Tennessee Valley Authority, Post Office Box 2000, Soddy-Daisy, Tennessee 37379-2000

February 5, 2007

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

Dear Mr. Chip Hannah,

SEQUOYAH NUCLEAR PLANT (SQN) - 2006 BIOCIDE/CORROSION TREATMENT PLAN ANNUAL REPORT – NPDES PERMIT NO. TN0026450

In accordance with Part IV.B. of NPDES Permit No. TN0026450, SQN developed a Biocide/Corrosion Treatment Plan (B/CTP) that was approved by the Division of Water Pollution Control on April 27, 2005 for the specific and limited application of oxidizing biocides, non-oxidizing biocides, dispersants, surfactants, corrosion inhibiting chemicals, and detoxification chemicals at SQN. The use of these chemicals is necessary to ensure the safe operation of the facility.

The B/CTP approval requires that "annually, a report shall be submitted to the Division presenting the biomonitoring data for tests conducted during treatments, a summary of all analytical results (daily maximum, daily average, number of samples), the approximate duration in hours of each chemical used, quantity in pounds of each chemical used, and any minor changes that have occurred to the plan. The report shall be submitted to the Enforcement and Compliance Section in Nashville and to the Chattanooga field office by February 15 of the year following the reporting year. Also, in order to compare reliability of the mass balance calculations with the methylene chloride extraction method, SQN shall compare both methods used for analyses of the effluent and report to the Division."

SQN compared the results of both methods (mass balance calculations and the methylene chloride extraction method) used for analyses of the effluent. However, SQN did not detoxify the effluent during any non-oxidizing biocide treatments in 2006. A total of 36 samples from the Diffuser effluent (Outfall 101) have been analyzed by each method, see summary on the following page.

IE25

H-150M	Analytical Results Mass Balance Calculations (mg/L)				Analytical Results Methylene Chloride Extraction (mg/L)			
Month	Maximum	Average	Limit	# of samples	Maximum	Average	Limit	# of samples
May	0.036	0.035	0.05	8	<0.02	<0.02	0.05	8
June	0.036	0.035	0.05	4	<0.02	<0.02	0.05	4
July	0.033	0.033	0.05	2	<0.02	<0.02	0.05	2
August	0.033	0.033	0.05	6	<0.02	<0.02	0.05	6
October	0.035	0.033	0.05	5	<0.02	<0.02	0.05	5
November	0.037	0.036	0.05	11	<0.02	<0.02	0.05	11
May-Nov.				36				36

From January 1, 2006 through December 31, 2006, SQN did not inject the following chemicals into any system (ERCW A, ERCW B, RCW): Nalco H-130M (non-oxidizing biocide), Betz Dearborn Spectrus CT1300 (non-oxidizing biocide), nor Nalco Coagulant Aid-35 (detoxification). MSW 101 was added to the RCW system in September 2006 (reference the March 27, 2006 and August 15, 2006 letters sent to Ms. Pamala Myers from Stephanie A. Howard).

Enclosed is the 2006 Biocide/Corrosion Treatment Plan Annual 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
Principal Environmental Engineer
Signatory Authority for
J. Randy Douet
Site Vice President
Sequoyah Nuclear Plant

Enclosure
cc (Enclosure):

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Chattanooga, Tennessee 37402-2013

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2006 Biocide/Corrosion Treatment Plan Annual Report

H 150M

Month	Quantity in Pounds (lbs/day) Maximum	Average	Limit	Duration in Hours (hrs/day) Maximum	Analytical Results mass balance calculations (mg/L) Maximum	Average	Limit	# of samples	Analytical Results methylene chloride extraction (mg/L) Maximum	Average	Limit	# of samples	Days in Service
January	0	0	855	0.00	0.000	0.000	0.05	0	0.00	0.00	0.05	0	0
February	0	0	855	0.00	0.000	0.000	0.05	0	0.00	0.00	0.05	0	0
March	0	0	855	0.00	0.000	0.000	0.05	0	0.00	0.00	0.05	0	0
April	0	0	855	0.00	0.000	0.000	0.05	0	0.00	0.00	0.05	0	0
May	452	303	855	24.00	0.036	0.035	0.05	8	<0.020	<0.020	0.05	8	8
June	461	288	855	24.00	0.036	0.035	0.05	4	<0.020	<0.020	0.05	4	4
July	248	237	855	13.75	0.033	0.033	0.05	2	<0.020	<0.020	0.05	2	2
August	299	240	855	16.58	0.033	0.033	0.05	6	<0.020	<0.020	0.05	6	6
September	0	0	855	0.00	0.000	0.000	0.05	0	0.00	0.00	0.05	0	0
October	290	250	855	15.92	0.035	0.033	0.05	5	<0.020	<0.020	0.05	5	5
November	481	379	855	24.00	0.037	0.036	0.05	11	<0.020	<0.020	0.05	11	11
December	0	0	855	0.00	0.000	0.000	0.05	0	0.00	0.00	0.05	0	0
Jan. - Dec.								36				36	36

Per the B/CTP approval: "Whole Effluent toxicity testing (biomonitoring) of Outfall 101 and Outall 110 shall be undertaken once per year when non-oxidizing biocides are being used."

Outfall 101: Toxicity was sampled November 12-17, 2006.
Test Results: *Pimephales promelas*: IC25 >100%
Ceriodaphnia dubia: IC25 > 100%

Outfall 110: There has been no discharge from Outfall 110 January - December 2006.

H-150M	system	injection start time	injection end time	duration in hours	total quantity	mass balance calc.	methylene chloride extraction	number/type of samples
					855 lbs/day	0.05 mg/L	0.05 mg/L	
05/17/2006	ERCW B	1030	2400	13.50	243.34	0.0345	<0.020	1 Comp. 05/17/06 @ 1039 - 05/18/06 @ 0939
05/18/2006	ERCW B	0000/1010	0826/2400	22.26	401.24	0.0344	<0.020	1 Comp. 05/18/06 @ 0955 - 05/19/06 @ 0855
05/19/2006	ERCW B	0000	1200	12.00	216.30	0.0340	<0.020	1 Comp. 05/19/06 @ 1042 - 05/20/06 @ 0942
05/22/2006	ERCW A	1315	2400	10.75	193.77	0.0340	<0.020	1 Comp. 05/22/06 @ 0830 - 05/23/06 @ 0730
05/23/2006	ERCW A	0000	2400	24.00	432.60	0.0340	<0.020	1 Comp. 05/23/06 @ 0757 - 05/24/06 @ 0657
05/24/2006	ERCW A	0000	1315	13.25	238.83	0.034	<0.020	1 Comp. 05/24/06 @ 0813 - 05/25/06 @ 0713
05/30/2006	RCW	1120	2400	12.67	243.60	0.0362	<0.020	1 Comp. 05/30/06 @ 0755 - 05/31/06 @ 0655
05/31/2006	RCW	0000/1500	1430/2400	23.50	451.83	0.036	<0.020	1 Comp. 05/31/06 @ 0725 - 06/01/06 @ 0625
H-150M	system	injection start time	injection end time	duration in hours	total quantity	mass balance calc.	methylene chloride extraction	number/type of samples
					855 lbs/day	0.05 mg/L	0.05 mg/L	
06/01/2006	RCW	0000	2400	24.00	461.45	0.036	<0.020	1 Comp. 06/01/06 @ 0824 - 06/02/06 @ 0724
06/02/2006	RCW	0000	1115	11.25	216.30	0.036	<0.020	1 Comp. 06/02/06 @ 0821 - 06/03/06 @ 0721
06/26/2006	ERCW B	1108	2400	12.87	231.98	0.033	<0.020	1 Comp. 06/26/06 @ 0737 - 06/27/06 @ 0637
06/27/2006	ERCW B	0000	1330	13.50	243.34	0.033	<0.020	1 Comp. 06/27/06 @ 0727 - 06/28/06 @ 0627
H-150M	system	injection start time	injection end time	duration in hours	total quantity	mass balance calc.	methylene chloride extraction	number/type of samples
					855 lbs/day	0.05 mg/L	0.05 mg/L	
07/05/2006	ERCW A	1015	2400	13.75	247.85	0.033	<0.020	1 Comp. 07/05/06 @ 0737 - 07/06/06 @ 0637
07/06/2006	ERCW A	0000	1235	12.58	226.75	0.033	<0.020	1 Comp. 07/06/06 @ 0741 - 07/07/06 @ 0641

H-150M	system	injection start time	injection end time	duration in hours	total quantity	mass balance calc.	methylene chloride extraction	number/type of samples
					855 lbs/day	0.05 mg/L	0.05 mg/L	
08/07/2006	ERCW B	1015	2400	13.75	247.85	0.033	<0.020	1 Comp. 08/07/06 @ 0715 - 08/08/06 @ 0615
08/08/2006	ERCW B	0000	1326	13.43	242.08	0.033	<0.020	1 Comp. 08/08/06 @ 0659 - 08/09/06 @ 0559
08/15/2006	ERCW A	1016	2400	13.73	247.49	0.033	<0.020	1 Comp. 08/15/06 @ 0738 - 08/16/06 @ 0638
08/16/2006	ERCW A	0000	1225	12.42	223.87	0.032	<0.020	1 Comp. 08/16/06 @ 0710 - 08/17/06 @ 0610
08/23/2006	RCW	1406	2400	9.90	178.45	0.033	<0.020	1 Comp. 08/23/06 @ 0910 - 08/24/06 @ 0635
08/24/2006	RCW	0000	1635	16.58	298.86	0.032	<0.020	1 Comp. 08/24/06 @ 0636 - 08/25/06 @ 0536
H-150M	system	injection start time	injection end time	duration in hours	total quantity	mass balance calc.	methylene chloride extraction	number/type of samples
					855 lbs/day	0.05 mg/L	0.05 mg/L	
10/02/2006	ERCW B	1015	2400	13.75	247.85	0.032	<0.020	1 Comp. 10/02/06 @ 0837 - 10/03/06 @ 0737
10/03/2006	ERCW B	0000	1330	13.50	243.35	0.032	<0.020	1 Comp. 10/03/06 @ 0744 - 10/04/06 @ 0844
10/24/2006	ERCW A	0810	2400	15.83	285.34	0.033	<0.020	1 Comp. 10/24/06 @ 0815 - 10/25/06 @ 0715
10/25/2006	ERCW A	0000	1015	10.25	184.76	0.033	<0.020	1 Comp. 10/25/06 @ 0737 - 10/26/06 @ 0637
10/31/2006	RCW	0805/1308	1308/2400	15.92	290.46	0.035	<0.020	1 Comp. 10/31/06 @ 0820 - 11/01/06 @ 0720
H-150M	system	injection start time	injection end time	duration in hours	total quantity	mass balance calc.	methylene chloride extraction	number/type of samples
					855 lbs/day	0.05 mg/L	0.05 mg/L	
11/01/2006	RCW	0000/1320	1245/2400	23.42	420.57	0.033	<0.020	1 Comp. 11/01/06 @ 0730 - 11/02/06 @ 0630
11/02/2006	RCW	0000	2400	24.00	432.60	0.033	<0.020	1 Comp. 11/02/06 @ 0647 - 11/03/06 @ 0547
11/03/2006	RCW	0000	2400	24.00	432.60	0.033	<0.020	1 Comp. 11/03/06 @ 0700 - 11/04/06 @ 0600
11/06/2006	ERCW A	1445	2400	9.25	185.26	0.037	<0.020	1 Comp. 11/06/06 @ 0808 - 11/07/06 @ 0708
11/07/2006	ERCW A	0000	2400	24.00	480.67	0.036	<0.020	1 Comp. 11/07/06 @ 0746 - 11/08/06 @ 0646
11/08/2006	ERCW A	0000/1145/1355	00/1335/2400	20.91	418.78	0.036	<0.020	1 Comp. 11/08/06 @ 0908 - 11/09/06 @ 0808
11/09/2006	ERCW A	0000	1750	17.83	357.10	0.036	<0.020	1 Comp. 11/09/06 @ 0838 - 11/10/06 @ 0738
11/13/2006	ERCW B	1155	2400	12.08	241.94	0.037	<0.020	1 Comp. 11/13/06 @ 0905 - 11/14/06 @ 0805
11/14/2006	ERCW B	0000/0914	0812/2400	22.97	460.04	0.037	<0.020	1 Comp. 11/14/06 @ 0816 - 11/15/06 @ 0716
11/15/2006	ERCW B	0000	2400	24.00	480.67	0.037	<0.020	1 Comp. 11/15/06 @ 0730 - 11/16/06 @ 0630
11/16/2006	ERCW B	0000	1300	13.00	260.36	0.037	<0.020	1 Comp. 11/16/06 @ 0724 - 11/17/06 @ 0624

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2006 Biocide/Corrosion Treatment Plan Annual Report

Biodetergent 73551

	Quantity in Pounds (lbs/day)			Duration in Hours (hrs/day)*		Analytical Results mass balance calculations (mg/L)				
Month	Maximum	Average	Limit	Maximum	Limit	Maximum	Average	Limit	# of samples	Days in Service
January	7	5	50	0.5	0.5	0.012	0.011	2.0	11	11
February	5	5	50	0.5	0.5	0.012	0.011	2.0	3	3
March	0	0	50	0.0	0.5	0.000	0.000	2.0	0	0
April	5	5	50	0.5	0.5	0.019	0.017	2.0	8	8
May	0	0	50	0.0	0.5	0.000	0.000	2.0	0	0
June	8	7	50	0.5	0.5	0.012	0.011	2.0	10	10
July	8	5	50	0.5	0.5	0.011	0.010	2.0	13	13
August	9	5	50	0.5	0.5	0.015	0.012	2.0	12	12
September	13	7	50	0.5	0.5	0.015	0.014	2.0	12	12
October	12	6	50	0.5	0.5	0.016	0.015	2.0	11	11
November	9	9	50	0.5	0.5	0.015	0.015	2.0	1	1
December	8	6	50	0.5	0.5	0.026	0.025	2.0	9	9
Jan. - Dec.									90	90

*Treatment durations shall not exceed 30 minutes at 2-3 times per week into ERCW Train A, ERCW Train B, and RCW systems.

Per the B/CTP approval: "Frequency of use would be appoximately 208 days per year and duration of use would be about 0.5 hours per day with a maximum daily usage of 50 lbs/day for all three-injection points."

Biodetergent 73551	system	injection start time	injection end time	duration in hours	total quantity	mass balance calc.
					50 lbs/day	2.0 mg/L
01/01/2006	n/a					
01/02/2006	N/A					
01/03/2006	ERCW A	1015	1045	0.50		
	ERCW B	1045	1115	0.50		
	RCW	1210	1239	0.48	7.27	0.012
01/04/2006	ERCW A	845	915	0.50		
	ERCW B	915	945	0.50		
	RCW	1050	1119	0.48	7.27	0.012
01/05/2006	N/A					
01/06/2006	N/A					
01/07/2006	N/A					
01/08/2006	N/A					
01/09/2006	ERCW A	900	930	0.50		
	ERCW B	930	1000	0.50	4.36	0.008
01/10/2006	N/A					
01/11/2006	N/A					
01/12/2006	RCW	900	929	0.48	2.91	0.012
01/13/2006	ERCW A	925	955	0.50		
	ERCW B	855	925	0.50		
	RCW	1030	1059	0.48	7.27	0.012
01/14/2006	N/A					
01/15/2006	N/A					
01/16/2006	N/A					
01/17/2006	N/A					
01/18/2006	RCW	1020	1049	0.48	2.91	0.012
01/19/2006	RCW	1040	1109	0.48	2.91	0.012
01/20/2006	ERCW A	835	905	0.50		
	ERCW B	905	935	0.50	4.36	0.008
01/21/2006	N/A					
01/22/2006	N/A					
01/23/2006	ERCW A	1110	1140	0.50		
	ERCW B	1140	1210	0.50		
	RCW	1300	1329	0.48	7.27	0.012
01/24/2006	ERCW A	930	1000	0.50		
	ERCW B	1000	1030	0.50		
	RCW	1125	1154	0.48	7.27	0.012
01/25/2006	N/A					
01/26/2006	N/A					
01/27/2006	N/A					
01/28/2006	N/A					
01/29/2006	N/A					
01/30/2006	N/A					
01/30/2006	N/A					
01/31/2006	RCW	1030	1059	0.48	2.91	0.012

Biodetergent 73551	system	injection start time	injection end time	duration in hours	total quantity	mass balance calc.
					50 lbs/day	2.0 mg/L
02/01/2006	ERCW A	1230	1300	0.50		
	ERCW B	1300	1330	0.50	5.42	0.011
02/02/2006	RCW	1025	1055	0.50	3.03	0.012
02/03/2006	ERCW A	905	935	0.50		
	ERCW B	935	1005	0.50	5.42	0.01
02/04/2006	N/A					
02/05/2006	N/A					
02/06/2006	N/A					
02/07/2006	N/A					
02/08/2006	N/A					
02/09/2006	N/A					
02/10/2006	N/A					
02/11/2006	N/A					
02/12/2006	N/A					
02/13/2006	N/A					
02/14/2006	N/A					
02/15/2006	N/A					
02/16/2006	N/A					
02/17/2006	N/A					
02/18/2006	N/A					
02/19/2006	N/A					
02/20/2006	N/A					
02/21/2006	N/A					
02/22/2006	N/A					
02/23/2006	N/A					
02/24/2006	N/A					
02/25/2006	N/A					
02/26/2006	N/A					
02/27/2006	N/A					
02/28/2006	N/A					

Biodetergent 73551	system	injection start time	injection end time	duration in hours	total quantity	mass balance calc.
					50 lbs/day	2.0 mg/L
04/01/2006	n/a					
04/02/2006	n/a					
04/03/2006	n/a					
04/04/2006	ERCW A	830	900	0.50		
	ERCW B	900	930	0.50		
	RCW	1020	1050	0.50	5.41	0.012
04/05/2006	n/a					
04/06/2006	ERCW A	1115	1145	0.50		
	ERCW B	1145	1215	0.50		
	RCW	935	1005	0.50	5.41	0.012
04/07/2006	n/a					
04/08/2006	n/a					
04/09/2006	n/a					
04/10/2006	N/A					
04/11/2006	ERCW A	1250	1320	0.50		
	ERCW B	1320	1350	0.50		
	RCW	940	1010	0.50	5.31	0.017
04/12/2006	N/A					
04/13/2006	ERCW A	1015	1045	0.50		
	ERCW B	1045	1115	0.50		
	RCW	915	945	0.50	5.31	0.02
04/14/2006	N/A					
04/15/2006	N/A					
04/16/2006	N/A					
04/17/2006	ERCW A	900	930	0.50		
	ERCW B	930	1000	0.50		
	RCW	1050	1120	0.50	5.31	0.02
04/18/2006	n/a					
04/19/2006	ERCW A	915	945	0.50		
	ERCW B	945	1015	0.50		
	RCW	1125	1155	0.50	5.31	0.02
04/20/2006	n/a					
04/21/2006	n/a					
04/22/2006	n/a					
04/23/2006	n/a					
04/24/2006	RCW	1048	1118	0.50	3.03	0.019
04/25/2006	N/A					
04/26/2006	ERCW A	955	1025	0.50		
	ERCW B	1025	1055	0.50		
	RCW	1155	1225	0.50	5.31	0.019
04/27/2006	N/A					
04/28/2006	N/A					
04/29/2006	N/A					
04/30/2006	N/A					

Biodetergent 73551	system	injection start time	injection end time	duration in hours	total quantity	mass balance calc.
					50 lbs/day	2.0 mg/L
06/01/2006	ERCW A	950	1020	0.50		
	ERCW B	1020	1050	0.50	4.56	0.008
06/02/2006	ERCW A	1440	1510	0.50		
	ERCW B	1510	1540	0.50	4.56	0.008
06/03/2006	n/a					
06/04/2006	n/a					
06/05/2006	n/a					
06/06/2006	ERCW A	850	920	0.50		
	ERCW B	920	950	0.50		
	RCW	1055	1125	0.50	8.14	0.012
06/07/2006	n/a					
06/08/2006	n/a					
06/09/2006	ERCW A	1135	1205	0.50		
	ERCW B	1205	1235	0.50		
	RCW	1330	1400	0.50	8.14	0.012
06/10/2006	n/a					
06/11/2006	n/a					
06/12/2006	n/a					
06/13/2006	n/a					
06/14/2006	ERCW A	940	1010	0.50		
	ERCW B	1010	1040	0.50		
	RCW	1215	1245	0.50	7.77	0.011
06/15/2006	n/a					
06/16/2006	ERCW A	1100	1130	0.50		
	ERCW B	1130	1200	0.50		
	RCW	1300	1330	0.50	7.59	0.011
06/17/2006	n/a					
06/18/2006	n/a					
06/19/2006	n/a					
06/20/2006	n/a					
06/21/2006	ERCW A	900	930	0.50		
	ERCW B	930	1000	0.50		
	RCW	1015	1045	0.50	7.59	0.011
06/22/2006	n/a					
06/23/2006	ERCW A	900	930	0.50		
	ERCW B	930	1000	0.50		
	RCW	1020	1050	0.50	7.59	0.011
06/24/2006	n/a					
06/25/2006	n/a					
06/26/2006	n/a					
06/27/2006	n/a					
06/28/2006	RCW	1005	1035	0.50	3.03	0.011
06/29/2006	n/a					
06/30/2006	ERCW A	1110	1140	0.50		
	ERCW B	1140	1210	0.50		
	RCW	1250	1320	0.50	7.59	0.011

Biodetergent 73551	system	injection start time	injection end time	duration in hours	total quantity	mass balance calc.
					50 lbs/day	2.0 mg/L
07/01/2006	ERCW A	1125	1155	0.50		
	ERCW B	1155	1225	0.50	4.56	0.008
07/02/2006	n/a					
07/03/2006	ERCW A	1125	1155	0.50		
	ERCW B	1155	1225	0.50	4.56	0.008
07/04/2006	n/a					
07/05/2006	n/a					
07/06/2006	RCW	935	1005	0.50	3.03	0.011
07/07/2006	RCW	935	1005	0.50	3.03	0.011
07/08/2006	n/a					
07/09/2006	n/a					
07/10/2006	n/a					
07/11/2006	n/a					
07/12/2006	n/a					
07/13/2006	n/a					
07/14/2006	ERCW A	935	1005	0.50		
	ERCW B	1005	1035	0.50		
	RCW	1205	1235	0.50	7.59	0.011
07/15/2006	ERCW A	905	935	0.50		
	ERCW B	935	1005	0.50	4.56	0.008
07/16/2006	RCW	925	955	0.50	3.03	0.011
07/17/2006	n/a					
07/18/2006	ERCW A	920	950	0.50		
	ERCW B	950	1020	0.50		
	RCW	1625	1655	0.50	7.59	0.011
07/19/2006	n/a					
07/20/2006	n/a					
07/21/2006	ERCW A	915	945	0.50		
	ERCW B	945	1015	0.50		
	RCW	1115	1145	0.50	7.59	0.011
07/22/2006	n/a					
07/23/2006	n/a					
07/24/2006	n/a					
07/25/2006	RCW	920	950	0.50	3.03	0.011
07/26/2006	ERCW A	850	920	0.50		
	ERCW B	920	950	0.50	4.56	0.009
07/27/2006	RCW	1100	1130	0.50	3.03	0.011
07/28/2006	ERCW A	945	1015	0.50		
	ERCW B	1015	1045	0.50	4.56	0.009
07/29/2006	n/a					
07/30/2006	n/a					
07/31/2006	n/a					

Biodetergent 73551	system	injection start time	injection end time	duration in hours	total quantity	mass balance calc.
					50 lbs/day	2.0 mg/L
08/01/2006	n/a					
08/02/2006	n/a					
08/03/2006	ERCW A	1225	1255	0.50		
	ERCW B	1255	1325	0.50	4.56	0.009
08/04/2006	ERCW A	1005	1035	0.50		
	ERCW B	1035	1105	0.50		
	RCW	1140	1210	0.50	7.59	0.011
08/05/2006	n/a					
08/06/2006	n/a					
08/07/2006	n/a					
08/08/2006	n/a					
08/09/2006	n/a					
08/10/2006	RCW	933	1003	0.50	3.03	0.011
08/11/2006	n/a					
08/12/2006	RCW	910	940	0.50	3.98	0.014
08/13/2006	n/a					
08/14/2006	n/a					
08/15/2006	n/a					
08/16/2006	RCW	855	925	0.50	3.98	0.015
08/17/2006	n/a					
08/18/2006	ERCW A	930	1000	0.50		
	ERCW B	1000	1030	0.50		
	RCW	1104	1134	0.50	8.54	0.014
08/19/2006	ERCW A	820	850	0.50		
	ERCW B	850	920	0.50	4.56	0.008
08/20/2006	n/a					
08/21/2006	n/a					
08/22/2006	ERCW A	850	920	0.50		
	ERCW B	920	950	0.50	4.56	0.008
08/23/2006	n/a					
08/24/2006	n/a					
08/25/2006	ERCW A	950	1015	0.42		
	ERCW B	1015	1045	0.50	4.19	0.008
08/26/2006	RCW	900	930	0.50	3.98	0.014
08/27/2006	RCW	925	955	0.50	3.98	0.015
08/28/2006	n/a					
08/29/2006	ERCW A	948	1018	0.50		
	ERCW B	1018	1048	0.50		
	RCW	830	900	0.50	8.73	0.015
08/30/2006	n/a					
08/31/2006	n/a					

Biodetergent 73551	system	injection start time	injection end time	duration in hours	total quantity	mass balance calc.
					50 lbs/day	2.0 mg/L
09/01/2006	ERCW A	952	1022	0.50		
	ERCW B	1022	1052	0.50		
	RCW	1145	1215	0.50	8.73	0.015
09/02/2006	n/a					
09/03/2006	n/a					
09/04/2006	n/a					
09/05/2006	n/a					
09/06/2006	ERCW A	935	1005	0.50		
	ERCW B	1005	1035	0.50		
	RCW	1135	1205	0.50	8.73	0.015
09/07/2006	n/a					
09/08/2006	ERCW A	940	1010	0.50		
	ERCW B	1010	1040	0.50		
	RCW	1130	1200	0.50	8.73	0.015
09/09/2006	n/a					
09/10/2006	n/a					
09/11/2006	n/a					
09/12/2006	RCW	1012	1042	0.50	4.17	0.015
09/13/2006	n/a					
09/14/2006	RCW	905	935	0.50	4.17	0.015
09/15/2006	n/a					
09/16/2006	ERCW A	805	835	0.50		
	ERCW B	835	905	0.50	4.56	0.008
09/17/2006	ERCW A	900	930	0.50		
	ERCW B	930	1000	0.50	4.56	0.008
09/18/2006	n/a					
09/19/2006	n/a					
09/20/2006	n/a					
09/21/2006	ERCW A	910	940	0.50		
	ERCW B	940	1010	0.50		
	RCW	1103	1133	0.50	9.95	0.015
09/22/2006	ERCW A	840	910	0.50		
	ERCW B	910	940	0.50		
	RCW	1025	1055	0.50	11.19	0.015
09/23/2006	n/a					
09/24/2006	n/a					
09/25/2006	n/a					
09/26/2006	ERCW A	920	950	0.50		
	ERCW B	950	1020	0.50		
	RCW	1107	1137	0.50	12.51	0.015
09/27/2006	n/a					
09/28/2006	RCW	931	1001	0.50	4.17	0.015
09/29/2006	n/a					
09/30/2006	ERCW A	855	925	0.50		
	ERCW B	925	955	0.50	8.35	0.015

Biodetergent 73551	system	injection start time	injection end time	duration in hours	total quantity	mass balance calc.
					50 lbs/day	2.0 mg/L
10/01/2006	n/a					
10/02/2006	n/a					
10/03/2006	RCW	937	1007	0.50	4.17	0.015
10/04/2006	n/a					
10/05/2006	n/a					
10/06/2006	ERCW A	850	920	0.50		
	ERCW B	920	950	0.50		
	RCW	1045	1115	0.50	11.75	0.015
10/07/2006	n/a					
10/08/2006	ERCW A	850	920	0.50		
	ERCW B	920	950	0.50	7.58	0.014
10/09/2006	RCW	820	850	0.50	4.17	0.015
10/10/2006	n/a					
10/11/2006	ERCW A	1010	1040	0.50		
	ERCW B	1040	1110	0.50	6.26	0.011
10/12/2006	RCW	1030	1100	0.50	4.17	0.015
10/13/2006	n/a					
10/14/2006	n/a					
10/15/2006	n/a					
10/16/2006	RCW	1124	1154	0.50	4.17	0.015
10/17/2006	n/a					
10/18/2006	RCW	955	1025	0.50	4.17	0.015
10/19/2006	n/a					
10/20/2006	n/a					
10/21/2006	n/a					
10/22/2006	n/a					
10/23/2006	RCW	955	1025	0.50	4.17	0.015
10/24/2006	n/a					
10/25/2006	RCW	915	945	0.50	4.17	0.015
10/26/2006	n/a					
10/27/2006	n/a					
10/28/2006	n/a					
10/29/2006	n/a					
10/30/2006	ERCW A	850	920	0.50		
	ERCW B	920	950	0.50	8.54	0.016
10/31/2006	n/a					

Biodetergent 73551	system	injection start time	injection end time	duration in hours	total quantity	mass balance calc.
					50 lbs/day	2.0 mg/L
11/01/2006	n/a					
11/02/2006	ERCW A	835	905	0.50		
	ERCW B	905	935	0.50	8.54	0.015
11/03/2006	n/a					
11/04/2006	n/a					
11/05/2006	n/a					
11/06/2006	n/a					
11/07/2006	n/a					
11/08/2006	n/a					
11/09/2006	n/a					
11/10/2006	n/a					
11/11/2006	n/a					
11/12/2006	n/a					
11/13/2006	n/a					
11/14/2006	n/a					
11/15/2006	n/a					
11/16/2006	n/a					
11/17/2006	n/a					
11/18/2006	n/a					
11/19/2006	n/a					
11/20/2006	n/a					
11/21/2006	n/a					
11/22/2006	n/a					
11/23/2006	n/a					
11/24/2006	n/a					
11/25/2006	n/a					
11/26/2006	n/a					
11/27/2006	n/a					
11/28/2006	n/a					
11/29/2006	n/a					
11/30/2006	n/a					

Biodetergent 73551	system	injection start time	injection end time	duration in hours	total quantity	mass balance calc.
					50 lbs/day	2.0 mg/L
12/01/2006	n/a					
12/02/2006	n/a					
12/03/2006	n/a					
12/04/2006	n/a					
12/05/2006	n/a					
12/06/2006	n/a					
12/07/2006	RCW	940	1010	0.50	4.17	0.026
12/08/2006	n/a					
12/09/2006	n/a					
12/10/2006	n/a					
12/11/2006	RCW	845	915	0.50	4.17	0.025
12/12/2006	ERCW A	925	955	0.50		
	ERCW B	955	1025	0.50	8.34	0.026
12/13/2006	RCW	905	935	0.50	4.17	0.026
12/14/2006	ERCW A	840	910	0.50		
	ERCW B	910	940	0.50	8.34	0.026
12/15/2006	n/a					
12/16/2006	n/a					
12/17/2006	n/a					
12/18/2006	ERCW A	840	910	0.50		
	ERCW B	910	940	0.50	8.34	0.026
12/19/2006	RCW	850	920	0.50	4.17	0.026
12/20/2006	ERCW A	850	920	0.50		
	ERCW B	920	950	0.50	8.34	0.026
12/21/2006	n/a					
12/22/2006	n/a					
12/23/2006	n/a					
12/24/2006	n/a					
12/25/2006	n/a					
12/26/2006	n/a					
12/27/2006	ERCW A	1220	1250	0.50		
	ERCW B	1250	1320	0.50	8.34	0.016
12/28/2006	n/a					
12/29/2006	n/a					
12/30/2006	n/a					
12/31/2006	n/a					

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PCL 222 Copolymer

Month	Quantity in Pounds (lbs/day)			Duration in Hours (hrs/day)	Analytical Results mass balance calculations (mg/L)				Days in Service
	Maximum	Average	Limit	Maximum	Maximum	Average	Limit	# of samples	
January	259	133	760	24.00	0.021	0.011	0.2	31	31
February	28	26	760	24.00	0.005	0.002	0.2	7	7
March	56	40	760	24.00	0.005	0.005	0.2	2	2
April	56	49	760	24.00	0.008	0.007	0.2	26	26
May	0	0	760	0.00	0.000	0.000	0.2	0	0
June	171	112	760	24.00	0.014	0.010	0.2	24	24
July	169	153	760	24.00	0.014	0.013	0.2	31	31
August	169	111	760	24.00	0.013	0.010	0.2	30	30
September	113	108	760	24.00	0.009	0.008	0.2	26	26
October	113	75	760	24.00	0.008	0.008	0.2	2	2
November	0	0	760	0.00	0.000	0.000	0.2	0	0
December	0	0	760	0.00	0.000	0.000	0.2	0	0
Jan. - Dec.								179	179

Per the B/CTP approval: "PCL-222 is injected into the ERCW Train A & B system only during warm weather months." PCL-222 was injected in January due to the average ambient temperature being above 35 degrees Fahrenheit.

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PCL 222 Phosphate

Month	Quantity in Pounds (lbs/day)			Duration in Hours (hrs/day)	Analytical Results mass balance calcualtions (mg/L)				
	Maximum	Average	Limit	Maximum	Maximum	Average	Limit	# of samples	Days in Service
January	755	389	2280	24.00	0.061	0.033	0.2	31	31
February	82	77	2280	24.00	0.013	0.007	0.2	7	7
March	165	116	2280	24.00	0.013	0.013	0.2	2	2
April	165	143	2280	24.00	0.023	0.019	0.2	26	26
May	0	0	2280	0.00	0.000	0.000	0.2	0	0
June	500	326	2280	24.00	0.041	0.029	0.2	24	24
July	494	447	2280	24.00	0.041	0.038	0.2	31	31
August	494	324	2280	24.00	0.039	0.028	0.2	30	30
September	330	315	2280	24.00	0.025	0.025	0.2	26	26
October	330	219	2280	24.00	0.025	0.025	0.2	2	2
November	0	0	2280	0.00	0.000	0.000	0.2	0	0
December	0	0	2280	0.00	0.000	0.000	0.2	0	0
Jan. - Dec.								179	179

Per the B/CTP approval: "PCL-222 is injected into the ERCW Train A & B system only during warm weather months." PCL-222 was injected in January due to the average ambient temperature being above 35 degrees Fahrenheit.

PCL-222	system	injection start time	injection end time	injection start time	injection end time	duration in hours	COPOLYMER		PHOSPHATE	
							total quantity	mass balance calc.	total quantity	mass balance calc.
							760 lbs/day	0.2 mg/L	2,280 lbs/day	0.2 mg/L
01/01/2006	ERCW A & B & RCW	00 : 00	24 : 00			24.00	258.76	0.021	755.45	0.061
01/02/2006	ERCW A & B & RCW	00 : 00	24 : 00			24.00	258.76	0.021	755.45	0.061
01/03/2006	ERCW A & B	00 : 00	24 : 00			24.00				
	RCW	00 : 00	12 : 05	17 : 05	24 : 00	19.00	234.25	0.021	683.91	0.06
01/04/2006	ERCW A & B	00 : 00	24 : 00			24.00				
	RCW	00 : 00	10 : 25	15 : 35	24 : 00	18.83	233.47	0.021	681.62	0.061
01/05/2006	ERCW A & B & RCW	00 : 00	24 : 00			24.00	258.76	0.021	755.45	0.061
01/06/2006	ERCW A & B & RCW	00 : 00	24 : 00			24.00	258.76	0.021	755.45	0.061
01/07/2006	ERCW A & B & RCW	00 : 00	24 : 00			24.00	258.76	0.021	755.45	0.061
01/08/2006	ERCW A & B & RCW	00 : 00	24 : 00			24.00	258.76	0.021	755.45	0.061
01/09/2006	RCW	00 : 00	24 : 00			24.00	117.62	0.009	343.39	0.028
01/10/2006	RCW	00 : 00	24 : 00			24.00	117.62	0.009	343.39	0.028
01/11/2006	RCW	00 : 00	24 : 00			24.00	117.62	0.009	343.39	0.028
01/12/2006	RCW	00 : 00	08 : 30	13 : 28	24 : 00	19.03	93.26	0.009	272.28	0.028
01/13/2006	RCW	00 : 00	10 : 05	14 : 55	24 : 00	19.17	93.93	0.009	274.23	0.027
01/14/2006	RCW	00 : 00	24 : 00			24.00	117.62	0.009	343.39	0.027
01/15/2006	RCW	00 : 00	24 : 00			24.00	117.62	0.009	343.39	0.027
01/16/2006	RCW	00 : 00	24 : 00			24.00	117.62	0.009	343.39	0.027
01/17/2006	RCW	00 : 00	24 : 00			24.00	117.62	0.01	343.39	0.028
01/18/2006	RCW	00 : 00	09 : 50	15 : 10	24 : 00	18.67	98.76	0.01	288.34	0.03
01/19/2006	RCW	00 : 00	10 : 15	15 : 35	24 : 00	18.67	91.5	0.01	267.13	0.028
01/20/2006	RCW	00 : 00	24 : 00			24.00	122.32	0.01	357.12	0.029
01/21/2006	RCW	00 : 00	24 : 00			24.00	122.32	0.01	357.12	0.028
01/22/2006	RCW	00 : 00	24 : 00			24.00	122.32	0.01	357.12	0.028
01/23/2006	RCW	00 : 00	12 : 35	17 : 50	24 : 00	18.75	95.56	0.01	279	0.029
01/24/2006	RCW	00 : 00	11 : 00	16 : 10	24 : 00	18.83	92.28	0.01	269.42	0.028
01/25/2006	RCW	00 : 00	11 : 20	16 : 10	24 : 00	19.17	93.9	0.009	274.14	0.028
01/26/2006	RCW	00 : 00	24 : 00			24.00	117.62	0.009	343.39	0.028
01/27/2006	RCW	00 : 00	24 : 00			24.00	30.58	0.002	89.28	0.007
01/28/2006	RCW	00 : 00	24 : 00			24.00	30.58	0.002	89.28	0.007
01/29/2006	RCW	00 : 00	24 : 00			24.00	30.58	0.002	89.28	0.007
01/30/2016	RCW	00 : 00	24 : 00			24.00	30.58	0.002	89.28	0.007
01/31/2006	RCW	00 : 00	10 : 25	15 : 25	24 : 00	19.00	24.21	0.002	70.68	0.007

PCL-222	system	injection start time	injection end time	injection start time	injection end time	duration in hours	COPOLYMER		PHOSPHATE	
							total quantity	mass balance calc.	total quantity	mass balance calc.
							760 lbs/day	0.2 mg/L	2,280 lbs/day	0.2 mg/L
02/01/2006	RCW	00 : 00	24 : 00			24.00	28.23	0.002	82.41	0.007
02/02/2006	RCW	00 : 00	09 : 50	16 : 00	24 : 00	17.83	20.97	0.002	61.22	0.007
02/03/2006	RCW	00 : 00	24 : 00			24.00	28.23	0.002	82.41	0.006
02/04/2006	RCW	00 : 00	24 : 00			24.00	28.23	0.002	82.41	0.006
02/05/2006	RCW	00 : 00	24 : 00			24.00	28.23	0.002	82.41	0.006
02/06/2006	RCW	00 : 00	24 : 00			24.00	28.23	0.002	82.41	0.006
02/07/2006	RCW	00 : 00	09 : 30			9.50	23.28	0.005	67.96	0.013
02/08/2006	N/A									
02/09/2006	N/A									
02/10/2006	N/A									
02/11/2006	N/A									
02/12/2006	N/A									
02/13/2006	N/A									
02/14/2006	N/A									
02/15/2006	N/A									
02/16/2006	N/A									
02/17/2006	N/A									
02/18/2006	N/A									
02/19/2006	N/A									
02/20/2006	N/A									
02/21/2006	N/A									
02/22/2006	N/A									
02/23/2006	N/A									
02/24/2006	N/A									
02/25/2006	N/A									
02/26/2006	N/A									
02/27/2006	N/A									
02/28/2006	N/A									

PCL-222	system	injection start time	injection end time	injection start time	injection end time	duration in hours	COPOLYMER		PHOSPHATE	
							total quantity	mass balance calc.	total quantity	mass balance calc.
							760 lbs/day	0.2 mg/L	2,280 lbs/day	0.2 mg/L
03/01/2006	N/A									
03/02/2006	N/A									
03/03/2006	N/A									
03/04/2006	N/A									
03/05/2006	N/A									
03/06/2006	N/A									
03/07/2006	N/A									
03/08/2006	N/A									
03/09/2006	N/A									
03/10/2006	N/A									
03/11/2006	N/A									
03/12/2006	N/A									
03/13/2006	N/A									
03/14/2006	N/A									
03/15/2006	N/A									
03/16/2006	N/A									
03/17/2006	N/A									
03/18/2006	N/A									
03/19/2006	N/A									
03/20/2006	N/A									
03/21/2006	N/A									
03/22/2006	N/A									
03/23/2006	N/A									
03/24/2006	N/A									
03/25/2006	N/A									
03/26/2006	N/A									
03/27/2006	N/A									
03/28/2006	N/A									
03/29/2006	N/A									
03/30/2006	RCW	14:15	24:00			9.75	22.93	0.005	66.96	0.013
03/31/2006	RCW	00:00	24:00			24.00	56.46	0.005	164.83	0.013

PCL-222	system	injection start time	injection end time	injection start time	injection end time	duration in hours	COPOLYMER		PHOSPHATE	
							total quantity	mass balance calc.	total quantity	mass balance calc.
							760 lbs/day	0.2 mg/L	2,280 lbs/day	0.2 mg/L
04/01/2006	RCW	00 : 00	24 : 00			24.00	56.45	0.005	164.83	0.013
04/02/2006	RCW	00 : 00	24 : 00			24.00	56.45	0.005	164.83	0.013
04/03/2006	RCW	00 : 00	10 : 20	15 : 35	24 : 00	18.75	44.11	0.005	128.77	0.013
04/04/2006	RCW	00 : 00	09 : 55	15 : 05	24 : 00	18.83	44.32	0.005	129.39	0.013
04/05/2006	RCW	00 : 00	08 : 45	13 : 45	24 : 00	19.00	44.69	0.005	130.49	0.013
04/06/2006	RCW	00 : 00	09 : 00	14 : 30	24 : 00	18.50	43.52	0.005	127.05	0.013
04/07/2006	RCW	00 : 00	24 : 00			24.00	56.46	0.005	164.83	0.013
04/08/2006	RCW	00 : 00	24 : 00			24.00	56.46	0.005	164.83	0.013
04/09/2006	RCW	00 : 00	24 : 00			24.00	56.46	0.005	164.83	0.013
04/10/2006	RCW	00 : 00	24 : 00			24.00	56.46	0.004	164.83	0.013
04/11/2006	RCW	00 : 00	09 : 15	14 : 55	24 : 00	18.33	43.12	0.007	125.91	0.019
04/12/2006	RCW	00 : 00	08 : 40	13 : 25	24 : 00	19.25	45.28	0.008	132.2	0.023
04/13/2006	RCW	00 : 00	08 : 55	14 : 10	24 : 00	18.75	44.11	0.008	128.77	0.023
04/14/2006	RCW	00 : 00	24 : 00			24.00	56.46	0.008	164.83	0.023
04/15/2006	RCW	00 : 00	24 : 00			24.00	56.46	0.008	164.83	0.023
04/16/2006	RCW	00 : 00	24 : 00			24.00	56.46	0.008	164.83	0.023
04/17/2006	RCW	00 : 00	10 : 30	16 : 00	24 : 00	18.50	43.52	0.008	127.05	0.023
04/18/2006	RCW	00 : 00	10 : 35	15 : 00	24 : 00	19.58	46.06	0.008	134.49	0.022
04/19/2006	RCW	00 : 00	11 : 00	16 : 25	24 : 00	18.58	43.71	0.008	127.6	0.023
04/20/2006	RCW	00 : 00	10 : 40	15 : 15	24 : 00	19.42	45.68	0.008	133.37	0.023
04/21/2006	RCW	00 : 00	09 : 25	14 : 15	24 : 00	19.17	45.09	0.008	131.65	0.023
04/22/2006	RCW	00 : 00	24 : 00			24.00	56.46	0.008	164.83	0.022
04/23/2006	RCW	00 : 00	24 : 00			24.00	56.46	0.008	164.83	0.022
04/24/2006	RCW	00 : 00	10 : 25	15 : 55	24 : 00	18.50	43.52	0.008	127.05	0.022
04/25/2006	RCW	00 : 00	08 : 50	13 : 30	24 : 00	19.33	45.47	0.007	132.75	0.021
04/26/2006	RCW	00 : 00	11 : 35			11.58	27.24	0.007	79.53	0.021
04/27/2006	N/A									
04/28/2006	N/A									
04/29/2006	N/A									
04/30/2006	N/A									

PCL-222	system	injection start time	injection end time	injection start time	injection end time	duration in hours	COPOLYMER		PHOSPHATE	
							total quantity	mass balance calc.	total quantity	mass balance calc.
							760 lbs/day	0.2 mg/L	2,280 lbs/day	0.2 mg/L
06/01/2006	n/a									
06/02/2006	n/a									
06/03/2006	n/a									
06/04/2006	n/a									
06/05/2006	RCW	15:25	24:00			8.58	20.18	0.004	58.93	0.013
06/06/2006	RCW	00:00	10:30	16:10	24:00	18.33	43.12	0.004	125.88	0.013
06/07/2006	RCW	00:00	10:40	15:10	24:00	19.50	45.87	0.004	133.92	0.013
06/08/2006	RCW	00:00	10:10	15:00	24:00	19.17	45.09	0.004	131.66	0.013
06/09/2006	RCW	00:00	13:05	18:25	24:00	18.67	43.89	0.004	128.15	0.013
06/10/2006	n/a									
06/11/2006	n/a									
06/12/2006	RCW	00:00	10:30	15:10	24:00	19.33	45.47	0.004	132.75	0.013
06/13/2006	RCW	00:00	11:55	16:35	24:00	19.33	45.49	0.004	132.82	0.013
06/14/2006	ERCW A & B	00:00	24:00			24.00				
	RCW	00:00	11:50	17:05	24:00	18.75	171.13	0.014	499.63	0.041
06/15/2006	ERCW A & B	00:00	24:00			24.00				
	RCW	00:00	08:30	13:05	24:00	19.42	158.59	0.013	463.02	0.039
06/16/2006	ERCW A & B	00:00	24:00			24.00				
	RCW	00:00	12:35	17:50	24:00	18.75	157.02	0.013	458.42	0.038
06/17/2006	ERCW A & B & RCW	00:00	24:00			24.00	169.37	0.013	494.48	0.038
06/18/2006	ERCW A & B & RCW	00:00	24:00			24.00	169.37	0.013	494.48	0.038
06/19/2006	ERCW A & B	00:00	24:00			24.00				
	RCW	00:00	09:40	15:05	24:00	18.58	156.64	0.013	457.32	0.038
06/20/2006	ERCW A & B	00:00	24:00			24.00				
	RCW	00:00	09:35	14:05	24:00	19.50	158.78	0.013	463.57	0.038
06/21/2006	ERCW A & B	00:00	24:00			24.00				
	RCW	00:00	09:50	15:10	24:00	18.67	156.81	0.013	457.8	0.038
06/22/2006	ERCW A & B	00:00	24:00			24.00				
	RCW	00:00	08:30	13:15	24:00	19.25	158.19	0.013	461.86	0.038
06/23/2006	ERCW A & B	00:00	24:00			24.00				
	RCW	00:00	09:55	15:40	24:00	18.25	155.84	0.013	454.99	0.038
06/24/2006	ERCW A & B & RCW	00:00	24:00			24.00	169.37	0.013	494.48	0.038
06/25/2006	ERCW A & B & RCW	00:00	24:00			24.00	169.37	0.013	494.48	0.038
06/26/2006	ERCW A & B	00:00	07:00			7.00				
	RCW	00:00	11:45	16:25	24:00	19.33	78.4	0.013	228.9	0.037
06/27/2006	RCW	00:00	10:10	15:00	24:00	19.17	45.09	0.004	131.66	0.0125
06/28/2006	RCW	00:00	09:45	15:15	24:00	18.50	43.52	0.004	127.05	0.013
06/29/2006	ERCW A & B	09:30	24:00			14.50				
	RCW	00:00	08:30	13:05	24:00	19.42	113.9	0.013	332.54	0.038
06/30/2006	ERCW A & B	00:00	24:00			24.00				
	RCW	00:00	12:30	17:45	24:00	18.75	157.02	0.013	458.42	0.038

PCL-222	system	injection start time	injection end time	injection start time	injection end time	duration in hours	COPOLYMER		PHOSPHATE	
							total quantity	mass balance calc.	total quantity	mass balance calc.
							760 lbs/day	0.2 mg/L	2,280 lbs/day	0.2 mg/L
07/01/2006	ERCW A & B & RCW	00 : 00	24 : 00			24.00	169.37	0.013	494.48	0.0375
07/02/2006	ERCW A & B & RCW	00 : 00	24 : 00			24.00	169.37	0.013	494.48	0.0375
07/03/2006	ERCW A & B	00 : 00	24 : 00			24.00				
	RCW	00 : 00	10 : 35	15 : 15	24 : 00	19.33	158.38	0.013	462.41	0.038
07/04/2006	ERCW A & B	00 : 00	24 : 00			24.00				
	RCW	00 : 00	08 : 20	13 : 05	24 : 00	19.25	158.19	0.013	461.86	0.038
07/05/2006	ERCW A & B	00 : 00	07 : 00			7.00				
	RCW	00 : 00	08 : 30	13 : 00	24 : 00	19.50	78.8	0.013	230.07	0.038
07/06/2006	RCW	00 : 00	09 : 05	14 : 45	24 : 00	18.33	43.12	0.004	125.89	0.013
07/07/2006	ERCW A & B	16 : 35	24 : 00			7.42				
	RCW	00 : 00	09 : 10	14 : 25	24 : 00	18.75	79.01	0.013	230.69	0.038
07/08/2006	ERCW A & B & RCW	00 : 00	24 : 00			24.00	169.37	0.013	494.48	0.038
07/09/2006	ERCW A & B & RCW	00 : 00	24 : 00			24.00	169.37	0.013	494.48	0.038
07/10/2006	ERCW A & B	00 : 00	24 : 00			24.00				
	RCW	00 : 00	09 : 30	14 : 30	24 : 00	19.00	157.61	0.013	460.14	0.039
07/11/2006	ERCW A & B & RCW	00 : 00	24 : 00			24.00	169.37	0.013	494.48	0.038
07/12/2006	ERCW A & B & RCW	00 : 00	24 : 00			24.00	169.37	0.013	494.48	0.038
07/13/2006	ERCW A & B	00 : 00	24 : 00			24.00				
	RCW	00 : 00	14 : 30	19 : 00	24 : 00	19.50	158.78	0.013	463.57	0.038
07/14/2006	ERCW A & B	00 : 00	24 : 00			24.00				
	RCW	00 : 00	11 : 45	16 : 55	24 : 00	18.83	157.21	0.013	458.97	0.038
07/15/2006	ERCW A & B	00 : 00	24 : 00			24.00				
	RCW	00 : 00	10 : 35	15 : 05	24 : 00	19.50	158.78	0.013	463.57	0.038
07/16/2006	ERCW A & B	00 : 00	24 : 00			24.00				
	RCW	00 : 00	09 : 10	14 : 45	24 : 00	18.42	156.24	0.013	456.16	0.037
07/17/2006	ERCW A & B	00 : 00	24 : 00			24.00				
	RCW	00 : 00	11 : 05	16 : 00	24 : 00	19.08	157.8	0.014	460.71	0.041
07/18/2006	ERCW A & B	00 : 00	24 : 00			24.00				
	RCW	00 : 00	16 : 00	21 : 15	24 : 00	18.75	157.02	0.013	458.42	0.039
07/19/2006	ERCW A & B	00 : 00	24 : 00			24.00				
	RCW	00 : 00	10 : 05	14 : 55	24 : 00	19.17	157.98	0.013	461.24	0.039
07/20/2006	ERCW A & B	00 : 00	24 : 00			24.00				
	RCW	00 : 00	11 : 55	16 : 35	24 : 00	19.33	158.41	0.013	462.47	0.039
07/21/2006	ERCW A & B	00 : 00	24 : 00			24.00				
	RCW	00 : 00	10 : 50	16 : 05	24 : 00	18.75	157.02	0.013	458.42	0.039
07/22/2006	ERCW A & B & RCW	00 : 00	24 : 00			24.00	169.37	0.013	494.48	0.039
07/23/2006	ERCW A & B & RCW	00 : 00	24 : 00			24.00	169.37	0.013	494.48	0.039
07/24/2006	ERCW A & B	00 : 00	24 : 00			24.00				
	RCW	00 : 00	09 : 05	13 : 45	24 : 00	19.33	158.38	0.013	462.4	0.038
07/25/2006	ERCW A & B	00 : 00	24 : 00			24.00				
	RCW	00 : 00	09 : 20	14 : 20	24 : 00	19.00	157.58	0.013	460.14	0.038
07/26/2006	ERCW A & B	00 : 00	24 : 00			24.00				
	RCW	00 : 00	10 : 15	16 : 00	24 : 00	18.25	155.84	0.013	454.99	0.039
07/27/2006	ERCW A & B	00 : 00	24 : 00			24.00				
	RCW	00 : 00	10 : 40	15 : 50	24 : 00	18.83	157.23	0.013	459.04	0.039
07/28/2006	ERCW A & B	00 : 00	24 : 00			24.00				
	RCW	00 : 00	11 : 10	15 : 40	24 : 00	19.50	158.76	0.013	463.57	0.038
07/29/2006	ERCW A & B & RCW	00 : 00	24 : 00			24.00	169.37	0.013	494.48	0.038
07/30/2006	ERCW A & B & RCW	00 : 00	24 : 00			24.00	169.37	0.013	494.48	0.038
07/31/2006	ERCW A & B & RCW	00 : 00	24 : 00			24.00	169.37	0.013	494.48	0.038

PCL-222	system	injection start time	injection end time	injection start time	injection end time	duration in hours	COPOLYMER		PHOSPHATE	
							total quantity	mass balance calc.	total quantity	mass balance calc.
							760 lbs/day	0.2 mg/L	2,280 lbs/day	0.2 mg/L
08/01/2006	ERCW A & B	00 : 00	24 : 00			24.00				
	RCW	00 : 00	13 : 00	17 : 30	24 : 00	19.50	158.78	0.013	463.57	0.038
08/02/2006	ERCW A & B	00 : 00	24 : 00			24.00				
	RCW	00 : 00	11 : 00	16 : 20	24 : 00	18.67	156.81	0.013	457.8	0.038
08/03/2006	ERCW A & B	00 : 00	24 : 00			24.00				
	RCW	00 : 00	09 : 55	14 : 40	24 : 00	19.25	158.19	0.013	461.86	0.039
08/04/2006	n/a									
08/05/2006	ERCW A & B	00 : 00	24 : 00			24.00				
	RCW	00 : 00	08 : 35	13 : 30	24 : 00	19.08	157.79	0.013	460.69	0.038
08/06/2006	ERCW A & B & RCW	00 : 00	24 : 00			24.00	169.37	0.013	494.48	0.038
08/07/2006	ERCW A & B	00 : 00	07 : 20			7.33				
	RCW	00 : 00	10 : 45	16 : 05	24 : 00	18.67	78.4	0.013	228.9	0.038
08/08/2006	RCW	00 : 00	09 : 25	13 : 55	24 : 00	19.50	45.87	0.004	133.92	0.013
08/09/2006	RCW	00 : 00	24 : 00			24.00	56.46	0.004	164.83	0.013
08/10/2006	RCW	00 : 00	09 : 10	14 : 45	24 : 00	18.42	43.33	0.004	126.5	0.013
08/11/2006	RCW	00 : 00	24 : 00			24.00	56.46	0.004	164.83	0.013
08/12/2006	RCW	00 : 00	08 : 48	14 : 05	24 : 00	18.72	44.04	0.004	128.56	0.013
08/13/2006	RCW	00 : 00	09 : 00	13 : 35	24 : 00	19.42	45.68	0.004	133.37	0.013
08/14/2006	RCW	00 : 00	24 : 00			24.00	56.46	0.004	164.83	0.012
08/15/2006	RCW	00 : 00	10 : 50	15 : 30	24 : 00	19.33	45.47	0.004	132.76	0.012
08/16/2006	RCW	00 : 00	08 : 35	14 : 15	24 : 00	18.33	43.12	0.004	125.88	0.013
08/17/2006	RCW	00 : 00	09 : 05	14 : 30	24 : 00	18.58	43.71	0.004	127.6	0.012
08/18/2006	ERCW A & B	10 : 45	24 : 00			13.25				
	RCW	00 : 00	10 : 45	16 : 00	24 : 00	18.75	106.44	0.013	310.77	0.037
08/19/2006	ERCW A & B	00 : 00	24 : 00			24.00				
	RCW	00 : 00	09 : 40	14 : 20	24 : 00	19.33	158.41	0.013	462.47	0.037
08/20/2006	ERCW A & B & RCW	00 : 00	24 : 00			24.00	169.37	0.013	494.48	0.037
08/21/2006	ERCW A & B	00 : 00	24 : 00			24.00				
	RCW	00 : 00	07 : 30			7.50	130.55	0.013	381.16	0.037
08/22/2006	ERCW A & B	00 : 00	24 : 00			24.00	112.91	0.008	329.65	0.025
08/23/2006	ERCW A & B	00 : 00	24 : 00			24.00	112.91	0.008	329.65	0.025
08/24/2006	ERCW A & B	00 : 00	24 : 00			24.00	112.91	0.008	329.65	0.025
08/25/2006	ERCW A & B	00 : 00	24 : 00			24.00				
	RCW	17 : 20	24 : 00			6.67	128.6	0.013	375.46	0.037
08/26/2006	ERCW A & B	00 : 00	24 : 00			24.00				
	RCW	00 : 00	08 : 30	13 : 35	24 : 00	18.92	157.42	0.013	459.59	0.037
08/27/2006	ERCW A & B	00 : 00	24 : 00			24.00				
	RCW	00 : 00	09 : 05	16 : 05	24 : 00	17.00	152.9	0.013	446.4	0.039
08/28/2006	ERCW A & B	00 : 00	24 : 00			24.00				
	RCW	00 : 00	09 : 20	14 : 00	24 : 00	19.33	158.38	0.013	462.4	0.037
08/29/2006	ERCW A & B	00 : 00	24 : 00			24.00				
	RCW	00 : 00	08 : 00	13 : 40	24 : 00	18.33	156.03	0.013	455.54	0.038
08/30/2006	ERCW A & B	00 : 00	24 : 00			24.00				
	RCW	00 : 00	11 : 10	15 : 55	24 : 00	19.25	158.19	0.013	461.86	0.038
08/31/2006	ERCW A & B	00 : 00	24 : 00			24.00				
	RCW	00 : 00	11 : 25	16 : 00	24 : 00	19.42	158.59	0.013	463.02	0.038

PCL-222	system	injection start time	injection end time	injection start time	injection end time	duration in hours	COPOLYMER		PHOSPHATE	
							total quantity	mass balance calc.	total quantity	mass balance calc.
							760 lbs/day	0.2 mg/L	2,280 lbs/day	0.2 mg/L
09/01/2006	ERCW A & B	00 : 00	24 : 00			24.00	112.91	0.009	329.65	0.025
09/02/2006	ERCW A & B	00 : 00	24 : 00			24.00	112.91	0.009	329.65	0.025
09/03/2006	ERCW A & B	00 : 00	24 : 00			24.00	112.91	0.009	329.65	0.025
09/04/2006	ERCW A & B	00 : 00	24 : 00			24.00	112.91	0.009	329.65	0.025
09/05/2006	ERCW A & B	00 : 00	24 : 00			24.00	112.91	0.008	329.65	0.024
09/06/2006	ERCW A & B	00 : 00	24 : 00			24.00	112.91	0.008	329.65	0.024
09/07/2006	ERCW A & B	00 : 00	24 : 00			24.00	112.91	0.008	329.65	0.025
09/08/2006	ERCW A & B	00 : 00	24 : 00			24.00	112.91	0.008	329.65	0.024
09/09/2006	ERCW A & B	00 : 00	24 : 00			24.00	112.91	0.008	329.65	0.024
09/10/2006	ERCW A & B	00 : 00	24 : 00			24.00	112.91	0.008	329.65	0.024
09/11/2006	ERCW A & B	00 : 00	24 : 00			24.00	112.91	0.008	329.65	0.024
09/12/2006	ERCW A & B	00 : 00	24 : 00			24.00	112.91	0.008	329.65	0.024
09/13/2006	ERCW A & B	00 : 00	10 : 25			10.42	49.02	0.008	143.12	0.024
09/14/2006	n/a									
09/15/2006	n/a									
09/16/2006	n/a									
09/17/2006	n/a									
09/18/2006	ERCW A & B	14 : 20	24 : 00			9.67	45.49	0.008	132.82	0.025
09/19/2006	ERCW A & B	00 : 00	24 : 00			24.00	112.91	0.008	329.65	0.024
09/20/2006	ERCW A & B	00 : 00	24 : 00			24.00	112.91	0.008	329.65	0.025
09/21/2006	ERCW A & B	00 : 00	24 : 00			24.00	112.91	0.008	329.65	0.025
09/22/2006	ERCW A & B	00 : 00	24 : 00			24.00	112.91	0.008	329.65	0.025
09/23/2006	ERCW A & B	00 : 00	24 : 00			24.00	112.91	0.009	329.65	0.025
09/24/2006	ERCW A & B	00 : 00	24 : 00			24.00	112.91	0.009	329.65	0.025
09/25/2006	ERCW A & B	00 : 00	24 : 00			24.00	112.91	0.008	329.65	0.025
09/26/2006	ERCW A & B	00 : 00	24 : 00			24.00	112.91	0.008	329.65	0.025
09/27/2006	ERCW A & B	00 : 00	24 : 00			24.00	112.91	0.008	329.65	0.025
09/28/2006	ERCW A & B	00 : 00	24 : 00			24.00	112.91	0.008	329.65	0.025
09/29/2006	ERCW A & B	00 : 00	24 : 00			24.00	112.91	0.008	329.65	0.025
09/30/2006	ERCW A & B	00 : 00	24 : 00			24.00	112.91	0.008	329.65	0.025

PCL-222	system	injection start time	injection end time	injection start time	injection end time	duration in hours	COPOLYMER		PHOSPHATE	
							total quantity	mass balance calc.	total quantity	mass balance calc.
							760 lbs/day	0.2 mg/L	2,280 lbs/day	0.2 mg/L
10/01/2006	ERCW A & B	00 : 00	24 : 00			24.00	112.91	0.008	329.65	0.025
10/02/2006	ERCW A & B	00 : 00	07 : 52			7.87	37.03	0.008	108.1	0.025
10/03/2006	n/a									
10/04/2006	n/a									
10/05/2006	n/a									
10/06/2006	n/a									
10/07/2006	n/a									
10/08/2006	n/a									
10/09/2006	n/a									
10/10/2006	n/a									
10/11/2006	n/a									
10/12/2006	n/a									
10/13/2006	n/a									
10/14/2006	n/a									
10/15/2006	n/a									
10/16/2006	n/a									
10/17/2006	n/a									
10/18/2006	n/a									
10/19/2006	n/a									
10/20/2006	n/a									
10/21/2006	n/a									
10/22/2006	n/a									
10/23/2006	n/a									
10/24/2006	n/a									
10/25/2006	n/a									
10/26/2006	n/a									
10/27/2006	n/a									
10/28/2006	n/a									
10/29/2006	n/a									
10/30/2006	n/a									
10/31/2006	n/a									

TN0026450 SQN

2006 Biocide/Corrosion Treatment Plan Annual Report

Towerbrom 960

Month	Quantity in Pounds (lbs/day)			Duration in Hours (hrs/day)	Analytical Results mass balance calculation (mg/L)				
	Maximum	Average (based on days in service)	Limit	Maximum	Maximum	Average	Limit	# of samples	Days in Service
January	150	77	1425	5.25	0.024	0.007	0.10	25	13
February	510	335	1425	24.00	0.040	<0.019	0.10	34	22
March	620	529	1425	24.00	0.029	0.018	0.10	30	30
April	610	212	1425	24.00	0.049	0.026	0.10	20	20
May	580	308	1425	24.00	0.028	0.014	0.10	28	28
June	380	148	1425	16.75	0.030	0.020	0.10	26	26
July	520	199	1425	13.58	0.028	0.020	0.10	22	22
August	560	238	1425	21.75	0.034	0.018	0.10	28	26
September	280	184	1425	5.03	0.033	0.020	0.10	25	25
October	530	236	1425	24.00	0.022	0.012	0.10	28	26
November	610	371	1425	24.00	0.038	0.014	0.10	30	30
December	480	148	1425	24.00	0.032	0.017	0.10	18	18
Jan. - Dec.								314	286

Per the B/CTP approval: "Whole Effluent toxicity testing (biomonitoring) of Outfall 101 and Outall 110 shall be undertaken once per year when oxidizing biocides are being used."

Outfall 101: Toxicity was sampled November 26-December 1, 2006.
Test Results: *Pimephales promelas*: IC25 >100%
Ceriodaphnia dubia: IC25 > 100%

Outfall 110: There has been no discharge from Outfall 110 January - December 2006.

Towerbrom 960	system	injection	injection	duration in hours	total quantity	mass balance calc.	Additional Results
					1,425 lbs/day	0.10 mg/L	0.10 mg/L
January 2006							
01/01/2006	N/A					0.0000	
01/02/2006	N/A					0.0000	
01/03/2006	ERCW A & B	11 : 15	15 : 45	4.50			
	RCW	12 : 45	16 : 45	4.00	150	0.0243	
01/04/2006	ERCW A & B	09 : 45	13 : 50	4.08			
	RCW	11 : 25	15 : 30	4.08	140	0.0200	
01/05/2006	N/A					0.0001	
01/06/2006	N/A					0.0001	
01/07/2006	N/A					0.0001	
01/08/2006	N/A					0.0001	
01/09/2006	ERCW A & B	10 : 00	14 : 08	4.13	100	0.0151	
01/10/2006	N/A					0.0000	
01/11/2006	N/A					0.0000	
01/12/2006	RCW	09 : 30	13 : 22	3.87	30	0.0087	
01/13/2006	ERCW A & B	10 : 00	14 : 00	4.00			
	RCW	11 : 00	14 : 25	3.42	100	0.0181	
01/14/2006	N/A					0.0000	
01/15/2006	N/A					0.0000	
01/16/2006	N/A					0.0001	
01/17/2006	N/A					0.0001	
01/18/2006	RCW	10 : 55	15 : 05	4.17	20	0.0111	
01/19/2006	RCW	11 : 15	15 : 30	4.25	20	0.0056	
01/20/2006	ERCW A & B	08 : 35	13 : 50	5.25	80	0.0068	
01/21/2006	ERCW A & B	09 : 37	13 : 51	4.23	80	0.0124	
01/22/2006	N/A						
01/23/2006	ERCW A & B	12 : 10	16 : 15	4.08			
	RCW	13 : 35	17 : 45	4.17	100	0.0144	
01/24/2006	ERCW A & B	10 : 30	14 : 45	4.25			
	RCW	11 : 35	16 : 05	4.50	120	0.0123	
01/25/2006	RCW	11 : 55	15 : 55	4.00	30	0.0084	
01/26/2006	N/A						
01/27/2006	N/A						
01/28/2006	N/A						
01/29/2006	N/A						
01/30/2006	N/A						
01/31/2006	RCW	11 : 15	15 : 15	4.00	30	0.0096	

Towerbrom 960	system	injection	injection	duration in hours	total quantity	mass balance calc.	Additional Results			
					1,425 lbs/day	0.10 mg/L	0.10 mg/L			
02/01/2006	ERCW A & B	13:30	17:30	4.00	80	0.0061				
02/02/2006	RCW	11:00	15:50	4.83	30	0.0084				
02/03/2006	ERCW A & B	10:15	14:20	4.08	100	0.0103				
02/04/2006	N/A									
02/05/2006	N/A									
02/06/2006	N/A									
02/07/2006	ERCW A & B	08:40	24:00	15.33						
	RCW	10:45	24:00	13.25	510	0.0176				
02/08/2006	ERCW A & B & RCW	00:00	24:00	24.00	460	0.0111				
02/09/2006	ERCW A & B & RCW	00:00	24:00	24.00	410	0.0130				
02/10/2006	ERCW A & B & RCW	00:00	24:00	24.00	400	0.0152				
02/11/2006	ERCW A & B & RCW	00:00	24:00	24.00	380	0.0134				
02/12/2006	ERCW A & B & RCW	00:00	24:00	24.00	400	0.0181				
02/13/2006	ERCW A & B & RCW	00:00	24:00	24.00	400	0.0133				
02/14/2006	ERCW A & B & RCW	00:00	24:00	24.00	340	0.0183				
02/15/2006	ERCW A & B & RCW	00:00	24:00	24.00	380	0.0165				
02/16/2006	ERCW A & B & RCW	00:00	24:00	24.00	390	0.0206				
02/17/2006	ERCW A & B & RCW	00:00	24:00	24.00	380	0.0072				
02/18/2006	ERCW A & B & RCW	00:00	24:00	24.00	300	0.0128				
02/19/2006	ERCW A & B	00:00	11:30	11.50						
	RCW	00:00	13:50	13.83	70	<0.0057	0.02	0.03	0.03	0.03
02/20/2006	N/A						0.03	0.03	0.03	0.03
02/21/2006	N/A						0.03	0.03	0.03	0.04
02/22/2006	N/A									
02/23/2006	ERCW A & B	16:45	24:00	7.25						
	RCW	16:10	24:00	7.83	290	0.0130				
02/24/2006	ERCW A & B & RCW	00:00	24:00	24.00	410	0.0162				
02/25/2006	ERCW A & B & RCW	00:00	24:00	24.00	410	0.0087				
02/26/2006	ERCW A & B & RCW	00:00	24:00	24.00	340	0.0117				
02/27/2006	ERCW A & B & RCW	00:00	24:00	24.00	430	0.0146				
02/28/2006	ERCW A & B & RCW	00:00	24:00	24.00	450	0.0190				

Towerbrom 960	system	injection	injection	duration in hours	total quantity	mass balance calc.	Additional Results
					1,425 lbs/day	0.10 mg/L	0.10 mg/L
03/01/2006	ERCW A & B & RCW	00:00	24:00	24.00	460	0.0183	
03/02/2006	ERCW A & B & RCW	00:00	24:00	24.00	440	0.0195	
03/03/2006	ERCW A & B & RCW	00:00	24:00	24.00	440	0.0188	
03/04/2006	ERCW A & B & RCW	00:00	24:00	24.00	440	0.0196	
03/05/2006	ERCW A & B & RCW	00:00	24:00	24.00	440	0.0146	
03/06/2006	ERCW A & B & RCW	00:00	24:00	24.00	450	0.0136	
03/07/2006	ERCW A & B & RCW	00:00	24:00	24.00	450	0.0073	
03/08/2006	ERCW A & B & RCW	00:00	24:00	24.00	510	0.0086	
03/09/2006	ERCW A & B & RCW	00:00	24:00	24.00	520	0.0116	
03/10/2006	ERCW A & B & RCW	00:00	24:00	24.00	520	0.0129	
03/11/2006	ERCW A & B & RCW	00:00	24:00	24.00	520	0.0145	
03/12/2006	ERCW A & B & RCW	00:00	24:00	24.00	520	0.0139	
03/13/2006	ERCW A & B	00:00	18:58	18.97			
	RCW	00:00	24:00	24.00	520	0.0293	
03/14/2006	ERCW A & B	00:04	24:00	23.93			
	RCW	00:00	24:00	24.00	530	0.0095	
03/15/2006	ERCW A & B & RCW	00:00	24:00	24.00	620	0.0231	
03/16/2006	ERCW A & B & RCW	00:00	24:00	24.00	610	0.0285	
03/17/2006	ERCW A & B & RCW	00:00	24:00	24.00	600	0.0265	
03/18/2006	ERCW A & B & RCW	00:00	24:00	24.00	600	0.0152	
03/19/2006	ERCW A & B & RCW	00:00	24:00	24.00	610	0.0159	
03/20/2006	ERCW A & B & RCW	00:00	24:00	24.00	610	0.0252	
03/21/2006	ERCW A & B & RCW	00:00	24:00	24.00	610	0.0269	
03/22/2006	ERCW A & B & RCW	00:00	24:00	24.00	610	0.0279	
03/23/2006	ERCW A & B & RCW	00:00	24:00	24.00	590	0.0113	
03/24/2006	ERCW A & B & RCW	00:00	24:00	24.00	590	0.0186	
03/25/2006	ERCW A & B & RCW	00:00	24:00	24.00	590	0.0199	
03/26/2006	ERCW A & B & RCW	00:00	24:00	24.00	590	0.0159	
03/27/2006	ERCW A & B & RCW	00:00	24:00	24.00	590	0.0113	
03/28/2006	ERCW A & B & RCW	00:00	24:00	24.00	580	0.0135	
03/29/2006	ERCW A & B & RCW	00:00	24:00	24.00	600	0.0169	
03/30/2006	ERCW A & B	00:00	12:56	12.93			
	RCW	00:00	13:34	13.57	120	0.0160	
03/31/2006	n/a						

Towerbrom 960	system	injection	injection	duration in hours	total quantity	mass balance calc.	Additional Results
					1,425 lbs/day	0.10 mg/L	0.10 mg/L
04/01/2006	n/a						
04/02/2006	n/a						
04/03/2006	ERCW A & B	11 : 15	15 : 45	4.50			
	RCW	10 : 30	15 : 25	4.92	130	0.0167	
04/04/2006	ERCW A & B	09 : 30	13 : 30	4.00			
	RCW	10 : 50	15 : 00	4.17	140	0.0144	
04/05/2006	ERCW A & B	10 : 10	14 : 15	4.08			
	RCW	09 : 10	13 : 35	4.42	110	0.0173	
04/06/2006	ERCW A & B	12 : 15	16 : 15	4.00			
	RCW	10 : 35	14 : 20	3.75	160	0.0192	
04/07/2006	n/a						
04/08/2006	n/a						
04/09/2006	n/a						
04/10/2006	n/a						
04/11/2006	ERCW A & B	13 : 50	17 : 50	4.00			
	RCW	10 : 10	14 : 50	4.67	130	0.0287	
04/12/2006	RCW	09 : 00	13 : 20	4.33	30	0.0148	
04/13/2006	ERCW A & B	11 : 15	15 : 15	4.00			
	RCW	09 : 45	14 : 00	4.25	130	0.0385	
04/14/2006	ERCW A & B	08 : 50	12 : 50	4.00	120	0.0225	
04/15/2006	n/a						
04/16/2006	n/a						
04/17/2006	ERCW A & B	10 : 00	14 : 00	4.00			
	RCW	11 : 20	15 : 50	4.50	150	0.0309	
04/18/2006	ERCW A & B	12 : 05	16 : 05	4.00			
	RCW	10 : 50	14 : 50	4.00	150	0.0494	
04/19/2006	ERCW A & B	12 : 15	14 : 20	2.08			
	RCW	12 : 15	16 : 15	4.00	150	0.0399	
04/20/2006	ERCW A & B	10 : 10	14 : 12	4.03			
	RCW	11 : 00	15 : 00	4.00	150	0.0336	
04/21/2006	RCW	09 : 40	14 : 00	4.33	30	0.0135	
04/22/2006	n/a						
04/23/2006	n/a						
04/24/2006	ERCW A & B	14 : 00	18 : 00	4.00			
	RCW	11 : 30	15 : 40	4.17	150	0.0389	
04/25/2006	RCW	09 : 05	13 : 15	4.17	30	0.0123	
04/26/2006	ERCW A & B	09 : 55	15 : 05	5.17			
	RCW	12 : 45	16 : 50	4.08	150	0.0314	
04/27/2006	ERCW A & B	16 : 35	24 : 00	7.42			
	RCW	12 : 35	24 : 00	11.42	500	0.0264	
04/28/2006	ERCW A & B & RCW	00 : 00	24 : 00	24.00	610	0.0276	
04/29/2006	ERCW A & B & RCW	00 : 00	24 : 00	24.00	610	0.0261	
04/30/2006	ERCW A & B & RCW	00 : 00	24 : 00	24.00	610	0.0229	

Towerbrom 960	system	injection	injection	duration in hours	total quantity	mass balance calc.	Additional Results
					1,425 lbs/day	0.10 mg/L	0.10 mg/L
05/01/2006	ERCW A & B & RCW	00 : 00	24 : 00	24.00	580	0.0239	
05/02/2006	ERCW A & B	00 : 00	14 : 00	14.00			
	RCW	00 : 00	13 : 30	13.50	30	0.0154	
05/03/2006	n/a						
05/04/2006	ERCW A & B	13 : 15	24 : 00	10.75			
	RCW	15 : 00	24 : 00	9.00	520	0.0278	
05/05/2006	ERCW A & B & RCW	00 : 00	24 : 00	24.00	560	0.0225	
05/06/2006	ERCW A & B & RCW	00 : 00	24 : 00	24.00	560	0.0200	
05/07/2006	ERCW A & B & RCW	00 : 00	24 : 00	24.00	560	0.0220	
05/08/2006	ERCW A & B & RCW	00 : 00	24 : 00	24.00	460	0.0218	
05/09/2006	ERCW A & B & RCW	00 : 00	24 : 00	24.00	460	0.0214	
05/10/2006	ERCW A & B & RCW	00 : 00	24 : 00	24.00	560	0.0261	
05/11/2006	ERCW A & B & RCW	00 : 00	24 : 00	24.00	560	0.0162	
05/12/2006	ERCW A & B & RCW	00 : 00	24 : 00	24.00	560	0.0196	
05/13/2006	ERCW A & B	00 : 00	19 : 32	19.53			
	RCW	00 : 00	24 : 00	24.00	270	0.0135	
05/14/2006	RCW	00 : 00	24 : 00	24.00	110	0.0042	
05/15/2006	RCW	00 : 00	24 : 00	24.00	110	0.0048	
05/16/2006	RCW	00 : 00	24 : 00	24.00	110	0.0041	
05/17/2006	RCW	00 : 00	24 : 00	24.00	140	0.0041	
05/18/2006	RCW	00 : 00	24 : 00	24.00	120	0.0041	
05/19/2006	ERCW A & B	13 : 15	24 : 00	10.75			
	RCW	00 : 00	24 : 00	24.00	350	0.0149	
05/20/2006	ERCW A & B	00 : 00	13 : 30	13.50			
	RCW	00 : 00	24 : 00	24.00	320	0.0171	
05/21/2006	RCW	00 : 00	24 : 00	24.00	160	0.0115	
05/22/2006	RCW	00 : 00	24 : 00	24.00	160	0.0072	
05/23/2006	RCW	00 : 00	24 : 00	24.00	180	0.0093	
05/24/2006	ERCW A & B	14 : 30	24 : 00	9.50			
	RCW	00 : 00	24 : 00	24.00	420	0.0180	
05/25/2006	ERCW A & B	00 : 00	14 : 30	14.50			
	RCW	00 : 00	24 : 00	24.00	220	0.0129	
05/26/2006	RCW	00 : 00	24 : 00	24.00	160	0.0041	
05/27/2006	RCW	00 : 00	24 : 00	24.00	160	0.0052	
05/28/2006	RCW	00 : 00	16 : 40	16.67	90	0.0052	
05/29/2006	n/a						
05/30/2006	n/a						
05/31/2006	ERCW A & B	10 : 40	16 : 05	5.42	120	0.0125	

Towerbrom 960	system	injection	injection	duration in hours	total quantity	mass balance calc.	Additional Results
					1,425 lbs/day	0.10 mg/L	0.10 mg/L
06/01/2006	ERCW A & B	10 : 50	14 : 50	4.00	120	0.0129	
06/02/2006	ERCW A & B	15 : 40	20 : 30	4.83			
	RCW	12 : 55	24 : 00	11.08	220	0.0197	
06/03/2006	ERCW A & B	09 : 50	14 : 20	4.50			
	RCW	00 : 00	14 : 35	14.58	180	0.0181	
06/04/2006	ERCW A & B	09 : 20	14 : 01	4.68	120	0.0122	
06/05/2006	ERCW A & B	09 : 45	13 : 45	4.00			
	RCW	10 : 35	15 : 15	4.67	170	0.0238	
06/06/2006	ERCW A & B	09 : 50	13 : 55	4.08			
	RCW	11 : 25	16 : 00	4.58	180	0.0255	
06/07/2006	ERCW A & B	09 : 40	13 : 45	4.08			
	RCW	11 : 00	15 : 00	4.00	170	0.0259	
06/08/2006	ERCW A & B	09 : 10	14 : 20	5.17			
	RCW	10 : 35	14 : 50	4.25	170	0.0276	
06/09/2006	ERCW A & B	11 : 35	16 : 45	5.17			
	RCW	14 : 00	18 : 15	4.25	150	0.0254	
06/10/2006	n/a						
06/11/2006	n/a						
06/12/2006	ERCW A & B	09 : 20	13 : 25	4.08			
	RCW	10 : 55	15 : 00	4.08	150	0.0239	
06/13/2006	ERCW A & B	10 : 55	15 : 05	4.17			
	RCW	12 : 20	16 : 25	4.08	150	0.0235	
06/14/2006	ERCW A & B	10 : 40	14 : 55	4.25			
	RCW	12 : 55	16 : 55	4.00	150	0.0204	
06/15/2006	RCW	08 : 50	12 : 55	4.08	40	0.0112	
06/16/2006	ERCW A & B	12 : 00	16 : 10	4.17			
	RCW	13 : 40	17 : 40	4.00	150	0.0238	
06/17/2006	ERCW A & B	08 : 55	12 : 55	4.00	110	0.0105	
06/18/2006	n/a						
06/19/2006	ERCW A & B	09 : 15	14 : 00	4.75			
	RCW	10 : 10	14 : 55	4.75	150	0.0284	
06/20/2006	ERCW A & B	09 : 05	14 : 20	5.25			
	RCW	09 : 55	13 : 55	4.00	150	0.0270	
06/21/2006	ERCW A & B	10 : 00	14 : 00	4.00			
	RCW	10 : 55	15 : 00	4.08	150	0.0244	
06/22/2006	RCW	08 : 55	13 : 05	4.17	40	0.0166	
06/23/2006	ERCW A & B	10 : 00	14 : 20	4.33			
	RCW	09 : 00	15 : 30	6.50	150	0.0300	
06/24/2006	ERCW A & B	09 : 00	12 : 42	3.7	110	0.0174	
06/25/2006	n/a						
06/26/2006	RCW	12 : 09	16 : 15	4.10	40	0.0178	
06/27/2006	ERCW A & B	16 : 40	24 : 00	7.33			
	RCW	09 : 20	14 : 50	5.50	380	0.0175	
06/28/2006	ERCW A & B	00 : 00	16 : 45	16.75			
	RCW	10 : 45	15 : 05	4.33	240	0.0202	
06/29/2006	RCW	08 : 50	12 : 55	4.08	50	0.0077	
06/30/2006	ERCW A & B	11 : 10	16 : 15	5.08			
	RCW	13 : 30	17 : 35	4.08	170	0.0184	

Towerbrom 960	system	injection	injection	duration in hours	total quantity	mass balance calc.	Additional Results
					1,425 lbs/day	0.10 mg/L	0.10 mg/L
07/01/2006	ERCW A & B	10 : 55	14 : 55	4.00	140	0.0085	
07/02/2006	n/a						
07/03/2006	ERCW A & B	12 : 25	16 : 25	4.00			
	RCW	11 : 10	15 : 10	4.00	190	0.0165	
07/04/2006	RCW	08 : 55	12 : 55	4.00	50	0.0055	
07/05/2006	RCW	08 : 50	12 : 50	4.00	60	0.0111	
07/06/2006	ERCW A & B	13 : 30	24 : 00	10.50			
	RCW	10 : 15	14 : 35	4.33	520	0.0260	
07/07/2006	ERCW A & B	00 : 00	13 : 35	13.58			
	RCW	10 : 15	14 : 15	4.00	120	0.0283	
07/08/2006	n/a						
07/09/2006	n/a						
07/10/2006	ERCW A & B	08 : 55	13 : 05	4.17			
	RCW	09 : 55	14 : 05	4.17	200	0.0174	
07/11/2006	n/a						
07/12/2006	n/a						
07/13/2006	ERCW A & B	15 : 05	19 : 05	4.00			
	RCW	15 : 55	18 : 55	3.00	180	0.0194	
07/14/2006	ERCW A & B	10 : 35	16 : 00	5.42			
	RCW	12 : 45	16 : 45	4.00	180	0.0224	
07/15/2006	ERCW A & B	10 : 05	14 : 45	4.67			
	RCW	10 : 50	14 : 55	4.08	190	0.0223	
07/16/2006	ERCW A & B	11 : 10	15 : 15	4.08			
	RCW	09 : 55	14 : 35	4.67	200	0.0214	
07/17/2006	ERCW A & B	09 : 25	13 : 35	4.17			
	RCW	11 : 30	15 : 50	4.33	180	0.0188	
07/18/2006	ERCW A & B	14 : 55	20 : 15	5.33			
	RCW	16 : 55	21 : 05	4.17	200	0.0203	
07/19/2006	ERCW A & B	09 : 30	14 : 30	5.00			
	RCW	10 : 35	14 : 40	4.08	200	0.0241	
07/20/2006	ERCW A & B	10 : 35	14 : 35	4.00			
	RCW	12 : 20	16 : 25	4.08	230	0.0247	
07/21/2006	ERCW A & B	10 : 15	14 : 35	4.33			
	RCW	11 : 55	15 : 55	4.00	260	0.0260	
07/22/2006	n/a						
07/23/2006	n/a						
07/24/2006	ERCW A & B	11 : 00	15 : 00	4.00			
	RCW	09 : 25	13 : 35	4.17	230	0.0207	
07/25/2006	ERCW A & B	10 : 50	14 : 55	4.08			
	RCW	10 : 00	14 : 08	4.13	220	0.0273	
07/26/2006	ERCW A & B	10 : 00	14 : 05	4.08			
	RCW	10 : 40	14 : 50	4.17	220	0.0248	
07/27/2006	ERCW A & B	10 : 05	14 : 08	4.05			
	RCW	11 : 40	15 : 40	4.00	220	0.0171	
07/28/2006	ERCW A & B	10 : 55	14 : 55	4.00			
	RCW	11 : 25	15 : 30	4.08	210	0.0167	
07/29/2006	n/a						
07/30/2006	n/a						
07/31/2006	ERCW A & B	11 : 45	15 : 45	4.00	170	0.0101	

Towerbrom 960	system	injection	injection	duration in hours	total quantity	mass balance calc.	Additional Results
					1,425 lbs/day	0.10 mg/L	0.10 mg/L
08/01/2006	ERCW A & B	09 : 50	14 : 30	4.67			
	RCW	13 : 20	17 : 20	4.00	240	0.0227	
08/02/2006	RCW	12 : 05	16 : 10	4.08	70	0.0094	
08/03/2006	ERCW A & B	13 : 35	17 : 35	4.00			
	RCW	10 : 10	14 : 30	4.33	260	0.0241	
08/04/2006	ERCW A & B	11 : 05	15 : 15	4.17			
	RCW	12 : 20	16 : 55	4.58	270	0.0241	
08/05/2006	RCW	09 : 00	13 : 25	4.42	90	0.0104	
08/06/2006	n/a						
08/07/2006	RCW	11 : 10	15 : 55	4.75	100	0.0103	
08/08/2006	ERCW A & B	21 : 30	24 : 00	2.50		0.0091	
	RCW	09 : 45	13 : 45	4.00	420	0.0087	
08/09/2006	ERCW A & B	00 : 00	21 : 45	21.75	300	0.0072	
08/10/2006	RCW	10 : 20	14 : 35	4.25	120	0.0171	
08/11/2006	n/a						
08/12/2006	RCW	09 : 45	13 : 58	4.22	120	0.0084	
08/13/2006	ERCW A & B	13 : 50	17 : 50	4.00			
	RCW	09 : 15	13 : 35	4.33	300	0.0221	
08/14/2006	n/a						
08/15/2006	RCW	11 : 15	15 : 20	4.08	120	0.0162	
08/16/2006	ERCW A & B	13 : 31	24 : 00	10.48			
	RCW	09 : 35	14 : 05	4.50	560	0.0255	
08/17/2006	ERCW A & B	00 : 00	13 : 40	13.67			
	RCW	09 : 25	14 : 17	4.87	300	0.0337	
08/18/2006	ERCW A & B	10 : 30	14 : 40	4.17			
	RCW	11 : 45	15 : 50	4.08	250	0.0329	
08/19/2006	ERCW A & B	09 : 20	13 : 20	4.00			
	RCW	10 : 15	14 : 15	4.00	280	0.0323	
08/20/2006	n/a						
08/21/2006	RCW	10 : 10	14 : 10	4.00	120	0.0159	
08/22/2006	ERCW A & B	09 : 50	13 : 50	4.00	180	0.0106	
08/23/2006	n/a						
08/24/2006	ERCW A & B	10 : 25	15 : 24	4.98		0.0098	
	RCW	17 : 06	24 : 00	6.90	300	0.0071	
08/25/2006	ERCW A & B	10 : 45	12 : 45	2.00			
	RCW	00 : 00	17 : 10	17.17	290	0.0167	
08/26/2006	ERCW A & B	07 : 50	11 : 50	4.00			
	RCW	09 : 30	13 : 30	4.00	240	0.0144	
08/27/2006	ERCW A & B	08 : 50	12 : 00	3.17			
	RCW	09 : 55	13 : 50	3.92	270	0.0262	
08/28/2006	ERCW A & B	09 : 00	13 : 20	4.33			
	RCW	09 : 40	13 : 50	4.17	210	0.0219	
08/29/2006	ERCW A & B	11 : 00	15 : 00	4.00			
	RCW	09 : 15	13 : 27	4.20	260	0.0207	
08/30/2006	ERCW A & B	10 : 50	14 : 50	4.00			
	RCW	11 : 40	15 : 45	4.08	270	0.0140	
08/31/2006	ERCW A & B	08 : 10	12 : 35	4.42			
	RCW	11 : 50	15 : 50	4.00	260	0.0235	

Towerbrom 960	system	injection	injection	duration in hours	total quantity	mass balance calc.	Additional Results
					1,425 lbs/day	0.10 mg/L	0.10 mg/L
09/01/2006	ERCW A & B	11 : 05	15 : 05	4.00			
	RCW	12 : 15	16 : 15	4.00	240	0.0210	
09/02/2006	n/a						
09/03/2006	n/a						
09/04/2006	n/a						
09/05/2006	ERCW A & B	11 : 10	15 : 11	4.02			
	RCW	12 : 15	16 : 16	4.02	280	0.0241	
09/06/2006	ERCW A & B	10 : 35	14 : 36	4.02			
	RCW	12 : 10	16 : 11	4.02	280	0.0276	
09/07/2006	ERCW A & B	10 : 40	14 : 41	4.02			
	RCW	11 : 50	15 : 51	4.02	200	0.0215	
09/08/2006	ERCW A & B	10 : 40	14 : 41	4.02			
	RCW	12 : 15	16 : 25	4.17	190	0.0218	
09/09/2006	ERCW A & B	08 : 55	13 : 00	4.08			
	RCW	09 : 20	13 : 25	4.08	190	0.0178	
09/10/2006	n/a						
09/11/2006	ERCW A & B	09 : 45	13 : 46	4.02			
	RCW	10 : 35	14 : 45	4.17	220	0.0165	
09/12/2006	RCW	11 : 00	15 : 01	4.02	100	0.0188	
09/13/2006	RCW	09 : 35	13 : 36	4.02	100	0.0146	
09/14/2006	RCW	09 : 50	13 : 51	4.02	100	0.0136	
09/15/2006	RCW	09 : 10	13 : 23	4.22	100	0.0188	
09/16/2006	ERCW A & B	09 : 05	13 : 05	4.00	150	0.0072	
09/17/2006	ERCW A & B	10 : 00	14 : 00	4.00	200	0.0182	
09/18/2006	ERCW A & B	10 : 00	14 : 10	4.17	200	0.0109	
09/19/2006	ERCW A & B	10 : 25	14 : 26	4.02			
	RCW	08 : 55	12 : 56	4.02	270	0.0249	
09/20/2006	ERCW A & B	09 : 40	13 : 41	4.02			
	RCW	10 : 25	14 : 32	4.12	250	0.0327	
09/21/2006	ERCW A & B	10 : 10	14 : 17	4.12			
	RCW	11 : 50	15 : 53	4.05	240	0.0241	
09/22/2006	ERCW A & B	09 : 40	13 : 58	4.30			
	RCW	11 : 10	15 : 20	4.17	250	0.0312	
09/23/2006	RCW	08 : 30	12 : 30	4.00	70	0.0309	
09/24/2006	n/a						
09/25/2006	ERCW A & B	09 : 05	13 : 20	4.25			
	RCW	10 : 10	14 : 30	4.33	190	0.0201	
09/26/2006	ERCW A & B	10 : 20	14 : 21	4.02			
	RCW	11 : 55	15 : 56	4.02	210	0.0246	
09/27/2006	ERCW A & B	07 : 35	12 : 37	5.03			
	RCW	08 : 49	13 : 51	5.03	160	0.0203	
09/28/2006	RCW	10 : 15	14 : 20	4.08	50	0.0109	
09/29/2006	ERCW A & B	11 : 05	15 : 06	4.02			
	RCW	11 : 50	16 : 21	4.52	190	0.0206	
09/30/2006	ERCW A & B	09 : 55	13 : 55	4.00	180	0.0114	

Towerbrom 960	system	injection	injection	duration in hours	total quantity	mass balance calc.	Additional Results
					1,425 lbs/day	0.10 mg/L	0.10 mg/L
10/01/2006	n/a						
10/02/2006	RCW	11 : 35	15 : 45	4.17	40	0.0062	
10/03/2006	ERCW A & B	14 : 30	24 : 00	9.50		0.0111	
	RCW	10 : 20	15 : 11	4.85	480	0.0050	
10/04/2006	ERCW A & B	00 : 00	15 : 02	15.03			
	RCW	10 : 30	14 : 35	4.08	270	0.0158	
10/05/2006	RCW	11 : 30	16 : 26	4.93	50	0.0093	
10/06/2006	ERCW A & B	09 : 50	13 : 55	4.08			
	RCW	11 : 35	15 : 45	4.17	230	0.0179	
10/07/2006	n/a						
10/08/2006	ERCW A & B	09 : 50	13 : 50	4.00	180	0.0108	
10/09/2006	RCW	08 : 50	12 : 50	4.00	50	0.0094	
10/10/2006	n/a						
10/11/2006	ERCW A & B	11 : 10	15 : 11	4.02			
	RCW	11 : 52	15 : 53	4.02	210	0.0199	
10/12/2006	ERCW A & B	14 : 00	24 : 00	10.00			
	RCW	11 : 10	15 : 20	4.17	490	0.0199	
10/13/2006	ERCW A & B	00 : 00	24 : 00	24.00			
	RCW	11 : 45	16 : 14	4.48	450	0.0178	
10/14/2006	ERCW A & B	00 : 00	24 : 00	24.00	500	0.0089	
10/15/2006	ERCW A & B	00 : 00	24 : 00	24.00			
	RCW	11 : 40	15 : 40	4.00	500	0.0191	
10/16/2006	ERCW A & B	00 : 00	24 : 00	24.00			
	RCW	12 : 05	16 : 12	4.12	530	0.0188	
10/17/2006	ERCW A & B	00 : 00	08 : 52	8.87		0.0212	
	RCW	10 : 32	14 : 32	4.00	180	0.0105	
10/18/2006	RCW	10 : 35	14 : 35	4.00	40	0.0105	
10/19/2006	ERCW A & B	11 : 40	24 : 00	12.33	250	0.0101	
10/20/2006	ERCW A & B	00 : 00	16 : 00	16.00			
	RCW	11 : 15	15 : 15	4.00	220	0.0223	
10/21/2006	n/a						
10/22/2006	RCW	09 : 00	13 : 00	4.00	40	0.0105	
10/23/2006	RCW	10 : 35	14 : 35	4.00	40	0.0084	
10/24/2006	RCW	09 : 53	13 : 53	4.00	40	0.0099	
10/25/2006	RCW	09 : 55	14 : 00	4.08	40	0.0084	
10/26/2006	ERCW A & B	08 : 25	24 : 00	15.58	510	0.0058	
10/27/2006	ERCW A & B	00 : 00	24 : 00	24.00			
	RCW	11 : 15	14 : 35	3.33	480	0.0160	
10/28/2006	ERCW A & B	00 : 00	14 : 00	14.00	110	0.0068	
10/29/2006	RCW	08 : 35	12 : 45	4.17	40	0.0115	
10/30/2006	ERCW A & B	09 : 50	14 : 30	4.67	160	0.0068	
10/31/2006	n/a						

Towerbrom 960	system	injection	injection	duration in hours	total quantity	mass balance calc.	Additional Results
					1,425 lbs/day	0.10 mg/L	0.10 mg/L
11/01/2006	ERCW A & B	08:25	12:25	4.00	180	0.0066	
11/02/2006	ERCW A & B	09:35	13:35	4.00	200	0.0134	
11/03/2006	RCW	11:15	24:00	12.75	110	0.0039	
11/04/2006	ERCW A & B	10:10	14:10	4.00			
	RCW	00:00	24:00	24.00	300	0.0127	
11/05/2006	RCW	00:00	24:00	24.00	120	0.0039	
11/06/2006	RCW	00:00	24:00	24.00	160	0.0041	
11/07/2006	RCW	00:00	24:00	24.00	170	0.0093	
11/08/2006	RCW	00:00	24:00	24.00	160	0.0103	
11/09/2006	ERCW A & B	18:55	24:00	5.08			
	RCW	00:00	24:00	24.00	520	0.0145	
11/10/2006	ERCW A & B & RCW	00:00	24:00	24.00	600	0.0287	
11/11/2006	ERCW A & B	00:00	15:15	15.25			
	RCW	00:00	24:00	24.00	380	0.0090	
11/12/2006	RCW	00:00	24:00	24.00	160	0.0055	
11/13/2006	RCW	00:00	24:00	24.00	160	0.0068	
11/14/2006	RCW	00:00	24:00	24.00	140	0.0143	
11/15/2006	RCW	00:00	24:00	24.00	150	0.0068	
11/16/2006	ERCW A & B	14:00	24:00	10.00			
	RCW	00:00	24:00	24.00	480	0.0267	
11/17/2006	ERCW A & B & RCW	00:00	24:00	24.00	610	0.0222	
11/18/2006	ERCW A & B & RCW	00:00	24:00	24.00	610	0.0191	
11/19/2006	ERCW A & B & RCW	00:00	24:00	24.00	610	0.0183	
11/20/2006	ERCW A & B & RCW	00:00	24:00	24.00	610	0.0086	
11/21/2006	ERCW A & B & RCW	00:00	24:00	24.00	530	0.0202	
11/22/2006	ERCW A & B & RCW	00:00	24:00	24.00	430	0.0101	
11/23/2006	ERCW A & B & RCW	00:00	24:00	24.00	430	0.0146	
11/24/2006	ERCW A & B & RCW	00:00	24:00	24.00	530	0.0056	
11/25/2006	ERCW A & B & RCW	00:00	24:00	24.00	440	0.0129	
11/26/2006	ERCW A & B & RCW	00:00	24:00	24.00	460	0.0188	
11/27/2006	ERCW A & B	00:00	24:00	24.00			
	RCW	00:00	16:00	16.00	470	0.0138	
11/28/2006	ERCW A & B	00:00	24:00	24.00	470	0.0120	
11/29/2006	ERCW A & B	00:00	24:00	24.00	470	0.0288	
11/30/2006	ERCW A & B	00:00	24:00	24.00	470	0.0376	

Towerbrom 960	system	injection	injection	duration in hours	total quantity	mass balance calc	Additional Results
					1,425 lbs/day	0.10 mg/L	0.10 mg/L
12/01/2006	ERCW A & B	00:00	24:00	24.00			
	RCW	11:42	16:00	4.30	480	0.0187	
12/02/2006	ERCW A & B	00:00	24:00	24.00	420	0.0131	
12/03/2006	ERCW A & B	00:00	20:00	20.00	230	0.0086	
12/04/2006	n/a						
12/05/2006	RCW	09:30	13:55	4.42	20	0.0092	
12/06/2006	ERCW A & B	12:25	16:25	4.00	220	0.0316	
12/07/2006	RCW	10:20	14:20	4.00	20	0.0104	
12/08/2006	n/a						
12/09/2006	n/a						
12/10/2006	ERCW A & B	15:45	19:45	4.00	170	0.0257	
12/11/2006	RCW	09:25	13:35	4.17	20	0.0117	
12/12/2006	ERCW A & B	10:35	14:45	4.17	160	0.0317	
12/13/2006	RCW	09:45	13:55	4.17	20	0.0110	
12/14/2006	ERCW A & B	09:40	13:40	4.00	140	0.0232	
12/15/2006	n/a						
12/16/2006	n/a						
12/17/2006	n/a						
12/18/2006	ERCW A & B	09:40	13:40	4.00	140	0.0161	
12/19/2006	RCW	09:30	13:35	4.08	20	0.0118	
12/20/2006	ERCW A & B	09:50	14:15	4.42	140	0.0198	
12/21/2006	RCW	11:15	15:15	4.00	20	0.0123	
12/22/2006	ERCW A & B	09:40	13:40	4.00	150	0.0167	
12/23/2006	n/a						
12/24/2006	n/a						
12/25/2006	n/a						
12/26/2006	n/a						
12/27/2006	ERCW A & B	13:20	17:20	4.00			
	RCW	09:25	13:50	4.42	140	0.0124	
12/28/2006	ERCW A & B	12:25	16:25	4.00			
	RCW	09:30	13:40	4.17	160	0.0164	
12/29/2006	n/a						
12/30/2006	n/a						
12/31/2006	n/a						

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Month	Quantity in Pounds (lbs/day)			Duration in Hours (hrs/day)	Analytical Results mass balance calculations (mg/L)				Days in Service
	Maximum	Average	Limit	Maximum	Maximum	Average	Limit	# of samples	
January	404	172	1480	24.00	0.033	0.014	0.2	23	23
February	108	81	1480	24.00	0.008	0.007	0.2	6	6
March	108	72	1480	24.00	0.009	0.009	0.2	2	2
April	108	105	1480	24.00	0.015	0.012	0.2	26	26
May	0	0	1480	0.00	0.000	0.000	0.2	0	0
June	108	91	1480	24.00	0.008	0.008	0.2	5	5
July	0	0	1480	0.00	0.008	0.000	0.2	0	0
August	0	0	1480	0.00	0.000	0.000	0.2	0	0
September	0	0	1480	0.00	0.000	0.000	0.2	0	0
October	0	0	1480	0.00	0.000	0.000	0.2	0	0
November	0	0	1480	0.00	0.000	0.000	0.2	0	0
December	0	0	1480	0.00	0.000	0.000	0.2	0	0
Jan. - Dec.								62	62

PCL-401	system	injection start time		injection end time		injection star	injection end time	duration in hours	total quantity	mass balance calc.
									1,480 lbs/day	0.2 mg/L
01/01/2006										
01/02/2006										
01/03/2006										
01/04/2006										
01/05/2006										
01/06/2006										
01/07/2006										
01/08/2006										
01/09/2006	ERCW A & B	00	00	24	00			24.00	404.06	0.033
01/10/2006	ERCW A & B	00	00	24	00			24.00	404.06	0.033
01/11/2006	ERCW A & B	00	00	24	00			24.00	404.06	0.033
01/12/2006	ERCW A & B	00	00	24	00			24.00	404.06	0.033
01/13/2006	ERCW A & B	00	00	24	00			24.00	404.06	0.032
01/14/2006	ERCW A & B	00	00	24	00			24.00	107.74	0.009
01/15/2006	ERCW A & B	00	00	24	00			24.00	107.74	0.009
01/16/2006	ERCW A & B	00	00	24	00			24.00	107.74	0.009
01/17/2006	ERCW A & B	00	00	24	00			24.00	107.76	0.009
01/18/2006	ERCW A & B	00	00	24	00			24.00	107.76	0.009
01/19/2006	ERCW A & B	00	00	24	00			24.00	107.76	0.009
01/20/2006	ERCW A & B	00	00	24	00			24.00	107.76	0.009
01/21/2006	ERCW A & B	00	00	24	00			24.00	107.76	0.009
01/22/2006	ERCW A & B	00	00	24	00			24.00	107.76	0.009
01/23/2006	ERCW A & B	00	00	24	00			24.00	107.76	0.009
01/24/2006	ERCW A & B	00	00	24	00			24.00	107.76	0.009
01/25/2006	ERCW A & B	00	00	24	00			24.00	107.76	0.009
01/26/2006	ERCW A & B	00	00	24	00			24.00	107.76	0.009
01/27/2006	ERCW A & B	00	00	24	00			24.00	107.76	0.009
01/28/2006	ERCW A & B	00	00	24	00			24.00	107.76	0.009
01/29/2006	ERCW A & B	00	00	24	00			24.00	107.76	0.009
01/30/2006	ERCW A & B	00	00	24	00			24.00	107.76	0.009
01/31/2006	ERCW A & B	00	00	24	00			24.00	107.76	0.009

PCL-401	system	injection start time		injection end time		injection star	injection end time	duration in hours	total quantity	mass balance calc.
									1,480 lbs/day	0.2 mg/L
02/01/2006	ERCW A & B	00	00	24	00			24.00	61.96	0.005
02/02/2006	ERCW A & B	00	00	24	00			24.00	61.96	0.005
02/03/2006	ERCW A & B	00	00	24	00			24.00	107.75	0.008
02/04/2006	ERCW A & B	00	00	24	00			24.00	107.75	0.008
02/05/2006	ERCW A & B	00	00	24	00			24.00	107.75	0.008
02/06/2006	ERCW A & B	00	00	08	25			8.42	37.8	0.008
02/07/2006	N/A									
02/08/2006	N/A									
02/09/2006	N/A									
02/10/2006	N/A									
02/11/2006	N/A									
02/12/2006	N/A									
02/13/2006	N/A									
02/14/2006	N/A									
02/15/2006	N/A									
02/16/2006	N/A									
02/17/2006	N/A									
02/18/2006	N/A									
02/19/2006	N/A									
02/20/2006	N/A									
02/21/2006	N/A									
02/22/2006	N/A									
02/23/2006	N/A									
02/24/2006	N/A									
02/25/2006	N/A									
02/26/2006	N/A									
02/27/2006	N/A									
02/28/2006	N/A									

PCL-401	system	injection start time		injection end time		injection star	injection end time	duration in hours	total quantity	mass balance calc.
									1,480 lbs/day	0.2 mg/L
03/01/2006	n/a									
03/02/2006	n/a									
03/03/2006	n/a									
03/04/2006	n/a									
03/05/2006	n/a									
03/06/2006	n/a									
03/07/2006	n/a									
03/08/2006	n/a									
03/09/2006	n/a									
03/10/2006	n/a									
03/11/2006	n/a									
03/12/2006	n/a									
03/13/2006	n/a									
03/14/2006	n/a									
03/15/2006	n/a									
03/16/2006	n/a									
03/17/2006	n/a									
03/18/2006	n/a									
03/19/2006	n/a									
03/20/2006	n/a									
03/21/2006	n/a									
03/22/2006	n/a									
03/23/2006	n/a									
03/24/2006	n/a									
03/25/2006	n/a									
03/26/2006	n/a									
03/27/2006	n/a									
03/28/2006	n/a									
03/29/2006	n/a									
03/30/2006	ERCW A & B	16	00	24	00			8.00	35.92	0.009
03/31/2006	ERCW A & B	00	00	24	00			24.00	107.76	0.009

PCL-401	system	injection start time		injection end time		injection star		injection end time	duration in hours	total quantity	mass balance calc.
										1,480 lbs/day	0.2 mg/L
04/01/2006	ERCW A & B	00	00	24	00				24.00	107.75	0.009
04/02/2006	ERCW A & B	00	00	24	00				24.00	107.75	0.009
04/03/2006	ERCW A & B	00	00	24	00				24.00	107.76	0.009
04/04/2006	ERCW A & B	00	00	24	00				24.00	107.76	0.009
04/05/2006	ERCW A & B	00	00	24	00				24.00	107.76	0.009
04/06/2006	ERCW A & B	00	00	24	00				24.00	107.76	0.009
04/07/2006	ERCW A & B	00	00	24	00				24.00	107.76	0.009
04/08/2006	ERCW A & B	00	00	24	00				24.00	107.76	0.009
04/09/2006	ERCW A & B	00	00	24	00				24.00	107.76	0.009
04/10/2006	ERCW A & B	00	00	24	00				24.00	107.76	0.008
04/11/2006	ERCW A & B	00	00	24	00				24.00	107.76	0.013
04/12/2006	ERCW A & B	00	00	24	00				24.00	107.76	0.015
04/13/2006	ERCW A & B	00	00	24	00				24.00	107.76	0.015
04/14/2006	ERCW A & B	00	00	24	00				24.00	107.76	0.015
04/15/2006	ERCW A & B	00	00	24	00				24.00	107.76	0.015
04/16/2006	ERCW A & B	00	00	24	00				24.00	107.76	0.015
04/17/2006	ERCW A & B	00	00	24	00				24.00	107.76	0.015
04/18/2006	ERCW A & B	00	00	24	00				24.00	107.76	0.015
04/19/2006	ERCW A & B	00	00	24	00				24.00	107.76	0.015
04/20/2006	ERCW A & B	00	00	24	00				24.00	107.76	0.015
04/21/2006	ERCW A & B	00	00	14	30	15	15	24.00	23.25	104.38	0.014
04/22/2006	ERCW A & B	00	00	24	00				24.00	107.76	0.015
04/23/2006	ERCW A & B	00	00	24	00				24.00	107.76	0.015
04/24/2006	ERCW A & B	00	00	24	00				24.00	107.76	0.014
04/25/2006	ERCW A & B	00	00	24	00				24.00	107.76	0.014
04/26/2006	ERCW A & B	00	00	09	00				9.00	40.4	0.014
04/27/2006	n/a										
04/28/2006	n/a										
04/29/2006	n/a										
04/30/2006	n/a										

PCL-401	system	injection start time		injection end time		injection star	injection end time	duration in hours	total quantity	mass balance calc.
									1,480 lbs/day	0.2 mg/L
06/01/2006	n/a									
06/02/2006	n/a									
06/03/2006	n/a									
06/04/2006	n/a									
06/05/2006	n/a									
06/06/2006	n/a									
06/07/2006	n/a									
06/08/2006	n/a									
06/09/2006	ERCW A & B	19	10	24	00			4.83	21.7	0.008
06/10/2006	ERCW A & B	00	00	24	00			24.00	107.76	0.008
06/11/2006	ERCW A & B	00	00	24	00			24.00	107.76	0.008
06/12/2006	ERCW A & B	00	00	24	00			24.00	107.76	0.008
06/13/2006	ERCW A & B	00	00	24	00			24.00	107.76	0.008
06/14/2006	n/a									
06/15/2006	n/a									
06/16/2006	n/a									
06/17/2006	n/a									
06/18/2006	n/a									
06/19/2006	n/a									
06/20/2006	n/a									
06/21/2006	n/a									
06/22/2006	n/a									
06/23/2006	n/a									
06/24/2006	n/a									
06/25/2006	n/a									
06/26/2006	n/a									
06/27/2006	n/a									
06/28/2006	n/a									
06/29/2006	n/a									
06/30/2006	n/a									

TN0026450 SQN

2006 Biocide/Corrosion Treatment Plan Annual Report

MSW 101

Month	Quantity in Pounds (lbs/day)			Duration in Hours (hrs/day)	Analytical Results mass balance calculations (mg/L)				Days in Service
	Maximum	Average	Limit	Maximum	Maximum	Average	Limit	# of samples	
January	0	0	2280	0.00	0.000	0.000	0.2	0	0
February	0	0	2280	0.00	0.000	0.000	0.2	0	0
March	0	0	2280	0.00	0.000	0.000	0.2	0	0
April	0	0	2280	0.00	0.000	0.000	0.2	0	0
May	0	0	2280	0.00	0.000	0.000	0.2	0	0
June	0	0	2280	0.00	0.000	0.000	0.2	0	0
July	0	0	2280	0.00	0.000	0.000	0.2	0	0
August	0	0	2280	0.00	0.000	0.000	0.2	0	0
September	243	178	2280	24.00	0.018	0.016	0.2	30	30
October	243	197	2280	24.00	0.018	0.018	0.2	27	27
November	0	0	2280	0.00	0.000	0.000	0.2	0	0
December	0	0	2280	0.00	0.000	0.000	0.2	0	0
Jan. - Dec.								57	57

Per the B/CTP approval: "MSW 101 is injected into the ERCW Train A & B system only during warm weather months."

MSW 101	system	injection	injection	injection	injection end	duration in hours	PHOSPHATE	
							total quantity	mass balance calc.
							2,280 lbs/day	0.2 mg/L
09/01/2006	RCW	00 : 00	11 : 25	16 : 25	24 : 00	19.00	192.01	0.018
09/02/2006	RCW	00 : 00	24 : 00			24.00	194.68	0.015
09/03/2006	RCW	00 : 00	24 : 00			24.00	194.68	0.015
09/04/2006	RCW	00 : 00	24 : 00			24.00	194.68	0.015
09/05/2006	RCW	00 : 00	11 : 35	16 : 25	24 : 00	19.17	155.42	0.014
09/06/2006	RCW	00 : 00	11 : 10	16 : 30	24 : 00	18.67	151.44	0.014
09/07/2006	RCW	00 : 00	11 : 23	16 : 05	24 : 00	19.30	156.55	0.015
09/08/2006	RCW	00 : 00	11 : 00	16 : 40	24 : 00	18.33	148.64	0.014
09/09/2006	RCW	00 : 00	09 : 05	13 : 30	24 : 00	19.58	158.82	0.014
09/10/2006	RCW	00 : 00	24 : 00			24.00	194.68	0.014
09/11/2006	RCW	00 : 00	10 : 15	15 : 00	24 : 00	19.25	156.15	0.014
09/12/2006	RCW	00 : 00	09 : 50	15 : 16	24 : 00	18.57	150.55	0.014
09/13/2006	RCW	00 : 00	09 : 10	14 : 00	24 : 00	19.17	155.5	0.014
09/14/2006	RCW	00 : 00	08 : 45	14 : 00	24 : 00	18.75	152.09	0.014
09/15/2006	RCW	00 : 00	08 : 47	13 : 45	24 : 00	19.03	154.36	0.015
09/16/2006	RCW	00 : 00	24 : 00			24.00	194.68	0.015
09/17/2006	RCW	00 : 00	24 : 00			24.00	194.68	0.015
09/18/2006	RCW	00 : 00	24 : 00			24.00	194.68	0.014
09/19/2006	RCW	00 : 00	08 : 30	13 : 15	24 : 00	19.25	156.15	0.014
09/20/2006	RCW	00 : 00	10 : 04	14 : 50	24 : 00	19.23	156.07	0.015
09/21/2006	RCW	00 : 00	10 : 40	16 : 10	24 : 00	18.50	187.58	0.018
09/22/2006	RCW	00 : 00	10 : 02	15 : 40	24 : 00	18.37	186.16	0.018
09/23/2006	RCW	00 : 00	08 : 30	12 : 35	24 : 00	19.92	161.58	0.015
09/24/2006	RCW	00 : 00	24 : 00			24.00	194.68	0.015
09/25/2006	RCW	00 : 00	09 : 30	14 : 45	24 : 00	18.75	190.11	0.018
09/26/2006	RCW	00 : 00	10 : 43	16 : 06	24 : 00	18.62	188.79	0.018
09/27/2006	RCW	00 : 00	09 : 08	14 : 01	24 : 00	19.12	193.76	0.018
09/28/2006	RCW	00 : 00	09 : 06	14 : 30	24 : 00	18.60	188.59	0.018
09/29/2006	RCW	00 : 00	11 : 27	16 : 31	24 : 00	18.93	191.94	0.018
09/30/2006	RCW	00 : 00	24 : 00			24.00	243.35	0.018

MSW 101	system	injection	injection	injection	injection end	duration in hours	PHOSPHATE	
							total quantity	mass balance calc.
							2,280 lbs/day	0.2 mg/L
10/01/2006	RCW	00 : 00	24 : 00			24.00	243.35	0.018
10/02/2006	RCW	00 : 00	11 : 08	15 : 55	24 : 00	19.22	194.78	0.018
10/03/2006	RCW	00 : 00	09 : 13	15 : 21	24 : 00	17.87	181.19	0.018
10/04/2006	RCW	00 : 00	10 : 05	14 : 45	24 : 00	19.33	195.99	0.018
10/05/2006	RCW	00 : 00	11 : 04	16 : 36	24 : 00	18.47	187.28	0.018
10/06/2006	RCW	00 : 00	10 : 15	15 : 20	24 : 00	18.92	191.84	0.018
10/07/2006	RCW	00 : 00	24 : 00			24.00	243.35	0.018
10/08/2006	RCW	00 : 00	24 : 00			24.00	243.35	0.018
10/09/2006	RCW	00 : 00	24 : 00			24.00	243.35	0.018
10/10/2006	RCW	00 : 00	24 : 00			24.00	243.35	0.018
10/11/2006	RCW	00 : 00	11 : 28	16 : 03	24 : 00	19.42	196.91	0.018
10/12/2006	RCW	00 : 00	09 : 50	15 : 30	24 : 00	18.33	185.85	0.018
10/13/2006	RCW	00 : 00	11 : 23	16 : 24	24 : 00	18.98	192.44	0.018
10/14/2006	RCW	00 : 00	24 : 00			24.00	243.35	0.018
10/15/2006	RCW	00 : 00	11 : 20	15 : 45	24 : 00	19.58	198.53	0.018
10/16/2006	RCW	00 : 00	11 : 01	16 : 22	24 : 00	18.65	189.1	0.018
10/17/2006	RCW	00 : 00	10 : 12	14 : 48	24 : 00	19.40	196.7	0.018
10/18/2006	RCW	00 : 00	09 : 32	14 : 45	24 : 00	18.78	190.42	0.018
10/19/2006	RCW	00 : 00	24 : 00			24.00	243.35	0.018
10/20/2006	RCW	00 : 00	10 : 53	15 : 25	24 : 00	19.47	197.31	0.018
10/21/2006	RCW	00 : 00	24 : 00			24.00	243.35	0.018
10/22/2006	RCW	00 : 00	08 : 30	13 : 10	24 : 00	19.33	195.99	0.018
10/23/2006	RCW	00 : 00	09 : 30	14 : 45	24 : 00	18.75	190.11	0.018
10/24/2006	RCW	00 : 00	09 : 32	14 : 03	24 : 00	19.48	197.51	0.018
10/25/2006	RCW	00 : 00	08 : 52			8.87	89.94	0.018
10/26/2006	RCW	14 : 50	24 : 00			9.17	92.98	0.018
10/27/2006	RCW	00 : 00	10 : 51			10.85	110.01	0.018
10/28/2006	n/a							
10/29/2006	n/a							
10/30/2006	n/a							
10/31/2006	n/a							

December 11, 2006

Ruth Ann Hurt, SB 2A-SQN

SEQUOYAH NUCLEAR PLANT (SQN) TOXICITY BIOMONITORING, NPDES PERMIT NO. TN0026450, OUTFALL 101, NOVEMBER, 2006

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 November 12-17, showed no toxic effects to fathead minnows or daphnids. The resulting IC_{25} values for both species were > 100 percent. Fathead minnows exposed to intake samples were significantly different (less than) from the control based on growth analyses using Homoscedastic t-Tests. Daphnids were not significantly different from control for either intake or upstream based on reproduction analyses using Homoscedastic t-Tests.

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.

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
CTR 2L-M

Attachment
cc (Attachment):
Files, RSO&E-EDMS-Muscle Shoals

SQN November 2006M

TENNESSEE VALLEY AUTHORITY
TOXICITY TEST REPORT

INTRODUCTION / EXECUTIVE SUMMARY

Report Date: December 11, 2006

1. Facility / Discharger: Sequoyah Nuclear Plant / TVA

2. County / State: Hamilton / Tennessee

3. NPDES Permit #: TN0026450

4. Type of Facility: Nuclear-Fueled Electric Generating Plant

5. Type of Facility: Nuclear-Fueled Electric Generating Plant

6. Design Flow (MGD): 1579

7. Receiving Stream: Tennessee River (TRM 483.6)

8. 1Q10: 3491

9. Outfall Tested: 101

10. Dates Sampled: November 12-17, 2006

11. Average Flow on Days Sampled (MGD): 1569, 1565, 1564, 1567, 1557, 1563

12. Pertinent Site Conditions:

H-150M was injected from November 13-16, 2006. The dates and times for the H-150M injection are in the following table. H-150M was shut down on 11/14/2006 from 0812-0914 due to backwashing of the ERCW traveling screens and/or H-150M tote change-out.

Injection Location	Date/Start Time (ET)	Date/Ending Time (ET)
Essential Raw Cooling Water (ERCW) Train B	11/13/2006 1155 11/14/2006 0914	11/14/2006 0812 11/16/2006 1300

13. Test Dates: November 14-21, 2006

14. Test Type: Short-term Chronic Definitive

15. Test Species: Fathead Minnows (*Pimephales promelas*)
Daphnids (*Ceriodaphnia dubia*)

16. Concentrations Tested (%): Outfall 101: 11.3, 22.6, 45.2, 72.6, 100
Intake: 100.0

Pimephales promelas: UV treated Outfall 101: 11.3, 22.6, 45.2, 72.6, 100
UV treated Intake: 100.0

17. Permit Limit Endpoint (%): Outfall 101: IC_{25} = 45.2%

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

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

19. Facility Contact: Stephanie Howard Phone #: (423) 843-6700

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

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

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

23. Notes: Outfall 101 samples collected November 12 - 17, 2006, showed no toxic effects to fathead minnows or daphnids. The resulting IC_{25} values, for both species, were > 100 percent. Fathead minnows exposed to intake samples were significantly different (less than) from the control based on growth analyses using Homoscedastic t-Tests. Daphnids were not significantly different from control for either intake or upstream based on reproduction analyses using Homoscedastic t-Tests.

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.

METHODS SUMMARY

Samples:

1. Sampling Point: Outfall 101, Intake

2. Sample Type: Composite

3. Sample Information:

Sample ID	Date (MM/DD/YY)/ Time (ET) Collected	Date (MM/DD/YY)/ Time (ET) Received	Arrival Temp. (°C)	Initial TRC* (mg/L)	Date (MM/DD/YY)/ Time (ET) Last Used By
101	11/12/06 0805 to 11/13/06 0705	11/13/06 1450	2.3/2.0†	<0.10	11/14/06 1425 11/15/06 1430
Intake	11/12/06 0840 to 11/13/06 0740	11/13/06 1450	1.5	<0.10	11/14/06 1425 11/15/06 1430
101	11/14/06 0824 to 11/15/06 0724	11/15/06 1425	4.5/5.0†	<0.10	11/16/06 1409 11/17/06 1355
Intake	11/14/06 0843 to 11/15/06 0743	11/15/06 1425	2.4	<0.10	11/16/06 1409 11/17/06 1355
101	11/16/06 0753 to 11/17/06 0653	11/17/06 1405	3.3/3.7†	<0.10	11/18/06 1345 11/19/06 1330 11/20/06 1336
Intake	11/16/06 0814 to 11/17/06 0714	11/17/06 1405	0.7	<0.10	11/18/06 1345 11/19/06 1330 11/20/06 1336

*TRC = Total Residual Chlorine

†Samples were collected in two 2.5 gallon cubitainers. Temperature was measured in each cubitainer upon arrival.

4. Sample Manipulation: Samples from Outfall 101 and intake were warmed to test temperature (25.0 ± 1.0°C) in a warm water bath.

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

	Pimephales promelas	*Ceriodaphnia dubia*
Test Organisms:		
1. Source:	Aquatic BioSystems, Inc.	In-house Cultures
2. Age:	22.5 - 24.5 hours old	<24-hours old
Test Method Summary:		
1. Test Conditions:	Static, Renewal	Static, Renewal
2. Test Duration:	7 days	Until at least 60% of control females have 3 broods
3. Control / Dilution Water:	Moderately Hard Synthetic	Moderately Hard Synthetic
4. Number of Replicates:	4	10
5. Organisms per Replicate:	10	1
6. Test Initiation: (Date/Time)		
Outfall 101	11/14/06 - 1425 ET	11/14/06 - 1218 ET
UV Treated Outfall 101	11/14/06 - 1407 ET	
7. Test Termination: (Date/Time)		
Outfall 101	11/21/06 - 1328 ET	11/21/06 - 1132 ET
UV Treated Outfall 101	11/21/06 - 1309 ET	
8. Test Temperature: Outfall 101:	Mean = 24.6°C (24.1 - 25.1°C)	Mean = 24.9°C (24.6 - 25.3°C)
Test Temperature: UV-Treated Outfall 101:	Mean = 24.7°C (24.1 - 25.1°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* (Genus species) Chronic/ 7-day (Type / Duration) Toxicity Test.

Conducted November 14 - 21, 2006 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
11.3%	100	100	100	100	100	100	100
22.6%	100	100	100	100	100	100	100
45.2%	100	100	100	100	100	100	100
72.6%	100	100	100	100	100	98	98
100.0%	100	100	100	100	100	100	100
Intake	100	100	98	98	98	98	98

Test Solutions (% Effluent)	Mean Dry Weight (mg) (replicate number)				
	1	2	3	4	Mean
Control	0.815	0.732	0.735	0.778	0.765
11.3%	0.662	0.656	0.684	0.744	0.687
22.6%	0.725	0.703	0.725	0.687	0.710
45.2%	0.679	0.657	0.650	0.563	0.637
72.6%	0.662	0.622	0.684	0.660	0.657
100.0%	0.671	0.745	0.683	0.669	0.692
Intake	0.674	0.604	0.742	0.628	0.662

IC_{25} Value: > 100% Permit Limit: 45.2% 95% Confidence Limits: Upper Limit: NA Lower Limit: NA	Calculated TU Estimates: < 1.0 TUc* Permit Limit: 2.2 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 November 14 - 21, 2006 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
11.3%	100	100	100	100	100	100	100
22.6%	100	100	100	100	100	100	100
45.2%	100	100	100	100	100	100	100
72.6%	100	100	100	100	100	100	100
100.0%	100	100	100	100	100	100	100

Test Solutions (% Effluent)	Reproduction (#young/female/7 days) Data (replicate number)										
	1	2	3	4	5	6	7	8	9	10	Mean
Control	29	27	27	30	27	30	30	27	32	30	28.9
11.3%	28	29	31	31	31	33	31	29	30	34	30.7
22.6%	33	34	32	28	31	31	35	36	35	30	32.5
45.2%	38	33	33	31	34	32	34	31	30	34	33.0
72.6%	31	37	31	36	34	32	35	33	35	34	33.8
100.0%	32	33	33	36	33	36	34	33	38	34	34.2

IC_{25} Value: > 100% Permit Limit: 45.2% 95% Confidence Limits: Upper Limit: NA Lower Limit: NA	Calculated TU Estimates: < 1.0 TUc* Permit Limit: 2.2 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 November 14 - 21, 2006 using water from Intake

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

Test Solutions (% Effluent)	Reproduction (#young/female/7 days) Data (replicate number)										
	1	2	3	4	5	6	7	8	9	10	Mean
Control	29	26	30	29	30	29	28	31	27	32	29.1
Intake	38	30	34	34	31	33	33	36	33	34	33.6

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

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

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

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

Conducted November 14 – 21, 2006 using effluent from UV Treated Outfall 101.

Test Solutions (% Effluent)	Percent Surviving (time interval used – days)						
	1	2	3	4	5	6	7
Control	100	100	100	100	100	100	100
11.3%	100	100	100	100	100	100	98
22.6%	100	100	100	100	100	100	98
45.2%	100	100	100	100	100	100	100
72.6%	100	100	100	100	100	100	98
100.0%	100	100	100	100	100	100	100
Intake	100	100	100	100	100	100	100

Test Solutions (% Effluent)	Mean Dry Weight (mg) (replicate number)				
	1	2	3	4	Mean
Control	0.809	0.735	0.789	0.766	0.775
11.3%	0.816	0.780	0.721	0.829	0.787
22.6%	0.726	0.939	0.804	0.739	0.802
45.2%	0.610	0.814	0.712	0.836	0.743
72.6%	0.787	0.776	0.762	0.754	0.770
100.0%	0.705	0.737	0.710	0.772	0.731
Intake	0.646	0.768	0.717	0.772	0.726

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

*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	November 14 - 21, 2006	1440	7-days	KCl	0.54 g/L
Ceriodaphnia dubia	November 7 - 14, 2006	1127	7-days	NaCl	1.06 g/L

PHYSICAL/CHEMICAL SUMMARY

Water Chemistry Mean Values and Ranges for *Pimephales promelas* and *Ceriodaphnia dubia* Tests, Sequoyah Nuclear Plant Effluent (SQN), Outfall 101, November 14-21, 2006.

Test	Sample ID	Temperature (°C)		Dissolved Oxygen (mg/L)		pH (S.U.)		Conductance (µmhos/cm)	Alkalinity (mg/L $CaCO_3$)	Hardness (mg/L $CaCO_3$)	Total Residual Chlorine (mg/L)
		Initial	Final	Initial	Final	Initial	Final				
Pimephales promelas	Control	24.7 24.6 - 24.8	24.4 24.2 - 24.6	7.9 7.7 - 8.2	7.5 7.0 - 7.9	7.71 7.52 - 7.81	7.29 7.08 - 7.58	313 308 - 320	59 57 - 60	93 91 - 93	- - - -
	11.3%	24.7 24.6 - 24.8	24.4 24.2 - 24.8	8.0 7.9 - 8.1	7.3 6.7 - 7.9	7.55 7.26 - 7.77	7.27 7.06 - 7.53	295 289 - 306	-	-	-
	22.6%	24.8 24.7 - 24.9	24.3 24.1 - 24.6	8.0 7.9 - 8.1	7.2 6.5 - 7.9	7.55 7.27 - 7.77	7.25 7.01 - 7.53	282 273 - 296	-	-	-
	45.2%	24.8 24.7 - 24.9	24.4 24.2 - 24.5	8.0 7.9 - 8.1	7.2 6.5 - 7.9	7.54 7.26 - 7.75	7.27 7.04 - 7.56	254 246 - 265	-	-	-
	72.6%	24.8 24.8 - 24.9	24.4 24.1 - 24.8	8.1 8.0 - 8.2	7.3 6.7 - 8.0	7.52 7.24 - 7.73	7.26 7.08 - 7.56	219 211 - 231	-	-	-
	100.0%	25.0 24.8 - 25.1	24.4 24.2 - 24.7	8.1 7.9 - 8.3	7.2 6.6 - 8.0	7.51 7.22 - 7.71	7.27 7.06 - 7.54	185 178 - 198	66 65 - 67	79 77 - 81	< 0.10 < 0.10 - < 0.10
	Intake	24.8 24.7 - 24.9	24.4 24.1 - 24.6	8.2 7.8 - 8.4	7.4 6.6 - 8.0	7.50 7.20 - 7.71	7.27 7.09 - 7.55	185 179 - 198	65 64 - 66	78 77 - 79	< 0.10 < 0.10 - < 0.10
Ceriodaphnia dubia	Control	24.7 24.6 - 24.9	24.9 24.6 - 25.2	7.9 7.7 - 8.2	8.0 7.6 - 8.3	7.71 7.52 - 7.81	7.49 7.27 - 7.71	313 308 - 320	59 57 - 60	93 91 - 93	- - - -
	11.3%	24.8 24.7 - 24.9	24.9 24.7 - 25.1	7.9 7.9 - 8.0	7.9 7.6 - 8.3	7.55 7.26 - 7.77	7.49 7.27 - 7.69	295 289 - 306	-	-	-
	22.6%	24.8 24.7 - 24.9	24.9 24.6 - 25.3	8.0 7.9 - 8.1	7.9 7.6 - 8.3	7.55 7.27 - 7.77	7.50 7.27 - 7.68	282 273 - 296	-	-	-
	45.2%	24.8 24.7 - 25.0	25.0 24.9 - 25.2	8.0 7.9 - 8.1	7.9 7.6 - 8.3	7.54 7.26 - 7.75	7.50 7.28 - 7.68	254 246 - 265	-	-	-
	72.6%	24.9 24.8 - 25.2	25.0 24.8 - 25.2	8.1 8.0 - 8.2	7.9 7.6 - 8.3	7.52 7.24 - 7.73	7.50 7.31 - 7.69	219 211 - 231	-	-	-
	100.0%	25.0 24.7 - 25.3	24.9 24.7 - 25.2	8.1 7.9 - 8.3	7.9 7.7 - 8.3	7.51 7.22 - 7.71	7.51 7.30 - 7.70	185 178 - 198	66 65 - 67	79 77 - 81	< 0.10 < 0.10 - < 0.10
	Intake	24.9 24.8 - 25.1	24.9 24.8 - 25.1	8.2 7.8 - 8.4	8.0 7.7 - 8.3	7.50 7.20 - 7.71	7.50 7.29 - 7.70	185 179 - 198	65 64 - 66	78 77 - 79	< 0.10 < 0.10 - < 0.10

Overall temperature (°C)	Average	Minimum	Maximum
Pimephales promelas	24.6	24.1	25.1
Ceriodaphnia dubia	24.9	24.6	25.3

PHYSICAL/CHEMICAL SUMMARY

Water Chemistry Mean Values and Ranges for the *Pimephales promelas* Test, Sequoyah Nuclear Plant Effluent (SQN), UV-Treated Outfall 101, November 14-21, 2006.

Test	Sample ID	Temperature (°C)		Dissolved Oxygen (mg/L)		pH (S.U.)		Conductance (µmhos/cm)
		Initial	Final	Initial	Final	Initial	Final	
Pimephales promelas	Control	24.8 24.7 - 24.9	24.5 24.3 - 24.6	7.9 7.8 - 8.2	7.5 7.1 - 7.8	7.62 7.49 - 7.83	7.34 7.11 - 7.59	302 296 - 308
	11.3%	24.8 24.7 - 24.9	24.5 24.1 - 24.8	7.9 7.8 - 8.2	7.4 7.0 - 7.8	7.62 7.48 - 7.83	7.33 7.11 - 7.53	298 288 - 304
	22.6%	24.8 24.7 - 24.9	24.5 24.2 - 24.7	8.0 7.8 - 8.2	7.4 6.8 - 7.7	7.62 7.47 - 7.82	7.32 7.10 - 7.55	283 276 - 293
	45.2%	24.9 24.8 - 24.9	24.4 24.2 - 24.7	8.0 7.9 - 8.2	7.4 6.8 - 7.8	7.62 7.44 - 7.79	7.31 7.11 - 7.55	257 248 - 267
	72.6%	24.9 24.9 - 25.0	24.4 24.2 - 24.5	8.1 7.9 - 8.2	7.4 6.8 - 7.8	7.60 7.43 - 7.77	7.33 7.11 - 7.55	221 216 - 230
	100.0%	25.0 24.6 - 25.1	24.5 24.2 - 24.7	8.0 7.9 - 8.1	7.3 6.8 - 7.9	7.58 7.39 - 7.74	7.33 7.13 - 7.57	191 188 - 202
	Intake	24.9 24.8 - 25.0	24.4 24.2 - 24.8	8.1 8.0 - 8.2	7.3 6.9 - 7.9	7.55 7.29 - 7.72	7.33 7.07 - 7.58	189 184 - 195

Overall temperature (°C)	Average	Minimum	Maximum
Pimephales promelas	24.7	24.1	25.1

SUMMARY / CONCLUSIONS

Outfall 101 samples collected November 12-17, 2006, showed no toxic effects to fathead minnows or daphnids. The resulting IC_{25} values, for both species, were > 100 percent. Fathead minnows exposed to intake samples were significantly different (less than) from the control based on growth analyses using Homoscedastic t-Tests. Daphnids were not significantly different from control for either intake or upstream based on reproduction analyses using Homoscedastic t-Tests.

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.

Appendix A

ADDITIONAL TOXICITY TEST INFORMATION

SUMMARY OF METHODS

1. *Pimephales promelas*

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

2. *Ceriodaphnia dubia*

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

DEVIATIONS / MODIFICATIONS TO TEST PROTOCOL

1. *Pimephales promelas*

   None

2. *Ceriodaphnia dubia*

   None

DEVIATIONS / MODIFICATIONS TO PRETEST CULTURE OR HOLDING OF TEST ORGANISMS

1. *Pimephales promelas*

   None

2. *Ceriodaphnia dubia*

   None

PHYSICAL AND CHEMICAL METHODS

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

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

3. Temperature was measured by EPA Method 170.1.

4. Dissolved oxygen was measured by EPA Method 360.1.

5. The pH was measured by EPA Method 150.1.

6. Conductance was measured by EPA Method 120.1.

7. Alkalinity was measured by EPA Method 310.1.

8. Total Hardness was measured by EPA Method 130.2.

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

QUALITY ASSURANCE

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

REFERENCE TOXICANT TESTS (See Appendix 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. TN0026450.

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

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

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

Sequoyah Nuclear Plant Biomonitoring
November 14-21, 2006

Appendix B

Diffuser Discharge Concentrations of Chemicals Used to Control Microbiologically Induced Corrosion and Mollusks, 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 Mollusks, During Toxicity Test Sampling, March 12, 1998 – December 1, 2006

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 Mollusks, During Toxicity Test Sampling, March 12, 1998 – December 1, 2006

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 Mollusks, During Toxicity Test Sampling, March 12, 1998 – December 1, 2006

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 Mollusks, During Toxicity Test Sampling, March 12, 1998 – December 1, 2006

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	-	-
02/01/2004	-	0.0093	0.027	0.009	-	-	-
02/02/2004	-	<0.0034	0.026	0.009	-	-	-
02/03/2004	-	<0.0034	0.026	0.009	-	-	-
02/04/2004	-	0.0124	0.026	0.009	0.009	-	-
02/05/2004	-	<0.0034	0.026	0.009	-	-	-
02/06/2004	-	0.0105	0.026	0.009	0.010	-	-
05/04/2004	-	<0.0123	0.026	0.019	-	-	0.025
05/05/2004	-	<0.0144	0.026	0.014	0.009	-	0.025
05/06/2004	-	<0.0146	0.037	0.013	-	-	0.025
05/07/2004	-	0.0227	0.058	0.020	0.009	-	0.025
05/08/2004	-	0.016	0.060	0.021	-	-	-
05/09/2004	-	<0.0104	0.058	0.020	-	-	-
07/04/2004	-	0.0217	0.057	0.019	-	-	-
07/05/2004	-	<0.0085	0.057	0.020	0.009	-	-
07/06/2004	-	<0.0077	0.058	0.020	-	-	0.031
07/07/2004	-	0.0252	0.056	0.019	-	-	0.031
07/08/2004	-	0.0223	0.057	0.019	0.009	-	-
07/09/2004	-	0.0182	0.057	0.020	0.009	-	-

Table B-1 (continued). Sequoyah Nuclear Plant Diffuser (Outfall 101) Discharge Concentrations of Chemicals Used to Control Growth of Microbiologically Induced Bacteria and Mollusks, During Toxicity Test Sampling, March 12, 1998 – December 1, 2006

Date	Sodium Hypochlorite mg/L TRC	Towerbrom mg/L TRC	PCL-222 mg/L Phosphate	PCL-401 mg/L Copolymer	CL-363 mg/L DMAD	Cuprostat-PF mg/L Azole	H-130M mg/L Quat	Nalco 73551 mg/L EO/PO	H-150M mg/L Quat
11/07/2004	-	<0.0187	0.000	0.014	-	-	-	-	-
11/08/2004	-	<0.0192	0.047	0.030	-	-	-	-	-
11/09/2004	-	<0.0233	0.048	0.016	-	-	0.041	-	-
11/10/2004	-	<0.0149	0.047	0.016	-	-	0.041	-	-
11/11/2004	-	<0.0149	0.049	0.017	-	-	0.043	-	-
11/12/2004	-	<0.0253	0.048	0.017	-	-	0.042	-	-
02/06/2005	-	<0.0042	0.028	0.010	-	-	-	-	-
02/07/2005	-	<0.0116	0.028	0.010	-	-	-	0.007	-
02/08/2005	-	<0.0080	0.028	0.010	-	-	-	-	-
02/09/2005	-	0.0199	0.028	0.010	-	-	-	-	-
02/10/2005	-	<0.0042	0.028	0.010	-	-	-	-	-
02/11/2005	-	0.0155	0.028	0.010	-	-	-	0.007	-
06/05/2005	-	0.0063	-	-	-	-	-	-	-
06/06/2005	-	0.0043	-	-	-	-	-	-	0.037
06/07/2005	-	0.0103	-	-	-	-	-	-	0.037
06/08/2005	-	0.0295	-	-	-	-	-	-	0.037
06/09/2005	-	0.0129	-	-	-	-	-	-	-
06/10/2005	-	0.0184	-	-	-	-	-	-	-
07/17/2005	-	0.0109	0.026	0.009	-	-	-	-	-
07/18/2005	-	0.0150	0.026	0.009	-	-	-	-	0.036
07/19/2005	-	0.0163	0.026	0.009	-	-	-	-	0.036
07/20/2005	-	0.0209	0.026	0.009	-	-	-	0.014	0.036
07/21/2005	-	0.0242	0.026	0.009	-	-	-	-	-
07/22/2005	-	0.0238	0.054	0.018	-	-	-	0.014	-
10/30/2005	-	0.0068	-	-	-	-	-	-	-
10/31/2005	-	0.0112	-	-	-	-	-	-	-
11/01/2005	-	0.0104	-	-	-	-	-	-	0.035
11/02/2005	-	0.0104	-	-	-	-	-	-	0.036
11/03/2005	-	0.0117	-	-	-	-	-	-	0.036
11/04/2005	-	0.0165	-	-	-	-	-	-	0.035
11/14/2005	-	0.0274	-	-	-	-	-	-	-
11/15/2005	-	0.0256	-	-	-	-	-	-	-
11/16/2005	-	0.0234	-	-	-	-	-	-	-
11/17/2005	-	0.0231	-	-	-	-	-	-	-
11/18/2005	-	0.0200	-	-	-	-	-	-	-
11/19/2005	-	0.0116	-	-	-	-	-	-	-

Table B-1 (continued). Sequoyah Nuclear Plant Diffuser (Outfall 101) Discharge Concentrations of Chemicals Used to Control Growth of Microbiologically Induced Bacteria and Mollusks, During Toxicity Test Sampling, March 12, 1998 – December 1, 2006

Date	Sodium Hypochlorite mg/L TRC	Towerbrom mg/L TRC	PCL-222 mg/L Phosphate	PCL-401 mg/L Copolymer	CL-363 mg/L DMAD	Cuprostat-PF mg/L Azole	H-130M mg/L Quat	Nalco 73551 mg/L EO/PO	H-150M mg/L Quat
11/12/2005	-	0.0055	-	-	-	-	-	-	-
11/13/2005	-	0.0068	-	-	-	-	-	-	0.037
11/14/2005	-	0.0143	-	-	-	-	-	-	0.037
11/15/2005	-	0.0068	-	-	-	-	-	-	0.037
11/16/2005	-	0.0267	-	-	-	-	-	-	0.037
11/17/2005	-	0.0222	-	-	-	-	-	-	-
11/26/2006	-	0.0188	-	-	-	-	-	-	-
11/27/2006	-	0.0138	-	-	-	-	-	-	-
11/28/2006	-	0.0120	-	-	-	-	-	-	-
11/29/2006	-	0.0288	-	-	-	-	-	-	-
11/30/2006	-	0.0376	-	-	-	-	-	-	-
12/01/2006	-	0.0187	-	-	-	-	-	-	-

Sequoyah Nuclear Plant Biomonitoring
November 14-21, 2006

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: Chevy Williams, Roy Quinn

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): Express Courier

General Comments:

Project# ~~291~~ 2078

Laboratory Use

Field Identification / Sample Description	Grab/Comp.	Collection Date/Time		Container Number & Volume Collected	Flow MGD	Rain Event? (Mark as Appropriate)				ETS Log Number	Arrival Temp. (°C)	By	Time	Appearance
	----	Date	Time	----	----	Yes	If Yes, Inches	No	Trace					
SQN-101-TOX	Comp	11/12/06-11/13/06	0805-0705	2 (2.5gal)	NA			X		061113.01	2 3/2.0	JL	1450	*
SQN-INT-TOX	Comp	11/12/06-11/13/06	0840-0740	1 (2.5 gal)	NA			X		061113.02	1.5	JL	1450	*

Sample Custody – Fill In From Top Down

* Custody seals intact. Samples received in good condition JL

Relinquished By (Signature):	Date/Time	Received By (Signature):	Date/Time
Chevy Williams	11/13/06 1025	Express Courier	11/13/06 1025
Express Courier	11/13/06	ETS	11/13/06
	11-13-06 1450		11-13-06 1450

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

Page 1 of

Client: TVA

Project Name: Sequoyah NP Toxicity

P.O. Number: N/A

Facility Sampled: Sequoyah NP

NPDES Number: TN0026450

Collected By: Chevy Williams, Roy Quinn

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): Express Courier

General Comments:

project # 2878

Field Identification / Sample Description	Grab/Comp	Collection Date/Time		Container Number & Volume Collected	Flow MGD	Rain Event? (Mark as Appropriate)				Laboratory Use				
		Date	Time			Yes	If Yes, Inches	No	Trace	ETS Log Number	Arrival Temp. (°C)	By	Time	A
SQN-101-TOX	Comp	11/14/06-11/15/06	0824-0724	2 (2.5gal)	NA	✓	~1.25"			06111513	4.5 / 5.0 C	JS	1425	*
SQN-INT-TOX	Comp	11/14/06-11/15/06	0843-0743	1 (2.5 gal)	NA	✓	~1.25"			06111514	2.4 C	JS	1425	*

Sample Custody – Fill In From Top Down

* Custody seals intact. Samples received in good condition.

Relinquished By (Signature):	Date/Time	Received By (Signature):	Date/Time
Chevy Williams	11/15/06 0954	Express Courier	11/15/06 9:55
Express Courier	11/15/06	ETS	11/15/06
	11-15-06 1425		11-15-06 1425

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 f 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. S 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: Chevy Williams, Roy Quinn

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): Express Courier

General Comments:

project # 2878

Field Identification / Sample Description	Grab/Comp.	Collection Date/Time		Container Number & Volume Collected	Flow MGD	Rain Event? (Mark as Appropriate)				Laboratory Use				
	----	Date	Time	----	----	Yes	If Yes, Inches	No	Trace	ETS Log Number	Arrival Temp. (°C)	By	Time	Appearance
SQN-101-TOX	Comp	11/16/06-11/17/06	0753-0653	2 (2.5gal)	NA			X		061117.09	3.3/3.7	JH	1405	*
SQN-INT-TOX	Comp	11/16/06-11/17/06	0814-0714	1 (2.5 gal)	NA			X		061117.10	0.7	JH	1405	*

Sample Custody – Fill In From Top Down

* Custody seals intact. Sample received in good condition JHunnicutt

Relinquished By (Signature):	Date/Time	Received By (Signature):	Date/Time
Chevy Williams	11/17/06 10:13	Express Courier	11/17/06 10:13
Express Courier	11/17/06	ETS	11/17/06
	2:05		11-17-06 1405

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
NPDES #: TN 0026450
Project #: 2878

County: Hamilton
Treatment: Non-treated
Outfall: 101

Dilution preparation information:						*Comments:*
Dilution prep (%)	11.3	22.6	45.2	72.6	100	
Effluent volume (mL)	282.5	~~339~~ 325	1130	1815	2500	
Diluent volume (mL)	2217.5	~~2161~~ 1035	1370	685	0	
Total volume (mL)	2500	2500	2500	2500	2500	

Test organism information:		*Test information:*	
Organism age:	22.5 TO 24.5 HOURS OLD	Randomizing template:	Yellow
Date and times organisms were born between:	11-13-06 1400 TO 1600	Incubator number:	3C
Organism source:	ABS BATCH Pp 11-13-06	*Artemia* lot number:	BS1204U
Transfer bowl information:	pH = 7.63 Temperature = 24.1 °C	Total drying time:	24.25 HOURS
		Date / Time in: 11-21-06	1350
Average transfer volume:	8.6 mL	Date / Time out: 11-22-06	1400
		Oven temperature:	60°C

Daily feeding and renewal information:

Day	Date	Morning feeding time	Afternoon feeding time	Test initiation, renewal, or termination time	Control water batch used MHSW	Sample numbers used	Analyst
0	11-14-06	~~1600~~	1600	1425	11-12-06A	061113.01 & 02	JH
1	11-15-06	1000	1605	1430	11-12-06B	061113.01 & 02	JH
2	11-16-06	1000	1600	1409	11-12-06B	061115.13 & 14	JH
3	11-17-06	1003	1611	1355	11-15-06A	061115.13 & 14	JH
4	11-18-06	1002	1605	1345	11-15-06A	061117.09 & 10	JH
5	11-19-06	0953	1600	1330	11-15-06B	061117.09 & 10	JH
6	11-20-06	0955	1602	1336	11-15-06B	061117.09 & 10	JH
7	11-21-06			1328			JH

Control information:		Acceptance criteria
% Mortality:	0%	≤ 20%
Average weight per initial larvae:	0.765	
Average weight per surviving larvae:	0.765	≥ 0.25 mg/larvae

Summary of test endpoints:	
7-day LC_{50}	>100%
NOEC *	<11.3%
LOEC *	11.3%
ChV *	<11.3%
IC_{25}	>100%

* INTERRUPTED DOSE RESPONSE. HYPOTHESIS TESTS ARE UNRELIABLE.

Species: *Pimephales promelas* Date: 11-14-06

Client: TVA / Sequoyah Nuclear Plant - Non-treated

Survival and Growth Data

Day	CONTROL				11.3%				22.6%			
	A	B	C	D	E	F	G	H	I	J	K	L
0	10	10	10	10	10	10	10	10	10	10	10	10
1	10	10	10	10	10	10	10	10	10	10	10	10
2	10	10	10	10	10	10	10	10	10	10	10	10
3	10	10	10	10	10	10	10	10	10	10	10	10
4	10	10	10	10	10	10	10	10	10	10	10	10
5	10	10	10	10	10	10	10	10	10	10	10	10
6	10	10	10	10	10	10	10	10	10	10	10	10
7	10 lg	10	10	10	10	10	10	10	10	10	10	10
A = Pan weight (mg) Color identification: LIGHT BLUE TRAY Analyst: LAB	14.25	14.47	14.22	14.99	13.78	13.97	14.98	14.45	15.00	12.98	13.46	14.88
B = Pan + Larvae weight (mg) Analyst: LAB	22.40	21.79	21.57	22.77	20.40	20.53	21.82	21.89	22.25	20.01	20.71	21.75
Larvae weight (mg) = A – B	8.15	7.32	7.35	7.78	6.62	6.56	6.84	7.44	7.25	7.03	7.25	6.87
Weight per initial number of larvae (mg) = C / Initial number of larvae	0.815	0.732	0.735	0.778	0.662	0.656	0.684	0.744	0.725	0.703	0.725	0.687
Average weight per initial number of larvae (mg)	0.765				0.687				0.710			
Percent reduction from control (%)					10.3%				7.2%			

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

Calculations and data reviewed:

Comments: * PATHOGENIC GROWTH WAS NOT OBSERVED ON THE MINNOWS IN THE EFFLUENT OR INTAKE TREATMENTS.

Species: *Pimephales promelas*

Client: TVA / Sequoyah Nuclear Plant - Non-treated Date: 11-14-06

Survival and Growth Data

Day	45.2%				72.6%				100%			
	M	N	O	P	Q	R	S	T	U	V	W	X
0	10	10	10	10	10	10	10	10	10	10	10	10
1	10	10	10	10	10	10	10	10	10	10	10	10
2	10	10	10	10	10	10	10	10	10	10	10	10
3	10	10	10	10	10	10	10	10	10	10	10	10
4	10	10	10	10	10	10	10	10	10	10	10	10
5	10	10	10	10	10	10	10	10	10	10	10	10
6	10	10	10	10	9 1d	10	10	10	10	10	10	10
7	10	10	10	10 ISM	9	10	10	10	10	10	ISM 10	10
A = Pan weight (mg) Color identification: LIGHT BLUE TRAY Analyst: LAB	15.37	14.72	13.76	14.75	13.48	14.21	14.12	13.80	14.12	13.69	14.02	13.42
B = Pan + Larvae weight (mg) Analyst: LAB	22.16	21.29	20.26	20.38	20.10	20.43	20.96	20.40	20.83	21.14	20.85	20.11
Larvae weight (mg) = A – B	6.79	6.57	6.50	5.63	6.62	6.22	6.84	6.60	6.71	7.45	6.83	6.69
Weight per initial number of larvae (mg) = C / Initial number of larvae	0.679	0.657	0.650	0.563	0.662	0.622	0.684	0.660	0.671	0.745	0.683	0.669
Average weight per initial number of larvae (mg)	0.637				0.657				0.692			
Percent reduction from control (%)			16.7%			14.1%				9.5%		

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

Calculations and data reviewed:

Comments:

Species: *Pimephales promelas*

Client: TVA / Sequoyah Nuclear Plant - Non-treated Date: 11-14-06

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	9id	10	10
4	10	9	10	10
5	10	9	10	10
6	10	9	10	10
7	ISM 10	9	10	10
A = Pan weight (mg) Color identification: LIGHT BLUE TRAY Analyst: LAB	13.55	16.04	13.38	13.75
B = Pan + Larvae weight (mg) Analyst: LAB	20.29	22.08	20.80	20.03
Larvae weight (mg) = A – B	6.74	6.04	7.42	6.28
Weight per initial number of larvae (mg) = C / Initial number of larvae	0.674	0.604	0.742	0.628

Average weight per initial number of larvae (mg)	Percent reduction from control (%)
0.662	13.57

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

Calculations and data reviewed: dl

Comments:

Non-treated
November 14-21, 2006

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

Project number: 2878

Reveiwed by:

							Not for Compliance Assessment, Internal Laboratory QC							
Concentration (%)	Replicate	Initial number of larvae	Final number of larvae	A = Pan weight (mg)	B = Pan + Larvae weight (mg)	Larvae weight (mg) = A - B	Weight / Surviving number of larvae (mg)	Mean weight / Surviving number of larvae (mg)	Coefficient of variation (Mean weight per surviving number of larvae) (%)	Weight / Initial number of larvae (mg)	Mean survival (%)	Mean weight / Initial number of larvae (mg)	Coefficient of variation (Mean weight per initial number of larvae) (%)	Percent reduc control (
Control	A	10	10	14.25	22.40	8.15	0.815	0.765	5.2	0.815	100.0	0.765	5.2	Not appli
	B	10	10	14.47	21.79	7.32	0.732			0.732				
	C	10	10	14.22	21.57	7.35	0.735			0.735				
	D	10	10	14.99	22.77	7.78	0.778			0.778				
11.3%	E	10	10	13.78	20.40	6.62	0.662	0.687	5.9	0.662	100.0	0.687	5.9	10.3
	F	10	10	13.97	20.53	6.56	0.656			0.656				
	G	10	10	14.98	21.82	6.84	0.684			0.684				
	H	10	10	14.45	21.89	7.44	0.744			0.744				
22.6%	I	10	10	15.00	22.25	7.25	0.725	0.710	2.6	0.725	100.0	0.710	2.6	7.2
	J	10	10	12.98	20.01	7.03	0.703			0.703				
	K	10	10	13.46	20.71	7.25	0.725			0.725				
	L	10	10	14.88	21.75	6.87	0.687			0.687				
45.2%	M	10	10	15.37	22.16	6.79	0.679	0.637	8.0	0.679	100.0	0.637	8.0	16.7
	N	10	10	14.72	21.29	6.57	0.657			0.657				
	O	10	10	13.76	20.26	6.50	0.650			0.650				
	P	10	10	14.75	20.38	5.63	0.563			0.563				
72.6%	Q	10	9	13.48	20.10	6.62	0.736	0.675	7.0	0.662	97.5	0.657	3.9	14.1
	R	10	10	14.21	20.43	6.22	0.622			0.622				
	S	10	10	14.12	20.96	6.84	0.684			0.684				
	T	10	10	13.80	20.40	6.60	0.660			0.660				
100%	U	10	10	14.12	20.83	6.71	0.671	0.692	5.2	0.671	100.0	0.692	5.2	9.5
	V	10	10	13.69	21.14	7.45	0.745			0.745				
	W	10	10	14.02	20.85	6.83	0.683			0.683				
	X	10	10	13.42	20.11	6.69	0.669			0.669				
100% Intake	Y	10	10	13.55	20.29	6.74	0.674	0.679	6.9	0.674	97.5	0.662	9.2	13.5
	Z	10	9	16.04	22.08	6.04	0.671			0.604				
	AA	10	10	13.38	20.80	7.42	0.742			0.742				
	BB	10	10	13.75	20.03	6.28	0.628			0.628				

Outfall 101:
Dunnett's MSD value: 0.0625
PMSD: 8.2

Intake:
Dunnett's MSD value: 0.0703
PMSD: 9.2

MSD = Minimum Significant Difference
PMSD = Percent Minimum Significant Difference

PMSD is a measure of test precision. The PMSD is the minimum percent difference between the control and treatment that can be declared statistically significant in a whole effluent toxicit
On average, a significant difference occurs for Environmental Testing Solutions, Inc. chronic toxicity tests when a toxicant reduces *Pimephales* growth by 15.0% from the control (determin
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

Non-treated

November 14-21, 2006

Statistical Analyses

Larval Fish Growth and Survival Test-7 Day Growth

Start Date:	11/14/2006	Test ID:	PpFRCR	Sample ID:	TVA / Sequoyah Nuclear Plant - Outfall 101
End Date:	11/21/2006	Lab ID:	ETS-Envir. Testing Sol	Sample Type:	DMR-Discharge Monitoring Report
Sample Date:		Protocol:	PWCHR-EPA-821-R-02-013	Test Species:	PP-Pimephales promelas
Comments:	Non-treated				

Conc-%	1	2	3	4
D-Control	0.8150	0.7320	0.7350	0.7780
11.3	0.6620	0.6560	0.6840	0.7440
22.6	0.7250	0.7030	0.7250	0.6870
45.2	0.5790	0.6570	0.6500	0.5630
72.6	0.6620	0.6220	0.6840	0.6600
100	0.6710	0.7450	0.6530	0.6690

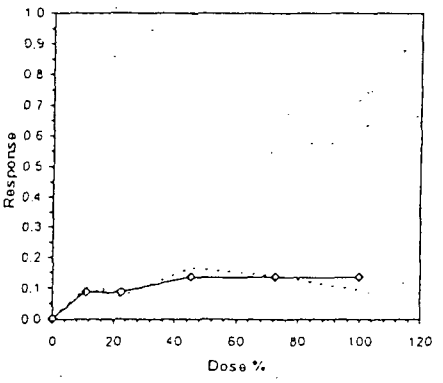
			Transform: Untransformed					1-Tailed			Isotonic	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.7650	1.0000	0.7650	0.7320	0.8150	5.151	4				0.7650	1.0000
*11.3	0.6865	0.8974	0.6865	0.6560	0.7440	5.853	4	3.029	2.410	0.0625	0.6983	0.9127
22.6	0.7100	0.9281	0.7100	0.6870	0.7250	2.607	4	2.122	2.410	0.0625	0.6983	0.9127
*45.2	0.6373	0.8330	0.6373	0.5630	0.6790	8.006	4	4.929	2.410	0.0625	0.6621	0.8655
*72.6	0.6570	0.8588	0.6570	0.6220	0.6840	3.918	4	4.167	2.410	0.0625	0.6621	0.8655
*100	0.6920	0.9046	0.6920	0.6690	0.7450	5.184	4	2.816	2.410	0.0625	0.6621	0.8655

Auxiliary Tests					Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)					0.966335654		0.884		-0.02448168	-0.12457175
Bartlett's Test indicates equal variances (p = 0.70)					2.993674994		15.08627224			
Hypothesis Test (1-tail, 0.05)		NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test		<11.3	11.3			0.062466272	0.081635257	0.007922242	0.001343653	0.002135572	5, 18
Treatments vs D-Control											

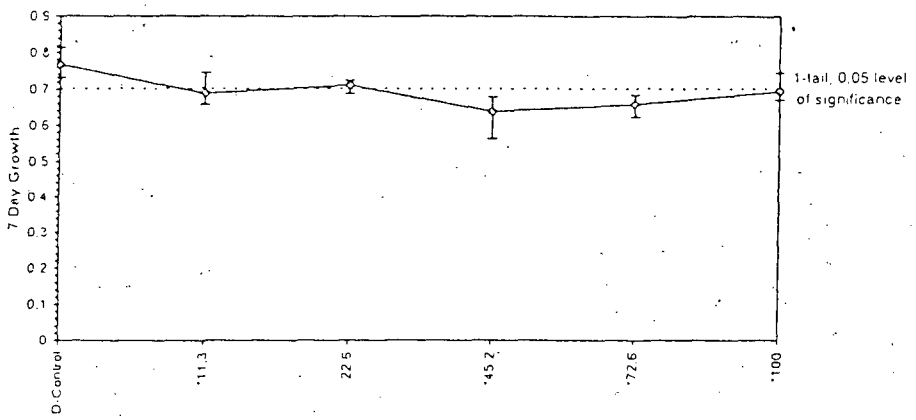
Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)		Skew
IC05*	6.475	6.109	3.285	39.169	2.0965
IC10	28.693				
IC15	>100				
IC20	>100				
IC25	>100				
IC40	>100				
IC50	>100				

* indicates IC estimate less than the lowest concentration



Dose-Response Plot



sqn_11-14-06data

Non-treated

November 14-21, 2006

Statistical Analyses

Larval Fish Growth and Survival Test-7 Day Growth

Start Date:	11/14/2006	Test ID:	PpFRCR	Sample ID:	TVA / Sequoyah Nuclear Plant - Intake
End Date:	11/21/2006	Lab ID:	ETS-Envir Testing Sol	Sample Type:	DMR-Discharge Monitoring Report
Sample Date:		Protocol:	FWCHR-EPA-821-R-02-013	Test Species:	PP-Pimephales promelas
Comments:	Non-treated				

Conc-%	1	2	3	4
D-Control	0.8150	0.7320	0.7350	0.7780
100	0.6740	0.6040	0.7420	0.6280

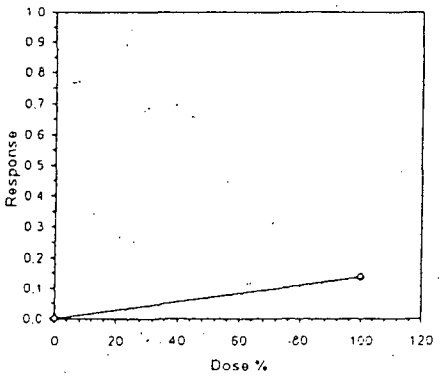
			Transform: Untransformed					1-Tailed			Isotonic	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.7650	1.0000	0.7650	0.7320	0.8150	5.151	4				0.7650	1.0000
100	0.6620	0.8654	0.6620	0.6040	0.7420	9.174	4	2.846	1.943	0.0703	0.6620	0.8654

Auxiliary Tests	Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.923090458		0.749		0.614814118	-0.69233823
F-Test indicates equal variances (p = 0.50)	2.375268459		47.46722794			
Hypothesis Test (1-tail, 0.05)	**MSDu**	**MSDp**	**MSB**	**MSE**	**F-Prob**	**df**
Homoscedastic t Test indicates significant differences	0.070335791	0.091942211	0.021218	0.002620333	0.029350473	1, 6
Treatments vs D-Control						

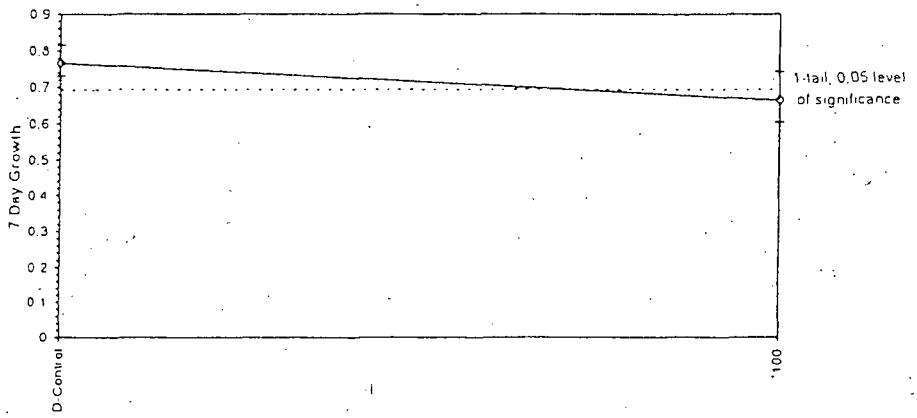
Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)	Skew
IC05*	37.136			
IC10*	74.272			
IC15	>100			
IC20	>100			
IC25	>100			
IC40	>100			
IC50	>100			

* indicates IC estimate less than the lowest concentration



Dose-Response Plot



Non-treated

November 14-21, 2006

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

Species: *Pimephales promelas*

Daily Chemical Analyses

Project number: 2878

Reviewed by:

Concentration	Parameter	Day 0		Day 1		Day 2		Day 3		Day 4		Day 5		Day 6	
		Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Fi
Control	pH (SU)	7.67	7.58	7.81	7.45	7.52	7.08	7.55	7.08	7.77	7.26	7.81	7.43	7.81	
	DO (mg/L)	8.1	7.9	8.2	7.7	7.8	7.0	7.7	7.3	7.7	7.9	7.8	7.4	8.0	
	Conductivity (µmhos/cm)	314		320		308		315		316		309		312	
	Alkalinity (mg/L $CaCO_3$)	59		57				59				60			
	Hardness (mg/L $CaCO_3$)	93		93				91				93			
	Temperature (°C)	24.6	24.5	24.7	24.2	24.7	24.4	24.7	24.4	24.8	24.5	24.8	24.4	24.6	
11.3%	pH (SU)	7.65	7.53	7.77	7.44	7.53	7.06	7.38	7.09	7.26	7.18	7.48	7.43	7.76	
	DO (mg/L)	8.0	7.9	8.1	7.6	7.9	6.7	7.9	7.2	7.9	6.8	7.9	7.4	8.0	
	Conductivity (µmhos/cm)	299		295		306		289		293		291		292	
	Temperature (°C)	24.6	24.2	24.7	24.2	24.7	24.7	24.8	24.8	24.8	24.4	24.8	24.2	24.7	
22.6%	pH (SU)	7.66	7.53	7.76	7.41	7.54	7.01	7.38	7.05	7.27	7.18	7.48	7.44	7.77	
	DO (mg/L)	8.0	7.9	8.1	7.6	8.0	6.6	8.0	7.2	7.9	6.5	7.9	7.4	8.1	
	Conductivity (µmhos/cm)	285		286		296		273		278		278		278	
	Temperature (°C)	24.7	24.1	24.8	24.2	24.7	24.5	24.8	24.6	24.9	24.4	24.8	24.1	24.8	
45.2%	pH (SU)	7.66	7.56	7.74	7.40	7.53	7.04	7.36	7.09	7.26	7.19	7.47	7.44	7.75	
	DO (mg/L)	8.0	7.9	8.1	7.5	8.1	6.7	8.0	7.2	7.9	6.5	8.0	7.3	8.1	
	Conductivity (µmhos/cm)	257		258		265		246		251		252		250	
	Temperature (°C)	24.7	24.2	24.8	24.3	24.9	24.5	24.8	24.5	24.9	24.4	24.8	24.3	24.8	
72.6%	pH (SU)	7.65	7.56	7.73	7.40	7.52	7.08	7.34	7.12	7.24	7.18	7.45	7.42	7.73	
	DO (mg/L)	8.1	8.0	8.1	7.5	8.0	6.9	8.0	7.3	8.0	6.7	8.1	7.4	8.2	
	Conductivity (µmhos/cm)	222		223		231		211		217		213		217	
	Temperature (°C)	24.9	24.2	24.8	24.1	24.9	24.5	24.8	24.8	24.9	24.3	24.8	24.2	24.8	
100%	pH (SU)	7.64	7.54	7.71	7.42	7.51	7.06	7.33	7.07	7.22	7.18	7.43	7.46	7.70	
	DO (mg/L)	8.0	8.0	8.2	7.5	7.9	6.8	8.2	7.3	8.2	6.6	8.2	7.2	8.3	
	Conductivity (µmhos/cm)	188		186		198		178		182		182		184	
	Alkalinity (mg/L $CaCO_3$)	66				65				67					
	Hardness (mg/L $CaCO_3$)	77				79				81					
	Total Residual Chlorine (mg/L)	<0.10				<0.10				<0.10					
	Temperature (°C)	25.1	24.4	24.8	24.3	25.0	24.5	25.0	24.6	25.1	24.4	24.9	24.2	24.8	
100% Intake	pH (SU)	7.65	7.55	7.71	7.41	7.51	7.09	7.30	7.10	7.20	7.17	7.41	7.43	7.69	
	DO (mg/L)	8.0	8.0	8.3	7.5	7.8	7.1	8.3	7.5	8.2	6.6	8.2	7.3	8.4	
	Conductivity (µmhos/cm)	184		186		198		180		182		179		183	
	Alkalinity (mg/L $CaCO_3$)	64				66				66					
	Hardness (mg/L $CaCO_3$)	79				77				77					
	Total Residual Chlorine (mg/L)	<0.10				<0.10				<0.10					
	Temperature (°C)	24.9	24.1	24.8	24.3	24.8	24.6	24.9	24.6	24.8	24.3	24.7	24.3	24.7	

Species: *Pimephales promelas* Date: 11-14-06

Client: TVA / Sequoyah Nuclear Plant – Non-treated

Daily Chemistry:

		Day					
		0		1		2	
	Analyst	MER	MER	MER	MER	MER	MER
Concentration	Parameter						
CONTROL	pH (S.U.)	7.67	7.58	7.81	7.45	7.52	7.08
	DO (mg/L)	8.1	7.9	8.2	7.7	7.8	7.0
	Conductivity (µmhos/cm)	314		320		308	
	Alkalinity (mg $CaCO_3$/L)	59		57			
	Hardness (mg $CaCO_3$/L)	93		93			
	Temperature (°C)	24.6	24.5	24.7	24.2	24.7	24.4
11.3%	pH (S.U.)	7.65	7.53	7.79	7.44	7.53	7.06
	DO (mg/L)	8.0	7.9	8.1	7.6	7.9	6.7
	Conductivity (µmhos/cm)	299		295		306	
	Temperature (°C)	24.6	24.2	24.7	24.2	24.7	24.7
22.6%	pH (S.U.)	7.66	7.53	7.76	7.41	7.54	7.01
	DO (mg/L)	8.0	7.9	8.1	7.6	8.0	6.6
	Conductivity (µmhos/cm)	285		290		296	
	Temperature (°C)	24.7	24.1	24.8	24.2	24.7	24.5
45.2%	pH (S.U.)	7.66	7.52	7.74	7.40	7.53	7.04
	DO (mg/L)	8.0	7.9	8.1	7.5	8.1	6.7
	Conductivity (µmhos/cm)	257		258		265	
	Temperature (°C)	24.7	24.2	24.8	24.3	24.9	24.5
72.6%	pH (S.U.)	7.65	7.52	7.73	7.40	7.52	7.08
	DO (mg/L)	8.1	8.0	8.1	7.5	8.0	6.9
	Conductivity (µmhos/cm)	222		223		231	
	Temperature (°C)	24.9	24.2	24.8	24.1	24.9	24.5
100%	pH (S.U.)	7.64	7.54	7.71	7.42	7.51	7.06
	DO (mg/L)	8.0	8.0	8.2	7.5	7.9	6.8
	Conductivity (µmhos/cm)	188		186		198	
	Alkalinity (mg $CaCO_3$/L)	66				65	
	Hardness (mg $CaCO_3$/L)	77				79	
	TR chlorine (mg/L)	<0.10				<0.10	
	Temperature (°C)	25.1	24.4	24.8	24.3	25.0	24.5
100% Intake	pH (S.U.)	7.65	7.55	7.71	7.41	7.51	7.09
	DO (mg/L)	8.0	8.0	8.3	7.5	7.8	7.1
	Conductivity (µmhos/cm)	184		186		198	
	Alkalinity (mg $CaCO_3$/L)	64				66	
	Hardness (mg $CaCO_3$/L)	79				77	
	TR chlorine (mg/L)	<0.10				<0.10	
	Temperature (°C)	24.9	24.1	24.8	24.3	24.8	24.6
		Initial	Final	Initial	Final	Initial	Final

Species: *Pimephales promelas* Date: 11-14-06

Client: TVA / Sequoyah Nuclear Plant – Non-treated

		Day							
		3		4		5		6	
	Analyst	MER	MER	MER	MER	KER	KER	MER	MER
Concentration	Parameter								
CONTROL	pH (S.U.)	7.55	7.08	7.77	7.26	7.81	7.43	7.81	7.16
	DO (mg/L)	7.7	7.3	7.7	7.9	7.8	7.4	8.0	7.2
	Conductivity (µmhos/cm)	315		316		309		312	
	Alkalinity (mg $CaCO_3$/L)	59				60			
	Hardness (mg $CaCO_3$/L)	91				93			
	Temperature (°C)	24.7	24.4	24.8	24.5	24.8	24.4	24.6	24.6
11.3%	pH (S.U.)	7.38	7.09	7.26	7.18	7.48	7.43	7.76	7.13
	DO (mg/L)	7.9	7.2	7.9	6.8	7.9	7.4	8.0	7.3
	Conductivity (µmhos/cm)	289		293		291		292	
	Temperature (°C)	24.8	24.8	24.8	24.4	24.8	24.2	24.7	24.4
22.6%	pH (S.U.)	7.38	7.05	7.27	7.18	7.48	7.44	7.77	7.13
	DO (mg/L)	8.0	7.2	7.9	6.5	7.9	7.4	8.1	7.3
	Conductivity (µmhos/cm)	273		278		278		278	
	Temperature (°C)	24.8	24.6	24.9	24.4	24.8	24.1	24.8	24.4
45.2%	pH (S.U.)	7.36	7.09	7.26	7.19	7.47	7.44	7.75	7.14
	DO (mg/L)	8.0	7.2	7.9	6.5	8.0	7.3	8.1	7.4
	Conductivity (µmhos/cm)	246		251		252		250	
	Temperature (°C)	24.8	24.5	24.9	24.4	24.8	24.3	24.8	24.3
72.6%	pH (S.U.)	7.34	7.12	7.24	7.18	7.45	7.42	7.73	7.08
	DO (mg/L)	8.0	7.3	8.0	6.7	8.1	7.4	8.2	7.3
	Conductivity (µmhos/cm)	211		217		213		217	
	Temperature (°C)	24.8	24.8	24.9	24.3	24.8	24.2	24.8	24.6
100%	pH (S.U.)	7.33	7.07	7.22	7.18	7.43	7.46	7.90	7.13
	DO (mg/L)	8.2	7.3	8.2	6.6	8.2	7.2	8.3	7.2
	Conductivity (µmhos/cm)	178		182		182		184	
	Alkalinity (mg $CaCO_3$/L)			67					
	Hardness (mg $CaCO_3$/L)			81					
	TR Chlorine (mg/L)			<0.10					
	Temperature (°C)	25.0	24.6	25.1	24.4	24.9	24.2	24.8	24.7
100% Intake	pH (S.U.)	7.30	7.10	7.20	7.17	7.41	7.43	~~7.78~~ 7.9	7.12
	DO (mg/L)	8.3	7.5	8.2	6.6	8.2	7.3	8.4	7.5
	Conductivity (µmhos/cm)	180		182		179		183	
	Alkalinity (mg $CaCO_3$/L)			66					
	Hardness (mg $CaCO_3$/L)			77					
	TR chlorine (mg/L)			<0.10					
	Temperature (°C)	24.9	24.6	24.8	24.3	24.7	24.3	24.7	24.4
		Initial	Final	Initial	Final	Initial	Final	Initial	Final

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

Client: TVA
Facility: Sequoyah Nuclear Plant
NPDES #: TN 0026450
Project #: 2878

County: Hamilton
Treatment: Non-treated
Outfall: 101

Dilution preparation information:						*Comments:*
Dilution prep (%)	11.3	22.6	45.2	72.6	100	
Effluent volume (mL)	282.5	~~325~~ 335	1130	1815	2500	
Diluent volume (mL)	2217.5	~~2175~~ 2165	1370	685	0	
Total volume (mL)	2500	2500	2500	2500	2500	

Test organism information:		*Test information:*	
Organism age:	< 24-HOURS OLD	Randomizing template:	GREEN + PINK
Date and times organisms were born between:	11-13-06 1523 TO 2006	Incubator number and shelf location:	2B1N2
Organism Source Culture board: 11-07-06 B	Cups: 28, 29, 30, 31, 33 34, 36, 42, 43, 44	YCT batch:	10-07-06
Transfer bowl information:	pH = 7.72 Temperature = 24.9	*Selenastrum* batch:	11-13-06

Daily renewal information:

Day	Date	Test initiation, renewal, or termination time	Control water batch used	Sample numbers used	Analyst
0	11-14-06	1218	11-12-06A	061113.01 & 02	dl
1	11-15-06	1135	11-12-06A & B	061113.01 & 02	dl
2	11-16-06	1130	11-12-06B	061115.13 & 14	dl
3	11-17-06	1213	11-15-06A	061115.13 & 14	dl
4	11-18-06	1134	11-15-06A	061117.09 & 10	dl
5	11-19-06	1129	11-15-06B	061117.09 & 10	dl
6	11-20-06	1122	11-15-06B	061117.09 & 10	dl
7	11-21-06	1132	[redacted]		dl

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:	28.9	29.1	≥ 15.0 offspring/female	ChV	>100%
% CV:	6.2%	6.2%	< 40.0 %	IC25	>100%

Species: *Ceriodaphnia dubia*
Client: Sequoyah Nuclear Plant - Non-treated Date: 11-14-06

CONTROL - 1 *Survival and Reproduction Data*

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

Note: Adult mortality (L = live, D = dead)

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	28.9

CONC: 11.3% *Survival and Reproduction Data*

Day		Replicate number									
		1	2	3	4	5	6	7	8	9	10
1	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
2	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
3	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
4	Young produced	4	4	5	5	4	5	4	4	4	5
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	10	11	10	12	10	10	11	12	11	11
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	14	14	16	14	17	18	16	13	15	18
Total young produced		28	29	31	31	31	33	31	29	30	34
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Note: Adult mortality (L = live, D = dead)

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	30.7
% Reduction from Control:	-6.2%

Species: *Ceriodaphnia dubia*
Client: Sequoyah Nuclear Plant - Non-treated Date: 11-14-06

CONC: 22.6% *Survival and Reproduction Data*

Day		Replicate number									
		1	2	3	4	5	6	7	8	9	10
1	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
2	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
3	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
4	Young produced	4	4	5	3	4	5	5	5	4	4
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	13	13	10	11	11	10	11	13	12	10
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	*3	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	13	17	17	14	16	16	19	18	19	16
Total young produced		33	34	32	28	31	31	35	36	35	30
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Note: Adult mortality (L = live, D = dead)
*SPLIT BROOD

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	32.5
% Reduction from Control:	-12.5%

CONC: 45.2% *Survival and Reproduction Data*

Day		Replicate number									
		1	2	3	4	5	6	7	8	9	10
1	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
2	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
3	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
4	Young produced	4	4	5	5	5	4	5	4	4	4
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	14	11	11	11	10	12	12	13	10	11
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	*2	0	0	15	0	0	0	0	16	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	18	18	17	0	19	16	17	14	0	19
Total young produced		38	33	33	31	34	32	34	31	30	34
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Note: Adult mortality (L = live, D = dead)
*SPLIT BROOD

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	33.0
% Reduction from Control:	-14.2%

Species: *Ceriodaphnia dubia*

Client: Sequoyah Nuclear Plant - Non-treated Date: 11-14-06

CONC: 72.6% *Survival and Reproduction Data*

Day		Replicate number									
		1	2	3	4	5	6	7	8	9	10
1	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
2	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
3	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
4	Young produced	4	4	5	4	5	5	5	5	4	6
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	11	14	10	14	11	11	15	10	12	13
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	16	0	16	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	0	19	0	18	18	16	15	18	19	15
Total young produced		31	37	31	36	34	32	35	33	35	34
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Note: Adult mortality (L = live, D = dead)

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	33.8
% Reduction from Control:	-17.0%

CONC: 100% *Survival and Reproduction Data*

Day		Replicate number									
		1	2	3	4	5	6	7	8	9	10
1	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
2	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
3	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
4	Young produced	4	5	4	6	5	5	4	5	5	5
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	12	13	11	12	10	14	11	14	14	12
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	16	0	18	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	0	15	0	18	18	17	19	14	19	17
Total young produced		32	33	33	36	33	36	38 (34)	33	38	34
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Note: Adult mortality (L = live, D = dead)

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	34.2
% Reduction from Control:	-18.3%

Species: *Ceriodaphnia dubia*

Client: Sequoyah Nuclear Plant - Non-treated Date: 11-14-06

CONTROL - 2 *Survival and Reproduction Data*

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

Note: Adult mortality (L = live, D = dead)

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	29.1

CONC: 100% Intake *Survival and Reproduction Data*

Day		Replicate number									
		1	2	3	4	5	6	7	8	9	10
1	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
2	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
3	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
4	Young produced	4	4	5	5	5	4	4	4	5	4
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	15	11	11	11	10	14	12	13	10	12
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	0	0	0	0	0	0	17	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	19	15	18	18	16	15	0	19	18	18
Total young produced		38	30	34	34	31	33	33	36	33	34
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Note: Adult mortality (L = live, D = dead)

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	33.6
% Reduction from Control:	-15.5%

TVA / Sequoyah Nuclear Plant, Outfall 101
Non-treated
November 14-21, 2006

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	4	4	5	4	4	4	4	4	4	4	41
5	10	10	9	10	9	9	11	10	13	11	102
6	0	0	0	0	0	0	0	0	0	0	0
7	15	13	13	16	14	17	15	13	15	15	146
Total	29	27	27	30	27	30	30	27	32	30	289

11.3%

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	5	4	5	4	4	4	5	44
5	10	11	10	12	10	10	11	12	11	11	108
6	0	0	0	0	0	0	0	0	0	0	0
7	14	14	16	14	17	18	16	13	15	18	155
Total	28	29	31	31	31	33	31	29	30	34	307

22.6%

Day	Replicate number										Total
	1	2	3	4	5	6	7	8	9	10	
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0
4	4	4	5	3	4	5	5	5	4	4	43
5	13	13	10	11	11	10	11	13	12	10	114
6	3	0	0	0	0	0	0	0	0	0	3
7	13	17	17	14	16	16	19	18	19	16	165
Total	33	34	32	28	31	31	35	36	35	30	325

45.2%

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	4	4	5	5	5	4	5	4	4	4	44
5	14	11	11	11	10	12	12	13	10	11	115
6	2	0	0	15	0	0	0	0	16	0	33
7	18	18	17	0	19	16	17	14	0	19	138
Total	38	33	33	31	34	32	34	31	30	34	330

72.6%

Day	Replicate number										Total
	1	2	3	4	5	6	7	8	9	10	
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0
4	4	4	5	4	5	5	5	5	4	6	47
5	11	14	10	14	11	11	15	10	12	13	121
6	16	0	16	0	0	0	0	0	0	0	32
7	0	19	0	18	18	16	15	18	19	15	138
Total	31	37	31	36	34	32	35	33	35	34	338

100%

Day	Replicate number										Total
	1	2	3	4	5	6	7	8	9	10	
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0
4	4	5	4	6	5	5	4	5	5	5	48
5	12	13	11	12	10	14	11	14	14	12	123
6	16	0	18	0	0	0	0	0	0	0	34
7	0	15	0	18	18	17	19	14	19	17	137
Total	32	33	33	36	33	36	34	33	38	34	342

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	4	4	4	4	5	4	4	3	4	4	40
5	10	9	9	9	11	10	10	11	10	12	101
6	0	0	0	0	0	0	0	0	0	0	0
7	15	13	17	16	14	15	14	17	13	16	150
Total	29	26	30	29	30	29	28	31	27	32	291

100% Intake

Day	Replicate number										Total
	1	2	3	4	5	6	7	8	9	10	
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0
4	4	4	5	5	5	4	4	4	5	4	44
5	15	11	11	11	10	14	12	13	10	12	119
6	0	0	0	0	0	0	17	0	0	0	17
7	19	15	18	18	16	15	0	19	18	18	156
Total	38	30	34	34	31	33	33	36	33	34	336

TVA / Sequoyah Nuclear Plant, Outfall 101
Non-treated
November 14-21, 2006

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

Project number: 2878

Reveiwed by: Jumse

Concentration (%)	Replicate number										Survival (%)	Average reproduction (offspring/female)	Coefficient of variation (%)	Percent reduction f pooled controls (
	1	2	3	4	5	6	7	8	9	10				
Control - 1	29	27	27	30	27	30	30	27	32	30	100	28.9	6.2	Not applicabl
11.3%	28	29	31	31	31	33	31	29	30	34	100	30.7	6.0	-6.2
22.6%	33	34	32	28	31	31	35	36	35	30	100	32.5	7.8	-12.5
45.2%	38	33	33	31	34	32	34	31	30	34	100	33.0	6.9	-14.2
72.6%	31	37	31	36	34	32	35	33	35	34	100	33.8	6.0	-17.0
100%	32	33	33	36	33	36	34	33	38	34	100	34.2	5.5	-18.3
Control - 2	29	26	30	29	30	29	28	31	27	32	100	29.1	6.2	Not applicab
100% Intake	38	30	34	34	31	33	33	36	33	34	100	33.6	6.8	-15.5

Outfall 101:
Dunnett's MSD value: 2.123
PMSD: 7.3

Intake:
Dunnett's MSD value: 1.586
PMSD: 5.5

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 w a toxicant reduces *Ceriodaphnia* reproduction by 9.6% from the control.

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

Upper PMSD bound determined by USEPA (90^{th} 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.

TVA / Sequoyah Nuclear Plant, Outfall 101
Non-treated
November 14-21, 2006

Statistical Analyses

Ceriodaphnia Survival and Reproduction Test-Reproduction

Start Date	11/14/2006	Test ID	CoFRCR	Sample ID	TVA / Sequoyah Nuclear Plant - Outfall 101
End Date	11/21/2006	Lab ID	ETS-Envir Testing Sol	Sample Type	DMR-Discharge Monitoring Report
Sample Date		Protocol	FWCHR-EPA-821-R-02-013	Test Species	CD-Ceriodaphnia dubia
Comments	Non-treated				

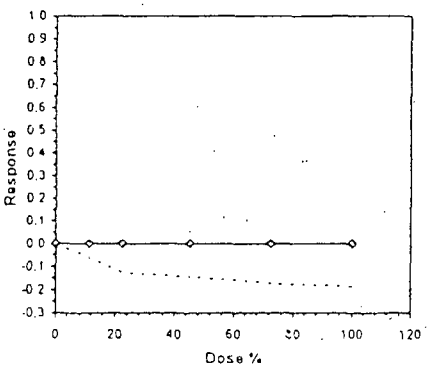
Conc-%	1	2	3	4	5	6	7	8	9	10
D-Control	29.000	27.000	27.000	30.000	27.000	30.000	30.000	27.000	32.000	30.000
11.3	28.000	29.000	31.000	31.000	31.000	33.000	31.000	29.000	30.000	34.000
22.6	33.000	34.000	32.000	28.000	31.000	31.000	35.000	36.000	35.000	30.000
45.2	38.050	33.000	33.000	31.000	34.000	32.000	34.000	31.000	30.000	34.000
72.6	31.000	37.000	31.000	36.000	34.000	32.000	35.000	33.000	35.000	34.000
100	32.000	33.000	33.000	36.000	33.000	36.000	34.000	33.000	38.000	34.000

			Transform: Untransformed					1-Tailed			Isotonic	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	28.900	1.0000	28.900	27.000	32.000	6.201	10				32.183	1.0000
11.3	30.700	1.0623	30.700	28.000	34.000	5.957	10	-1.939	2.287	2.123	32.183	1.0000
22.6	32.500	1.1246	32.500	28.000	36.000	7.845	10	-3.878	2.287	2.123	32.183	1.0000
45.2	33.000	1.1419	33.000	30.000	38.000	6.851	10	-4.416	2.287	2.123	32.183	1.0000
72.6	33.800	1.1696	33.800	31.000	37.000	6.047	10	-5.278	2.287	2.123	32.183	1.0000
100	34.200	1.1834	34.200	32.000	38.000	5.479	10	-5.709	2.287	2.123	32.183	1.0000

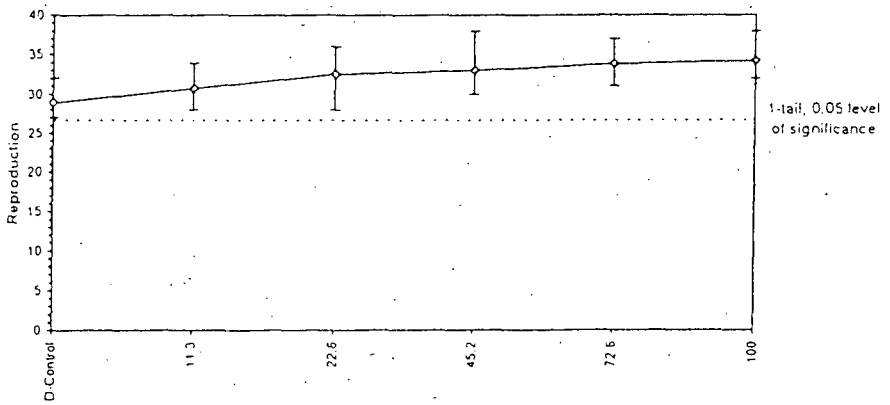
Auxiliary Tests					Statistic		Critical		Skew	Kurt
Kolmogorov D Test indicates normal distribution (p > 0.01)					0.736118853		1.035		0.267812653	-0.34924831
Bartlett's Test indicates equal variances (p = 0.88)					1.74052		15.08627224			
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	100	>100		1	2.122849295	0.073454993	40.85666667	4.309259259	1.6E-06	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



TVA / Sequoyah Nuclear Plant, Intake
Non-treated
November 14-21, 2006

Statistical Analyses

Ceriodaphnia Survival and Reproduction Test-Reproduction

Start Date:	11/14/2006	Test ID	CdFRCR	Sample ID	TVA / Sequoyah Nuclear Plant - Intake
End Date:	11/21/2006	Lab ID:	ETS-Envir Testing Sol	Sample Type	DMR Discharge Monitoring Report
Sample Date		Protocol	FWCHR-EPA-821-R-02-013	Test Species	CD-Ceriodaphnia dubia
Comments:	Non-treated				

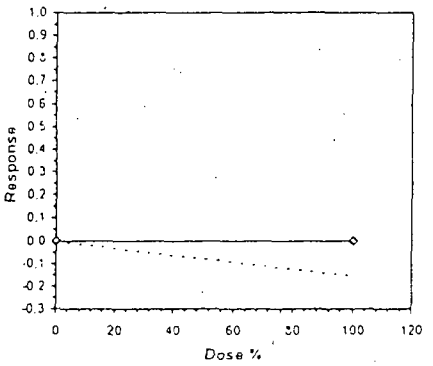
Conc-%	1	2	3	4	5	6	7	8	9	10
D-Control	29.000	26.000	30.000	29.000	30.000	29.000	28.000	31.000	27.000	32.000
100	38.000	30.000	34.000	34.000	31.000	33.000	33.000	36.000	33.000	34.000

			Transform: Untransformed					1-Tailed			Isotonic	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	29.100	1.0000	29.100	26.000	32.000	6.158	10				31.350	1.0000
100	33.600	1.1546	33.600	30.000	38.000	6.758	10	-4.920	1.734	1.586	31.350	1.0000

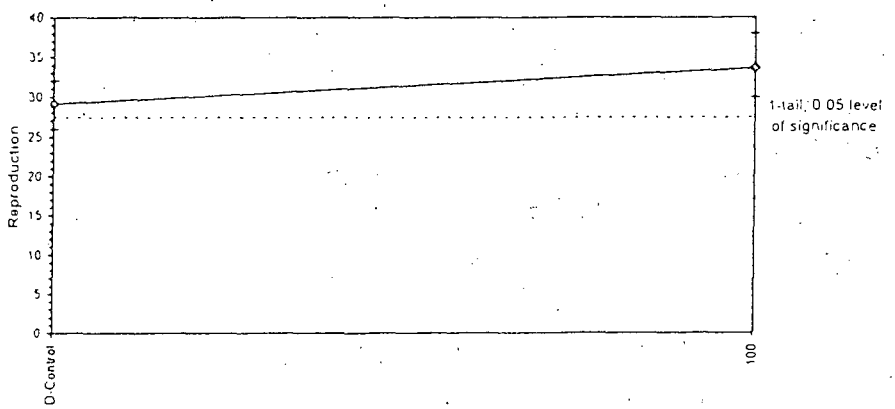
Auxiliary Tests	Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.973339081		0.868		0.197458597	0.234273437
F-Test indicates equal variances (p = 0.49)	1.605536342		6.541089535			
Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates no significant differences	1.586139066	0.054506497	101.25	4.183333333	1.1E-04	1, 18
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



TVA / Sequoyah Nuclear Plant, Outfall 101

Non-treated

November 14-21, 2006

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

Species: *Ceriodaphnia dubia*

Daily Chemical Analyses

Project number: 2878

Reviewed by:

Concentration	Parameter	Day 0		Day 1		Day 2		Day 3		Day 4		Day 5		Day 6	
		Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Fina
Control	pH (SU)	7.67	7.71	7.81	7.48	7.52	7.34	7.55	7.27	7.77	7.51	7.81	7.67	7.81	7
	DO (mg/L)	8.1	8.3	8.2	7.7	7.8	7.6	7.7	8.2	7.7	7.9	7.8	7.9	8.0	
	Conductivity (µmhos/cm)	314		320		308		315		316		309		312	
	Alkalinity (mg/L $CaCO_3$)	59		57				59				60			
	Hardness (mg/L $CaCO_3$)	93		93				91				93			
	Temperature (°C)	24.7	25.1	24.9	24.6	24.6	25.2	24.8	24.9	24.7	25.1	24.8	24.9	24.6	2
11.3%	pH (SU)	7.65	7.69	7.77	7.46	7.53	7.34	7.38	7.27	7.26	7.51	7.48	7.67	7.76	7
	DO (mg/L)	8.0	8.3	8.0	7.7	7.9	7.6	7.9	8.0	7.9	7.8	7.9	7.8	8.0	
	Conductivity (µmhos/cm)	299		295		306		289		293		291		292	
	Temperature (°C)	24.7	24.8	24.8	24.8	24.7	24.8	24.9	24.9	24.7	24.9	24.8	24.7	24.7	2
22.6%	pH (SU)	7.66	7.67	7.76	7.48	7.54	7.35	7.38	7.27	7.27	7.52	7.48	7.68	7.77	7
	DO (mg/L)	8.0	8.3	8.1	7.7	8.0	7.6	8.0	7.8	7.9	7.7	7.9	7.8	8.1	
	Conductivity (µmhos/cm)	285		286		296		273		278		278		278	
	Temperature (°C)	24.7	24.8	24.8	24.6	24.7	24.7	24.9	24.8	24.9	25.3	24.9	25.1	24.7	2
45.2%	pH (SU)	7.66	7.67	7.74	7.48	7.53	7.35	7.36	7.28	7.26	7.51	7.47	7.68	7.75	7
	DO (mg/L)	8.0	8.3	8.1	7.8	8.1	7.6	8.0	7.7	7.9	7.8	8.0	8.0	8.1	
	Conductivity (µmhos/cm)	257		258		265		246		251		252		250	
	Temperature (°C)	24.8	24.9	24.8	24.9	24.7	25.1	24.9	24.9	25.0	25.0	24.9	25.2	24.8	2
72.6%	pH (SU)	7.65	7.66	7.73	7.47	7.52	7.38	7.34	7.31	7.24	7.50	7.45	7.69	7.73	7
	DO (mg/L)	8.1	8.3	8.1	7.8	8.0	7.6	8.0	7.8	8.0	7.9	8.1	7.9	8.2	
	Conductivity (µmhos/cm)	222		223		231		211		217		213		217	
	Temperature (°C)	24.8	24.8	24.8	24.8	24.8	25.1	25.0	24.9	25.2	25.0	25.0	25.1	24.8	2
100%	pH (SU)	7.64	7.67	7.71	7.47	7.51	7.39	7.33	7.30	7.22	7.50	7.43	7.70	7.70	7
	DO (mg/L)	8.0	8.3	8.2	7.8	7.9	7.7	8.2	7.8	8.2	7.9	8.2	7.9	8.3	
	Conductivity (µmhos/cm)	188		186		198		178		182		182		184	
	Alkalinity (mg/L $CaCO_3$)	66				65				67					
	Hardness (mg/L $CaCO_3$)	77				79				81					
	Total Residual Chlorine (mg/L)	<0.10				<0.10				<0.10					
	Temperature (°C)	25.2	25.0	24.7	24.8	24.9	24.9	25.2	24.7	25.3	25.1	25.0	24.7	24.8	
100% Intake	pH (SU)	7.65	7.67	7.71	7.48	7.51	7.36	7.30	7.29	7.20	7.47	7.41	7.70	7.69	
	DO (mg/L)	8.0	8.3	8.3	7.7	7.8	7.9	8.3	7.8	8.2	8.0	8.2	8.1	8.4	
	Conductivity (µmhos/cm)	184		186		198		180		182		179		183	
	Alkalinity (mg/L $CaCO_3$)	64				66				66					
	Hardness (mg/L $CaCO_3$)	79				77				77					
	Total Residual Chlorine (mg/L)	<0.10				<0.10				<0.10					
	Temperature (°C)	25.0	24.8	24.8	24.9	24.8	24.9	25.1	24.9	24.9	25.1	24.9	24.9	24.8	

Species: *Ceriodaphnia dubia* Date: 11-14-06

Client: Sequoyah Nuclear Plant - Non-treated

Daily Chemistry:

		Day					
		0		1		2	
	Analyst	KEK	KEK	KEK	KEK	KEK	KEK
Concentration	Parameter						
CONTROL	pH (S.U.)	7.67	7.71	7.81	7.48	7.52	7.34
	DO (mg/L)	8.1	8.3	8.2	7.7	7.8	7.6
	Conductivity (µmhos/cm)	314		320		308	
	Alkalinity (mg $CaCO_3$/L)	59		(57)			
	Hardness (mg $CaCO_3$/L)	93		(93)			
	Temperature (°C)	24.7	25.1	24.9	24.6	24.6	25.2
11.3%	pH (S.U.)	7.65	7.69	7.77	7.46	7.53	7.34
	DO (mg/L)	8.0	8.3	8.0	7.7	7.9	7.6
	Conductivity (µmhos/cm)	299		295		300	
	Temperature (°C)	24.7	24.8	24.8	24.8	24.7	24.8
22.6%	pH (S.U.)	7.66	7.67	7.76	7.48	7.54	7.35
	DO (mg/L)	8.0	8.3	8.1	7.7	8.0	7.6
	Conductivity (µmhos/cm)	285		280		296	
	Temperature (°C)	24.7	24.8	24.8	24.6	24.7	24.7
45.2%	pH (S.U.)	7.66	7.67	7.74	7.48	7.53	7.35
	DO (mg/L)	8.0	8.3	8.1	7.8	8.1	7.6
	Conductivity (µmhos/cm)	257		258		265	
	Temperature (°C)	24.8	24.9	24.8	24.9	24.7	25.1
72.6%	pH (S.U.)	7.65	7.66	7.73	7.47	7.52	7.38
	DO (mg/L)	8.1	8.3	8.1	7.8	8.0	7.6
	Conductivity (µmhos/cm)	222		223		231	
	Temperature (°C)	24.8	24.8	24.8	24.8	24.8	25.1
100%	pH (S.U.)	7.61	7.67	7.71	7.47	7.51	7.39
	DO (mg/L)	8.0	8.3	8.2	7.8	7.9	7.7
	Conductivity (µmhos/cm)	188		186		198	
	Alkalinity (mg $CaCO_3$/L)	66				65	
	Hardness (mg $CaCO_3$/L)	77				79	
	TR chlorine (mg/L)	<0.10				<0.10	
	Temperature (°C)	25.2	25.0	24.7	24.8	24.9	24.9
100% Intake	pH (S.U.)	7.65	7.67	7.71	7.48	7.51	7.36
	DO (mg/L)	8.0	8.3	8.3	7.7	7.8	7.9
	Conductivity (µmhos/cm)	184		186		198	
	Alkalinity (mg $CaCO_3$/L)	64				66	
	Hardness (mg $CaCO_3$/L)	79				77	
	TR chlorine (mg/L)	<0.10				<0.10	
	Temperature (°C)	25.0	24.8	24.8	24.9	24.8	24.9
		Initial	Final	Initial	Final	Initial	Final

Environmental Testing Solutions, Inc.

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

Date: 11-14-06

		Day							
		3		4		5		6	
	Analyst	KEK	KEK	KEK	KEK	KEK	KEK	KEK	KEK
Concentration	Parameter								
CONTROL	pH (S.U.)	7.55	7.27	7.77	7.51	7.81	7.67	7.81	7.47
	DO (mg/L)	7.7	8.2	7.7	7.9	7.8	7.9	8.0	8.2
	Conductivity (umhos/cm)	315		316		309		312	
	Alkalinity (mg $CaCO_3$/L)	59				60			
	Hardness (mg $CaCO_3$/L)	91				93			
	Temperature (°C)	24.8	24.9	24.7	25.1	24.8	24.9	24.6	24.8
11.3%	pH (S.U.)	7.38	7.27	7.26	7.51	7.48	7.67	7.76	7.48
	DO (mg/L)	7.9	8.0	7.9	7.8	7.9	7.8	8.0	8.2
	Conductivity (µmhos/cm)	289		293		291		292	
	Temperature (°C)	24.9	24.9	24.7	24.9	24.8	24.7	24.7	25.1
22.6%	pH (S.U.)	7.38	7.27	7.27	7.52	7.48	7.68	7.77	7.50
	DO (mg/L)	8.0	7.8	7.9	7.7	7.9	7.8	~~8.1~~ 8.1	8.3
	Conductivity (µmhos/cm)	273		278		278		278	
	Temperature (°C)	24.9	24.8	24.9	25.3	24.9	25.1	24.7	25.0
45.2%	pH (S.U.)	7.36	7.28	7.24	7.51	7.47	7.68	7.75	7.50
	DO (mg/L)	8.0	7.7	7.9	7.8	8.0	8.0	8.1	8.3
	Conductivity (µmhos/cm)	246		251		252		250	
	Temperature (°C)	24.9	24.9	25.0	25.0	24.9	25.2	24.8	25.2
72.6%	pH (S.U.)	7.34	7.31	7.24	7.50	7.45	7.69	7.73	7.50
	DO (mg/L)	8.0	7.8	8.0	7.9	8.1	7.9	8.2	8.2
	Conductivity (µmhos/cm)	211		217		213		217	
	Temperature (°C)	25.0	24.9	25.2	25.0	25.0	25.1	24.8	25.2
100%	pH (S.U.)	7.33	7.30	7.22	7.50	7.43	7.70	7.70	7.54
	DO (mg/L)	8.2	7.8	8.2	7.9	8.2	7.9	8.3	8.1
	Conductivity (µmhos/cm)	178		182		182		184	
	Alkalinity (mg $CaCO_3$/L)			67					
	Hardness (mg $CaCO_3$/L)			81					
	TR Chlorine (mg/L)			<0.10					
	Temperature (°C)	25.2	24.7	25.3	25.1	25.0	24.7	24.8	25.2
100% Intake	pH (S.U.)	7.30	7.29	7.20	7.47	7.41	7.70	7.69	7.52
	DO (mg/L)	8.3	7.8	8.2	8.0	8.2	8.1	8.4	8.3
	Conductivity (µmhos/cm)	180		182		179		183	
	Alkalinity (mg $CaCO_3$/L)			66					
	Hardness (mg $CaCO_3$/L)			77					
	TR chlorine (mg/L)			<0.10					
	Temperature (°C)	25.1	24.9	24.9	25.1	24.9	24.9	24.8	25.1
		Initial	Final	Initial	Final	Initial	Final	Initial	Final

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

Client: TVA
Facility: Sequoyah Nuclear Plant
NPDES #: TN 0026450
Project #: 2878

County: Hamilton
Treatment: UV-treated
Outfall: 101

Dilution preparation information:						*Comments:*
Dilution prep (%)	11.3	22.6	45.2	72.6	100	Each concentration was treated
Effluent volume (mL)	282.5	~~339~~ 565	1130	1815	2500	for 2 minutes with a UV sterilizer
Diluent volume (mL)	2217.5	~~2160~~ 1935	1370	685	0	to remove pathogenic
Total volume (mL)	2500	2500	2500	2500	2500	interferences.

Test organism information: 22.25 24.25		*Test information:*	
Organism age:	~~21.25~~ TO ~~23.25~~ HOURS OLD	Randomizing template:	Blue
Date and times organisms were born between:	11-13-06 1400 TO 1600	Incubator number:	3B
Organism source:	ABS BATCH B 11-13-06	*Artemia* lot number:	B617040
Transfer bowl information:	pH = 7.63 Temperature = 24.1 °C	Total drying time:	24.25 HOURS
		Date / Time in: 11-21-06	~~1345~~ 1350
Average transfer volume:	8.6 mL	Date / Time out: 11-22-06	1400
		Oven temperature:	60°C

Daily feeding and renewal information:

Day	Date	Morning feeding time	Afternoon feeding time	Test initiation, renewal, or termination time	MHS batch used	Sample numbers used	Analyst
0	11-14-06	~~0900~~	1600	1407	11-12-06A	061113.01 & 02	JF
1	11-15-06	1000	1605	1412	11-12-06B	061113.01 & 02	JF
2	11-16-06	1000	1600	1422	11-12-06B	061115.13 & 14	JF
3	11-17-06	1003	1611	1346	11-15-06A	061115.13 & 14	JF
4	11-18-06	1002	1605	1329	11-15-06A	061117.09 & 10	JF
5	11-19-06	0953	1600	1313	11-15-06B	061117.09 & 10	JF
6	11-20-06	0955	1602	1311	11-15-06B	061117.09 & 10	JF
7	11-21-06			1309			JF

Control information:		Acceptance criteria	*Summary of test endpoints:*	
% Mortality:	0%	≤ 20%	7-day LC_{50}	>100%
Average weight per initial larvae:	0.775		NOEC	100
Average weight per surviving larvae:	0.775	≥ 0.25 mg/larvae	LOEC	>100%
			ChV	>100%
			IC_{25}	>100%

Species: *Pimephales promelas* Date: 11-14-06

Client: TVA / Sequoyah Nuclear Plant - UV-treated

Survival and Growth Data

Day	CONTROL				11.3%				22.6%			
	A	B	C	D	E	F	G	H	I	J	K	L
0	10	10	10	10	10	10	10	10	10	10	10	10
1	10	10	10	10	10	10	10	10	10	10	10	10
2	10	10	10	10	10	10	10	10	10	10	10	10
3	10	10	10	10	10	10	10	10	10	10	10	10
4	10	10	10	10	10	10	10	10	10	10	10	10
5	10	10	10	10	10	10	10	10	10	10	10	10
6	10	10	10	10	10	10	10	10	10	10	10	10
7	10	10	10	10	9 1d	10	10	10	9 1d	10 2G	10	10
A = Pan weight (mg) Color identification: MAGENTA TRAY Analyst: LAB	13.91	13.38	15.34	15.07	13.02	14.70	13.22	13.66	15.38	14.35	15.20	13.77
B = Pan + Larvae weight (mg) Analyst: LAB	22.00	20.73	23.23	22.73	21.18	22.50	20.43	21.95	22.64	23.74	23.24	21.16
Larvae weight (mg) = A – B	8.09	7.35	7.89	7.66	8.16	7.80	7.21	8.29	7.26	9.39	8.04	7.39
Weight per initial number of larvae (mg) = C / Initial number of larvae	0.809	0.735	0.789	0.766	0.816	0.780	0.721	0.829	0.726	0.939	0.804	0.739
Average weight per initial number of larvae (mg)	0.775				0.787				0.802			
Percent reduction from control (%)					-1.5%				-3.5%			

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

Calculations and data reviewed:

Comments:

Species: *Pimephales promelas*

Client: TVA / Sequoyah Nuclear Plant - UV-treated Date: 11-14-06

Survival and Growth Data

Day	45.2%				72.6%				100%			
	M	N	O	P	Q	R	S	T	U	V	W	X
0	10	10	10	10	10	10	10	10	10	10	10	10
1	10	10	10	10	10	10	10	10	10	10	10	10
2	10	10	10	10	10	10	10	10	10	10	10	10
3	10	10	10	10	10	10	10	10	10	10	10	10
4	10	10	10	10	10	10	10	10	10	10	10	10
5	10	10	10	10	10	10	10	10	10	10	10	10
6	10	10	10	10	10	10	10	10	10	10	10	10
7	10 (1sk)	10	10	10	9 d	10	10	10	10	10	10	10
A = Pan weight (mg) Color identification: MAGENTA TRAY Analyst: UAB	14.58	15.44	15.14	14.29	15.57	13.64	14.35	14.53	14.97	14.74	13.72	15.02
B = Pan + Larvae weight (mg) Analyst: UAB	20.68	23.58	22.26	22.65	23.44	21.40	21.97	22.07	22.02	22.11	20.82	22.74
Larvae weight (mg) = A - B	6.10	8.14	7.12	8.36	7.87	7.76	7.62	7.54	7.05	7.37	7.10	7.72
Weight per initial number of larvae (mg) = C / Initial number of larvae	0.610	0.814	0.712	0.836	0.787	0.776	0.762	0.754	0.705	0.737	0.710	0.772
Average weight per initial number of larvae (mg)	0.743				0.770				0.731			
Percent reduction from control (%)		4.1%				0.6%				5.6%		

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

Calculations and data reviewed: JH

Comments:

Species: *Pimephales promelas*

Client: TVA / Sequoyah Nuclear Plant - UV-treated Date: 11-14-06

Survival and Growth Data

Day	100% Intake			
	Y	Z	AA	BB
0	10	10	10	10
1	10	10	10	10
2	10	10	10	10
3	10	10	10	10
4	10	10	10	10
5	10	10	10	10
6	10	10	10	10
7	10 ISM	10	10	10
A = Pan weight (mg) Color identification: MAGENTA TRAY Analyst: LHB	14.40	14.60	14.64	14.34
B = Pan + Larvae weight (mg) Analyst: LHB	20.86	22.28	21.81	22.06
Larvae weight (mg) = A - B	6.46	7.68	7.17	7.72
Weight per initial number of larvae (mg) = C / Initial number of larvae	0.646	0.768	0.717	0.772
Average weight per initial number of larvae (mg)	0.726			
Percent reduction from control (%)	6.3%			

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

Calculations and data reviewed: JH

Comments:

UV-treated
November 14-21, 2006

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

Project number: 2878

Reviewed by:

							Not for Compliance Assessment, Internal Laboratory QC							
Concentration (%)	Replicate	Initial number of larvae	Final number of larvae	A = Pan weight (mg)	B = Pan + Larvae weight (mg)	Larvae weight (mg) = A - B	Weight / Surviving number of larvae (mg)	Mean weight / Surviving number of larvae (mg)	Coefficient of variation (Mean weight per surviving number of larvae) (%)	Weight / Initial number of larvae (mg)	Mean survival (%)	Mean weight / Initial number of larvae (mg)	Coefficient of variation (Mean weight per initial number of larvae) (%)	Percent reduct control (
Control	A	10	10	13.91	22.00	8.09	0.809	0.775	4.1	0.809	100.0	0.775	4.1	Not appli
	B	10	10	13.38	20.73	7.35	0.735			0.735				
	C	10	10	15.34	23.23	7.89	0.789			0.789				
	D	10	10	15.07	22.73	7.66	0.766			0.766				
11.3%	E	10	9	13.02	21.18	8.16	0.907	0.809	9.7	0.816	97.5	0.787	6.1	-1.5
	F	10	10	14.70	22.50	7.80	0.780			0.780				
	G	10	10	13.22	20.43	7.21	0.721			0.721				
	H	10	10	13.66	21.95	8.29	0.829			0.829				
22.6%	I	10	9	15.38	22.64	7.26	0.807	0.822	10.2	0.726	97.5	0.802	12.2	-3.5
	J	10	10	14.35	23.74	9.39	0.939			0.939				
	K	10	10	15.20	23.24	8.04	0.804			0.804				
	L	10	10	13.77	21.16	7.39	0.739			0.739				
45.2%	M	10	10	14.58	20.68	6.10	0.610	0.743	14.0	0.610	100.0	0.743	14.0	4.1
	N	10	10	15.44	23.58	8.14	0.814			0.814				
	O	10	10	15.14	22.26	7.12	0.712			0.712				
	P	10	10	14.29	22.65	8.36	0.836			0.836				
72.6%	Q	10	9	15.57	23.44	7.87	0.874	0.792	7.1	0.787	97.5	0.770	1.9	0.6
	R	10	10	13.64	21.40	7.76	0.776			0.776				
	S	10	10	14.35	21.97	7.62	0.762			0.762				
	T	10	10	14.53	22.07	7.54	0.754			0.754				
100%	U	10	10	14.97	22.02	7.05	0.705	0.731	4.2	0.705	100.0	0.731	4.2	5.6
	V	10	10	14.74	22.11	7.37	0.737			0.737				
	W	10	10	13.72	20.82	7.10	0.710			0.710				
	X	10	10	15.02	22.74	7.72	0.772			0.772				
100% Intake	Y	10	10	14.40	20.86	6.46	0.646	0.726	8.1	0.646	100.0	0.726	8.1	6.3
	Z	10	10	14.60	22.28	7.68	0.768			0.768				
	AA	10	10	14.64	21.81	7.17	0.717			0.717				
	BB	10	10	14.34	22.06	7.72	0.772			0.772				

Outfall 101:
Dunnett's MSD value: 0.1095
PMSD: 14.1

Intake:
Dunnett's MSD value: 0.0649
PMSD: 8.4

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 te
average, a significant difference occurs for Environmental Testing Solutions, Inc. chronic toxicity tests when a toxicant reduces *Pimephales* growth by 15.0% from the control (determined throu
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.

UV-treated
November 14-21, 2006

Statistical Analyses

Larval Fish Growth and Survival Test-7 Day Growth

Start Date	11/14/2006	Test ID:	PpJFRCR	Sample ID:	TVA / Sequoyah Nuclear Plant - Outfall 101
End Date	11/21/2006	Lab ID	ETS-Enve Testing Sol	Sample Type	DM-IR-Discharge Monitoring Report
Sample Date		Protocol:	FWCHR-EPA-821-R-02-013	Test Species	PP-Pimephales promelas
Comments	UV-treated				

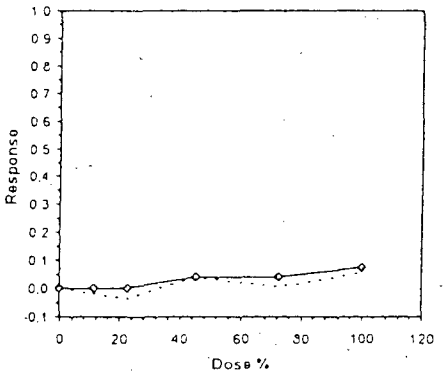
Conc-%	1	2	3	4
D-Control	0.8090	0.7350	0.7890	0.7660
11.3	0.8160	0.7800	0.7210	0.8290
22.6	0.7260	0.9390	0.8040	0.7390
45.2	0.6100	0.8140	0.7120	0.8360
72.6	0.7870	0.7760	0.7620	0.7540
100	0.7050	0.7370	0.7100	0.7720

			Transform: Untransformed					1-Tailed			Isotonic	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.7748	1.0000	0.7748	0.7350	0.8090	4.104	4				0.7878	1.0000
11.3	0.7865	1.0152	0.7865	0.7210	0.8290	6.146	4	-0.259	2.410	0.1095	0.7878	1.0000
22.6	0.8020	1.0352	0.8020	0.7260	0.9390	12.157	4	-0.500	2.410	0.1095	0.7878	1.0000
45.2	0.7430	0.9590	0.7430	0.6100	0.8360	13.974	4	0.699	2.410	0.1095	0.7564	0.9602
72.6	0.7698	0.9935	0.7698	0.7540	0.7870	1.905	4	0.110	2.410	0.1095	0.7564	0.9602
100	0.7310	0.9435	0.7310	0.7050	0.7720	4.205	4	0.963	2.410	0.1095	0.7310	0.9280

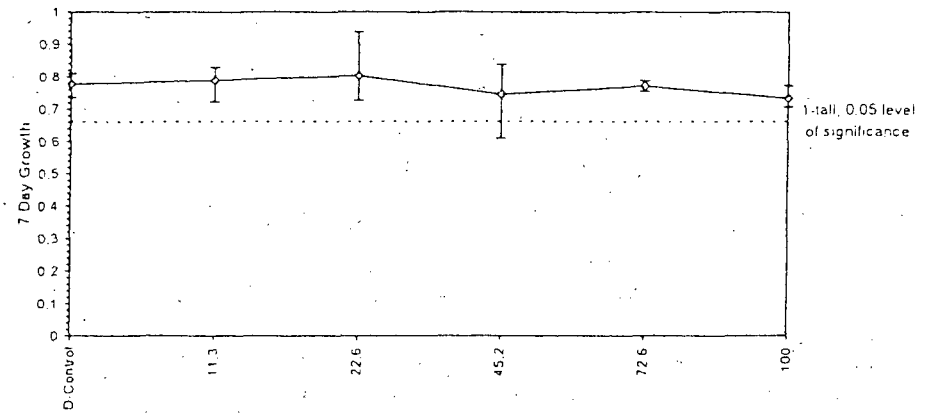
Auxiliary Tests					Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)					0.979922116		0.884		0.130565288	1.129624347
Bartlett's Test indicates equal variances (p = 0.03)					12.26457691		15.08627224			
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	100	>100		1	0.109544232	0.141393007	0.002832567	0.004132139	0.640509248	5, 18
Treatments vs D-Control										

Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)	Skew
IC05	81.252			
IC10	>100			
IC15	>100			
IC20	>100			
IC25	>100			
IC40	>100			
IC50	>100			



Dose-Response Plot



UV-treated
November 14-21, 2006

Statistical Analyses

Larval Fish Growth and Survival Test-7 Day Growth

Start Date	11/14/2006	Test ID	PpFRCR	Sample ID	TVA / Sequoyah Nuclear Plant - Intake
End Date	11/21/2006	Lab ID	ETS-Envir Testing Sol	Sample Type	DMR-Discharge Monitoring Report
Sample Date		Protocol	FWCHR-EPA-821-R-02-013	Test Species	PP-Pimephales promelas
Comments	UV-treated				

Conc-%	1	2	3	4
D-Control	0.8090	0.7350	0.7890	0.7660
100	0.6460	0.7680	0.7170	0.7720

			Transform: Untransformed					1-Tailed			Isotonic	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.7748	1.0000	0.7748	0.7350	0.8090	4.104	4				0.7748	1.0000
100	0.7258	0.9368	0.7258	0.6460	0.7720	8.097	4	1.467	1.943	0.0649	0.7258	0.9368

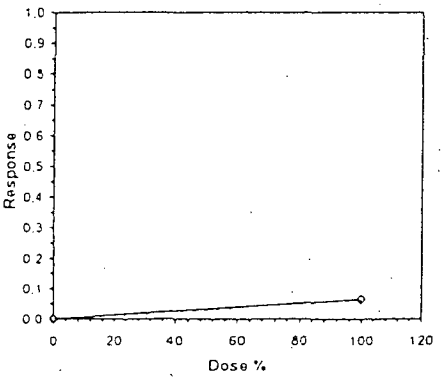
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.919678569	0.749	-0.80552162	-0.017172049
F-Test indicates equal variances (p = 0.34)	3.416288853	47.46722794		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates no significant differences	0.064918556	0.083793038	0.004802	0.002223225	0.192823291	1, 6
Treatments vs D-Control						

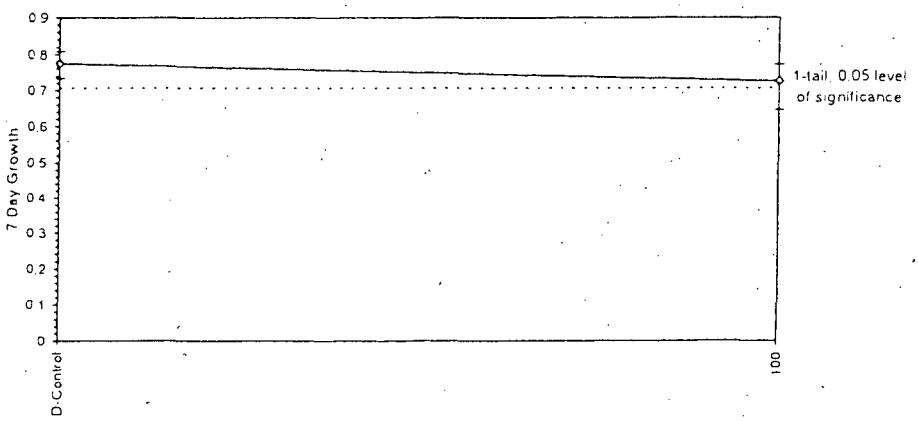
Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)	Skew
IC05*	79.056			
IC10	>100			
IC15	>100			
IC20	>100			
IC25	>100			
IC40	>100			
IC50	>100			

* indicates IC estimate less than the lowest concentration



Dose-Response Plot



UV-treated
November 14-21, 2006

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

Daily Chemical Analyses

Project number: 2878

Reviewed by: [signature]

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	Fin
Control	pH (SU)	7.68	7.59	7.69	7.48	7.57	7.20	7.49	7.29	7.50	7.27	7.61	7.46	7.83	
	DO (mg/L)	8.1	7.8	8.2	7.7	7.8	7.3	7.8	7.6	7.9	7.1	7.9	7.5	7.8	
	Conductivity (µmhos/cm)	307		308		307		296		301		297		300	
	Temperature (°C)	24.7	24.5	24.6	24.4	24.8	24.6	24.8	24.6	24.8	24.3	24.9	24.5	24.7	
11.3%	pH (SU)	7.68	7.53	7.68	7.45	7.57	7.17	7.48	7.29	7.50	7.27	7.63	7.47	7.83	
	DO (mg/L)	8.1	7.8	8.2	7.7	7.9	7.2	7.8	7.5	7.8	7.0	7.9	7.5	7.8	
	Conductivity (µmhos/cm)	301		302		304		288		299		298		295	
	Temperature (°C)	24.7	24.2	24.7	24.2	24.8	24.8	24.9	24.7	24.9	24.6	24.9	24.1	24.9	
22.6%	pH (SU)	7.68	7.55	7.68	7.48	7.58	7.18	7.47	7.26	7.50	7.26	7.64	7.43	7.82	
	DO (mg/L)	8.1	7.7	8.2	7.7	8.0	7.2	7.9	7.6	7.8	6.8	7.8	7.4	7.9	
	Conductivity (µmhos/cm)	281		285		293		276		285		282		279	
	Temperature (°C)	24.8	24.7	24.7	24.2	24.8	24.7	24.9	24.7	24.9	24.7	24.9	24.2	24.9	
45.2%	pH (SU)	7.69	7.55	7.68	7.46	7.58	7.13	7.44	7.26	7.49	7.26	7.64	7.43	7.79	
	DO (mg/L)	8.1	7.8	8.2	7.7	8.1	6.9	7.9	7.6	7.9	6.8	7.9	7.3	8.0	
	Conductivity (µmhos/cm)	258		259		267		248		258		254		256	
	Temperature (°C)	24.8	24.3	24.9	24.3	24.8	24.5	24.8	24.7	24.9	24.5	24.9	24.2	24.9	
72.6%	pH (SU)	7.69	7.55	7.67	7.40	7.57	7.11	7.43	7.25	7.48	7.26	7.59	7.50	7.77	
	DO (mg/L)	8.2	7.8	8.1	7.5	8.1	6.8	7.9	7.6	8.0	7.0	8.1	7.4	8.0	
	Conductivity (µmhos/cm)	218		222		230		216		225		220		219	
	Temperature (°C)	24.9	24.3	24.9	24.3	25.0	24.5	24.9	24.5	25.0	24.5	25.0	24.2	24.9	
100%	pH (SU)	7.69	7.57	7.67	7.43	7.57	7.13	7.39	7.36	7.45	7.26	7.58	7.43	7.74	
	DO (mg/L)	8.1	7.9	8.1	7.4	7.9	6.8	8.0	7.5	8.0	6.8	8.1	7.4	8.0	
	Conductivity (µmhos/cm)	188		192		202		188		189		188		190	
	Temperature (°C)	25.1	24.3	24.9	24.2	25.0	24.6	24.9	24.7	25.1	24.6	25.0	24.5	25.0	
100% Intake	pH (SU)	7.68	7.58	7.68	7.43	7.55	7.16	7.36	7.48	7.29	7.25	7.57	7.36	7.72	
	DO (mg/L)	8.2	7.9	8.2	7.4	8.1	6.9	8.0	7.4	8.1	6.9	8.2	7.1	8.0	
	Conductivity (µmhos/cm)	186		185		195		190		192		184		189	
	Temperature (°C)	25.0	24.4	24.8	24.2	24.9	24.4	24.9	24.8	25.0	24.6	25.0	24.3	24.8	

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

Date: 11-14-06

Daily Chemistry:

		Day					
		0		1		2	
	Analyst	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Concentration	Parameter						
CONTROL	pH (S.U.)	7.68	7.59	7.69	7.48	7.57	7.20
	DO (mg/L)	8.1	7.8	8.2	7.7	7.8	7.3
	Conductivity (µmhos/cm)	307		308		307	
	Temperature (°C)	24.7	24.5	24.6	24.4	24.8	24.6
11.3%	pH (S.U.)	7.68	7.53	7.68	7.45	7.57	7.17
	DO (mg/L)	8.1	7.8	8.2	7.7	7.9	7.2
	Conductivity (µmhos/cm)	301		302		304	
	Temperature (°C)	24.7	24.2	24.7	24.2	24.8	24.8
22.6%	pH (S.U.)	7.68	7.55	7.68	7.48	7.58	7.18
	DO (mg/L)	8.1	7.7	8.2	7.7	8.0	7.2
	Conductivity (µmhos/cm)	281		285		293	
	Temperature (°C)	24.8	24.7	24.7	24.2	24.8	24.7
45.2%	pH (S.U.)	7.69	7.55	7.68	7.40	7.58	7.13
	DO (mg/L)	8.1	7.8	8.2	7.7	8.1	6.9
	Conductivity (µmhos/cm)	258		259		267	
	Temperature (°C)	24.8	24.3	24.9	24.3	24.8	24.5
72.6%	pH (S.U.)	7.69	7.55	7.67	7.40	7.57	7.11
	DO (mg/L)	8.2	7.8	8.1	7.5	8.1	6.8
	Conductivity (µmhos/cm)	218		222		230	
	Temperature (°C)	24.9	24.3	24.9	24.3	25.0	24.5
100%	pH (S.U.)	7.69	7.57	7.67	7.43	7.57	7.13
	DO (mg/L)	8.1	7.9	8.1	7.4	7.9	6.8
	Conductivity (µmhos/cm)	188		192		202	
	Temperature (°C)	25.1	24.3	24.9	24.2	25.0	24.6
100% Intake	pH (S.U.)	7.68	7.58	7.68	7.43	7.55	7.16
	DO (mg/L)	8.2	7.9	8.2	7.4	8.1	6.9
	Conductivity (µmhos/cm)	186		185		195	
	Temperature (°C)	25.0	24.4	24.8	24.2	24.9	24.4
		Initial	Final	Initial	Final	Initial	Final

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

Date: 11-14-06

		Day							
		3		4		5		6	
	Analyst	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Concentration	Parameter								
CONTROL	pH (S.U.)	7.49	7.29	7.50	7.27	7.61	7.46	7.83	7.11
	DO (mg/L)	7.8	7.6	7.9	7.1	7.9	7.5	7.8	7.4
	Conductivity (µmhos/cm)	296		301		297		300	
	Temperature (°C)	24.8	24.6	24.8	24.3	24.9	24.5	24.7	24.3
11.3%	pH (S.U.)	7.48	7.29	7.50	7.27	7.63	7.47	7.83	7.11
	DO (mg/L)	7.8	7.5	7.8	7.0	7.9	7.5	7.8	7.4
	Conductivity (µmhos/cm)	288		299		298		295	
	Temperature (°C)	24.9	24.7	24.9	24.6	24.9	24.1	24.9	24.7
22.6%	pH (S.U.)	7.47	7.26	7.50	7.26	7.64	7.43	7.82	7.10
	DO (mg/L)	7.9	7.6	7.8	6.8	7.8	7.4	7.9	7.4
	Conductivity (µmhos/cm)	276		285		282		279	
	Temperature (°C)	24.9	24.7	24.9	24.7	24.9	24.2	24.9	24.6
45.2%	pH (S.U.)	7.44	7.26	7.49	7.26	7.64	7.43	7.79	7.11
	DO (mg/L)	7.9	7.6	7.9	6.8	7.9	7.3	8.0	7.5
	Conductivity (µmhos/cm)	248		258		254		226	
	Temperature (°C)	24.8	24.7	24.9	24.5	24.9	24.2	24.9	24.6
72.6%	pH (S.U.)	7.43	7.25	7.48	7.26	7.59	7.50	7.77	7.21
	DO (mg/L)	7.9	7.6	8.0	7.0	8.1	7.4	8.0	7.5
	Conductivity (µmhos/cm)	216		225		220		219	
	Temperature (°C)	24.9	24.5	25.0	24.5	25.0	24.2	24.9	24.3
100%	pH (S.U.)	7.39	7.36	7.45	7.26	7.58	7.43	7.74	7.16
	DO (mg/L)	8.0	7.5	8.0	6.8	8.1	7.4	8.0	7.6
	Conductivity (µmhos/cm)	188		189		188		190	
	Temperature (°C)	24.9	24.7	25.1	24.6	25.0	24.5	25.0	24.5
100% Intake	pH (S.U.)	7.36	7.48	7.29	7.25	7.57	7.36	7.72	7.07
	DO (mg/L)	8.0	7.4	8.4	6.9	8.2	7.1	8.0	7.4
	Conductivity (µmhos/cm)	190		192		184		189	
	Temperature (°C)	24.9	24.8	25.0	24.6	25.0	24.3	24.8	24.2
		Initial	Final	Initial	Final	Initial	Final	Initial	Final

Alkalinity
(EPA Method 310.1)

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

Time started: 1742
Time ended: 1837

Analyst: KEK
Date analyzed: 11-18-06

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
5.3	INR241	CHM244	0.1	12.2	12.1	0.0207	10.3

Blank correction 0.0ml - 0.1ml = 0.1ml

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%)
INR223	100	100	12.2	21.6	9.4	10.3	97	97.0%

Duplicate sample precision:

Sample number	Sample ID	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Alkalinity (mg $CaCO_3$/L)	%RPD = {(S - D) /[(S+D)/2]} x 100 (acceptable range = ± 10%)
11.15.06	SSW H2O	100	21.6	24.8	3.2	10.3	S 33	
↓	Duplicate	↓	24.8	28.0	3.2	↓	D 33	—

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)
INR223	50	100	24.8	32.9	8.1	10.3	83

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%)
33	50	100%

Sample measurements:

Sample number	Sample ID	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Alkalinity (mg $CaCO_3$/L)
11.15.06A	MHS H2O	100	32.9	38.6	5.7	10.3	59
11.15.06B	↓	↓	38.8	44.6	5.8	↓	60
11.05.06			0.0	5.8	5.8		60
11.12.06A			5.8	11.5	5.7		59
11.12.06B			11.5	17.0	5.5		57
11.05.06	SSW H2O		17.0	20.2	3.2		33
061114.01	Smith Creek 1		20.2	24.2	4.0		41
061116.01	↓ 2		24.3	28.4	4.1		42
061118.07	↓ 3	↓	28.4	32.3	3.9	↓	40

Reviewed by: [signature]

Date reviewed: 11-19-06

Alkalinity
(EPA Method 310.1)

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

Analyst	KER
Date analyzed	11.18.06

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%)
INR223	100	100	32.3	41.6	9.3	10.3	96	96.0%

Duplicate sample precision:

Sample number	Sample ID	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Alkalinity (mg $CaCO_3$/L)	%RPD = [(S - D) /[(S+D)/2]] x 100 (acceptable range = ± 10%)
06 1114.02	Forward 2	100	0.0	3.5	3.5	10.3	S 36	
↓	Duplicate	↓	3.5	7.0	3.5	↓	D 36	—

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)
INR223	50	100	3.5	11.9	8.4	10.3	86

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%)
36	50	100.0%

Sample measurements:

Sample number	Sample ID	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Alkalinity (mg $CaCO_3$/L)
06 1116.03	Forward 1	100	11.9	17.3	5.4	10.3	56
06 1116.16	↓ 3	↓	17.3	21.6	4.3	↓	44
06 1113.01	TVA SQN 101 1		21.6	28.0	6.4		66
06 1115.13	↓ 2		28.0	34.3	6.3		65
06 1117.09	↓ 3		34.3	40.8	6.5		67
06 1113.02	INT 1		40.8	47.0	6.2		64
06 1115.14	↓ 2		0.0	6.4	6.4		66
06 1117.10	↓ 3		6.4	12.8	6.4		66
11-12-06	SATH SW	↓	12.8	22.3	9.5	↓	98

Reviewed by: dl Date reviewed: 11-19-06

Alkalinity
(EPA Method 310.1)

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

Analyst	KER
Date analyzed	11.18.06

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%)
INR 223	100	100	22.3	32.0	9.7	10.3	100	100.0%

Duplicate sample precision:

Sample number	Sample ID	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Alkalinity (mg $CaCO_3$/L)	%RPD = {(S - D) /[(S+D)/2]} x 100 (acceptable range = ± 10%)
061114.05	LeJeune 1	25	32.1	35.1	3.0	(4) 10.3	S 120	
↓	Duplicate	↓	35.2	38.2	3.0	↓ ↓	D 120	—

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)
	200	25	35.2	42.9	7.7	(4) 10.3	320

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

Sample measurements:

Sample number	Sample ID	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Alkalinity (mg $CaCO_3$/L)
061116.04	LeJeune 2	25	43.0	45.9	2.9	(4) 10.3	120
061118.12	↓ 3	↓	45.9	49.0	3.1	↓ ↓	130
061111.12	Hercules 1	↓	0.0	3.0	3.0	↓ ↓	120
061114.06	↓ 2	↓	3.3	6.0	2.7	↓ ↓	110
061116.02	↓ 3	↓	6.0	9.0	3.0	↓ ↓	120
35352	EES 116021	100	9.0	10.6	1.6	↓ ↓	16
35353	↓ 116022	↓	10.6	12.4	1.8	↓ ↓	18
35354	↓ 116023	↓	12.5	12.7	0.2	↓ ↓	2.1
11.13.06	SAHSW	↓	13.0	21.6	8.6	↓ ↓	99

Reviewed by: dl Date reviewed: 11-19-06

Alkalinity
(EPA Method 310.1)

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

Analyst	JKW
Date analyzed	11-18-06

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 = 0.019 - 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%)
INR823	100	100	21.6	31.3	9.7	10.3	100	100.0%

Duplicate sample precision:

Sample number	Sample ID	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Alkalinity (mg $CaCO_3$/L)	%RPD = {(S - D) /[(S+D)/2]} x 100 (acceptable range = ± 10%)
11-15-06	SAIT SW	100	31.3	40.9	9.6	10.3	S 99	
	Duplicate	↓	0.0	9.7	9.7	↓	D 100	1.0%

Matrix spike recovery:

Reference standard number	Spike value (SV) (mg $CaCO_3$/L)	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Spike alkalinity (A) (mg $CaCO_3$/L)
INR823	50	100	0.0	14.5	14.5	10.3	150

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%)
100	50	100.0%

Sample measurements:

Sample number	Sample ID	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Alkalinity (mg $CaCO_3$/L)
11-16-06A	SAIT SW	100	14.5	23.9	9.4	10.3	97
11-16-06B	↓	↓	23.9	33.6	9.7	↓	100
11-18-06	↓	↓	33.6	43.1	9.5	↓	98

Reviewed by: JL Date reviewed: 11-19-06

Total Hardness
(EPA Method 130.2)

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

Analyst	KEN	Time initiated:	1703
Date analyzed	11-16-06	Time completed:	1730

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
INRAB	IN A804	0.0	9.9	9.9	0.0202	20.2

Laboratory control standard:

Reference standard number	True value (TV) (mg $CaCO_3$/L)	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Hardness (MV) (mg $CaCO_3$/L)	% RS = MV / TV x 100 (acceptable range = 90 to 110%)
INSS436	40	50	9.9	11.8	1.9	20.2	38	95.0%

Duplicate sample precision:

Sample number	Sample ID	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Hardness (mg $CaCO_3$/L)	%RPD = {(S - D) /[(S+D)/2]} x 100 (acceptable range = ± 10%)
11.15.06	SSW1t20	50	11.8	14.0	2.2	20.2	S 44	
↓	Duplicate (B)	↓	14.0	16.1	2.1	↓	D 42	4.6%

Matrix spike recovery:

Reference standard number	Spike value (SV) (mg $CaCO_3$/L)	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Spike hardness (A) (mg $CaCO_3$/L)
INSS436	40	50	14.0	18.1	4.1	20.2	83

Sample hardness (B) (mg $CaCO_3$/L)	Measured spike value (MV) MV = A - B (mg $CaCO_3$/L)	% R = MV / SV x 100 (acceptable range = 75 to 125%)
42	41	102.5%

Sample measurements:

Sample number	Sample ID	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Hardness (mg $CaCO_3$/L)
TV=ND	Blank (should be = 0 mg $CaCO_3$/L)	50	0.0	0.0	0.0	20.2	ND
11.15.06A	MHS H2O		18.1	22.6	4.5		91
11.15.06B			22.6	27.2	4.6		93
11.05.06			27.2	31.9	4.7		96
11.12.06A			31.9	36.5	4.6		93
11.12.06B	↓		36.5	41.1	4.6		93
11.05.06	SSW H20		41.1	43.2	2.1		42
061114.01	Smith Creek 1		0.0	2.2	2.2		44
061116.01	2		2.2	4.8	2.6		52
061118.07	↓ 3	↓	4.8	7.4	2.6	↓	52

Note: If >15ml of titrant is used, sample must be diluted. Reviewed by: JL Date reviewed: 11-19-06

Total Hardness
(EPA Method 130.2)

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

Analyst	JL-VL	Time initiated:	
Date analyzed	11-18-06	Time completed:	VL

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%)
INSS436	40	50	7.4	9.5	2.1	20.2	42	105.0 %

Duplicate sample precision:

Sample number	Sample ID	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Hardness (mg $CaCO_3$/L)	%RPD = ((S - D) /[(S+D)/2]) x 100 (acceptable range = ± 10%)
061114.02	Foxwood 1	50	9.5	11.1	1.6	20.2	S 32	
↓	Duplicate (B)	↓	11.1	12.6	1.5	↓	D 30	6.4 %

Matrix spike recovery:

Reference standard number	Spike value (SV) (mg $CaCO_3$/L)	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Spike hardness (A) (mg $CaCO_3$/L)
INSS436	40	50	11.1	14.5	3.4	20.2	69

Sample hardness (B) (mg $CaCO_3$/L)	Measured spike value (MV) MV = A - B (mg $CaCO_3$/L)	% R = MV / SV x 100 (acceptable range = 75 to 125%)
30	39	97.5 %

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)						VL
061116.03	Foxwood 2	50	14.5	16.2	1.7	20.2	34
061118.16	↓ 3	↓	16.2	17.3	1.1	↓	22
061113.01	TVA-SON 101 1		17.3	21.1	3.8		77
061115.13	↓ 2		21.2	25.1	3.9		79
061117.09	↓ 3		25.1	29.1	4.0		81
061113.02	INT 1		29.1	33.0	3.9		79
061115.14	↓ 2		33.0	36.8	3.8		77
061117.10	↓ 3	↓	36.8	40.6	3.8	↓	77
							VL

Note: If >15ml of titrant is used, sample must be diluted: Reviewed by: JL Date reviewed 11-19-06

Total Residual Chlorine
(EPA Method 330.5)

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

Analyst: LAB
Date analyzed: 11-14-06

Iodide reagent: INR235
Acid reagent: INR247

Calibration:

	0.10 mg/L	1.00 mg/L
Reference standard number	INSS353	INSS353

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%)
INSS353	0.50	0.493	98.6%

Duplicate sample precision:

Sample number	Sample ID	Sample characteristics	Residual chlorine (mg/L)	%RPD = {(S - D) /[(S+D)/2]} x 100 (acceptable range = ± 10%)
061114.06	Hercules, Inc	clear w/particles, no color	S <0.00127	
↓	Duplicate		D <0.000624	——— LAB

Sample measurements:

Sample number	Sample ID	Sample characteristics	Residual chlorine (mg/L)
	Blank (should be = < 0.10 mg/L)		<0.00579
061114.07	CapeFear SE	slightly cloudy w/particles, pale tan	<0.00351
061114.08	Cape Fear SE Up 1In	slightly cloudy w/particles, pale tan	<0.00716
061114.01	Smith Creek WWTP	clear, no color	<0.000168
061114.02	Foxwood Hills Sel	slightly cloudy w/particles, pale tan	<0.0000212
061114.05	Camp Le Jeune	clear, no color	<0.0000478
061114.03	PCS Phosphate -007	clear, no color	<0.0000262
061114.04	↓ 100	clear, no color	<0.000 262 ~~<0.0000246~~ LAB
061113.01	TVA SGN 101	clear, no color	<0.000371
061113.02	↓ INT	clear, no color	<0.0275

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%)
INSS353	0.50	0.468	93.6%

Reviewed by: KEF
Date reviewed: 11.14.06

Total Residual Chlorine
(EPA Method 330.5)

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

Analyst	UAB	Iodide reagent:	INR235
Date analyzed	11-16-06	Acid reagent:	INR247

Calibration:

	0.10 mg/L	1.00 mg/L
Reference standard number	INSS353	INSS353

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%)
INSS353	0.50	0.511	102.2%

Duplicate sample precision:

Sample number	Sample ID	Sample characteristics	Residual chlorine (mg/L)	%RPD = {(S - D) /[(S+D)/2]} x 100 (acceptable range = ± 10%)
061116.05	S. Harris ~~edge~~	clear w/ particles, no color	S <0.0000213	
↓	Duplicate		D 0.0000133	UAB

Sample measurements:

Sample number	Sample ID	Sample characteristics	Residual chlorine (mg/L)
	Blank (should be = < 0.10 mg/L)		<0.00681
061116.06	S. Harris	slightly cloudy w/particles, tan	<0.00658
061116.03	Foxwood Hills	clear w/particles, no color	<0.00000300
061116.01	Smith Creek	clear, no color	<0.00000809
061116.04	Camp Lejune	clear, no color	<0.0000593
061116.02	Hercules	clear w/particles, no color	<0.0000197
061115.13	TVA-SQN-101	clear, no color	<0.0000738
061115.14	TVA-SQN-INT	clear, no color	~~<0.00011~~ <0.000114 UAB
			UAB

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%)
INSS353	0.50	0.537	107.4%

Reviewed by
Date reviewed 11-16-06

Total Residual Chlorine
(EPA Method 330.5)

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

Analyst	LAB	Iodide reagent:	INR235
Date analyzed	11-18-06	Acid reagent:	INR247

Calibration:

	0.10 mg/L	1.00 mg/L
Reference standard number	INSS353	INSS353

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%)
INSS353	0.50	0.544	108.8%

Duplicate sample precision:

Sample number	Sample ID	Sample characteristics	Residual chlorine (mg/L)	%RPD = {(S - D) /[(S+D)/2]} x 100 (acceptable range = ± 10%)
061118.16	Foxwood Hills	~~slightly cloudy~~ w/part., clear ~~<0.0000100~~ LAB	S ~~<0.0000100~~	
"	Duplicate		D <0.0000250	LAB

Sample measurements:

Sample number	Sample ID	Sample characteristics	Residual chlorine (mg/L)
	Blank (should be = < 0.10 mg/L)		<0.00584
061117.01	~~Seafear~~ C. Seafear-007	clear, pale tan	<0.000853
061117.02	~~Seafear~~ C. Seafear-INT-UP	clear, pale tan	<0.00648
061117.06	Baxter	clear, NO color	<0.00197
061118.13	Bladeburrow	slightly cloudy w/particles, NO color	<0.000181
061117.07	Com-Scope	clear, pale tan	<0.0000398
061118.15	Raleigh CC	clear, NO color	0.00486
061118.17	Scarlette Acres	slightly cloudy w/particles, gray	<0.00209
061117.08	~~Spruce~~ Spruce Pine	clear, NO color	<0.000193
061118.01	Apex	clear, NO color	<0.0000142

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%)
INSS353	0.50	0.493	98.6%

Reviewed by	KEW
Date reviewed	11-18-06

Total Residual Chlorine
(EPA Method 330.5)

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

Analyst	UAB
Date analyzed	11-18-06

Iodide reagent:	INR235
Acid reagent:	INR247

Calibration:

	0.10 mg/L	1.00 mg/L
Reference standard number	INSS353	INSS353

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%)
~~———~~	~~0.50~~		UAB

Duplicate sample precision:

Sample number	Sample ID	Sample characteristics	Residual chlorine (mg/L)	%RPD = {(S - D) /[(S+D)/2]} x 100 (acceptable range = ± 10%)
061118.02	Dynea	slightly cloudy, pale yellow	S <0.00255	
J	Duplicate		D <0.00380	UAB

Sample measurements:

Sample number	Sample ID	Sample characteristics	Residual chlorine (mg/L)
	Blank (should be = < 0.10 mg/L)		UAB
061118.04	North Carrie	clear, no color	<0.00117
061118.05			
061118.07	Smith Creek	clear, pale yellow	<0.000575
061118.14	BASF	yellow, cloudy w/part.	<0.00219
061118.11	Craven County	clear, no color	<0.000128
061118.06	Raleigh Nuse	clear, no color	<0.0000183
061118.0809	RDU-001	opaque w/part., orange	<0.000205
061118.0910	↓ 003	cloudy w/part., orange	<0.000433
061118.1008	↓ 004	opaque w/part, orange	<0.000280
061118.12	Camp Lejune	clear, no color	<0.000349

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%)
INSS353	0.50	0.489	97.8%

Reviewed by	KEV
Date reviewed	11-18-06

Total Residual Chlorine
(EPA Method 330.5)

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

Analyst	UAB	Iodide reagent:	INR235
Date analyzed	11-18-06	Acid reagent:	INR247

Calibration:

	0.10 mg/L	1.00 mg/L
Reference standard number	INSS353	INSS353

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%)
	0.50		UAB

Duplicate sample precision:

Sample number	Sample ID	Sample characteristics	Residual chlorine (mg/L)	%RPD = {(S - D) /[(S+D)/2]} x 100 (acceptable range = ± 10%)
061117D9	TVA-SQN-101	clear, no color	S <0.00617	
J	Duplicate		D <0.00209	UAB

Sample measurements:

Sample number	Sample ID	Sample characteristics	Residual chlorine (mg/L)
	Blank (should be = < 0.10 mg/L)		UAB
061117.10	TVA-SQN-INT	clear, no color	<0.00260

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%)
INSS353	0.50	0.474	94.0%

Reviewed by:	KEL
Date reviewed	11/18/06

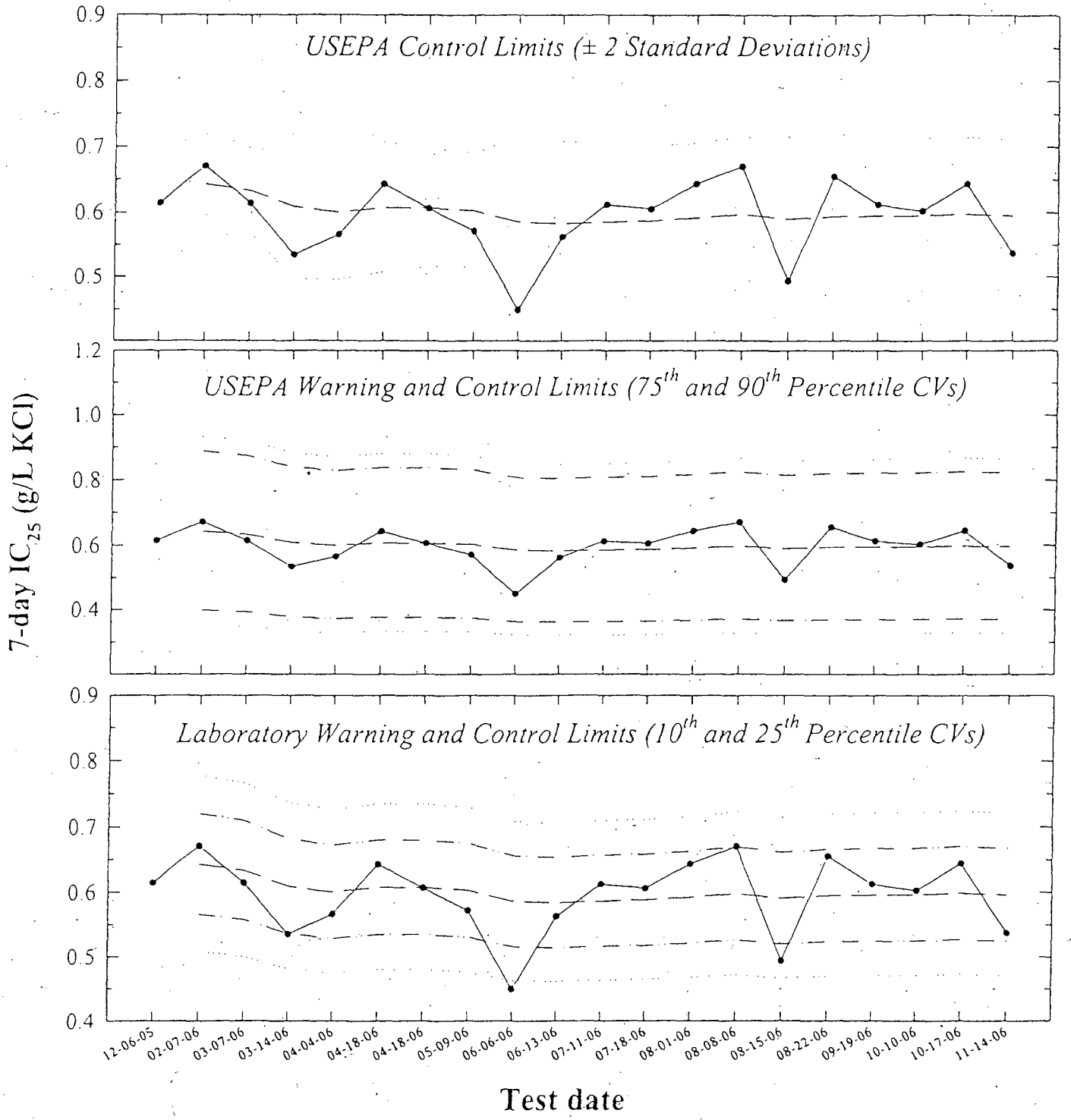
Sequoyah Nuclear Plant Biomonitoring
November 14-21, 2006

Appendix D

Reference Toxicant Test and
Control Chart

Pimephales promelas

Potassium Chloride Chronic Reference Toxicant Control Chart 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 $IC_{25} \pm S_{A.10}$ or $S_{A.75}$)

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

Environmental Testing Solutions, Inc.

Pimephales promelas

Potassium Chloride Chronic Reference Toxicant Control Chart

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_{A10}	Laboratory Warning Limits CT - S_{A10}	CT + S_{A10}	S_{A25}	Laboratory Control Limits CT - S_{A25}	CT + S_{A25}	S_{A75}	USEPA Warning Limits CT - S_{A75}	CT + S_{A75}	S_{A90}	USEPA Control Limits CT - S_{A90}	CT + S_{A90}	C
1	12-06-05	0.61																	
2	02-07-06	0.67	0.64	0.04	0.56	0.72	0.08	0.57	0.72	0.13	0.51	0.78	0.24	0.40	0.89	0.29	0.35	0.93	0.
3	03-07-06	0.61	0.63	0.03	0.57	0.70	0.08	0.56	0.71	0.13	0.50	0.77	0.24	0.39	0.87	0.28	0.35	0.92	0.
4	03-14-06	0.53	0.61	0.06	0.50	0.72	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.
5	04-04-06	0.57	0.60	0.05	0.50	0.70	0.07	0.53	0.67	0.13	0.47	0.73	0.23	0.37	0.83	0.27	0.33	0.87	0.
6	04-18-06	0.64	0.61	0.05	0.51	0.71	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.
7	04-18-06	0.61	0.61	0.05	0.52	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.
8	05-09-06	0.57	0.60	0.04	0.51	0.69	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.
9	06-06-06	0.45	0.59	0.07	0.45	0.72	0.07	0.52	0.66	0.12	0.46	0.71	0.22	0.36	0.81	0.26	0.32	0.85	0.
10	06-13-06	0.56	0.58	0.06	0.46	0.71	0.07	0.51	0.65	0.12	0.46	0.71	0.22	0.36	0.80	0.26	0.32	0.85	0
11	07-11-06	0.61	0.59	0.06	0.47	0.71	0.07	0.52	0.66	0.12	0.46	0.71	0.22	0.36	0.81	0.26	0.32	0.85	0
12	07-18-06	0.61	0.59	0.06	0.47	0.70	0.07	0.52	0.66	0.12	0.46	0.71	0.22	0.36	0.81	0.26	0.32	0.85	0
13	08-01-06	0.64	0.59	0.06	0.48	0.71	0.07	0.52	0.66	0.12	0.47	0.72	0.22	0.37	0.82	0.27	0.33	0.86	0
14	08-08-06	0.67	0.60	0.06	0.48	0.71	0.07	0.53	0.67	0.13	0.47	0.72	0.23	0.37	0.82	0.27	0.33	0.87	0.
15	08-15-06	0.49	0.59	0.06	0.47	0.72	0.07	0.52	0.66	0.12	0.47	0.71	0.22	0.37	0.81	0.27	0.32	0.86	0
16	08-22-06	0.65	0.59	0.06	0.47	0.72	0.07	0.52	0.67	0.12	0.47	0.72	0.23	0.37	0.82	0.27	0.33	0.86	0.
17	09-19-06	0.61	0.60	0.06	0.47	0.72	0.07	0.52	0.67	0.13	0.47	0.72	0.23	0.37	0.82	0.27	0.33	0.86	0
18	10-10-06	0.60	0.60	0.06	0.48	0.71	0.07	0.52	0.67	0.13	0.47	0.72	0.23	0.37	0.82	0.27	0.33	0.86	0.
19	10-17-06	0.64	0.60	0.06	0.48	0.72	0.07	0.53	0.67	0.13	0.47	0.72	0.23	0.37	0.83	0.27	0.33	0.87	0.
20	11-14-06	0.54	0.60	0.06	0.48	0.71	0.07	0.52	0.67	0.12	0.47	0.72	0.23	0.37	0.82	0.27	0.33	0.86	0.

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_{A10} = Standard deviation corresponding to the 10th percentile CV. (S_{A10} = 0.12)

S_{A25} = Standard deviation corresponding to the 25th percentile CV. (S_{A25} = 0.21)

USEPA Control and Warning Limits

S_{A75} = Standard deviation corresponding to the 75th percentile CV. (S_{A75} = 0.38)

S_{A90} = Standard deviation corresponding to the 90th percentile CV. (S_{A90} = 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.

Precision of Endpoint Measurements

Pimephales promelas
Potassium Chloride Chronic Reference Toxicant Data
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	12-06-05	100	0.626		7.1		0.06	10.0	
2	02-07-06	100	0.711	0.669	7.8	7.5	0.09	13.2	11.6
3	03-07-06	100	0.774	0.704	8.4	7.8	0.10	13.3	12.2
4	03-14-06	100	0.745	0.714	9.7	8.3	0.14	18.9	13.8
5	04-04-06	100	0.766	0.724	11.5	8.9	0.08	10.7	13.2
6	04-18-06	100	0.621	0.707	9.7	9.0	0.09	13.8	13.3
7	04-18-06	100	0.668	0.702	13.3	9.7	0.10	15.4	13.6
8	05-09-06	100	0.841	0.719	7.5	9.4	0.12	14.4	13.7
9	06-06-06	100	0.783	0.726	5.9	9.0	0.08	9.6	13.2
10	06-13-06	97.5	0.709	0.724	8.2	8.9	0.16	22.0	14.1
11	07-11-06	100	0.673	0.720	2.5	8.3	0.09	13.1	14.0
12	07-18-06	97.5	0.623	0.712	17.1	9.1	0.10	16.6	14.2
13	08-01-06	100	0.746	0.714	10.5	9.2	0.13	17.0	14.5
14	08-08-06	100	0.613	0.707	10.4	9.3	0.08	13.6	14.4
15	08-15-06	100	0.765	0.711	8.0	9.2	0.16	20.4	14.8
16	08-22-06	100	0.768	0.714	8.7	9.2	0.12	15.5	14.8
17	09-19-06	100	0.699	0.713	12.7	9.4	0.12	17.2	15.0
18	10-10-06	100	0.685	0.712	5.1	9.1	0.10	14.0	14.9
19	10-17-06	100	0.781	0.716	7.3	9.0	0.15	18.7	15.1
20	11-14-06	100	0.737	0.717	5.3	8.8	0.10	13.4	15.0

Note: CV = Coefficient of variation for control growth.
On average, the CV for control growth is 8.8% in Environmental Testing Solutions, Inc. *Pimephales* chronic toxicity tests
Lower CV bound determined by USEPA (10^{th} percentile) = 3.5%.
Upper CV bound determined by USEPA (90^{th} percentile) = 20%

MSD = Minimum Significant Difference

PMSD = Percent Minimum Significant Difference
PMSD is a measure of test precision. The PMSD is the minimum percent difference between the control and treatment that can be declared statistically significant in a whole effluent toxicity test. On average, a significant difference occurs for Environmental Testing Solutions, Inc. chronic toxicity tests when a toxicant reduces *Pimephales* growth by 15.0% from the control.
Lower PMSD bound determined by USEPA (10^{th} percentile) = 9.4%.
Upper PMSD bound determined by USEPA (90^{th} percentile) = 35%.

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

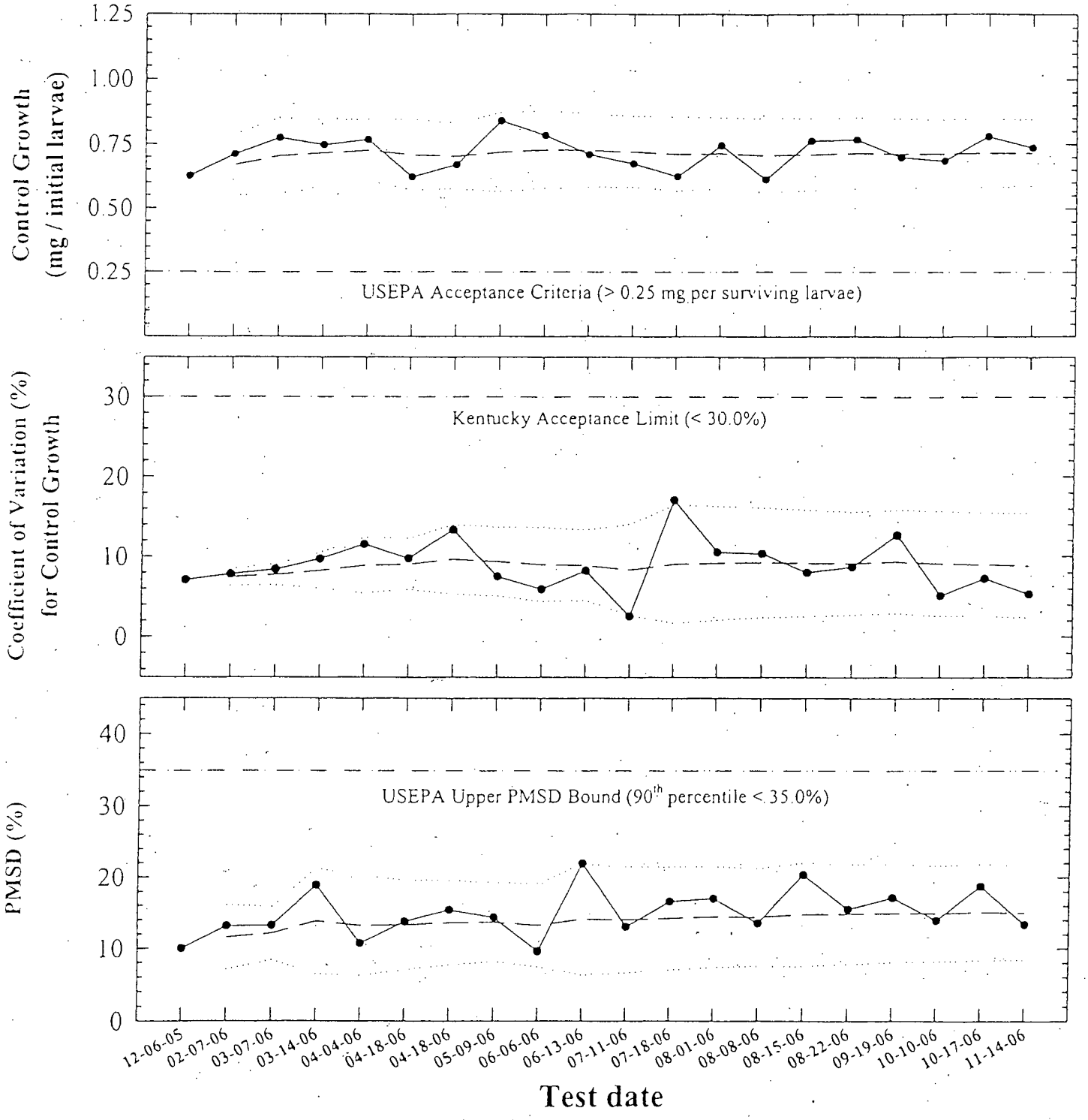
The lower and upper bounds were calculated by the USEPA using 205 tests conducted from 19 laboratories for *Pimephales* growth in chronic reference toxicant tests.

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.

Organisms obtained from Aquatic BioSystems, Inc.

11-14-06

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



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

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

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

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

PpKClCR Test Number: 105

Dilution preparation information:						*Comments:*
KCl CHM number:		CHM267				
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:	22.75 TO 24.75 HOURS OLD	Randomizing template:	PURPLE
Date and times organisms were born between:	11-13-06 1400 TO 1600	Incubator number and shelf location:	3E
Organism source:	ABS BATCH Pp 11-13-06	*Artemia* lot number:	BG1204U
Transfer bowl information:	pH = 7.63 SU Temperature = 24.2 °C	Total drying time:	24.25 HOURS
		Date / Time in:	11-21-06 1350
Average transfer volume:	8.6 mL	Date / Time out:	11-22-06 1400
		Oven temperature:	60 C

Daily feeding and renewal information:

Day	Date	Morning feeding time	Afternoon feeding time	Test initiation, renewal, or termination time	MHS batch used	Analyst
0	11-14-06	~~dl~~	1600	1440	11-12-06A	dl
1	11-15-06	1000	1605	1447	11-12-06B	dl
2	11-16-06	1000	1600	1434	11-12-06B	dl
3	11-17-06	1003	1611	1410	11-15-06A	dl
4	11-18-06	1002	1605	1400	11-15-06A	dl
5	11-19-06	0953	1600	1348	11-15-06B	dl
6	11-20-06	0955	1602	1351	11-15-06B	dl
7	11-21-06			1345		dl

Control information:		Acceptance criteria
% Mortality:	0%	≤ 20%
Average weight per initial larvae:	0.737	
Average weight per surviving larvae:	0.737	≥ 0.25 mg/larvae

Summary of test endpoints:	
7-day LC_{50}	728.4
NOEC	< 300
LOEC	300
ChV	< 300
IC_{25}	536.8

Species: *Pimephales promelas*

PpKCICR Test Number: 105

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	9 id	10
3	10	10	10	10	10	10	10	10	10	10	9	9 id
4	10	10	10	10	10	10	10	10	10	10	9	9
5	10	10	10	10	10	10	10	10	10	10	9	9
6	10	10	10	10	10	10	10	10	10	10	9	9
7	10	10	10	10	ISM 10	10	10	10	10	ISM 10	9	9
A = Pan weight (mg) Tray color code: RED/CAN Analyst: LAB	13.16	14.83	12.52	13.78	15.82	13.72	14.56	14.50	14.33	14.10	15.67	13.60
B = Pan + Larvae weight (mg) Analyst: LAB	20.90	22.20	20.07	20.61	21.04	19.49	21.42	21.42	21.05	20.41	22.11	18.91
Larvae weight (mg) = A – B	7.74	7.37	7.55	6.83	5.22	5.77	6.86	6.92	6.72	6.31	6.44	5.31
Weight per initial number of larvae (mg) = C / Initial number of larvae	0.774	0.737	0.755	0.683	0.522	0.577	0.686	0.692	0.672	0.631	0.644	0.531
Average weight per initial number of larvae (mg)	0.737				0.619				0.620			
Percent reduction from control (%)					16.0%				16.0%			

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

Calculations and data reviewed: dl

Comments:

Species: *Pimephales promelas*

PpKCICR Test Number: 105

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	9 1d	10	8 2d	9 1d	6 4d	6 4d	7 3d	7 3d	3 7d	5 5d	2 8d	3 7d
2	8 1d	10	7 1d	9	5 1d	5 1d	6 1d	7	3	5	2	3
3	8	10	7	9	5	5	6	6 1d	3	4 1d	2	3
4	8	10	7	9	5	5	6	6	2 1d	3 1d	2	3
5	7 1d	10	7	9	5	5	6	6	2	3	2	2 1d
6	7	8 2d	7	8 1d	5	5	6	4 2d	2	3	2	1 1d
7	7	8	7 2dS	8	5	5	6	4	2	3 1SM	2	1
A = Pan weight (mg) Tray color code:: Red Tray Analyst: LAB	13.34	14.82	13.18	14.37	13.38	14.34	14.37	13.94	14.50	14.04	13.93	15.19
B = Pan + Larvae weight (mg) Analyst: LAB	17.05	19.85	19.20	19.79	16.52	17.94	18.10	16.44	15.81	15.59	15.38	15.93
Larvae weight (mg) = A – B	3.71	5.03	6.02	5.42	3.14	3.60	3.73	2.50	1.31	1.55	1.45	0.74
Weight per initial number of larvae (mg) = C / Initial number of larvae	0.371	0.503	0.602	0.542	0.314	0.360	0.373	0.250	0.131	0.155	1.45	0.074
Average weight per initial number of larvae (mg)	0.505				0.324				0.126			
Percent reduction from control (%)	31.67%				56.07%				82.97%			

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

Calculations and data reviewed: dl

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

Test number: PpKCICR # 145 (#105 at 351 Depot St.)
Test dates: November 14-21, 2006

Reveiwed by:

Concentration (mg/L KCl)	Replicate	Initial number of larvae	Final number of larvae	A = Pan weight (mg)	B = Pan + Larvae weight (mg)	Larvae weight (mg) = A - B	Weight / Surviving number of larvae (mg)	Mean weight/ Surviving number of larvae (mg)	Coefficient of variation (Mean weight per surviving number of larvae) (%)	Weight / Initial number of larvae (mg)	Mean survival (%)	Mean weight/ Initial number of larvae (mg)	Coefficient of variation (%)	Percent reductio control (%
Control	A	10	10	13.16	20.90	7.74	0.774	0.737	5.3	0.774	100.0	0.737	5.3	Not applic
	B	10	10	14.83	22.20	7.37	0.737			0.737				
	C	10	10	12.52	20.07	7.55	0.755			0.755				
	D	10	10	13.78	20.61	6.83	0.683			0.683				
300	E	10	10	15.82	21.04	5.22	0.522	0.619	13.5	0.522	100.0	0.619	13.5	16.0
	F	10	10	13.72	19.49	5.77	0.577			0.577				
	G	10	10	14.56	21.42	6.86	0.686			0.686				
	H	10	10	14.50	21.42	6.92	0.692			0.692				
450	I	10	10	14.33	21.05	6.72	0.672	0.652	8.3	0.672	95.0	0.620	9.9	16.0
	J	10	10	14.10	20.41	6.31	0.631			0.631				
	K	10	9	15.67	22.11	6.44	0.716			0.644				
	L	10	9	13.60	18.91	5.31	0.590			0.531				
600	M	10	7	13.34	17.05	3.71	0.530	0.674	20.5	0.371	75.0	0.505	19.4	31.6
	N	10	8	14.82	19.85	5.03	0.629			0.503				
	O	10	7	13.18	19.20	6.02	0.860			0.602				
	P	10	8	14.37	19.79	5.42	0.678			0.542				
750	Q	10	5	13.38	16.52	3.14	0.628	0.649	7.3	0.314	50.0	0.324	17.1	56.0
	R	10	5	14.34	17.94	3.60	0.720			0.360				
	S	10	6	14.37	18.10	3.73	0.622			0.373				
	T	10	4	13.94	16.44	2.50	0.625			0.250				
900	U	10	2	14.50	15.81	1.31	0.655	0.659	15.5	0.131	20.0	0.126	28.7	82.9
	V	10	3	14.04	15.59	1.55	0.517			0.155				
	W	10	2	13.93	15.38	1.45	0.725			0.145				
	X	10	1	15.19	15.93	0.74	0.740			0.074				

Dunnett's MSD value: 0.0987
PMSD: 13.4

MSD = Minimum Significant Difference
PMSD = Percent Minimum Significant Difference

PMSD is a measure of test precision. The PMSD is the minimum percent difference between the control and treatment that can be declared statistically significant in a whole effluent toxicity te
average, a significant difference occurs for Environmental Testing Solutions, Inc. chronic toxicity tests when a toxicant reduces *Pimephales* growth by 15.0% from the control (determined throu
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 Survival

Start Date	11/14/2006	Test ID	PpKCICR	Sample ID	REF-Ref Toxicant
End Date	11/21/2006	Lab ID	ETS-Envir. Testing Sol	Sample Type	KCL-Potassium chloride
Sample Date		Protocol	FWCHR-EPA-821-R-02-013	Test Species	PP-Pimephales promelas
Comments					

Conc-mg/L	1	2	3	4
D-Control	1.0000	1.0000	1.0000	1.0000
300	1.0000	1.0000	1.0000	1.0000
450	1.0000	1.0000	0.9000	0.9000
600	0.7000	0.8000	0.7000	0.8000
750	0.5000	0.5000	0.6000	0.4000
900	0.2000	0.3000	0.2000	0.1000

			Transform: Arcsin Square Root					Rank	1-Tailed	Number	Total
Conc-mg/L	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical	Resp	Number
D-Control	1.0000	1.0000	1.4120	1.4120	1.4120	0.000	4			0	40
300	1.0000	1.0000	1.4120	1.4120	1.4120	0.000	4	18.00	10.00	0	40
450	0.9500	0.9500	1.3305	1.2490	1.4120	7.072	4	14.00	10.00	2	40
*600	0.7500	0.7500	1.0492	0.9912	1.1071	6.383	4	10.00	10.00	10	40
*750	0.5000	0.5000	0.7854	0.6847	0.8861	10.467	4	10.00	10.00	20	40
*900	0.2000	0.2000	0.4572	0.3218	0.5796	23.087	4	10.00	10.00	32	40

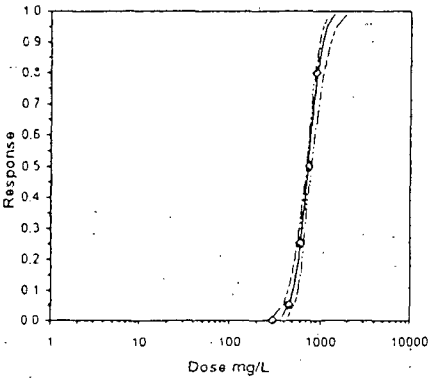
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution ($p > 0.01$)	0.927304924	0.884	-0.11783462	-0.07299576
Equality of variance cannot be confirmed				

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	450	600	519.6152423	
Treatments vs D-Control				

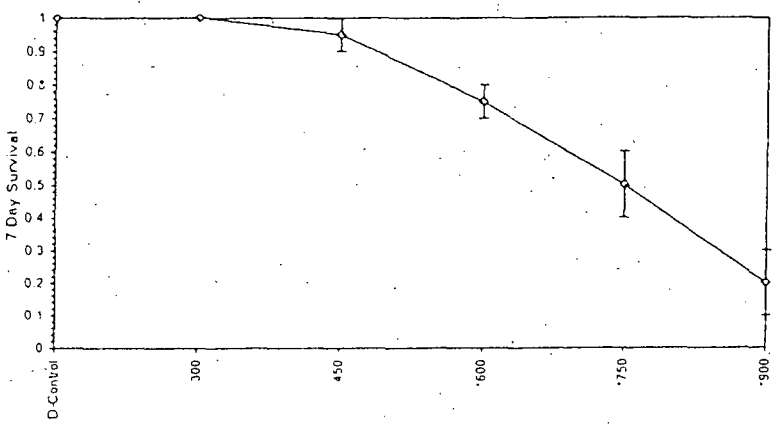
Maximum Likelihood-Probit

Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter
Slope	8.218545127	1.185542237	5.894882038	10.54220822	0	0.510637251	7.814727783	0.92	2.862395394	0.121676037	3
Intercept	-18.5247257	3.373327762	-25.13644853	-11.91130032							
TSCR											

Point	Probits	mg/L	95% Fiducial Limits	
EC01	2.674	379.6073413	295.2835229	439.0208562
EC05	3.355	459.468902	383.559901	511.8507084
EC10	3.718	508.6994638	440.1419331	556.5132553
EC15	3.964	544.8617129	482.2758146	589.6651074
EC20	4.158	575.4270324	517.9312937	618.2379899
EC25	4.326	603.012277	549.8515822	644.7448404
EC40	4.747	678.5301092	633.4494993	723.2887018
EC50	5.000	728.4427003	683.7392443	781.8840101
EC60	5.253	782.0268659	733.1090911	850.8899764
EC75	5.674	879.9634494	814.8968753	989.3037695
EC80	5.842	922.1477985	848.0480517	1052.488559
EC85	6.036	973.8779028	887.6041206	1132.258219
EC90	6.282	1043.108519	939.1191681	1242.443569
EC95	6.645	1154.874127	1019.754797	1427.556739
EC99	7.326	1397.83602	1187.558721	1856.653025



Dose-Response Plot



Organisms obtained from Aquatic BioSystems, Inc.

11-14-06

Environmental Testing Solutions, Inc.

Statistical Analyses

Larval Fish Growth and Survival Test-7 Day Growth

Start Date:	11/14/2006	Test ID	PpKCICR	Sample ID	REP-Ref Toxicant
End Date:	11/21/2006	Lab ID	ETS-Envr. Testing Sol	Sample Type:	KCL-Potassium chloride
Sample Date:		Protocol:	FWCHR-EPA-821-R-02-013	Test Species	PP-Pimephales promelas
Comments:					

Conc-mg/L	1	2	3	4
D-Control	0.7740	0.7370	0.7550	0.6830
300	0.5220	0.5770	0.6860	0.6920
450	0.6720	0.6310	0.6440	0.5310
600	0.3710	0.5030	0.6020	0.5420
750	0.3140	0.3600	0.3730	0.2500
900	0.1310	0.1550	0.1450	0.0740

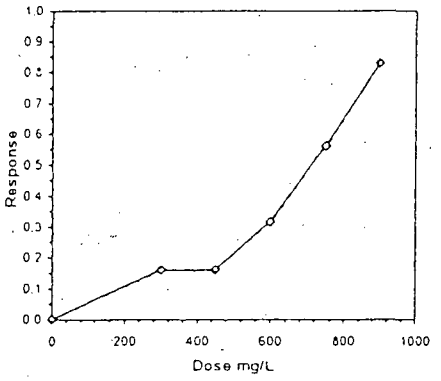
			Transform: Untransformed					1-Tailed			Isotonic	
Conc-mg/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.7373	1.0000	0.7373	0.6830	0.7740	5.316	4				0.7373	1.0000
*300	0.6193	0.8399	0.6193	0.5220	0.6920	13.508	4	2.605	2.180	0.0987	0.6194	0.8401
*450	0.6195	0.8403	0.6195	0.5310	0.6720	9.916	4	2.600	2.180	0.0987	0.6194	0.8401
600	0.5045	0.6843	0.5045	0.3710	0.6020	19.400	4				0.5045	0.6843
750	0.3243	0.4398	0.3243	0.2500	0.3730	17.146	4				0.3243	0.4398
900	0.1263	0.1712	0.1263	0.0740	0.1550	28.671	4				0.1263	0.1712

Auxiliary Tests					Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)					0.9244993849		0.805		-0.53262068	-0.95050657
Bartlett's Test indicates equal variances (p = 0.50)					1.389453173		9.2103405			
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	<300	300			0.098731115	0.1339180 94	0.015526083	0.0041022 78	0.04384 1291	2, 9
Treatments vs D-Control										

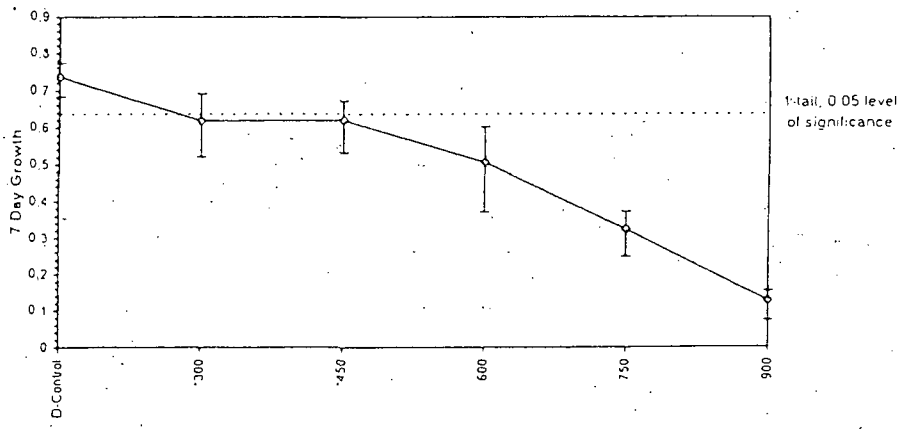
Linear Interpolation (200 Resamples)

Point	mg/L	SD	95% CL(Exp)		Skew
IC05*	93.82	47.73	51.72	346.70	2.4121
IC10*	187.64	73.50	103.45	609.95	1.4317
IC15*	281.45	98.11	155.17	615.17	0.2127
IC20	488.62	75.26	138.89	622.17	-1.2522
IC25	536.75	42.15	421.08	668.52	0.2086
IC40	651.72	29.45	524.79	716.72	-1.1008
IC50	713.07	20.57	644.68	778.29	-0.1493

* indicates IC estimate less than the lowest concentration



Dose-Response Plot



Species: *Pimephales promelas*

PpKCICR Test Number: 105

Daily Chemistry:

		Day					
		0		1		2	
	Analyst	MEK	MEK	MEK	MEK	MEK	MEK
Concentration	Parameter						
CONTROL	pH (S.U.)	7.67	7.71	7.81	7.33	7.52	7.17
	DO (mg/L)	8.1	7.7	8.2	7.9	7.8	7.2
	Conductivity (µmhos/cm)	314		320.		308	
	Alkalinity (mg $CaCO_3$/L)	59		57			
	Hardness (mg $CaCO_3$/L)	93		93			
	Temperature (°C)	24.7	24.5	24.8	24.4	24.7	24.5
300 mg KCl/L	pH (S.U.)	7.74	7.81	7.88	7.39	7.49	7.25
	DO (mg/L)	8.2	7.7	8.2	8.0	8.1	7.2
	Conductivity (µmhos/cm)	843		848		835	
	Temperature (°C)	24.6	24.4	24.7	24.7	24.6	24.3
450 mg KCl/L	pH (S.U.)	7.75	7.84	7.93	7.41	7.52	7.24
	DO (mg/L)	8.1	7.8	8.2	8.0	8.1	7.2
	Conductivity (µmhos/cm)	1080		1150		1130	
	Temperature (°C)	24.6	24.6	24.7	24.3	24.9	24.6
600 mg KCl/L	pH (S.U.)	7.77	7.82	7.95	7.45	7.56	7.31
	DO (mg/L)	8.2	7.9	8.3	8.0	8.1	7.2
	Conductivity (µmhos/cm)	1410		1400		1390	
	Temperature (°C)	24.6	24.2	24.7	24.4	24.7	24.6
750 mg KCl/L	pH (S.U.)	7.79	7.87	7.98	7.48	7.59	7.35
	DO (mg/L)	8.2	7.9	8.3	8.0	8.1	7.2
	Conductivity (µmhos/cm)	1660		1660		1650	
	Temperature (°C)	24.9	24.6	24.7	24.4	24.8	24.5
900 mg KCl/L	pH (S.U.)	7.79	7.87	7.97	7.51	7.60	7.42
	DO (mg/L)	8.2	8.0	8.3	8.0	8.1	7.3
	Conductivity (µmhos/cm)	1930		1940		1950	
	Temperature (°C)	24.7	24.6	24.7	24.3	24.8	24.5
STOCK	Conductivity (µmhos/cm)	72,900		—K		73800	
		Initial	Final	Initial	Final	Initial	Final

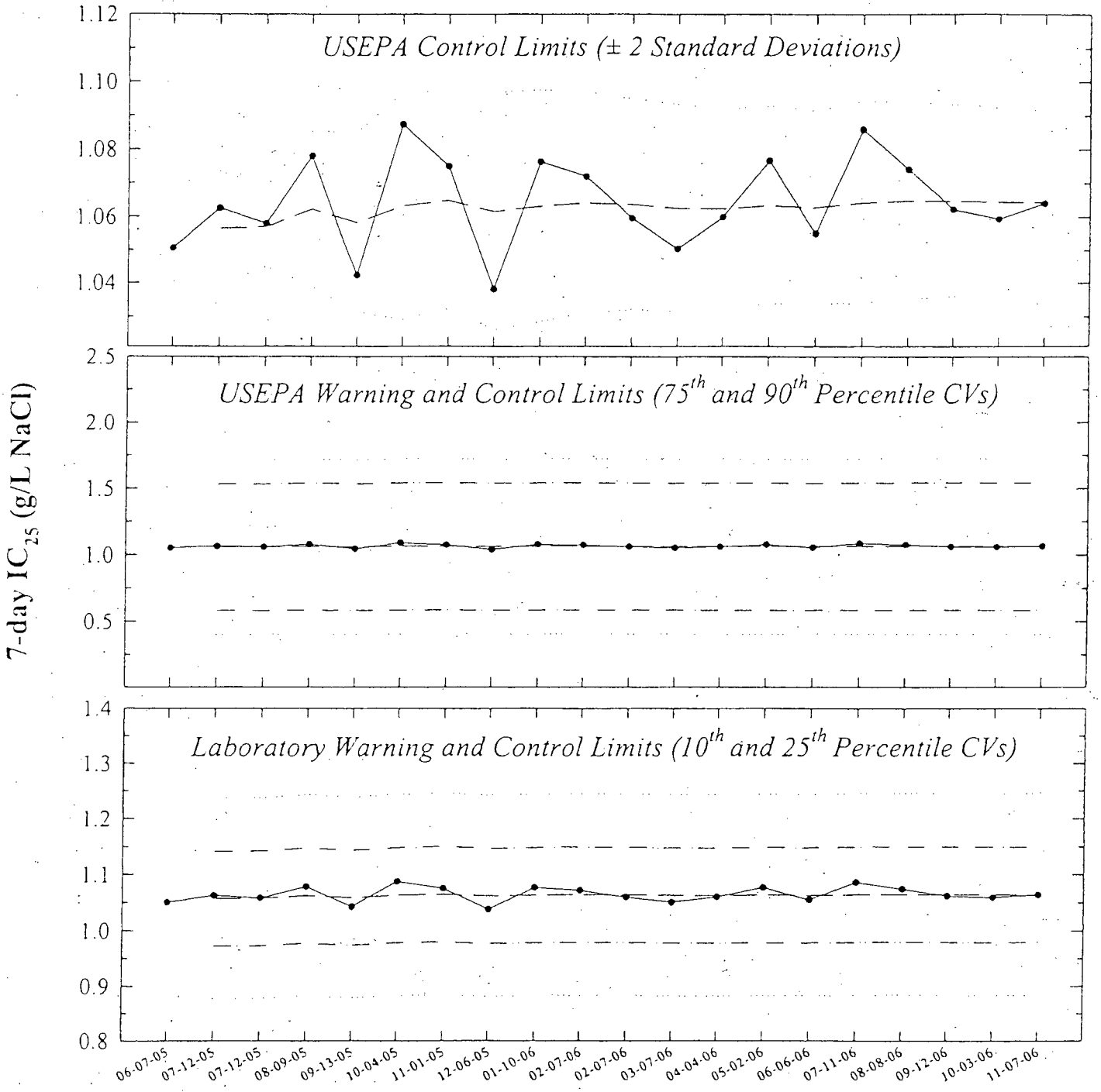
Species: *Pimephales promelas*

PpKClCR Test Number: 105

		Day							
		3		4		5		6	
	Analyst	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Concentration	Parameter								
CONTROL	pH (S.U.)	7.55	7.26	7.77	7.34	7.81	7.41	7.81	7.56
	DO (mg/L)	7.7	7.0	7.7	6.9	7.8	7.2	8.0	7.2
	Conductivity (µmhos/cm)	315		316		309		312	
	Alkalinity (mg $CaCO_3$/L)	59				60			
	Hardness (mg $CaCO_3$/L)	91				93			
	Temperature (°C)	24.7	24.6	24.7	24.5	24.8	24.6	24.5	24.7
300 mg KCl/L	pH (S.U.)	7.64	7.22	7.79	7.32	7.79	7.36	7.87	7.54
	DO (mg/L)	7.8	7.0	7.7	6.9	7.8	6.8	7.9	7.2
	Conductivity (µmhos/cm)	810		817		813		828	
	Temperature (°C)	24.8	24.5	24.8	24.4	24.9	24.4	24.7	24.6
450 mg KCl/L	pH (S.U.)	7.66	7.25	7.77	7.31	7.79	7.36	7.88	7.54
	DO (mg/L)	7.7	6.9	7.7	6.9	7.7	6.7	8.0	7.2
	Conductivity (µmhos/cm)	1110		1120		1110		1110	
	Temperature (°C)	24.7	24.5	24.8	24.4	24.9	24.6	24.7	24.3
600 mg KCl/L	pH (S.U.)	7.67	7.29	7.76	7.29	7.80	7.35	7.88	7.54
	DO (mg/L)	7.8	7.0	7.8	6.8	7.9	6.8	8.1	7.2
	Conductivity (µmhos/cm)	1450		1410		1400		1420	
	Temperature (°C)	24.7	24.7	24.7	24.4	24.8	24.7	24.6	24.2
750 mg KCl/L	pH (S.U.)	7.69	7.32	7.76	7.32	7.79	7.50	7.89	7.56
	DO (mg/L)	7.8	7.1	7.8	6.7	7.9	6.8	8.2	7.2
	Conductivity (µmhos/cm)	1700		1690		1670		1660	
	Temperature (°C)	24.7	24.5	24.8	24.4	24.9	24.2	24.6	24.2
900 mg KCl/L	pH (S.U.)	7.70	7.39	7.75	7.35	7.78	7.57	7.90	7.59
	DO (mg/L)	7.7	7.1	7.8	6.7	8.0	7.2	8.1	7.4
	Conductivity (µmhos/cm)	1970		1940		1920		1940	
	Temperature (°C)	24.7	24.5	24.7	24.4	24.7	24.4	24.7	24.4
STOCK	Conductivity (µmhos/cm)	—		72300		—		75600	
		Initial	Final	Initial	Final	Initial	Final	Initial	Final

Ceriodaphnia dubia

Sodium Chloride Chronic Reference Toxicant Control Chart using Moderately Hard Synthetic Water



Test date

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

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

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

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

Environmental Testing Solutions, Inc.

Ceriodaphnia dubia
Sodium Chloride Chronic Reference Toxicant Control Chart
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_{A10}	Laboratory Warning Limits CT - S_{A10}	CT + S_{A10}	S_{A25}	Laboratory Control Limits CT - S_{A25}	CT + S_{A25}	S_{A75}	USEPA Warning Limits CT - S_{A75}	CT + S_{A75}	S_{A90}	USEPA Control Limits CT - S_{A90}	CT + S_{A90}
1	06-07-05	1.05																
2	07-12-05	1.06	1.06	0.01	1.04	1.07	0.08	0.97	1.14	0.18	0.88	1.24	0.48	0.58	1.53	0.66	0.40	1.71
3	07-12-05	1.06	1.06	0.01	1.04	1.07	0.08	0.97	1.14	0.18	0.88	1.24	0.48	0.58	1.53	0.66	0.40	1.71
4	08-09-05	1.08	1.06	0.01	1.04	1.09	0.08	0.98	1.15	0.18	0.88	1.24	0.48	0.58	1.54	0.66	0.40	1.72
5	09-13-05	1.04	1.06	0.01	1.03	1.09	0.08	0.97	1.14	0.18	0.88	1.24	0.48	0.58	1.53	0.66	0.40	1.71
6	10-04-05	1.09	1.06	0.02	1.03	1.10	0.09	0.98	1.15	0.18	0.88	1.24	0.48	0.58	1.54	0.66	0.40	1.72
7	11-01-05	1.08	1.06	0.02	1.03	1.10	0.09	0.98	1.15	0.18	0.88	1.25	0.48	0.59	1.54	0.66	0.40	1.73
8	12-06-05	1.04	1.06	0.02	1.03	1.10	0.08	0.98	1.15	0.18	0.88	1.24	0.48	0.58	1.54	0.66	0.40	1.72
9	01-10-06	1.08	1.06	0.02	1.03	1.10	0.09	0.98	1.15	0.18	0.88	1.24	0.48	0.58	1.54	0.66	0.40	1.72
10	02-07-06	1.07	1.06	0.02	1.03	1.10	0.09	0.98	1.15	0.18	0.88	1.24	0.48	0.59	1.54	0.66	0.40	1.72
11	02-07-06	1.06	1.06	0.02	1.03	1.10	0.09	0.98	1.15	0.18	0.88	1.24	0.48	0.58	1.54	0.66	0.40	1.72
12	03-07-06	1.05	1.06	0.02	1.03	1.09	0.08	0.98	1.15	0.18	0.88	1.24	0.48	0.58	1.54	0.66	0.40	1.72
13	04-04-06	1.06	1.06	0.01	1.03	1.09	0.08	0.98	1.15	0.18	0.88	1.24	0.48	0.58	1.54	0.66	0.40	1.72
14	05-02-06	1.08	1.06	0.01	1.03	1.09	0.09	0.98	1.15	0.18	0.88	1.24	0.48	0.58	1.54	0.66	0.40	1.72
15	06-06-06	1.06	1.06	0.01	1.03	1.09	0.09	0.98	1.15	0.18	0.88	1.24	0.48	0.58	1.54	0.66	0.40	1.72
16	07-11-06	1.09	1.06	0.02	1.03	1.09	0.09	0.98	1.15	0.18	0.88	1.25	0.48	0.59	1.54	0.66	0.40	1.72
17	08-08-06	1.07	1.06	0.01	1.04	1.09	0.09	0.98	1.15	0.18	0.88	1.25	0.48	0.59	1.54	0.66	0.40	1.72
18	09-12-06	1.06	1.06	0.01	1.04	1.09	0.09	0.98	1.15	0.18	0.88	1.25	0.48	0.59	1.54	0.66	0.40	1.72
19	10-03-06	1.06	1.06	0.01	1.04	1.09	0.09	0.98	1.15	0.18	0.88	1.25	0.48	0.59	1.54	0.66	0.40	1.72
20	11-07-06	1.06	1.06	0.01	1.04	1.09	0.09	0.98	1.15	0.18	0.88	1.25	0.48	0.59	1.54	0.66	0.40	1.72

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 warni limits recommended by USEPA for the test method and endpoint.

S_{A10} = Standard deviation corresponding to the 10th percentile CV. (S_{A10} = 0.08)

S_{A25} = Standard deviation corresponding to the 25th percentile CV. (S_{A25} = 0.17)

USEPA Control and Warning Limits

S_{A75} = Standard deviation corresponding to the 75th percentile CV. (S_{A75} = 0.45)

S_{A90} = Standard deviation corresponding to the 90th percentile CV. (S_{A90} = 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, Cincinnat

Environmental Testing Solutions, Inc.

Precision of Endpoint Measurements

Ceriodaphnia dubia
Sodium Chloride Chronic Reference Toxicant Data
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	06-07-05	100	30.4		5.0		2.6	8.5	
2	07-12-05	100	30.4	30.4	7.5	6.2	2.7	8.8	8.7
3	07-12-05	100	31.1	30.6	7.2	6.5	3.2	10.2	9.2
4	08-09-05	100	28.3	30.1	7.3	6.7	2.9	10.3	9.5
5	09-13-05	100	27.9	29.6	7.3	6.8	3.9	13.9	10.3
6	10-04-05	100	27.0	29.2	5.8	6.7	3.0	11.1	10.5
7	11-01-05	100	28.4	29.1	10.3	7.2	3.8	13.2	10.9
8	12-06-05	100	32.6	29.5	6.3	7.1	2.3	7.1	10.4
9	01-10-06	100	29.2	29.5	4.8	6.8	2.3	7.8	10.1
10	02-07-06	100	30.7	29.6	6.0	6.7	2.4	7.9	9.9
11	02-07-06	100	29.9	29.6	6.8	6.7	2.2	7.5	9.7
12	03-07-06	100	28.8	29.6	5.9	6.7	2.6	8.9	9.6
13	04-04-06	100	27.0	29.4	5.2	6.5	2.1	7.6	9.5
14	05-02-06	100	28.6	29.3	8.6	6.7	2.7	9.3	9.4
15	06-06-06	100	30.3	29.4	5.2	6.6	3.0	9.8	9.5
16	07-11-06	100	29.0	29.4	5.4	6.5	2.5	8.6	9.4
17	08-08-06	100	28.6	29.3	8.9	6.7	3.7	12.8	9.6
18	09-12-06	100	30.9	29.4	5.4	6.6	3.3	10.6	9.7
19	10-03-06	100	32.3	29.5	4.6	6.5	3.1	9.5	9.7
20	11-07-06	100	31.0	29.6	6.3	6.5	2.4	7.8	9.6

Note.

CV = Coefficient of variation for control reproduction.
On average, the CV for control reproduction is 6.5% in Environmental Testing Solutions, Inc. *Ceriodaphnia* chronic toxicity tests.
Lower CV bound determined by USEPA (10^{th} percentile) = 8.9%.
Upper CV bound determined by USEPA (90^{th} percentile) = 42%

MSD = Minimum Significant Difference

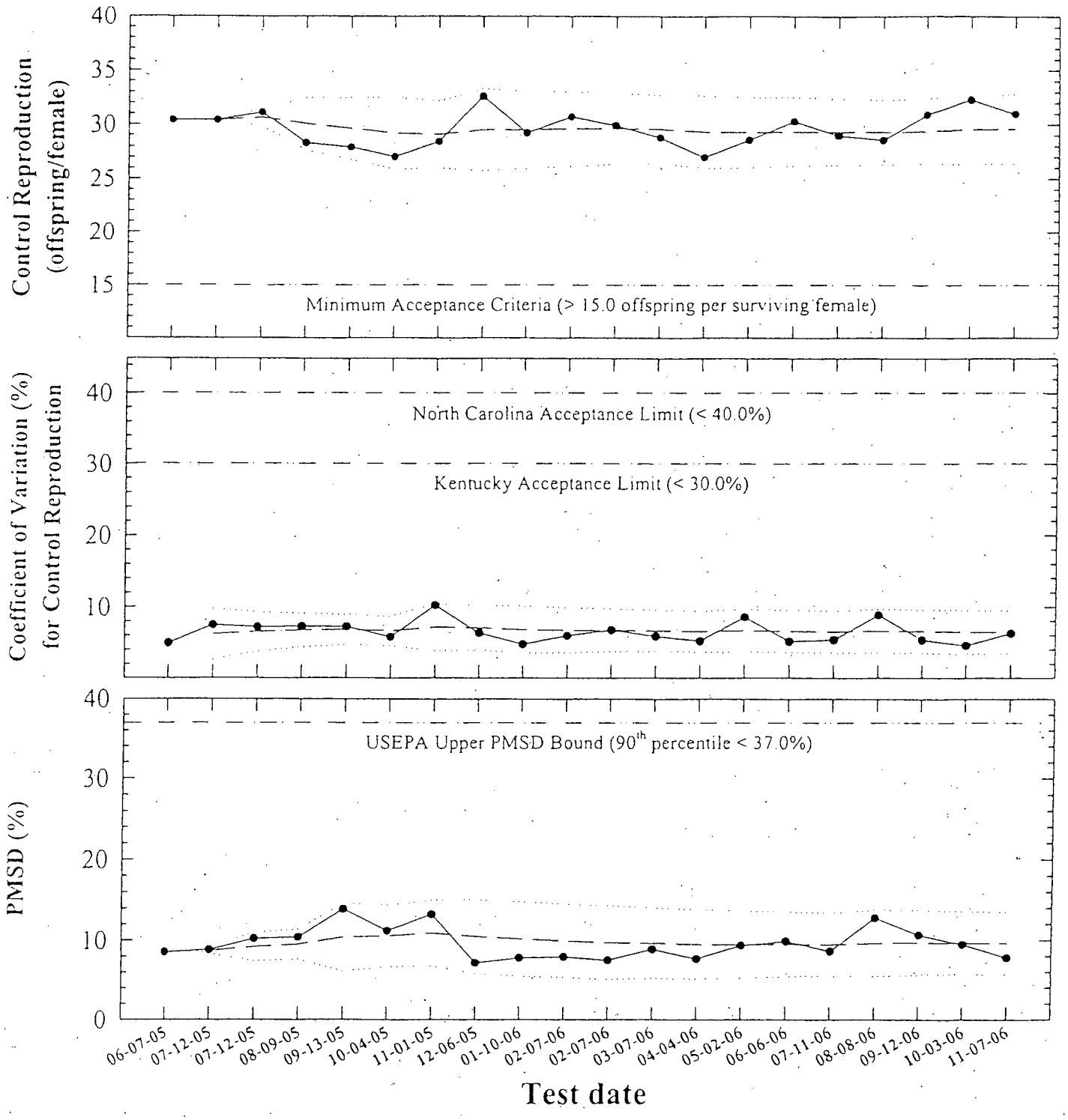
PMSD = Percent Minimum Significant Difference
PMSD is a measure of test precision. The PMSD is the minimum percent difference between the control and treatment that can be declared statistically significant in a whole effluent toxicity test. On average, a significant difference occurs for Environmental Testing Solutions, Inc. chronic toxicity tests when a toxicant reduces *Ceriodaphnia* reproduction by 9.6% from the control
Lower PMSD bound determined by USEPA (10^{th} percentile) = 11%.
Upper PMSD bound determined by USEPA (90^{th} 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.

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



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

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

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

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

CdNaCLCR #: 55

Dilution preparation information:						*Comments:*
NaCl CHM number:		CHM 120				
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:	ORANGE
Date and times organisms were born between:	11-06-06 1547 TO 2002	Incubator number and shelf location:	2B1
Organism source: 10-31-06A	CWR: 1,2,3,4,5,6,10,14,15,20	YCT batch:	10-01-06
Transfer bowl information:	pH = 7.83 SU Temperature = 21.6°C	*Selenastrum* batch:	10-28-06

Daily renewal information:

Day	Date	Test initiation, renewal, or termination time	MHS water batch used	Analyst
0	11-07-06	1127	10-27-06 B	JH
1	11-08-06	1030	10-27-06 B	JH
2	11-09-06	1120	10-27-06 C	JH
3	11-10-06	1034	10-27-06 C	JH
4	11-11-06	1042	10-27-06 C	JH
5	11-12-06	1033	10-27-06 C	JH
6	11-13-06	~~1107~~ 1203	10-27-06 C	JH
7	11-14-06	1034	[redacted]	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	1000
% Mortality:	0%	≤ 20%	LOEC	1200
Mean Offspring/Female:	31.0	≥ 15.0 offspring/female	ChV	1095.4
% CV:	6.3%	< 40.0 %	IC25	1064.0

Species: *Ceriodaphnia dubia*

CdNaCLCR #: 55

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	5	5	5	4	5	5	4	4	4
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	10	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	0	13	10	11	12	12	9	13	10	10
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	16	15	15	15	13	17	18	15	14	15
Total young produced		32	33	30	31	29	34	32	32	28	29
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L
X for 3rd Broods		X	X	X	X	X	X	X	X	X	X

Note: Adult mortality (L = live, D = dead)

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	31.0

600 mg NaCl/L

Survival and Reproduction Data

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

Note: Adult mortality (L = live, D = dead)

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	31.7
% Reduction from Control:	-2.3%

Species: *Ceriodaphnia dubia*

CdNaCLCR #: SS

800 mg NaCl/L

Survival and Reproduction Data

Day		Replicate number									
		1	2	3	4	5	6	7	8	9	10
1	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
2	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
3	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
4	Young produced	5	5	5	4	5	4	4	4	5	5
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	0	10	11	12	0	12	0	0	11	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	13	0	0	0	10	0	9	10	0	10
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	14	14	17	16	15	15	19	16	17	13
Total young produced		32	29	33	32	30	31	32	30	33	28
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Note: Adult mortality (L = live, D = dead)

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	31.0
% Reduction from Control:	0%

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	6	4	4	4	5	5	4	4	5	4
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	14	10	0	10	11	10	12	12	10	10
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	0	0	9	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	14	13	16	15	15	18	15	13	17	14
Total young produced		34	27	29	29	31	33	31	29	32	28
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Note: Adult mortality (L = live, D = dead)

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	30.3
% Reduction from Control:	2.37%

Species: *Ceriodaphnia dubia*

CdNaCLCR #: 55

1200 mg NaCl/L — *Survival and Reproduction Data*

Day		Replicate number									
		1	2	3	4	5	6	7	8	9	10
1	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
2	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
3	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
4	Young produced	3	2	2	0	2	4	1	1	3	3
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	10	0	2	8	2	12	0	5	5	3
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	0	6	0	0	0	0	2	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	0	0	6	0	8	0	1	0	0	0
Total young produced		13	8	10	8	12	16	4	6	8	6
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Note: Adult mortality (L = live, D = dead)

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	9.1
% Reduction from Control:	70.6%

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

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

Note: Adult mortality (L = live, D = dead)

Concentration:	
% Mortality:	20%
Mean Offspring/Female:	2.5
% Reduction from Control:	91.9%

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	6	5	5	5	4	5	5	4	4	4	47
5	10	0	0	0	0	0	0	0	0	0	10
6	0	13	10	11	12	12	9	13	10	10	100
7	16	15	15	15	13	17	18	15	14	15	153
Total	32	33	30	31	29	34	32	32	28	29	310

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	6	4	4	4	5	5	4	4	5	4	45
5	14	10	0	10	11	10	12	12	10	10	99
6	0	0	9	0	0	0	0	0	0	0	9
7	14	13	16	15	15	18	15	13	17	14	150
Total	34	27	29	29	31	33	31	29	32	28	303

600 mg NaCl/L

Day	Replicate number										Total
	1	2	3	4	5	6	7	8	9	10	
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0
4	4	5	5	5	5	5	4	6	4	4	47
5	0	11	0	11	13	0	0	0	0	0	35
6	12	0	10	0	0	13	11	11	10	12	79
7	16	18	14	15	17	15	15	14	18	14	156
Total	32	34	29	31	35	33	30	31	32	30	317

1200 mg NaCl/L

Day	Replicate number										Total
	1	2	3	4	5	6	7	8	9	10	
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0
4	3	2	2	0	2	4	1	1	3	3	21
5	10	0	2	8	2	12	0	5	5	3	47
6	0	6	0	0	0	0	2	0	0	0	8
7	0	0	6	0	8	0	1	0	0	0	15
Total	13	8	10	8	12	16	4	6	8	6	91

800 mg NaCl/L

Day	Replicate number										Total
	1	2	3	4	5	6	7	8	9	10	
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0
4	5	5	5	4	5	4	4	4	5	5	46
5	0	10	11	12	0	12	0	0	11	0	56
6	13	0	0	0	10	0	9	10	0	10	52
7	14	14	12	16	15	15	19	16	17	13	156
Total	32	29	33	32	30	31	32	30	33	28	310

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	2	0	0	0	1	0	0	2	2	1	8
5	5	0	0	0	0	4	3	0	0	0	12
6	0	3	0	0	0	0	0	0	2	0	5
7	0	0	0	0	0	0	0	0	0	0	0
Total	7	3	0	0	1	4	3	2	4	1	25

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 #84 (#55 at 351 Depot St.)

Test dates: November 07-14, 2006

Reveiwed by:

Concentration (mg/L NaCl)	Replicate number										Survival (%)	Average reproduction (offspring/female)	Coefficient of variation (%)	Percent reduction from control (%)
	1	2	3	4	5	6	7	8	9	10				
Control	32	33	30	31	29	34	32	32	28	29	100	31.0	6.3	Not applicable
600	32	34	29	31	35	33	30	31	32	30	100	31.7	6.0	-2.3
800	32	29	33	32	30	31	32	30	33	28	100	31.0	5.5	0.0
1000	34	27	29	29	31	33	31	29	32	28	100	30.3	7.5	2.3
1200	13	8	10	8	12	16	4	6	8	6	100	9.1	40.3	70.6
1400	7	3	0	0	1	4	3	2	4	1	80	2.5	86.9	91.9

Dunnett's MSD value: 2.417

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 9.6% from the control.

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

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

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

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

Statistical Analyses

Ceriodaphnia Survival and Reproduction Test-Reproduction

Start Date	11/7/2006	Test ID:	CdNaClCR	Sample ID:	REF-Ref Toxicant
End Date	11/14/2006	Lab ID:	ETS-Envir. Testing Sol	Sample Type:	NACL-Sodium chloride
Sample Date		Protocol:	FWCHR-EPA-821-R-02-013	Test Species:	CD-Ceriodaphnia dubia
Comments:					

Conc-mg/L	1	2	3	4	5	6	7	8	9	10
D-Control	32.000	33.000	30.000	31.000	29.000	34.000	32.000	32.000	28.000	29.000
600	32.000	34.000	29.000	31.000	35.000	33.000	30.000	31.000	32.000	30.000
800	32.000	29.000	33.000	32.000	30.000	31.000	32.000	30.000	33.000	28.000
1000	34.000	27.000	29.000	29.000	31.000	33.000	31.000	29.000	32.000	28.000
1200	13.000	8.000	10.000	8.000	12.000	16.000	4.000	6.000	8.000	6.000
1400	7.000	3.000	0.000	0.000	1.000	4.000	3.000	2.000	4.000	1.000

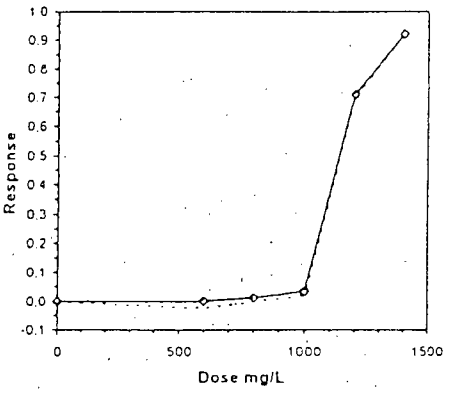
			Transform: Untransformed					1-Tailed			Isotonic	
Conc-mg/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	31.000	1.0000	31.000	28.000	34.000	6.270	10				31.350	1.0000
600	31.700	1.0226	31.700	29.000	35.000	5.958	10	-0.662	2.287	2.417	31.350	1.0000
800	31.000	1.0000	31.000	28.000	33.000	5.483	10	0.000	2.287	2.417	31.000	0.9888
1000	30.300	0.9774	30.300	27.000	34.000	7.469	10	0.662	2.287	2.417	30.300	0.9665
*1200	9.100	0.2935	9.100	4.000	16.000	40.276	10	20.721	2.287	2.417	9.100	0.2903
*1400	2.500	0.0806	2.500	0.000	7.000	86.923	10	26.966	2.287	2.417	2.500	0.0797

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Kolmogorov D Test indicates normal distribution ($p > 0.01$)	0.81748134	1.035	0.44619717	0.3712335
Bartlett's Test indicates equal variances ($p = 0.18$)	7.55277777	15.0862722		

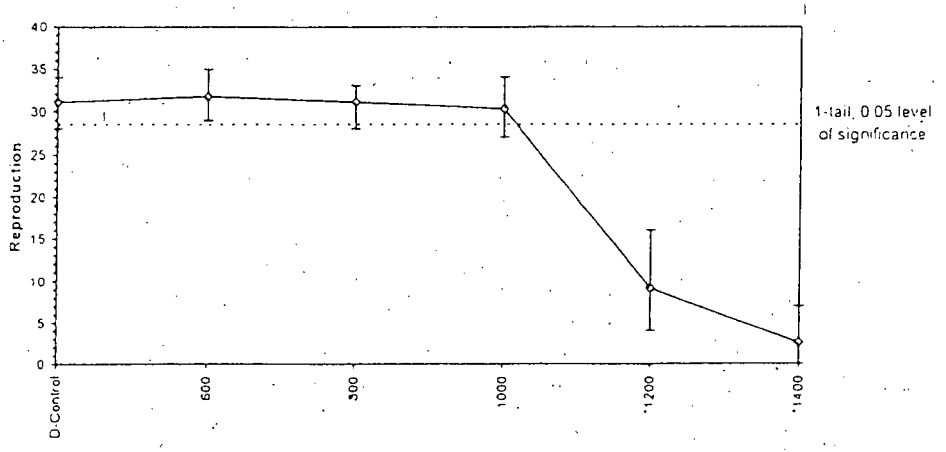
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	1000	1200	1095.44512		2.41677734	0.07796036	1738.96	5.58518519	1.6E-38	5, 54
Treatments vs D-Control										

Linear Interpolation (200 Resamples)

Point	mg/L	SD	95% CL		Skew
IC05	1004.88208	51.0038904	825.635417	1014.14902	-2.5889
IC10	1019.66981	5.96832498	1007.34438	1028.34195	-0.3117
IC15	1034.45755	5.61835965	1023.38686	1043.09093	-0.2720
IC20	1049.24528	5.40692453	1038.23354	1057.91483	-0.2188
IC25	1064.03302	5.35046783	1052.85837	1072.74883	-0.1422
IC40	1108.39623	6.09494531	1095.59506	1118.42537	0.2053
IC50	1137.9717	7.17272292	1123.85682	1151.46069	0.4115



Dose-Response Plot



Species: *Ceriodaphnia dubia*

CdNaCLCR #: 55

Daily Chemistry:

		Day					
		0		1		2	
	Analyst	KEN	KEN	KEN	KEN	KEN	KEN
Concentration	Parameter						
CONTROL	pH (S.U.)	7.82	7.91	7.99	7.86	7.80	7.69
	DO (mg/L)	7.6	7.8	7.8	7.9	7.8	8.0
	Conductivity (µmhos/cm)	312		318		312	
	Alkalinity (mg $CaCO_3$/L)	59				61	
	Hardness (mg $CaCO_3$/L)	84				84	
	Temperature (°C)	24.5	24.9	24.4	25.0	24.7	24.7
600 mg NaCl/L	pH (S.U.)	7.89	7.90	7.97	7.87	7.93	7.72
	DO (mg/L)	7.6	7.8	7.9	7.8	7.8	8.0
	Conductivity (µmhos/cm)	1510		1500		1490	
	Temperature (°C)	24.7	25.2	24.4	24.8	24.6	24.7
800 mg NaCl/L	pH (S.U.)	7.91	7.89	7.96	7.90	7.94	7.72
	DO (mg/L)	7.6	7.9	7.9	7.8	7.8	8.1
	Conductivity (µmhos/cm)	1900		1910		1910	
	Temperature (°C)	24.4	25.3	24.4	24.9	24.7	24.7
1000 mg NaCl/L	pH (S.U.)	7.90	7.89	7.95	7.92	7.94	7.75
	DO (mg/L)	7.7	7.9	7.9	7.9	7.9	8.1
	Conductivity (µmhos/cm)	2360		2300		2360	
	Temperature (°C)	24.6	25.1	24.5	24.9	24.7	24.6
1200 mg NaCl/L	pH (S.U.)	7.91	7.91	7.96	7.90	7.95	7.74
	DO (mg/L)	7.7	7.8	7.9	7.9	7.9	8.2
	Conductivity (µmhos/cm)	2780		2710		2700	
	Temperature (°C)	24.6	25.1	24.6	25.1	24.5	24.7
1400 mg NaCl/L	pH (S.U.)	7.90	7.91	7.93	7.92	7.95	7.73
	DO (mg/L)	7.7	7.8	7.9	7.8	7.9	8.2
	Conductivity (µmhos/cm)	3110		3060		3050	
	Temperature (°C)	24.6	25.0	24.4	25.1	24.6	24.6
STOCK	Conductivity (µmhos/cm)	129000					
		Initial	Final	Initial	Final	Initial	Final

Species: *Ceriodaphnia dubia*

CdNaCLCR #: 55

		Day							
		3		4		5		6	
	Analyst	MEK	MEK	MEK	MEK	MEK	MEK	MEK	MEK
Concentration	Parameter								
CONTROL	pH (S.U.)	7.67	7.74	7.89	7.83	8.11	7.90	7.99	7.89
	DO (mg/L)	7.8	7.6	7.5	7.8	7.8	8.0	8.1	7.7
	Conductivity (µmhos/cm)	301		303		309		312	
	Alkalinity (mg $CaCO_3$/L)								
	Hardness (mg $CaCO_3$/L)								
	Temperature (°C)	24.8	24.7	24.9	24.9	24.8	24.8	24.7	24.9
600 mg NaCl/L	pH (S.U.)	7.76	7.75	7.80	7.82	7.96	7.91	8.00	7.91
	DO (mg/L)	7.9	7.6	7.5	7.8	7.7	8.0	8.2	7.6
	Conductivity (µmhos/cm)	1510		1470		1470		1420	
	Temperature (°C)	24.8	25.1	24.7	25.0	24.6	24.8	24.7	25.2
800 mg NaCl/L	pH (S.U.)	7.79	7.75	7.81	7.84	8.01	7.95	8.07	7.93
	DO (mg/L)	7.9	7.6	7.5	7.9	7.8	8.1	8.2	7.5
	Conductivity (µmhos/cm)	1850		1820		1880		1850	
	Temperature (°C)	24.7	25.1	24.8	25.2	24.7	25.1	24.6	24.9
1000 mg NaCl/L	pH (S.U.)	7.77	7.78	7.79	7.84	8.00	7.95	8.07	7.93
	DO (mg/L)	8.1	7.7	7.5	7.9	7.8	8.1	8.2	7.6
	Conductivity (µmhos/cm)	2240		2250		2300		2320	
	Temperature (°C)	24.8	25.0	24.8	25.0	24.8	24.8	24.8	24.8
1200 mg NaCl/L	pH (S.U.)	7.79	7.75	7.79	7.83	7.99	7.95	8.07	7.93
	DO (mg/L)	8.1	7.7	7.5	7.9	7.8	8.1	8.3	7.7
	Conductivity (µmhos/cm)	2640		2670		2670		2670	
	Temperature (°C)	24.7	24.9	24.6	25.1	24.6	25.0	24.5	24.8
1400 mg NaCl/L	pH (S.U.)	7.79	7.73	7.78	7.84	7.98	7.94	8.07	7.94
	DO (mg/L)	8.1	7.8	7.5	7.9	7.9	8.0	8.3	7.7
	Conductivity (µmhos/cm)	2970		2980		3010		3010	
	Temperature (°C)	24.7	25.0	24.9	24.9	24.7	25.0	24.6	25.1
STOCK	Conductivity (µmhos/cm)	—		127000		—		—	
		Initial	Final	Initial	Final	Initial	Final	Initial	Final

January 4, 2007

Ruth Ann Hurt, SB 2A-SQN

SEQUOYAH NUCLEAR PLANT (SQN) TOXICITY BIOMONITORING, NPDES PERMIT NO. TN0026450, OUTFALL 101, NOVEMBER, 2006

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 November 26-December 1, showed no toxic effects to fathead minnows or daphnids. The resulting IC_{25} values for both species were > 100 percent. Fathead minnows exposed to intake samples were significantly different (less than) from the control based on growth analyses using Homoscedastic t-Tests. Daphnids were not significantly different from control for either intake or upstream based on reproduction analyses using Homoscedastic t-Tests.

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.

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

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

Attachment
cc (Attachment):
R. M. Sherrard, PSC 1X-C
Files, RSO&E-EDMS-Muscle Shoals

SQN November 2006M-second test

TENNESSEE VALLEY AUTHORITY
TOXICITY TEST REPORT

INTRODUCTION / EXECUTIVE SUMMARY

Report Date: January 4, 2007

1. Facility / Discharger: Sequoyah Nuclear Plant / TVA

2. County / State: Hamilton / Tennessee

3. NPDES Permit #: TN0026450

4. Type of Facility: Nuclear-Fueled Electric Generating Plant

5. Design Flow (MGD): 1579

7. Receiving Stream: Tennessee River (TRM 483.6)

8. 1Q10: 3491

9. Outfall Tested: 101

10. Dates Sampled: November 26-December 1, 2006

11. Average Flow on Days Sampled (MGD): 1528, 1493, 910, 908, 911, 915
12. Pertinent Site Conditions:

Towerbrom 960 (chlorination) was injected from November 26 - December 1, 2006. The dates and times for the Towerbrom 960 injection are in the following table.

Injection Location	Date/Start Time (ET)	Date/Ending Time (ET)
Essential Raw Cooling Water (ERCW) Train A & B	11/26/2006 0000	12/01/2006 2400
Raw Cooling Water (RCW)	11/26/2006 0000 12/01/2006 1142	11/27/2006 1600 12/01/2006 1600

13. Test Dates: November 28-December 5, 2006

14. Test Type: Short-term Chronic Definitive

15. Test Species: Fathead Minnows (*Pimephales promelas*)
Daphnids (*Ceriodaphnia dubia*)

16. Concentrations Tested (%): Outfall 101: 11.3, 22.6, 45.2, 72.6, 100
Intake: 100.0

Pimephales promelas: UV treated Outfall 101: 11.3, 22.6, 45.2, 72.6, 100
UV treated Intake: 100.0

17. Permit Limit Endpoint (%): Outfall 101: $IC_{25} = 45.2\%$

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

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

19. Facility Contact: Stephanie Howard Phone #: (423) 843-6700

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

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

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

23. Notes: Outfall 101 samples collected November 26-December 1, 2006, showed no toxic effects to fathead minnows or daphnids. The resulting IC_{25} values, for both species, were > 100 percent. Exposure of daphnids to intake samples resulted in no significant differences from the control during this study period. Growth in minnows exposed to intake samples was significantly lower than minnow growth in the control.

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.

METHODS SUMMARY

Samples:

1. Sampling Point: Outfall 101, Intake

2. Sample Type: Composite

3. Sample Information:

Sample ID	Date (MM/DD/YY)/ Time (ET) Collected	Date (MM/DD/YY)/ Time (ET) Received	Arrival Temp. (°C)	Initial TRC* (mg/L)	Date (MM/DD/YY)/ Time (ET) First Used By
101	11/26/06 0753 to 11/27/06 0653	11/27/06 1400	3.7/3.4†	<0.10	11/28/06 1559 11/29/06 1507
Intake	11/26/06 0809 to 11/27/06 0709	11/27/06 1400	1.4	<0.10	11/28/06 1559 11/29/06 1507
101	11/28/06 0826 to 11/29/06 0726	11/29/06 1400	4.3/4.6†	<0.10	11/30/06 1510 12/01/06 1513
Intake	11/28/06 0843 to 11/29/06 0743	11/29/06 1400	1.1	<0.10	11/30/06 1510 12/01/06 1513
101	11/30/06 0758 to 12/01/06 0658	12/01/06 1350	4.5/5.2†	<0.10	12/02/06 1507 12/03/06 1511 12/04/06 1512
Intake	11/30/06 0813 to 12/01/06 0713	12/01/06 1350	2.5	<0.10	12/02/06 1507 12/03/06 1511 12/04/06 1512

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

4. Sample Manipulation: Samples from Outfall 101 and intake were warmed to test temperature (25.0 ± 1.0°C) in a warm water bath.

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

	Pimephales promelas	*Ceriodaphnia dubia*
Test Organisms:		
1. Source:	Aquatic BioSystems, Inc.	In-house Cultures
2. Age:	24-26 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	11/28/06 - 1559 ET	11/28/06 - 1042 ET
UV Treated Outfall 101	11/28/06 - 1547 ET	
7. Test Termination: (Date/Time)		
Outfall 101	12/05/06 - 1600 ET	12/05/06 - 0954 ET
UV Treated Outfall 101	12/05/06 - 1545 ET	
8. Test Temperature: Outfall 101:	Mean = 24.6°C (24.1 - 25.1°C)	Mean = 24.8°C (24.5 - 25.2°C)

Test Temperature: UV-Treated Outfall 101: Mean = 24.7°C (24.1 - 25.1°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* (Genus species) Chronic/ 7-day Toxicity Test. (Type / Duration)

Conducted November 28-December 5, 2006 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
11.3%	100	100	100	100	100	100	100
22.6%	100	100	100	100	100	100	100
45.2%	100	100	100	100	100	100	100
72.6%	100	100	100	100	100	100	100
100.0%	100	100	100	100	100	100	98
Intake	100	100	100	100	100	100	100

Test Solutions (% Effluent)	Mean Dry Weight (mg) (replicate number)				
	1	2	3	4	Mean
Control	0.707	0.726	0.706	0.682	0.705
11.3%	0.644	0.641	0.682	0.601	0.642
22.6%	0.668	0.650	0.667	0.692	0.669
45.2%	0.649	0.745	0.637	0.677	0.677
72.6%	0.600	0.618	0.628	0.588	0.609
100.0%	0.536	0.595	0.571	0.666	0.592
Intake	0.614	0.593	0.615	0.637	0.615

IC_{25} Value: > 100% Permit Limit: 45.2% 95% Confidence Limits: Upper Limit: NA Lower Limit: NA	Calculated TU Estimates: < 1.0 TUc* Permit Limit: 2.2 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 November 28-December 5, 2006 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
11.3%	100	100	100	100	100	100	100
22.6%	100	100	100	100	100	100	100
45.2%	100	100	100	100	100	100	100
72.6%	100	100	100	100	100	100	100
100.0%	100	100	100	100	100	100	100

Test Solutions (% Effluent)	Reproduction (#young/female/7 days) Data (replicate number)										
	1	2	3	4	5	6	7	8	9	10	Mean
Control	25	27	31	28	28	27	28	29	29	30	28.2
11.3%	26	28	32	29	28	32	33	28	29	29	29.4
22.6%	29	30	29	32	29	31	30	31	31	31	30.3
45.2%	31	32	31	32	29	28	30	30	32	29	30.4
72.6%	28	35	31	30	28	34	31	36	30	28	31.1
100.0%	31	31	30	33	30	36	30	37	29	32	31.9

IC_{25} Value: > 100% Permit Limit: 45.2% 95% Confidence Limits: Upper Limit: NA Lower Limit: NA	Calculated TU Estimates: < 1.0 TUc* Permit Limit: 2.2 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 November 28-December 5, 2006 using water from Intake

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

Test Solutions (% Effluent)	Reproduction (#young/female/7 days) Data (replicate number)										
	1	2	3	4	5	6	7	8	9	10	Mean
Control	28	25	25	28	30	26	30	28	28	28	27.6
Intake	32	28	31	33	29	28	32	30	31	30	30.4

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

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

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

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

Conducted November 28-December 5, 2006 using effluent from UV Treated Outfall 101.

Test Solutions (% Effluent)	Percent Surviving (time interval used – days)						
	1	2	3	4	5	6	7
Control	100	100	100	100	100	100	100
11.3%	100	100	100	100	100	100	100
22.6%	100	100	100	100	100	100	100
45.2%	100	100	100	100	100	100	100
72.6%	100	100	100	100	100	100	100
100.0%	100	100	100	100	100	100	100
Intake	100	100	100	100	100	100	100

Test Solutions (% Effluent)	Mean Dry Weight (mg) (replicate number)				
	1	2	3	4	Mean
Control	0.565	0.645	0.669	0.763	0.661
11.3%	0.645	0.738	0.661	0.656	0.675
22.6%	0.597	0.602	0.630	0.709	0.635
45.2%	0.634	0.604	0.513	0.602	0.588
72.6%	0.542	0.583	0.583	0.630	0.585
100.0%	0.637	0.705	0.748	0.623	0.678
Intake	0.619	0.608	0.667	0.682	0.644

IC_{25} Value: > 100%	Calculated TU Estimates: < 1.0 TUc*
95% Confidence Limits: Upper Limit: NA Lower 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	November 28 - December 5, 2006	1609	7-days	KCl	0.63 g/L
Ceriodaphnia dubia	November 7 - 14, 2006	1127	7-days	NaCl	1.06 g/L

PHYSICAL/CHEMICAL SUMMARY

Water Chemistry Mean Values and Ranges for *Pimephales promelas* and *Ceriodaphnia dubia* Tests, Sequoyah Nuclear Plant Effluent (SQN), Outfall 101, November 28 - December 5, 2006

Test	Sample ID	Temperature (°C)		Dissolved Oxygen (mg/L)		pH (S.U.)		Conductance (µmhos/cm)	Alkalinity (mg/L $CaCO_3$)	Hardness (mg/L $CaCO_3$)	Total Residual Chlorine (mg/L)
		Initial	Final	Initial	Final	Initial	Final				
Pimephales promelas	Control	24.7 24.5 - 24.8	24.5 24.2 - 24.8	7.7 7.6 - 7.8	7.3 7.1 - 7.7	7.76 7.59 - 7.90	7.17 7.03 - 7.35	310 300 - 318	58 58 - 59	89 86 - 92	- - - -
	11.3%	24.8 24.7 - 24.8	24.4 24.2 - 24.8	7.8 7.6 - 8.1	7.3 6.9 - 7.7	7.50 7.28 - 8.00	7.13 6.92 - 7.31	293 284 - 304	- - -	- - -	- - -
	22.6%	24.8 24.7 - 24.9	24.4 24.2 - 24.6	7.8 7.6 - 8.1	7.2 6.7 - 7.5	7.49 7.27 - 8.00	7.12 6.93 - 7.26	280 273 - 289	- - -	- - -	- - -
	45.2%	24.8 24.7 - 24.9	24.5 24.2 - 24.9	7.9 7.6 - 8.2	7.1 6.4 - 7.5	7.47 7.25 - 8.01	7.13 6.89 - 7.27	255 248 - 261	- - -	- - -	- - -
	72.6%	24.9 24.7 - 25.0	24.4 24.1 - 24.9	7.9 7.7 - 8.2	7.2 6.3 - 7.6	7.45 7.23 - 7.99	7.14 6.88 - 7.27	222 215 - 234	- - -	- - -	- - -
	100.0%	24.9 24.7 - 25.1	24.5 24.1 - 25.0	8.0 7.7 - 8.2	7.2 6.2 - 7.6	7.43 7.20 - 7.97	7.16 6.89 - 7.29	189 185 - 192	66 66 - 66	81 78 - 86	< 0.10 < 0.10 - < 0.10
	Intake	24.8 24.7 - 25.0	24.5 24.3 - 24.9	8.0 7.7 - 8.2	7.3 6.6 - 7.7	7.40 7.17 - 7.95	7.15 6.91 - 7.30	190 184 - 192	65 64 - 67	81 80 - 84	< 0.10 < 0.10 - < 0.10
Ceriodaphnia dubia	Control	24.7 24.6 - 24.8	24.9 24.7 - 25.2	7.7 7.6 - 7.8	7.7 7.5 - 7.9	7.76 7.59 - 7.90	7.36 7.21 - 7.50	310 300 - 318	58 58 - 59	89 86 - 92	- - -
	11.3%	24.7 24.6 - 24.8	24.8 24.6 - 25.0	7.8 7.6 - 8.1	7.8 7.5 - 7.9	7.50 7.28 - 8.00	7.35 7.20 - 7.49	293 284 - 304	- - -	- - -	- - -
	22.6%	24.8 24.7 - 24.9	24.8 24.6 - 25.0	7.8 7.6 - 8.1	7.7 7.5 - 7.9	7.49 7.27 - 8.00	7.35 7.20 - 7.50	280 273 - 289	- - -	- - -	- - -
	45.2%	24.8 24.7 - 24.9	24.8 24.5 - 25.1	7.9 7.6 - 8.2	7.7 7.4 - 7.9	7.47 7.25 - 8.01	7.35 7.21 - 7.51	255 248 - 261	- - -	- - -	- - -
	72.6%	24.9 24.7 - 25.0	24.8 24.6 - 24.9	7.9 7.7 - 8.2	7.7 7.3 - 7.9	7.45 7.23 - 7.99	7.35 7.20 - 7.49	222 215 - 234	- - -	- - -	- - -
	100.0%	24.9 24.7 - 25.2	24.8 24.6 - 25.0	8.0 7.7 - 8.2	7.6 7.2 - 7.9	7.43 7.20 - 7.97	7.35 7.22 - 7.49	189 185 - 192	66 66 - 66	81 78 - 86	< 0.10 < 0.10 - < 0.10
	Intake	24.9 24.6 - 25.1	24.8 24.7 - 25.0	8.0 7.7 - 8.2	7.8 7.6 - 8.1	7.40 7.17 - 7.95	7.35 7.21 - 7.50	190 184 - 192	65 64 - 67	81 80 - 84	< 0.10 < 0.10 - < 0.10

Overall temperature (°C)	Average	Minimum	Maximum
Pimephales promelas	24.6	24.1	25.1
Ceriodaphnia dubia	24.8	24.5	25.2

PHYSICAL/CHEMICAL SUMMARY

Water Chemistry Mean Values and Ranges for the *Pimephales promelas* Test, Sequoyah Nuclear Plant Effluent (SQN), UV-Treated Outfall 101, November 28 - December 5, 2006.

Test	Sample ID	Temperature (°C)		Dissolved Oxygen (mg/L)		pH (S.U.)		Conductance (µmhos/cm)
		Initial	Final	Initial	Final	Initial	Final	
Pimephales promelas	Control	24.8 24.6 - 24.9	24.5 24.2 - 24.9	7.9 7.7 - 8.1	7.5 7.0 - 7.8	7.45 7.25 - 7.91	7.18 7.11 - 7.31	300 294 - 311
	11.3%	24.8 24.7 - 25.0	24.4 24.1 - 24.8	7.9 7.7 - 8.1	7.4 6.8 - 7.9	7.45 7.25 - 7.91	7.17 7.08 - 7.28	294 288 - 305
	22.6%	24.9 24.8 - 24.9	24.5 24.2 - 24.8	7.9 7.7 - 8.1	7.4 6.9 - 7.7	7.45 7.25 - 7.90	7.17 7.07 - 7.28	280 275 - 290
	45.2%	24.9 24.8 - 25.0	24.5 24.2 - 24.9	7.9 7.8 - 8.2	7.3 6.8 - 7.6	7.44 7.24 - 7.90	7.15 7.05 - 7.25	257 253 - 263
	72.6%	24.9 24.8 - 25.1	24.5 24.2 - 24.9	7.9 7.8 - 8.1	7.3 6.7 - 7.8	7.42 7.20 - 7.90	7.16 7.06 - 7.29	223 218 - 230
	100.0%	25.0 24.8 - 25.1	24.5 24.2 - 24.9	7.9 7.6 - 8.1	7.2 6.6 - 7.6	7.41 7.19 - 7.92	7.17 7.06 - 7.29	192 190 - 194
	Intake	24.9 24.8 - 25.0	24.4 24.3 - 24.7	7.9 7.6 - 8.1	7.3 6.7 - 7.6	7.37 7.16 - 7.91	7.15 6.96 - 7.25	188 185 - 195

Overall temperature (°C)	Average	Minimum	Maximum
Pimephales promelas	24.7	24.1	25.1

SUMMARY / CONCLUSIONS

Outfall 101 samples collected November 26-December 1, 2006, showed no toxic effects to fathead minnows or daphnids. The resulting IC_{25} values, for both species, were > 100 percent. Exposure of daphnids to intake samples resulted in no significant differences from the control during this study period. Growth in minnows exposed to intake samples was significantly lower than minnow growth in the control.

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.

Appendix A

ADDITIONAL TOXICITY TEST INFORMATION

SUMMARY OF METHODS

1. *Pimephales promelas*

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

2. *Ceriodaphnia dubia*

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

DEVIATIONS / MODIFICATIONS TO TEST PROTOCOL

1. *Pimephales promelas*

   None

2. *Ceriodaphnia dubia*

   None

DEVIATIONS / MODIFICATIONS TO PRETEST CULTURE OR HOLDING OF TEST ORGANISMS

1. *Pimephales promelas*

   None

2. *Ceriodaphnia dubia*

   None

PHYSICAL AND CHEMICAL METHODS

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

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

3. Temperature was measured by EPA Method 170.1.

4. Dissolved oxygen was measured by EPA Method 360.1.

5. The pH was measured by EPA Method 150.1.

6. Conductance was measured by EPA Method 120.1.

7. Alkalinity was measured by EPA Method 310.1.

8. Total Hardness was measured by EPA Method 130.2.

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

QUALITY ASSURANCE

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

REFERENCE TOXICANT TESTS (See Appendix 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. TN0026450.

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

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

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

Sequoyah Nuclear Plant Biomonitoring
November 28 – December 5, 2006

Appendix B

Diffuser Discharge Concentrations of Chemicals Used to Control Microbiologically Induced Corrosion and Mollusks, 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 Mollusks, During Toxicity Test Sampling, March 12, 1998 – December 1, 2006

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 Mollusks, During Toxicity Test Sampling, March 12, 1998 – December 1, 2006

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 Mollusks, During Toxicity Test Sampling, March 12, 1998 – December 1, 2006

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 Mollusks, During Toxicity Test Sampling, March 12, 1998 – December 1, 2006

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	-	-
02/01/2004	-	0.0093	0.027	0.009	-	-	-
02/02/2004	-	<0.0034	0.026	0.009	-	-	-
02/03/2004	-	<0.0034	0.026	0.009	-	-	-
02/04/2004	-	0.0124	0.026	0.009	0.009	-	-
02/05/2004	-	<0.0034	0.026	0.009	-	-	-
02/06/2004	-	0.0105	0.026	0.009	0.010	-	-
05/04/2004	-	<0.0123	0.026	0.019	-	-	0.025
05/05/2004	-	<0.0144	0.026	0.014	0.009	-	0.025
05/06/2004	-	<0.0146	0.037	0.013	-	-	0.025
05/07/2004	-	0.0227	0.058	0.020	0.009	-	0.025
05/08/2004	-	0.016	0.060	0.021	-	-	-
05/09/2004	-	<0.0104	0.058	0.020	-	-	-
07/04/2004	-	0.0217	0.057	0.019	-	-	-
07/05/2004	-	<0.0085	0.057	0.020	0.009	-	-
07/06/2004	-	<0.0077	0.058	0.020	-	-	0.031
07/07/2004	-	0.0252	0.056	0.019	-	-	0.031
07/08/2004	-	0.0223	0.057	0.019	0.009	-	-
07/09/2004	-	0.0182	0.057	0.020	0.009	-	-

Table B-1 (continued). Sequoyah Nuclear Plant Diffuser (Outfall 101) Discharge Concentrations of Chemicals Used to Control Growth of Microbiologically Induced Bacteria and Mollusks, During Toxicity Test Sampling, March 12, 1998 – December 1, 2006

Date	Sodium Hypochlorite mg/L TRC	Towerbrom mg/L TRC	PCL-222 mg/L Phosphate	PCL-401 mg/L Copolymer	CL-363 mg/L DMAD	Cuprostat-PF mg/L Azole	H-130M mg/L Quat	Nalco 73551 mg/L EO/PO	H-150M mg/L Quat
11/07/2004	-	<0.0187	0.000	0.014	-	-	-	-	-
11/08/2004	-	<0.0192	0.047	0.030	-	-	-	-	-
11/09/2004	-	<0.0233	0.048	0.016	-	-	0.041	-	-
11/10/2004	-	<0.0149	0.047	0.016	-	-	0.041	-	-
11/11/2004	-	<0.0149	0.049	0.017	-	-	0.043	-	-
11/12/2004	-	<0.0253	0.048	0.017	-	-	0.042	-	-
02/06/2005	-	<0.0042	0.028	0.010	-	-	-	-	-
02/07/2005	-	<0.0116	0.028	0.010	-	-	-	0.007	-
02/08/2005	-	<0.0080	0.028	0.010	-	-	-	-	-
02/09/2005	-	0.0199	0.028	0.010	-	-	-	-	-
02/10/2005	-	<0.0042	0.028	0.010	-	-	-	-	-
02/11/2005	-	0.0155	0.028	0.010	-	-	-	0.007	-
06/05/2005	-	0.0063	-	-	-	-	-	-	-
06/06/2005	-	0.0043	-	-	-	-	-	-	0.037
06/07/2005	-	0.0103	-	-	-	-	-	-	0.037
06/08/2005	-	0.0295	-	-	-	-	-	-	0.037
06/09/2005	-	0.0129	-	-	-	-	-	-	-
06/10/2005	-	0.0184	-	-	-	-	-	-	-
07/17/2005	-	0.0109	0.026	0.009	-	-	-	-	-
07/18/2005	-	0.0150	0.026	0.009	-	-	-	-	0.036
07/19/2005	-	0.0163	0.026	0.009	-	-	-	-	0.036
07/20/2005	-	0.0209	0.026	0.009	-	-	-	0.014	0.036
07/21/2005	-	0.0242	0.026	0.009	-	-	-	-	-
07/22/2005	-	0.0238	0.054	0.018	-	-	-	0.014	-
10/30/2005	-	0.0068	-	-	-	-	-	-	-
10/31/2005	-	0.0112	-	-	-	-	-	-	-
11/01/2005	-	0.0104	-	-	-	-	-	-	0.035
11/02/2005	-	0.0104	-	-	-	-	-	-	0.036
11/03/2005	-	0.0117	-	-	-	-	-	-	0.036
11/04/2005	-	0.0165	-	-	-	-	-	-	0.035
11/14/2005	-	0.0274	-	-	-	-	-	-	-
11/15/2005	-	0.0256	-	-	-	-	-	-	-
11/16/2005	-	0.0234	-	-	-	-	-	-	-
11/17/2005	-	0.0231	-	-	-	-	-	-	-
11/18/2005	-	0.0200	-	-	-	-	-	-	-
11/19/2005	-	0.0116	-	-	-	-	-	-	-

Table B-1 (continued). Sequoyah Nuclear Plant Diffuser (Outfall 101) Discharge Concentrations of Chemicals Used to Control Growth of Microbiologically Induced Bacteria and Mollusks, During Toxicity Test Sampling, March 12, 1998 – December 1, 2006

Date	Sodium Hypochlorite mg/L TRC	Towerbrom mg/L TRC	PCL-222 mg/L Phosphate	PCL-401 mg/L Copolymer	CL-363 mg/L DMAD	Cuprostat-PF mg/L Azole	H-130M mg/L Quat	Nalco 73551 mg/L EO/PO	H-150M mg/L Quat
11/12/2006	-	0.0055	-	-	-	-	-	-	-
11/13/2006	-	0.0068	-	-	-	-	-	-	0.037
11/14/2006	-	0.0143	-	-	-	-	-	-	0.037
11/15/2006	-	0.0068	-	-	-	-	-	-	0.037
11/16/2006	-	0.0267	-	-	-	-	-	-	0.037
11/17/2006	-	0.0222	-	-	-	-	-	-	-
11/26/2006	-	0.0188	-	-	-	-	-	-	-
11/27/2006	-	0.0138	-	-	-	-	-	-	-
11/28/2006	-	0.0120	-	-	-	-	-	-	-
11/29/2006	-	0.0288	-	-	-	-	-	-	-
11/30/2006	-	0.0376	-	-	-	-	-	-	-
12/01/2006	-	0.0187	-	-	-	-	-	-	-

Sequoyah Nuclear Plant Biomonitoring
November 28 – December 5, 2006

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: Chevy Williams, Roy Quinn

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): Express Courier

General Comments:

Field Identification / Sample Description	Grab/Comp.	Collection Date/Time		Container Number & Volume Collected	Flow MGD	Rain Event? (Mark as Appropriate)				Project #2906 Laboratory Use				
	---	Date	Time	---	---	Yes	If Yes, Inches	No	Trace	ETS Log Number	Arrival Temp. (°C)	By	Time	Appearance
SQN-101-TOX	Comp	11/26/06-11/27/06	0753-0653	2 (2.5gal)	NA			X		061127.01	3.7/3.4C	JH	1400	*
SQN-INT-TOX	Comp	11/26/06-11/27/06	0809-0709	1 (2.5 gal)	NA			X		061127.02	1.4C	JH	1400	*

Sample Custody – Fill In From Top Down

* Custody seals intact. Samples rec in good condition. JH

Relinquished By (Signature):	Date/Time	Received By (Signature):	Date/Time
Chevy Williams	11/27/06 10:05	Express Courier	11/27/06 10:05
Express Courier	11/27/06 2:00	ETS	11/27/06 1400

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: Chevy Williams, Roy Quinn

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): Express Courier

General Comments:

Field Identification / Sample Description	Grab/Comp.	Collection Date/Time		Container Number & Volume Collected	Flow MGD	Rain Event? (Mark as Appropriate)				project # 2906 Laboratory Use				
		Date	Time			Yes	If Yes, Inches	No	Trace	ETS Log Number	Arrival Temp. (°C)	By	Time	Appearance
SQN-101-TOX	Comp	11/28/06-11/29/06	0826-0726	2 (2.5gal)	NA			X		061129.07	4.3 | 4.6	JS	1400	*
SQN-INT-TOX	Comp	11/28/06-11/29/06	0843-0743	1 (2.5 gal)	NA			X		06112908	1.1	JS	1400	*

Sample Custody – Fill In From Top Down

* Custody seals intact. Samples received in good condition. JSumner

Relinquished By (Signature):	Date/Time	Received By (Signature):	Date/Time
Chevy Williams	11/29/06 10:22am	Express Courier	11/29/06 10:22
Express Courier	11/29/06 2:00PM	ETS	11/29/06 1400

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 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. Sar 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: Chevy Williams, Roy Quinn

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): Express Courier

General Comments:

Field Identification / Sample Description	Grab/Comp.	Collection Date/Time		Container Number & Volume Collected	Flow MGD	Rain Event? (Mark as Appropriate)				project #2906 Laboratory Use				
		Date	Time			Yes	If Yes, Inches	No	Trace	ETS Log Number	Arrival Temp. (°C)	By	Time	Appe anc
SQN-101-TOX	Comp	11/30/06-12/01/06	0758-0658	2 (2.5gal)	NA				X	061201.01	4.5C/5.2	jl	1350	*
SQN-INT-TOX	Comp	11/30/06-12/01/06	0813-0713	1 (2.5 gal)	NA				X	061201.02	25C	jl	1350	*

Sample Custody – Fill In From Top Down

* Custody seals intact. Sample received in good condition. jlm

Relinquished By (Signature):	Date/Time	Received By (Signature):	Date/Time
Chevy Williams	12/01/06 09:47	Express Courier	12/01/06 9:47
Express Courier	12/01/06 1:50	ETS KKeenan ETS	12/01/06 1350

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 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. Sa 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
NPDES #: TN 0026450
Project #: 2906

County: Hamilton
Treatment: Non-treated
Outfall: 101

Dilution preparation information:						*Comments:*
Dilution prep (%)	11.3	22.6	45.2	72.6	100	
Effluent volume (mL)	282.5	~~339~~ 565	1130	1815	2500	
Diluent volume (mL)	2217.5	~~2161~~ 1935	1370	685	0	
Total volume (mL)	2500	2500	2500	2500	2500	

Test organism information:		*Test information:*	
Organism age:	24 TO 26 HOURS OLD	Randomizing template:	YELLOW
Date and times organisms were born between:	11-27-06 1400 TO 1600	Incubator number:	3C
Organism source:	ABS BATCH PP 11-27-06	*Artemia* lot number:	BG 12040
Transfer bowl information:	pH = 7.66 Temperature = 24.2 °C	Total drying time:	24 HOURS
		Date / Time in: 12-05-06	1620
Average transfer volume:	8.6 ml	Date / Time out: 12-06-06	1625
		Oven temperature:	60°C

Daily feeding and renewal information:

Day	Date	Morning feeding time	Afternoon feeding time	Test initiation, renewal, or termination time	Control water batch used	Sample numbers used	Analyst
0	11-28-06	~~1400~~	1636	1559	11-26-06A	061127.01 & 02	dl
1	11-29-06	0930	1530	1507	11-26-06A	061127.01 & 02	dl
2	11-30-06	0918	1521	1510	11-26-06B	061129.07 & 08	dl
3	12-01-06	0922	1527	1513	11-26-06B	061129.07 & 08	dl
4	12-02-06	0930	1531	1507	11-26-06B	061201.01 & 02	dl
5	12-03-06	0917	1520	1511	12-02-06A	061201.01 & 02	dl
6	12-04-06	0910	1510	1512	12-02-06A	061201.01 & 02	dl
7	12-05-06			1600			dl

Control information:		Acceptance criteria
% Mortality:	0%	≤ 20%
Average weight per initial larvae:	0.705	
Average weight per surviving larvae:	0.705	≥ 0.25 mg/larvae

Summary of test endpoints:	
7-day LC_{50}	>100%
NOEC *	<11.3%
LOEC *	11.3%
ChV *	<11.3%
IC_{25}	>100%

* INTERRUPTED DOSE RESPONSE. HYPOTHESIS TEST RESULTS ARE UNRELIABLE.

Species: *Pimephales promelas* Date: 11.28.06

Client: TVA / Sequoyah Nuclear Plant - Non-treated

Survival and Growth Data

Day	CONTROL				11.3%				22.6%			
	A	B	C	D	E	F	G	H	I	J	K	L
0	10	10	10	10	10	10	10	10	10	10	10	10
1	10	10	10	10	10	10	10	10	10	10	10	10
2	10	10	10	10	10	10	10	10	10	10	10	10
3	10	10	10	10	10	10	10	10	10	10	10	10
4	10	10	10	10	10	10	10	10	10	10	10	10
5	10	10	10	10	10	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) Color identification: black tray Analyst: LAB	14.29	14.31	15.32	13.59	13.50	14.72	14.34	14.12	14.84	14.97	14.14	14.19
B = Pan + Larvae weight (mg) Analyst: LAB	21.36	21.57	22.38	20.41	19.94	21.13	21.16	20.13	21.52	21.47	20.81	21.11
Larvae weight (mg) = A – B	7.07	7.26	7.06	6.82	6.44	6.41	6.82	6.01	6.68	6.50	6.67	6.92
Weight per initial number of larvae (mg) = C / Initial number of larvae	0.707	0.726	0.706	0.682	0.644	0.641	0.682	0.601	0.668	0.650	0.667	0.692
Average weight per initial number of larvae (mg)	0.705				0.642				0.669			
Percent reduction from control (%)							9.0%				5.1%	

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

Calculations and data reviewed: JA

Comments: * PATHOGENIC GROWTH WAS NOT IDENTIFIED ON THE SURFACE OF THE MINNOWS OR IN THE GILL AREA OF MINNOWS IN THE EFFLUENT OR INTAKE TREATMENTS. jlm

Species: *Pimephales promelas*

Client: TVA / Sequoyah Nuclear Plant - Non-treated Date: 11-28-06

Survival and Growth Data

Day	45.2%				72.6%				100%			
	M	N	O	P	Q	R	S	T	U	V	W	X
0	10	10	10	10	10	10	10	10	10	10	10	16
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 lg	10	10	10	10	10	10	9 id	10	10	10 lg
A = Pan weight (mg) Color identification: black tray Analyst: LAB	13.58	14.45	14.04	14.59	14.85	13.64	14.49	13.84	15.04	13.81	15.26	14.70
B = Pan + Larvae weight (mg) Analyst: LAB	20.07	21.90	20.41	21.36	20.85	19.82	20.77	19.72	20.40	19.76	20.97	21.36
Larvae weight (mg) = A – B	6.49	7.45	6.37	6.77	6.00	6.18	6.28	5.88	5.36	5.95	5.71	6.66
Weight per initial number of larvae (mg) = C / Initial number of larvae	0.649	0.745	0.637	0.677	0.600	0.618	0.628	0.588	0.536	0.595	0.571	0.666
Average weight per initial number of larvae (mg)	0.677				0.609				0.592			
Percent reduction from control (%)		4.0%				13.7%				16.1%		

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

Calculations and data reviewed: dl

Comments:

Species: *Pimephales promelas*

Client: TVA / Sequoyah Nuclear Plant - Non-treated Date: 11.28.06

Survival and Growth Data

Day	100% Intake			
	Y	Z	AA	BB
0	10	10	10	10
1	10	10	10	10
2	10	10	10	10
3	10	10	10	10
4	10	10	10	10
5	10	10	10	10
6	10	10	10	10
7	10	10	10	10
A = Pan weight (mg) Color identification black tray Analyst: LAB	14.30	14.45	14.15	16.01
B = Pan + Larvae weight (mg) Analyst: LAB	20.44	20.38	20.30	22.38
Larvae weight (mg) = A - B	6.14	5.93	6.15	6.37
Weight per initial number of larvae (mg) = C / Initial number of larvae	0.614	0.593	0.615	0.637
Average weight per initial number of larvae (mg) / Percent reduction from control (%)	0.615		12.8%	

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

Calculations and data reviewed:

Comments:

TVA / Sequoyah Nuclear Plant, Outfall 101
Non-treated
November 28 - December 05, 2006

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

Project number: 2906

Reviewed by:

							Not for Compliance Assessment, Internal Laboratory QC							
Concentration (%)	Replicate	Initial number of larvae	Final number of larvae	A = Pan weight (mg)	B = Pan + Larvae weight (mg)	Larvae weight (mg) = A - B	Weight / Surviving number of larvae (mg)	Mean weight / Surviving number of larvae (mg)	Coefficient of variation (Mean weight per surviving number of larvae) (%)	Weight / Initial number of larvae (mg)	Mean survival (%)	Mean weight / Initial number of larvae (mg)	Coefficient of variation (Mean weight per initial number of larvae) (%)	Percent reduction f control (%)
Control	A	10	10	14.29	21.36	7.07	0.707	0.705	2.6	0.707	100.0	0.705	2.6	Not applicabl
	B	10	10	14.31	21.57	7.26	0.726			0.726				
	C	10	10	15.32	22.38	7.06	0.706			0.706				
	D	10	10	13.59	20.41	6.82	0.682			0.682				
11.3%	E	10	10	13.50	19.94	6.44	0.644	0.642	5.2	0.644	100.0	0.642	5.2	9.0
	F	10	10	14.72	21.13	6.41	0.641			0.641				
	G	10	10	14.34	21.16	6.82	0.682			0.682				
	H	10	10	14.12	20.13	6.01	0.601			0.601				
22.6%	I	10	10	14.84	21.52	6.68	0.668	0.669	2.6	0.668	100.0	0.669	2.6	5.1
	J	10	10	14.97	21.47	6.50	0.650			0.650				
	K	10	10	14.14	20.81	6.67	0.667			0.667				
	L	10	10	14.19	21.11	6.92	0.692			0.692				
45.2%	M	10	10	13.58	20.07	6.49	0.649	0.677	7.1	0.649	100.0	0.677	7.1	4.0
	N	10	10	14.45	21.90	7.45	0.745			0.745				
	O	10	10	14.04	20.41	6.37	0.637			0.637				
	P	10	10	14.59	21.36	6.77	0.677			0.677				
72.6%	Q	10	10	14.85	20.85	6.00	0.600	0.609	2.9	0.600	100.0	0.609	2.9	13.7
	R	10	10	13.64	19.82	6.18	0.618			0.618				
	S	10	10	14.49	20.77	6.28	0.628			0.628				
	T	10	10	13.84	19.72	5.88	0.588			0.588				
100%	U	10	9	15.04	20.40	5.36	0.596	0.607	6.8	0.536	97.5	0.592	9.3	16.1
	V	10	10	13.81	19.76	5.95	0.595			0.595				
	W	10	10	15.26	20.97	5.71	0.571			0.571				
	X	10	10	14.70	21.36	6.66	0.666			0.666				
100% Intake	Y	10	10	14.30	20.44	6.14	0.614	0.615	2.9	0.614	100.0	0.615	2.9	12.8
	Z	10	10	14.45	20.38	5.93	0.593			0.593				
	AA	10	10	14.15	20.30	6.15	0.615			0.615				
	BB	10	10	16.01	22.38	6.37	0.637			0.637				

Outfall 101:
Dunnett's MSD value: 0.0598
PMSD: 8.5

Intake:
Dunnett's MSD value: 0.0247
PMSD: 3.5

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 t
On average, a significant difference occurs for Environmental Testing Solutions, Inc. chronic toxicity tests when a toxicant reduces *Pimephales* growth by 15.5% 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.

Non-treated
November 28 - December 05, 2006

Statistical Analyses

Larval Fish Growth and Survival Test-7 Day Growth

Start Date:	11/28/2006	Test ID:	PpPRCR	Sample ID:	TVA / Sequoyah Nuclear Plant, Outfall 101
End Date:	12/5/2006	Lab ID:	ETS-Envir. Testing Sol	Sample Type:	DMR-Discharge Monitoring Report
Sample Date:		Protocol:	FWCHR-EPA-821-R-02-013	Test Species:	PP-Pimephales promelas
Comments:	Non-treated				

Conc-%	1	2	3	4
D-Control	0.7070	0.7260	0.7060	0.6820
11.3	0.6440	0.6410	0.6820	0.6010
22.6	0.6680	0.6500	0.6670	0.6920
45.2	0.6490	0.7450	0.6370	0.6770
72.6	0.6000	0.6180	0.6280	0.5880
100	0.5360	0.5950	0.5710	0.6660

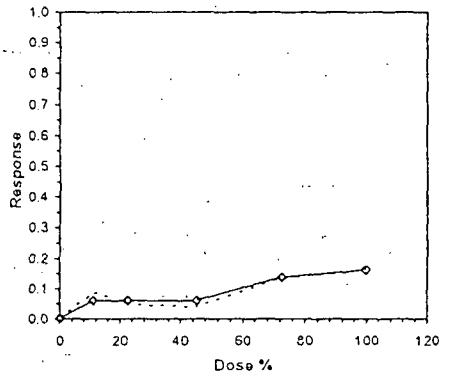
			Transform: Untransformed					1-Tailed			Isotonic	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.7053	1.0000	0.7053	0.6820	0.7260	2.556	4				0.7053	1.0000
*11.3	0.6420	0.9103	0.6420	0.6010	0.6820	5.155	4	2.548	2.410	0.0598	0.6628	0.9397
22.6	0.6693	0.9490	0.6693	0.6500	0.6920	2.580	4	1.459	2.410	0.0598	0.6628	0.9397
45.2	0.6770	0.9599	0.6770	0.6370	0.7450	7.139	4	1.138	2.410	0.0598	0.6628	0.9397
*72.6	0.6085	0.8628	0.6085	0.5880	0.6280	2.944	4	3.897	2.410	0.0598	0.6085	0.8628
*100	0.5920	0.8394	0.5920	0.5360	0.6660	9.284	4	4.562	2.410	0.0598	0.5920	0.8394

Auxiliary Tests					Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)					0.942544222		0.884		0.702791759	0.883183654
Bartlett's Test indicates equal variances (p = 0.21)					7.118869305		15.08627224			
Hypothesis Test (1-tail, 0.05)	**NOEC**	**LOEC**	**ChV**	**TU**	**MSDu**	**MSDp**	**MSB**	**MSE**	**F-Prob**	**df**
Dunnett's Test	<11.3	11.3			0.059831485	0.08483727	0.0074371	0.001232694	0.0018978	5, 18
Treatments vs D-Control										

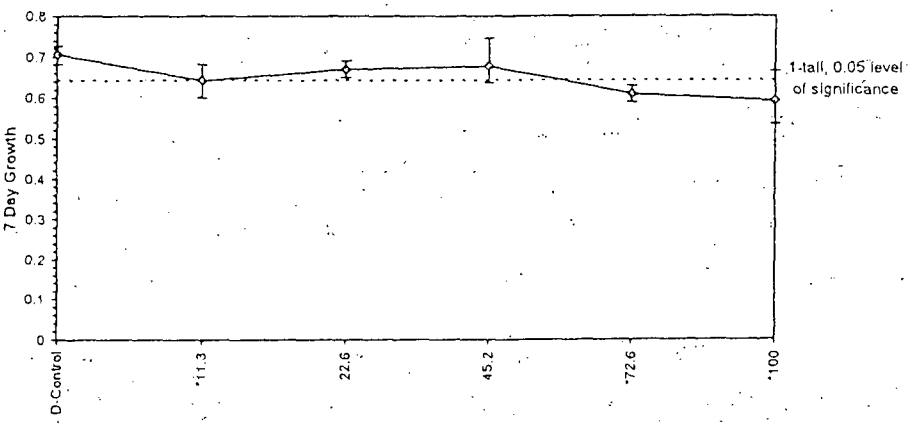
Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)		Skew
IC05*	9.376	16.565	4.511	76.887	1.2631
IC10	59.355				
IC15	87.608				
IC20	>100				
IC25	>100				
IC40	>100				
IC50	>100				

* indicates IC estimate less than the lowest concentration



Dose-Response Plot



sqn_11-28-06data

Non-treated
November 28 - December 05, 2006

Statistical Analyses

Larval Fish Growth and Survival Test-7 Day Growth

Start Date:	11/28/2006	Test ID:	PpFRCR	Sample ID:	TVA / Sequoyah Nuclear Plant, Intake
End Date:	12/5/2006	Lab ID:	ETS-Envir. Testing Sol	Sample Type:	DMR-Discharge Monitoring Report
Sample Date:		Protocol:	FWCHR-EPA-821-R-02-013	Test Species:	PP-Pimephales promelas
Comments:	Non-treated				

Conc-%	1	2	3	4
D-Control	0.7070	0.7260	0.7060	0.6820
100	0.6140	0.5930	0.6150	0.6370

			Transform: Untransformed					1-Tailed			Isotonic	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.7053	1.0000	0.7053	0.6820	0.7260	2.556	4				0.7053	1.0000
*100	0.6148	0.8717	0.6148	0.5930	0.6370	2.923	4	7.111	1.943	0.0247	0.6148	0.8717

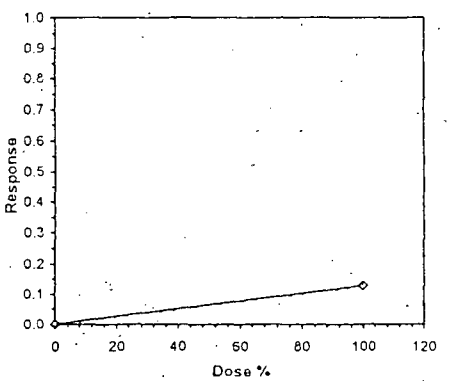
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.883914053	0.749	-0.1195042	-0.69030905
F-Test indicates equal variances (p = 1.00)	1.006193519	47.46722794		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates significant differences Treatments vs D-Control	0.024729467	0.035064824	0.0163805	0.000323917	3.9E-04	1, 6

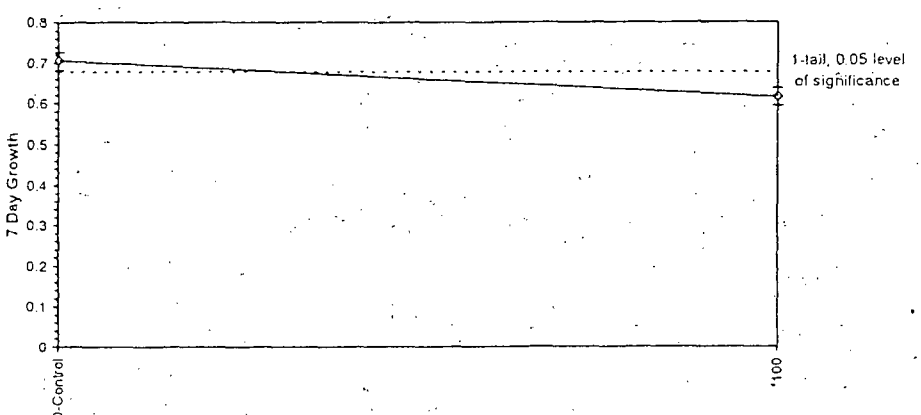
Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)		Skew
IC05*	38.964	5.006	24.112	63.702	0.8889
IC10*	77.928				
IC15	>100				
IC20	>100				
IC25	>100				
IC40	>100				
IC50	>100				

* indicates IC estimate less than the lowest concentration



Dose-Response Plot



sqn_11-28-06data

TVA / Sequoyah Nuclear Plant, Outfall 101
Non-treated
November 28 - December 05, 2006
Chronic Whole Effluent Toxicity Test (EPA-821-R-02-013, Method 1000.0)
Species: *Pimephales promelas*

Daily Chemical Analyses

Project number: 2906

Reviewed by:

Concentration	Parameter	Day 0		Day 1		Day 2		Day 3		Day 4		Day 5		Day 6	
		Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Fina
Control	pH (SU)	7.69	7.35	7.75	7.03	7.59	7.17	7.82	7.19	7.89	7.22	7.90	7.04	7.65	7
	DO (mg/L)	7.7	7.7	7.8	7.1	7.7	7.4	7.6	7.4	7.7	7.3	7.8	7.1	7.8	
	Conductivity (µmhos/cm)	318		318		315		307		304		300		309	
	Alkalinity (mg/L $CaCO_3$)	58				59						58			
	Hardness (mg/L $CaCO_3$)	92				86						90			
	Temperature (°C)	24.6	24.5	24.5	24.6	24.7	24.8	24.8	24.5	24.7	24.6	24.8	24.2	24.6	2
11.3%	pH (SU)	8.00	7.31	7.43	6.92	7.28	7.11	7.33	7.13	7.44	7.13	7.66	7.02	7.38	7
	DO (mg/L)	7.7	7.7	7.8	6.9	7.6	7.3	7.8	7.2	7.8	7.3	8.1	7.0	8.1	
	Conductivity (µmhos/cm)	301		304		295		286		289		284		290	
	Temperature (°C)	24.8	24.2	24.7	24.5	24.8	24.8	24.8	24.5	24.7	24.4	24.8	24.5	24.7	
22.6%	pH (SU)	8.00	7.26	7.42	6.93	7.27	7.12	7.32	7.14	7.43	7.14	7.64	7.02	7.38	
	DO (mg/L)	7.7	7.5	7.8	6.7	7.6	7.2	7.8	7.2	7.8	7.1	8.1	7.0	8.1	
	Conductivity (µmhos/cm)	287		289		282		275		275		273		277	
	Temperature (°C)	24.8	24.2	24.7	24.5	24.8	24.6	24.8	24.4	24.7	24.4	24.9	24.3	24.7	
45.2%	pH (SU)	8.01	7.27	7.40	6.89	7.25	7.14	7.29	7.15	7.43	7.14	7.58	7.07	7.36	
	DO (mg/L)	7.7	7.5	7.8	6.4	7.6	7.4	7.9	7.2	7.8	7.0	8.2	6.9	8.1	
	Conductivity (µmhos/cm)	260		261		256		260		248		251		252	
	Temperature (°C)	24.9	24.2	24.7	24.7	24.9	24.9	24.9	24.6	24.7	24.3	24.9	24.6	24.7	
72.6%	pH (SU)	7.99	7.27	7.39	6.88	7.23	7.13	7.27	7.16	7.38	7.18	7.56	7.07	7.35	
	DO (mg/L)	7.7	7.6	7.7	6.3	7.8	7.4	8.0	7.3	7.8	7.0	8.2	7.0	8.1	
	Conductivity (µmhos/cm)	234		225		222		218		215		218		222	
	Temperature (°C)	25.0	24.3	24.8	24.6	24.9	24.9	24.9	24.4	24.8	24.6	24.9	24.2	24.7	
100%	pH (SU)	7.97	7.29	7.40	6.89	7.20	7.15	7.22	7.16	7.38	7.18	7.49	7.17	7.32	
	DO (mg/L)	7.7	7.6	7.7	6.2	7.9	7.4	8.2	7.2	8.0	7.0	8.2	7.3	8.1	
	Conductivity (µmhos/cm)	189		190		192		185		188		189		192	
	Alkalinity (mg/L $CaCO_3$)	66				66				66					
	Hardness (mg/L $CaCO_3$)	78				86				80					
	Total Residual Chlorine (mg/L)	<0.10				<0.10				<0.10					
	Temperature (°C)	25.1	24.6	24.9	24.6	25.0	25.0	24.9	24.4	24.8	24.6	24.9	24.1	24.7	
100% Intake	pH (SU)	7.95	7.30	7.39	6.91	7.17	7.16	7.20	7.19	7.32	7.11	7.44	7.08	7.32	
	DO (mg/L)	7.7	7.7	7.9	6.6	7.9	7.5	8.2	7.5	8.0	7.1	8.2	7.4	8.2	
	Conductivity (µmhos/cm)	191		192		191		184		189		188		192	
	Alkalinity (mg/L $CaCO_3$)	65				67				64					
	Hardness (mg/L $CaCO_3$)	80				84				80					
	Total Residual Chlorine (mg/L)	<0.10				<0.10				<0.10					
	Temperature (°C)	25.0	24.4	24.7	24.6	25.0	24.9	24.8	24.4	24.8	24.4	24.9	24.3	24.7	

Species: *Pimephales promelas* Date: 11.28.06

Client: TVA / Sequoyah Nuclear Plant – Non-treated

Daily Chemistry:

		Day					
		0		1		2	
	Analyst	KH	KH	KH	KH	KH	KH
Concentration	Parameter						
CONTROL	pH (S.U.)	7.69	7.35	7.75	7.03	7.59	7.17
	DO (mg/L)	7.7	7.7	7.8	7.1	7.7	7.4
	Conductivity (µmhos/cm)	318		318		315	
	Alkalinity (mg $CaCO_3$/L)	58				59	
	Hardness (mg $CaCO_3$/L)	92				86	
	Temperature (°C)	24.6	24.5	24.5	24.6	24.7	24.8
11.3%	pH (S.U.)	8.00	7.31	7.43	6.92	7.28	7.11
	DO (mg/L)	7.7	7.7	7.8	6.9	7.6	7.3
	Conductivity (µmhos/cm)	301		304		295	
	Temperature (°C)	24.8	24.2	24.7	24.5	24.8	24.8
22.6%	pH (S.U.)	8.00	7.26	7.42	6.93	7.27	7.12
	DO (mg/L)	7.7	7.5	7.8	6.7	7.6	7.2
	Conductivity (µmhos/cm)	287		289		282	
	Temperature (°C)	24.8	24.2	24.7	24.5	24.8	24.6
45.2%	pH (S.U.)	8.01	7.27	7.40	6.89	7.25	7.14
	DO (mg/L)	7.7	7.5	7.8	6.4	7.6	7.4
	Conductivity (µmhos/cm)	260		261		256	
	Temperature (°C)	24.9	24.2	24.7	24.7	24.9	24.9
72.6%	pH (S.U.)	7.99	7.27	7.39	6.88	7.23	7.13
	DO (mg/L)	7.7	7.6	7.7	6.3	7.8	7.4
	Conductivity (µmhos/cm)	234		225		222	
	Temperature (°C)	25.0	24.3	24.8	24.6	24.9	24.9
100%	pH (S.U.)	7.97	7.29	7.40	6.89	7.20	7.15
	DO (mg/L)	7.7	7.6	7.7	6.2	7.9	7.4
	Conductivity (µmhos/cm) (189)	~~234~~		190		192	
	Alkalinity (mg $CaCO_3$/L)	66				66	
	Hardness (mg $CaCO_3$/L)	78				86	
	TR chlorine (mg/L)	< 0.10				< 0.10	
	Temperature (°C)	25.1	24.6	24.9	24.6	25.0	25.0
100% Intake	pH (S.U.)	7.95	7.30	7.39	6.91	7.17	7.16
	DO (mg/L)	7.7	7.7	7.9	6.6	7.9	7.5
	Conductivity (µmhos/cm)	191		192		191	
	Alkalinity (mg $CaCO_3$/L)	65				67	
	Hardness (mg $CaCO_3$/L)	80				84	
	TR chlorine (mg/L)	< 0.10				< 0.10	
	Temperature (°C)	25.0	24.4	24.7	24.6	25.0	24.9
		Initial	Final	Initial	Final	Initial	Final

Species: *Pimephales promelas* Date: 11.28.06

Client: TVA / Sequoyah Nuclear Plant – Non-treated

		Day							
		3		4		5		6	
	Analyst	KH	MDL	KH	MDL	KH	KH	KH	MDL
Concentration	Parameter								
CONTROL	pH (S.U.)	7.82	7.19	7.89	7.22	7.90	7.04	7.65	7.22
	DO (mg/L)	7.6	7.4	7.7	7.3	7.8	7.1	7.8	7.3
	Conductivity (µmhos/cm)	307		304		300		309	
	Alkalinity (mg $CaCO_3$/L)					58			
	Hardness (mg $CaCO_3$/L)					90			
	Temperature (°C)	24.8	24.5	24.7	24.6	24.8	24.2	24.6	24.4
11.3%	pH (S.U.)	7.33	7.13	7.44	7.13	7.66	7.02	7.38	7.26
	DO (mg/L)	7.8	7.2	7.8	7.3	8.1	7.0	8.1	7.4
	Conductivity (µmhos/cm)	280		289		284		290	
	Temperature (°C)	24.8	24.5	24.7	24.4	24.8	24.5	24.7	24.2
22.6%	pH (S.U.)	7.32	7.14	7.43	7.14	7.64	7.02	7.38	7.26
	DO (mg/L)	7.8	7.2	7.8	7.1	8.1	7.0	8.1	7.4
	Conductivity (µmhos/cm)	275		275		273		277	
	Temperature (°C)	24.8	24.4	24.7	24.4	24.9	24.3	24.7	24.2
45.2%	pH (S.U.)	7.29	7.15	7.43	7.14	7.58	7.07	7.36	7.26
	DO (mg/L)	7.9	7.2	7.8	7.0	8.2	6.9	8.1	7.5
	Conductivity (µmhos/cm)	260		240		251		252	
	Temperature (°C)	24.9	24.6	24.7	24.3	24.9	24.6	24.7	24.3
72.6%	pH (S.U.)	7.27	7.16	7.38	7.18	7.56	7.07	7.35	7.26
	DO (mg/L)	8.0	7.3	7.8	7.0	8.2	7.0	8.1	7.6
	Conductivity (µmhos/cm)	218		215		218		222	
	Temperature (°C)	24.9	24.4	24.8	24.6	24.9	24.2	24.7	24.1
100%	pH (S.U.)	7.22	7.16	7.38	7.18	7.49	7.17	7.32	7.27
	DO (mg/L)	8.2	7.2	8.0	7.0	8.2	7.3	8.1	7.6
	Conductivity (µmhos/cm)	185		188		189		192	
	Alkalinity (mg $CaCO_3$/L)			66					
	Hardness (mg $CaCO_3$/L)			80					
	TR Chlorine (mg/L)			<0.10					
	Temperature (°C)	24.9	24.4	24.8	24.6	24.9	24.1	24.7	24.1
100% Intake	pH (S.U.)	7.20	7.19	7.32	7.11	7.44	7.08	7.32	7.27
	DO (mg/L)	8.2	7.5	8.0	7.1	8.2	7.4	8.2	7.5
	Conductivity (µmhos/cm)	184		189		188		192	
	Alkalinity (mg $CaCO_3$/L)			64					
	Hardness (mg $CaCO_3$/L)			80					
	TR chlorine (mg/L)			<0.10					
	Temperature (°C)	24.8	24.4	24.8	24.4	24.9	24.3	24.7	24.3
		Initial	Final	Initial	Final	Initial	Final	Initial	Final

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

Client: TVA
Facility: Sequoyah Nuclear Plant
NPDES #: TN 0026450
Project #: 2906

County: Hamilton
Treatment: Non-treated
Outfall: 101

Dilution preparation information:						*Comments:*
Dilution prep (%)	11.3	22.6	45.2	72.6	100	
Effluent volume (mL)	282.5	~~339~~ 565	1130	1815	2500	
Diluent volume (mL)	2217.5	~~2161~~ 1935	1370	685	0	
Total volume (mL)	2500	2500	2500	2500	2500	

Test organism information:		*Test information:*	
Organism age:	< 24 HOURS OLD	Randomizing template:	ORANGE + ANK
Date and times organisms were born between:	11-21-06 1718 TO 2106	Incubator number and shelf location:	2B1+2
Organism Source Culture board: 11-21-06A	Cups: 5, 6, 8, 14, 15, 18, 20, 21, 22, 23	YCT batch:	10-07-06
Transfer bowl information:	pH = 7.73 Temperature = 24.5	*Selenastrum* batch:	11-13-06

Daily renewal information:

Day	Date	Test initiation, renewal, or termination time	Control water batch used	Sample numbers used	Analyst
0	11-28-06	1042	11-26-06A	061127.01+02	JH
1	11-29-06	0955	11-26-06 A	061127.01+02	JH
2	11-30-06	0950	11-26-06B	061129.07+08	JH
3	12-01-06	0956	11-26-06 B	061129.07+08	JH
4	12-02-06	0945	11-26-06 B	061201.01+02	JH
5	12-03-06	0952	12-02-06 A	061201.01+02	JH
6	12-04-06	0957	12-02-06 A	061201.01+02	JH
7	12-05-06	0954			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:	28.2	27.6	≥ 15.0 offspring/female	ChV	>100%
% CV:	6.0%	6.4%	< 40.0 %	IC25	>100%

Species: *Ceriodaphnia dubia*

Client: Sequoyah Nuclear Plant - Non-treated Date: 11-28-06

CONTROL - 1 *Survival and Reproduction Data*

Day		Replicate number									
		1	2	3	4	5	6	7	8	9	10
1	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
2	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
3	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
4	Young produced	3	4	4	4	4	3	4	3	3	4
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	9	11	12	10	10	10	12	10	13	11
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	13	12	15	14	14	14	12	16	13	15
Total young produced		25	27	31	28	28	27	28	29	29	30
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L
X for 3rd Broods		X	X	X	X	X	X	X	X	X	X

Note: Adult mortality (L = live, D = dead)

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	28.2

CONC: 11.3% *Survival and Reproduction Data*

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

Note: Adult mortality (L = live, D = dead)

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	29.4
% Reduction from Control:	-4.3%

Species: *Ceriodaphnia dubia*

Client: Sequoyah Nuclear Plant - Non-treated Date: 11-28-06

CONC: 22.6% *Survival and Reproduction Data*

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

Note: Adult mortality (L = live, D = dead)

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	30.3
% Reduction from Control:	-7.47%

CONC: 45.2% *Survival and Reproduction Data*

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

Note: Adult mortality (L = live, D = dead)

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	30.4
% Reduction from Control:	-7.89%

Species: *Ceriodaphnia dubia*

Client: Sequoyah Nuclear Plant - Non-treated Date: 11-28-06

CONC: 72.6% *Survival and Reproduction Data*

Day		Replicate number									
		1	2	3	4	5	6	7	8	9	10
1	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
2	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
3	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
4	Young produced	4	5	6	4	4	6	5	5	4	4
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	11	0	0	0	0	12	0	13	11	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	0	13	11	12	10	0	11	0	0	11
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	13	17	14	14	14	16	15	18	15	13
Total young produced		28	35	31	30	28	34	31	36	30	28
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Note: Adult mortality (L = live, D = dead)

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	31.1
% Reduction from Control:	-10.3%

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	5	4	4	5	4	6	5	6	4	5
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	0	12	0	0	0	0	0	0	0	13
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	12	0	10	13	11	12	11	14	10	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	14	15	16	15	15	18	14	17	15	14
Total young produced		31	31	30	33	30	36	30	37	29	32
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Note: Adult mortality (L = live, D = dead)

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	31.9
% Reduction from Control:	-13.1%

Species: *Ceriodaphnia dubia*
Client: Sequoyah Nuclear Plant - Non-treated Date: 11-28-06

CONTROL - 2 *Survival and Reproduction Data*

Day		Replicate number 1	2	3	4	5	6	7	8	9	10
1	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
2	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
3	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
4	Young produced	4	3	3	3	4	3	5	4	4	3
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	11	0	0	0	0	0	0	0	0	11
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	0	10	10	9	12	10	9	11	10	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	13	12	12	16	14	13	16	13	14	14
Total young produced		28	25	25	28	30	26	30	28	28	28
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Note: Adult mortality (L = live, D = dead)

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	27.6

CONC: 100% Intake *Survival and Reproduction Data*

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

Note: Adult mortality (L = live, D = dead)

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	30.4
% Reduction from Control:	-10.1%

TVA / Sequoyah Nuclear Plant, Outfall 101
Non-treated
November 28 - December 05, 2006

Verification of *Ceriodaphnia* Reproduction Totals

Control-1

Day	Replicate number										Total
	1	2	3	4	5	6	7	8	9	10	
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0
4	3	4	4	4	4	3	4	3	3	4	36
5	0	0	0	0	0	0	0	0	0	0	0
6	9	11	12	10	10	10	12	10	13	11	108
7	13	12	15	14	14	14	12	16	13	15	138
Total	25	27	31	28	28	27	28	29	29	30	282

72.6%

Day	Replicate number										Total
	1	2	3	4	5	6	7	8	9	10	
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0
4	4	5	6	4	4	6	5	5	4	4	47
5	11	0	0	0	0	12	0	13	11	0	47
6	0	13	11	12	10	0	11	0	0	11	68
7	13	17	14	14	14	16	15	18	15	13	149
Total	28	35	31	30	28	34	31	36	30	28	311

11.3%

Day	Replicate number										Total
	1	2	3	4	5	6	7	8	9	10	
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0
4	4	4	3	5	5	6	4	4	4	4	43
5	0	0	0	0	0	0	0	0	0	0	0
6	9	12	12	10	10	11	13	10	11	11	109
7	13	12	17	14	13	15	16	14	14	14	142
Total	26	28	32	29	28	32	33	28	29	29	294

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	5	4	4	5	4	6	5	6	4	5	48
5	0	12	0	0	0	0	0	0	0	13	25
6	12	0	10	13	11	12	11	14	10	0	93
7	14	15	16	15	15	18	14	17	15	14	153
Total	31	31	30	33	30	36	30	37	29	32	319

22.6%

Day	Replicate number										Total
	1	2	3	4	5	6	7	8	9	10	
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0
4	3	4	4	5	4	4	6	4	4	5	43
5	0	0	0	0	0	0	0	0	0	0	0
6	10	12	10	13	11	11	11	12	10	12	112
7	16	14	15	14	14	16	13	15	17	14	148
Total	29	30	29	32	29	31	30	31	31	31	303

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	4	3	3	3	4	3	5	4	4	3	36
5	11	0	0	0	0	0	0	0	0	11	22
6	0	10	10	9	12	10	9	11	10	0	81
7	13	12	12	16	14	13	16	13	14	14	137
Total	28	25	25	28	30	26	30	28	28	28	276

45.2%

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	4	4	5	4	5	4	6	4	4	5	45
5	0	14	0	11	0	0	0	0	0	0	25
6	11	0	13	0	10	10	12	11	13	10	90
7	16	14	13	17	14	14	12	15	15	14	144
Total	31	32	31	32	29	28	30	30	32	29	304

100% Intake

Day	Replicate number										Total
	1	2	3	4	5	6	7	8	9	10	
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0
4	4	4	5	4	4	4	3	4	4	5	41
5	13	0	12	12	0	11	13	12	12	0	85
6	0	11	0	0	12	0	0	0	0	10	33
7	15	13	14	17	13	13	16	14	15	15	145
Total	32	28	31	33	29	28	32	30	31	30	304

TVA / Sequoyah Nuclear Plant, Outfall 101
Non-treated
November 28 - December 05, 2006

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

Project number: 2906

Reveiwed by:

Concentration (%)	Replicate number										Survival (%)	Average reproduction (offspring/female)	Coefficient of variation (%)	Percent reduction fr pooled controls (%
	1	2	3	4	5	6	7	8	9	10				
Control - 1	25	27	31	28	28	27	28	29	29	30	100	28.2	6.0	Not applicabl
11.3%	26	28	32	29	28	32	33	28	29	29	100	29.4	7.6	-4.3
22.6%	29	30	29	32	29	31	30	31	31	31	100	30.3	3.5	-7.4
45.2%	31	32	31	32	29	28	30	30	32	29	100	30.4	4.7	-7.8
72.6%	28	35	31	30	28	34	31	36	30	28	100	31.1	9.5	-10.3
100%	31	31	30	33	30	36	30	37	29	32	100	31.9	8.4	-13.1
Control - 2	28	25	25	28	30	26	30	28	28	28	100	27.6	6.4	Not applicabl
100% Intake	32	28	31	33	29	28	32	30	31	30	100	30.4	5.6	-10.1

Outfall 101:
Dunnett's MSD value: 2.166
PMSD: 7.7

Intake:
Dunnett's MSD value: 1.353
PMSD: 4.9

MSD = Minimum Significant Difference
PMSD = Percent Minimum Significant Difference

PMSD is a measure of test precision. The PMSD is the minimum percent difference between the control and treatment that can be declared statistically significant in a whole effluent toxicity test. On average, a significant difference occurs for Environmental Testing Solutions, Inc. chronic toxicity tests wl a toxicant reduces *Ceriodaphnia* reproduction by 9.6% from the control.

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

Upper PMSD bound determined by USEPA (90^{th} 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.

TVA / Sequoyah Nuclear Plant, Outfall 101
Non-treated
November 28 - December 05, 2006

Statistical Analyses

Ceriodaphnia Survival and Reproduction Test-Reproduction

Start Date:	11/28/2006	Test ID:	CdFRCR	Sample ID:	TVA / Sequoyah Nuclear Plant, Outfall 101
End Date:	12/5/2006	Lab ID:	ETS-Envir. Testing Sol	Sample Type:	DMR-Discharge Monitoring Report
Sample Date:		Protocol:	FWCHR-EPA-821-R-02-013	Test Species:	CD-Ceriodaphnia dubia
Comments:	Non-treated				

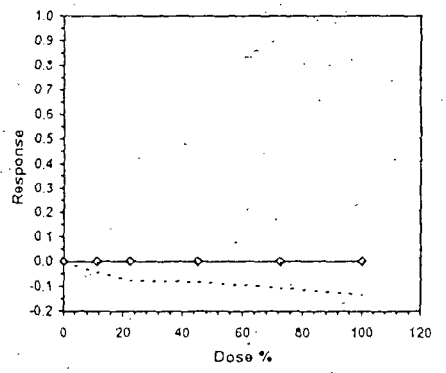
Conc-%	1	2	3	4	5	6	7	8	9	10
D-Control	25.000	27.000	31.000	28.000	28.000	27.000	28.000	29.000	29.000	30.000
11.3	26.000	28.000	32.000	29.000	28.000	32.000	33.000	28.000	29.000	29.000
22.6	29.000	30.000	29.000	32.000	29.000	31.000	30.000	31.000	31.000	31.000
45.2	31.000	32.000	31.000	32.000	29.000	28.000	30.000	30.000	32.000	29.000
72.6	28.000	35.000	31.000	30.000	28.000	34.000	31.000	36.000	30.000	28.000
100	31.000	31.000	30.000	33.000	30.000	36.000	30.000	37.000	29.000	32.000

			Transform: Untransformed					1-Tailed			Isotonic	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	28.200	1.0000	28.200	25.000	31.000	5.981	10				30.217	1.0000
11.3	29.400	1.0426	29.400	26.000	33.000	7.555	10	-1.257	2.287	2.166	30.217	1.0000
22.6	30.300	1.0745	30.300	29.000	32.000	3.496	10	-2.217	2.287	2.166	30.217	1.0000
45.2	30.400	1.0780	30.400	28.000	32.000	4.703	10	-2.322	2.287	2.166	30.217	1.0000
72.6	31.100	1.1028	31.100	28.000	36.000	9.520	10	-3.061	2.287	2.166	30.217	1.0000
100	31.900	1.1312	31.900	29.000	37.000	8.418	10	-3.906	2.287	2.166	30.217	1.0000

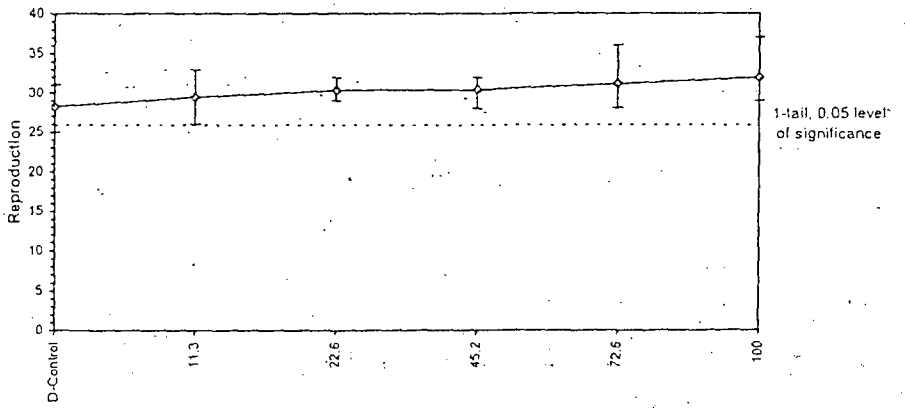
Auxiliary Tests					Statistic		Critical		Skew	Kurt
Kolmogorov D Test indicates normal distribution ($p > 0.01$)					0.938959122		1.035		0.601190678	0.062444916
Bartlett's Test indicates equal variances ($p = 0.04$)					11.9811039		15.08627224			
Hypothesis Test (1-tail, 0.05)	**NOEC**	**LOEC**	**ChV**	**TU**	**MSDu**	**MSDp**	**MSB**	**MSE**	**F-Prob**	**df**
Dunnett's Test	100	>100		1	2.16619565	0.076815449	16.77666667	4.487037037	0.00559108	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



TVA / Sequoyah Nuclear Plant, Intake
Non-treated
November 28 - December 05, 2006

Statistical Analyses

Ceriodaphnia Survival and Reproduction Test-Reproduction

Start Date:	11/28/2006	Test ID:	CdFRCR	Sample ID:	TVA / Sequoyah Nuclear Plant, Intake
End Date:	12/5/2006	Lab ID:	ETS-Envir. Testing Sol	Sample Type:	DMR-Discharge Monitoring Report
Sample Date:		Protocol:	FWCHR-EPA-821-R-02-013	Test Species:	CD-Ceriodaphnia dubia
Comments:	Non-treated				

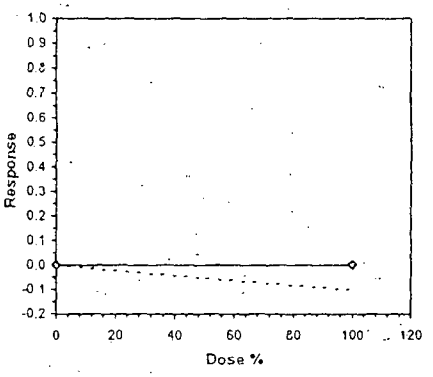
Conc-%	1	2	3	4	5	6	7	8	9	10
D-Control	28.000	25.000	25.000	28.000	30.000	26.000	30.000	28.000	28.000	28.000
100	32.000	28.000	31.000	33.000	29.000	28.000	32.000	30.000	31.000	30.000

			Transform: Untransformed					1-Tailed			Isotonic	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	27.600	1.0000	27.600	25.000	30.000	6.436	10				29.000	1.0000
100	30.400	1.1014	30.400	28.000	33.000	5.634	10	-3.588	1.734	1.353	29.000	1.0000

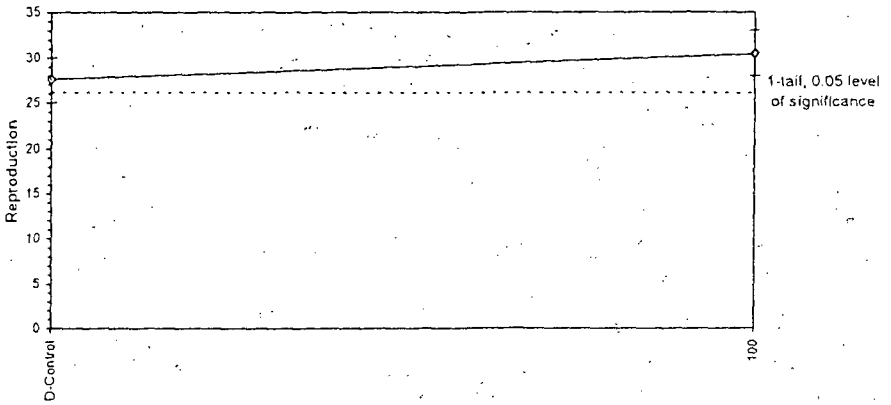
Auxiliary Tests	Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.919082224		0.868		-0.18624647	-0.98833966
F-Test indicates equal variances (p = 0.92)	1.075757623		6.541089535			
Hypothesis Test (1-tail, 0.05)	**MSDu**	**MSDp**	**MSB**	**MSE**	**F-Prob**	**df**
Homoscedastic t Test indicates no significant differences	1.353112957	0.049025832	39.2	3.044444444	0.002101165	1, 18
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



TVA / Sequoyah Nuclear Plant, Outfall 101
Non-treated
November 28 - December 05, 2006
Chronic Whole Effluent Toxicity Test (EPA-821-R-02-013, Method 1002.0)
Species: *Ceriodaphnia dubia*

Daily Chemical Analyses

Project number: 2906

Reviewed by:

Concentration	Parameter	Day 0		Day 1		Day 2		Day 3		Day 4		Day 5		Day 6	
		Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Fina
Control	pH (SU)	7.69	7.35	7.75	7.21	7.59	7.27	7.82	7.36	7.89	7.50	7.90	7.34	7.65	
	DO (mg/L)	7.7	7.8	7.8	7.5	7.7	7.7	7.6	7.7	7.7	7.8	7.8	7.8	7.8	
	Conductivity (µmhos/cm)	318		318		315		307		304		300		309	
	Alkalinity (mg/L $CaCO_3$)	58				59						58			
	Hardness (mg/L $CaCO_3$)	92				86						90			
	Temperature (°C)	24.7	25.1	24.7	24.7	24.6	24.9	24.8	25.2	24.7	24.7	24.8	24.8	24.6	2
11.3%	pH (SU)	8.00	7.35	7.43	7.20	7.28	7.26	7.33	7.35	7.44	7.49	7.66	7.34	7.38	
	DO (mg/L)	7.7	7.8	7.8	7.5	7.6	7.7	7.8	7.8	7.8	7.8	8.1	7.8	8.1	
	Conductivity (µmhos/cm)	301		304		295		286		289		284		290	
	Temperature (°C)	24.7	24.8	24.8	24.7	24.8	24.6	24.8	25.0	24.7	25.0	24.8	24.7	24.6	2
22.6%	pH (SU)	8.00	7.35	7.42	7.20	7.27	7.27	7.32	7.35	7.43	7.50	7.64	7.33	7.38	
	DO (mg/L)	7.7	7.8	7.8	7.5	7.6	7.7	7.8	7.7	7.8	7.8	8.1	7.7	8.1	
	Conductivity (µmhos/cm)	287		289		282		275		275		273		277	
	Temperature (°C)	24.9	24.8	24.8	24.7	24.8	24.8	24.9	24.9	24.7	25.0	24.9	24.8	24.7	2
45.2%	pH (SU)	8.01	7.35	7.40	7.21	7.25	7.25	7.29	7.34	7.43	7.51	7.58	7.32	7.36	
	DO (mg/L)	7.7	7.8	7.8	7.4	7.6	7.6	7.9	7.7	7.8	7.8	8.2	7.7	8.1	
	Conductivity (µmhos/cm)	260		261		256		260		248		251		252	
	Temperature (°C)	24.9	24.8	24.8	24.9	24.9	24.7	24.9	25.1	24.7	25.1	24.9	24.8	24.7	
72.6%	pH (SU)	7.99	7.34	7.39	7.20	7.23	7.26	7.27	7.34	7.38	7.49	7.56	7.35	7.35	
	DO (mg/L)	7.7	7.9	7.7	7.3	7.8	7.5	8.0	7.7	7.8	7.8	8.2	7.7	8.1	
	Conductivity (µmhos/cm)	234		225		222		218		215		218		222	
	Temperature (°C)	25.0	24.8	24.9	24.6	24.9	24.7	24.9	24.9	24.8	24.9	24.9	24.8	24.7	
100%	pH (SU)	7.97	7.36	7.40	7.22	7.20	7.26	7.22	7.33	7.38	7.49	7.49	7.35	7.32	
	DO (mg/L)	7.7	7.9	7.7	7.2	7.9	7.5	8.2	7.6	8.0	7.7	8.2	7.7	8.1	
	Conductivity (µmhos/cm)	189		190		192		185		188		189		192	
	Alkalinity (mg/L $CaCO_3$)	66				66				66					
	Hardness (mg/L $CaCO_3$)	78				86				80					
	Total Residual Chlorine (mg/L)	<0.10				<0.10				<0.10					
	Temperature (°C)	25.2	24.9	24.9	24.6	25.1	24.8	25.0	25.0	24.8	24.9	24.9	24.9	24.7	
100% Intake	pH (SU)	7.95	7.35	7.39	7.21	7.17	7.23	7.20	7.41	7.32	7.50	7.44	7.33	7.32	
	DO (mg/L)	7.7	8.1	7.9	7.6	7.9	7.6	8.2	7.8	8.0	7.8	8.2	7.8	8.2	
	Conductivity (µmhos/cm)	191		192		191		184		189		188		192	
	Alkalinity (mg/L $CaCO_3$)	65				67				64					
	Hardness (mg/L $CaCO_3$)	80				84				80					
	Total Residual Chlorine (mg/L)	<0.10				<0.10				<0.10					
	Temperature (°C)	25.1	24.7	24.7	24.8	25.0	24.7	24.9	25.0	24.8	24.8	24.9	24.7	24.6	

Species: *Ceriodaphnia dubia* Date: 11-28-06

Client: Sequoyah Nuclear Plant - Non-treated

Daily Chemistry:

		Day					
		0		1		2	
	Analyst	KEH	KEH	KEH	KEH	KEH	KEH
Concentration	Parameter						
CONTROL	pH (S.U.)	7.69	7.35	7.75	7.21	7.59	7.27
	DO (mg/L)	7.7	7.8	7.8	7.5	7.7	7.7
	Conductivity (µmhos/cm)	318		318		315	
	Alkalinity (mg $CaCO_3$/L)	58				59	
	Hardness (mg $CaCO_3$/L)	92				86	
	Temperature (°C)	24.7	25.1	24.7	24.7	24.6	24.9
11.3%	pH (S.U.)	8.00	7.35	7.43	7.20	7.28	7.26
	DO (mg/L)	7.7	7.8	7.8	7.5	7.6	7.7
	Conductivity (µmhos/cm)	301		304		295	
	Temperature (°C)	24.7	24.8	24.8	24.7	24.8	24.6
22.6%	pH (S.U.)	8.00	7.35	7.42	7.20	7.27	7.27
	DO (mg/L)	7.7	7.8	7.8	7.5	7.6	7.7
	Conductivity (µmhos/cm)	287		289		282	
	Temperature (°C)	24.9	24.8	24.8	24.7	24.8	24.8
45.2%	pH (S.U.)	8.01	7.35	7.40	7.21	7.25	7.25
	DO (mg/L)	7.7	7.8	7.8	7.4	7.6	7.6
	Conductivity (µmhos/cm)	260		261		256	
	Temperature (°C)	24.9	24.8	24.8	24.9	24.9	24.7
72.6%	pH (S.U.)	7.99	7.34	7.39	7.20	7.23	7.26
	DO (mg/L)	7.7	7.9	7.7	7.3	7.8	7.5
	Conductivity (µmhos/cm)	234		225		222	
	Temperature (°C)	25.0	24.8	24.9	24.6	24.9	24.7
100%	pH (S.U.)	7.97	7.36	7.40	7.22	7.20	7.26
	DO (mg/L)	7.7	7.9	7.7	7.2	7.9	7.5
	Conductivity (µmhos/cm) (189)	~~231~~		190		192	
	Alkalinity (mg $CaCO_3$/L)	66				66	
	Hardness (mg $CaCO_3$/L)	78				86	
	TR chlorine (mg/L)	<0.10				<0.10	
	Temperature (°C)	25.2	24.9	24.9	24.6	25.1	24.8
100% Intake	pH (S.U.)	7.95	7.35	7.39	7.21	7.17	7.23
	DO (mg/L)	7.7	8.1	7.9	7.6	7.9	7.6
	Conductivity (µmhos/cm)	191		192		191	
	Alkalinity (mg $CaCO_3$/L)	65				67	
	Hardness (mg $CaCO_3$/L)	80				84	
	TR chlorine (mg/L)	<0.10				<0.10	
	Temperature (°C)	25.1	24.7	24.7	24.8	25.0	24.7
		Initial	Final	Initial	Final	Initial	Final

Environmental Testing Solutions, Inc.

Species: *Ceriodaphnia dubia*

Client: Sequoyah Nuclear Plant - Non-treated

Date: 11-28-06

		Day							
		3		4		5		6	
	Analyst	KEK	KEK	KEK	KEK	KEK	KEK	KEK	KEK
Concentration	Parameter								
CONTROL	pH (S.U.)	7.82	7.36	7.89	7.50	7.90	7.34	7.45	7.50
	DO (mg/L)	7.6	7.7	7.7	7.8	7.8	7.8	7.9	7.9
	Conductivity (µmhos/cm)	307		304		300		309	
	Alkalinity (mg $CaCO_3$/L)					58			
	Hardness (mg $CaCO_3$/L)					90			
	Temperature (°C)	24.8	25.2	24.7	24.7	24.8	24.8	24.6	24.8
11.3%	pH (S.U.)	7.33	7.35	7.44	7.49	7.66	7.34	7.38	7.43
	DO (mg/L)	7.8	7.8	7.8	7.8	8.1	7.8	8.1	7.9
	Conductivity (µmhos/cm)	286		289		284		290	
	Temperature (°C)	24.8	25.0	24.7	25.0	24.8	24.7	24.6	24.6
22.6%	pH (S.U.)	7.32	7.35	7.43	7.50	7.64	7.33	7.38	7.44
	DO (mg/L)	7.8	7.7	7.8	7.8	8.1	7.7	8.1	7.9
	Conductivity (µmhos/cm)	275		275		273		277	
	Temperature (°C)	24.9	24.9	24.7	25.0	24.9	24.8	24.7	24.6
45.2%	pH (S.U.)	7.29	7.34	7.43	7.51	7.58	7.32	7.36	7.45
	DO (mg/L)	7.9	7.7	7.8	7.8	8.2	7.7	8.1	7.9
	Conductivity (µmhos/cm)	260		246		251		252	
	Temperature (°C)	24.9	25.1	24.7	25.1	24.9	24.8	24.7	24.5
72.6%	pH (S.U.)	7.27	7.34	7.39	7.49	7.50	7.35	7.35	7.45
	DO (mg/L)	8.0	7.7	7.8	7.8	8.2	7.7	8.1	7.9
	Conductivity (µmhos/cm)	218		215		218		222	
	Temperature (°C)	24.9	24.9	24.8	24.9	24.9	24.8	24.7	24.7
100%	pH (S.U.)	7.22	7.33	7.38	7.49	7.49	7.35	7.32	7.45
	DO (mg/L)	8.2	7.6	8.0	7.7	8.2	7.7	8.1	7.8
	Conductivity (µmhos/cm)	195		188		189		192	
	Alkalinity (mg $CaCO_3$/L)			66					
	Hardness (mg $CaCO_3$/L)			80					
	TR Chlorine (mg/L)			<0.10					
	Temperature (°C)	25.0	25.0	24.8	24.9	24.9	24.9	24.7	24.6
100% Intake	pH (S.U.)	7.20	7.41	7.32	7.50	7.44	7.33	7.32	7.44
	DO (mg/L)	8.2	7.8	8.0	7.8	8.2	7.8	8.2	7.8
	Conductivity (µmhos/cm)	184		189		180		192	
	Alkalinity (mg $CaCO_3$/L)			64					
	Hardness (mg $CaCO_3$/L)			80					
	TR chlorine (mg/L)			<0.10					
	Temperature (°C)	24.9	25.0	24.8	24.8	24.9	24.7	24.6	24.9
		Initial	Final	Initial	Final	Initial	Final	Initial	Final

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

Client: TVA
Facility: Sequovah Nuclear Plant
NPDES #: TN 0026450
Project #: 2906

County: Hamilton
Treatment: UV-treated
Outfall: 101

Dilution preparation information:						*Comments:*
Dilution prep (%)	11.3	22.6	45.2	72.6	100	Each concentration was treated
Effluent volume (mL)	282.5	~~339~~ 565	1130	1815	2500	for 2 minutes with a UV sterilizer
Diluent volume (mL)	2217.5	~~2161~~ 1935	1370	685	0	to remove pathogenic
Total volume (mL)	2500	2500	2500	2500	2500	interferences.

Test organism information:		*Test information:*	
Organism age:	23.75 TO 25.75 HOURS OLD	Randomizing template:	BLUE
Date and times organisms were born between:	11-27-06 1400 TO 1600	Incubator number:	38
Organism source:	ABS BATCH Pp 11-27-06	*Artemia* lot number:	B612041U
Transfer bowl information:	pH = 7.66 Temperature = 24.2 °C	Total drying time:	24-HOURS
		Date / Time in: 12-05-06	1620
Average transfer volume:	8.6 ml	Date / Time out: 12-06-06	1625
		Oven temperature:	60°C

Daily feeding and renewal information:

Day	Date	Morning feeding time	Afternoon feeding time	Test initiation, renewal, or termination time	MHS batch used	Sample numbers used	Analyst
0	11-28-06	~~—~~	1636	1547	11-26-06A	061127.01 & 02	JL
1	11-29-06	0930	1530	1452	11-26-06A	061127.01 & 02	JL
2	11-30-06	0918	1521	1450	11-26-06B	061129.07 & 08	JL
3	12-01-06	0922	1527	1456	11-26-06B	061129.07 & 08	JL
4	12-02-06	0930	1531	1450	11-26-06B	061201.01 & 02	JL
5	12-03-06	0917	1520	1453	12-02-06A	061201.01 & 02	JL
6	12-04-06	0910	1510	1450	12-02-06A	061201.01 & 02	JL
7	12-05-06			1545			JL

Control information:		Acceptance criteria
% Mortality:	0%	≤ 20%
Average weight per initial larvae:	0.661	
Average weight per surviving larvae:	0.661	≥ 0.25 mg/larvae

Summary of test endpoints:	
7-day LC_{50}	>100%
NOEC	100%
LOEC	>100%
ChV	>100%
IC_{25}	>100%

Species: *Pimephales promelas* Date: 11-28-06

Client: TVA / Sequoyah Nuclear Plant - UV-treated

Survival and Growth Data

Day	CONTROL				11.3%				22.6%			
	A	B	C	D	E	F	G	H	I	J	K	L
0	10	10	10	10	10	10	10	10	10	10	10	10
1	10	10	10	10	10	10	10	10	10	10	10	10
2	10	10	10	10	10	10	10	10	10	10	10	10
3	10	10	10	10	10	10	10	10	10	10	10	10
4	10	10	10	10	10	10	10	10	10	10	10	10
5	10	10	10	10	10	10	10	10	10	10	10	10
6	10	10	10	10	10	10	10	10	10	10	10	10
7	1SM 10	10	10	1LG 10	10	1LG 10	10	10	10	10	10	1LG 10
A = Pan weight (mg) Color identification: purple tray Analyst: LAB	14.67	13.99	13.49	14.31	14.60	14.76	14.09	16.31	14.14	14.70	14.83	14.51
B = Pan + Larvae weight (mg) Analyst: LAB	20.32	20.44	20.18	21.94	21.05 ~~20.~~ 50	22.14	20.70	22.87	20.11	20.72	21.13	21.60
Larvae weight (mg) = A – B	5.65	6.45	6.69	7.63	6.45	7.38	6.61	6.56	5.97	6.02	6.30	7.09
Weight per initial number of larvae (mg) = C / Initial number of larvae	0.565	0.645	0.669	0.763	0.645	0.738	0.661	0.656	0.597	0.602	0.630	0.709
Average weight per initial number of larvae (mg)	0.661				0.675		-2.2%		0.635		3.9%	
Percent reduction from control (%)												

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

Calculations and data reviewed:

Comments:

Species: *Pimephales promelas*

Client: TVA / Sequoyah Nuclear Plant - UV-treated Date: 11-28-06

Survival and Growth Data

Day	45.2%				72.6%				100%			
	M	N	O	P	Q	R	S	T	U	V	W	X
0	10	10	10	10	10	10	10	10	10	10	10	10
1	10	10	10	10	10	10	10	10	10	10	10	10
2	10	10	10	10	10	10	10	10	10	10	10	10
3	10	10	10	10	10	10	10	10	10	10	10	10
4	10	10	10	10	10	10	10	10	10	10	10	10
5	10	10	10	10	10	10	10	10	10	10	10	10
6	10	10	10	10	10	10	10	10	10	10	10	10
7	10	10	10 ISM	10	10	10	10	10	10	10	10 LG	10
A = Pan weight (mg) Color identification: purple tray Analyst: LAB	13.90	14.78	14.70	14.31	14.23	14.98	14.99	14.31	14.64	14.71	15.23	14.26
B = Pan + Larvae weight (mg) Analyst: LAB	20.24	20.82	19.83	20.33	19.65	20.81	20.82	20.61	21.01	21.76	22.71	20.49
Larvae weight (mg) = A – B	6.34	6.04	5.13	6.02	5.42	5.83	5.83	6.30	6.37	7.05	7.48	6.23
Weight per initial number of larvae (mg) = C / Initial number of larvae	0.634	0.604	0.513	0.602	0.542	0.583	0.583	0.630	0.637	0.705	0.748	0.623
Average weight per initial number of larvae (mg)	0.588				0.585				0.678			
Percent reduction from control (%)			10.9%				11.5%				-2.7%	

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

Calculations and data reviewed: JL

Comments:

Species: *Pimephales promelas*

Client: TVA / Sequoyah Nuclear Plant - UV-treated Date: 11.28.00

Survival and Growth Data

Day	100% Intake			
	Y	Z	AA	BB
0	10	10	10	10
1	10	10	10	10
2	10	10	10	10
3	10	10	10	10
4	10	10	10	10
5	10	10	10	10
6	10	10	10	10
7	10	10	10	10
A = Pan weight (mg) Color identification: orange beakers Analyst: UAB	14.95	14.08	14.66	14.33
B = Pan + Larvae weight (mg) Analyst: UAB	21.14	20.16	21.33	21.15
Larvae weight (mg) = A – B	6.19	6.08	6.67	6.82
Weight per initial number of larvae (mg) = C / Initial number of larvae	0.619	0.608	0.667	0.682
Average weight per initial number of larvae (mg) / Percent reduction from control (%)	0.644		2.5%	

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

Calculations and data reviewed:

Comments:

TVA / Sequoyah Nuclear Plant, Outfall 101
UV-treated
November 28 - December 05, 2006

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

Project number: 2906

Reveiwed by:

							Not for Compliance Assessment, Internal Laboratory QC							
Concentration (%)	Replicate	Initial number of larvae	Final number of larvae	A = Pan weight (mg)	B = Pan + Larvae weight (mg)	Larvae weight (mg) = A - B	Weight / Surviving number of larvae (mg)	Mean weight / Surviving number of larvae (mg)	Coefficient of variation (Mean weight per surviving number of larvae) (%)	Weight / Initial number of larvae (mg)	Mean survival (%)	Mean weight / Initial number of larvae (mg)	Coefficient of variation (Mean weight per initial number of larvae) (%)	Percent reduction f control (%)
Control	A	10	10	14.67	20.32	5.65	0.565	0.661	12.3	0.565	100.0	0.661	12.3	Not applicab
	B	10	10	13.99	20.44	6.45	0.645			0.645				
	C	10	10	13.49	20.18	6.69	0.669			0.669				
	D	10	10	14.31	21.94	7.63	0.763			0.763				
11.3%	E	10	10	14.60	21.05	6.45	0.645	0.675	6.3	0.645	100.0	0.675	6.3	-2.2
	F	10	10	14.76	22.14	7.38	0.738			0.738				
	G	10	10	14.09	20.70	6.61	0.661			0.661				
	H	10	10	16.31	22.87	6.56	0.656			0.656				
22.6%	I	10	10	14.14	20.11	5.97	0.597	0.635	8.2	0.597	100.0	0.635	8.2	3.9
	J	10	10	14.70	20.72	6.02	0.602			0.602				
	K	10	10	14.83	21.13	6.30	0.630			0.630				
	L	10	10	14.51	21.60	7.09	0.709			0.709				
45.2%	M	10	10	13.90	20.24	6.34	0.634	0.588	8.9	0.634	100.0	0.588	8.9	10.9
	N	10	10	14.78	20.82	6.04	0.604			0.604				
	O	10	10	14.70	19.83	5.13	0.513			0.513				
	P	10	10	14.31	20.33	6.02	0.602			0.602				
72.6%	Q	10	10	14.23	19.65	5.42	0.542	0.585	6.2	0.542	100.0	0.585	6.2	11.5
	R	10	10	14.98	20.81	5.83	0.583			0.583				
	S	10	10	14.99	20.82	5.83	0.583			0.583				
	T	10	10	14.31	20.61	6.30	0.630			0.630				
100%	U	10	10	14.64	21.01	6.37	0.637	0.678	8.7	0.637	100.0	0.678	8.7	-2.7
	V	10	10	14.71	21.76	7.05	0.705			0.705				
	W	10	10	15.23	22.71	7.48	0.748			0.748				
	X	10	10	14.26	20.49	6.23	0.623			0.623				
100% Intake	Y	10	10	14.95	21.14	6.19	0.619	0.644	5.6	0.619	100.0	0.644	5.6	2.5
	Z	10	10	14.08	20.16	6.08	0.608			0.608				
	AA	10	10	14.66	21.33	6.67	0.667			0.667				
	BB	10	10	14.33	21.15	6.82	0.682			0.682				

Outfall 101:
Dunnett's MSD value: 0.0949
PMSD: 14.4

Intake:
Dunnett's MSD value: 0.0866
PMSD: 13.1

MSD = Minimum Significant Difference
PMSD = Percent Minimum Significant Difference

PMSD is a measure of test precision. The PMSD is the minimum percent difference between the control and treatment that can be declared statistically significant in a whole effluent toxicity test average, a significant difference occurs for Environmental Testing Solutions, Inc. chronic toxicity tests when a toxicant reduces *Pimephales* growth by 15.5% from the control (determined throug 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.

UV-treated
November 28 - December 05, 2006

Statistical Analyses

Larval Fish Growth and Survival Test-7 Day Growth

Start Date:	11/28/2006	Test ID:	PpFRCR	Sample ID:	TVA / Sequoyah Nuclear Plant, Outfall 101
End Date:	12/5/2006	Lab ID:	ETS-Envir. Testing Sol.	Sample Type:	DMR-Discharge Monitoring Report
Sample Date:		Protocol:	FWCHR-EPA-821-R-02-013	Test Species:	PP-Pimephales promelas
Comments:	UV-treated				

Conc-%	1	2	3	4
D-Control	0.5650	0.6450	0.6690	0.7630
11.3	0.6450	0.7380	0.6610	0.6560
22.6	0.5970	0.6020	0.6300	0.7090
45.2	0.6340	0.6040	0.5130	0.6020
72.6	0.5420	0.5830	0.5830	0.6300
100	0.6370	0.7050	0.7480	0.6230

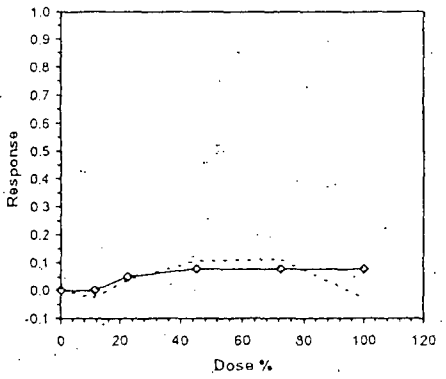
			Transform: Untransformed					1-Tailed			Isotonic	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.6605	1.0000	0.6605	0.5650	0.7630	12.343	4				0.6678	1.0000
11.3	0.6750	1.0220	0.6750	0.6450	0.7380	6.301	4	-0.368	2.410	0.0949	0.6678	1.0000
22.6	0.6345	0.9606	0.6345	0.5970	0.7090	8.155	4	0.660	2.410	0.0949	0.6345	0.9502
45.2	0.5883	0.8906	0.5883	0.5130	0.6340	8.884	4	1.835	2.410	0.0949	0.6170	0.9240
72.6	0.5845	0.8849	0.5845	0.5420	0.6300	6.154	4	1.930	2.410	0.0949	0.6170	0.9240
100	0.6783	1.0269	0.6783	0.6230	0.7480	8.654	4	-0.451	2.410	0.0949	0.6170	0.9240

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.98408103	0.884	0.220567588	-0.320463385
Bartlett's Test indicates equal variances (p = 0.82)	2.173702478	15.08627224		

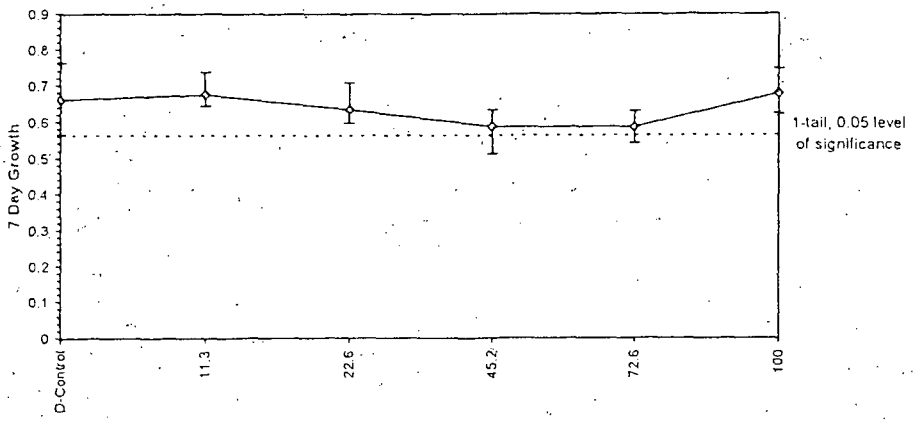
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	100	>100		1	0.094887324	0.14365984	0.007069367	0.003100361	0.090179361	5, 18
Treatments vs D-Control										

Linear Interpolation (200 Resamples)

Point	%	SD	95% CL(Exp)	Skew
IC05	22.778			
IC10	>100			
IC15	>100			
IC20	>100			
IC25	>100			
IC40	>100			
IC50	>100			



Dose-Response Plot



UV-treated
November 28 - December 05, 2006

Statistical Analyses

Larval Fish Growth and Survival Test-7 Day Growth

Start Date:	11/28/2006	Test ID:	PpFRCR	Sample ID:	TVA / Sequoyah Nuclear Plant, Intake
End Date:	12/5/2006	Lab ID:	ETS-Envir. Testing Sol.	Sample Type:	DMR-Discharge Monitoring Report
Sample Date:		Protocol:	FWCHR-EPA-821-R-02-013	Test Species:	PP-Pimephales promelas
Comments:	UV-treated				

Conc-%	1	2	3	4
D-Control	0.5650	0.6450	0.6690	0.7630
100	0.6190	0.6080	0.6670	0.6820

			Transform: Untransformed					1-Tailed			Isotonic	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	0.6605	1.0000	0.6605	0.5650	0.7630	12.343	4				0.6605	1.0000
100	0.6440	0.9750	0.6440	0.6080	0.6820	5.594	4	0.370	1.943	0.0856	0.6440	0.9750

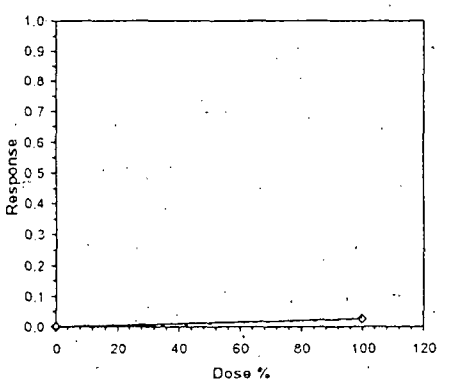
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.98164469	0.749	0.198999913	0.957942952
F-Test indicates equal variances (p = 0.21)	5.120441914	47.46722794		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates no significant differences	0.086598793	0.131110965	0.0005445	0.003972167	0.723920584	1, 6

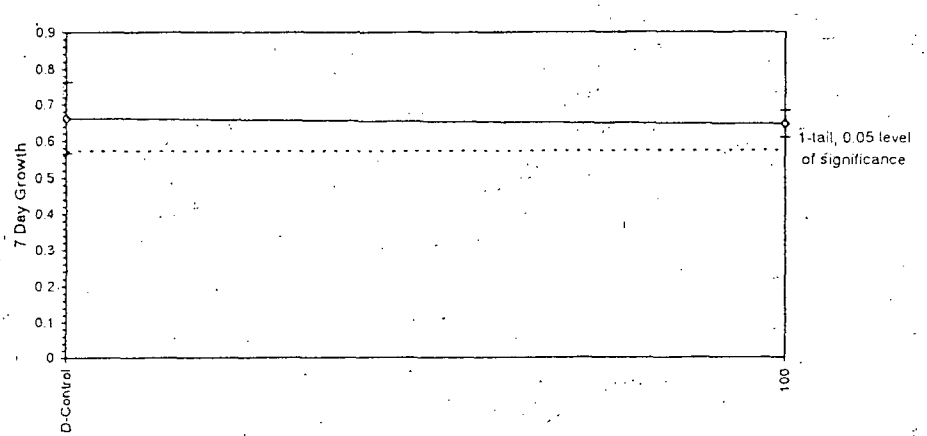
Treatments vs D-Control

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



sqn_11-28-06data

TVA / Sequoyah Nuclear Plant, Outfall 101
UV-treated
November 28 - December 05, 2006

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

Daily Chemical Analyses

Project number: 2906

Reviewed by:

Concentration	Parameter	Day 0		Day 1		Day 2		Day 3		Day 4		Day 5		Day 6	
		Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Fina
Control	pH (SU)	7.91	7.31	7.40	7.11	7.42	7.14	7.25	7.18	7.38	7.15	7.44	7.14	7.37	
	DO (mg/L)	7.8	7.8	8.1	7.1	7.7	7.4	7.7	7.7	7.7	7.0	8.0	7.8	8.1	
	Conductivity (µmhos/cm)	311		307		304		294		295		294		298	
	Temperature (°C)	24.9	24.7	24.6	24.5	24.8	24.9	24.8	24.6	24.8	24.4	24.9	24.2	24.7	
11.3%	pH (SU)	7.91	7.28	7.40	7.08	7.41	7.14	7.25	7.16	7.36	7.15	7.46	7.13	7.37	
	DO (mg/L)	7.7	7.9	8.1	6.8	7.7	7.4	7.7	7.5	7.8	7.0	8.0	7.8	8.0	
	Conductivity (µmhos/cm)	305		299		291		290		291		288		291	
	Temperature (°C)	24.9	24.5	24.7	24.7	24.9	24.8	24.9	24.3	24.8	24.3	25.0	24.1	24.7	
22.6%	pH (SU)	7.90	7.28	7.39	7.07	7.40	7.13	7.25	7.16	7.36	7.14	7.46	7.13	7.36	
	DO (mg/L)	7.7	7.7	8.1	6.9	7.7	7.4	7.8	7.5	7.9	6.9	8.1	7.7	8.0	
	Conductivity (µmhos/cm)	290		284		276		276		277		275		279	
	Temperature (°C)	24.9	24.8	24.8	24.5	24.9	24.8	24.9	24.3	24.8	24.3	24.9	24.3	24.8	
45.2%	pH (SU)	7.90	7.23	7.40	7.05	7.37	7.13	7.24	7.17	7.34	7.10	7.45	7.13	7.36	
	DO (mg/L)	7.8	7.6	8.2	6.8	7.8	7.4	7.8	7.5	7.9	6.9	8.1	7.5	8.0	
	Conductivity (µmhos/cm)	261		258		254		263		254		253		255	
	Temperature (°C)	25.0	24.6	25.0	24.6	24.9	24.9	24.9	24.4	24.8	24.4	24.9	24.2	24.8	
72.6%	pH (SU)	7.90	7.29	7.38	7.06	7.37	7.13	7.20	7.19	7.32	7.15	7.42	7.09	7.33	
	DO (mg/L)	7.8	7.5	8.1	6.7	7.8	7.3	7.9	7.4	7.9	6.8	8.1	7.8	8.0	
	Conductivity (µmhos/cm)	230		223		223		220		218		220		224	
	Temperature (°C)	25.1	24.6	25.0	24.6	25.0	24.9	24.9	24.4	24.8	24.5	24.9	24.2	24.8	
100%	pH (SU)	7.92	7.29	7.37	7.06	7.35	7.12	7.19	7.18	7.31	7.10	7.42	7.20	7.34	
	DO (mg/L)	7.6	7.4	8.1	6.6	7.8	7.4	7.9	7.5	7.8	6.8	7.9	7.4	8.0	
	Conductivity (µmhos/cm)	194		192		194		190		191		190		193	
	Temperature (°C)	25.1	24.4	25.0	24.6	25.1	24.9	25.0	24.5	25.0	24.4	25.0	24.2	24.8	
100% Intake	pH (SU)	7.91	7.25	7.38	6.96	7.16	7.12	7.16	7.18	7.28	7.14	7.37	7.15	7.31	
	DO (mg/L)	7.6	7.6	8.0	6.7	7.9	7.5	8.0	7.5	8.0	6.9	8.0	7.5	8.1	
	Conductivity (µmhos/cm)	195		185		187		187		188		187		190	
	Temperature (°C)	25.0	24.4	24.9	24.6	24.9	24.7	24.9	24.3	24.8	24.5	25.0	24.3	24.8	

Species: *Pimephales promelas* Date: 11.28.06
Client: TVA / Sequoyah Nuclear Plant – UV-treated

Daily Chemistry:

		Day					
		0		1		2	
	Analyst	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Concentration	Parameter						
CONTROL	pH (S.U.)	7.91	7.31	7.40	7.11	7.42	7.14
	DO (mg/L)	7.8	7.8	8.1	7.1	7.7	7.4
	Conductivity (µmhos/cm)	311	[illegible]	307	[illegible]	304	[illegible]
	Temperature (°C)	24.9	24.7	24.6	24.5	24.8	24.9
11.3%	pH (S.U.)	7.91	7.28	7.40	7.08	7.41	7.14
	DO (mg/L)	7.7	7.9	8.1	6.8	7.7	7.4
	Conductivity (µmhos/cm)	305	[illegible]	299	[illegible]	891	[illegible]
	Temperature (°C)	24.9	24.5	24.7	24.7	24.9	24.8
22.6%	pH (S.U.)	7.90	7.28	7.39	7.07	7.40	7.13
	DO (mg/L)	7.7	7.7	8.1	6.9	7.7	7.4
	Conductivity (µmhos/cm)	290	[illegible]	284	[illegible]	276	[illegible]
	Temperature (°C)	24.9	24.8	24.8	24.5	24.9	24.8
45.2%	pH (S.U.)	7.90	7.23	7.40	7.05	7.37	7.13
	DO (mg/L)	7.8	7.6	8.2	6.8	7.8	7.4
	Conductivity (µmhos/cm)	261	[illegible]	250	[illegible]	254	[illegible]
	Temperature (°C)	25.0	24.6	25.0	24.6	24.9	24.9
72.6%	pH (S.U.)	7.90	7.29	7.38	7.06	7.37	7.13
	DO (mg/L)	7.8	7.5	8.1	6.7	7.8	7.3
	Conductivity (µmhos/cm)	230	[illegible]	223	[illegible]	223	[illegible]
	Temperature (°C)	25.1	24.6	25.0	24.6	25.0	24.9
100%	pH (S.U.)	7.92	7.29	7.37	7.06	7.35	7.12
	DO (mg/L)	7.6	7.4	8.1	6.6	7.8	7.4
	Conductivity (µmhos/cm)	194	[illegible]	192	[illegible]	194	[illegible]
	Temperature (°C)	25.1	24.4	25.0	24.6	25.1	24.9
100% Intake	pH (S.U.)	7.91	7.25	7.38	6.96	7.16	7.12
	DO (mg/L)	7.6	7.6	8.0	6.7	7.9	7.5
	Conductivity (µmhos/cm)	195	[illegible]	185	[illegible]	187	[illegible]
	Temperature (°C)	25.0	24.4	24.9	24.6	24.9	24.7
		Initial	Final	Initial	Final	Initial	Final

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

Date: 11.28.06

		Day							
		3		4		5		6	
	Analyst	KEK	MEK	MEK	MEK	MEK	MEK	MEK	MEK
Concentration	Parameter								
CONTROL	pH (S.U.)	7.25	7.18	7.38	7.15	7.44	7.14	7.37	7.26
	DO (mg/L)	7.7	7.7	7.7	7.0	8.0	7.8	8.1	7.6
	Conductivity (µmhos/cm)	294		295		294		298	
	Temperature (°C)	24.8	24.6	24.8	24.4	24.9	24.2	24.7	24.5
11.3%	pH (S.U.)	7.25	7.16	7.36	7.15	7.46	7.13	7.37	7.22
	DO (mg/L)	7.7	7.5	7.8	7.0	8.0	7.8	8.0	7.6
	Conductivity (µmhos/cm)	290		291		288		291	
	Temperature (°C)	24.9	24.3	24.8	24.3	25.0	24.1	24.7	24.1
22.6%	pH (S.U.)	7.25	7.16	7.36	7.14	7.46	7.13	7.36	7.25
	DO (mg/L)	7.8	7.5	7.9	6.9	8.1	7.7	8.0	7.6
	Conductivity (µmhos/cm)	276		277		275		279	
	Temperature (°C)	24.9	24.3	24.8	24.3	24.9	24.3	24.8	24.2
45.2%	pH (S.U.)	7.24	7.17	7.34	7.10	7.45	7.13	7.36	7.25
	DO (mg/L)	7.8	7.5	7.9	6.9	8.1	7.5	8.0	7.5
	Conductivity (µmhos/cm)	263		254		253		255	
	Temperature (°C)	24.9	24.4	24.8	24.4	24.9	24.2	24.8	24.3
72.6%	pH (S.U.)	7.20	7.19	7.32	7.15	7.42	7.09	7.33	7.23
	DO (mg/L)	7.9	7.4	7.9	6.8	8.1	(7.8) 7.8	8.0	7.6
	Conductivity (µmhos/cm)	220		218		220		224	
	Temperature (°C)	24.9	24.4	24.8	24.5	24.9	24.2	24.8	24.2
100%	pH (S.U.)	7.19	7.18	7.31	7.10	7.42	7.20	7.34	7.24
	DO (mg/L)	7.9	7.5	7.8	6.8	7.9	7.4	8.0	7.6
	Conductivity (µmhos/cm)	190		191		190		193	
	Temperature (°C)	25.0	24.5	25.0	24.4	25.0	24.2	24.8	24.2
100% Intake	pH (S.U.)	7.16	7.18	7.28	7.14	7.37	7.15	7.31	7.24
	DO (mg/L)	8.0	7.5	8.0	6.9	8.0	7.5	8.1	7.6
	Conductivity (µmhos/cm)	187		188		187		190	
	Temperature (°C)	24.9	24.3	24.8	24.5	25.0	24.3	24.8	24.3
		Initial	Final	Initial	Final	Initial	Final	Initial	Final

Total Residual Chlorine
(EPA Method 330.5)

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

Analyst	KEW
Date analyzed	11.28.06

Iodide reagent:	INR235
Acid reagent:	INR347

Calibration:

	0.10 mg/L	1.00 mg/L
Reference standard number	INSS353	INSS353

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%)
INSS353	0.50	0.540	108.0%

Duplicate sample precision:

Sample number	Sample ID	Sample characteristics	Residual chlorine (mg/L)	%RPD = {(S - D) /[(S+D)/2]} x 100 (acceptable range = ± 10%)
061128.01	Mt Olive WWTP	nocolor, clear	S <0.00410	
↓	Duplicate		D <0.00383	→

Sample measurements:

Sample number	Sample ID	Sample characteristics	Residual chlorine (mg/L)
	Blank (should be = < 0.10 mg/L)		<0.00859
061122.01	Elementis Chromium	nocolor, clear	<0.00803
061128.02	Exide	nocolor, clear	<0.000503
061127.01	TVA-SQN-101	nocolor, clear	<0.00200
061127.02	↓ INT	pale yellow, clear	0.00214

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%)
INSS353	0.50	0.511	102.2%

Reviewed by	
Date reviewed	11-28-06

Total Residual Chlorine
(EPA Method 330.5)

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

Analyst	KEH	Iodide reagent:	INR235
Date analyzed	11.30.06	Acid reagent:	INR247

Calibration:

	0.10 mg/L	1.00 mg/L
Reference standard number	INSS353	INSS353

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%)
INSS353	0.50	0.492	98.4

Duplicate sample precision:

Sample number	Sample ID	Sample characteristics	Residual chlorine (mg/L)	%RPD = {(S - D) /[(S+D)/2]} x 100 (acceptable range = ± 10%)
061130.01	Mt Olive WWTP	nocolor clear	S <0.00802	
↓	Duplicate		D <0.00020	—

Sample measurements:

Sample number	Sample ID	Sample characteristics	Residual chlorine (mg/L)
	Blank (should be = < 0.10 mg/L)		<0.00802
061129.07 ~~061201.01~~	TVA-SQN-101	nocolor, Clear	<0.00323
061129.08 ~~061201.02~~	↓ INT	pale yellow, Clear	<0.00294

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%)
INSS353	0.50	0483	96.6

Reviewed by	JL
Date reviewed	11.30.06

Total Residual Chlorine
(EPA Method 330.5)

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

Analyst	HEM
Date analyzed	12-02-06

Iodide reagent:	INR235
Acid reagent:	INR247

Calibration:

	0.10 mg/L	1.00 mg/L
Reference standard number	INSS353	INSS353

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%)
INSS353	0.50	0.460	92.0%

Duplicate sample precision:

Sample number	Sample ID	Sample characteristics	Residual chlorine (mg/L)	%RPD = {(S - D) /[(S+D)/2]} x 100 (acceptable range = ± 10%)
061202.01	Mt Olive WWTP	no color, clear	S <0.00352	
↓	Duplicate		D <0.00150	—

Sample measurements:

Sample number	Sample ID	Sample characteristics	Residual chlorine (mg/L)
	Blank (should be = < 0.10 mg/L)		<0.0091
061201.01	TVA-SQN 101	no color, clear	<0.00990
061201.02	↓ INT	pale yellow, clear	<0.00604

HEM

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%)
INSS353	0.50	0.453	90.6%

Reviewed by	
Date reviewed	12-02-06

Alkalinity
(EPA Method 310.1)

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

Time started: 1317
Time ended: 1335

Analyst: VEL
Date analyzed: 11-27-06

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
5.6	INR841	CHM844	0.1	12.2	12.1	0.0207	10.3

Bill correction 0.0 - 0.1 = 0.1 ml

Laboratory control standard:

Reference standard number	True value (TV) (mg $CaCO_3$/L)	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Alkalinity (MV) (mg $CaCO_3$/L)	% RS = MV / TV x 100 (acceptable range = 90 to 110%)
INR823	100	100	12.2	21.5	9.3	10.3	96	96.01

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%)
11-20-06	Mits H_2O	100	21.5	27.2	5.7	10.3	S 59	
↓	Duplicate	↓	27.2	32.9	5.7	↓	D 59	0

Matrix spike recovery:

Reference standard number	Spike value (SV) (mg $CaCO_3$/L)	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Spike alkalinity (A) (mg $CaCO_3$/L)
INR823	50	100	27.2	37.7	10.5	10.3	110

Sample alkalinity (B) (mg $CaCO_3$/L)	Measured spike value (MV) MV = A - B (mg $CaCO_3$/L)	% R = MV / SV x 100 (acceptable range = 75 to 125%)
59	51	102.01

Sample measurements:

Sample number	Sample ID	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Alkalinity (mg $CaCO_3$/L)
11.26.06A	Mits H_2O	100	37.7	43.3	5.6	10.3	58
11.26.06B	↓	↓	43.3	49.0	5.7	↓	59
11.26.06	SSW H_2O		17.0	20.1	3.1		32
~~110629~~ 35480	EES 110629		20.1	21.5	1.4		14
35481	↓ 110630		21.6	23.2	1.6		16
35482	↓ 110631	↓	23.2	23.3	0.1	↓	1.0

Reviewed by: JL

Date reviewed: 11-27-06

Alkalinity
(EPA Method 310.1)

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

Time started: 1033
Time ended: 1109

Analyst: KEK
Date analyzed: 12-03-06

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
5.3	INR241	CHm944	0.0	12.2	12.2	0.0205	10.2

BIR correction 0.0 - 0.0 = 0.0 ml

Laboratory control standard:

Reference standard number	True value (TV) (mg $CaCO_3$/L)	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Alkalinity (MV) (mg $CaCO_3$/L)	% RS = MV / TV x 100 (acceptable range = 90 to 110%)
INSS407	100	100	12.2	21.3	9.1	10.2	93	93.0%

Duplicate sample precision:

Sample number	Sample ID	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Alkalinity (mg $CaCO_3$/L)	%RPD = {(S - D) /[(S+D)/2]} x 100 (acceptable range = ± 10%)
12-02-06 A	MHS H_2O	100	21.3	27.0	5.7	10.2	S 58	
↓	Duplicate	↓	27.0	32.7	5.7	↓	D 58	0

Matrix spike recovery:

Reference standard number	Spike value (SV) (mg $CaCO_3$/L)	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Spike alkalinity (A) (mg $CaCO_3$/L)
INSS407	50	100	27.0	37.0	10.0	10.2	100

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%)
58	42	84.0%

Sample measurements:

Sample number	Sample ID	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Alkalinity (mg $CaCO_3$/L)
12-02-06 B	MHS H_2O	100	37.0	42.8	5.8	10.2	59
12-02-06 C	↓	↓	42.8	~~48~~ 48.6	5.8	↓	59
11-30-06	SSW H_2O		0.0	3.0	3.0		31
12-02-06 A	SALT SW		3.0	11.5	~~4.2~~ 8.5		~~Hot~~ 87
12-02-06 B	↓		11.7	20.5	8.8		90
061128.01	MT OLIVE WATER	↓	20.5	29.3	8.8		90
061130.01	2	50	29.3	33.8	4.5	(2)	92
061202.01	3	↓	33.8	38.1	4.3	↓	88
061128.02	Exide	100	38.2	38.7	0.5	↓	5.1

Reviewed by: JL

Date reviewed: 12-03-06

Total Hardness
(EPA Method 130.2)

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

Analyst	KEV	Time initiated:	1109
Date analyzed	11-27-06	Time completed:	1139

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
INR198	INR204	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%)
INSS436	40	50	9.8	11.9	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%)
11-20-06	MHS H20	50	11.9	16.2	4.3	20.4	S 88	
↓	Duplicate (B)	↓	16.2	20.6	4.4	↓	D 90	2.2 %

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)
INSS436	40	50	20.6	27.1	6.5	20.4	130

11-26-06A

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%)
92	38	95 %

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
11-26-06 A	MHS H20	↓	20.6	25.1	4.5	↓	92
11-26-06 B	↓	↓	27.1	31.3	4.2	↓	86
11-26-06	SSW H20	↓	31.3	33.5	2.2	↓	45

Note: If >15ml of titrant is used, sample must be diluted. Reviewed by: [signature] Date reviewed 11-27-06

Total Hardness
(EPA Method 130.2)

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

Analyst:	MEF	Time initiated:	0916
Date analyzed	12-03-06	Time completed:	0942

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
INR198	INR204	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%)
INS5436	40	50	9.8	11.8	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%)
12-02-06A	MHS H20	50	11.8	16.2	4.4	20.4	S 90	
↓	Duplicate (B)	↓	16.2	20.6	4.4	↓	D 90	0

Matrix spike recovery:

Reference standard number	Spike value (SV) (mg $CaCO_3$/L)	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Spike hardness (A) (mg $CaCO_3$/L)
INS5436	40	50	16.2	22.5	6.3	20.4	130

Sample hardness (B) (mg $CaCO_3$/L)	Measured spike value (MV) MV = A - B (mg $CaCO_3$/L)	% R = MV / SV x 100 (acceptable range = 75 to 125%)
90	40	100.0%

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
12-02-06B	MHS H20		22.5	27.0	4.5		92
12-02-06C	1		27.0	31.5	4.5		92
11-30-06	SSW H20		31.8	33.7	2.1		43
061128.01	Mt Olive WWTP 1		33.7	38.4	4.7		96
061130.01	2		38.4	42.8	4.4		90
061202.01	3	42.8	48.2	47.4	4.6		94
061127.01	TVA-SQN 101 1		0.0	3.8	3.8		78
061129.07	2		3.8	6.0	4.2		84
061201.01	3	↓	0.0	11.9	3.9	↓	80

Note: If >15ml of titrant is used, sample must be diluted. Reviewed by: [signature] Date reviewed 12-03-06

Total Hardness
(EPA Method 130.2)

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

Analyst	KEC	Time initiated:	
Date analyzed	12-03-06	Time completed:	

Titrant normality and multiplier determination:

Titrant reference number	Normality check standard number	Begin ml	End ml	Total ml (E)	Normality (N) of EDTA ~~= 0.2/E~~ (acceptable range = 0.018 - 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%)
INS5436	40	50	11.9	13.9	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%)
061127.02	TVA SQN-INT 1	50	13.9	17.8	3.9	20.4	S 80	
↓	Duplicate (B)	↓	17.8	21.7	3.9	↓	D 80	0

Matrix spike recovery:

Reference standard number	Spike value (SV) (mg $CaCO_3$/L)	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Spike hardness (A) (mg $CaCO_3$/L)
INS5436	40	50	17.8	23.8	6.0	20.4	120

Sample hardness (B) (mg $CaCO_3$/L)	Measured spike value (MV) MV = A - B (mg $CaCO_3$/L)	% R = MV / SV x 100 (acceptable range = 75 to 125%)
80	40	100.0%

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)						0
061129.08	TVA SQN INT 2	50	23.8	27.9	4.1	20.4	84
061201.02	↓ 3	↓	27.9	31.8	3.9	↓	80
061128.02	~~Exide~~ Exide	↓	31.8	35.1	3.3	↓	67

Note: If >15ml of titrant is used, sample must be diluted. Reviewed by: [signature] Date reviewed 12-03-06

Alkalinity
(EPA Method 310.1)

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

Analyst	KEN
Date analyzed	12-03-06

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%)
INS5407	100	100	39.0	48.4	9.4	10.2	96	96.0%

Duplicate sample precision:

Sample number	Sample ID	Sample volume (ml)	0.0 Begin ml	6.5 End ml	6.5 Total ml	Multiplier	Alkalinity (mg $CaCO_3$/L)	%RPD = {(S - D) /[(S+D)/2]} x 100 (acceptable range = ± 10%)
061127.01	TVA SQN 101 1	100	~~39.0~~	~~48.4~~	~~9.4~~	10.2	S 66	
↓	Duplicate	↓	6.5	13.1	6.6	↓	D 67	1.5%

Matrix spike recovery:

Reference standard number	Spike value (SV) (mg $CaCO_3$/L)	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Spike alkalinity (A) (mg $CaCO_3$/L)
INS5407	50	100	6.5	17.8	11.3	10.2	120

Sample alkalinity (B) (mg $CaCO_3$/L)	Measured spike value (MV) MV = A - B (mg $CaCO_3$/L)	% R = MV / SV x 100 (acceptable range = 75 to 125%)
67	53	106.0%

Sample measurements:

Sample number	Sample ID	Sample volume (ml)	Begin ml	End ml	Total ml	Multiplier	Alkalinity (mg $CaCO_3$/L)
061129.07	TVA-SQN 101 2	100	17.8	24.3	6.5	10.2	66
061201.01	↓ 3	↓	24.3	30.8	6.5	↓	66
061127.02	TVASQN INT 1		30.8	37.2	6.4		65
061129.08	↓ 2		37.2	43.8	6.6		67
061201.02	↓ 3		26.4	32.7	6.3		64
35528	EES 110638		32.7	34.4	1.7		17
35529	↓ 110639	↓	34.4	36.1	1.7	↓	17

Reviewed by: [signature] Date reviewed: 12-03-06

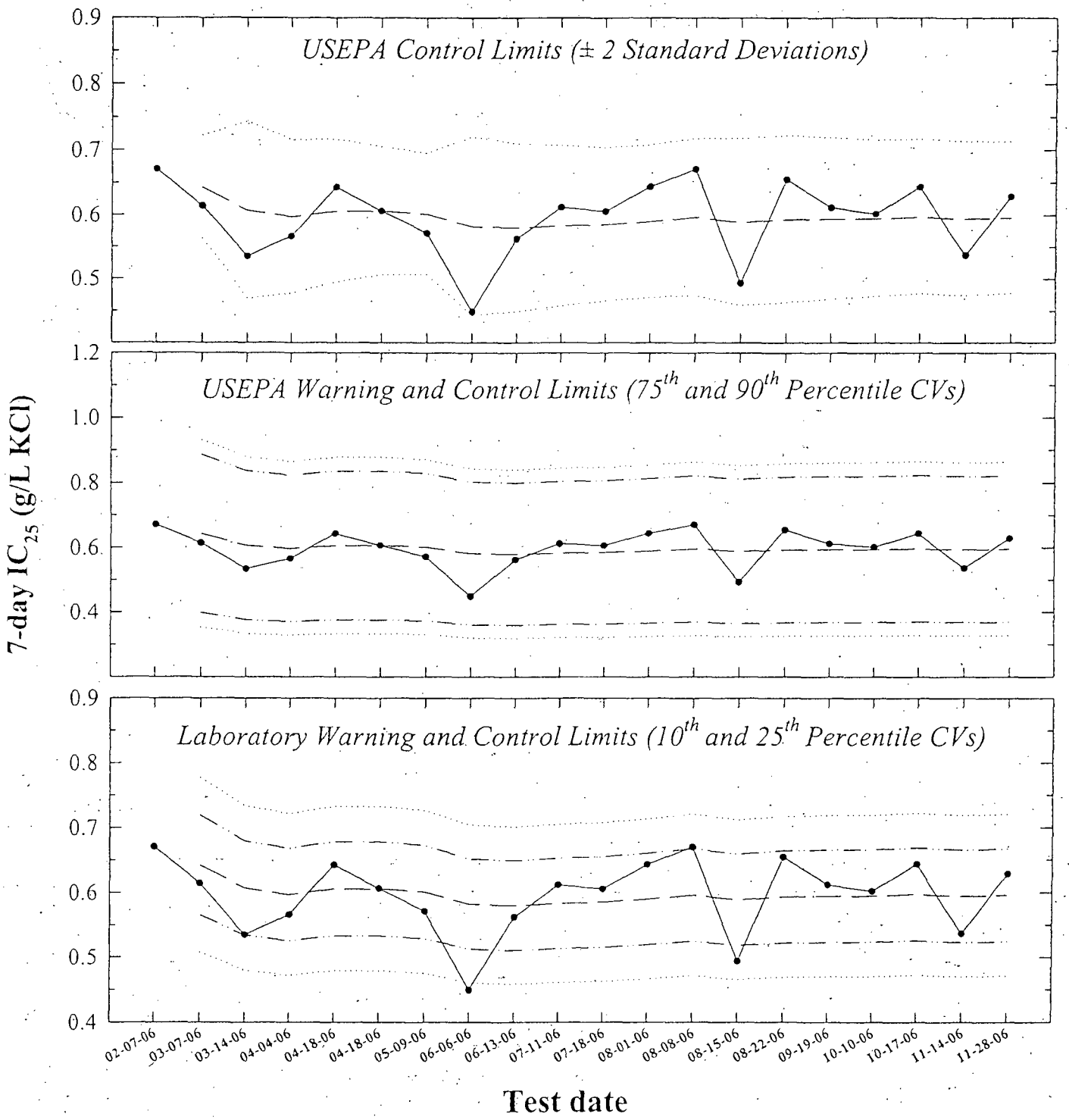
Sequoyah Nuclear Plant Biomonitoring
November 28 – December 5, 2006

Appendix D

Reference Toxicant Test and
Control Chart

Pimephales promelas

Potassium Chloride Chronic Reference Toxicant Control Chart 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 $IC_{25} \pm S_{A.10}$ or $S_{A.75}$)

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

Environmental Testing Solutions, Inc.

Pimephales promelas

Potassium Chloride Chronic Reference Toxicant Control Chart

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		$S_{A,10}$	Laboratory Warning Limits		$S_{A,25}$	Laboratory Control Limits		$S_{A,75}$	USEPA Warning Limits		$S_{A,90}$	USEPA Control Limits		CV
					CT - 2S	CT + 2S		CT - $S_{A,10}$	CT + $S_{A,10}$		CT - $S_{A,25}$	CT + $S_{A,25}$		CT - $S_{A,75}$	CT + $S_{A,75}$		CT - $S_{A,90}$	CT + $S_{A,90}$	
1	02-07-06	0.67																	
2	03-07-06	0.61	0.64	0.04	0.56	0.72	0.08	0.57	0.72	0.13	0.51	0.78	0.24	0.40	0.89	0.29	0.35	0.93	0.0
3	03-14-06	0.53	0.61	0.07	0.47	0.74	0.07	0.53	0.68	0.13	0.48	0.73	0.23	0.38	0.84	0.27	0.33	0.88	0.1
4	04-04-06	0.57	0.60	0.06	0.48	0.72	0.07	0.52	0.67	0.13	0.47	0.72	0.23	0.37	0.82	0.27	0.33	0.86	0.1
5	04-18-06	0.64	0.61	0.06	0.49	0.72	0.07	0.53	0.68	0.13	0.48	0.73	0.23	0.38	0.84	0.27	0.33	0.88	0.0
6	04-18-06	0.61	0.61	0.05	0.51	0.71	0.07	0.53	0.68	0.13	0.48	0.73	0.23	0.38	0.84	0.27	0.33	0.88	0.0
7	05-09-06	0.57	0.60	0.05	0.51	0.70	0.07	0.53	0.67	0.13	0.47	0.73	0.23	0.37	0.83	0.27	0.33	0.87	0.0
8	06-06-06	0.45	0.58	0.07	0.44	0.72	0.07	0.51	0.65	0.12	0.46	0.70	0.22	0.36	0.80	0.26	0.32	0.84	0.1
9	06-13-06	0.56	0.58	0.07	0.45	0.71	0.07	0.51	0.65	0.12	0.46	0.70	0.22	0.36	0.80	0.26	0.32	0.84	0.1
10	07-11-06	0.61	0.58	0.06	0.46	0.71	0.07	0.51	0.65	0.12	0.46	0.71	0.22	0.36	0.80	0.26	0.32	0.85	0.1
11	07-18-06	0.61	0.58	0.06	0.47	0.70	0.07	0.51	0.65	0.12	0.46	0.71	0.22	0.36	0.81	0.26	0.32	0.85	0.1
12	08-01-06	0.64	0.59	0.06	0.47	0.71	0.07	0.52	0.66	0.12	0.47	0.71	0.22	0.37	0.81	0.27	0.32	0.86	0.1
13	08-08-06	0.67	0.60	0.06	0.47	0.72	0.07	0.52	0.67	0.13	0.47	0.72	0.23	0.37	0.82	0.27	0.33	0.86	0.1
14	08-15-06	0.49	0.59	0.06	0.46	0.72	0.07	0.52	0.66	0.12	0.46	0.71	0.22	0.36	0.81	0.26	0.32	0.85	0.1
15	08-22-06	0.65	0.59	0.06	0.46	0.72	0.07	0.52	0.66	0.12	0.47	0.72	0.23	0.37	0.82	0.27	0.33	0.86	0.1
16	09-19-06	0.61	0.59	0.06	0.47	0.72	0.07	0.52	0.67	0.12	0.47	0.72	0.23	0.37	0.82	0.27	0.33	0.86	0.1
17	10-10-06	0.60	0.59	0.06	0.47	0.72	0.07	0.52	0.67	0.12	0.47	0.72	0.23	0.37	0.82	0.27	0.33	0.86	0.1
18	10-17-06	0.64	0.60	0.06	0.48	0.72	0.07	0.53	0.67	0.13	0.47	0.72	0.23	0.37	0.82	0.27	0.33	0.87	0.1
19	11-14-06	0.54	0.59	0.06	0.47	0.71	0.07	0.52	0.67	0.12	0.47	0.72	0.23	0.37	0.82	0.27	0.33	0.86	0.1
20	11-28-06	0.63	0.60	0.06	0.48	0.71	0.07	0.52	0.67	0.13	0.47	0.72	0.23	0.37	0.82	0.27	0.33	0.86	0.1

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.

Precision of Endpoint Measurements

Pimephales promelas
Potassium Chloride Chronic Reference Toxicant Data
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	02-07-06	100	0.711		7.8		0.09	13.2	
2	03-07-06	100	0.774	0.743	8.4	8.1	0.10	13.3	13.2
3	03-14-06	100	0.745	0.743	9.7	8.6	0.14	18.9	15.1
4	04-04-06	100	0.766	0.749	11.5	9.4	0.08	10.7	14.0
5	04-18-06	100	0.621	0.723	9.7	9.4	0.09	13.8	14.0
6	04-18-06	100	0.668	0.714	13.3	10.1	0.10	15.4	14.2
7	05-09-06	100	0.841	0.732	7.5	9.7	0.12	14.4	14.2
8	06-06-06	100	0.783	0.739	5.9	9.2	0.08	9.6	13.7
9	06-13-06	97.5	0.709	0.735	8.2	9.1	0.16	22.0	14.6
10	07-11-06	100	0.673	0.729	2.5	8.5	0.09	13.1	14.4
11	07-18-06	97.5	0.623	0.719	17.1	9.3	0.10	16.6	14.6
12	08-01-06	100	0.746	0.722	10.5	9.4	0.13	17.0	14.8
13	08-08-06	100	0.613	0.713	10.4	9.4	0.08	13.6	14.7
14	08-15-06	100	0.765	0.717	8.0	9.3	0.16	20.4	15.1
15	08-22-06	100	0.768	0.720	8.7	9.3	0.12	15.5	15.2
16	09-19-06	100	0.699	0.719	12.7	9.5	0.12	17.2	15.3
17	10-10-06	100	0.685	0.717	5.1	9.2	0.10	14.0	15.2
18	10-17-06	100	0.781	0.720	7.3	9.1	0.15	18.7	15.4
19	11-14-06	100	0.737	0.721	5.3	8.9	0.10	13.4	15.3
20	11-28-06	100	0.621	0.716	14.0	9.2	0.12	18.7	15.5

Note: CV = Coefficient of variation for control growth.

On average, the CV for control growth is 9.2% in Environmental Testing Solutions, Inc. *Pimephales* chronic toxicity tests.

Lower CV bound determined by USEPA (10^{th} percentile) = 3.5%.

Upper CV bound determined by USEPA (90^{th} percentile) = 20%

MSD = Minimum Significant Difference

PMSD = Percent Minimum Significant Difference

PMSD is a measure of test precision. The PMSD is the minimum percent difference between the control and treatment that can be declared statistically significant in a whole effluent toxicity test. On average, a significant difference occurs for Environmental Testing Solutions, Inc. chronic toxicity tests when a toxicant reduces *Pimephales* growth by 15.5% from the control.

Lower PMSD bound determined by USEPA (10^{th} percentile) = 9.4%.

Upper PMSD bound determined by USEPA (90^{th} percentile) = 35%.

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

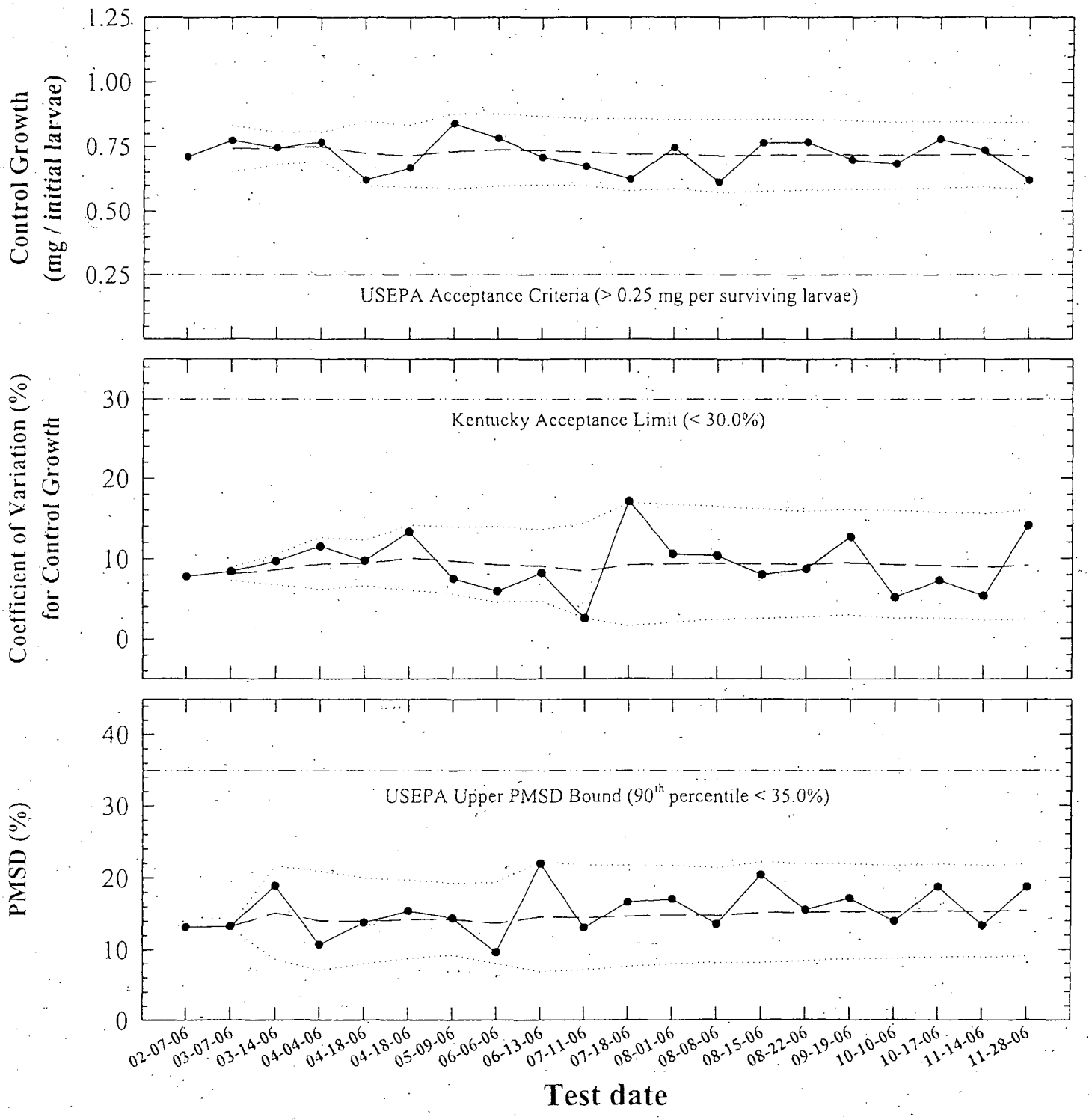
The lower and upper bounds were calculated by the USEPA using 205 tests conducted from 19 laboratories for *Pimephales* growth in chronic reference toxicant tests.

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.

Organisms obtained from Aquatic BioSystems, Inc.

11-28-06

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



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

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

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

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

PpKClCR Test Number: 106

Dilution preparation information:						*Comments:*
KCl CHM number:		CHM 267				
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:	24.25 TO 26.25 HOURS OLD	Randomizing template:	PURPLE
Date and times organisms were born between:	11-27-06 1400 TO 1600	Incubator number and shelf location:	3E
Organism source:	ABS BATCH Pp 11-27-06	*Artemia* lot number:	BG1204 U
Transfer bowl information:	pH = 7.66 SU Temperature = 24.2 °C	Total drying time:	24 HOURS
		Date / Time in: 12-05-06	1620
Average transfer volume:	8.6 mL	Date / Time out: 12-06-06	1625
		Oven temperature:	60 °C

Daily feeding and renewal information:

Day	Date	Morning feeding time	Afternoon feeding time	Test initiation, renewal, or termination time	MHS batch used	Analyst
0	11-28-06	—	1636	1609	11-26-06 A	dl
1	11-29-06	0930	1530	1521	11-26-06A	dl
2	11-30-06	0918	1521	1520	11-26-06B	dl
3	12-01-06	0922	1527	1526	11-26-06B	dl
4	12-02-06	0930	1531	1530	11-26-06B	dl
5	12-03-06	0917	1520	1519	12-02-06A	dl
6	12-04-06	0910	1540	1530	12-02-06A	dl
7	12-05-06			1617		dl

Control information:		Acceptance criteria	*Summary of test endpoints:*	
% Mortality:	0%	≤ 20%	7-day LC_{50}	707.2
Average weight per initial larvae:	0.621		NOEC	450
Average weight per surviving larvae:	0.621	≥ 0.25 mg/larvae	LOEC	600
			ChV	519.6
			IC_{25}	628.9

Species: *Pimephales promelas* PpKCICR Test Number: 106

Survival and Growth Data

Day	Control				300 mg KCl/L				450 mg KCl/L			
	A	B	C	D	E	F	G	H	I	J	K	L
0	10	10	10	10	10	10	10	10	10	10	10	10
1	10	10	10	10	10	10	10	10	10	10	10	10
2	10	10	10	10	10	10	10	10	10	10	10	10
3	10	10	10	10	10	10	10	10	10	10	10	10
4	10	10	10	10	10	10	10	10	10	10	10	10
5	10	10	10	10	10	10	10	10	10	10	10	10
6	10	10	10	10	10	10	10	10	10	10	10	10
7	10	10	10 LG	10	10	10	10	10 SM	10	10	10	10
A = Pan weight (mg) Tray color code:: Lime Green Analyst: LAB	14.55	13.96	13.64	14.56	14.85	14.78	13.95	14.62	15.05	14.49	14.01	14.44
B = Pan + Larvae weight (mg) Analyst: LAB	20.37	20.18	21.05	19.94	21.06	21.51	19.85	19.29	21.32	21.03	19.55	20.46
Larvae weight (mg) = A – B	5.82	6.22	7.41	5.38	6.21	6.73	5.90	4.67	6.27	6.54	5.54	6.02
Weight per initial number of larvae (mg) = C / Initial number of larvae	0.582	0.622	0.741	0.538	0.621	0.673	0.590	0.467	0.627	0.654	0.554	0.602
Average weight per initial number of larvae (mg)	0.621				0.588				0.609			
Percent reduction from control (%)					5.3%				1.9%			

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

Calculations and data reviewed: JH

Comments:

Species: *Pimephales promelas* PpKClCR Test Number: 106

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	9 1d	10	9 1d	10	7 3d	7 3d	8 2d	6 4d	2 8d	4 6d	4 6d	4 6d
2	8 1d	10	8 1d	8 2d	6 1d	4 3d	6 2d	4 2d	1 1d	2 2d	1 3d	2 2d
3	8	10	8	8	6	4	6	4	1	2	1	2
4	8	10	8	8	6	4	6	4	1	2	1	2
5	7 1d	9 1d	8	8	5 1d	4	4 2d	3 1d	0 1d	1 1d	0 1d	2
6	7	9	8	8	5	4	4	3	0	1	0	2
7	7	9 1SM	8 1LG	8	5	4	4	3	0	1	0	2
A = Pan weight (mg) Tray color code:: Lime Green Analyst: LAB	13.74	14.37	13.33	15.06	14.11	13.85	14.28	14.30	~~15.65~~	12.90	~~14.68~~	13.77
B = Pan + Larvae weight (mg) Analyst: LAB	18.29	18.84	20.55	19.61	17.04	16.17	16.87	15.98	~~15.63~~	13.58	~~14.68~~	15.01
Larvae weight (mg) = A – B	4.55	4.47	7.22	4.55	2.93	2.32	2.59	1.68	0	0.68	0	1.24
Weight per initial number of larvae (mg) = C / Initial number of larvae	0.455	0.447	0.722	0.455	0.293	0.232	0.259	0.168	0	0.068	0	0.124
Average weight per initial number of larvae (mg)	0.520		16.3%		0.238		61.7%		0.048		92.3%	
Percent reduction from control (%)												

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

Calculations and data reviewed: JL

Comments:

Environmental Testing Solutions, Inc.

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: PpKCICR # 146 (#106 at 351 Depot St.)
Test dates: November 28 - December 05, 2006

Reveiwed by:

Concentration (mg/L KCl)	Replicate	Initial number of larvae	Final number of larvae	A = Pan weight (mg)	B = Pan + Larvae weight (mg)	Larvae weight (mg) = A - B	Weight / Surviving number of larvae (mg)	Mean weight/ Surviving number of larvae (mg)	Coefficient of variation (Mean weight per surviving number of larvae) (%)	Weight / Initial number of larvae (mg)	Mean survival (%)	Mean weight/ Initial number of larvae (mg)	Coefficient of variation (%)	Percent reduction control (%)
Control	A	10	10	14.55	20.37	5.82	0.582	0.621	14.0	0.582	100.0	0.621	14.0	Not applicab
	B	10	10	13.96	20.18	6.22	0.622			0.622				
	C	10	10	13.64	21.05	7.41	0.741			0.741				
	D	10	10	14.56	19.94	5.38	0.538			0.538				
300	E	10	10	14.85	21.06	6.21	0.621	0.588	14.9	0.621	100.0	0.588	14.9	5.3
	F	10	10	14.78	21.51	6.73	0.673			0.673				
	G	10	10	13.95	19.85	5.90	0.590			0.590				
	H	10	10	14.62	19.29	4.67	0.467			0.467				
450	I	10	10	15.05	21.32	6.27	0.627	0.609	7.0	0.627	100.0	0.609	7.0	1.9
	J	10	10	14.49	21.03	6.54	0.654			0.654				
	K	10	10	14.01	19.55	5.54	0.554			0.554				
	L	10	10	14.44	20.46	6.02	0.602			0.602				
600	M	10	7	13.74	18.29	4.55	0.650	0.654	27.0	0.455	80.0	0.520	26.0	16.3
	N	10	9	14.37	18.84	4.47	0.497			0.447				
	O	10	8	13.33	20.55	7.22	0.903			0.722				
	P	10	8	15.06	19.61	4.55	0.569			0.455				
750	Q	10	5	14.11	17.04	2.93	0.586	0.593	6.4	0.293	40.0	0.238	22.2	61.7
	R	10	4	13.85	16.17	2.32	0.580			0.232				
	S	10	4	14.28	16.87	2.59	0.648			0.259				
	T	10	3	14.30	15.98	1.68	0.560			0.168				
900	U	10	0	0.00	0.00	0.00	0.000	0.650	6.5	0.000	7.5	0.048	124.9	92.3
	V	10	1	12.90	13.58	0.68	0.680			0.068				
	W	10	0	0.00	0.00	0.00	0.000			0.000				
	X	10	2	13.77	15.01	1.24	0.620			0.124				

Dunnett's MSD value: 0.1163
PMSD: 18.7

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 average, a significant difference occurs for Environmental Testing Solutions, Inc. chronic toxicity tests when a toxicant reduces *Pimephales* growth by 15.5% from the control (determined throug 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 Survival

Start Date:	11/28/2006	Test ID:	PpKClCR	Sample ID:	REF-Ref Toxicant
End Date:	12/5/2006	Lab ID:	ETS-Envir Testing Sol.	Sample Type:	KCL-Potassium chloride
Sample Date:		Protocol:	FWCHR-EPA-821-R-02-013	Test Species:	PP-Pimephales promelas
Comments:					

Conc-mg/L	1	2	3	4
D-Control	1.0000	1.0000	1.0000	1.0000
300	1.0000	1.0000	1.0000	1.0000
450	1.0000	1.0000	1.0000	1.0000
600	0.7000	0.9000	0.8000	0.8000
750	0.5000	0.4000	0.4000	0.3000
900	0.0000	0.1000	0.0000	0.2000

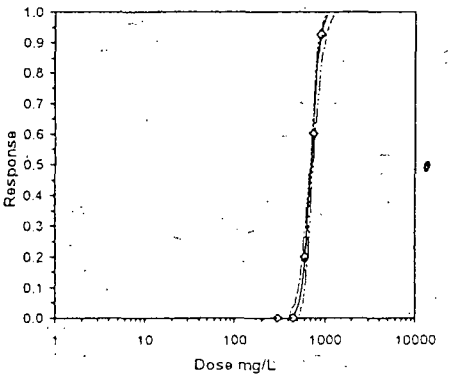
			Transform: Arcsin Square Root					Rank	1-Tailed	Number	Total
Conc-mg/L	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical	Resp	Number
D-Control	1.0000	1.0000	1.4120	1.4120	1.4120	0.000	4			0	40
300	1.0000	1.0000	1.4120	1.4120	1.4120	0.000	4	18.00	10.00	0	40
450	1.0000	1.0000	1.4120	1.4120	1.4120	0.000	4	18.00	10.00	0	40
*600	0.8000	0.8000	1.1136	0.9912	1.2490	9.478	4	10.00	10.00	8	40
*750	0.4000	0.4000	0.6836	0.5796	0.7854	12.289	4	10.00	10.00	24	40
*900	0.0750	0.0750	0.2757	0.1588	0.4636	53.294	4	10.00	10.00	37	40

Auxiliary Tests				Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)				0.795636058	0.884	0.52113979	1.618140669
Equality of variance cannot be confirmed.							
Hypothesis Test (1-tail, 0.05)	**NOEC**	**LOEC**	**ChV**	**TU**			
Steel's Many-One Rank Test	450	600	519.6152423				
Treatments vs D-Control							

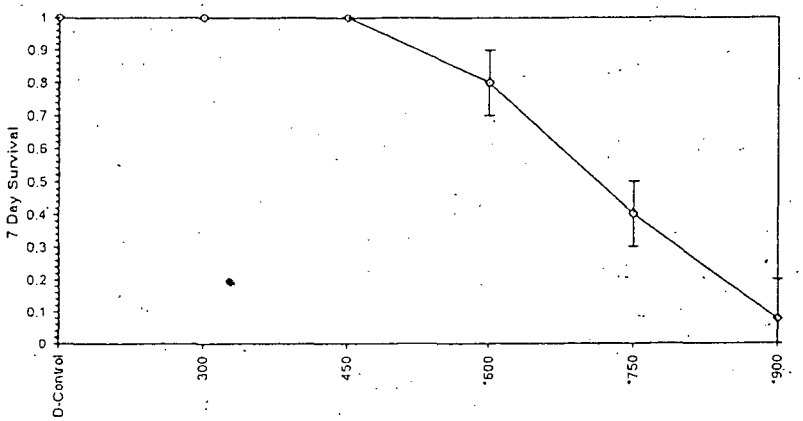
Maximum Likelihood-Probit

Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter
Slope	13.16756983	1.804761012	9.630238175	16.70490148	0	0.603478868	7.814727783	0.9	2.849547769	0.075944158	3
Intercept	-32.5216192	5.153545422	-42.6225685	-22.42067							
TSCR											

Point	Probits	mg/L	95% Fiducial Limits	
EC01	2.674	470.8420465	400.1998345	519.0476467
EC05	3.355	530.4332572	469.5403967	571.9700907
EC10	3.718	565.2250698	510.7644752	602.9745341
EC15	3.964	589.9792149	540.2163463	625.2854703
EC20	4.158	610.4239368	564.4820016	644.0018976
EC25	4.326	628.5273978	585.815428	660.900742
EC40	4.747	676.5619012	640.8299499	708.1026987
EC50	5.000	707.2089864	673.905148	740.8218287
EC60	5.253	739.2443377	706.2829966	777.6913987
EC75	5.674	795.7402488	758.3724828	848.8783814
EC80	5.842	819.3396792	778.711648	880.4631334
EC85	6.036	847.7325071	802.4164168	919.5582422
EC90	6.282	884.8590825	832.4719031	972.1556955
EC95	6.645	942.8981527	877.9592221	1057.071685
EC99	7.326	1062.234314	967.8556655	1239.739429



Dose-Response Plot



Organisms obtained from Aquatic BioSystems, Inc.

11-28-06

Environmental Testing Solutions, Inc.

Statistical Analyses

Larval Fish Growth and Survival Test-7 Day Growth

Start Date:	11/28/2006	Test ID:	PpKClCR	Sample ID:	REF-Ref Toxicant
End Date:	12/5/2006	Lab ID:	ETS-Envir. Testing Sol.	Sample Type:	KCL-Potassium chloride
Sample Date:		Protocol	FWCHR-EPA-821-R-02-013	Test Species:	PP-Pimephales promelas
Comments:					

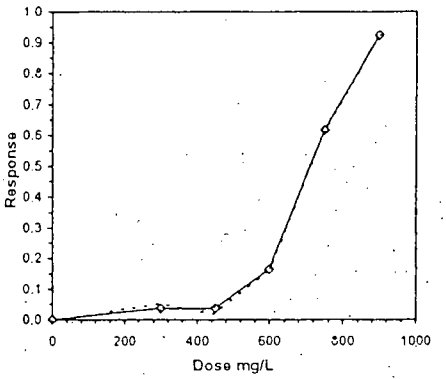
Conc-mg/L	1	2	3	4
D-Control	0.5820	0.6220	0.7410	0.5380
300	0.6210	0.6730	0.5900	0.4670
450	0.6270	0.6540	0.5540	0.6020
600	0.4550	0.4470	0.7220	0.4550
750	0.2930	0.2320	0.2590	0.1680
900	0.0000	0.0680	0.0000	0.1240

			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	0.6208	1.0000	0.6208	0.5380	0.7410	14.047	4				0.6208	1.0000
300	0.5878	0.9468	0.5878	0.4670	0.6730	14.884	4	0.619	2.180	0.1163	0.5985	0.9642
450	0.6093	0.9815	0.6093	0.5540	0.6540	6.978	4	0.216	2.180	0.1163	0.5985	0.9642
600	0.5198	0.8373	0.5198	0.4470	0.7220	25.952	4				0.5198	0.8373
750	0.2380	0.3834	0.2380	0.1680	0.2930	22.236	4				0.2380	0.3834
900	0.0480	0.0773	0.0480	0.0000	0.1240	124.907	4				0.0480	0.0773

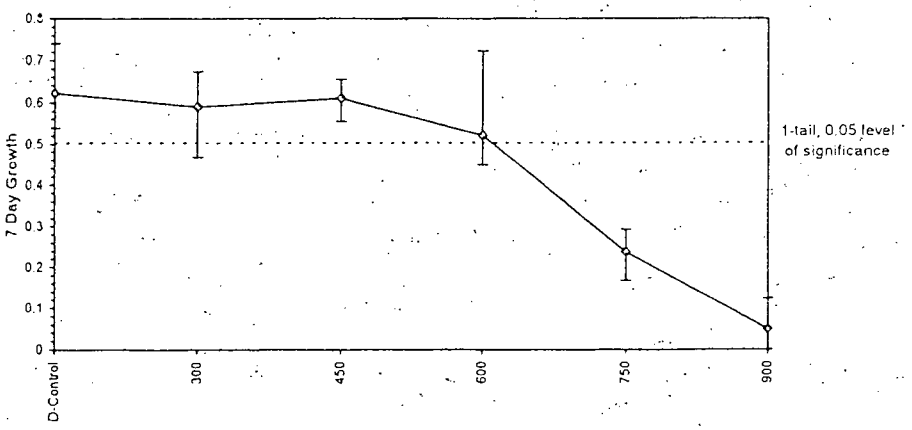
Auxiliary Tests					Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)					0.989200532		0.805		-0.0220246	-0.11689876
Bartlett's Test indicates equal variances (p = 0.48)					1.461641073		9.2103405			
Hypothesis Test (1-tail, 0.05)	**NOEC**	**LOEC**	**ChV**	**TU**	**MSDu**	**MSDp**	**MSB**	**MSE**	**F-Prob**	**df**
Dunnett's Test	450	>450			0.11625787	0.187286138	0.001122333	0.005688028	0.824389994	2, 9
Treatments vs D-Control										

Linear Interpolation (200 Resamples)

Point	mg/L	SD	95% CL(Exp)		Skew
IC05	466.74	175.37	0.00	699.35	-0.3523
IC10	525.86	120.25	0.00	653.50	-1.3121
IC15	584.98	74.33	115.33	668.60	-1.9295
IC20	612.32	44.55	432.71	672.24	-0.8215
IC25	628.85	34.38	485.90	682.25	-0.8810
IC40	678.42	19.72	607.93	716.26	-0.4679
IC50	711.47	15.17	657.93	746.32	-0.2958



Dose-Response Plot



Organisms obtained from Aquatic BioSystems, Inc.

11-28-06

Species: *Pimephales promelas* PpKCICR Test Number: 106

Daily Chemistry:

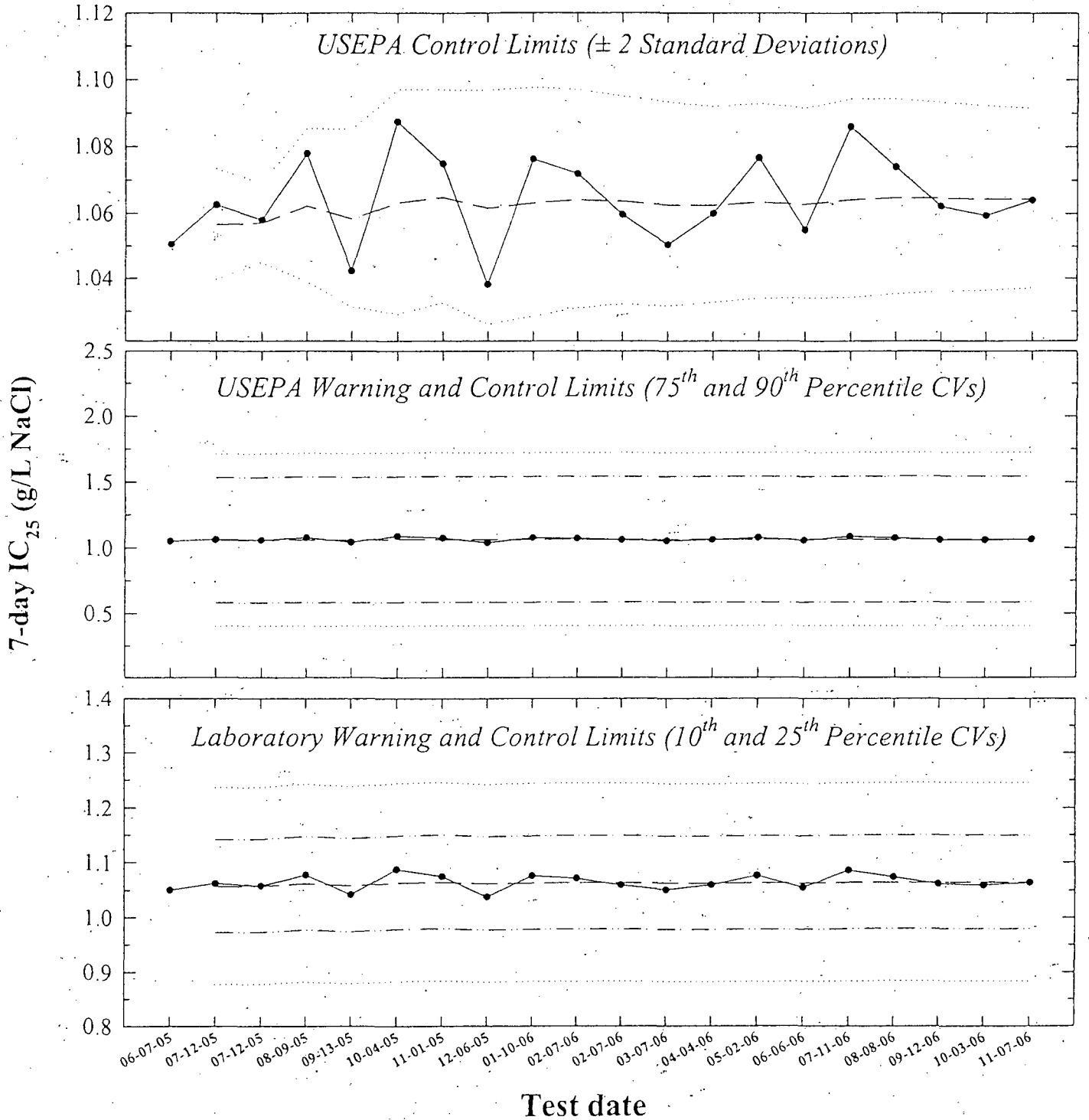
		Day					
		0		1		2	
	Analyst	MEK	MEK	MEK	MEK	MEK	MEK
Concentration	Parameter						
CONTROL	pH (S.U.)	7.69	7.54	7.75	7.15	7.59	7.55
	DO (mg/L)	7.7	7.7	7.8	6.7	7.7	7.3
	Conductivity (µmhos/cm)	318		318		315	
	Alkalinity (mg $CaCO_3$/L)	58				59	
	Hardness (mg $CaCO_3$/L)	92				86	
	Temperature (°C)	24.6	24.2	24.5	24.5	24.8	24.7
300 mg KCl/L	pH (S.U.)	7.75	7.51	7.77	7.18	7.60	7.55
	DO (mg/L)	7.6	7.7	7.9	6.8	7.7	7.3
	Conductivity (µmhos/cm)	834		839		852	
	Temperature (°C)	24.8	24.2	24.4	24.6	24.7	24.8
450 mg KCl/L	pH (S.U.)	7.75	7.52	7.78	7.17	7.60	7.55
	DO (mg/L)	7.7	7.7	7.9	6.8	7.6	7.2
	Conductivity (µmhos/cm)	1130		1110		1160	
	Temperature (°C)	24.8	24.2	24.4	24.6	24.9	24.6
600 mg KCl/L	pH (S.U.)	7.74	7.50	7.76	7.16	7.60	7.53
	DO (mg/L)	7.7	7.8	8.0	6.6	7.6	7.2
	Conductivity (µmhos/cm)	1430		1410		1500	
	Temperature (°C)	24.7	24.0	24.6	24.6	24.7	24.6
750 mg KCl/L	pH (S.U.)	7.73	7.54	7.77	7.20	7.61	7.57
	DO (mg/L)	7.8	7.7	8.0	6.6	7.6	7.2
	Conductivity (µmhos/cm)	1700		1690		1780	
	Temperature (°C)	24.8	24.3	24.5	24.6	24.8	24.4
900 mg KCl/L	pH (S.U.)	7.75	7.54	7.76	7.25	7.60	7.59
	DO (mg/L)	7.7	7.7	8.0	6.6	7.6	7.4
	Conductivity (µmhos/cm)	1930		1940		2010	
	Temperature (°C)	24.7	24.1	24.5	24.4	~~24.8~~ 24.8	24.7
STOCK	Conductivity (µmhos/cm)	72900				77800	
		Initial	Final	Initial	Final	Initial	Final

Species: *Pimephales promelas*

PpKCICR Test Number: 106

		Day							
		3		4		5		6	
	Analyst	MER	MER	MER	MER	MER	MER	MER	MER
Concentration	Parameter								
CONTROL	pH (S.U.)	7.82	7.53	7.89	7.42	7.90	7.26	7.65	7.65
	DO (mg/L)	7.6	7.2	7.7	6.5	7.8	7.2	7.8	7.4
	Conductivity (µmhos/cm)	307		304		300		309	
	Alkalinity (mg $CaCO_3$/L)					58			
	Hardness (mg $CaCO_3$/L)					90			
	Temperature (°C)	24.8	24.4	24.7	24.5	24.8	24.4	24.7	24.5
300 mg KCl/L	pH (S.U.)	7.81	7.54	7.92	7.43	7.93	7.29	7.73	7.67
	DO (mg/L)	7.5	7.3	7.7	6.7	7.8	7.2	7.9	7.4
	Conductivity (µmhos/cm)	822		827		827		836	
	Temperature (°C)	24.8	24.3	24.6	24.3	24.9	24.6	24.7	24.5
450 mg KCl/L	pH (S.U.)	7.81	7.54	7.91	7.39	7.92	7.30	7.74	7.68
	DO (mg/L)	7.5	7.3	7.7	6.8	7.9	7.2	7.9	7.5
	Conductivity (µmhos/cm)	1130		1120		1160		1130	
	Temperature (°C)	24.8	24.5	24.6	24.4	24.9	24.7	24.6	24.5
600 mg KCl/L	pH (S.U.)	7.81	7.59	7.91	7.45	7.91	7.31	7.73	7.66
	DO (mg/L)	7.5	7.2	7.7	6.7	7.9	7.1	7.9	7.5
	Conductivity (µmhos/cm)	1420		1450		1430		1430	
	Temperature (°C)	24.8	24.5	24.6	24.5	24.9	24.6	24.7	24.3
750 mg KCl/L	pH (S.U.)	7.81	7.62	7.90	7.47	7.90	7.43	7.74	7.64
	DO (mg/L)	7.6	7.4	7.8	7.0	7.8	7.3	7.9	7.4
	Conductivity (µmhos/cm)	1700		1680		1710		1720	
	Temperature (°C)	24.7	24.5	24.7	24.2	24.9	24.6	24.6	24.4
900 mg KCl/L	pH (S.U.)	7.80	7.63	7.90	7.56	7.96	7.44	7.77	7.66
	DO (mg/L)	7.6	7.4	7.8	7.2	7.8	7.4	7.8	7.4
	Conductivity (µmhos/cm)	1980		1970		1970		1960	
	Temperature (°C)	24.7	24.5	24.5	24.5	24.9	24.3	24.6	24.3
STOCK	Conductivity (µmhos/cm)	—		76300		—		78500	
		Initial	Final	Initial	Final	Initial	Final	Initial	Final

Ceriodaphnia dubia
Sodium Chloride Chronic Reference Toxicant Control Chart 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 $IC_{25} \pm S_{A.10}$ or $S_{A.75}$)
- **Control Limits** (mean $IC_{25} \pm S_{A.25}$, $S_{A.90}$, or 2 Standard Deviations)

Environmental Testing Solutions, Inc.

Ceriodaphnia dubia
Sodium Chloride Chronic Reference Toxicant Control Chart
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		$S_{A.10}$	Laboratory Warning Limits		$S_{A.25}$	Laboratory Control Limits		$S_{A.75}$	USEPA Warning Limits		$S_{A.90}$	USEPA Control Limits		C
					CT - 2S	CT + 2S		$CT - S_{A.10}$	$CT + S_{A.10}$		$CT - S_{A.25}$	$CT + S_{A.25}$		$CT - S_{A.75}$	$CT + S_{A.75}$		$CT - S_{A.90}$	$CT + S_{A.90}$	
1	06-07-05	1.05																	
2	07-12-05	1.06	1.06	0.01	1.04	1.07	0.08	0.97	1.14	0.18	0.88	1.24	0.48	0.58	1.53	0.66	0.40	1.71	0
3	07-12-05	1.06	1.06	0.01	1.04	1.07	0.08	0.97	1.14	0.18	0.88	1.24	0.48	0.58	1.53	0.66	0.40	1.71	0
4	08-09-05	1.08	1.06	0.01	1.04	1.09	0.08	0.98	1.15	0.18	0.88	1.24	0.48	0.58	1.54	0.66	0.40	1.72	0
5	09-13-05	1.04	1.06	0.01	1.03	1.09	0.08	0.97	1.14	0.18	0.88	1.24	0.48	0.58	1.53	0.66	0.40	1.71	0
6	10-04-05	1.09	1.06	0.02	1.03	1.10	0.09	0.98	1.15	0.18	0.88	1.24	0.48	0.58	1.54	0.66	0.40	1.72	0
7	11-01-05	1.08	1.06	0.02	1.03	1.10	0.09	0.98	1.15	0.18	0.88	1.25	0.48	0.59	1.54	0.66	0.40	1.73	0
8	12-06-05	1.04	1.06	0.02	1.03	1.10	0.08	0.98	1.15	0.18	0.88	1.24	0.48	0.58	1.54	0.66	0.40	1.72	0
9	01-10-06	1.08	1.06	0.02	1.03	1.10	0.09	0.98	1.15	0.18	0.88	1.24	0.48	0.58	1.54	0.66	0.40	1.72	0
10	02-07-06	1.07	1.06	0.02	1.03	1.10	0.09	0.98	1.15	0.18	0.88	1.24	0.48	0.59	1.54	0.66	0.40	1.72	0
11	02-07-06	1.06	1.06	0.02	1.03	1.10	0.09	0.98	1.15	0.18	0.88	1.24	0.48	0.58	1.54	0.66	0.40	1.72	0
12	03-07-06	1.05	1.06	0.02	1.03	1.09	0.08	0.98	1.15	0.18	0.88	1.24	0.48	0.58	1.54	0.66	0.40	1.72	0
13	04-04-06	1.06	1.06	0.01	1.03	1.09	0.08	0.98	1.15	0.18	0.88	1.24	0.48	0.58	1.54	0.66	0.40	1.72	0
14	05-02-06	1.08	1.06	0.01	1.03	1.09	0.09	0.98	1.15	0.18	0.88	1.24	0.48	0.58	1.54	0.66	0.40	1.72	0
15	06-06-06	1.06	1.06	0.01	1.03	1.09	0.09	0.98	1.15	0.18	0.88	1.24	0.48	0.58	1.54	0.66	0.40	1.72	0
16	07-11-06	1.09	1.06	0.02	1.03	1.09	0.09	0.98	1.15	0.18	0.88	1.25	0.48	0.59	1.54	0.66	0.40	1.72	0
17	08-08-06	1.07	1.06	0.01	1.04	1.09	0.09	0.98	1.15	0.18	0.88	1.25	0.48	0.59	1.54	0.66	0.40	1.72	0
18	09-12-06	1.06	1.06	0.01	1.04	1.09	0.09	0.98	1.15	0.18	0.88	1.25	0.48	0.59	1.54	0.66	0.40	1.72	0
19	10-03-06	1.06	1.06	0.01	1.04	1.09	0.09	0.98	1.15	0.18	0.88	1.25	0.48	0.59	1.54	0.66	0.40	1.72	0
20	11-07-06	1.06	1.06	0.01	1.04	1.09	0.09	0.98	1.15	0.18	0.88	1.25	0.48	0.59	1.54	0.66	0.40	1.72	0

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 warnin 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,

Environmental Testing Solutions, Inc.

Precision of Endpoint Measurements

Ceriodaphnia dubia
Sodium Chloride Chronic Reference Toxicant Data
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	06-07-05	100	30.4		5.0		2.6	8.5	
2	07-12-05	100	30.4	30.4	7.5	6.2	2.7	8.8	8.7
3	07-12-05	100	31.1	30.6	7.2	6.5	3.2	10.2	9.2
4	08-09-05	100	28.3	30.1	7.3	6.7	2.9	10.3	9.5
5	09-13-05	100	27.9	29.6	7.3	6.8	3.9	13.9	10.3
6	10-04-05	100	27.0	29.2	5.8	6.7	3.0	11.1	10.5
7	11-01-05	100	28.4	29.1	10.3	7.2	3.8	13.2	10.9
8	12-06-05	100	32.6	29.5	6.3	7.1	2.3	7.1	10.4
9	01-10-06	100	29.2	29.5	4.8	6.8	2.3	7.8	10.1
10	02-07-06	100	30.7	29.6	6.0	6.7	2.4	7.9	9.9
11	02-07-06	100	29.9	29.6	6.8	6.7	2.2	7.5	9.7
12	03-07-06	100	28.8	29.6	5.9	6.7	2.6	8.9	9.6
13	04-04-06	100	27.0	29.4	5.2	6.5	2.1	7.6	9.5
14	05-02-06	100	28.6	29.3	8.6	6.7	2.7	9.3	9.4
15	06-06-06	100	30.3	29.4	5.2	6.6	3.0	9.8	9.5
16	07-11-06	100	29.0	29.4	5.4	6.5	2.5	8.6	9.4
17	08-08-06	100	28.6	29.3	8.9	6.7	3.7	12.8	9.6
18	09-12-06	100	30.9	29.4	5.4	6.6	3.3	10.6	9.7
19	10-03-06	100	32.3	29.5	4.6	6.5	3.1	9.5	9.7
20	11-07-06	100	31.0	29.6	6.3	6.5	2.4	7.8	9.6

Note:

CV = Coefficient of variation for control reproduction.
On average, the CV for control reproduction is 6.5% in Environmental Testing Solutions, Inc. *Ceriodaphnia* chronic toxicity tests.
Lower CV bound determined by USEPA (10^{th} percentile) = 8.9%.
Upper CV bound determined by USEPA (90^{th} percentile) = 42%

MSD = Minimum Significant Difference

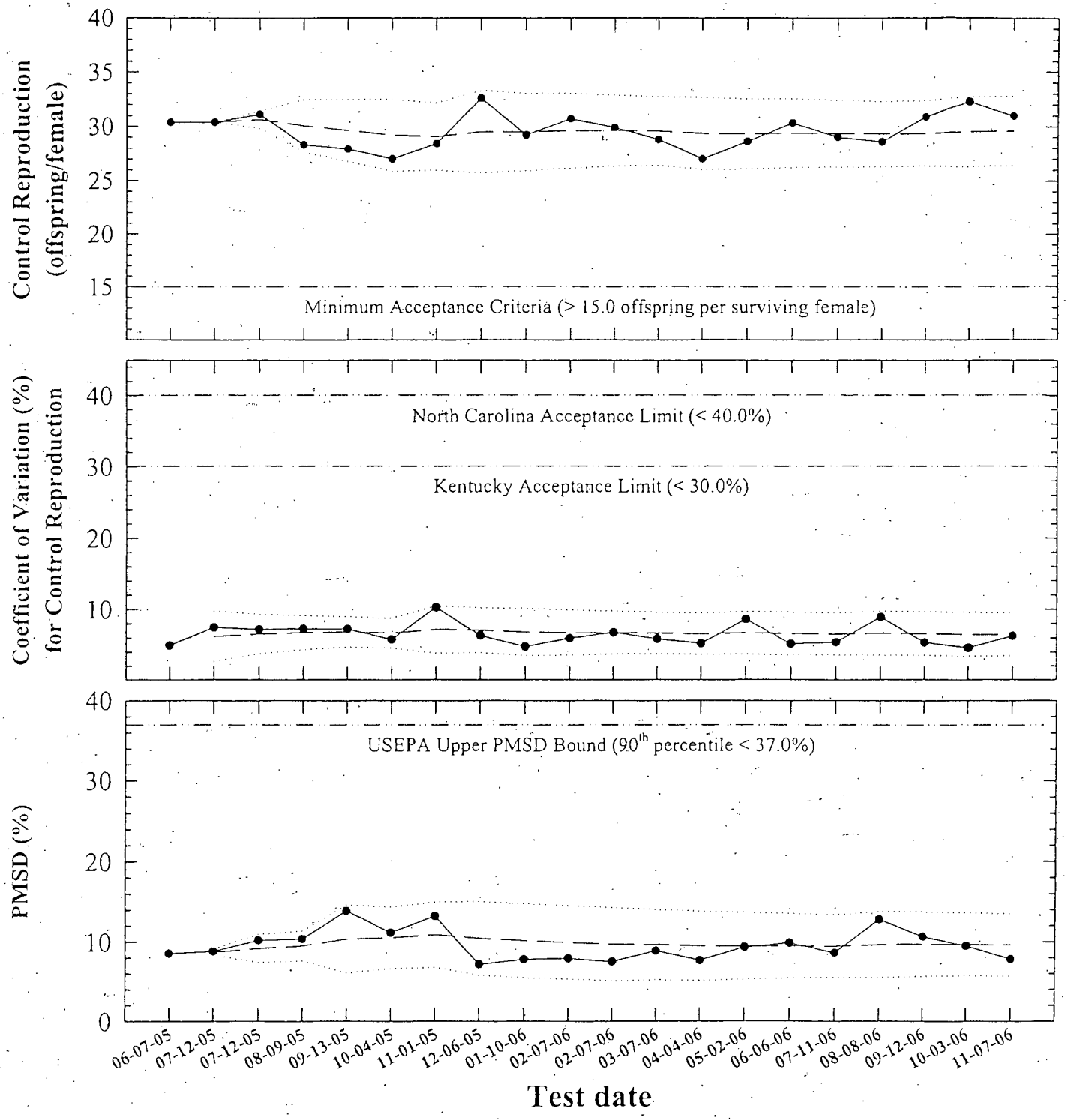
PMSD = Percent Minimum Significant Difference
PMSD is a measure of test precision. The PMSD is the minimum percent difference between the control and treatment that can be declared statistically significant in a whole effluent toxicity test. On average, a significant difference occurs for Environmental Testing Solutions, Inc. chronic toxicity tests when a toxicant reduces *Ceriodaphnia* reproduction by 9.6% from the control.
Lower PMSD bound determined by USEPA (10^{th} percentile) = 11%.
Upper PMSD bound determined by USEPA (90^{th} 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.

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



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

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

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

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

CdNaCLCR #: 55

Dilution preparation information:						*Comments:*
NaCl CHM number:		CHM 120				
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:	ORANGE
Date and times organisms were born between:	11-06-06 1547 TO 2002	Incubator number and shelf location:	2B1
Organism source: 10-31-06 A	CUBS: 1,2,3,4,5,6,10,14,15,20	YCT batch:	10-01-06
Transfer bowl information:	pH = 7.83 SU Temperature = 24.6°C	*Selenastrum* batch:	10-28-06

Daily renewal information:

Day	Date	Test initiation, renewal, or termination time	MHS water batch used	Analyst
0	11-07-06	1127	10-27-06 B	JH
1	11-08-06	1030	10-27-06 B	JH
2	11-09-06	1120	10-27-06 C	JH
3	11-10-06	1034	10-27-06 C	JH
4	11-11-06	1042	10-27-06 C	JH
5	11-12-06	1033	10-27-06 C	JH
6	11-13-06	~~1038~~ 1203	10-27-06 C	JH
7	11-14-06	1034	[redacted]	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	1000
% Mortality:	0%	≤ 20%	LOEC	1200
Mean Offspring/Female:	31.0	≥ 15.0 offspring/female	ChV	1095.4
% CV:	6.3%	< 40.0 %	IC25	1064.0

Species: *Ceriodaphnia dubia*

CdNaCLCR #: 55

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	5	5	5	4	5	5	4	4	4
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	10	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	0	13	10	11	12	12	9	13	10	10
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	16	15	15	15	13	17	18	15	14	15
Total young produced		32	33	30	31	29	34	32	32	28	29
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L
X for 3rd Broods		X	X	X	X	X	X	X	X	X	X

Note: Adult mortality (L = live, D = dead)

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	31.0

600 mg NaCl/L

Survival and Reproduction Data

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

Note: Adult mortality (L = live, D = dead)

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	31.7
% Reduction from Control:	-2.3%

Species: *Ceriodaphnia dubia*

CdNaCLCR #: 55

800 mg NaCl/L

Survival and Reproduction Data

Day		Replicate number									
		1	2	3	4	5	6	7	8	9	10
1	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
2	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
3	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
4	Young produced	5	5	5	4	5	4	4	4	5	5
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	0	10	11	12	0	12	0	0	11	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	13	0	0	0	10	0	9	10	0	10
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	14	14	17	16	15	15	19	16	17	13
Total young produced		32	29	33	32	30	31	32	30	33	28
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Note: Adult mortality (L = live, D = dead)

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	31.0
% Reduction from Control:	0%

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	6	4	4	4	5	5	4	4	5	4
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	14	10	0	10	11	10	12	12	10	10
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	0	0	9	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	14	13	16	15	15	18	15	13	17	14
Total young produced		34	27	29	29	31	33	31	29	32	28
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Note: Adult mortality (L = live, D = dead)

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	30.3
% Reduction from Control:	2.3%

Species: *Ceriodaphnia dubia*

CdNaCLCR #: 55

1200 mg NaCl/L — *Survival and Reproduction Data*

Day		Replicate number 1	2	3	4	5	6	7	8	9	10
1	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
2	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
3	Young produced	0	0	0	0	0	0	0	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
4	Young produced	3	2	2	0	2	4	1	1	3	3
	Adult mortality	L	L	L	L	L	L	L	L	L	L
5	Young produced	10	0	2	8	2	12	0	5	5	3
	Adult mortality	L	L	L	L	L	L	L	L	L	L
6	Young produced	0	6	6	0	0	0	2	0	0	0
	Adult mortality	L	L	L	L	L	L	L	L	L	L
7	Young produced	0	0	6	0	8	0	1	0	0	0
Total young produced		13	8	10	8	12	16	4	6	8	6
Final Adult Mortality		L	L	L	L	L	L	L	L	L	L

Note: Adult mortality (L = live, D = dead)

Concentration:	
% Mortality:	0%
Mean Offspring/Female:	9.1
% Reduction from Control:	70.67%

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

Note: Adult mortality (L = live, D = dead)

Concentration:	
% Mortality:	20%
Mean Offspring/Female:	2.5
% Reduction from Control:	91.9%

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	6	5	5	5	4	5	5	4	4	4	47
5	10	0	0	0	0	0	0	0	0	0	10
6	0	13	10	11	12	12	9	13	10	10	100
7	16	15	15	15	13	17	18	15	14	15	153
Total	32	33	30	31	29	34	32	32	28	29	310

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	6	4	4	4	5	5	4	4	5	4	45
5	14	10	0	10	11	10	12	12	10	10	99
6	0	0	9	0	0	0	0	0	0	0	9
7	14	13	16	15	15	18	15	13	17	14	150
Total	34	27	29	29	31	33	31	29	32	28	303

600 mg NaCl/L

Day	Replicate number										Total
	1	2	3	4	5	6	7	8	9	10	
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0
4	4	5	5	5	5	5	4	6	4	4	47
5	0	11	0	11	13	0	0	0	0	0	35
6	12	0	10	0	0	13	11	11	10	12	79
7	16	18	14	15	17	15	15	14	18	14	156
Total	32	34	29	31	35	33	30	31	32	30	317

1200 mg NaCl/L

Day	Replicate number										Total
	1	2	3	4	5	6	7	8	9	10	
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0
4	3	2	2	0	2	4	1	1	3	3	21
5	10	0	2	8	2	12	0	5	5	3	47
6	0	6	0	0	0	0	2	0	0	0	8
7	0	0	6	0	8	0	1	0	0	0	15
Total	13	8	10	8	12	16	4	6	8	6	91

800 mg NaCl/L

Day	Replicate number										Total
	1	2	3	4	5	6	7	8	9	10	
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0
4	5	5	5	4	5	4	4	4	5	5	46
5	0	10	11	12	0	12	0	0	11	0	56
6	13	0	0	0	10	0	9	10	0	10	52
7	14	14	17	16	15	15	19	16	17	13	156
Total	32	29	33	32	30	31	32	30	33	28	310

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	2	0	0	0	1	0	0	2	2	1	8
5	5	0	0	0	0	4	3	0	0	0	12
6	0	3	0	0	0	0	0	0	2	0	5
7	0	0	0	0	0	0	0	0	0	0	0
Total	7	3	0	0	1	4	3	2	4	1	25

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 #84 (#55 at 351 Depot St.)

Test dates: November 07-14, 2006

Reveiwed by:

Concentration (mg/L NaCl)	Replicate number										Survival (%)	Average reproduction (offspring/female)	Coefficient of variation (%)	Percent reduction from control (%)
	1	2	3	4	5	6	7	8	9	10				
Control	32	33	30	31	29	34	32	32	28	29	100	31.0	6.3	Not applicable
600	32	34	29	31	35	33	30	31	32	30	100	31.7	6.0	-2.3
800	32	29	33	32	30	31	32	30	33	28	100	31.0	5.5	0.0
1000	34	27	29	29	31	33	31	29	32	28	100	30.3	7.5	2.3
1200	13	8	10	8	12	16	4	6	8	6	100	9.1	40.3	70.6
1400	7	3	0	0	1	4	3	2	4	1	80	2.5	86.9	91.9

Dunnett's MSD value: 2.417

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 9.6% from the control.

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

Upper PMSD bound determined by USEPA (90^{th} 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:	11/7/2006	Test ID:	CdNaClCR	Sample ID:	REF-Ref Toxicant
End Date:	11/14/2006	Lab ID:	ETS-Envir. Testing Sol	Sample Type:	NACL-Sodium chloride
Sample Date:		Protocol:	FWCHR-EPA-821-R-02-013	Test Species:	CD-Ceriodaphnia dubia
Comments:					

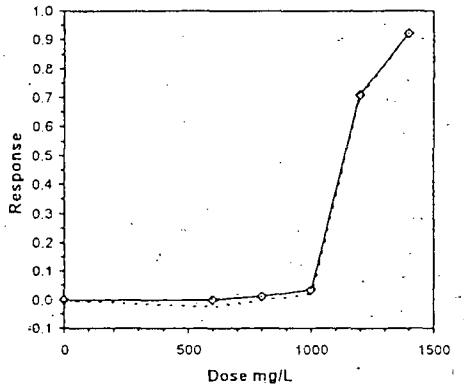
Conc-mg/L	1	2	3	4	5	6	7	8	9	10
D-Control	32.000	33.000	30.000	31.000	29.000	34.000	32.000	32.000	28.000	29.000
600	32.000	34.000	29.000	31.000	35.000	33.000	30.000	31.000	32.000	30.000
800	32.000	29.000	33.000	32.000	30.000	31.000	32.000	30.000	33.000	28.000
1000	34.000	27.000	29.000	29.000	31.000	33.000	31.000	29.000	32.000	28.000
1200	13.000	8.000	10.000	8.000	12.000	16.000	4.000	6.000	8.000	6.000
1400	7.000	3.000	0.000	0.000	1.000	4.000	3.000	2.000	4.000	1.000

			Transform: Untransformed					1-Tailed			Isotonic	
Conc-mg/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Mean	N-Mean
D-Control	31.000	1.0000	31.000	28.000	34.000	6.270	10				31.350	1.0000
600	31.700	1.0226	31.700	29.000	35.000	5.958	10	-0.662	2.287	2.417	31.350	1.0000
800	31.000	1.0000	31.000	28.000	33.000	5.483	10	0.000	2.287	2.417	31.000	0.9888
1000	30.300	0.9774	30.300	27.000	34.000	7.469	10	0.662	2.287	2.417	30.300	0.9665
*1200	9.100	0.2935	9.100	4.000	16.000	40.276	10	20.721	2.287	2.417	9.100	0.2903
*1400	2.500	0.0806	2.500	0.000	7.000	86.923	10	26.966	2.287	2.417	2.500	0.0797

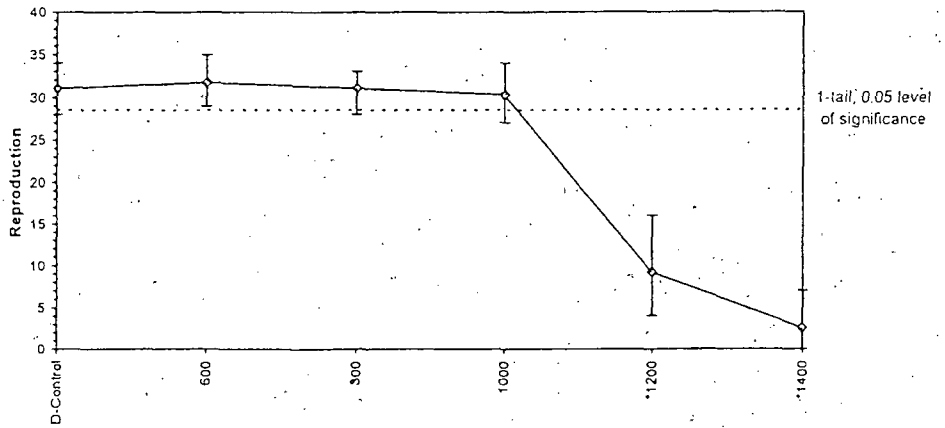
Auxiliary Tests					Statistic		Critical		Skew	Kurt
Kolmogorov D Test indicates normal distribution (p > 0.01)					0.81748134		1.035		0.44619717	0.3712335
Bartlett's Test indicates equal variances (p = 0.18)					7.55277777		15.0862722			
Hypothesis Test (1-tail, 0.05)	**NOEC**	**LOEC**	**ChV**	**TU**	**MSDu**	**MSDp**	**MSB**	**MSE**	**F-Prob**	**df**
Dunnett's Test	1000	1200	1095.44512		2.41677734	0.07796056	1738.96	5.58518519	1.6E-38	5, 54
Treatments vs D-Control										

Linear Interpolation (200 Resamples)

Point	mg/L	SD	95% CL		Skew
IC05	1004.88208	51.0038904	825.635417	1014.14902	-2.5889
IC10	1019.66981	5.96832498	1007.34438	1028.34195	-0.3117
IC15	1034.45755	5.61835965	1023.38686	1043.09093	-0.2720
IC20	1049.24528	5.40692453	1038.23354	1057.91483	-0.2188
IC25	1064.03302	5.35046783	1052.85837	1072.74883	-0.1422
IC40	1108.39623	6.09494531	1095.59506	1118.42537	0.2053
IC50	1137.9717	7.17272292	1123.85682	1151.46069	0.4115



Dose-Response Plot



Species: *Ceriodaphnia dubia*

CdNaCLCR #: 55

Daily Chemistry:

		Day					
		0		1		2	
	Analyst	KEK	KEK	KEK	KEK	KEK	KEK
Concentration	Parameter						
CONTROL	pH (S.U.)	7.82	7.91	7.99	7.86	7.80	7.69
	DO (mg/L)	7.6	7.8	7.8	7.9	7.8	8.0
	Conductivity (µmhos/cm)	312		318		312	
	Alkalinity (mg $CaCO_3$/L)	59				61	
	Hardness (mg $CaCO_3$/L)	84				84	
	Temperature (°C)	24.5	24.9	24.4	25.0	24.7	24.7
600 mg NaCl/L	pH (S.U.)	7.89	7.90	7.97	7.87	7.93	7.72
	DO (mg/L)	7.6	7.8	7.9	7.8	7.8	8.0
	Conductivity (µmhos/cm)	1510		1500		1490	
	Temperature (°C)	24.7	25.2	24.4	24.8	24.6	24.7
800 mg NaCl/L	pH (S.U.)	7.91	7.89	7.96	7.90	7.94	7.72
	DO (mg/L)	7.6	7.9	7.9	7.8	7.8	8.1
	Conductivity (µmhos/cm)	1980		1910		1910	
	Temperature (°C)	24.4	25.3	24.4	24.9	24.7	24.7
1000 mg NaCl/L	pH (S.U.)	7.90	7.89	7.95	7.92	7.94	7.75
	DO (mg/L)	7.7	7.9	7.9	7.9	7.9	8.1
	Conductivity (µmhos/cm)	2360		2300		2360	
	Temperature (°C)	24.6	25.1	24.5	24.9	24.7	24.6
1200 mg NaCl/L	pH (S.U.)	7.91	7.91	7.96	7.90	7.95	7.74
	DO (mg/L)	7.7	7.8	7.9	7.9	7.9	8.2
	Conductivity (µmhos/cm)	2780		2710		2700	
	Temperature (°C)	24.6	25.1	24.6	25.1	24.5	24.7
1400 mg NaCl/L	pH (S.U.)	7.90	7.91	7.93	7.92	7.95	7.73
	DO (mg/L)	7.7	7.8	7.9	7.8	7.9	8.2
	Conductivity (µmhos/cm)	3110		3060		3050	
	Temperature (°C)	24.6	25.0	24.4	25.1	24.6	24.6
STOCK	Conductivity (µmhos/cm)	129000					
		Initial	Final	Initial	Final	Initial	Final

Species: *Ceriodaphnia dubia*

CdNaCLCR #: 55

		Day							
		3		4		5		6	
	Analyst	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Concentration	Parameter								
CONTROL	pH (S.U.)	7.67	7.74	7.89	7.83	8.11	7.90	7.99	7.89
	DO (mg/L)	7.8	7.6	7.5	7.8	7.8	8.0	8.1	7.7
	Conductivity (µmhos/cm)	301		303		300		312	
	Alkalinity (mg $CaCO_3$/L)								
	Hardness (mg $CaCO_3$/L)								
	Temperature (°C)	24.8	24.7	24.9	24.9	24.8	24.8	24.7	24.9
600 mg NaCl/L	pH (S.U.)	7.76	7.75	7.80	7.82	7.96	7.91	8.00	7.91
	DO (mg/L)	7.9	7.6	7.5	7.8	7.7	8.0	8.2	7.6
	Conductivity (µmhos/cm)	1510		1470		1470		1420	
	Temperature (°C)	24.8	25.1	24.7	25.0	24.6	24.8	24.7	25.2
800 mg NaCl/L	pH (S.U.)	7.79	7.75	7.81	7.84	8.01	7.95	8.07	7.93
	DO (mg/L)	7.9	7.6	7.5	7.9	7.8	8.1	8.2	7.5
	Conductivity (µmhos/cm)	1850		1820		1880		1850	
	Temperature (°C)	24.7	25.1	24.8	25.2	24.7	25.1	24.6	24.9
1000 mg NaCl/L	pH (S.U.)	7.77	7.78	7.79	7.84	8.00	7.95	8.07	7.93
	DO (mg/L)	8.1	7.7	7.5	7.9	7.8	8.1	8.2	7.6
	Conductivity (µmhos/cm)	2240		2250		2300		2320	
	Temperature (°C)	24.8	25.0	24.8	25.0	24.8	24.8	24.8	24.8
1200 mg NaCl/L	pH (S.U.)	7.79	7.75	7.79	7.83	7.99	7.95	8.07	7.93
	DO (mg/L)	8.1	7.7	7.5	7.9	7.8	8.1	8.3	7.7
	Conductivity (µmhos/cm)	2640		2670		2670		2670	
	Temperature (°C)	24.7	24.9	24.6	25.1	24.6	25.0	24.5	24.8
1400 mg NaCl/L	pH (S.U.)	7.79	7.73	7.79	7.84	7.98	7.94	8.07	7.94
	DO (mg/L)	8.1	7.8	7.5	7.9	7.9	8.0	8.3	7.7
	Conductivity (µmhos/cm)	2970		2980		3010		3010	
	Temperature (°C)	24.7	25.0	24.9	24.9	24.7	25.0	24.6	25.1
STOCK	Conductivity (µmhos/cm)	—		127000		—		—	
		Initial	Final	Initial	Final	Initial	Final	Initial	Final