**F/H AREA ETF EFFLUENT (H-016 OUTFALL) CERIODAPHNIA
SURVIVAL/REPRODUCTION TEST, TEST DATE: DECEMBER 12,
1990 (U)**

by

W. L. Specht, et al.

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

A Technical Report for Publication

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

This paper was prepared in connection with work done under Contract No. DE-AC09-89SR18035 with the U.S. Department of Energy. By acceptance of this paper, the publisher and/or recipient acknowledges the U.S. Government's right to retain a nonexclusive, royalty-free license in and to any copyright covering this paper, along with the right to reproduce and to authorize others to reproduce all or part of the copyrighted paper.

MASTER

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

WSRC-TR-91-474-1

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

MAY 26 1992

F/H AREA ETF EFFLUENT (H-016 OUTFALL)
CERIODAPHNIA SURVIVAL/REPRODUCTION TEST,
TEST DATE: DECEMBER 12, 1990

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-AC09-89SR18035

Chem-Nuclear Laboratory Services, Inc.

One College Park Drive
Greenville, South Carolina 29615
(803) 799-0000

Ceriodaphnia SURVIVAL/REPRODUCTION TEST

Sample Identification: H - F Area

Client: Savannah River Site
Location: Aiken, SC

Test Date: December 12, 1990

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 the Trimmed Spearman-Kärber method 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 appropriate statistical test for analysis of statistical differences in reproduction among dilutions. Results are summarized as follows:

Acute Toxicity:

Probit Analysis

		95% Confidence Limits	
		Lower	Upper
LC50=	44.38 % Effluent	27.47	71.71

Fisher's Exact Test

NOEC= 30.0% Effluent
LOEC= 100.0% Effluent

Chronic Toxicity

Bonferroni's t-Test

(NOEC) No Observed Effect Conc.:	30.0%
(LOEC) Lowest Observed Effect Conc.:	100.0%
Chronic Value:	54.96%
	($p=0.05$)

SAMPLING INFORMATION

Three effluent samples were collected by Chem-Nuclear Laboratory Services by on-site personnel and were transported by either same-day or overnight delivery. Samples were collected in 4 1 L plastic cubitainers.

Client: Savannah River Site
Sample Identification: H - F Area
Start Date: December 12, 1990

	Sample #1	Sample #2	Sample #3
Lab #	BIO730-1	BIO730-2	BIO730-3
Type	grab	grab	grab
Date sampled	12/11/90	12/14/90	12/17/90
Time sampled	9:50 AM	9:40 AM	12:45 PM
Days of use	0,1,2	3,4	5,6
Maximum hold time before use:	36 hrs	72 hrs	72 hrs
Temperature Upon Receipt:	2.5°C	1.8°C	4.0°C

Effluent Field Parameters	Sample #1	Sample #2	Sample #3
D.O. (ppm)		11.0	11.5
pH	6.87	7.00	6.95
Temp (C)	15°C	16°C	17.5°C
Res Cl (ppm)	<0.05*	0.05*	0.05*

* By DPD Method for Residual Chlorine Detection

TEST SYSTEM

Client: Savannah River Site
Start Date: December 12, 1990

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

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

Test Procedure: Short-Term Methods for Estimating the Chronic Toxicity
of Effluents and Receiving Waters to Freshwater Organisms.
2nd Edition. EPA 600/4-89/001 Method 1002

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

Dilutions Used: 0, 1, 3, 10, 30, and 100%

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

Test Performed By: Joel Stephens
Analytical Biologist

Joel A. Stephens

Test Results and
Report Prepared By: Joel Stephens
Analytical Biologist

Joel A. Stephens *JS*

RESULTS

Client: Savannah River Site
Sample Identification: H - F Area
Start Date: December 12, 1990

CHRONIC TOXICITY - Daily Reproduction Totals

	Rep	Day 4	Day 5	Day 6	Day 7	Total
Control	A	4	6	2	9	21
	B	3	9	0	5	17
	C	4	7	0	8	19
	D	3	3	0	9	15
	E	2	0	5	4	11
	F	4	5	5	8	22
	G	2	6	0	8	16
	H	2	0	6	0	8
	I	4	9	1	8	22
	J	0	6	1	0	7
	Total	28	51	20	59	158
1.0% Effluent	A	0	0	4	8	12
	B	4	9	6	X	19
	C	4	0	2	8	14
	D	1	5	8	9	23
	E	0	3	7	X	10
	F	7	1	0	0	8
	G	3	6	6	6	15
	H	3	5	7	0	15
	I	0	3	0	0	3
	J	0	3	0	0	3
	Total	22	35	40	31	122
3.0% Effluent	A	4	4	9	0	17
	B	3	7	6	1	17
	C	3	7	0	7	17
	D	6	8	0	10	24
	E	4	6	3	1	14
	F	0	3	4	1	8
	G	2	0	6	6	14
	H	2	5	9	0	16
	I	5	0	7	4	16
	J	2	7	0	11	20
	Total	31	47	44	41	163

RESULTS

Client: Savannah River Site
 Sample Identification: H - F Area
 Start Date: December 12, 1990

CHRONIC TOXICITY - Daily Reproduction Totals

	Rep	Day 4	Day 5	Day 6	Day 7	Total
10.0% Effluent	A	0	0	0	M	0
	B	0	4	0	0	4
	C	0	0	M	X	0
	D	0	0	7	X	7
	E	0	6	2	2	10
	F	2	8	0	3	13
	G	0	4	3	0	7
	H	4	0	7	0	11
	I	4	7	0	13	24
	J	1	3	8	5	17
	Total	11	32	27	23	93
30.0% Effluent	A	0	4	0	0	4
	B	1	7	13	0	21
	C	2	10	0	5	17
	D	0	3	5	X	8
	E	1	4	7	0	12
	F	6	0	8	12	26
	G	0	0	7	0	7
	H	0	4	6	5	15
	I	2	7	8	0	17
	J	1	3	0	8	12
	Total	13	42	54	30	139
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
Start Date: December 12, 1990

SURVIVAL DATA (At Test Termination)

	0.0%	1%	Effluent Concentration			
			3%	10%	30%	100%
Survival	10	8	10	8	9	0
	100%	80%	100%	80%	90%	0%
Mortality	0	2	0	2	1	10
(7 day)	0%	20%	0%	20%	10%	100%
# Lost	0	0	0	0	0	0
# Males	0	0	0	2	0	0
Bad Brood	0	0	0	0	0	0

SURVIVAL - DATA ANALYSIS

Spearman-Kärber

		95% Confidence Limits	
		Lower	Upper
LC50=	44.38 % Effluent	27.47	71.71

Fisher's Exact Test

NOEC= 30.0% Effluent
LOEC= 100.0% Effluent

RESULTS

Client: Savannah River Site
Sample Identification: H - F Area
Start Date: December 12, 1990

CHRONIC TOXICITY - Statistical Analysis

Bonferroni's t-Test

Conc.	0.0%	1.0%	3.0%	10.0%	30.0%	100.0%
Average Young per Female	15.8	12.2	16.3	11.6	13.9	0.0
Std. Dev.	5.55	6.44	4.14	6.41	6.71	0
Calculated "t" Value	—	1.364	-0.189	1.491	.720	100% Mortality
Critical "t" Value	2.324					
Reproduction significantly less than control? (95% confidence)		no	no	no	no	yes

95% conf.

(NOEC) No Observed Effect Conc.: 30.0%
(LOEC) Lowest Observed Effect Conc.: 100.0%
Chronic Value: 54.96%

The data are normally distributed.
The data are homogenous in variance.
The number of replicates in each concentration is not equal.
The appropriate statistical test is Bonferroni's t Test.

WATER CHEMISTRY ANALYSIS

Client: Savannah River Site
Sample Identification: H - F Area
Start Date: December 12, 1990

Dilution Water

ID: Upper Three Runs Creek Water
Preparation: Filtered with a 37 micron Nytex mesh filter

Temperature Measurements (°C)

Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
24.6	26.0	26.0	25.4	25.7	25.1	25.5	25.6

Conductivity Measurements (umhos)

Sample 1	49
Sample 2	135
Sample 3	127

WATER CHEMISTRY ANALYSIS

Client: Savannah River Site
Sample Identification: H - F Area
Start Date: December 12, 1990

Test Solutions

	pH	D.O. (mg/L)	D.O. (%)	Alkal. (mg/L)	Hardness (mg/L)	Conduct. (umhos)
CONTROL						
Initial	6.20	8.3	102%	2	9	11
Day 1 (old)	6.91	7.7	99%			
Day 1 (new)	6.73	8.0	103%	2	11	18
Day 2 (old)	6.76	8.2	105%			
Day 2 (new)	6.24	8.4	108%	2	10	11
Day 3 (old)	6.52	8.0	100%			
Day 3 (new)	6.34	8.2	103%	3	10	10
Day 4 (old)	6.60	7.6	96%			
Day 4 (new)	6.33	7.7	97%	2	10	9
Day 5 (old)	6.66	7.2	90%			
Day 5 (new)	6.53	7.5	94%	3	9	4
Day 6 (old)	6.73	7.9	100%			
Day 6 (new)	6.52	8.3	104%	3	10	20
Final	6.81	7.6	96%			

	D.O. (mg/L)	D.O. (%)	pH	Conductance
1.0% Effluent				
Initial	8.2	101%	6.25	12
Day 1 (old)	7.7	99%	6.92	
Day 1 (new)	8.0	103%	6.76	15
Day 2 (old)	7.9	101%	6.79	
Day 2 (new)	8.1	104%	6.35	14
Day 3 (old)	7.9	99%	6.62	
Day 3 (new)	8.2	103%	6.34	13
Day 4 (old)	7.4	94%	6.65	
Day 4 (new)	7.7	97%	6.35	9
Day 5 (old)	6.9	86%	6.68	
Day 5 (new)	7.4	93%	6.50	4
Day 6 (old)	7.7	97%	6.75	
Day 6 (new)	8.1	103%	6.37	20
Final	7.4	94%	6.89	

WATER CHEMISTRY ANALYSIS

Client: Savannah River Site
Sample Identification: H - F Area
Start Date: December 12, 1990

	D.O. (mg/L)	D.O. (%)	pH	Conductance
3.0% Effluent				
Initial	8.1	100%	6.29	14
Day 1 (old)	7.7	99%	6.94	
Day 1 (new)	8.1	104%	6.74	16
Day 2 (old)	7.8	100%	6.81	
Day 2 (new)	7.9	101%	6.45	11
Day 3 (old)	7.8	98%	6.69	
Day 3 (new)	8.2	103%	6.32	15
Day 4 (old)	7.0	89%	6.72	
Day 4 (new)	7.6	96%	6.38	12
Day 5 (old)	7.0	88%	6.76	
Day 5 (new)	7.4	93%	6.49	7
Day 6 (old)	7.7	97%	6.81	
Day 6 (new)	8.1	103%	6.61	24
Final	7.4	94%	6.89	

	D.O. (mg/L)	D.O. (%)	pH	Conductance
10.0% Effluent				
Initial	8.1	100%	6.32	16
Day 1 (old)	7.7	99%	6.98	
Day 1 (new)	8.2	105%	6.72	19
Day 2 (old)	7.8	100%	6.92	
Day 2 (new)	8.2	105%	6.50	12
Day 3 (old)	7.8	98%	6.78	
Day 3 (new)	8.2	103%	6.36	24
Day 4 (old)	7.2	91%	6.79	
Day 4 (new)	7.6	96%	6.38	18
Day 5 (old)	7.1	89%	6.79	
Day 5 (new)	7.4	93%	6.47	7
Day 6 (old)	7.7	97%	6.83	
Day 6 (new)	8.1	103%	6.63	31
Final	7.3	92%	6.94	

QUALITY CONTROL

Client: Savannah River Site
Sample Identification: H - F Area
Start Date: December 12, 1990

Culture Health:

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

Current LC50:	0.593 g/L	
Central Tendency:	0.593 g/L	
Standard Dev:	0.115	
Upper Limit:	0.823 g/L	(+2 std. dev.)
Lower Limit:	0.363 g/L	(-2 std. dev.)

The health of the Ceriodaphnia dubia used in this test were well within the normal range.

WATER CHEMISTRY ANALYSIS

Client: Savannah River Site
 Sample Identification: H - F Area
 Start Date: December 12, 1990

30.0% Effluent	D.O. (mg/L)	D.O. (%)	pH	Alk. (mg/L)	Hard. (mg/L)	Cond. (umhos)
Initial	8.1	100%	6.42	—	—	22
Day 1 (old)	7.7	99%	7.16	—	—	—
Day 1 (new)	8.1	104%	6.80	—	—	27
Day 2 (old)	7.6	97%	7.16	—	—	—
Day 2 (new)	8.0	103%	6.67	—	—	17
Day 3 (old)	7.7	96%	6.85	—	—	—
Day 3 (new)	8.3	104%	6.50	—	—	42
Day 4 (old)	7.2	91%	6.89	—	—	—
Day 4 (new)	7.7	97%	6.59	5	8	10
Day 5 (old)	7.0	88%	6.79	—	—	—
Day 5 (new)	7.5	94%	7.00	5	9	38
Day 6 (old)	7.8	99%	6.93	—	—	—
Day 6 (new)	8.3	105%	6.71	6	10	57
Final	7.2	91%	6.99	—	—	—

100.0% Effluent	pH	D.O. (mg/L)	D.O. (%)	Alkal. (mg/L)	Hardness (mg/L)	Conduct. (umhos)
Initial	6.97	8.2	101%	9	3	49
Day 1 (old)	7.35	7.7	99%	—	—	—
Day 1 (new)	7.29	8.2	105%	10	2	54
Day 2 (old)	8.25	7.9	101%	—	—	—
Day 2 (new)	7.22	8.2	105%	9	4	44
Day 3 (old)	7.14	7.6	98%	—	—	—
Day 3 (new)	7.01	8.4	105%	10	3	135
Day 4 (old)	7.21	7.2	91%	—	—	—
Day 4 (new)	—	—	—	—	—	—
Day 5 (old)	—	—	—	—	—	—
Day 5 (new)	—	—	—	—	—	—
Day 6 (old)	—	—	—	—	—	—
Day 6 (new)	—	—	—	—	—	—
Final	—	—	—	—	—	—

END

**DATE
FILMED**

7 / 13 / 92