**F/H AREA ETF EFFLUENT (H-016 OUTFALL) CERIODAPHNIA
SURVIVAL/REPRODUCTION TEST, TEST DATE: MARCH 21,
1991 (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-91-474-2

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

F/H AREA ETF EFFLUENT (H-016 OUTFALL)
CERIODAPHNIA SURVIVAL/REPRODUCTION TEST,
TEST DATE: MARCH 21, 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) 235-0707

Ceriodaphnia SURVIVAL/REPRODUCTION TEST

Sample Identification: H - F Area

Client: Savannah River Site
Location: Aiken, South Carolina

Test Date: March 21, 1991

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 test 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 in reproduction among dilutions. Results are summarized as follows:

Acute Toxicity:

Trimmed Spearman-Kärber Analysis

		95% Confidence Limits
		Lower Upper
LC50=	54.77 % Effluent	Not Reliable

Fisher's Exact Test

NOEC=	30.0% Effluent
LOEC=	100.0% Effluent
ChV=	54.76% Effluent

Chronic Toxicity

Bonferroni's t-test

(NOEC) No Observed Effect Conc.:	30.0%
(LOEC) Lowest Observed Effect Conc.:	100.0%
Chronic Value:	54.76%
	($p=0.05$)

RESULTS

Client: Savannah River Site
Sample Identification: H - F Area
Start Date: March 21, 1991

SURVIVAL DATA (At Test Termination)

	0.0%	1%	Effluent Concentration			
			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	0	0
# Males	0	0	0	0	0	0
Bad Brood	0	0	0	0	0	0

SURVIVAL - DATA ANALYSIS

Trimmed Spearman-Kärber Analysis

(Probit Analysis cannot be used because there are not 2 effluent concentrations that have between 0 and 100% mortality.)

			95% Confidence Limits
			Lower Upper
LC50=	54.77	% Effluent	Not Reliable

Fisher's Exact Test

NOEC= 30.0% Effluent
LOEC= 100.0% Effluent
ChV= 54.76% Effluent

RESULTS

Client: Savannah River Site
Sample Identification: H - F Area
Start Date: March 21, 1991

CHRONIC TOXICITY - Daily Reproduction Totals

	Rep	Day 4	Day 5	Day 6	Day 7	Total
Control	A	2	4	13	0	19
	B	4	6	0	10	20
	C	5	1	13	8	27
	D	1	1	5	11	18
	E	2	3	7	8	20
	F	2	2	5	10	19
	G	1	1	5	6	13
	H	1	9	0	10	20
	I	1	5	9	9	24
	J	2	1	6	11	20
	Total	21	33	63	83	200
1.0% Effluent	A	1	1	10	10	22
	B	0	8	0	5	13
	C	2	6	0	13	21
	D	2	1	6	8	17
	E	1	6	0	12	19
	F	2	1	4	8	15
	G	3	L	L	L	3
	H	2	4	0	9	15
	I	2	4	9	4	19
	J	2	1	11	3	17
	Total	17	32	40	72	161
3.0% Effluent	A	1	0	6	10	17
	B	2	0	6	9	17
	C	1	0	7	10	18
	D	2	0	3	9	14
	E	2	3	6	17	28
	F	3	0	8	9	20
	G	2	0	6	8	16
	H	2	0	8	7	17
	I	1	2	1	19	23
	J	5	0	2	15	22
	Total	21	5	53	113	192

RESULTS

Client: Savannah River Site
Sample Identification: H - F Area
Start Date: March 21, 1991

CHRONIC TOXICITY - Daily Reproduction Totals

	Rep	Day 4	Day 5	Day 6	Day 7	Total
10.0% Effluent	A	3	7	12	0	22
	B	0	4	9	8	21
	C	3	1	6	9	19
	D	1	0	4	17	22
	E	1	1	6	10	18
	F	0	5	8	0	13
	G	2	0	4	12	18
	H	2	0	7	12	21
	I	2	0	6	13	21
	J	2	4	0	17	23
	Total	16	22	62	98	198
30.0% Effluent	A	2	0	8	7	17
	B	0	1	7	8	16
	C	1	6	0	8	15
	D	1	5	5	11	22
	E	2	0	3	11	16
	F	0	4	0	9	13
	G	2	6	0	2	10
	H	0	10	0	7	17
	I	2	2	8	1	13
	J	1	0	7	9	17
	Total	11	34	38	73	156
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: March 21, 1991

CHRONIC TOXICITY - Statistical Analysis

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

Conc.	0.0%	1.0%	3.0%	10.0%	30.0%	100.0%
Average Young per Female	20.0	17.6	19.2	19.8	15.6	0.0
Std. Dev.	3.65	2.96	4.13	2.94	3.20	0
"t" Value		1.557	.523	.131	2.879	
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: 54.76%

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.

SAMPLING INFORMATION

Three effluent samples were collected by and transported to Chem-Nuclear Laboratory Services by on-site personnel. Samples were collected in 4 1 L plastic cubitainers.

Client: Savannah River Site
Sample Identification: H - F Area
Start Date: March 21, 1991

	Sample #1	Sample #2	Sample #3
Lab #	BIO811-1	BIO811-2	BIO811-3
Type	grab	grab	grab
Date sampled	3/20/91	3/22/91	3/25/91
Time sampled	11 AM	9:30 AM	12:11 PM
Days of use	0,1	2,3	4,5,6
Maximum hold time:	36 hrs	72 hrs	72 hrs
Temperature Upon Receipt:	4.0°C	0.5°C	1.0°C

Effluent Field Parameters	Sample #1	Sample #2	Sample #3
D.O. (ppm)	8.2	—	—
pH	7.46	7.23	7.61
Temp (C)	18.5 C	18.0 C	22.0 C
Res Cl (ppm)	<0.05	<0.05	<0.05

TEST SYSTEM

Client: Savannah River Site
Start Date: March 21, 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

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

Test Performed By: Joel Stephens
Analytical Biologist

Joel A. Stephens

Test Results and
Report Prepared By: Joel Stephens
Analytical Biologist

Joel A. Stephens

WEM

WATER CHEMISTRY ANALYSIS

Client: Savannah River Site
Sample Identification: H - F Area
Start Date: March 21, 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
25.4	25.2	25.1	25.5	25.0	26.0	26.0	25.4

WATER CHEMISTRY ANALYSIS

Client: Savannah River Site
Sample Identification: H - F Area
Start Date: March 21, 1991

Test Solutions

	pH	D.O. (mg/L)	D.O. (%)	Alkal. (mg/L)	Hardness (mg/L)	Conduct. (umhos)
CONTROL						
Initial	6.05	8.2	103%	3	8	16
Day 1 (old)	6.65	7.6	95%			
Day 1 (new)	6.50	8.1	101%	2	9	17
Day 2 (old)	6.70	8.1	101%			
Day 2 (new)	6.50	8.3	104%	3	8	19
Day 3 (old)	7.00	8.1	103%			
Day 3 (new)	7.10	7.9	100%	4	9	23
Day 4 (old)	6.20	8.0	100%			
Day 4 (new)	6.05	8.0	100%	3	8	28
Day 5 (old)	6.40	8.2	105%			
Day 5 (new)	6.20	8.2	105%	2	6	18
Day 6 (old)	6.60	8.1	104%			
Day 6 (new)	6.50	8.0	103%	2	8	18
Final	7.10	8.2	103%			

	D.O. (mg/L)	D.O. (%)	pH	Conduct. (umhos)
1.0% Effluent				
Initial	8.1	101%	6.10	18
Day 1 (old)	7.7	96%	6.75	
Day 1 (new)	8.1	101%	6.50	18
Day 2 (old)	7.9	99%	6.70	
Day 2 (new)	8.3	104%	6.50	19
Day 3 (old)	8.0	101%	7.00	
Day 3 (new)	7.5	95%	7.10	18
Day 4 (old)	8.0	100%	6.05	
Day 4 (new)	8.1	101%	6.10	24
Day 5 (old)	8.2	105%	6.50	
Day 5 (new)	8.0	103%	6.25	18
Day 6 (old)	8.1	104%	6.65	
Day 6 (new)	8.0	103%	6.55	19
Final	8.0	100%	7.10	

WATER CHEMISTRY ANALYSIS

Client: Savannah River Site
Sample Identification: H - F Area
Start Date: March 21, 1991

3.0% Effluent	D.O. (mg/L)	D.O. (%)	pH	Conduct. (umhos)
Initial	8.0	100%	6.15	18
Day 1 (old)	7.7	96%	6.80	
Day 1 (new)	8.0	100%	6.50	19
Day 2 (old)	8.0	100%	6.80	
Day 2 (new)	8.1	101%	6.50	19
Day 3 (old)	7.9	100%	7.00	
Day 3 (new)	7.6	96%	7.00	18
Day 4 (old)	8.1	101%	6.10	
Day 4 (new)	8.2	103%	6.05	25
Day 5 (old)	8.2	105%	6.60	
Day 5 (new)	7.9	101%	6.30	19
Day 6 (old)	8.2	105%	6.70	
Day 6 (new)	8.1	104%	6.55	19
Final	8.0	100%	7.05	

10.0% Effluent	D.O. (mg/L)	D.O. (%)	pH	Conduct. (umhos)
Initial	8.1	101%	6.20	20
Day 1 (old)	7.8	98%	6.90	
Day 1 (new)	8.0	100%	6.50	20
Day 2 (old)	7.9	99%	6.90	
Day 2 (new)	8.3	104%	6.50	19
Day 3 (old)	7.9	100%	7.00	
Day 3 (new)	7.6	96%	7.00	19
Day 4 (old)	8.0	100%	6.20	
Day 4 (new)	8.2	103%	6.15	29
Day 5 (old)	8.2	105%	6.65	
Day 5 (new)	8.1	104%	6.40	22
Day 6 (old)	8.2	105%	6.70	
Day 6 (new)	8.1	104%	6.75	22
Final	7.9	99%	7.05	

WATER CHEMISTRY ANALYSIS

Client: Savannah River Site
Sample Identification: H - F Area
Start Date: March 21, 1991

	D.O. (mg/L)	D.O. (%)	pH	Alk. (mg/L)	Hard. (mg/L)	Cond. (umhos)
30.0% Effluent						
Initial	8.1	101%	6.35	—	—	22
Day 1 (old)	7.9	99%	6.95	—	—	—
Day 1 (new)	8.1	101%	6.60	—	—	22
Day 2 (old)	8.0	100%	6.90	—	—	—
Day 2 (new)	8.3	104%	6.60	—	—	21
Day 3 (old)	8.0	101%	7.00	—	—	—
Day 3 (new)	7.8	99%	7.00	6	6	19
Day 4 (old)	8.0	100%	6.25	—	—	—
Day 4 (new)	3.2	103%	5.15	5	6	37
Day 5 (old)	8.2	105%	6.80	—	—	—
Day 5 (new)	8.3	106%	6.40	<9	6	30
Day 6 (old)	8.3	106%	6.70	—	—	—
Day 6 (new)	8.2	105%	6.80	5	6	32
Final	7.9	99%	7.15	—	—	—

	pH	D.O. (mg/L)	D.O. (%)	Alkal. (mg/L)	Hardness (mg/L)	Cond. (umhos)
100.0% Effluent						
Initial	7.00	8.0	100%	11	4	32
Day 1 (old)	7.25	7.7	96%	—	—	—
Day 1 (new)	7.20	8.0	100%	10	3	34
Day 2 (old)	7.40	8.0	100%	—	—	—
Day 2 (new)	7.30	8.5	106%	8	2	27
Day 3 (old)	7.10	8.2	104%	—	—	—
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
Start Date: March 21, 1991

Culture Health:

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

Current LC50:	0.672 g/L
Date:	3/28/91
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.)
Current LC50 is	0.687 standard deviation units

Reproduction: Control test organisms

Reproduction:	20.0 (young/female)
Central Tendency:	20.48 (young/female)
Standard Dev.:	4.08
Upper Limit:	28.64 g/L (+2 std. dev.)
Lower Limit:	12.32 g/L (-2 std. dev.)
Current LC50 is	0.118 standard deviation units below the central tendency.

**DATE
FILMED**
7/22/92