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APPENDIX B

CHRONIC TOXICITY DATA SHEETS AND STATISTICAL ANALYSES FOR AMPHIPOD, *Hyalella azteca*, TESTS WITH WHOLE SEDIMENT SAMPLES

DOCUMENTATION FORM

Client: GZA - Central Landfill

Test ID #: 98-2238 → 98-2243

Date: 6/2/98

Job # 198-015

Investigator: M Halmear

COC # 98-1806 → 98-1812

Test System Design

Test chambers consist of 1 qt wide mouth Mason jars with a 7/8" hole drilled at the 750 mL mark. The A 800 µm Nitex screen was glued externally to the hole with silicone sealant.

200.0 g sediment was added to each of 8 test chambers for each site. 500 mL of moderately hard reconstituted freshwater was gently added to each chamber to minimize the disturbance of the sediment.

The Dilution water was delivered continuously to each test chamber at a rate of Two change-overs / day (1000 mL MHRCF daily) by the following system: A surge air control valve (Second Nature Whisper # 56001) was added to the neck of each test chamber and connected to the other seven test chambers of each site with airline tubing (Aquarium grade). Each series of control valves was connected to a single channel

DOCUMENTATION FORM

Client: GZA - Centralandfill

Date: 6/2/98

Investigator: M Galawea

Test ID #: 98-2238 → 98-2243

Job # 198-015

COC # 98-1806 → 98-1812

of a peristaltic pump (Thermo Model 7338-20) using silicone tubing (Cole Parmer 3/32" I.D. #06411-63) Moderately Hard Reconstituted freshwater (MHRCF) was delivered to each test chamber from a 30 gallon Nalgene container via the pump at a rate of approximately 0.7 mL/minute - 1.0 mL/min. Each control valve was calibrated to approx 2 drops per 3 seconds and checked twice daily.

Single bubble aeration was supplied to all test chambers by suspending a trimmed 1 mL disposable pipet (Falcon Brand 7506) approximately 1" above the sediment surface.

Test chambers were placed in a water bath of MHRCF overflow at a temperature of 23°C. A stand-pipe in the bath was adjusted to the height sufficient to maintain a constant temperature but prevent back flow to the test chambers. This system ran for 24h prior to introducing organisms.

DOCUMENTATION FORM

Client: GZA

Date: 6-1-98

Investigator: KS

Test ID #: NA

Job #: 198-015

COC #: NA

Lab. Sediment Prep:

Flint Silica numbers 18, 45 and 90 were washed w/ RO water and sieved through a 500, 300 and 75 micrometer sieve respectively. Each was then transferred to a clean bucket. Each bucket was filled to drain off excess R.O. water.

Sphagnum Peat Moss was milled and sieved through a 2mm sieve.

A homogenized batch of control sediment was mixed using the following quantities:

Constituents:	%	target weight (g)	actual weight (g)
#18 Silica	0.6	19.2	19.2
#45 Silica	8.7	278.4	278.4
#90 Silica	69.2	2214.4	2214.4
Montmorillonite Silt	10.2	326.4	326.4
Kaolinite clay	6.4	204.8	204.8

(cont.)

DOCUMENTATION FORM

Client: GZA

Test ID #: NA

Date: 6/1/98

Job # 198-015

Investigator: KS

COC # NA

Constituent	%	target weight (g)	actual (g)
peat moss	4.9	156.8	156.8
total =		3200g	3200g

DOCUMENTATION FORM

Client: GZA

Test ID #: NA

Date: 6/2/98

Job # A5-015

Investigator: M Schumann

COC # 98-1806, 98-1807

Central Landfill Sediment Characterization

SED 98-50 WEB ID# 98-1806

Received as: Two 1-gal plastic Jars

Sediment was composited in a large container.

Silty Black Muck.

uniform consistency

Mild H_2S odor

SED 98-51 WEB ID# 98-1807

Received in 2 1-gal Plastic Jars

Composited in a large container

Sandy Black Muck

Mild H_2S odor

Little organic matter visible

DOCUMENTATION FORM

Client: GZA

Date: 6/2/98

Investigator: M. Johnson

Test ID #: NA

Job #: 198-015

COC #: 98-1808 + 98-1809

Central Landfill Sediment Characterization

SED 98-052 (98-1808)
Received in 2 1 gal plastic jars
Sediment was composited in a large container and returned to original containers
Sediment was a homogeneous black silty muck.
Mild H_2S odor.
Red worm Removed

SED 98-053 (98-1809)
2 1-gal plastic jars of sediment were composited in a larger container and returned to the original jars
Sediment was a silty black muck
Many Hair-like fibers present

DOCUMENTATION FORM

Client: GZA

Test ID #: NA

Date: 6/2/98

Job # 198-015

Investigator: [illegible]

COC # 98-1810

Central

SED 98-054 (98-1810)

2 1-gal jars sediment are composited and returned to the original container

Sediment was a silty black muck.

Large amount of organic matter - ~~Mostly~~ Mostly grass

Mild H_2S odor

DOCUMENTATION FORM

Client: GZA - Central Landfill

Test ID #: 98-2238 → 98-22

Date: 6/2/98

Job # 198-015

Investigator: G. Motyer

COC # N/A

Moderately Hard Reconstituted Freshwater (MHRCF)
MHRCF prepared from 190L Milli-Q prepared Reverse Osmosis water and the following salts:

$NaHCO_3$	22.5269 g
KCl	~~0.9324~~ g 0.93248 gm
$CaSO_4$	14.0994 g
$MgSO_4$	14.0994 g

Actual weights measured for salts:

					Batch # A
on 6/2	$NaHCO_3$	22.5 g	on 6/5	22.5 g	6/9 22.5
Lot #	KCl	0.9328 g	Batch #	0.9323 g	0.9316
A98-MH035	$CaSO_4$	14.1 g	A98-MH036	14.1 g	14.1 g
	$MgSO_4$	14.1 g		14.1 g	14.1 g

Final Hardness: 92 mg/L as $CaCO_3$
Alkalinity: 65 mg/L

6/11 Batch # A98-MH039 actual weights:

$NaHCO_3$	22.5 g	$MgSO_4$	14.1 g
KCl	0.9325 g		
$CaSO_4$	14.1 g		

DOCUMENTATION FORM

Client: GZA Central Landfill
Date: 6/13/98
Investigator: [illegible]

Test ID #: 98-2238 → 98-2243
Job #: 198-015
COC #: N/A

Moderately Hard Reconstituted Freshwater Preparation

190L MilliQ prepared deionized water used as base water with the following salts added:

$NaHCO_3$	22.5	Batch# A98-MH040
KCl	0.93	
$CaSO_4 \cdot 2H_2O$	14.1	
$MgSO_4$	14.1	

6/11/98 190L MilliQ used to prepare MHRCF, Lot# A98-MH042

Salts added:	weight (g)
$NaHCO_3$	22.5
KCl	0.93
$CaSO_4 \cdot 2H_2O$	14.1
$MgSO_4$	14.1

HYALLELA AZTECA FEEDING SCHEDULE

Start Date: 6/5 Ref TOX

ACUTE & REFERENCE TOXICANT (KCL) TEST FEEDING SCHEDULE

FOOD TYPE	DAY-0	DAY-1	DAY-2	DAY-3	DAY-4	DAY-5	DAY-6	DAY-7	DAY-8	DAY-9	DAY-10
1 mL YAT Acute test in Env. chamber	MA		MA								

Start Date: 6/3 GZA

CHRONIC 10-DAY SEDIMENT TEST FEEDING SCHEDULE

FOOD TYPE	DAY-0	DAY-1	DAY-2	DAY-3	DAY-4	DAY-5	DAY-6	DAY-7	DAY-8	DAY-9	DAY-10	DAY11	DAY-12	DAY-13	DAY-14
Add 4.3 mL YAT/replicate	MA	MA	MA	MA	MA	KS	KS	KS	KS	[illegible]	MA	MA	KS	KS	
Feed 1.0 ml cerophyll food (10g cerophyll/100 ml DI) on days 0 & 5.	N/A					N/A									
Check aeration daily (100 bubbles/min)	MA	KS	KS	MA	MA	KS	KS	KS	KS	MA	MA	MA	KS	KS	KS
Check flow rate (1 drop/3 sec.)	MA	KS	KS	MA	MA	KS	KS	KS	KS	MA	MA	MA	KS	KS	KS
Check for fungal & bacterial slime spots or layers. If present * notify management	MA	MA	KS	MA	MA	KS	KS	KS	KS	MA	MA	MA	KS	KS	KS

DOCUMENTATION FORM

Client: GZA

Date: 6.4.98

Investigator: KS

Test ID #: 98-2238 -> 98-2245

Job # 198-015

COC # 98-1806, -> 98-1810

0810 The following test chambers were not dripping when checked:

Control H, g, F, e, D, C
-50 H, G, F
de ~~-50~~ -51 H
-52 H
-54 H, g

All values were adjusted to a drip of 1/3 sec.

de: data entry error

DOCUMENTATION FORM

Client: GZA Central Landfill

Date: 6-10-98

Investigator: KS

Test ID #: 98-2238 -> 98-22

Job # 198-015

COC # 98-1866 - 98-1810

Hardness and alkalinity were measured for each sediment:

Test Sediment	Hardness	Alkalinity
Control	92	60
50	96	60
51	106	65
52	100	60
53	100	60
54	98	60

NEW ENGLAND BIOASSAY, INC.
AMMONIA CALIBRATION DATA SHEET

Calibration Date: 6-24-98 Technician: KS

Slope Check

	DI Water	ISA Buffer	Std Conc	Std ml	mV
A	100 ml	2 ml	121	1 ml	141.9
B	---	---	121	10 ml	84.3
Slope = mV A - mV B Acceptable Range: -54 to -60 mV					Slope -57.6

Calibration

CAL.	Matrix mL	ISA Buffer mL	NH3 Std ppm	NH3 Vol mL	Calc Conc. ppm	mV
A	100	2	121	0.10	0.12	154.6
B	---	-	121	1.00	1.32	KS 155.4 141
C	---	-	1210	1.00	13.2	70.7
Salinity				Slope (mv/decade)		-60.8

Notes: New membrane installed, 2.5ml of fresh filling solution added.

NEW ENGLAND BIOASSAY, INC.
AMMONIA DATA RECORD SHEET

Client: GZA Central Landfill

Test ID:

Date: 6-24-98

Proj #: 198-015

Analytical Results

Technician: KS

COC#	Sample ID	mV	Direct Reading	Dilution Correction	Final ppm
	Control	158.9	0.50	x1	0.50
	50	177.6	0.24	x1	0.24
	51	180.9	0.22	x1	0.22
	52	181.0	0.22	x1	0.22
	53	181.1	0.22	x1	0.22
	54	182.1	0.21	x1	0.21

Notes: Sample Volume = 50ml + 1ml ISA.
Samples previously preserved with H_2SO_4 to pH < 2.

NEW ENGLAND BIOASSAY CHRONIC DATA SHEET
Hyalella azteca Initial Length/Weight Data

Project No. 98-015

Client: GZA / Central Landfill Test Species: Hyalella azteca

Tech: Tare Wt: MA Date: 6/5/98 Total Wt: MA Date: 6/6/98

Initial Weight LOT #: Hy 98AB(6/2)	REPLICATE			
	A	B	C	D
Total Weight (g)	1.09683	1.10080	1.08893	1.08474
- Tare Weight (g)	1.09593	1.10003	1.08837	1.08393
= Total Larvae Wt (g)	0.00090	0.00077	0.00056	0.00081
Conv. (g to mg)	0.90	0.77	0.56	0.81
No. Surviving	10	10	10	10
Mean Weight (mg)	0.090	0.077	0.056	0.081

Oven Temp (°C) 100 Date/Time In: 6/5/98 1525

Oven Temp (°C) 98 Date/Time Out: 6/6/98 0800

Initial Length LOT #:	REPLICATE			
	A	B	C	D
1	1.5	2.0	2.0	1.5
2	1.5	2.0	2.0	1.5
3	3.0	2.0	2.5	2.0
4	2.0	1.5	1.0	1.5
5	1.5	2.0	1.0	2.0
6	2.5	2.0	1.0	2.5
7	1.5	1.5	1.5	2.0
8	1.0	2.0	1.0	3.0
9	3.0	2.5	2.0	1.0
10	1.0	1.0	1.0	2.0
Mean Length (mm)	1.85	1.85	1.50	1.90

Length Measurement: MA Falcone Date: 6/5/98

Reviewed by: JO Carney Date: 6/15/98

NEW ENGLAND BIOASSAY TOXICITY DATA FORM
CHRONIC SEDIMENT TOXICITY COVER SHEET

CLIENT: GZA - Central Landfill

ADDRESS:

CONTACT: Mr. Tim Briggs

H. azteca TEST NO: 98-2238 -

PROJECT NO: 198-015

SAMPLE TYPE: WHOLE SEDIMENT

TEST ID NUMBER	SAMPLE ID		COLLECTION TIME		TEST DURATION	
	CLIENT ID #	NEB ID #	DATE	TIME	START DATE/TIME	END DATE/TIME
98-2238	Not Applicable	LAB CONTROL	Prepared 6/1/98	NA	6/3/98 1630	6/17/98 1100
98-2239	SED98-50	98-1806	5/27/98	NA	6/3/98 1640	6/17/98 1200
98-2240	SED98-51	98-1807	5/27/98	NA	6/3/98 1650	6/17/98 1400
98-2241	SED98-52	98-1808	5/27/98	NA	6/3/98 1700	6/17/98 1440
98-2242	SED98-53	98-1811	5/28/98	NA	6/3/98 1710	6/17/98 1520
98-2243	SED98-54	98-1812	5/28/98	NA	6/3/98 1720	6/17/98 1645

INVERTEBRATES:

PRESET BY:(TECH INIT.): MN/KS

TEST LOADED BY(TECH. INIT.): MN/KS

TEST SPECIES: Hyalella azteca

SOURCE\NEB LOT #: HA-AB98(6/2)

AGE: ~~9 to 11~~ 8 TO 14 DAYS (MN 6/3/98)

TEST CONDITIONS

SEDIMENT WT: 200 ± .3 g

TEST SOLUTION VOLUME: 500

NO. ORGANISMS PER TEST CHAMBER: 10

NO. ORGANISMS PER CONCENTRATION: 80

NO. ORGANISMS PER CONTROL: 80

DILUTION WATER SOURCE:

TYPE: Reconstituted Freshwater

BATCH #: A98-035 *

HARDNESS: 92 mg/L as Ca

ALKALINITY: 65 mg/L as Ca

Results of Hyalella azteca Chronic Test

TEST ID NUMBERS	% SURVIVAL IN 100% SEDIMENT
98-2238 LAB CONTROL	35.0
98-2239 (SED98-50)	86.3
98-2240 (SED98-51)	90.0
98-2241 (SED98-52)	91.3
98-2242 (SED98-53)	93.8
98-2243 (SED98-54)	81.3

COMMENTS:

Batch MHREF	Hardness	Alkalinity	Used for Renewal	
* A98-MH036	93	65	6/7/98	Batch: A98-MH0
A98-MH039	98	60	6/10/98	Hardness: 97 mg/
A98-MH039	98	63	6/12/98	Alkalinity: 62 mg/
A98-MH042	94	60	6/16/98	Date used: 6/14/

REVIEWED BY: [signature]

DATE: 6/19/98

Test No: 98-2239
Proj No: 198-015
COC No: 98-1806

Client: GZA
Sample: Central Landfill
Start Date/Time: 6/3/98 1640 Source: Aquatic Biosystems
Tech: Day 1 KS 2 GM 3 RTF 4 RTF 5 KS 6 KS 7 KS 8 JM 9 JM 10 AM 11 MG 12 KS 13 KS 14 KS

Test Species: Hyalella azteca
Diluent: MHRCF
Animals/Rep: 10 Conc: 80
Age: 8-14 d Lot#: HA98-8(6/2)

CONC	TEST DAY	REPLICATE LETTER A	B	C	D	E	F	G	H	D.O. (mg/L)	Temperature (°C)	pH (SU)	Cond (µmhos)
Sed 98-50	0	10	10	10	10	10	10	10	10	8.8	22.2	7.5	315
	1	--	--	--	--	--	--	--	--	8.0	22.4	7.7	343
	2	--	--	--	--	--	--	--	--	7.8	22.5	7.8	347
	3	--	--	--	--	--	--	--	--	8.0	22.4	7.7	348
	4	--	--	--	--	--	--	--	--	8.0	22.4	7.5	353
	5	--	--	--	--	--	--	--	--	7.3	22.2	7.8	377
	6	--	--	--	--	--	--	--	--	7.9	22.1	7.7	342
	7	--	--	--	--	--	--	--	--	7.4	23.2	7.9	346
	8	--	--	--	--	--	--	--	--	7.9	23.1	7.9	346
	9	--	--	--	--	--	--	--	--	8.2	22.9	7.8	349
	10	--	--	--	--	--	--	--	--	8.0	23.1	8.0	353
	11	--	--	--	--	--	--	--	--	7.7	23.0	7.9	355
	12	--	--	--	--	--	--	--	--	8.1	23.2	7.9	357
	13	--	--	--	--	--	--	--	--	8.4	23.1	8.0	350
	14	8	10	6	8	10	10	9	8	8.0	23.1	7.9	353

Data Reviewed By: JP Carney Date Reviewed: 6/12/98

Test No: 98-2240
Proj No: 198-015
COC No: 98-1807

Client: GZA
Sample: Central Landfill
Start Date/Time: 6/3/98 1650
Source: Aquatic Biosystems
Test Species: Hyalella azteca
Diluent: MHRCF
Animals/Rep: 10 Conc: 80
Age: 8-14d
Lot#: HA98AB(1/2)
Tech: Day 1 KS 2 GM 3 RTF 4 RTF 5 KS 6 KS 7 KS 8 GM 9 GM 10 NA 11 PKJ 12 KS 13 KS 14 KS

CONC	TEST DAY	REPLICATE LETTER A	B	C	D	E	F	G	H	D.O. (mg/L)	Temperature (°C)	pH (SU)	Cond (µmhos)
Sed 98-51	0	10	10	10	10	10	10	10	10	8.9	22.2	7.5	320
	1	--	--	--	--	--	--	--	--	7.9	22.6	7.8	346
	2	--	--	--	--	--	--	--	--	7.7	22.6	7.8	349
	3	--	--	--	--	--	--	--	--	7.9	22.4	7.8	353
	4	--	--	--	--	--	--	--	--	8.2	22.6	7.7	360
	5	--	--	--	--	--	--	--	--	7.3	22.4	7.8	350
	6	--	--	--	--	--	--	--	--	8.1	22.4	7.7	347
	7	--	--	--	--	--	--	--	--	7.4	23.4	7.9	3606
	8	--	--	--	--	--	--	--	--	7.8	22.1	7.8	349
	9	--	--	--	--	--	--	--	--	8.2	23.1	7.7	350
	10	--	--	--	--	--	--	--	--	7.9	23.1	7.9	352
	11	--	--	--	--	--	--	--	--	7.3	23.1	7.9	359
	12	--	--	--	--	--	--	--	--	7.7	23.2	7.8	368
	13	--	--	--	--	--	--	--	--	8.3	23.2	8.0	356
	14	10	9	7	7	10	10	9	10	7.5	23.2	7.8	351

Data Reviewed By: [signature]
Date Reviewed: 6/19/98

Test No: 98-2241
Proj No: 198-015
COC No: 98-1808

Client: GZA
Sample: Central Landfill
Start Date/Time: 6/3/98 1700 Source: Aquatic Biosystems
Tech: Day 1 RS 2 [illegible] 3 RP 4 RP 5 RS 6 RS 7 RS 8 [illegible] 9 [illegible] 10 [illegible] 11 [illegible] 12 RS 13 RS 14 RS

Test Species: Hyalella azteca
Diluent: MHRCF
Animals/Rep: 10 Conc: 80
Age: 8-14d Lot#: HA98AB(6/2)

CONC	TEST DAY	REPLICATE LETTER A	B	C	D	E	F	G	H	D.O. (mg/L)	Temperature (°C)	pH (SU)	Cond (µmhos)
Sed 98-52	0	10	10	10	10	10	10	10	10	8.6	22.2	7.3	302
	1	--	--	--	--	--	--	--	--	7.4	22.6	8.1	397
	2	--	--	--	--	--	--	--	--	7.9	22.6	7.7	344
	3	--	--	--	--	--	--	--	--	7.5	22.4	7.6	349
	4	--	--	--	--	--	--	--	--	7.8	22.6	7.6	350
	5	--	--	--	--	--	--	--	--	6.9	22.5	7.8	352
	6	--	--	--	--	--	--	--	--	8.3	22.1	7.8	336
	7	--	--	--	--	--	--	--	--	7.5	23.4	7.8	354
	8	--	--	--	--	--	--	--	--	7.6	23.1	7.8	345
	9	--	--	--	--	--	--	--	--	8.2	23.2	7.7	346
	10	--	--	--	--	--	--	--	--	7.7	23.1	7.9	352
	11	--	--	--	--	--	--	--	--	7.3	23.1	7.8	360
	12	--	--	--	--	--	--	--	--	7.4	23.3	7.7	364
	13	--	--	--	--	--	--	--	--	8.0	23.2	7.9	352
	14	9	10	9	9	8	9	9	10	7.3	23.2	7.8	352

Data Reviewed By: [illegible]

Date Reviewed: 6/15/98

Test No: 98-2242
Proj No: 198-015
COC No: 98-1811

Client: GZA
Sample: Central Landfill
Start Date/Time: 6/3/98 1710
Tech: Day 1 KS 2 GM 3 RF 4 RF 5 KS 6 KS 7 KS 8 GM 9 GM 10 HK 11 HK 12 KS 13 KS 14 KS

Test Species: Hyalella azteca
Diluent: MHRCF
Source: Aquatic Biosystems
Animals/Rep: 10 Conc: 80
Age: 8-14d Lot#: HA98AA(6/2)

CONC	TEST DAY	REPLICATE LETTER A	B	C	D	E	F	G	H	D.O. (mg/L)	Temperature (°C)	pH (SU)	Cond (µmhos)
Sed 98-53	0	10	10	10	10	10	10	10	10	8.8	22.2	7.5	302
	1	--	--	--	--	--	--	--	--	7.9	22.6	8.1	375
	2	--	--	--	--	--	--	--	--	8.0	22.6	7.9	347
	3	--	--	--	--	--	--	--	--	7.7	22.4	7.7	351
	4	--	--	--	--	--	--	--	--	8.0	22.4	7.6	355
	5	--	--	--	--	--	--	--	--	6.7	22.4	7.8	352
	6	--	--	--	--	--	--	--	--	8.0	22.3	7.7	339
	7	--	--	--	--	--	--	--	--	7.6	23.4	7.9	369
	8	--	--	--	--	--	--	--	--	7.8	23.0	7.8	342
	9	--	--	--	--	--	--	--	--	8.0	23.0	7.8	347
	10	--	--	--	--	--	--	--	--	7.8	23.1	8.0	356
	11	--	--	--	--	--	--	--	--	7.5	23.1	8.0	353
	12	--	--	--	--	--	--	--	--	8.1	23.2	7.8	357
	13	--	--	--	--	--	--	--	--	8.2	23.1	7.9	349
	14	10	9	10	8	9	10	9	10	7.9	23.1	7.8	345

Data Reviewed By: J D Cuneo
Date Reviewed: 6/19/98

Test No: 98-2243
Proj No: 198-015
COC No: 98-1812

Client: GZA
Sample: Central Landfill
Start Date/Time: 6/3/98 1720
Source: Aquatic Biosystems
Test Species: Hyalella azteca
Diluent: MHRCF
Animals/Rep: 10 Conc: 80
Age:
Lot#: HA98A8 (6/2)
Tech: Day 1 KS 2 GM 3 RP 4 RP 5 KS 6 KS 7 KS 8 GM 9 GM 10 GM 11 GM 12 KS 13 KS 14 KS

CONC	TEST DAY	REPLICATE LETTER A	B	C	D	E	F	G	H	D.O. (mg/L)	Temperature (°C)	pH (SU)	Cond (µmhos)
Sed 98-54	0	10	10	10	10	10	10	10	10	8.7	22.2	7.8	307
	1	--	--	--	--	--	--	--	--	7.5	22.4	7.5	347
	2	--	--	--	--	--	--	--	--	7.5	22.5	7.6	347
	3	--	--	--	--	--	--	--	--	7.4	22.4	7.6	349
	4	--	--	--	--	--	--	--	--	7.8	22.4	7.6	353
	5	--	--	--	--	--	--	--	--	6.8	22.2	7.8	341
	6	--	--	--	--	--	--	--	--	7.9	22.2	7.6	335
	7	--	--	--	--	--	--	--	--	7.5	23.2	7.8	344
	8	--	--	--	--	--	--	--	--	6.9	22.8	7.6	341
	9	--	--	--	--	--	--	--	--	7.2	23.1	7.6	343
	10	--	--	--	--	--	--	--	--	7.4	23.1	7.8	350
	11	--	--	--	--	--	--	--	--	7.4	23.0	7.9	352
	12	--	--	--	--	--	--	--	--	7.8	23.1	7.7	355
	13	--	--	--	--	--	--	--	--	8.2	23.1	7.8	350
	14	8	8	9	6	4	10	10	10	7.4	23.1	7.6	346

Data Reviewed By: J. P. Carey
Date Reviewed: 6/15/98

Test No: 98-2238
Proj No: 198-015
COC No: N/A

Client: GZA
Sample: Central Landfill
Start Date/Time: 6/3/98 1630
Tech: Day 1 KS 2 GM 3 RTF 4 RTF 5 KS 6 KS 7 KS 8 GM 9 GM 10 MM 11 MM 12 KS 13 KS 14 KS

Test Species: Hyalella azteca
Diluent: MHRCF
Source: Aquatic Biosystems
Animals/Rep: 10 Conc: 80
Age: 8-14d Lot#: MA98A6(1/2)

CONC	TEST DAY	REPLICATE LETTER A	B	C	D	E	F	G	H	D.O. (mg/L)	Temperature (°C)	pH (SU)	Cond (µmhos)
LAB CONTROL	0	10	10	10	10	10	10	10	10	9.2	22.2	7.8	318
	1	--	--	--	--	--	--	--	--	8.2	22.4	7.9	349
	2	--	--	--	--	--	--	--	--	8.2	22.4	8.0	358
	3	--	--	--	--	--	--	--	--	8.2	22.2	7.8	360
	4	--	--	--	--	--	--	--	--	8.4	22.2	7.7	361
	5	--	--	--	--	--	--	--	--	7.5	22.2	7.8	365
	6	--	--	--	--	--	--	--	--	8.3	22.0	7.7	358
	7	--	--	--	--	--	--	--	--	7.8	22.8	7.9	415
	8	--	--	--	--	--	--	--	--	8.2	22.7	7.8	380
	9	--	--	--	--	--	--	--	--	8.6	22.9	7.6	353
	10	--	--	--	--	--	--	--	--	8.0	23.1	7.9	355
	11	--	--	--	--	--	--	--	--	7.7	23.0	7.9	356
	12	--	--	--	--	--	--	--	--	8.2	23.1	7.8	361
	13	--	--	--	--	--	--	--	--	8.3	23.2	7.9	367
	14	3	4	5	1	3	4	7	1	7.9	23.1	7.9	422

Data Reviewed By: J. Carney
Date Reviewed: 6/12/98

CHRONIC SEDIMENT DATA SHEET

Client: GZA - Central Landfill Test Species: Hyalella azteca Project No: 198-015

Tech: Tare Wt: VS Date: 6-15-98 Total Wt: VS Date: 6-18-98

Test ID#: (Control) 98-2238 / 98-2239 (Sed 98-50)

Sample ID	Replicate							
Control	A	B	C	D	E	F	G	H
Total Weight (g)	1.08594	1.107166	1.108916	1.101693	1.10040	1.10223	1.08875	1.101605 ~~1.101620~~ IE
- Tare Weight (g)	1.085564	1.101698	1.10818	1.101683	1.10003	1.10147	1.08778	1.10164
= Organism Weight (g)	0.00030	0.000068	0.00078	0.00010	0.00037	0.00076	0.00097	0.00001
Conv. (g to mg)	0.300	0.680	0.780	0.1000	0.370	0.760	0.970	0.010
No. Surviving	3	4	5	1	3	4	7	1
Mean Weight (mg)	0.100	0.170	0.156	0.100	0.123	0.190	0.139	0.010
50 → Total Weight (g)	1.10040	1.09127	1.101651	1.08484	1.088165	1.08985	1.09005	1.11215
- Tare Weight (g)	1.098601	1.08914	1.10508	1.083007	1.08573	1.08740	1.08733	1.10991
= Organism Weight (g)	0.00179	0.00213	0.00143	0.00177	0.00292	0.00245	0.00272	0.00224
Conv. (g to mg)	1.79	2.13	1.43	1.77	2.92	2.45	2.72	2.24
No. Surviving	8	10	6	8	10	10	9	8
Mean Weight (mg)	0.224	0.213	0.238	0.221	0.292	0.245	0.302	0.280

Oven Temp (°C) 100 Time In 1720 h 6/17/98 Time Out 0820 h 6/18/98

Reviewed By: J. Curey Date: 6/15/98

IE: incorrect entry

CHRONIC SEDIMENT DATA SHEET

Client: GZA - Central Landfill Test Species: Hyalella azteca Project No: 198-015

Tech: Tare Wt: VS Date: 6-15-98 Total Wt: VS Date: 6-18-98

Test ID#: (Sed 98-51) 98-2240 / (Sed-98-52) 98-2241

Sample ID 51	Replicate A	B	C	D	E	F	G	H
Total Weight (g)	1.08582	1.08490	1.08414	1.08379	1.08770	1.10229	1.10650	1.09110
- Tare Weight (g)	1.08322	1.08262	1.08199	1.08151	1.08544	1.09996	1.10429	1.08871
= Organism Weight (g)	0.00260	0.00228	0.00215	0.00228	0.00226	0.00233	0.00221	0.00239
Conv. (g to mg)	2.60	2.28	2.15	2.28	2.26	2.33	2.21	2.39
No. Surviving	10	9	7	7	10	10	9	10
Mean Weight (mg)	0.260	0.253	0.307	0.326	0.226	0.233	0.246	0.239
52 → Total Weight (g)	1.10614	1.10557	1.09870	1.10946	1.11035	1.09861	1.09368	1.09451
- Tare Weight (g)	1.10389	1.10244	1.09647	1.10654	1.10799	1.09624	1.09114	1.09124
= Organism Weight (g)	0.00225	0.00313	0.00223	0.00292	0.00236	0.00237	0.00254	0.00327
Conv. (g to mg)	2.25	3.13	2.23	2.92	2.36	2.37	2.54	3.27
No. Surviving	9	10	9	9	8	9	9	10
Mean Weight (mg)	0.250	0.313	0.248	0.324	0.295	0.263	0.282	0.327

Oven Temp (°C) 100 Time In 1740 h 6/12/98 Time Out 0820 h 6/18/98

Reviewed By: [signature] Date: 6/19/98

CHRONIC SEDIMENT DATA SHEET

Client: GZA - Central Landfill Test Species: Hyalella azteca Project No: 198-015

Tech: Tare Wt: VS Date: 6-15-98 Total Wt: VS Date: 6-18-98

Test ID#: (Sed-98-53) 98-2242 / (Sed-98-54) 98-2243

Sample ID 53	Replicate A	B	C	D	E	F	G	H
Total Weight (g)	1.10341	1.11246	1.10957	1.09335	1.11785	1.11800	1.07953	1.08587
- Tare Weight (g)	1.10128	1.10914	1.10716	1.09094	1.10827	1.11471	1.07684	1.08314
= Organism Weight (g)	0.00213	0.00332	0.00241	0.00241	0.00358	0.00329	0.00269	0.00273
Conv. (g to mg)	2.13	3.32	2.41	2.41	3.58	3.29	2.69	2.73
No. Surviving	10	9	10	8	9	10	9	10
Mean Weight (mg)	0.213	0.369	0.241	0.301	~~0.111~~ 0.398 IE	0.329	0.299	0.273
54 → Total Weight (g)	1.08143	1.11075	1.10951	1.09375	1.09757	1.10172	1.08708	1.10370
- Tare Weight (g)	1.07892	1.10951	1.10760	1.09246	1.09654	1.09920	1.08388	1.10076
= Organism Weight (g)	0.00251	0.00124	0.00191	0.00129	0.00103	0.00252	0.00320	0.00294
Conv. (g to mg)	2.51	1.24	1.91	1.29	1.03	2.52	3.20	2.94
No. Surviving	8	8	9	6	4	10	10	10
Mean Weight (mg)	0.314	0.155	0.212	0.215	0.258	0.252	0.320	0.294

Oven Temp (°C) 100 Time In 1720 6/17/98 Time Out 0820 h 6/18/98

Reviewed By: JL Curry Date: 6/19/98

IE - Incorrect entry HMG 6/18/98

TITLE: GZA Central Landfill H. azteca Survival
FILE: GZAHaSur.dat
TRANSFORM: NO TRANSFORM NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Lab. Control	1	0.3000	0.3000
1	Lab. Control	2	0.4000	0.4000
1	Lab. Control	3	0.5000	0.5000
1	Lab. Control	4	0.1000	0.1000
1	Lab. Control	5	0.3000	0.3000
1	Lab. Control	6	0.4000	0.4000
1	Lab. Control	7	0.7000	0.7000
1	Lab. Control	8	0.1000	0.1000
2	Sed 98-50	1	0.8000	0.8000
2	Sed 98-50	2	1.0000	1.0000
2	Sed 98-50	3	0.6000	0.6000
2	Sed 98-50	4	0.8000	0.8000
2	Sed 98-50	5	1.0000	1.0000
2	Sed 98-50	6	1.0000	1.0000
2	Sed 98-50	7	0.9000	0.9000
2	Sed 98-50	8	0.8000	0.8000
3	Sed 98-51	1	1.0000	1.0000
3	Sed 98-51	2	0.9000	0.9000
3	Sed 98-51	3	0.7000	0.7000
3	Sed 98-51	4	0.7000	0.7000
3	Sed 98-51	5	1.0000	1.0000
3	Sed 98-51	6	1.0000	1.0000
3	Sed 98-51	7	0.9000	0.9000
3	Sed 98-51	8	1.0000	1.0000
4	Sed 98-52	1	0.9000	0.9000
4	Sed 98-52	2	1.0000	1.0000
4	Sed 98-52	3	0.9000	0.9000
4	Sed 98-52	4	0.9000	0.9000
4	Sed 98-52	5	0.8000	0.8000
4	Sed 98-52	6	0.9000	0.9000
4	Sed 98-52	7	0.9000	0.9000
4	Sed 98-52	8	1.0000	1.0000
5	Sed 98-53	1	1.0000	1.0000
5	Sed 98-53	2	0.9000	0.9000
5	Sed 98-53	3	1.0000	1.0000
5	Sed 98-53	4	0.8000	0.8000
5	Sed 98-53	5	0.9000	0.9000
5	Sed 98-53	6	1.0000	1.0000
5	Sed 98-53	7	0.9000	0.9000
5	Sed 98-53	8	1.0000	1.0000
6	Sed 98-54	1	0.8000	0.8000
6	Sed 98-54	2	0.8000	0.8000
6	Sed 98-54	3	0.9000	0.9000
6	Sed 98-54	4	0.6000	0.6000
6	Sed 98-54	5	0.4000	0.4000
6	Sed 98-54	6	1.0000	1.0000
6	Sed 98-54	7	1.0000	1.0000
6	Sed 98-54	8	1.0000	1.0000

GZA Central Landfill H. azteca Survival
File: GZAHaSur.dat Transform: NO TRANSFORM

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Lab. Control	8	0.100	0.700	0.350
2	Sed 98-50	8	0.600	1.000	0.863
3	Sed 98-51	8	0.700	1.000	0.900
4	Sed 98-52	8	0.800	1.000	0.913
5	Sed 98-53	8	0.800	1.000	0.938
6	Sed 98-54	8	0.400	1.000	0.813

GZA Central Landfill H. azteca Survival
File: GZAHaSur.dat Transform: NO TRANSFORM

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Lab. Control	0.040	0.200	0.071	57.14
2	Sed 98-50	0.020	0.141	0.050	16.32
3	Sed 98-51	0.017	0.131	0.046	14.55
4	Sed. 98-52	0.004	0.064	0.023	7.02
5	Sed 98-53	0.006	0.074	0.026	7.94
6	Sed 98-54	0.047	0.217	0.077	26.67

TITLE: GZA Central Landfill H. azteca Survival
FILE: GZAHaSur.da2
TRANSFORM: NO TRANSFORM NUMBER OF GROUPS: 5

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Sed 98-50	1	0.8000	0.8000
1	Sed 98-50	2	1.0000	1.0000
1	Sed 98-50	3	0.6000	0.6000
1	Sed 98-50	4	0.8000	0.8000
1	Sed 98-50	5	1.0000	1.0000
1	Sed 98-50	6	1.0000	1.0000
1	Sed 98-50	7	0.9000	0.9000
1	Sed 98-50	8	0.8000	0.8000
2	Sed 98-51	1	1.0000	1.0000
2	Sed 98-51	2	0.9000	0.9000
2	Sed 98-51	3	0.7000	0.7000
2	Sed 98-51	4	0.7000	0.7000
2	Sed 98-51	5	1.0000	1.0000
2	Sed 98-51	6	1.0000	1.0000
2	Sed 98-51	7	0.9000	0.9000
2	Sed 98-51	8	1.0000	1.0000
3	Sed 98-52	1	0.9000	0.9000
3	Sed 98-52	2	1.0000	1.0000
3	Sed 98-52	3	0.9000	0.9000
3	Sed 98-52	4	0.9000	0.9000
3	Sed 98-52	5	0.8000	0.8000
3	Sed 98-52	6	0.9000	0.9000
3	Sed 98-52	7	0.9000	0.9000
3	Sed 98-52	8	1.0000	1.0000
4	Sed 98-53	1	1.0000	1.0000
4	Sed 98-53	2	0.9000	0.9000
4	Sed 98-53	3	1.0000	1.0000
4	Sed 98-53	4	0.8000	0.8000
4	Sed 98-53	5	0.9000	0.9000
4	Sed 98-53	6	1.0000	1.0000
4	Sed 98-53	7	0.9000	0.9000
4	Sed 98-53	8	1.0000	1.0000
5	Sed 98-54	1	0.8000	0.8000
5	Sed 98-54	2	0.8000	0.8000
5	Sed 98-54	3	0.9000	0.9000
5	Sed 98-54	4	0.6000	0.6000
5	Sed 98-54	5	0.4000	0.4000
5	Sed 98-54	6	1.0000	1.0000
5	Sed 98-54	7	1.0000	1.0000
5	Sed 98-54	8	1.0000	1.0000

GZA Central Landfill H. azteca Survival
File: GZAHaSur.da2 Transform: NO TRANSFORM

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Sed 98-50	8	0.600	1.000	0.863
2	Sed 98-51	8	0.700	1.000	0.900
3	Sed 98-52	8	0.800	1.000	0.913
4	Sed 98-53	8	0.800	1.000	0.938
5	Sed 98-54	8	0.400	1.000	0.813

GZA Central Landfill H. azteca Survival
File: GZAHaSur.da2 Transform: NO TRANSFORM

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Sed 98-50	0.020	0.141	0.050	16.32
2	Sed 98-51	0.017	0.131	0.046	14.55
3	Sed 98-52	0.004	0.064	0.023	7.02
4	Sed 98-53	0.006	0.074	0.026	7.94
5	Sed 98-54	0.047	0.217	0.077	26.67

TITLE: GZA Central Landfill H. azteca Survival
FILE: GZAHaSur.da2
TRANSFORM: ARC SINE(SQUARE ROOT(Y)) NUMBER OF GROUPS: 5

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Sed 98-50	1	0.8000	1.1071
1	Sed 98-50	2	1.0000	1.4120
1	Sed 98-50	3	0.6000	0.8861
1	Sed 98-50	4	0.8000	1.1071
1	Sed 98-50	5	1.0000	1.4120
1	Sed 98-50	6	1.0000	1.4120
1	Sed 98-50	7	0.9000	1.2490
1	Sed 98-50	8	0.8000	1.1071
2	Sed 98-51	1	1.0000	1.4120
2	Sed 98-51	2	0.9000	1.2490
2	Sed 98-51	3	0.7000	0.9912
2	Sed 98-51	4	0.7000	0.9912
2	Sed 98-51	5	1.0000	1.4120
2	Sed 98-51	6	1.0000	1.4120
2	Sed 98-51	7	0.9000	1.2490
2	Sed 98-51	8	1.0000	1.4120
3	Sed 98-52	1	0.9000	1.2490
3	Sed 98-52	2	1.0000	1.4120
3	Sed 98-52	3	0.9000	1.2490
3	Sed 98-52	4	0.9000	1.2490
3	Sed 98-52	5	0.8000	1.1071
3	Sed 98-52	6	0.9000	1.2490
3	Sed 98-52	7	0.9000	1.2490
3	Sed 98-52	8	1.0000	1.4120
4	Sed 98-53	1	1.0000	1.4120
4	Sed 98-53	2	0.9000	1.2490
4	Sed 98-53	3	1.0000	1.4120
4	Sed 98-53	4	0.8000	1.1071
4	Sed 98-53	5	0.9000	1.2490
4	Sed 98-53	6	1.0000	1.4120
4	Sed 98-53	7	0.9000	1.2490
4	Sed 98-53	8	1.0000	1.4120
5	Sed 98-54	1	0.8000	1.1071
5	Sed 98-54	2	0.8000	1.1071
5	Sed 98-54	3	0.9000	1.2490
5	Sed 98-54	4	0.6000	0.8861
5	Sed 98-54	5	0.4000	0.6847
5	Sed 98-54	6	1.0000	1.4120
5	Sed 98-54	7	1.0000	1.4120
5	Sed 98-54	8	1.0000	1.4120

GZA Central Landfill H. azteca Survival
File: GZAHaSur.da2 Transform: ARC SINE(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Sed 98-50	8	0.886	1.412	1.212
2	Sed 98-51	8	0.991	1.412	1.266
3	Sed 98-52	8	1.107	1.412	1.272
4	Sed 98-53	8	1.107	1.412	1.313
5	Sed 98-54	8	0.685	1.412	1.159

GZA Central Landfill H. azteca Survival
File: GZAHaSur.da2 Transform: ARC SINE(SQUARE ROOT(Y))

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Sed 98-50	0.037	0.193	0.068	15.93
2	Sed 98-51	0.034	0.184	0.065	14.53
3	Sed 98-52	0.010	0.099	0.035	7.81
4	Sed 98-53	0.013	0.116	0.041	8.82
5	Sed 98-54	0.072	0.269	0.095	23.18

GZA Central Landfill H. azteca Survival
File: GZAHaSur.da2 Transform: ARC SINE(SQUARE ROOT(Y))

Chi-square test for normality: actual and expected frequencies

INTERVAL	<-1.5	-1.5 to <-0.5	-0.5 to 0.5	>0.5 to 1.5	>1.5
EXPECTED	2.680	9.680	15.280	9.680	2.680
OBSERVED	4	9	11	16	0

Calculated Chi-Square goodness of fit test statistic = 8.7030
Table Chi-Square value (alpha = 0.01) = 13.277

Data PASS normality test. Continue analysis.

GZA Central Landfill H. azteca Survival
File: GZAHaSur.da2 Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's test for normality

D = 1.165

W = 0.944

Critical W (P = 0.05) (n = 40) = 0.940
Critical W (P = 0.01) (n = 40) = 0.919

Data PASS normality test at P=0.01 level. Continue analysis.

GZA Central Landfill H. azteca Survival
File: GZAHaSur.da2 Transform: ARC SINE(SQUARE ROOT(Y))

Bartlett's test for homogeneity of variance
Calculated B1 statistic = 8.11

Table Chi-square value = 13.28 (alpha = 0.01, df = 4)
Table Chi-square value = 9.49 (alpha = 0.05, df = 4)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

GZA Central Landfill H. azteca Survival
File: GZAHaSur.da2 Transform: ARC SINE(SQUARE ROOT(Y))

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	4	0.115	0.029	0.860
Within (Error)	35	1.165	0.033	
Total	39	1.280		

Critical F value = 2.69 (0.05,4,30)
Since F < Critical F FAIL TO REJECT Ho: All equal

GZA Central Landfill H. azteca Survival
File: GZAHaSur.da2 Transform: ARC SINE(SQUARE ROOT(Y))

TUKEY method of multiple comparisons

GROUP	IDENTIFICATION	TRANSFORMED MEAN	ORIGINAL MEAN	GROUP 05	01	02	03	04
5	Sed 98-54	1.159	0.813	\				
1	Sed 98-50	1.212	0.863	.	\			
2	Sed 98-51	1.266	0.900	.	.	\		
3	Sed 98-52	1.272	0.913	.	.	.	\	
4	Sed 98-53	1.313	0.938	.	.	.	.	\

* = significant difference (p=0.05) . = no significant difference
Tukey value (5,35) = 4.10 s = 0.033

TITLE: GZA Central Landfill H. azteca Growth
FILE: GZAHaGro.dat
TRANSFORM: NO TRANSFORM NUMBER OF GROUPS: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Lab. Control	1	0.1000	0.1000
1	Lab. Control	2	0.1700	0.1700
1	Lab. Control	3	0.1560	0.1560
1	Lab. Control	4	0.1000	0.1000
1	Lab. Control	5	0.1230	0.1230
1	Lab. Control	6	0.1900	0.1900
1	Lab. Control	7	0.1390	0.1390
1	Lab. Control	8	0.0100	0.0100
2	Sed 98-50	1	0.2240	0.2240
2	Sed 98-50	2	0.2130	0.2130
2	Sed 98-50	3	0.2380	0.2380
2	Sed 98-50	4	0.2210	0.2210
2	Sed 98-50	5	0.2920	0.2920
2	Sed 98-50	6	0.2450	0.2450
2	Sed 98-50	7	0.3020	0.3020
2	Sed 98-50	8	0.2800	0.2800
3	Sed 98-51	1	0.2600	0.2600
3	Sed 98-51	2	0.2530	0.2530
3	Sed 98-51	3	0.3070	0.3070
3	Sed 98-51	4	0.3260	0.3260
3	Sed 98-51	5	0.2260	0.2260
3	Sed 98-51	6	0.2330	0.2330
3	Sed 98-51	7	0.2460	0.2460
3	Sed 98-51	8	0.2390	0.2390
4	Sed 98-52	1	0.2500	0.2500
4	Sed 98-52	2	0.3130	0.3130
4	Sed 98-52	3	0.2480	0.2480
4	Sed 98-52	4	0.3240	0.3240
4	Sed 98-52	5	0.2950	0.2950
4	Sed 98-52	6	0.2630	0.2630
4	Sed 98-52	7	0.2820	0.2820
4	Sed 98-52	8	0.3270	0.3270
5	Sed 98-53	1	0.2130	0.2130
5	Sed 98-53	2	0.3690	0.3690
5	Sed 98-53	3	0.2410	0.2410
5	Sed 98-53	4	0.3010	0.3010
5	Sed 98-53	5	0.3980	0.3980
5	Sed 98-53	6	0.3290	0.3290
5	Sed 98-53	7	0.2990	0.2990
5	Sed 98-53	8	0.2730	0.2730
6	Sed 98-54	1	0.3140	0.3140
6	Sed 98-54	2	0.1550	0.1550
6	Sed 98-54	3	0.2120	0.2120
6	Sed 98-54	4	0.2150	0.2150
6	Sed 98-54	5	0.2580	0.2580
6	Sed 98-54	6	0.2520	0.2520
6	Sed 98-54	7	0.3200	0.3200
6	Sed 98-54	8	0.2940	0.2940

GZA Central Landfill H. azteca Growth
File: GZAHaGro.dat Transform: NO TRANSFORM

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Lab. Control	8	0.010	0.190	0.124
2	Sed 98-50	8	0.213	0.302	0.252
3	Sed 98-51	8	0.226	0.326	0.261
4	Sed 98-52	8	0.248	0.327	0.288
5	Sed 98-53	8	0.213	0.398	0.303
6	Sed 98-54	8	0.155	0.320	0.253

GZA Central Landfill H. azteca Growth
File: GZAHaGro.dat Transform: NO TRANSFORM

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Lab. Control	0.003	0.056	0.020	45.26
2	Sed 98-50	0.001	0.035	0.012	13.75
3	Sed 98-51	0.001	0.036	0.013	13.82
4	Sed 98-52	0.001	0.032	0.011	11.14
5	Sed 98-53	0.004	0.062	0.022	20.48
6	Sed 98-54	0.003	0.057	0.020	22.53

TITLE: GZA Central Landfill H. azteca Growth
FILE: GZAHaGro.da2
TRANSFORM: NO TRANSFORM

NUMBER OF GROUPS: 5

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Sed 98-50	1	0.2240	0.2240
1	Sed 98-50	2	0.2130	0.2130
1	Sed 98-50	3	0.2380	0.2380
1	Sed 98-50	4	0.2210	0.2210
1	Sed 98-50	5	0.2920	0.2920
1	Sed 98-50	6	0.2450	0.2450
1	Sed 98-50	7	0.3020	0.3020
1	Sed 98-50	8	0.2800	0.2800
2	Sed 98-51	1	0.2600	0.2600
2	Sed 98-51	2	0.2530	0.2530
2	Sed 98-51	3	0.3070	0.3070
2	Sed 98-51	4	0.3260	0.3260
2	Sed 98-51	5	0.2260	0.2260
2	Sed 98-51	6	0.2330	0.2330
2	Sed 98-51	7	0.2460	0.2460
2	Sed 98-51	8	0.2390	0.2390
3	Sed 98-52	1	0.2500	0.2500
3	Sed 98-52	2	0.3130	0.3130
3	Sed 98-52	3	0.2480	0.2480
3	Sed 98-52	4	0.3240	0.3240
3	Sed 98-52	5	0.2950	0.2950
3	Sed 98-52	6	0.2630	0.2630
3	Sed 98-52	7	0.2820	0.2820
3	Sed 98-52	8	0.3270	0.3270
4	Sed 98-53	1	0.2130	0.2130
4	Sed 98-53	2	0.3690	0.3690
4	Sed 98-53	3	0.2410	0.2410
4	Sed 98-53	4	0.3010	0.3010
4	Sed 98-53	5	0.3980	0.3980
4	Sed 98-53	6	0.3290	0.3290
4	Sed 98-53	7	0.2990	0.2990
4	Sed 98-53	8	0.2730	0.2730
5	Sed 98-54	1	0.3140	0.3140
5	Sed 98-54	2	0.1550	0.1550
5	Sed 98-54	3	0.2120	0.2120
5	Sed 98-54	4	0.2150	0.2150
5	Sed 98-54	5	0.2580	0.2580
5	Sed 98-54	6	0.2520	0.2520
5	Sed 98-54	7	0.3200	0.3200
5	Sed 98-54	8	0.2940	0.2940

GZA Central Landfill H. azteca Growth
File: GZAHaGro.dat Transform: NO TRANSFORM

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Lab. Control	8	0.010	0.190	0.124
2	Sed 98-50	8	0.213	0.302	0.252
3	Sed 98-51	8	0.226	0.326	0.261
4	Sed 98-52	8	0.248	0.327	0.288
5	Sed 98-53	8	0.213	0.398	0.303
6	Sed 98-54	8	0.155	0.320	0.253

GZA Central Landfill H. azteca Growth
File: GZAHaGro.dat Transform: NO TRANSFORM

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Lab. Control	0.003	0.056	0.020	45.26
2	Sed 98-50	0.001	0.035	0.012	13.75
3	Sed 98-51	0.001	0.036	0.013	13.82
4	Sed 98-52	0.001	0.032	0.011	11.14
5	Sed 98-53	0.004	0.062	0.022	20.48
6	Sed 98-54	0.003	0.057	0.020	22.53

TITLE: GZA Central Landfill H. azteca Growth
FILE: GZAHaGro.da2
TRANSFORM: NO TRANSFORM

NUMBER OF GROUPS: 5

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Sed 98-50	1	0.2240	0.2240
1	Sed 98-50	2	0.2130	0.2130
1	Sed 98-50	3	0.2380	0.2380
1	Sed 98-50	4	0.2210	0.2210
1	Sed 98-50	5	0.2920	0.2920
1	Sed 98-50	6	0.2450	0.2450
1	Sed 98-50	7	0.3020	0.3020
1	Sed 98-50	8	0.2800	0.2800
2	Sed 98-51	1	0.2600	0.2600
2	Sed 98-51	2	0.2530	0.2530
2	Sed 98-51	3	0.3070	0.3070
2	Sed 98-51	4	0.3260	0.3260
2	Sed 98-51	5	0.2260	0.2260
2	Sed 98-51	6	0.2330	0.2330
2	Sed 98-51	7	0.2460	0.2460
2	Sed 98-51	8	0.2390	0.2390
3	Sed 98-52	1	0.2500	0.2500
3	Sed 98-52	2	0.3130	0.3130
3	Sed 98-52	3	0.2480	0.2480
3	Sed 98-52	4	0.3240	0.3240
3	Sed 98-52	5	0.2950	0.2950
3	Sed 98-52	6	0.2630	0.2630
3	Sed 98-52	7	0.2820	0.2820
3	Sed 98-52	8	0.3270	0.3270
4	Sed 98-53	1	0.2130	0.2130
4	Sed 98-53	2	0.3690	0.3690
4	Sed 98-53	3	0.2410	0.2410
4	Sed 98-53	4	0.3010	0.3010
4	Sed 98-53	5	0.3980	0.3980
4	Sed 98-53	6	0.3290	0.3290
4	Sed 98-53	7	0.2990	0.2990
4	Sed 98-53	8	0.2730	0.2730
5	Sed 98-54	1	0.3140	0.3140
5	Sed 98-54	2	0.1550	0.1550
5	Sed 98-54	3	0.2120	0.2120
5	Sed 98-54	4	0.2150	0.2150
5	Sed 98-54	5	0.2580	0.2580
5	Sed 98-54	6	0.2520	0.2520
5	Sed 98-54	7	0.3200	0.3200
5	Sed 98-54	8	0.2940	0.2940

GZA Central Landfill H. azteca Growth
File: GZAHaGro.da2 Transform: NO TRANSFORM

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Sed 98-50	8	0.213	0.302	0.252
2	Sed 98-51	8	0.226	0.326	0.261
3	Sed 98-52	8	0.248	0.327	0.288
4	Sed 98-53	8	0.213	0.398	0.303
5	Sed 98-54	8	0.155	0.320	0.253

GZA Central Landfill H. azteca Growth
File: GZAHaGro.da2 Transform: NO TRANSFORM

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Sed 98-50	0.001	0.035	0.012	13.75
2	Sed 98-51	0.001	0.036	0.013	13.82
3	Sed 98-52	0.001	0.032	0.011	11.14
4	Sed 98-53	0.004	0.062	0.022	20.48
5	Sed 98-54	0.003	0.057	0.020	22.53

GZA Central Landfill H. azteca Growth
File: GZAHaGro.da2 Transform: NO TRANSFORMATION

Chi-square test for normality: actual and expected frequencies

INTERVAL	<-1.5	-1.5 to <-0.5	-0.5 to 0.5	>0.5 to 1.5	>1.5
EXPECTED	2.680	9.680	15.280	9.680	2.680
OBSERVED	1	13	13	11	2

Calculated Chi-Square goodness of fit test statistic = 2.8846
Table Chi-Square value (alpha = 0.01) = 13.277

Data PASS normality test. Continue analysis.

GZA Central Landfill H. azteca Growth
File: GZAHaGro.da2 Transform: NO TRANSFORMATION

Shapiro - Wilk's test for normality

D = 0.074

W = 0.971

Critical W (P = 0.05) (n = 40) = 0.940
Critical W (P = 0.01) (n = 40) = 0.919

Data PASS normality test at P=0.01 level. Continue analysis.

GZA Central Landfill H. azteca Growth
File: GZAHaGro.da2 Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance
Calculated B1 statistic = 5.08

Table Chi-square value = 13.28 (alpha = 0.01, df = 4)
Table Chi-square value = 9.49 (alpha = 0.05, df = 4)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

GZA Central Landfill H. azteca Growth
File: GZAHaGro.da2 Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	4	0.017	0.004	1.978
Within (Error)	35	0.074	0.002	
Total	39	0.091		

Critical F value = 2.69 (0.05,4,30)
Since F < Critical F FAIL TO REJECT Ho: All equal

GZA Central Landfill H. azteca Growth
File: GZAHaGro.da2 Transform: NO TRANSFORMATION

TUKEY method of multiple comparisons

GROUP	IDENTIFICATION	TRANSFORMED MEAN	ORIGINAL MEAN	GROUP 01	05	02	03	04
1	Sed 98-50	0.252	0.252	\				
5	Sed 98-54	0.253	0.253	.	\			
2	Sed 98-51	0.261	0.261	.	.	\		
3	Sed 98-52	0.288	0.288	.	.	.	\	
4	Sed 98-53	0.303	0.303	.	.	.	.	\

* = significant difference (p=0.05) . = no significant difference
Tukey value (5,35) = 4.10 s = 0.002

APPENDIX C

ACUTE TOXICITY DATA SHEETS AND STATISTICAL ANALYSES FOR REFERENCE TOXICANT TESTS WITH AMPHIPODS, *H. azteca*, (POTASSIUM CHLORIDE) AND DAPHNIDS, *C. dubia* (SODIUM CHLORIDE)

NEW ENGLAND BIOASSAY ACUTE TOXICITY DATA FORM
COVER SHEET FOR REFERENCE TOXICANT (NaCL) LC50 TESTS

CLIENT: New England Bioassay, Inc.
ADDRESS: 77 Batson Drive
Manchester, CT 06040
CONTACT: John D. Cooney

SAMPLE TYPE: Reference Toxicant - NaCl

C. dubia TEST ID NO: 98-2206
COC NO: NA
PROJECT NO: 190-084

INVERTEBRATE

TYPE OF TEST TEST SET UP (TECH. INIT.): JM
DEFINITIVE (X) SCREEN ( ) RANGE ( ) RENEWAL ( )

TEST SPECIES: Ceriodaphnia dubia
NEB LOT # CD988 Ods A,B
AGE: < 24 HOURS
TEST SOLUTION VOLUME: 30 (mL)
NO. ORGANISMS PER TEST CHAMBER: 5
NO. ORGANISMS PER CONCENTRATION: 20
NO. ORGANISMS PER CONTROL: 20
START DATE: Mon 6/1/98 AT 1335 (hours)
END DATE: Wed 6/3/98 AT 1340 (hours)

DILUTION WATER SOURCE
ARTIFICIAL FW: NEB Batch # C98S-011 HARDNESS: 48 (mg/L as $CaCO_3$) ALKALINITY: 35 (mg/L as C

Stock Solution Preparation: See MISDOC FORM. (6/1/98) JM

Authorization: —

RESULTS OF Ceriodaphnia dubia LC_{50} TEST

METHOD	LC_{50} (g/L)	95% CONFIDENCE LIMITS (g/L)
* BINOMIAL DISTRIBUTION:	2.00	1.00 - 3.00
MOVING AVERAGE-ANGLE:		
PROBIT:		
TRIMMED SPEARMAN KARBER:	1.86	1.65 - 2.10
OTHER:		

NOAEL: 1.0 g/L
NOAEL: NO-OBSERVED-ACUTE-EFFECT LEVEL

ANIMAL CONDITION/BEHAVIOR:
COMMENTS:

REVIEWED BY: R. Foulk DATE: 6/9/98

Test ID # 78-2206
Proj # 190-084

NEW ENGLAND BIOASSAY
ACUTE TOXICITY DATA

Start Date: Mon 6/1/98 at 1335
End Date: Wed 6/3/98 at 1340

Client: NEB - Reference Toxicant
Sample: NaCl

Test Species: C. dubia

Concentration or Dilution	No. of Live Organisms					Dissolved Oxygen mg/L					Temperature °C					pH					Cond µmhos
	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	
Lab Cont A	5	5	5			8.2		8.2			24.2		24.2			7.8		7.5			181
B	5	5	5																		
C	5	5	5																		
D	5	5	5																		
0.3 g/L A	5	5	5			8.0		8.1			24.4		24.3			7.8		7.6			807
B	5	5	5																		
C	5	5	5																		
D	5	5	5																		
0.5 g/L A	5	5	5			8.2		8.1			24.5		24.2			7.8		7.6			1211
B	5	5	5																		
C	5	5	5																		
D	5	5	5																		
1.0 g/L A	5	5	5			8.2		8.1			24.5		24.4			7.8		7.6			2200
B	5	5	5																		
C	5	5	5																		
D	5	5	5																		
Tech Initials	DMN	MICMLS																			

Test ID #_ -2206
Proj #_190-084

NEW ENGLAND BIOASSAY
ACUTE TOXICITY DATA

Client: NEB - Reference Toxicant
Sample: NaCl

Test Species: C. dubia

Start Date: Mon 6/1/98 at 1335
End Date: Wed. 6/3/98 at 1340

Concentration or Dilution	No. of Live Organisms					Dissolved Oxygen mg/L					Temperature °C					pH					Cond µmhos
	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	
2.0 g/L A	5	5	4			8.2					24.6					7.7					4100
B	5	5	1																		
C	5	5	2																		
D	5	5	3																		
3.0 g/L A	5	0	—			8.2	8.0				24.6	24.0				7.7	7.7				5990
B	5	0	—																		
C	5	0	—																		
D	5	0	—																		
Tech Initials	[illegible]	MLS	MLS																		

DOCUMENTATION FORM

Client: NEB

Test ID #: 98-2206, -2207, -2208

Date: 6/1/98

Job # 190-084

Investigator: J. Motyka

COC # NA

Preparation of 10g/L NaCl Stock Solution

50.0g NaCl weighed by Mettler top loading balance added to a 500 ml volumetric flask partially filled with Milli-Q prepared Reverse ~~Osmosis~~ Osmosis water. The flask was filled to volume with Milli-Q and agitated until NaCl crystals dissolved. The volumetric was again filled with water ~~to volume~~ as the volume decreased as the NaCl dissolved.

Lot # NaCl-010-(6/1/98)

Authorization: [illegible]

CT-TOX: BINOMIAL, MOVING AVERAGE, PROBIT, AND SPEARMAN METHODS

SPEARMAN-KARBER

TRIM:	.00%
LC50:	1.861
95% LOWER CONFIDENCE:	1.646
95% UPPER CONFIDENCE:	2.104

CONC. g/L	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB. (%)
.30	20.	0.	.00	.9537D-04
.50	20.	0.	.00	.9537D-04
1.00	20.	0.	.00	.9537D-04
2.00	20.	10.	50.00	.5881D+02
3.00	20.	20.	100.00	.9537D-04

THE BINOMIAL TEST SHOWS THAT 1.00 AND 3.00 CAN BE USED AS STATISTICALLY SOUND CONSERVATIVE 95 PERCENT CONFIDENCE LIMITS SINCE THE ACTUAL CONFIDENCE LEVEL ASSOCIATED WITH THESE LIMITS IS 99.9998 PERCENT.
AN APPROXIMATE LC50 FOR THIS DATA SET IS 2.000

WHEN THERE ARE LESS THAN TWO CONCENTRATIONS AT WHICH THE PERCENT DEAD IS BETWEEN 0 AND 100, NEITHER THE MOVING AVERAGE NOR THE PROBIT METHOD CAN GIVE ANY STATISTICALLY SOUND RESULTS.

DATE: 6/1/98 TEST NUMBER: 98-2206 DURATION: 48 h

SAMPLE: NaCl SPECIES: C. dubia

METHOD	LC50	CONFIDENCE LIMITS LOWER	UPPER	SPAN
BINOMIAL	2.000	1.000	3.000	2.000
MAA	*******	*******	*******	*******
PROBIT	*******	*******	*******	*******
SPEARMAN	1.861	1.646	2.104	.458

**** = LIMIT DOES NOT EXIST

NEW ENGLAND BIOASSAY ACUTE TOXICITY DATA FORM
COVER SHEET FOR REFERENCE TOXICANT TESTS

CLIENT: NEW ENGLAND BIOASSAY

ADDRESS: 77 BATSON DR.
MANCHESTER, CT. 06040

CONTACT: John D. Cooney, Ph.D.

H. azteca TEST ID NO: 98-2279

PROJECT NO: 190-084

REFERENCE TOXICANT: Potassium Chloride LOT# KCl-002 (6/5/98)

TEST CONDITIONS FOR Hyalella azteca

TYPE OF TEST TEST SET UP (TECH. INIT.): MK

DEFINITIVE [X] SCREEN [ ] RANGE [ ] RENEWAL [ ]

TEST SPECIES: Hyalella azteca

NEB LOT #: Hz 98AB(6/2)

AGE: 10-16 days

TEST SOLUTION VOLUME: 200 (mL)

NO. ORGANISMS PER TEST CHAMBER: ___

NO. ORGANISMS PER CONCENTRATION: ___

NO. ORGANISMS PER CONTROL: 20

TEST DURATION

START DATE: Fri 6/5/98 AT 1255 (hours)

END DATE: Tue 6/9/98 AT 1320 (hours)

DILUTION WATER SOURCE

ARTIFICIAL FW: NEB Batch # A98-MH035

HARDNESS: 92 (mg/L as $CaCO_3$)

ALKALINITY: 65 (mg/L as $CaCO_3$)

SAMPLE & SURVIVAL OBSERVATIONS:

SAMPLE COLOR: None	TECH. INIT.	H. azteca	00 H: MK	24 H: MK	48 H: MK	72 H: MK	96 H: MK
AERATION REQUIRED: YES [ ] NO [✓]							

RESULTS OF Hyalella azteca LC_{50} TEST

METHOD	LC_{50} (mg/L)	95% CONFIDENCE LIMITS (mg/L)
BINOMIAL DISTRIBUTION:	321.7	250.0 - 500.0
MOVING AVERAGE-ANGLE:	276.0	217.6 - 354.9
PROBIT:	277.7	92.6 - 845.7
*TRIMMED SPEARMAN KARBER:	300.2	244.3 - 368.9
OTHER:		

NOAEL: 125 mg/L

NOAEL: NO-OBSERVED-ACUTE-EFFECT LEVEL

COMMENTS:

Stock Solution Preparation: 1000 mg/L KCl
1.000g (Actual 1.00058g) KCl was weighed on an analytical balance. KCl was added to a 1-L volumetric flask partially filled with Moderately Hard Reconstituted Freshwater (98-MH035). Solution was clear and colorless - Reagent dissolved thoroughly.
All remaining test solutions were prepared from the 1000 mg/L solution by serial dilution. 500 mL of the stock solution was diluted to 1000 mL in a 1-L graduated cylinder using MHRCF. 500 mL was used for further dilution and the remaining solution was distributed to the test chambers.

REVIEWED BY: R. Faulk DATE: 6/12/98

Test ID # 98-2279

Proj #190-084

NEW ENGLAND BIOASSAY
ACUTE TOXICITY DATA

Client: New England Bioassay, Inc.
Sample: Potassium Chloride

Test Species: H. azteca

Start Date: Fri 6/5/98 at 1255
End Date: Tue 6/9/98 at 1320

Concentration or Dilution	No. of Live Organisms					Dissolved Oxygen mg/L					Temperature °C					pH					Cond µmhos
	0*	24	48*	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	
Lab Cont A	10	10	10	10	10	8.9	7.4	8.0	6.7	6.8	22.8	22.3	22.2	22.6	23.1	8.0	7.8	7.9	8.1	7.9	360
B	10	10	9	9	9	8.9	7.4	7.9	6.7	7.1											
62.5 mg/L A	10	10	10	10	10	8.8	7.3	7.9	7.2	7.4	22.8	22.8	22.8	23.0	22.6	8.0	7.9	8.0	8.0	8.0	477
B	10	10	10	10	1x 9	8.8	7.5	7.8	7.0	7.4											
125 mg/L A	10	10	10	10	10	8.8	7.3	8.0	7.0	7.4	22.8	23.1	23.0	23.1	22.8	8.0	8.0	8.1	8.0	8.0	595
B	10	10	10	9	1x 8	8.8	7.6	7.7	7.0	7.4											
250 mg/L A	10	10	10	1x 9	9	8.8	7.3	7.7	6.7	7.4	22.8	23.3	23.1	23.1	22.8	8.0	8.1	8.1	8.0	8.0	827
B	10	3x 7	7	7	6 1x	8.7	7.3	7.6	6.7	7.5											
500 mg/L A	10	5x 5	3x 2	0	–	8.7	7.5	8.1	6.9	–	22.8	22.7	22.9	23.0	–	8.1	8.0	8.1	8.0	–	1292
B	10	3x 7	2x 5	3x 2	2	8.7	7.5	8.1	7.0	7.5					22.6					8.0	
1000 mg/L A	10	0	–	–	–	8.7	7.6	–	–	–	22.8	23.3	–	–	–	8.1	8.1	–	–	–	2230
B	10	0	–	–	–	8.7	7.6	–	–	–											
Tech Initials	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	* 1 mL YAT (2000 mg/L dry weight) / Replicate															

Reviewed by: R. Faulk DATE: 6/12/98

CT-TOX: BINOMIAL, MOVING AVERAGE, PROBIT, AND SPEARMAN METHODS

SPEARMAN-KARBER

TRIM:	5.00%
LC50:	300.178
95% LOWER CONFIDENCE:	244.255
95% UPPER CONFIDENCE:	368.904

CONC. mg/L	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB.(%)
62.50	20.	1.	5.00	.2003D-02
125.00	20.	2.	10.00	.2012D-01
250.00	20.	5.	25.00	.2069D+01
500.00	20.	18.	90.00	.2012D-01
1000.00	20.	20.	100.00	.9537D-04

THE BINOMIAL TEST SHOWS THAT 250.00 AND 500.00 CAN BE USED AS STATISTICALLY SOUND CONSERVATIVE 95 PERCENT CONFIDENCE LIMITS SINCE THE ACTUAL CONFIDENCE LEVEL ASSOCIATED WITH THESE LIMITS IS 97.9104 PERCENT.
AN APPROXIMATE LC50 FOR THIS DATA SET IS 321.695

RESULTS USING MOVING AVERAGE

SPAN	G	LC50	95% CONFIDENCE LIMIT	
4	.066	275.95	217.56	354.92

****** RESULTS CALCULATED BY PROBIT METHOD

ITERATIONS	G	H	GOODNESS OF FIT
6	.737	2.69	.04

SINCE THE PROBABILITY IS LESS THAN 0.05,
RESULTS CALCULATED USING THE PROBIT METHOD
PROBABLY SHOULD NOT BE USED.
SLOPE = 3.69
95% CONFIDENCE LIMITS: .52 AND 6.87
LC50= 277.68
95% CONFIDENCE LIMITS: 92.64 AND 865.70
LC1 = 65.12
95% CONFIDENCE LIMITS: .01 AND 144.54

DATE: 6/5/98 TEST NUMBER: 98-2279 DURATION: 96 hours
SAMPLE: Ref. Tox. SPECIES: H.azteca
[Lot # KCl 002(6/5/98)]

METHOD	LC50	CONFIDENCE LIMITS LOWER	UPPER	SPAN
BINOMIAL	321.695	250.000	500.000	250.000
MAA	275.952	217.556	354.921	137.365
PROBIT	277.680	92.637	865.697	773.060
SPEARMAN	300.178	244.255	368.904	124.650

**** = LIMIT DOES NOT EXIST

APPENDIX H

MAY 1993 ACUTE TOXICITY TEST REPORT

NEW ENGLAND BIOASSAY, INC.

25 May 1993

Mr. Tim Briggs
GZA Environmental
320 Needham Street
Newton Upper Falls, MA 02164

Dear Mr. Briggs:

**ACUTE TOXICITY TEST REPORT
TO GZA ENVIRONMENTAL INC. FOR
SEDIMENT SAMPLES COLLECTED ON
12 MAY 1993 FROM A FRESHWATER SITE IN
THE VICINITY OF THE CENTRAL LANDFILL
IN JOHNSTON, RI**

This report contains the results of six static-acute elutriate toxicity tests performed with the daphnid, Ceriodaphnia dubia, and the fathead minnow, Pimephales promelas. The definitive acute toxicity tests were conducted with elutriates (water-extractable phase) prepared from three sediment samples collected on 12 May 1993 by GZA Environmental staff from a freshwater site in the vicinity of the Central Landfill in Johnston, RI. This report details procedures for preparing elutriates from the sediment samples and the biological and chemical evaluations associated with performance of the acute toxicity tests with the three elutriate samples.

Sample Collection and Elutriate Preparation

On 12 May 1993, sediment samples were collected from three locations at the freshwater site by GZA staff. Sediment samples were picked up by a New England Bioassay (NEB) courier at 1520 h on 12 May 1993. Upon receipt at NEB, the sediment samples were logged into the laboratory (Table 1; Appendix A) and then stored in the dark in a cold room (4° ± 2°C); elutriate preparation was initiated on the next day. On the morning of 13 May 1993, the three sediment samples from each of the three sites were removed from the cold room and combined in individual, clean 3-L beakers; any large stones, sticks, or extraneous plant material were removed.

77 BATSON DRIVE / MANCHESTER, CONN. 06040 / TEL. (203) 643-9560 / FAX. (203) 646-7169

TABLE 1. DESCRIPTION OF SEDIMENT SAMPLES COLLECTED BY GZA ENVIRONMENTAL FROM A FRESHWATER SITE IN JOHNSTON, RI FOR STATIC-ACUTE ELUTRIATE TOXICITY TESTS

Sediment Sample Description	Sample Date	Sample Type	NEB ID Nos.
Site No. 21 (GZA No. SED93-21-I)	5/12/93 (1030 h)	Grab	93-1836
Site No. 24 (GZA No. SED93-24-I)	5/12/93 (1110 h)	Grab	93-1837
Site No. 30 (GZA No. SED93-30-I)	5/12/93 (1145 h)	Grab	93-1838
Mashapaug Sediment (Samples A & B)	5/10/93 (1130-1200)	Grab	93-1823

In addition to testing the three sediment samples from the Johnston, RI site, an additional reference sediment was evaluated as an quality-control check to determine the adequacy of the test system and the health of the test organisms. The reference sediment sample was collected by NEB on 10 May 1993 from an oligotrophic lake (Mashapaug Pond) located in Union, CT. Mashapaug Pond sediment was chosen for the reference sediment because the pond is a relatively pristine lentic system with low levels of human activity/pollution. Previous chemical characterizations performed by the Connecticut Department of Environmental Protection (CTDEP) found that Mashapaug Pond sediments were low in organic contaminants and metals. The reference sediment was handled similarly to the site sediments.

Samples were manually stirred to ensure a homogeneous sediment sample. Homogenized sediment and laboratory-prepared water (hardness: 50 mg/L as $CaCO_3$) were combined in a 1:4 ratio (680 mL sediment: 2720 mL water; volume:volume) in 1-gallon glass wide-mouth specimen jars (with teflon lid inserts). For each site, two 1-gallon specimen jars were prepared in this manner.

Sediment:water mixtures were placed in foam inserts in a 55-gallon polypropylene drum. The drum containing four glass jars (2 sediment samples) was placed on an electric drum rotator set at 12 rpm, which mixed the samples at room temperature (about 22°C) for 30 minutes in an end-over-end manner. The drum rotation was then repeated for the remaining two sediment samples.

After stirring was terminated, samples were allowed to settle for about 1 h. After settling, the supernatant (elutriate) from each jar was removed by carefully siphoning off the supernatant without disturbing the settled material. For each sediment, the supernatants collected from the two duplicate jars were combined into one sample. The supernatants were gray in color and high in suspended fine clay and silt particles. To obtain an estimate of the amount of suspended material present in the samples, aliquots of the supernatants were dried in an oven at about 100°C and weighed (Table 2); the amount of dry material in the supernatants (before filtering) averaged 14.5, 32.5, and 16.9 mg dry material/mL of liquid. Because of the high turbidity in the supernatants caused by the suspended clay and silt particles, the supernatants were filtered through a 1 μm Gelman glass-fiber filter to reduce the amount of suspended materials before use in testing.

Because the 1 μm filtration did not completely remove the fine silt/clay particles, an aliquot of each elutriate sample was centrifuged for 15 minutes at about 3700 revolutions per minute; the undiluted centrifuged elutriate was evaluated for acute toxicity to C. dubia during 13-15 May 1993 (Table 3). In this manner, the effects of the suspended materials on daphnid survival could be assessed.

TABLE 2. WET CHEMISTRY RESULTS FOR SEDIMENT ELUTRIATE SAMPLES

Analysis Performed Site No.:	Elutriate Samples 21	24	30
pH (SU)	6.9	7.3	7.4
Dissolved oxygen (mg/L)	6.8	7.0	6.0
Sp. Conductivity (μmhos/cm)	171	159	161
Hardness (mg/L as $CaCO_3$)	50	24	32
Alkalinity (mg/L as $CaCO_3$)	25	50	45
Color[a]	Gray	Gray	Gray
Dry Weight of[a] Suspended Materials (mg dry material/mL elutriate)	14.5	32.5	16.9

[a] Sample color and dry weight measurements were obtained on samples of the supernatants before filtering.

TABLE 3. TEST DATES AND TEST IDENTIFICATION NUMBERS FOR ACUTE TOXICITY TESTS PERFORMED WITH SEDIMENT ELUTRIATE SAMPLES

Sample Description	Test Species	Test Dates	NEB Test ID Nos.
	Definitive Acute Toxicity Tests (1 µm Filtered Elutriates)		
Site No. 21	*C. dubia*	5/14-16/93	93-2043
	P. promelas	5/14-18/93	93-2044
Site No. 24	*C. dubia*	5/14-16/93	93-2047
	P. promelas	5/14-18/93	93-2048
Site No. 30	*C. dubia*	5/14-16/93	93-2045
	P. promelas	5/14-18/93	93-2046
	Screening Acute Toxicity Tests (Centrifuged Elutriates)		
Site No. 21	*C. dubia*	5/13-15/93	93-2032
Site No. 24	*C. dubia*	5/13-15/93	93-2033
Site No. 30	*C. dubia*	5/13-15/93	93-2034

After centrifugation, standard wet chemistry analyses [pH, dissolved oxygen, specific conductivity, hardness, and alkalinity] were performed on each sediment elutriate sample. Wet chemistry data are provided in Table 2.

The filtered elutriate samples were used in toxicity tests. Each sediment elutriate sample was serially diluted with clean laboratory-prepared water and evaluated for acute toxicity to Ceriodaphnia dubia and fathead minnows during 14-16 and 14-18 May 1993, respectively (Table 3). For the reference sediment elutriate, only the undiluted elutriate sample was evaluated for acute toxicity. Laboratory water controls were also be set up concurrently with each test to document health of test organisms. Test suspensions were not changed during the acute tests.

The basic references for the initial manipulations of the sediments for toxicity testing are the ASTM document titled "Standard Guide for Collection, Storage, Characterization, and Manipulation of Sediments for Toxicological Testing" and the National Fisheries Contaminant Research Center's Standard Operating Procedures for evaluating contaminated freshwater sediments. Additional guidance was provided by adapting the saltwater test procedures described in "Evaluation of Dredged Material Proposed for Ocean Disposal" (EPA-500/8-91/001; February 1991) and "Guidance for Performing Tests on Dredged Material to be Disposed of in Open Waters" (EPA Region I; 15 May 1989).

Test Water

The dilution/control water for the C. dubia and fathead minnow elutriate toxicity tests was dilute mineral water (DMW; nominal hardness: 50 mg/L as $CaCO_3$). The DMW was prepared based on instructions cited in Weber et al. (1989). Base water used in preparing the DMW was deionized water from a Millipore Milli-Q® water system. To prepare the DMW, Perrier® water was added in the appropriate amount to a carboy containing deionized water and mixed. After preparation, each batch of DMW was aerated at room temperature and then used in testing. Hardness and alkalinity of DMW used as the dilution/control water for acute elutriate tests averaged 50 mg/L (as $CaCO_3$) and 36 mg/L (as $CaCO_3$), respectively.

Test Organisms

Ceriodaphnia dubia

Original stock cultures of the freshwater crustacean water flea, Ceriodaphnia dubia, used in acute elutriate toxicity tests were obtained from the CTDEP and were cultured at NEB in dilute mineral water (DMW; 12% Perrier® water) in a controlled environment chamber at the specified conditions (temperature 25° ± 2°C; photoperiod 16-h light and 8-h dark).

C. dubia were individually cultured in 30-mL plastic cups (1 C. dubia per cup) containing 15 mL of DMW. Each culture chamber received 50 µL of a yeast/trout chow/Cerophyl® (YTC) food suspension (see Weber et al., 1989, for procedures for preparing the food suspension) and 150 µL of the green alga, Selenastrum capricornutum, when the cultures were changed. Survival and reproduction of culture animals were checked each time the culture water was changed (on a daily basis after production of a first brood of young). After 14 days, cultures were not used for testing. All young were removed from culture chambers 24 h before the start of a test to ensure that only ceriodaphnids ≤ 24 h old would be available to start the acute tests.

Fathead Minnows (Pimephales promelas)

Immature fathead minnows (Pimephales promelas) used in the acute elutriate toxicity tests were obtained from NEB in-house cultures. The original sources of NEB brood stocks of fathead minnows were the EPA Environmental Monitoring Systems Laboratory (Newtown, OH) and Aquatic Biosystems (Fort Collins, CO). Young fathead minnows (9-days old at test initiation) were used to initiate the acute tests.

ACUTE TOXICITY TESTS

Test Systems

C. dubia Static-Acute Elutriate Toxicity Tests

Specific procedures of the C. dubia 48-h static-acute test system are described in Appendix B. These procedures are based on EPA guidelines (Weber et al., 1989; Peltier and Weber, 1985). Static-acute toxicity tests using C. dubia were initiated with each sediment elutriate. Young C. dubia (≤ 24 h old at test initiation) were continuously exposed for 48 h under static conditions to five concentrations of each sediment elutriate sample (6.25, 12.5, 25, 50, and 100% elutriate), a dilution-water control, and a procedural blank control. Mashapaug Pond sediment mixed with DMW was used as the procedural blank.

C. dubia were exposed in groups of five animals in 50-mL polypropylene beakers containing 30 mL of test solution or control water. Six replicates were used for each test concentration and control (30 animals per concentration). Test chambers were maintained under the specified test conditions (mean temperature 25° ± 1°C and individual temperature observations 25° ± 2°C; photoperiod 16-h light and 8-h dark). Per acute test protocols, organisms were not fed during the 48-h test.

Temperature, dissolved oxygen, pH, and specific conductivity were measured at test initiation in a composite sample from each test concentration and the controls before distribution to the test chambers. Temperature, dissolved oxygen, and pH were measured in one replicate at each test concentration at test completion. Hardness and alkalinity of 100% elutriate were measured at sample preparation. Hardness and alkalinity of DMW were measured at time of preparation. Observations on the number of live and dead animals were made at 24 h and 48 h.

Fathead Minnow Static-Acute Elutriate Toxicity Tests

Specific procedures of the fathead minnow 48-h static-acute toxicity test system are described in Appendix B and are based on EPA guidelines (Peltier and Weber, 1985; EPA Region I biomonitoring protocols, 1990). Static-acute toxicity tests using fathead minnows were conducted with each sediment elutriate. Young fathead minnows (9-days old at test initiation) were continuously exposed for 96 h under static conditions to five concentrations of each elutriate sample (6.25, 12.5, 25, 50, and 100% sediment elutriate), a dilution water control, and procedural blank control. DMW was used as test dilution/control water. Mashapaug Pond sediment mixed with DMW was used as the procedural blank.

Fathead minnows were exposed in groups of 10 animals in 1000-mL Tri-pour polypropylene beakers containing 700 mL of test solution or control water. Three replicates were used for each test concentration and control (30 animals per concentration). Test beakers were maintained under the specified test conditions (mean temperature 25° ± 1°C and individual temperature observations 25° ± 2°C; photoperiod 16-h light and 8-h dark). Per acute testing protocols, organisms were not fed during the 96-h tests.

Temperature, dissolved oxygen, pH, and specific conductivity were measured in a single composite sample from each test concentration and the control before distribution to the test chambers. Temperature and pH were measured daily in one replicate at each test concentration; dissolved oxygen was measured daily in each test chamber. Hardness and alkalinity were measured on the 100% elutriate after sample preparation. Hardness and alkalinity of DMW were measured at the time of preparation. Observations on the number of live and dead animals were made daily until test completion (96 h).

Statistical Analysis

Data from the acute elutriate toxicity tests with C. dubia and fathead minnows were used to estimate daily median lethal concentrations (LC_{50}) and acute no-observed-effects concentration (A-NOEC). The LC_{50} is the elutriate concentration that is lethal to 50% of the organisms within the test period. Estimates of daily LC_{50} values were obtained by using a computer program provided by the CTDEP. This program estimates an LC_{50} by using one of four methods: binomial, moving-average, probit, or trimmed Spearman-Karber.

The method selected is based on the shape of the concentration - effects curve and the number of concentrations with partial mortalities (mortality greater than 0% but less than 100%). The moving-average, probit, and trimmed Spearman-Karber methods both estimate the LC_{50} with 95% confidence limits. The bounds placed on the LC_{50} by using the binomial test are not 95% confidence limits, but can be used as statistically sound conservative bounds that are always above 95% when animal sample size per concentration is large ($N \geq 6$) (Stephan, 1977). Sample size in all acute toxicity tests conducted for this study was 30 animals per concentration.

To determine the A-NOEC, C. dubia and fathead minnow survival data were analyzed by using Fisher's exact test comparing survival of organisms in the test concentrations with survival in the laboratory-water control.

RESULTS

Results of the acute toxicity tests with the three sediment elutriates are summarized in Tables 4 and 5. The filtered elutriates (1 μm filtered samples) prepared from sediments collected from Site Nos. 21, 24, and 30 exhibited significant acute toxicity to C. dubia. Only the sediment elutriate from the Site No. 30 sample exhibited significant acute toxicity to fathead minnows (Table 4). Copies of the raw toxicity data sheets and the statistical analyses printouts are located in Appendix C.

Ceriodaphnia dubia

Survival of C. dubia at test completion (48 h) in the undiluted filtered elutriate samples was 7, 33, and 70% for sediments collected from Site Nos. 21, 24, and 30, respectively (Table 5). The 48-h LC_{50} values for C. dubia were 40.4, 58.9, and > 100% elutriate for sediments collected from Site Nos. 21, 24, and 30, respectively (Table 4).

TABLE 4. SUMMARY OF ACUTE TOXICITY TEST RESULTS

Test ID No.	Test Species	LC_{50} (% elutriate)	A-NOEC (% elutriate)	Control Survival (%)
Sediment Elutriate from Site No. 21			**(Sample ID No. 93-1836)**	
93-2043	C. dubia	24 h: > 100	50	100
		48 h: 40.4 (32.6-50.1)	12.5	97
93-2044	P. promelas	24 h: > 100	100	97
		48 h: > 100	100	97
		48 h: > 100	100	97
		96 h: > 100	100	97
Sediment Elutriate from Site No. 24			**(Sample ID No. 93-1837)**	
93-2047	C. dubia	24 h: > 100	50	100
		48 h: 58.9 (38.0-91.4)	12.5	97
93-2048	P. promelas	24 h: > 100	100	100
		48 h: > 100	100	100
		48 h: > 100	100	100
		96 h: > 100	100	100
Sediment Elutriate from Site No. 30			**(Sample ID No. 93-1838)**	
93-2045	C. dubia	24 h: > 100	100	100
		48 h: > 100	6.25	100
93-2046	P. promelas	24 h: > 100	50	93
		48 h: > 100	50	93
		48 h: > 100	50	93
		96 h: > 100	50	93

TABLE 5. RESULTS OF ACUTE TOXICITY TESTS WITH ELUTRIATES PREPARED FROM SEDIMENT SAMPLES COLLECTED BY GZA ENVIRONMENTAL ON 12 MAY 1993 FROM A FRESHWATER SITE IN THE VICINITY OF THE CENTRAL LANDFILL IN JOHNSTON, RI

Test Concentration	Survival (%) 24 h	48 h	72 h	96 h	pH (SU)	DO (mg/L)	Temp. (°C)	Cond. (µmhos/cm)
Sediment Elutriate from Site No. 21								**(Sample ID No. 93-1836)**
					Ceriodaphnia dubia			
Lab. Water Control	100	97	---	---	7.8 7.6-7.9	7.4 7.2-7.6	24.3 24.2-24.4	116
6.25%	100	93	---	---	7.9 7.6-8.0	7.4 7.3-7.7	24.3 24.2-24.4	119
12.5%	100	90	---	---	7.8 7.5-7.9	7.4 7.3-7.8	24.3 24.1-24.5	122
25%	100	77	---	---	7.8 7.4-7.9	7.4 7.3-7.6	24.4 24.3-24.5	128
50%	90	43	---	---	7.8 7.2-7.9	7.3 7.2-7.6	24.3 24.3-24.4	142
100% (1µ filtered)	80	7	---	---	7.6 6.9-7.9	7.1 6.8-7.2	24.2 24.0-24.5	171
100% (Centrifuged)	100	83	---	---	7.8 6.6-8.0	7.3 3.7-8.1	24.8 24.1-25.0	155
					Fathead Minnows			
Lab. Water Control	97	97	97	97	7.5 7.3-7.7	6.8 6.2-7.6	24.5 24.2-24.7	116
6.25%	100	97	97	97	7.4 7.2-7.7	6.7 6.1-7.7	24.6 24.2-24.7	119
12.5%	97	97	97	97	7.6 7.3-7.8	6.9 6.0-7.8	24.6 24.2-24.9	122
25%	97	97	97	97	7.7 7.4-7.8	7.1 6.5-7.6	24.4 24.0-24.8	128
50%	100	100	100	97	7.7 7.2-7.9	7.1 6.6-7.4	24.5 24.1-24.7	142
100% (1 µ filtered)	97	97	97	97	7.5 6.9-7.8	6.7 5.8-7.2	24.7 24.5-24.9	171

TABLE 5. RESULTS OF ACUTE TOXICITY TESTS WITH ELUTRIATES PREPARED FROM SEDIMENT SAMPLES COLLECTED BY GZA ENVIRONMENTAL ON 12 MAY 1993 FROM A FRESHWATER SITE IN THE VICINITY OF THE CENTRAL LANDFILL IN JOHNSTON, RI

(CONTINUED)

Test Concentration	Survival (%) 24 h	48 h	72 h	96 h	pH (SU)	DO (mg/L)	Temp. (°C)	Cond. (µmhos/cm)
Sediment Elutriate from Site No. 24								**(Sample ID No. 93-1837)**
					Ceriodaphnia dubia			
Lab. Water Control	100	97	---	---	7.4 6.7-7.8	7.5 7.2-7.8	24.4 24.1-24.5	116
6.25%	93	83	---	---	7.8 7.8	7.3 7.2-7.7	24.5 24.1-24.6	117
12.5%	93	83	---	---	7.9 7.7-7.9	7.4 7.3-7.7	24.5 24.2-24.5	119
25%	100	70	---	---	7.9 7.7-7.9	7.4 7.2-7.6	24.4 24.1-24.5	125
50%	93	57	---	---	7.8 7.4-7.9	7.3 7.2-7.4	24.5 24.4-24.6	136
100% (1µ filtered)	77	33	---	---	7.7 7.3-7.9	7.2 7.0-7.2	24.5 24.4-24.6	159
100% (Centrifuged)	100	40	---	---	7.7 7.0-7.9	7.3 4.3-8.0	25.9 25.5-26.0	141
					Fathead Minnows			
Lab. Water Control	100	100	100	100	7.6 7.3-7.8	7.0 6.4-7.7	24.5 24.1-24.9	116
6.25%	97	97	97	97	7.7 7.4-7.9	7.2 6.8-7.7	24.6 24.0-24.9	117
12.5%	97	97	97	97	7.7 7.5-7.9	7.2 6.8-7.7	24.5 24.1-24.7	119
25%	97	97	97	93	7.7 7.5-7.9	7.1 6.8-7.6	24.4 24.0-24.7	125
50%	97	97	97	93	7.7 7.4-7.9	6.8 5.7-7.4	24.7 24.6-24.9	136
100% (1 µ filtered)	97	97	97	93	7.6 7.3-7.9	6.6 5.9-7.0	24.7 24.5-24.8	159

TABLE 5. RESULTS OF ACUTE TOXICITY TESTS WITH ELUTRIATES PREPARED FROM SEDIMENT SAMPLES COLLECTED BY GZA ENVIRONMENTAL ON 12 MAY 1993 FROM A FRESHWATER SITE IN THE VICINITY OF THE CENTRAL LANDFILL IN JOHNSTON, RI

(CONTINUED)

Test Concentration	Survival (%) 24 h	48 h	72 h	96 h	pH (SU)	DO (mg/L)	Temp. (°C)	Cond. (µmhos/cm)
Sediment Elutriate from Site No. 30							**(Sample ID No. 93-1838)**	
Ceriodaphnia dubia								
Lab. Water Control	100	100	---	---	7.9 7.8-7.9	7.5 7.4-7.7	24.0 23.7-24.4	114
6.25%	100	97	---	---	7.9 7.8-8.0	7.4 7.3-7.7	24.2 24.0-24.4	118
12.5%	93	73	---	---	7.9 7.7-8.0	7.4 7.4-7.6	24.2 24.1-24.6	121
25%	93	70	---	---	7.9 7.6-7.9	7.4 7.3-7.4	24.2 24.0-24.5	126
50%	100	67	---	---	7.8 7.5-7.9	7.2 7.0-7.4	24.2 24.1-24.5	137
100% (1µ filtered)	97	70	---	---	7.6 7.4-7.7	6.6 6.0-6.8	24.3 24.2-24.5	161
100% (Centrifuged)	100	100	---	---	7.8 7.0-8.0	7.3 3.6-8.1	25.6 24.6-25.9	153
Fathead Minnows								
Lab. Water Control	93	93	93	93	7.3 7.0-7.8	7.0 6.4-7.7	24.6 24.4-24.8	114
6.25%	100	100	100	100	7.5 7.2-7.8	7.2 6.6-7.7	24.5 24.0-24.7	118
12.5%	100	100	100	100	7.5 7.2-7.8	7.0 6.4-7.6	24.6 24.3-24.8	121
25%	97	97	97	97	7.5 7.3-7.9	7.0 6.2-7.6	24.6 24.3-24.9	126
50%	100	97	97	97	7.4 7.0-7.7	6.6 6.0-7.5	24.7 24.5-24.9	137
100% (1 µ filtered)	67	53	53	53	6.9 6.6-7.4	6.2 4.8-7.2	24.6 24.1-24.9	161

For Site No. 21, C. dubia survival in the 6.25, 12.5, 25, and 50% elutriate was 93, 90, 77, and 43%, respectively; the A-NOEC for Site No. 21 sediment elutriate was 12.5% elutriate.

For Site No. 24, C. dubia survival in the 6.25, 12.5, 25, and 50% elutriate was 83, 83, 70, and 57%, respectively; the A-NOEC for Site No. 24 sediment elutriate was also 12.5% elutriate.

For Site No. 30, C. dubia survival in the 6.25, 12.5, 25, and 50% elutriate was 97, 73, 70, and 67%, respectively; the A-NOEC for Site No. 30 sediment elutriate was 6.25% elutriate.

All three filtered elutriates were brown in color and exhibited some turbidity (i.e., cloudy suspensions). Because C. dubia are filter feeders and are sensitive to suspended particulates in the water column, aliquots of the three sediment elutriates were centrifuged and then evaluated for acute toxicity. Survival of C. dubia in the undiluted centrifuged elutriate samples was 83, 40, and 100% for sediments collected from Site Nos. 21, 24, and 30, respectively (Table 5). Thus, centrifuged elutriates prepared from sediments collected from Site Nos. 21 and 30 were less toxic than the filtered elutriates; the centrifuged elutriate from the Site No. 24 sediment was similar in toxicity to the filtered elutriate (40% and 33% survival for the centrifuged and filtered elutriates, respectively).

C. dubia survival in the laboratory-water controls was ≥ 97% for the elutriate toxicity tests. Survival in the 1 μm filtered elutriate and the centrifuged elutriate from the reference sediment (Mashapaug Pond) was 77% and 97%, respectively (Table 6). Lower survival in the filtered elutriate may have been due to suspended particulates in the sample; centrifugation removed the particulates and eliminated the acute toxicity.

Fathead Minnows

Fathead minnow survival at test completion (96 h) in the undiluted filtered elutriate samples was 97, 93, and 53% for sediments collected from Site Nos. 21, 24, and 30, respectively (Table 5). The 96-h LC_{50} values for fathead minnows were all > 100% elutriate (Table 4).

For Site No. 21, fathead minnow survival after 96 h in the 6.25, 12.5, 25, and 50% sediment elutriate was 97%; the A-NOEC for Site No. 21 sediment elutriate was 100% elutriate.

For Site No. 24, fathead minnow survival in the 6.25, 12.5, 25, and 50% sediment elutriate was ≥ 93%; the A-NOEC for Site No. 24 sediment elutriate was also 100% elutriate.

TABLE 6. RESULTS OF ACUTE SCREENING TOXICITY TESTS WITH AN ELUTRIATE PREPARED FROM A REFERENCE SEDIMENT SAMPLE COLLECTED ON 10 MAY 1993 FROM MASHAPAUG POND IN UNION, CT

Test Concentration	Survival (%) 24 h	48 h	72 h	96 h	pH (SU)	DO (mg/L)	Temp. (°C)	Cond. (µmhos/cm)
Sediment Elutriate from Reference Site								**(Sample ID No. 93-1823)**
					Ceriodaphnia dubia			
Lab. Water[a] Control	100	100	---	---	7.5 6.8-7.9	7.7 7.2-8.0	24.8 24.7-25.0	115
100% (1µ filtered)	100	77	---	---	7.5 7.4-7.8	7.5 7.4-7.8	24.5 24.1-24.7	116
100% (Centrifuged)	100	97	---	---	7.7 7.2-7.9	7.4 5.8-7.9	24.4 24.4-24.5	74
					Fathead Minnows			
100% (1 µ filtered)	97	97	97	97	7.3 6.9-7.8	6.6 6.0-7.7	24.6 24.1-24.7	116

[a] Laboratory-water control using C. dubia was evaluated concurrently with the 100% screening tests using the centrifuged elutriate samples (Test Dates: 13-15 May 1993).

For Site No. 30, fathead minnow survival in the 6.25, 12.5, 25, and 50% elutriate was ≥ 97%; survival in the 100% sediment elutriate was only 53% at test completion. The A-NOEC for Site No. 30 sediment elutriate was 50% elutriate.

Although all three filtered elutriates were brown in color and exhibited some turbidity, the turbidity did not appear to affect the fathead minnows.

Fathead minnow survival in the laboratory-water controls was ≥ 93% for the elutriate toxicity tests. Survival in the 1 μm filtered elutriate from the reference sediment (Mashapaug Pond) was 97% (Table 6).

Summary

The elutriate test results for the sediment samples collected by GZA Environmental on 12 May 1993 can be summarized as follows:

- **Site No. 21:** Significant acute toxicity of filtered elutriate to C. dubia (48-h LC_{50} = 40.4% elutriate; A-NOEC = 12.5% elutriate) with 7% survival in the undiluted elutriate at test completion (survival in the centrifuged elutriate was increased to 83%). No significant acute toxicity to fathead minnows (96-h LC_{50} > 100% elutriate; A-NOEC = 100% elutriate) with 97% survival in undiluted filtered elutriate at test completion.

- **Site No. 24:** Significant acute toxicity of filtered elutriate to C. dubia (48-h LC_{50} = 58.9% elutriate; A-NOEC = 12.5% elutriate) with 33% survival at test completion (survival in the centrifuged elutriate was increased to only 40%). No significant acute toxicity to fathead minnows (96-h LC_{50} > 100% elutriate; A-NOEC = 100% elutriate) with 93% survival in undiluted filtered elutriate at test completion.

- **Site No. 30:** Significant acute toxicity of filtered elutriate to C. dubia (48-h LC_{50} > 100% elutriate; A-NOEC = 6.25% elutriate) with 70% survival at test completion (survival in the centrifuged elutriate was increased to 100%). Significant acute toxicity to fathead minnows (96-h LC_{50} > 100% elutriate; A-NOEC = 50% elutriate) with 53% survival in undiluted filtered elutriate at test completion.

If you have any questions concerning the elutriate toxicity test results, please contact me at (203) 643-9560.

Sincerely,

John D. Cooney

John D. Cooney, Ph.D.
Laboratory Director

References

American Society For Testing and Materials (ASTM). 1990. Standard Guide for Collection, Storage, Characterization, and Manipulation of Sediments for Toxicological Testing. Designation E 1391-90. ASTM, Philadelphia, PA. 15 pp.

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APPENDIX A

CHAIN OF CUSTODY FORMS

NEW ENGLAND BIOASSAY, INC.
77 BATSON DRIVE
MANCHESTER, CT 06040
(203) 643-9560

CHAIN OF CUSTODY

PROJECT NAME: GZA Environmental
PROJECT LOCATION: Newton Upper Falls, MA
PROJECT NUMBER: 193-017

SOURCE CODE:
W = WELL O = OUTFALL RO = RUNOFF B = BOTTOM SEDIMENT DR = DILUENT RIVER
LF = LANDFILL T = TREATMENT FACILITY L = LAKE/OCEAN X = OTHER/SPECIFY _____ DO= DILUENT OCEAN

NEB SAMPLE NUMBER	SAMPLE ID.	SOURCE CODE	SAMPLE TYPE GRAB	SAMPLE TYPE COMP.	CONTAINER NO.	CONTAINER TYPE	CONTAINER SIZE	CONTAINER PRES	ANALYSIS REQUIRED	DATE/TIME OF COLLECTION
93-1836	SED 93-27-I	B	✓		3	P	1l	I	Static-acute definitive w/ C. dubia and P. promelas	DATE: 5-12-93 TIME: 10:30 h
93-1837	SED 93-24 I	B	✓		3	P	1l	I	"	DATE: 5/12/93 TIME: 1110 h
93-1838	SED 93-30 I	B	✓		3	P	1l	I	"	DATE: 5/12/93 TIME: 1145 h
										DATE: TIME:
										DATE: TIME:
										DATE: TIME:
										DATE: TIME:
										DATE: TIME:

CONTAINER TYPE: P = PLASTIC E = EPA VIAL C = CUBE G = GLASS A = AMBER GLASS B = BACTERIA BOTTLE
PRESERVATION CODE: I = ICED F = FILTERED N = NITRIC ACID H = HYDROCHLORIC ACID (HCL)
S = SODIUM HYDROXIDE (NaOH) T = SODIUM THIOSULFATE O = OTHER/SPECIFY

SAMPLER'S SIGNATURE	AFFILIATION	DATE	TIME
X Mark P. Wolfe	GZA	5/12	1515

TRANSFERS RELINQUISHED BY:	ACCEPTED BY:	DATE	TIME
X Mark P. Wolfe	Warren J. Eldridge	5-12	3:20
Warren J. Eldridge	NEB	5/12	5:45
NEB	Richard M. Martin	5/13/93	0750 ~~0800~~

ADDITIONAL COMMENTS:

METHOD OF SHIPMENT:	DATE	TIME
Picked up by NEB		

IEA
An Aquarion Company

200 Monroe Turnpike
Monroe, CT 06468
203-261-4458

New England Division

CHAIN OF CUSTODY RECORD

PAGE 1 OF 1 NO.

~~IEA JOB #~~

CLIENT: GZA GeoEnvironmental, Inc.

PROJECT ID: 31030.01

~~IEA PROJECT MGR~~: John Cooper

RUSH ☐ YES ☒ NO DUE DATE 5-28-93

TESTS								GENERAL REMARKS
Elutriate Toxicity Test								
BOTTLE TYPE AND PRESERVATIVE								
Poly/None								

BOTTLE SET #	CLIENT SAMPLE ID	DATE / TIME SAMPLED	MATRIX	LAB ID	QC Y / N	FIELD FILTERED - CIRCLE Y or N: Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	SAMPLE REMARKS
1	SED93-21-I	5-12-93/10:30	SED			3x1 liter								
2	SED93-24-I	5-12-93/11:10	SED			3x1 liter								
3	SED93-30-I	5-12-93/1145	SED			3x1 liter								

MATRIX CODES

A - AIR
AQ - AQUEOUS
C - COMPLEX
D - DRUM WASTE
OI - OIL
S - SOIL
SL - SLUDGE
W - WIPE
O - OTHER
FB - FIELD BLANK
TB - TRIP BLANK

BOTTLES SHIPPED BY: Tim Driggs DATE / TIME 5/12/93
SIGNATURE

BOTTLES REC'D BY: MARK F. DALPE DATE / TIME 5/12 1515
SIGNATURE: Mark F. Dalpe

SAMPLES COLLECTED BY: Tim Driggs DATE / TIME 5/12/93
SIGNATURE

RECEIVED IN LAB BY: Warren Ellis DATE / TIME
SIGNATURE

REMARKS ON SAMPLE RECEIPT

☐ BOTTLES INTACT ☐ CUSTODY SEALS
☐ PRESERVED ☐ SEALS INTACT
☐ CHILLED ☐ SEE REMARKS

NEW ENGLAND BIOASSAY, INC.
77 BATSON DRIVE
MANCHESTER, CT 06040
(203) 643-9560

CHAIN OF CUSTODY

PROJECT NAME: GZA ENVIRONMENTAL
PROJECT LOCATION: Johnston R.I.
PROJECT NUMBER: 193-017

SOURCE CODE:
W = WELL O = OUTFALL RO = RUNOFF B = BOTTOM SEDIMENT DR = DILUENT RIVER
LF = LANDFILL T = TREATMENT FACILITY L = LAKE/OCEAN X = OTHER/SPECIFY _____ DO= DILUENT OCEAN

NEB SAMPLE NUMBER	SAMPLE ID.	SOURCE CODE	SAMPLE TYPE GRAB	SAMPLE TYPE COMP.	CONTAINER NO.	CONTAINER TYPE	CONTAINER SIZE	CONTAINER PRES	ANALYSIS REQUIRED	DATE/TIME OF COLLECTION
93-1823A	MACHAPUNG SEDIMENTS	B	✓		1	P	5GAL	I	Acute Elutriate	DATE: 5/10/93 TIME: 1130
93-1823B	MACHAPUNG SEDIMENTS	B	✓		1	P	5GAL	I	Controls (GZA)	DATE: 5/10/93 TIME: 1200
										DATE: TIME:
										DATE: TIME:
										DATE: TIME:
										DATE: TIME:
										DATE: TIME:
										DATE: TIME:

CONTAINER TYPE: P = PLASTIC E = EPA VIAL C = CUBE G = GLASS A = AMBER GLASS B = BACTERIA BOTTLE
PRESERVATION CODE: I = ICED F = FILTERED N = NITRIC ACID H = HYDROCHLORIC ACID (HCL)
S = SODIUM HYDROXIDE (NaOH) T = SODIUM THIOSULFATE O = OTHER/SPECIFY

SAMPLER'S SIGNATURE	AFFILIATION	DATE	TIME	TRANSFERS RELINQUISHED BY:	ACCEPTED BY:	DATE	TIME
Tracy L. Fleck	NEB	5/10/93	1320				
				Tracy L. Fleck	Richard M. Murphy	5/10/93	1600 ~~1400~~

ADDITIONAL COMMENTS:

METHOD OF SHIPMENT:	DATE	TIME

MISCELLANEOUS DOCUMENTATION FORM

Client: GZA

Test ID #: NA

Date: 5/18/93

Job # 193-017

Investigator: R. Montgomery

COC # 93-1836-93-1838

Type of Manipulation Dry Weight of Pre Filtered Elutriates

~~Sample #~~

3 ml of each subsample of Elutriates were pipetted onto a tared weigh pan, dried at 100+4°C for 24h then weighed for g/ml All Weights in grams

Tare wt 5/18 TF Total Wt RM 5/20

Sample #	total Wt	Tare Wt	Wt/3ml	wt/ml
24 A	1.26923	1.17335	0.09588	0.03196 g
24 B	1.20425	1.10668	0.09757	0.03252 g
24 C	1.26308	1.16429	0.09879	0.03293 g
21 A	1.12515	1.08390	0.04125	0.01375 g
21 B	1.14933	1.10023	0.04407	0.01469 g
21 C	1.18488	1.14011	0.04477	0.01492 g
30 A	1.23529	1.18482	0.05047	0.01682 g
30 B	1.17141	1.12086	0.05055	0.01685 g
30 C	1.25361	1.20262	0.05099	~~0.0170~~ 0.0170 g

Math error RM 5/20

Date/Time In Oven 5/18 @1630 96°C

Date/Time Out Oven 5/19 @ 1600 99°C