HYDROSPHERE
research

September 8, 2009

Rick Sherrard
Tennessee Valley Authority
1101 Market St, PSC 1X-C
Chattanooga, TN 37402

Rick:

Enclosed are the toxicity test results for samples received April through early June 2009 for the first round of tests conducted in support of the Kingston Fly Ash Recovery Project.

All unusual observations or other deviations from standard test protocol are documented on the bench sheets. These test results only relate to the samples described in this report and meet all requirements of NELAC.

Sincerely,

J. Craig Watts
Lab Director

CC: William Rogers

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PROJECT NARRATIVE

General Information:
A study design outlined in the TVA document, "Kingston Fossil Plant, Fly Ash Recovery Project, Sampling Plan For Phase 1 Dredging Operations" was provided to Hydrosphere Research for conducting a suite of aquatic and sediment toxicity tests. This report serves as a compendium for the first round of test results.

Samples:
Two (2) composite ash samples were collected from the Emory River with a Vibracore® sampler and submitted to Hydrosphere Research. In addition, laboratory control sediments were collected from Clinch River mile 189.0 (CRM 189.0).

Unaffected Emory River water was used as reference control, dilution, and overlay water. Moderately-Hard Synthetic Water (MHSW) was used as the laboratory control water.

Sample Storage:
All ash and water samples were stored in a cold-room at 4 ºC.

Hold Time:
Ash samples – 8 weeks.
Unaffected Emory River water samples – 2 weeks.
Emory River Plume water samples – first use in 36 hours.
Outfall 001 water samples – first use in 36 hours.

Test methods:
Hyalella azteca 10-day Survival and Growth Test for Sediments
5-day Freshwater Juvenile Mussel Survival Test for Sediments
10-day Freshwater Juvenile Mussel Survival Test for Sediments
4-day *Lumbriculus variegatus* Toxicity Test (*Pre-bioaccumulation test*)
Corbicula fluminea Bioaccumulation Test for Sediments
10-day Freshwater Juvenile Mussel Survival Test with Whole Ash Elutriates
Ceriodaphnia dubia Survival and Reproduction Test with Emory River Plume (2)
Pimephales promelas Larval Survival and Growth Test with Emory River Plume (2)
Ceriodaphnia dubia Survival and Reproduction Test with Outfall 001 (2)
Pimephales promelas Larval Survival and Growth Test with Outfall 001 (2)

Interim Reporting:
All laboratory benchsheets were submitted to TVA following completion of tests.

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Statistical Analyses:
Due to the unique nature of the study design, TVA's Senior Toxicologist performed calculations with benchsheet data using ToxCalc™ v5.0.23F. Draft report printouts were submitted to Hydrosphere for Quality Assurance review and concurrence.

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TOXICITY TEST RESULTS

Job: *Hyalella azteca* 10-day Survival and Growth Test for Sediments

Job No.: 09105

Date Initiated: 05/01/09

Date Terminated: 05/11/09

Test Protocol: EPA Method 100.1 in EPA 600/R-99/064

Test Results: (see ToxCalc Report – Attachment A for details)

Sample: Ash (Upstream VB.1) and Lab Control (CRM 189.0)

10-day Survival = ***Significant difference between ash and lab control***

10-day Biomass = ***Significant difference between ash and lab control***

10-day Growth = ***Significant difference between ash and lab control***

Sample: Ash (Upstream VB.2) and Lab Control (CRM 189.0)

10-day Survival = ***Significant difference between ash and lab control***

10-day Biomass = ***Significant difference between ash and lab control***

10-day Growth = ***Significant difference between ash and lab control***

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TOXICITY TEST RESULTS

Job: 5-day Freshwater Juvenile Mussel Survival Test for Sediments

Job No.: 09120

Date Initiated: 05/07/09

Date Terminated: 05/12/09

Test Protocol: TVA-KIF-SOP-TTL-009

Test Results: (see ToxCalc Report – Attachment B for details)

Sample: Ash (Upstream VB.1) and Lab Control (CRM 189.0)

5-day Survival = *No Significant difference between ash and lab control*

Sample: Ash (Upstream VB.2) and Lab Control (CRM 189.0)

5-day Survival = *No Significant difference between ash and lab control*

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TOXICITY TEST RESULTS

Job: 10-day Freshwater Juvenile Mussel Survival Test for Sediments

Job No.: 09120

Date Initiated: 05/07/09

Date Terminated: 05/17/09

Test Protocol: TVA-KIF-SOP-TTL-009

Test Results: (see ToxCalc Report – Attachment C for details)

Sample: Ash (Upstream VB.1) and Lab Control (CRM 189.0)

5-day Survival = ***Significant difference between ash and lab control***

Sample: Ash (Upstream VB.2) and Lab Control (CRM 189.0)

5-day Survival = *No Significant difference between ash and lab control*

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TOXICITY TEST RESULTS

Job: 4-day *Lumbriculus variegatus* Toxicity Test (*Pre-bioaccumulation test*)

Job No.: 09102

Date Initiated: 04/23/09

Date Terminated: 04/27/09

Test Protocol: EPA 600/R-99/064

Test Results: (see ToxCalc Report – Attachment D for details)

Sample: Ash (Upstream VB.1) and Lab Control (CRM 189.0)

% Burrowed @ 96h = ***Significant difference between ash and lab control***

96-hour Survival = *No Significant difference between ash and lab control*

Sample: Ash (Upstream VB.2) and Lab Control (CRM 189.0)

% Burrowed @ 96h = ***Significant difference between ash and lab control***

96-hour Survival = *No Significant difference between ash and lab control*

Note: Criteria for conducting 28-day bioaccumulation test were not met.

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TOXICITY TEST RESULTS

Job: *Corbicula fluminea* Bioaccumulation Test for Sediments

Job No.: 09121

Date Initiated: 05/01/09

Date Terminated: 05/29/09

Test Protocol: Provided by USACE Vicksburg; EPA/COE Inland Testing Manual

Note: At the end of the 28-day exposure, clam guts were dissected and flushed, tissues were frozen, and samples were submitted to Pace Analytical (reference Pace Project No. 4018226). Hydrosphere benchsheets were submitted to TVA.

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TOXICITY TEST RESULTS

Job: 10-day Freshwater Juvenile Mussel Survival Test with Whole Ash Elutriates

Job No.: 09119

Date Initiated: 04/22/09

Date Terminated: 05/02/09

Test Protocol: TVA-KIF-SOP-TTL-009

Test Results: (see ToxCalc Report – Attachment E for details)

Sample: Ash Elutriate (Upstream VB.1) with Emory River Water (ERW)

10-day NOEC = 100% Elutriate (*No Significant difference between elutriate and ERW*)

Sample: Centrifuged Ash Elutriate (Upstream VB.1) with Emory River Water (ERW)

10-day Survival = *No Significant difference between centrifuged elutriate and ERW*

Sample: Ash Elutriate (Upstream VB.2) with Emory River Water (ERW)

10-day NOEC = 100% Elutriate (*No Significant difference between elutriate and ERW*)

Sample: Centrifuged Ash Elutriate (Upstream VB.2) with Emory River Water (ERW)

10-day Survival = *No Significant difference between centrifuged elutriate and ERW*

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TOXICITY TEST RESULTS

Job: *Ceriodaphnia dubia* Survival and Reproduction Test with Emory River Plume

Job No.: 09092

Date Initiated: 04/17/09

Date Terminated: 04/24/09

Test Protocol: EPA Method 1002.0 in EPA 821-R-02-013

Test Results: (see ToxCalc Report – Attachment F for details)

Sample: Emory River Plume Water

7-day Survival = *No Significant difference between plume and ERW control*)

7-day Reproduction = *No Significant difference between plume and ERW control*)

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TOXICITY TEST RESULTS

Job: *Ceriodaphnia dubia* Survival and Reproduction Test with Emory River Plume

Job No.: 09123

Date Initiated: 05/28/09

Date Terminated: 06/04/09

Test Protocol: EPA Method 1002.0 in EPA 821-R-02-013

Test Results: (see ToxCalc Report – Attachment G for details)

Sample: Emory River Plume Water

7-day Survival = *No Significant difference between plume and ERW control*)

7-day Reproduction = *No Significant difference between plume and ERW control*)

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TOXICITY TEST RESULTS

Job: *Pimephales promelas* Larval Survival and Growth Test with Emory River Plume

Job No.: 09092

Date Initiated: 04/17/09

Date Terminated: 04/24/09

Test Protocol: EPA Method 1000.0 in EPA 821-R-02-013

Test Results: (see ToxCalc Report – Attachment H for details)

Sample: Emory River Plume Water

7-day Survival = *Invalid test due to pathogen interference*

7-day Biomass = *Invalid test due to pathogen interference*

7-day Growth = *Invalid test due to pathogen interference*

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TOXICITY TEST RESULTS

Job: *Pimephales promelas* Larval Survival and Growth Test with Emory River Plume

Job No.: 09123

Date Initiated: 05/28/09

Date Terminated: 06/04/09

Test Protocol: EPA Method 1000.0 in EPA 821-R-02-013

Test Results: (see ToxCalc Report – Attachment I for details)

Sample: Emory River Plume Water

7-day Survival = *Invalid test due to pathogen interference*

7-day Biomass = *Invalid test due to pathogen interference*

7-day Growth = *Invalid test due to pathogen interference*

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TOXICITY TEST RESULTS

Job: *Ceriodaphnia dubia* Survival and Reproduction Test with Outfall 001

Job No.: 09095

Date Initiated: 04/21/09

Date Terminated: 04/28/09

Test Protocol: EPA Method 1002.0 in EPA 821-R-02-013

Test Results: (see ToxCalc Report – Attachment J for details)

Sample: Outfall 001 Effluent

7-day Survival NOEC = *100%*

7-day Reproduction NOEC = *100%*

7-day Reproduction IC_{25} > *100%*

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TOXICITY TEST RESULTS

Job: *Ceriodaphnia dubia* Survival and Reproduction Test with Outfall 001

Job No.: 09124

Date Initiated: 05/26/09

Date Terminated: 06/02/09

Test Protocol: EPA Method 1002.0 in EPA 821-R-02-013

Test Results: (see ToxCalc Report – Attachment K for details)

Sample: Outfall 001 Effluent

7-day Survival NOEC = *100%*

7-day Reproduction NOEC = *100%*

7-day Reproduction IC_{25} > *100%*

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TOXICITY TEST RESULTS

Job: *Pimephales promelas* Larval Survival and Growth Test with Outfall 001

Job No.: 09095

Date Initiated: 04/21/09

Date Terminated: 04/28/09

Test Protocol: EPA Method 1000.0 in EPA 821-R-02-013

Test Results: (see ToxCalc Report – Attachment L for details)

Sample: Outfall 001 Effluent

7-day Survival = *Invalid test due to pathogen interference*

7-day Biomass = *Invalid test due to pathogen interference*

7-day Growth = *Invalid test due to pathogen interference*

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TOXICITY TEST RESULTS

Job: *Pimephales promelas* Larval Survival and Growth Test with Outfall 001

Job No.: 09124

Date Initiated: 05/26/09

Date Terminated: 06/02/09

Test Protocol: EPA Method 1000.0 in EPA 821-R-02-013

Test Results: (see ToxCalc Report – Attachment M for details)

Sample: Outfall 001 Effluent

7-day Survival = *Invalid test due to pathogen interference*

7-day Biomass = *Invalid test due to pathogen interference*

7-day Growth = *Invalid test due to pathogen interference*

ATTACHMENT A

ToxCalc™ v5.0.23F Report Printout for

Hyalella azteca 10-day Survival and Growth Test for Sediments

Hydrosphere Research Job No. 09105

-Hyalella azteca 10d Survival & Growth Test-10-d Survival

Start Date:	05/01/2009	Test ID:	9105	Sample ID:	UpAsh-09091A
End Date:	05/11/2009	Lab ID:	HS-Hydrosphere Research	Sample Type:	VAC-Vibracore Ash Composite
Sample Date:	03/17/2009	Protocol:	EPA --600-R-99-064	Test Species:	HA--Hyalella azteca

Comments: CRM189 = Lab Control Sediment; MHW = Moderately Hard Water; ERW = Emory River Water

Conc-%	1	2	3	4	5	6	7	8
CRM189+MHW	0.9000	0.7000	0.7000	1.0000	1.0000	0.9000	0.8000	0.8000
CRM189+ERW	0.8000	1.0000	0.8000	0.9000	1.0000	0.9000	0.9000	0.8000
UpAsh+ERW	0.3000	0.0000	0.2000	0.2000	0.0000	0.1000	0.0000	0.1000

			Transform: Arcsin Square Root						1-Tailed	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
CRM189+MHW	0.8500	0.9577	1.1898	0.9912	1.4120	14.148	8			
CRM189+ERW	0.8875	1.0000	1.2366	1.1071	1.4120	10.242	8			
*UpAsh+ERW	0.1125	0.1268	0.3283	0.1588	0.5796	49.659	8	12.442	1.761	0.1286

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.90159	0.844	0.28504	-1.2225
F-Test indicates equal variances (p = 0.52)	1.65753	8.88539		
The control means are not significantly different (p = 0.54)	0.62749	2.14479		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates significant differences Treatments vs CRM189+ERW	0.09171	0.10276	3.29953	0.02131	5.9E-09	1, 14

-Hyalella azteca 10d Survival & Growth Test-10-d Biomass

Start Date:	05/01/2009	Test ID:	9105	Sample ID:	UpAsh-09091A
End Date:	05/11/2009	Lab ID:	HS-Hydrosphere Research	Sample Type:	VAC-Vibracore Ash Composite
Sample Date:	03/17/2009	Protocol:	EPA --600-R-99-064	Test Species:	HA--Hyalella azteca
Comments:	CRM189 = Lab Control Sediment; MHW = Moderately Hard Water; ERW = Emory River Water				

Conc-%	1	2	3	4	5	6	7	8
CRM189+MHW	0.1080	0.0750	0.0840	0.1180	0.1080	0.1160	0.0980	0.0710
CRM189+ERW	0.1300	0.1390	0.1020	0.1330	0.1130	0.0900	0.0900	0.1020
UpAsh+ERW	0.0250	0.0020	0.0140	0.0240	0.0000	0.0070	0.0020	0.0070

			Transform: Untransformed					1-Tailed		
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
CRM189+MHW	0.0973	0.8654	0.0973	0.0710	0.1180	18.935	8			
CRM189+ERW	0.1124	1.0000	0.1124	0.0900	0.1390	17.353	8			
*UpAsh+ERW	0.0101	0.0901	0.0101	0.0000	0.0250	97.550	8	13.230	1.761	0.0136

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.94006	0.844	0.28225	-0.8832
F-Test indicates equal variances (p = 0.09)	3.89804	8.88539		
The control means are not significantly different (p = 0.13)	1.59505	2.14479		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates significant differences Treatments vs CRM189+ERW	0.01361	0.12113	0.04182	0.00024	2.6E-09	1, 14

-Hyalella azteca 10d Survival & Growth Test-10-d Growth

Start Date:	05/01/2009	Test ID:	9105	Sample ID:	UpAsh-09091A
End Date:	05/11/2009	Lab ID:	HS-Hydrosphere Research	Sample Type:	VAC-Vibracore Ash Composite
Sample Date:	03/17/2009	Protocol:	EPA --600-R-99-064	Test Species:	HA--Hyalella azteca

Comments: CRM189 = Lab Control Sediment; MHW = Moderately Hard Water; ERW = Emory River Water

Conc-%	1	2	3	4	5	6	7	8
CRM189+MHW	0.1200	0.1071	0.1200	0.1180	0.1080	0.1289	0.1225	0.0888
CRM189+ERW	0.1625	0.1390	0.1275	0.1478	0.1130	0.1000	0.1000	0.1275
UpAsh+ERW	0.0833	0.0700	0.1200	0.0700	0.0700			

			Transform: Untransformed					1-Tailed		
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
CRM189+MHW	0.1142	0.8978	0.1142	0.0888	0.1289	10.992	8			
CRM189+ERW	0.1272	1.0000	0.1272	0.1000	0.1625	17.560	8			
*UpAsh+ERW	0.0827	0.6501	0.0827	0.0700	0.1200	26.194	5	3.534	1.796	0.0226

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.91531	0.814	0.59987	-0.5424
F-Test indicates equal variances (p = 1.00)	1.06338	21.6217		
The control means are not significantly different (p = 0.17)	1.43547	2.14479		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates significant differences Treatments vs CRM189+ERW	0.02261	0.17782	0.00609	0.00049	0.00468	1, 11

-Hyalella azteca 10d Survival & Growth Test-10-d Survival

Start Date:	05/01/2009	Test ID:	9105	Sample ID:	DnAsh-09091B
End Date:	05/11/2009	Lab ID:	HS-Hydrosphere Research	Sample Type:	VAC-Vibracore Ash Composite
Sample Date:	03/17/2009	Protocol:	EPA --600-R-99-064	Test Species:	HA--Hyalella azteca
Comments:	CRM189 = Lab Control Sediment; MHW = Moderately Hard Water; ERW = Emory River Water				

Conc-%	1	2	3	4	5	6	7	8
CRM189+MHW	0.9000	0.7000	0.7000	1.0000	1.0000	0.9000	0.8000	0.8000
CRM189+ERW	0.8000	1.0000	0.8000	0.9000	1.0000	0.9000	0.9000	0.8000
DnAsh+ERW	0.5000	0.2000	0.2000	0.4000	0.1000	0.4000	0.2000	0.0000

			Transform: Arcsin Square Root						1-Tailed	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
CRM189+MHW	0.8500	0.9577	1.1898	0.9912	1.4120	14.148	8			
CRM189+ERW	0.8875	1.0000	1.2366	1.1071	1.4120	10.242	8			
*DnAsh+ERW	0.2500	0.2817	0.5033	0.1588	0.7854	41.255	8	8.528	1.761	0.1515

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.95	0.844	-0.1389	-0.2545
F-Test indicates equal variances (p = 0.22)	2.68773	8.88539		
The control means are not significantly different (p = 0.54)	0.62749	2.14479		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates significant differences Treatments vs CRM189+ERW	0.1103	0.1236	2.15085	0.02958	6.5E-07	1, 14

-Hyalella azteca 10d Survival & Growth Test-10-d Biomass

Start Date:	05/01/2009	Test ID:	9105	Sample ID:	DnAsh-09091B
End Date:	05/11/2009	Lab ID:	HS-Hydrosphere Research	Sample Type:	VAC-Vibracore Ash Composite
Sample Date:	03/17/2009	Protocol:	EPA --600-R-99-064	Test Species:	HA--Hyalella azteca

Comments: CRM189 = Lab Control Sediment; MHW = Moderately Hard Water; ERW = Emory River Water

Conc-%	1	2	3	4	5	6	7	8
CRM189+MHW	0.1080	0.0750	0.0840	0.1180	0.1080	0.1160	0.0980	0.0710
CRM189+ERW	0.1300	0.1390	0.1020	0.1330	0.1130	0.0900	0.0900	0.1020
DnAsh+ERW	0.0330	0.0180	0.0180	0.0200	0.0070	0.0230	0.0090	0.0010

			Transform: Untransformed						1-Tailed	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
CRM189+MHW	0.0973	0.8654	0.0973	0.0710	0.1180	18.935	8			
CRM189+ERW	0.1124	1.0000	0.1124	0.0900	0.1390	17.353	8			
*DnAsh+ERW	0.0161	0.1435	0.0161	0.0010	0.0330	62.759	8	12.391	1.761	0.0137

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.95561	0.844	0.20523	-0.8617
F-Test indicates equal variances (p = 0.10)	3.71316	8.88539		
The control means are not significantly different (p = 0.13)	1.59505	2.14479		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates significant differences Treatments vs CRM189+ERW	0.01368	0.12174	0.03706	0.00024	6.2E-09	1, 14

-Hyalella azteca 10d Survival & Growth Test-10-d Growth

Start Date:	05/01/2009	Test ID:	9105	Sample ID:	DnAsh-09091B
End Date:	05/11/2009	Lab ID:	HS-Hydrosphere Research	Sample Type:	VAC-Vibracore Ash Composite
Sample Date:	03/17/2009	Protocol:	EPA --600-R-99-064	Test Species:	HA--Hyalella azteca

Comments: CRM189 = Lab Control Sediment; MHW = Moderately Hard Water; ERW = Emory River Water

Conc-%	1	2	3	4	5	6	7	8
CRM189+MHW	0.1200	0.1071	0.1200	0.1180	0.1080	0.1289	0.1225	0.0888
CRM189+ERW	0.1625	0.1390	0.1275	0.1478	0.1130	0.1000	0.1000	0.1275
DnAsh+ERW	0.0660	0.0900	0.0900	0.0500	0.0700	0.0575	0.0450	

			Transform: Untransformed					1-Tailed		
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
CRM189+MHW	0.1142	0.8978	0.1142	0.0888	0.1289	10.992	8			
CRM189+ERW	0.1272	1.0000	0.1272	0.1000	0.1625	17.560	8			
*DnAsh+ERW	0.0669	0.5263	0.0669	0.0450	0.0900	26.806	7	5.699	1.771	0.0187

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.94945	0.835	0.21642	-1.0017
F-Test indicates equal variances (p = 0.61)	1.5491	10.7859		
The control means are not significantly different (p = 0.17)	1.43547	2.14479		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates significant differences Treatments vs CRM189+ERW	0.01872	0.14719	0.01354	0.00042	7.3E-05	1, 13

ATTACHMENT B

ToxCalc™ v5.0.23F Report Printout for

5-day Freshwater Juvenile Mussel Survival Test for Sediments

Hydrosphere Research Job No. 09120

Freshwater Juvenile Mussel Test-5-day Survival

Start Date:	05/07/2009	Test ID:	09120-5d	Sample ID:	UPASH-09091A
End Date:	05/12/2009	Lab ID:	HR-Hydrosphere Research	Sample Type:	VAC-Vibracore Ash Composite
Sample Date:	03/17/2009	Protocol:	TVA-KIF-SOP-TTL-009	Test Species:	LS-Lampsilis siliquoidea
Comments:	Controls (CRM189) with MHSW or ERW, 100% Ash with ERW				

Conc-%	1	2	3	4	5
MHS-Control	0.9000	1.0000	1.0000	1.0000	1.0000
Emory-Control	1.0000	1.0000	1.0000	1.0000	1.0000
100	1.0000	1.0000	1.0000	1.0000	1.0000

			Transform: Arcsin Square Root				
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N
MHS-Control	0.9800	0.9800	1.3794	1.2490	1.4120	5.284	5
Emory-Control	1.0000	1.0000	1.4120	1.4120	1.4120	0.000	5
100	1.0000	1.0000	1.4120	1.4120	1.4120	0.000	5

No mortality in upstream ash exposure. NOEC = 100% Upstream Ash.

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	1	0.781		
Equality of variance cannot be confirmed				
The control means are not significantly different (p = 0.35)	1	2.306		

Freshwater Juvenile Mussel Test-5-day Survival

Start Date:	05/07/2009	Test ID:	09120-5d	Sample ID:	DNASH-09091B
End Date:	05/12/2009	Lab ID:	HR-Hydrosphere Research	Sample Type:	VAC-Vibracore Ash Composite
Sample Date:	03/17/2009	Protocol:	TVA-KIF-SOP-TTL-009	Test Species:	LS-Lampsilis siliquoidea
Comments:	Controls (CRM189) with MHSW or ERW, 100% Ash with ERW				

Conc-%	1	2	3	4	5
MHS-Control	0.9000	1.0000	1.0000	1.0000	1.0000
Emory-Control	1.0000	1.0000	1.0000	1.0000	1.0000
100	1.0000	1.0000	1.0000	1.0000	1.0000

			Transform: Arcsin Square Root				
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N
MHS-Control	0.9800	0.9800	1.3794	1.2490	1.4120	5.284	5
Emory-Control	1.0000	1.0000	1.4120	1.4120	1.4120	0.000	5
100	1.0000	1.0000	1.4120	1.4120	1.4120	0.000	5

No mortality in downstream ash exposure. NOEC = 100% Downstream Ash.

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	1	0.781		
Equality of variance cannot be confirmed				
The control means are not significantly different (p = 0.35)	1	2.306		

ATTACHMENT C

ToxCalc™ v5.0.23F Report Printout for

10-day Freshwater Juvenile Mussel Survival Test for Sediments

Hydrosphere Research Job No. 09120

Freshwater Juvenile Mussel Test-10-day Survival

Start Date:	05/07/2009	Test ID:	09120-10d	Sample ID:	UPASH-09091A
End Date:	05/17/2009	Lab ID:	HR-Hydrosphere Research	Sample Type:	VAC-Vibracore Ash Composite
Sample Date:	03/17/2009	Protocol:	TVA-KIF-SOP-TTL-009	Test Species:	LS-Lampsilis siliquoidea
Comments:	Controls (CRM189) with MHSW or ERW, 100% Ash with ERW				

Conc-%	1	2	3	4	5
MHS-Control	0.9000	1.0000	1.0000	0.9000	1.0000
Emory-Control	1.0000	0.8000	0.9000	0.9000	1.0000
100	0.5000	0.7000	0.5000	0.3000	0.4000

			Transform: Arcsin Square Root						1-Tailed	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
MHS-Control	0.9600	1.0435	1.3468	1.2490	1.4120	6.628	5			
Emory-Control	0.9200	1.0000	1.2859	1.1071	1.4120	10.026	5			
*100	0.4800	0.5217	0.7653	0.5796	0.9912	19.902	5	5.834	1.860	0.1659

Auxiliary Tests	Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.95503		0.781		0.16723	-0.6008
F-Test indicates equal variances (p = 0.75)	1.39566		23.1545			
The control means are not significantly different (p = 0.41)	0.8695		2.306			
Hypothesis Test (1-tail, 0.05)	**MSDu**	**MSDp**	**MSB**	**MSE**	**F-Prob**	**df**
Homoscedastic t Test indicates significant differences	0.11087	0.12038	0.67754	0.01991	3.9E-04	1, 8
Treatments vs Emory-Control						

Freshwater Juvenile Mussel Test-10-day Survival

Start Date:	05/07/2009	Test ID:	09120-10d	Sample ID:	DNASH-09091B
End Date:	05/17/2009	Lab ID:	HR-Hydrosphere Research	Sample Type:	VAC-Vibracore Ash Composite
Sample Date:	03/17/2009	Protocol:	TVA-KIF-SOP-TTL-009	Test Species:	LS-Lampsilis siliquoidea
Comments:	Controls (CRM189) with MHSW or ERW, 100% Ash with ERW				

Conc-%	1	2	3	4	5
MHS-Control	0.9000	1.0000	1.0000	0.9000	1.0000
Emory-Control	1.0000	0.8000	0.9000	0.9000	1.0000
100	1.0000	1.0000	0.9000	0.9000	1.0000

			Transform: Arcsin Square Root					1-Tailed		
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
MHS-Control	0.9600	1.0435	1.3468	1.2490	1.4120	6.628	5			
Emory-Control	0.9200	1.0000	1.2859	1.1071	1.4120	10.026	5			
100	0.9600	1.0435	1.3468	1.2490	1.4120	6.628	5	-0.869	1.860	0.1304

Auxiliary Tests	Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.91576		0.781		-0.344	-1.1093
F-Test indicates equal variances (p = 0.49)	2.08587		23.1545			
The control means are not significantly different (p = 0.41)	0.8695		2.306			
Hypothesis Test (1-tail, 0.05)	**MSDu**	**MSDp**	**MSB**	**MSE**	**F-Prob**	**df**
Homoscedastic t Test indicates no significant differences	0.0838	0.09099	0.00929	0.01229	0.4099	1, 8
Treatments vs Emory-Control						

ATTACHMENT D

ToxCalc™ v5.0.23F Report Printout for

4-day *Lumbriculus variegatus* Toxicity Test

Hydrosphere Research Job No. 09102

Preliminary Survival and Burrowing Test-% Burrowed @ 96 h

Start Date:	04/23/2009	Test ID:	9102	Sample ID:	UPASH-09091A
End Date:	04/27/2009	Lab ID:	HR-Hydrosphere Research	Sample Type:	VAC-Vibracore Ash Composite
Sample Date:	03/17/2009	Protocol:	EPA --600-R-99-064	Test Species:	LV-Lumbriculus variegatus
Comments:	Upstream Ash + Emory River Water; No worms burrowed				

Sample	1	2	3	4
CRM-189.0	1.0000	1.0000	1.0000	1.0000
UpAsh	0.0000	0.0000	0.0000	0.0000

			Transform: Arcsin Square Root				
Sample	Mean	N-Mean	Mean	Min	Max	CV%	N
CRM-189.0	1.0000	1.0000	1.4120	1.4120	1.4120	0.000	4
UpAsh	0.0000	0.0000	0.1588	0.1588	0.1588	0.000	4

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	1	0.749		
Equality of variance cannot be confirmed				

Preliminary Survival and Burrowing Test-% Survival @ 96 h

Start Date:	04/23/2009	Test ID:	9102	Sample ID:	UPASH-09091A
End Date:	04/27/2009	Lab ID:	HR-Hydrosphere Research	Sample Type:	VAC-Vibracore Ash Composite
Sample Date:	03/17/2009	Protocol:	EPA --600-R-99-064	Test Species:	LV-Lumbriculus variegatus
Comments:	Upstream Ash + Emory River Water; No worms burrowed				

Sample	1	2	3	4
CRM-189.0	1.0000	1.0000	1.0000	1.0000
UpAsh	0.9000	1.0000	1.0000	1.0000

			Transform: Arcsin Square Root					Rank	1-Tailed
Sample	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical
CRM-189.0	1.0000	1.0000	1.4120	1.4120	1.4120	0.000	4		
UpAsh	0.9750	0.9750	1.3713	1.2490	1.4120	5.942	4	16.00	11.00

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.7064	0.749	-2.0367	4.9
Equality of variance cannot be confirmed				

Hypothesis Test (1-tail, 0.05)

Wilcoxon Two-Sample Test indicates no significant differences

Treatments vs CRM-189.0

Preliminary Survival and Burrowing Test-% Burrowed @ 96 h

Start Date:	04/23/2009	Test ID:	9102	Sample ID:	DNASH-09091B
End Date:	04/27/2009	Lab ID:	HR-Hydrosphere Research	Sample Type:	VAC-Vibracore Ash Composite
Sample Date:	03/17/2009	Protocol:	EPA --600-R-99-064	Test Species:	LV-Lumbriculus variegatus
Comments:	Downstream Ash + Emory River Water				

Sample	1	2	3	4
CRM-189.0	1.0000	1.0000	1.0000	1.0000
DnAsh	0.7000	0.9000	0.4000	0.4000

			Transform: Arcsin Square Root					1-Tailed		
Sample	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
CRM-189.0	1.0000	1.0000	1.4120	1.4120	1.4120	0.000	4			
*DnAsh	0.6000	0.6000	0.9024	0.6847	1.2490	30.200	4	3.740	2.353	0.3207

Auxiliary Tests	Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.86293		0.749		0.72842	1.52666
Equality of variance cannot be confirmed						
Hypothesis Test (1-tail, 0.05)	**MSDu**	**MSDp**	**MSB**	**MSE**	**F-Prob**	**df**
Heteroscedastic t Test indicates significant differences	0.18779	0.19261	0.5194	0.03714	0.00962	1, 6
Treatments vs CRM-189.0						

Preliminary Survival and Burrowing Test-% Survival @ 96 h

Start Date:	04/23/2009	Test ID:	9102	Sample ID:	DNASH-09091B
End Date:	04/27/2009	Lab ID:	HR-Hydrosphere Research	Sample Type:	VAC-Vibracore Ash Composite
Sample Date:	03/17/2009	Protocol:	EPA --600-R-99-064	Test Species:	LV-Lumbriculus variegatus
Comments:	Downstream Ash + Emory River Water				

Sample	1	2	3	4
CRM-189.0	1.0000	1.0000	1.0000	1.0000
DnAsh	1.0000	1.0000	1.0000	1.0000

			Transform: Arcsin Square Root				
Sample	Mean	N-Mean	Mean	Min	Max	CV%	N
CRM-189.0	1.0000	1.0000	1.4120	1.4120	1.4120	0.000	4
DnAsh	1.0000	1.0000	1.4120	1.4120	1.4120	0.000	4

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	1	0.749		
Equality of variance cannot be confirmed				

ATTACHMENT E

ToxCalc™ v5.0.23F Report Printout for

10-day Freshwater Juvenile Mussel Survival Test with Whole Ash Elutriates

Hydrosphere Research Job No. 09119

Freshwater Juvenile Mussel Test-10-day Survival

Start Date:	04/22/2009	Test ID:	9119	Sample ID:	UPASH-09091A
End Date:	05/02/2009	Lab ID:	HR-Hydrosphere Research	Sample Type:	AE-Ash Elutriate
Sample Date:	03/17/2009	Protocol:	TVA-KIF-SOP-TTL-009	Test Species:	LS-Lampsilis siliquoidea
Comments:	All exposures with lab control sediment (CRM189)				

Conc-%	1	2	3	4	5
MHS-Control	0.2000	0.2000	1.0000	1.0000	0.8000
Emory-Control	0.8000	1.0000	1.0000	1.0000	1.0000
6.25	0.9000	1.0000	0.8000	0.9000	0.9000
12.5	1.0000	1.0000	0.8000	1.0000	0.9000
25	1.0000	0.9000	0.9000	1.0000	1.0000
50	1.0000	1.0000	0.9000	0.9000	0.9000
100	0.9000	1.0000	1.0000	1.0000	1.0000

			Transform: Arcsin Square Root					1-Tailed		
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
MHS-Control	0.6400	0.6667	0.9717	0.4636	1.4120	49.418	5			
Emory-Control	0.9600	1.0000	1.3510	1.1071	1.4120	10.092	5			
6.25	0.9000	0.9375	1.2533	1.1071	1.4120	8.613	5	1.427	2.360	0.1617
12.5	0.9400	0.9792	1.3184	1.1071	1.4120	10.436	5	0.476	2.360	0.1617
25	0.9600	1.0000	1.3468	1.2490	1.4120	6.628	5	0.062	2.360	0.1617
50	0.9400	0.9792	1.3142	1.2490	1.4120	6.792	5	0.537	2.360	0.1617
100	0.9800	1.0208	1.3794	1.2490	1.4120	5.284	5	-0.414	2.360	0.1617

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.91566	0.9	-0.8533	0.1242
Bartlett's Test indicates equal variances (p = 0.80)	2.32109	15.0863		
The control means are not significantly different (p = 0.13)	1.69931	2.306		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test Treatments vs Emory-Control	100	>100		1	0.09107	0.09561	0.00939	0.01174	0.56043	5, 24

Freshwater Juvenile Mussel Test-10-day Survival

Start Date:	04/22/2009	Test ID:	9119	Sample ID:	UPASH-09091A
End Date:	05/02/2009	Lab ID:	HR-Hydrosphere Research	Sample Type:	CAE-Centrifuged Ash Elutriate
Sample Date:	03/17/2009	Protocol:	TVA-KIF-SOP-TTL-009	Test Species:	LS-Lampsilis siliquoidea
Comments:	All exposures with lab control sediment (CRM189)				

Conc-%	1	2	3	4	5
MHS-Control	0.2000	0.2000	1.0000	1.0000	0.8000
Emory-Control	0.8000	1.0000	1.0000	1.0000	1.0000
100	1.0000	0.5000	1.0000	0.9000	0.9000

			Transform: Arcsin Square Root					Rank	1-Tailed
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical
MHS-Control	0.6400	0.6667	0.9717	0.4636	1.4120	49.418	5		
Emory-Control	0.9600	1.0000	1.3510	1.1071	1.4120	10.092	5		
100	0.8600	0.8958	1.2215	0.7854	1.4120	21.044	5	23.00	19.00

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.77962	0.781	-1.5731	2.19686
F-Test indicates equal variances (p = 0.25)	3.55449	23.1545		
The control means are not significantly different (p = 0.13)	1.69931	2.306		

Hypothesis Test (1-tail, 0.05)

Wilcoxon Two-Sample Test indicates no significant differences

Treatments vs Emory-Control

Freshwater Juvenile Mussel Test-10-day Survival

Start Date:	04/22/2009	Test ID:	9119	Sample ID:	DNASH-09091B
End Date:	05/02/2009	Lab ID:	HR-Hydrosphere Research	Sample Type:	AE-Ash Elutriate
Sample Date:	03/17/2009	Protocol:	TVA-KIF-SOP-TTL-009	Test Species:	LS-Lampsilis siliquoidea
Comments:	All exposures with lab control sediment (CRM189)				

Conc-%	1	2	3	4	5
MHS-Control	0.2000	0.2000	1.0000	1.0000	0.8000
Emory-Control	0.8000	1.0000	1.0000	1.0000	1.0000
6.25	1.0000	0.9000	0.8000	0.8000	1.0000
12.5	1.0000	1.0000	0.8000	0.8000	1.0000
25	1.0000	1.0000	0.7000	1.0000	0.8000
50	0.9000	1.0000	0.8000	1.0000	1.0000
100	0.7000	1.0000	1.0000	1.0000	1.0000

			Transform: Arcsin Square Root					Rank	1-Tailed
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical
MHS-Control	0.6400	0.6667	0.9717	0.4636	1.4120	49.418	5		
Emory-Control	0.9600	1.0000	1.3510	1.1071	1.4120	10.092	5		
6.25	0.9000	0.9375	1.2575	1.1071	1.4120	12.128	5	23.00	16.00
12.5	0.9200	0.9583	1.2901	1.1071	1.4120	12.944	5	25.00	16.00
25	0.9000	0.9375	1.2669	0.9912	1.4120	16.019	5	24.50	16.00
50	0.9400	0.9792	1.3184	1.1071	1.4120	10.436	5	25.50	16.00
100	0.9400	0.9792	1.3278	0.9912	1.4120	14.174	5	27.00	16.00

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.8335	0.9	-0.8455	-0.7482
Bartlett's Test indicates equal variances (p = 0.96)	0.98935	15.0863		
The control means are not significantly different (p = 0.13)	1.69931	2.306		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test Treatments vs Emory-Control	100	>100		1

Freshwater Juvenile Mussel Test-10-day Survival

Start Date:	04/22/2009	Test ID:	9119	Sample ID:	DNASH-09091B
End Date:	05/02/2009	Lab ID:	HR-Hydrosphere Research	Sample Type:	CAE-Centrifuged Ash Elutriate
Sample Date:	03/17/2009	Protocol:	TVA-KIF-SOP-TTL-009	Test Species:	LS-Lampsilis siliquoidea
Comments:	All exposures with lab control sediment (CRM189)				

Conc-%	1	2	3	4	5
MHS-Control	0.2000	0.2000	1.0000	1.0000	0.8000
Emory-Control	0.8000	1.0000	1.0000	1.0000	1.0000
100	0.9000	1.0000	0.9000	0.8000	1.0000

			Transform: Arcsin Square Root					1-Tailed		
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
MHS-Control	0.6400	0.6667	0.9717	0.4636	1.4120	49.418	5			
Emory-Control	0.9600	1.0000	1.3510	1.1071	1.4120	10.092	5			
100	0.9200	0.9583	1.2859	1.1071	1.4120	10.026	5	0.777	1.860	0.1560

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.84814	0.781	-1.0921	0.22772
F-Test indicates equal variances (p = 0.92)	1.11848	23.1545		
The control means are not significantly different (p = 0.13)	1.69931	2.306		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates no significant differences	0.08718	0.09153	0.01062	0.0176	0.45961	1, 8
Treatments vs Emory-Control						

ATTACHMENT F

ToxCalc™ v5.0.23F Report Printout for

Ceriodaphnia dubia Survival and Reproduction Test with Emory River Plume

Hydrosphere Research Job No. 09092

Ceriodaphnia Survival and Reproduction Test-7 Day Survival

Start Date:	04/17/2009	Test ID:	9092
End Date:	04/24/2009	Lab ID:	HR-Hydrosphere Research
Sample Date:	04/16/2009	Protocol:	EPA--821-R-02-013 1002.0
Comments:	One dredge plume grab used throughout test exposure		

Sample ID:	DP-Dredge Plume		
Sample Type:	EmoryRiver-Plume		
Test Species:	CD-Ceriodaphnia dubia		

Conc-%	1	2	3	4	5	6	7	8	9	10
MHS-Control	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
EMORY-Control	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Plume	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000

Conc-%	Mean	N-Mean	Resp	Not Resp	Total	N	Fisher's Exact P	1-Tailed Critical
MHS-Control	1.0000	1.0000	0	10	10	10	0.6238	
EMORY-Control	1.0000	1.0000	0	10	10	10		
Plume	0.8000	0.8000	2	8	10	10	0.2368	0.0500

Hypothesis Test (1-tail, 0.05)

Fisher's Exact Test indicates no significant differences

Treatments vs EMORY-Control

Ceriodaphnia Survival and Reproduction Test-Reproduction

Start Date:	04/17/2009	Test ID:	9092
End Date:	04/24/2009	Lab ID:	HR-Hydrosphere Research
Sample Date:	04/16/2009	Protocol:	EPA--821-R-02-013 1002.0
Comments:	One dredge plume grab used throughout test exposure		
Sample ID:	DP-Dredge Plume		
Sample Type:	EmoryRiver-Plume		
Test Species:	CD-Ceriodaphnia dubia		

Conc-%	1	2	3	4	5	6	7	8	9	10
MHS-Control	25.000	22.000	31.000	24.000	27.000	18.000	23.000	26.000	30.000	29.000
EMORY-Control	29.000	12.000	29.000	21.000	28.000	30.000	22.000	28.000	27.000	26.000
Plume	26.000	26.000	34.000	9.000	26.000	14.000	18.000	38.000	10.000	8.000

			Transform: Untransformed						1-Tailed	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
MHS-Control	25.500	1.0119	25.500	18.000	31.000	15.604	10			
EMORY-Control	25.200	1.0000	25.200	12.000	30.000	21.879	10			
Plume	20.900	0.8294	20.900	8.000	38.000	51.059	10	1.132	1.734	6.587

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.93784	0.868	0.00313	-0.2442
F-Test indicates equal variances (p = 0.06)	3.74598	6.54109		
The control means are not significantly different (p = 0.89)	0.13952	2.10092		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates no significant differences	6.58665	0.26138	92.45	72.1389	0.27247	1, 18
Treatments vs EMORY-Control						

ATTACHMENT G

ToxCalc™ v5.0.23F Report Printout for

Ceriodaphnia dubia Survival and Reproduction Test with Emory River Plume

Hydrosphere Research Job No. 09123

Ceriodaphnia Survival and Reproduction Test-7 Day Survival

Start Date:	05/28/2009	Test ID:	9123
End Date:	06/04/2009	Lab ID:	HR-Hydrosphere Research
Sample Date:	05/27/2009	Protocol:	EPA--821-R-02-013 1002.0
Comments:	One dredge plume grab used throughout test exposure.		
Sample ID:	DP-Dredge Plume		
Sample Type:	EMORYRIVER-Plume		
Test Species:	CD-Ceriodaphnia dubia		

Conc-%	1	2	3	4	5	6	7	8	9	10
MHS-Control	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000	1.0000	1.0000	1.0000
EMORY-Control	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Plume	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Conc-%	Mean	N-Mean	Resp	Not Resp	Total	N	Fisher's Exact P	1-Tailed Critical
MHS-Control	0.9000	0.9000	1	9	10	10	0.5619	
EMORY-Control	1.0000	1.0000	0	10	10	10		
Plume	1.0000	1.0000	0	10	10	10	1.0000	0.0500

Hypothesis Test (1-tail, 0.05)

Fisher's Exact Test indicates no significant differences

Treatments vs EMORY-Control

Ceriodaphnia Survival and Reproduction Test-Reproduction

Start Date:	05/28/2009	Test ID:	9123
End Date:	06/04/2009	Lab ID:	HR-Hydrosphere Research
Sample Date:	05/27/2009	Protocol:	EPA--821-R-02-013 1002.0
Comments:	One dredge plume grab used throughout test exposure.		

Sample ID:	DP-Dredge Plume									
Sample Type:	EMORYRIVER-Plume									
Test Species:	CD-Ceriodaphnia dubia									

Conc-%	1	2	3	4	5	6	7	8	9	10
MHS-Control	14.000	17.000	14.000	15.000	17.000	6.000	19.000	17.000	19.000	12.000
EMORY-Control	15.000	18.000	17.000	12.000	15.000	12.000	14.000	16.000	19.000	13.000
Plume	17.000	8.000	13.000	5.000	14.000	18.000	13.000	16.000	14.000	11.000

			Transform: Untransformed					1-Tailed		
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
MHS-Control	15.000	0.9934	15.000	6.000	19.000	25.915	10			
EMORY-Control	15.100	1.0000	15.100	12.000	19.000	16.056	10			
Plume	12.900	0.8543	12.900	5.000	18.000	31.105	10	1.484	1.734	2.571

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.96734	0.868	-0.6309	0.50022
F-Test indicates equal variances (p = 0.15)	2.73913	6.54109		
The control means are not significantly different (p = 0.95)	0.06902	2.10092		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates no significant differences	2.57073	0.17025	24.2	10.9889	0.15511	1, 18
Treatments vs EMORY-Control						

ATTACHMENT H

ToxCalc™ v5.0.23F Report Printout for

Pimephales promelas Larval Survival and Growth Test with Emory River Plume

Hydrosphere Research Job No. 09092

Larval Survival and Growth Test-7 Day Survival

Start Date:	04/17/2009	Test ID:	9092	Sample ID:	DP-Dredge Plume
End Date:	04/24/2009	Lab ID:	HR-Hydrosphere Research	Sample Type:	EmoryRiver-Plume
Sample Date:	04/16/2009	Protocol:	EPA.-821-R-02-013 1000.0	Test Species:	PP-Pimephales promelas
Comments:	Pathogen interference - Invalid test results				

Conc-%	1	2	3	4
MHS-Control	0.9000	1.0000	1.0000	1.0000
EMORY-Control	0.3000	0.4000	0.5000	0.7000
Plume	0.4000	0.0000	0.3000	0.4000

			Transform: Arcsin Square Root					1-Tailed		
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
MHS-Control	0.9750	2.0526	1.3713	1.2490	1.4120	5.942	4			
EMORY-Control	0.4750	1.0000	0.7602	0.5796	0.9912	23.069	4			
Plume	0.2750	0.5789	0.5270	0.1588	0.6847	47.518	4	1.526	1.943	0.2970

Auxiliary Tests	Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.93435		0.749		-0.8531	0.13547
F-Test indicates equal variances (p = 0.57)	2.03855		47.4672			
The control means are significantly different (p = 7.33E-04)	6.31943		2.44691			
Hypothesis Test (1-tail, 0.05)	**MSDu**	**MSDp**	**MSB**	**MSE**	**F-Prob**	**df**
Homoscedastic t Test indicates no significant differences	0.2752	0.57956	0.10882	0.04673	0.17785	1, 6
Treatments vs EMORY-Control						

Larval Survival and Growth Test-7 Day Biomass

Start Date:	04/17/2009	Test ID:	9092
End Date:	04/24/2009	Lab ID:	HR-Hydrosphere Research
Sample Date:	04/16/2009	Protocol:	EPA.-821-R-02-013 1000.0
Comments:	Pathogen interference - Invalid test results		

Sample ID:	DP-Dredge Plume			
Sample Type:	EmoryRiver-Plume			
Test Species:	PP-Pimephales promelas			

Conc-%	1	2	3	4
MHS-Control	0.4480	0.5040	0.6270	0.5670
EMORY-Control	0.1970	0.2280	0.3540	0.4070
Plume	0.2860	0.0000	0.2370	0.2380

			Transform: Untransformed					1-Tailed		
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
MHS-Control	0.5365	1.8094	0.5365	0.4480	0.6270	14.442	4			
EMORY-Control	0.2965	1.0000	0.2965	0.1970	0.4070	33.788	4			
Plume	0.1903	0.6417	0.1903	0.0000	0.2860	67.741	4	1.302	1.943	0.1586

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.88387	0.749	-0.8685	-0.4722
F-Test indicates equal variances (p = 0.69)	1.65495	47.4672		
The control means are significantly different (p = 9.07E-03)	3.79008	2.44691		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates no significant differences Treatments vs EMORY-Control	0.1586	0.5349	0.02258	0.01332	0.24073	1, 6

Larval Survival and Growth Test-7 Day Growth

Start Date:	04/17/2009	Test ID:	9092	Sample ID:	DP-Dredge Plume
End Date:	04/24/2009	Lab ID:	HR-Hydrosphere Research	Sample Type:	EmoryRiver-Plume
Sample Date:	04/16/2009	Protocol:	EPA.-821-R-02-013 1000.0	Test Species:	PP-Pimephales promelas
Comments:	Pathogen interference - Invalid test results				

Conc-%	1	2	3	4
MHS-Control	0.4978	0.5040	0.6270	0.5670
EMORY-Control	0.6567	0.5700	0.7080	0.5814
Plume	0.7150	0.7900	0.5950	

			Transform: Untransformed					1-Tailed		
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
MHS-Control	0.5489	0.8727	0.5489	0.4978	0.6270	11.059	4			
EMORY-Control	0.6290	1.0000	0.6290	0.5700	0.7080	10.364	4			
Plume	0.7000	1.1128	0.7000	0.5950	0.7900	14.052	3	-1.160	2.015	0.1233

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.94221	0.73	-0.1341	-1.4224
F-Test indicates equal variances (p = 0.50)	2.27638	49.7993		
The control means are not significantly different (p = 0.12)	1.79787	2.44691		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates no significant differences Treatments vs EMORY-Control	0.12331	0.19604	0.00864	0.00642	0.2985	1, 5

ATTACHMENT I

ToxCalc™ v5.0.23F Report Printout for

Pimephales promelas Larval Survival and Growth Test with Emory River Plume

Hydrosphere Research Job No. 09123

Larval Fish Growth and Survival Test-7 Day Survival

Start Date:	05/28/2009	Test ID:	9123	Sample ID:	DP-Dredge Plume
End Date:	06/04/2009	Lab ID:	HR-Hydrosphere Research	Sample Type:	EMORYRIVER-Plume
Sample Date:	05/27/2009	Protocol:	EPA.-821-R-02-013 1000.0	Test Species:	PP-Pimephales promelas
Comments:	Pathogen interference - Invalid test results				

Conc-%	1	2	3	4
MHS-Control	1.0000	0.9000	0.9000	0.9000
EMORY-Control	0.2000	0.7000	0.5000	0.6000
Plume	0.6000	0.7000	0.8000	0.4000

			Transform: Arcsin Square Root					1-Tailed		
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
MHS-Control	0.9250	1.8500	1.2898	1.2490	1.4120	6.318	4			
EMORY-Control	0.5000	1.0000	0.7816	0.4636	0.9912	29.171	4			
Plume	0.6250	1.2500	0.9173	0.6847	1.1071	19.559	4	-0.936	1.943	0.2819

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.91432	0.749	-0.7547	-0.547
F-Test indicates equal variances (p = 0.70)	1.61483	47.4672		
The control means are significantly different (p = 5.70E-03)	4.19818	2.44691		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates no significant differences Treatments vs EMORY-Control	0.26658	0.53727	0.03683	0.04208	0.38563	1, 6

Larval Fish Growth and Survival Test-7 Day Biomass

Start Date:	05/28/2009	Test ID:	9123	Sample ID:	DP-Dredge Plume
End Date:	06/04/2009	Lab ID:	HR-Hydrosphere Research	Sample Type:	EMORYRIVER-Plume
Sample Date:	05/27/2009	Protocol:	EPA.-821-R-02-013 1000.0	Test Species:	PP-Pimephales promelas
Comments:	Pathogen interference - Invalid test results				

Conc-%	1	2	3	4
MHS-Control	0.5220	0.5460	0.5960	0.5160
EMORY-Control	0.0230	0.2700	0.1820	0.3300
Plume	0.3350	0.4260	0.4290	0.1680

			Transform: Untransformed					1-Tailed		
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
MHS-Control	0.5450	2.7081	0.5450	0.5160	0.5960	6.676	4			
EMORY-Control	0.2012	1.0000	0.2012	0.0230	0.3300	66.323	4			
Plume	0.3395	1.6870	0.3395	0.1680	0.4290	36.045	4	-1.527	1.943	0.1759

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.86034	0.749	-0.788	-0.9209
F-Test indicates equal variances (p = 0.89)	1.18969	47.4672		
The control means are significantly different (p = 2.53E-03)	4.96943	2.44691		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates no significant differences Treatments vs EMORY-Control	0.17594	0.87422	0.03823	0.0164	0.17763	1, 6

Larval Fish Growth and Survival Test-7 Day Growth

Start Date:	05/28/2009	Test ID:	9123	Sample ID:	DP-Dredge Plume
End Date:	06/04/2009	Lab ID:	HR-Hydrosphere Research	Sample Type:	EMORYRIVER-Plume
Sample Date:	05/27/2009	Protocol:	EPA.-821-R-02-013 1000.0	Test Species:	PP-Pimephales promelas
Comments:	Pathogen interference - Invalid test results				

Conc-%	1	2	3	4
MHS-Control	0.5220	0.6067	0.6622	0.5733
EMORY-Control	0.1150	0.3857	0.3640	0.5500
Plume	0.5583	0.6086	0.5362	0.4200

			Transform: Untransformed					1-Tailed		
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
MHS-Control	0.5911	1.6712	0.5911	0.5220	0.6622	9.957	4			
EMORY-Control	0.3537	1.0000	0.3537	0.1150	0.5500	50.747	4			
Plume	0.5308	1.5008	0.5308	0.4200	0.6086	15.038	4	-1.803	1.943	0.1909

Auxiliary Tests	Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.93238		0.749		-0.6149	1.2683
F-Test indicates equal variances (p = 0.22)	5.05642		47.4672			
The control means are significantly different (p = 0.05)	2.51344		2.44691			
Hypothesis Test (1-tail, 0.05)	**MSDu**	**MSDp**	**MSB**	**MSE**	**F-Prob**	**df**
Homoscedastic t Test indicates no significant differences Treatments vs EMORY-Control	0.19085	0.53961	0.06274	0.01929	0.1214	1, 6

ATTACHMENT J

ToxCalc™ v5.0.23F Report Printout for

Ceriodaphnia dubia Survival and Reproduction Test with Outfall 001

Hydrosphere Research Job No. 09095

Ceriodaphnia Survival and Reproduction Test-7 Day Survival

Start Date:	04/21/2009	Test ID:	9095
End Date:	04/28/2009	Lab ID:	HR-Hydrosphere Research
Sample Date:	04/20/2009	Protocol:	EPA--821-R-02-013 1002.0
Comments:	(3) 24-h composite samples April 19-24		
Sample ID:	Outfall001-24h Composite		
Sample Type:	KIF-Stilling Pond Discharge		
Test Species:	CD-Ceriodaphnia dubia		

Conc-%	1	2	3	4	5	6	7	8	9	10
MHS-Control	1.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
EMORY-Control	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
6.25	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000
12.5	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
25	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Conc-%	Mean	N-Mean	Resp	Not Resp	Total	N	Fisher's Exact P	1-Tailed Critical
MHS-Control	0.9000	0.9000	1	9	10	10	0.5619	
EMORY-Control	1.0000	1.0000	0	10	10	10		
6.25	0.9000	0.9000	1	9	10	10	0.5000	0.0500
12.5	1.0000	1.0000	0	10	10	10	1.0000	0.0500
25	1.0000	1.0000	0	10	10	10	1.0000	0.0500
50	1.0000	1.0000	0	10	10	10	1.0000	0.0500
100	1.0000	1.0000	0	10	10	10	1.0000	0.0500

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Fisher's Exact Test	100	>100		1
Treatments vs EMORY-Control				

Ceriodaphnia Survival and Reproduction Test-Reproduction

Start Date:	04/21/2009	Test ID:	9095	Sample ID:	Outfall001-24h Composite
End Date:	04/28/2009	Lab ID:	HR-Hydrosphere Research	Sample Type:	KIF-Stilling Pond Discharge
Sample Date:	04/20/2009	Protocol:	EPA--821-R-02-013 1002.0	Test Species:	CD-Ceriodaphnia dubia
Comments:	(3) 24-h composite samples April 19-24				

Conc-%	1	2	3	4	5	6	7	8	9	10
MHS-Control	27.000	14.000	29.000	13.000	32.000	31.000	29.000	31.000	23.000	26.000
EMORY-Control	32.000	23.000	34.000	26.000	31.000	29.000	30.000	32.000	16.000	30.000
6.25	35.000	35.000	33.000	26.000	33.000	35.000	22.000	36.000	0.000	24.000
12.5	34.000	37.000	33.000	18.000	33.000	29.000	34.000	33.000	35.000	13.000
25	35.000	35.000	36.000	23.000	33.000	34.000	33.000	39.000	39.000	15.000
50	33.000	28.000	35.000	16.000	27.000	29.000	35.000	31.000	36.000	32.000
100	26.000	33.000	32.000	11.000	21.000	27.000	29.000	29.000	33.000	28.000

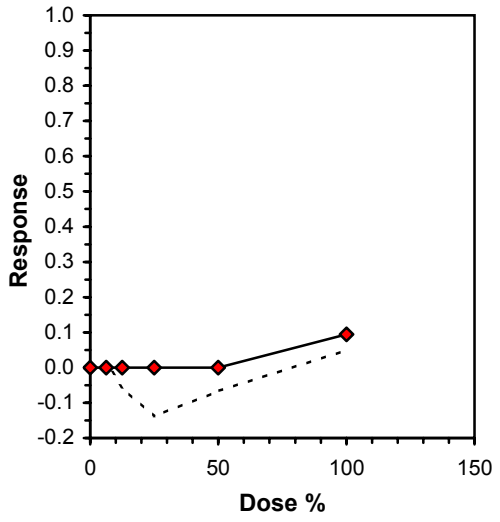
			Transform: Untransformed					Rank	1-Tailed	Isotonic	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical	Mean	N-Mean
MHS-Control	25.500	0.9011	25.500	13.000	32.000	26.933	10				
EMORY-Control	28.300	1.0000	28.300	16.000	34.000	18.923	10			29.700	1.0000
6.25	27.900	0.9859	27.900	0.000	36.000	39.641	10	118.50	75.00	29.700	1.0000
12.5	29.900	1.0565	29.900	13.000	37.000	26.544	10	125.50	75.00	29.700	1.0000
25	32.200	1.1378	32.200	15.000	39.000	23.323	10	134.00	75.00	29.700	1.0000
50	30.200	1.0671	30.200	16.000	36.000	19.421	10	118.50	75.00	29.700	1.0000
100	26.900	0.9505	26.900	11.000	33.000	24.749	10	97.50	75.00	26.900	0.9057

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Kolmogorov D Test indicates non-normal distribution (p <= 0.01)	1.60739	1.035	-1.7521	3.20958
Bartlett's Test indicates equal variances (p = 0.29)	6.16012	15.0863		
The control means are not significantly different (p = 0.32)	1.01671	2.10092		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	100	>100		1
Treatments vs EMORY-Control				

Linear Interpolation (200 Resamples)

Point	%	SD	95% CL	Skew
IC05	76.518			
IC10	>100			
IC15	>100			
IC20	>100			
IC25	>100			
IC40	>100			
IC50	>100			



ATTACHMENT K

ToxCalc™ v5.0.23F Report Printout for

Ceriodaphnia dubia Survival and Reproduction Test with Outfall 001

Hydrosphere Research Job No. 09124

Ceriodaphnia Survival and Reproduction Test-7 Day Survival

Start Date:	05/26/2009	Test ID:	9124	Sample ID:	OUTFALL001-24h Composite
End Date:	06/02/2009	Lab ID:	HR-Hydrosphere Research	Sample Type:	KIF-Stilling Pond Discharge
Sample Date:	05/25/2009	Protocol:	EPA--821-R-02-013 1002.0	Test Species:	CD-Ceriodaphnia dubia
Comments:	(3) 24-h composite samples May 24-29				

Conc-%	1	2	3	4	5	6	7	8	9	10
MHS-Control	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
EMORY-Control	1.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
6.25	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12.5	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
25	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000	1.0000	1.0000	1.0000
100	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Conc-%	Mean	N-Mean	Resp	Not Resp	Total	N	Fisher's Exact P	1-Tailed Critical
MHS-Control	1.0000	1.1111	0	10	10	10	0.5619	
EMORY-Control	0.9000	1.0000	1	9	10	10		
6.25	1.0000	1.1111	0	10	10	10	0.5000	0.0500
12.5	1.0000	1.1111	0	10	10	10	0.5000	0.0500
25	1.0000	1.1111	0	10	10	10	0.5000	0.0500
50	0.9000	1.0000	1	9	10	10	0.7632	0.0500
100	1.0000	1.1111	0	10	10	10	0.5000	0.0500

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Fisher's Exact Test	100	>100		1
Treatments vs EMORY-Control				

Ceriodaphnia Survival and Reproduction Test-Reproduction

Start Date:	05/26/2009	Test ID:	9124	Sample ID:	OUTFALL001-24h Composite
End Date:	06/02/2009	Lab ID:	HR-Hydrosphere Research	Sample Type:	KIF-Stilling Pond Discharge
Sample Date:	05/25/2009	Protocol:	EPA--821-R-02-013 1002.0	Test Species:	CD-Ceriodaphnia dubia
Comments:	(3) 24-h composite samples May 24-29				

Conc-%	1	2	3	4	5	6	7	8	9	10
MHS-Control	15.000	18.000	19.000	18.000	17.000	19.000	12.000	18.000	17.000	19.000
EMORY-Control	14.000	3.000	17.000	20.000	19.000	20.000	11.000	19.000	21.000	14.000
6.25	21.000	22.000	20.000	16.000	21.000	13.000	16.000	18.000	7.000	17.000
12.5	18.000	18.000	14.000	17.000	17.000	20.000	12.000	17.000	18.000	10.000
25	21.000	18.000	23.000	21.000	17.000	24.000	21.000	21.000	23.000	21.000
50	23.000	27.000	24.000	24.000	18.000	0.000	15.000	25.000	18.000	24.000
100	28.000	35.000	28.000	25.000	29.000	31.000	29.000	30.000	29.000	32.000

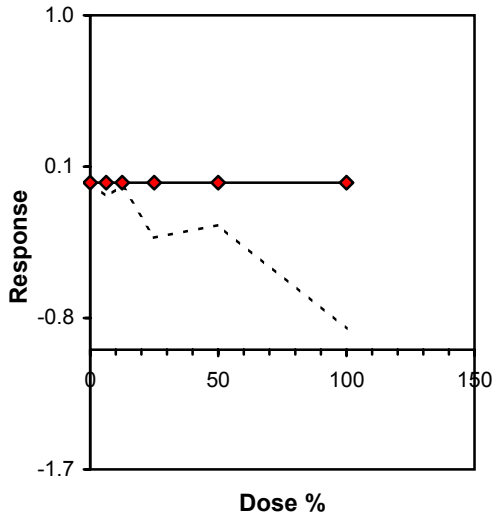
			Transform: Untransformed					Rank	1-Tailed	Isotonic	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical	Mean	N-Mean
MHS-Control	17.200	1.0886	17.200	12.000	19.000	12.797	10				
EMORY-Control	15.800	1.0000	15.800	3.000	21.000	35.150	10			19.900	1.0000
6.25	17.100	1.0823	17.100	7.000	22.000	26.506	10	112.50	75.00	19.900	1.0000
12.5	16.100	1.0190	16.100	10.000	20.000	19.300	10	97.50	75.00	19.900	1.0000
25	21.000	1.3291	21.000	17.000	24.000	10.287	10	142.00	75.00	19.900	1.0000
50	19.800	1.2532	19.800	0.000	27.000	39.967	10	129.00	75.00	19.900	1.0000
100	29.600	1.8734	29.600	25.000	35.000	9.037	10	155.00	75.00	19.900	1.0000

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Kolmogorov D Test indicates non-normal distribution (p <= 0.01)	1.14607	1.035	-1.8703	5.76837
Bartlett's Test indicates unequal variances (p = 1.16E-03)	20.1726	15.0863		
The control means are not significantly different (p = 0.47)	0.74107	2.10092		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test	100	>100		1
Treatments vs EMORY-Control				

Linear Interpolation (200 Resamples)

Point	%	SD	95% CL	Skew
IC05	>100			
IC10	>100			
IC15	>100			
IC20	>100			
IC25	>100			
IC40	>100			
IC50	>100			



Ceriodaphnia Survival and Reproduction Test-Reproduction

Start Date:	05/26/2009	Test ID:	9124
End Date:	06/02/2009	Lab ID:	HR-Hydrosphere Research
Sample Date:	05/25/2009	Protocol:	EPA--821-R-02-013 1002.0
Comments:	For PMSD Calculation Only		

Sample ID:	OUTFALL001-24h Composite		
Sample Type:	KIF-Stilling Pond Discharge		
Test Species:	CD-Ceriodaphnia dubia		

Conc-%	1	2	3	4	5	6	7	8	9	10
MHS-Control	15.000	18.000	19.000	18.000	17.000	19.000	12.000	18.000	17.000	19.000
EMORY-Control	14.000	3.000	17.000	20.000	19.000	20.000	11.000	19.000	21.000	14.000
6.25	21.000	22.000	20.000	16.000	21.000	13.000	16.000	18.000	7.000	17.000
12.5	18.000	18.000	14.000	17.000	17.000	20.000	12.000	17.000	18.000	10.000
25	21.000	18.000	23.000	21.000	17.000	24.000	21.000	21.000	23.000	21.000
50	23.000	27.000	24.000	24.000	18.000	0.000	15.000	25.000	18.000	24.000
100	28.000	35.000	28.000	25.000	29.000	31.000	29.000	30.000	29.000	32.000

			Transform: Untransformed					1-Tailed		
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
MHS-Control	17.200	1.0886	17.200	12.000	19.000	12.797	10			
EMORY-Control	15.800	1.0000	15.800	3.000	21.000	35.150	10			
6.25	17.100	1.0823	17.100	7.000	22.000	26.506	10	-0.612	2.287	4.860
12.5	16.100	1.0190	16.100	10.000	20.000	19.300	10	-0.141	2.287	4.860
25	21.000	1.3291	21.000	17.000	24.000	10.287	10	-2.447	2.287	4.860
50	19.800	1.2532	19.800	0.000	27.000	39.967	10	-1.882	2.287	4.860
100	29.600	1.8734	29.600	25.000	35.000	9.037	10	-6.494	2.287	4.860

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Kolmogorov D Test indicates non-normal distribution (p <= 0.01)	1.14607	1.035	-1.8703	5.76837
Bartlett's Test indicates unequal variances (p = 1.16E-03)	20.1726	15.0863		
The control means are not significantly different (p = 0.47)	0.74107	2.10092		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test Treatments vs EMORY-Control	100	>100		1	4.85953	0.30757	268.8	22.5815	8.7E-08	5, 54

ATTACHMENT L

ToxCalc™ v5.0.23F Report Printout for

Pimephales promelas Larval Survival and Growth Test with Outfall 001

Hydrosphere Research Job No. 09095

Larval Survival and Growth Test-7 Day Survival

Start Date:	04/21/2009	Test ID:	9095	Sample ID:	Outfall001-24h Composite
End Date:	04/28/2009	Lab ID:	HR-Hydrosphere Research	Sample Type:	KIF-Stilling Pond Discharge
Sample Date:	04/20/2009	Protocol:	EPA.-821-R-02-013 1000.0	Test Species:	PP-Pimephales promelas
Comments:	Pathogen interference - Invalid test results				

Conc-%	1	2	3	4
MHS-Control	1.0000	0.8000	0.9000	0.9000
EMORY-Control	0.3000	0.2000	0.3000	0.3000
6.25	1.0000	0.5000	0.3000	0.3000
12.5	0.2000	0.5000	0.2000	0.4000
25	0.5000	0.3000	0.3000	0.4000
50	0.3000	0.8000	0.5000	0.2000
100	0.7000	0.8000	0.8000	0.7000

			Transform: Arcsin Square Root					1-Tailed		
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
MHS-Control	0.9000	3.2727	1.2543	1.1071	1.4120	9.935	4			
EMORY-Control	0.2750	1.0000	0.5506	0.4636	0.5796	10.532	4			
6.25	0.5250	1.9091	0.8392	0.5796	1.4120	46.953	4	-1.893	2.410	0.3673
12.5	0.3250	1.1818	0.5994	0.4636	0.7854	27.029	4	-0.320	2.410	0.3673
25	0.3750	1.3636	0.6573	0.5796	0.7854	15.014	4	-0.700	2.410	0.3673
50	0.4500	1.6364	0.7340	0.4636	1.1071	38.440	4	-1.203	2.410	0.3673
100	0.7500	2.7273	1.0492	0.9912	1.1071	6.383	4	-3.271	2.410	0.3673

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.89677	0.884	1.26066	2.73777
Bartlett's Test indicates equal variances (p = 0.01)	14.2093	15.0863		
The control means are significantly different (p = 5.06E-05)	10.2393	2.44691		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test Treatments vs EMORY-Control	100	>100		1	0.24052	0.87855	0.13432	0.04645	0.04353	5, 18

Larval Survival and Growth Test-7 Day Biomass

Start Date:	04/21/2009	Test ID:	9095	Sample ID:	Outfall001-24h Composite
End Date:	04/28/2009	Lab ID:	HR-Hydrosphere Research	Sample Type:	KIF-Stilling Pond Discharge
Sample Date:	04/20/2009	Protocol:	EPA.-821-R-02-013 1000.0	Test Species:	PP-Pimephales promelas
Comments:	Pathogen interference - Invalid test results				

Conc-%	1	2	3	4
MHS-Control	0.5180	0.4630	0.5980	0.5070
EMORY-Control	0.1620	0.1180	0.1960	0.1550
6.25	0.6260	0.2880	0.2670	0.2390
12.5	0.1670	0.3320	0.1650	0.2770
25	0.2670	0.3090	0.2320	0.2500
50	0.2200	0.3080	0.2310	0.1560
100	0.3430	0.3440	0.4330	0.3560

			Transform: Untransformed					Rank	1-Tailed
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical
MHS-Control	0.5215	3.3059	0.5215	0.4630	0.5980	10.789	4		
EMORY-Control	0.1578	1.0000	0.1578	0.1180	0.1960	20.275	4		
6.25	0.3550	2.2504	0.3550	0.2390	0.6260	51.205	4	26.00	10.00
12.5	0.2353	1.4913	0.2353	0.1650	0.3320	35.307	4	24.00	10.00
25	0.2645	1.6767	0.2645	0.2320	0.3090	12.450	4	26.00	10.00
50	0.2287	1.4501	0.2287	0.1560	0.3080	27.248	4	24.00	10.00
100	0.3690	2.3391	0.3690	0.3430	0.4330	11.673	4	26.00	10.00

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.86911	0.884	1.74016	5.11892
Bartlett's Test indicates equal variances (p = 0.02)	13.1256	15.0863		
The control means are significantly different (p = 2.96E-05)	11.2409	2.44691		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU
Steel's Many-One Rank Test Treatments vs EMORY-Control	100	>100		1

Larval Survival and Growth Test-7 Day Growth

Start Date:	04/21/2009	Test ID:	9095	Sample ID:	Outfall001-24h Composite
End Date:	04/28/2009	Lab ID:	HR-Hydrosphere Research	Sample Type:	KIF-Stilling Pond Discharge
Sample Date:	04/20/2009	Protocol:	EPA.-821-R-02-013 1000.0	Test Species:	PP-Pimephales promelas
Comments:	Pathogen interference - Invalid test results				

Conc-%	1	2	3	4
MHS-Control	0.5180	0.5787	0.6644	0.5633
EMORY-Control	0.5400	0.5900	0.6533	0.5167
6.25	0.6260	0.5760	0.8900	0.7967
12.5	0.8350	0.6640	0.8250	0.6925
25	0.5340	1.0300	0.7733	0.6250
50	0.7333	0.3850	0.4620	0.7800
100	0.4900	0.4300	0.5412	0.5086

			Transform: Untransformed					1-Tailed		
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
MHS-Control	0.5811	1.0107	0.5811	0.5180	0.6644	10.537	4			
EMORY-Control	0.5750	1.0000	0.5750	0.5167	0.6533	10.526	4			
6.25	0.7222	1.2559	0.7222	0.5760	0.8900	20.277	4	-1.469	2.410	0.2414
12.5	0.7541	1.3115	0.7541	0.6640	0.8350	11.732	4	-1.788	2.410	0.2414
25	0.7406	1.2880	0.7406	0.5340	1.0300	29.260	4	-1.653	2.410	0.2414
50	0.5901	1.0262	0.5901	0.3850	0.7800	33.188	4	-0.151	2.410	0.2414
100	0.4925	0.8564	0.4925	0.4300	0.5412	9.486	4	0.824	2.410	0.2414

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.97817	0.884	0.34084	-0.1479
Bartlett's Test indicates equal variances (p = 0.12)	8.75792	15.0863		
The control means are not significantly different (p = 0.89)	0.14244	2.44691		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test Treatments vs EMORY-Control	100	>100		1	0.24143	0.41987	0.04655	0.02007	0.086	5, 18

ATTACHMENT M

ToxCalc™ v5.0.23F Report Printout for

Pimephales promelas Larval Survival and Growth Test with Outfall 001

Hydrosphere Research Job No. 09124

Larval Fish Growth and Survival Test-7 Day Survival

Start Date:	05/26/2009	Test ID:	9124	Sample ID:	OUTFALL001-24h Composite
End Date:	06/02/2009	Lab ID:	HR-Hydrosphere Research	Sample Type:	KIF-Stilling Pond Discharge
Sample Date:	05/25/2009	Protocol:	EPA.-821-R-02-013 1000.0	Test Species:	PP-Pimephales promelas
Comments:	Pathogen interference - Invalid test results				

Conc-%	1	2	3	4
MHS-Control	1.0000	1.0000	0.4000	1.0000
EMORY-Control	0.3000	0.0000	0.1000	0.2000
6.25	0.0000	0.2000	0.3000	0.7000
12.5	0.5000	0.5000	0.5000	0.2000
25	0.1000	0.2000	0.3000	0.3000
50	0.3000	0.4000	0.0000	0.4000
100	0.9000	1.0000	1.0000	0.9000

			Transform: Arcsin Square Root					1-Tailed		
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
MHS-Control	0.8500	5.6667	1.2302	0.6847	1.4120	29.560	4			
EMORY-Control	0.1500	1.0000	0.3810	0.1588	0.5796	47.729	4			
6.25	0.3000	2.0000	0.5483	0.1588	0.9912	62.826	4	-1.128	2.410	0.3576
12.5	0.4250	2.8333	0.7050	0.4636	0.7854	22.820	4	-2.184	2.410	0.3576
25	0.2250	1.5000	0.4862	0.3218	0.5796	25.196	4	-0.709	2.410	0.3576
50	0.2750	1.8333	0.5270	0.1588	0.6847	47.518	4	-0.984	2.410	0.3576
100	0.9500	6.3333	1.3305	1.2490	1.4120	7.072	4	-6.400	2.410	0.3576

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.93632	0.884	-0.2434	0.83529
Bartlett's Test indicates equal variances (p = 0.33)	5.71846	15.0863		
The control means are significantly different (p = 5.83E-03)	4.17756	2.44691		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test Treatments vs EMORY-Control	100	>100		1	0.13769	0.99605	0.47187	0.04403	6.7E-05	5, 18

Larval Fish Growth and Survival Test-7 Day Biomass

Start Date:	05/26/2009	Test ID:	9124	Sample ID:	OUTFALL001-24h Composite
End Date:	06/02/2009	Lab ID:	HR-Hydrosphere Research	Sample Type:	KIF-Stilling Pond Discharge
Sample Date:	05/25/2009	Protocol:	EPA.-821-R-02-013 1000.0	Test Species:	PP-Pimephales promelas
Comments:	Pathogen interference - Invalid test results				

Conc-%	1	2	3	4
MHS-Control	0.4340	0.5370	0.2300	0.5380
EMORY-Control	0.0910	0.0000	0.0380	0.1040
6.25	0.0000	0.1120	0.1810	0.3590
12.5	0.2470	0.2100	0.3290	0.0350
25	0.0220	0.0670	0.0420	0.1060
50	0.0890	0.2280	0.0000	0.1980
100	0.3110	0.4480	0.4310	0.4950

			Transform: Untransformed					1-Tailed		
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
MHS-Control	0.4348	7.4635	0.4348	0.2300	0.5380	33.343	4			
EMORY-Control	0.0582	1.0000	0.0582	0.0000	0.1040	82.741	4			
6.25	0.1630	2.7983	0.1630	0.0000	0.3590	92.304	4	-1.498	2.410	0.1685
12.5	0.2053	3.5236	0.2053	0.0350	0.3290	60.373	4	-2.102	2.410	0.1685
25	0.0593	1.0172	0.0593	0.0220	0.1060	61.093	4	-0.014	2.410	0.1685
50	0.1288	2.2103	0.1288	0.0000	0.2280	81.217	4	-1.008	2.410	0.1685
100	0.4212	7.2318	0.4212	0.3110	0.4950	18.594	4	-5.190	2.410	0.1685

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.97479	0.884	-0.1225	0.28891
Bartlett's Test indicates equal variances (p = 0.25)	6.67524	15.0863		
The control means are significantly different (p = 2.63E-03)	4.92928	2.44691		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test Treatments vs EMORY-Control	100	>100		1	0.16855	2.89352	0.07267	0.00978	6.2E-04	5, 18

Larval Fish Growth and Survival Test-7 Day Growth

Start Date:	05/26/2009	Test ID:	9124	Sample ID:	OUTFALL001-24h Composite
End Date:	06/02/2009	Lab ID:	HR-Hydrosphere Research	Sample Type:	KIF-Stilling Pond Discharge
Sample Date:	05/25/2009	Protocol:	EPA.-821-R-02-013 1000.0	Test Species:	PP-Pimephales promelas
Comments:	Pathogen interference - Invalid test results				

Conc-%	1	2	3	4
MHS-Control	0.4340	0.5370	0.5750	0.5380
EMORY-Control	0.3033	0.3800	0.5200	
6.25	0.5600	0.6033	0.5129	
12.5	0.4940	0.4200	0.6580	0.1750
25	0.2200	0.3350	0.1400	0.3533
50	0.2967	0.5700	0.4950	
100	0.3456	0.4480	0.4310	0.5500

			Transform: Untransformed					1-Tailed		
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
MHS-Control	0.5210	1.2989	0.5210	0.4340	0.5750	11.638	4			
EMORY-Control	0.4011	1.0000	0.4011	0.3033	0.5200	27.390	3			
6.25	0.5587	1.3930	0.5587	0.5129	0.6033	8.099	3	-1.524	2.602	0.2691
12.5	0.4367	1.0889	0.4367	0.1750	0.6580	45.988	4	-0.368	2.602	0.2517
25	0.2621	0.6534	0.2621	0.1400	0.3533	38.358	4	1.437	2.602	0.2517
50	0.4539	1.1316	0.4539	0.2967	0.5700	31.115	3	-0.510	2.602	0.2691
100	0.4436	1.1060	0.4436	0.3456	0.5500	18.909	4	-0.440	2.602	0.2517

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.9818	0.873	-0.3741	0.571
Bartlett's Test indicates equal variances (p = 0.47)	4.5937	15.0863		
The control means are not significantly different (p = 0.12)	1.87161	2.57058		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Bonferroni t Test Treatments vs EMORY-Control	100	>100		1	0.25173	0.62757	0.03307	0.01604	0.12749	5, 15