Results of Toxicity Studies Conducted on Outfall X-08 and Its Contributing Waste Streams, November 1999 - June 2000

by

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**RESULTS OF TOXICITY STUDIES CONDUCTED ON
OUTFALL X-08 AND ITS CONTRIBUTING WASTE STREAMS,
NOVEMBER 1999 - JUNE 2000**

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Forward

This interim report summarizes the results of toxicity tests, Toxicity Identification Evaluations, and chemical analyses that have been conducted on SRS's NPDES Outfall X-08 and its contributing waste streams between November 1999 and June 2000. A final report will be issued when the toxicant and its source have been identified.

Executive Summary

The Savannah River Site's Outfall X-08 failed acute toxicity tests conducted on 33% effluent in October and November 1999. Toxicity investigations were initiated in November 1999 to identify the cause of the toxicity failures. The results of toxicity tests conducted on contributing waste streams to the indicate that the Effluent Treatment Plant (ETP), which discharges via Outfall X-8B, is clearly responsible for the observed toxicity. The toxicity failures began immediately a cooling tower was taken off-line, which reduced the volume of water being treated by the ETP and increased the holding time of water in the treatment tanks.

Extensive toxicity testing has been performed on samples collected at various points within the ETP. Most of the data indicate that the toxicity is produced within the ETP treatment tanks, which suggests that the toxicity is due to a degradation product that is produced in the tanks. A study is in progress to monitor the toxicity as a treatment tank fills over the course of four weeks. However, a recent set of test results indicated that the collection sump that feeds to the treatment tanks was also toxic. These results indicate that there may also be an intermittent source of toxicity in the wastewater that is treated by the ETP.

Two Phase I TIEs have been performed on the toxic effluent. The results of the first TIE indicated that filtration at pH 11 and C-18 SPE at initial pH were the only treatments that removed toxicity. The results of the second TIE indicated that C-18 SPE and EDTA remove toxicity, and filtration at pH 11 reduced, but did not eliminate toxicity. The results of a methanol elution extraction indicate that the toxicity is contained in the 80 to 95% methanol fractions, and that the 85% fraction contains approximately half of the toxicity. These results indicate that the toxicity is most likely due to a non-polar organic. A GC/MS scan of the 85% methanol fraction detected no organics present in toxic concentrations. An LC/MS scan of fresh and aged tank samples indicates that two groups of unknown organics are present in higher concentrations in aged samples than in fresh samples. The LC/MS data are presently being interpreted by chemists at SRS to attempt to identify the organic compounds of interest. At this time it seems most likely that the toxicant is present in a group of compounds that have molecular weights ranging from 900 to 1350, that the toxicant may contain an amine, and that it is probably a polymer, and possibly a polyethylene glycol.

Because EDTA also was effective in removing the toxicity and Outfall X-08 had a problem with toxic levels of zinc several years ago, analyses for zinc, as well as a suite of other metals were performed. The metals data indicate that zinc is the only metal found in elevated concentrations. A zinc spiking study was performed to determine the concentration of zinc that is toxic in the X-08 effluent, and the results indicate an LC50 for zinc of 300 µg/l. Based on these results, zinc is not present at Outfall X-08 in concentrations that would be acutely toxic in 33% effluent.

Toxicity testing performed on samples collected in the X-08 effluent ditch downstream from the compliance point and in the Savannah River indicate that toxicity is removed in the effluent ditch and does not reach the river. Therefore, the discharge is not impairing the biota of the receiving stream.

Our conclusions to date are that the toxicity appears to be due to the degradation of a nonpolar organic chemical that is occurring in the treatment tanks of the Effluent Treatment Plant. A thorough investigation of organic chemicals that are used at TNX indicates that no nonpolar organics are disposed of in laboratory drains. To date, we have found no cleaning products used at TNX that should be toxic at the concentrations that would be present in the wastewater. A sublation test performed on a toxic sample of tank water indicated that toxicity was not reduced by sublation, which indicates that the toxicity is probably not due to the presence of a surfactant. This conclusion is further substantiated by the results of a GC/MS scan that did not reveal the presence of organic surfactants or their degradation products. Further studies are in progress to identify the toxicant and its source.

1.0 Background Information

TNX is a small research facility located near the Savannah River along the western border of SRS. In all, approximately 50 to 60 people work at TNX. Operations at TNX include 11 chemistry laboratories/modules that are involved in preparation of waste for immobilization, and three microbiological laboratories that are involved in biotechnology research. Although numerous chemicals are used in the laboratories, most are collected as hazardous waste and are not released to laboratory drains. Chemicals that do reach the drain system, and ultimately the X-08 outfall, include small amounts of cleaning products (dish detergent, and cleansers) and very small volumes of alcohols, acetone, biological stains, and bacterial culture media. Other activities at TNX include pilot scale and mock-up operations in support of various site missions and general infrastructure operations to provide support utilities and distribution systems (electrical, plant air, water and steam). Much of the work that was previously performed at TNX has been relocated to other areas at SRS. WSRC is continuing to shut down and close facilities at TNX that are no longer required to support site missions, and it is anticipated that the volume of effluent discharged via Outfall X-08 will undergo further reductions in the future.

Outfall X-08 receives noncontact cooling water, domestic well overflow, treated sanitary wastewater from outfall X-8A, treated process water from the TNX Effluent Treatment Plant (ETP) via Outfall X-8B, air stripper effluent via X-8C, and stormwater (Figure 1). Within the past 8 months, there have been two significant changes in effluent contributions to the X-08 outfall. In September 1999, a major source of cooling tower blowdown that had been routed to the ETP was eliminated when use of the cooling tower was discontinued. This change reduced the volume of water treated by the ETP substantially, and increased the residence time of water in the ETP treatment tanks from approximately one week to three or four weeks (depending upon the volume of stormwater treated by the ETP). X-08 began failing toxicity tests immediately after the cooling tower flow to the ETP was discontinued. As shown in Figure 2, wastewater to the ETP flows through a grit chamber and into a collection sump, where it is pumped to one of two 30,000 stainless steel tanks that are open at the top. Wastewater accumulates in a tank until the tank is full, at which time the pH of the water is adjusted if necessary (pH adjustment is rarely needed), using sodium hydroxide or sulfuric acid. The water in a tank is then pumped to a clarifier, where a flocculant (JayFloc 842) is

Figure 1. Schematic of Contributing Waste Flows to Outfall X-08

Figure 2. Schematic of TNX Effluent Treatment Plant (ETP)

added. The treated water flows through the clarifier and is discharged via the X-8B outfall. From X-8B, the water is piped for a distance of approximately 200 meters to the X-08 outfall. The ETP operates in a batch discharge mode, with a batch discharge consisting of approximately 20,000 gallons of treated effluent that is discharged at a rate of 80 gallons/minute. When a batch discharge occurs, X-8B comprises approximately 25% of the discharge volume at X-08. Since acute toxicity tests on X-08 effluent are run on 33% effluent, the concentration of X-8B water in a toxicity test is 8.25% ($25\% \times 33\%$).

The second operational change at TNX occurred in April 2000, when a process well that provided water to TNX failed, and chlorinated water was substituted for the well water for a short period of time. This change resulted in the addition of chlorinated water to Outfall X-08 and resulted in toxicity failures in March and April 2000. The process well was put back into service in mid-June and it is anticipated that there will be no further discharges of chlorinated water to the X-08 outfall.

2.0 Methods

All toxicity testing, TIE's, and chemical analyses were conducted following approved EPA methods. With the exception of GC/MS and LC/MS analyses, all analyses were conducted by SCDHEC-certified laboratories (ETT Environmental and Shealy Environmental). GC/MS analyses were performed by the Analytical Development Section of WSRC's Savannah River Technology Center; LC/MS analyses were performed by the University of Georgia's Savannah River Ecology Laboratory.

3.0 Results

Sections 3.1 through 3.3 discuss the results of the toxicity tests, Toxicity Identification Evaluations, and chemical analyses that have been performed on Outfall X-08 and its contributing waste streams since October 1999. Toxicity results are summarized in Table 1; metal results are summarized in Table 2. Subcontractor reports containing the results of toxicity tests and chemical analyses are organized in three appendices (toxicity tests, TIE's, and chemical analyses) to this report.

3.1 Toxicity Tests

Since X-08 failed a routine acute toxicity test in October 1999, numerous toxicity tests have been performed on X-08 and its contributing waste streams. Table 1 describes the toxicity tests that have been performed, the rationale for conducting the tests, and the results/conclusions of the tests.

The major findings from the toxicity tests are:

- Of the five major waste streams that contribute to X-08, only X-8B (effluent from the Effluent Treatment Plant) is toxic.
- The influent to the ETP is usually not toxic; the effluent from the ETP is almost always very toxic. More specifically, the influent to the ETP treatment tanks is usually not toxic; the effluent from the treatment tanks is very toxic. The only chemicals added to the treatment tanks are sodium hydroxide and sulfuric acid, which are used to adjust pH. However, pH adjustment is rarely needed (only twice in the past year).

Table 1. Summary of Toxicity Tests Conducted on the X-08 Outfall and Its Contributing Waste Streams, October 1999 - June 2000

DATE	LOCATION	ACTION	RATIONALE	RESULTS/CONCLUSIONS
10/6/99	X-08	Routine monthly toxicity test on 33% effluent	Required for monthly NPDES compliance	Acute toxicity. This is the first time X-08 has failed a toxicity test since corrective actions were completed in 1997 to reduce zinc concentrations at the outfall
10/12/99	X-08	Retesting of outfall	Determine if outfall is toxic	Pass. Resume monthly testing
11/8/99	X-08	Routine monthly toxicity test on 33% effluent	Required for monthly NPDES compliance	Acute toxicity. Studies will be initiated to determine the cause of the cause of the toxicity.
11/99	X-08	Initiate Phase I TIE	Identify toxicant	Toxicity was removed by filtration at pH 11 and by C-18 SPE. Most likely toxicants include non-polar organics and non-chelatable metals (Al, Cr, As, Se). Metal analyses indicate that none of these metals are present in toxic concentrations.
12/13/99	X-08, X-8A, X-8B, X-8C, clear water overflow, noncontact cooling water	Perform toxicity tests on waste streams that contribute to X-08	Identify which waste streams are toxic	X-8A pass; X-8B fail; X-8C marginally toxic; clear water overflow pass; noncontact cooling water pass. Conclusions - X-8B (ETP) and possibly X-8C (airstripper) are responsible for the toxicity at X-08.
1/4/00	ETP grit chamber, collection sump, Tank 1, Tank 2, Buildings 772, 672, X-8B	Perform toxicity tests at locations within the ETP and buildings that contribute wastewater to the ETP	Identify source of toxicity within the ETP	Grit chamber, collection sump, and 672 passed; remaining locations failed, with 95-100% mortality. What goes into the holding tanks is not toxic; what comes out is. This suggests an intermittent source of toxicity or that toxicity increases in the holding tanks.
1/12/00	X-08, X-8B and Tank 2	Perform toxicity tests on X-08, X-8B and Tank 2	Re-examine toxicity within the ETP	X-08 was not toxic. X-8B and Tank 2 were toxic. A re-examination of travel times of water from X-8B to X-08 indicate that X-8B effluent had probably not reached X-08 when X-08 was sampled.
1/13/00	ETP Collection Sump	The ETP operator noticed foam in the ETP collection sump. Samples were collected and analyzed for organic surfactants and toxicity	Determine if this foamy sample is responsible for ETP toxicity, which would suggest that the toxicity is due to intermittent inputs of cleaning products	Sample was not toxic; no organic surfactants were detected by GC/MS. Foam in the collection sump does not appear to be related to ETP toxicity.
1/23/00	X-08	Perform toxicity tests on effluent filtered through a 0.45 u filter and effluent filtered by C-18 SPE	to determine if SPE is more effective than normal filtration at removing toxicity	Both treatments slightly reduced toxicity, but neither treatment removed toxicity.
1/27/00	X-08, X-8B and Tank 2	Perform toxicity tests on X-08, X-8B and Tank 2	Re-examine toxicity within the ETP	All three locations were toxic, which indicates that X-8B is responsible for the toxicity at X-08.

Table 1. Summary of Toxicity Tests Conducted on the X-08 Outfall and Its Contributing Waste Streams, October 1999 - June 2000

2/16/00	X-8C, Air Comp Coating water, well overflow, and X-08	Perform toxicity tests at these locations	X-8C was marginally toxic during earlier testing. Determine if X-8C and other minor contributors to X-08 are contributing to the toxicity	None were toxic. These sources do not contribute to the toxicity at X-08
2/22/00	ETP grit chamber	Perform toxicity test on "milky" sample	The ETP operator noticed a milky blue color in the grit chamber. A sample was collected to determine if this might be an intermittent source of toxicity to the ETP	The sample was not toxic.
2/00	ETP Collection Sump (composite), Tank 1	Toxicity tests on composited sample from Collection sump collected during the same time period that a tank was filling; metal analyses (Al, Fe, Cu, Zn) on Tank 1	Determine if there is an intermittent source of toxicity in ETP influent; determine if there are toxic levels of metals in Tank 1	Neither the composited collection sump sample nor Tank 1 were toxic. Tank 1 metals results Al - 50 ug/l; Fe 92 ug/l; Cu - 5 ug/l; Zn - 701 ug/l. Zinc is the only metal present in potentially toxic concentrations.
3/6/00	X-8B	Phase I TIE	Confirm results of TIE conducted on X-08	Toxicity was removed by EDTA and C-18 SPE and toxicity was reduced by filtration at pH 11 and C-18 at pH 9.
3/27/00	X-8B	Sublation test on sample collected on 3/6/00	Determine if toxicity may be due to surfactants	This test was run on a portion of the same batch of water that was used for the TIE. Sublation did not reduce toxicity, which indicates that the toxicity is probably not due to surfactants
3/29/00	Tank 1, with and without Jayfloc; X-08B	Acute toxicity tests	Determine if Jayfloc (floculant used in ETP clarifier) is contributing to the toxicity	Tank 1 - LC50 <1.03%; Tank 1 w/Jayfloc LC50 = 1.67%; X-08B LC50 <1.03%. These results indicate that Jayfloc does not contribute to the toxicity and may decrease toxicity slightly.
4/17/00	X-8B	Methanol elution test on sample collected on 3/6/00	Determine if toxicity may be due to nonpolar organics	The 80, 85, 90, and 95% methanol elutions were toxic, with the 85% elution being the most toxic (it contained ~50% of the toxicity). These results strongly suggest that the toxicity is due to a relatively non-polar organic
4/00	X-8B	GC/MS	Identify organic compounds present in the 85% methanol fraction	A second methanol elution was performed on the same batch of effluent used for the first set of elutions and a GC/MS scan was performed to try to identify the organic compound(s) responsible for the toxicity. No organic chemicals were identified in toxic concentrations
4/20/00	Tank 2	Toxicity test	Determine toxicity of Tank 2	LC50 is 12.5%
5/3/00	X-08 Zn spiking study	Spike X-08 with zinc	Determine the LC50 of zinc in X-08 effluent when ETP is not discharging to determine if zinc is contributing to the toxicity of X-08	48 hr LC50 for zinc in X-08 effluent is 300 ug/l. Maximum concentration of zinc in ETP is 1000 ug/l, which equates to 82.5 ug/l at X-08. Even though zinc is elevated, the maximum concentration of zinc expected at X-08 is well below the LC50.

Table 1. Summary of Toxicity Tests Conducted on the X-08 Outfall and Its Contributing Waste Streams, October 1999 - June 2000

5/9/00 and 5/10/00	Collection sump, Tank 1 and Tank 2 heel	Toxicity tests	Past studies have indicated that the collection sump is not toxic, but that the tanks are. This set of studies examines the toxicity of the collection sump as it begins to flow into a drained tank (Tank 2), as well as the toxicity of Tank 1 as it begins to drain, the water remaining in Tank 2 as it begins to fill	Collection sump LC50 = 5%; Tank 1- LC50 = 2.7%; Tank 2 heel LC50 = 1.91%. These results indicate that all three waters are toxic, but the oldest water is most toxic.
5/10/00	Tank 1	Algal analysis	Determine if toxin-producing algae are present in the ETP tanks	Algal densities were high (>1 million cells/ml). Dominant species were the diatom, <i>Achnanthes minutissima</i> and the green alga, <i>Scenedesmus</i> abundans. While these species are pollution tolerant, they are not known to produce toxins. Therefore, it is unlikely that the toxicity in the tanks is due to the production of algal toxins.
5/17 to 6/14	Tank 2	Weekly toxicity tests	Determine if tank toxicity changes over time	In order to determine if tank toxicity changes over time, samples were collected weekly as a tank fills. However, since a considerable amount of water is routinely left in a tank when it drains, it was not possible to follow changes in toxicity over time. However, the data that were collected indicate that the tank water was relatively toxic for the first two weeks (LC50's ~ 9%). Toxicity decreased in Week 3 (LC50>16.5%, and then increased somewhat in Week 4 (LC50 = 6%).
5/23/00	X-08, with X-8B discharging, X-8A, X-8B, X-8C, X-08 drainage ditch (2 locations, Savannah River upstream and downstream from X-08 discharge)	Pass/Fail acute toxicity tests	Confirm that other contributing waste streams (X-8A and X-8C) are not toxic; determine that river is not impacted by X-08 discharge; determine if toxicity decreases in the discharge ditch between X-08 and the river	X-8A and X-8C were not toxic. X-8B and X-08 were toxic. The two locations sampled in the effluent ditch and the two samples collected from the river were not toxic. These tests confirm that X-8B is the sole source of toxicity at X-08 and that X-08 is toxic when X-8B is discharging. Toxicity seems to dissipate very quickly once the effluent contacts the sediment in the effluent ditch (possibly due to binding to clays or organic particles). X-08 is not impacting the mixing zone in the Savannah River.
5/31/00	Collection sump composite sample	Toxicity test	Determine if there may be an intermittent source of toxicity in the collection sump that is missed by grab sampling	LC50 > 16.5% effluent. A composite sampled from the collection sump does not display the same degree of toxicity as water in the ETP tanks. This suggests that the toxicity is being generated in the tanks.
6/7 to 7/5	Tank 1	Weekly toxicity tests	Determine if tank toxicity changes over time	Tank 1 was drained completely and samples for toxicity testing are being collected weekly. Results for Week 1 indicate that the tank water was very toxic (LC50 <2.06%)

Table 2. Results of Analyses for Metals (ug/l) and CTAS (mg/l) at Various TNX Locations, October 1999 - May 2000

Date	10/7/99	1/4/00	1/12/00	1/12/00	2/8/00	2/9/00	2/9/00	2/9/00	3/6/00	3/28/00	3/28/00	3/28/00	4/18/00	4/18/00	4/18/00	4/18/00	4/18/00	5/8/00	5/8/00	5/8/00
Location	X-08	X-08B	X-8B	Tank 2	Coll. sump	Grit chamber	Tank 2	Tank 2	X-8B	Tank 1	Tank 1	X-08B	904-Sump	Tank 2	X-08	X-08 w/o X-8B	Eq. Tank w/o dike sump	Coll. sump	Tank 2 heel	Tank 1
Parameter																				
aluminum	350					394	88		50	140	<50	<50								
antimony	<5									<5										
arsenic	<5									<5										
barium	42																			
beryllium	<4									<4										
cadmium	<2									<2										
calcium	4700																			
chromium	<5					<5	<5			<5										
cobalt	<25					41	37		5	43	50	32	16	57	12	<10				
copper	<5					102	<50		92	340	348	255								
iron	170																			
lead	<3									<3										
magnesium	890									390										
manganese	27									32										
mercury										1.2				0.36	<0.2	<0.2				
nickel	<10					6	7			<10										
potassium	3000																			
selenium	<5									<5										
silver	<5									<5										
thallium	<50									<100										
titanium	<50																			
vanadium	<50																			
zinc	50	530		850		253	703	1000	646	740	602	413	763	889	278	70	2740	1140	565	540
CTAS					<1															

- The toxicity of wastewater in the treatment tanks increases over time.
- The treatment tanks contain algae, but are not dominated by species known to produce toxins. The toxicity does not appear to be due to algal toxins.
- The only other chemical used in the ETP is a flocculant (JayFloc 842) that is added to the clarifier, which is located downstream from the treatment tanks. Toxicity tests conducted on the flocculant and on influent and effluent from the clarifier indicate that the flocculant does not contribute to the toxicity and that the toxicity of clarifier effluent is slightly lower than clarifier influent.
- Toxicity disappears rapidly in the X-08 effluent ditch downstream from the compliance sampling location, which suggests that the toxicant is rapidly bound to clays or organic particles.
- The mixing zone in the Savannah River was not toxic, which indicates that biota in the mixing zone are not being impacted by the effluent.

We have concluded that the toxicity is being produced in the open-topped treatment tanks, most likely as the result of degradation of an organic compound (see Section 3.2). It is possible that exposure to sunlight in the open tanks exacerbates the degradation of the organic compound. Experiments are being initiated to test this hypothesis.

3.2 Toxicity Identification Evaluations

Toxicity Identification Evaluations (TIEs) involve chemical and physical manipulations of a toxic effluent to determine which treatments reduce or remove toxicity from an effluent. Table 3 lists Phase I TIE treatments and the types of toxicants typically removed by each treatment.

Table 3. Phase I TIE Treatments/Toxicants Removed

<u>Treatment</u>	<u>Potential Toxicants Removed</u>
Adjust to pH 3	Insoluble at low pH
Adjust of pH 10	Insoluble at high pH
Aerate at initial pH	Volatile; oxidizable
Aerate at pH 3	Volatile; oxidizable at low pH
Aerate at pH 10	Volatile; oxidizable at high pH
Filter at initial pH	Total suspended solids
Filter at pH 3	Insoluble at low pH
Filter at pH 10	Cationic metals; insoluble at high pH
C-18 column at initial pH	Non-polar organics; metals
C-18 column at pH 3	Non-polar organics
C-18 column at pH 9	Non-polar organics; metals
Sodium thiosulfate addition	Residual chlorine; some metals
1 mg/l	
5 mg/l	
10 mg/l	
EDTA chelation	Some metals; some surfactants
1 mg/l	
5 mg/l	
10 mg/l	
Graduated pH	Ammonia; some metals; sulfide

A Phase I TIE was performed on effluent collected Outfall X-08 in November 1999 and an additional Phase I TIE was subsequently performed on X-8B in March 2000 after it was identified as the source of the toxicity (see Section 3.1). The results of the TIEs are summarized in Table 4; more detailed results can be found in Appendix B.

Table 4. Results of Toxicity Identification Evaluations Conducted on X-08 (November 1999) and X-8B (March 2000)

Treatment	X-08 November 1999	X-8B March 2000
Baseline	acute toxicity	acute toxicity
pH 3	slight reduction	no effect
pH 11	slight reduction	no effect
Filtration at pH 3	slight reduction	slight reduction
Filtration at initial pH	toxicity reduced	no effect
Filtration at pH 11	toxicity removed	toxicity reduced
Aeration at pH 3	toxicity reduced	no effect
Aeration at initial pH	no effect	slight reduction
Aeration at pH 11	toxicity reduced	no effect
SPE at pH 3		no effect
SPE at initial pH	toxicity removed	toxicity removed
SPE at pH 9		toxicity reduced
EDTA 1 mg/l	toxicity increased	slight reduction
EDTA 5 mg/l	toxicity increased	toxicity removed
EDTA 10 mg/l	toxicity increased	toxicity removed
EDTA 50 mg/l	toxicity increased	-
Na thiosulfate 1 mg/l	toxicity increased	no effect
Na thiosulfate 5 mg/l	toxicity increased	no effect
Na thiosulfate 10 mg/l	toxicity increased	no effect
Na thiosulfate 50 mg/l	toxicity increased	-
Graduated pH 6.5	no effect	no effect
Graduated pH 7.5	no effect	no effect
Graduated pH 8.5	More toxic at high pH	no effect

While the TIE results varied to some extent among the two samples that were tested, C-18 SPE always removed the toxicity, which suggests that the toxicity is due to a non-polar organic. However SPE is also somewhat effective at removing metals (especially metal chelates, which are relatively non-polar) and some surfactants. Treatments that sometimes removed the toxicity included EDTA and filtration at pH 11. Treatments that moderately reduced, but did not eliminate the toxicity included filtration at initial pH, aeration at high and low pH, and C-18 SPE at pH 9. The graduated pH tests that were run in November indicated that the toxicant was more toxic in weakly alkaline conditions than at ambient pH or slightly acidic conditions, which suggests that the toxicant may contain an amine group. Filtration at pH 11 always reduced or removed the toxicity, which suggests that the toxicant is precipitated at high pH. This hypothesis was confirmed by performing a toxicity test on a sample prepared by soaking the membrane filter from the pH 11 filtration in MHSF and then running a toxicity test on the resulting solution. The sample was toxic, which suggests that the toxicant could be removed from the filter and redissolved in water. Filtration at pH 11 is most effective at removing toxicity due to cationic metals or surfactants. EDTA, which sometimes removed the toxicity, is effective with cationic metals, but also sometimes works for surfactants or other polar compounds. However, repeated analyses for metals indicates that metals are not present in toxic quantities (see Section 3.3.1). The results of a sublation test, an

analysis for cobalt thiocyanate active substances (CTAS; detects nonionic surfactants), and the lack of toxic degradation products of surfactants, such as nonylphenol, in the GC/MS scan all suggest that toxicity due to a surfactant is unlikely (see Section 3.3.2). The results of the TIEs indicated that aeration and sodium thiosulfate did not remove the toxicity, which suggest that the toxicant is neither a volatile nor an oxidant.

Since C-18 SPE consistently removed the toxicity, the most likely class of toxicants is non-polar organics. A methanol elution was performed on a C-18 SPE column that had removed the toxicity from an effluent sample, and toxicity tests were performed on the eluates. The results indicate that the toxicity was present in the 80, 85, 90, and 95% methanol fractions, with 50% of the toxicity present in the 85% methanol fraction and the remaining toxicity distributed among the remaining three fractions (Table 5; Appendix C).

**Table 5. Results of a Methanol Elution Test on ETP Effluent
(sample collected 3/28/00)**

Mortality at 48 hours, by methanol concentration								
Effluent Conc.	25%	50%	75%	80%	85%	90%	95%	100%
10%	0%	0%	0%	0%	60%	0%	0%	0%
25%	0%	0%	0%	0%	100%	0%	60%	40%
50%	0%	0%	20%	80%	100%	100%	100%	20%
100%	0%	20%	40%	100%	100%	100%	100%	40%
LC50	>100%	>100%	>100%	40.6%	9.8%	35.3%	21.8%	>100%
Toxic Units	0	0	0	2.5	10.2	2.8	4.6	0

These results indicate that the toxicity is due to a relatively non-polar organic. However, since none of the toxicity was present in the 100% methanol fraction, the organic was not completely non-polar, but probably contained one or more small polar functional groups (e.g. an amine or hydroxyl group). GC/MS failed to identify semi-volatile organic compounds that were present in toxic quantities, so LC/MS scans were also performed. The results of the organic scans are presented and discussed in Section 3.3.3.

3.3 Chemical Analyses

3.3.1 Metals

TNX is an old facility that contains long runs of copper, galvanized, and iron pipe. Many of the buildings have galvanized roofs. The Effluent Treatment Plant, which has been identified as the source of the toxicity (see Section 3.1), contains stainless steel treatment tanks, and galvanized catwalks and stairs.

Due to a previous problem with toxic levels of zinc at the X-08 outfall, and preliminary TIE results, metals were suspected as the cause of the toxicity failures in October and November 1999. Two comprehensive sets of metal analyses and numerous other analyses for the metals believed most likely to occur at elevated concentrations were performed. These metals include copper (from pipes); zinc (from galvanized pipes, roofs, and elevated catwalks/stairs); and iron, nickel, and chromium (from the stainless steel treatment tanks). Analyses were also run for several metals that are not readily

chelatable by EDTA (arsenic, selenium, aluminum, chromium), since our early suspicions were that the toxicity was due to a metal, but early TIE results indicated that toxicity was not reduced by EDTA or thiosulfate. The results of the metal analyses are summarized in Table 2.

The results indicate that with the possible exception of zinc, no metals were detected at concentrations that would produce toxicity at the X-08 outfall. Zinc levels as high as 1000 µg/l have been detected within the ETP. Since X-8B contributes a maximum of 25% of the flow to X-08 and X-08 toxicity tests are run at a concentration of 33% effluent, 1000 µg/l would be diluted to 8.25% (25% x 33%), or 82.5 µg/l during a toxicity test. The highest concentration of zinc measured at X-08 when X-8B was discharging was 278 µg/l, which when diluted to 33% is 93 µg/l.

In order to determine the concentration of zinc that would produce acute toxicity in X-08 effluent, a sample of X-08 effluent was collected when the ETP was not discharging. The initial concentration of zinc present in the effluent was measured, and then zinc concentrations of 100 to 800 µg/l were spiked into the effluent and acute toxicity tests were performed on the spiked samples. The results indicate that the LC50 for zinc in X-08 effluent is 300 µg/l (Table 6). Since the highest zinc concentrations that have been measured or calculated for Outfall X-08 are < 100 µg/l, zinc is not present at Outfall X-08 in concentrations that would produce acute toxicity at a dilution of 33%. Therefore, zinc does not appear to responsible for the observed toxicity.

Table 6. Results of Zinc Spiking in X-08 Effluent, 5/3/00

Concentration of Zinc Added to X-08 Effluent	Mean % Mortality, 48 hr
0 µg/l	10%
100 µg/l	0%
200 µg/l	0%
400 µg/l	75%
600 µg/l	100%
800 µg/l	100%

48 hour LC50 (calculated by Spearman Karber) = 300 µg/l zinc

3.3.2 Surfactants

Small quantities of surfactants are used at TNX for cleaning glassware and also for general maintenance of the TNX facility. Sunlight hand dishwashing detergent is the most common detergent used for cleaning glassware; numerous cleaning products are used for cleaning floors and carpets (Table 7). Because no other sources of toxic chemicals could be identified and because some of the TIE results indicated that surfactants could not be eliminated as a source of toxicity, an analysis for CTAS was performed, and a sublation treatment was also performed on a toxic sample of effluent (see Section 3.2 for results). The CTAS analysis indicated that non-ionic surfactants were not present at a detectable concentration (1 mg/l; Table 2).

Table 7. Cleaning Products Used at TNX

Product	Use	Composition	Possible source of toxicity
Sunlight dish detergent	glassware cleaner	surfactant	doubtful
Comet cleanser	sink cleaner	abrasive; chlorine	no
Multi-clean biopower	water based cleaner	enzymatic/bacterial cultures	no
Multi-clean bro-go	water-based cleaner	citric acid; surfactants (1-5%)	doubtful
Multi-clean buff n clean	spray buffer for floors	acrylic polymers	yes, but shouldn't reach drains
Multi-clean century maintenance cleaner	used to mop floors	7.5% surfactants	doubtful
Multi-clean non-volatile spotter #105	carpet spot cleaner	1 butoxy-2propanol 5%; dimethyl adipate 27.5%; dimethyl glutarate 27.5%; dipropylene glycol monomethylether 27.5%	doubtful, and shouldn't reach drains
multi-clean premier water-borne floor polish	floor polish	glycols and polymers	yes
multi-clean pre-treat	pretreatment for carpet stains	1 butoxy-2-propanol 3%; dipropylene glycol monomethyl ether 5% sodium sesquicarbonate 3%; surfactants 3%	yes, but shouldn't reach drains
multi-clean quick strip	floor stripper	2-butoxyethanol 30%; ethanolamine 3%	yes
multi-clean splendor	floor polish	diethylene glycol monoethyl ether 5% tributoxymethyl phosphate 3%; emulsified polymer wax 3%; emulsified acrylic polymer 20%	yes
multi-clean spinshield	floor cleaner	surfactants (3%)	doubtful
multi-clean stampede	floor stripper	5% phenoxyethanol; 5% ethanolamine	yes
multi-clean stainless	floor polish	diethyleneglycol monobutylether 5%; diethyleneglycol monoethylether 5%; emulsified acrylic powder 20%; tributoxymethylphosphate 3%	yes
multi-clean super synth-clean	multipurpose cleaner	EDTA; glycols	yes
multi-clean take-out	carpet spot cleaner	1 butoxy-2-propanol 3% dipropylene glycol monomethyl ether 37.5%	yes, but shouldn't reach drains
peerless stain remover	carpet spot remover	proteolytic enzymes 1% butoxyethanol	no

3.3.3 Organics

As discussed in Section 3.2, the results of the TIEs indicate that the toxicity appears to be due to a non-polar organic chemical. An extensive review of the organic chemicals that are used in TNX laboratories and a review of waste disposal practices indicates that no non-polar organics should be reaching the ETP in toxic quantities. Table 8 lists the organic chemicals that are used in laboratories at TNX and the approximate volumes of chemicals that reach drains that go to the ETP. These chemicals consist of very small volumes of alcohols, acetone, biological stains, and microbial nutrients/media. We have not been able to identify any non-polar organic chemicals used in laboratories that are being disposed of in drains that are routed to the ETP. Table 7 lists the cleaning products that are used at TNX, as well as the types of chemicals that they contain. There are numerous non-polar organics present in the cleaning products, but the janitorial staff has been directed to dispose of cleaning solutions in the janitorial sinks that discharge to the Sanitary Treatment Plant, and not to the ETP. Investigations are in progress to ascertain that no cleaning products are disposed of in laboratory drains that flow to the ETP.

In January 2000, analyses for base neutral/acid extractables were performed on a sample of effluent from X-8B that was collected on January 12 (see Appendix C for detailed results). The only organic that was present at concentrations above the detection limit was bis(2-ethylhexyl)phthalate, which was present at a concentration of 12 ug/l. Phthalates are plasticizers that are common in many plastic compounds. The EPA's acute water quality criteria for phthalate esters is 940 ug/l. The low concentration of bis(2-ethylhexyl)phthalate that was detected in the X-8B sample should not produce acute toxicity and is not believed to contribute to the toxicity at X8B.

In order to identify the non-polar organic(s) that is may be responsible for the observed toxicity, a GC/MS scans for semivolatiles and an LC/MS scan were performed on TNX samples. The results of the GC/MS scan conducted on Tank 1 (Table 9) indicate that numerous organics were detected at relatively low levels. Bis(2-ethylhexyl) phthalate (a plasticizer) was the organic detected at the highest concentration (370 ug/l). Many of the organics are present in petroleum products most likely are present in stormwater runoff. No organics were detected in concentrations that produce acute toxicity at the levels seen in the ETP (LC50's as low as 1% effluent).

As discussed in Section 3.1, the toxicity data indicate that the ETP tanks are the source of the toxicity, and that toxicity increases over time. The results of LC/MS scans performed on "fresh" and "aged" samples of ETP tank water indicate that two groups of compounds are present at higher concentrations in aged samples. One group has molecular weights that ranged from 300 to 640, and has attached chlorines. The results of methanol elution indicates that these compounds are very non-polar, and only elute in 100% methanol. Because the results of the methanol elution toxicity test indicated that the toxicity was present in the 80 to 95% methanol fractions, this group of organics is not likely to be the source of the toxicity. The second group of organics that displays a temporal increase in concentration have molecular weights ranging from 900 to 1350 and contain a functional group with a mass of 17, which could be either an amine or hydroxyl group. The conclusion of the chemists are that the compounds are probably polymers (most likely a polyethylene glycol) that contain an amine group. These compounds elute in 80% methanol, which is within the range of methanol concentrations

that also eluted toxicity from the C-18 column (80 to 95%; see Section 3.2). To date, no positive identification of this group of compounds has been made.

Table 8. Organic Chemicals Used at TNX/Disposed of in Lab Drains

CHEMICALS THAT GO TO WASTE DRUMS

1-butyl alcohol
acetone
acetonitrile
AE 1147
benzene
biphenyl
CE 2672
CE Polyfloc CE1161
citric acid
ethyl acetate
glycolic acid
hexane
isopropanol
methanol
methylene chloride
n(2-hydroxyethyl) EDTA
nitritotriacetic acid
Novus CE2651
oxalic acid
phenol
Poly floc AE1115
Polyfloc AE1125
Polyfloc AE1132
Polyfloc AE1700
Polyfloc AE1703
pump oil
silicone oils
sodium acetate
sodium formate
sodium gluconate
sodium tetraphenylborate
surfynol 420 surfactant
tributyl phosphate
Vcarfloc polymer

CHEMICALS THAT GO DOWN LAB DRAINS

Chemical	Amount used /week
Sunlight dish detergent	175 ml
acetone	190 ml
Comet cleanser	33 g
bar soap	20g
agar	20 g
crystal violet	trace
dextrose	5 g
ethanol	50 ml
isopropanol	50 ml
methanol	50 ml
peptone	5 g
safranin	trace
tryptone	15 g
yeast extract	2 g

**Table 9. Results of GC/MS Scan for Semivolatile Organics Conducted
on Water from TNX ETP Tank 1**

Analyte	CAS No.	µg/L
Bis(2-ethylhexyl) phthalate	000117-81-7	370
Undecane	001120-21-4	59
Heptadecane	000629-78-7	58
Heneicosane	000629-94-7	56
Nonadecane	000629-92-5	51
Eicosane	000112-95-8	49
Octadecane	000593-45-3	38
Nonadecane, 9-methyl-	013287-24-6	38
Nonadecane, 2-methyl-	001560-86-7	37
1-Nonadecene	018435-45-5	27
n-Pentadecylcyclohexane	006006-95-7	27
Tridecane	000629-50-5	26
Isopropyl Myristate	000110-27-0	24
Docosane	000629-97-0	24
Cyclohexane, pentyl-	004292-92-6	23
Hexadecane	000544-76-3	22
n-Tridecylcyclohexane	006006-33-3	16
Phenol, 4-(1,1,3,3-tetramethylbutyl)	000140-66-9	14
trans-Decalin, 2-methyl-	1000152-47-	13
Decane, 3-methyl-	013151-34-3	12
Cyclohexane, butyl-	001678-93-9	11
Chloromethyl p-tolyl sulfone	1000224-89-	10
Heptadecane, 2,6,10,15-tetramethyl	054833-48-6	10
Eicosane, 2-methyl-	001560-84-5	9.9
Decane, 2,9-dimethyl-	001002-17-1	9.1
Tetradecane, 5-methyl-	025117-32-2	8.8
Benzene, 1-chloro-2-methyl-	000095-49-8	7.5
Octadecane, 2-methyl-	001560-88-9	7.5
2,6-Dimethyldecane	013150-81-7	6.7
Nonadecane, 2,3-dimethyl-	075163-99-4	6.7
Decane, 3,8-dimethyl-	017312-55-9	6.3
Eicosane	000112-95-8	6.3
Benzene, 1,3-dimethyl-	000108-38-3	5.7
Methylparaben	000099-76-3	5.4
Tetradecane	000629-59-4	5.3
Cyclohexane, 1-ethyl-1,4-dimethyl-	062238-30-6	5.2
Cyclohexane, 1-methyl-2-pentyl-	054411-01-7	5.2
Diethyl Phthalate	000084-66-2	5.2
Benzene, 1,3,5-trimethyl-	000108-67-8	4.9
Nonane, 5-(1-methylpropyl)-	062185-54-0	4.9
Phenol, 2-methyl-5-(1-methylethyl)	000499-75-2	4.9
Heptadecane, 2-methyl-	001560-89-0	4.6
Benzene, 1-methyl-4-(methylsulfonyl)	003185-99-7	4.5
Naphthalene, decahydro-, trans-	000493-02-7	4.5
Cyclohexane, decyl-	001795-16-0	4.0
Cycloheptane, methyl-	004126-78-7	3.8
Cyclopentane, undecyl-	006785-23-5	3.8
Benzene, 1,2-dimethyl-	000095-47-6	3.6
Decane, 2-methyl-	006975-98-0	3.6
Heptadecane, 3-methyl-	006418-44-6	3.6
Pentadecane	000629-62-9	3.5
1,3,5-Triazine-2,4,6(1H,3H,5H)-trione, 1,3,5-tri-2-propenyl	001025-15-6	3.2
2-(3-Methylbuta-1,3-dienyl)cyclohexanone	1000191-75-	3.1
Benzene, propoxy-	000622-85-5	3.1
Nonadecane, 4-methyl-	025117-27-5	3.1

Table 9 continued.

Analyte	CAS No.	µg/L
2(1H)-Quinolinone, 4-phenyl-	005855-57-2	2.9
Heptane, 4-ethyl-	002216-32-2	2.5
Morpholine-4-carboxylic acid, ethyl ester	006976-49-4	2.5
Octane, 3,3-dimethyl-	004110-44-5	2.5
3-Pentanone, 2,2,4,4-tetramethyl-	000815-24-7	2.1
Decane	000124-18-5	2.0
Formamide, N,N-dibutyl-	000761-65-9	1.8
Cyclohexanol, 1-ethyl-	001940-18-7	1.5
Ethanol, 2-(2-methoxyethoxy)-	000111-77-3	1.5
Octane, 3-ethyl-	005881-17-4	1.5
Phenol	000108-95-2	1.5

3.3.4 Summary of Chemical Results

The results of the chemical analyses indicate that no metals are present in concentrations that would produce acute toxicity at Outfall X-08 and also that surfactants do not appear to be present in detectable concentrations. LC/MS results detected the presence of a class of non-polar organics present in the ETP treatment tanks that display a temporal increase in concentration and elute at the same concentration of methanol as the toxicant (see toxicity results in Section 3.2). These compounds have molecular weights ranging from 900 to 1350 and have a functional group with a mass of 17. They are believed to be polymeric compounds (possibly a polyethylene glycol) that contain either an amine or hydroxyl group. To date, we have not been able to identify the compounds or their source, but they are believed to be a degradation product of another organic compound, rather than a parent compound.

4.0 Path Forward

We are continuing our investigations into the source of the toxicity at Outfall X-08. Most of our efforts at this time are focussed on the Effluent Treatment Plant, since it has been identified as the source of the toxicity at X-08.

Chemical Analyses - We are continuing our efforts to identify the organic compound that is believed to be responsible for the toxicity. Additional GS/MS, LC/MS, and possibly infrared scans will be performed to attempt to identify the compound believed to be the toxicant. GC/MS and LC/MS scans will be performed on the material retained on a filter during filtration at pH 11, since the toxicant appears to precipitate at high pH and be retained on the filter. Once we have identified the spectral signature of the toxicant, we will attempt to match the spectral signature with those of known compounds, using spectral library searches. If no match is found, tests will be run on cleaning products that are likely to contain compounds similar to the toxicant.

Toxicity Testing - Since the data collected to date indicate that ETP tank influent is usually not toxic and tank effluent is toxic, it is likely that chemical reactions or degradation that is taking place in the tanks are resulting in the formation of a toxicant. Studies are in progress to examine temporal changes in toxicity as the effluent treatment

plant tanks fill. Samples are also being collected for organic analyses, but these samples will not be run until the results of the toxicity tests are available.

In order to better investigate temporal changes in toxicity, a set of controlled experiments will be set up in a greenhouse under ambient natural lighting conditions. A batch of composited effluent will be collected and a baseline toxicity test will be performed to confirm its toxicity. A portion of the sample will then be refrigerated, and the remainder will be divided into two treatments. One treatment will be exposed to ambient sunlight at ambient temperature and the second treatment will exclude sunlight. Samples for toxicity tests and organic analyses will be collected weekly for 4 weeks. If degradation of an organic is occurring, these experiments will determine whether light is playing a critical role in the degradation of the organics, and will also help to determine how toxicity changes over time. We may also be able to better identify the parent compound and the toxicant by following temporal changes in the chemical composition of the samples over time. If we determine that toxicity increases over time, studies will be continued to determine if additional degradation will occur over time that would render the toxicant non-toxic. It is possible that increasing the holding time of water in the tanks beyond three or four weeks will decrease the toxicity if further degradation is occurring.

Outfall Testing - Preliminary data indicate that the toxicity of the X-08 effluent may dissipate in the effluent ditch before the effluent reaches the Savannah River. Additional samples for toxicity testing will be collected at X-08 when X-8B is discharging to X-08 and at two locations in the effluent ditch. If toxicity dissipates (due to binding or organic material and/or clays), and we can demonstrate that toxicants are not reaching the river, SRS may consider the feasibility of moving the NPDES sampling location to the mouth of the effluent ditch, since the Point of Compliance, as stated in the NPDES permit, is the Savannah River.

APPENDIX A
RESULTS OF TOXICITY TESTS

DMR Attachment for Toxicity Test Results. Bureau of Water

WSRC/X-08

Permit number SC

Discharge #:

Final Limits:

Parameter Code TGA3B MLOC=1 IWC= 33.00%Effluent

Monitoring Period		Year	Month	Day	To	Year	Month	Day
From		99	11	1		99	11	30

		All tests				Chronic Tests Only		
Date	11-9-99	Group	#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID	23104	Control	20	1	FAIL			
		Test	20	20				

		All tests			Chronic Tests Only		
Date	Group	#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID	Control						
	Test						

		All tests			Chronic Tests Only			
Date		Group	#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID		Control						
		Test						

		All tests			Chronic Tests Only		
Date	Group	#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID	Control						
	Test						

		All tests			Chronic Tests Only		
Date	Group	#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID	Control						
	Test						

		All tests			Chronic Tests Only		
Date	Group	#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID	Control						
	Test						

Signature of Principal Executive Officer or Authorized Agent _____

Name/Title of Principal Executive Officer (typed or printed) _____

STATISTICAL ANALYSIS RESULTS

Facility:	WSRC/X-08	NPDES#	SC
Sample ID:	X-08	ETT#	T13253
		Date:	11-9-99
Laboratory:	ETT Environmental, Inc.	Certification #:	23104
		Exp. Date:	10/99

Survival Data			
	48 Hrs. Survival	Test Used:	Fisher's Test
Control	95%	Test Statistic:	P= 0.000
Effluent	0%	Critical Value:	P= 0.05
FAIL: The effluent reduces survival of the test organisms.			

QUALITY CONTROL RESULTS

Reference Toxicant: NaCl					
Current Acute LC50:	1.96	g/L	Current Chronic NOEC:	0.8	g/L
Mean Acute LC50:	2.01	g/L	Mean Chronic NOEC::	0.8	g/L
Lower & Upper Limits (g/L)	1.75	2.22	Lower & Upper Limits (g/L)	0.4	1.5

DMR Attachment for Toxicity Test Results. Bureau of Water

WSRC/SANITARY DISCHARGE

Permit number **SC**

Discharge #:

Final Limits:

Parameter Code **TGA3B** MLOC=1 IWC= 0.40%Effluent

Monitoring Period	Year	Month	Day		Year	Month	Day
	From 99	12	1		To 99	12	31

		All tests			Chronic Tests Only			
Date	12-14-99	Group	#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID	23104	Control	10	1	PASS			
		Test	10	0				

		All tests			Chronic Tests Only			
Date		Group	#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID		Control						
		Test						

		All tests			Chronic Tests Only			
Date		Group	#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID		Control						
		Test						

		All tests			Chronic Tests Only		
Date	Group	#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID	Control						
	Test						

		All tests			Chronic Tests Only		
Date	Group	#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID	Control						
	Test						

		All tests			Chronic Tests Only		
Date	Group	#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID	Control						
	Test						

Signature of Principal Executive Officer or Authorized Agent _____

Name/Title of Principal Executive Officer (typed or printed) _____

STATISTICAL ANALYSIS RESULTS

Facility:	WSRC/SANITARY DISCHARGE	NPDES#	SC
Sample ID:	SANITARY DISCHARGE	ETT#	T13457
		Date:	12-14-99
Laboratory:	ETT Environmental, Inc.	Certification #:	23104
		Exp. Date:	10/2001

Survival Data			
	48 Hrs. Survival	Test Used:	Fisher's Test
Control	90%	Test Statistic:	P= 0.500
Effluent	100%	Critical Value:	P= 0.05
PASS: The effluent does not reduce survival of the test organisms.			

QUALITY CONTROL RESULTS

Reference Toxicant: NaCl					
Current Acute LC50:	1.96	g/L	Current Chronic NOEC:	0.8	g/L
Mean Acute LC50:	2.01	g/L	Mean Chronic NOEC::	0.8	g/L
Lower & Upper Limits (g/L)	1.75	2.22	Lower & Upper Limits (g/L)	0.4	1.5

DMR Attachment for Toxicity Test Results. Bureau of Water

WSRC/ETP

Permit number **SC**

Discharge #:

Final Limits:

Parameter Code **TGA3B** MLOC=1 IWC= 24.90%Effluent

Monitoring Period	Year	Month	Day		Year	Month	Day
	From 99	12	1		To 99	12	31

		All tests			Chronic Tests Only			
Date	12-14-99	Group	#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID	23104	Control	10	1	FAIL			
		Test	10	10				

		All tests			Chronic Tests Only			
Date		Group	#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID		Control						
		Test						

		All tests			Chronic Tests Only			
Date		Group	#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID		Control						
		Test						

		All tests			Chronic Tests Only		
Date	Group	#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID	Control						
	Test						

		All tests			Chronic Tests Only		
Date	Group	#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID	Control						
	Test						

		All tests			Chronic Tests Only		
Date	Group	#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID	Control						
	Test						

Signature of Principal Executive Officer or Authorized Agent _____

Name/Title of Principal Executive Officer (typed or printed) _____

STATISTICAL ANALYSIS RESULTS

Facility:	WSRC/ETP	NPDES#	SC
Sample ID:	ETP	ETT#	T13458
		Date:	12-14-99
Laboratory:	ETT Environmental, Inc.	Certification #:	23104
		Exp. Date:	10/2001

Survival Data			
	48 Hrs. Survival	Test Used:	Fisher's Test
Control	90%	Test Statistic:	P= 0.000
Effluent	0%	Critical Value:	P= 0.05
FAIL: The effluent reduces survival of the test organisms.			

QUALITY CONTROL RESULTS

Reference Toxicant: NaCl					
Current Acute LC50:	1.96	g/L	Current Chronic NOEC:	0.8	g/L
Mean Acute LC50:	2.01	g/L	Mean Chronic NOEC::	0.8	g/L
Lower & Upper Limits (g/L)	1.75	2.22	Lower & Upper Limits (g/L)	0.4	1.5

DMR Attachment for Toxicity Test Results. Bureau of Water

WSRC/AIR STRIPPER

Permit number SC

Discharge #:

Final Limits:

Parameter Code TGA3B MLOC=1 IWC= 38.20%Effluent

Monitoring Period							
From				To			
Year	Month	Day		Year	Month	Day	
99	12	1		99	12	31	

		All tests			Chronic Tests Only			
Date	12-14-99	Group	#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID	23104	Control	10	1	PASS			
		Test	10	2				

		All tests			Chronic Tests Only			
Date		Group	#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID		Control						
		Test						

		All tests			Chronic Tests Only			
Date		Group	#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID		Control						
		Test						

		All tests			Chronic Tests Only		
Date	Group	#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID	Control						
	Test						

		All tests			Chronic Tests Only		
Date	Group	#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID	Control						
	Test						

		All tests			Chronic Tests Only		
Date	Group	#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID	Control						
	Test						

Signature of Principal Executive Officer or Authorized Agent _____

Name/Title of Principal Executive Officer (typed or printed) _____

STATISTICAL ANALYSIS RESULTS

Facility:	WSRC/AIR STRIPPER	NPDES#	SC
Sample ID:	AIR STRIPPER	ETT#	T13459
		Date:	12-14-99
Laboratory:	ETT Environmental, Inc.	Certification #:	23104
		Exp. Date:	10/2001

Survival Data			
	48 Hrs. Survival	Test Used:	Fisher's Test
Control	90%	Test Statistic:	P= 0.395
Effluent	80%	Critical Value:	P= 0.05
PASS: The effluent does not reduce survival of the test organisms.			

QUALITY CONTROL RESULTS

Reference Toxicant: NaCl					
Current Acute LC50:	1.96	g/L	Current Chronic NOEC:	0.8	g/L
Mean Acute LC50:	2.01	g/L	Mean Chronic NOEC::	0.8	g/L
Lower & Upper Limits (g/L)	1.75	2.22	Lower & Upper Limits (g/L)	0.4	1.5

DMR Attachment for Toxicity Test Results. Bureau of Water

WSRC/NCCW

Permit number **SC**

Discharge #:

Final Limits:

Parameter Code **TGA3B** MLOC=1 IWC= 24.90%Effluent

Monitoring Period		Year	Month	Day		Year	Month	Day
From	To	99	12	1		99	12	31

Date	12-14-99	Group	All tests			Chronic Tests Only		
			#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID	23104	Control	10	0	PASS			
		Test	10	0				

Date		Group	All tests			Chronic Tests Only		
			#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID		Control						
		Test						

Date		Group	All tests			Chronic Tests Only		
			#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID		Control						
		Test						

Date		Group	All tests			Chronic Tests Only		
			#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID		Control						
		Test						

Date		Group	All tests			Chronic Tests Only		
			#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID		Control						
		Test						

Date		Group	All tests			Chronic Tests Only		
			#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID		Control						
		Test						

Signature of Principal Executive Officer or Authorized Agent _____

Name/Title of Principal Executive Officer (typed or printed) _____

STATISTICAL ANALYSIS RESULTS

Facility:	WSRC/NCCW	NPDES#	SC
Sample ID:	NCCW	ETT#	T13460
		Date:	12-14-99
Laboratory:	ETT Environmental, Inc.	Certification #:	23104
		Exp. Date:	10/2001

Survival Data			
	48 Hrs. Survival	Test Used:	Fisher's Test
Control	100%	Test Statistic:	P= 1.000
Effluent	100%	Critical Value:	P= 0.05
PASS: The effluent does not reduce survival of the test organisms.			

QUALITY CONTROL RESULTS

Reference Toxicant: NaCl					
Current Acute LC50:	1.96	g/L	Current Chronic NOEC:	0.8	g/L
Mean Acute LC50:	2.01	g/L	Mean Chronic NOEC::	0.8	g/L
Lower & Upper Limits (g/L)	1.75	2.22	Lower & Upper Limits (g/L)	0.4	1.5

DMR Attachment for Toxicity Test Results. Bureau of Water

WSRC/WELL OVERFLOW

Permit number **SC**

Discharge #:

Final Limits:

Parameter Code **TGA3B** MLOC=1 IWC= 11.60%Effluent

Monitoring Period		Year	Month	Day	To	Year	Month	Day
From		99	12	1		99	12	31

		All tests			Chronic Tests Only			
Date	12-14-99	Group	#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID	23104	Control	10	0	PASS			
		Test	10	0				

		All tests			Chronic Tests Only			
Date		Group	#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID		Control						
		Test						

		All tests			Chronic Tests Only			
Date		Group	#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID		Control						
		Test						

		All tests			Chronic Tests Only		
Date	Group	#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID	Control						
	Test						

		All tests			Chronic Tests Only		
Date	Group	#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID	Control						
	Test						

		All tests			Chronic Tests Only			
Date		Group	#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID		Control						
		Test						

Signature of Principal Executive Officer or Authorized Agent _____

Name/Title of Principal Executive Officer (typed or printed) _____

SHEALY ENVIRONMENTAL SERVICES, INC.

Reported To: WESTINGHOUSE SRS
STUART STINSON
PO BOX 616
BUILDING 735-11A
AIKEN, SC 29808

48 HOUR ACUTE BIOASSAY WITH *CERIODAPHNIA DUBIA*
(SESI FORM 105 - PASS/FAIL ACUTE TESTS)

CLIENT: WESTINGHOUSE SRS

SAMPLE LOCATION: X-8B

TEST CONCENTRATION: 8.25%

Test Start Date/Time: 1/5/2000 1000

Test End Date/Time: 1/7/2000 1035

SAMPLE USAGE

SAMPLE ID	COLLECTION DATE/TIME	WHEN USED
184414ST	1/4/00 0950	1/5

(Attach C-O-C)

SUMMARY OF SURVIVAL

TREATMENT	# ADULTS	# DEAD	TEST RESULTS PASS/FAIL
CONTROL	20	0	FAIL
8.25%	20	20	

STATISTICAL PROGRAM USED: TOXIS Version 2.4a

Reported By: [Signature]
SC DHEC No. 32010

QC By: BK

Comments:

SHEALY ENVIRONMENTAL SERVICES, INC.

Reported To: WESTINGHOUSE SRS
STUART STINSON
PO BOX 616
BUILDING 735-11A
AIKEN, SC 29808

48 HOUR ACUTE BIOASSAY WITH *CERIODAPHNIA DUBIA*
(SESI FORM 105 - PASS/FAIL ACUTE TESTS)

CLIENT: WESTINGHOUSE SRS

SAMPLE LOCATION: 772

TEST CONCENTRATION: 8.25%

Test Start Date/Time: 1/5/2000 1705

Test End Date/Time: 1/7/2000 1630

SAMPLE USAGE

SAMPLE ID	COLLECTION DATE/TIME	WHEN USED
184510ST	1/4/00 1522	1/5

(Attach C-O-C)

SUMMARY OF SURVIVAL

TREATMENT	# ADULTS	# DEAD	TEST RESULTS PASS/FAIL
CONTROL	20	0	FAIL
8.25%	20	20	

STATISTICAL PROGRAM USED: TOXIS Version 2.4a

Reported By: [Signature]
SC DHEC No. 32010

QC By: BK

Comments:

SHEALY ENVIRONMENTAL SERVICES, INC.

Reported To: WESTINGHOUSE SRS
STUART STINSON
PO BOX 616
BUILDING 735-11A
AIKEN, SC 29808

48 HOUR ACUTE BIOASSAY WITH *CERIODAPHNIA DUBIA*
(SESI FORM 105 - PASS/FAIL ACUTE TESTS)

CLIENT: WESTINGHOUSE SRS

SAMPLE LOCATION: 672

TEST CONCENTRATION: 8.25%

Test Start Date/Time: 1/5/2000 1700

Test End Date/Time: 1/7/2000 1625

SAMPLE USAGE

SAMPLE ID	COLLECTION DATE/TIME	WHEN USED
184511ST	1/4/00 1540	1/5

(Attach C-O-C)

SUMMARY OF SURVIVAL

TREATMENT	# ADULTS	# DEAD	TEST RESULTS PASS/FAIL
CONTROL	20	0	PASS
8.25%	20	1	

STATISTICAL PROGRAM USED: TOXIS Version 2.4a

Reported By: *Ray Scott*
SC DHEC No. 32010

QC By: *BK*

Comments:

SHEALY ENVIRONMENTAL SERVICES, INC.

Reported To: WESTINGHOUSE SRS
STUART STINSON
PO BOX 616
BUILDING 735-11A
AIKEN, SC 29808

48 HOUR ACUTE BIOASSAY WITH *CERIODAPHNIA DUBIA*
(SESI FORM 105 - PASS/FAIL ACUTE TESTS)

CLIENT: WESTINGHOUSE SRS

SAMPLE LOCATION: COLLECTION SUMP

TEST CONCENTRATION: 8.25%

Test Start Date/Time: 1/5/2000 1010

Test End Date/Time: 1/7/2000 1055

SAMPLE USAGE

SAMPLE ID	COLLECTION DATE/TIME	WHEN USED
184417ST	1/4/00 1012	1/5

(Attach C-O-C)

SUMMARY OF SURVIVAL

TREATMENT	#ADULTS	#DEAD	TEST RESULTS PASS/FAIL
CONTROL	20	0	PASS
8.25%	20	0	

STATISTICAL PROGRAM USED: TOXIS Version 2.4a

Reported By: [Signature]
SC DHEC No. 32010

QC By: BK

Comments:

SHEALY ENVIRONMENTAL SERVICES, INC.

Reported To: WESTINGHOUSE SRS
STUART STINSON
PO BOX 616
BUILDING 735-11A
AIKEN, SC 29808

48 HOUR ACUTE BIOASSAY WITH *CERIODAPHNIA DUBIA*
(SESI FORM 105 - PASS/FAIL ACUTE TESTS)

CLIENT: WESTINGHOUSE SRS

SAMPLE LOCATION: TANK #2

TEST CONCENTRATION: 8.25%

Test Start Date/Time: 1/5/2000 1015

Test End Date/Time: 1/7/2000 1105

SAMPLE USAGE

SAMPLE ID	COLLECTION DATE/TIME	WHEN USED
184419ST	1/4/00 1020	1/5

(Attach C-O-C)

SUMMARY OF SURVIVAL

TREATMENT	# ADULTS	# DEAD	TEST RESULTS PASS/FAIL
CONTROL	20	1	FAIL
8.25%	20	19	

STATISTICAL PROGRAM USED: TOXIS Version 2.4a

Reported By: *D. J. L. H.*
SC DHEC No. 32010

QC By: *PK*

Comments:

SHEALY ENVIRONMENTAL SERVICES, INC.

Reported To: WESTINGHOUSE SRS
STUART STINSON
PO BOX 616
BUILDING 735-11A
AIKEN, SC 29808

48 HOUR ACUTE BIOASSAY WITH *CERIODAPHNIA DUBIA*
(SESI FORM 105 - PASS/FAIL ACUTE TESTS)

CLIENT: WESTINGHOUSE SRS

SAMPLE LOCATION: GRIT CHAMBER

TEST CONCENTRATION: 8.25%

Test Start Date/Time: 1/5/2000 1005

Test End Date/Time: 1/7/2000 1045

SAMPLE USAGE

SAMPLE ID	COLLECTION DATE/TIME	WHEN USED
184416ST	1/4/00 1010	1/5

(Attach C-O-C)

SUMMARY OF SURVIVAL

TREATMENT	#ADULTS	#DEAD	TEST RESULTS PASS/FAIL
CONTROL	20	0	PASS
8.25%	20	0	

STATISTICAL PROGRAM USED: TOXIS Version 2.4a

Reported By: *R. J. H.*
SC DHEC No. 32010

QC By: *BK*

Comments:

SHEALY ENVIRONMENTAL SERVICES, INC.

Reported To: WESTINGHOUSE SRS
STUART STINSON
PO BOX 616
BUILDING 735-11A
AIKEN, SC 29808

48 HOUR ACUTE BIOASSAY WITH *CERIODAPHNIA DUBIA*
(SESI FORM 105 - PASS/FAIL ACUTE TESTS)

CLIENT: WESTINGHOUSE SRS

SAMPLE LOCATION: TANK #1

TEST CONCENTRATION: 8.25%

Test Start Date/Time: 1/5/2000 0950

Test End Date/Time: 1/7/2000 1025

SAMPLE USAGE

SAMPLE ID	COLLECTION DATE/TIME	WHEN USED
184414ST	1/4/00 0950	1/5

(Attach C-O-C)

SUMMARY OF SURVIVAL

TREATMENT	#ADULTS	#DEAD	TEST RESULTS PASS/FAIL
CONTROL	20	0	FAIL
8.25%	20	20	

STATISTICAL PROGRAM USED: TOXIS Version 2.4a

Reported By: Ang Sath
SC DHEC No. 32010

QC By: BK

Comments:

SHEALY ENVIRONMENTAL SERVICES, INC.

Reported To: WESTINGHOUSE SRS
STUART STINSON
PO BOX 616
BUILDING 735-11A
AIKEN, SC 29808

48 HOUR ACUTE BIOASSAY WITH *CERIODAPHNIA DUBIA*
(SESI FORM 105 - PASS/FAIL ACUTE TESTS)

CLIENT: WESTINGHOUSE SRS

SAMPLE LOCATION: X-8B

TEST CONCENTRATION: 8.25%

Test Start Date/Time: 1/13/2000 1450

Test End Date/Time: 1/15/2000 1410

SAMPLE USAGE

SAMPLE ID	COLLECTION DATE/TIME	WHEN USED
185188ST	1/12/00 1010	1/13

(Attach C-O-C)

SUMMARY OF SURVIVAL

TREATMENT	# ADULTS	# DEAD	TEST RESULTS PASS/FAIL
CONTROL	20	0	FAIL
8.25%	20	20	

STATISTICAL PROGRAM USED: TOXIS Version 2.4a

Reported By: B. Sath
SC DHEC No. 32010

QC By: W. J. H.

Comments:

2-1-00
Winona
Larry

45/

SHEALY ENVIRONMENTAL SERVICES, INC.

Reported To: WESTINGHOUSE SRS
STUART STINSON
PO BOX 616
BUILDING 735-11A
AIKEN, SC 29808

48 HOUR ACUTE BIOASSAY WITH *CERIODAPHNIA DUBIA*
(SESI FORM 105 - PASS/FAIL ACUTE TESTS)

CLIENT: WESTINGHOUSE SRS

SAMPLE LOCATION: TANK #2

TEST CONCENTRATION: 8.25%

Test Start Date/Time: 1/13/2000 1445

Test End Date/Time: 1/15/2000 1405

SAMPLE USAGE

SAMPLE ID	COLLECTION DATE/TIME	WHEN USED
185189ST	1/12/00 1030	1/13

(Attach C-O-C)

SUMMARY OF SURVIVAL

TREATMENT	#ADULTS	#DEAD	TEST RESULTS PASS/FAIL
CONTROL	20	0	FAIL
8.25%	20	17	

STATISTICAL PROGRAM USED: TOXIS Version 2.4a

Reported By: [Signature]
SC DHEC No. 32010

QC By: [Signature]

Comments:

2-1-00

Winona
Larry

45

SHEALY ENVIRONMENTAL SERVICES, INC.

Reported To: WESTINGHOUSE SRS
STUART STINSON
PO BOX 616
BUILDING 735-11A
AIKEN, SC 29808

48 HOUR ACUTE BIOASSAY WITH *CERIODAPHNIA DUBIA*
(SESI FORM 105 - PASS/FAIL ACUTE TESTS)

CLIENT: WESTINGHOUSE SRS

SAMPLE LOCATION: X-08

TEST CONCENTRATION: 33%

Test Start Date/Time: 1/13/2000 1450

Test End Date/Time: 1/15/2000 1455

SAMPLE USAGE

SAMPLE ID	COLLECTION DATE/TIME	WHEN USED
185190ST	1/12/00 1120	1/13

(Attach C-O-C)

SUMMARY OF SURVIVAL

TREATMENT	# ADULTS	# DEAD	TEST RESULTS PASS/FAIL
CONTROL	20	0	PASS
33%	20	0	

STATISTICAL PROGRAM USED: TOXIS Version 2.4a

Reported By: D. Sall
SC DHEC No. 32010

QC By: W. Specht

Comments:

2-1-00
W. Specht 773-42A
L. Eldridge 742-A

45

DMR Attachment for Toxicity Test Results. Bureau of Water

WSRC/X-08-MEMBRANE FILTERED

Permit number **SC**

Discharge #:

Final Limits:

Parameter Code **TGA3B** MLOC=1 IWC= 8.25%Effluent

Monitoring Period							
				Year	Month	Day	
From				00	1	1	To
				00	1	31	

		All tests			Chronic Tests Only			
Date	1-24-00	Group	#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID	23104	Control	20	1	FAIL			
		Test	20	20				

		All tests			Chronic Tests Only			
Date		Group	#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID		Control						
		Test						

		All tests			Chronic Tests Only		
Date	Group	#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID	Control						
	Test						

		All tests			Chronic Tests Only		
Date	Group	#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID	Control						
	Test						

		All tests			Chronic Tests Only		
Date	Group	#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID	Control						
	Test						

		All tests			Chronic Tests Only		
Date	Group	#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID	Control						
	Test						

Signature of Principal Executive Officer or Authorized Agent _____

Name/Title of Principal Executive Officer (typed or printed) _____

DMR Attachment for Toxicity Test Results. Bureau of Water

WSRC/X-08- SPE

Permit number **SC**

Discharge #:

Final Limits:

Parameter Code **TGA3B** MLOC=1 IWC= 8.25%Effluent

Monitoring Period From	Year	Month	Day	To	Year	Month	Day
	00	1	1		00	1	31

Date	1-24-00	Group	All tests			Chronic Tests Only		
			#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID	23104	Control	20	1	FAIL			
		Test	20	20				

Date		Group	All tests			Chronic Tests Only		
			#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID		Control						
		Test						

Date		Group	All tests			Chronic Tests Only		
			#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID		Control						
		Test						

Date		Group	All tests			Chronic Tests Only		
			#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID		Control						
		Test						

Date		Group	All tests			Chronic Tests Only		
			#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID		Control						
		Test						

Date		Group	All tests			Chronic Tests Only		
			#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID		Control						
		Test						

Signature of Principal Executive Officer or Authorized Agent _____

Name/Title of Principal Executive Officer (typed or printed) _____

STATISTICAL ANALYSIS RESULTS

Facility:	WSRC/X-08- SPE	NPDES#	SC
Sample ID:	X-08- SPE	ETT#	T13692-1
		Date:	1-24-00
Laboratory:	ETT Environmental, Inc.	Certification #:	23104
		Exp. Date:	10/2001

Survival Data			
	48 Hrs. Survival	Test Used:	Fisher's Test
Control	95%	Test Statistic:	P= 0.000
Effluent	0%	Critical Value:	P= 0.05
FAIL: The effluent reduces survival of the test organisms.			

QUALITY CONTROL RESULTS

Reference Toxicant: NaCl					
Current Acute LC50:	1.96	g/L	Current Chronic NOEC:	0.8	g/L
Mean Acute LC50:	2.01	g/L	Mean Chronic NOEC::	0.8	g/L
Lower & Upper Limits (g/L)	1.75	2.22	Lower & Upper Limits (g/L)	0.4	1.5

SHEALY ENVIRONMENTAL SERVICES, INC.

Reported To: WESTINGHOUSE SRS
STUART STINSON
PO BOX 616
BUILDING 735-11A
AIKEN, SC 29808

48 HOUR ACUTE BIOASSAY WITH *CERIODAPHNIA DUBIA*
(SESI FORM 105 - PASS/FAIL ACUTE TESTS)

CLIENT: WESTINGHOUSE SRS

SAMPLE LOCATION: TANK #2

TEST CONCENTRATION: 8.25%

Test Start Date/Time: 1/27/00 1350

Test End Date/Time: 1/29/00 1150

SAMPLE USAGE

SAMPLE ID	COLLECTION DATE/TIME	WHEN USED
186049ST	1/26/00 0910	1/27

(Attach C-O-C)

SUMMARY OF SURVIVAL

TREATMENT	#ADULTS	#DEAD	TEST RESULTS PASS/FAIL
CONTROL	20	0	FAIL
8.25%	20	18	

STATISTICAL PROGRAM USED: TOXIS Version 2.4a

Reported By: D. Sabel
SC DHEC No. 32010

QC By: 22

Comments:

45

SHEALY ENVIRONMENTAL SERVICES, INC.

Reported To: WESTINGHOUSE SRS
STUART STINSON
PO BOX 616
BUILDING 735-11A
AIKEN, SC 29808

48 HOUR ACUTE BIOASSAY WITH *CERIODAPHNIA DUBIA*
(SESI FORM 105 - PASS/FAIL ACUTE TESTS)

CLIENT: WESTINGHOUSE SRS

SAMPLE LOCATION: X-8B

TEST CONCENTRATION: 8.25%

Test Start Date/Time: 1/27/00 1410

Test End Date/Time: 1/29/00 1425

SAMPLE USAGE

SAMPLE ID	COLLECTION DATE/TIME	WHEN USED
186051ST	1/26/00 0930	1/27

(Attach C-O-C)

SUMMARY OF SURVIVAL

TREATMENT	#ADULTS	#DEAD	TEST RESULTS PASS/FAIL
CONTROL	20	0	FAIL
8.25%	20	20	

STATISTICAL PROGRAM USED: TOXIS Version 2.4a

Reported By: DJL
SC DHEC No. 32010

QC By: zm

Comments:

SHEALY ENVIRONMENTAL SERVICES, INC.

Reported To: WESTINGHOUSE SRS
STUART STINSON
PO BOX 616
BUILDING 735-11A
AIKEN, SC 29808

48 HOUR ACUTE BIOASSAY WITH *CERIODAPHNIA DUBIA*
(SESI FORM 105 - PASS/FAIL ACUTE TESTS)

CLIENT: WESTINGHOUSE SRS

SAMPLE LOCATION: X-08

TEST CONCENTRATION: 33%

Test Start Date/Time: 1/27/00 1410

Test End Date/Time: 1/29/00 1415

SAMPLE USAGE

SAMPLE ID	COLLECTION DATE/TIME	WHEN USED
186052ST	1/26/00 0940	1/27

(Attach C-O-C)

SUMMARY OF SURVIVAL

TREATMENT	# ADULTS	# DEAD	TEST RESULTS PASS/FAIL
CONTROL	20	1	FAIL
8.25%	20	20	

STATISTICAL PROGRAM USED: TOXIS Version 2.4a

Reported By: D. J. H.
SC DHEC No. 32010

QC By: 202

Comments:

65/

SHEALY ENVIRONMENTAL SERVICES, INC.

Reported to: WESTINGHOUSE SRS
STUART STINSON
WESTINGHOUSE SRS
PO BOX 616, BUILDING 735-11A
AIKEN, SC, 29808

48 HOUR ACUTE BIOASSAY WITH *CERIODAPHNIA DUBIA*
(SESI FORM 105 - PASS/FAIL ACUTE TESTS)

CLIENT: Westinghouse SRS

SAMPLE LOCATION: X8C

TEST CONCENTRATION: 14.44%

Test Start Date/Time: 02/17/00 1620

Test End Date/Time: 02/19/00 1440

SAMPLE USAGE

SAMPLE ID	COLLECTION DATE/TIME	WHEN USED
187904ST	02/16/00 0910	2/17

(Attach C-O-C)

SUMMARY OF SURVIVAL

TREATMENT	# ADULTS	# DEAD	TEST RESULTS PASS/FAIL
CONTROL	20	0	PASS
14.44%	20	0	

STATISTICAL PROGRAM USED: TOXIS Version 2.4a

Reported By: D. L. L.
SC DHEC No. 32010

QC By: 222

Comments:

47/

SHEALY ENVIRONMENTAL SERVICES, INC.

Reported to: WESTINGHOUSE SRS
STUART STINSON
WESTINGHOUSE SRS
PO BOX 616, BUILDING 735-11A
AIKEN, SC, 29808

48 HOUR ACUTE BIOASSAY WITH *CERIODAPHNIA DUBIA*
(SESI FORM 105 - PASS/FAIL ACUTE TESTS)

CLIENT: WSRC Westinghouse SRS

SAMPLE LOCATION: Air Comp Coating H2O

TEST CONCENTRATION: 10.31%

Test Start Date/Time: 02/17/00 1610

Test End Date/Time: 02/19/00 1445

SAMPLE USAGE

SAMPLE ID	COLLECTION DATE/TIME	WHEN USED
187905ST	02/16/00 0935	2/17

(Attach C-O-C)

SUMMARY OF SURVIVAL

TREATMENT	# ADULTS	# DEAD	TEST RESULTS PASS/FAIL
CONTROL	20	1	PASS
10.31%	20	2	

STATISTICAL PROGRAM USED: TOXIS Version 2.4a

Reported By: D. L. L.
SC DHEC No. 32010

QC By: J. R.

Comments:

8/5

SHEALY ENVIRONMENTAL SERVICES, INC.

Reported to: WESTINGHOUSE SRS
STUART STINSON
WESTINGHOUSE SRS
PO BOX 616, BUILDING 735-11A
AIKEN, SC, 29808

48 HOUR ACUTE BIOASSAY WITH *CERIODAPHNIA DUBIA*
(SESI FORM 105 - PASS/FAIL ACUTE TESTS)

CLIENT: Westinghouse SRS

SAMPLE LOCATION: X08 Grab

TEST CONCENTRATION: 33%

Test Start Date/Time: 02/17/00 1615

Test End Date/Time: 02/19/00 1440

SAMPLE USAGE

SAMPLE ID	COLLECTION DATE/TIME	WHEN USED
187907ST	02/16/00 1000	2/17

(Attach C-O-C)

SUMMARY OF SURVIVAL

TREATMENT	# ADULTS	# DEAD	TEST RESULTS PASS/FAIL
CONTROL	20	0	PASS
33%	20	0	

STATISTICAL PROGRAM USED: TOXIS Version 2.4a

Reported By: D L M
SC DHEC No. 32010

QC By: 222

Comments:

67 ✓

SHEALY ENVIRONMENTAL SERVICES, INC.

Reported to: WESTINGHOUSE SRS
STUART STINSON
WESTINGHOUSE SRS
PO BOX 616, BUILDING 735-11A
AIKEN, SC, 29808

48 HOUR ACUTE BIOASSAY WITH *CERIODAPHNIA DUBIA*
(SESI FORM 105 - PASS/FAIL ACUTE TESTS)

CLIENT: WSRC Westinghouse SRS

SAMPLE LOCATION: Wet Well Over

TEST CONCENTRATION: 10.31%

Test Start Date/Time: 02/17/00 1615

Test End Date/Time: 02/19/00 1445

SAMPLE USAGE

SAMPLE ID	COLLECTION DATE/TIME	WHEN USED
187906ST	02/16/00 0940	2/17

(Attach C-O-C)

SUMMARY OF SURVIVAL

TREATMENT	# ADULTS	# DEAD	TEST RESULTS PASS/FAIL
CONTROL	20	1	PASS
10.31%	20	0	

STATISTICAL PROGRAM USED: TOXIS Version 2.4a

Reported By: DLH
SC DHEC No. 32010

QC By: ZZ

Comments:

47 /

DMR Attachment for Toxicity Test Results. Bureau of Water .

WSRC/TNX GRIT CHAMBER

Permit number **SC**

Discharge #:

Final Limits:

Parameter Code **TGA3B** MLOC=1 IWC= 8.25%Effluent

Monitoring Period		Year	Month	Day	To	Year	Month	Day
From		00	2	1		00	2	28

Date	2-23-00	Group	All tests			Chronic Tests Only		
			#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID	23104	Control	19	0	PASS			
		Test	20	0				

Date		Group	All tests			Chronic Tests Only		
			#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID		Control						
		Test						

Date		Group	All tests			Chronic Tests Only		
			#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID		Control						
		Test						

Date		Group	All tests			Chronic Tests Only		
			#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID		Control						
		Test						

Date		Group	All tests			Chronic Tests Only		
			#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID		Control						
		Test						

Date		Group	All tests			Chronic Tests Only		
			#Adults	#Dead	Pass/Fail	Average	Variance	Pass/Fail
Lab ID		Control						
		Test						

Signature of Principal Executive Officer or Authorized Agent _____

Name/Title of Principal Executive Officer (typed or printed) _____

STATISTICAL ANALYSIS RESULTS

Facility:	WSRC/TNX GRIT CHAMBER	NPDES#	SC		
Sample ID:	TNX GRIT CHAMBER	ETT#	T13953	Date:	2-23-00
Laboratory:	ETT Environmental, Inc.	Certification #:	23104	Exp. Date:	10/2001

Survival Data					
	48 Hrs. Survival		Test Used:	Fisher's Test	
Control	100%		Test Statistic:	P=	1.000
Effluent	100%		Critical Value:	P=	0.05
PASS: The effluent does not reduce survival of the test organisms.					

QUALITY CONTROL RESULTS

Reference Toxicant: NaCl					
Current Acute LC50:	1.96	g/L	Current Chronic NOEC:	0.8	g/L
Mean Acute LC50:	2.01	g/L	Mean Chronic NOEC::	0.8	g/L
Lower & Upper Limits (g/L)	1.75	2.22	Lower & Upper Limits (g/L)	0.4	1.5

Environmental, Inc.

(864) 877-6942 • FAX (864) 877-6938

P.O. Box 16414, Greenville, SC 29606

4 Craftsman Court, Greer, SC 29650

Client: WSRC	Sample ID: X-8B	Lab ID# T14015
Start Date: 3/10/00 Time: 1515	Set By: ML	Test Species:
End Date: 3/12/00 Time: 1930	Ended By: TF	Ceriodaphnia dubia
Dilution Water: MHSF		

MORTALITY DATA

Conc.	Rep.	# organisms	Cumulative Mortality				Mean
			24hr	48hr	72hr	96hr	
0%	A	5	0	0			0%
	B	5	0	0			
	C	5	0	0			
	D	5	0	0			
0.625%	A	5	0	0			5%
	B	5	0	0			
	C	5	0	1			
	D	4	0	0			
1.25%	A	5	0	0			5%
	B	5	0	1			
	C	5	0	0			
	D	5	0	0			
2.5%	A	5	0	0			30%
	B	5	0	2			
	C	5	0	3			
	D	5	0	1			
5%	A	5	0	3			30%
	B	5	0	1			
	C	5	0	2			
	D	5	0	0			
10%	A	5	1	4			70%
	B	5	1	5			
	C	5	1	4			
	D	5	0	1			

WATER QUALITY DATA

Parameter	units		Measured Value				
			0hr	24hr	48hr	72hr	96hr
Dissolved	mg/L	pre-renewal			8.7		
Oxygen	mg/L	post-renewal	8.3				
pH		pre-renewal			8.21		
		post-renewal	7.75				
Dissolved	mg/L	pre-renewal			8.6		
Oxygen	mg/L	post-renewal	8.4				
pH		pre-renewal			8.28		
		post-renewal	8.21				
Dissolved	mg/L	pre-renewal			8.5		
Oxygen	mg/L	post-renewal	8.4				
pH		pre-renewal			8.28		
		post-renewal	8.29				
Dissolved	mg/L	pre-renewal			8.5		
Oxygen	mg/L	post-renewal	8.4				
pH		pre-renewal			8.19		
		post-renewal	7.68				
Dissolved	mg/L	pre-renewal			8.5		
Oxygen	mg/L	post-renewal	8.4				
pH		pre-renewal			8.24		
		post-renewal	8.19				
Dissolved	mg/L	pre-renewal			8.3		
Oxygen	mg/L	post-renewal	8.5				
pH		pre-renewal			8.28		
		post-renewal	8.24				

STATISTICAL ANALYSIS

48 Hour LC50 5.5% effluent
 95% Confidence Limits: Upper:
 Lower:
 Method: Spearman Karber

COMMENTS:

Approved By:

Date:

R. V. V.
 3/12/00

3/29/00

The results of the latest X-08B tests are as follows;

Tank 1	Untreated	LC50= <1.03%
Tank 1	w/ Jay Flocc	LC50= 1.67%
X-08B		LC50= <1.03%

The results suggest the Tank 1 water is toxic before addition of J Flocc and that J Flocc does not add toxicity. In fact the J Flocc addition appeared to slightly decrease toxicity. If the toxicant is a metal we might expect addition of J Flocc to reduce toxicity.

Metal results on X-08B; Cu = 0.005 mg/L, Al = 0.050 mg/L
Fe = 0.092 mg/L, Zn = incomplete

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4 Craftsman Court, Greer, SC 29650

Client: WSRC	Sample ID: Tank 2	Lab ID# T14294
Start Date: 4/20/00 Time: 1640	Set By: TF	Test Species:
End Date: 4/22/00 Time: 1600	Ended By: ML	<i>Ceriodaphnia dubia</i>
Dilution Water: MHSF		

MORTALITY DATA

Conc.	Rep.	# organisms	Cumulative Mortality				Mean
			24hr	48hr	72hr	96hr	
0%	A	5	0	0			5%
	B	5	0	0			
	C	5	1	1			
	D	5	0	0			
1%	A	5	0	0			0%
	B	5	0	0			
	C	5	0	0			
	D	5	0	0			
5%	A	5	0	0			5%
	B	5	0	0			
	C	5	0	1			
	D	5	0	0			
10%	A	5	0	0			10%
	B	5	0	1			
	C	5	0	0			
	D	5	0	1			
20%	A	5	5	5			100%
	B	5	5	5			
	C	5	5	5			
	D	5	5	5			
50%	A	5	5	5			100%
	B	5	4	5			
	C	5	3	5			
	D	5	4	5			

WATER QUALITY DATA

Parameter	units		Measured Value				
			0hr	24hr	48hr	72hr	96hr
Dissolved Oxygen	mg/L	pre-renewal			8.3		
	mg/L	post-renewal	7.6				
pH		pre-renewal			8.14		
		post-renewal	7.97				
Dissolved Oxygen	mg/L	pre-renewal			8.3		
	mg/L	post-renewal	8.0				
pH		pre-renewal			7.86		
		post-renewal	7.94				
Dissolved Oxygen	mg/L	pre-renewal			8.4		
	mg/L	post-renewal	8.1				
pH		pre-renewal			7.98		
		post-renewal	7.95				
Dissolved Oxygen	mg/L	pre-renewal			8.4		
	mg/L	post-renewal	8.2				
pH		pre-renewal			7.78		
		post-renewal	7.94				
Dissolved Oxygen	mg/L	pre-renewal			8.5		
	mg/L	post-renewal	8.2				
pH		pre-renewal			7.87		
		post-renewal	7.96				
Dissolved Oxygen	mg/L	pre-renewal			8.5		
	mg/L	post-renewal	8.3				
pH		pre-renewal			7.68		
		post-renewal	8.00				

STATISTICAL ANALYSIS

48 Hour LC50	12.5%	effluent
95% Confidence Limits:	Upper:	0.11
	Lower:	0.14
Method: Spearman Karber		

COMMENTS:

Approved By:

Date:

4/28/00

P.O. Box 16414, Greenville, SC 29606

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4 Craftsman Court, Greer, SC 29650

Client: WSRC/X-08 w/o Discharge	Sample ID: Spiked w/ Zinc	Lab ID# T14296
Start Date: 5/3/00	Time: 1700	Set By: RK
End Date: 5/5/00	Time: 1730	Ended By: TF
	Dilution Water: MHSF	Test Species: <i>Ceriodaphnia dubia</i>

MORTALITY DATA

Conc.	Rep.	# organisms	Cumulative Mortality				Mean
			24hr	48hr	72hr	96hr	
0%	A	5	0	0			10%
	B	5	0	2			
	C	5	0	0			
	D	5	0	0			
100 µg/L Zinc	A	5	0	0			0%
	B	5	0	0			
	C	5	0	0			
	D	5	0	0			
200 µg/L Zinc	A	5	0	0			0%
	B	5	0	0			
	C	5	0	0			
	D	5	0	0			
400 µg/L Zinc	A	5	2	4			75%
	B	5	0	5			
	C	5	2	2			
	D	5	1	4			
600 µg/L Zinc	A	5	3	5			100%
	B	5	5	5			
	C	5	4	5			
	D	5	5	5			
800 µg/L Zinc	A	5	3	5			100%
	B	5	2	5			
	C	5	4	5			
	D	5	4	5			

WATER QUALITY DATA

Parameter	units		Measured Value				
			0hr	24hr	48hr	72hr	96hr
Dissolved	mg/L	pre-renewal			8.0		
Oxygen	mg/L	post-renewal	8.5				
pH		pre-renewal			7.93		
		post-renewal	7.92				
Dissolved	mg/L	pre-renewal					
Oxygen	mg/L	post-renewal					
pH		pre-renewal					
		post-renewal					
Dissolved	mg/L	pre-renewal					
Oxygen	mg/L	post-renewal					
pH		pre-renewal					
		post-renewal					
Dissolved	mg/L	pre-renewal			7.6		
Oxygen	mg/L	post-renewal	8.5				
pH		pre-renewal			7.81		
		post-renewal	7.98				

STATISTICAL ANALYSIS

48 Hour LC50 300 µg/L effluent
 95% Confidence Limits: Upper:
 Lower:
 Method: Spearman Karber

COMMENTS:

Approved By: R. V. H.
 Date: 5/10/00

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4 Craftsman Court, Greer, SC 29650

Client: WSRC	Sample ID: Collection Sump	Lab ID# T14468
Start Date: 5/10/00 Time: 1640-	Set By: ML	Test Species:
End Date: 5/12/00 Time: 1830	Ended By: AR	<i>Ceriodaphnia dubia</i>
Dilution Water: MHSF		

MORTALITY DATA

Conc.	Rep.	# organisms	Cumulative Mortality				Mean
			24hr	48hr	72hr	96hr	
0%	A	5	0	0			0%
	B	5	0	0			
	C	5	0	0			
	D	5	0	0			
1.03%	A	5	0	0			0%
	B	5	0	0			
	C	5	0	0			
	D	5	0	0			
2.06%	A	5	0	0			0%
	B	5	0	0			
	C	5	0	0			
	D	5	0	0			
4.12%	A	5	4	4			26%
	B	4	1	1			
	C	5	0	0			
	D	5	0	0			
8.25%	A	5	4	5			95%
	B	5	5	5			
	C	5	4	5			
	D	5	4	4			
16.5%	A	5	5	5			100%
	B	5	4	5			
	C	5	5	5			
	D	5	5	5			

WATER QUALITY DATA

Parameter	units		Measured Value				
			0hr	24hr	48hr	72hr	96hr
Dissolved	mg/L	pre-renewal			8.3		
Oxygen	mg/L	post-renewal	8.2				
pH		pre-renewal			8.15		
		post-renewal	7.70				
Dissolved	mg/L	pre-renewal			8.4		
Oxygen	mg/L	post-renewal	8.6				
pH		pre-renewal			7.71		
		post-renewal	8.03				
Dissolved	mg/L	pre-renewal			8.4		
Oxygen	mg/L	post-renewal	8.6				
pH		pre-renewal			7.75		
		post-renewal	8.02				
Dissolved	mg/L	pre-renewal			8.4		
Oxygen	mg/L	post-renewal	8.6				
pH		pre-renewal			8.17		
		post-renewal	8.02				
Dissolved	mg/L	pre-renewal			8.4		
Oxygen	mg/L	post-renewal	8.7				
pH		pre-renewal			7.80		
		post-renewal	7.97				
Dissolved	mg/L	pre-renewal			8.4		
Oxygen	mg/L	post-renewal	8.7				
pH		pre-renewal			8.16		
		post-renewal	7.95				

STATISTICAL ANALYSIS

48' Hour LC50	5.0%	effluent
95% Confidence Limits:	Upper:	0.04
	Lower:	0.06
Method: Spearman Karber		

COMMENTS:

Approved By:

Date:

Bob Kelly
5/15/00

Client: WSRC	Sample ID: Tank 1	Lab ID# T14470
Start Date: 5/11/00	Time: 1535	Set By: ML
End Date: 5/13/00	Time: 1215	Ended By: BB
	Dilution Water: MHSF	Test Species: <i>Ceriodaphnia dubia</i>

MORTALITY DATA

Conc.	Rep.	# organisms	Cumulative Mortality				Mean
			24hr	48hr	72hr	96hr	96hr
0%	A	5	0	0			5%
	B	5	0	0			
	C	5	0	0			
	D	5	0	1			
1.03%	A	5	1	1			15%
	B	5	0	1			
	C	5	0	0			
	D	5	0	1			
2.06%	A	5	4	5			50%
	B	5	0	1			
	C	5	0	2			
	D	5	0	2			
4.12%	A	5	5	5			100%
	B	4	5	5			
	C	5	4	4			
	D	5	4	5			
8.25%	A	5	5	5			100%
	B	5	5	5			
	C	5	5	5			
	D	5	3	5			
16.5%	A	5	5	5			100%
	B	5	5	5			
	C	5	5	5			
	D	5	5	5			

WATER QUALITY DATA

Parameter	units		Measured Value				
			0hr	24hr	48hr	72hr	96hr
Dissolved	mg/L	pre-renewal			8.4		
Oxygen	mg/L	post-renewal	8.4				
pH		pre-renewal			7.89		
		post-renewal	7.59				
Dissolved	mg/L	pre-renewal			8.3		
Oxygen	mg/L	post-renewal	8.7				
pH		pre-renewal			7.68		
		post-renewal	7.99				
Dissolved	mg/L	pre-renewal			8.3		
Oxygen	mg/L	post-renewal	8.7				
pH		pre-renewal			8.38		
		post-renewal	7.95				
Dissolved	mg/L	pre-renewal			8.4		
Oxygen	mg/L	post-renewal	8.7				
pH		pre-renewal			8.68		
		post-renewal	7.94				
Dissolved	mg/L	pre-renewal			8.4		
Oxygen	mg/L	post-renewal	8.8				
pH		pre-renewal			8.08		
		post-renewal	7.94				
Dissolved	mg/L	pre-renewal			8.5		
Oxygen	mg/L	post-renewal	8.8				
pH		pre-renewal			7.70		
		post-renewal	7.94				

STATISTICAL ANALYSIS

48 Hour LC50	2.7%	effluent
95% Confidence Limits:	Upper:	0.02
	Lower:	0.04
Method: Spearman Karber		

COMMENTS:

Approved By:

Date:

A. Kelly
5/15/00

P.O. Box 16414, Greenville, SC 29606

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4 Craftsman Court, Greer, SC 29650

Client: WSRC	Sample ID: Tank 2 heel	Lab ID# T14469
Start Date: 5/11/00 Time: 1500	Set By: ML	Test Species: Ceriodaphnia dubia
End Date: 5/13/00 Time: 1215	Ended By: BB	
	Dilution Water: MHSF	

MORTALITY DATA

Conc.	Rep.	# organisms	Cumulative Mortality				Mean
			24hr	48hr	72hr	96hr	
0%	A	5	0	0			5%
	B	5	0	0			
	C	5	0	0			
	D	5	0	1			
1.03%	A	5	0	3			40%
	B	5	1	3			
	C	5	0	2			
	D	5	0	0			
2.06%	A	5	4	5			95%
	B	5	0	4			
	C	5	3	5			
	D	5	4	5			
4.12%	A	5	5	5			100%
	B	4	4	4			
	C	5	5	5			
	D	5	5	5			
8.25%	A	5	5	5			100%
	B	5	5	5			
	C	5	5	5			
	D	5	5	5			
16.5%	A	5	5	5			100%
	B	5	5	5			
	C	5	5	5			
	D	5	5	5			

WATER QUALITY DATA

Parameter	units		Measured Value				
			0hr	24hr	48hr	72hr	96hr
Dissolved Oxygen	mg/L	pre-renewal			8.4		
		post-renewal	8.4				
pH		pre-renewal			7.89		
		post-renewal	7.59				
Dissolved Oxygen	mg/L	pre-renewal			8.2		
		post-renewal	8.6				
pH		pre-renewal			8.16		
		post-renewal	7.92				
Dissolved Oxygen	mg/L	pre-renewal			8.3		
		post-renewal	8.6				
pH		pre-renewal			8.15		
		post-renewal	7.90				
Dissolved Oxygen	mg/L	pre-renewal		8.3			
		post-renewal	8.6				
pH		pre-renewal		8.09			
		post-renewal	7.91				
Dissolved Oxygen	mg/L	pre-renewal		8.2			
		post-renewal	8.7				
pH		pre-renewal		7.77			
		post-renewal	7.91				
Dissolved Oxygen	mg/L	pre-renewal		8.3			
		post-renewal	8.8				
pH		pre-renewal		7.73			
		post-renewal	7.91				

STATISTICAL ANALYSIS

48 Hour LC50	1.91%	effluent
95% Confidence Limits:	Upper:	1.13
	Lower:	3.23
Method: Spearman Karber		

COMMENTS:

Approved By:

Date: 5/15/00

Author: Ed Wilde at SRCCC05

Date: 5/15/2000 4:19 PM

Priority: Normal

CC: Michael Long at SRCCC11, Roy Roaden at SRS, John Gladden at SRCCA09

TO: Winona Specht at SRCCA13

CC: Michael Heitkamp at SRCCB01

Subject: Re: TNX Toxicity

Winona,

Thanks for sending some algae work my way.

I obtained a sample from Mike Long late in the day on 5/10/00. It was labeled "ETP 904T-139A Tk #1". The next morning, 5/11/00, I performed a qualitative microscopical analysis of the sample and preserved a portion for a quantitative algal analysis using an inverted microscope. The qualitative analysis revealed that the sample contained a considerable amount of particulate material and much of this material was covered with epiphytic algae. Actively feeding rotifers were also commonly observed in the sample. There was also quite a bit of pine pollen in the sample. The quantitative analysis revealed that the sample contained approximately 1,120,277 algal cells/ml. The algal community was almost totally (>99%) comprised of two species, the diatom *Achnanthes minutissima*, which was primarily attached to particulate material, and the green alga *Scenedesmus abundans*. Both of these species are common pollution-tolerant species typical of highly eutrophic conditions such as this tank sample appears to represent. Although able to survive in conditions where many other algae cannot, *A. minutissima* and *S. abundans* are not known to produce toxins and are an unlikely source of the toxicity observed in your tests.

Let me know if I can be of further assistance.

Ed

Reply Separator

Subject: TNX Toxicity

Author: Winona Specht at SRCCA13

Date: 5/10/00 2:27 PM

Ed-

As you probably know, we've been investigating a toxicity problem at the TNX ETP. What goes into the holding tanks isn't toxic, what comes out is very toxic. It's probably a long-shot, but can you get in touch with Mike Long at TNX and arrange to get a sample either from the tank that they are about to discharge or from the heel of the tank that they are just starting to fill and take a quick look for potentially toxic algae. Nutrient concentrations in the tanks should be low, so I can't imagine that algal blooms are a problem, but we need to check it out - the sooner the better. Charge your time to JJ99ANATX. Thanks.

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P.O. Box 16414, Greenville, SC 29606

4 Craftsman Court, Greer, SC 29650

Client: WSRC/TNX ETP	Sample ID: Tank 2, Week 1	Lab ID# T14525
Start Date: 5/17/00 Time: 1645	Set By: ML	Test Species:
End Date: 5/19/00 Time: 1540	Ended By: ML	<i>Ceriodaphnia dubia</i>
Dilution Water: MHSF		

MORTALITY DATA

Conc.	Rep.	# organisms	Cumulative Mortality				Mean
			24hr	48hr	72hr	96hr	
0%	A	5	0	0			5%
	B	5	1	1			
	C	5	0	0			
	D	5	0	0			
1.03%	A	5	0	0			0%
	B	5	0	0			
	C	5	0	0			
	D	4	0	0			
2.06%	A	5	0	0			0%
	B	5	0	0			
	C	5	0	0			
	D	5	0	0			
4.12%	A	5	0	1			5%
	B	5	0	0			
	C	5	0	0			
	D	5	0	0			
8.25%	A	5	1	2			20%
	B	5	0	0			
	C	5	0	0			
	D	5	2	2			
16.5%	A	5	4	5			100%
	B	5	5	5			
	C	5	5	5			
	D	5	2	5			

WATER QUALITY DATA

Parameter	units		Measured Value				
			0hr	24hr	48hr	72hr	96hr
Dissolved Oxygen	mg/L	pre-renewal			8.1		
	mg/L	post-renewal	8.4				
pH		pre-renewal			8.04		
		post-renewal	7.72				
Dissolved Oxygen	mg/L	pre-renewal			8.3		
	mg/L	post-renewal	8.6				
pH		pre-renewal			7.75		
		post-renewal	7.65				
Dissolved Oxygen	mg/L	pre-renewal			8.3		
	mg/L	post-renewal	8.6				
pH		pre-renewal			7.73		
		post-renewal	7.64				
Dissolved Oxygen	mg/L	pre-renewal			8.3		
	mg/L	post-renewal	8.7				
pH		pre-renewal			8.10		
		post-renewal	7.66				
Dissolved Oxygen	mg/L	pre-renewal			8.3		
	mg/L	post-renewal	8.7				
pH		pre-renewal			7.90		
		post-renewal	8.00				
Dissolved Oxygen	mg/L	pre-renewal			8.4		
	mg/L	post-renewal	8.8				
pH		pre-renewal			8.15		
		post-renewal	7.61				

STATISTICAL ANALYSIS

48 Hour LC50 9.81% effluent
 95% Confidence Limits: Upper: 8.58
 Lower: 11.04
 Method: Spearman Karber

COMMENTS:

Approved By:

Date:

L Kelly
 5/23/00

P.O. Box 16414, Greenville, SC 29606

(864) 877-6942 • FAX (864) 877-6938

4 Craftsman Court, Greer, SC 29650

Client: WSRC/TNX ETP	Sample ID: Tank 2, Week 2	Lab ID# T14560
Start Date: 5/23/00 Time: 1545	Set By: ML	Test Species: <i>Ceriodaphnia dubia</i>
End Date: 5/25/00 Time: 1548	Ended By: ML	
Dilution Water: MHSF		

MORTALITY DATA

Conc.	Rep.	# organisms	Cumulative Mortality				Mean 96hr
			24hr	48hr	72hr	96hr	
0%	A	5	0	0			10%
	B	5	0	0			
	C	5	0	0			
	D	5	0	2			
1.03%	A	5	0	1			5%
	B	4	0	0			
	C	5	0	0			
	D	5	0	0			
2.06%	A	5	0	0			5%
	B	5	0	1			
	C	5	0	0			
	D	5	0	0			
4.12%	A	5	0	0			5%
	B	5	0	0			
	C	5	1	1			
	D	5	0	0			
8.25%	A	5	1	2			40%
	B	5	1	1			
	C	5	3	3			
	D	5	2	2			
16.5%	A	5	5	5			100%
	B	5	5	5			
	C	5	5	5			
	D	5	5	5			

WATER QUALITY DATA

Parameter	units		Measured Value				
			0hr	24hr	48hr	72hr	96hr
Dissolved	mg/L	pre-renewal			8.4		
Oxygen	mg/L	post-renewal	8.2				
pH		pre-renewal			7.84		
		post-renewal	7.51				
Dissolved	mg/L	pre-renewal			8.1		
Oxygen	mg/L	post-renewal	8.4				
pH		pre-renewal			7.94		
		post-renewal	7.41				
Dissolved	mg/L	pre-renewal			8.1		
Oxygen	mg/L	post-renewal	8.4				
pH		pre-renewal			7.42		
		post-renewal	7.42				
Dissolved	mg/L	pre-renewal			8.2		
Oxygen	mg/L	post-renewal	8.5				
pH		pre-renewal			8.02		
		post-renewal	7.41				
Dissolved	mg/L	pre-renewal			8.2		
Oxygen	mg/L	post-renewal	8.4				
pH		pre-renewal			8.06		
		post-renewal	7.47				
Dissolved	mg/L	pre-renewal			8.2		
Oxygen	mg/L	post-renewal	8.4				
pH		pre-renewal			7.88		
		post-renewal	7.47				

STATISTICAL ANALYSIS

48 Hour LC50	9.04%	effluent
95% Confidence Limits:	Upper:	8.58
	Lower:	11.04
Method: Spearman Karber		

COMMENTS:

Approved By:
Date:

R. Vally
6/1/00

P.O. Box 16414, Greenville, SC 29606

(864) 877-6942 • FAX (864) 877-6938

4 Craftsman Court, Greer, SC 29650

Client: WSRC/TNX ETP	Sample ID: Tank 2, Week 3	Lab ID# T14614
Start Date: 6/1/00	Time: 1440	Set By: ML
End Date: 6/3/00	Time: 1315	Test Species: <i>Ceriodaphnia dubia</i>
Dilution Water: MHSF		

MORTALITY DATA

Conc.	Rep.	# organisms	Cumulative Mortality				Mean
			24hr	48hr	72hr	96hr	
0%	A	5	0	0			0%
	B	5	0	0			
	C	5	0	0			
	D	5	0	0			
1.03%	A	5	0	0			0%
	B	5	0	0			
	C	5	0	0			
	D	5	0	0			
2.06%	A	5	0	0			0%
	B	5	0	0			
	C	5	0	0			
	D	5	0	0			
4.12%	A	5	0	0			0%
	B	5	0	0			
	C	5	0	0			
	D	5	0	0			
8.25%	A	5	0	0			0%
	B	5	0	0			
	C	5	0	0			
	D	5	0	0			
16.5%	A	5	0	0			25%
	B	5	1	2			
	C	5	2	2			
	D	5	0	1			

WATER QUALITY DATA

Parameter	units		Measured Value				
			0hr	24hr	48hr	72hr	96hr
Dissolved	mg/L	pre-renewal			8.4		
Oxygen	mg/L	post-renewal	8.2				
pH		pre-renewal			7.67		
		post-renewal	7.80				
Dissolved	mg/L	pre-renewal			8.4		
Oxygen	mg/L	post-renewal	8.3				
pH		pre-renewal			7.75		
		post-renewal	7.67				
Dissolved	mg/L	pre-renewal			8.4		
Oxygen	mg/L	post-renewal	8.3				
pH		pre-renewal			7.83		
		post-renewal	7.71				
Dissolved	mg/L	pre-renewal			8.3		
Oxygen	mg/L	post-renewal	8.4				
pH		pre-renewal			7.97		
		post-renewal	7.68				
Dissolved	mg/L	pre-renewal			8.4		
Oxygen	mg/L	post-renewal	8.5				
pH		pre-renewal			7.93		
		post-renewal	7.50				
Dissolved	mg/L	pre-renewal			8.4		
Oxygen	mg/L	post-renewal	8.6				
pH		pre-renewal			8.01		
		post-renewal	7.88				

STATISTICAL ANALYSIS

48 Hour LC50 > 16.50% effluent
95% Confidence Limits: Upper: N/A
Lower: N/A
Method: Spearman Karber

COMMENTS:

Approved By:

Date: 6-7-00

(864) 877-6942 • FAX (864) 877-6938

P.O. Box 16414, Greenville, SC 29606

4 Craftsman Court, Greer, SC 29650

Client: WSRC	Sample ID: Collect. Sump- Composi Lab ID# T14615
Start Date: 6/1/00 Time: 1510	Set By: ML Test Species:
End Date: 6/3/00 Time: 1315	Ended By: BB <i>Ceriodaphnia dubia</i>
	Dilution Water: MHSF

MORTALITY DATA

Conc.	Rep.	# organisms	Cumulative Mortality				Mean
			24hr	48hr	72hr	96hr	
0%	A	5	0	0			0%
	B	5	0	0			
	C	5	0	0			
	D	5	0	0			
1.03%	A	5	0	0			0%
	B	5	0	0			
	C	5	0	0			
	D	5	0	0			
2.06%	A	5	0	0			0%
	B	5	0	0			
	C	5	0	0			
	D	5	0	0			
4.12%	A	5	0	0			0%
	B	5	0	0			
	C	5	0	0			
	D	5	0	0			
8.25%	A	5	0	0			5%
	B	5	0	1			
	C	5	0	0			
	D	5	0	0			
16.5%	A	5	0	1			20%
	B	5	1	2			
	C	5	0	0			
	D	5	1	1			

WATER QUALITY DATA

Parameter	units		Measured Value				
			0hr	24hr	48hr	72hr	96hr
Dissolved	mg/L	pre-renewal			8.4		
Oxygen	mg/L	post-renewal	8.2				
pH		pre-renewal			7.67		
		post-renewal	7.80				
Dissolved	mg/L	pre-renewal			8.4		
Oxygen	mg/L	post-renewal	8.5				
pH		pre-renewal			8.01		
		post-renewal	7.91				
Dissolved	mg/L	pre-renewal			8.4		
Oxygen	mg/L	post-renewal	8.5				
pH		pre-renewal			8.03		
		post-renewal	7.68				
Dissolved	mg/L	pre-renewal			8.4		
Oxygen	mg/L	post-renewal	8.2				
pH		pre-renewal			7.92		
		post-renewal	7.93				
Dissolved	mg/L	pre-renewal			8.4		
Oxygen	mg/L	post-renewal	8.2				
pH		pre-renewal			7.89		
		post-renewal	7.69				
Dissolved	mg/L	pre-renewal			8.3		
Oxygen	mg/L	post-renewal	8.3				
pH		pre-renewal			7.81		
		post-renewal	7.53				

STATISTICAL ANALYSIS

48 Hour LC50 > 16.50% effluent
 95% Confidence Limits: Upper: N/A
 Lower: N/A
 Method: Spearman Karber

COMMENTS:

Approved By:

Date:

R. V. V.
 6-7-00

SHEALY ENVIRONMENTAL SERVICES, INC.

Reported to: WESTINGHOUSE SRS
CHUCK HAYES
PO BOX 616, BUILDING 735-11A
AIKEN, SC, 29808

48 HOUR ACUTE BIOASSAY WITH *CERIODAPHNIA DUBIA*
(SESI FORM 105 - PASS/FAIL ACUTE TESTS)

CLIENT: Westinghouse SRS

SAMPLE LOCATION: X-08

TEST CONCENTRATION: 33%

CRH

Test Start Date/Time: 05/24/00 1600

Test End Date/Time: 05/26/00 1415

SAMPLE USAGE

SAMPLE ID	COLLECTION DATE/TIME	WHEN USED
BE23026-001	05/23/00 1245	5/24

(Attach C-O-C)

SUMMARY OF SURVIVAL

TREATMENT	# ADULTS	# DEAD	TEST RESULTS PASS/FAIL
CONTROL	20	0	FAIL
33%	20	14	

STATISTICAL PROGRAM USED: TOXIS Version 2.4a

Reported By: DJH
SC DHEC No. 32010

QC By: WJH

Comments:

cc: L. ELDRIDGE
W. SPECT

SHEALY ENVIRONMENTAL SERVICES, INC.

Reported to: WESTINGHOUSE SRS
CHUCK HAYES
PO BOX 616, BUILDING 735-11A
AIKEN, SC, 29808

48 HOUR ACUTE BIOASSAY WITH *CERIODAPHNIA DUBIA*
(SESI FORM 105 - PASS/FAIL ACUTE TESTS)

CLIENT: Westinghouse SRS

SAMPLE LOCATION: X-8A

TEST CONCENTRATION: 1%

Test Start Date/Time: 05/24/00 1700

Test End Date/Time: 05/26/00 1530

CRH

SAMPLE USAGE

SAMPLE ID	COLLECTION DATE/TIME	WHEN USED
BE23028-002	05/23/00 1220	5/24

(Attach C-O-C)

SUMMARY OF SURVIVAL

TREATMENT	# ADULTS	# DEAD	TEST RESULTS PASS/FAIL
CONTROL	20	0	PASS
1%	20	0	

STATISTICAL PROGRAM USED: TOXIS Version 2.4a

Reported By: D. S. H.
SC DHEC No. 32010

QC By: W. H. T.

Comments:

CC: L. ELDRIDGE

SHEALY ENVIRONMENTAL SERVICES, INC.

Reported to: WESTINGHOUSE SRS
CHUCK HAYES
PO BOX 616, BUILDING 735-11A
AIKEN, SC, 29808

48 HOUR ACUTE BIOASSAY WITH *CERIODAPHNIA DUBIA*
(SESI FORM 105 - PASS/FAIL ACUTE TESTS)

CLIENT: Westinghouse SRS

SAMPLE LOCATION: X-08-100 (effluent ditch, downstream from
X-08)

TEST CONCENTRATION: 33%

Test Start Date/Time: 05/24/00 1630

CELH

Test End Date/Time: 05/26/00 1435

SAMPLE USAGE

SAMPLE ID	COLLECTION DATE/TIME	WHEN USED
BE23026-002	05/23/00 1255	5/24

(Attach C-O-C)

SUMMARY OF SURVIVAL

TREATMENT	# ADULTS	# DEAD	TEST RESULTS PASS/FAIL
CONTROL	20	0	PASS
33%	20	0	

STATISTICAL PROGRAM USED: TOXIS Version 2.4a

Reported By: [Signature]
SC DHEC No. 32010

QC By: [Signature]

Comments:

CC: L. ELDRIDGE

SHEALY ENVIRONMENTAL SERVICES, INC.

Reported to: WESTINGHOUSE SRS
CHUCK HAYES
PO BOX 616, BUILDING 735-11A
AIKEN, SC, 29808

48 HOUR ACUTE BIOASSAY WITH *CERIODAPHNIA DUBIA*
(SESI FORM 105 - PASS/FAIL ACUTE TESTS)

CLIENT: Westinghouse SRS

SAMPLE LOCATION: X-08-200 effluent ditch, mouth

TEST CONCENTRATION: 33%

Test Start Date/Time: 05/24/00 1615

CEH

Test End Date/Time: 05/26/00 1430

SAMPLE USAGE

SAMPLE ID	COLLECTION DATE/TIME	WHEN USED
BE23026-003	05/23/00 1310	5/24

(Attach C-O-C)

SUMMARY OF SURVIVAL

TREATMENT	# ADULTS	# DEAD	TEST RESULTS PASS/FAIL
CONTROL	20	0	PASS
33%	20	0	

STATISTICAL PROGRAM USED: TOXIS Version 2.4a

Reported By: D. L. L.
SC DHEC No. 32010

QC By: W. H.

Comments:

CC: L. ELDRIDGE

SHEALY ENVIRONMENTAL SERVICES, INC.

Reported to: WESTINGHOUSE SRS
CHUCK HAYES
PO BOX 616, BUILDING 735-11A
AIKEN, SC, 29808

48 HOUR ACUTE BIOASSAY WITH *CERIODAPHNIA DUBIA*
(SESI FORM 105 - PASS/FAIL ACUTE TESTS)

CLIENT: Westinghouse SRS

SAMPLE LOCATION: X-08-300

Savannah River, upstream
from X-08 ditch

TEST CONCENTRATION: 100%

Test Start Date/Time: 05/24/00 1645

CLH

Test End Date/Time: 05/26/00 1440

SAMPLE USAGE

SAMPLE ID	COLLECTION DATE/TIME	WHEN USED
BE23026-004	05/23/00 1320	5/24

(Attach C-O-C)

SUMMARY OF SURVIVAL

TREATMENT	# ADULTS	# DEAD	TEST RESULTS PASS/FAIL
CONTROL	20	0	PASS
100%	20	0	

STATISTICAL PROGRAM USED: TOXIS Version 2.4a

Reported By: ASL
SC DHEC No. 32010

QC By: KLH

Comments:

cc: L. EDRIDGE

SHEALY ENVIRONMENTAL SERVICES, INC.

Reported to: WESTINGHOUSE SRS
CHUCK HAYES
PO BOX 616, BUILDING 735-11A
AIKEN, SC, 29808

48 HOUR ACUTE BIOASSAY WITH *CERIODAPHNIA DUBIA*
(SESI FORM 105 - PASS/FAIL ACUTE TESTS)

CLIENT: Westinghouse SRS

SAMPLE LOCATION: X-08-400

Savannah River, downstream
from X-08 ditch, in mixing
zone

TEST CONCENTRATION: 100%

CRH

Test Start Date/Time: 05/24/00 1650

Test End Date/Time: 05/26/00 1500

SAMPLE USAGE

SAMPLE ID	COLLECTION DATE/TIME	WHEN USED
BE23026-005	05/23/00 1330	5/24

(Attach C-O-C)

SUMMARY OF SURVIVAL

TREATMENT	# ADULTS	# DEAD	TEST RESULTS PASS/FAIL
CONTROL	20	0	PASS
100%	20	0	

STATISTICAL PROGRAM USED: TOXIS Version 2.4a

Reported By: DLH
SC DHEC No. 32010

QC By: NDH

Comments:

CC: L. ELDRIDGE

SHEALY ENVIRONMENTAL SERVICES, INC.

Reported to: WESTINGHOUSE SRS
CHUCK HAYES
PO BOX 616, BUILDING 735-11A
AIKEN, SC, 29808

48 HOUR ACUTE BIOASSAY WITH *CERIODAPHNIA DUBIA*
(SESI FORM 105 - PASS/FAIL ACUTE TESTS)

CLIENT: Westinghouse SRS

SAMPLE LOCATION: X-8B

TEST CONCENTRATION: 12.2%

Test Start Date/Time: 05/24/00 1710

CH

Test End Date/Time: 05/26/00 1540

SAMPLE USAGE

SAMPLE ID	COLLECTION DATE/TIME	WHEN USED
BE23028-001	05/23/00 1210	5/24

(Attach C-O-C)

SUMMARY OF SURVIVAL

TREATMENT	# ADULTS	# DEAD	TEST RESULTS PASS/FAIL
CONTROL	20	0	FAIL
12.2%	20	6	

STATISTICAL PROGRAM USED: TOXIS Version 2.4a

Reported By: D. L. Elderidge
SC DHEC No. 32010

QC By: MDH

Comments:

CC: L. ELDRIDGE

SHEALY ENVIRONMENTAL SERVICES, INC.

Reported to: WESTINGHOUSE SRS
CHUCK HAYES
PO BOX 616, BUILDING 735-11A
AIKEN, SC, 29808

48 HOUR ACUTE BIOASSAY WITH *CERIODAPHNIA DUBIA*
(SESI FORM 105 - PASS/FAIL ACUTE TESTS)

CLIENT: Westinghouse SRS

SAMPLE LOCATION: X-8C

TEST CONCENTRATION: 20.2%

Test Start Date/Time: 05/24/00 1705

CEL

Test End Date/Time: 05/26/00 1550

SAMPLE USAGE

SAMPLE ID	COLLECTION DATE/TIME	WHEN USED
BE23028-003	05/23/00 1235	5/24

(Attach C-O-C)

SUMMARY OF SURVIVAL

TREATMENT	# ADULTS	# DEAD	TEST RESULTS PASS/FAIL
CONTROL	19	2	PASS
20.2%	20	4	

STATISTICAL PROGRAM USED: TOXIS Version 2.4a

Reported By: D. Loh
SC DHEC No. 32010

QC By: WDH

Comments:

CC: L. ELDRIDGE

APPENDIX B
RESULTS OF TOXICITY IDENTIFICATION EVALUATIONS

P.O. Box 16414, Greenville, SC 29606

(864) 877-6942 • FAX (864) 877-6938

4 Craftsman Court, Greer, SC 29650

CHRONIC TOXICITY IDENTIFICATION EVALUATION PHASE I

**Facility: Westinghouse Savannah River Company
Sample ID: X-08 Effluent**

Subcontract # AC08813N

November 1999

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1.0 INTRODUCTION

Effluent discharged from outfall X-008 has been found to be acutely toxic to the test organism *Ceriodaphnia dubia* at a 33% test concentration (the In-Stream Waste Concentration). A Phase I Acute Toxicity Identification Evaluation (TIE) was conducted in November 1999 to identify the toxicant(s) present in the effluent. This report presents the results of the Phase I Toxicity Characterization.

2.0 SAMPLING

A composite effluent sample was collected on November 9, 1999 for use in the TIE. The sample was approximately 8 days old when the Phase I TIE was conducted.

3.0 SAMPLE TREATMENTS

The sample was subjected to a series of treatments to attempt to remove toxicity. Each treated sample was used in a chronic definitive toxicity test to determine the effectiveness of the treatment. The treatments of the associated toxicity tests are summarized as follows:

<u>Treatment</u>	<u>Start Date</u>	<u>Sample ID</u>	<u>Potential Toxicants Removed</u>
Adjust to pH 3	11/17/99	13253	Insoluble at low pH
Adjust to pH 10	11/17/99		Insoluble at high pH
Aerated at Initial pH	11/17/99		Volatile; oxidizable
Aerated at pH 3	11/17/99		Volatile, oxidizable at low pH
Aerated at pH 10	11/17/99		Volatile, oxidizable at high pH
Filtered at Initial pH	11/17/99		TSS
Filtered at pH 3	11/17/99		Insoluble at low pH
Filtered at pH 10	11/17/99		metals; insoluble at pH 10
C-18 SPE at Initial pH	12/7/99		non-polar organics, metals
Na Thiosulfate Addition	11/17/99		residual chlorine; some metals
EDTA Chelation	11/17/99		some metals; surfactants
Graduated pH	11/18/99		ammonia; metals; sulfide

The initial pH of the X-08 Plant effluent was 7.01.

Methodology for the individual treatments is discussed below by treatment.

3.1 Adjustment to pH 3

A 1000 mL aliquot of the sample was adjusted to pH 3.0 with H_2SO_4 . A 1000 mL aliquot of dilution water also was adjusted to pH 3.01 with H_2SO_4 , to serve as a control. The pH of 150 mL of the pH 3 control was readjusted to 7.71 with NaOH. The pH of 150 mL of the pH 3 effluent sample was readjusted to 7.00 with NaOH. This treated sample was used for the toxicity test identified pH 3 Adjustment. The remaining 850 mL of pH 3 sample was used for additional treatments.

3.2 Adjustment to pH 11

A 1000 mL aliquot of the sample was adjusted to pH 11.0 with NaOH. A 1000 mL aliquot of dilution water also was adjusted to pH 11.0 with NaOH, to serve as a control. The pH of 150 mL of the pH 11 control was readjusted to 7.71 with H_2SO_4 . The pH of 150 mL of the pH 11 sample was readjusted to 7.0 with H_2SO_4 . This treated sample was used for the toxicity test identified pH 11 Adjustment. The remaining 850 mL of the pH 10 sample was used for additional treatments.

3.3 Aeration at Initial pH

A 200 mL aliquot of the untreated sample was vigorously aerated for a period of one hour with air pumped by a diaphragm aerator. A 200 mL aliquot of dilution water was also aerated for the same length of time.

3.4 Aeration at pH 3

A 200 mL aliquot of sample which had been adjusted to pH 3 was vigorously aerated for a period of one hour with air pumped by a diaphragm aerator. A 100 mL aliquot of pH 3 adjusted dilution water was also aerated for the same length of time. The pH of the aerated effluent sample was re-adjusted to pH 6.98 with NaOH and the pH of the aerated dilution water was re-adjusted to 7.73.

3.5 Aeration at pH 11

A 200 mL aliquot of effluent sample which had been adjusted to pH 11 was vigorously aerated for a period of one hour with air pumped from a diaphragm aerator. A 100 mL aliquot of pH 11 adjusted dilution water was also aerated for the same length of time. The pH of the aerated effluent sample was re-adjusted to pH 6.98 with H_2SO_4 and the pH of the aerated dilution water was re-adjusted to 7.61.

3.6 Filtration at Initial pH

A 500 mL aliquot of untreated sample was filtered through a membrane filter which had been pre-rinsed with deionized water. After filtration the pH of the filtered sample was 7.17. 200 mL was used for testing and the remaining 300 mL was set aside for treatment by a C-18 SPE column. A 500 mL aliquot of dilution water was filtered in the same manner, to serve as a treated control. 200 mL of the filtered control was readjusted to pH 7.85 after filtration. The remaining treated control aliquot was set aside for treatment by a C-18 SPE column.

3.7 Filtration at pH 3

A 500 mL aliquot of effluent sample which had been adjusted to pH 3 was filtered through a membrane type filter which had been pre-rinsed with dilute H_2SO_4 . After filtration the pH of 200 mL was readjusted to 7.00 with NaOH. The remaining 300 mL was set aside for treatment by a C-18 SPE column. A 500 mL aliquot of dilution water was filtered in the same manner, to serve as a treated control. 200 mL of the filtered control was readjusted to pH 7.69 after filtration. The remaining treated control aliquot was set aside for treatment by a C-18 SPE column.

3.8 Filtration at pH 10

A 500 mL aliquot of sample which had been adjusted to pH 11 was filtered through a membrane type filter which had been pre-rinsed with deionized water. After filtration the pH of 200 mL was readjusted to 6.92 with H_2SO_4 . The remaining 300 mL was set aside for treatment by a C-18 SPE column. A 500 mL aliquot of dilution water was filtered in the same manner, to serve as a treated control. 200 mL of the filtered control

was readjusted to pH 7.70 after filtration. The remaining treated control aliquot was set aside for treatment by a C-18 SPE column.

3.9 C-18 SPE Column at Initial pH

A 300 mL aliquot of the filtered sample at initial pH was pumped through a Baker 6 mL C-18 SPE column at a rate of 10 mL per minute. Positive pressure was provided by a chemical metering pump. The column was initially pre-conditioned with 25 mL of methanol and 25 mL of ultra-pure water. After conditioning an aliquot of dilution water was run through the column. The first 50 mL of dilution water were not kept, and the remaining portion was used as a treated control for toxicity testing. After the dilution water the 300 mL aliquot of filtered effluent was run through the same column. The first 50 mL were not kept, and the remaining portion was readjusted to the initial pH and used for the toxicity test.

3.10 Oxidant Reduction

A 2.5 g/L stock solution of sodium thiosulfate was prepared. This stock solution was added to aliquots of undiluted sample water as follows;

<u>Amt. Sodium Thiosulfate</u>	<u>Amount Sample</u>	<u>Final Concentration</u>
0.04 mL	100 mL	1.0 mg/L
0.20 mL	100 mL	5.0 mg/L
0.40 mL	100 mL	10.0 mg/L
2.00 mL	100 mL	50.0 mg/L

After addition of the sodium thiosulfate, the test solutions were allowed to sit for two hours. In the same manner dilution water controls were treated with sodium thiosulfate.

Effluent test solutions after sodium thiosulfate addition ranged from 6.91 to 7.23, and control test solutions ranged from 7.30 to pH 7.44.

3.11 EDTA Chelation

A 15 g/L stock solution of diSodium EDTA was prepared. This stock solution was used to prepare aliquots of sample with 1, 5, 10, and 50 mg/L of EDTA. These aliquots were used for an acute definitive toxicity test. Dilution water controls were prepared in the same manner. After addition of the EDTA the solutions were adjusted to the initial pH (6.93-7.47 for dilution water; 6.59-7.36 for effluent). Aliquots of sample with EDTA added were left for 2 hours prior to use in testing, because equilibration times can be relatively slow for some metals.

3.12 Graduated pH Test

An effluent test was conducted with effluent adjusted to pH 6.5, 7.5 and 8.5. Effluent pH was monitored and readjusted at 2 and 24 hours.

4.0 TOXICITY TESTING METHODS

48 hour acute serial dilution (definitive) toxicity tests were set with all treated effluent samples. Tests were set at concentrations of 25, 50, and 100% effluent. The test organism was the invertebrate *Ceriodaphnia dubia*. The dilution water was moderately hard synthetic freshwater (MHSF) with a hardness of 80-100 mg/L. Each test dilution was comprised of two replicates of five test organisms. A treated control was prepared for each treatment set, where dilution water was subjected to the same treatment as the effluent samples.

5.0 RESULTS AND DISCUSSION

Upon arrival the sample was observed to be clear in color. The effluent was low in hardness (24.0 mg/L), alkalinity (12.9 mg/L), and conductivity (161 μ mhos/cm). Residual chlorine was not detected. A summary of the results is provided below.

	Mortality			48 Hr LC ₅₀	Results
	25	50	100%		
Untreated Effluent	30%	100%	100%	28.7%	Toxicity present
pH 3 Adjustment	10%	20%	100%	57.4%	Toxicity reduced
pH 11 Adjustment	0%	40%	100%	53.6%	Toxicity reduced
Aeration at Initial pH	0%	100%	100%	35.4	No change
Aeration at pH 3	0%	0%	40%	>100%	Toxicity reduced
Aeration at pH 11	0%	0%	100%	70.7%	Toxicity reduced
Filtration at Initial pH	0%	0%	100%	70.7%	Toxicity reduced
Filtration at pH 3	0%	30%	100%	57.4%	Toxicity reduced
Filtration at pH 11	0%	0%	0%	>100%	Toxicity removed
C-18 SPE at Initial pH		0%	0%	>100%	Toxicity removed
Na Thiosulfate Addition					
1 mg/L	100%	100%	100%	<25%	No change
5 mg/L	100%	100%	100%	<25%	No change
10 mg/L	100%	100%	100%	<25%	No change
50 mg/L	100%	100%	100%	<25%	No change
EDTA Chelation					
1 mg/L	100%	100%	100%	<25%	No toxicity
5 mg/L	100%	100%	100%	<25%	No toxicity
10 mg/L	100%	100%	100%	<25%	No toxicity
50 mg/L	80%	100%	100%	<25%	No toxicity
Graduated pH (6.5)	8 hour mortality			20%	More toxic at high pH
Graduated pH (7.5)	8 hour mortality			30%	
Graduated pH (8.5)	8 hour mortality			80%	

5.1 Baseline Test

The baseline toxicity test conducted on November 17, 1999 indicated that the sample remained acutely toxic despite an elapsed time of 8 days from sampling. The sample was toxic at the 33% IWC concentration and the 48 Hour LC_{50} was 28.7% (3.48 TU).

Another baseline test was set on December 7, 1999 with effluent at 50% and 100% concentrations. As in the original test the effluent was noted to be highly acutely toxic, this after an interval of one month from the sample date. The results suggests that there is little or no degradation of the toxicant over time.

5.2 pH Adjustment Tests

pH adjustment to an acidic pH and pH adjustment to an alkaline pH (followed by readjustment to initial pH) were both effective in slightly reducing toxicity. In readjusting the pH to the initial pH after treatment it typically requires addition of both acid and base to achieve the initial pH goal. Therefore, both sulfuric acid and sodium hydroxide could be responsible for change in molecular structure and toxicity related to pH modification. The slight effectiveness of pH adjustment suggests an organic toxicant may be involved.

5.3 Aeration

Aeration of effluent at the initial pH and aeration of effluent at pH 11 had no significant effect upon the toxicity. The sample aerated at pH 11 was only slightly less toxic than the sample treated by pH adjustment to pH 11 alone. However, aeration at pH 3 appeared to be more effective at reducing toxicity. This result may indicate that the toxicant can be transformed to a more volatile form at an acidic pH. An example would be an organic base which is rendered less soluble at an acidic pH.

5.4 Filtration

Filtration at pH 3 was ineffective at removing any additional toxicity beyond that removed by pH adjustment alone. However, at initial pH filtration was partially effective and at pH 11 filtration was very effective at reducing toxicity. Filtration could reduce toxicity in a number of ways including, 1) binding of the toxicant to the membrane filter, 2) removal of solids with which the toxicity might be associated, and 3) volatilization in the filtration process. Because filtration was more effective at pH 11 rather than pH 3 (as observed in the aeration treated sample), it would seem that volatilization is not the cause of toxicity reduction during filtration. Cationic metals are typically less soluble at alkaline pH values and are often removed by filtration at pH 11. If, as discussed in the aeration section, the toxicant was an organic base it should become ionized at an alkaline pH and have a greater tendency to bind with the organic substrate of the membrane filter.

5.5 C-18 Solid Phase Extraction

C-18 solid phase extraction treatment at initial pH removed all toxicity from the effluent. This is consistent with a non-polar organic toxicant, although cationic metals also can be trapped in the column, resulting in toxicity reduction.

5.6 EDTA Chelation

EDTA addition did not reduce sample toxicity. The results suggest that the toxicant was not a cationic metal. A few metals, such as aluminum, do not bind with EDTA.

5.7 Sodium Thiosulfate Addition

Addition of sodium thiosulfate did not reduce effluent toxicity. Sodium thiosulfate addition can reduce toxicity when oxidizing compounds (such as residual chlorine) are present and when some cations (such as copper) are present. The results indicate that the toxicant does not belong to either one of these groups.

5.8 Graduated pH Test

The effluent was found to be more toxic at a higher pH (8.5) than at a lower pH (6.5-7.5). The metals zinc and nickel are more toxic at the higher pH. It would be expected that an organic base would be ionized at a higher pH and thus more soluble and less toxic. On the other hand an organic acid would be more likely to be in a higher pH, because it is in a less soluble un-ionized form. Ammonia is another toxicant which is more soluble at a higher pH (in its un-ionized form).

6.0 CONCLUSIONS

The results of the Phase 1 Toxicity Identification Evaluation best fit the pattern expected from an organic toxicant. Cationic metals would appear to be excluded on the basis of the EDTA treatment test, which showed no reduction in toxicity. Ammonia does not appear a likely toxicant due to the effectiveness of C-18 SPE treatment. The type of organic toxicant is not defined, although an organic base (such as a compound with a phenol group) would be consistent with much of the data.

7.0 RESULTS OF METAL ANALYSES OF EFFLUENT SAMPLE

The effluent sample was analyzed for the presence of several metals, including Al, As, Cr, Fe, and Se. The results are as follows;

<u>Metal</u>	<u>Result</u>	<u>Det. Limit</u>
T-Al	<0.050 mg/L	0.050 mg/L
T-As	<0.020 mg/L	0.020 mg/L
T-Cr	<0.005 mg/L	0.005 mg/L
T-Fe	0.130 mg/L	0.050 mg/L
T-Se	<0.020 mg/L	0.020 mg/L

None of the analyzed metals were present at concentrations high enough to cause acute toxicity.

8.0 ADDITIONAL TESTS OF FILTERED SAMPLES

On November 29, 1999 additional treatments and tests with filtered samples were conducted. Effluent was once again filtered at initial pH and pH 11. However, the effluent was filtered using both glass fiber filters (TSS type) and membrane filters (0.4 μ). At initial pH there was slightly less toxicity in the effluent sample filtered through the membrane filter than in the effluent filtered by the glass fiber filter. The 24 Hr results are as follows;

<u>Effluent Conc.</u>	<u>Percent Mortality</u>		
	<u>Unfiltered</u>	<u>Glass Fiber Filtered</u>	<u>Membrane Filtered</u>
0%	0%	0%	0%
25%	0%	0%	0%
50%	50%	35%	10%
100%	70%	100%	60%

The results suggest that the toxicant may have bound to the membrane filters or was more effectively removed due to the smaller pore size of the membrane filters.

At pH 11 all the toxicity was removed by the membrane filter, even at 100% concentration. A small, possibly insignificant, amount of toxicity remained in the sample filtered by the glass fiber filter (20% mortality at 100% concentration). This result confirmed both the results of the initial filtration tests on November 17 and the November 29 filtration at initial pH tests.

Finally, on December 9, 1999 another aliquot of sample was filtered (membrane) at pH 11. Once the pH was readjusted the filtered sample was assessed for toxicity. All toxicity had been removed from the sample by filtration. The membrane filter was soaked in a 100 mL sample of MHSF and the MHSF was found to be acutely toxic at 100% concentration. This suggested that the toxicant could be removed from the filter and resuspended in solution.

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SUMMARY OF RESULTS - ACUTE PHASE I TIE
WSRC Outfall X-08B Effluent
November 1999

pH Adjustment / Aeration / Sublation/Filtration / C-18 SPE

48 Hr LC50	Date	pH 3	Initial pH	pH 11
Baseline	10/22/96	57.4%	28.7%	53.6%
Aeration	10/22/96	100.0%	35.4%	70.7%
Filtration	10/22/96	57.4%	70.7%	100.0%
C-18 SPE Column	10/22/96		100.0%

Summary: Toxicity was slightly reduced by adjustment to pH 3 and pH 11.
Aeration removed toxicity at pH 3 and reduced toxicity at pH 11.
Filtration removed toxicity at pH 11.
C-18 SPE treatment removed toxicity at initial pH.

SUMMARY OF RESULTS - ACUTE PHASE I TIE **WSRC Outfall X-08** **November 1999**

Sodium Thiosulfate Addition - 48 Hr. Mortality

Effluent Conc.	Sodium Thiosulfate Conc. (mg/L)				
	0	1	5	10	50
0%	0%	0%	0%	0%	0%
25%	100%		100%	100%	80%
50%	100%		100%	100%	100%
100%	100%		100%	100%	100%

EDTA Chelation - 48 Hr. Mortality

Effluent Conc.	EDTA Conc. (g/L)				
	0	1	5	10	50
0%	0%	0%	0%	0%	0%
25%	100%	100%	100%	100%	100%
50%	100%	100%	100%	100%	100%
100%	100%	100%	100%	100%	100%

Summary: Addition of sodium thiosulfate and DiSodium EDTA did not remove toxicity.

SUMMARY OF RESULTS - ACUTE PHASE I TIE **WSRC Outfall X-08** **November 1999**

Graduated pH Test

Effluent Conc.	Mortality at Nominal pH					
	pH 8.5		pH 7.5		pH 6.5	
	Buffer: None		Buffer: None		Buffer: None	
0% @ 8 Hr	0%		0%		0%	
100% @ 3 hr	0%		0%		0%	
100% @ 6 Hr	60%		20%		20%	
100% @ 8 Hr	80%		30%		20%

Discussion: The pH of the effluent was less toxic at 8.5 than at 6.5.

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CHRONIC TOXICITY IDENTIFICATION EVALUATION PHASE I

**Facility: Westinghouse Savannah River Company
Sample ID: X-008B Effluent**

Subcontract # AC08813N

March 2000

(Sample collected 3/6/00)

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1.0 INTRODUCTION

Effluent discharged from outfall X-008 has been found to be acutely toxic to the test organism *Ceriodaphnia dubia* at a 33% test concentration (the In-Stream Waste Concentration). 25% of the X-008 wastewater comes from outfall X-008B. A Phase I Acute Toxicity Identification Evaluation (TIE) was conducted in November 1999 to identify the toxicant(s) present in effluent X-008. Subsequent toxicity testing indicated that the most toxic source to X-008 came from X-008B. This report presents the results of a Phase I Toxicity Characterization of Outfall X-008B.

2.0 SAMPLING

A grab effluent sample was collected on March 6, 2000 for use in the TIE. The sample was approximately 7 days old when the Phase I TIE was conducted.

3.0 SAMPLE TREATMENTS

The sample was subjected to a series of treatments to attempt to remove toxicity. Each treated sample was used in an acute definitive toxicity test to determine the effectiveness of the treatment. The treatments of the associated toxicity tests are summarized as follows:

<u>Treatment</u>	<u>Start Date</u>	<u>Sample ID</u>	<u>Potential Toxicants Removed</u>
Adjust to pH 3	3/13/00	14015	Insoluble at low pH
Adjust to pH 10	3/13/00		Insoluble at high pH
Aerated at Initial pH	3/13/00		Volatile; oxidizable
Aerated at pH 3	3/13/00		Volatile, oxidizable at low pH
Aerated at pH 10	3/13/00		Volatile, oxidizable at high pH
Filtered at Initial pH	3/13/00		TSS
Filtered at pH 3	3/13/00		Insoluble at low pH
Filtered at pH 10	3/13/00		metals; insoluble at pH 10
C-18 SPE at Initial pH	3/13/00		non-polar organics, metals
C-18 SPE at pH 3	3/13/00		non-polar organics, metals
C-18 SPE at pH 9	3/13/00		non-polar organics, metals
Na Thiosulfate Addition	3/14/00		residual chlorine; some metals
EDTA Chelation	3/15/00		some metals; surfactants
Graduated pH	3/14/00		ammonia; metals; sulfide

The initial pH of the X-08 Plant effluent was 7.46.

Methodology for the individual treatments is discussed below by treatment.

3.1 Adjustment to pH 3

A 1000 mL aliquot of the sample was adjusted to pH 3.04 with H_2SO_4 . A 1000 mL aliquot of dilution water also was adjusted to pH 3.05 with H_2SO_4 , to serve as a control. The pH of 150 mL of the pH 3 control was readjusted to 7.68 with NaOH. The pH of 150 mL of the pH 3 effluent sample was readjusted to 7.31 with NaOH. This treated sample was used for the toxicity test identified pH 3 Adjustment. The remaining 850 mL of pH 3 sample was used for additional treatments.

3.2 Adjustment to pH 11

A 1000 mL aliquot of the sample was adjusted to pH 10.95 with NaOH. A 1000 mL aliquot of dilution water also was adjusted to pH 10.95 with NaOH, to serve as a control. The pH of 150 mL of the pH 11 control was readjusted to 7.43 with H_2SO_4 . The pH of 150 mL of the pH 11 sample was readjusted to 6.95 with H_2SO_4 . This treated sample was used for the toxicity test identified pH 11 Adjustment. The remaining 850 mL of the pH 10 sample was used for additional treatments.

3.3 Aeration at Initial pH

A 200 mL aliquot of the untreated sample was vigorously aerated for a period of one hour with air pumped by a diaphragm aerator. A 200 mL aliquot of dilution water was also aerated for the same length of time.

3.4 Aeration at pH 3

A 200 mL aliquot of sample which had been adjusted to pH 3 was vigorously aerated for a period of one hour with air pumped by a diaphragm aerator. A 100 mL aliquot of pH 3 adjusted dilution water was also aerated for the same length of time. The pH of the aerated effluent sample was re-adjusted to pH 7.53 with NaOH and the pH of the aerated dilution water was re-adjusted to 7.87.

3.5 Aeration at pH 11

A 200 mL aliquot of effluent sample which had been adjusted to pH 11 was vigorously aerated for a period of one hour with air pumped from a diaphragm aerator. A 100 mL aliquot of pH 11 adjusted dilution water was also aerated for the same length of time. The pH of the aerated effluent sample was re-adjusted to pH 7.02 with H_2SO_4 and the pH of the aerated dilution water was re-adjusted to 7.65.

3.6 Filtration at Initial pH

A 500 mL aliquot of untreated sample was filtered through a membrane filter which had been pre-rinsed with deionized water. After filtration the pH of the filtered sample was 7.91. 200 mL was used for testing and the remaining 300 mL was set aside for treatment by a C-18 SPE column. A 500 mL aliquot of dilution water was filtered in the same manner, to serve as a treated control. 200 mL of the filtered control was readjusted to pH 7.79 after filtration. The remaining treated control aliquot was set aside for treatment by a C-18 SPE column.

3.7 Filtration at pH 3

A 500 mL aliquot of effluent sample which had been adjusted to pH 3 was filtered through a membrane type filter which had been pre-rinsed with dilute H_2SO_4 . After filtration the pH of 200 mL was readjusted to 7.26 with NaOH. The remaining 300 mL was set aside for treatment by a C-18 SPE column. A 500 mL aliquot of dilution water was filtered in the same manner, to serve as a treated control. 200 mL of the filtered control was readjusted to pH 7.67 after filtration. The remaining treated control aliquot was set aside for treatment by a C-18 SPE column.

3.8 Filtration at pH 10

A 500 mL aliquot of sample which had been adjusted to pH 11 was filtered through a membrane type filter which had been pre-rinsed with deionized water. After filtration the pH of 200 mL was readjusted to 7.26 with H_2SO_4 . The remaining 300 mL was set aside for treatment by a C-18 SPE column. A 500 mL aliquot of dilution water was filtered in the same manner, to serve as a treated control. 200 mL of the filtered control

was readjusted to pH 7.62 after filtration. The remaining treated control aliquot was set aside for treatment by a C-18 SPE column.

3.9 C-18 SPE Column

A 300 mL aliquot of the filtered sample at initial pH was pumped through a Baker 6 mL C-18 SPE column at a rate of 10 mL per minute. Positive pressure was provided by a chemical metering pump. The column was initially pre-conditioned with 25 mL of methanol and 25 mL of ultra-pure water. After conditioning an aliquot of dilution water was run through the column. The first 50 mL of dilution water were not kept, and the remaining portion was used as a treated control for toxicity testing. After the dilution water the 300 mL aliquot of filtered effluent was run through the same column. The first 50 mL were not kept, and the remaining portion was readjusted to the initial pH and used for the toxicity test.

The same procedure was used for samples adjusted to pH 3 and pH 11. However, the pH of the sample at pH 11 was adjusted to pH 9 before the sample was run through the column.

3.10 Oxidant Reduction

A 2.5 g/L stock solution of sodium thiosulfate was prepared. This stock solution was added to aliquots of undiluted sample water as follows;

<u>Amt. Sodium Thiosulfate</u>	<u>Amount Sample</u>	<u>Final Concentration</u>
0.08 mL	200 mL	1.0 mg/L
0.40 mL	200 mL	5.0 mg/L
0.80 mL	200 mL	10.0 mg/L

After addition of the sodium thiosulfate, the test solutions were allowed to sit for two hours. In the same manner dilution water controls were treated with sodium thiosulfate.

Effluent test solutions after sodium thiosulfate addition ranged from 7.65 to 7.77, and control test solutions ranged from 7.58 to pH 7.71.

3.11 EDTA Chelation

A 15 g/L stock solution of diSodium EDTA was prepared. This stock solution was used to prepare aliquots of sample with 1, 5, and 10 mg/L of EDTA. These aliquots were used for an acute definitive toxicity test. Dilution water controls were prepared in the same manner. After addition of the EDTA the solutions were adjusted to the initial pH (7.53-7.62 for dilution water; 7.31-7.69 for effluent). Aliquots of sample with EDTA added were left for 2 hours prior to use in testing, because equilibration times can be relatively slow for some metals.

3.12 Graduated pH Test

An effluent test was conducted with effluent adjusted to pH 6.5, 7.5 and 8.5. Effluent pH was monitored and readjusted at 2, 4, 6, 22 and 24 hours.

4.0 TOXICITY TESTING METHODS

48 hour acute serial dilution (definitive) toxicity tests were set with all treated effluent samples. Tests were set at concentrations of 1, 5, 10, 20, and 50% effluent. The test organism was the invertebrate cladoceran *Ceriodaphnia dubia*. The dilution water was moderately hard synthetic freshwater (MHSF) with a hardness of 80-100 mg/L. Each test dilution was comprised of two replicates of five test organisms (only a single replicate of five test organisms was used for each EDTA/effluent concentration combination and each sodium thiosulfate/effluent concentration combination). A treated control was prepared for each treatment set, where dilution water was subjected to the same treatment as the effluent samples.

5.0 RESULTS AND DISCUSSION

Upon arrival the sample was observed to be clear in color. The effluent was low in hardness (10.8 mg/L) and alkalinity (33.5 mg/L). Residual chlorine was not detected. A summary of the results is provided below.

ACUTE TOXICITY IDENTIFICATION EVALUATION SUMMARY

Outfall X-08B

March 2000

Treatment	Percent Mortality By Concentration						pH of 50% eff		48 Hr LC50	Comment
	0	1%	5%	10%	20%	50%	start	end		
Baseline	0%	20%	10%	60%	100%	100%	7.81	7.74	8.3%	
pH 3 Adjustment		30%	40%	100%	100%	100%	7.83	7.66	3.5%	no change
pH 11 Adjustment		10%	40%	70%	100%	90%	7.72	8.12	5.1%	no change
Aeration at Initial pH	10%	0%	10%	10%	40%	100%	7.56	7.97	19.1%	slight decrease in toxicity
Aeration at pH 3	0%	30%	20%	30%	80%	100%	7.53	7.82	10.7%	no change
Aeration at pH 11	20%	10%	10%	100%	100%	100%	7.79	8.57	5.8%	no change
Filtration at Initial pH		20%	40%	90%	100%	100%	7.91	7.85	4.1%	no change
Filtration at pH 3		0%	0%	10%	100%	100%	7.76	7.83	13.2%	slight decrease in toxicity?
Filtration at pH 11	0%	0%	0%	0%	10%	100%	7.82	8.29	29.2%	moderate decrease in toxicity
C-18 SPE at Initial pH		0%	0%	0%	0%	10%	7.59	7.94	>50%	toxicity removed
C-18 SPE at pH 3		10%	10%	100%	100%	100%	7.68	7.66	5.8%	no change
C-18 SPE at pH 9		0%	0%	30%	20%	90%	7.73	8.09	23.6%	moderate decrease in toxicity
EDTA 1 mg/L		10%	0%	20%	90%	100%	7.31	7.89	13.3%	slight decrease in toxicity?
EDTA 5 mg/L		0%	0%	0%	0%	0%	7.41	7.96	>50%	toxicity removed
EDTA 10 mg/L		0%	0%	10%	0%	0%	7.69	8.03	>50%	toxicity removed
Sodium Thiosulfate 1mg/L	10%	0%	40%	100%	100%	100%	7.76	7.74	4.5%	no change
Sodium Thiosulfate 5mg/L	10%	0%	40%	100%	100%	100%	7.65	7.75	4.5%	no change
Sodium Thiosulfate 10mg/L	0%	0%	60%	100%	100%	100%	7.77	7.80	3.5%	no change
Graduated pH - 6.5						100%	6.52	7.09		no change in toxicity w/ pH
Graduated pH - 7.5						100%	7.53	7.71		no change in toxicity w/ pH
Graduated pH - 8.5						100%	8.56	8.58		no change in toxicity w/ pH

Summary: Toxicity was removed by EDTA chelation. Toxicity was reduced by filtration at pH 11 and C18 SPE at Initial pH.

Conclusions: The removal of toxicity by EDTA and filtration at pH 11 is consistent with a metal. Metals also be removed by C18 SPE. However, the removal of toxicity could also be consistent with a surfactant, some of which will chelate with EDTA and are removed by C18 SPE treatment.

5.1 Baseline Test

The baseline toxicity test conducted on March 13-15, 2000 indicated that the sample remained acutely toxic despite an elapsed time of 7 days from sampling. Based on a dilution of 25% of X-008B in X-008 and an IWC of 33% for X-008, the final dilution of X-008B is 8.25%. The 48 Hour LC_{50} of the baseline X-008 B test was 8.5%. This indicates that X-008B effluent can account for toxicity in the final X-008 effluent.

5.2 pH Adjustment Tests

pH adjustment to an acidic pH and pH adjustment to an alkaline pH (followed by readjustment to initial pH) were both ineffective in substantially reducing toxicity.

5.3 Aeration

Aeration of effluent at the initial pH slightly decreased the toxicity. Aeration at pH 3 and pH 11 did not reduce toxicity.

5.4 Filtration

Filtration at initial pH and pH 3 were ineffective at significantly reducing toxicity. However, at pH 11 filtration was quite effective at reducing toxicity. Filtration could reduce toxicity in a number of ways including, 1) binding of the toxicant to the membrane filter, 2) removal of solids with which the toxicity might be associated, and 3) volatilization in the filtration process. Cationic metals are typically less soluble at alkaline pH values and are often removed by filtration at pH 11. If the toxicant was an organic base it should become ionized at an alkaline pH and have a greater tendency to bind with the organic substrate of the membrane filter.

5.5 C-18 Solid Phase Extraction

C-18 solid phase extraction treatment at initial pH removed all toxicity from the effluent. This is consistent with a non-polar organic toxicant, although cationic metals also can be trapped in the column, resulting in toxicity reduction.

5.6 EDTA Chelation

EDTA addition of 5-10 mg/L removed all sample toxicity. The results are consistent with a toxicant which is a cationic metal. A few metals, such as aluminum, do not bind with EDTA. Also, organics with functional groups such as amines may show some tendency to bind with EDTA.

5.7 Sodium Thiosulfate Addition

Addition of sodium thiosulfate did not reduce effluent toxicity. Sodium thiosulfate addition can reduce toxicity when oxidizing compounds (such as residual chlorine) are present and when some cations (such as copper) are present. The results indicate that the toxicant does not belong to either one of these groups.

5.8 Graduated pH Test

The effluent was found to be equally toxic at all pH values. However, it should be noted that no toxicity was noted at any pH at 6 hours and at 22 hours nearly all test organisms were dead at all pH values. It is possible that during the intervening period between 6 hours and 22 hours toxicity may have occurred more rapidly in one pH than another, but no records are available for this period.

6.0 RESULTS OF METAL ANALYSES OF EFFLUENT SAMPLE

The effluent sample was analyzed for the presence of zinc. The result was as follows;

<u>Metal</u>	<u>Result</u>	<u>Det. Limit</u>
T-Zn	0.646 mg/L	0.010 mg/L

7.0 CONCLUSIONS

The results of the Phase I Toxicity Identification Evaluation best fit the pattern expected from a cationic metal, primarily on the basis of the effectiveness of EDTA chelation and filtration at pH 11. Zinc was measured at 646 $\mu\text{g/L}$, which would be expected to be toxic at 100% concentration. However, at the 48 Hour LC_{50} of 8.3% (baseline test), only 54 $\mu\text{g/L}$ of zinc would be present, a concentration insufficient to cause acute toxicity. Thus, zinc can account for some of the toxicity in the sample but another toxicant which is treatable with EDTA also must be present. No other cationic metals are known to be present at potentially toxic concentrations in X-008B effluent. An organic toxicant would be consistent with the data generated in this Phase I TIE, and appears to be the most likely second toxicant.

8.0 SUBLATION TESTS FOR SURFACTANTS

On March 27, 2000 another treatment of the March 6th X-008B effluent sample was conducted. This was a sublation treatment consisting of vigorous aeration of an aliquot of the effluent sample to separate a foam 'sublate' portion from a 'residual' portion. If toxic surfactants are present the toxicity can typically be concentrated in the sublate, leaving a relatively non-toxic residual. An acute definitive toxicity test was conducted on both the sublate and residual portions. The results are as follows;

	<u>48 Hour LC_{50}</u>
Baseline	8.4% effluent
Sublate	9.0%
Residual	9.0%

No concentration of toxicity in the sublate or reduction of toxicity in the residual was noted. This suggests that a toxic surfactant was not present in the sample. It should be noted that surfactant toxicity often degrades over time. However, the baseline test indicated no reduction in toxicity between March 13 and March 27.

TABLES

SUMMARY OF RESULTS - ACUTE PHASE I TIE
WSRC Outfall X-08B Effluent
March 2000

pH Adjustment / Aeration / Sublation/Filtration / C-18 SPE

48 Hr LC50	Date	pH 3	Initial pH	pH 11
Baseline	3/13/00	3.5%	8.3%	5.1%
Aeration	3/13/00	10.7%	19.1%	5.8%
Filtration	3/13/00	13.2%	4.1%	29.2%
C-18 SPE Column	3/13/00	5.8%	50.0%	23.6%

Summary: Toxicity was not reduced by adjustment to pH 3 and pH 11.
 Toxicity was not reduced by aeration.
 Toxicity was reduced by filtration at pH 11.
 C-18 SPE treatment removed toxicity at initial pH.

SUMMARY OF RESULTS - ACUTE PHASE I TIE **WSRC Outfall X-08B** **March 2000**

Sodium Thiosulfate Addition - 48 Hr. Mortality

Effluent Conc.	Sodium Thiosulfate Conc. (mg/L)				
	0	1	5	10	
0%	0%	0%	0%	0%	
10%	60%	100%	100%	100%	
20%	100%	100%	100%	100%	
50%	100%	100%	100%	100%

EDTA Chelation - 48 Hr. Mortality

Effluent Conc.	EDTA Conc. (mg/L)				
	0	1	5	10	
0%	0%	0%	0%	0%	
10%	60%	30%	0%	10%	
20%	100%	100%	0%	0%	
50%	100%	100%	0%	0%

Summary: Addition of sodium thiosulfate did not remove toxicity. Addition of EDTA did remove toxicity.

SUMMARY OF RESULTS - ACUTE PHASE I TIE **WSRC Outfall X-08B** **March 2000**

Graduated pH Test

Effluent Conc.	Mortality at Nominal pH					
	pH 8.5		pH 7.5		pH 6.5	
	Buffer: None		Buffer: None		Buffer: None	
0% @ 8 Hr	0%		0%		0%	
50% @ 4 hr	0%		0%		0%	
50% @ 6 Hr	0%		0%		0%	
50% @ 22 Hr	90%		90%		100%

Discussion: The pH of the effluent did not affect toxicity.

WSRC

SUMMARY OF METHANOL ELUTION TEST RESULTS

April 2000 (sample collected 3/6/00)

Effluent Conc.	Mortality at 48 Hours By Methanol Concentration							
	25%	50%	75%	80%	85%	90%	95%	100%
10%	0%	0%	0%	0%	60%	0%	0%	0%
25%	0%	0%	0%	0%	100%	0%	60%	40%
50%	0%	0%	20%	80%	100%	100%	100%	20%
100%	0%	20%	40%	100%	100%	100%	100%	40%
LC50	>100%	>100%	>100%	40.6%	9.8%	35.3%	21.8%	>100%
Toxic Units	0	0	0	2.5	10.2	2.8	4.6	0

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Westinghouse Savannah River Company

Sublation Tests of X-08B Sample

March 2000 (sample collected on 3/6/00)

A sample of Outfall X-08B was treated by sublation in order to determine if surfactants might be a cause of toxicity in the effluent. Sublation was conducted by vigorously aerating the sample and collecting the foam from the surface. The foam portion was identified as the 'sublate' and the remaining effluent was identified as the 'residual'. Typically, the sublate of a sample with toxicity caused by surfactants will be more toxic than the residual and the untreated sample. Conversely, the residual of the sample will be less toxic than the sublate and the untreated sample.

48 Hour acute static toxicity tests with *Ceriodaphnia dubia* were conducted using untreated effluent, sublate, and residual. The results are as follows;

	48 Hour LC ₅₀
Untreated Effluent	8.41%
Residual Effluent	9.01%
Sublate of Effluent	9.01%

No significant difference in the toxicity of the three samples was observed. This suggests that surfactants did not contribute to effluent toxicity.

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Client: WSRC	Sample ID: X-08/Baseline	Lab ID# T14015
Start Date: 3/27/00 Time: 1550	Set By: ML	Test Species:
End Date: 3/29/00 Time: 1525	Ended By: ML	<i>Ceriodaphnia dubia</i>
Dilution Water: MHSF		

MORTALITY DATA

Conc.	Rep.	# organisms	Cumulative Mortality				Mean
			24hr	48hr	72hr	96hr	
0%	A	5	0	1			5%
	B	5	0	0			
	C	5	0	0			
	D	5	0	0			
1.25%	A	5	0	0			10%
	B	5	0	0			
	C	5	0	2			
	D	5	0	0			
2.5%	A	5	0	0			0%
	B	5	0	0			
	C	5	0	0			
	D	5	0	0			
5%	A	5	0	1			5%
	B	5	0	0			
	C	5	0	0			
	D	5	0	0			
10%	A	5	1	5			70%
	B	5	0	2			
	C	5	1	4			
	D	5	0	3			
20%	A	5	2	3			90%
	B	5	0	5			
	C	5	5	5			
	D	5	5	5			

WATER QUALITY DATA

Parameter	units		Measured Value				
			0hr	24hr	48hr	72hr	96hr
Dissolved	mg/L	pre-renewal			8.8		
Oxygen	mg/L	post-renewal	9.2				
pH		pre-renewal			8.05		
		post-renewal	7.67				
Dissolved	mg/L	pre-renewal			8.8		
Oxygen	mg/L	post-renewal	8.5				
pH		pre-renewal			8.05		
		post-renewal	7.91				
Dissolved	mg/L	pre-renewal			8.8		
Oxygen	mg/L	post-renewal	8.5				
pH		pre-renewal			8.02		
		post-renewal	7.82				
Dissolved	mg/L	pre-renewal			8.8		
Oxygen	mg/L	post-renewal	8.5				
pH		pre-renewal			8.03		
		post-renewal	7.92				
Dissolved	mg/L	pre-renewal			8.9		
Oxygen	mg/L	post-renewal	8.6				
pH		pre-renewal			8.03		
		post-renewal	7.83				
Dissolved	mg/L	pre-renewal			8.1		
Oxygen	mg/L	post-renewal	8.6				
pH		pre-renewal			8.06		
		post-renewal	7.85				

STATISTICAL ANALYSIS

48 Hour LC50 8.41% effluent
 95% Confidence Limits: Upper:
 Lower:
 Method: Spearman Karber

COMMENTS:

Approved By:
 Date:

R. Kelly
 4/5/00

P.O. Box 16414, Greenville, SC 29606

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4 Craftsman Court, Greer, SC 29650

Client: WSRC	Sample ID: X-08/Residual	Lab ID# T14015
Start Date: 3/27/00 Time: 1550	Set By: ML	Test Species: <i>Ceriodaphnia dubia</i>
End Date: 3/29/00 Time: 1525	Ended By: ML	
	Dilution Water: MHSF	

MORTALITY DATA

Conc.	Rep.	# organisms	Cumulative Mortality				Mean
			24hr	48hr	72hr	96hr	
0%	A	5	0	1			5%
	B	5	0	0			
	C	5	0	0			
	D	5	0	0			
1.25%	A	5	0	0			10%
	B	5	0	1			
	C	5	0	0			
	D	5	0	1			
2.5%	A	5	0	1			20%
	B	5	0	2			
	C	5	0	1			
	D	5	0	0			
5%	A	5	0	0			5%
	B	5	0	0			
	C	5	0	0			
	D	5	0	1			
10%	A	5	1	2			60%
	B	5	0	5			
	C	5	1	2			
	D	5	1	3			
20%	A	5	5	5			100%
	B	5	5	5			
	C	5	5	5			
	D	5	3	5			

WATER QUALITY DATA

Parameter	units		Measured Value				
			0hr	24hr	48hr	72hr	96hr
Dissolved Oxygen	mg/L	pre-renewal			8.8		
		post-renewal	9.2				
pH		pre-renewal			8.05		
		post-renewal	7.67				
Dissolved Oxygen	mg/L	pre-renewal			8.6		
		post-renewal	8.9				
pH		pre-renewal			8.05		
		post-renewal	7.92				
Dissolved Oxygen	mg/L	pre-renewal			8.6		
		post-renewal	8.9				
pH		pre-renewal			8.03		
		post-renewal	7.86				
Dissolved Oxygen	mg/L	pre-renewal			8.6		
		post-renewal	8.9				
pH		pre-renewal			8.01		
		post-renewal	7.94				
Dissolved Oxygen	mg/L	pre-renewal			8.5		
		post-renewal	8.9				
pH		pre-renewal			8.00		
		post-renewal	7.85				
Dissolved Oxygen	mg/L	pre-renewal			8.5		
		post-renewal	8.9				
pH		pre-renewal			8.04		
		post-renewal	7.89				

STATISTICAL ANALYSIS

48 Hour LC50 9.01% effluent
 95% Confidence Limits: Upper:
 Lower:
 Method: Spearman Karber

COMMENTS:

Approved By:

Date:

R Kelly
 4/6/00

P.O. Box 16414, Greenville, SC 29606

(864) 877-6942 • FAX (864) 877-6938

4 Craftsman Court, Greer, SC 29650

Client: WSRC	Sample ID: X-08/Sublation	Lab ID# T14015
Start Date: 3/27/00 Time: 1630	Set By: ML	Test Species:
End Date: 3/29/00 Time: 1515	Ended By: ML	Ceriodaphnia dubia
Dilution Water: MHSF		

MORTALITY DATA

Conc.	Rep.	# organisms	Cumulative Mortality				Mean
			24hr	48hr	72hr	96hr	
0%	A	5	0	1			5%
	B	5	0	0			
	C	5	0	0			
	D	5	0	0			
1.25%	A	5	0	1			5%
	B	5	0	0			
	C	5	0	0			
	D	5	0	0			
2.5%	A	5	0	1			10%
	B	5	0	1			
	C	5	0	0			
	D	5	0	0			
5%	A	5	0	0			0%
	B	5	0	0			
	C	5	0	0			
	D	5	0	0			
10%	A	5	0	1			65%
	B	5	3	4			
	C	5	3	4			
	D	5	4	4			
20%	A	5	5	5			100%
	B	5	5	5			
	C	5	5	5			
	D	5	5	5			

WATER QUALITY DATA

Parameter	units		Measured Value				
			0hr	24hr	48hr	72hr	96hr
Dissolved	mg/L	pre-renewal			8.8		
Oxygen	mg/L	post-renewal	9.2				
pH		pre-renewal			8.05		
		post-renewal	7.67				
Dissolved	mg/L	pre-renewal			8.3		
Oxygen	mg/L	post-renewal	8.7				
pH		pre-renewal			7.99		
		post-renewal	7.94				
Dissolved	mg/L	pre-renewal			8.3		
Oxygen	mg/L	post-renewal	8.7				
pH		pre-renewal			7.97		
		post-renewal	7.84				
Dissolved	mg/L	pre-renewal			8.2		
Oxygen	mg/L	post-renewal	8.7				
pH		pre-renewal			7.92		
		post-renewal	7.96				
Dissolved	mg/L	pre-renewal	8.0		8.2		
Oxygen	mg/L	post-renewal	0.7				
pH		pre-renewal			7.89		
		post-renewal	7.88				
Dissolved	mg/L	pre-renewal			8.1		
Oxygen	mg/L	post-renewal	8.7				
pH		pre-renewal			7.81		
		post-renewal	7.96				

STATISTICAL ANALYSIS

48 Hour LC50 9.01% effluent
 95% Confidence Limits: Upper:
 Lower:
 Method: Spearman Karber

COMMENTS:

Approved By:

Date:

 4/5/00

APPENDIX C
RESULTS OF CHEMICAL ANALYSES

Post-It Fax Note 7671

Date	10-19-99	# of pages	2
To	Larry Eldridge		
From	S. Stinson		
Co./Dept.	Co.		
Phone #	Phone #		
Fax #	Fax #		

S

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CAYCE, SOUTH CAROLINA 29033

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FAX (803) 791-9111
www.shealyenvironmental.com

SC DHEC No. 32010

NC DEHNR No. 329

Client: Westinghouse Savannah River Company
PO Box 616
Aiken, SC 29808

Project Name: AA82244N

Attention: Stuart Stinson

SHEALY Lab No: 177565ST
Description: X-08

Coll. Date: 10/07/99
Coll. Time: 0930

Date Received: 10/07/99
Date Reported: 10/19/99

QA/QC officer

V.P. Analytical

MA

Parameters	Method	Result	Units	PQL	Date Prepared	Date Analyzed	Anal.
METALS							
Aluminum	200.7	0.35	mg/l	0.050	10/14/99 0830	10/18/99 1027	FTS
Antimony	200.7	<0.0050	mg/l	0.0050	10/14/99 0830	10/18/99 1027	FTS
Arsenic	200.7	<0.0050	mg/l	0.0050	10/14/99 0830	10/18/99 1027	FTS
Barium	200.7	0.042	mg/l	0.0050	10/14/99 0830	10/18/99 1027	FTS
Beryllium	200.7	<0.0040	mg/l	0.0040	10/14/99 0830	10/18/99 1027	FTS
Cadmium	200.7	<0.0020	mg/l	0.0020	10/14/99 0830	10/18/99 1027	FTS
Calcium	200.7	4.7	mg/l	0.10	10/14/99 0830	10/18/99 1027	FTS
Chromium	200.7	<0.0050	mg/l	0.0050	10/14/99 0830	10/18/99 1027	FTS
Cobalt	200.7	<0.025	mg/l	0.025	10/14/99 0830	10/18/99 1027	FTS
Copper	200.7	<0.0050	mg/l	0.0050	10/14/99 0830	10/18/99 1027	FTS
Iron	200.7	0.17	mg/l	0.020	10/14/99 0830	10/18/99 1134	FTS
Lead	200.7	<0.0030	mg/l	0.0030	10/14/99 0830	10/18/99 1027	FTS
Magnesium	200.7	0.89	mg/l	0.050	10/14/99 0830	10/18/99 1027	FTS
Manganese	200.7	0.027	mg/l	0.0050	10/14/99 0830	10/18/99 1027	FTS
Nickel	200.7	<0.010	mg/l	0.010	10/14/99 0830	10/18/99 1027	FTS
Potassium	200.7	3.0	mg/l	0.10	10/14/99 0830	10/18/99 1027	FTS
Selenium	200.7	<0.0050	mg/l	0.0050	10/14/99 0830	10/18/99 1027	FTS
Silver	200.7	<0.0050	mg/l	0.0050	10/14/99 0830	10/18/99 1027	FTS
Sodium	200.7	PENDING	mg/l	0.10	10/14/99 0830		FTS
Thallium	200.7	<0.050	mg/l	0.050	10/14/99 0830	10/18/99 1027	FTS
Titanium	200.7	<0.050	mg/l	0.050	10/14/99 0830	10/18/99 1027	FTS
Vanadium	200.7	<0.050	mg/l	0.050	10/14/99 0830	10/18/99 1027	FTS

10/19/99 TUE 15:00 FAX 53272

PCHR

002
:803 791 9111
5/ 6

Page 2 (Continuation of 177565ST)

Parameters	Method	Result	Units	PQL	Date Prepared	Date Analyzed	Anal.
Zinc	200.7	0.050	mg/l	0.0050	10/14/99 0830	10/18/99 1027	FTS
Mercury	245.1	PENDING	mg/l	0.00010			

SHEALY ENVIRONMENTAL SERVICES, INC.**Report of Analysis**

SC DHEC No. 32010

NC DEHNR No. 329

Client : Westinghouse Savannah River Company
PO Box 616
Building 735-11A
Aiken, SC 29808

Attention : Chuck Hayes

Project Number : AA82244N

Description : X-08B Collect Date : 01/04/2000
Lot Number : BD07022-001 (192128) Collect Time : 0000
Date Received : 04/07/2000 Matrix : Aqueous

Parameter	Prep Method	Analytical Method	Result	Q	Units	PQL	Prep Date/Time	Analysis Date/Time	Analyst
ICP-AES									
Zinc		200.7	0.53		mg/L	0.0050	04/12/2000 0900	04/12/2000 1555	FTS

PQL = Practical quantitation limit

B = Detected in method blank

E = Quantitation of compound exceeded the calibration range

ND = Not detected at PQL

J = Estimated result less than the PQL

Soils reported on a dry weight basis unless flagged with a "W"

SHEALY ENVIRONMENTAL SERVICES, INC.

106 Vantage Point Drive, Cayce, South Carolina 29033 (803) 791-9700 Fax (803) 791-9111 www.shealyenvironmental.com

P.O. Box 16414, Greenville, SC 29606

(864) 877-6942 • FAX (864) 877-6938

4 Craftsman Court, Greer, SC 29650

DATE REPORTED: March 2, 2000

CLIENT: Attn: Winona Specht
Westinghouse Savannah River Company
P.O. Box 616
Aiken, SC 29802

LAB #: SAMPLE ID
W13843 TNX Collection Sump
W13844 TNX Grit Chamber
W13845 TNX Tank 2

CHEMICAL ANALYSIS REPORT

<u>Sample ID</u>	<u>Sample Date</u>	<u>Parameter</u>	<u>Result</u>	<u>Units</u>	<u>Method</u>
TNX Collection Sump	2-8-00	CTAS	<1.0	mg/L	5540D
TNX Grit Chamber	2-9-00	Total Aluminum	0.394	mg/L	200.7
TNX Grit Chamber	2-9-00	Total Iron	0.102	mg/L	200.7
TNX Grit Chamber	2-9-00	Total Nickel	0.006	mg/L	200.7
TNX Grit Chamber	2-9-00	Total Chromium	<0.005	mg/L	200.7
TNX Grit Chamber	2-9-00	Total Copper	0.041	mg/L	220.1
TNX Grit Chamber	2-9-00	Total Zinc	0.253	mg/L	289.1
TNX Tank 2	2-9-00	Total Aluminum	0.088	mg/L	200.7
TNX Tank 2	2-9-00	Total Iron	<0.050	mg/L	200.7
TNX Tank 2	2-9-00	Total Nickel	0.007	mg/L	200.7
TNX Tank 2	2-9-00	Total Chromium	<0.005	mg/L	200.7
TNX Tank 2	2-9-00	Total Copper	0.037	mg/L	220.1
TNX Tank 2	2-9-00	Total Zinc	0.703	mg/L	289.1

SC Laboratory Certification #23104

Outside Laboratory Certification #02002

Reported By:

Robert W. Kelley, Ph.D., Laboratory Manager

Description : ETP - Tank2
Lot Number : BD07022-002 (192129)
Client : Westinghouse Savannah River Company
Date Received : 04/07/2000

Collect Date : 01/12/2000
Collect Time : 0000
Matrix : Aqueous

Parameter	Prep Method	Analytical Method	Result	Q	Units	PQL	Prep Date/Time	Analysis Date/Time	Analyst
ICP-AES									
Zinc		200.7	0.85		mg/L	0.0050	04/12/2000 0900	04/12/2000 1601	FTS

PQL = Practical quantitation limit

B = Detected in method blank

E = Quantitation of compound exceeded the calibration range

ND = Not detected at PQL

J = Estimated result less than the PQL

Soils reported on a dry weight basis unless flagged with a "W"

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1-27-00; 6:40PM;

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SHEALY ENVIRONMENTAL SERVICES, INC.

Scientists and Consultants

106 VANTAGE POINT DRIVE
CAYCE, SOUTH CAROLINA 29033

CERTIFICATE OF ANALYSIS

(803) 791-9700
FAX (803) 791-9111
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SC DHEC No. 32010

NC DEHNR No. 329

Client: Westinghouse Savannah River Company
PO Box 616
Aiken, SC 29808

Project Name: AA82244N

Attention: Stuart Stinson

SHEALY Lab No: 185184S
Description: X-8B

Coll. Date: 01/12/00
Coll. Time: 1010

Date Received: 01/12/00
Date Reported: 01/27/00

QA/QC Officer *h*

V.P. Analytical *M*

Parameters	Method	Result	Units	PQL	Date Prepared	Date Analyzed	Anal.
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BASE NEUTRAL/ACID EXTRACTABLES

01/17/00 01/26/00 MNK
1550 1900

Acenaphthene	8270C	<5.0	ug/l	5.0
Acenaphthylene	8270C	<5.0	ug/l	5.0
Acetophenone	8270C	<5.0	ug/l	5.0
4-Aminobiphenyl	8270C	<10	ug/l	10
Aniline	8270C	<5.0	ug/l	5.0
Anthracene	8270C	<5.0	ug/l	5.0
Benzidine	8270C	<25	ug/l	25
Benzoic acid	8270C	<250	ug/l	250
Benzo(a)anthracene	8270C	<5.0	ug/l	5.0
Benzo(b)fluoranthene	8270C	<5.0	ug/l	5.0
Benzo(k)fluoranthene	8270C	<5.0	ug/l	5.0
Benzo(g,h,i)perylene	8270C	<5.0	ug/l	5.0
Benzo(a)pyrene	8270C	<5.0	ug/l	5.0
Benzyl alcohol	8270C	<5.0	ug/l	5.0
bis(2-Chloroethoxy)methane	8270C	<5.0	ug/l	5.0
bis(2-Chloroethyl)ether	8270C	<5.0	ug/l	5.0
bis(2-Chloroisopropyl)ether	8270C	<5.0	ug/l	5.0
bis(2-Ethylhexyl)phthalate	8270C	<10	ug/l	10
4-Bromophenylphenylether	8270C	<5.0	ug/l	5.0
Butylbenzylphthalate	8270C	<10	ug/l	10
4-Chloroaniline	8270C	<5.0	ug/l	5.0
4-Chloro-3-methylphenol	8270C	<5.0	ug/l	5.0
1-Chloronaphthalene	8270C	<5.0	ug/l	5.0
2-Chloronaphthalene	8270C	<5.0	ug/l	5.0
2-Chlorophenol	8270C	<5.0	ug/l	5.0
4-Chlorophenylphenylether	8270C	<5.0	ug/l	5.0
Chrysene	8270C	<5.0	ug/l	5.0
m+p-Cresol	8270C	<10	ug/l	10
o-Cresol	8270C	<10	ug/l	10
Dibenzo(a,h)anthracene	8270C	<5.0	ug/l	5.0
Dibenzofuran	8270C	<5.0	ug/l	5.0
Di-N-Butylphthalate	8270C	<5.0	ug/l	5.0
1,2-Dichlorobenzene	8270C	<5.0	ug/l	5.0
1,3-Dichlorobenzene	8270C	<5.0	ug/l	5.0
1,4-Dichlorobenzene	8270C	<5.0	ug/l	5.0
3,3'-Dichlorobenzidine	8270C	<5.0	ug/l	5.0
2,4-Dichlorophenol	8270C	<5.0	ug/l	5.0
2,6-Dichlorophenol	8270C	<5.0	ug/l	5.0
Diethylphthalate	8270C	<5.0	ug/l	5.0
p-Dimethylaminoazobenzene	8270C	<5.0	ug/l	5.0
7,12-Dimethylbenzo(a)anthracene	8270C	<5.0	ug/l	5.0
a,a-Dimethylphenethylamine	8270C	<50	ug/l	50
2,4-Dimethylphenol	8270C	<5.0	ug/l	5.0

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Page 2 (Continuation of 185184S)

Parameters	Method	Result	Units	PQL	Date Prepared	Date Analyzed	Anal.
Dimethylphthalate	8270C	<5.0	ug/l	5.0			
4,6-Dinitro-2-methylphenol	8270C	<25	ug/l	25			
2,4-Dinitrophenol	8270C	<25	ug/l	25			
2,4-Dinitrotoluene	8270C	<10	ug/l	10			
2,6-Dinitrotoluene	8270C	<10	ug/l	10			
Di-N-Octylphthalate	8270C	<5.0	ug/l	5.0			
Diphenylamine	8270C	<5.0	ug/l	5.0			
Ethyl methanesulfonate	8270C	<5.0	ug/l	5.0			
Fluoranthene	8270C	<5.0	ug/l	5.0			
Fluorene	8270C	<5.0	ug/l	5.0			
Hexachlorobenzene	8270C	<5.0	ug/l	5.0			
Hexachlorobutadiene	8270C	<5.0	ug/l	5.0			
Hexachlorocyclopentadiene	8270C	<25	ug/l	25			
Hexachloroethane	8270C	<5.0	ug/l	5.0			
Indeno(1,2,3-c,d)pyrene	8270C	<5.0	ug/l	5.0			
Isophorone	8270C	<5.0	ug/l	5.0			
3-Methylcholanthrene	8270C	<10	ug/l	10			
Methyl methanesulfonate	8270C	<5.0	ug/l	5.0			
2-Methylnaphthalene	8270C	<5.0	ug/l	5.0			
Naphthalene	8270C	<5.0	ug/l	5.0			
1-Naphthylamine	8270C	<5.0	ug/l	5.0			
2-Naphthylamine	8270C	<5.0	ug/l	5.0			
2-Nitroaniline	8270C	<10	ug/l	10			
3-Nitroaniline	8270C	<10	ug/l	10			
4-Nitroaniline	8270C	<10	ug/l	10			
Nitrobenzene	8270C	<5.0	ug/l	5.0			
2-Nitrophenol	8270C	<10	ug/l	10			
4-Nitrophenol	8270C	<25	ug/l	25			
N-Nitroso-di-butylamine	8270C	<5.0	ug/l	5.0			
N-Nitrosodimethylamine	8270C	<5.0	ug/l	5.0			
N-Nitrosodiphenylamine	8270C	<5.0	ug/l	5.0			
N-Nitroso-di-N-propylamine	8270C	<5.0	ug/l	5.0			
N-Nitrosopiperidine	8270C	<5.0	ug/l	5.0			
Pentachlorobenzene	8270C	<5.0	ug/l	5.0			
Pentachloronitrobenzene	8270C	<25	ug/l	25			
Pentachlorophenol	8270C	<25	ug/l	25			
Phenacetin	8270C	<5.0	ug/l	5.0			
Phenanthrene	8270C	<5.0	ug/l	5.0			
Phenol	8270C	<5.0	ug/l	50			
2-Picoline	8270C	<5.0	ug/l	5.0			
Pronamide	8270C	<10	ug/l	10			
Pyrene	8270C	<5.0	ug/l	5.0			
1,2,4,5-Tetrachlorobenzene	8270C	<5.0	ug/l	5.0			
2,3,4,6-Tetrachlorophenol	8270C	<10	ug/l	10			
1,2,4-Trichlorobenzene	8270C	<5.0	ug/l	5.0			
2,4,5-Trichlorophenol	8270C	<5.0	ug/l	5.0			
2,4,6-Trichlorophenol	8270C	<5.0	ug/l	5.0			
SURROGATE							
2-Fluorophenol		50.5	%	5.0			
2-Fluorobiphenyl		54.9	%	5.0			
Phenol-d5		40.4	%	5.0			
2,4,6-Tribromophenol		47.4	%	5.0			
Nitrobenzene-d5		64.1	%	5.0			
Terphenyl-d14		95.6	%	0.2			

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FAX (803) 791-9111
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SC DHEC No. 32010

NC DEHNR No. 329

Client: Westinghouse Savannah River Company
PO Box 616
Aiken, SC 29808

Project Name: AA82244N

Attention: Stuart Stinson

SHEALY Lab No: 185185S
Description: TANK#2

Coll. Date: 01/12/00
Coll. Time: 1030

Date Received: 01/12/00
Date Reported: 01/27/00

QA/QC Officer ma

V.P. Analytical ma

Parameters	Method	Result	Units	PQL	Date Prepared	Date Analyzed
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BASE NEUTRAL/ACID EXTRACTABLES

01/17/00 01/26/00 MWK
1550 2001

Acenaphthene	8270C	<5.0	ug/l	5.0
Acenaphthylene	8270C	<5.0	ug/l	5.0
Acetophenone	8270C	<5.0	ug/l	5.0
4-Aminobiphenyl	8270C	<10	ug/l	10
Aniline	8270C	<5.0	ug/l	5.0
Anthracene	8270C	<5.0	ug/l	5.0
Benidine	8270C	<25	ug/l	25
Benzoic acid	8270C	<250	ug/l	250
Benzo(a)anthracene	8270C	<5.0	ug/l	5.0
Benzo(b)fluoranthene	8270C	<5.0	ug/l	5.0
Benzo(k)fluoranthene	8270C	<5.0	ug/l	5.0
Benzo(g,h,i)perylene	8270C	<5.0	ug/l	5.0
Benzo(a)pyrene	8270C	<5.0	ug/l	5.0
Benzyl alcohol	8270C	<5.0	ug/l	5.0
bis(2-Chloroethoxy)methane	8270C	<5.0	ug/l	5.0
bis(2-Chloroethyl)ether	8270C	<5.0	ug/l	5.0
bis(2-Chloroisopropyl)ether	8270C	<5.0	ug/l	5.0
bis(2-Ethylhexyl)phthalate	8270C	<10	ug/l	10
4-Bromophenylphenylether	8270C	<5.0	ug/l	5.0
Butylbenzylphthalate	8270C	<10	ug/l	10
4-Chloroaniline	8270C	<5.0	ug/l	5.0
4-Chloro-3-methylphenol	8270C	<5.0	ug/l	5.0
1-Chloronaphthalene	8270C	<5.0	ug/l	5.0
2-Chloronaphthalene	8270C	<5.0	ug/l	5.0
2-Chlorophenol	8270C	<5.0	ug/l	5.0
4-Chlorophenylphenylether	8270C	<5.0	ug/l	5.0
Chrysene	8270C	<5.0	ug/l	5.0
m+p-Cresol	8270C	<10	ug/l	10
o-Cresol	8270C	<10	ug/l	10
Dibenzo(a,h)anthracene	8270C	<5.0	ug/l	5.0
Dibenzofuran	8270C	<5.0	ug/l	5.0
Di-N-Butylphthalate	8270C	<5.0	ug/l	5.0
1,2-Dichlorobenzene	8270C	<5.0	ug/l	5.0
1,3-Dichlorobenzene	8270C	<5.0	ug/l	5.0
1,4-Dichlorobenzene	8270C	<5.0	ug/l	5.0
3,3'-Dichlorobenzidine	8270C	<5.0	ug/l	5.0
2,4-Dichlorophenol	8270C	<5.0	ug/l	5.0
2,6-Dichlorophenol	8270C	<5.0	ug/l	5.0
Diethylphthalate	8270C	<5.0	ug/l	5.0
p-Dimethylaminoazobenzene	8270C	<5.0	ug/l	5.0
7,12-Dimethylbenzo(a)anthracene	8270C	<5.0	ug/l	5.0
a,a-Dimethylphenethylamine	8270C	<50	ug/l	50
2,4-Dimethylphenol	8270C	<5.0	ug/l	5.0

Page 2 (Continuation of 1851853)

Parameters	Method	Result	Units	PQL	Date Prepared	Date Analyzed
Dimethylphthalate	8270C	<5.0	ug/l	5.0		
4,6-Dinitro-2-methylphenol	8270C	<25	ug/l	25		
2,4-Dinitrophenol	8270C	<25	ug/l	25		
2,4-Dinitrotoluene	8270C	<10	ug/l	10		
2,6-Dinitrotoluene	8270C	<10	ug/l	10		
Di-N-Octylphthalate	8270C	<5.0	ug/l	5.0		
Diphenylamine	8270C	<5.0	ug/l	5.0		
Ethyl methanesulfonate	8270C	<5.0	ug/l	5.0		
Fluoranthene	8270C	<5.0	ug/l	5.0		
Fluorene	8270C	<5.0	ug/l	5.0		
Hexachlorobenzene	8270C	<5.0	ug/l	5.0		
Hexachlorobutadiene	8270C	<5.0	ug/l	5.0		
Hexachlorocyclopentadiene	8270C	<25	ug/l	25		
Hexachloroethane	8270C	<5.0	ug/l	5.0		
Indeno(1,2,3-c,d)pyrene	8270C	<5.0	ug/l	5.0		
Isophorone	8270C	<5.0	ug/l	5.0		
3-Methylcholanthrene	8270C	<10	ug/l	10		
Methyl methanesulfonate	8270C	<5.0	ug/l	5.0		
2-Methylnaphthalene	8270C	<5.0	ug/l	5.0		
Naphthalene	8270C	<5.0	ug/l	5.0		
1-Naphthylamine	8270C	<5.0	ug/l	5.0		
2-Naphthylamine	8270C	<5.0	ug/l	5.0		
2-Nitroaniline	8270C	<10	ug/l	10		
3-Nitroaniline	8270C	<10	ug/l	10		
4-Nitroaniline	8270C	<10	ug/l	10		
Nitrobenzene	8270C	<5.0	ug/l	5.0		
2-Nitrophenol	8270C	<10	ug/l	10		
4-Nitrophenol	8270C	<25	ug/l	25		
N-Nitroso-di-butylamine	8270C	<5.0	ug/l	5.0		
N-Nitrosodimethylamine	8270C	<5.0	ug/l	5.0		
N-Nitrosodiphenylamine	8270C	<5.0	ug/l	5.0		
N-Nitroso-di-N-propylamine	8270C	<5.0	ug/l	5.0		
N-Nitrosopiperidine	8270C	<5.0	ug/l	5.0		
Pentachlorobenzene	8270C	<5.0	ug/l	5.0		
Pentachloronitrobenzene	8270C	<25	ug/l	25		
Pentachlorophenol	8270C	<25	ug/l	25		
Phenacetin	8270C	<5.0	ug/l	5.0		
Phenanthrene	8270C	<5.0	ug/l	5.0		
Phenol	8270C	<5.0	ug/l	50		
2-Picoline	8270C	<5.0	ug/l	5.0		
Pronamide	8270C	<10	ug/l	10		
Pyrene	8270C	<5.0	ug/l	5.0		
1,2,4,5-Tetrachlorobenzene	8270C	<5.0	ug/l	5.0		
2,3,4,6-Tetrachlorophenol	8270C	<10	ug/l	10		
1,2,4-Trichlorobenzene	8270C	<5.0	ug/l	5.0		
2,4,5-Trichlorophenol	8270C	<5.0	ug/l	5.0		
2,4,6-Trichlorophenol	8270C	<5.0	ug/l	5.0		

SURROGATE

2-Fluorophenol	71.9	%	5.0
2-Fluorobiphenyl	85.1	%	5.0
Phenol-d5	55.1	%	5.0
2,4,6-Tribromophenol	69.4	%	5.0
Nitrobenzene-d5	88.5	%	5.0
Terphenyl-d14	109	%	0.2

SHEALY ENVIRONMENTAL SERVICES, INC.

Scientists and Consultants

106 VANTAGE POINT DRIVE
CAYCE, SOUTH CAROLINA 29033

CERTIFICATE OF ANALYSIS

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FAX (803) 791-9111
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SC DHEC No. 32010

NC DEHNR No. 329

Client: Westinghouse Savannah River Company
PO Box 616
Aiken, SC 29808

Project Name: AA82244N

Attention: Stuart Stinson

SHEALY Lab No: 185186S
Description: 772-D

Coll. Date: 01/12/00
Coll. Time: 1100

Date Received: 01/12/00
Date Reported: 01/27/00

QA/QC Officer V.F. Analytical

Parameters	Method	Result	Units	PQL	Date Prepared	Date Analyzed	Anal.
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BASE NEUTRAL/ACID EXTRACTABLES

01/17/00 01/26/00 MWK
1550 1829

Acenaphthene	8270C	<5.0	ug/l	5.0			
Acenaphthylene	8270C	<5.0	ug/l	5.0			
Acetophenone	8270C	<5.0	ug/l	5.0			
4-Aminobiphenyl	8270C	<10	ug/l	10			
Aniline	8270C	<5.0	ug/l	5.0			
Anthracene	8270C	<5.0	ug/l	5.0			
Benzidine	8270C	<25	ug/l	25			
Benzoic acid	8270C	<250	ug/l	250			
Benzo(a)anthracene	8270C	<5.0	ug/l	5.0			
Benzo(b)fluoranthene	8270C	<5.0	ug/l	5.0			
Benzo(k)fluoranthene	8270C	<5.0	ug/l	5.0			
Benzo(g,h,i)perylene	8270C	<5.0	ug/l	5.0			
Benzo(a)pyrene	8270C	<5.0	ug/l	5.0			
Benzyl alcohol	8270C	<5.0	ug/l	5.0			
bis(2-Chloroethoxy)methane	8270C	<5.0	ug/l	5.0			
bis(2-Chloroethyl)ether	8270C	<5.0	ug/l	5.0			
bis(2-Chloroisopropyl)ether	8270C	<5.0	ug/l	5.0			
bis(2-Ethylhexyl)phthalate	8270C	<10	ug/l	10			
4-Bromophenylphenylether	8270C	<5.0	ug/l	5.0			
Butylbenzylphthalate	8270C	<10	ug/l	10			
4-Chloroaniline	8270C	<5.0	ug/l	5.0			
4-Chloro-3-methylphenol	8270C	<5.0	ug/l	5.0			
1-Chloronaphthalene	8270C	<5.0	ug/l	5.0			
2-Chloronaphthalene	8270C	<5.0	ug/l	5.0			
2-Chlorophenol	8270C	<5.0	ug/l	5.0			
4-Chlorophenylphenylether	8270C	<5.0	ug/l	5.0			
Chrysene	8270C	<5.0	ug/l	5.0			
m+p-Cresol	8270C	<10	ug/l	10			
o-Cresol	8270C	<10	ug/l	10			
Dibenzo(a,h)anthracene	8270C	<5.0	ug/l	5.0			
Dibenzofuran	8270C	<5.0	ug/l	5.0			
Di-N-Butylphthalate	8270C	<5.0	ug/l	5.0			
1,2-Dichlorobenzene	8270C	<5.0	ug/l	5.0			
1,3-Dichlorobenzene	8270C	<5.0	ug/l	5.0			
1,4-Dichlorobenzene	8270C	<5.0	ug/l	5.0			
3,3'-Dichlorobenzidine	8270C	<5.0	ug/l	5.0			
2,4-Dichlorophenol	8270C	<5.0	ug/l	5.0			
2,6-Dichlorophenol	8270C	<5.0	ug/l	5.0			
Diethylphthalate	8270C	<5.0	ug/l	5.0			
p-Dimethylaminoazobenzene	8270C	<5.0	ug/l	5.0			
7,12-Dimethylbenzo(a)anthracene	8270C	<5.0	ug/l	5.0			
a,a-Dimethylphenethylamine	8270C	<50	ug/l	50			
2,4-Dimethylphenol	8270C	<5.0	ug/l	5.0			

Page 2 (Continuation of 1851868)

Parameters	Method	Result	Units	PQL	Date Prepared	Date Analyzed	Anal.
Dimethylphthalate	8270C	<5.0	ug/l	5.0			
4,6-Dinitro-2-methylphenol	8270C	<25	ug/l	25			
2,4-Dinitrophenol	8270C	<25	ug/l	25			
2,4-Dinitrotoluene	8270C	<10	ug/l	10			
2,6-Dinitrotoluene	8270C	<10	ug/l	10			
Di-N-Octylphthalate	8270C	<5.0	ug/l	5.0			
Diphenylamine	8270C	<5.0	ug/l	5.0			
Ethyl methanesulfonate	8270C	<5.0	ug/l	5.0			
Fluoranthene	8270C	<5.0	ug/l	5.0			
Fluorene	8270C	<5.0	ug/l	5.0			
Hexachlorobenzene	8270C	<5.0	ug/l	5.0			
Hexachlorobutadiene	8270C	<5.0	ug/l	5.0			
Hexachlorocyclopentadiene	8270C	<25	ug/l	25			
Hexachloroethane	8270C	<5.0	ug/l	5.0			
Indeno(1,2,3-c,d)pyrene	8270C	<5.0	ug/l	5.0			
Isophorone	8270C	<5.0	ug/l	5.0			
3-Methylcholanthrene	8270C	<10	ug/l	10			
Methyl methanesulfonate	8270C	<5.0	ug/l	5.0			
2-Methylnaphthalene	8270C	<5.0	ug/l	5.0			
Naphthalene	8270C	<5.0	ug/l	5.0			
1-Naphthylamine	8270C	<5.0	ug/l	5.0			
2-Naphthylamine	8270C	<5.0	ug/l	5.0			
2-Nitroaniline	8270C	<10	ug/l	10			
3-Nitroaniline	8270C	<10	ug/l	10			
4-Nitroaniline	8270C	<10	ug/l	10			
Nitrobenzene	8270C	<5.0	ug/l	5.0			
2-Nitrophenol	8270C	<10	ug/l	10			
4-Nitrophenol	8270C	<25	ug/l	25			
N-Nitroso-di-butylamine	8270C	<5.0	ug/l	5.0			
N-Nitrosodimethylamine	8270C	<5.0	ug/l	5.0			
N-Nitrosodiphenylamine	8270C	<5.0	ug/l	5.0			
N-Nitroso-di-N-propylamine	8270C	<5.0	ug/l	5.0			
N-Nitrosopiperidine	8270C	<5.0	ug/l	5.0			
Pentachlorobenzene	8270C	<5.0	ug/l	5.0			
Pentachloronitrobenzene	8270C	<25	ug/l	25			
Pentachlorophenol	8270C	<25	ug/l	25			
Phenacetin	8270C	<5.0	ug/l	5.0			
Phenanthrene	8270C	<5.0	ug/l	5.0			
Phenol	8270C	<5.0	ug/l	50			
2-Picoline	8270C	<5.0	ug/l	5.0			
Pronamide	8270C	<10	ug/l	10			
Pyrene	8270C	<5.0	ug/l	5.0			
1,2,4,5-Tetrachlorobenzene	8270C	<5.0	ug/l	5.0			
2,3,4,6-Tetrachlorophenol	8270C	<10	ug/l	10			
1,2,4-Trichlorobenzene	8270C	<5.0	ug/l	5.0			
2,4,5-Trichlorophenol	8270C	<5.0	ug/l	5.0			
2,4,6-Trichlorophenol	8270C	<5.0	ug/l	5.0			

SURROGATE

2-Fluorophenol	63.0	%	5.0
2-Fluorobiphenyl	67.2	%	5.0
Phenol-d5	49.0	%	5.0
2,4,6-Tribromophenol	52.5	%	5.0
Nitrobenzene-d5	78.0	%	5.0
Terphenyl-d14	99.2	%	0.2

SHEALY ENVIRONMENTAL SERVICES, INC.

Scientists and Consultants

106 VANTAGE POINT DRIVE
CAYCE, SOUTH CAROLINA 29033

CERTIFICATE OF ANALYSIS

(803) 791-9700
FAX (803) 791-9111
www.shealyenvironmental.com

SC DHEC No. 32010

NC DEHNR No. 329

Client: Westinghouse Savannah River Company
PO Box 616
Aiken, SC 29808

Project Name: AA82244N

Attention: Stuart Stinson

SHEALY Lab No: 185187S

Description: X-08

Coll. Date: 01/12/00

Coll. Time: 1120

Date Received: 01/12/00

Date Reported: 01/27/00

QA/QC Officer max

V.P. Analytical ma

Parameters	Method	Result	Units	PQL	Date Prepared	Date Analyzed	Anal.
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BASE NEUTRAL/ACID EXTRACTABLES

01/17/00 01/26/00 MWK
1550 1930

Acenaphthene	8270C	<5.0	ug/l	5.0
Acenaphthylene	8270C	<5.0	ug/l	5.0
Acetophenone	8270C	<5.0	ug/l	5.0
4-Aminobiphenyl	8270C	<10	ug/l	10
Aniline	8270C	<5.0	ug/l	5.0
Anthracene	8270C	<5.0	ug/l	5.0
Benzidine	8270C	<25	ug/l	25
Benzoic acid	8270C	<250	ug/l	250
Benzo (a) anthracene	8270C	<5.0	ug/l	5.0
Benzo (b) fluoranthene	8270C	<5.0	ug/l	5.0
Benzo (k) fluoranthene	8270C	<5.0	ug/l	5.0
Benzo (g, h, i) perylene	8270C	<5.0	ug/l	5.0
Benzo (a) pyrene	8270C	<5.0	ug/l	5.0
Benzyl alcohol	8270C	<5.0	ug/l	5.0
bis (2-Chloroethoxy) methane	8270C	<5.0	ug/l	5.0
bis (2-Chloroethyl) ether	8270C	<5.0	ug/l	5.0
bis (2-Chloroisopropyl) ether	8270C	<5.0	ug/l	5.0
bis (2-Ethylhexyl) phthalate	8270C	12	ug/l	10
4-Bromophenylphenylether	8270C	<5.0	ug/l	5.0
Butylbenzylphthalate	8270C	<10	ug/l	10
4-Chloroaniline	8270C	<5.0	ug/l	5.0
4-Chloro-3-methylphenol	8270C	<5.0	ug/l	5.0
1-Chloronaphthalene	8270C	<5.0	ug/l	5.0
2-Chloronaphthalene	8270C	<5.0	ug/l	5.0
2-Chlorophenol	8270C	<5.0	ug/l	5.0
4-Chlorophenylphenylether	8270C	<5.0	ug/l	5.0
Chrysene	8270C	<5.0	ug/l	5.0
m+p-Cresol	8270C	<10	ug/l	10
o-Cresol	8270C	<10	ug/l	10
Dibenzo (a, h) anthracene	8270C	<5.0	ug/l	5.0
Dibenzofuran	8270C	<5.0	ug/l	5.0
Di-N-Butylphthalate	8270C	<5.0	ug/l	5.0
1,2-Dichlorobenzene	8270C	<5.0	ug/l	5.0
1,3-Dichlorobenzene	8270C	<5.0	ug/l	5.0
1,4-Dichlorobenzene	8270C	<5.0	ug/l	5.0
3,3'-Dichlorobenzidine	8270C	<5.0	ug/l	5.0
2,4-Dichlorophenol	8270C	<5.0	ug/l	5.0
2,6-Dichlorophenol	8270C	<5.0	ug/l	5.0
Diethylphthalate	8270C	<5.0	ug/l	5.0
p-Dimethylaminoazobenzene	8270C	<5.0	ug/l	5.0
7,12-Dimethylbenzo (a) anthracene	8270C	<5.0	ug/l	5.0
a, a-Dimethylphenethylamine	8270C	<50	ug/l	50
2,4-Dimethylphenol	8270C	<5.0	ug/l	5.0

1-27-00; 6:40PM;

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Page 2 (Continuation of 1851875)

Parameters	Method	Result	Units	PQL	Date Prepared	Date Analyzed	Anal.
Dimethylphthalate	8270C	<5.0	ug/l	5.0			
4,6-Dinitro-2-methylphenol	8270C	<25	ug/l	25			
2,4-Dinitrophenol	8270C	<25	ug/l	25			
2,4-Dinitrotoluene	8270C	<10	ug/l	10			
2,6-Dinitrotoluene	8270C	<10	ug/l	10			
D1-N-Octylphthalate	8270C	<5.0	ug/l	5.0			
Diphenylamine	8270C	<5.0	ug/l	5.0			
Ethyl methanesulfonate	8270C	<5.0	ug/l	5.0			
Fluoranthene	8270C	<5.0	ug/l	5.0			
Fluorene	8270C	<5.0	ug/l	5.0			
Hexachlorobenzene	8270C	<5.0	ug/l	5.0			
Hexachlorobutadiene	8270C	<5.0	ug/l	5.0			
Hexachlorocyclopentadiene	8270C	<25	ug/l	25			
Hexachloroethane	8270C	<5.0	ug/l	5.0			
Indeno(1,2,3-c,d)pyrene	8270C	<5.0	ug/l	5.0			
Isophorone	8270C	<5.0	ug/l	5.0			
3-Methylcholanthrene	8270C	<10	ug/l	10			
Methyl methanesulfonate	8270C	<5.0	ug/l	5.0			
2-Methylnaphthalene	8270C	<5.0	ug/l	5.0			
Naphthalene	8270C	<5.0	ug/l	5.0			
1-Naphthylamine	8270C	<5.0	ug/l	5.0			
2-Naphthylamine	8270C	<5.0	ug/l	5.0			
2-Nitroaniline	8270C	<10	ug/l	10			
3-Nitroaniline	8270C	<10	ug/l	10			
4-Nitroaniline	8270C	<10	ug/l	10			
Nitrobenzene	8270C	<5.0	ug/l	5.0			
2-Nitrophenol	8270C	<10	ug/l	10			
4-Nitrophenol	8270C	<25	ug/l	25			
N-Nitroso-di-butylamine	8270C	<5.0	ug/l	5.0			
N-Nitrosodimethylamine	8270C	<5.0	ug/l	5.0			
N-Nitrosodiphenylamine	8270C	<5.0	ug/l	5.0			
N-Nitroso-di-N-propylamine	8270C	<5.0	ug/l	5.0			
N-Nitrosopiperidine	8270C	<5.0	ug/l	5.0			
Pentachlorobenzene	8270C	<5.0	ug/l	5.0			
Pentachloronitrobenzene	8270C	<25	ug/l	25			
Pentachlorophenol	8270C	<25	ug/l	25			
Phenacetin	8270C	<5.0	ug/l	5.0			
Phenanthrene	8270C	<5.0	ug/l	5.0			
Phenol	8270C	<5.0	ug/l	50			
2-Picoline	8270C	<5.0	ug/l	5.0			
Pronamide	8270C	<10	ug/l	10			
Pyrene	8270C	<5.0	ug/l	5.0			
1,2,4,5-Tetrachlorobenzene	8270C	<5.0	ug/l	5.0			
2,3,4,6-Tetrachlorophenol	8270C	<10	ug/l	10			
1,2,4-Trichlorobenzene	8270C	<5.0	ug/l	5.0			
2,4,5-Trichlorophenol	8270C	<5.0	ug/l	5.0			
2,4,6-Trichlorophenol	8270C	<5.0	ug/l	5.0			
SURROGATE							
2-Fluorophenol		72.0	%	5.0			
2-Fluorobiphenyl		81.3	%	5.0			
Phenol-d5		54.2	%	5.0			
2,4,6-Tribromophenol		64.7	%	5.0			
Nitrobenzene-d5		86.3	%	5.0			
Terphenyl-d14		107	%	0.2			

1-27-00; 6:40PM;

;803 791 9111

13/ 18

3754

BA 12053

SAMPLES CHAIN OF CUSTODY RECORD		Sampling Program: SPECIAL -NPDES			
Sampler: Print Name: <u>David H. Hughey</u>		Sampler Signature: <u>David H. Hughey</u>			
By my signature I verify addition of required preservatives for all samples listed below.					
Reviewer: Print Name: <u>Stuart Stinson</u>		Reviewer Signature: <u>Stuart Stinson</u>			
DATE		1-12-00	1-12-00	1-12-00	1-12-00
TIME		1010	1030	1100	1120
OUTFALL NO.		X-8B	TANK # 2	772-D	X-08
GRAB		✓	✓	✓	✓
COMP. Start Time					
COMP. Start Date					
COMP. Stop Time					
COMP. Stop Date					
# of Containers		1	1	1	1
CHRONIC DEFINITIVE	ICED	1851845	1851855	1851865	1851875
CHRONIC TOXICITY	ICED				
O&G	H ₂ SO ₄				
TSS	ICED				
BOD	ICED				
SULFATE	ICED				
AMMONIA (NH ₃ -N)	H ₂ SO ₄				
NITRATE (NO ₃)	ICED				
NITRITE (NO ₂)	ICED				
PHOSPHOROUS (PO ₄ -P)	H ₂ SO ₄				
COD	H ₂ SO ₄				
TOC	H ₂ SO ₄				
SULFIDE	NaOH				
PHENOL	H ₂ SO ₄				
CYANIDE (CN ⁻)	NaOH				
8270 Semi-vol, all compounds	ICED	X	X	X	X
8260 Volatiles, all compounds	ICED	X dkk			
VQA Blank	ICED	X 1-12-00			
BENZENE BLANK	HCl				
ARSENIC (AS)	ICED				
CADMIUM (CD)	ICED				
COPPER (CU)	ICED				
LEAD (PB)	ICED				
MANGANESE (MN)	ICED				
NICKEL (NI)	ICED				
SILVER (AG)	ICED				
ZINC (ZN)	ICED				
PESTICIDES	ICED				
FLUORIDE	ICED				
Comments:					
Samples REL. by: <u>David H. Hughey</u>		Samples REC. by: <u>Keith C. Atkinson</u>		Date/Time 1-12-00 1505	
Samples REL. by: <u>Keith C. Atkinson</u>		Samples REC. by: <u>Keith C. Atkinson</u>		Date/Time 1/12/00 1641	
Samples REL. by:		Samples REC. by:		Date/Time	

Sample Receipt Checklist

Client: WSRS Cooler received by/date: 1/11/00Sample numbers: 1851845 thru 1851875Cooler temperature upon receipt 2.5 °CMethod of coolant: ☒ Wet Ice ☐ Blue Ice ☐ Dry Ice ☐ NoneMeans of receipt: ☒ SEISI ☐ Client ☐ UPS ☐ FedEx ☐ DirectX ☐ Other

Yes ☐	No ☐	NA ☒	1. Is the shipper's packing slip attached to this form? (if applicable)
Yes ☒	No ☐	NA ☐	2. Was a chain of custody provided with the samples and relinquished?
Yes ☒	No ☐	NA ☐	3. Did the laboratory sign the chain of custody in the appropriate place?
Yes ☒	No ☐	NA ☐	4. Was the client name/address listed?
Yes ☒	No ☐	NA ☐	5. Were sample IDs listed?
Yes ☒	No ☐	NA ☐	6. Was collection date & time listed?
Yes ☒	No ☐	NA ☐	7. Were the tests to be performed listed on C of C?
Yes ☒	No ☐	NA ☐	8. Were proper custody procedures followed?
Yes ☒	No ☐	NA ☐	9. Did all samples arrive in the proper containers for each test?
Yes ☒	No ☐	NA ☐	10. Did all bottle labels agree with custody papers?
Yes ☒	No ☐	NA ☐	11. Did all containers arrive in good condition (unbroken)?
Yes ☒	No ☐	NA ☐	12. Was adequate sample volume available?
Yes ☒	No ☐	NA ☐	13. Were all samples received within ½ the holding time or 48 hours, whichever comes first?
Yes ☐	No ☒	NA ☐	14. Were any samples containers missing?
Yes ☐	No ☒	NA ☐	15. Were there any excess samples not listed on C of C?
Yes ☐	No ☐	NA ☒	16. Were air bubbles >6 mm in any VOA vials (if applicable)?
Yes ☐	No ☐	NA ☐	17. Were all Metals; Oil & Grease; Nutrient samples received at a pH of <2?
Yes ☐	No ☐	NA ☐	18. Were all Cyanide; Sulfide samples received at a pH >12?
Yes ☐	No ☐	NA ☒	19. Were all NH ₃ ; TKN; Cyanide; BNA; PEST; PCB; HERB samples free of residual chlorine?

Sample Preservation (Must be completed for any sample(s) incorrectly preserved.)

Sample(s) _____ were received incorrectly preserved and were adjusted accordingly in sample receiving.

Sample(s) _____ were received incorrectly preserved and were unable to be analyzed

Sample(s) _____ were received with bubble >6 mm in diameter

Comments on resolutions to any discrepancies (if applicable, include date/time/client/agency contacted):

P.O. Box 16414, Greenville, SC 29606

(864) 877-6942 • FAX (864) 877-6938

4 Craftsman Court, Greer, SC 29650

DATE REPORTED: March 2, 2000

CLIENT: Attn: Winona Specht
Westinghouse Savannah River Company
P.O. Box 616
Aiken, SC 29802

LAB #: SAMPLE ID
W13843 TNX Collection Sump
W13844 TNX Grit Chamber
W13845 TNX Tank 2

CHEMICAL ANALYSIS REPORT

<u>Sample ID</u>	<u>Sample Date</u>	<u>Parameter</u>	<u>Result</u>	<u>Units</u>	<u>Method</u>
TNX Collection Sump	2-8-00	CTAS	<1.0	mg/L	5540D
TNX Grit Chamber	2-9-00	Total Aluminum	0.394	mg/L	200.7
TNX Grit Chamber	2-9-00	Total Iron	0.102	mg/L	200.7
TNX Grit Chamber	2-9-00	Total Nickel	0.006	mg/L	200.7
TNX Grit Chamber	2-9-00	Total Chromium	<0.005	mg/L	200.7
TNX Grit Chamber	2-9-00	Total Copper	0.041	mg/L	220.1
TNX Grit Chamber	2-9-00	Total Zinc	0.253	mg/L	289.1
TNX Tank 2	2-9-00	Total Aluminum	0.088	mg/L	200.7
TNX Tank 2	2-9-00	Total Iron	<0.050	mg/L	200.7
TNX Tank 2	2-9-00	Total Nickel	0.007	mg/L	200.7
TNX Tank 2	2-9-00	Total Chromium	<0.005	mg/L	200.7
TNX Tank 2	2-9-00	Total Copper	0.037	mg/L	220.1
TNX Tank 2	2-9-00	Total Zinc	0.703	mg/L	289.1

SC Laboratory Certification #23104

Outside Laboratory Certification #02002

Reported By:

Robert W. Kelley, Ph.D., Laboratory Manager

Description : ETP - Tank2
Lot Number : BD07022-003 (192130)
Client : Westinghouse Savannah River Company
Date Received : 04/07/2000

Collect Date : 02/09/2000
Collect Time : 0000
Matrix : Aqueous

Parameter	Prep Method	Analytical Method	Result	Q	Units	PQL	Prep Date/Time	Analysis Date/Time	Analyst
ICP-AES									
Zinc		200.7	1.0		mg/L	0.0050	04/12/2000 0900	04/12/2000 1607	FTS

PQL = Practical quantitation limit

B = Detected in method blank

E = Quantitation of compound exceeded the calibration range

ND = Not detected at PQL

J = Estimated result less than the PQL

Soils reported on a dry weight basis unless flagged with a "W"

SHEALY ENVIRONMENTAL SERVICES, INC.

106 Vantage Point Drive, Cayce, South Carolina 29033 (803) 791-9700 Fax (803) 791-9111 www.shealyenvironmental.com

Page 2 of 4

P.O. Box 16414, Greenville, SC 29606

(864) 877-6942 • FAX (864) 877-6938

4 Craftsman Court, Greer, SC 29650

DATE REPORTED: April 4, 2000

CLIENT: Attn: Winona Specht
Westinghouse Savannah River Company
P.O. Box 616
Aiken, SC 29802

LAB #: SAMPLE ID
W14015 X-08B

CHEMICAL ANALYSIS REPORT

<u>Sample ID</u>	<u>Sample Date</u>	<u>Parameter</u>	<u>Result</u>	<u>Units</u>	<u>Method</u>
X-08B	3-6-00	Total Aluminum	0.050	mg/L	200.7
X-08B	3-6-00	Total Iron	0.092	mg/L	200.7
X-08B	3-6-00	Total Copper	0.005	mg/L	220.1
X-08B	3-6-00	Total Zinc	0.646	mg/L	289.1

SC Laboratory Certification #23104
Outside Laboratory Certification #02002

Reported By:

Robert W. Kelley, Ph.D., Laboratory Manager

Description : ETP - Tank1
 Lot Number : BD07022-004 (192131)
 Client : Westinghouse Savannah River Company
 Date Received : 04/07/2000

Collect Date : 03/28/2000
 Collect Time : 0000
 Matrix : Aqueous

Parameter	Prep Method	Analytical Method	Result	Q	Units	PQL	Prep Date/Time	Analysis Date/Time	Analyst
ICP-AES									
Aluminum		200.7	0.14		mg/L	0.050	04/12/2000 0900	04/12/2000 1612	FTS
Antimony		200.7	ND		mg/L	0.0050	04/12/2000 0900	04/12/2000 1612	FTS
Arsenic		200.7	ND		mg/L	0.0050	04/12/2000 0900	04/12/2000 1612	FTS
Beryllium		200.7	ND		mg/L	0.0040	04/12/2000 0900	04/12/2000 1612	FTS
Cadmium		200.7	ND		mg/L	0.0020	04/12/2000 0900	04/12/2000 1612	FTS
Chromium		200.7	ND		mg/L	0.0050	04/12/2000 0900	04/12/2000 1612	FTS
Copper		200.7	0.043		mg/L	0.0050	04/12/2000 0900	04/12/2000 1612	FTS
Iron		200.7	0.34		mg/L	0.020	04/12/2000 0900	04/12/2000 1612	FTS
Lead		200.7	ND		mg/L	0.0030	04/12/2000 0900	04/12/2000 1612	FTS
Magnesium		200.7	0.39		mg/L	0.050	04/12/2000 0900	04/12/2000 1612	FTS
Manganese		200.7	0.032		mg/L	0.0050	04/12/2000 0900	04/12/2000 1612	FTS
Nickel		200.7	ND		mg/L	0.010	04/12/2000 0900	04/12/2000 1612	FTS
Selenium		200.7	ND		mg/L	0.0050	04/12/2000 0900	04/12/2000 1612	FTS
Silver		200.7	ND		mg/L	0.0050	04/12/2000 0900	04/12/2000 1612	FTS
Thallium		200.7	ND		mg/L	0.10	04/12/2000 0900	04/12/2000 1612	FTS
Zinc		200.7	0.74		mg/L	0.0050	04/12/2000 0900	04/12/2000 1612	FTS
CVAA									
Mercury		245.1	0.0012		mg/L	0.00010	04/11/2000 0900	04/11/2000 1025	CRB

PQL = Practical quantitation limit

B = Detected in method blank

E = Quantitation of compound exceeded the calibration range

ND = Not detected at PQL

J = Estimated result less than the PQL

Soils reported on a dry weight basis unless flagged with a "W"

SHEALY ENVIRONMENTAL SERVICES, INC.

106 Vantage Point Drive, Cayce, South Carolina 29033 (803) 791-9700 Fax (803) 791-9111 www.shealyenvironmental.com

P.O. Box 16414, Greenville, SC 29606

(864) 877-6942 • FAX (864) 877-6938

4 Craftsman Court, Greer, SC 29650

DATE REPORTED: April 20, 2000

CLIENT: Attn: Winona Specht
Westinghouse Savannah River Company
P.O. Box 616
Aiken, SC 29802

LAB #: SAMPLE ID

T14129 X-8B
T14130 Tank 1

CHEMICAL ANALYSIS REPORT

<u>Sample ID</u>	<u>Sample Date</u>	<u>Parameter</u>	<u>Result</u>	<u>Units</u>	<u>Method</u>
X-8B	3-28-00	Total Copper	0.032	mg/L	220.1
X-8B	3-28-00	Total Zinc	0.413	mg/L	289.1
X-8B	3-28-00	Total Aluminum	<0.050	mg/L	200.7
X-8B	3-28-00	Total Iron	0.255	mg/L	200.7
Tank 1	3-28-00	Total Copper	0.050	mg/L	220.1
Tank 1	3-28-00	Total Zinc	0.602	mg/L	289.1
Tank 1	3-28-00	Total Aluminum	<0.050	mg/L	200.7
Tank 1	3-28-00	Total Iron	0.348	mg/L	200.7

SC Laboratory Certification #23104
Outside Laboratory Certification #02002

Reported By:

Robert W. Kelley, Ph.D., Laboratory Manager

P.O. Box 16414, Greenville, SC 29606

(864) 877-6942 • FAX (864) 877-6938

4 Craftsman Court, Greer, SC 29650

DATE REPORTED: May 23, 2000

CLIENT: Attn: Winona Specht
Westinghouse Savannah River Company
P.O. Box 616
Aiken, SC 29802

LAB #: SAMPLE ID

W14290 904-Sump
W14291 X-08
W14292 Tank 2
W14293 X-08 w/out discharge

CHEMICAL ANALYSIS REPORT

<u>Sample ID</u>	<u>Sample Date</u>	<u>Parameter</u>	<u>Result</u>	<u>Units</u>	<u>Method</u>
904-Sump	4-18-00	Total Copper	0.016	mg/L	220.1
904-Sump	4-18-00	Total Zinc	0.763	mg/L	289.1
X-08	4-18-00	Total Copper	0.012	mg/L	220.1
X-08	4-18-00	Total Zinc	0.278	mg/L	289.1
X-08	4-18-00	Total Mercury	<0.0002	mg/L	245.1
Tank 2	4-18-00	Total Copper	0.057	mg/L	220.1
Tank 2	4-18-00	Total Zinc	0.889	mg/L	289.1
Tank 2	4-18-00	Total Mercury	0.00036	mg/L	245.1
X-08 w/out discharge	4-18-00	Total Copper	<0.010	mg/L	220.1
X-08 w/out discharge	4-18-00	Total Zinc	0.070	mg/L	289.1
X-08 w/out discharge	4-18-00	Total Mercury	<0.0002	mg/L	245.1

SC Laboratory Certification #23104
Outside Laboratory Certification #02002

Reported By:

Robert W. Kelley, Ph.D., Laboratory Manager

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(864) 877-6942 • FAX (864) 877-6938

4 Craftsman Court, Greer, SC 29650

DATE REPORTED: June 1, 2000

CLIENT: Attn: Winona Specht
Westinghouse Savannah River Company
P.O. Box 616
Aiken, SC 29802

LAB #: SAMPLE ID

W14467 Eq. Tank Dike Sump
T14468 Collection Sump
T14469 Tank 2 heel
T14470 Tank 1

CHEMICAL ANALYSIS REPORT

<u>Sample ID</u>	<u>Sample Date</u>	<u>Parameter</u>	<u>Result</u>	<u>Units</u>	<u>Method</u>
Eq. Tank Dike Sump	5-8-00	Total Zinc	2.74	mg/L	289.1
Collection Sump	5-8-00	Total Zinc	1.14	mg/L	289.1
Tank 2 heel	5-8-00	Total Zinc	0.565	mg/L	289.1
Tank 1	5-8-00	Total Zinc	0.540	mg/L	289.1

SC Laboratory Certification #23104

Reported By:

Robert W. Kelley, Ph.D., Laboratory Manager

Results of LC/MS Scan, May 2000

Aged

Fresh