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F/H AREA ETF EFFLUENT (H-016 OUTFALL) CERIODAPHNIA SURVIVAL/REPRODUCTION TEST, TEST DATE: JUNE 27, 1991 (U)

by

W. L. Specht, et al.

Westinghouse Savannah River Company
Savannah River Laboratory
Aiken, South Carolina 29808

A Technical Report for Publication

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

F/H AREA ETF EFFLUENT (H-016 OUTFALL)
CERIODAPHNIA SURVIVAL/REPRODUCTION TEST,
TEST DATE: JUNE 27, 1991 (U)

WSRC Technical Representative: W. L. Specht

Approved by : D. B. Moore-Shedrow
D. B. Moore-Shedrow, Section Manager
Environmental Sciences Section
Savannah River Laboratory

Publication Date: August 1991

WESTINGHOUSE SAVANNAH RIVER COMPANY
SAVANNAH RIVER SITE
AIKEN, SC 29808

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

Chem-Nuclear Laboratory Services, Inc.

Post Office Box 17467
Greenville South Carolina 29606
(803) 235-5707

Ceriodaphnia SURVIVAL/REPRODUCTION TEST

Sample Identification: H - F Area (U3RC)

Test Date: June 27, 1991

Client: Savannah River Site
Location: Aiken, South Carolina

BIO - 871

A subsidiary of

Chemical Waste Management, Inc.

Printed on Recycled Paper

INTERPRETATION OF RESULTS

This toxicity test was conducted to determine if the effluent affects the survival or reproduction of the test organisms during a seven day period. The test involved exposing the test organisms to a series of dilutions of the effluent. At each dilution the survival and reproduction of ten test organisms was recorded. Each effluent dilution was compared to a control set of test organisms. Survival data were analyzed by Fisher's Exact Test and Probit Analysis (or Trimmed Spearman Karber if Probit can not be used) to determine the effluent concentration necessary to cause statistically significant ($p=0.05$) mortality. Reproduction data was analyzed for normality, homogeneity of variance and equality of replicates among dilutions to determine the appropriate statistical test for analysis of statistical differences among dilutions. Results are summarized as follows:

Acute Toxicity:

Trimmed Spearman-Karber

LC50= 54.77 % Effluent

Fisher's Exact Test

NOEC= 30.0% Effluent
LOEC= 100.0% Effluent
ChV= 54.77% Effluent

Chronic Toxicity

T-test with Bonferroni adjustment

(NOEC) No Observed Effect Conc.:	30.0%
(LOEC) Lowest Observed Effect Conc.:	100.0%
Chronic Value:	54.77%
	($p=0.05$)

SAMPLING INFORMATION

Three effluent samples were collected by and transported to Chem-Nuclear Laboratory Services by on-site personnel. Samples were collected in four one liter plastic cubitainers.

Client: Savannah River Site
Sample Identification: H - F Area (U3RC)
Start Date: June 27, 1991

	Sample #1	Sample #2	Sample #3
Lab #	BIO871-1	BIO871-2	BIO871-3
Type	grab	grab	grab
Date sampled	6/26/91	6/28/91	7/01/91
Time sampled	9:55 AM	9:30 AM	9:30 AM
Days of use	0,1	2,3	4,5,6
Maximum hold time:	54 hrs	58 hrs	55 hrs
Temperature Upon Receipt:	3.0°C	3.0°C	8.0°C

EFFLUENT FIELD PARAMETERS

	Sample #1	Sample #2	Sample #3
D.O. (mg/L)	6.5	7.2	7.3
pH	6.95	6.9	7.33
Temp (C)	21.0°C	25.8°C	27.0°C
Res Cl (mg/L)	<.05	<.05	<.05

TEST SYSTEM

Client: Savannah River Site
Sample Identification: H - F Area (U3RC)
Start Date: June 27, 1991

Test Type: 7 Day Chronic Toxicity - Reproduction Test
Test Location: Chem-Nuclear Laboratory Services

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

Test Procedure: Short-Term Methods for Estimating the Chronic Toxicity
of Effluents and Receiving Waters to Freshwater Organisms.
2nd Edition. EPA 600/4-85/014 Method 1002.0

Test vessels: 30 ml plastic beakers
Amount Test Soln: 15 ml / replicate
Replicates/Concentration: 10 (test vessels randomized)
Test Organisms/Replicate: 1

of Test Concentrations Used (excluding control): 5
Test Solution Renewal: Daily

Food Source: 0.10 ml Selenastrum ($3.1-3.5 \times 10^7$ cells/ml)
and 0.05 ml YCT daily / test vessel

Testing Performed, Results Checked
and Report Prepared By:

Joel Stephens
Analytical Biologist

Joel A. Stephens JEM

RESULTS

Client: Savannah River Site
Sample Identification: H - F Area (U3RC)
Start Date: June 27, 1991

SURVIVAL DATA (At Test Termination)

	Effluent Concentration					
	0.0%	1%	3%	10%	30%	100%
Survival	10 100%	10 100%	10 100%	10 100%	10 100%	0 0%
Mortality (7 day)	0 0%	0 0%	0 0%	0 0%	0 0%	10 100%
# Lost	0	1	0	0	1	0
# Males	0	1	0	0	0	0
Bad Brood	0	0	0	0	0	0

SURVIVAL - DATA ANALYSIS

Probit Analysis

LC50= 54.77 % Effluent

Fisher's Exact Test

NOEC= 30.0% Effluent
LOEC= 100.0% Effluent
ChV= 54.77% Effluent

RESULTS

Client: Savannah River Site
Sample Identification: H - F Area (U3RC)
Start Date: June 27, 1991

CHRONIC TOXICITY - Daily Reproduction Totals

	Rep	Day 4	Day 5	Day 6	Day 7	Total
Control	A	1	9	12	0	22
	B	5	3	8	0	16
	C	3	2	13	0	18
	D	1	2	8	0	11
	E	5	6	10	0	21
	F	1	4	12	1	18
	G	1	4	12	7	24
	H	11	0	10	1	22
	I	0	3	8	7	18
	J	4	19	0	15	38
	Total	32	52	93	31	208
1% Effluent	A	0	0	13	16	29
	B	7	8	0	8	23
	C	0	4	10	7	21
	D	2	9	0	13	24
	E	M	M	M	M	0
	F	1	4	10	8	23
	G	0	9	7	0	16
	H	5	6	17	0	28
	I	5	L	L	L	5
	J	4	6	4	0	14
	Total	24	46	61	52	178
3.0% Effluent	A	4	7	14	0	25
	B	5	8	0	11	24
	C	0	3	5	4	12
	D	5	10	0	12	27
	E	7	0	10	9	26
	F	1	8	16	0	25
	G	0	13	16	0	29
	H	0	13	0	7	20
	I	6	8	13	0	27
	J	0	10	17	0	27
	Total	28	80	91	43	242

RESULTS

Client: Savannah River Site
Sample Identification: H - F Area (U3RC)
Start Date: June 27, 1991

CHRONIC TOXICITY - Daily Reproduction Totals

	Rep	Day 4	Day 5	Day 6	Day 7	Total
10.0% Effluent	A	6	3	10	12	31
	B	0	8	9	0	17
	C	0	10	12	0	22
	D	2	0	12	5	19
	E	3	4	0	10	17
	F	0	10	15	0	25
	G	3	2	12	5	22
	H	0	0	0	4	4
	I	2	13	0	11	26
	J	0	5	10	1	16
	Total	16	55	80	48	199
30.0% Effluent	A	5	0	7	12	24
	B	6	8	0	7	21
	C	L	L	L	L	0
	D	4	0	12	11	27
	E	5	7	0	12	24
	F	0	0	6	0	6
	G	0	0	0	9	9
	H	0	0	1	0	1
	I	4	8	0	6	18
	J	4	6	1	8	19
	Total	28	29	27	65	149
100.0% Effluent	A	X	X	X	X	0
	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

Client: Savannah River Site
Sample Identification: H - F Area (U3RC)
Start Date: June 27, 1991

CHRONIC TOXICITY - Statistical Analysis

T-test with Bonferroni adjustment
(Assumes Data is Normally Distributed and Homogeneous)

Conc.	0.0%	1%	3.0%	10.0%	30.0%
Average Young per Female	20.8	22.3	24.2	19.9	16.6
Std. Dev.	7.08	5.23	4.92	7.31	9.07
Calculated Value		-.443	-1.102	0.292	1.339
Critical Value		2.329	2.329	2.329	2.329
Reproduction significantly less than control? (95% confidence)		no	no	no	no

95% conf.

(NOEC) No Observed Effect Conc.: 30.0%
(LOEC) Lowest Observed Effect Conc.: 100.0%
Chronic Value: 54.77%

The data are normally distributed.
The data are homogeneous in variance.
The number of replicates in each concentration is not equal.
The appropriate statistical test is the T-test with
Bonferroni adjustment.

WATER CHEMISTRY ANALYSIS

Client: Savannah River Site
Sample Identification: H - F Area (U3RC)
Start Date: June 27, 1991

Dilution Water

ID: Upper Three Runs Creek Water
Preparation: Filtered through a 37 micron Nitex mesh.

Temperature Measurements (°C)

Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
25.2	26.0	26.0	27.7	26.4	26.4	25.7	24.9

Effluent Chemistry Parameters

	Conductivity (umhos)	Hardness (mg/L)	Alkalinity (mg/L)	Res. Cl. (mg/L)
Sample 1	200	<1.0	24.0	<0.05
Sample 2	138	<1.0	16.2	<0.05
Sample 3	78	1.0	21.2	<0.05

WATER CHEMISTRY ANALYSIS

ient: Savannah River Site
 mple Identification: H - F Area (U3RC)
 art Date: June 27, 1991

st Solutions

	pH	D.O. (mg/L)	D.O. (%)	Hardness (mg/L)	Alkalinity (mg/L)	Conduc. (umhos)
NTROL						
itial	6.00	8.2	103%	8.0	4.21	21
y 1 (old)	6.60	8.0	103%			
y 1 (new)	5.90	8.2	105%	8.0	5.26	21
y 2 (old)	6.20	8.3	106%			
y 2 (new)	6.40	8.3	106%	8.0	5.26	20
y 3 (old)	6.30	7.0	90%			
y 3 (new)	5.80	7.5	96%	10.0	5.26	22
y 4 (old)	6.00	9.0	103%			
y 4 (new)	6.40	8.1	104%	6.0	5.26	19
y 5 (old)	6.80	6.3	81%			
y 5 (new)	6.30	7.2	92%	8.0	5.26	19
y 6 (old)	6.80	8.1	103%			
y 6 (new)	6.40	8.3	105%	7.0	4.21	17
nal	6.80	8.2	101%			

	D.O. (mg/L)	D.O. (%)	pH	Conductivity (umhos)
Effluent				
itial	8.2	103%	6.00	23
y 1 (old)	8.0	103%	6.70	
y 1 (new)	8.1	104%	5.90	23
y 2 (old)	8.2	105%	6.30	
y 2 (new)	7.9	101%	6.40	23
y 3 (old)	6.9	88%	6.40	
y 3 (new)	7.3	94%	5.90	23
y 4 (old)	7.9	101%	6.10	
y 4 (new)	8.1	104%	6.30	21
y 5 (old)	6.4	82%	6.90	
y 5 (new)	7.1	91%	6.30	20
y 6 (old)	8.0	101%	6.80	
y 6 (new)	8.2	104%	6.40	19
nal	8.2	101%	6.80	

WATER CHEMISTRY ANALYSIS

Client: Savannah River Site
Sample Identification: H - F Area (U3RC)
Start Date: June 27, 1991

	D.O. (mg/L)	D.O. (%)	pH	Conductivity (umhos)
3.0% Effluent				
Initial	8.3	104%	6.10	26
Day 1 (old)	8.2	105%	6.80	
Day 1 (new)	8.2	105%	5.90	26
Day 2 (old)	7.9	101%	6.40	
Day 2 (new)	8.1	104%	6.60	25
Day 3 (old)	7.2	92%	6.40	
Day 3 (new)	7.1	91%	6.00	25
Day 4 (old)	8.0	103%	6.20	
Day 4 (new)	8.2	105%	6.40	23
Day 5 (old)	6.5	83%	7.00	
Day 5 (new)	7.1	91%	6.30	21
Day 6 (old)	8.2	104%	6.90	
Day 6 (new)	8.2	104%	6.40	21
Final	8.2	101%	6.90	

	D.O. (mg/L)	D.O. (%)	pH	Conductivity (umhos)
10.0% Effluent				
Initial	8.3	104%	6.20	45
Day 1 (old)	8.3	106%	6.90	
Day 1 (new)	8.2	105%	6.00	41
Day 2 (old)	8.0	103%	6.50	
Day 2 (new)	8.2	105%	6.60	34
Day 3 (old)	7.1	91%	6.50	
Day 3 (new)	7.0	90%	6.10	34
Day 4 (old)	8.1	104%	6.30	
Day 4 (new)	8.1	104%	6.40	26
Day 5 (old)	6.6	85%	7.00	
Day 5 (new)	7.1	91%	6.50	24
Day 6 (old)	8.1	103%	7.00	
Day 6 (new)	8.2	104%	6.50	24
Final	8.3		6.90	

WATER CHEMISTRY ANALYSIS

Client: Savannah River Site
Sample Identification: H - F Area (U3RC)
Start Date: June 27, 1991

30% Effluent	D.O. (mg/L)	D.O. (%)	pH	Hardness (mg/L)	Alkalinity (mg/L)	Conduc (umhos)
Initial	8.2	103%	6.30	—	—	79
Day 1 (old)	8.2	105%	7.20	—	—	
Day 1 (new)	8.2	105%	6.20	—	—	84
Day 2 (old)	8.0	103%	6.70	—	—	
Day 2 (new)	8.1	104%	6.70	6.0	10.5	57
Day 3 (old)	7.2	92%	6.80	—	—	
Day 3 (new)	6.9	88%	6.30	5.0	7.37	55
Day 4 (old)	8.1	104%	6.50	—	—	
Day 4 (new)	8.1	104%	6.50	4.0	8.42	38
Day 5 (old)	6.5	83%	7.30	—	—	
Day 5 (new)	7.1	91%	6.70	6.0	10.5	35
Day 6 (old)	8.1	103%	7.00	—	—	
Day 6 (new)	8.2	104%	6.70	6.0	8.42	34
Final	8.2	101%	7.10	—	—	

100% Effluent	D.O. (mg/L)	D.O. (%)	pH	Hardness (mg/L)	Alkalinity (mg/L)	Conduc (umhos)
Initial	8.3	100%	7.00	<1.0	23.2	200
Day 1 (old)	8.1	101%	7.80	—	—	
Day 1 (new)	8.3	104%	6.90	<1.0	24.2	221
Day 2 (old)	8.1	105%	7.30	—	—	
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
Sample Identification: H - F Area (U3RC)
Start Date: June 27, 1991

Culture Health:

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

Current LC50: 0.707 g/L
Date: 7/25/91

Reproduction: Control test organisms
Reproduction: 20.8 (young/female)

**DATE
FILMED**
7/22/92