PRELIMINARY ECOLOGICAL EVALUATION OF SURFACE WATER DRAINAGES AT THE CHEMFAX SUPERFUND SITE GULFPORT, MISSISSIPPI

prepared for

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Introduction

This document reports the findings of a preliminary ecological evaluation of surface water drainages at the Chemfax Superfund Site, Gulfport, Mississippi. The study was conducted by US EPA Region IV Environmental Services Division (ESD), Ecological Support Branch (ESB) and Environmental Services Assistance Team (ESAT) in cooperation with the Environmental Compliance Branch, January 1995.

This preliminary ecological evaluation was performed to determine the need for a full-scale Ecological Risk Assessment. The evaluation was based on toxicity tests conducted on surface water and sediment samples collected both on and off-site, supported by *in-situ* water chemistry measurements and chemical analyses conducted on portions of the same water and sediment samples. Chemical, physical, and toxicological samples and data were collected simultaneously at each station to provide complementary supporting data to aid in interpretation of the test results.

Objectives of this study were to evaluate the impact of previous activities at the Chemfax site on the aquatic environment in and around the site and to determine if potentially toxic materials were being transported off-site. The primary chemicals of concern were polynuclear aromatic hydrocarbons (PAH's), various organic solvents, organic resins, and possibly some phenolic compounds (USEPA 1994a).

Site Description

Chemfax occupies 11 acres and is located in an industrial park area. Surface waters that have historically received effluent and/or surface water run-off from the Chemfax facility include two man-made holding ponds and a number of intermittent surface water drainage ditches. At the time of this study, Chemfax held an NPDES permit to release effluent into a surface water drainage ditch that originates on-site. Their effluent entered the drainage ditch at a location just downstream of the lower holding pond (Figure 1). Most of the surface water leaving the site, including the permitted effluent, flows in a north or northeast direction, draining into the Bernard Bayou.

Selection of Sampling Sites

Following a ground-truth survey and reconnaissance of the Chemfax site and surrounding areas conducted on January 18, 1995, seven surface water/sediment sampling stations (Figure 1) were selected from among 245 stations already established by EPA Region IV (USEPA 1994). Five sampling stations were located on-site (stations 202, 204, 206, 210, and 217) and two on Bernard Bayou (stations 223 and 224). One additional sampling station (234) was established on a small drainage about 2 miles south of the Chemfax site (see map Fig. 1). Station 234 was selected as a potential reference site. The 8 sampling stations can be described as follows:

Station 202	On-site drainage ditch originating in center of Chemfax site and draining northward along fence separating inactive and active facilities.
Station 204	On-site drainage ditch originating inside fence encompassing inactive area and flowing north along entrance road.
Station 206	On-site drainage ditch approximately 60 feet downstream of lower holding pond.
Station 210	On-site main ditch just before stream enters culvert at County Barn Road.
Station 217	On-site, former spray irrigation pond.
Station 223	Bernard Bayou immediately upstream of Chemfax outfall.
Station 224	Bernard Bayou immediately downstream of Chemfax outfall.
Station 234	Off-site, west side of Three Rivers Road, 0.5 miles south of main entrance to Chemfax Inc.

Methods

At each sampling station, *in-situ* water chemistry was measured and a water and sediment sample taken. At the time of collection, water and sediment samples were split. Portions of each sample were labeled and packaged for shipment to the appropriate in-house or contract laboratories for chemical analysis. Another portion of each sample was retained for toxicity testing. Toxicity tests were conducted in the EPA Region 4 toxicity testing laboratory in Athens, Georgia. Chain-of-custody was maintained throughout sampling, shipping, and testing.

Water Quality Measurements - *In-situ* dissolved oxygen (DO), pH, temperature, and conductivity were measured using a calibrated Hydrolab® H_2O Multiprobe. Alkalinity, hardness, and turbidity were determined later (within 72 hrs.) in the laboratory using EPA approved methods (APHA 1992).

Water and Sediment Sampling - was conducted according to EPA standard operating procedures (USEPA 1991). At the time of collection, each sample was split as follows:

Water
2 - 40 ml glass vials with teflon septum (volatile organics)
1 - 1 liter polyethylene bottle (metals)
1 - 500 ml polyethylene bottle (total organic carbon - TOC)
1 - 500 ml polyethylene bottle (turbidity)

1 - 4 liter amber glass jug (pesticides/extractable organics)
1 - 4 liter cubitainer (toxicity testing)

Sediment
1 - 2 oz glass jar (volatile organics)
1 - 8 oz glass jar (metals)
1 - 8 oz glass jar (pesticides/extractable organics)
1 - 8 oz. glass jar (TOC)
1 - 1 liter glass jar (toxicity testing)
1 - whirl pack (particle size analysis)

Immediately after collection, samples were stored on wet ice.

Toxicity Tests - were conducted according to EPA Region IV Ecological Support Branch standard operating procedures (USEPA 1993a). Samples were kept at 4° C until toxicity tests were initiated. Tests on water samples were initiated within 72 hours of sample collection. Tests on sediment samples were initiated within 6 weeks of sample collection. The following tests were performed:

Water samples
Ceriodaphnia 7-day Survival/Reproduction Test (SOP XV)
Selenastrum capricornutum 96 hr Growth Test (SOP XX)
Microtox® Basic Test

Sediment samples

Ceriodaphnia 7-day Whole Sediment Test (SOP XV A)
Microtox Basic Test (performed on sediment pore water)

Results

Water and Sediment - The results of in-situ water measurements (supplemented by laboratory determinations of water alkalinity, hardness, turbidity, TOC), are summarized in Table 1. Other water and sediment chemistry results are summarized in Tables 4 and 5.

Toxicity Tests - The results of toxicity tests conducted on water and sediment samples are summarized in Tables 2 and 3 respectively. Copies of laboratory bench sheets for each test are included in Appendix A.

Ceriodaphnia 7-day Survival/Reproduction Test

One water sample (station 217) was clearly toxic to *Ceriodaphnia dubia*, producing a statistically significant reduction in the number of young produced (Table 2). Three other samples, 204, 206, and 210 also showed a statistically significant reduction in the number of young produced but their biological significance is questionable (see Discussion section). No significant mortality occurred among adult animals in any of the above water samples.

In contrast, five sediment samples (Table 3) caused a significant reduction in the number of young produced (samples 202, 204, 210, 217, and 234), and two of those samples (202 and 234) were also acutely toxic to adult *Ceriodaphnia.*

Selenastrum capricornutum 96 hr Growth Test

One water sample (station 217) significantly inhibited algal growth.

Microtox® Basic Test

None of the surface water samples were toxic (Table 2) to Microtox bacteria. However, two sediment pore water samples (Table 3) from stations 204 and 206, elicited a toxic response, producing EC50's of 82.55% and 15.41% respectively. Insufficient pore water was obtained from sample 202. Therefore, no microtox test was performed on this sediment sample.

Discussion

Toxicity tests indicate that potentially toxic water and sediment samples were restricted to on-site sampling locations and to the single off-site location chosen as a potential reference station. No toxic effects were observed in samples taken from Bernard Bayou.

Because samples collected at the reference station exhibited toxic effects, on-site samples were statistically compared to laboratory controls (dilute mineral water). Due to the unusually high number of young produced in the control sample to which the test samples were compared, several water samples produced an endpoint significantly different from their respective controls and therefore appeared toxic. This is a case where statistical significance does not necessarily mean biological significance. Normally, it is preferable to test a site sample against a background sample. If a background sample can not be obtained, then a reference sample is the next best choice. In both cases any natural factors (e.g. alkalinity, hardness, pH, non-site-derived toxicity etc.) that may prevent growth and survival of test organisms in site samples would also be

expected to prevent growth and survival of test organisms in the background and/or reference sample. Comparing test results of site samples against a corresponding background or reference sample eliminates potential false positives that sometimes result when the test results of site samples are compared to a laboratory control, which, by design, lacks natural inhibiting or toxic factors. In the present study, all site samples were compared to a laboratory control. Consequently, it is possible that false positives were generated in the *Ceriodaphnia dubia* tests for water samples 204, 206, and 210 and for sediment samples 204, 210, and 217. Eventhough these stations are marked as statistically significant in Tables 2 and 3, these test results were not considered biologically significant (i.e. samples were not toxic to *Ceriodaphnia*) because of the high number of young produced and the lack of adult mortality.

Disregarding the false positives, the only surface water sample that appeared to have a toxic affect on test organisms was from the irrigation pond (station 217). The pond appears to be isolated, it does not connect with the drainage from which the other on-site samples were collected. However, water from the pond significantly reduced the number of young produced in the *Ceriodaphnia dubia* test and it inhibited the growth of *Selenastrum capricornutum* in the algal test. However the source of the toxicity remains a mystery. Chemical analyses did not detect any identifiable site-derived COC's in the water sample from station 217. Analysis did detect 17 unidentified compounds and phytol. Phytol is a breakdown product of chlorophyll. It is likely that a chemical had been added to the pond to control a phytoplankton "bloom," resulting in a residual of phytol and unidentifiable breakdown products that still inhibit algal growth and depress production of young in *Ceriodaphnia*. In any case, the toxicity at this sampling location does not appear to be a result of site-derived COC's.

Results of water chemistry from the remaining stations revealed a few elevated metals concentrations. Copper exceeded the Region IV Water Management Division (WMD) fresh water quality chronic screening value of 6.54 µg/L (USEPA 1993b) at stations 217 (29 µg/L) and 223 (33µg/L). Zinc exceeded the chronic screening value of 58.91 µg/L at stations 202 (83 µg/L) and 206 (65 µg/L). However, these exceedences did not appear to cause a notable impact on test organisms.

Sediment from stations 202, 204, 206, and 234 had a significant toxic effect on test organisms. Sediment from stations 202 and 234 were acutely toxic to *Ceriodaphnia dubia* causing 90% adult mortality (Table 3). Chemical analyses (summarized in Table 5) showed that sediment from stations 202, 204, and 206 contained measurable levels of extractable organics (especially PAH's), many of which exceeded Region IV WMD screening values for hazardous waste sites (USEPA 1994b). Station 202 sediments revealed measurable levels of purgeable organics and DDD. Levels of copper (36 µg/L), lead (31 µg/L), and zinc (210 µg/L) at station 204 exceeded WMD screening values of 28 µg/L, 21 µg/L, and 68 µg/L, respectively.

Toxicity in sediment collected at stations 204 and 206 was detected only in the pore water (see Microtox in Table 3). Extractable organics, especially PAH's (naphthalene, acenaphthene, phenanthrene etc.) and related purgeable organics (e.g. methylphenanthrenes) are the suspected

source of toxicity in the Microtox pore water tests. Published Microtox EC50's for naphthalene, acenaphthene, and phenanthrene are 1990, 293, and 73 ppb, respectively (Kaiser and Palabrica 1991). As shown in Table 5, levels of these chemicals in sediment from stations 204 and 206 (and 202, eventhough there was insufficient pore water for a microtox test) were above the published EC50's.

Off-site, toxicity was detected in only one sample, sediment from the potential reference station (234). Chemical analyses indicate that the toxicity at this location does not appear to be related to site-derived COC's. This station was eliminated as a reference site.

References

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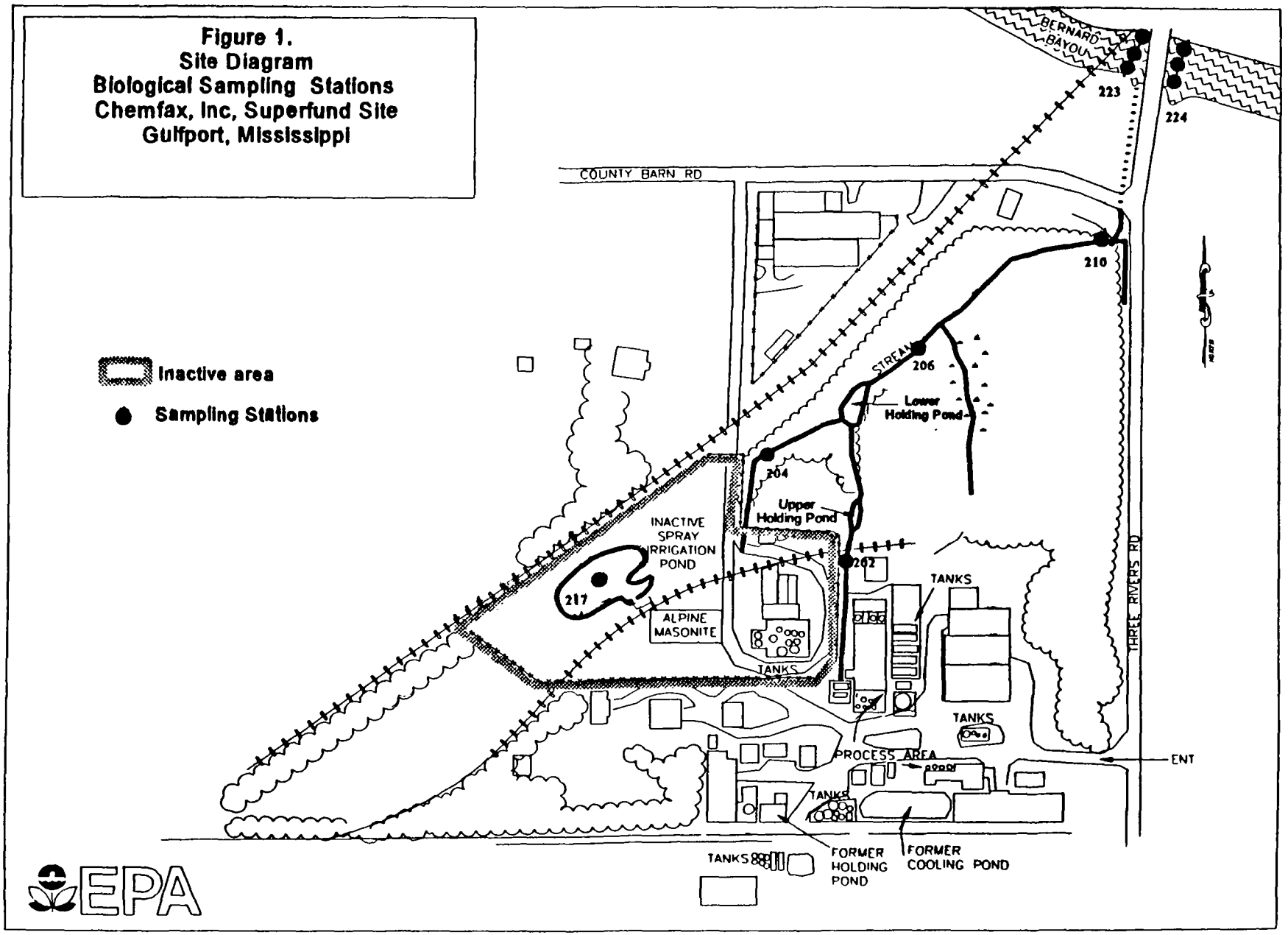
Figure 1.
Site Diagram
Biological Sampling Stations
Chemfax, Inc, Superfund Site
Gulfport, Mississippi



DHSE003

Table 1. Water quality measurements for streams in the vicinity of Chemfax, Gulfport, Mississippi, January, 1995.

Sampling Stations	Stream Water Quality data						
	In-situ measurements				Laboratory determinations		
	Temperature (C°)	Dissolved O_2 (mg/l)	pH	Conductivity (μmhos/cm^2)	Alkalinity	Hardness (mg/l $CaCO_3$)	TOC (mg/l)
CI-202-SW	17.11	2.91	7.28	277	113	18	8.3
CI-204-SW	17.23	4.75	7.06	297	135	142	7.7
CI-206-SW	14.85	3.26	6.87	215	85	36	15
CI-210-SW	16.08	2.24	6.82	173	63	38	16
CI-217-SW	16.10	11.43	8.65	68.9	42	16	11
CI-223-SW	14.01	7.59	6.60	241	10	32	5.8
CI-224-SW	14.07	7.69	6.58	294	11	38	5.6
CI-234-SW	12.69	7.78	6.41	97.7	28	40	5.5

Table 2. Summary of toxicity test results on surface water samples collected in the vicinity of Chemfax , Gulfport, MS. January 1995.

Sample ID #	Sampling Location	Ceriodaphnia 7 day Chronic		Algae Growth (mean cell density in fluorometer units)	Microtox LC50 (% sample)
		Adult Survival	Average # Young		
CI-202-SW	Main ditch (originating in center of Chemfax site)	10	25.3	4.246	>100
CI-204-SW	Drainage Ditch (along entrance road; originating just inside fence encompassing inactive area)	9	18.3*	3.825	>100
CI-206-SW	Main Ditch (60' below lower holding pond)	10	18.9*	4.587	>100
CI-210-SW	Main Ditch (just before stream enters culvert at County Barn Road)	10	19.9*	4.853	>100
CI-217-SW	On-site, former spray irrigation pond	10	13.1*	0.071*	>100
CI-223-SW	Bernard Bayou (immediately upstream of Chemfax outfall)	10	21.1	4.018	>100
CI-224-SW	Bernard Bayou (immediately downstream of Chemfax outfall)	10	23.3	4.838	>100
CI-234-SW	Off-site reference station (west side of Three Rivers Rd.; 1/2 mile south of main entrance to Chemfax Inc.	10	22.4	4.160	>100
CONTROL	Dilute Mineral Water (DMW)	10[1] / 10[2]	27.8[1] / 20.6[2]	3.422	>100

1 - laboratory control value against which values for samples 202, 204, 206, and 210 were statistically compared. An * indicates a statistically significant difference.
2 - laboratory control value against which values for samples 217, 223, 224, and 234 were statistically compared. An * indicates a statistically significant difference.
3 - LC50 values calculated from 5 minute readings.

Table 3. Summary of toxicity test results on sediment samples collected in the vicinity of Chemfax Inc., Gulfport, MS. January, 1995.

Sample ID #	Sampling Location	Ceriodaphnia 7 day Chronic[1]		Microtox LC50[2] (%Sample)
		Adult Survival	Average # Young	
CI-202-SD	Drainage Ditch (originating in center of Chemfax site)	1*	2*	Insufficient pore water
CI-204-SD	Drainage Ditch (along entrance road; originating just inside fence encompassing inactive area)	10	18.4*	82.55
CI-206-SD	Main Ditch (60' below lower holding pond)	10	23.6	15.41
CI-210-SD	Main Ditch (just upstream of culvert at County Barn Road)	9	19.7*	>100
CI-217-SD	On-site, former spray irrigation pond	10	20.1*	>100
CI-223-SD	Bernard Bayou (immediately upstream of Chemfax outfall)	9	24.9	>100
CI-224-SD	Bernard Bayou (immediately downstream of Chemfax outfall)	10	28.5	>100
CI-234-SD	Off-site reference station (west side of Three Rivers Rd.; 1/2 mile south of main entrance to Chemfax)	1*	2*	>100
CONTROL	Dilute Mineral Water (DMW)	10	24.2	>100

1 - test completed in 6 days.
2 - LC50 values calculated from 5 minute readings.
* - indicates the value is significantly different from the value for the laboratory control (at p=.05)

Table 4. Summary of chemical analysis of surface water samples collected in the vicinity of Chemfax Inc., Gulfport Mississippi, January 1995.

ANALYSIS	STATIONS							
PURGEABLE ORGANICS UG/L	202-SW	204-SW	206-SW	210-SW	217-SW	223-SW	224-SW	234-SW
	U	U	U	U	U	U	U	U
EXTRACTABLE ORGANICS UG/L	202-SW	204-SW	206-SW	210-SW	217-SW	223-SW	224-SW	234-SW
	U	U	U	U	U	U	U	U
MISC. EXTRACTABLE ORGANICS UG/L	202-SW	204-SW	206-SW	210-SW	217-SW	223-SW	224-SW	234-SW
METHYLNAPHTHALENE	3000JN							
26 UNIDENTIFIED COMPOUNDS	100000J							
5 UNIDENTIFIED COMPOUNDS		90J						
14 UNIDENTIFIED COMPOUNDS			300J					
12 UNIDENTIFIED COMPOUNDS				200J				
PHYTOL					20JN			
17 UNIDENTIFIED COMPOUNDS					6000J			
PESTICIDES / PCB's UG/L	202-SW	204-SW	206-SW	210-SW	217-SW	223-SW	224-SW	234-SW
	U	U	U	U	U	U	U	U
METALS UG/L	202-SW	204-SW	206-SW	210-SW	217-SW	223-SW	224-SW	234-SW
ARSENIC							10J	
CHROMIUM								
COPPER					29	33		
LEAD	4			3J	3		5	7
NICKEL								26J
ZINC	83	37	65	33	34		39	38

J - ESTIMATED VALUE

JN - ESTIMATED VALUE \ PRESUMPTIVE EVIDENCE OF PRESENCE

U - MATERIAL WAS ANALYZED FOR BUT NOT DETECTED

Table 5. Summary of chemical analysis of sediment samples collected in the vicinity of Chemfax Inc., Gulfport Mississippi, January 1995.

ANALYSIS	STATIONS							
PURGEABLE ORGANICS UG/KG	202-SD	204-SD	206-SD	210-SD	217-SD	223-SD	224-SD	234-SD
TOLUENE	3J							
ETHYL BENZENE	13J							
TOTAL XYLENES	45							
PINENE	50JN							
CAMPHENE	20JN							
PETROLEUM PRODUCT	N							
8 UNIDENTIFIED COMPOUNDS	400J							
EXTRACTABLE ORGANICS UG/KG	202-SD	204-SD	206-SD	210-SD	217-SD	223-SD	224-SD	234-SD
NAPTHALENE	1600	800	180J	49J				
2-METHYLNAPHTHALENE	6900	16000	540					
ACENAPHTHENE	330J	2800	160J					
DIBENZOFURAN		690						
FLUORENE		2400						
PHENANTHRENE	1200	10000	1100	52J				
ANTHRACENE			210J					
FLUORANTHENE		950	420J					
PYRENE	460	2200	1200	77J				
BENZO (A) ANTHRACENE	87J		240J					
CHRYSENE	200J	440J	360J					
ETHYLNAPHTHALENE		9000JN						
DIMETHYI NAPHTHALENE (5 ISOMERS)		50000JN						
METHYLETHYLNAPHTHALENE		9000JN						
TRIMETHYLNAPHTHALENE (4 ISOMERS)		30000JN						
METHYLANTHRACENE (2 ISOMERS)		20000JN						
METHYLPHENANTHRENE (2 ISOMERS)		10000JN						
15 UNIDENTIFIED COMPOUNDS		200000J						
METHYLPHENANTHRENE (3 ISOMERS)			4000JN					
DIMETHYLPHENANTHRENE			2000JN					
METHYLPYRENE			1000JN					
24 UNIDENTIFIED COMPOUNDS			50000J					
CARYOPHYLLENE				200JN				
TETRAMETHYLPHENANTHRENE				2000JN				
13 UNIDENTIFIED COMPOUNDS				10000J				
4 UNIDENTIFIED COMPOUNDS								3000J
PESTICIDES / PCB's UG/KG	202-SD	204-SD	206-SD	210-SD	217-SD	223-SD	224-SD	234-SD
ALDRIN		4	1.7JN					
4 , 4 -DDD (P , P' -DDD)	14			4.4J				
METALS MG/KG	202-SD	204-SD	206-SD	210-SD	217-SD	223-SD	224-SD	234-SD
ARSENIC	2.5J	5.9						3.9
CHROMIUM	18	15	5.1	3.3	6.1			8.5
COPPER	19	36	13	16	13	21	11	8.9
LEAD	13	31	8.5	4.7	5.9	3.4	4.7	7.5
NICKEL	3.4J	6.7J		2.6J				3.9J
ZINC	46	210	21	21	9.4	8.9	10	7.8

J - ESTIMATED VALUE

JN - ESTIMATED VALUE \ PRESUMPTIVE EVIDENCE OF PRESENCE

N - PRESUMPTIVE EVIDENCE OF PRESENCE

APPENDIX A

Toxicity Test Bench Sheets

cfax - sd1

Chemfax
Filter:
Sediment
Thabire

page 1 of 2.

SUMMARY DATA

D 521. Industry/Study: Chemfax Inc Date: 1/21/95
Location: Gulfport, Ms Analyst: J. Maudsley, R. Lewis, M. Welrich
0.35%

Critical
Critical

Data: PASS

Sample / and/or Concentration	Day	Replicate 1	2	3	4	5	6	7	8	9	10	Number of Young	Number of Surviving Adults	Young per Adult
Control	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
	3	3	4	3	2	3	3	2	3	3	4	30		
	4	✓	✓	✓	1	✓	✓	1	✓	✓	✓	-2		
	5	10	10	8	8	7	9	10	10	8	8	88		
	6	12	12	12	13	13	12	11	12	13	12	122		
	7													
	Total	25	26	23	24	23	24	24	25	24	24	242	10	24.2
202	1	✓	✓	✓	✓	✓	✓	✓	M	✓	✓			
	2	✓	✓	✓	X	X	M	M	X	X	X			
	3	X	M	M			X	X						
	4		✓	X										
	5		✓											
	6		2									2		
	7													
	Total	X	2	X	X	X	X	X	X	X	X	2	1	2.0
204	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
	3	✓	2	3	✓	✓	✓	✓	✓	✓	✓	5		
	4	3	✓	✓	3	4	4	3	2	✓	4	23		
	5	6	6	6	6	9	7	6	8	4	9	67	7	
	6	9	7	7	9	11	10	12	3	8	13	89		
	7													
	Total	18	15	16	18	24	21	21	13	12	26	184	10	18.4
206	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
	3	4	5	4	4	✓	4	4	4	4	4	37		
	4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	—		
	5	8	10	8	10	5	10	8	10	8	10	87		
	6	13	11	11	11	12	11	10	10	13	10	112		
	7													
	Total	25	26	23	25	17	25	22	24	25	24	236	10	23.6
210	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
	3	3	5	2	2	4	4	4	4	4	4	34		
	4	✓	✓	2	1	✓	✓	✓	✓	✓	2	3		
	5	9	8	5	8	9	7	8	8	9	8	741		
	6	13	6	X2	1	4	10	9	11	6	6	66		
	7													
	Total	25	19	X	12	17	21	21	23	19	20	177	9	19.7
217	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
	3	4	5	4	4	4	3	4	5	5	6	44		
	4	✓	✓	✓	✓	✓	1	✓	✓	✓	✓	1		
	5	9	10	9	8	11	8	9	8	10	8	90		
	6	12	5	5	7	✓	1	7	10	11	8	66		
	7													
	Total	25	20	18	19	15	13	20	23	26	22	201	10	20.1

= Total number ... A = Total number ... # = Number of live young ... ad = Number of dead young ... M = Lost or missing ... A = Adult

Figure XV.4 Short-Term Chronic Toxicity Test -- Cladoceran Summary Data

Cfor - sd 2

Sediment

p 2 of 2

SUMMARY DATA

Industry/Study: Chemfox, Inc. Date: 1/21/95
Location: Gulfport, MS Analyst: J. Maudsley, R. Lewis, M. Weirich
Sediment

Sample # and/or Concentration	Day	Replicate 1	2	3	4	5	6	7	8	9	10	Number of Young	Number of Surviving Adults	Young per Adult
223	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
	3	5	4	5	6	5	4	5	6	3	5	48		
	4	✓	✓	✓	✓	✓	✓	1	✓	✓	✓	1		
	5	10	7	11	9	10	8	8	10	9	11	93		
	6	12	13	12	14	13	13	5	8	6	11	107		
	7													
	Total	27	24	28	29	28	25	19	24	18	27	249	10	24.9
224	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
	3	4	6	4	5	6	5	6	4	6	5	51		
	4	✓	4	2	✓	✓	✓	✓	2	✓	✓	8		
	5	11	5	9	9	8	11	9	10	9	7	88		
	6	14	15	15	14	14	14	12	12	14	14	138		
	7													
	Total	29	30	30	28	28	30	27	28	29	26	285	10	28.5
234	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
	2	M	M	M	M	X	X	X	X	✓	M			
	3	X	X	X	X					2	X			
	4									✓				
	5									✓				
	6									M				
	7													
	Total	X	X	X	X	X	X	X	X	2	X	2	1	
	1													
	2													
	3													
	4													
	5													
	6													
	7													
	Total													
	1													
	2													
	3													
	4													
	5													
	6													
	7													
	Total													
	1													
	2													
	3													
	4													
	5													
	6													
	7													
	Total													

✓ = Test organism alive   X = Test organism dead   = Number of live young   = Number of dead young   M = Lost or missing   = Male

Figure XV.4   Short-Term Chronic Toxicity Test -- Cladoceran Summary Data

Surface water Chemfax-sw1

p1 of 2

SUMMARY DATA
Industry/Study: Chemfax, Inc. Date: 1/20/95 1045
Location: Gulfport, MS Analyst: MW

Sample and/or Concentration	Day	Replicate 1	2	3	4	5	6	7	8	9	10	Number of Young	Number of Surviving Adults	Young per Adult
Control DMW	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0		
	3	✓	7	5	5	6	6	5	6	6	6	52		
	4	6	M	✓	✓	✓	✓	✓	✓	✓	✓	6		
	5	8	10	9	8	8	11	7	10	9	9	89		
	6	10	11	14	12	14	13	13	15	14	15	131		
	7	—	—	—	—	—	—	—	—	—	—	—		
	Total	24	28	28	25	28	30	25	31	29	30	278	10	27.8
202	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0		
	3	5	4	5	6	5	6	5	5	4	✓	45		
	4	✓	✓	✓	✓	✓	✓	✓	✓	✓	5	5		
	5	8	8	8	8	9	8	8	8	9	9	83		
	6	13	13	11	7	12	12	13	10	13	16	120		
	7	—	—	—	—	—	—	—	—	—	—	—		
	Total	26	25	24	21	26	26	26	23	26	30	253	10	25.3
204	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0		
	3	4	3	2	4	4	5	6	3	M	3	34		
	4	✓	4	3	✓	✓	✓	✓	✓	|	✓	7		
	5	7	✓	✓	6	6	7	8	5	|	6	45		
	6	10	8	6	7	9	12	10	8	|	9	79		
	7	—	—	—	—	—	—	—	—	—	—	—		
	Total	21	15	11	17	19	24	24	16	—	18	165	9	18.3
206	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0		
	3	4	4	5	5	5	5	4	4	3	3	42		
	4	✓	✓	6	6	6	5	✓	✓	✓	✓	23		
	5	7	6	✓	1	✓	✓	6	6	4	4	34		
	6	11	11	9	9	8	9	9	8	7	9	901		
	7	—	—	—	—	—	—	—	—	—	—	—		
	Total	22	21	20	21	19	19	19	18	14	16	189	10	18.9
210	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0		
	3	✓	5	5	6	5	5	5	5	5	✓	40		
	4	4	✓	1	✓	✓	✓	✓	✓	✓	6	11		
	5	6	6	6	8	5	3	6	8	5	6	59		
	6	6	11	11	11	12	9	9	11	9	✓	89		
	7	—	—	—	—	—	—	—	—	—	—	—		
	Total	16	22	23	24	22	17	20	24	19	12	199	10	19.9
	1													
	2													
	3													
	4													
	5													
	6													
	7													
	Total													

✓ = Test organism alive X = Test organism dead / = Number = Number of dead young L = Lost or missing d = Male

Figure XV.4 Short-Term Chronic Toxicity Test -- Cladoceran Summary Data

Cfax-SW2

Surface water

p 2 of 2

SUMMARY DATA
Industry/Study: Chemfax, Inc. Date: 11/20/95 1100
Location: Gulfport, MS Analyst: MW
Water Samples

Sample # and/or Concentration	Day	Replicate 1	2	3	4	5	6	7	8	9	10	Number of Young	Number of Surviving Adults	Young per Adult
Control DMW	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	-	-
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0		
	3	✓	✓	✓	✓	✓	✓	3	4	3	3	13		
	4	4	4	4	5	4	2	✓	✓	✓	✓	23		
	5	10	9	9	10	8	8	9	9	7	10	89		
	6	✓	11	11	✓	9	✓	14	14	11	11	81		
	7													
	Total	14	24	24	15	21	10	26	27	21	24	206	10	20.6
217	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0		
	3	✓	✓	✓	✓	✓	✓	✓	1	1	✓	2		
	4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0		
	5	4	5	5	4	4	4	2	3	4	4	39		
	6	11	7	9	10	10	5	11	9	8	10	90		
	7													
	Total	15	12	14	14	14	9	13	13	13	14	131	10	13.1
223	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0		
	3	4	3	4	5	4	3	3	3	6	4	39		
	4	1	7	✓	✓	✓	✓	✓	✓	✓	✓	8		
	5	7	✓	7	6	4	7	7	8	9	7	62		
	6	8	12	11	11	10	8	11	10	12	9	102		
	7													
	Total	20	22	22	22	18	18	21	21	27	20	211	10	21.1
224	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0		
	3	6	5	✓	✓	✓	7	✓	✓	✓	✓	18		
	4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0		
	5	7	6	✓	✓	✓	7	✓	✓	✓	✓	20		
	6	10	11	✓	✓	✓	11	✓	✓	✓	✓	32		
	7												3	
	Total	23	22	0	0	0	25	0	0	0	0	70	10	17.0
234	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0		
	3	6	4	4	3	5	5	4	5	4	3	43		
	4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0		
	5	9	8	8	8	8	8	7	6	5	6	73		
	6	10	10	12	8	10	12	13	11	11	11	108		
	7													
	Total	25	22	24	19	23	25	24	22	20	20	224	10	22.4
	1													
	2													
	3													
	4													
	5													
	6													
	7													
	Total													

✓ = Test organism alive X = test organism dead # = Number of live young # = number of dead young = Lost or missing d = Male

Figure X Chronic Toxicity Test -- Cladoceran Summary Data

ALGAL TOXICITY TEST

EPA, ESD, TES
AUG. 1990

INDUSTRY/STUDY: Chemfax Inc

INITIAL INNOCULUM: ≈ 10,000 cells/ml

LOCATION: Gulfport MS

ORGANISM: Selenastrum capricornutum

DATE COLLECTED: 1/18-19/95

ANALYST: J. Mandley / D. Dunn

DATE TEST STARTED: 1/21/95 11:Am

std 1/21/95 = 1.38

std 1/25/95 = 1.42

SAMPLE ID #	INITIAL BLANK	INITIAL READING OF REP #1	96 HR BLANK	96 HR REP #1 READING	96 HR REP #2 READING	96 HR REP #3 READING	COMMENTS
control (20% A&M)	0.0000	0.028	0.000	3.44	3.73	3.18	
C1-202-SW	0.011	0.039	0.256	4.54	4.35	4.70	
C1-204-SW	0.041	0.068	0.635	4.15	4.51	4.80	
C1-206-SW	0.028	0.056	0.565	5.22	5.22	5.10	
C1-210-SW	0.045	0.079	0.146	4.95	5.15	5.00	
C1-217-SW	0.358 ~~0.474~~	0.412	0.250 ~~0.250~~	0.308	0.410	0.408	rotifers and ciliates observed
C1-223-SW	0.027	0.056	0.270 ~~0.149~~	4.61	4.59	3.75	need to run again after removal rotifers
C1-224-SW	0.025	0.055	0.149	4.95	5.42	4.68	
reference C1-234-SW	0.033	0.061	.432	4.61	4.24	5.01	

RERUN of sample 217 surface water
(Sample 217 filtered to remove Rotifers)

ALGAL TOXICITY TEST

EPA, ESD, TES
AUG. 1990

INDUSTRY/STUDY: Chemfax Inc
INITIAL INNOCULUM: 210,000 cells/ml
LOCATION: Gulfport, MS
ORGANISM: S. capricornutum
DATE COLLECTED: 1/18/95
ANALYST: J. Mandsley
DATE TEST STARTED: 1/26/95 11:10 Am

std 1/26/95 = 1.40
std 1/30/95 1.43

SAMPLE ID #	INITIAL BLANK	INITIAL READING OF REP #1	96 HR BLANK	96 HR REP #1 READING	96 HR REP #2 READING	96 HR REP #3 READING	COMMENTS
Control (20% AHM) unfiltered	0.000	0.018	0.000	2.89	2.85	3.20	
filtered 217	0.181	0.174	0.020	0.020	0.020	0.021	no ciliates or rotifers observed at 96 hr

STUDY: Chemfax Inc.
LOCATIO Gulfport, MS
STARTING DATE/TIM 1/21/95 1100
ENDING DATE/TIME 1/25/95 1100
ANALYST J. Maudsley

RELATIVE ALGAL GROWTH = T - B - IN

WHERE:

B = MEAN CELL DENSITY FOR 96 HOUR BLANK FLASK.
T = MEAN CELL DENSITY FOR TEST FLASK AFTER 96 H.
IN = MEAN INITIAL CELL DENSITY AT START OF TEST

INITIAL CELL DENSITY (IN) = (INITIAL READING REP #1) - (INITIAL BLANK)

SAMPLE ID #	INITIAL BLANK	INITIAL READING REP #1	96 HR BLANK	96 HR REP #1 READING	96 HR REP #2 READING	96 HR REP #3 READING	INITIAL CELL DENSITY	MEAN CELL DENSITY (C or T)
CONTRO	0.000	0.028	0.000	3.440	3.730	3.180	0.028	3.422
CI202SW	0.011	0.039	0.256	4.540	4.350	4.700	0.028	4.246
CI204SW	0.041	0.068	0.635	4.150	4.510	4.800	0.027	3.825
CI206SW	0.028	0.056	0.565	5.220	5.220	5.100	0.028	4.587
CI210SW	0.045	0.079	0.146	4.950	5.150	5.000	0.034	4.853
CI217SW	0.358	0.412	0.250	0.308	0.410	0.408	0.054	0.071
CI223SW	0.027	0.056	0.270	4.610	4.590	3.750	0.029	4.018
CI224SW	0.025	0.055	0.149	4.950	5.420	4.680	0.030	4.838
CI234SW	0.033	0.061	0.432	4.610	4.240	5.010	0.028	4.160

RELATIVE GROWTH REP #1	RELATIVE GROWTH REP #2	RELATIVE GROWTH REP #3
3.412	3.702	3.152
4.256	4.066	4.416
3.488	3.848	4.138
4.627	4.627	4.507
4.770	4.970	4.820
0.004	0.106	0.104
4.311	4.291	3.451
4.771	5.241	4.501
4.150	3.780	4.550

Microtox Data Sheet

Study: Chemfax Inc Date: 1/20/95

Location: Gulfport, MS Analyst: J. Maudsley

Sample	Reading Time	Cuvette Number				
		1	2	3	4	5
phenol std	Initial	93	89	97	94	91
	5 minute	91	66	55	39	25
	15 minute	95	69	58	40	25
C1-202-SW	Initial	82	(75)	(71)	92	89
	5 minute	89	84	81	83	72
	15 minute	92	86	82	82	68
C1-204-SW	Initial	96	93	88	89	96
	5 minute	96	90	89	90	96
	15 minute	98	92	91	91	97
C1-206-SW	Initial	93	92	94	91	91
	5 minute	87	84	82	77	70
	15 minute	90	85	82	77	66
C1-210-SW	Initial	89	87	86	91	90
	5 minute	83	82	79	80	75
	15 minute	85	83	80	80	73
C1-217SW	Initial	87	89	94	88	90
	5 minute	81	85	87	82	80
	15 minute	84	88	90	86	85
C1-223-SW	Initial	94	95	95	94	89
	5 minute	81	89	86	84	79
	15 minute	86	92	88	86	82

name: std

X

must be run again

Microtox Data Sheet

Study: Chem Fix Inc Date: 1/20/95

Location: Gulfport, MS Analyst: J. Mandsley

Sample	Reading Time	Cuvette Number				
		1	2	3	4	5
C1-224-SW	Initial	93	90	95	91	91
	5 minute	80	80	83	80	80
	15 minute	84	83	85	81	80
C1-234-SW	Initial	88	95	90	91	91
	5 minute	81	87	83	85	87
	15 minute	85	89	86	86	87
rerun C1-202-SW	Initial	94	84	84	83	83
	5 minute	91	89	90	85	79
	15 minute	91	91	89	82	73
pore water control	Initial	89	87	85	87	86
	5 minute	95	90	87	88	83
	15 minute	99	93	88	87	84
pore water C1-204-SD	Initial	101	88	89	85	0
	5 minute	96	81	77	66	53
	15 minute	98	83	78	68	55
pore water C1-206-SD	Initial	92	90	85	78	79
	5 minute	88	70	52	27	12
	15 minute	94	73	55	31	15
pore water C1-210-SD	Initial	87	84	85	84	81
	5 minute	81	69	54	27	10
	15 minute	85	76	63	35	11

rerun: un 202 *

unacceptable - Dave

must be run again

Microtox Data Sheet

Study: Chemfax Inc Date: 1/20/95

Location: Gulfport, MS Analyst: J Maudsley

Sample	Reading Time	Cuvette Number 1	2	3	4	5
rerun C1-204-SD pore water	Initial	88	91	89	89	86
	5 minute	85	83	74	72	48
	15 minute	90	86	78	74	52
phenol std (for endpoint reagent)	Initial	93	95	88	83	87
	5 minute	83	68	48	33	23
	15 minute	87	72	50	33	24
pore water C1-217-SD	Initial	85	92	87	90	88
	5 minute	76	82	77	68	40
	15 minute	81	84	81	74	49
pore water C1-223-SD	Initial	93	88	95	90	92
	5 minute	85	100	92	87	91
	15 minute	90	102	95	92	96
pore water C1-224-SD	Initial	95	88	93	85	88
	5 minute	87	82	89	81	83
	15 minute	91	85	94	86	92
pore water C1-234-SD	Initial	93	87	90	91	89
	5 minute	86	82	83	84	79
	15 minute	89	85	86	88	84
2nd rerun C1-204-SD pore water	Initial	91	91	91	90	93
	5 minute	80	77	73	65	55
	15 minute	82	79	74	65	56

x name = 204

must rerun again

bname: std 2

bname: rrun204 *