WSRC-OS-89-94-1

Derivative Classifier
D. B. Moore-Shedrow, Section Manager
Authorized Derivative Classifer

F/H AREA ETF EFFLUENT (H-016 OUTFALL) CERIODAPHNIA SURVIVAL/REPRODUCTION TEST, TEST DATE: JUNE 17, 1989 (U)

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Prepared for the U.S. Department of Energy under Contract No. DE-AC09-88SR18035

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392731

ENWRIGHT
LABORATORIES

Ceriodaphnia SURVIVAL/REPRODUCTION TEST

Sample Identification: F/H Area ETF Discharge

Client: Savannah River Site
Location: Aiken, South Carolina

Test Date: June 17, 1989

25 Woods Lake Road (29607) • Post Office Box 5287 • Greenville, South Carolina 29606 • (803)235-0707

INTERPRETATION OF RESULTS

This toxicity test was conducted to determine if the effluent causes death (acute toxicity) or reduction in the reproduction of the test organisms (chronic toxicity) during a seven day period. A series of dilutions of the effluent are set to determine how much the effluent must be diluted before toxic effects are no longer noted. Acute toxicity is checked by statistically analyzing whether significantly more organisms die in the effluent dilutions than in the control treatment.

Chronic toxicity is checked by statistically analyzing whether significantly fewer young are produced by test organisms exposed to the effluent dilutions. Results indicate the lowest effluent concentration which shows a toxic effect (the LOEC) and the highest effluent concentration which does not demonstrate an effect (NOEC). Results are summarized as follows:

Acute Toxicity:

Significant acute toxicity was present down to a concentration of 3% effluent (by Fisher's Exact Test).

Chronic Toxicity:

The data are normally distributed and homogenous in variance. The number of replicates in each concentration was not equal. Results using Bonferroni's "t" Test are as follows:

(NOEC) No Observed Effect Concentration:	1.0%
(LOEC) Lowest Observed Effect Concentration:	3.0%
Chronic Value:	1.7%

TEST SYSTEM

Client: Savannah River Site
Start Date: June 17, 1989

Test Type: 7 Day Chronic Toxicity - Reproduction Test
Test Location: Enwright Environmental Consulting Laboratories
Measured Effects: Survival and Reproduction

Test Organism: Ceriodaphnia dubia Source: Enwright
Age: <24 hrs

Test Conditions: Temperature: 25 + 1 C
Light: 80 ft-c / 16 hr lt

Test Procedure: Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms. EPA 600/4-89/001 Method 1002

Test vessels: 30 ml plastic cups
Amount Test Soln: 15 ml / replicate
Replicates/Concentration: 10
Test Organisms/Replicate: 1

Test Dilutions Used: 0 & 1,3,10,30,100% (0.3 dilution factor)
Test Solution Renewal: Daily
Dilution Water: Upper Three Runs Creek (Receiving Stream)

Food Source: 1 drop Selenastrum and 1 drop YCT daily / test vessel

Test Set By: Sharla Brunson - Biologist

Sharla Brunson

Test Results Checked By: Robert W. Kelley, Ph.D
Biology Laboratory Manager

Robert W Kelley

SAMPLING INFORMATION

Three effluent samples were collected by and transported to Enwright Environmental Consulting Laboratories by Enwright personnel. Samples were collected in 1 L plastic cubitainers and chilled during shipping.

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Sample Identification: F/H Area ETF Discharge
Start Date: June 17, 1989

	Sample #1	Sample #2	Sample #3
Lab #	BIO-141	BIO-145	BIO-152
Type	grab	grab	grab
Date sampled	Jun 16	Jun 19	Jun 23
Time sampled	1 PM	2 PM	2 PM
Days of use	Init,1	2,3,4,5	6
Maximum hold time:	48 hr	72 hr	24 hr

Effluent Field Parameters	Sample #1	Sample #2	Sample #3
D.O. (ppm)	8.2	8.0	7.6
pH	7.4	7.2	7.0
Temp (C)	29	29	28

RESULTS

Client: Savannah River Site
Sample Identification: F/H Area ETF Discharge
Start Date: June 17, 1989

ACUTE TOXICITY (Effects on Survival)

Conc.	0.0%	1%	3%	10%	30%	100%
Mortality (7 day)	0.0%	0.0%	50.0%	30.0%	50.0%	100.0%
# Males	0	0	0	1	0	0

Significant acute toxicity was present down to a concentration of 3% effluent. (by Fisher's Exact Test)

RESULTS

Client: Savannah River Site
Sample Identification: F/H Area ETF Discharge
Start Date: June 17, 1989

CHRONIC TOXICITY - Daily Reproduction Totals

	Rep	Day 4	Day 5	Day 6	Day 7	Total
Control	A	4	0	4	5	13
	B	4	0	7	7	18
	C	2	6	8	10	26
	D	1	4	8	7	20
	E	4	0	7	10	21
	F	4	7	0	5	16
	G	0	4	6	5	15
	H	0	3	5	7	15
	I	3	0	4	6	13
	J	4	0	8	5	17
	Total	26	24	57	67	174
1% Effluent	A	0	3	4	6	13
	B	4	0	5	8	17
	C	0	4	4	6	14
	D	0	4	6	6	16
	E	0	3	4	7	14
	F	0	2	4	6	12
	G	0	4	4	7	15
	H	0	3	5	7	15
	I	0	3	4	7	14
	J	0	0	4	2	6
	Total	4	26	44	62	136
3% Effluent	A	0	0	0	0	0
	B	1	3	0	4	8
	C	X	X	X	X	0
	D	0	3	4	4	11
	E	X	X	X	X	0
	F	X	X	X	X	0
	G	X	X	X	X	0
	H	0	6	0	3	9
	I	X	X	X	X	0
	J	4	0	5	6	15
	Total	5	12	9	17	43

RESULTS

Client: Savannah River Site
Sample Identification: F/H Area ETF Discharge
Start Date: June 17, 1989

CHRONIC TOXICITY - Daily Reproduction Totals

	Rep	Day 4	Day 5	Day 6	Day 7	Total
10%	A	0	4	5	5	14
Effluent	B	X	X	X	X	0
	C	3	0	6	4	13
	D	X	X	X	X	0
	E	4	6	7	5	22
	F	4	0	6	7	17
	G	4	0	5	4	13
	H	3	3	4	0	10
	I					0
	J	X	X	X	X	0
	Total	18	13	33	25	89
30%	A	X	X	X	X	0
Effluent	B	X	X	X	X	0
	C	X	X	X	X	0
	D	0	0	X	X	0
	E	2	X	X	X	2
	F	0	3	X	X	3
	G	0	0	0	6	6
	H	0	3	0	3	6
	I	0	0	0	4	4
	J	4	0	0	3	7
	Total	6	6	0	16	28
100%	A	X	X	X	X	0
Effluent	B	X	X	X	X	0
	C	X	X	X	X	0
	D	X	X	X	X	0
	E	X	X	X	X	0
	F	X	X	X	X	0
	G	X	X	X	X	0
	H	X	X	X	X	0
	I	X	X	X	X	0
	J	X	X	X	X	0
	Total	0	0	0	0	0

X represents the mortality of the test organism.

RESULTS

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CHRONIC TOXICITY - Statistical Analysis

ANOVA and Bonferroni's "t" Test: (Assumes Data is Normally Distributed)

Conc.	0.0%	1%	3%	10%	30%	100%
Average Young/ Female	17.4	13.6	4.3	9.9	2.8	0
"t" Value		1.56	5.39	3.40		
Reproduction significantly less than control? (95% confidence)		no	yes	yes		

	95% conf.
(NOEC) No Observed Effect Conc.:	1.0%
(LOEC) Lowest Observed Effect Conc.:	3.0%
Chronic Value:	1.73%

The data are normally distributed and have homogenous variances. As a result of the male organism present in the 10% effluent concentration, the number of replicates in each concentration is not equal. Therefore, the t test with a Bonferroni adjustment is used in place of Dunnett's Procedure

WATER CHEMISTRY ANALYSIS

Client: Savannah River Site
Sample Identification: F/H Area ETF Discharge
Start Date: June 17, 1989

Dilution Water

ID: Upper Three Runs Creek (collected Jan.11)
Preparation: Filtered (70 micron net)

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
Hardness (ppm)	5.5	*	6.0	5.5	6.0	5.5
Alkalinity (ppm)	4.0	*	5.0	5.0	5.0	5.0

Effluent Samples

	100% Day 1	100% Day 2	30% Day 3	30% Day 4	30% Day 5	30% Day 6
Hardness (ppm)	0.2	*	4.0	4.0	4.0	4.0
Alkalinity (ppm)	75.0	*	21.0	11.0	11.0	11.0
Res Cl (ppm)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

* no reading

WATER CHEMISTRY ANALYSIS

Client: Savannah River Site
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Start Date: June 17, 1989

Test Solutions

CONTROL	D.O. (ppm)	pH	Temp (C)	Cond (umhos)
Initial	8.1	6.6	25.2	20
Day 1 (old)	8.1			
Day 1 (new)	8.2	6.2	24.5	20
Day 2 (old)	7.9			
Day 2 (new)	7.8	7.0	25.2	
Day 3 (old)	7.5			
Day 3 (new)	7.9	6.6	25.3	20
Day 4 (old)	7.6			
Day 4 (new)	8.2	6.6	25.2	20
Day 5 (old)	7.8			
Day 5 (new)	8.6	6.7	25.1	20
Day 6 (old)	7.8			
Day 6 (new)	8.0	6.8	25.1	20
Final	7.8	7.0	24.7	30

1% Effluent	D.O. (ppm)	pH	Temp (C)	Cond (umhos)
Initial	8.1	6.7	25.2	20
Day 1 (old)	8.1			
Day 1 (new)	8.2	6.3	24.5	20
Day 2 (old)	7.9			
Day 2 (new)	7.6	7.1	25.2	
Day 3 (old)	7.8			
Day 3 (new)	7.9	6.9	25.3	20
Day 4 (old)	7.6			
Day 4 (new)	8.2	6.8	25.2	20
Day 5 (old)	7.8			
Day 5 (new)	8.0	6.7	25.1	20
Day 6 (old)	7.7			
Day 6 (new)	8.0	7.0	25.1	20
Final	7.8	7.0	24.7	

WATER CHEMISTRY ANALYSIS

Client: Savannah River Site
Sample Identification: F/H Area ETF Discharge
Start Date: June 17, 1989

3% Effluent	D.O. (ppm)	pH	Temp (C)	Cond (umhos)
Initial	7.9	6.7	25.2	20
Day 1 (old)	8.2			
Day 1 (new)	8.2	6.4	24.5	20
Day 2 (old)				
Day 2 (new)	7.6	7.1	25.2	
Day 3 (old)	7.4			
Day 3 (new)	7.9	6.6	25.3	20
Day 4 (old)	7.4			
Day 4 (new)	8.2	6.9	25.2	20
Day 5 (old)	7.8			
Day 5 (new)	8.0	6.8	25.1	20
Day 6 (old)	7.8			
Day 6 (new)	8.0	7.0	25.1	25
Final	7.8	7.0	24.7	

10% Effluent	D.O. (ppm)	pH	Temp (C)	Cond (umhos)
Initial	7.9	6.7	25.2	30
Day 1 (old)	8.2			
Day 1 (new)	8.2	6.5	24.5	30
Day 2 (old)				
Day 2 (new)	7.6	7.1	25.2	
Day 3 (old)	7.5			
Day 3 (new)	8.0	6.6	25.3	30
Day 4 (old)	7.6			
Day 4 (new)	8.2	6.9	25.2	30
Day 5 (old)	8.0			
Day 5 (new)	8.0	6.9	25.1	30
Day 6 (old)	7.9			
Day 6 (new)	8.0	7.0	25.1	40
Final	7.8	7.0	24.7	

WATER CHEMISTRY ANALYSIS

Client: Savannah River Site
Sample Identification: F/H Area ETF Discharge
Start Date: June 17, 1989

30% Effluent	D.O. (ppm)	pH	Temp (C)	Cond (umhos)
Initial	8.0	6.8	25.2	55
Day 1 (old)	8.1			
Day 1 (new)	8.2	6.7	24.5	60
Day 2 (old)				
Day 2 (new)	7.5	7.2	25.2	
Day 3 (old)	7.6			
Day 3 (new)	8.0	6.7	25.3	60
Day 4 (old)	7.7			
Day 4 (new)	8.2	7.0	25.2	50
Day 5 (old)	7.7			
Day 5 (new)	8.0	6.9	25.1	55
Day 6 (old)	7.6			
Day 6 (new)	8.2	7.1	25.1	100
Final	7.8	7.1	24.7	

100% Effluent	D.O. (ppm)	pH	Temp (C)	Cond (umhos)
Initial	8.0	7.2	25.2	150
Day 1 (old)	8.1			
Day 1 (new)	8.2	7.2	24.5	160
Day 2 (old)	7.8	7.6	25.2	
Day 2 (new)				
Day 3 (old)				
Day 3 (new)				
Day 4 (old)				
Day 4 (new)				
Day 5 (old)				
Day 5 (new)				
Day 6 (old)				
Day 6 (new)				
Final				

QUALITY CONTROL

Client: Savannah River Site
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Start Date: June 17, 1989

Culture Health:

Sensitivity: Culture organisms were exposed to NaCl as a reference toxicant.

The 48 Hour LC50 for this test was 2.13 g/L.

The mean LC50 value at this laboratory for NaCl as a toxicant is 2.03 g/L + 0.24. The current LC50 of the culture organisms is 0.42 standard deviation units above the mean. This suggests the test organisms were well within the normal range.

Reproduction: The control test organisms produced a mean of 17.4 young over the 7 day test period. The mean number of young produced at this laboratory for weekly control tests is 23.5 young/female (+ 3.74). Reproduction levels for this test were 1.63 standard deviation units below normal. Results suggest control reproduction was slightly below normal.

Test Precision:

Mean Significant Difference (MSD):

The MSD for this test was 5.339 young. This is the least difference in the number of young produced by the control organisms vs. the number of young produced by any effluent treatment organisms which can be detected as statistically significant.

The ratio of the MSD to the control mean (percent reduction) for this data is 28.73 percent. This result is indicative of a moderately good level of precision.