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

November 11, 2003

State of Tennessee
Department of Environment and Conservation
Division of Water Pollution Control
Enforcement & Compliance Section
6th Floor, L & C Annex
401 Church Street
Nashville, Tennessee 37243-1534

Attention: Mr. Chip Hannah

Dear Mr. Hannah:

SEQUOYAH NUCLEAR PLANT - DISCHARGE MONITORING REPORT FOR OCTOBER 2003

Enclosed is the October 2003 Discharge Monitoring Report for Sequoyah Nuclear Plant. Please contact me at (423) 843-6700 if you have any questions or comments.

Sincerely,

Stephanie A. Howard

Stephanie A. Howard
Acting Environmental Supervisor
Signatory Authority for
Richard T. Purcell
Site Vice President
Sequoyah Nuclear Plant

Enclosure
cc (Enclosure):

Chattanooga Environmental Assistance Center
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, D.C. 20555

IE25

Printed on recycled paper

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

Name TVA - SEQUOYAH NUCLEAR PLANT
Address P.O. BOX 2000
(INTEROFFICE SB-2A)
SODDY - DAISY TN 37384
Facility TVA - SEQUOYAH NUCLEAR PLANT
Location HAMILTON COUNTY

ATTN: Stephanie A. Howard

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

TN0026450	101 G
PERMIT NUMBER	DISCHARGE NUMBER

MONITORING PERIOD	YEAR	MO	DAY		YEAR	MO	DAY
From	03	10	01	To	03	10	31

MAJOR
(SUBR 01)
F - FINAL
DIFFUSER DISCHARGE
EFFLUENT

*** NO DISCHARGE ☐ ***

Form Approved.
OMB No. 2040-0004

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	********	********	**	********	********	24.6	04	0	31 / 31	MODELD
00010 Z 0 0 INSTREAM MONITORING	PERMIT REQUIREMENT	********	********	****	********	********	30.5 DAILY MX	DEG. C.		SEE PERMIT	CK REQ
TEMPERATURE, WATER DEG. CENTIGRADE	SAMPLE MEASUREMENT	********	********	**	********	********	37.7	04	0	31 / 31	RCORDR
00010 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT	********	********	****	********	********	REPORT DAILY MX	DEG. C.		SEE PERMIT	CK REQ
PH	SAMPLE MEASUREMENT	********	********	**	7.1	********	7.4	12	0	10 / 31	GRAB
00400 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT	********	********	****	6.0 MINIMUM	********	9.0 MAXIMUM	SU		WEEKLY	GRAB
SOLIDS, TOTAL SUSPENDED	SAMPLE MEASUREMENT	********	********	**	********	6	8	19	0	5 / 31	GRAB
00530 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT	********	********	****	********	30 MO AVG	100 DAILY MX	MG/L		WEEKLY	GRAB
OIL AND GREASE	SAMPLE MEASUREMENT	********	********	**	********	<5	<5	19	0	5 / 31	GRAB
00556 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT	********	********	****	********	15 MO AVG	20 DAILY MX	MG/L		WEEKLY	GRAB
FLOW, IN CONDUIT OR THRU TREATMENT PLANT	SAMPLE MEASUREMENT	********	1590	03	********	********	********	**	0	31 / 31	RCORDR
50050 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT	********	REPORT DAILY MX	MGD	********	********	********	****		CONTIN UOUS	RCORDR
CHLORINE, TOTAL RESIDUAL	SAMPLE MEASUREMENT	********	********	**	********	<0.012	0.018	19	0	32 / 31	GRAB
50060 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT	********	********	****	********	0.036	0.058 INST MAX	MG/L		WEEK-DAYS	CALCTD

NAME/TITLE PRINCIPAL EXECUTIVE OFFICER			TELEPHONE		DATE		
Richard T. Purcell Site Vice President	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.	Stephanie A. Howard Acting Environmental Supervisor SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	423	843-6700	03	11	13
TYPED OR PRINTED			AREA CODE	NUMBER	YEAR	MO	DAY

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

No closed mode operation. The following injections occured: 1. PCL-222 (max. calc. conc. was 0.058mg/L--limit 0.100mg/L) 2. CL-363 (max. calc. conc. was 0.009mg/L--limit 0.100mg/L) 3. PCL-222/PCL-401 (max. calc. conc. was 0.025mg/L--limit 0.100mg/L) 4. H-130M (max. calc. conc. was 0.025mg/L--limit 0.050mg/L) 5. H-130M (low detection level analytical method was 0.046mg/L--limit 0.050mg/L))

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ATTN: Stephanie A. Howard

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

TN0026450	101 G
PERMIT NUMBER	DISCHARGE NUMBER

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From	03	10	01	To	03	10	31

MAJOR
(SUBR 01)
F - FINAL
DIFFUSER DISCHARGE
EFFLUENT

*** NO DISCHARGE ☐ ***

Form Approved.
OMB No. 2040-0004

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TEMPERATURE - C, RATE OF CHANGE	SAMPLE MEASUREMENT	********	********	**	********	********	0.2	62	0	31 / 31	CALCTD
82234 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT	********	********	****	********	********	2.0	DEG C /HR		CONTIN UOUS	CALCTD
TEMP. DIFF. BETWEEN SAMP. & UPSTRM DEG.C	SAMPLE MEASUREMENT	********	********	**	********	********	2.4	04	0	31 / 31	CALCTD
00016 1 S 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT	********	********	****	********	********	3.0	DEG. C.		CONTIN UOUS	CALCTD
BORON, TOTAL	SAMPLE MEASUREMENT	********	********	**	<0.2	<0.2	<0.2	19	0	1 / 31	GRAB
01022 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT	********	********	****	REPORT	REPORT	REPORT	MG/L		ONCE/ MONTH	GRAB
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										

NAME/TITLE PRINCIPAL EXECUTIVE OFFICER			TELEPHONE		DATE		
Richard T. Purcell Site Vice President	*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.*	Stephanie A. Howard Acting Environmental Supervisor	423	843-6700	03	11	13
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)*

CCW data for October 2003 is attached.

CCW CHANNEL

Date/Time Collected	Extractable Petroleum Hydrocarbons	Analysis Date/Time	Analyst	Method
10/20/2003 0812	< 0.5 mg/L	10/23/2003 2306	JBR	EPA 8015B

CCW TRENCH

Date/Time Collected	Extractable Petroleum Hydrocarbons	Analysis Date/Time	Analyst	Method
10/20/2003 0815	< 0.5 mg/L	10/23/2003 2344	JBR	EPA 8015B

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ATTN: Stephanie A. Howard

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

TN0026450	101 T
PERMIT NUMBER	DISCHARGE NUMBER

MONITORING PERIOD	YEAR	MO	DAY		YEAR	MO	DAY
From	03	10	01	To	03	10	31

MAJOR
(SUBR 01)
F - FINAL
BIOMONITORING FOR OUTFALL 101
EFFLUENT

*** NO DISCHARGE ☐ ***

Form Approved.
OMB No. 2040-0004

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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	********	********	23	0	1 / 90	COMPOS
TRP3B 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT	********	********	****	43.9 MINIMUM	********	********	PERCENT		QUART-ERLY	COMPOS
IC25 STATRE 7DAY CHR PIMEPHALES	SAMPLE MEASUREMENT	********	********	**	>100	********	********	23	0	1 / 90	COMPOS
TRP6C 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT	********	********	****	43.9 MIMINUM	********	********	PERCENT		QUART-ERLY	COMPOS
	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			TELEPHONE		DATE		
Richard T. Purcell Site Vice President	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.	Stephanie A. Howard Acting Environmental Supervisor SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	423	843-6700	03	11	13
TYPED OR PRINTED			AREA CODE	NUMBER	YEAR	MO	DAY

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

Toxicity was sampled October 5 -10, 2003. Report is attached.

November 6, 2003

Ruth Ann Hurt, SB 2A-SQN

SEQUOYAH NUCLEAR PLANT (SQN) TOXICITY BIOMONITORING, NPDES PERMIT NO. TN0026450, H130M SPECIAL STUDY, OCTOBER, 2003

Attached are two copies of the subject report for submission to the state of Tennessee and a copy of the report for your records. The report provides results of compliance testing using fathead minnows and daphnids. Outfall 101 samples collected October 5-10, showed no toxic effects to fathead minnows or daphnids. The resulting IC_{25} values for both species were > 100 percent. Exposure of fathead minnows and daphnids to intake samples resulted in no significant differences from controls during this study period.

In addition to the routine compliance test, fathead minnows were also tested in Outfall 101 and intake samples which were treated using UV exposure for pathogen removal prior to introduction of test organisms. Fish pathogens present in intake water have been the suspected cause of anomalous dose responses and high variability among replicates in previous toxicity testing at Sequoyah. At the time this study was conducted, mortality which occurred in minnows exposed to routine compliance samples and UV treated samples was not sufficient to jeopardize statistical validity.

Call me at (256) 386-2755 if you have any questions or comments following your review of the report.

Cynthia L Russell

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

Attachment
cc (Attachment):
Files, ER&TA, CEB 1B-M

SQN H130M-October 2003m

TENNESSEE VALLEY AUTHORITY
TOXICITY TEST REPORT

INTRODUCTION / EXECUTIVE SUMMARY

Report Date: November 6, 2003

1. Facility / Discharger: Sequoyah Nuclear Plant / TVA
2. County / State: Hamilton / Tennessee
3. NPDES Permit #: TN 0026450
4. Type of Facility: Nuclear-Fueled Electric Generating Plant
5. Design Flow (MGD): 3,266
6. Receiving Stream: Tennessee River (TRM 483.6)
7. 1Q10: 2,992.4
8. Outfall Tested: 101
9. Dates Sampled: October 5-10, 2003
10. Average Flow on Days Sampled (MGD): 1582, 1584, 1585
11. Pertinent Site Conditions:

    H130M was injected from October 5-10, 2003. The dates and times for the H130M injection are in the following table.

Injection Location	Date/Start Time (EDT)	Date/Ending Time (EDT)
Essential Raw Cooling Water (ERCW) B Train	10-6-2003/1005	10-7-2003/1004
Raw Cooling Water (RCW)	10-8-2003/1000	10-9-2003/0959

12. Test Dates: October 7 - 14, 2003
13. Test Type: Short-term Chronic Definitive
14. Test Species: Fathead Minnows (*Pimephales promelas*)
    Daphnids (*Ceriodaphnia dubia*)

15. Concentrations Tested (%): Outfall 101: 10.98, 22, 43.9, 72, 100
Intake: 100

Pimephales promelas: UV treated Outfall 101: 10.98, 22, 43.9, 72, 100
UV treated Intake: 100

16. Permit Limit Endpoint (%): Outfall 101: $IC_{25} = 43.9\%$

17. Test Results: Outfall 101: *Pimephales promelas:* $IC_{25} > 100$
Ceriodaphnia dubia: $IC_{25} > 100$

UV treated Outfall 101: *Pimephales promelas:* $IC_{25} > 100$

18. Facility Contact: Ruth Ann Hurt
Phone #: (423) 843-6714

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

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

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

22. Notes: Outfall 101 samples collected October 5-10, 2003, showed no toxic effects to fathead minnows or daphnids. The resulting IC_{25} values, for both species, were > 100 percent. Exposure of fathead minnows and daphnids to intake samples resulted in no significant differences from controls during this study period.

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, suggesting that pathogenic bacteria were not present.

METHODS SUMMARY

Samples:

1. Sampling Point: Outfall 101, Intake

2. Sample Type: Composite

3. Sample Information:

Sample ID	Date (MM/DD/YY)/ Time (EDT) Collected	Date (MM/DD/YY)/ Time (EDT) Received	Arrival Temp. (°C)	Initial TRC* (mg/L)	Date (MM/DD/YY)/ Time (EDT) Used
101	10/05/03 1357 to 10/06/03 1257	10/07/03 0942	0.8†	<0.10	10/07/03 1245 10/08/03 1231
Intake	10/05/03 1413 to 10/06/03 1313	10/07/03 0942	0.9	<0.10	10/07/03 1245 10/08/03 1231
101	10/07/03 1330 to 10/08/03 1230	10/09/03 1000	1.1†	<0.10	10/09/03 1233 10/10/03 1235
Intake	10/07/03 1347 to 10/08/03 1247	10/09/03 1000	0.8	<0.10	10/09/03 1233 10/10/03 1235
101	10/09/03 1305 to 10/10/03 1205	10/10/03 1931	1.3 1.9	<0.10	10/11/03 1219 10/12/03 1228 10/13/03 1231
Intake	10/09/03 1320 to 10/10/03 1220	10/10/03 1931	2.1	<0.10	10/11/03 1219 10/12/03 1228 10/13/03 1231

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

4. Sample Manipulation: Samples from Outfall 101 and the 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:	Aquatic BioSystems, Inc.	In-house Cultures
2. Age:	20.75 – 22.25 -hours old	< 24-hours old
Test Method Summary:		
1. Test Conditions:	Static, Renewal	Static, Renewal
2. Test Duration:	7 days	Until at least 60% of control females have 3 broods
3. Control / Dilution Water:	Moderately Hard Synthetic	Moderately Hard Synthetic
4. Number of Replicates:	4	10
5. Organisms per Replicate:	10	1
6. Test Initiation: (Date/Time)		
Outfall 101:	10/07/03-1245 EDT	10/07/03-1212 EDT
UV Treated Outfall 101:	10/07/03-1232 EDT	
7. Test Termination: (Date/Time)		
Outfall 101:	10/14/03-1226 EDT	10/14/03-1200 EDT
UV Treated Outfall 101:	10/14/03-1244 EDT	
8. Test Temperature: Outfall 101:	Mean =25.1°C (24.6-25.6°C)	Mean = 25.1°C (24.6-25.5°C)
Test Temperature: UV-Treated Outfall 101:	Mean = 25.1°C (24.6-25.7°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 October 7- 14, 2003 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
10.98%	100	100	100	100	100	100	100
22%	100	100	100	100	100	100	100
43.9%	100	100	100	100	100	100	100
72%	100	100	100	100	100	100	100
100%	100	100	100	100	100	100	100
Intake	100	100	100	100	98	98	98

Test Solutions (% Effluent)	Mean Dry Weight (mg) (replicate number)				
	1	2	3	4	Mean
Control	1.120	1.016	1.105	1.029	1.067
10.98%	1.123	1.166	1.084	1.156	1.132
22%	1.240	1.105	1.169	1.206	1.180
43.9%	1.233	1.071	1.060	1.193	1.139
72%	1.165	0.951	1.219	1.258	1.148
100%	1.236	1.120	1.143	1.206	1.176
Intake	1.142	1.134	1.100	1.212	1.147

IC_{25} Value: > 100% Permit Limit: 43.9 95% Confidence Limits: Upper Limit: NA Lower Limit: NA	Calculated TU Estimates: < 1.0 TUc* Permit Limit: 2.3 TUc

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

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 October 7- 14, 2003 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
10.98%	100	100	100	100	100	100	100
22%	100	100	100	100	100	100	100
43.9%	100	100	100	100	100	100	100
72%	100	100	100	100	100	100	100
100%	100	100	100	100	100	100	100

Test Solutions (% Effluent)	Reproduction (#young/female/7 days) Data (replicate number)										
	1	2	3	4	5	6	7	8	9	10	Mean
Control	34	30	34	31	33	35	30	32	33	35	32.7
10.98%	39	38	33	37	33	36	35	32	36	31	35.0
22%	39	32	35	34	35	37	34	36	35	32	34.9
43.9%	42	40	34	34	37	35	34	39	35	35	36.5
72%	40	37	37	38	33	38	38	41	35	38	37.5
100%	42	34	35	35	38	42	38	39	34	40	37.7

IC_{25} Value: > 100% Permit Limit: 43.9 95% Confidence Limits: Upper Limit: NA Lower Limit: NA	Calculated TU Estimates: < 1.0 TUc* Permit Limit: 2.3 TUc

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

TOXICITY TEST RESULTS (see Appendix C for Bench Sheets)

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

Conducted October 7-14, 2003 using water collected 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	38	30	29	37	39	38	30	32	34	31	33.8
Intake	40	40	38	32	37	36	36	32	39	36	36.6
No significant difference based on Homoscedastic t-Test											

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

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

Conducted October 7 - 14, 2003 using effluent from Outfall 101 (UV Treated).

Test Solutions (% Effluent)	Percent Surviving (time interval used – days)						
	1	2	3	4	5	6	7
Control	100	100	100	100	100	100	100
10.98%	100	100	100	100	100	100	100
22%	100	100	100	100	100	100	100
43.9%	100	100	100	100	100	100	100
72%	100	100	100	100	100	100	100
100%	100	100	100	100	100	100	100
Intake	100	100	100	100	100	100	98

Test Solutions (% Effluent)	Mean Dry Weight (mg) (replicate number)				
	1	2	3	4	Mean
Control	1.069	1.156	1.173	1.233	1.157
10.98%	1.093	1.199	1.144	1.088	1.131
22%	1.179	1.105	0.930	1.193	1.102
43.9%	1.156	1.216	1.197	1.107	1.169
72%	1.009	1.137	1.312	1.094	1.138
100%	1.241	1.266	1.216	1.233	1.239
Intake	1.225	1.197	1.035	1.221	1.169

IC_{25} Value: $\geq$ 100% 95% Confidence Limits: Upper Limit: NA Lower Limit: NA	Calculated TU Estimates: $\leq$ 1.0 TUc* Permit Limit: NA

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

REFERENCE TOXICANT TEST RESULTS (see Appendix A and D)

Species	Date	Time	Duration	Toxicant	Results (IC_{25})
Pimephales promelas	October 7, 2003	1306	7-days	KCl	614.8 mg/L
Ceriodaphnia dubia	October 7, 2003	1150	7-days	NaCl	1020.4 mg/L

PHYSICAL/CHEMICAL SUMMARY

Water Chemistry Mean Values and Ranges for *Pimephales promelas* and *Ceriodaphnia dubia* Tests, Sequoyah Nuclear Plant Effluent (SQN), Outfall 101, October 7- 14, 2003.

Test	Sample ID	Temperature (°C)		Dissolved Oxygen (mg/L)		pH (S.U.)		Conductance	Alkalinity	Hardness	Total Residual
		Initial	Final	Initial	Final	Initial	Final	(µmhos/cm)	(mg/L $CaCO_3$)	(mg/L $CaCO_3$)	Chlorine (mg/L)
Pimephales promelas	Control	25.2 24.6 - 25.6	25.0 24.7 - 25.2	7.9 7.7 - 8.3	7.2 6.1 - 8.0	7.70 7.50 - 7.81	7.33 7.11 - 7.52	294 287 - 313	60 60 - 61	85 84 - 86	- - -
	10.98%	25.2 24.6 - 25.6	25.0 24.7 - 25.2	8.0 7.6 - 8.3	7.2 5.9 - 7.9	7.64 7.57 - 7.74	7.31 7.08 - 7.53	277 268 - 286	- - -	- - -	- - -
	22%	25.2 24.6 - 25.6	25.0 24.7 - 25.2	8.0 7.6 - 8.3	7.1 5.9 - 7.9	7.62 7.55 - 7.66	7.29 7.04 - 7.52	263 249 - 275	- - -	- - -	- - -
	43.9%	25.2 24.6 - 25.6	25.0 24.7 - 25.2	8.0 7.6 - 8.3	7.1 6.2 - 7.9	7.57 7.52 - 7.64	7.27 7.06 - 7.51	240 235 - 248	- - -	- - -	- - -
	72%	25.2 24.6 - 25.6	25.0 24.7 - 25.2	8.0 7.6 - 8.3	7.1 6.3 - 7.8	7.52 7.44 - 7.62	7.29 7.07 - 7.51	206 203 - 213	- - -	- - -	- - -
	100%	25.3 24.7 - 25.6	25.0 24.7 - 25.2	8.0 7.6 - 8.3	7.2 6.3 - 7.9	7.46 7.33 - 7.59	7.30 7.05 - 7.51	172 168 - 178	63 62 - 66	70 69 - 71	<0.10 <0.10 - <0.10
	Intake	25.3 24.7 - 25.6	25.0 24.7 - 25.2	8.0 7.5 - 8.3	7.2 6.2 - 7.9	7.44 7.24 - 7.58	7.30 7.05 - 7.52	170 167 - 179	63 62 - 64	70 69 - 71	<0.10 <0.10 - <0.10
Ceriodaphnia dubia	Control	25.1 24.6 - 25.5	25.1 24.9 - 25.2	7.9 7.7 - 8.3	7.8 7.5 - 8.1	7.71 7.58 - 7.81	7.67 7.57 - 7.81	294 287 - 313	60 60 - 61	85 84 - 86	- - -
	10.98%	25.1 24.6 - 25.5	25.1 24.9 - 25.2	8.0 7.6 - 8.3	7.8 7.6 - 8.0	7.64 7.57 - 7.74	7.66 7.57 - 7.79	277 268 - 286	- - -	- - -	- - -
	22%	25.1 24.6 - 25.5	25.1 24.9 - 25.2	8.0 7.6 - 8.3	7.8 7.5 - 8.0	7.62 7.55 - 7.66	7.65 7.57 - 7.77	266 259 - 275	- - -	- - -	- - -
	43.9%	25.1 24.6 - 25.5	25.1 24.9 - 25.2	8.0 7.6 - 8.3	7.8 7.5 - 8.0	7.57 7.52 - 7.64	7.64 7.58 - 7.73	240 235 - 248	- - -	- - -	- - -
	72%	25.1 24.6 - 25.5	25.1 24.9 - 25.2	8.0 7.6 - 8.3	7.8 7.6 - 8.0	7.52 7.44 - 7.62	7.62 7.55 - 7.67	206 203 - 213	- - -	- - -	- - -
	100%	25.1 24.6 - 25.5	25.1 24.9 - 25.2	8.0 7.6 - 8.3	7.8 7.6 - 7.9	7.46 7.33 - 7.59	7.60 7.53 - 7.66	172 168 - 178	63 62 - 66	70 69 - 71	<0.10 <0.10 - <0.10
	Intake	25.1 24.6 - 25.5	25.1 24.9 - 25.2	8.0 7.5 - 8.3	7.7 7.5 - 7.9	7.43 7.24 - 7.58	7.61 7.52 - 7.66	170 167 - 179	63 62 - 64	70 69 - 71	<0.10 <0.10 - <0.10

Overall temperature (°C)	Average	Minimum	Maximum
Pimephales promelas	25.1	24.6	25.6
Ceriodaphnia dubia	25.1	24.6	25.5

PHYSICAL/CHEMICAL SUMMARY

Water Chemistry Mean Values and Ranges for the *Pimephales promelas* Test, Sequoyah Nuclear Plant Effluent (SQN), UV Treated Outfall 101, October 7 - 14, 2003.

Test	Sample ID	Temperature (°C)		Dissolved Oxygen (mg/L)		pH (S.U.)		Conductance (µmhos/cm)
		Initial	Final	Initial	Final	Initial	Final	
Pimephales promelas	Control	25.3 24.6 - 25.7	24.9 24.7 - 25.1	8.0 7.8 - 8.4	7.3 6.3 - 8.2	7.60 7.52 - 7.66	7.34 7.05 - 7.60	286 277 - 295
	10.98%	25.3 24.6 - 25.7	24.9 24.7 - 25.1	8.1 7.9 - 8.4	7.2 6.2 - 8.1	7.61 7.53 - 7.68	7.33 7.05 - 7.55	279 274 - 290
	22%	25.3 24.6 - 25.7	24.9 24.7 - 25.1	8.1 7.8 - 8.4	7.3 6.3 - 8.1	7.59 7.51 - 7.67	7.34 7.10 - 7.57	266 262 - 276
	43.9%	25.3 24.6 - 25.7	24.9 24.7 - 25.1	8.1 7.8 - 8.4	7.3 6.3 - 8.1	7.58 7.47 - 7.67	7.32 7.09 - 7.54	240 232 - 249
	72%	25.3 24.6 - 25.7	24.9 24.7 - 25.1	8.0 7.8 - 8.3	7.2 5.9 - 8.2	7.54 7.41 - 7.64	7.32 7.04 - 7.55	208 203 - 215
	100%	25.3 24.6 - 25.7	24.9 24.7 - 25.1	8.0 7.8 - 8.3	7.2 5.9 - 8.2	7.51 7.35 - 7.63	7.30 7.00 - 7.53	172 168 - 179
	Intake	25.3 24.6 - 25.7	24.9 24.7 - 25.1	8.1 7.8 - 8.4	7.2 6.1 - 8.0	7.48 7.31 - 7.62	7.30 7.02 - 7.52	171 167 - 177

Overall temperature (°C)	Average	Minimum	Maximum
Pimephales promelas	25.1	24.6	25.7

SUMMARY / CONCLUSIONS

Outfall 101 samples collected October 5 - 10, 2003, showed no toxic effects to fathead minnows or daphnids. The resulting IC_{25} values, for both species, were > 100 percent. Exposure of fathead minnows and daphnids to intake samples resulted in no significant differences from controls during this study period.

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, suggesting that pathogenic bacteria were not present.

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 400-mL polypropylene beakers, 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. Regents, Titrants, Buffers, etc.: All chemicals were certified products used before expiration dates (where applicable).

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

3. Temperature was measured using EPA Method 170.1.

4. Dissolved oxygen was measured using EPA Method 360.1.

5. The pH was measured EPA Method 150.1.

6. Conductance was measured EPA Method 120.1.

7. Alkalinity was measured using EPA Method 310.1.

8. Total Hardness was measured EPA Method 130.2.

9. Total residual chlorine was measured using EPA Method 330.5.

QUALITY ASSURANCE

Toxicity Test Methods: All phases of the study including, but not limited to, sample collection, handling and storage, glassware preparation, test organism culturing/acquisition and acclimation, test organism handling during test, and maintaining appropriate test conditions were conducted according to the protocol as described in this report and EPA-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 IC_{25} values in g/L KCl or NaCl.

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

3. Dilution Water Used: Moderately hard synthetic water.

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

REFERENCES

1. NPDES Permit No. TN 0026450.

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. Methods for Chemical Analysis of Water and Wastes, EPA/600/4-79/020 (March 1983).

Sequoyah Nuclear Plant Biomonitoring
October 7 - 14, 2003

Appendix B

Diffuser Discharge Concentrations of Total Residual Chlorine,

Diffuser Discharge Concentrations of Chemicals Used to Control Growth of Microbiologically Induced Bacteria and Asiatic Clams, During Toxicity Test Sampling,

Table B-1. Sequoyah Nuclear Plant Diffuser (Outfall 101) Discharge Concentrations of Chemicals Used to Control Growth of Microbiologically Induced Bacteria and Asiatic Clams, During Toxicity Test Sampling, March 12, 1998-October 10, 2003

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
03/12/1998	0.016	-	-	-	-	-	-
03/13/1998	0.015	-	-	-	-	-	-
03/14/1998	0.013	-	-	-	-	-	-
03/15/1998	0.030	-	-	-	-	-	-
03/16/1998	0.013	-	-	-	-	-	-
03/17/1998	0.020	-	-	-	-	-	-
03/18/1998	0.018	-	-	-	-	-	-
09/08/1998	0.015	-	0.014	0.005	-	-	0.021
09/09/1998	0.003	-	0.031	0.011	-	-	-
09/10/1998	0.014	-	0.060	0.021	-	-	-
09/11/1998	0.013	-	0.055	0.019	-	-	-
09/12/1998	<0.001	-	0.044	0.015	-	-	-
09/13/1998	<0.001	-	0.044	0.015	-	-	-
09/14/1998	0.008	-	0.044	0.015	-	-	-
02/22/1999	<0.001	-	-	-	-	-	-
02/23/1999	0.005	-	-	-	-	-	-
02/24/1999	0.009	-	-	-	-	-	-
02/25/1999	0.012	-	-	-	-	-	-
02/26/1999	0.008	-	-	-	-	-	-
02/27/1999	<0.001	-	-	-	-	-	-
02/28/1999	<0.001	-	-	-	-	-	-
08/18/1999	-	0.015	0.069	0.024	0.006	-	-
08/19/1999	-	0.012	0.068	0.024	-	-	-
08/20/1999	-	0.023	0.070	0.024	-	0.120	-
08/21/1999	-	0.022	0.068	0.024	-	-	-
08/22/1999	-	0.022	0.068	0.024	-	-	-
08/23/1999	-	0.025	0.068	0.024	0.006	-	-
08/24/1999	-	0.016	0.067	0.023	0.020	-	-

Table B-1 (continued). Sequoyah Nuclear Plant Diffuser (Outfall 101) Discharge Concentrations of Chemicals Used to Control Growth of Microbiologically Induced Bacteria and Asiatic Clams, During Toxicity Test Sampling, March 12, 1998-October 10, 2003

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
01/31/2000	-	< 0.002	0.026	0.009	-	-	-
02/01/2000	-	0.011	0.026	0.028	-	-	-
02/02/2000	-	0.028	0.026	0.009	0.006	-	-
02/03/2000	-	0.008	0.027	0.009	-	-	-
02/04/2000	-	0.006	0.027	0.009	0.005	0.109	-
02/05/2000	-	< 0.002	0.027	0.009	-	-	-
02/06/2000	-	< 0.002	0.027	0.009	-	-	-
07/26/2000	-	< 0.0057	0.055	0.019	-	-	-
07/27/2000	-	0.019	0.055	0.019	-	-	-
07/28/2000	-	0.0088	0.053	0.018	0.004	0.108	-
07/29/2000	-	< 0.0088	0.055	0.019	-	-	-
07/30/2000	-	< 0.0076	0.055	0.019	-	-	-
07/31/2000	-	< 0.0152	0.055	0.019	0.006	-	-
08/01/2000	-	< 0.0141	0.055	0.019	0.005	-	-
12/11/2000	-	0.0143	0.025	0.020	0.005	-	-
12/12/2000	-	0.0092	0.025	0.020	0.005	-	-
12/13/2000	-	< 0.0120	0.025	0.020	-	-	-
12/14/2000	-	< 0.0087	0.025	0.020	-	-	-
12/15/2000	-	0.0120	0.025	0.020	0.005	-	-
12/16/2000	-	< 0.0036	0.025	0.020	-	-	-
12/17/2000	-	< 0.0036	0.025	0.020	-	-	-
08/26/2001	-	0.017	0.06	0.021	0.006	-	-
08/27/2001	-	<0.0096	0.06	0.021	0.005	-	0.021
08/28/2001	-	<0.0085	0.06	0.021	-	-	-
08/29/2001	-	<0.0094	0.059	0.020	0.005	-	0.021
08/30/2001	-	<0.0123	0.06	0.021	0.005	-	-
08/31/2001	-	<0.005	0.059	0.020	-	-	-
11/25/2001	-	<0.0044	-	-	-	-	-
11/26/2001	-	<0.0119	0.024	0.02	0.005	-	-
11/27/2001	-	0.0137	0.023	0.019	0.007	-	-
11/28/2001	-	<0.0089	0.022	0.019	0.006	-	-
11/29/2001	-	0.0132	0.024	0.02	0.007	-	-
11/30/2001	-	< 0.0043	0.024	0.02	-	-	-
12/09/2001	-	<0.0042	-	-	-	-	-
12/10/2001	-	<0.0042	-	-	-	-	-
12/11/2001	-	<0.0104	-	-	-	-	-
12/12/2001	-	0.0128	0.024	0.02	0.008	-	-
12/13/2001	-	<0.0088	0.024	0.02	-	-	-
12/14/2001	-	0.0134	0.024	0.02	0.007	-	-

Table B-1 (continued). Sequoyah Nuclear Plant Diffuser (Outfall 101) Discharge Concentrations of Chemicals Used to Control Growth of Microbiologically Induced Bacteria and Asiatic Clams, During Toxicity Test Sampling, March 12, 1998-October 10, 2003

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
01/02/2002	-	< 0.0079	0.023	0.02	0.006	-	-
01/03/2002	-	< 0.0042	0.023	0.014	-	-	-
01/04/2002	-	0.0124	0.024	0.014	0.009	-	-
01/05/2002	-	< 0.0042	-	-	-	-	-
01/06/2002	-	< 0.0042	-	-	-	-	-
01/07/2002	-	< 0.0089	0.024	0.014	0.006	-	-
02/24/2002	-	< 0.004	-	-	-	-	-
02/25/2002	-	< 0.004	0.023	0.023	-	-	-
02/26/2002	-	0.0143	0.023	0.023	0.007	-	-
02/27/2002	-	< 0.0041	0.023	0.023	-	-	-
02/28/2002	-	< 0.0041	0.024	0.008	-	-	-
03/01/2002	-	<0.0041	0.024	0.008	-	-	-
05/05/2002	-	-	-	-	-	-	-
05/06/2002	-	-	0.058	0.02	0.014	-	-
05/07/2002	-	-	0.058	0.02	0.015	-	-
05/08/2002	-	-	0.056	0.019	-	-	-
05/09/2002	-	-	0.057	0.02	0.014	-	-
05/10/2002	-	-	0.056	0.019	-	-	-
08/04/2002	-	<0.0058	-	-	-	-	-
08/05/2002	-	<0.0058	0.053	0.018	-	-	0.025
08/06/2002	-	0.0092	0.053	0.018	-	-	-
08/07/2002	-	<0.0107	0.055	0.019	0.007	-	-
08/08/2002	-	<0.0061	0.055	0.019	-	-	-
08/09/2002	-	0.0152	0.054	0.018	0.008	-	-
10/06/2002	-	<0.00497	-	-	-	-	-
10/07/2002	-	0.0153	0.054	0.018	0.009	-	-
10/08/2002	-	<0.0092	0.054	0.018	0.007	-	-
10/09/2002	-	0.0124	0.053	0.018	0.009	-	-
10/10/2002	-	0.0134	0.054	0.018	0.009	-	-
10/11/2002	-	<0.0042	0.054	0.018	-	-	-
01/12/2003	-	<0.0035	-	-	-	-	-
01/13/2003	-	<0.006	0.025	0.019	0.009	-	-
01/14/2003	-	<0.0118	0.026	0.020	-	-	-
01/15/2003	-	<0.0063	0.026	0.020	0.009	-	-
01/16/2003	-	<0.0034	0.026	0.020	-	-	-
01/17/2003	-	<0.0034	0.026	0.009	-	-	-
04/06/2003	-	<0.0073	-	-	-	-	-
04/07/2003	-	<0.0189	-	0.021	-	-	-
04/08/2003	-	<0.0117	-	0.021	-	-	-
04/09/2003	-	<0.0139	-	0.021	0.016	-	-
04/10/2003	-	<0.0113	-	0.021	0.018	-	-
04/11/2003	-	<0.0073	-	0.022	-	-	-

Table B-1 (continued). Sequoyah Nuclear Plant Diffuser (Outfall 101) Discharge Concentrations of Chemicals Used to Control Growth of Microbiologically Induced Bacteria and Asiatic Clams, During Toxicity Test Sampling, March 12, 1998-October 10, 2003

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
06/15/2003	-	< 0.0045	-	-	-	-	-
06/16/2003	-	< 0.0037	0.057	0.020	-	-	0.022
06/17/2003	-	< 0.0048	0.041	0.014	-	-	0.024
06/18/2003	-	< 0.0048	0.041	0.014	-	-	0.024
06/19/2003	-	< 0.0085	0.058	0.020	-	-	0.025
06/20/2003	-	< 0.0048	0.058	0.020	-	-	0.025
08/03/2003	-	<0.0050	-	-	-	-	-
08/04/2003	-	<0.0050	0.058	0.020	-	-	-
08/05/2003	-	<0.0051	0.057	0.020	-	-	0.025
08/06/2003	-	<0.0084	0.057	0.020	-	-	0.025
08/07/2003	-	0.0129	0.057	0.020	-	-	0.024
08/08/2003	-	0.0153	0.057	0.020	0.009	-	-
10/05/2003	-	<0.0043	0.057	0.020	-	-	-
10/06/2003	-	<0.0043	0.057	0.020	-	-	0.025
10/07/2003	-	<0.0090	0.057	0.020	-	-	0.025
10/08/2003	-	<0.0106	0.057	0.020	-	-	0.025
10/09/2003	-	0.0181	0.026	0.022	-	-	0.025
10/10/2003	-	0.0183	0.026	0.024	0.009	-	-

Sequoyah Nuclear Plant Biomonitoring
October 7 - 14, 2003

Appendix C

Chain of Custody Records and
Toxicity Test Bench Sheets

BIOMONITORING CHAIN OF CUSTODY RECORD

Client: TVA

Project Name: Sequoyah NP Toxicity

P.O. Number: N/A

Facility Sampled: Sequoyah NP

NPDES Number: TN0026450

Collected By: Wanda Allen, Ronnie Hankins

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):_____

General Comments:
* Custody seals intact. Samples received in good condition. JC

Field Identification / Sample Description	Grab/Comp.	Collection Date/Time		Container Number & Volume Collected	Flow (MGD)	Rain Event? (Mark as Appropriate)				Laboratory Use Project # 876				
	—	Date	Time	—	—	Yes	If Yes, Inches	No	Trace	ETS Log Number	Arrival Temp. (°C)	By	Time	Appearance
SQN-101-TOX	Comp	10/5/03 1357	10/6/03 1257	2(2.5gal)	NA	✓				031007.02	0.8C	KEK	0942	See COMMENTS
SQN-INT-TOX	Comp	10/5/03 1413	10/6/03 1313	1(2.5 gal)	NA	✓				031007.03	0.9C	KEK	0942	

Sample Custody – Fill In From Top Down

Relinquished By (Signature):	Date/Time	Received By (Signature):	Date/Time
Ronnie Hankins Ronnie Hankins	10/6/2003 1500	FedEx	10/6/2003 1500
FedEx	~~10/6/2003~~ 10-07-03 0942	KEKeenan ETS	10-07-03 0942

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.

BIOMONITORING CHAIN OF CUSTODY RECORD

Client: TVA

Project Name: Sequoyah NP Toxicity

P.O. Number: N/A

Facility Sampled: Sequoyah NP

NPDES Number: TN0026450

Collected By: Wanda Allen, Ronnie Hankins

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):_____

General Comments:
* Custody seals intact. Samples received in good condition
JLumner

Field Identification / Sample Description	Grab/Comp.	Collection Date/Time		Container Number & Volume Collected	Flow (MGD)	Rain Event? (Mark as Appropriate)				Laboratory Use Project 576				
	—	Date	Time	—	—	Yes	If Yes, Inches	No	Trace	ETS Log Number	Arrival Temp (°C)	By	Time	Appearance
SQN-101-TOX	Comp	10/7/03 1350	10/8/03 1250	2(2.5gal)	NA			✓		031009.02	1.1°C	JL	1000	* see comments
SQN-INT-TOX	Comp	10/7/03 1347	10/8/03 1247	1(2.5 gal)	NA			✓		031009.03	0.8°C	JL	1000	

Sample Custody – Fill In From Top Down

Relinquished By (Signature):	Date/Time	Received By (Signature):	Date/Time
Ronnie Hankins Ronnie Hankins	10/8/2003 1500	FedEx	10/8/2003 1500
FedEx	~~10/8/2003~~ 10-09-03 1000	JLumner	10-09-03 1000

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.

BIOMONITORING CHAIN OF CUSTODY RECORD

Client: TVA

Project Name: Sequoyah NP Toxicity

P.O. Number: N/A

Facility Sampled: Sequoyah NP

NPDES Number: TN0026450

Collected By: Wanda Allen, Ronnie Hankins

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):_____

General Comments:

* Custody seals intact. Samples received in good condition
JSumner

Field Identification / Sample Description	Grab/Comp.	Collection Date/Time		Container Number & Volume Collected	Flow (MGD)	Rain Event? (Mark as Appropriate)				Laboratory Use: Project # 876				
	—	Date	Time	—	—	Yes	If Yes, Inches	No	Trace	ETS Log Number	Arrival Temp. (°C)	By	Time	Appearance
SQN-101-TOX	Comp	10/9/03 1305	10/10/03 1205	2(2.5gal)	NA	✓				031010.05	1.3°C / 1.9°C	JS	1931	* See COMMENTS
SQN-INT-TOX	Comp	10/9/03 1320	10/10/03 1220	1(2.5 gal)	NA	✓				031010.06	2.1°C	JS	1931	

Sample Custody – Fill In From Top Down

Relinquished By (Signature):	Date/Time	Received By (Signature):	Date/Time
Ronnie Hankins Ronnie Hankins	10/10/2003 14:31	Adam Day	10/10/2003 1431
Adam Day	10/10/03 1931 est	J SUMNER JSumner	10-10-03 1931

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.

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

Client: TVA
Facility: Sequoyah Nuclear Plant - Non-treated
NPDES #: TN 0026450
Project #: 876

Dilution preparation information:						*Comments:*
Dilution prep (%)	10.98	22	43.9	72	100	
Effluent volume (mL)	274.5	550	1097.5	1800	2500	
Diluent volume (mL)	2225.5	1950	1402.5	700	0	
Total volume (mL)	2500	2500	2500	2500	2500	

Test organism information:		*Test information:*	
Organism age:	24.75 TO 27.25 - HOURS OLD	Randomizing template:	GREEN
Date and times organisms were born between:	10-06-03 1230 TO 1400 MDT	Incubator number:	3C1
Organism source:	ABS BATCH 10-06-03	*Artemia* lot number:	860403Q
Transfer bowl information:	pH = 7.82 Temperature = 24.7 °C	Total drying time:	17-HOURS
		Date / Time in: 10-14-03	1500
Average transfer volume:	10.4 ml	Date / Time out: 10-15-03	0800
		Oven temperature:	100°C

Daily feeding and renewal information:

Day	Date	Morning feeding time	Afternoon feeding time	Test initiation, renewal, or termination time	Control water batch used	Sample numbers used	Analyst
0	10-07-03	—	1600	1245	10.06.03	031007.02/.03	JJ
1	10-08-03	0900	1500	1202	10-06-03	031007.02/.03	JJ
2	10-09-03	0900	1515	1206	10-08-03	031009.02/.03	JJ
3	10-10-03	0900	1500	1210	10-08-03	031009.02/.03	JJ
4	10-11-03	0853	1500	1219	10-08-03	031010.05/.06	JJ
5	10-12-03	0850	1504	1215	10-08-03	031010.05/.06	JJ
6	10-13-03	0902	1500	1231	10-10-03	031010.05/.06	JJ
7	10-14-03			1226			JJ

Control information:		Acceptance criteria	*Summary of test endpoints:*	
% Mortality:	0%	≤ 20%	7-day LC_{50}	>100%
Average weight per initial larvae:	1.0673		NOEC	100%
Average weight per surviving larvae:	1.0673	≥ 0.25 mg/larvae	LOEC	>100%
			ChV	>100%
			IC_{25}	>100%

Species: *Pimephales promelas* **Date:** 10.07-03

Client: TVA / Sequoyah Nuclear Plant
Non-treated

Survival and Growth Data

Day	CONTROL				10.98%				22%			
	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) Back	14.945	14.881	14.968	15.244	15.079	15.175	15.202	15.240	15.076	15.106	14.947	15.240
B = Pan + Larvae weight (mg)	26.14	25.04	26.02	25.53	26.31	26.83	26.04	26.80	27.48	26.16	26.64	27.30
Larvae weight (mg) = A – B	11.195	10.159	11.052	~~10.286~~ 10.286	11.231	11.655	10.838	11.560	12.404	11.054	11.693	12.060
Weight per initial number of larvae (mg) = C / Initial number of larvae	1.1195	1.0159	1.1052	1.0286	1.1231	1.1655	1.0838	1.1560	1.2404	1.1054	1.1693	1.2060
Average weight per initial number of larvae (mg)	1.0673				1.1321				1.1803			

Calculations and data reviewed: [illegible]

Comments:

Species: *Pimephales promelas*

Client: TVA / Sequoyah Nuclear Plant
Non-treated

Date: 10.07.03

Survival and Growth Data

Day	43.9%				72%				100%			
	M	N	O	P	Q	R	S	T	U	V	W	X
0	10	10	10	10	10	10	10	10	10	10	10	10
1	10	10	10	10	10	10	10	10	10	10	10	10
2	10	10	10	10	10	10	10	10	10	10	10	10
3	10	10	10	10	10	10	10	10	10	10	10	10
4	10	10	10	10	10	10	10	10	10	10	10	10
5	10	10	10	10	10	10	10	10	10	10	10	10
6	10	10	10	10	10	10	10	10	10	10	10	10
7	10	10	10	10	10	10	10	10	10	10	10	10
A = Pan weight (mg)	15.180	15.203	15.221	15.213	15.199	14.928	14.906	14.934	14.959	14.902	15.005	14.900
B = Pan + Larvae weight (mg)	27.51	25.91	25.82	27.14	26.85	24.44	27.10	27.51	27.32	26.10	26.43	26.97
Larvae weight (mg) = A – B	12.330	10.707	10.599	11.927	11.651	9.512	12.194	12.576	12.361	11.198	11.425	12.062
Weight per initial number of larvae (mg) = C / Initial number of larvae	1.2330	1.0707	1.0599	1.1927	1.1651	0.9512	1.2194	1.2576	1.2361	1.1198	1.1425	1.2062
Average weight per initial number of larvae (mg)	1.1391				1.1483				1.1762			

Calculations and data reviewed: [illegible]

Comments:

Species: *Pimephales promelas*

Client: TVA / Sequoyah Nuclear Plant
Non-treated

Date: 10.07.03

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	9 1d	10
6	10	10	9	10
7	10	10	9	10
A = Pan weight (mg)	15.023	14.953	15.020	15.020
B = Pan + Larvae weight (mg)	26.44	26.29	26.02	27.14
Larvae weight (mg) = A – B	11.417	11.337	11.000	12.120
Weight per initial number of larvae (mg) = C / Initial number of larvae	1.1417	1.1337	1.1000	1.2120
Average weight per initial number of larvae (mg)	1.1469			

Calculations and data reviewed: JH

Comments:

Environmental Testing Solutions, Inc.

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

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

Client: TVA Sequoyah Nuclear Plant, Nontreated

Test dates: October 7-14, 2003

Project number: 876

Reviewed by: [signature]

Concentration (%)	Replicate	Initial number of larvae	Final number of larvae	A = Pan weight (mg)	B = Pan + Larvae weight (mg)	Larvae weight (mg) = A - B	Weight / Initial number of larvae (mg)	Mean survival (%)	Mean weight (mg)	Coefficient of variation (%)	Percent reduction from control (%)
Control	A	10	10	14 945	26 140	11 195	1.1195	100.0	1.0673	4.9	Not applicable
	B	10	10	14 881	25 040	10 159	1 0159				
	C	10	10	14 968	26 020	11 052	1.1052				
	D	10	10	15 244	25 530	10 286	1 0286				
10.98%	E	10	10	15 079	26 310	11.231	1.1231	100.0	1.1321	3.3	-6.1
	F	10	10	15 175	26 830	11 655	1.1655				
	G	10	10	15 202	26 040	10 838	1 0838				
	H	10	10	15 240	26 800	11 560	1.1560				
22%	I	10	10	15 076	27.480	12 404	1.2404	100.0	1.1803	4.9	-10.6
	J	10	10	15.106	26 160	11 054	1.1054				
	K	10	10	14 947	26 640	11 693	1.1693				
	L	10	10	15 240	27.300	12 060	1.2060				
43.9%	M	10	10	15 180	27.510	12 330	1 2330	100.0	1.1391	7.6	-6.7
	N	10	10	15 203	25 910	10.707	1 0707				
	O	10	10	15 221	25 820	10.599	1 0599				
	P	10	10	15 213	27 140	11.927	1.1927				
72%	Q	10	10	15.199	26 850	11 651	1.1651	100.0	1.1483	11.9	-7.6
	R	10	10	14 928	24 440	9 512	0 9512				
	S	10	10	14 906	27.100	12 194	1.2194				
	T	10	10	14 934	27.510	12 576	1.2576				
100%	U	10	10	14 959	27.320	12 361	1.2361	100.0	1.1762	4.6	-10.2
	V	10	10	14 902	26 100	11.198	1.1198				
	W	10	10	15 005	26 430	11.425	1.1425				
	X	10	10	14 908	26 970	12 062	1.2062				
100% Intake	U	10	10	15 023	26 440	11 417	1.1417	97.5	1.1469	4.1	-7.5
	V	10	10	14 953	26 290	11.337	1.1337				
	W	10	9	15 020	26 020	11 000	1.1000				
	X	10	10	15 020	27.140	12.120	1 2120				

Outfall 101:
Dunnett's MSD value: 0.1332
PMSD: 12.5

Intake:
Dunnett's MSD value: 0.0686
PMSD: 6.4

MSD = Minimum Significant Difference
PMSD = Percent Minimum Significant Difference

PMSD is a measure of test precision The PMSD is the minimum percent difference between the control and treatment that can be declared statistically significant in a whole effluent toxicity test On average, a significant difference occurs for Environmental Testing Solutions, Inc. chronic toxicity tests when a toxicant reduces Pimephales growth by 17.0% from the control (determined through reference toxicant testing).
Lower PMSD bound determined by USEPA (10th percentile) = 9.4%
Upper PMSD bound determined by USEPA (90th percentile) = 35%
The lower and upper bounds were calculated by the USEPA using 205 tests conducted from 19 laboratories for Pimephales growth in chronic reference toxicant tests

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

Environmental Testing Solutions, Inc.

Statistical Analyses

Larval Fish Growth and Survival Test-7 Day Growth

Start Date:	10/7/03	Test ID:	PpFRCR	Sample ID:	Sequoyah Nuclear Plant, Intake - Nontreated
End Date:	10/14/03	Lab ID:	ETS-Env. Testing Solutions	Sample Type:	DMR-Discharge Monitoring Report
Sample Date:		Protocol:	CHRONIC-(EPA-821-R-02-013)	Test Species:	PP-Pimephales promelas
Comments:					

Conc-%	1	2	3	4
D-Control	1.1195	1.0159	1.1052	1.0286
100	1.1417	1.1337	1.1000	1.2120

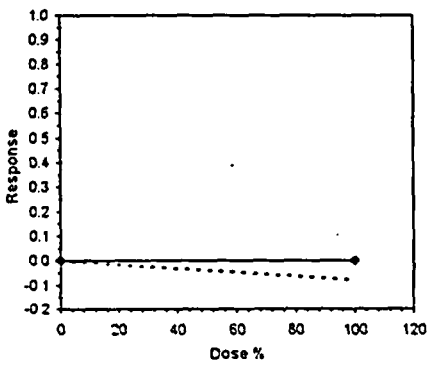
			Transform: Untransformed						1-Tailed		Isotonic	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	1.0673	1.0000	1.0673	1.0159	1.1195	4.929	4				1.1071	1.0000
100	1.1469	1.0745	1.1469	1.1000	1.2120	4.102	4	-2.255	1.943	0.0686	1.1071	1.0000

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.895652354	0.749	0.336540408	-1.77063761
F-Test indicates equal variances (p = 0.86)	1.250344515	47.46834564		

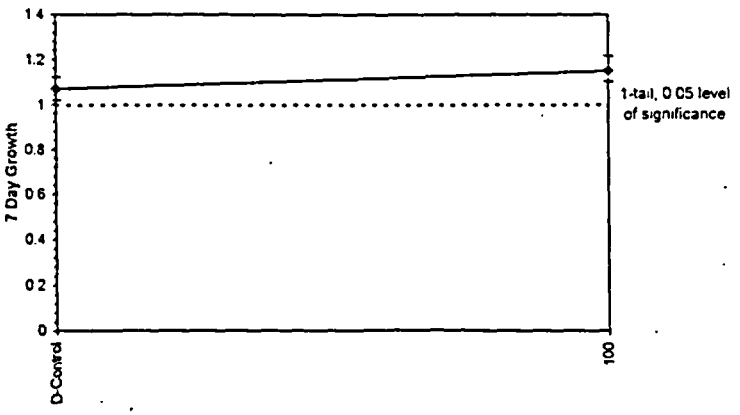
Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t-Test indicates no significant differences Treatments vs D-Control	0.068563797	0.064240417	0.012656405	0.002489965	0.065033898	1, 6

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



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

Client: TVA
Facility: Sequoyah Nuclear Plant - Non-treated
NPDES #: TN 0026450
Project #: 876

Dilution preparation information:						*Comments:*
Dilution prep (%)	10.98	22	43.9	72	100	
Effluent volume (mL)	274.5	550	1097.5	1800	2500	
Diluent volume (mL)	2225.5	1950	1402.5	700	0	
Total volume (mL)	2500	2500	2500	2500	2500	

Test organism information:		*Test information:*	
Organism age:	<24-hours old	Randomizing template:	Purple
Date and times organisms were born between:	10-07-03 0752 to 1016	Incubator number and shelf location:	2 D1
Organism source:	~~ABS~~ 09-30-03 A-D	YCT batch: ABS	09-11-03
Transfer bowl information:	pH = 7.0 Temperature = 24.4°C	*Selenastrum* batch: ABS	09-11-03

Daily renewal information:

Day	Date	Test initiation, renewal, or termination time	Control water batch used	Sample numbers used	Analyst
0	10-07-03	1212	10-06-03	031007.02/.03	JH
1	10-08-03	1231	10-06-03	031007.02/.03	JH
2	10-09-03	1233	10-08-03	031009.02/.03	JH
3	10-10-03	1235	10-08-03	031009.02/.03	JH
4	10-11-03	1206	10-08-03	031010.05/.06	JH
5	10-12-03	1228	10-08-03	031010.05/.06	JH
6	10-13-03	1216	10-10-03	031010.05/.06	JH
7	10-14-03	1200			JH

Control information:	#1	#2	Acceptance criteria	*Summary of test endpoints:*	
% of Male Adults:	0%	0%	≤ 20%	7-day LC50	>100%
% Adults having 3rd Broods:	100%	100%	≥ 80%	NOEC	100%
% Mortality:	0%	0%	≤ 20%	LOEC	>100%
Mean Offspring/Female:	32.7	33.8	≥ 15.0 offspring/female	ChV	>100%
% CV:	5.8%	11.5%	< 40.0 %	IC25	>100%

Species: *Ceriodaphnia dubia*
Client: Sequoyah Nuclear Plant - Non-treated **Date:** 10.07.03

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	6	4	6	4	4	4	5	4	5	5
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	14	10	10	11	10	13	10	10	10	13
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	14	16	18	16	19	18	15	18	18	17
Total young produced		34	30	34	31	33	35	30	32	33	35
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L
X for 3rd Broods		X	X	X	X	X	X	X	X	X	X

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	32.7

CONC: 10.98% *Survival and Reproduction Data*

Day		Replicate number 1	2	3	4	5	6	7	8	9	10
1	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
2	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
3	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
4	Young produced	5	5	6	5	4	4	5	4	5	4
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	15	12	10	15	11	13	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	19	21	17	17	18	19	18	18	21	15
Total young produced		39	38	33	37	33	36	35	32	36	31
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	35.0
% Reduction from Control:	-7.0%

Species: *Ceriodaphnia dubia*
Client: Sequoyah Nuclear Plant - Non-treated Date: 10.07.03

CONC: 22% *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	5	4	5	5	5	5	4
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	14	10	13	12	10	12	12	12	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	20	16	17	17	21	20	17	19	17	18
Total young produced		39	32	35	34	35	37	34	36	35	32
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	34.9
% Reduction from Control:	-67%

CONC: 43.9% *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	4	5	5	5	5	6	4	5
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	16	13	10	12	14	10	12	16	14	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	21	21	20	17	18	20	17	17	17	19
Total young produced		42	40	34	34	37	35	34	39	35	35
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	36.5
% Reduction from Control:	-11.6%

Species: *Ceriodaphnia dubia*
Client: Sequoyah Nuclear Plant - Non-treated **Date:** 10-07-03

CONC: 72% *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	5	4	5	5	5	5
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	15	12	12	16	10	13	13	14	10	15
	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	21	20	20	17	18	21	20	22	20	18
Total young produced		40	37	37	38	33	38	38	41	35	38
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	37.5
% Reduction from Control:	-14.7%

CONC: 100% *Survival and Reproduction Data*

Day		Replicate number 1	2	3	4	5	6	7	8	9	10
1	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
2	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
3	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
4	Young produced	4	~~8~~ 6	5	5	6	5	5	5	6	6
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	16	12	10	12	12	16	15	16	13	14
	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	22	16	20	18	20	21	18	18	15	20
Total young produced		42	34	35	35	38	42	38	39	34	40
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	37.7
% Reduction from Control:	-15.3%

Species: *Ceriodaphnia dubia*
Client: Sequoyah Nuclear Plant - Non-treated **Date:** 10.07.03

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	6	4	4	5	6	5	5	4	6	5
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	12	10	10	14	14	14	10	10	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	20	16	15	18	19	19	15	18	17	14
Total young produced		38	30	29	37	39	38	30	32	34	31
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	~~32.7~~ 33.8
% Reduction from Control:	~~—~~

CONC: 100% Intake *Survival and Reproduction Data*

Day		Replicate number 1	2	3	4	5	6	7	8	9	10
1	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
2	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
3	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
4	Young produced	5	5	5	4	5	6	5	5	5	5
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	15	16	14	12	14	13	11	10	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	20	19	19	16	18	17	20	17	21	19
Total young produced		40	40	38	32	37	36	36	32	39	36
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	~~35.0~~ 36.6
% Reduction from Control:	~~-7.0%~~ -8.3%

Environmental Testing Solutions, Inc.

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	6	4	6	4	4	4	5	4	5	5	47
5	14	10	10	11	10	13	10	10	10	13	111
6	0	0	0	0	0	0	0	0	0	0	0
7	14	16	18	16	19	18	15	18	18	17	169
Total	34	30	34	31	33	35	30	32	33	35	327

10.98%

Day	Replicate number										Total
	1	2	3	4	5	6	7	8	9	10	
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0
4	5	5	6	5	4	4	5	4	5	4	47
5	15	12	10	15	11	13	12	10	10	12	120
6	0	0	0	0	0	0	0	0	0	0	0
7	19	21	17	17	18	19	18	18	21	15	183
Total	39	38	33	37	33	36	35	32	36	31	350

22%

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	5	4	5	5	5	5	4	49
5	14	10	13	12	10	12	12	12	13	10	118
6	0	0	0	0	0	0	0	0	0	0	0
7	20	16	17	17	21	20	17	19	17	18	182
Total	39	32	35	34	35	37	34	36	35	32	349

43.9%

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	4	5	5	5	5	6	4	5	50
5	16	13	10	12	14	10	12	16	14	11	128
6	0	0	0	0	0	0	0	0	0	0	0
7	21	21	20	17	18	20	17	17	17	19	187
Total	42	40	34	34	37	35	34	39	35	35	365

72%

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	5	4	5	5	5	5	48
5	15	12	12	16	10	13	13	14	10	15	130
6	0	0	0	0	0	0	0	0	0	0	0
7	21	20	20	17	18	21	20	22	20	18	197
Total	40	37	37	38	33	38	38	41	35	38	375

100%

Day	Replicate number										Total
	1	2	3	4	5	6	7	8	9	10	
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0
4	4	6	5	5	6	5	5	5	6	6	53
5	16	12	10	12	12	16	15	16	13	14	136
6	0	0	0	0	0	0	0	0	0	0	0
7	22	16	20	18	20	21	18	18	15	20	188
Total	42	34	35	35	38	42	38	39	34	40	377

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	6	4	4	5	6	5	5	4	6	5	50
5	12	10	10	14	14	14	10	10	11	12	117
6	0	0	0	0	0	0	0	0	0	0	0
7	20	16	15	18	19	19	15	18	17	14	171
Total	38	30	29	37	39	38	30	32	34	31	338

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	5	5	4	5	6	5	5	5	5	50
5	15	16	14	12	14	13	11	10	13	12	130
6	0	0	0	0	0	0	0	0	0	0	0
7	20	19	19	16	18	17	20	17	21	19	186
Total	40	40	38	32	37	36	36	32	39	36	366

Environmental Testing Solutions, Inc.

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

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

Client: TVA Sequoyah Nuclear Plant, Nontreated

Test dates: October 7-14, 2003

Project number: 876

Reviewed by: [signature]

Concentration (%)	Replicate number										Survival (%)	Average reproduction (offspring/female)	Coefficient of variation (%)	Percent reduction from pooled controls (%)
	1	2	3	4	5	6	7	8	9	10				
Control - 1	34	30	34	31	33	35	30	32	33	35	100	32.7	5.8	Not applicable
10.98%	39	38	33	37	33	36	35	32	36	31	100	35.0	7.6	-7.0
22%	39	32	35	34	35	37	34	36	35	32	100	34.9	6.1	-6.7
43.9%	42	40	34	34	37	35	34	39	35	35	100	36.5	7.9	-11.6
72%	40	37	37	38	33	38	38	41	35	38	100	37.5	6.1	-14.7
100%	42	34	35	35	38	42	38	39	34	40	100	37.7	8.2	-15.3
Control - 2	38	30	29	37	39	38	30	32	34	31	100	33.8	11.5	Not applicable
100% Intake	40	40	38	32	37	36	36	32	39	36	100	36.6	7.9	-8.3

Outfall 101:

Dunnett's MSD value: 2.581

PMSD: 7.9

Intake:

Dunnett's MSD value: 2.649

PMSD: 7.8

MSD = Minimum Significant Difference

PMSD = Percent Minimum Significant Difference

PMSD is a measure of test precision. The PMSD is the minimum percent difference between the control and treatment that can be declared statistically significant in a whole effluent toxicity test. On average, a significant difference occurs for Environmental Testing Solutions, Inc. chronic toxicity tests when a toxicant reduces Ceriodaphnia reproduction by 9.9% from the control.

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

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

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

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

Environmental Testing Solutions, Inc.

Statistical Analyses

Ceriodaphnia Survival and Reproduction Test-Reproduction

Start Date:	10/7/03	Test ID:	CdFRCR	Sample ID:	Sequoyah Nuclear Plant - Outfall 101
End Date:	10/14/03	Lab ID:	ETS-Env. Testing Solutions	Sample Type:	DMR-Discharge Monitoring Report
Sample Date		Protocol:	CHRONIC-(EPA-821-R-02-013)	Test Species:	CD-Ceriodaphnia dubia
Comments:					

Conc-%	1	2	3	4	5	6	7	8	9	10
D-Control	34.000	30.000	34.000	31.000	33.000	35.000	30.000	32.000	33.000	35.000
10.98	39.000	38.000	33.000	37.000	33.000	36.000	35.000	32.000	36.000	31.000
22	39.000	32.000	35.000	34.000	35.000	37.000	34.000	36.000	35.000	32.000
43.9	42.000	40.000	34.000	34.000	37.000	35.000	34.000	39.000	35.000	35.000
72	40.000	37.000	37.000	38.000	33.000	38.000	38.000	41.000	35.000	38.000
100	42.000	34.000	35.000	35.000	38.000	42.000	38.000	39.000	34.000	40.000

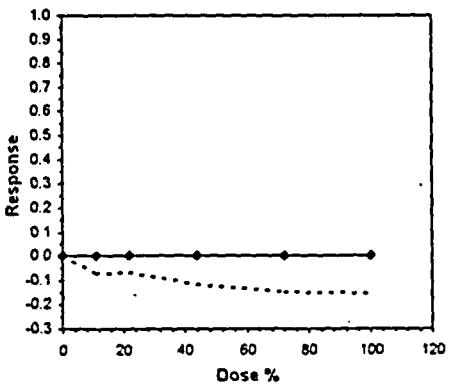
			Transform: Untransformed						1-Tailed		Isotonic	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	32.700	1.0000	32.700	30.000	35.000	5.775	10				35.717	1.0000
10.98	35.000	1.0703	35.000	31.000	39.000	7.619	10	-2.037	2.287	2.581	35.717	1.0000
22	34.900	1.0673	34.900	32.000	39.000	6.108	10	-1.949	2.287	2.581	35.717	1.0000
43.9	36.500	1.1162	36.500	34.000	42.000	7.883	10	-3.366	2.287	2.581	35.717	1.0000
72	37.500	1.1468	37.500	33.000	41.000	6.061	10	-4.252	2.287	2.581	35.717	1.0000
100	37.700	1.1529	37.700	34.000	42.000	8.204	10	-4.429	2.287	2.581	35.717	1.0000

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Kolmogorov D Test indicates normal distribution (p > 0.01)	0.78230977	1.035	0.19942737	-0.7217265
Bartlett's Test indicates equal variances (p = 0.70)	3.02303815	15.0863171		

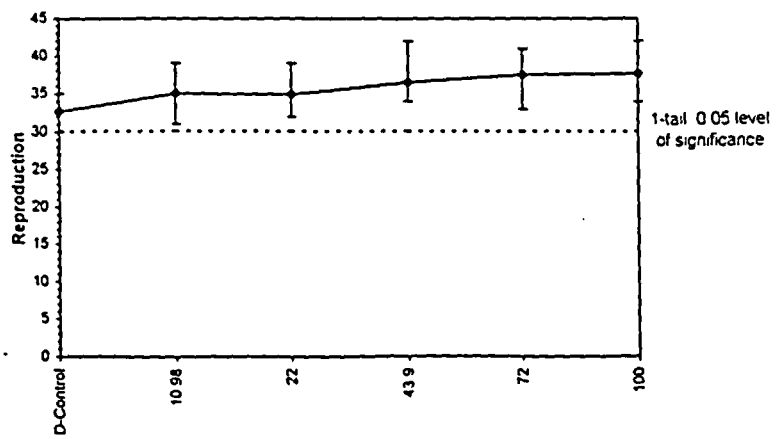
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	100	>100		1	2.58144757	0.07894335	36.0166667	6.37222222	2.9E-04	5, 54
Treatments vs D-Control										

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



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Environmental Testing Solutions, Inc.

Statistical Analyses

Ceriodaphnia Survival and Reproduction Test-Reproduction

Start Date:	10/7/03	Test ID:	CdFRCR	Sample ID:	Sequoyah Nuclear Plant - Intake
End Date:	10/14/03	Lab ID:	ETS-Env. Testing Solutions	Sample Type:	DMR-Discharge Monitoring Report
Sample Date		Protocol:	CHRONIC-(EPA-821-R-02-013)	Test Species:	CD-Ceriodaphnia dubia
Comments:					

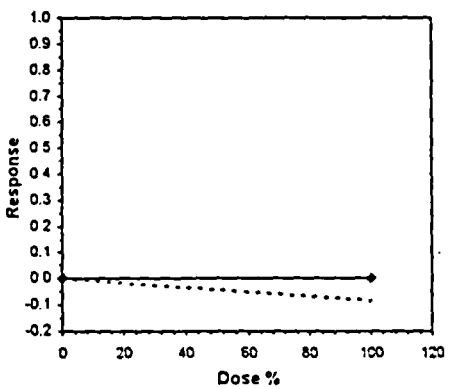
Conc-%	1	2	3	4	5	6	7	8	9	10
D-Control	38.000	30.000	29.000	37.000	39.000	38.000	30.000	32.000	34.000	31.000
100	40.000	40.000	38.000	32.000	37.000	36.000	36.000	32.000	39.000	36.000

			Transform: Untransformed						1-Tailed		Isotonic	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	33.800	1.0000	33.800	29.000	39.000	11.484	10				35.200	1.0000
100	36.600	1.0828	36.600	32.000	40.000	7.856	10	-1.833	1.734	2.649	35.200	1.0000

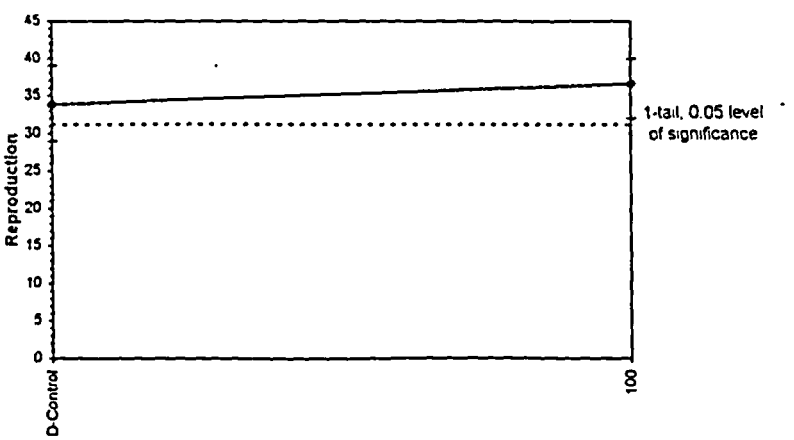
Auxiliary Tests	Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.92713833		0.868		-0.0423974	-1.364012
F-Test indicates equal variances (p = 0.38)	1.8225807		6.54108572			
Hypothesis Test (1-tail, 0.05)	**MSDu**	**MSDp**	**MSB**	**MSE**	**F-Prob**	**df**
Homoscedastic t Test indicates no significant differences Treatments vs D-Control	2.64882503	0.0783676	39.2	11.6666667	0.08339144	1, 18

Linear Interpolation (200 Resamples)

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



Dose-Response Plot



sqn_10-07-03data.xls

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

Client: TVA
Facility: Sequoyah Nuclear Plant - UV-treated
NPDES #: TN 0026450
Project #: 876

Dilution preparation information:						*Comments:*
Dilution prep (%)	10.98	22	43.9	72	100	
Effluent volume (mL)	274.5	550	1097.5	1800	2500	
Diluent volume (mL)	2225.5	1950	1402.5	700	0	
Total volume (mL)	2500	2500	2500	2500	2500	

Test organism information:		*Test information:*	
Organism age:	24.5 TO 27 HOURS OLD	Randomizing template:	RED
Date and times organisms were born between:	10-06-03 1230 TO 1400 MDT	Incubator number:	3 B1
Organism source:	ABS BATCH 10-06-03	*Artemia* lot number:	860403Q
Transfer bowl information:	pH = 7.82 Temperature = 24.7 °C	Total drying time:	17-HOURS
		Date / Time in: 10-14-03	1500
Average transfer volume:	10.4 ml	Date / Time out: 10-15-03	0800
		Oven temperature:	100°C

Daily feeding and renewal information:

Day	Date	Morning feeding time	Afternoon feeding time	Test initiation, renewal, or termination time	Control water batch used	Sample numbers used	Analyst
0	10-07-03	—	1600	1232	10.06.03	031007.02/.03	JH
1	10-08-03	0900	1500	1215	10-06-03	031007.02/.03	JH
2	10-09-03	0900	1515	1212	10-08-03	031009.02/.03	JH
3	10-10-03	0900	1500	1222	10-08-03	031009.02/.03	JH
4	10-11-03	0853	1500	1235	10-08-03	031010.05/.06	JH
5	10-12-03	0850	1504	1231	10-08-03	031010.05/.06	JH
6	10-13-03	0902	1500	1245	10-10-03	031010.05/.06	JH
7	10-14-03			1244			JH

Control information:		Acceptance criteria	*Summary of test endpoints:*	
% Mortality:	0%	≤ 20%	7-day LC_{50}	>100%
Average weight per initial larvae:	1.1574		NOEC	100%
Average weight per surviving larvae:	1.1574	≥ 0.25 mg/larvae	LOEC	>100%
			ChV	>100%
			IC_{25}	>100%

Species: *Pimephales promelas* **Date:** 10.0763

Client: TVA / Sequoyah Nuclear Plant
UV-treated

Survival and Growth Data

Day	CONTROL				10.98%				22%			
	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) Blue	14.950	14.905	15.234	15.284	15.214	15.217	15.301	15.245	14.970	15.285	15.053	15.144
B = Pan + Larvae weight (mg)	25.64	26.46	26.96	27.56	26.14	27.21	26.74	26.12	26.76	26.33	24.39	27.07
Larvae weight (mg) = A – B	10.690	11.555	11.726	12.326	10.926	11.993	11.439	10.875	11.790	11.045	9.297	11.926
Weight per initial number of larvae (mg) = C / Initial number of larvae	1.0690	1.1555	1.1726	1.2326	1.0926	1.1993	1.1439	1.0875	1.1790	1.1045	0.9297	1.1926
Average weight per initial number of larvae (mg)	1.1574				1.1308				1.1015			

Calculations and data reviewed: JL

Comments:

Species: ***Pimephales promelas***

Client: **TVA / Sequoyah Nuclear Plant**
UV-treated

Date: 10-09-03

Survival and Growth Data

Day	43.9%				72%				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 ISMALL	10	10	10	10
A = Pan weight (mg)	15.023	15.125	14.958	14.968	15.165	14.988	14.983	15.090	15.202	15.069	14.955	15.240
B = Pan + Larvae weight (mg)	26.58	27.28	26.93	26.04	25.25	26.36	28.10	26.03	27.61	27.73	27.11	27.57
Larvae weight (mg) = A – B	11.557	12.155	11.972	11.072	10.085	11.372	13.117	10.940	12.408	12.661	12.155	12.330
Weight per initial number of larvae (mg) = C / Initial number of larvae	1.1557	1.2155	1.1972	1.1072	1.0085	1.1372	1.3117	1.0940	1.2408	1.2661	1.2155	1.2330
Average weight per initial number of larvae (mg)	1.1689				1.1379				1.2389			

Calculations and data reviewed: JL

Comments:

Species: *Pimephales promelas*

Client: TVA / Sequoyah Nuclear Plant
UV-treated

Date: 10-07-03

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	9'd	10
A = Pan weight (mg)	14.992	15.006	15.302	15.009
B = Pan + Larvae weight (mg)	27.24	26.98	25.65	27.21
Larvae weight (mg) = A – B	12.248	11.974	10.348	12.207
Weight per initial number of larvae (mg) = C / Initial number of larvae	1.2248	1.1974	1.0348	1.2207
Average weight per initial number of larvae (mg)	1.1694			

Calculations and data reviewed: JL

Comments:

Environmental Testing Solutions, LLC

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

Species: *Pimephales promelas*

Quality Control

Verification of Data Entry, Calculations, and Statistical Analyses

Client: TVA Sequoyah Nuclear Plant, UV Treated

Test dates: October 7-14, 2003

Project number: 876

Reviewed by: [signature]

Concentration (%)	Replicate	Initial number of larvae	Final number of larvae	A = Pan weight (mg)	B = Pan + Larvae weight (mg)	Larvae weight (mg) = A - B	Weight / Initial number of larvae (mg)	Mean survival (%)	Mean weight (mg)	Coefficient of variation (%)	Percent reduction from control (%)
Control	A	10	10	14.950	25.640	10.690	1.0690	100.0	1.1574	5.8	Not applicable
	B	10	10	14.905	26.460	11.555	1.1555				
	C	10	10	15.234	26.960	11.726	1.1726				
	D	10	10	15.234	27.560	12.326	1.2326				
10.98%	E	10	10	15.214	26.140	10.926	1.0926	100.0	1.1308	4.6	2.3
	F	10	10	15.217	27.210	11.993	1.1993				
	G	10	10	15.301	26.740	11.439	1.1439				
	H	10	10	15.245	26.120	10.875	1.0875				
22%	I	10	10	14.970	26.760	11.790	1.1790	100.0	1.1015	11.0	4.8
	J	10	10	15.285	26.330	11.045	1.1045				
	K	10	10	15.093	24.390	9.297	0.9297				
	L	10	10	15.144	27.070	11.926	1.1926				
43.9%	M	10	10	15.023	26.580	11.557	1.1557	100.0	1.1689	4.1	-1.0
	N	10	10	15.125	27.280	12.155	1.2155				
	O	10	10	14.958	26.930	11.972	1.1972				
	P	10	10	14.968	26.040	11.072	1.1072				
72%	Q	10	10	15.165	25.250	10.085	1.0085	100.0	1.1379	11.2	1.7
	R	10	10	14.988	26.360	11.372	1.1372				
	S	10	10	14.983	28.100	13.117	1.3117				
	T	10	10	15.090	26.030	10.940	1.0940				
100%	U	10	10	15.202	27.610	12.408	1.2408	100.0	1.2389	1.7	-7.0
	V	10	10	15.069	27.730	12.661	1.2661				
	W	10	10	14.955	27.110	12.155	1.2155				
	X	10	10	15.240	27.570	12.330	1.2330				
100% Intake	Y	10	10	14.992	27.240	12.248	1.2248	97.5	1.1694	7.7	-1.0
	Z	10	10	15.006	26.980	11.974	1.1974				
	AA	10	9	15.302	25.650	10.348	1.0348				
	BB	10	10	15.003	27.210	12.207	1.2207				

Outfall 101:
Dunnett's MSD value: 0.1408
PMSD: 12.2

Intake:
Dunnett's MSD value: 0.1098
PMSD: 9.5

MSD = Minimum Significant Difference
PMSD = Percent Minimum Significant Difference
PMSD is a measure of test precision. The PMSD is the minimum percent difference between the control and treatment that can be declared statistically significant in a whole effluent toxicity test. On average, a significant difference occurs for Environmental Testing Solutions, Inc. chronic toxicity tests when a toxicant reduces Pimephales growth by 17.0% from the control (determined through reference toxicant testing).
Lower PMSD bound determined by USEPA (10th percentile) = 9.4%.
Upper PMSD bound determined by USEPA (90th percentile) = 35%.
The lower and upper bounds were calculated by the USEPA using 205 tests conducted from 19 laboratories for Pimephales growth in chronic reference toxicant tests.

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

Environmental Testing Solutions, Inc.

Statistical Analyses

Larval Fish Growth and Survival Test-7 Day Growth

Start Date:	10/7/03	Test ID:	PpFRCR	Sample ID:	Sequoyah Nuclear Plant, Outfall 101 - UV Treated
End Date:	10/14/03	Lab ID:	ETS-Env. Testing Solutions	Sample Type:	DMR-Discharge Monitoring Report
Sample Date		Protocol:	CHRONIC-(EPA-821-R-02-013)	Test Species:	PP-Pimephales promelas
Comments:					

Conc-%	1	2	3	4
D-Control	1.0690	1.1555	1.1726	1.2326
10.98	1.0926	1.1993	1.1439	1.0875
22	1.1790	1.1045	0.9297	1.1926
43.9	1.1557	1.2155	1.1972	1.1072
72	1.0085	1.1372	1.3117	1.0940
100	1.2408	1.2661	1.2155	1.2330

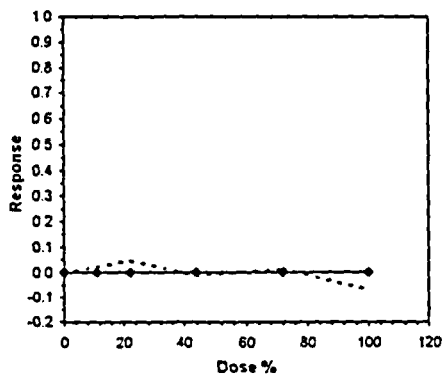
			Transform: Untransformed						1-Tailed		Isotonic	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	1.1574	1.0000	1.1574	1.0690	1.2326	5.839	4				1.1574	1.0000
10.98	1.1308	0.9770	1.1308	1.0875	1.1993	4.623	4	0.455	2.410	0.1408	1.1556	0.9984
22	1.1015	0.9516	1.1015	0.9297	1.1926	10.974	4	0.958	2.410	0.1408	1.1556	0.9984
43.9	1.1689	1.0099	1.1689	1.1072	1.2155	4.119	4	-0.196	2.410	0.1408	1.1556	0.9984
72	1.1379	0.9831	1.1379	1.0085	1.3117	11.218	4	0.335	2.410	0.1408	1.1556	0.9984
100	1.2389	1.0704	1.2389	1.2155	1.2661	1.697	4	-1.394	2.410	0.1408	1.1556	0.9984

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.97380805	0.884	-0.1238307	1.14176387
Bartlett's Test indicates equal variances (p = 0.10)	9.3074255	15.0863171		

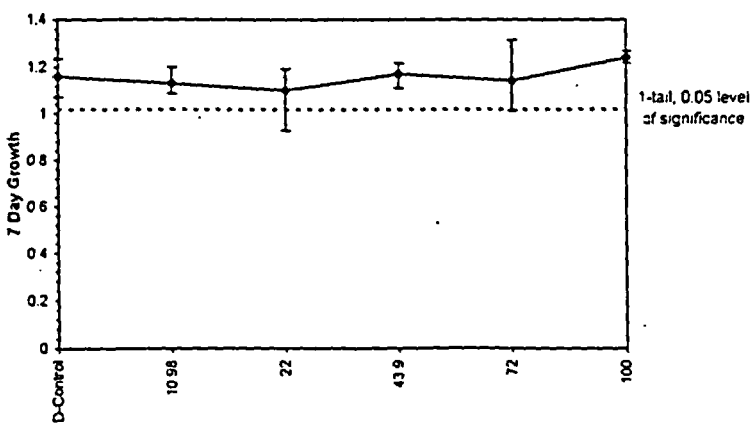
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	100	>100		1	0.14080683	0.12165526	0.00877711	0.00682721	0.3131732	5, 18
Treatments vs D-Control										

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



Environmental Testing Solutions, Inc.

Statistical Analyses

Larval Fish Growth and Survival Test-7 Day Growth

Start Date:	10/7/03	Test ID:	PpFRCR	Sample ID:	Sequoyah Nuclear Plant, Intake - UV Treated
End Date:	10/14/03	Lab ID:	ETS-Env. Testing Solutions	Sample Type:	DMR-Discharge Monitoring Report
Sample Date		Protocol:	CHRONIC-(EPA-821-R-02-013)	Test Species:	PP-Pimephales promelas
Comments:					

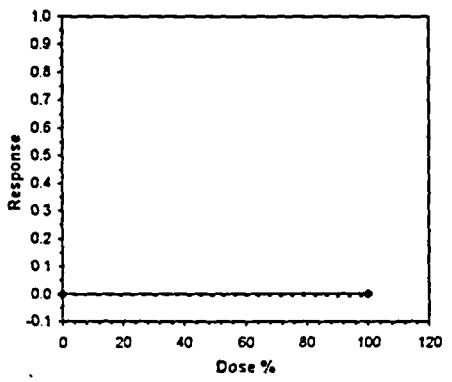
Conc-%	1	2	3	4
D-Control	1.0690	1.1555	1.1726	1.2326
100	1.2248	1.1974	1.0348	1.2207

			Transform: Untransformed						1-Tailed		Isotonic	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	1.1574	1.0000	1.1574	1.0690	1.2326	5.839	4				1.1634	1.0000
100	1.1694	1.0104	1.1694	1.0348	1.2248	7.744	4	-0.212	1.943	0.1098	1.1634	1.0000

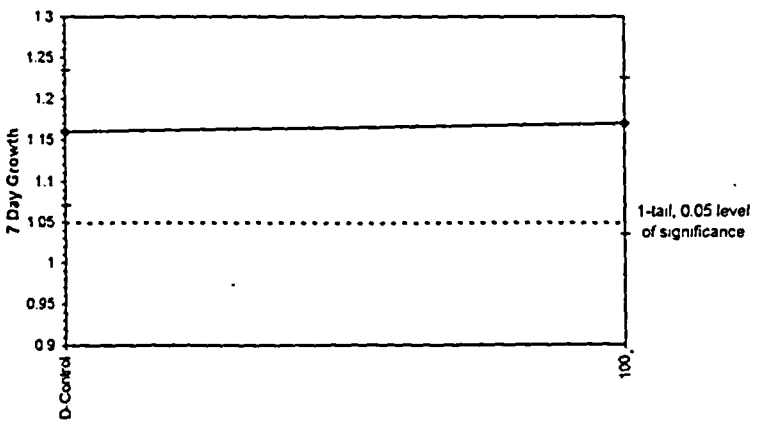
Auxiliary Tests	Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.86909294		0.749		-1.1182024	0.12075012
F-Test indicates equal variances (p = 0.64)	1.79521036		47.4683456			
Hypothesis Test (1-tail, 0.05)	**MSDu**	**MSDp**	**MSB**	**MSE**	**F-Prob**	**df**
Homoscedastic t Test indicates no significant differences Treatments vs D-Control	0.10978865	0.09485596	0.000288	0.00638438	0.83883339	1, 6

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



Environmental Testing Solutions, Inc.

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

Daily Chemical Analyses

Client: Sequoyah Nuclear Plant Non-Treated

Test dates: October 07 - 14, 2003

Project number: 876

Reviewed by: [illegible]

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)	7.81	7.41	7.50	7.52	7.64	7.50	7.75	7.11	7.77	7.13	7.72	7.50	7.68	7.11
	DO (mg/L)	7.9	7.8	8.1	8.0	8.1	7.9	8.3	6.7	7.8	6.5	7.7	7.6	7.7	6.1
	Conductivity (µmhos/cm)	313		292		291		287		294		290		294	
	Alkalinity (mg/L $CaCO_3$)	60				60								61	
	Hardness (mg/L $CaCO_3$)	84				86								84	
	Temperature (°C)	25.6	25.2	25.6	25.1	24.6	24.9	25.2	25.0	24.9	25.1	25.5	25.2	25.3	24.7
10.98%	pH (SU)	7.58	7.37	7.57	7.53	7.61	7.47	7.66	7.12	7.74	7.08	7.67	7.51	7.68	7.10
	DO (mg/L)	8.2	7.8	8.1	7.9	8.1	7.9	8.3	6.9	7.6	6.6	7.9	7.5	7.7	5.9
	Conductivity (µmhos/cm)	286		276		268		270		281		277		279	
	Temperature (°C)	25.6	25.2	25.6	25.1	24.6	24.9	25.2	25.0	24.9	25.1	25.5	25.2	25.3	24.7
22%	pH (SU)	7.58	7.33	7.55	7.52	7.58	7.46	7.65	7.06	7.66	7.04	7.63	7.52	7.66	7.07
	DO (mg/L)	8.2	7.7	8.2	7.8	8.1	7.9	8.3	6.5	7.6	6.2	7.8	7.5	7.7	5.9
	Conductivity (µmhos/cm)	275		263		259		263		268		265		249	
	Temperature (°C)	25.6	25.2	25.6	25.1	24.6	24.9	25.2	25.0	24.9	25.1	25.5	25.2	25.3	24.7
43.9%	pH (SU)	7.56	7.27	7.52	7.50	7.55	7.44	7.64	7.06	7.56	7.06	7.54	7.51	7.64	7.07
	DO (mg/L)	8.1	7.7	8.2	7.9	8.2	7.8	8.3	6.7	7.6	6.2	7.9	7.5	7.8	6.2
	Conductivity (µmhos/cm)	248		241		235		240		243		239		237	
	Temperature (°C)	25.6	25.2	25.6	25.1	24.6	24.9	25.2	25.0	24.9	25.1	25.5	25.2	25.3	24.7
72%	pH (SU)	7.53	7.32	7.48	7.49	7.50	7.46	7.61	7.08	7.45	7.07	7.44	7.51	7.62	7.09
	DO (mg/L)	8.2	7.8	8.1	7.8	8.1	7.8	8.3	6.4	7.6	6.3	7.9	7.5	7.8	6.4
	Conductivity (µmhos/cm)	213		208		203		205		206		204		203	
	Temperature (°C)	25.6	25.2	25.6	25.1	24.6	24.9	25.2	25.0	24.9	25.1	25.5	25.2	25.3	24.7
100%	pH (SU)	7.51	7.40	7.41	7.48	7.46	7.46	7.58	7.15	7.33	7.07	7.37	7.51	7.59	7.05
	DO (mg/L)	8.1	7.7	8.0	7.8	8.0	7.9	8.3	7.0	7.6	6.3	7.9	7.5	7.9	6.3
	Conductivity (µmhos/cm)	178		174		172		168		171		169		169	
	Alkalinity (mg/L $CaCO_3$)	66				62				62					
	Hardness (mg/L $CaCO_3$)	71				69				69					
	Total Residual Chlorine (mg/L)	<0.10				<0.10				<0.10					
	Temperature (°C)	25.6	25.2	25.6	25.1	24.7	24.9	25.2	25.0	24.9	25.1	25.5	25.2	25.3	24.7
100% Intake	pH (SU)	7.52	7.38	7.42	7.51	7.45	7.47	7.56	7.09	7.24	7.05	7.28	7.52	7.58	7.09
	DO (mg/L)	8.1	7.7	8.1	7.8	8.1	7.9	8.3	6.9	7.5	6.2	8.0	7.4	7.9	6.8
	Conductivity (µmhos/cm)	179		170		169		169		169		167		169	
	Alkalinity (mg/L $CaCO_3$)	64				62				62					
	Hardness (mg/L $CaCO_3$)	69				71				69					
	Total Residual Chlorine (mg/L)	<0.10				<0.10				<0.10					
	Temperature (°C)	25.6	25.2	25.6	25.1	24.7	24.9	25.2	25.0	24.9	25.1	25.5	25.2	25.3	24.7

Species: *Pimephales promelas*
Client: TVA / Sequoyah Nuclear Plant – Non-treated

Date: 10.07.03

Daily Chemistry:

		Day					
		0		1		2	
	Analyst	HEL	CAJ	CAJ	CAJ	CAJ	CAJ
Concentration	Parameter						
CONTROL	pH (S.U.)	7.81	7.41	7.58	7.52	7.64	7.50
	DO (mg/L)	7.9	7.8	8.1	8.0	8.1	7.9
	Conductivity (µmhos/cm)	313		292		291	
	Alkalinity (mg $CaCO_3$/L)	60				60	
	Hardness (mg $CaCO_3$/L)	84				86	
	Temperature (°C)	25.6	25.2	25.6	25.1	24.6	24.9
10.98%	pH (S.U.)	7.58	7.37	7.57	7.53	7.61	7.47
	DO (mg/L)	8.2	7.8	8.1	7.9	8.1	7.9
	Conductivity (µmhos/cm)	286		276		268	
	Temperature (°C)	25.6	25.2	25.6	25.1	24.6	24.9
22%	pH (S.U.)	7.58	7.33	7.55	7.52	7.58	7.46
	DO (mg/L)	8.2	7.7	8.2	7.8	8.1	7.9
	Conductivity (µmhos/cm)	275		263		259	
	Temperature (°C)	25.6	25.2	25.6	25.1	24.6	24.9
43.9%	pH (S.U.)	7.56 ~~7.53~~	7.27	7.52	7.50	7.50 ~~7.55~~	7.44
	DO (mg/L)	8.1	7.7	8.2	7.9	8.2	7.8
	Conductivity (µmhos/cm)	248		241		235	
	Temperature (°C)	25.6	25.2	25.6	25.1	24.6	24.9
72%	pH (S.U.)	7.53	7.32	7.48	7.49	7.50	7.46
	DO (mg/L)	8.2	7.8	8.1	7.8	8.1	7.8
	Conductivity (µmhos/cm)	213		208		203	
	Temperature (°C)	25.6	25.2	25.6	25.1	24.6	24.9
100%	pH (S.U.)	7.51	7.40	7.41	7.48	7.46	7.46
	DO (mg/L)	8.1	7.7	8.0	7.8	8.0	7.9
	Conductivity (µmhos/cm)	178		174		172	
	Alkalinity (mg $CaCO_3$/L)	66				62	
	Hardness (mg $CaCO_3$/L)	71				69	
	TR chlorine (mg/L)	<0.10				<0.10	
	Temperature (°C)	25.6	25.2	25.6	25.1	24.7	24.9
100% Intake	pH (S.U.)	7.52	7.38	7.42	7.57	7.45	7.47
	DO (mg/L)	8.1	7.7	8.1	7.8	8.1	7.9
	Conductivity (µmhos/cm)	179		170		169	
	Alkalinity (mg $CaCO_3$/L)	64				62	
	Hardness (mg $CaCO_3$/L)	69				71	
	TR chlorine (mg/L)	<0.10				<0.10	
	Temperature (°C)	25.6	25.2	25.6	25.1	24.7	24.9
		Initial	Final	Initial	Final	Initial	Final

Species: *Pimephales promelas* Date: 10.07-03
Client: TVA / Sequoyah Nuclear Plant – Non-treated

		Day							
		3		4		5		6	
	Analyst	CAL	KEN	KEN	KEN	KEN	KEN	KEN	KEN
Concentration	Parameter								
CONTROL	pH (S.U.)	7.75	7.11	7.77	7.13	7.72	7.50	7.68	7.11
	DO (mg/L)	8.3	6.7	7.8	6.5	7.7	7.6	7.7	6.1
	Conductivity (µmhos/cm)	287		294		290		294	
	Alkalinity (mg $CaCO_3$/L)							61	
	Hardness (mg $CaCO_3$/L)							84	
	Temperature (°C)	25.2	25.0	24.9	25.1	25.5	25.2	25.3	24.7
10.98%	pH (S.U.)	7.66	7.12	7.74	7.08	7.67	7.51	7.68	7.10
	DO (mg/L)	8.3	6.9	7.6	6.6	7.9	7.5	7.7	5.9
	Conductivity (µmhos/cm)	270		281		277		279	
	Temperature (°C)	25.2	25.0	24.9	25.1	25.5	25.2	25.3	24.7
22%	pH (S.U.)	7.65	7.06	7.66	7.04	7.63	7.52	7.66	7.07
	DO (mg/L)	8.3	6.5	7.6	6.2	7.8	7.5	7.7	5.9
	Conductivity (µmhos/cm)	263		268		265		249	
	Temperature (°C)	25.2	25.0	24.9	25.1	25.5	25.2	25.3	24.7
43.9%	pH (S.U.)	7.64	7.06	7.56	7.06	7.54	7.51	7.64	7.07
	DO (mg/L)	8.3	6.7	7.6	6.2	7.9	7.5	7.8	6.2
	Conductivity (µmhos/cm)	248		243		239		237	
	Temperature (°C)	25.2	25.0	24.9	25.1	25.5	25.2	25.3	24.7
72%	pH (S.U.)	7.61	7.08	7.45	7.07	7.44	7.51	7.62	7.09
	DO (mg/L)	8.3	6.4	7.6	6.3	7.9	7.5	7.8	6.4
	Conductivity (µmhos/cm)	205		206		204		203	
	Temperature (°C)	25.2	25.0	24.9	25.1	25.5	25.2	25.3	24.7
100%	pH (S.U.)	7.58	7.15	7.33	7.07	7.37	7.51	7.59	7.05
	DO (mg/L)	8.3	7.0	7.6	6.3	7.9	7.5	7.9	6.3
	Conductivity (µmhos/cm)	168		171		169		169	
	Alkalinity (mg $CaCO_3$/L)			62					
	Hardness (mg $CaCO_3$/L)			69					
	TR Chlorine (mg/L)			<0.10					
	Temperature (°C)	25.2	25.0	24.9	25.1	25.5	25.2	25.3	24.7
100% Intake	pH (S.U.)	7.56	7.09	7.24	7.05	7.28	7.52	7.58	7.09
	DO (mg/L)	8.3	6.9	7.5	6.2	8.0	7.4	7.9	6.8
	Conductivity (µmhos/cm)	169		169		167		169	
	Alkalinity (mg $CaCO_3$/L)			62					
	Hardness (mg $CaCO_3$/L)			69					
	TR chlorine (mg/L)			<0.10					
	Temperature (°C)	25.2	25.0	24.9	25.1	25.5	25.2	25.3	24.7
		Initial	Final	Initial	Final	Initial	Final	Initial	Final

Environmental Testing Solutions, Inc.

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

Daily Chemical Analyses

Client: Sequoyah Nuclear Plant Non-Treated

Test dates: October 07 - 14, 2003

Project number: 876

Reviewed by: Cwc

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)	7.81	7.57	7.58	7.62	7.64	7.62	7.75	7.71	7.77	7.81	7.72	7.65	7.68	7.70
	DO (mg/L)	7.9	8.0	8.1	7.9	8.1	8.1	8.3	7.5	7.8	7.8	7.7	7.7	7.7	7.5
	Conductivity (µmhos/cm)	313		292		291		287		294		290		294	
	Alkalinity (mg/L $CaCO_3$)	60				60								61	
	Hardness (mg/L $CaCO_3$)	84				86								84	
	Temperature (°C)	25.4	25.2	25.5	25.0	24.6	24.9	24.7	24.9	24.7	25.2	25.5	25.1	25.0	25.0
10.98%	pH (SU)	7.58	7.57	7.57	7.63	7.61	7.61	7.66	7.70	7.74	7.79	7.67	7.64	7.68	7.69
	DO (mg/L)	8.2	8.0	8.1	7.9	8.1	8.0	8.3	7.6	7.6	7.8	7.9	7.7	7.7	7.6
	Conductivity (µmhos/cm)	286		276		268		270		281		277		279	
	Temperature (°C)	25.4	25.2	25.5	25.1	24.6	24.9	24.7	24.9	24.7	25.2	25.5	25.1	25.0	25.0
22%	pH (SU)	7.58	7.57	7.55	7.62	7.58	7.60	7.65	7.70	7.66	7.77	7.63	7.62	7.66	7.68
	DO (mg/L)	8.2	7.9	8.2	7.9	8.1	8.0	8.3	7.5	7.6	7.8	7.8	7.7	7.7	7.6
	Conductivity (µmhos/cm)	275		263		259		263		268		265		269	
	Temperature (°C)	25.4	25.2	25.5	25.1	24.6	24.9	24.7	24.9	24.7	25.2	25.5	25.1	25.0	25.0
43.9%	pH (SU)	7.56	7.58	7.52	7.63	7.55	7.60	7.64	7.68	7.56	7.73	7.54	7.60	7.64	7.67
	DO (mg/L)	8.1	8.0	8.2	7.9	8.2	8.0	8.3	7.5	7.6	7.9	7.9	7.8	7.8	7.6
	Conductivity (µmhos/cm)	248		241		235		240		243		239		237	
	Temperature (°C)	25.4	25.2	25.5	25.1	24.6	24.9	24.7	24.9	24.7	25.2	25.5	25.1	25.0	25.0
72%	pH (SU)	7.53	7.55	7.48	7.59	7.50	7.58	7.61	7.66	7.45	7.67	7.44	7.60	7.62	7.67
	DO (mg/L)	8.2	8.0	8.1	7.9	8.1	8.0	8.3	7.6	7.6	7.9	7.9	7.8	7.8	7.6
	Conductivity (µmhos/cm)	213		208		203		205		206		204		203	
	Temperature (°C)	25.4	25.2	25.5	25.1	24.6	24.9	24.7	24.9	24.7	25.2	25.5	25.1	25.0	25.0
100%	pH (SU)	7.51	7.53	7.41	7.58	7.46	7.55	7.58	7.64	7.33	7.61	7.37	7.60	7.59	7.66
	DO (mg/L)	8.1	7.9	8.0	7.9	8.0	7.8	8.3	7.6	7.6	7.7	7.9	7.8	7.9	7.6
	Conductivity (µmhos/cm)	178		174		172		168		171		169		169	
	Alkalinity (mg/L $CaCO_3$)	66				62				62					
	Hardness (mg/L $CaCO_3$)	71				69				69					
	Total Residual Chlorine (mg/L)	<0.10				<0.10				<0.10					
	Temperature (°C)	25.4	25.2	25.5	25.1	24.6	24.9	24.7	24.9	24.7	25.2	25.5	25.1	25.0	25.0
100% Intake	pH (SU)	7.52		7.42	7.60	7.45	7.52	7.56	7.62	7.24	7.65	7.25	7.60	7.58	7.66
	DO (mg/L)	8.1		8.1	7.9	8.1	7.8	8.3	7.5	7.5	7.8	8.0	7.7	7.9	7.6
	Conductivity (µmhos/cm)	179		170		169		169		169		167		169	
	Alkalinity (mg/L $CaCO_3$)	64				62				62					
	Hardness (mg/L $CaCO_3$)	69				71				69					
	Total Residual Chlorine (mg/L)	<0.10				<0.10				<0.10					
	Temperature (°C)	25.4	25.2	25.5	25.1	24.6	24.9	24.7	24.9	24.7	25.2	25.5	25.1	25.0	25.0

* Spilled sample.

Species: *Ceriodaphnia dubia* **Date:** 10-07-03

Client: Sequoyah Nuclear Plant - Non-treated

Daily Chemistry:

		Day					
		0		1		2	
	Analyst	KEL	CAF	CAF	CAF	CAF	CAF
Concentration	Parameter						
CONTROL	pH (S.U.)	7.81	7.57	7.58	7.62	7.64	7.62
	DO (mg/L)	7.9	7.9 8.0	8.1	7.9	8.1	8.1
	Conductivity (µmhos/cm)	313		292		291	
	Alkalinity (mg $CaCO_3$/L)	60				60	
	Hardness (mg $CaCO_3$/L)	84				86	
	Temperature (°C)	25.4	25.2	25.5	25.0	24.6	24.9
10.98%	pH (S.U.)	7.58	7.57	7.57	7.63	7.61	7.61
	DO (mg/L)	8.2	8.0	8.1	7.9	8.1	8.0
	Conductivity (µmhos/cm)	286		276		268	
	Temperature (°C)	25.4	25.2	25.5	25.1	24.6	24.9
22%	pH (S.U.)	7.58	7.57	7.55	7.62	7.58	7.60
	DO (mg/L)	8.2	8.0 7.9	8.2	7.9	8.1	8.0
	Conductivity (µmhos/cm)	275		263		259	
	Temperature (°C)	25.4	25.2	25.5	25.1	24.6	24.9
43.9%	pH (S.U.)	7.56	7.58	7.52	7.63	7.55	7.60
	DO (mg/L)	8.1	8.0	8.2	7.9	8.2	8.0
	Conductivity (µmhos/cm)	248		241		235	
	Temperature (°C)	25.4	25.2	25.5	25.1	24.6	24.9
72%	pH (S.U.)	7.53	7.55	7.48	7.59	7.50	7.58
	DO (mg/L)	8.2	8.0	8.1	7.9	8.1	8.0
	Conductivity (µmhos/cm)	213		208		203	
	Temperature (°C)	25.4	25.2	25.5	25.1	24.6	24.9
100%	pH (S.U.)	7.51	7.53	7.41	7.58	7.46	7.55
	DO (mg/L)	8.1	7.9	8.0	7.9	8.0	7.8
	Conductivity (µmhos/cm)	178		174		172	
	Alkalinity (mg $CaCO_3$/L)	66				62	
	Hardness (mg $CaCO_3$/L)	~~69~~ 71				71 ~~69~~	
	TR chlorine (mg/L)	<0.10				<0.10	
	Temperature (°C)	25.4	25.2	25.5	25.1	24.6	24.9
100% Intake	pH (S.U.)	7.52	* SPILLED	7.42	7.60	7.45	7.52
	DO (mg/L)	8.1	* SPILLED	8.1	7.9	8.1	7.8
	Conductivity (µmhos/cm)	179		170		169	
	Alkalinity (mg $CaCO_3$/L)	64				62	
	Hardness (mg $CaCO_3$/L)	69				71	
	TR chlorine (mg/L)	<0.10				<0.10	
	Temperature (°C)	25.4	25.2	25.5	25.1	24.6	24.9
		Initial	Final	Initial	Final	Initial	Final

* Chemistry cup was spilled and final analyses for pH & DO could not be performed. J/mm

Species: *Ceriodaphnia dubia*
Client: Sequoyah Nuclear Plant - Non-treated **Date:** 10-07-03

		Day							
		3		4		5		6	
	Analyst	CAA	KEL	KEL	KEL	KEL	KEL	KEL	KEL
Concentration	Parameter								
CONTROL	pH (S.U.)	7.75	7.71	7.77	7.81	7.72	7.65	7.68	7.70
	DO (mg/L)	8.3	7.5	7.8	7.8	7.7	7.7	7.7	7.5
	Conductivity (µmhos/cm)	287		294		290		294	
	Alkalinity (mg $CaCO_3$/L)							61	
	Hardness (mg $CaCO_3$/L)							84	
	Temperature (°C)	24.7	24.9	24.7	25.2	25.5	25.1	25.0	25.0
10.98%	pH (S.U.)	7.66	7.70	7.74	7.79	7.67	7.64	7.68	7.69
	DO (mg/L)	8.3	7.6	7.6	7.8	7.9	7.7	7.7	7.6
	Conductivity (µmhos/cm)	270		281		277		279	
	Temperature (°C)	24.7	24.9	24.7	25.2	25.5	25.1	25.0	25.0
22%	pH (S.U.)	7.65	7.70	7.66	7.77	7.63	7.62	7.66	7.68
	DO (mg/L)	8.3	7.5	7.6	7.8	7.8	7.7	7.7	7.6
	Conductivity (µmhos/cm)	263		268		265		269 ~~249~~	
	Temperature (°C)	24.7	24.9	24.7	25.2	25.5	25.1	25.0	25.0
43.9%	pH (S.U.)	7.64	7.68	7.56	7.73	7.54	7.60	7.64	7.67
	DO (mg/L)	8.3	7.5	7.6	7.9	7.9	7.8	7.8	7.6
	Conductivity (µmhos/cm)	240		243		239		237 ~~203~~	
	Temperature (°C)	24.7	24.9	24.7	25.2	25.5	25.1	25.0	25.0
72%	pH (S.U.)	7.61	7.66	7.45	7.67	7.44	7.60	7.62	7.67
	DO (mg/L)	8.3	7.6	7.6	7.9	7.9	7.8	7.8	7.6
	Conductivity (µmhos/cm)	205		206		204		203 ~~169~~	
	Temperature (°C)	24.7	24.9	24.7	25.2	25.5	25.1	25.0	25.0
100%	pH (S.U.)	7.58	7.64	7.33	7.61	7.37	7.60	7.59	7.66
	DO (mg/L)	8.3	7.6	7.6	7.7	7.9	7.8	7.9	7.6
	Conductivity (µmhos/cm)	168		171		169		169	
	Alkalinity (mg $CaCO_3$/L)			62					
	Hardness (mg $CaCO_3$/L)			69					
	TR Chlorine (mg/L)			<0.10					
	Temperature (°C)	24.7	24.9	24.7	25.2	25.5	25.1	25.0	25.0
100% Intake	pH (S.U.)	7.56	7.62	7.24	7.65	7.25	7.60	7.58	7.60
	DO (mg/L)	8.3	7.5	7.5	7.8	~~16~~ 8.0	7.7	7.9	7.6
	Conductivity (µmhos/cm)	169		169		~~8.0~~ 167		169	
	Alkalinity (mg $CaCO_3$/L)			62					
	Hardness (mg $CaCO_3$/L)			69					
	TR chlorine (mg/L)			<0.10					
	Temperature (°C)	24.7	24.9	24.7	25.2	25.5	25.1	25.0	25.0
		Initial	Final	Initial	Final	Initial	Final	Initial	Final

Environmental Testing Solutions, Inc.

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

Daily Chemical Analyses

Client: Sequoyah Nuclear Plant UV-Treated

Test dates: October 07 - 14, 2003

Project number: 876

Reviewed by: Cue

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)	7.56	7.41	7.62	7.54	7.61	7.52	7.66	7.17	7.52	7.05	7.62	7.60	7.60	7.11
	DO (mg/L)	8.0	8.0	8.0	7.9	8.1	8.2	8.4	6.8	7.9	6.3	7.8	7.5	7.8	6.3
	Conductivity (µmhos/cm)	295		277		279		286		289		284		292	
	Alkalinity (mg/L $CaCO_3$)														
	Hardness (mg/L $CaCO_3$)														
	Temperature (°C)	25.6	25.1	25.7	25.1	24.6	24.7	25.2	25.0	25.1	24.8	25.7	24.9	25.4	24.8
10.98%	pH (SU)	7.56	7.43	7.61	7.55	7.61	7.47	7.64	7.18	7.53	7.05	7.61	7.54	7.68	7.10
	DO (mg/L)	8.2	7.7	8.1	7.9	8.1	8.1	8.4	6.9	7.9	6.2	7.9	7.5	8.0	6.4
	Conductivity (µmhos/cm)	290		276		274		279		283		277		274	
	Temperature (°C)	25.6	25.1	25.7	25.1	24.6	24.7	25.2	25.0	25.1	24.9	25.7	24.9	25.4	24.8
22%	pH (SU)	7.56	7.39	7.60	7.57	7.60	7.45	7.63	7.17	7.51	7.16	7.59	7.54	7.67	7.10
	DO (mg/L)	8.2	7.8	8.1	8.0	8.1	8.1	8.4	6.9	8.0	6.6	7.8	7.4	7.9	6.3
	Conductivity (µmhos/cm)	276		264		262		265		270		265		263	
	Temperature (°C)	25.6	25.1	25.7	25.1	24.6	24.7	25.2	25.0	25.1	24.9	25.7	24.9	25.4	24.8
43.9%	pH (SU)	7.55	7.38	7.58	7.54	7.58	7.44	7.62	7.15	7.47	7.10	7.56	7.54	7.67	7.09
	DO (mg/L)	8.2	7.7	8.2	8.0	8.1	8.1	8.4	6.9	7.8	6.4	7.8	7.5	7.9	6.3
	Conductivity (µmhos/cm)	249		239		237		241		245		232		237	
	Temperature (°C)	25.6	25.1	25.7	25.1	24.6	24.7	25.2	25.0	25.1	24.9	25.7	24.9	25.4	24.8
72%	pH (SU)	7.54	7.43	7.55	7.55	7.57	7.45	7.60	7.16	7.41	7.06	7.48	7.53	7.64	7.04
	DO (mg/L)	8.1	7.8	8.1	7.9	8.1	8.2	8.3	6.9	7.9	6.1	7.8	7.4	7.9	5.9
	Conductivity (µmhos/cm)	215		207		207		207		209		206		203	
	Temperature (°C)	25.6	25.1	25.7	25.1	24.6	24.7	25.2	25.0	25.1	24.9	25.7	24.9	25.4	24.8
100%	pH (SU)	7.54	7.40	7.51	7.53	7.54	7.47	7.59	7.12	7.35	7.07	7.42	7.49	7.63	7.00
	DO (mg/L)	8.3	7.9	8.1	7.9	8.0	8.2	8.3	6.8	7.9	6.1	7.8	7.3	7.9	5.9
	Conductivity (µmhos/cm)	179		173		172		173		172		169		168	
	Alkalinity (mg/L $CaCO_3$)														
	Hardness (mg/L $CaCO_3$)														
	Total Residual Chlorine (mg/L)														
	Temperature (°C)	25.6	25.1	25.7	25.1	24.6	24.7	25.2	25.0	25.1	24.9	25.7	24.9	25.4	24.8
100% Intake	pH (SU)	7.51	7.42	7.47	7.52	7.52	7.44	7.52	7.15	7.31	7.04	7.38	7.52	7.62	7.02
	DO (mg/L)	8.2	7.9	8.1	7.9	8.1	8.0	8.4	6.7	7.9	6.1	7.8	7.4	8.0	6.5
	Conductivity (µmhos/cm)	177		171		170		171		169		167		169	
	Alkalinity (mg/L $CaCO_3$)														
	Hardness (mg/L $CaCO_3$)														
	Total Residual Chlorine (mg/L)														
	Temperature (°C)	25.6	25.1	25.7	25.1	24.6	24.7	25.2	25.0	25.1	24.9	25.7	24.9	25.4	24.8

Species: *Pimephales promelas* Date: 10-07-03

Client: TVA / Sequoyah Nuclear Plant – UV-treated

Daily Chemistry:

		Day 0		Day 1		Day 2	
	Analyst	KB	CAA	CAA	CAA	CAA	CAA
Concentration	Parameter						
CONTROL	pH (S.U.)	7.56	7.41	7.62	7.54	7.61	7.52
	DO (mg/L)	8.0	8.0	8.0	7.9	8.1	8.2
	Conductivity (µmhos/cm)	295		277		279	
	Alkalinity (mg $CaCO_3$/L)						
	Hardness (mg $CaCO_3$/L)						
	Temperature (°C)	25.6	25.1	25.7	25.1	24.6	24.7
10.98%	pH (S.U.)	7.56	7.43	7.61	7.55	7.61	7.47
	DO (mg/L)	8.2	7.7	8.1	7.9	8.1	8.1
	Conductivity (µmhos/cm)	290		276		274	
	Temperature (°C)	25.6	25.1	25.7	25.1	24.6	24.7
22%	pH (S.U.)	7.56	7.39	7.60	7.57	7.60	7.45
	DO (mg/L)	8.2	7.8	8.1	8.0	8.1	8.1
	Conductivity (µmhos/cm)	276		264		262	
	Temperature (°C)	25.6	25.1	25.7	25.1	24.6	24.7
43.9%	pH (S.U.)	7.55	7.38	7.58	7.54	7.58	7.44
	DO (mg/L)	8.2	7.7	8.2	8.0	8.1	8.1
	Conductivity (µmhos/cm)	249		239		237	
	Temperature (°C)	25.6	25.1	25.7	25.1	24.6	24.7
72%	pH (S.U.)	7.54	7.43	7.55	7.55	7.57	7.45
	DO (mg/L)	8.1	7.8	8.1	7.9	8.1	8.2
	Conductivity (µmhos/cm)	215		207		207	
	Temperature (°C)	25.6	25.1	25.7	25.1	24.6	24.7
100%	pH (S.U.)	7.54	7.40	7.51	7.53	7.54	7.47
	DO (mg/L)	8.3	7.9	8.1	7.9	8.0	8.2
	Conductivity (µmhos/cm)	179		173		172	
	Alkalinity (mg $CaCO_3$/L)						
	Hardness (mg $CaCO_3$/L)						
	TR chlorine (mg/L)	<0.10				<0.10	
	Temperature (°C)	25.6	25.1	25.7	25.1	24.6	24.7
100% Intake	pH (S.U.)	7.51	7.42	7.47	7.52	7.52	7.44
	DO (mg/L)	8.2	7.9	8.1	7.9	8.1	8.0
	Conductivity (µmhos/cm)	177		171		170	
	Alkalinity (mg $CaCO_3$/L)						
	Hardness (mg $CaCO_3$/L)						
	TR chlorine (mg/L)	<0.10				<0.10	
	Temperature (°C)	25.6	25.1	25.7	25.1	24.6	24.7
		Initial	Final	Initial	Final	Initial	Final

Species: *Pimephales promelas* **Date:** 10.07.03
Client: TVA / Sequoyah Nuclear Plant – UV-treated

		Day							
		3		4		5		6	
	Analyst	CAX	KEL	KEL	KEL	KEL	KEL	KEL	KEL
Concentration	Parameter								
CONTROL	pH (S.U.)	7.66	7.17	7.52	7.05	7.62	7.60	7.60	7.11
	DO (mg/L)	8.4	6.8	7.9	6.3	7.8	7.5	7.8	6.3
	Conductivity (µmhos/cm)	286		289		284		292	
	Alkalinity (mg $CaCO_3$/L)								
	Hardness (mg $CaCO_3$/L)								
	Temperature (°C)	25.2	25.0	25.1	24.9	25.7	24.9	25.4	24.8
10.98%	pH (S.U.)	7.64	7.18	7.53	7.05	7.61	7.54	7.68	7.10
	DO (mg/L)	8.4	6.9	7.9	6.2	7.9	7.5	8.0	6.4
	Conductivity (µmhos/cm)	279		283		277		274	
	Temperature (°C)	25.2	25.0	25.1	24.9	25.7	24.9	25.4	24.8
22%	pH (S.U.)	7.63	7.17	7.51	7.16	7.59	7.54	7.67	7.10
	DO (mg/L)	8.4	6.9	8.0	6.6	7.8	7.4	7.9	6.3
	Conductivity (µmhos/cm)	265		270		265		263	
	Temperature (°C)	25.2	25.0	25.1	24.9	25.7	24.9	25.4	24.8
43.9%	pH (S.U.)	7.62	7.15	7.47	7.10	7.56	7.54	7.67	7.09
	DO (mg/L)	8.4	6.9	7.8	6.4	7.8	7.5	7.9	6.3
	Conductivity (µmhos/cm)	241		245		232		237	
	Temperature (°C)	25.2	25.0	25.1	24.9	25.7	24.9	25.4	24.8
72%	pH (S.U.)	7.60	7.16	7.41	7.06	7.48	7.53	7.64	7.04
	DO (mg/L)	8.3	6.9	7.9	6.1	7.8	7.4	7.9	5.9
	Conductivity (µmhos/cm)	207		209		206		203	
	Temperature (°C)	25.2	25.0	25.1	24.9	25.7	24.9	25.4	24.8
100%	pH (S.U.)	7.59	7.12	7.35	7.07	7.42	7.49	7.63	7.00
	DO (mg/L)	8.3	6.8	7.9	6.1	7.8	7.3	7.9	5.9
	Conductivity (µmhos/cm)	173		172		169		168	
	Alkalinity (mg $CaCO_3$/L)								
	Hardness (mg $CaCO_3$/L)								
	TR Chlorine (mg/L)								
	Temperature (°C)	25.2	25.0	25.1	24.9	25.7	24.9	25.4	24.8
100% Intake	pH (S.U.)	7.52	7.15	7.31	7.04	7.38	7.52	7.62	7.02
	DO (mg/L)	8.4	6.7	7.9	6.1	7.8	7.4	8.0	6.5
	Conductivity (µmhos/cm)	171		169		167		169	
	Alkalinity (mg $CaCO_3$/L)								
	Hardness (mg $CaCO_3$/L)								
	TR chlorine (mg/L)								
	Temperature (°C)	25.2	25.0	25.1	24.9	25.7	24.9	25.4	24.8
		Initial	Final	Initial	Final	Initial	Final	Initial	Final

Total Hardness
(EPA Method 130.2)
Matrix: Water, MDL = 1.0 mg $CaCO_3$/L

Analyst: CAJ
Date analyzed: 10-14-03

Titrant normality and multiplier determination:

Titrant reference number	Normality check standard number	Begin ml	End ml	Total ml (E)	Normality (N) of EDTA = 0.2/E (acceptable range = 0.018 - 0.022)	pH Factor or Multiplier = (N x 50000)/ 50 ml sample = N x 1000
INK078	INSS 092	0.0	9.8	9.8	0.0204	20.4

Laboratory control standard:

Reference standard number	True value (TV) (mg $CaCO_3$/L)	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Hardness (MV) (mg $CaCO_3$/L)	% RS = MV / TV x 100 (acceptable range = 90 to 110%)
INSS 160	40	50	9.8	11.8	2	20.4	41	102.5

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 (acceptable range = ± 10%)
10-06-03	MHS H2OA	~~11.9~~ 50	11.9	16.0	4.1	20.4	S 84	
↓	Duplicate	50	16.0	20.1	4.1	↓	D 84	—

Matrix spike recovery:

Reference standard number	Spike value (SV) (mg $CaCO_3$/L)	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Spike hardness (A) (mg $CaCO_3$/L)
INSS 160	40	100	16.0	22.2	6.2	20.4	126

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	42	105.0%

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	20.4	ND
10-06-03	MHS H2O B		22.3	26.4	4.1		84
↓	SSW H2O		26.4	28.6	2.2		45
10-08-03	MHS H2O A		28.6	32.8	4.2		86
↓	↓ B		32.8	36.9	4.1		84
10-10-03	MHS H2O A		36.9	41.0	4.1		84
	B		41.0	45.2	4.2		86
↓	↓ C		45.2	49.3	4.1		84
03100 8.19	Fuji Kura AFL New		12.2	12.8	0.6		12
03100 8.18	↓ old	↓	12.3	13.0	0.2	↓	4.1

Note: If >15ml of titrant is used, sample must be diluted. Reviewed by: JH Date reviewed: 10-16-03

Total Hardness
(EPA Method 130.2)
Matrix: Water, MDL = 1.0 mg $CaCO_3$/L

Analyst: CAJ
Date analyzed: 10-14-03

Titrant normality and multiplier determination:

Titrant reference number	Normality check standard number	Begin ml	End ml	Total ml (E)	Normality (N) of EDTA = 0.2/E (acceptable range = 0.018 - 0.022)	pH Factor or Multiplier = (N x 50000)/ 50 ml sample = N x 1000

Laboratory control standard:

Reference standard number	True value (TV) (mg $CaCO_3$/L)	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Hardness (MV) (mg $CaCO_3$/L)	% RS = MV / TV x 100 (acceptable range = 90 to 110%)
NSS 160	40	50	13.0	15.0	2.0	20.4	41	102.5%

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 (acceptable range = ± 10%)
031009.06	AFL Comm	50	15.1	15.9	0.8	20.4	S CAJ 16	
↓	Duplicate	↓	15.9	16.7	0.8	↓	D CAJ 16	—

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)
NSS 160	40	50	15.9	18.7	2.8	20.4	57

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%)
CAJ 16	41	102.5 %

Sample measurements:

Sample number	Sample ID	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Hardness (mg $CaCO_3$/L)
	Blank (should be = 0 mg $CaCO_3$/L)	—					—
031007.06	BF 001 1	50	18.7	22.3	3.6	20.4	73
031009.05	2		22.3	25.8	3.5		71
031010.04	3		25.8	29.1	3.3		67
031007.05	BF Intake 1		29.1	32.5	3.4		69
031009.04	2		32.5	35.8	3.3		67
031010.03	3		35.8	39.2	3.4		69
031007.03	SQN intake 1		1.8	5.2	3.4		69
031009.03	2		5.2	8.7	3.5		71
031010.06	3		8.7	12.1	3.4		69

Note: If >15ml of titrant is used, sample must be diluted. Reviewed by: [illegible] Date reviewed: 10-16-03

Total Hardness
(EPA Method 130.2)
Matrix: Water, MDL = 1.0 mg $CaCO_3$/L

Analyst: CAJ
Date analyzed: 10.14.03

Titrant normality and multiplier determination:

Titrant reference number	Normality check standard number	Begin ml	End ml	Total ml (E)	Normality (N) of EDTA = 0.2/E (acceptable range = 0.018 - 0.022)	pH Factor or Multiplier = (N x 50000)/ 50 ml sample = N x 1000

Laboratory control standard:

CAJ

Reference standard number	True value (TV) (mg $CaCO_3$/L)	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Hardness (MV) (mg $CaCO_3$/L)	% RS = MV / TV x 100 (acceptable range = 90 to 110%)
INSS 160	40	50	12.1	14.2	2.1	20.4	43	107.5%

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 (acceptable range = ± 10%)
031007.02	Son 1	50	14.2	17.7	3.5	20.4	S 71	
↓	Duplicate	↓	17.7	21.3	3.6	↓	D 73	2.8%

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)
INSS160	40	50	17.7	23.3	5.6	20.4	114

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%)
73	41	102.5%

Sample measurements:

Sample number	Sample ID	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Hardness (mg $CaCO_3$/L)
	Blank (should be = 0 mg $CaCO_3$/L)						
031009.02	Son 2	50	23.3	26.7	3.4	20.4	69
031010.05	↓ 3	↓	26.7	30.1	3.4	↓	69
031007.01	Und 1	↓	30.1	37.9	7.8	↓	159 = 160
031009.01	↓ 2	↓	37.9	46.0	8.1	↓	165 = 160
031011.01	↓ 3	↓	32.7	40.6	7.9	↓	161 = 160

Note: If >15ml of titrant is used, sample must be diluted. Reviewed by: JL Date reviewed 10-16-03

Environmental Testing Solutions, LLC

Total Residual Chlorine
(EPA Method 330.5)
Matrix: Water, MDL = 0.10 mg/L
Meter: Accumet Model AR25 pH/Ion Meter

Analyst: KEW
Date analyzed: 10.07.03

Iodide reagent: INR092
Acid reagent: INR083

Calibration:

	0.10 mg/L	1.00 mg/L
Reference standard number	INSS134	INSS134

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

Laboratory control standard:

Reference standard number	True value (TV) (mg/L)	Measured value (MV) (mg/L)	% RS = MV / TV x 100 (acceptable range = 90 to 110%)
INSS134	0.50	0.543	108.6 %

Duplicate sample precision:

Sample number	Sample ID	Sample characteristics	Residual chlorine (mg/L)	%RPD = {(S - D) /[(S+D)/2]} x 100 (acceptable range = ± 10%)
031007.01	Anderson Co	pale green, slightly cloudy	S <0.00821	
↓	Duplicate		D <0.00579	— 10%

Sample measurements:

Sample number	Sample ID	Sample characteristics	Residual chlorine (mg/L)
	Blank (should be = < 0.10 mg/L)		<0.00905
031007.02	TVA-SQN 101	no color, floating particles	<0.00293
031007.03	TVA SQN INT	pale tan, floating particles	<0.00323
031007.06	TVA BFN 001 DIFFUSE	pale tan, slightly cloudy, floating particles	<0.00360
031007.05	TVA BFN INT	no color, clear	<0.00484
		KEW	

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%)
INSS134	0.50	0.505	101 %

Reviewed by: [signature]
Date reviewed: 10-07-03

Total Residual Chlorine
(EPA Method 330.5)

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

Analyst	CAJ
Date analyzed	10-09-03

Iodide reagent:	IN R092
Acid reagent:	IN R083

Calibration:

	0.10 mg/L	1.00 mg/L
Reference standard number	INSS 134	INSS 134

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

Laboratory control standard:

Reference standard number	True value (TV) (mg/L)	Measured value (MV) (mg/L)	% RS = MV / TV x 100 (acceptable range = 90 to 110%)
INSS 134	0.50	0.457	91.4%

Duplicate sample precision:

Sample number	Sample ID	Sample characteristics	Residual chlorine (mg/L)	%RPD = {(S - D) /[(S+D)/2]} x 100 (acceptable range = ± 10%)
031009.04	BFN Intake	pale yellow, clear	S <0.00932	
↓	Duplicate		D <0.00611	—

Sample measurements:

Sample number	Sample ID	Sample characteristics	Residual chlorine (mg/L)
	Blank (should be = < 0.10 mg/L)		<0.0554
031009.03	SQN Intake - Tox	pale yellow, clear	<0.00459
031009.05	BFN Diffuse	pale yellow, clear	<0.00314
031009.08	Henderson - Americal	yellow w/ floating particles	<0.00253
031009.01	Anderson	pale green, clear	<0.00164
031009.06	APL Telecommunication	lt brown, particles	<0.000226
031009.02	SQN 2	pale yellow, clear	0.000483

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%)
INSS 134	0.50	0.471	94.2%

Reviewed by	
Date reviewed	10-09-03

Total Residual Chlorine
(EPA Method 330.5)

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

Analyst	KLX
Date analyzed	10-11-03

Iodide reagent:	1NR092
Acid reagent:	1NR083

Calibration:

	0.10 mg/L	1.00 mg/L
Reference standard number	1NSS134	1NSS134

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

Laboratory control standard:

Reference standard number	True value (TV) (mg/L)	Measured value (MV) (mg/L)	% RS = MV / TV x 100 (acceptable range = 90 to 110%)
1NSS134	0.50	0.464	92.8%

Duplicate sample precision:

Sample number	Sample ID	Sample characteristics	Residual chlorine (mg/L)	%RPD = {(S - D) /[(S+D)/2]} x 100 (acceptable range = ± 10%)
031011.01	Anderson Co	pale green, clear	S <0.00555	
↓	Duplicate		D <0.00462	–

Sample measurements:

Sample number	Sample ID	Sample characteristics	Residual chlorine (mg/L)
	Blank (should be = < 0.10 mg/L)		<0.00987
03010.05	TVA-SQN 101	no color, clear, particles	<0.00469
031010.06	↓ INT	no color, clear, particles	<0.00310
031010.04	TVA BFN 001	tan, cloudy, dirt particles	0.0271
031010.03	↓ INT	tan, cloudy, dirt particles	<0.0190
031010.02	Progress - Asheville	no color, clear	0.0124
031011.08	SCME - Cauillon	no color, clear	<0.00855
031011.13	Trident - Henderson	no color, clear	<0.00464
031011.14	↓ Hend. Clarifier	no color, particles	<0.00740
03011.03	3 R's MHP	pale tan, slightly cloudy	<0.00307

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

~~Laboratory control standard:~~

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

Reviewed by	JL
Date reviewed	10-11-03

Alkalinity
(EPA Method 310.1)
Matrix: Water, MDL = 1.0 mg $CaCO_3$/L

Analyst: CM
Date analyzed: 10-14-03

Titrate samples to pH = 4.50 S.U.

Titrant normality and multiplier determination:

pH of Deionized water = 4.5 S.U.	Titrant reference number	Normality check standard number	Begin ml	End ml	Total ml (E)	Normality (N) of H_2SO_4 = (5 ml Na_2CO_3 x 0.05)/E = 0.25/E (acceptable range = 0.018 - 0.022)	pH Factor or Multiplier = (N x 50000)/ 100 ml sample = N x 500
4.41	INL074	INR071	0.0	12.2	12.2	0.0205	10.2

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%)
INSS136	100	100	12.2	22.0	9.8	10.2	100	100%

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%)
10.06.03	MHS H2O B	100	22.0	27.7	5.7	10.2	S 58	
	Duplicate	↓	27.7	33.5	5.8	↓	D 59	1.7%

Matrix spike recovery:

Reference standard number	Spike value (SV) (mg $CaCO_3$/L)	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Spike alkalinity (A) (mg $CaCO_3$/L)
INSS136	50	100	27.7	38.9	11.2	10.2	114

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	55	110%

Sample measurements:

Sample number	Sample ID	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Alkalinity (mg $CaCO_3$/L)
10.06.03	MHS H2O A	100	16.7 ~~38.9~~	~~44.3~~ 22.6	5.9	10.2	60
↓	SSW H2O		13.3 ~~39.80~~	16.6	3.3		34
10.08.03	MHS H2O A		22.6	28.5	5.9		60
↓	↓ B		28.5	34.4	5.9		60
10.10.03	MHS H2O A		34.0	40.4	6.0		61
	B		40.4	46.5	6.1		62
↓	↓ C		3.9	9.8	5.9		60
031008.19	Fug. Kure ATL New	↓	9.8	10.1	0.3		3.1
031008.18	↓ Old		10.2	10.2	0.0	↓	~~0~~ ND

Reviewed by: dl Date reviewed: 10-16-03

Alkalinity
(EPA Method 310.1)
Matrix: Water, MDL = 1.0 mg $CaCO_3$/L

Analyst: CAJ | KJL
Date analyzed: 10.14.03

Titrate samples to pH = 4.50 S.U.

~~Titrant normality and multiplier determination:~~

pH of Deionized water = 4.5 S.U.	Titrant reference number	Normality check standard number	Begin ml	End ml	Total ml (E)	Normality (N) of H_2SO_4 = (5 ml Na_2CO_3 x 0.05)/E = 0.25/E (acceptable range = 0.018 - 0.022)	pH Factor or Multiplier = (N x 50000)/ 100 ml sample = N x 500

CAJ

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%)
INS 134	100	100	10.2	20.2	10.0	10.2	102	102%

Duplicate sample precision:

Sample number	Sample ID	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Alkalinity (mg $CaCO_3$/L)	%RPD = {(S - D) /[(S+D)/2]} x 100 (acceptable range = ± 10%)
031009.04	~~BF 001 1~~ AFL Comm	50	20.2	20.5	0.3	(2) 10.2	S 6.1	
↓	Duplicate	↓	20.5	20.9	0.4	(2) ↓	D 8.2	29.4%

Matrix spike recovery: Not enough to recheck

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)
INS 134	~~100~~ 50	~~20~~ 50	20.5	25.9	5.4	(2) 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%)
8.2	102	102.0%

Sample measurements:

Sample number	Sample ID	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Alkalinity (mg $CaCO_3$/L)
031007.06	BF 001 1	100	25.9	32.3	6.4	10.2	65
031009.05	2		32.3	38.5	6.2		63
031010.04	3		38.5	44.2	5.7		58
031007.05	BF Intake 1		3.3	10.4	7.1		72
031009.04	2		10.6	15.7	5.1		52
031010.03	3		15.7	21.6	5.9		60
031007.02	SQN 1		21.7	28.2	6.5		66
031009.02	2		28.2	34.3	6.1		62
031010.05	3		34.3	40.4	6.1		62

Reviewed by: [illegible] Date reviewed: 10-16-03

Alkalinity
(EPA Method 310.1)
Matrix: Water, MDL = 1.0 mg $CaCO_3$/L

Analyst: KSL
Date analyzed: 10.14.03

Titrate samples to pH = 4.50 S.U.

Titrant normality and multiplier determination:

pH of Deionized water = 4.5 S.U.	Titrant reference number	Normality check standard number	Begin ml	End ml	Total ml (E)	Normality (N) of H_2SO_4 = (5 ml Na_2CO_3 x 0.05)/E = 0.25/E (acceptable range = 0.018 - 0.022)	pH Factor or Multiplier = (N x 50000)/ 100 ml sample = N x 500

Laboratory control standard:

Reference standard number	True value (TV) (mg $CaCO_3$/L)	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Alkalinity (MV) (mg $CaCO_3$/L)	% RS = MV / TV x 100 (acceptable range = 90 to 110%)
INSS136	100	100	0.2	9.7	9.5	10.2	97	97%

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%)
031007.03	SQN IN 1	100	10.0	16.3	6.3	10.2	S 64	
↓	Duplicate	↓	16.3	22.5	6.2	↓	D 63	1.6%

Matrix spike recovery:

Reference standard number	Spike value (SV) (mg $CaCO_3$/L)	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Spike alkalinity (A) (mg $CaCO_3$/L)
INSS136	50	100	16.3	27.4	11.1	10.2	113

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%)
63	50	100%

Sample measurements:

Sample number	Sample ID	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Alkalinity (mg $CaCO_3$/L)
031009.03	SQN IN 2	100	27.4	33.5	6.1	10.2	62
031010.06	↓ 3	↓	33.5	39.6	6.1	↓	62
031007.01	Anderson 1		39.6	47.5	7.9		81
031009.01	↓ 2		14.8	24.0	9.2		94
031011.01	↓ 3	↓	24.0	33.2	9.2	↓	94

KSL

Reviewed by: [illegible] Date reviewed: 10-16-03

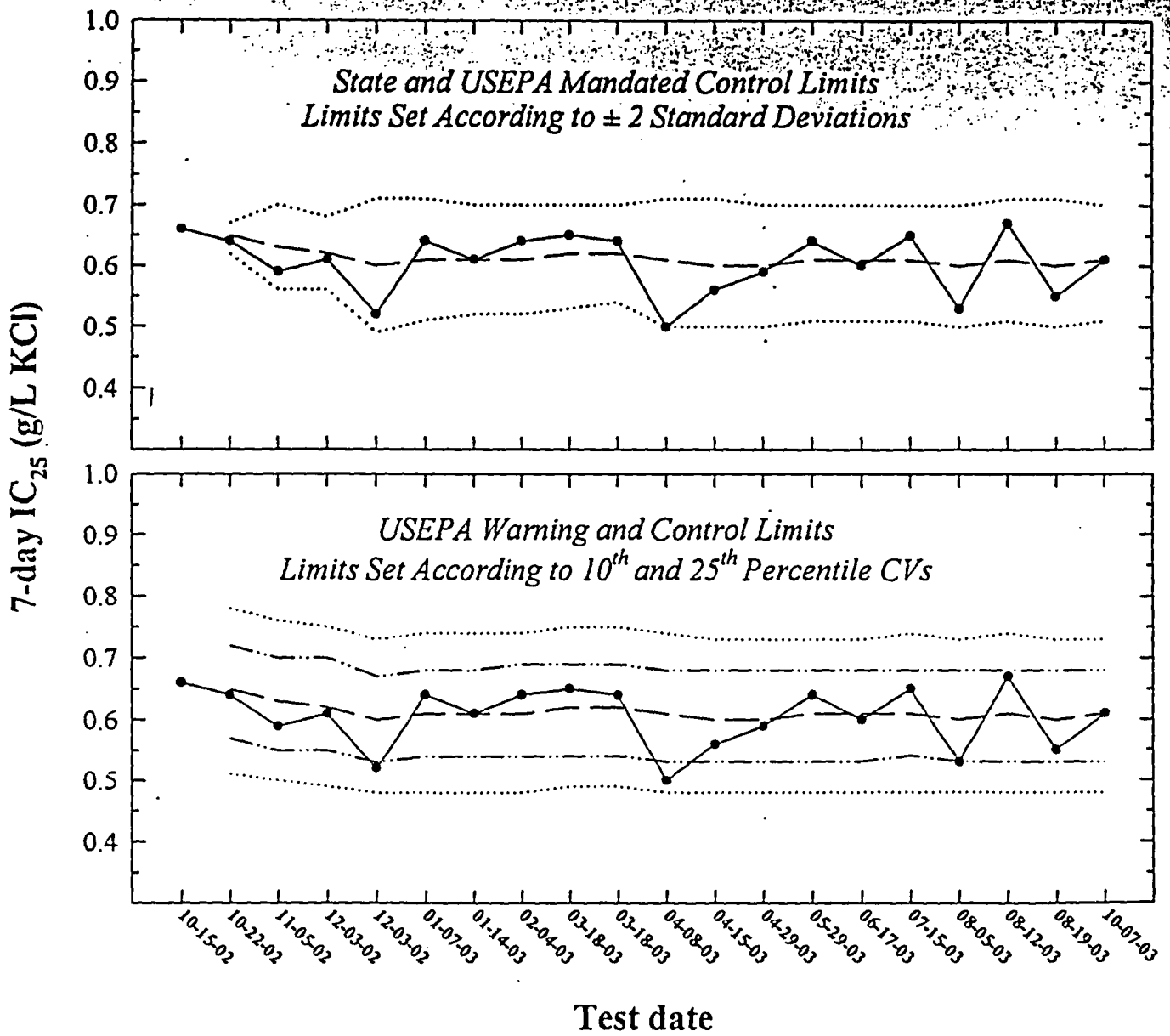
Sequoyah Nuclear Plant Biomonitoring
October 7 - 14, 2003

Appendix D

Reference Toxicant Test and
Control Chart

Environmental Testing Solutions, Inc.

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



—•— 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 $IC_{25} \pm S_{A.10}$)

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

Environmental Testing Solutions, Inc.

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

Test number	Test date	7-day IC_{25} (g/L KCl)	CT (g/L KCl)	S	State and USEPA Control Limits CT - 2S	CT + 2S	$S_{A.10}$	Laboratory Warning Limits CT - $S_{A.10}$	CT + $S_{A.10}$	$S_{A.25}$	Laboratory Control Limits CT - $S_{A.25}$	CT + $S_{A.25}$	$S_{A.75}$	USEPA Warning Limits CT - $S_{A.75}$	CT + $S_{A.75}$	$S_{A.90}$	USEPA Control Limits CT - $S_{A.90}$	CT + $S_{A.90}$	CV
1	10-15-02	0.66																	
2	10-22-02	0.64	0.65	0.01	0.62	0.67	0.08	0.57	0.72	0.14	0.51	0.78	0.25	0.40	0.89	0.29	0.36	0.94	0.02
3	11-05-02	0.59	0.63	0.03	0.56	0.70	0.08	0.55	0.70	0.13	0.50	0.76	0.24	0.39	0.87	0.28	0.35	0.91	0.06
4	12-03-02	0.61	0.62	0.03	0.56	0.68	0.07	0.55	0.70	0.13	0.49	0.75	0.24	0.39	0.86	0.28	0.34	0.90	0.05
5	12-03-02	0.52	0.60	0.05	0.49	0.71	0.07	0.53	0.67	0.13	0.48	0.73	0.23	0.37	0.83	0.27	0.33	0.87	0.09
6	01-07-03	0.64	0.61	0.05	0.51	0.71	0.07	0.54	0.68	0.13	0.48	0.74	0.23	0.38	0.84	0.27	0.33	0.88	0.08
7	01-14-03	0.61	0.61	0.05	0.52	0.70	0.07	0.54	0.68	0.13	0.48	0.74	0.23	0.38	0.84	0.27	0.33	0.88	0.08
8	02-04-03	0.64	0.61	0.04	0.52	0.70	0.07	0.54	0.69	0.13	0.48	0.74	0.23	0.38	0.84	0.28	0.34	0.89	0.07
9	03-18-03	0.65	0.62	0.04	0.53	0.70	0.07	0.54	0.69	0.13	0.49	0.75	0.23	0.38	0.85	0.28	0.34	0.89	0.07
10	03-18-03	0.64	0.62	0.04	0.54	0.70	0.07	0.54	0.69	0.13	0.49	0.75	0.24	0.38	0.85	0.28	0.34	0.90	0.07
11	04-08-03	0.50	0.61	0.05	0.50	0.71	0.07	0.53	0.68	0.13	0.48	0.74	0.23	0.38	0.84	0.27	0.33	0.88	0.09
12	04-15-03	0.56	0.60	0.05	0.50	0.71	0.07	0.53	0.68	0.13	0.48	0.73	0.23	0.37	0.83	0.27	0.33	0.88	0.09
13	04-29-03	0.59	0.60	0.05	0.50	0.70	0.07	0.53	0.68	0.13	0.48	0.73	0.23	0.37	0.83	0.27	0.33	0.87	0.08
14	05-29-03	0.64	0.61	0.05	0.51	0.70	0.07	0.53	0.68	0.13	0.48	0.73	0.23	0.38	0.84	0.27	0.33	0.88	0.08
15	06-17-03	0.60	0.61	0.05	0.51	0.70	0.07	0.53	0.68	0.13	0.48	0.73	0.23	0.38	0.84	0.27	0.33	0.88	0.08
16	07-15-03	0.65	0.61	0.05	0.51	0.70	0.07	0.54	0.68	0.13	0.48	0.74	0.23	0.38	0.84	0.27	0.33	0.88	0.08
17	08-05-03	0.53	0.60	0.05	0.50	0.70	0.07	0.53	0.68	0.13	0.48	0.73	0.23	0.37	0.83	0.27	0.33	0.88	0.08
18	08-12-03	0.67	0.61	0.05	0.51	0.71	0.07	0.53	0.68	0.13	0.48	0.74	0.23	0.38	0.84	0.27	0.33	0.88	0.08
19	08-19-03	0.55	0.60	0.05	0.50	0.71	0.07	0.53	0.68	0.13	0.48	0.73	0.23	0.38	0.83	0.27	0.33	0.88	0.08
20	10-07-03	0.61	0.61	0.05	0.51	0.70	0.07	0.53	0.68	0.13	0.48	0.73	0.23	0.38	0.84	0.27	0.33	0.88	0.08

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

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

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

Laboratory Control and Warning Limits

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

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

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

USEPA Control and Warning Limits

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

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

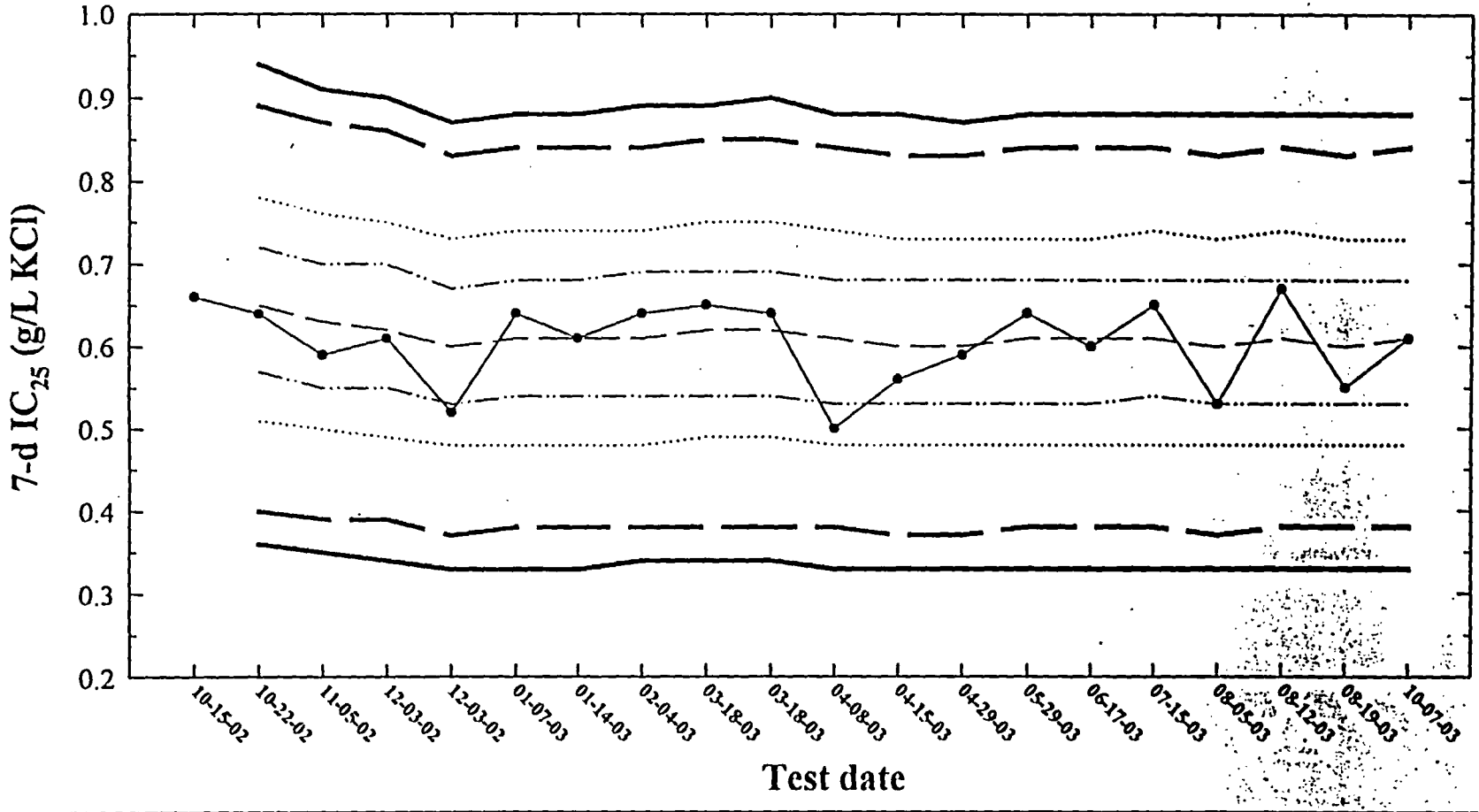
CV = Coefficient of variation of the IC_{25} values.

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

Organisms obtained from Aquatic BioSystems, Inc.

Environmental Testing Solutions, Inc.

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



—●— 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})

—·—·— Laboratory Warning Limits (mean $IC_{25} \pm S_{A.10}$, $S_{A.10} = 0.12$)

····· Laboratory Control Limits (mean $IC_{25} \pm S_{A.25}$, $S_{A.25} = 0.21$)

— — USEPA Warning Limits (mean $IC_{25} \pm S_{A.75}$, $S_{A.75} = 0.38$)

——— USEPA Control Limits (mean $IC_{25} \pm S_{A.90}$, $S_{A.90} = 0.45$)

Environmental Testing Solutions, Inc.

Precision of Endpoint Measurements

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

Test number	Test date	Control Survival (%)	Control Mean Growth (mg/larvae)	CT for Control Growth (mg/larvae)	CV (%)	CT for Control Growth CV (%)	MSD	PMSD (%)	CT for PMSD (%)
1	10-15-02	100	1.037		16.9		0.23	21.9	
2	10-22-02	100	0.822	0.929	10.6	13.8	0.13	15.6	18.7
3	11-05-02	100	0.874	0.911	2.8	10.1	0.12	13.8	17.1
4	12-03-02	100	0.852	0.896	9.1	9.9	0.12	13.7	16.2
5	12-03-02	100	0.668	0.850	10.4	10.0	0.15	22.4	17.5
6	01-07-03	100	0.886	0.856	4.1	9.0	0.14	15.7	17.2
7	01-14-03	100	0.677	0.831	3.0	8.1	0.07	11.0	16.3
8	02-04-03	97.5	0.933	0.844	14.1	8.9	0.15	16.5	16.3
9	03-18-03	100	0.838	0.843	8.0	8.8	0.15	18.5	16.6
10	03-18-03	100	0.803	0.839	21.3	10.0	0.21	26.5	17.6
11	04-08-03	100	1.083	0.861	6.1	9.7	0.09	8.0	16.7
12	04-15-03	100	0.892	0.864	17.0	10.3	0.17	18.7	16.9
13	04-29-03	97.5	1.021	0.876	6.7	10.0	0.18	17.5	16.9
14	05-29-03	100	1.005	0.885	7.9	9.9	0.11	11.1	16.5
15	06-17-03	97.5	0.888	0.885	4.2	9.5	0.18	20.7	16.8
16	07-15-03	100	0.910	0.887	6.7	9.3	0.12	13.7	16.6
17	08-05-03	97.5	1.092	0.899	6.5	9.2	0.13	11.8	16.3
18	08-12-03	100	0.693	0.887	9.7	9.2	0.20	28.2	17.0
19	08-19-03	100	0.745	0.880	2.9	8.8	0.08	10.7	16.6
20	10-07-03	97.5	0.762	0.874	20.0	9.4	0.18	23.1	17.0

Note:

CV = Coefficient of variation for control growth.
On average, the CV for control growth is 9.4% in Environmental Testing Solutions, Inc. Pimephales chronic toxicity tests.
Lower CV bound determined by USEPA (10th percentile) = 3.5%.
Upper CV bound determined by USEPA (90th percentile) = 20%

MSD = Minimum Significant Difference

PMSD = Percent Minimum Significant Difference
PMSD is a measure of test precision. The PMSD is the minimum percent difference between the control and treatment that can be declared statistically significant in a whole effluent toxicity test. On average, a significant difference occurs for Environmental Testing Solutions, Inc. chronic toxicity tests when a toxicant reduces Pimephales growth by 17.0% from the control.
Lower PMSD bound determined by USEPA (10th percentile) = 9.4%.
Upper PMSD bound determined by USEPA (90th percentile) = 35%.

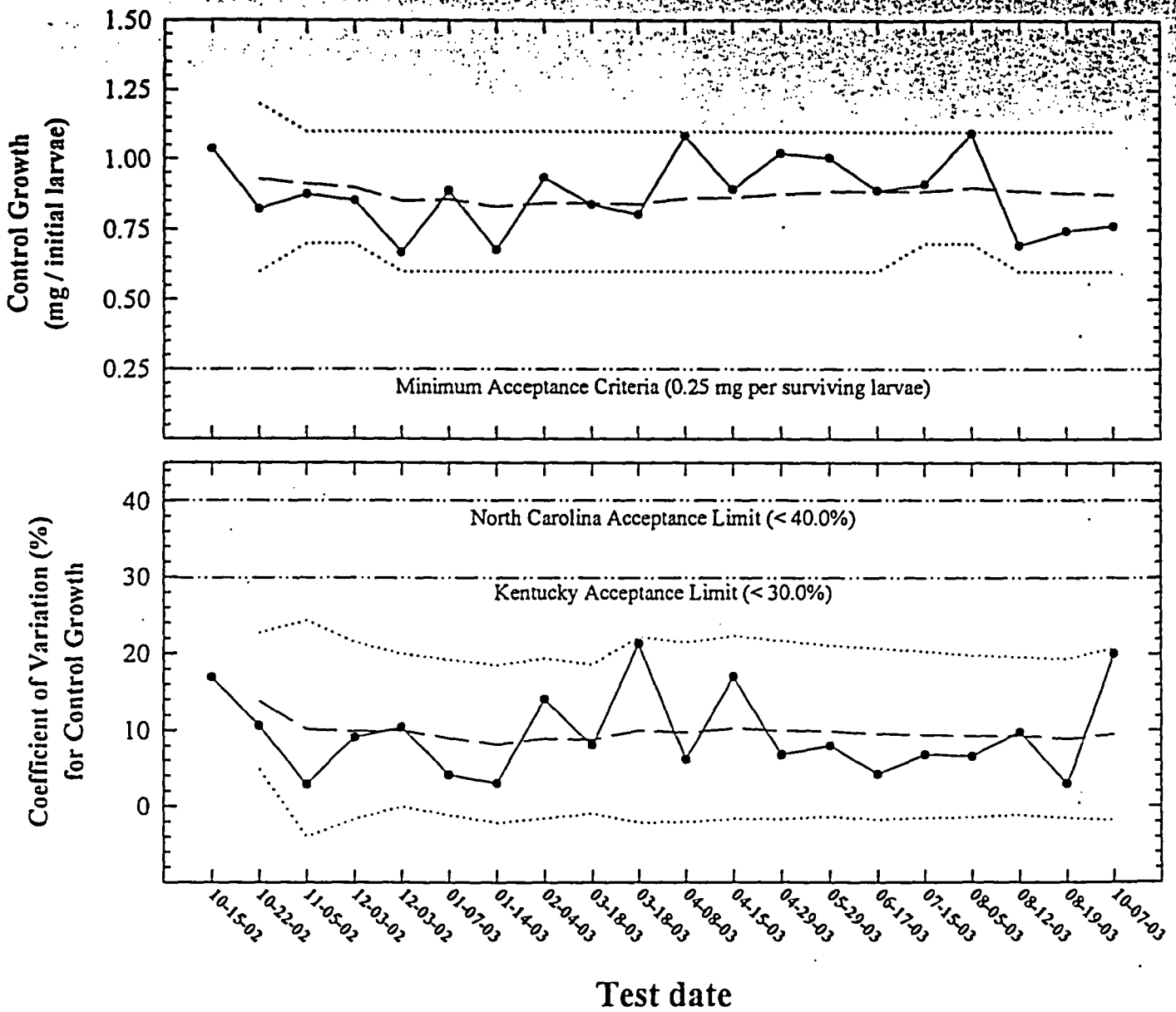
CT = Central Tendancy (mean Control Growth, CV, or PMSD)

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

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

Environmental Testing Solutions, Inc.

Pimephales promelas Control Growth and Coefficient of Variation in Potassium Chloride Chronic Reference Toxicant Tests

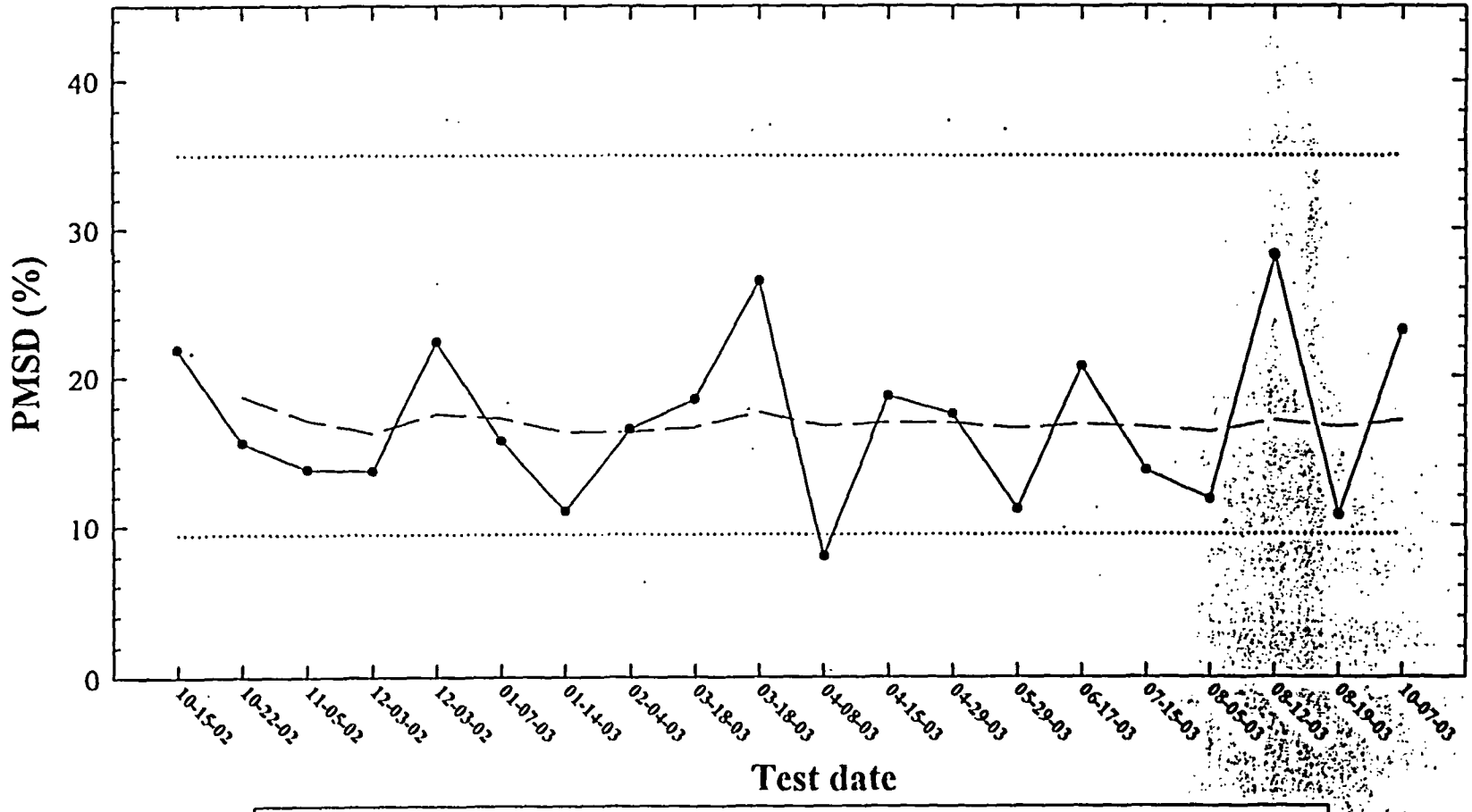


- Control Growth or Coefficient of Variation (CV)
- Central Tendency (mean Control Growth or CV)
- Control Limits (mean Control Growth or CV ± 2 Standard Deviations)

Environmental Testing Solutions, Inc.

Precision of Endpoint Measurements

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



—●— PMSD = percent minimum significant difference. PMSD is the minimum significant difference between the control and treatment that can be declared statistically significant.

—— · Central Tendency (mean PMSD)

····· Lower and Upper PMSD Bounds

Lower PMSD Bound (10th percentile) = 9.4%, Upper PMSD Bound (90th percentile) = 35%

(Lower and upper PMSD bounds were determined by USEPA for the method and endpoint.)

Environmental Testing Solutions, Inc.

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

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

Test number: PpKClCR # 56

Test dates: October 7-14, 2003

Reviewed by:

Concentration (mg/L KCl)	Replicate	Initial number of larvae	Final number of larvae	A = Pan weight (mg)	B = Pan + Larvae weight (mg)	Larvae weight (mg) = A - B	Weight / Initial number of larvae (mg)	Mean survival (%)	Mean weight (mg)	Coefficient of variation (%)	Percent reduction from control (%)
Control	A	10	10	15.114	22.770	7.656	0.7656	97.5	0.7616	20.0	Not applicable
	B	10	10	15.124	24.380	9.256	0.9256				
	C	10	10	15.106	23.070	7.964	0.7964				
	D	10	9	15.233	20.820	5.587	0.5587				
300	E	10	10	15.242	22.870	7.628	0.7628	100.0	0.8110	12.8	-6.5
	F	10	10	15.158	22.540	7.382	0.7382				
	G	10	10	15.187	24.830	9.643	0.9643				
	H	10	10	15.262	23.050	7.788	0.7788				
450	I	10	8	15.292	21.250	5.958	0.5958	90.0	0.7136	15.7	6.3
	J	10	10	15.264	22.830	7.566	0.7566				
	K	10	9	15.249	21.780	6.531	0.6531				
	L	10	9	15.263	23.750	8.487	0.8487				
600	M	10	8	15.057	20.800	5.743	0.5743	87.5	0.6069	5.2	20.3
	N	10	8	15.023	20.880	5.857	0.5857				
	O	10	9	14.990	21.340	6.350	0.6350				
	P	10	10	15.005	21.330	6.325	0.6325				
750	Q	10	5	15.056	18.660	3.604	0.3604	65.0	0.4334	27.9	43.1
	R	10	6	15.020	19.170	4.150	0.4150				
	S	10	7	15.012	18.500	3.488	0.3488				
	T	10	8	14.886	20.980	6.094	0.6094				
900	U	10	1	14.946	15.760	0.814	0.0814	5.0	0.0323	123.0	95.8
	V	10	0	0.000	0.000	0.000	0.0000				
	W	10	0	0.000	0.000	0.000	0.0000				
	X	10	1	14.951	15.430	0.479	0.0479				

Dunnett's MSD value: 0.1762 — MSD = Minimum Significant Difference

PMSD: 23.1 — PMSD = Percent Minimum Significant Difference

PMSD is a measure of test precision. The PMSD is the minimum percent difference between the control and treatment that can be declared statistically significant in a whole effluent toxicity test. On average, a significant difference occurs for Environmental Testing Solutions, Inc. chronic toxicity tests when a toxicant reduces Pimephales growth by 17.0% from the control (determined through reference toxicant testing).
Lower PMSD bound determined by USEPA (10th percentile) = 9.4%.
Upper PMSD bound determined by USEPA (90th percentile) = 35%.
The lower and upper bounds were calculated by the USEPA using 205 tests conducted from 19 laboratories for Pimephales growth in chronic reference toxicant tests.

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

Organisms obtained from Aquatic BioSystems, Inc.

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

PpKCICR Test Number: 16

Dilution preparation information:						*Comments:*
KCl CHM number:		CHM067				
Stock preparation:		50 g KCl/L: Dissolve 50 g KCl in 1-L Deionized water				
Dilution prep (mg/L)	300	450	600	750	900	
Stock volume (mL)	6	9	12	15	18	
Diluent volume (mL)	994	991	988	985	982	
Total volume (mL)	1000	1000	1000	1000	1000	

Test organism information:		*Test information:*	
Organism age:	~~23 TO 26~~ 25 TO 27.5 HOURS	Randomizing template:	Red
Date and times organisms were born between:	10-06-03 1230 TO 1400 HOT	Incubator number and shelf location:	3 F1
Organism source:	ABS BATCH 10-06-03	*Artemia* lot number:	BG0403Q
Transfer bowl information:	pH = 7.82SU Temperature = 24.7 °C	Total drying time:	17 HOURS
		Date / Time in:	10-14-03 1500
Average transfer volume:	10.4 ml	Date / Time out:	10-15-03 0800
		Oven temperature:	100°C

Daily feeding and renewal information:

Day	Date	Morning feeding time	Afternoon feeding time	Test initiation, renewal, or termination time	Control water batch used	Analyst
0	10-07-03	—	1600	1306	10.06.03	dl
1	10-08-03	0900	1500	1310	10-06-03	dl
2	10-09-03	0900	1515	1315	10-08-03	dl
3	10-10-03	0900	1500	1313	10-08-03	dl
4	10-11-03	0853	1500	1256	10-08-03	dl
5	10-12-03	0850	1504	1305	10-08-03	dl
6	10-13-03	0962	1500	1300	10-08-03	dl
7	10-14-03			1309		dl

Control information:		Acceptance criteria	*Summary of test endpoints:*	
% Mortality:	2.5%	≤ 20%	7-day LC_{50}	782.6
Average weight per initial larvae:	0.7616		NOEC	600
Average weight per surviving larvae:	0.7771	≥ 0.25 mg/larvae	LOEC	750
			ChV	670.8
			IC_{25}	614.8

Species: *Pimephales promelas* PpKClCR Test Number: 16

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	9 14
4	10	10	10	10	10	10	10	10	10	10	10	9
5	10	10	10	10	10	10	10	10	9 24	10	9 14	9
6	10	10	10	9 14	10	10	10	10	8	10	9	9
7	10	10	10	1 SMAL 9	10	10	10	10	8	10	9	9
A = Pan weight (mg) TRAY	15.114	15.124	15.106	15.233	15.242	15.158	15.187	15.262	15.292	15.264	15.244	15.263
B = Pan + Larvae weight (mg)	22.77	24.38	23.07	20.82	22.87	22.54	24.83	23.05	21.25	22.83	21.78	23.75
C= Larvae weight (mg) = A – B	7.656	9.256	7.964	5.587	7.628	7.382	9.643	7.788	5.958	7.566	6.531	8.487
Weight per initial number of larvae (mg) = C / Initial number of larvae	0.7656	0.9256	0.7964	0.5587	0.7628	0.7382	0.9643	0.7788	0.5958	0.7566	0.6531	0.8487
Average weight per initial number of larvae (mg)	0.7616				0.8110				0.7336			

Calculations and data reviewed: dl

Comments:

Species: ***Pimephales promelas*** PpKClCR Test Number: 16

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	8^{2d}	8^{2d}	9^{1d}	9^{1d}	4^{1d}	3^{2d}	4^{1d}	3^{2d}
2	10	8^{2d}	9^{1d}	10	8	8	9	8^{1d}	4	3	4	3
3	9^{1d}	8	9	10	8	8	9	8	4	1^{2d}	2^{2d}	2^{1d}
4	9	8	9	10	8	8	7^{2d}	8	2^{2d}	1	2	2
5	8^{1d}	8	9	10	7^{1d}	6^{2d}	7	8	2	0^{1d}	1^{1d}	2
6	8	8	9	10	5^{2d}	6	7	8	2	0	0^{1d}	2
7	8	8	9	10	5	6	7	8	1^{1d}	0	0	1^{1d}
A = Pan weight (mg)	15.057	15.023	14.990	15.005	15.056	15.020	15.012	14.886	14.944	14.987	14.911	14.951
B = Pan + Larvae weight (mg)	20.80	20.88	21.34	21.33	18.66	19.17	18.50	20.98	15.76	—	—	15.43
Larvae weight (mg) = A – B	5.743	5.857	6.350	6.325	3.604	4.150	3.488	6.094	0.814	—	—	0.479
Weight per initial number of larvae (mg) = C / Initial number of larvae	0.5743	0.5857	0.6350	0.6325	0.3604	0.4150	0.3488	0.6094	0.0814	0	0	0.0479
Average weight per initial number of larvae (mg)	0.6069				0.4334				0.0323			

Calculations and data reviewed: JH

Comments:

Environmental Testing Solutions, Inc.
Statistical Analyses

Larval Fish Growth and Survival Test-7 Day Survival

Start Date:	10/7/03	Test ID:	PpKCICR	Sample ID:	REF-Ref Toxicant
End Date:	10/14/03	Lab ID:	ETS-Env. Testing Solutions	Sample Type:	KCL-Potassium chloride
Sample Date:		Protocol:	CHRONIC-(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	0.9000
300	1.0000	1.0000	1.0000	1.0000
450	0.8000	1.0000	0.9000	0.9000
600	0.8000	0.8000	0.9000	1.0000
750	0.5000	0.6000	0.7000	0.8000
900	0.1000	0.0000	0.0000	0.1000

			Transform: Arcsin Square Root					Rank	1-Tailed	Number	Total
Conc-mg/L	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical	Resp	Number
D-Control	0.9750	1.0000	1.3713	1.2490	1.4120	3.942	4			1	40
300	1.0000	1.0256	1.4120	1.4120	1.4120	0.000	4	20.00	10.00	0	40
450	0.9000	0.9231	1.2543	1.1071	1.4120	9.935	4	13.50	10.00	4	40
600	0.8750	0.8974	1.2188	1.1071	1.4120	11.906	4	13.00	10.00	5	40
*750	0.6500	0.6667	0.9424	0.7854	1.1071	14.670	4	10.00	10.00	14	40
*900	0.0500	0.0513	0.2403	0.1588	0.3218	39.161	4	10.00	10.00	38	40

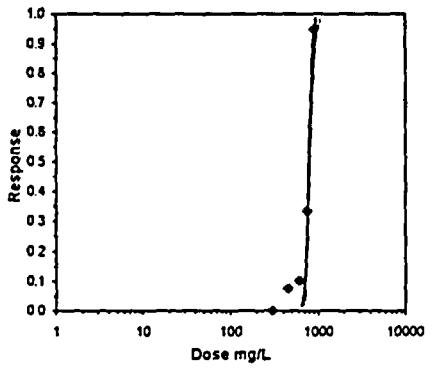
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.955804884	0.884	0.216894366	-0.44923595
Equality of variance cannot be confirmed				

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	600	750	670.8203932	
Treatments vs D-Control				

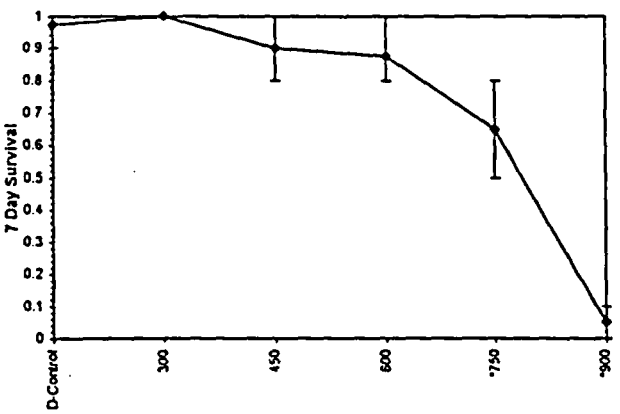
Maximum Likelihood-Probit

Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter
Slope	26.21882114	5.116792651	16.18990735	36.24773493	0.025	6.278453582	7.814724922	0.1	2.893552263	0.03814054	12
Intercept	-70.8655292	14.84069562	-99.9532932	-41.7777652							
TSCR	0.061689346	0.019147973	0.024159318	0.099219374							

Point	Probits	mg/L	95% Fiducial Limits	
EC01	2.674	638.0050228	552.9614929	682.4289625
EC05	3.355	677.3554925	607.9715615	714.1079396
EC10	3.718	699.3155644	639.0847806	732.0680261
EC15	3.964	714.5327431	660.6757919	744.7731476
EC20	4.158	726.8626868	678.0947615	755.3172716
EC25	4.326	737.6101076	693.1451142	764.7678779
EC40	4.747	765.4017799	730.8248485	790.9911428
EC50	5.000	782.6223806	752.5827038	809.2234782
EC60	5.253	800.2304271	772.9876295	830.0188392
EC75	5.674	830.381502	803.4198929	870.8613713
EC80	5.842	842.6595601	814.4996111	889.0674917
EC85	6.036	857.2004598	826.9364588	911.5088294
EC90	6.282	875.8532105	842.0997986	941.3950781
EC95	6.645	904.2486406	864.0535856	988.684212
EC99	7.326	960.0203541	904.9241604	1086.127778



Dose-Response Plot



Organisms obtained from Aquatic BioSystems, Inc.

Environmental Testing Solutions, Inc.
Statistical Analyses

Larval Fish Growth and Survival Test-7 Day Growth

Start Date:	10/7/03	Test ID:	PpKCICR	Sample ID:	REF-Ref Toxicant
End Date:	10/14/03	Lab ID:	ETS-Env. Testing Solutions	Sample Type:	KCL-Potassium chloride
Sample Date		Protocol:	CHRONIC-(EPA-821-R-02-013)	Test Species:	PP-Pimephales promelas
Comments:					

Conc-mg/L	1	2	3	4
D-Control	0.7656	0.9256	0.7964	0.5587
300	0.7628	0.7382	0.9643	0.7788
450	0.5958	0.7566	0.6531	0.8487
600	0.5743	0.5857	0.6350	0.6325
750	0.3604	0.4150	0.3488	0.6094
900	0.0814	0.0000	0.0000	0.0479

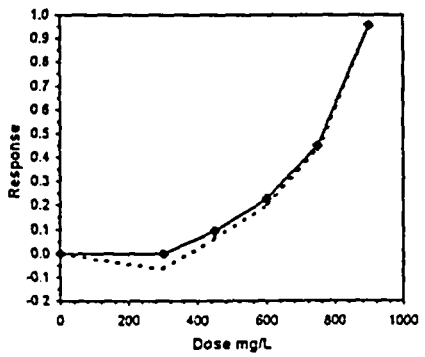
			Transform: Untransformed					1-Tailed			Isotonic	
Conc-mg/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.7616	1.0000	0.7616	0.5587	0.9256	19.936	4				0.7863	1.0000
300	0.8110	1.0649	0.8110	0.7382	0.9643	12.766	4	-0.643	2.290	0.1762	0.7863	1.0000
450	0.7136	0.9369	0.7136	0.5958	0.8487	15.697	4	0.624	2.290	0.1762	0.7136	0.9075
600	0.6069	0.7969	0.6069	0.5743	0.6350	5.173	4	2.011	2.290	0.1762	0.6069	0.7718
750	0.4334	0.5691	0.4334	0.3488	0.6094	27.880	4				0.4334	0.5512
900	0.0323	0.0424	0.0323	0.0000	0.0814	122.977	4				0.0323	0.0411

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.959667146	0.844	-0.01122482	0.236322648
Bartlett's Test indicates equal variances (p = 0.18)	4.894640446	11.34488201		

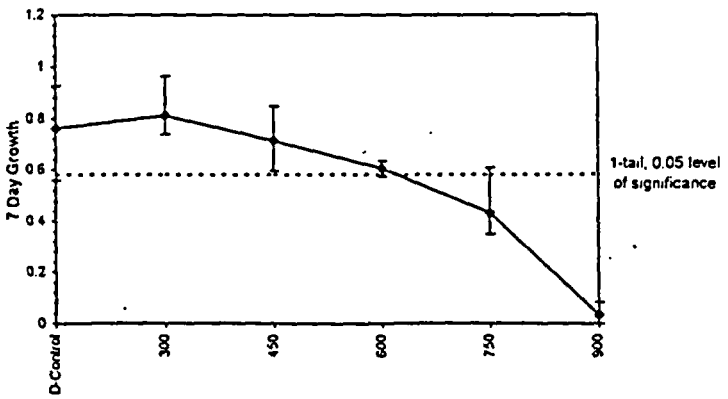
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	600	>600			0.17617597	0.231331083	0.030413982	0.011837293	0.103036903	3, 12
Treatments vs D-Control										

Linear Interpolation (200 Resamples)

Point	mg/L	SD	95% CL(Exp)		Skew
IC05	381.06	109.13	0.00	562.43	-0.7379
IC10	458.27	82.58	76.11	587.18	-0.7464
IC15	513.55	70.26	242.68	649.79	-0.5336
IC20	568.83	66.23	306.95	683.05	-0.6208
IC25	614.83	55.16	344.12	731.24	-0.8017
IC40	716.81	34.00	615.30	802.81	0.0270
IC50	765.05	21.92	677.92	809.32	-0.5590



Dose-Response Plot



Organisms obtained from Aquatic BioSystems, Inc.

Species: ***Pimephales promelas*** PpKClCR Test Number: 16

Daily Chemistry:

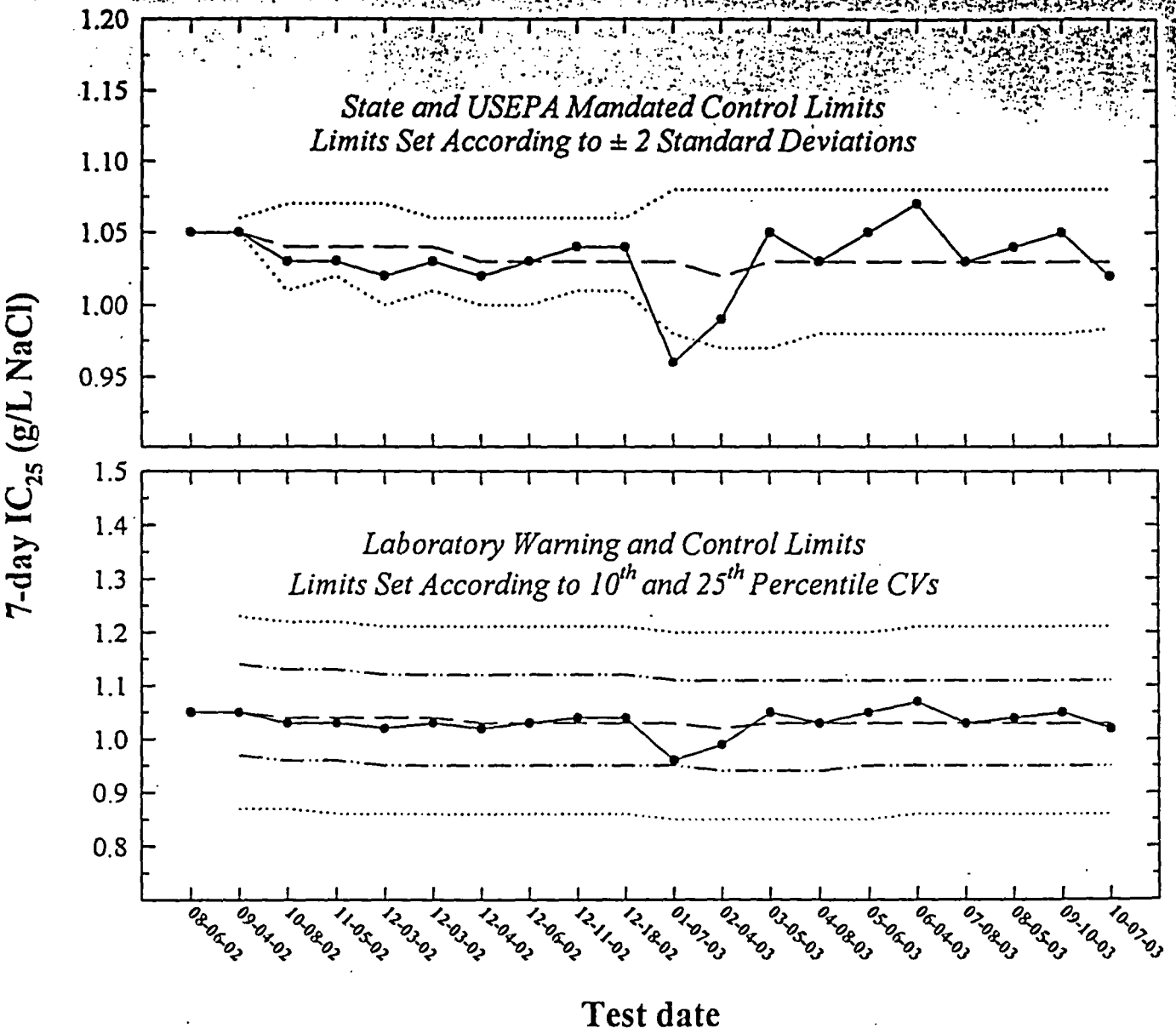
		Day					
		0		1		2	
	Analyst	MK	CAJ	CAJ	CAJ	CAJ	MKL
Concentration	Parameter						
CONTROL	pH (S.U.)	7.81	7.53	7.58	7.42	7.64	7.58
	DO (mg/L)	7.9	8.1	81	7.9	8.1	7.7
	Conductivity (µmhos/cm)	313		292		291	
	Alkalinity (mg $CaCO_3$/L)	60				60	
	Hardness (mg $CaCO_3$/L)	84				86	
	Temperature (°C)	25.6	25.2	25.5	24.4	24.6	24.8
300 mg KCl/L	pH (S.U.)	8.09	7.64	7.83	7.55	7.76	7.59
	DO (mg/L)	8.4	8.1	8.4	8.1	8.3	7.8
	Conductivity (µmhos/cm)	899		814		796	
	Temperature (°C)	25.6	25.2	25.5	24.4	24.6	24.8
450 mg KCl/L	pH (S.U.)	8.06	7.65	7.85	7.55	7.78	7.60
	DO (mg/L)	8.3	8.1	8.3	8.0	8.3	7.8
	Conductivity (µmhos/cm)	1090		1040		1060	
	Temperature (°C)	25.6	25.2	25.5	24.4	24.6	24.8
600 mg KCl/L	pH (S.U.)	8.03	7.69	7.84	7.59	7.78	7.63
	DO (mg/L)	8.3	8.1	8.3	8.0	8.2	7.8
	Conductivity (µmhos/cm)	1380		1280		1300	
	Temperature (°C)	25.6	25.2	25.5	24.4	24.6	24.8
750 mg KCl/L	pH (S.U.)	8.02	7.69	7.84	7.62	7.78	7.68
	DO (mg/L)	8.3	8.1	8.2	8.0	8.2	7.9
	Conductivity (µmhos/cm)	1630		1500		1530	
	Temperature (°C)	25.6	25.2	25.5	24.4	24.6	24.8
900 mg KCl/L	pH (S.U.)	8.02	7.71	7.85	7.65	7.77	7.70
	DO (mg/L)	8.4	8.2	8.3	8.1	8.2	7.7
	Conductivity (µmhos/cm)	1910		1720		1810	
	Temperature (°C)	25.6	25.2	25.5	24.4	24.6	24.8
STOCK	Conductivity (µmhos/cm)	74500				71900	
		Initial	Final	Initial	Final	Initial	Final

Species: *Pimephales promelas* PpKClCR Test Number: 16

		Day							
		3		4		5		6	
	Analyst	KBL	KBL	KBL	KBL	KBL	KBL	KBL	KBL
Concentration	Parameter								
CONTROL	pH (S.U.)	7.75	7.54	7.77	7.26	7.72	7.76	7.68	7.08
	DO (mg/L)	8.3	7.3	7.8	6.5	7.7	7.8	7.8	7.2
	Conductivity (µmhos/cm)	287		294		290		309	
	Alkalinity (mg $CaCO_3$/L)								
	Hardness (mg $CaCO_3$/L)								
	Temperature (°C)	24.9	24.9	25.2	25.1	25.6	24.8	25.3	24.6
300 mg KCl/L	pH (S.U.)	7.71	7.54	7.87	7.23	7.85	7.76	7.80	7.27
	DO (mg/L)	8.0	7.3	7.7	6.1	7.8	7.6	8.0	6.8
	Conductivity (µmhos/cm)	819		834		821		827	
	Temperature (°C)	24.9	24.9	25.2	25.1	25.6	24.8	25.3	24.6
450 mg KCl/L	pH (S.U.)	7.75	7.60	7.80	7.36	7.84	7.75	7.85	7.28
	DO (mg/L)	8.0	7.2	7.7	6.5	7.8	7.7	8.0	6.4
	Conductivity (µmhos/cm)	1030		1070		1070		1070	
	Temperature (°C)	24.9	24.9	25.2	25.1	25.6	24.8	25.3	24.6
600 mg KCl/L	pH (S.U.)	7.77	7.58	7.86	7.36	7.85	7.76	7.85	7.36
	DO (mg/L)	8.0	7.3	7.8	6.7	7.9	7.7	8.0	6.7
	Conductivity (µmhos/cm)	1300		1350		1310		1340	
	Temperature (°C)	24.9	24.9	25.2	25.1	25.6	24.8	25.3	24.6
750 mg KCl/L	pH (S.U.)	7.79	7.63	7.86	7.37	7.83	7.77	7.80	7.35
	DO (mg/L)	8.0	7.1	7.8	6.2	7.9	7.8	8.0	6.5
	Conductivity (µmhos/cm)	1610		1590		1620		1600	
	Temperature (°C)	24.9	24.9	25.2	25.1	25.6	24.8	25.3	24.6
900 mg KCl/L	pH (S.U.)	7.81	7.63	7.85	7.38	7.85	7.78	7.87	7.36
	DO (mg/L)	8.0	7.2	7.7	7.0	7.9	7.8	8.0	7.0
	Conductivity (µmhos/cm)	1880		1900		1900		1860	
	Temperature (°C)	24.9	24.9	25.2	25.1	25.6	24.8	72700	24.6
STOCK	Conductivity (µmhos/cm)			73800				25.3	
		Initial	Final	Initial	Final	Initial	Final	Initial	Final

Environmental Testing Solutions, Inc.

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



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

— – Central Tendency (mean IC_{25})

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

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

Environmental Testing Solutions, Inc.

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

Test number	Test date	7-day IC_{25} (g/L NaCl)	CT (g/L NaCl)	S	State and USEPA Control Limits CT - 2S	CT + 2S	$S_{A.10}$	Laboratory Warning Limits CT - $S_{A.10}$	CT + $S_{A.10}$	$S_{A.25}$	Laboratory Control Limits CT - $S_{A.25}$	CT + $S_{A.25}$	$S_{A.75}$	USEPA Warning Limits CT - $S_{A.75}$	CT + $S_{A.75}$	$S_{A.90}$	USEPA Control Limits CT - $S_{A.90}$	CT + $S_{A.90}$	CV
1	08-06-02	1.05																	
2	09-04-02	1.05	1.05	0.00	1.05	1.06	0.08	0.97	1.14	0.18	0.87	1.23	0.47	0.58	1.53	0.65	0.40	1.71	0.00
3	10-08-02	1.03	1.04	0.02	1.01	1.07	0.08	0.96	1.13	0.18	0.87	1.22	0.47	0.57	1.51	0.65	0.40	1.69	0.01
4	11-05-02	1.03	1.04	0.01	1.02	1.07	0.08	0.96	1.13	0.18	0.86	1.22	0.47	0.57	1.51	0.65	0.40	1.69	0.01
5	12-03-02	1.02	1.04	0.02	1.00	1.07	0.08	0.95	1.12	0.18	0.86	1.21	0.47	0.57	1.50	0.64	0.39	1.68	0.02
6	12-03-02	1.03	1.04	0.01	1.01	1.06	0.08	0.95	1.12	0.18	0.86	1.21	0.47	0.57	1.50	0.64	0.39	1.68	0.01
7	12-04-02	1.02	1.03	0.02	1.00	1.06	0.08	0.95	1.12	0.18	0.86	1.21	0.46	0.57	1.50	0.64	0.39	1.67	0.01
8	12-06-02	1.03	1.03	0.01	1.00	1.06	0.08	0.95	1.12	0.18	0.86	1.21	0.46	0.57	1.50	0.64	0.39	1.67	0.01
9	12-11-02	1.04	1.03	0.01	1.01	1.06	0.08	0.95	1.12	0.18	0.86	1.21	0.46	0.57	1.50	0.64	0.39	1.67	0.01
10	12-18-02	1.04	1.03	0.01	1.01	1.06	0.08	0.95	1.12	0.18	0.86	1.21	0.47	0.57	1.50	0.64	0.39	1.68	0.01
11	01-07-03	0.96	1.03	0.02	0.98	1.08	0.08	0.95	1.11	0.17	0.85	1.20	0.46	0.57	1.49	0.64	0.39	1.66	0.02
12	02-04-03	0.99	1.02	0.03	0.97	1.08	0.08	0.94	1.11	0.17	0.85	1.20	0.46	0.56	1.49	0.64	0.39	1.66	0.03
13	03-05-03	1.05	1.03	0.03	0.97	1.08	0.08	0.94	1.11	0.17	0.85	1.20	0.46	0.56	1.49	0.64	0.39	1.66	0.03
14	04-08-03	1.03	1.03	0.03	0.98	1.08	0.08	0.94	1.11	0.17	0.85	1.20	0.46	0.56	1.49	0.64	0.39	1.66	0.02
15	05-06-03	1.05	1.03	0.02	0.98	1.08	0.08	0.95	1.11	0.17	0.85	1.20	0.46	0.57	1.49	0.64	0.39	1.66	0.02
16	06-04-03	1.07	1.03	0.03	0.98	1.08	0.08	0.95	1.11	0.18	0.86	1.21	0.46	0.57	1.49	0.64	0.39	1.67	0.03
17	07-08-03	1.03	1.03	0.03	0.98	1.08	0.08	0.95	1.11	0.18	0.86	1.21	0.46	0.57	1.49	0.64	0.39	1.67	0.02
18	08-05-03	1.04	1.03	0.02	0.98	1.08	0.08	0.95	1.11	0.18	0.86	1.21	0.46	0.57	1.49	0.64	0.39	1.67	0.02
19	09-10-03	1.05	1.03	0.02	0.98	1.08	0.08	0.95	1.11	0.18	0.86	1.21	0.46	0.57	1.50	0.64	0.39	1.67	0.02
20	10-07-03	1.02	1.03	0.02	0.9834	1.08	0.08	0.95	1.11	0.18	0.86	1.21	0.46	0.57	1.49	0.64	0.39	1.67	0.02

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

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

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

Laboratory Control and Warning Limits

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

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

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

USEPA Control and Warning Limits

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

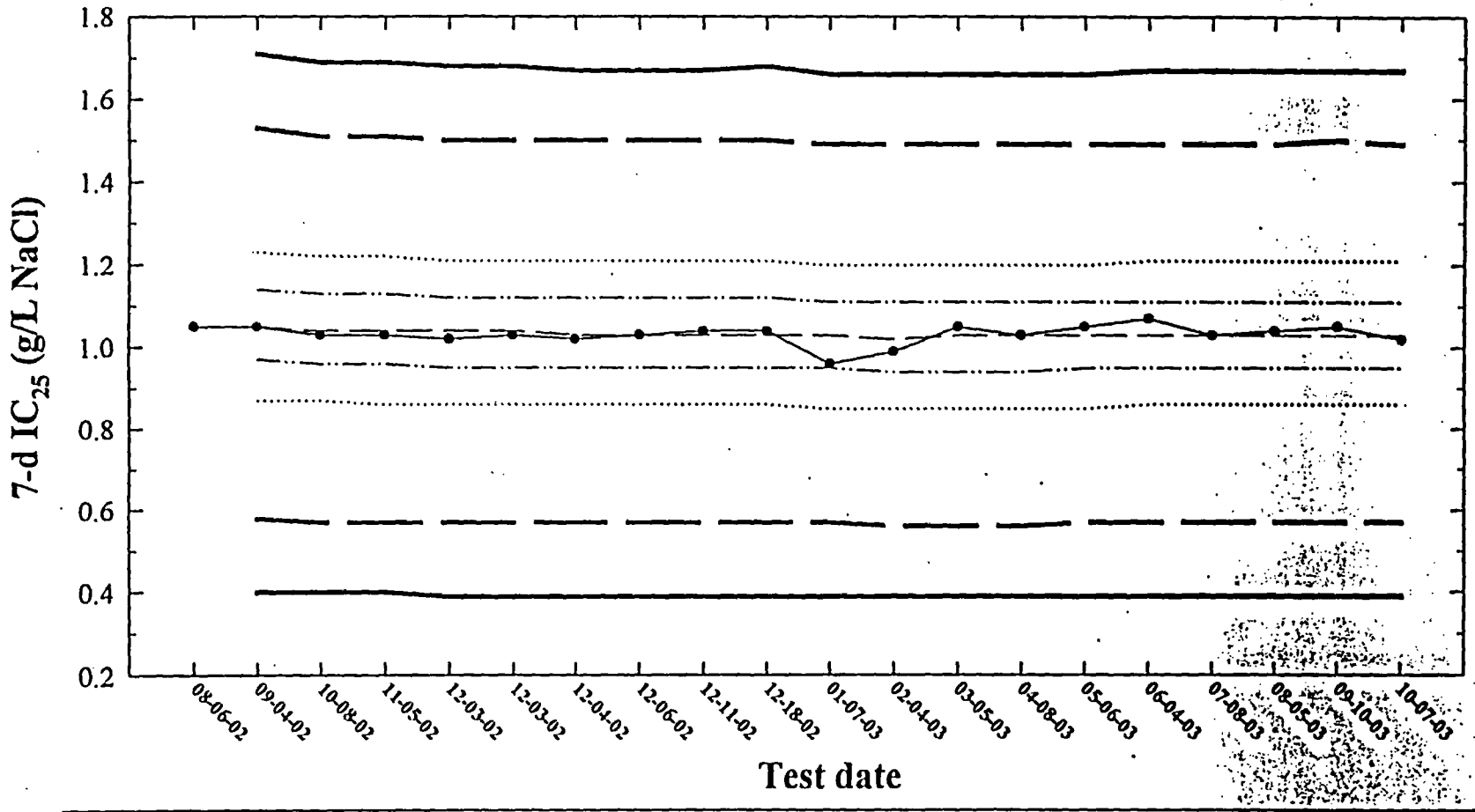
$S_{A.90}$ = Standard deviation corresponding to the 90th percentile CV. ($S_{A.90}$ = 0.62)

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

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

Environmental Testing Solutions, Inc.

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



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

— – Central Tendency (mean IC_{25})

—·— Laboratory Warning Limits (mean $IC_{25} \pm S_{A.10}$, $S_{A.10} = 0.08$)

····· Laboratory Control Limits (mean $IC_{25} \pm S_{A.25}$, $S_{A.25} = 0.17$)

— — USEPA Warning Limits (mean $IC_{25} \pm S_{A.75}$, $S_{A.75} = 0.45$)

——— USEPA Control Limits (mean $IC_{25} \pm S_{A.90}$, $S_{A.90} = 0.62$)

Environmental Testing Solutions, Inc.

Precision of Endpoint Measurements

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

Test number	Test date	Control Survival (%)	Control Mean Reproduction (offspring/female)	CT for Control Mean Reproduction (offspring/female)	CV (%)	CT for Control Reproduction CV (%)	MSD	PMSD (%)	CT for PMSD (%)
1	08-06-02	100	28.4		8.0		2.7	9.5	
2	09-04-02	100	31.4	29.9	10.4	9.2	3.0	9.5	9.5
3	10-08-02	100	31.1	30.3	6.7	8.4	2.9	9.4	9.5
4	11-05-02	100	29.5	30.1	9.2	8.6	2.5	8.4	9.2
5	12-03-02	90	34.0	30.9	8.0	8.5	2.7	8.0	8.9
6	12-03-02	100	33.2	31.3	6.2	8.1	3.3	9.9	9.1
7	12-04-02	100	32.5	31.4	6.0	7.8	3.2	9.8	9.2
8	12-06-02	100	29.7	31.2	11.0	8.2	3.0	10.0	9.3
9	12-11-02	100	33.8	31.5	13.7	8.8	2.9	8.5	9.2
10	12-18-02	100	30.5	31.4	7.4	8.7	2.9	9.4	9.2
11	01-07-03	100	33.2	31.6	7.0	8.5	2.9	8.6	9.2
12	02-04-03	100	32.3	31.6	8.1	8.5	2.7	8.4	9.1
13	03-05-03	100	28.7	31.4	5.1	8.2	3.5	12.1	9.3
14	04-11-03	100	26.3	31.0	6.2	8.1	2.5	9.6	9.4
15	05-06-03	100	27.6	30.8	10.8	8.2	3.2	11.5	9.5
16	06-04-03	100	25.9	30.5	5.9	8.1	2.6	10.1	9.5
17	07-08-03	100	29.0	30.4	11.6	8.3	3.2	10.9	9.6
18	08-05-03	100	33.3	30.6	6.6	8.2	4.7	14.1	9.9
19	09-10-03	100	29.3	30.5	4.3	8.0	3.1	10.7	9.9
20	10-07-03	100	33.4	30.7	8.0	8.0	3.2	9.5	9.9

Note:

CV = Coefficient of variation for control reproduction.
On average, the CV for control reproduction is 8.0% in Environmental Testing Solutions, Inc. *Ceriodaphnia* chronic toxicity tests.
Lower CV bound determined by USEPA (10th percentile) = 8.9%.
Upper CV bound determined by USEPA (90th percentile) = 42%

MSD = Minimum Significant Difference

PMSD = Percent Minimum Significant Difference
PMSD is a measure of test precision. The PMSD is the minimum percent difference between the control and treatment that can be declared statistically significant in a whole effluent toxicity test. On average, a significant difference occurs for Environmental Testing Solutions, Inc. chronic toxicity tests when a toxicant reduces Ceriodaphnia reproduction by 9.9% from the control.
Lower PMSD bound determined by USEPA (10th percentile) = 11%.
Upper PMSD bound determined by USEPA (90th percentile) = 37%.

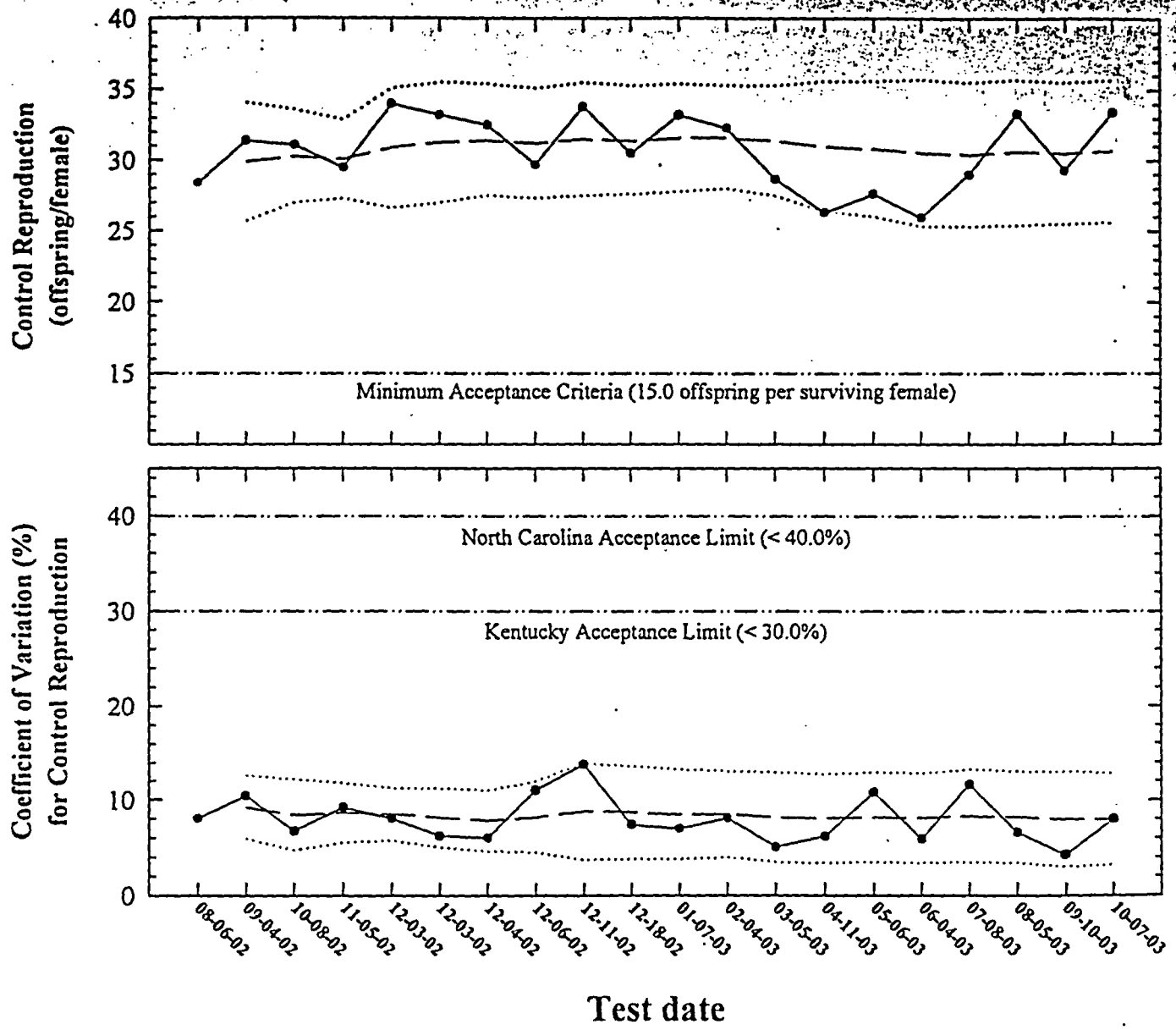
CT = Central Tendancy (Mean Control Reproduction, CV, or PMSD)

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

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

Environmental Testing Solutions, Inc.

Ceriodaphnia dubia Control Reproduction and Coefficient of Variation in Sodium Chloride Chronic Reference Toxicant Tests



—•— Control Reproduction or Coefficient of Variation (CV)

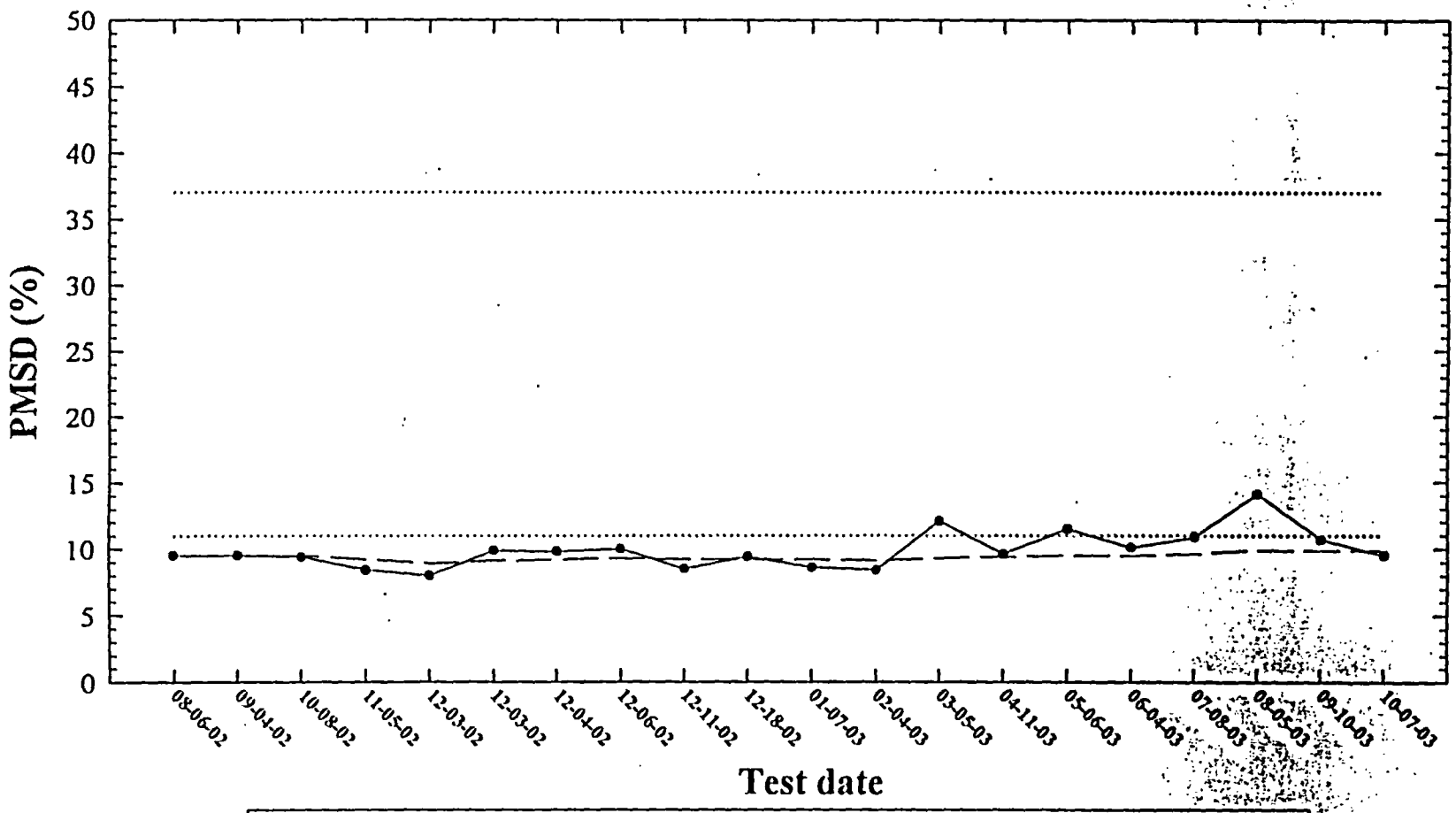
— – Central Tendency (mean Control Reproduction or CV)

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

Environmental Testing Solutions, Inc.

Precision of Endpoint Measurements

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



—•— **PMSD** = percent minimum significant difference. PMSD is the minimum significant difference between the control and treatment that can be declared statistically significant.

— - **Central Tendency** (mean PMSD)

····· **Lower and Upper PMSD Bounds**

Lower PMSD Bound (10th percentile) = 11%, Upper PMSD Bound (90th percentile) = 37%

(Lower and upper PMSD bounds were determined by USEPA for the method and endpoint.)

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

CdNaCLCR #: 15

Dilution preparation information:						*Comments:*
NaCl CHM number:		CHM 060				
Stock preparation:		100 g NaCl/l (dissolve 50 g NaCl in 500 ml deionized water)				
Dilution prep (mg/L)	600	800	1000	1200	1400	
Stock volume (mL)	9	12	15	18	21	
Diluent volume (mL)	1491	1488	1485	1482	1479	
Total volume (mL)	1500	1500	1500	1500	1500	

Test organism information:		*Test information:*	
Organism age:	< 24-hours old	Randomizing template:	yellow
Date and times organisms were born between:	10-07-03 0752 to 1016	Incubator number and shelf location:	2 C2
Organism source:	09-30-03 A-1	YCT batch: ABS	09-11-03
Transfer bowl information:	pH = 7.96 SU Temperature 24.4°C	*Selenastrum* batch: ABS	09-11-03

Daily renewal information:

Day	Date	Test initiation, renewal, or termination time	Control water batch used	Analyst
0	10-07-03	1150	10-06-03	JH
1	10-08-03	1056	10-06-03	JH
2	10-09-03	1059	10-08-03	JH
3	10-10-03	1110	10-08-03	JH
4	10-11-03	1114	10-08-03	JH
5	10-12-03	1130	10-08-03	JH
6	10-13-03	1126	10-08-03	JH
7	10-14-03	1119		JH

Control information:		Acceptance criteria	*Summary of test endpoints:*	
% of Male Adults:	0%	≤ 20%	7-day LC50	>1400
% Adults having 3rd Broods:	100%	≥ 80%	NOEC	800
% Mortality:	0%	≤ 20%	LOEC	1000
Mean Offspring/Female:	33.4	≥ 15.0 offspring/female	ChV	894.4
% CV:	8.0%	< 40.0 %	IC25	1020.4

Species: *Ceriodaphnia dubia*

CdNaCLCR #: 15

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	5	6	4	6	4	5	5	5	5	5
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	12	13	11	11	10	10	13	12	12	10
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	0	0	0	0	1*	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	18	18	17	17	14	16	17	20	16	16
Total young produced		35	37	32	34	29	31	35	37	33	31
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L
X for 3rd Broods		X	X	X	X	X	X	X	X	X	X

* carryover

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	33.4

600 mg NaCl/L

Survival and Reproduction Data

Day		Replicate number 1	2	3	4	5	6	7	8	9	10
1	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
2	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
3	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
4	Young produced	4	6	6	5	5	5	4	5	5	5
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	12	13	12	11	12	13	10	10	10	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	19	17	19	19	15	16	17
Total young produced		34	35	36	35	34	37	33	30	31	35
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	34.0
% Reduction from Control:	-1.8%

Species: *Ceriodaphnia dubia*

CdNaCLCR #: 15

800 mg NaCl/L *Survival and Reproduction Data*

Day		Replicate number 1	2	3	4	5	6	7	8	9	10
1	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
2	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
3	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
4	Young produced	4	6	5	5	4	5	6	5	5	4
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	10	13	11	10	10	14	11	10	10	12
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	17	17	20	17	17	16	18	15	15	19
Total young produced		31	36	36	32	31	35	35	30	30	35
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	33.1
% Reduction from Control:	0.9%

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	4	5	4	5	6	5	3	4	4
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	11	10	10	10	10	13	10	12	8	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	10	12	16	13	13	10	10	13	9	11
Total young produced		25	26	31	27	28	29	25	28	21	26
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	26.6
% Reduction from Control:	20.4%

Species: *Ceriodaphnia dubia*

CdNaCLCR #: 15

1200 mg NaCl/L

Survival and Reproduction Data

Day		Replicate number 1	2	3	4	5	6	7	8	9	10
1	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
2	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
3	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
4	Young produced	0	0	3	2	0	3	0	2	2	2
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	8	7	3	5	9	6	4	7	6	4
	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	4	4	3	9	10	10	4	10	6	3
Total young produced		12	11	9	16	19	19	8	19	14	9
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	13.6
% Reduction from Control:	59.3%

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	2	0	0	0	0	3
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	3	1	5	0	0	4	4	5	0	6
	Adult mortality	L	L	L	D	L	L	L	L	L	L
6	Young produced	0	0	0	↓	0	0	0	0	2	0
	Adult mortality	L	L	L		L	L	L	L	L	L
7	Young produced	3	5	8		4	2	7	0	0	0
Total young produced		6	6	13	2	6	6	11	5	2	9
Final Adult Mortality		L	L	L	D	L	L	L	L	L	L

Concentration:	
% Mortality:	10%
Mean Offspring/Female:	6.6
% Reduction from Control:	80.2%

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	5	6	4	6	4	5	5	5	5	5	50
5	12	13	11	11	10	10	13	12	12	10	114
6	0	0	0	0	1	0	0	0	0	0	1
7	18	18	17	17	14	16	17	20	16	16	169
Total	35	37	32	34	29	31	35	37	33	31	334

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	4	5	4	5	6	5	3	4	4	44
5	11	10	10	10	10	13	10	12	8	11	105
6	0	0	0	0	0	0	0	0	0	0	0
7	10	12	16	13	13	10	10	13	9	11	117
Total	25	26	31	27	28	29	25	28	21	26	266

600 mg NaCl/L

Day	Replicate number										Total
	1	2	3	4	5	6	7	8	9	10	
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0
4	4	6	6	5	5	5	4	5	5	5	50
5	12	13	12	11	12	13	10	10	10	13	116
6	0	0	0	0	0	0	0	0	0	0	0
7	18	16	18	19	17	19	19	15	16	17	174
Total	34	35	36	35	34	37	33	30	31	35	340

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	0	0	3	2	0	3	0	2	2	2	14
5	8	7	3	5	9	6	4	7	6	4	59
6	0	0	0	0	0	0	0	0	0	0	0
7	4	4	3	9	10	10	4	10	6	3	63
Total	12	11	9	16	19	19	8	19	14	9	136

800 mg NaCl/L

Day	Replicate number										Total
	1	2	3	4	5	6	7	8	9	10	
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0
4	4	6	5	5	4	5	6	5	5	4	49
5	10	13	11	10	10	14	11	10	10	12	111
6	0	0	0	0	0	0	0	0	0	0	0
7	17	17	20	17	17	16	18	15	15	19	171
Total	31	36	36	32	31	35	35	30	30	35	331

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	2	0	0	0	0	3	7
5	3	1	5	0	0	4	4	5	0	6	28
6	0	0	0	0	0	0	0	0	2	0	2
7	3	5	8	0	4	2	7	0	0	0	29
Total	6	6	13	2	6	6	11	5	2	9	66

Environmental Testing Solutions, Inc.

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

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

Test number: CdNaClCR #44

Test dates: October 7-14, 2003

Reviewed by: [signature]

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	35	37	32	34	29	31	35	37	33	31	100	33.4	8.0	Not applicable
600	34	35	36	35	34	37	33	30	31	35	100	34.0	6.4	-1.8
800	31	36	36	32	31	35	35	30	30	35	100	33.1	7.6	0.9
1000	25	26	31	27	28	29	25	28	21	26	100	26.6	10.2	20.4
1200	12	11	9	16	19	19	8	19	14	9	100	13.6	32.6	59.3
1400	6	6	13	2	6	6	11	5	2	9	90	6.6	53.5	80.2

Dunnett's MSD value: 3.169

PMSD: 9.5

MSD = Minimum Significant Difference

PMSD = Percent Minimum Significant Difference

PMSD is a measure of test precision. The PMSD is the minimum percent difference between the control and treatment that can be declared statistically significant in a whole effluent toxicity test. On average, a significant difference occurs for Environmental Testing Solutions, Inc. chronic toxicity tests when a toxicant reduces Ceriodaphnia reproduction by 9.9% from the control.

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

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

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

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

Environmental Testing Solutions, Inc.

Statistical Analyses

Ceriodaphnia Survival and Reproduction Test-Reproduction

Start Date:	10/7/03	Test ID:	CdNaClCR	Sample ID:	REF-Ref Toxicant
End Date:	10/14/03	Lab ID:	ETS-Env. Testing Solutions	Sample Type:	NACL-Sodium chloride
Sample Date		Protocol:	CHRONIC-(EPA-821-R-02-013)	Test Species:	CD-Ceriodaphnia dubia
Comments:					

Conc-mg/L	1	2	3	4	5	6	7	8	9	10
D-Control	35.000	37.000	32.000	34.000	29.000	31.000	35.000	37.000	33.000	31.000
600	34.000	35.000	36.000	35.000	34.000	37.000	33.000	30.000	31.000	35.000
800	31.000	36.000	36.000	32.000	31.000	35.000	35.000	30.000	30.000	35.000
1000	25.000	26.000	31.000	27.000	28.000	29.000	25.000	28.000	21.000	26.000
1200	12.000	11.000	9.000	16.000	19.000	19.000	8.000	19.000	14.000	9.000
1400	6.000	6.000	13.000	2.000	6.000	6.000	11.000	5.000	2.000	9.000

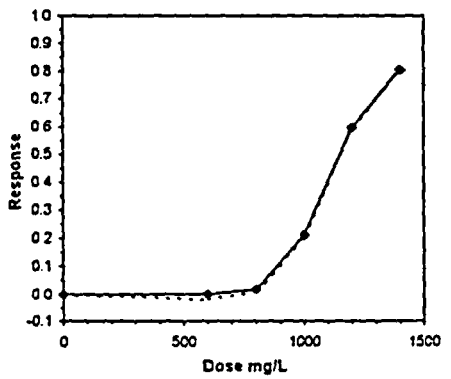
			Transform: Untransformed					1-Tailed			Isotonic	
Conc-mg/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	33.400	1.0000	33.400	29.000	37.000	8.009	10				33.700	1.0000
600	34.000	1.0180	34.000	30.000	37.000	6.354	10	-0.433	2.287	3.169	33.700	1.0000
800	33.100	0.9910	33.100	30.000	36.000	7.596	10	0.216	2.287	3.169	33.100	0.9822
*1000	26.600	0.7964	26.600	21.000	31.000	10.211	10	4.907	2.287	3.169	26.600	0.7893
*1200	13.600	0.4072	13.600	8.000	19.000	32.553	10	14.288	2.287	3.169	13.600	0.4036
*1400	6.600	0.1976	6.600	2.000	13.000	53.545	10	19.339	2.287	3.169	6.600	0.1958

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Kolmogorov D Test indicates normal distribution (p > 0.01)	0.49843666	1.035	0.06606336	-0.5946375
Bartlett's Test indicates equal variances (p = 0.29)	6.21582174	15.0863171		

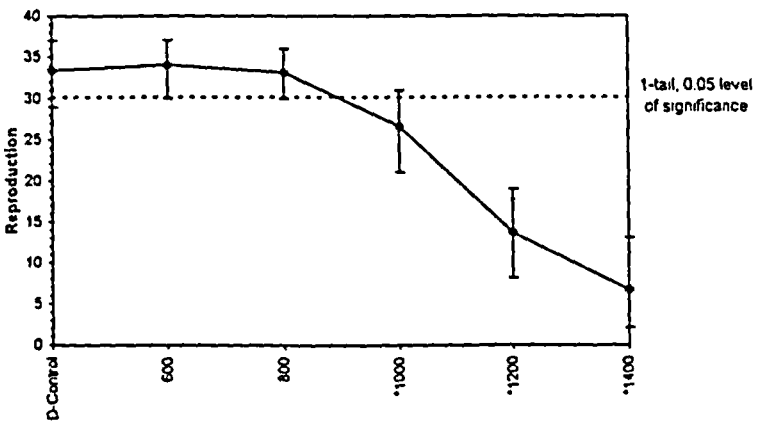
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	800	1000	894.427191		3.16880382	0.09487437	1374.07	9.60185185	7.1E-30	5, 54
Treatments vs D-Control										

Linear Interpolation (200 Resamples)

Point	mg/L	SD	95% CL		Skew
IC05	833.384615	39.2356661	717.402664	855.594655	-2.7821
IC10	885.230769	20.1520687	840.248208	916.389376	-0.3552
IC15	937.076923	21.9180878	900.592865	980.909722	0.3403
IC20	988.923077	20.1158609	948.376049	1016.6902	-0.3971
IC25	1020.38462	12.8514456	993.793282	1042.40643	-0.4658
IC40	1098.15385	12.6588099	1073.17747	1120.73381	0.0644
IC50	1150	16.3166188	1119.46398	1184.16621	0.3061



Dose-Response Plot



Species: *Ceriodaphnia dubia*

CdNaCLCR #: 15

Daily Chemistry:

		Day 0		Day 1		Day 2	
	Analyst	KEL	CA	CA	CA	CA	KEL
Concentration	**Parameter**						
CONTROL	pH (S.U.)	7.81	7.77	7.58	7.77	7.64	7.71
	DO (mg/L)	7.9	8.2	8.1	8.1	8.1	7.8
	Conductivity (µmhos/cm)	313		292		291	
	Alkalinity (mg $CaCO_3$/L)	60				60	
	Hardness (mg $CaCO_3$/L)	84				86	
	Temperature (°C)	24.6	25.0	25.1	24.4	25.1	24.6
600 mg NaCl/L	pH (S.U.)	8.01	7.77	7.74	7.78	7.87	7.77
	DO (mg/L)	8.2	~~8.3~~ 8.2	8.2	8.1	8.2	7.8
	Conductivity (µmhos/cm)	1510		1340		1410	
	Temperature (°C)	24.6	25.0	25.1	24.4	25.1	24.6
800 mg NaCl/L	pH (S.U.)	7.99	7.78	7.77	7.76	7.85	7.77
	DO (mg/L)	8.3	8.2	8.2	8.2	8.2	7.8
	Conductivity (µmhos/cm)	1850		1680		1750	
	Temperature (°C)	24.6	25.0	25.1	24.4	25.1	24.6
1000 mg NaCl/L	pH (S.U.)	7.99	7.79	7.78	7.76	7.85	7.77
	DO (mg/L)	8.3	8.3	8.3	8.2	8.2	7.9
	Conductivity (µmhos/cm)	2250		2090		2120	
	Temperature (°C)	24.6	25.0	25.1	24.4	25.1	24.6
1200 mg NaCl/L	pH (S.U.)	7.99	7.81	7.80	7.78	7.84	7.76
	DO (mg/L)	8.4	8.2	8.3	8.3	8.2	7.8
	Conductivity (µmhos/cm)	2700		2390		2520	
	Temperature (°C)	24.6	25.0	25.1	24.4	25.1	24.6
1400 mg NaCl/L	pH (S.U.)	7.99	7.80	7.81	7.78	7.83	7.77
	DO (mg/L)	8.4	8.4	8.3	8.2	8.2	7.8
	Conductivity	3010		2780		2820	
	Temperature (°C)	24.6	25.0	25.1	24.4	25.1	24.6
STOCK	Conductivity (µmhos/cm)	130000		~~25.1~~		—	
		Initial	Final	Initial	Final	Initial	Final

Species: *Ceriodaphnia dubia*

CdNaCLCR #: 15

		Day							
		3		4		5		6	
	Analyst	KEK	KEK	KEK	KEK	KEK	KEK	KEK	KEK
Concentration	Parameter								
CONTROL	pH (S.U.)	7.75	7.82	7.77	7.68	7.72	7.74	7.68	7.57
	DO (mg/L)	8.3	8.1	7.8	7.8	7.7	7.9	7.8	7.5
	Conductivity (µmhos/cm)	287		294		290		309	
	Alkalinity (mg $CaCO_3$/L)								
	Hardness (mg $CaCO_3$/L)								
	Temperature (°C)	24.8	24.6	25.1	24.4	25.7	24.6	25.1	24.5
600 mg NaCl/L	pH (S.U.)	7.79	7.84	7.80	7.73	7.80	7.78	7.77	7.84
	DO (mg/L)	7.9	8.1	8.0	7.7	7.9	7.8	8.0	7.5
	Conductivity (µmhos/cm)	1350		1370		1390		1400	
	Temperature (°C)	24.8	24.6	25.1	24.4	25.7	24.6	25.1	24.5
800 mg NaCl/L	pH (S.U.)	7.79	7.84	7.82	7.75	7.80	7.78	7.78	7.82
	DO (mg/L)	8.0	8.1	8.1	7.7	7.8	7.9	8.0	7.5
	Conductivity (µmhos/cm)	1720		1780		1780		1760	
	Temperature (°C)	24.8	24.6	25.1	24.4	25.7	24.6	25.1	24.5
1000 mg NaCl/L	pH (S.U.)	7.81	7.84	7.83	7.79	7.81	7.78	7.87	7.83
	DO (mg/L)	8.0	8.1	8.1	7.7	7.9	7.9	8.0	7.5
	Conductivity (µmhos/cm)	2150		2170		2180		2130	
	Temperature (°C)	24.8	24.6	25.1	24.4	25.7	24.6	25.1	24.5
1200 mg NaCl/L	pH (S.U.)	7.83	7.83	7.85	7.78	7.84	7.80	7.87	7.84
	DO (mg/L)	8.0	8.1	8.1	7.8	7.8	7.9	8.0	7.5
	Conductivity (µmhos/cm)	2550		2580		2580		2560	
	Temperature (°C)	24.8	24.6	25.1	24.4	25.7	24.6	25.1	24.5
1400 mg NaCl/L	pH (S.U.)	7.83	7.83	7.85	7.82	7.84	7.80	7.88	7.84
	DO (mg/L)	7.9	8.2	8.1	7.8	7.8	7.9	8.0	7.6
	Conductivity (µmhos/cm)	2910		2970		2940		2950	
	Temperature (°C)	24.8	24.6	130000	24.4	25.7	24.6	25.1	24.5
STOCK	Conductivity (µmhos/cm)			25.1					
		Initial	Final	Initial	Final	Initial	Final	Initial	Final

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

Name: TVA - SEQUOYAH NUCLEAR PLANT
Address: P.O. BOX 2000
(INTEROFFICE SB-2A)
SODDY - DAISY TN 37384
Facility: TVA - SEQUOYAH NUCLEAR PLANT
Location: HAMILTON COUNTY

ATTN: Stephanie A. Howard

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

TN0026450	103 G
PERMIT NUMBER	DISCHARGE NUMBER

MONITORING PERIOD	YEAR	MO	DAY		YEAR	MO	DAY
From	03	10	01	To	03	10	31

MAJOR
(SUBR 01)
F - FINAL
LOW VOL. WASTE TREATMENT POND
EFFLUENT
*** NO DISCHARGE ☐ ***

Form Approved.
OMB No. 2040-0004

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	SAMPLE MEASUREMENT	********	********	**	7.0	********	8.6	12	0	14 / 31	GRAB
00400 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT	********	********	**	6.0 MINIMUM	********	9.0 MAXIMUM	SU		THREE/ WEEK	GRAB
SOLIDS, TOTAL SUSPENDED	SAMPLE MEASUREMENT	158	169	26	********	13	14	19	0	5 / 31	GRAB
00530 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT	380 MO AVG	1250 DAILY MX	LBS/DY	********	30 MO AVG	100 DAILY MX	MG/L		WEEKLY	GRAB
OIL AND GREASE	SAMPLE MEASUREMENT	<60	<64	26	********	<5	<5	19	0	5 / 31	GRAB
00556 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT	190 MO AVG	250 DAILY MX	LBS/DY	********	15 MO AVG	20 DAILY MX	MG/L		WEEKLY	GRAB
FLOW, IN CONDUIT OR THRU TREATMENT PLANT	SAMPLE MEASUREMENT	1.327	1.524	03	********	********	********	**	0	31 / 31	TOTAL
50050 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT	REPORT MO AVG	REPORT DAILY MX	MGD	********	********	********	**		DAILY	TOTAL
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										

NAME/TITLE PRINCIPAL EXECUTIVE OFFICER			TELEPHONE		DATE		
Richard T. Purcell Site Vice President	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.	Stephanie A. Howard Acting Environmental Supervisor	423	843-6700	03	11	13
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)*

PERMITTEE NAME/ADDRESS *(Include Facility Name/Location if Different)*
Name TVA - SEQUOYAH NUCLEAR PLANT
Address P.O. BOX 2000
(INTEROFFICE SB-2A)
SODDY - DAISY TN 37384
Facility TVA - SEQUOYAH NUCLEAR PLANT
Location HAMILTON COUNTY

ATTN: Stephanie A. Howard

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

TN0026450	107 G
PERMIT NUMBER	DISCHARGE NUMBER

MONITORING PERIOD	YEAR	MO	DAY		YEAR	MO	DAY
From	03	10	01	To	03	10	31

MAJOR
(SUBR 01)
F - FINAL
METAL CLEANING WASTE POND
EFFLUENT

*** NO DISCHARGE ☐ ***

Form Approved.
OMB No. 2040-0004

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	SAMPLE MEASUREMENT	********	********	**	8.4	********	8.5	12	0	2 / 31	GRAB
00400 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT	********	********	****	6.0 MINIMUM	********	9.0 MAXIMUM	SU		DAILY	GRAB
PHOSPHORUS, TOTAL (AS P)	SAMPLE MEASUREMENT	********	********	**	********	********		19			
00665 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT	********	********	****	********	********	1.0 DAILY MX	MG/L		DAILY	COMPOS
SOLIDS, TOTAL SUSPENDED	SAMPLE MEASUREMENT	********	********	**	********	********	10	19	0	2 / 31	COMPOS
00530 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT	********	********	****	********	********	30 DAILY MX	MG/L		DAILY	COMPOS
OIL AND GREASE	SAMPLE MEASUREMENT	********	********	**	********	********	<5	19	0	2 / 31	GRAB
00556 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT	********	********	****	********	********	15 DAILY MX	MG/L		DAILY	GRAB
COPPER, TOTAL (AS CU)	SAMPLE MEASUREMENT	********	********	**	********	********	<0.010	19	0	2 / 31	COMPOS
01042 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT	********	********	****	********	********	1.0 DAILY MX	MG/L		DAILY	COMPOS
IRON, TOTAL (AS FE)	SAMPLE MEASUREMENT	********	********	**	********	********	0.13	19	0	2 / 31	COMPOS
01045 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT	********	********	****	********	********	1.0 DAILY MX	MG/L		DAILY	COMPOS
FLOW, IN CONDUIT OR THRU TREATMENT PLANT	SAMPLE MEASUREMENT	0.044	0.045	03	********	********	********	**	0	2 / 31	CALCTD
50050 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT	REPORT MO AVG	REPORT DAILY MX	MGD	********	********	********	****		DAILY	CALCTD

NAME/TITLE PRINCIPAL EXECUTIVE OFFICER			TELEPHONE		DATE		
Richard T. Purcell Site Vice President	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.	Stephanie A. Howard Acting Environmental Supervisor SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	423	843-6700	03	11	13
TYPED OR PRINTED			AREA CODE	NUMBER	YEAR	MO	DAY

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

No phosphorous bearing cleaning solutions were used. Metal pond was released October 30-31, 2003.

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

Name TVA - SEQUOYAH NUCLEAR PLANT
Address P.O. BOX 2000
(INTEROFFICE SB-2A)
SODDY - DAISY TN 37384
Facility TVA - SEQUOYAH NUCLEAR PLANT
Location HAMILTON COUNTY

ATTN: Stephanie A. Howard

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

TN0026450	110 G
PERMIT NUMBER	DISCHARGE NUMBER

MONITORING PERIOD	YEAR	MO	DAY		YEAR	MO	DAY
From	03	10	01	To	03	10	31

MAJOR
(SUBR 01)
F - FINAL
RECYCLED COOLING WATER
EFFLUENT

*** NO DISCHARGE XX ***

Form Approved.
OMB No. 2040-0004

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	SAMPLE MEASUREMENT	********	********	**		********		12			
00400 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT	********	********	****	6.0 MINIMUM	********	9.0 MAXIMUM	SU		DAILY	GRAB
SOLIDS, TOTAL SUSPENDED	SAMPLE MEASUREMENT	********	********	**	********	********		19			
00530 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT	********	********	****	********	********	30 DAILY MX	MG/L		DAILY	COMPOS
OIL AND GREASE	SAMPLE MEASUREMENT	********	********	**	********	********		19			
00556 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT	********	********	****	********	********	15 DAILY MX	MG/L		DAILY	COMPOS
COPPER, TOTAL (AS CU)	SAMPLE MEASUREMENT	********	********	**	********	********		19			
01042 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT	********	********	****	********	********	1.0 DAILY MX	MG/L		DAILY	COMPOS
IRON, TOTAL (AS FE)	SAMPLE MEASUREMENT	********	********	**	********	********		19			
01045 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT	********	********	****	********	********	1.0 DAILY MX	MG/L		DAILY	COMPOS
PHOSPHORUS, TOTAL (AS P)	SAMPLE MEASUREMENT	********	********	**	********	********		19			
00665 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT	********	********	****	********	********	1.0 DAILY MX	MG/L		DAILY	COMPOS
FLOW, IN CONDUIT OR THRU TREATMENT PLANT	SAMPLE MEASUREMENT			03	********	********	********	**			
50050 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT	REPORT MO AVG	REPORT DAILY MX	MGD	********	********	********	****		DAILY	CALCTD

NAME/TITLE PRINCIPAL EXECUTIVE OFFICER			TELEPHONE		DATE		
Richard T. Purcell Site Vice President	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.	Stephanie A. Howard Acting Environmental Supervisor SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	423	843-6700	03	11	13
TYPED OR PRINTED			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 SB-2A)
SODDY - DAISY TN 37384
Facility TVA - SEQUOYAH NUCLEAR PLANT
Location HAMILTON COUNTY

ATTN: Stephanie A. Howard

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

TN0026450	116 G
PERMIT NUMBER	DISCHARGE NUMBER

MONITORING PERIOD	YEAR	MO	DAY		YEAR	MO	DAY
From	03	10	01	To	03	10	31

MAJOR
(SUBR 01)
F - FINAL
BACKWASH
EFFLUENT

*** NO DISCHARGE ☐ ***

Form Approved.
OMB No. 2040-0004

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			
DEBRIS, FLOATING (SEVERITY)	SAMPLE MEASUREMENT	********	********	**	********	********	0	9A	0	1 / 31	VISUAL
01345 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT	********	********	****	********	********	REPORT MO TOTAL	PASS=0 FAIL=1		SEE PERMIT	VISUAL
OIL AND GREASE VISUAL	SAMPLE MEASUREMENT	********	0	94	********	********	********	**	0	1 / 31	VISUAL
84066 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT	********	REPORT MO TOTAL	YES=1 NO=0	********	********	********	****		SEE PERMIT	VISUAL
	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			TELEPHONE		DATE		
Richard T. Purcell Site Vice President	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.	Stephanie A. Howard Acting Environmental Supervisor SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	423	843-6700	03	11	13
TYPED OR PRINTED			AREA CODE	NUMBER	YEAR	MO	DAY

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

Operations performs visual inspections for floating debris and oil and grease during all backwashes.

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

Name TVA - SEQUOYAH NUCLEAR PLANT
Address P.O. BOX 2000
(INTEROFFICE SB-2A)
SODDY - DAISY TN 37384
Facility TVA - SEQUOYAH NUCLEAR PLANT
Location HAMILTON COUNTY

ATTN: Stephanie A. Howard

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

TN0026450	117 G
PERMIT NUMBER	DISCHARGE NUMBER

MONITORING PERIOD	YEAR	MO	DAY		YEAR	MO	DAY
From	03	10	01	To	03	10	31

MAJOR
(SUBR 01)
F - FINAL
BACKWASH
EFFLUENT

*** NO DISCHARGE ☐ ***

Form Approved.
OMB No. 2040-0004

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			
DEBRIS, FLOATING (SEVERITY)	SAMPLE MEASUREMENT	********	********	**	********	********	0	9A	0	1 / 31	VISUAL
01345 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT	********	********	****	********	********	REPORT MO TOTAL	PASS=0 FAIL=1		SEE PERMIT	VISUAL
OIL AND GREASE VISUAL	SAMPLE MEASUREMENT	********	0	94	********	********	********	**	0	1 / 31	VISUAL
84066 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT	********	REPORT MO TOTAL	YES=1 NO=0	********	********	********	****		SEE PERMIT	VISUAL
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
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	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										

NAME/TITLE PRINCIPAL EXECUTIVE OFFICER			TELEPHONE		DATE		
Richard T. Purcell Site Vice President	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.	Stephanie A. Howard Acting Environmental Supervisor	423	843-6700	03	11	13
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)*

Operations performs visual inspections for floating debris and oil and grease during all backwashes.

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

Name TVA - SEQUOYAH NUCLEAR PLANT
Address P.O. BOX 2000
(INTEROFFICE SB-2A)
SODDY - DAISY TN 37384
Facility TVA - SEQUOYAH NUCLEAR PLANT
Location HAMILTON COUNTY

ATTN: Stephanie A. Howard

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

TN0026450	118 G
PERMIT NUMBER	DISCHARGE NUMBER

MONITORING PERIOD	YEAR	MO	DAY		YEAR	MO	DAY
From	03	10	01	To	03	10	31

MAJOR
(SUBR 01)
F - FINAL
WASTEWATER & STORM WATER
EFFLUENT

*** NO DISCHARGE [XX] ***

Form Approved.
OMB No. 2040-0004

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)	SAMPLE MEASUREMENT	********	********	**		********	********	19			
00300 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT	********	********	****	2.0 DAILY MN	********	********	MG/L		TWICE/ WEEK	GRAB
SOLIDS, TOTAL SUSPENDED	SAMPLE MEASUREMENT	********	********	**	********	********		19			
00530 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT	********	********	****	********	********	100 DAILY MX	MG/L		TWICE/ WEEK	GRAB
SOLIDS, SETTLEABLE	SAMPLE MEASUREMENT	********	********	**	********	********		25			
00545 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT	********	********	****	********	********	1.0 DAILY MX	ML/L		ONCE/ MONTH	GRAB
FLOW, IN CONDUIT OR THRU TREATMENT PLANT	SAMPLE MEASUREMENT			03	********	********	********	**			
50050 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT	REPORT MO AVG	REPORT DAILY MX	MGD	********	********	********	*		ONCE/ BATCH	ESTIMA
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										

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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.