>3.6</u> | <u>(2) 10.2</u> | <u>S 73</u> | |
| <u>↓</u> | <u>Duplicate (B)</u> | <u>↓</u> | <u>13.3</u> | <u>16.9</u> | <u>3.6</u> | <u>↓ ↓</u> | <u>D 73</u> | <u>→ 0.01615</u> |

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) |
|------------------------------|--|--------------------------|-------------|-------------|-------------|-----------------|---|
| <u>INSS1304</u> | <u>100</u> | <u>50</u> | <u>13.3</u> | <u>21.5</u> | <u>8.2</u> | <u>(2) 10.2</u> | <u>170</u> |

| 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%) |
|--|--|---|
| <u>73</u> | <u>97</u> | <u>97.07</u> |

Sample measurements:

| Sample number | Sample ID | Sample volume (ml) | Begin ml | End ml | Total ml | Multiplier | Alkalinity (mg CaCO ₃ /L) |
|------------------|------------------------|-----------------------|-------------|-------------|-------------|-----------------|---|
| <u>150810.02</u> | <u>TVA SQN INTUW1</u> | <u>50</u> | <u>21.5</u> | <u>24.8</u> | <u>3.3</u> | <u>(2) 10.2</u> | <u>67</u> |
| <u>150812.12</u> | <u>↓ 2</u> | | <u>24.0</u> | <u>28.2</u> | <u>3.4</u> | | <u>69</u> |
| <u>150814.09</u> | <u>↓ 3</u> | | <u>28.2</u> | <u>31.7</u> | <u>3.5</u> | | <u>71</u> |
| <u>150810.01</u> | <u>TVA SQN 101</u> | <u>1</u> | <u>31.7</u> | <u>35.1</u> | <u>3.4</u> | | <u>69</u> |
| <u>150812.11</u> | <u>↓ 2</u> | | <u>35.1</u> | <u>38.4</u> | <u>3.3</u> | | <u>67</u> |
| <u>150814.08</u> | <u>↓ 3</u> | | <u>38.4</u> | <u>42.0</u> | <u>3.6</u> | | <u>73</u> |
| <u>150810.01</u> | <u>TVA SQN 101UW 1</u> | | <u>42.0</u> | <u>45.4</u> | <u>3.4</u> | | <u>69</u> |
| <u>150812.11</u> | <u>↓ 2</u> | | <u>45.4</u> | <u>48.2</u> | <u>3.3</u> | | <u>67</u> |
| <u>150814.08</u> | <u>↓ 3</u> | | <u>48.2</u> | <u>43.7</u> | <u>3.5</u> | | <u>71</u> |

Reviewed by: W

Date reviewed: 08-16-15

Hardness (SM 2340 C-1997)

RL = 1.0 mg CaCO₃/L

Analyst KL
Date analyzed 08.16.15

Time initiated 1027
Time completed 1103

Titrant normality and multiplier determination:

| Titration 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 |
|----------------------------|---------------------------------|----------|--------|--------------|--|---|
| 1N2.039 | 1NSS1284 | 0.0 | 10.0 | 10.0 | 0.0200 | 20.0 |

Laboratory control standard:

| Reference standard number | True value (TV) (mg CaCO ₃ /L) | Sample volume (ml) | Begin ml | End ml | Total ml | Multiplier | Hardness (MV) (mg CaCO ₃ /L) | % RS = MV / TV x 100 (acceptable range = 90 to 110%) |
|---------------------------|---|--------------------|----------|--------|----------|------------|---|--|
| 1NSS1330 | 40 | 50 | 10.0 | 13.0 | 23.0 | 20.0 | 40 | 100.07 |

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 |
|---------------|---------------|--------------------|----------|--------|----------|------------|------------------------------------|------------------------------------|
| 00-13.15 | MHSW | 50 | 13.0 | 16.1 | 4.1 | 20.0 | ^S 82 | |
| J | Duplicate (B) | J | 16.1 | 20.3 | 4.2 | J | ^D 84 | 2mg/L 1.47 |

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) |
|---------------------------|--|--------------------|----------|--------|----------|------------|--|
| 1NSS1330 | 40 | 50 | 16.1 | 22.3 | 6.2 | 20.0 | 120 |

| 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%) |
|---|--|---|
| 84 | 36 | 90.07 |

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 | 20.0 | ND |
| 00-14.15 | MHSW | | 22.3 | 26.6 | 4.3 | | 86 |
| 00-09.15 | J | | 26.6 | 30.9 | 4.3 | | 86 |
| 00-10.15A | J | | 30.9 | 35.1 | 4.2 | | 84 |
| 00-10.15B | J | | 35.1 | 39.5 | 4.4 | | 88 |
| 08-09-15 | MHSW UV 1 | | 39.5 | 43.6 | 4.1 | | 82 |
| 08-10-15A | 1 | 2 | 43.6 | 47.8 | 4.2 | | 84 |
| 08-10-15B | 1 | 3 | 0.0 | 4.3 | 4.3 | | 86 |
| 150810.01 | TVASQ101 | 1 | 25 | 4.3 | 6.2 | 1.9 (2) | 76 |
| 150812.11 | J | 2 | J | 4.2 | 8.0 | 1.0 | 72 |

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

Reviewed by:

Date reviewed:

08-15-15

Hardness (SM 2340 C-1997)

RL = 1.0 mg CaCO₃/L

Analyst KL
Date analyzed 08/15

Time initiated 08:05
Time completed 1

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 |
|--------------------------|---------------------------------|----------|--------|--------------|--|---|
| | | | | | | <u>1001515</u> |

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%) |
|---------------------------|---|--------------------|------------|-------------|------------|-------------|---|--|
| <u>1NSS133B</u> | <u>40</u> | <u>50</u> | <u>0.0</u> | <u>10.0</u> | <u>2.0</u> | <u>20.0</u> | <u>40</u> | <u>100.0</u> |

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 |
|------------------|----------------------|--------------------|-------------|-------------|------------|-----------------|------------------------------------|------------------------------------|
| <u>150814.08</u> | <u>TVASQJ101 3</u> | <u>25</u> | <u>10.0</u> | <u>11.0</u> | <u>1.0</u> | <u>(2) 20.0</u> | <u>S 72</u> | |
| <u>↓</u> | <u>Duplicate (B)</u> | <u>↓</u> | <u>11.0</u> | <u>13.0</u> | <u>1.0</u> | <u>↓</u> | <u>D 72</u> | <u>100.1515</u> |

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) |
|---------------------------|--|--------------------|-------------|-------------|------------|-----------------|--|
| <u>1NSS133B</u> | <u>80</u> | <u>25</u> | <u>11.0</u> | <u>15.0</u> | <u>3.0</u> | <u>(2) 20.0</u> | <u>150</u> |

| 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%) |
|---|--|---|
| <u>72</u> | <u>78</u> | <u>97.5</u> |

Sample measurements:

| Sample number | Sample ID | Sample volume (ml) | Begin ml | End ml | Total ml | Multiplier | Hardness (mg CaCO ₃ /L) |
|------------------|---|--------------------|-------------|-------------|------------|-----------------|------------------------------------|
| <u>TV-NB</u> | <u>Blank</u> (should be = 0 mg CaCO ₃ /L) | | | | | <u>1001515</u> | |
| <u>150810.01</u> | <u>TVASQJ101 VV1</u> | <u>25</u> | <u>15.7</u> | <u>17.0</u> | <u>1.9</u> | <u>(2) 20.0</u> | <u>76</u> |
| <u>150812.11</u> | <u>1</u> | <u>2</u> | <u>17.0</u> | <u>19.4</u> | <u>1.0</u> | | <u>72</u> |
| <u>150814.08</u> | <u>1</u> | <u>3</u> | <u>19.4</u> | <u>21.2</u> | <u>1.0</u> | | <u>72</u> |
| <u>150810.02</u> | <u>TVASQJINT 1</u> | | <u>21.2</u> | <u>23.0</u> | <u>1.0</u> | | <u>72</u> |
| <u>150812.12</u> | <u>1</u> | <u>2</u> | <u>23.0</u> | <u>24.0</u> | <u>1.0</u> | | <u>72</u> |
| <u>150814.09</u> | <u>1</u> | <u>3</u> | <u>24.0</u> | <u>26.0</u> | <u>1.0</u> | | <u>72</u> |
| <u>150810.02</u> | <u>TVASQJINTW 1</u> | | <u>26.0</u> | <u>28.4</u> | <u>1.0</u> | | <u>72</u> |
| <u>150812.12</u> | <u>1</u> | <u>2</u> | <u>28.5</u> | <u>30.3</u> | <u>1.0</u> | | <u>72</u> |
| <u>150814.09</u> | <u>1</u> | <u>3</u> | <u>30.3</u> | <u>32.1</u> | <u>1.0</u> | | <u>72</u> |

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

H

Date reviewed

08.15.15

Meter: Accumet Model AR25 pH/Ion Meter

| | |
|-----------------|---------|
| Iodide reagent: | INR 690 |
| Acid reagent: | INR 691 |

| | 0.10 mg/L | 1.00 mg/L | mV Change (suggested range = 26 to 30 mV) |
|---------------------------|-----------|-----------|--|
| Reference standard number | INSS 1323 | INSS 1323 | |
| Millivolts (mV) | 572.3 | 601.9 | 29.6 |

Laboratory control standard:

| Reference standard number | True value (TV) (mg/L) | Measured value (MV) (mg/L) | % RS = $MV / TV \times 100$ (acceptable range = 90 to 110%) |
|---------------------------|---------------------------|-------------------------------|--|
| INSS 1323 | 0.50 | 0.498 | 99.6 % |

| Sample number | Sample ID | Sample characteristics | Residual chlorine (mg/L) | %RPD = $\{(S - D) / [(S + D) / 2]\} \times 100$ (acceptable range = $\pm 10\%$) |
|---------------|-------------|------------------------|--------------------------|---|
| 150310.01 | TVA/SQN 101 | Pale tan clear | 0.00711 | |
| J | Duplicate | | 0.00364 | 16.00115 |

[illegible]

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%) |
|---------------------------|---------------------------|-------------------------------|---|
| INS 1323 | 0.50 | 0.468 | 93.6 % |

Reviewed by
Date reviewed: 08.11.5



Environmental Testing Solutions, Inc.

Total Residual Chlorine (ORION-1977)

Matrix: Water, RL = 0.10 mg/L

Meter: Accumet Model AR25 pH/Ton Meter

Analyst: N6
Date analyzed: 08-12-15Iodide reagent: INR 690
Acid reagent: INR 691**Calibration:**

| | 0.10 mg/L | 1.00 mg/L | mV Change (suggested range = 26 to 30 mV) |
|---------------------------|------------------|------------------|--|
| Reference standard number | <u>INSS 1323</u> | <u>INSS 1323</u> | |
| Millivolts (mV) | <u>525.2</u> | <u>604.3</u> | <u>29.1</u> |

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

Laboratory control standard:

| Reference standard number | True value (TV) (mg/L) | Measured value (MV) (mg/L) | % RS = MV / TV x 100 (acceptable range = 90 to 110%) |
|---------------------------|---------------------------|-------------------------------|---|
| <u>INSS 1323</u> | <u>0.50</u> | <u>0.511</u> | <u>102.2 %</u> |

Duplicate sample precision:

| Sample number | Sample ID | Sample characteristics | Residual chlorine (mg/L) | %RPD = ((S - D) / ((S + D) / 2)) x 100 (acceptable range = ± 10%) |
|------------------|------------------|---------------------------------|-----------------------------|--|
| <u>150011.01</u> | <u>ANDREWS</u> | <u>NO color Clear particles</u> | <u>S < 0.00760</u> | |
| <u>1</u> | <u>Duplicate</u> | | <u>D < 0.00518</u> | <u>Mod 12/15</u> |

Sample measurements:

| Sample number | Sample ID | Sample characteristics | Residual chlorine (mg/L) |
|------------------|----------------------|--------------------------------------|-----------------------------|
| | Reagent Blank | | <u>< 0.0185</u> |
| <u>150011.03</u> | <u>JEFFERSON</u> | <u>Pale tan Clear particles</u> | <u>< 0.00299</u> |
| <u>150011.05</u> | <u>MT. PISGAH</u> | <u>tan slightly cloudy particles</u> | <u>< 0.000460</u> |
| <u>150011.02</u> | <u>ROBBINSVILLE</u> | <u>NO color Clear particles</u> | <u>< 0.00431</u> |
| <u>150011.04</u> | <u>UNIMIN</u> | <u>NO color Clear</u> | <u>< 0.00369</u> |
| <u>150012.01</u> | <u>ALCOA COS</u> | <u>NO color Clear</u> | <u>< 0.00419</u> |
| <u>150012.02</u> | <u>APEX</u> | <u>Pale tan Clear</u> | <u>< 0.00305</u> |
| <u>150012.03</u> | <u>DAIKEN</u> | <u>Pale yellow Clear particles</u> | <u>< 0.00317</u> |
| <u>150012.04</u> | <u>DALLAS</u> | <u>Pale tan Clear particles</u> | <u>< 0.00216</u> |
| <u>150012.05</u> | <u>MCGUIRE COS</u> | <u>Pale tan Clear</u> | <u>< 0.00513</u> |

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

Laboratory control standard:

| Reference standard number | True value (TV) (mg/L) | Measured value (MV) (mg/L) | % RS = MV / TV x 100 (acceptable range = 90 to 110%) |
|---------------------------|---------------------------|-------------------------------|---|
| <u>INSS 1323</u> | <u>0.50</u> | <u>0.493</u> | <u>98.6 %</u> |

Reviewed by: N
Date reviewed: 08/12/15



Total Residual Chlorine (ORION-1977)

Matrix: Water, RL = 0.10 mg/L

Meter: Accumet Model AR25 pH/Ion Meter

Analyst N6
Date analyzed 08-12-15

Iodide reagent:
Acid reagent:

Calibration:

| | 0.10 mg/L | 1.00 mg/L | mV Change (suggested range = 26 to 30 mV) |
|---------------------------|-----------|-----------|--|
| Reference standard number | | | |
| Millivolts (mV) | | | |

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

Laboratory control standard:

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

Duplicate sample precision:

| Sample number | Sample ID | Sample characteristics | Residual chlorine (mg/L) | %RPD = {(S - D) / [(S+D)/2]} x 100 (acceptable range = ± 10%) |
|---------------|-----------|------------------------|-----------------------------|--|
| 150012.06 | CWE | pale tan clear | S 0.00205 | |
| ↓ | Duplicate | | D 0.00185 | |

Sample measurements:

| Sample number | Sample ID | Sample characteristics | Residual chlorine (mg/L) |
|---------------|---------------|--------------------------|-----------------------------|
| | Reagent Blank | | |
| 150012.07 | ELEMENTIS | no color clear | 0.00175 |
| 150012.08 | WOODLAKE | pale yellow clear | 0.00242 |
| 150012.09 | MCGUIRE 001 | no color clear particles | 0.000577 |
| 150012.10 | ↓ 002 | pale yellow clear | 0.00344 |
| 150012.11 | TVA / SON 101 | pale tan clear | 0.00985 |
| 150012.12 | ↓ INTAKE | pale tan clear particles | 0.00310 |
| | | | |
| | | | |

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%) |
|---------------------------|---------------------------|-------------------------------|---|
| IN/SS 1323 | 0.50 | 0.487 | 97.4% |

Reviewed by N
Date reviewed 08/12/15

Matrix: Water, RL = 0.10 mg/L

| | |
|---------------|----------|
| Analyst | N6 |
| Date analyzed | 02-15-15 |

Iodide reagent: IMA 680
Acid reagent: IMA 691

| | 0.10 mg/L | 1.00 mg/L | mV Change (suggested range = 26 to 30 mV) |
|---------------------------|------------|------------|--|
| Reference standard number | IN 33 1323 | IN 33 1323 | |
| Millivolts (mV) | 578.8 | 62.4 | 26.6 |

Laboratory control standard:

| Reference standard number | True value (TV) (mg/L) | Measured value (MV) (mg/L) | % RS = $MV / TV \times 100$ (acceptable range = 90 to 110%) |
|---------------------------|---------------------------|-------------------------------|--|
| INSS 1323 | 0.50 | 0.492 | 96.4% |

| Sample number | Sample ID | Sample characteristics | Residual chlorine (mg/L) | %RPD = $\{(S - D) / [(S+D)/2]\} \times 100$ (acceptable range = $\pm 10\%$) |
|---------------|-------------|------------------------|--------------------------|---|
| 150814.08 | TVA/SQN 101 | No color clear | S < 0.00718 | |
| ↓ | Duplicate | | D < 0.00594 | NG 08/5/15 |

[illegible]

Laboratory control standard:

| Reference standard number | True value (TV) (mg/L) | Measured value (MV) (mg/L) | % RS = $MV / TV \times 100$ (acceptable range = 90 to 110%) |
|---------------------------|---------------------------|-------------------------------|--|
| INS/323 | 0.50 | 0.477 | 95.4% |

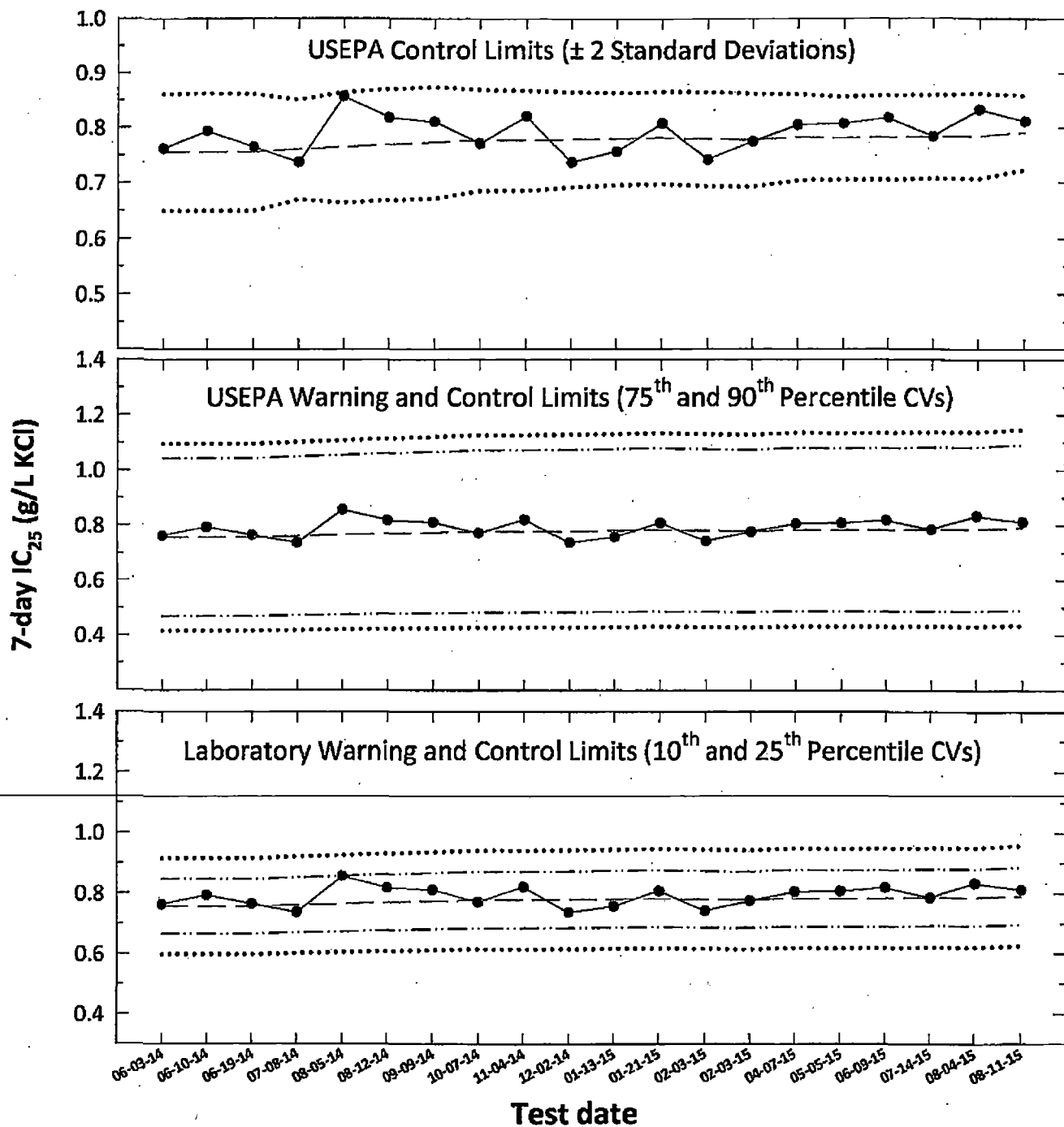
| | |
|---------------|----------|
| Reviewed by | <i>M</i> |
| Date reviewed | 08-15-15 |

Sequoyah Nuclear Plant Biomonitoring
August 11 – 18, 2015


Appendix D

Reference Toxicant Test and
Control Chart

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 | | S _{A,10} | Laboratory Warning Limits | | S _{A,25} | Laboratory Control Limits | | S _{A,75} | USEPA Warning Limits | | S _{A,90} | USEPA Control Limits | | CV |
|-------------|-----------|-------------------------------------|-----------------|------|-----------------------------------|---------|-------------------|------------------------------|------------------------|-------------------|------------------------------|------------------------|-------------------|-------------------------|------------------------|-------------------|-------------------------|------------------------|------|
| | | | | | CT - 25 | CT + 25 | | CT - S _{A,10} | CT + S _{A,10} | | CT - S _{A,25} | CT + S _{A,25} | | CT - S _{A,75} | CT + S _{A,75} | | CT - S _{A,90} | CT + S _{A,90} | |
| 1 | 06-03-14 | 0.76 | 0.76 | 0.05 | 0.65 | 0.86 | 0.09 | 0.66 | 0.85 | 0.16 | 0.60 | 0.91 | 0.29 | 0.47 | 1.04 | 0.34 | 0.42 | 1.10 | 0.07 |
| 2 | 06-10-14 | 0.79 | 0.76 | 0.05 | 0.65 | 0.86 | 0.09 | 0.67 | 0.85 | 0.16 | 0.60 | 0.91 | 0.29 | 0.47 | 1.04 | 0.34 | 0.42 | 1.10 | 0.07 |
| 3 | 06-19-14 | 0.76 | 0.76 | 0.05 | 0.65 | 0.86 | 0.09 | 0.66 | 0.85 | 0.16 | 0.60 | 0.91 | 0.29 | 0.47 | 1.04 | 0.34 | 0.42 | 1.10 | 0.07 |
| 4 | 07-08-14 | 0.74 | 0.76 | 0.05 | 0.67 | 0.85 | 0.09 | 0.67 | 0.85 | 0.16 | 0.60 | 0.92 | 0.29 | 0.47 | 1.05 | 0.34 | 0.42 | 1.10 | 0.06 |
| 5 | 08-05-14 | 0.86 | 0.76 | 0.05 | 0.66 | 0.86 | 0.09 | 0.67 | 0.86 | 0.16 | 0.60 | 0.93 | 0.29 | 0.47 | 1.06 | 0.34 | 0.42 | 1.11 | 0.07 |
| 6 | 08-12-14 | 0.82 | 0.77 | 0.05 | 0.67 | 0.87 | 0.09 | 0.68 | 0.86 | 0.16 | 0.61 | 0.93 | 0.29 | 0.48 | 1.06 | 0.35 | 0.42 | 1.12 | 0.07 |
| 7 | 09-09-14 | 0.81 | 0.77 | 0.05 | 0.67 | 0.87 | 0.09 | 0.68 | 0.87 | 0.16 | 0.61 | 0.94 | 0.29 | 0.48 | 1.07 | 0.35 | 0.43 | 1.12 | 0.07 |
| 8 | 10-07-14 | 0.77 | 0.78 | 0.05 | 0.69 | 0.87 | 0.09 | 0.68 | 0.87 | 0.16 | 0.61 | 0.94 | 0.30 | 0.48 | 1.07 | 0.35 | 0.43 | 1.13 | 0.06 |
| 9 | 11-04-14 | 0.82 | 0.78 | 0.05 | 0.69 | 0.87 | 0.09 | 0.68 | 0.87 | 0.16 | 0.61 | 0.94 | 0.30 | 0.48 | 1.07 | 0.35 | 0.43 | 1.13 | 0.06 |
| 10 | 12-02-14 | 0.74 | 0.78 | 0.04 | 0.69 | 0.87 | 0.09 | 0.69 | 0.87 | 0.16 | 0.61 | 0.94 | 0.30 | 0.48 | 1.07 | 0.35 | 0.43 | 1.13 | 0.06 |
| 11 | 01-13-15 | 0.76 | 0.78 | 0.04 | 0.70 | 0.86 | 0.09 | 0.69 | 0.87 | 0.16 | 0.62 | 0.94 | 0.30 | 0.48 | 1.08 | 0.35 | 0.43 | 1.13 | 0.05 |
| 12 | 01-21-15 | 0.81 | 0.78 | 0.04 | 0.70 | 0.87 | 0.09 | 0.69 | 0.88 | 0.16 | 0.62 | 0.95 | 0.30 | 0.49 | 1.08 | 0.35 | 0.43 | 1.13 | 0.05 |
| 13 | 02-03-15 | 0.74 | 0.78 | 0.04 | 0.69 | 0.87 | 0.09 | 0.69 | 0.87 | 0.16 | 0.62 | 0.94 | 0.30 | 0.48 | 1.08 | 0.35 | 0.43 | 1.13 | 0.05 |
| 14 | 02-03-15 | 0.78 | 0.78 | 0.04 | 0.69 | 0.86 | 0.09 | 0.69 | 0.87 | 0.16 | 0.61 | 0.94 | 0.30 | 0.48 | 1.07 | 0.35 | 0.43 | 1.13 | 0.05 |
| 15 | 04-07-15 | 0.81 | 0.78 | 0.04 | 0.71 | 0.86 | 0.09 | 0.69 | 0.88 | 0.16 | 0.62 | 0.95 | 0.30 | 0.49 | 1.08 | 0.35 | 0.43 | 1.14 | 0.05 |
| 16 | 05-05-15 | 0.81 | 0.78 | 0.04 | 0.71 | 0.86 | 0.09 | 0.69 | 0.88 | 0.16 | 0.62 | 0.95 | 0.30 | 0.48 | 1.08 | 0.35 | 0.43 | 1.13 | 0.05 |
| 17 | 06-09-15 | 0.82 | 0.78 | 0.04 | 0.71 | 0.86 | 0.09 | 0.69 | 0.88 | 0.16 | 0.62 | 0.95 | 0.30 | 0.49 | 1.08 | 0.35 | 0.43 | 1.14 | 0.05 |
| 18 | 07-14-15 | 0.78 | 0.78 | 0.04 | 0.71 | 0.86 | 0.09 | 0.69 | 0.88 | 0.16 | 0.62 | 0.95 | 0.30 | 0.49 | 1.08 | 0.35 | 0.43 | 1.14 | 0.05 |
| 19 | 08-04-15 | 0.83 | 0.79 | 0.04 | 0.71 | 0.86 | 0.09 | 0.69 | 0.88 | 0.16 | 0.62 | 0.95 | 0.30 | 0.49 | 1.08 | 0.35 | 0.43 | 1.14 | 0.05 |
| 20 | 08-11-15 | 0.81 | 0.79 | 0.03 | 0.72 | 0.86 | 0.09 | 0.70 | 0.89 | 0.17 | 0.62 | 0.96 | 0.30 | 0.49 | 1.09 | 0.36 | 0.43 | 1.15 | 0.04 |

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

CT = Central tendency (mean IC₂₅).

S = Standard deviation of the IC₂₅ values.

Laboratory Control and Warning Limits

Laboratory control and warning limits were established using the standard deviation of the IC₂₅ 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

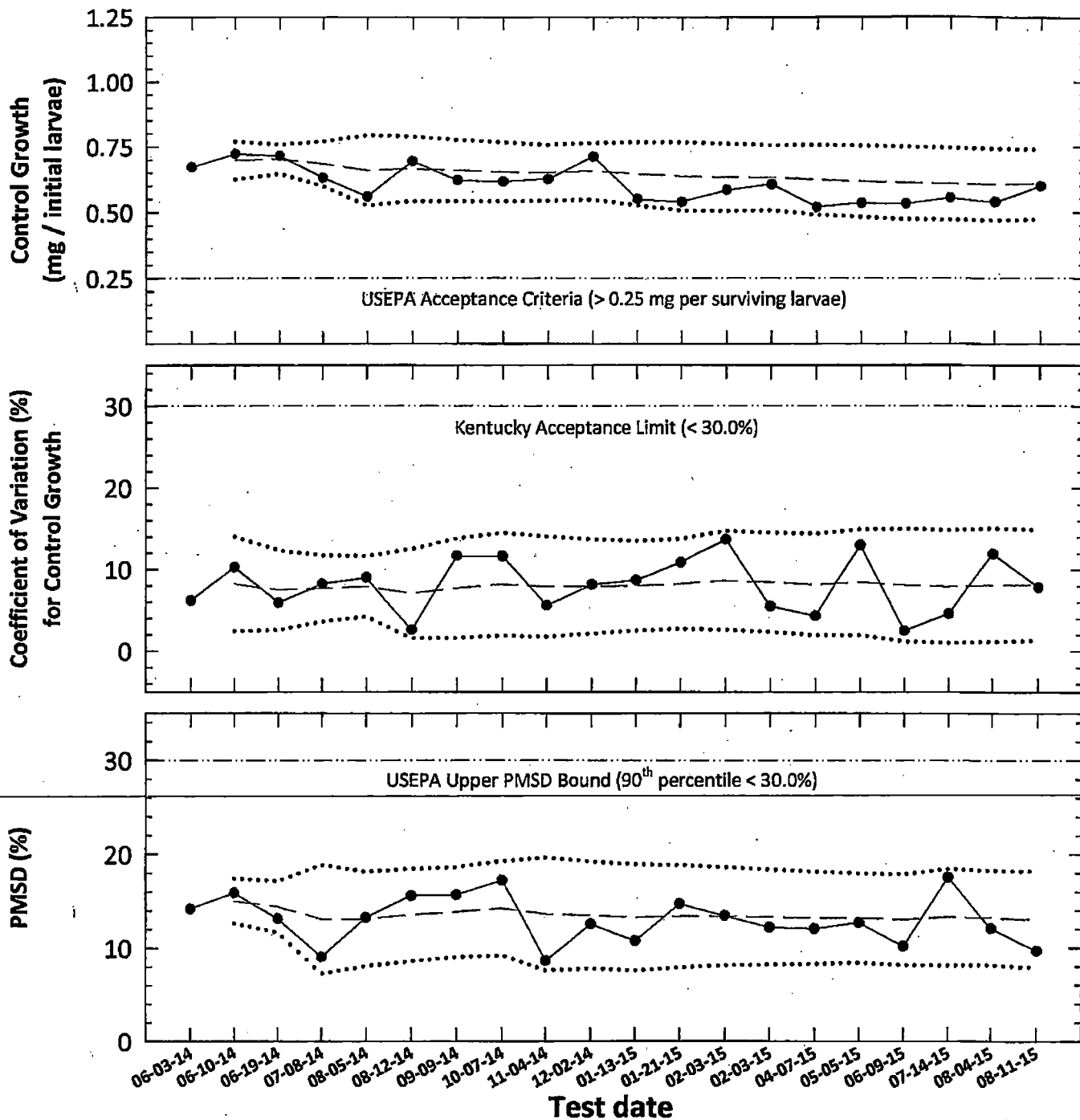
S_{A,75} = Standard deviation corresponding to the 75th percentile CV. (S_{A,75} = 0.38)

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

CV = Coefficient of variation of the IC₂₅ values.

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

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 \pm 2 Standard Deviations)





Precision of Endpoint Measurements

Pimephales promelas Chronic Reference Toxicant Data

| Test number | Test date | Control Survival | Control Mean Growth | CT | CV | CT | MSD | PMSD | CT |
|-------------|-----------|------------------|---------------------|--------------------------------|------|---------------------------|------|------|--------------|
| | | (%) | (mg/larvae) | for Control Growth (mg/larvae) | (%) | for Control Growth CV (%) | | (%) | for PMSD (%) |
| 1 | 06-03-14 | 100 | 0.672 | | 6.2 | | 0.10 | 14.2 | |
| 2 | 06-10-14 | 100 | 0.723 | 0.697 | 10.3 | 8.2 | 0.11 | 15.9 | 15.0 |
| 3 | 06-19-14 | 100 | 0.715 | 0.703 | 5.9 | 7.5 | 0.09 | 13.2 | 14.4 |
| 4 | 07-08-14 | 100 | 0.631 | 0.685 | 8.3 | 7.7 | 0.06 | 9.0 | 13.1 |
| 5 | 08-05-14 | 100 | 0.560 | 0.660 | 9.0 | 7.9 | 0.07 | 13.3 | 13.1 |
| 6 | 08-12-14 | 100 | 0.694 | 0.666 | 2.6 | 7.0 | 0.11 | 15.6 | 13.5 |
| 7 | 09-09-14 | 100 | 0.622 | 0.660 | 11.7 | 7.7 | 0.10 | 15.7 | 13.8 |
| 8 | 10-07-14 | 100 | 0.617 | 0.654 | 11.6 | 8.2 | 0.11 | 17.2 | 14.2 |
| 9 | 11-04-14 | 100 | 0.627 | 0.651 | 5.6 | 7.9 | 0.05 | 8.6 | 13.6 |
| 10 | 12-02-14 | 100 | 0.712 | 0.657 | 8.2 | 7.9 | 0.09 | 12.6 | 13.5 |
| 11 | 01-13-15 | 100 | 0.551 | 0.648 | 8.7 | 8.0 | 0.06 | 10.8 | 13.3 |
| 12 | 01-21-15 | 100 | 0.540 | 0.639 | 10.9 | 8.2 | 0.08 | 14.7 | 13.4 |
| 13 | 02-03-15 | 100 | 0.585 | 0.635 | 13.7 | 8.7 | 0.08 | 13.5 | 13.4 |
| 14 | 02-03-15 | 100 | 0.607 | 0.633 | 5.5 | 8.4 | 0.07 | 12.2 | 13.3 |
| 15 | 04-07-15 | 100 | 0.520 | 0.625 | 4.3 | 8.2 | 0.06 | 12.1 | 13.2 |
| 16 | 05-05-15 | 97.5 | 0.536 | 0.620 | 13.0 | 8.5 | 0.07 | 12.7 | 13.2 |
| 17 | 06-09-15 | 100 | 0.534 | 0.615 | 2.5 | 8.1 | 0.05 | 10.2 | 13.0 |
| 18 | 07-14-15 | 100 | 0.556 | 0.611 | 4.6 | 7.9 | 0.10 | 17.5 | 13.3 |
| 19 | 08-04-15 | 100 | 0.539 | 0.607 | 11.9 | 8.1 | 0.07 | 12.1 | 13.2 |
| 20 | 08-11-15 | 100 | 0.600 | 0.607 | 7.8 | 8.1 | 0.06 | 9.7 | 13.0 |

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 Tendency (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.



Potassium Chloride Chronic Reference Toxicant Test

(EPA-821-R-02-013 Method 1000.0)

Species: *Pimephales promelas*

PpKClCR Test Number: 304

| Dilution preparation information: | | | | | | | Comments: |
|-----------------------------------|------|------|--|------|------|------|-----------|
| KCl Stock INSS number: | | | INSS 1400 | | | | |
| Stock preparation: | | | 50 g KCl/L: Dissolve 50 g KCl in 1-L Milli-Q water. | | | | |
| Dilution prep (mg/L) | 300 | 450 | 600 | 750 | 900 | 1050 | |
| Stock volume (mL) | 6 | 9 | 12 | 15 | 18 | 21 | |
| Diluent volume (mL) | 994 | 991 | 988 | 985 | 982 | 979 | |
| Total volume (mL) | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | |

| Test organism information: | | Test information: | |
|---|-------------------------|--|---------------|
| Organism age: | 18 to 19 hours old | Randomizing template: | BWJ |
| Date and times organisms were born between: | 08-10-15 1600-1700 | Incubator number and shelf location: | 3B |
| Organism source: | ATOX Batch Pp: 08-10-15 | Artemia CHM number: | CHM836 |
| Transfer vessel information: | | Drying information for weight determination: | |
| Average transfer volume: | | Date / Time in oven: | 08-18-15 1040 |
| | | Initial oven temperature: | 60°C |
| | | Date / Time out of oven: | 08-19-15 1040 |
| | | 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 | 08-11-15 | 0730 | J | 1530 | J | 1100 | J | 08-09-15 |
| 1 | 08-12-15 | 0730 | J | 1330 | J | 1000 | J | 08-09-15 |
| 2 | 08-13-15 | 0730 | J | 1330 | J | 1000 | J | 08-10-15 A |
| 3 | 08-14-15 | 0715 | J | 1315 | J | 1000 | J | 08-10-15 A |
| 4 | 08-15-15 | 0805 | J | 1405 | J | 1008 | J | 08-10-15 B |
| 5 | 08-16-15 | 0805 | J | 1405 | J | 1005 | J | 08-10-15 B |
| 6 | 08-17-15 | 0745 | J | 1345 | J | 1000 | J | 08-10-15 B |
| 7 | 08-18-15 | | | | | 1000 | J | |

| Control information: | | Acceptance criteria | Summary of test endpoints: | |
|--------------------------------------|-------|---------------------|----------------------------|-------|
| % Mortality: | 07. | ≤ 20% | 7-day LC ₅₀ | 897.6 |
| Average weight per initial larvae: | 0.600 | | NOEC | 600 |
| Average weight per surviving larvae: | 0.600 | ≥ 0.25 mg/larvae | LOEC | 750 |
| | | | ChV | 670.8 |
| | | | IC ₂₅ | 811.6 |

Species: Pimephales promelas

PpKCICR Test Number: 304

Survival and Growth Data

| Day | Control | | | | 300 mg KCl/L | | | | 450 mg KCl/L | | | |
|--|---------|----|----|----|--------------|----|----|----|--------------|----|----|----|
| | A | B | C | D | E | F | G | H | I | J | K | L |
| 0 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 1 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 2 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 3 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 4 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 5 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 6 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 7 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| A = Pan weight (mg) Tray color code: <u>Light Blue</u> Analyst: <u>ML</u> Date: <u>08-03-15</u> | | | | | | | | | | | | |
| B = Pan + Larvae weight (mg) Analyst: <u>ML</u> Date: <u>08-19-15</u> | | | | | | | | | | | | |
| C = Larvae weight (mg) = B - A | | | | | | | | | | | | |
| Hand calculated. Analyst: <u>ML</u> | | | | | | | | | | | | |
| Weight per initial number of larvae (mg) = C / Initial number of larvae Hand calculated. Analyst: <u>ML</u> | | | | | | | | | | | | |
| Average weight per initial number of larvae (mg) Percent reduction from control (%) | | | | | | | | | | | | |
| 0.600 0.633 -5.67 0.567 5.47 | | | | | | | | | | | | |

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:



Species: *Pimephales promelas*

PpKCICR Test Number: 304

Survival and Growth Data

| Day | 600 mg KCl/L | | | | 750 mg KCl/L | | | | 900 mg KCl/L | | | |
|--|--------------|-----------------|----|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| | M | N | O | P | Q | R | S | T | U | V | W | X |
| 0 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 1 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 8 ^{2d} | 10 | 8 ^{2d} | 10 |
| 2 | 10 | 9 ^{1d} | 10 | 10 | 10 | 10 | 10 | 10 | 8 | 10 | 8 | 10 |
| 3 | 10 | 9 | 10 | 10 | 10 | 10 | 10 | 10 | 8 | 9 ^{1d} | 8 | 10 |
| 4 | 10 | 9 | 10 | 10 | 10 | 10 | 10 | 10 | 8 | 9 | 8 | 10 |
| 5 | 10 | 9 | 10 | 10 | 9 ^{1d} | 9 ^{1d} | 9 ^{1d} | 10 | 8 | 8 ^{1d} | 8 | 9 ^{1d} |
| 6 | 10 | 9 | 10 | 10 | 9 | 9 | 9 | 10 | 8 | 8 | 8 | 9 |
| 7 | 10 | 9 | 10 | 9 ^{1d} | 8 ^{1d} | 8 ^{1d} | 9 | 9 ^{1d} | 5 ^{2d} | 5 ^{2d} | 7 ^{1d} | 6 ^{2d} |
| A = Pan weight (mg) Tray color code: <u>Light Blue</u> Analyst: <u>Me</u> Date: <u>08-03-15</u> | | | | | | | | | | | | |
| B = Pan + Larvae weight (mg) Analyst: <u>AI</u> Date: <u>08-19-15</u> | | | | | | | | | | | | |
| C = Larvae weight (mg) = B - A | | | | | | | | | | | | |
| Hand calculated. Analyst: <u>gh</u> | | | | | | | | | | | | |
| Weight per initial number of larvae (mg) = C / Initial number of larvae Hand calculated. Analyst: <u>gh</u> | | | | | | | | | | | | |
| Average weight per initial number of larvae (mg) Percent reduction from control (%) | | | | | | | | | | | | |
| 0.574 4.37 0.535 10.77 0.357 40.47 | | | | | | | | | | | | |

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:

Species: *Pimephales promelas*

PpKCICR Test Number: 304

Survival and Growth Data

| Day | 1050 mg KCl/L | | | |
|--|-----------------|------------------------------------|-----------------|-----------------|
| | Y | Z | AA | BB |
| 0 | 10 | 10 | 10 | 10 |
| 1 | 6 ^{4d} | 6 ^{4d} | 6 ^{4d} | 8 ^{2d} |
| 2 | 6 | 6 | 6 | 6 ^{2d} |
| 3 | 5 ^{1d} | 5 ^{1d} | 6 | 5 ^{1d} |
| 4 | 4 ^{1d} | 4 ^{1d} | 5 ^{1d} | 5 |
| 5 | 4 | 3 ^{1d} | 4 ^{1d} | 5 |
| 6 | 4 | 3 | 3 ^{1d} | 5 |
| 7 | 2 ^{2d} | 1 ^{1d} 1 ^{1d} | 1 ^{2d} | 1 ^{4d} |
| A = Pan weight (mg) Tray color code: <u>Light Blue</u> Analyst: <u>N6</u> Date: <u>08-03-15</u> | | | | |
| 15.59 15.20 16.89 15.26 | | | | |
| B = Pan + Larvae weight (mg) Analyst: <u>AI</u> Date: <u>08-19-15</u> | | | | |
| 16.49 16.15 17.62 15.92 | | | | |
| C = Larvae weight (mg) = B - A | | | | |
| Hand calculated. <u>Jh</u> Analyst: <u>Jh</u> | | | | |
| 0.90 0.95 0.73 0.66 | | | | |
| Weight per initial number of larvae (mg) = C / Initial number of larvae Hand calculated. <u>Jh</u> Analyst: <u>Jh</u> | | | | |
| 0.090 0.095 0.073 0.066 | | | | |
| Average weight per initial number of larvae (mg) | | Percent reduction from control (%) | | |
| 0.081 | | 86.57 | | |

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

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





Environmental Testing Solutions, Inc.

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

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

Test number: 304

Test dates: August 11-18, 2015

| Concentration (mg/L KO) | Replicate | Initial number of larvae | Final number of larvae | A = Pan weight (mg) | B = Pan + larvae weight (mg) | Larvae weight (mg) = B - A | 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 | 16.05 | 21.47 | 5.37 | 0.537 | 0.600 | 7.8 | 0.537 | 100.0 | 0.600 | 7.8 | Not applicable |
| | B | 10 | 10 | 16.19 | 22.53 | 6.34 | 0.634 | | | 0.634 | | | | |
| | C | 10 | 10 | 16.26 | 22.16 | 5.90 | 0.590 | | | 0.590 | | | | |
| | D | 10 | 10 | 13.43 | 19.80 | 6.37 | 0.637 | | | 0.637 | | | | |
| 300 | E | 10 | 10 | 16.41 | 23.13 | 6.72 | 0.672 | 0.633 | 5.4 | 0.672 | 100.0 | 0.633 | 5.4 | -5.6 |
| | F | 10 | 10 | 16.75 | 23.05 | 6.31 | 0.631 | | | 0.631 | | | | |
| | G | 10 | 10 | 16.12 | 22.01 | 5.89 | 0.589 | | | 0.589 | | | | |
| | H | 10 | 10 | 15.99 | 22.39 | 6.40 | 0.640 | | | 0.640 | | | | |
| 450 | I | 10 | 10 | 16.19 | 22.33 | 6.14 | 0.614 | 0.567 | 5.6 | 0.614 | 100.0 | 0.567 | 5.6 | 5.4 |
| | J | 10 | 10 | 16.33 | 21.86 | 5.53 | 0.553 | | | 0.553 | | | | |
| | K | 10 | 10 | 16.39 | 21.98 | 5.59 | 0.559 | | | 0.559 | | | | |
| | L | 10 | 10 | 15.01 | 20.44 | 5.43 | 0.543 | | | 0.543 | | | | |
| 600 | M | 10 | 10 | 16.70 | 22.37 | 5.67 | 0.567 | 0.605 | 6.0 | 0.567 | 95.0 | 0.574 | 4.7 | 4.3 |
| | N | 10 | 9 | 16.07 | 21.46 | 5.39 | 0.599 | | | 0.539 | | | | |
| | O | 10 | 10 | 15.87 | 21.88 | 6.01 | 0.601 | | | 0.601 | | | | |
| | P | 10 | 9 | 14.24 | 20.13 | 5.89 | 0.654 | | | 0.589 | | | | |
| 750 | Q | 10 | 8 | 15.43 | 20.30 | 4.87 | 0.609 | 0.630 | 3.3 | 0.487 | 85.0 | 0.535 | 7.0 | 10.7 |
| | R | 10 | 8 | 15.57 | 20.82 | 5.25 | 0.656 | | | 0.525 | | | | |
| | S | 10 | 9 | 16.20 | 21.92 | 5.72 | 0.636 | | | 0.572 | | | | |
| | T | 10 | 9 | 14.95 | 20.52 | 5.57 | 0.619 | | | 0.557 | | | | |
| 900 | U | 10 | 5 | 15.84 | 19.31 | 3.47 | 0.694 | 0.628 | 10.2 | 0.347 | 57.5 | 0.357 | 8.7 | 40.4 |
| | V | 10 | 5 | 15.06 | 18.24 | 3.18 | 0.636 | | | 0.318 | | | | |
| | W | 10 | 7 | 16.23 | 20.01 | 3.78 | 0.540 | | | 0.378 | | | | |
| | X | 10 | 6 | 15.77 | 19.63 | 3.86 | 0.643 | | | 0.386 | | | | |
| 1050 | Y | 10 | 2 | 15.59 | 16.49 | 0.90 | 0.450 | 0.698 | 29.5 | 0.090 | 12.5 | 0.081 | 17.0 | 86.5 |
| | Z | 10 | 1 | 15.20 | 16.15 | 0.95 | 0.950 | | | 0.095 | | | | |
| | AA | 10 | 1 | 16.89 | 17.62 | 0.73 | 0.730 | | | 0.073 | | | | |
| | BB | 10 | 1 | 15.26 | 15.92 | 0.66 | 0.660 | | | 0.066 | | | | |

Dunnett's MSD value:

0.0580

MSD =

Minimum Significant Difference

PMSD:

9.7

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: ppkclcr_081115.xlsx

Entered by: J. Sumner

Reviewed by:



Larval Fish Growth and Survival Test-7 Day Survival

Start Date: 8/11/2015 Test ID: PpKICIR Sample ID: REF-Ref Toxicant
 End Date: 8/18/2015 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:

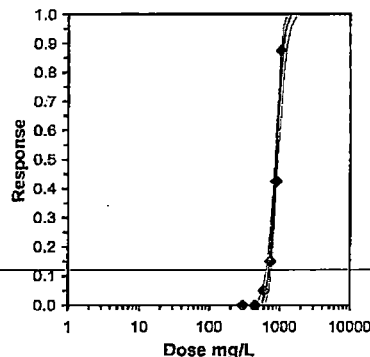
| Conc-mg/L | 1 | 2 | 3 | 4 |
|-----------|--------|--------|--------|--------|
| D-Control | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 300 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 450 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 600 | 1.0000 | 0.9000 | 1.0000 | 0.9000 |
| 750 | 0.8000 | 0.8000 | 0.9000 | 0.9000 |
| 900 | 0.5000 | 0.5000 | 0.7000 | 0.6000 |
| 1050 | 0.2000 | 0.1000 | 0.1000 | 0.1000 |

| Conc-mg/L | Transform: Arcsin Square Root | | | | | | | Rank Sum | 1-Tailed Critical | Number Resp | Total Number |
|-----------|-------------------------------|--------|--------|--------|--------|--------|---|----------|-------------------|-------------|--------------|
| | Mean | N-Mean | Mean | Min | Max | CV% | N | | | | |
| D-Control | 1.0000 | 1.0000 | 1.4120 | 1.4120 | 1.4120 | 0.000 | 4 | | | 0 | 40 |
| 300 | 1.0000 | 1.0000 | 1.4120 | 1.4120 | 1.4120 | 0.000 | 4 | 18.00 | 10.00 | 0 | 40 |
| 450 | 1.0000 | 1.0000 | 1.4120 | 1.4120 | 1.4120 | 0.000 | 4 | 18.00 | 10.00 | 0 | 40 |
| 600 | 0.9500 | 0.9500 | 1.3305 | 1.2490 | 1.4120 | 7.072 | 4 | 14.00 | 10.00 | 2 | 40 |
| *750 | 0.8500 | 0.8500 | 1.1781 | 1.1071 | 1.2490 | 6.954 | 4 | 10.00 | 10.00 | 8 | 40 |
| *900 | 0.5750 | 0.5750 | 0.8820 | 0.7854 | 0.9912 | 11.405 | 4 | 10.00 | 10.00 | 17 | 40 |
| *1050 | 0.1250 | 0.1250 | 0.3572 | 0.3218 | 0.4636 | 19.861 | 4 | 10.00 | 10.00 | 35 | 40 |

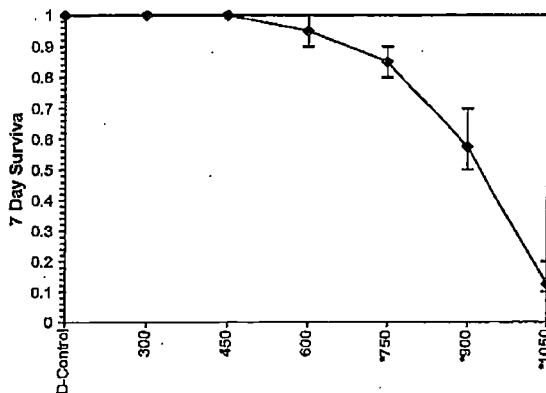
| Auxiliary Tests | Statistic | Critical | Skew | Kurt |
|--|-----------|----------|---------|---------|
| Shapiro-Wilk's Test indicates normal distribution ($p > 0.01$) | 0.9 | 0.896 | 0.47869 | -0.2624 |
| Equality of variance cannot be confirmed | | | | |
| Hypothesis Test (1-tail, 0.05) | NOEC | LOEC | Chv | TU |
| Steel's Many-One Rank Test | 600 | 750 | 670.82 | |
| Treatments vs D-Control | | | | |

| Parameter | Value | SE | 95% Fiducial Limits | | Maximum Likelihood-Probit | | | | | |
|-----------|---------|---------|---------------------|---------|---------------------------|---------|---------|---------|---------|---|
| | | | Control | Chi-Sq | Critical | P-value | Mu | Sigma | Iter | |
| Slope | 11.9904 | 1.7056 | 8.64743 | 15.3334 | 0 | 5.01278 | 9.48773 | 0.28599 | 2.95064 | 3 |
| Intercept | -30.379 | 5.01456 | -40.208 | -20.551 | | | | | | |

| Point | Probits | mg/L | 95% Fiducial Limits |
|-------|---------|---------|---------------------|
| EC01 | 2.674 | 570.98 | 481.206 631.152 |
| EC05 | 3.365 | 650.816 | 574.964 701.582 |
| EC10 | 3.718 | 697.842 | 631.368 743.265 |
| EC15 | 3.984 | 731.476 | 671.845 773.549 |
| EC20 | 4.158 | 759.359 | 705.217 799.222 |
| EC25 | 4.326 | 784.127 | 734.486 822.685 |
| EC40 | 4.747 | 850.177 | 808.951 890.149 |
| EC50 | 5.000 | 892.563 | 852.612 938.541 |
| EC60 | 5.253 | 937.061 | 894.778 993.824 |
| EC75 | 5.674 | 1016.99 | 962.914 1100.54 |
| EC80 | 5.842 | 1049.13 | 989.898 1147.7 |
| EC85 | 6.036 | 1089.12 | 1021.63 1206.03 |
| EC90 | 6.282 | 1141.62 | 1082.27 1284.54 |
| EC95 | 6.645 | 1224.11 | 1124.44 1411.74 |
| EC99 | 7.326 | 1395.26 | 1248.96 1688.08 |



Dose-Response Plot



File: ppkolor_081115.xlsx
 Entered by: J. Suttner
 Reviewed by:



Statistical Analyses

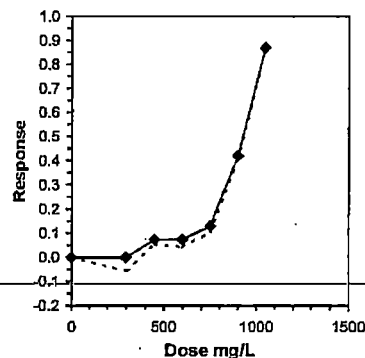
| Larval Fish Growth and Survival Test-7 Day Growth | | | | | |
|---|-----------|-----------|-------------------------|---------------|------------------------|
| Start Date: | 8/11/2015 | Test ID: | PpKICIR | Sample ID: | REF-Ref Toxicant |
| End Date: | 8/18/2015 | Lab ID: | ETS-Envir. Testing Sol. | 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 | 0.5370 | 0.6340 | 0.6900 | 0.6370 |
| 300 | 0.6720 | 0.6310 | 0.5890 | 0.6400 |
| 450 | 0.6140 | 0.5530 | 0.5590 | 0.5430 |
| 600 | 0.5670 | 0.5390 | 0.6010 | 0.5890 |
| 750 | 0.4870 | 0.5250 | 0.5720 | 0.5570 |
| 900 | 0.3470 | 0.3180 | 0.3780 | 0.3880 |
| 1050 | 0.0900 | 0.0950 | 0.0730 | 0.0860 |

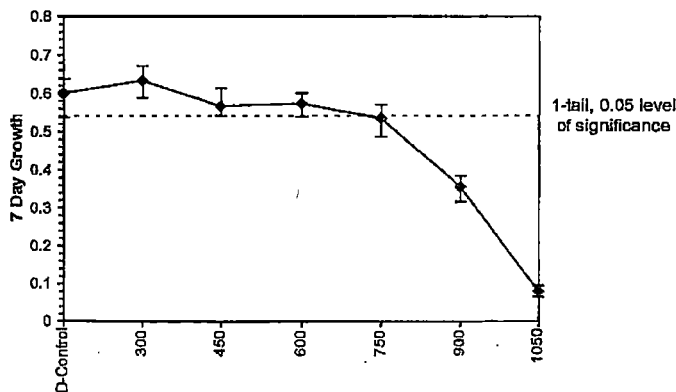
| Conc-mg/L | Mean | N-Mean | Transform: Untransformed | | | | N | 1-Tailed | | | Isotonic | |
|-----------|--------|--------|--------------------------|--------|--------|--------|---|----------|----------|--------|----------|--------|
| | | | Mean | Min | Max | CV% | | t-Stat | Critical | MSD | Mean | N-Mean |
| D-Control | 0.5995 | 1.0000 | 0.5995 | 0.5370 | 0.6370 | 7.820 | 4 | | | | 0.6163 | 1.0000 |
| 300 | 0.6330 | 1.0559 | 0.6330 | 0.5890 | 0.6720 | 5.404 | 4 | -1.324 | 2.290 | 0.0580 | 0.6163 | 1.0000 |
| 450 | 0.5673 | 0.9462 | 0.5673 | 0.5430 | 0.6140 | 5.616 | 4 | 1.274 | 2.290 | 0.0580 | 0.5706 | 0.9260 |
| 600 | 0.5740 | 0.9575 | 0.5740 | 0.5390 | 0.6010 | 4.748 | 4 | 1.007 | 2.290 | 0.0580 | 0.5706 | 0.9260 |
| 750 | 0.5353 | 0.8928 | 0.5353 | 0.4870 | 0.5720 | 7.038 | 4 | | | | 0.5353 | 0.8886 |
| 900 | 0.3573 | 0.5959 | 0.3573 | 0.3180 | 0.3880 | 8.707 | 4 | | | | 0.3573 | 0.5797 |
| 1050 | 0.0810 | 0.1351 | 0.0810 | 0.0660 | 0.0950 | 16.958 | 4 | | | | 0.0810 | 0.1314 |

| Auxiliary Tests | | | | | Statistic | | Critical | Skew | Kurt | | | | | |
|--|--|--|--|--|-----------|------|----------|--------|---------|---------|---------|---------|---------|-------|
| Shapiro-Wilk's Test indicates normal distribution (p > 0.01) | | | | | 0.96241 | | 0.844 | -0.261 | -0.6765 | | | | | |
| Bartlett's Test indicates equal variances (p = 0.83) | | | | | 0.86885 | | 11.3449 | | | | | | | |
| Hypothesis Test (1-tail, 0.05) | | | | | NOEC | LOEC | ChV | TU | MSDu | MSDp | MSB | MSE | F-Prob | df |
| Dunnett's Test | | | | | 600 | >600 | | | 0.05796 | 0.09668 | 0.00355 | 0.00128 | 0.08716 | 3, 12 |
| Treatments vs D-Control | | | | | | | | | | | | | | |

| Linear Interpolation (200 Resamples) | | | | | |
|--------------------------------------|--------|-------|-------------|--------|---------|
| Point | mg/L | SD | 95% CL(Exp) | Skew | |
| IC05 | 401.30 | 89.61 | 339.92 | 815.13 | 1.6308 |
| IC10 | 667.84 | 98.87 | 286.82 | 820.20 | -0.9283 |
| IC15 | 759.64 | 27.79 | 625.04 | 801.91 | -1.3380 |
| IC20 | 785.60 | 14.63 | 735.32 | 823.90 | -0.5965 |
| IC25 | 811.57 | 12.60 | 770.97 | 847.30 | -0.2674 |
| IC40 | 889.47 | 10.93 | 858.23 | 920.03 | -0.1488 |
| IC50 | 928.67 | 6.78 | 904.09 | 948.21 | -0.3354 |



Dose-Response Plot



Independent
Review by
Kelsey E. Keenan:

File: ppkicir_081115.xlsx
Entered by: J. Seigner
Reviewed by:

Species: Pimephales promelas

PpKCICR Test Number: 304

Daily Chemistry:

| | | Day (Analyst identified for each day, performed pH, D.O. and conductivity measurements only.) | | | | | |
|---------------|---------------------------------------|--|-------|---------|-------|---------|-------|
| | | 0 | | 1 | | 2 | |
| | | Analyst | | | | | |
| Concentration | Parameter | AN | N6 | N6 | N6 | N6 | N |
| CONTROL | pH (S.U.) | 7.77 | 7.43 | 7.63 | 7.46 | 7.70 | 7.52 |
| | DO (mg/L) | 7.8 | 7.8 | 7.9 | 7.9 | 7.8 | 7.4 |
| | Conductivity (µmhos/cm) | 323 | | 307 | | 305 | |
| | *Alkalinity (mg CaCO ₃ /L) | 59 | | | | 61 | |
| | *Hardness (mg CaCO ₃ /L) | 86 | | | | 84 | |
| | *Temperature (°C) | 24.8 | 24.6 | 24.8 | 24.5 | 24.7 | 24.4 |
| 300 mg KCl/L | pH (S.U.) | 7.74 | 7.56 | 7.92 | 7.55 | 7.76 | 7.41 |
| | DO (mg/L) | 7.8 | 7.8 | 7.9 | 7.9 | 7.8 | 7.3 |
| | Conductivity (µmhos/cm) | 897 | | 845 | | 868 | |
| | *Temperature (°C) | 24.8 | 24.5 | 24.9 | 24.7 | 24.7 | 24.6 |
| 450 mg KCl/L | pH (S.U.) | 7.74 | 7.61 | 7.86 | 7.56 | 7.78 | 7.45 |
| | DO (mg/L) | 7.8 | 7.8 | 7.9 | 7.9 | 7.8 | 7.2 |
| | Conductivity (µmhos/cm) | 1170 | | 1110 | | 1130 | |
| | *Temperature (°C) | 24.8 | 24.5 | 24.9 | 24.3 | 24.7 | 24.6 |
| 600 mg KCl/L | pH (S.U.) | 7.73 | 7.59 | 7.85 | 7.55 | 7.79 | 7.49 |
| | DO (mg/L) | 7.8 | 7.8 | 7.9 | 7.9 | 7.8 | 7.2 |
| | Conductivity (µmhos/cm) | 1390 | | 1390 | | 1400 | |
| | *Temperature (°C) | 24.8 | 24.3 | 24.9 | 24.3 | 24.7 | 24.6 |
| 750 mg KCl/L | pH (S.U.) | 7.73 | 7.62 | 7.88 | 7.52 | 7.80 | 7.47 |
| | DO (mg/L) | 7.8 | 7.8 | 7.9 | 7.9 | 7.9 | 7.1 |
| | Conductivity (µmhos/cm) | 1700 | | 1620 | | 1680 | |
| | *Temperature (°C) | 24.7 | 24.3 | 24.9 | 24.6 | 24.7 | 24.4 |
| 900 mg KCl/L | pH (S.U.) | 7.74 | 7.60 | 7.89 | 7.52 | 7.81 | 7.45 |
| | DO (mg/L) | 7.9 | 7.8 | 8.0 | 8.0 | 7.9 | 7.2 |
| | Conductivity (µmhos/cm) | 1940 | | 1860 | | 1960 | |
| | *Temperature (°C) | 24.8 | 24.2 | 24.9 | 24.6 | 24.7 | 24.4 |
| 1050 mg KCl/L | pH (S.U.) | 7.73 | 7.70 | 7.89 | 7.61 | 7.81 | 7.45 |
| | DO (mg/L) | 7.9 | 7.9 | 8.0 | 8.0 | 7.9 | 7.3 |
| | Conductivity (µmhos/cm) | 2200 | | 2160 | | 2200 | |
| | *Temperature (°C) | 24.8 | 24.4 | 24.9 | 24.6 | 24.7 | 24.2 |
| | | Initial | Final | Initial | Final | Initial | Final |

*Temperatures performed at the time of test initiation, renewal or termination by the analyst identified in the Daily Renewal Information table located on Page 1.
Alkalinity and hardness performed by the analyst identified on the bench sheet specific for each analysis and transcribed to this bench sheet by: AL

Indep
Review by
Valley E. Kananah
N

Species: Pimephales promelas

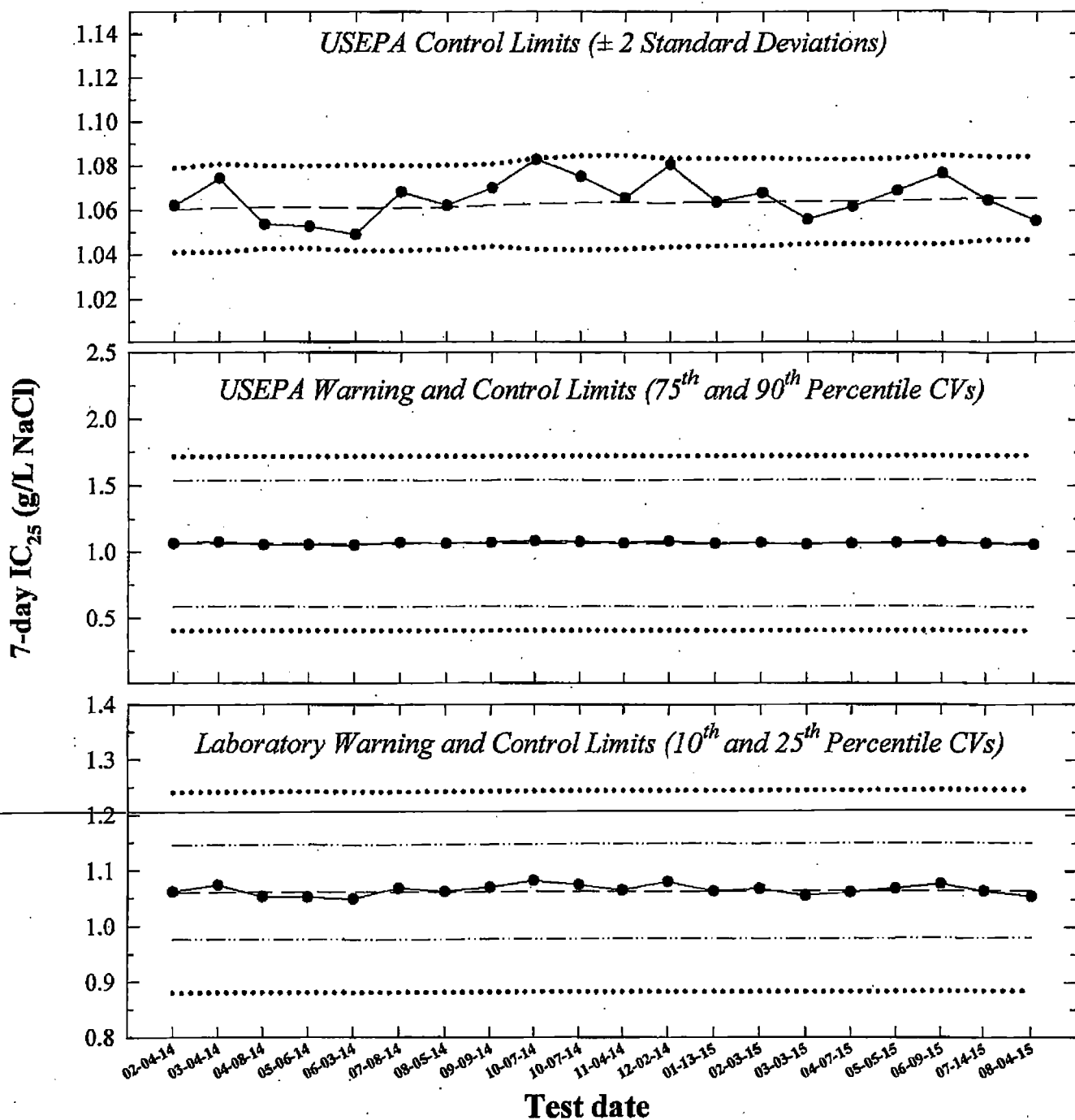
PpKCICR Test Number: 304

| Analyst | | Day (Analyst identified for each day, performed pH, D.O. and conductivity measurements only.) | | | | | | | |
|---------------|---------------------------------------|--|-------|---------|-------|---------------------|-------|---------------------|-------|
| | | 3 | | 4 | | 5 | | 6 | |
| | | N | N6 | N6 | N6 | N6 | N6 | N6 | AL |
| Concentration | Parameter | | | | | | | | |
| CONTROL | pH (S.U.) | 7.90 | 7.41 | 7.68 | 7.39 | 7.71 | 7.67 | 7.75 | 7.43 |
| | DO (mg/L) | 7.6 | 7.9 | 7.8 | 7.9 | 7.9 | 7.8 | 7.7 | 7.0 |
| | Conductivity (µmhos/cm) | 317 | | 326 | | 327 | | 318 | |
| | *Alkalinity (mg CaCO ₃ /L) | not done | | 61 | | not done | | not done | |
| | *Hardness (mg CaCO ₃ /L) | | | 88 | | | | | |
| | *Temperature (°C) | 24.7 | 24.4 | 24.8 | 24.3 | 24.7 | 24.6 | 24.8 | 24.3 |
| 300 mg KCl/L | pH (S.U.) | 7.91 | 7.74 | 7.70 | 7.44 | 7.78 | 7.65 | 7.75 | 7.41 |
| | DO (mg/L) | 7.6 | 7.9 | 7.8 | 7.9 | 7.9 | 7.8 | 7.7 | 7.0 |
| | Conductivity (µmhos/cm) | 836 | | 850 | | 830 | | 859 | |
| | *Temperature (°C) | 24.8 | 24.7 | 24.8 | 24.4 | 24.8 | 24.6 | 24.8 | 24.5 |
| 450 mg KCl/L | pH (S.U.) | 7.91 | 7.71 | 7.72 | 7.42 | 7.81 | 7.66 | 7.78 | 7.45 |
| | DO (mg/L) | 7.6 | 7.8 | 7.8 | 8.0 | 7.9 | 7.8 | 7.7 | 7.1 |
| | Conductivity (µmhos/cm) | 1090 | | 1120 | | 1090 | | 1136 | |
| | *Temperature (°C) | 24.8 | 24.7 | 24.8 | 24.4 | 24.7 | 24.4 | 24.8 | 24.5 |
| 600 mg KCl/L | pH (S.U.) | 7.89 | 7.44 | 7.74 | 7.47 | 7.83 | 7.67 | 7.79 | 7.46 |
| | DO (mg/L) | 7.6 | 7.9 | 7.8 | 8.0 | 7.9 | 7.8 | 7.7 | 7.2 |
| | Conductivity (µmhos/cm) | 1340 | | 1390 | | 1360 | | 1390 | |
| | *Temperature (°C) | 24.8 | 24.5 | 24.8 | 24.2 | 24.7 | 24.2 | 24.9 | 24.6 |
| 750 mg KCl/L | pH (S.U.) | 7.88 | 7.44 | 7.75 | 7.49 | 7.84 | 7.68 | 7.81 | 7.42 |
| | DO (mg/L) | 7.7 | 8.0 | 7.9 | 8.0 | 7.9 | 7.8 | 7.7 | 7.2 |
| | Conductivity (µmhos/cm) | 1610 | | 1650 | | 1640 | | 1640 | |
| | *Temperature (°C) | 24.9 | 24.5 | 24.8 | 24.4 | 24.8 | 24.6 | 24.9 | 24.5 |
| 900 mg KCl/L | pH (S.U.) | 7.88 | 7.45 | 7.77 | 7.46 | 7.81 | 7.66 | 7.82 | 7.39 |
| | DO (mg/L) | 7.7 | 8.0 | 7.9 | 8.0 | 7.9 | 7.8 | 7.7 | 7.1 |
| | Conductivity (µmhos/cm) | 1870 | | 1890 | | 1860 | | 1910 | |
| | *Temperature (°C) | 24.9 | 24.3 | 24.8 | 24.4 | 24.8 | 24.6 | 24.9 | 24.7 |
| 1050 mg KCl/L | pH (S.U.) | 7.86 | 7.45 | 7.76 | 7.47 | 7.82 | 7.70 | 7.82 | 7.41 |
| | DO (mg/L) | 7.8 | 8.0 | 7.9 | 8.1 | 7.9 | 7.9 | 7.7 | 7.1 |
| | Conductivity (µmhos/cm) | 2090 | | 2170 | | 2110 | | 2120 | |
| | *Temperature (°C) | 25.0 | 24.5 | 24.8 | 24.4 | 24.7 | 24.4 | 25.0 | 24.6 |
| | | Initial | Final | Initial | Final | Initial | Final | Initial | Final |



Temperatures performed at the time of test initiation, renewal or termination by the analyst identified in the Daily Renewal Information table located on Page 1.
Alkalinity and hardness performed by the analyst identified on the bench sheet specific for each analysis and transcribed to this bench sheet by: AL

Ceriodaphnia dubia
Chronic Reference Toxicant Control Chart



- 7-day IC₂₅ = 25% inhibition concentration. An estimation of the concentration of sodium chloride that would cause a 25% reduction in *Ceriodaphnia* reproduction for the test population.
- Central Tendency (mean IC₂₅)
- Warning Limits (mean IC₂₅ \pm S_{A.10} or S_{A.75})
- Control Limits (mean IC₂₅ \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:



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 | | S _{A,10} | Laboratory | | S _{A,25} | Laboratory | | S _{A,75} | USEPA | | S _{A,90} | USEPA | | CV |
|-------------|-----------|--------------------------------------|------------------|------|-----------------|---------|-------------------|------------------------|------------------------|-------------------|------------------------|------------------------|-------------------|------------------------|------------------------|-------------------|------------------------|------------------------|------|
| | | | | | Control Limits | | | Warning Limits | | | Control Limits | | | Warning Limits | | | Control Limits | | |
| | | | | | CT - 2S | CT + 2S | | CT - S _{A,10} | CT + S _{A,10} | | CT - S _{A,25} | CT + S _{A,25} | | CT - S _{A,75} | CT + S _{A,75} | | CT - S _{A,90} | CT + S _{A,90} | |
| 1 | 02-04-14 | 1.06 | 1.06 | 0.01 | 1.04 | 1.08 | 0.08 | 0.98 | 1.14 | 0.18 | 0.88 | 1.24 | 0.48 | 0.58 | 1.54 | 0.66 | 0.40 | 1.72 | 0.01 |
| 2 | 03-04-14 | 1.07 | 1.06 | 0.01 | 1.04 | 1.08 | 0.08 | 0.98 | 1.15 | 0.18 | 0.88 | 1.24 | 0.48 | 0.58 | 1.54 | 0.66 | 0.40 | 1.72 | 0.01 |
| 3 | 04-08-14 | 1.05 | 1.06 | 0.01 | 1.04 | 1.08 | 0.08 | 0.98 | 1.15 | 0.18 | 0.88 | 1.24 | 0.48 | 0.58 | 1.54 | 0.66 | 0.40 | 1.72 | 0.01 |
| 4 | 05-06-14 | 1.05 | 1.06 | 0.01 | 1.04 | 1.08 | 0.08 | 0.98 | 1.15 | 0.18 | 0.88 | 1.24 | 0.48 | 0.58 | 1.54 | 0.66 | 0.40 | 1.72 | 0.01 |
| 5 | 06-03-14 | 1.05 | 1.06 | 0.01 | 1.04 | 1.08 | 0.08 | 0.98 | 1.15 | 0.18 | 0.88 | 1.24 | 0.48 | 0.58 | 1.54 | 0.66 | 0.40 | 1.72 | 0.01 |
| 6 | 07-08-14 | 1.07 | 1.06 | 0.01 | 1.04 | 1.08 | 0.08 | 0.98 | 1.15 | 0.18 | 0.88 | 1.24 | 0.48 | 0.58 | 1.54 | 0.66 | 0.40 | 1.72 | 0.01 |
| 7 | 08-05-14 | 1.06 | 1.06 | 0.01 | 1.04 | 1.08 | 0.08 | 0.98 | 1.15 | 0.18 | 0.88 | 1.24 | 0.48 | 0.58 | 1.54 | 0.66 | 0.40 | 1.72 | 0.01 |
| 8 | 09-09-14 | 1.07 | 1.06 | 0.01 | 1.04 | 1.08 | 0.08 | 0.98 | 1.15 | 0.18 | 0.88 | 1.24 | 0.48 | 0.58 | 1.54 | 0.66 | 0.40 | 1.72 | 0.01 |
| 9 | 10-07-14 | 1.08 | 1.06 | 0.01 | 1.04 | 1.08 | 0.09 | 0.98 | 1.15 | 0.18 | 0.88 | 1.24 | 0.48 | 0.58 | 1.54 | 0.66 | 0.40 | 1.72 | 0.01 |
| 10 | 10-07-14 | 1.08 | 1.06 | 0.01 | 1.04 | 1.08 | 0.09 | 0.98 | 1.15 | 0.18 | 0.88 | 1.24 | 0.48 | 0.58 | 1.54 | 0.66 | 0.40 | 1.72 | 0.01 |
| 11 | 11-04-14 | 1.07 | 1.06 | 0.01 | 1.04 | 1.08 | 0.09 | 0.98 | 1.15 | 0.18 | 0.88 | 1.24 | 0.48 | 0.58 | 1.54 | 0.66 | 0.40 | 1.72 | 0.01 |
| 12 | 12-02-14 | 1.08 | 1.06 | 0.01 | 1.04 | 1.08 | 0.09 | 0.98 | 1.15 | 0.18 | 0.88 | 1.24 | 0.48 | 0.58 | 1.54 | 0.66 | 0.40 | 1.72 | 0.01 |
| 13 | 01-13-15 | 1.06 | 1.06 | 0.01 | 1.04 | 1.08 | 0.09 | 0.98 | 1.15 | 0.18 | 0.88 | 1.24 | 0.48 | 0.58 | 1.54 | 0.66 | 0.40 | 1.72 | 0.01 |
| 14 | 02-03-15 | 1.07 | 1.06 | 0.01 | 1.04 | 1.08 | 0.09 | 0.98 | 1.15 | 0.18 | 0.88 | 1.24 | 0.48 | 0.59 | 1.54 | 0.66 | 0.40 | 1.72 | 0.01 |
| 15 | 03-03-15 | 1.06 | 1.06 | 0.01 | 1.04 | 1.08 | 0.09 | 0.98 | 1.15 | 0.18 | 0.88 | 1.24 | 0.48 | 0.59 | 1.54 | 0.66 | 0.40 | 1.72 | 0.01 |
| 16 | 04-07-15 | 1.06 | 1.06 | 0.01 | 1.04 | 1.08 | 0.09 | 0.98 | 1.15 | 0.18 | 0.88 | 1.24 | 0.48 | 0.59 | 1.54 | 0.66 | 0.40 | 1.72 | 0.01 |
| 17 | 05-05-15 | 1.07 | 1.06 | 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 | 1.72 | 0.01 |
| 18 | 06-09-15 | 1.08 | 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 | 07-14-15 | 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 | 1.54 | 0.66 | 0.40 | 1.73 | 0.01 |
| 20 | 08-04-15 | 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 |

Note: 7-d IC₂₅ = 7-day 25% inhibition concentration. An estimation of the concentration of sodium chloride that would cause a 25% reduction in *Ceriodaphnia* reproduction for the test population.

CT = Central tendency (mean IC₂₅).

S = Standard deviation of the IC₂₅ values.

Laboratory Control and Warning Limits

Laboratory control and warning limits were established using the standard deviation of the IC₂₅ 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

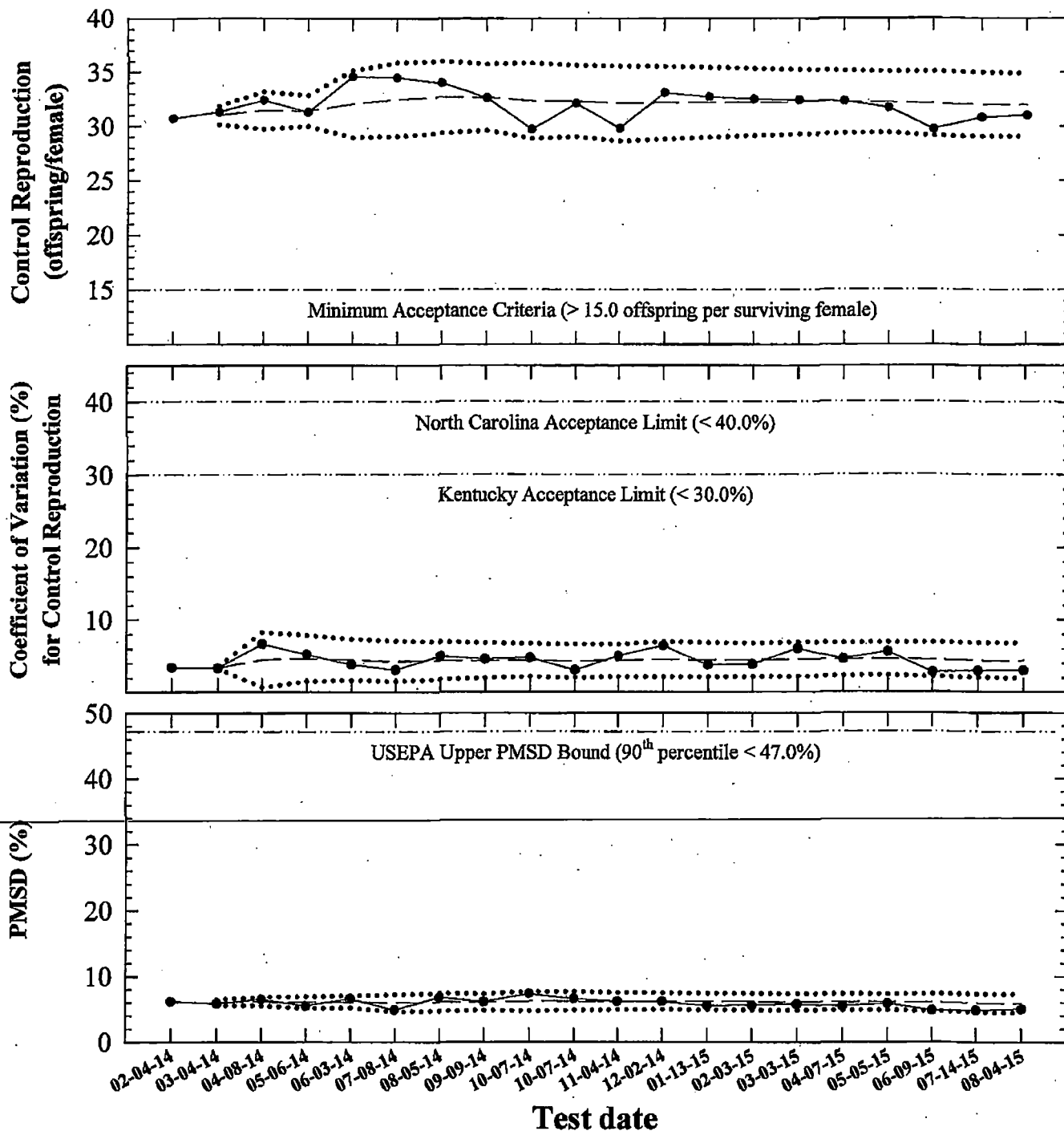
S_{A,75} = Standard deviation corresponding to the 75th percentile CV. (S_{A,75} = 0.45)

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

CV = Coefficient of variation of the IC₂₅ values.

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

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 \pm 2 Standard Deviations)





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 | 02-04-14 | 100 | 30.7 | | 3.5 | | 1.9 | 6.2 | |
| 2 | 03-04-14 | 100 | 31.3 | 31.0 | 3.4 | 3.4 | 1.8 | 5.9 | 6.0 |
| 3 | 04-08-14 | 100 | 32.4 | 31.5 | 6.7 | 4.5 | 2.1 | 6.5 | 6.2 |
| 4 | 05-06-14 | 100 | 31.3 | 31.4 | 5.2 | 4.7 | 1.7 | 5.5 | 6.0 |
| 5 | 06-03-14 | 100 | 34.6 | 32.1 | 3.9 | 4.5 | 2.3 | 6.6 | 6.1 |
| 6 | 07-08-14 | 100 | 34.5 | 32.5 | 3.1 | 4.3 | 1.7 | 4.9 | 5.9 |
| 7 | 08-05-14 | 100 | 34.0 | 32.7 | 5.0 | 4.4 | 2.3 | 6.8 | 6.0 |
| 8 | 09-09-14 | 100 | 32.6 | 32.7 | 4.6 | 4.4 | 2.0 | 6.1 | 6.1 |
| 9 | 10-07-14 | 100 | 29.7 | 32.3 | 4.8 | 4.5 | 2.2 | 7.4 | 6.2 |
| 10 | 10-07-14 | 100 | 32.1 | 32.3 | 3.1 | 4.3 | 2.1 | 6.6 | 6.2 |
| 11 | 11-04-14 | 100 | 29.8 | 32.1 | 5.0 | 4.4 | 1.8 | 6.2 | 6.2 |
| 12 | 12-02-14 | 100 | 33.1 | 32.2 | 6.4 | 4.6 | 2.0 | 6.2 | 6.2 |
| 13 | 01-13-15 | 100 | 32.7 | 32.2 | 3.8 | 4.5 | 1.8 | 5.6 | 6.2 |
| 14 | 02-03-15 | 100 | 32.5 | 32.2 | 3.9 | 4.5 | 1.8 | 5.6 | 6.1 |
| 15 | 03-03-15 | 100 | 32.4 | 32.2 | 6.0 | 4.6 | 1.9 | 5.8 | 6.1 |
| 16 | 04-07-15 | 100 | 32.3 | 32.3 | 4.6 | 4.6 | 1.8 | 5.5 | 6.1 |
| 17 | 05-05-15 | 100 | 31.7 | 32.2 | 5.6 | 4.6 | 1.8 | 5.8 | 6.1 |
| 18 | 06-09-15 | 100 | 29.7 | 32.1 | 2.8 | 4.5 | 1.4 | 4.8 | 6.0 |
| 19 | 07-14-15 | 100 | 30.8 | 32.0 | 3.0 | 4.4 | 1.5 | 4.8 | 5.9 |
| 20 | 08-04-15 | 100 | 31.0 | 32.0 | 3.0 | 4.4 | 1.6 | 5.0 | 5.9 |

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 Tendency (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.



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

Species: Ceriodaphnia dubia

CdNaCICR #: 177

| Dilution preparation information: | | | | | Comments: |
|--|------|--|------|------|------------------|
| NaCl Stock INSS number: | | INSS <u>0385</u> | | | |
| 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: | | RED | |
| Date and times organisms were born between: | | | | 08-04-15 0645 TO 0915 | | | | | | | Incubator number and shelf location: | | 2B1 | |
| Culture board: | | 07-28-15 A | | | | | | | | | YWT batch: | | 07-29-15 | |
| Replicate number: | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | | | | 10 |
| Culture board cup number: | | 2 | 4 | 7 | 9 | 10 | 12 | 18 | 22 | 27 | | | | 28 |
| Transfer vessel information: | | | | pH = 7.88 S.U. Temperature = 24.8°C | | | | | | | Selenastrum batch: | | 07-22-15 | |
| Average transfer volume (mL): | | 0.0121 mL | | | | | | | | | | | | |

Daily renewal information:

| Day | Date | Test initiation and feeding, renewal and feeding, or termination time | MHSW batch used | Analyst |
|-----|----------|---|------------------|-----------|
| 0 | 08-04-15 | <u>0935</u> | <u>07-30-15A</u> | <u>JK</u> |
| 1 | 08-05-15 | <u>0835</u> | <u>07-30-15A</u> | <u>JK</u> |
| 2 | 08-06-15 | <u>0836</u> | <u>07-30-15B</u> | <u>JK</u> |
| 3 | 08-07-15 | <u>0835</u> | <u>07-30-15B</u> | <u>JK</u> |
| 4 | 08-08-15 | <u>0850</u> | <u>08-04-15</u> | <u>JK</u> |
| 5 | 08-09-15 | <u>0835</u> | <u>08-04-15</u> | <u>JK</u> |
| 6 | 08-10-15 | <u>0835</u> | <u>08-04-15</u> | <u>JK</u> |
| 7 | 08-11-15 | <u>0835</u> | | <u>JK</u> |

| Control information: | | Acceptance criteria | Summary of test endpoints: | |
|---|--------------|-------------------------|-----------------------------------|-----------------|
| % of Male Adults: | <u>07.</u> | ≤ 20% | 7-day LC ₅₀ | <u>>1400</u> |
| % Adults having 3 rd Broods: | <u>1007.</u> | ≥ 80% | NOEC | <u>800</u> |
| % Mortality: | <u>07.</u> | ≤ 20% | LOEC | <u>1000</u> |
| Mean Offspring/Female: | <u>31.0</u> | ≥ 15.0 offspring/female | ChV | <u>894.4</u> |
| % CV: | <u>3.07.</u> | < 40.0 % | IC ₂₅ | <u>1055.4</u> |



Species: Ceriodaphnia dubia

CdNaClCR #: 177

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 | 3 | 4 | 4 | 5 | 4 | 3 | 4 | 4 | 4 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 5 | Young produced | 12 | 12 | 13 | 10 | 12 | 11 | 13 | 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 | 16 | 15 | 15 | 17 | 14 | 15 | 14 | 17 | 15 | 15 |
| Total young produced | | 32 | 30 | 32 | 31 | 31 | 30 | 30 | 32 | 30 | 32 |
| Final Adult Mortality | | L | L | L | L | L | L | L | L | L | L |
| X for 3 rd Broods | | X | X | X | X | X | X | X | X | X | X |

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: | 31.0 |

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 | 5 | 4 | 4 | 5 | 3 | 5 | 4 | 4 | 4 | 4 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 5 | Young produced | 12 | 12 | 13 | 12 | 13 | 11 | 11 | 12 | 13 | 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 | 15 | 16 | 14 | 16 | 15 | 15 | 17 | 15 |
| Total young produced | | 34 | 33 | 32 | 33 | 30 | 32 | 30 | 31 | 34 | 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: | 31.9 |
| % Reduction from Control: | -2.9% |



Species: Ceriodaphnia dubia
800 mg NaCl/L

CdNaClCR #: 177

Survival and Reproduction Data

| Day | | Replicate number | | | | | | | | | |
|-----------------------|-----------------|------------------|----|----|----|----|----|----|----|----|----|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1 | Young produced | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 2 | Young produced | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 3 | Young produced | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 4 | Young produced | 5 | 4 | 4 | 3 | 4 | 5 | 4 | 4 | 4 | 4 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 5 | Young produced | 12 | 12 | 12 | 11 | 10 | 13 | 12 | 10 | 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 | 16 | 17 | 14 | 14 | 15 | 14 | 17 | 15 | 15 | 15 |
| Total young produced | | 33 | 33 | 30 | 28 | 29 | 32 | 35 | 29 | 31 | 31 |
| 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: | 07. |
| Mean Offspring/Female: | 30.9 |
| % Reduction from Control: | 0.37. |

1000 mg NaCl/L

Survival and Reproduction Data

| Day | | Replicate number | | | | | | | | | |
|-----------------------|-----------------|------------------|----|----|----|----|----|----|----|----|----|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1 | Young produced | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 2 | Young produced | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 3 | Young produced | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 4 | Young produced | 4 | 3 | 4 | 4 | 5 | 4 | 5 | 5 | 4 | 4 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 5 | Young produced | 10 | 10 | 11 | 13 | 10 | 12 | 13 | 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 | 14 | 14 | 16 | 13 | 16 | 14 | 12 | 15 | 13 | 14 |
| Total young produced | | 28 | 27 | 31 | 30 | 31 | 30 | 30 | 30 | 27 | 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: | 07. |
| Mean Offspring/Female: | 29.4 |
| % Reduction from Control: | 5.27. |



Species: Ceriodaphnia dubia
1200 mg NaCl/L

CdNaCICR #: 177

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 | 5 | 3 | 2 | 4 | 2 | 3 | 3 | 3 | 2 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 5 | Young produced | 5 | 4 | 2 | 0 | 3 | 0 | 0 | 3 | 6 | 0 |
| | 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 | 2 | 2 | 5 | 6 | 0 | 4 | 7 | 0 | 0 | 5 |
| Total young produced | | 10 | 11 | 10 | 8 | 7 | 6 | 10 | 6 | 9 | 7 |
| 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: | 07. |
| Mean Offspring/Female: | 2.4 |
| % Reduction from Control: | 72.97. |

1400 mg NaCl/L

Survival and Reproduction Data

| Day | | Replicate number | | | | | | | | | |
|-----------------------|-----------------|------------------|---|---|---|---|---|---|---|---|----|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1 | Young produced | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 2 | Young produced | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 3 | Young produced | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 4 | Young produced | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 |
| | Adult mortality | L | L | L | L | L | L | L | L | L | L |
| 5 | Young produced | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 3 | 0 |
| | 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 | 2 | 1 | 1 | 0 | 0 | 3 | 1 | 1 | 2 | 3 |
| Total young produced | | 2 | 1 | 1 | 2 | 2 | 3 | 2 | 1 | 5 | 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: | 07. |
| Mean Offspring/Female: | 2.2 |
| % Reduction from Control: | 92.97. |





ETS

Environmental Testing Solutions, Inc.

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 | 3 | 4 | 4 | 5 | 4 | 3 | 4 | 4 | 4 | 39 |
| 5 | 12 | 12 | 13 | 10 | 12 | 11 | 13 | 11 | 11 | 13 | 118 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 16 | 15 | 15 | 17 | 14 | 15 | 14 | 17 | 15 | 15 | 153 |
| Total | 32 | 30 | 32 | 31 | 31 | 30 | 30 | 32 | 30 | 32 | 310 |

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 | 5 | 4 | 4 | 5 | 3 | 5 | 4 | 4 | 4 | 4 | 42 |
| 5 | 12 | 12 | 13 | 12 | 13 | 11 | 11 | 12 | 13 | 11 | 120 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 17 | 17 | 15 | 16 | 14 | 16 | 15 | 15 | 17 | 15 | 157 |
| Total | 34 | 33 | 32 | 33 | 30 | 32 | 30 | 31 | 34 | 30 | 319 |

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 | 4 | 4 | 3 | 4 | 5 | 4 | 4 | 4 | 4 | 41 |
| 5 | 12 | 12 | 12 | 11 | 10 | 13 | 12 | 10 | 12 | 12 | 116 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 16 | 17 | 14 | 14 | 15 | 14 | 17 | 15 | 15 | 15 | 152 |
| Total | 33 | 33 | 30 | 28 | 29 | 32 | 33 | 29 | 31 | 31 | 309 |

1000 mg NaCl/L

| Day | Replicate number | | | | | | | | | | Total |
|-------|------------------|----|----|----|----|----|----|----|----|----|-------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 4 | 3 | 4 | 4 | 5 | 4 | 5 | 5 | 4 | 4 | 42 |
| 5 | 10 | 10 | 11 | 13 | 10 | 12 | 13 | 10 | 10 | 12 | 111 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 14 | 14 | 16 | 13 | 16 | 14 | 12 | 15 | 13 | 14 | 141 |
| Total | 28 | 27 | 31 | 30 | 31 | 30 | 30 | 30 | 27 | 30 | 294 |

1200 mg NaCl/L

| Day | Replicate number | | | | | | | | | | Total |
|-------|------------------|----|----|---|---|---|----|---|---|----|-------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 3 | 5 | 3 | 2 | 4 | 2 | 3 | 3 | 3 | 2 | 30 |
| 5 | 5 | 4 | 2 | 0 | 3 | 0 | 0 | 3 | 6 | 0 | 23 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 2 | 2 | 5 | 6 | 0 | 4 | 7 | 0 | 0 | 5 | 31 |
| Total | 10 | 11 | 10 | 8 | 7 | 6 | 10 | 6 | 9 | 7 | 84 |

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 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 3 |
| 5 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 3 | 0 | 5 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 2 | 1 | 1 | 0 | 0 | 3 | 1 | 1 | 2 | 3 | 14 |
| Total | 2 | 1 | 1 | 2 | 2 | 3 | 2 | 1 | 5 | 3 | 22 |



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: CdNaCICR #177

Test dates: August 04-11, 2015

| 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 | 32 | 30 | 32 | 31 | 31 | 30 | 30 | 32 | 30 | 32 | 100 | 31.0 | 3.0 | Not applicable |
| 600 | 34 | 33 | 32 | 33 | 30 | 32 | 30 | 31 | 34 | 30 | 100 | 31.9 | 5.0 | -2.9 |
| 800 | 33 | 33 | 30 | 28 | 29 | 32 | 33 | 29 | 31 | 31 | 100 | 30.9 | 6.0 | 0.3 |
| 1000 | 28 | 27 | 31 | 30 | 31 | 30 | 30 | 30 | 27 | 30 | 100 | 29.4 | 5.1 | 5.2 |
| 1200 | 10 | 11 | 10 | 8 | 7 | 6 | 10 | 6 | 9 | 7 | 100 | 8.4 | 21.9 | 72.9 |
| 1400 | 2 | 1 | 1 | 2 | 2 | 3 | 2 | 1 | 5 | 3 | 100 | 2.2 | 55.9 | 92.9 |

Dunnett's MSD value: 1.563

PMSD: 5.0

MSD = Minimum Significant Difference

PMSD = Percent Minimum Significant Difference

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

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: CdNaCICR_080415.xlsx
Table populated from associated "Verification of *Ceriodaphnia* Reproduction Totals" spreadsheet.

Spreadsheet entered by: J. Sumner

Reviewed by: JK

Statistical Analyses

Ceriodaphnia Survival and Reproduction Test-Reproduction

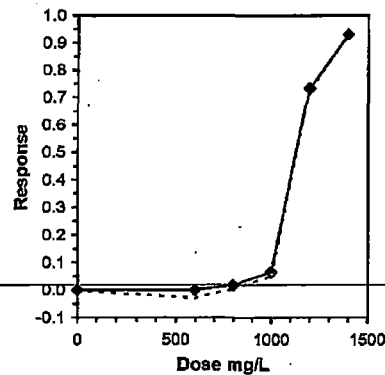
Start Date: 8/4/2016 Test ID: CdNaClCR Sample ID: REF-Ref Toxicant
End Date: 8/11/2015 Lab ID: ETS-Envir. Testing Sol. Sample Type: NaCl-Sodium chloride
Sample Date: Protocol: FWCHR-EPA-821-R-02-013 Test Species: CD-Ceriodaphnia dubia

| Conc-mg/L | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|-----------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| D-Control | 32.000 | 30.000 | 32.000 | 31.000 | 31.000 | 30.000 | 30.000 | 32.000 | 30.000 | 32.000 |
| 600 | 34.000 | 33.000 | 32.000 | 33.000 | 30.000 | 32.000 | 30.000 | 31.000 | 34.000 | 30.000 |
| 800 | 33.000 | 33.000 | 30.000 | 28.000 | 29.000 | 32.000 | 33.000 | 29.000 | 31.000 | 31.000 |
| 1000 | 28.000 | 27.000 | 31.000 | 30.000 | 31.000 | 30.000 | 30.000 | 30.000 | 27.000 | 30.000 |
| 1200 | 10.000 | 11.000 | 10.000 | 8.000 | 7.000 | 6.000 | 10.000 | 6.000 | 9.000 | 7.000 |
| 1400 | 2.000 | 1.000 | 1.000 | 2.000 | 2.000 | 3.000 | 2.000 | 1.000 | 5.000 | 3.000 |

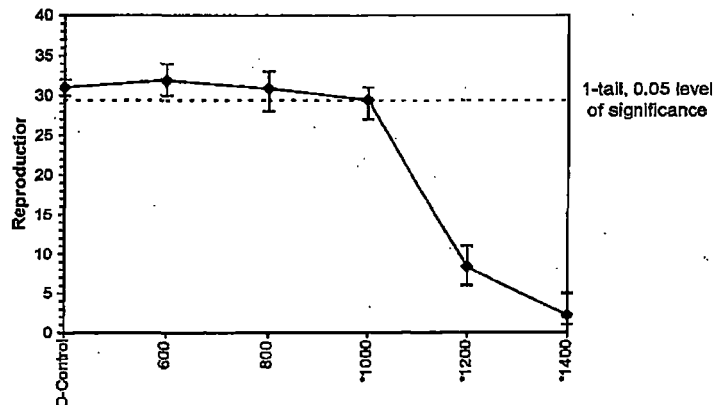
| Conc-mg/L | Mean | N-Mean | Transform: Untransformed | | | | | N | t-Stat | 1-Tailed Critical | MSD | Isotonic | |
|-----------|--------|--------|--------------------------|--------|--------|--------|------|--------|--------|-------------------|--------|----------|--------|
| | | | Mean | Min | Max | CV% | Mean | | | | | N-Mean | |
| D-Control | 31.000 | 1.0000 | 31.000 | 30.000 | 32.000 | 3.041 | 10 | | | | | 31.450 | 1.0000 |
| 600 | 31.900 | 1.0290 | 31.900 | 30.000 | 34.000 | 5.000 | 10 | -1.316 | 2.287 | 1.563 | 31.450 | 1.0000 | |
| 800 | 30.900 | 0.9968 | 30.900 | 28.000 | 33.000 | 5.997 | 10 | 0.148 | 2.287 | 1.563 | 30.900 | 0.9825 | |
| *1000 | 29.400 | 0.9484 | 29.400 | 27.000 | 31.000 | 5.121 | 10 | 2.340 | 2.287 | 1.563 | 29.400 | 0.9348 | |
| *1200 | 8.400 | 0.2710 | 8.400 | 6.000 | 11.000 | 21.879 | 10 | 33.057 | 2.287 | 1.563 | 8.400 | 0.2671 | |
| *1400 | 2.200 | 0.0710 | 2.200 | 1.000 | 5.000 | 55.876 | 10 | 42.125 | 2.287 | 1.563 | 2.200 | 0.0700 | |

| Auxiliary Tests | | | | | Statistic | Critical | Skew | Kurt |
|--|--|--|--|--|-----------|----------|---------|---------|
| Kolmogorov D Test indicates normal distribution ($p > 0.01$) | | | | | 0.85666 | 1.035 | -0.0915 | -0.9489 |
| Bartlett's Test indicates equal variances ($p = 0.40$) | | | | | 5.13552 | 15.0863 | | |
| Hypothesis Test (1-tail, 0.05) | | | | | NOEC | LOEC | ChV | TU |
| Dunnett's Test | | | | | 800 | 1000 | 894.427 | |
| Treatments vs D-Control | | | | | | | | |
| | | | | | MSDu | MSDp | MSB | MSE |
| | | | | | 1.56333 | 0.05043 | 1778.88 | 2.33704 |
| | | | | | F-Prob | df | | |
| | | | | | 0.0E+00 | 5, 54 | | |

| Linear Interpolation (200 Resamples) | | | | |
|--------------------------------------|---------|---------|---------|---------|
| Point | mg/L | SD | 95% CL | Skew |
| IC05 | 936.333 | 59.1013 | 771.977 | 1003.81 |
| IC10 | 1010.43 | 5.61691 | 1002.55 | 1018.58 |
| IC15 | 1025.4 | 4.06401 | 1017.88 | 1033.34 |
| IC20 | 1040.38 | 3.87809 | 1033.32 | 1048.14 |
| IC25 | 1055.36 | 3.75027 | 1048.63 | 1062.99 |
| IC40 | 1100.29 | 3.74598 | 1093.57 | 1107.3 |
| IC50 | 1130.24 | 4.05478 | 1122.81 | 1137.89 |



Dose-Response Plot



File: CdNaClCR_080415.xlsx
Entered by: J. Sumner
Reviewed by:



Species: Ceriodaphnia dubia

CdNaCICR #: 177

Daily Chemistry:

| | | Day (Analyst identified for each day, performed pH, D.O. and conductivity measurements only.) | | | | | |
|----------------|---------------------------------------|--|-------|---------|-------|---------|-------|
| | | 0 | 1 | 2 | 3 | 4 | 5 |
| Analyst | | N/G | N/G | N/G | N | N | N |
| Concentration | Parameter | | | | | | |
| CONTROL | pH (S.U.) | 7.83 | 7.75 | 7.67 | 7.65 | 7.92 | 7.00 |
| | DO (mg/L) | 7.8 | 7.8 | 7.8 | 7.6 | 7.7 | 7.6 |
| | Conductivity (µmhos/cm) | 317 | | 309 | | 306 | |
| | *Alkalinity (mg CaCO ₃ /L) | 62 | | | | 62 | |
| | *Hardness (mg CaCO ₃ /L) | 86 | | | | 86 | |
| | *Temperature (°C) | 24.8 | 24.9 | 24.8 | 25.2 | 24.8 | 24.9 |
| 600 mg NaCl/L | pH (S.U.) | 7.89 | 7.80 | 7.81 | 7.83 | 7.92 | 7.70 |
| | DO (mg/L) | 7.8 | 7.8 | 7.8 | 7.5 | 7.6 | 7.7 |
| | Conductivity (µmhos/cm) | 1440 | | 1400 | | 1390 | |
| | *Temperature (°C) | 24.9 | 25.1 | 24.8 | 24.8 | 24.9 | 24.8 |
| 800 mg NaCl/L | pH (S.U.) | 7.90 | 7.78 | 7.82 | 7.83 | 7.92 | 7.70 |
| | DO (mg/L) | 7.8 | 7.8 | 7.8 | 7.6 | 7.7 | 7.7 |
| | Conductivity (µmhos/cm) | 1800 | | 1780 | | 1760 | |
| | *Temperature (°C) | 24.9 | 24.8 | 24.8 | 24.8 | 24.9 | 24.8 |
| 1000 mg NaCl/L | pH (S.U.) | 7.90 | 7.80 | 7.82 | 7.85 | 7.92 | 7.70 |
| | DO (mg/L) | 7.9 | 7.9 | 7.8 | 7.7 | 7.8 | 7.8 |
| | Conductivity (µmhos/cm) | 2170 | | 2160 | | 2110 | |
| | *Temperature (°C) | 24.8 | 24.8 | 24.8 | 24.9 | 24.9 | 24.9 |
| 1200 mg NaCl/L | pH (S.U.) | 7.91 | 7.80 | 7.82 | 7.86 | 7.91 | 7.77 |
| | DO (mg/L) | 7.9 | 7.9 | 7.8 | 7.7 | 7.8 | 7.9 |
| | Conductivity (µmhos/cm) | 2550 | | 2530 | | 2470 | |
| | *Temperature (°C) | 24.8 | 24.8 | 24.9 | 25.1 | 24.9 | 24.9 |
| 1400 mg NaCl/L | pH (S.U.) | 7.90 | 7.81 | 7.82 | 7.83 | 7.92 | 7.70 |
| | DO (mg/L) | 7.9 | 8.0 | 7.8 | 7.8 | 7.8 | 7.9 |
| | Conductivity (µmhos/cm) | 2840 | | 2860 | | 2800 | |
| | *Temperature (°C) | 24.8 | 24.9 | 24.9 | 24.8 | 25.0 | 24.9 |
| | | Initial | Final | Initial | Final | Initial | Final |

*Temperatures performed at the time of test initiation, renewal or termination by the analyst identified in the Daily Renewal Information table located on Page 1. Alkalinity and hardness performed by the analyst identified on the bench sheet specific for each analysis and transcribed to this bench sheet by: JA



Species: Ceriodaphnia dubia

CdNaClCR #: 177

| | | Day (Analyst identified for each day, performed pH, D.O. and conductivity measurements only.) | | | | | | | |
|----------------|---------------------------------------|--|---------|---------|---------|---------|---------|---------|---------|
| | | 3 | | 4 | | 5 | | 6 | |
| | | Analyst | Analyst | Analyst | Analyst | Analyst | Analyst | Analyst | Analyst |
| Concentration | Parameter | | | | | | | | |
| CONTROL | pH (S.U.) | 7.92 | 7.85 | 7.82 | 7.88 | 7.87 | 7.82 | 7.95 | 7.59 |
| | DO (mg/L) | 7.4 | 7.6 | 7.7 | 7.6 | 7.8 | 7.6 | 7.7 | 7.6 |
| | Conductivity (µmhos/cm) | 3003 | | 303 | | 302 | | 308 | |
| | *Alkalinity (mg CaCO ₃ /L) | 309 | | 62 | | | | | |
| | *Hardness (mg CaCO ₃ /L) | | | 86 | | | | | |
| | *Temperature (°C) | 24.8 | 24.9 | 24.8 | 25.1 | 24.8 | 25.0 | 24.9 | 25.0 |
| 600 mg NaCl/L | pH (S.U.) | 7.92 | 7.83 | 7.87 | 7.82 | 7.91 | 7.82 | 7.93 | 7.63 |
| | DO (mg/L) | 7.6 | 7.6 | 7.7 | 7.6 | 7.8 | 7.6 | 7.7 | 7.6 |
| | Conductivity (µmhos/cm) | 1380 | | 1360 | | 1420 | | 1410 | |
| | *Temperature (°C) | 24.9 | 25.1 | 24.9 | 24.8 | 24.9 | 24.8 | 25.0 | 24.8 |
| 800 mg NaCl/L | pH (S.U.) | 7.91 | 7.82 | 7.88 | 7.80 | 7.92 | 7.80 | 7.93 | 7.66 |
| | DO (mg/L) | 7.6 | 7.6 | 7.7 | 7.6 | 7.8 | 7.6 | 7.7 | 7.7 |
| | Conductivity (µmhos/cm) | 1760 | | 1720 | | 1810 | | 1810 | |
| | *Temperature (°C) | 24.9 | 24.8 | 24.9 | 24.8 | 24.8 | 24.8 | 25.0 | 24.8 |
| 1000 mg NaCl/L | pH (S.U.) | 7.91 | 7.84 | 7.88 | 7.81 | 7.92 | 7.80 | 7.93 | 7.69 |
| | DO (mg/L) | 7.7 | 7.6 | 7.7 | 7.6 | 7.8 | 7.7 | 7.8 | 7.8 |
| | Conductivity (µmhos/cm) | 2120 | | 2090 | | 2210 | | 2200 | |
| | *Temperature (°C) | 24.9 | 24.8 | 25.0 | 24.8 | 24.8 | 24.8 | 25.0 | 24.9 |
| 1200 mg NaCl/L | pH (S.U.) | 7.90 | 7.83 | 7.89 | 7.81 | 7.92 | 7.80 | 7.92 | 7.70 |
| | DO (mg/L) | 7.7 | 7.7 | 7.8 | 7.7 | 7.8 | 7.7 | 7.8 | 7.9 |
| | Conductivity (µmhos/cm) | 2470 | | 2430 | | 2580 | | 2580 | |
| | *Temperature (°C) | 24.9 | 24.8 | 25.0 | 24.8 | 24.9 | 25.0 | 25.0 | 24.9 |
| 1400 mg NaCl/L | pH (S.U.) | 7.90 | 7.83 | 7.89 | 7.81 | 7.93 | 7.80 | 7.93 | 7.70 |
| | DO (mg/L) | 7.8 | 7.7 | 7.8 | 7.7 | 7.9 | 7.7 | 7.8 | 7.9 |
| | Conductivity (µmhos/cm) | 2810 | | 2810 | | 2960 | | 2940 | |
| | *Temperature (°C) | 24.9 | 25.0 | 25.0 | 24.9 | 24.9 | 24.9 | 24.9 | 24.9 |
| | | Initial | Final | Initial | Final | Initial | Final | Initial | Final |

*Temperatures performed at the time of test initiation, renewal or termination by the analyst identified in the Daily Renewal Information table located on Page 1. Alkalinity and hardness performed by the analyst identified on the bench sheet specific for each analysis and transcribed to this bench sheet by: JK

Independent
Review by
Kelley E. Keenan: