NMP-RMT--910329-Rev.1

DE93 000456

TOXICITY TESTING RESULTS ON INCREASED SUPERNATE TREATMENT RATE OF 3700 GALLONS/BATCH(U)

by

J. B. Pickett, H. L. Martin, and G. A. Diener

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

DISCLAIMER

WESTINGHOUSE SAVANNAH RIVER COMPANY NMP-RMT-910329, Rev.1

INTER-OFFICE MEMORANDUM

September 16, 1991
Revised July 6, 1992

RECORD AUTHENTICATED BY SIGNATURE Lawrence B. Johnson 7/27/92

TO: C. P. Thompson, 730-M
Reactor Materials Engineering and Technology

FROM: J. B. Pickett, H. L. Martin, and G. A. Diener, 730-M GAD
Reactor Materials Engineering and Technology

Toxicity Testing Results on Increased Supernate Treatment Rate of 3700 gallons/batch (U)

Summary

In July 1991, Reactor Materials increased the supernate treatment concentration in the M-Area Dilute Effluent Treatment Facility (DETF) from 2700 gallons of supernate per 36,000 gallon dilute wastewater batch to 3700 gallons/batch.

A series of whole effluent toxicity tests was conducted on the treated effluent from the DETF to determine if any chronic toxicity affects would be expected in the receiving stream(Tims Branch). The toxicity tests were conducted at instream concentrations equivalent to DETF release rates of 5, 10, 15, 20, and 25 gallons/min.

The test results, based on 7-day Ceriodaphnia dubia chronic toxicity, indicated no toxicity effects at any instream concentration tested. Supernate treatment in the DETF continued at the higher concentration.

The toxicity results are summarized below:

Toxicity Results, Average No. of Young					
Control	Effluent Tests				
24.0	24.6	23.4	22.5	23.5	24.0
	Test different From Control				
	No	No	No	No	No
	Instream Concentration, Vol. %				
	0.44	0.89	1.33	1.78	2.22
	DETF Release Rate, gpm				
	5	10	15	20	25

TABLE 2

M-AREA EFFLUENT TOXICITY TESTING, TREATED SUPERNATE

SUPERNATE BATCH NO. 56 (3700 GALS SUPERNATE/36,000 GALS WASTEWATER)

Date*	8/12/91	8/14/91	8/16/91
Time Sampled	1015	0930	0940
Flow rate, gpm	5	5	5
Collection location	M-004	M-004	M-004

*Sample collection dates for Chronic Toxicity Test Renewals
(Each sample was diluted by the testing laboratory to the concentrations equivalent to various DETF release rates)

7 Day Chronic Toxicity Test Results **
Average No. of Young

Control, 20% Perrier/ 80% Milli Q water		**24.0**				
Effluent toxicity results		**24.6**	**23.4**	**22.5**	**23.5**	**24.0**
Pass/Fail		Pass	Pass	Pass	Pass	Pass
"Instream" concentration*	%	0.44	0.89	1.33	1.78	2.22
Equivalent DETF release rate	gpm	5	10	15	20	25

* Assuming 1125 gpm (1.6 MGD) at A-014

**Toxicity testing by Normandeau Associates, Inc., New Ellenton, SC.

Normandeau Laboratory Results**

Sample Id	%	Control*	0.44*	0.89*	1.33*	1.78*	2.22*	100**
pH		7.82	7.68	7.8	7.83	7.84	7.84	7.50
Temp.	°C	24.5	24.1	24.3	24.7	24.5	24.3	-
Alkalinity	(ppm CaCO3)	64.3	-	-	-	-	65.4	53.3
Hardness	(ppm CaCO3)	80.3	-	-	-	-	81	4.33
Conductivity	(mS/cm)	0.186	0.289	0.364	0.461	0.577	0.671	16.3
Dissolved Oxygen	mg/L	7.53	7.38	7.46	7.32	7.25	7.39	-
Total Residual Cl	mg/L	-	-	-	-	-	-	0.03

The Normandeau lab. results are the average of 7 analyses (*) and 3 analyses (**), respectively

320-M Lab. Analyses on Equalization Tank and Release Tank Samples#

		Equalization Tank	Effluent#
Date sampled (Batch No. 56)		7/30/91	8/5/91
Time sampled		1250	0824
320 Lab. Id. No.		9100042	9100057
pH		8.25	7.49
Tot. Suspended solids	mg/L	2065	6.0
Al	mg/L	384	0.44
B	mg/L	2.65	1.81
Cd	mg/L	<0.002	0.004
Cr	mg/L	0.25	0.015
Cu	mg/L	0.042	0.008
Fe	mg/L	3.72	0.14
Ni	mg/L	0.060	0.021
Pb	mg/L	0.053	<0.013
Sn	mg/L	0.078	<0.005
Zn	mg/L	0.62	0.048
U	mg/L	<0.01	0.01
NITRATE (as N)	mg/L	1910.0	1410.0
PHOSPHATE (as P)	mg/L	251.0	9.3
CHLORIDE	mg/L	30	-
SULFATE(as S)	mg/L	2295	-

#A grab sample from the DETF release hold tank.

ATTACHMENTS

1. NORMANDEAU Report, M. Harmon to J. B. Pickett, 9/6/91, 12 pages.

2. LETF Discharge Analyses for Batch 56, 5 pages.

3. G. A. Diener to F. M. Harter, "Processing Batches with 3700 Gallons of Supernate (U)," 7/19/91, 1 page.

ATTACHMENT I

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Normandeau Associates, Inc.
P.O. Box 1393
Aiken, SC 29802
(803) 652-2206
(803)652-7428 (Fax)

NORMANDEAU ASSOCIATES

6 September 1991

John Pickett
Westinghouse Savannah River Co.
Building 730 - M
PO Box 616
Aiken, SC 29802

Dear John:

Enclosed please find copies of tables summarizing the results of the 5 SC Pass/Fail chronic toxicity tests. This contract specifies that we perform only SC chronic toxicity tests and the price we quoted reflects the level of effort associated with performing and reporting these test results. The tables that I've submitted are adopted from those used by the state of State Carolina to summarize these tests. I've provided the chemistry data in more detail than would have appeared on the SC form; chemistry data is summarized in Tables 6 and 7. As you can see, no chronic effect was indicated at any of the concentrations tested.

Please contact me if I can answer any questions you might have regarding these data.

Sincerely,

Michele Harmon

Michele Harmon
Laboratory Supervisor
Aquatic Toxicology

MH/md

Table 2. Summary of observations made during a 7-day Ceriodaphnia dubia chronic toxicity test performed on an effluent sample from the M004 outfall located on the Savannah River Site. Laboratory water (20% Perrier/Milli-Q water) served as the control and diluent for this test. A 0.89% effluent solution was tested. 13 - 20 August 1991.

	Control		Effluent	
Replicate	Adult (L/D)	# of Young	Adult (L/D)	# of Young
1	L	23	L	17
2	L	28	L	23
3	L	25	L	28
4	L	22	L	23
5	L	24	L	24
6	L	25	L	26
7	L	29	L	23
8	L	26	L	24
9	L	12	L	13
10	L	26	L	20
11	L	25	L	22
12	L	23	L	22
13	L	27	L	26
14	L	21	L	25
15	L	22	L	25
16	L	23	L	26
17	L	28	L	29
18	L	19	L	31
19	L	27	L	22
20	L	24	L	18

Mean number of young:	24.0	23.4
Standard deviation:	3.80	4.18

Results	% Mortality	# Young
Control:	0	24.0
Effluent:	0	23.4
Statistical Test:	Fisher's	t-Test
Pass/Fail:	Pass	Pass

Table 4. Summary of observations made during a 7-day Ceriodaphnia dubia chronic toxicity test performed on an effluent sample from the M004 outfall located on the Savannah River Site. Laboratory water (20% Perrier/Milli-Q water) served as the control and diluent for this test. A 1.78% effluent solution was tested. 13 - 20 August 1991.

	Control		Effluent	
Replicate	Adult (L/D)	# of Young	Adult (L/D)	# of Young
1	L	23	L	17
2	L	28	L	27
3	L	25	L	22
4	L	22	L	25
5	L	24	L	28
6	L	25	L	24
7	L	29	L	25
8	L	26	L	26
9	L	12	L	26
10	L	26	D	3
11	L	25	L	19
12	L	23	L	23
13	L	27	L	28
14	L	21	L	27
15	L	22	L	13
16	L	23	L	25
17	L	28	L	31
18	L	19	L	28
19	L	27	L	27
20	L	24	L	26
Mean number of young:		24.0		23.5
Standard deviation:		3.80		6.39

Results	% Mortality	% Young
Control:	0	24.0
Effluent:	5	23.5
Statistical Test:	Fisher's	t-Test
Pass/Fail:	Pass	Pass

Table 6. Summary of initial basic water chemistry for a 7-d Ceriodaphnia dubia chronic static renewal toxicity test conducted on effluent discharged from NPDES Outfall M004 located on the Savannah River Site. Values are the mean, standard deviation, range and number of observations. Dilute mineral water served as the control and diluent. 13 - 20 August 1991.

Concentration (%)	Dissolved Oxygen (mg/L)	Temperature (°C)	pH	Conductivity (mS/cm)	Alkalinity (mg/L)[a]	Hardness (mg/L)[a]	Total Residual Chlorine (mg/L)
Control	7.53 ± 0.22 (7.23-7.76) n = 7	24.5 ± 0.60 (24.0-25.8) n = 7	7.82 ± 0.14 (7.60-8.00) n = 7	0.186 ± 0.006 (0.180-0.195) n = 7	64.3 ± 2.1 (61.0-67.0) n = 7	80.3 ± 0.8 (79.0-81.0) n = 7	--
0.44	7.38 ± 0.14 (7.21-7.56) n = 7	24.1 ± 0.11 (24.0-24.3) n = 7	7.68 ± 0.11 (7.50-7.80) n = 7	0.289 ± 0.025 (0.250-0.330) n = 7	---	---	--
0.89	7.46 ± 0.21 (7.22-7.76) n = 7	24.3 ± 0.33 (24.0-24.9) n = 7	7.80 ± 0.10 (7.60-7.90) n = 7	0.364 ± 0.011 (0.350-0.380) n = 7	---	---	--
1.33	7.32 ± 0.14 (7.11-7.56) n = 7	24.7 ± 0.56 (24.0-25.5) n = 7	7.83 ± 0.10 (7.65-7.95) n = 7	0.461 ± 0.013 (0.440-0.480) n = 7	---	---	--
1.78	7.25 ± 0.21 (6.99-7.62) n = 7	24.5 ± 0.43 (24.0-25.3) n = 7	7.84 ± 0.11 (7.65-8.00) n = 7	0.577 ± 0.026 (0.550-0.600) n = 7	---	---	--
2.22	7.39 ± 0.34 (6.92-8.04) n = 7	24.3 ± 0.21 (24.0-24.6) n = 7	7.84 ± 0.12 (7.65-8.00) n = 7	0.671 ± 0.064 (0.600-0.800) n = 7	65.4 ± 3.6 (61.0-72.0) n = 7	81.0 ± 1.4 (80.0-84.0) n = 7	
100	---	---	7.50 ± 0.11 (7.40-7.60) n = 3	16.3 ± 2.1 (14.0 - 18.0) n = 3	53.3 ± 1.2 (52.0-54.0) n = 3	4.33 ± 0.58 (4.0 - 5.0) n = 3	0.03 ± 0.02 (<0.02-0.05) n = 3

[a]mg/L as $CaCO_3$

ATTACHMENT 2 page 7 of 12

NAI AT Report No. : 12808.02

Report Title: SC Pass/Fail Chronic Toxicity Test

Performed for: Westinghouse Savannah River Company
Building 730 - M
Aiken, SC 29802

Prepared by: Normandeau Associates, Inc.
P.O. Box 1393
Aiken, SC 29802

Prepared By _____ 9-6-91 Date

Reviewed By _____ 9-7-91 Date

OSR 4-423

ENVIRONMENTAL COLLECTIONS CHAIN OF CUSTODY RECORD

~~FMA~~ NAI

Distribution Vendor
Lab Receiving Samples
File, 735-A

PROJECT NAME: Westinghouse (SRS)

SAMPLERS (SIGNATURE): J Piers

STA NO	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS	SAMPLE ANALYSIS (✓) HAZ WASTE WELLS	VOL ORGANICS	PESTICIDES/ HERBICIDES	TOTAL COLIFORM (400-D)	NITRATE (735-A)	GROSS β (736-A)	TDS, ETC (COOL) 735-A (✓)	TOXICITY		REMARKS
	8-14-91	0930		✓	M-004	1								✓		Special Sample

ATTACHMENT 2, Page 11 of 12

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)
J Piers	8-14-91	1310	
RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)
RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY LAB BY (SIGNATURE)

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)
RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)
DATE	TIME	REMARKS	

ATTACHMENT 2

page 2 of 5

BUILDING 341-M DISCHARGE ANALYSIS

Filtrate Tank No.		2	3	2	1	3	2	
Discharge Started	Date	7/30/91	8/3/91	8/6/91	8/12/91	8/19/91	8/27/91	
	Time	8:35 AM	12:20 PM	10:38 PM	1:00 AM	12:01 AM	12:03 AM	
Discharge Ended	Date	8/3/91	8/4/91	8/9/91	8/17/91	8/26/91	8/28/91	
	Time	11:20 AM	7:20 AM	5:10 PM	11:35 PM	10:15 AM	9:00 AM	
Δt, hours		98.7	19.0	66.5	142.6	178.2	33.0	NPDES
Volume, gal		58,610	46,324	58,963	42,707	47,923	18,615	Maximum
Discharge Rate, gpm		9.9	40.6	14.8	5.0	4.5	9.4	Daily
pH		7.63	7.71	7.51	7.49	7.65	7.65	Limits
								6 - 10
TSS	mg/L	1.00	3.20	4.00	6.00	1.29	1.20	60
	Tot. Kg	0.22	0.56	0.89	0.97	0.23	0.08	-
	Kg/day	0.05	0.71	0.32	0.16	0.03	0.06	-
Aluminum	mg/L	0.152	0.593	0.867	0.437	0.111	0.471	6.43
	Tot. Kg	0.034	0.104	0.193	0.071	0.020	0.033	-
	Kg/day	0.008	0.131	0.070	0.012	0.003	0.024	2.080
Cadmium	mg/L	0.002	< 0.002	0.032	0.004	< 0.002	< 0.002	< 0.1
	Tot. Kg	0.0004	< 0.0004	0.0071	0.0006	< 0.0004	< 0.0001	-
	Kg/day	0.0001	< 0.0004	0.0026	0.0001	< 0.0000	< 0.0001	0.04
Chromium	mg/L	0.013	0.004	0.008	0.015	0.009	< 0.002	1.24
	Tot. Kg	0.0029	0.0007	0.0018	0.0024	0.0016	< 0.0001	-
	Kg/day	0.0007	0.0009	0.0006	0.0004	0.0002	< 0.0001	0.4
Copper	mg/L	0.004	0.040	0.006	0.008	0.003	< 0.002	0.42
	Tot. Kg	0.0009	0.0070	0.0013	0.0013	0.0005	< 0.0001	-
	Kg/day	0.0002	0.0089	0.0005	0.0002	0.0001	< 0.0001	0.1
Lead	mg/L	< 0.013	0.025	< 0.013	< 0.013	0.021	< 0.013	0.69
	Tot. Kg	< 0.0029	0.0044	< 0.0029	0.0021	0.0038	< 0.0009	-
	Kg/day	< 0.0007	0.0055	< 0.0010	0.0004	0.0005	< 0.0007	0.2
Nickel	mg/L	0.020	0.026	0.023	0.021	0.013	0.005	2.46
	Tot. Kg	0.0044	0.0046	0.0051	0.0034	0.0024	0.0004	-
	Kg/day	0.0011	0.0058	0.0019	0.0006	0.0003	0.0003	0.8
Tin	mg/L	0.012	< 0.005	0.029	< 0.005	0.030	0.011	0.69 *
	Tot. Kg	0.0027	< 0.0009	0.0065	< 0.0008	0.0054	0.0008	-
	Kg/day	0.0006	< 0.0011	0.0023	< 0.0001	0.0007	0.0006	0.23 *
Zinc	mg/L	0.021	0.054	0.033	0.048	0.023	0.075	0.64
	Tot. Kg	0.005	0.009	0.007	0.008	0.004	0.005	-
	Kg/day	0.001	0.012	0.003	0.001	0.001	0.004	0.2
Uranium	mg/L	0.02	< 0.01	0.04	0.01	0.24	< 0.01	1 *
	Tot. Kg	0.004	< 0.002	0.009	0.002	0.044	< 0.001	-
	Kg/day	0.001	< 0.002	0.003	0.0003	0.006	< 0.001	-
Nitrates (as N)	mg/L	1245.6	622.7	88.4	1410.7	514.3	978.1	1355 *
	Tot. Kg	276.3	109.2	19.7	228.0	93.3	68.9	-
	Kg/day	67.2	137.9	7.1	38.4	12.6	50.2	388 *
Phosphates (as P)	mg/L	6.10	3.10	0.50	9.30	3.70	6.90	17.6 *
	Tot. Kg	1.35	0.54	0.11	1.50	0.67	0.49	-
	Kg/day	0.33	0.69	0.04	0.25	0.09	0.35	5.43 *

* Discharge Guideline

ATTACHMENT 2, page 3 of 5

SRP SPECTROCHEMICAL ANALYSIS

LAB NO.: 9100042

ELEMENT	PPM	ELEMENT	PPM	ELEMENT	PPM	ELEMENT	PPM
Ag		Al	384.6	As		Au	
B		Ba	2.65	Be		Bi	
Ca		Cd	<.002	Ce		Co	
Cr	0.250	Cs		Cu	0.042	Dy	
Er		Eu		Fe	3.715	Ga	
Gd		Ge		Hf		Hg	
Ho		In		Ir		K	
La		Li		Lu		Mg	
Mn		Mo		Na		Nb	
Nd		Ni	0.060	Os		P	
Pb	0.053	Pd		Pr		Pt	
Rb		Re		Rh		Ru	
Sb		Sc		Se		Si	
Sm		Sn	0.078	Sr		Ta	
Tb		Te		Th		Ti	
Tl		Tm		U		V	
W		Y		Yb		Zn	0.624
Zr							

REMARKS:

ATTACHMENT 2, page 5 of 5

SRP SPECTROCHEMICAL ANALYSIS

LAB NO.: 9100057

ELEMENT	PPM	ELEMENT	PPM	ELEMENT	PPM	ELEMENT	PPM
Ag		Al	0.437	As		Au	
B	1.809	Ba		Be		Bi	
Ca		Cd	0.0042	Ce		Co	
Cr	0.0147	Cs		Cu	0.0084	Dy	
Er		Eu		Fe	0.1355	Ga	
Gd		Ge		Hf		Hg	
Ho		In		Ir		K	
La		Li		Lu		Mg	
Mn		Mo		Na		Nb	
Nd		Ni	0.0210	Os		P	
Pb	<0.013	Pd		Pr		Pt	
Rb		Re		Rh		Ru	
Sb		Sc		Se		Si	
Sm		Sn	<0.005	Sr		Ta	
Tb		Te		Th		Ti	
Tl		Tm		U		V	
W		Y		Yb		Zn	0.0483
Zr							

REMARKS:

ATTACHMENT 3 Page 1 of 1

SAVANNAH RIVER SITE

REACTOR MATERIALS

TOTAL QUALITY

WESTINGHOUSE SAVANNAH RIVER COMPANY

INTER-OFFICE MEMORANDUM

July 19, 1991

TO: F. M. Harter, 305-1M

FROM: G. A. Diener, 730-M

Processing Batches with 3700 Gallons of Supernate (U)

This memo provides guidance for processing batches 55 and 56. Batch 55 will contain no supernate and batch 56 will contain 3700 gallons of supernate per 36,000 gallon wastewater batch which is equal to the supernate concentration in batch 54 now being filtered.

No supernate was added to batch 55 in equalization tank 1. However, due to the problems we encountered with batch 54, equalization tank 1 contains some supernate and polymer recycled from the floc tank during polymer optimization. To destroy the excess polymer in equalization tank 1, please lower the pH to 2 or less. Allow the wastewater to remain at a pH of 2 for at least 1 hour before neutralizing the tank. Waste acid and caustic can be used for all pH adjustments. I do not think we will need to add alum to batch 55, but test the phosphate concentration per procedure when the tank is full.

Batch 55 also contains 12 gallons of Cimcool from Building 321-M (dumped on 7/19/91). Jack Musall and I performed treatability tests on the Cimcool and found no adverse affects to the DETF process. Please ensure that this is put on the batch sheets for future reference.

The operators should process batch 55 using a 1.5-to-1 weight ratio filter aid-to-TSS in the equalization tank. Polymer dosage should be approximately 10 - 12 ml polymer per 100 gallons of wastewater However, some optimization may be required.

For batch 56, when the equalization tank is at 30%, please transfer 3700 gallons of supernate into the tank. Lower the pH to 2.3, and add 190 gallons of alum (this is a calculated amount, more alum may be needed). Then, fill the tank to 70% with dilute wastewater and test the phosphate concentration in the filtrate. If the phosphate concentration is 30 ppm or less, neutralize the tank to 8 - 8.5 pH. Please resume routine use of waste acid and waste caustic with this batch.

At the beginning of filtration, the operators should start at a 1.5-to-1 weight ratio filter aid-to-TSS in the equalization tank and the polymer dosage should start at 25 ml polymer per 100 gallons of wastewater. Lee and I will be present during the initial optimization. Hopefully, batch 56 will filter better than batch 54.

Please analysis the filtrate from batch 56 and begin discharge at 5 gpm on August 12. Chronic toxicity samples are scheduled to be collected from outfall M-004 on August 12, 14, and 16.

If you have any questions, please call me at ext. 5-4197.

END

DATE
FILMED
11/12/92