DEPARTMENT OF THE NAVY
CRANE DIVISION
NAVAL SURFACE WARFARE CENTER
300 HIGHWAY 361
CRANE INDIANA 47522-5001

IN REPLY REFER TO:

5090
Ser 095/2036
28 JAN 2002

U.S. Environmental Protection Agency, Region V
Waste, Pesticides, & Toxics Division
Waste Management Branch
Corrective Action Section
Attn: Mr. Peter Ramanauskas (DW-8J)
77 West Jackson Blvd.
Chicago, IL 60604

Dear Mr. Ramanauskas:

Crane Division, Naval Surface Warfare Center (NSWC Crane) resubmits for review and approval with incorporated comments the Supplemental Toxicity Report Revision 1. Three copies of the report are provided as enclosure (1). Enclosure (2) is the required certification statement.

NSWC Crane point of contact is Ms. Christine D. Freeman, Code 09511, telephone 812-854-4423.

Sincerely,

James M. Hunsicker

JAMES M. HUNSICKER
Director Environmental Protection
Department
By Direction
of The Commander

Encl:
(1) Supplemental Toxicity Report Revision 1
(2) Certification Statement

Copy to:
Administrative Record
IDEM (D. Griffin)
SOUTHNAVFACENGCOM (Code ES32)
TolTest

Response to Comments on the Supplemental Toxicity Report
NSWC CRANE, Indiana
For Comments Received from EPA Dated 12/18/01

Comment 1:

The report is a bit confusing with respect to sampling. It appears toxicity data from aged compost were compared to S-001 Day 26 data collected and analyzed 2.5 years earlier (Executive Summary, Para 3; Introduction, Sect 1.1, Para 2). Yet in some parts of the report it seems S-001 Day 26 samples were analyzed along with aged samples (Introduction, Sect 1.1.1, 1.1.2; Test Results, Para 1, Sent 4; Table 2-1). This should be stated more clearly. Much of this information is probably found in the Toxicity Report (MK, 1999) and Sampling Plan (MK, 2000). However, it would be helpful to the reader of this report to include identities of the samples analyzed.

Response 1:

Toxicity data from aged compost was indeed compared to S-001 Day 26 data collected and analyzed 2.5 years earlier. This has been clarified in the report.

Comment 2:

The report should describe the differences between piles S-001, S-096, S-159, and S-178. Any differences between Mine Fill A and Mine Fill B should be described. What is the difference between sample PCS-001 and PCS-002 FC in Table 1-1?

Response 2:

The difference between piles S-001, S-096, S-159, and S-178 has been distinguished in the report to include their ages. There is virtually no difference between Mine Fill A and Mine Fill B in regards to soil type and Mine Fill operations. This fact has been placed in the report. PCS-002 FD is a field duplicate of PCS-001, and this has been distinguished in the report.

Comment 3:

It appears only duplicates were collected from aged compost piles. If correct, was there a specific reason to analyze duplicates while five replicates were available from S-001 Day 26?

Response 3:

The Work Plan for the Supplemental Toxicity sampling required that one sample be obtained from each of the four aged windrows and that one duplicate be obtained. This duplicate was taken from windrow S-001 aged 2.5 years. When S-001 was initially sampled on Day 26, five samples were obtained from it, one per cross section.

Comment 4:

Table 2-1 shows greatly reduced toxicity for windrows S-159, S-096, and S-178 relative to S-001 Day 26 (no statistics). However, aged (2.5 years) S-001 compost shows no decrease in toxicity to earthworms. This outcome is mentioned in the Summary (Sect 2.4) and Conclusion (Sect 5.0) where it states, "no explanation is provided for this dose response." I realize there is no good explanation for these data, but I recommend a little more discussion of them since the report implies aging of compost decreases toxicity.

Response 4:

A possible explanation of the data has now been added to Section 2.4.

Comment 5:

Page E-1, Para 2, states that acute toxicity testing was performed on composted soil from Mine Fill A to determine the toxic effects of the composted soil on the environment. What about Mine Fill B?

Response 5:

Toxicity testing on MFB soil is now discussed in the second paragraph of Section 1.1.

Comment 6:

Page E-1, Para 2, change the word "affects" to "effects".

Response 6:

The word "affects" has been changed to "effects".

Comment 7:

Page E-1, Para 3, Sen. 3, change the word "is" to "was".

Response 7:

The word "is" has been changed to "was".

Comment 8:

Page E-1, Para 3 is unclear. Was S-001generated just prior to testing or were the original results [used]?

Response 8:

The text of the Executive Summary and the Introduction has been changed to clarify the issue.

Comment 9:
Page E-1, Para 6, Sen. 1, change the word "bacteria" to "bacterium".

Response 9:
The word "bacteria" has been changed to "bacterium".

Comment 10:
Page 1-1, Para 1, Sen. 5; "Mine Fill B [MK, 2000]" needs to be defined.

Response 10:
"Mine Fill B [MK, 2000]" is part of a title. The entire title has now been italicized.

Comment 11:
Page 1-1, Para 2, Sen. 3, change the first "toxicity" to "toxic".

Response 11:
The word "toxicity" has been changed to "toxic".

Comment 12:
Page 1-1, Para 2, the validity of comparisons should be discussed briefly.

Response 12:
The validity of comparing aged to un-aged compost is now provided in the text. Further explanation can be found in the STS-SAP.

Comment 13:
Page 1-1, Para 4, Sen. 3 states "five samples collected from Windrow S-001 Day 26". Is this 2.5 years ago? This is confusing the way it is written.

Response 13:
This issue has been clarified in previous paragraphs and has been removed from this section.

Comment 14:
Page 1-2, table 1-1, what is the difference between Sample ID PCS-001 and PCS-002 FD?

Response 14:
PCS-002 FD is a field duplicate of PCS-001.

Comment 15:

There is a question about standard error for the text on Page 2-2, Sec 2.2, Para 1.

Response 15:

The averaged results have now been removed from the tables 2-1 and 3-1. The values listed are as they appear in the laboratory reports. The laboratory reports can be found in Appendix A and B.

Comment 16:

Page 2-2, Table 2-1, does the Earthworm Toxicity Results (%) project standard error?

Response 16:

See Response 15.

Comment 17:

Page 2-2, Table 2-1, "S-001 appears to have become more toxic at 2.5 years."

Response 17:

The data supports this theory and a possible explanation has been added to Section 2.4.

Comment 18:

Page 2-4, Sec 2.4, Para 1, Sen. 2, change the first "in" to "is".

Response 18:

This paragraph has been re-worded.

Comment 19:

Page 3-1, Sec 3.2, Sen. 4 states "five samples collected from Windrow S-001 Day 26 have been averaged". How many new samples from sites were averaged? Were there any duplicates?

Response 19:

All averaging has been eliminated, as previously noted. One duplicate was obtained, as previously noted.

Supplemental Toxicity Report

Full-Scale Bioremediation
NSWC Crane
Crane, Indiana

Revision 2

May 2002

Southern Division
Naval Facilities Engineering Command
North Charleston, South Carolina
29419-9010

SUPPLEMENTAL TOXICITY REPORT

FULL-SCALE BIOREMEDIATION
NSWC CRANE
CRANE, INDIANA

Revision 2

May 2002

ENVIRONMENTAL JOB ORDER CONTRACT
CONTRACT N68950-96-D-0052
DELIVERY ORDER #FC08
TolTest Project No. 37324.11

Prepared for

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Peter J. Chevalier 5/21/02
Peter J. Chevalier — Date
Project Manager/Environmental Specialist

APPROVED BY:

5/21/02
Lance Parsons — Date
Regional Manager

EXECUTIVE SUMMARY

Explosives contaminated soil at Naval Surface Warfare Center (NSWC) Crane, Indiana, is being treated through a composting bioremediation process. While treatment of the soil in this process results in contaminant reduction to industrial use clean-up levels as established by the United States Environmental Protection Agency Region V (U.S. EPA Region V), the toxic effect of the treated soil, or compost, on the environment is a concern.

Acute toxicity testing was initially performed on composted soil from Mine Fill A (MFA) to determine the toxic effects of the composted soil on the environment. The compost used for this study was obtained from Windrow S-001 on Day 26, the last day of its process cycle. The findings were reported in the *Toxicity Report, Full-Scale Bioremediation, NSWC Crane, Crane, Indiana [MK, 1999].*

The initial toxicity testing performed by MK [MK, 1999] verified that treated contaminated soil compost did not show a greater toxicity than treated non-contaminated soil compost. However, the testing program was not designed to evaluate the effects on toxicity of aged compost. Consequently a supplemental toxicity testing plan was developed to determine if there was a reduction in the toxicity of treated compost over time. This plan is entitled *Sampling and Analysis Plan for Supplemental Toxicity Sampling of Composted Material from Mine Fill A and Mine Fill B, NSWC Crane, Crane, Indiana [MK, 2000].*

To determine the effects of age on compost toxicity, four windrows of varying age (including S-001) which had been placed in the field as backfill, were sampled and analyzed for toxicity parameters. The results of the aged compost toxicity tests were then compared with results from the un-aged, original toxicity tests performed by MK on windrow S-001 Day 26 samples.

Environmental effects were evaluated using two toxicity methods: Earthworm and Microtox® Toxicity; and two pathogen tests: fecal coliform and salmonella.

The Earthworm Toxicity analysis subjected earthworms, *Eisenia foetida,* to various concentrations of compost to determine the concentration of compost that would result in a 50% mortality of the sample population (LC-50). Results show a decrease in toxicity with increasing age of the compost except for the most aged compost. A possible explanation for this anomaly was attributed to the infusion of compost leachate which resulted in an elevated toxic effect.

Microtox® analysis was used to evaluate the toxic effects of the composted soil on the illuminance of the marine bacterium *Photobacterium phosphoreum.* This organism was subjected to various concentrations of compost to determine the concentration of compost which resulted in a 50% reduction in the illuminance of the bacteria (EC-50).

The results indicated that all aged compost was less toxic to this organism than freshly processed compost.

Pathogen analysis was performed based on specifications found in 40 CFR 503.32, which state that sewage sludge may be used in land application if it meets established requirements for fecal coliform and salmonella analysis. The compost resulting from full-scale biofacility operations is intended to be used for land application; therefore, these same standards were applied to the compost. The results from all samples, regardless of age, met the requirements for use in land application.

Given these results, the composted soil should be considered acceptable for use as a topsoil or backfill for general land application.

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B Pathogen Testing Results, Pure Earth Environmental Lab, Inc.

C Letter from Aqua Survey Inc.'s Laboratory Manager

D Aqua Survey Inc.'s SOP/SEP/202

E Field Change Request FS-032

ACRONYMS AND ABBREVIATIONS

ASI	Aqua Survey, Inc.
^{o}C	degrees Centigrade
EC	effective concentration
FCR	Field Change Request
FS-QAPP	Full-Scale Quality Assurance Project Plan
KCl	potassium chloride
LC	lethal concentration
LCS	laboratory control sample
MFA	Mine Fill A
MFB	Mine Fill B
mg/L	milligrams per liter
MK	Morrison Knudsen
ml	milliliter
MPN	most probable number
NSWC	Naval Surface Warfare Center
ppm	parts per million
PE	Pure Earth Environmental Lab, Inc.
QAPP	Quality Assurance Project Plan
QC	quality control
STS-SAP	Supplemental Toxicity Sampling –Sampling and Analysis Plan
SOP	Standard Operating Procedure
su	standard unit
TT	TolTest Inc
TtNUS	TetraTech, NUS
U.S. EPA	U.S. Environmental Protection Agency Region V

1.0 INTRODUCTION

1.1 PURPOSE AND OBJECTIVES

Full-scale operations of the Soils Bioremediation Facility began April 13, 1998 at the Naval Surface Warfare Center (NSWC) Crane Division in Crane, Indiana. Acute toxicity testing was initially performed by Morrison Knudsen, Corp. (MK) on contaminated soil from Mine Fill A (MFA) composted in Windrow S-001, the first full-scale windrow. The windrow was sampled on Day 26, the last day of its process cycle. The objective of the testing was to determine the toxic affects of the composted soil on the environment. The findings of this testing, reported in *Toxicity Report Full-Scale Bioremediation NSWC Crane, Crane, Indiana [MK, 1999],* verified that treated contaminated soil compost did not show a greater toxicity than treated non-contaminated soil compost.

Toxicity testing was not performed on contaminated soil from Mine Fill B (MFB) since it was determined that MFA and MFB had such similar characteristics (primarily soil type and constituents of concern) that a separate toxicity study for MFB was not necessary. Correspondence regarding this decision can be found in Appendix A of the *Sampling and Analysis Plan for Supplemental Toxicity Sampling of Composted Material from Mine Fill A and Mine Fill B [MK, 2000]* (STS-SAP).

The initial toxicity testing program was not, however, designed to evaluate the effects on toxicity of aged compost. Therefore the STS-SAP was developed and approved by the EPA to determine if there was a reduction in the toxicity of the treated compost over time. To determine this, the toxicity results of the initial Windrow S-001 Day 26 samples (i.e. un-aged compost) were compared to toxicity results from compost that had been previously processed and placed as backfill (i.e. aged compost). The aged compost included Windrow S-001.

This report summarizes the activities for the supplemental toxicity sampling and analysis performed on four select windrows of varying age: S-001, S-096, S-159, and S-178. The age of these windrows at the time of sampling is shown in Table 1-1. All four windrows had previously been placed as backfill at either MFA or MFB. The results of this analysis were then compared to the results of the initial S-001 Day 26 samples. The differences were then compared to determine if the aged compost was less toxic than the fresh, un-aged compost.

The toxic effects were studied using two toxicity methods: Earthworm and Microtox® Toxicity; and two pathogen tests: fecal coliform and salmonella. Details of the earthworm and Microtox® test procedures and results can be found in the Microtox® and Earthworm Toxicity Report from Aqua Survey, Inc. (ASI) provided in Appendix A. Pathogen test results from Pure Earth Environmental Labs, Inc. (PE) are provided in Appendix B.

1.1.1 Earthworm Toxicity

The objective of earthworm toxicity testing is to assess the acute toxicity of the composted soil on earthworms. This test determines the lethal concentration of compost which causes a 50% mortality of earthworms (LC-50).

1.1.2 Microtox® Analysis

The objective of Microtox® toxicity testing is to assess the acute toxicity of the composted soil on the marine bacterium *Photobacterium phosphoreum*. This test determines the effective concentration of compost which causes a 50% decrease in the illuminance of the test organisms (EC-50).

1.1.3 Pathogen Testing and Analysis

The objectives for pathogen testing were based on specifications found in 40 CFR 503.32, which pertain to the use or disposal of sewage sludge. These specifications state that sewage sludge may be used for land application if the sludge contains less than the regulated amounts of fecal coliform and salmonella. The composted soil has been returned to the land therefore these same standards will be applied to the compost. Objectives for the density of fecal coliform in the compost are less than 1000 Most Probable Number (MPN) per gram of dry solids on a dry weight basis, and salmonella is less than three MPN per four grams of dry solids on a dry weight basis.

1.2 SAMPLE COLLECTION

For this study, 5 samples (including one duplicate) were collected from the four aged compost windrows. The windrows were chosen specifically for their age at the time of sampling. Details concerning the four windrows and their identifying sample numbers are listed in Table 1-1. Figures 1 through 4 depict the field placement locations for these windrows.

The sampling procedures outlined in Appendix D of the STS-SAP were followed while collecting the compost samples. Windrow S-001 was exposed with a backhoe prior to sampling since it was buried at the bottom of the berm. The other three windrows were at the surface and the top foot was exposed with a shovel prior to sampling. Samples for Microtox® and Pathogens analysis were contained in 8 ounce glass jars. The samples for earthworm toxicity were contained in a 3.5-gallon HDPE pail lined with two plastic bags.

Table 1-1
Windrow Identifiers

Sample ID	Windrow #	Day Zero	Day Last	# of Days Processed	Cleanup Goal Achieved	Date Placed in Field	Approximate Compost Age	Burial Depth	Placement Area
PCS-001	S-001	4/15/98	5/11/98	26	Residential	5/98	2.5 years	8 feet	MFA, B-159
PCS-002 FD	S-001	4/15/98	5/11/98	26	Residential	5/98	2.5 years	8 feet	MFA, B-159
PCS-003	S-096	8/5/99	8/11/99	6	Residential	8/17/99	15 months	Surface	MFA, South PPA*
PCS-004	S-159	5/1/00	5/10/00	9	Residential	5/16/00	6 months	Surface	MFB, PPA
PCS-005	S-178	7/25/00	8/4/00	10	Residential	8/10/00	3 months	Surface	MFB, B-166

*PPA = Permanent Placement Area
FD = Field Duplicate

2.0 EARTHWORM TOXICITY

2.1 TEST METHOD DESCRIPTION

Earthworm Toxicity analysis was performed at ASI using the test organism, *Eisenia foetida,* supplied by Carolina Biological Supply Company. The laboratory standard operating procedure (SOP) followed in performing the analysis is included in the Full-Scale Quality Assurance Project Plan [MK, 1998] Appendix G, page A-4. Adult earthworms, which were greater than 60 days of age, were received at the laboratory in a healthy condition by overnight delivery from the supplier. The earthworms were maintained by the laboratory in artificial soil consisting of a mixture of sphagnum moss, clay and silica sand during the one-day acclimation period. The earthworm environment was kept at a temperature of 20 $\pm$ 2 degrees Centigrade (°C) during which time the earthworms were fed with Magic Worm Food® prior to use in this analysis. Feedings were documented on the culture laboratory livestock record.

The laboratory SOP specifies that the earthworms should be allowed to acclimate to the experimental environment for five days prior to initiating any tests, but the earthworms were subjected to only a one-day acclimation period before testing began. The discrepancy in SOP protocol was due to supply and shipping problems. The Laboratory Manager for ASI concluded that the shortened acclimation period did not affect the results of the testing (see the letter from ASI's Laboratory Manager in Appendix C).

After the stabilization period, the earthworms were exposed to five concentrations of the compost mix: 6.25%, 12.5%, 25%, 50%, and 100%. The varying concentrations of compost were prepared using a grinder to homogenize the appropriate quantity of compost with artificial soil from the laboratory. Artificial soil was prepared from a homogenous mixture of 10% sphagnum peat, 20% colloidal kaolinite clay, and 70% grade 70 silica sand. Prior to initializing the test, the water holding capacity of the compost was determined and the test media was hydrated with deionized water to 75% of its water holding capacity.

For each exposure concentration, three testing vessels, each containing 200 grams of compost and artificial soil were prepared (total of 15 test vessels). Ten earthworms were placed in each testing vessel by sequential randomization where no more than two earthworms were added into each vessel at a time. The vessels consisted of a one-liter cleaned canning jar with screw top lids with 1/16-inch diameter holes in the center top for air. The test was conducted under continuous illumination at a temperature of 20+/-2°C. The earthworms were exposed to the compost for 14 days in order to permit a more accurate and complete assessment of the environmental impact of the compost. The earthworms were evaluated at 7-day and 14-day intervals from project initiation. The earthworms were not fed during the duration of the analysis.

2.2 TEST RESULTS

Each test vessel was analyzed separately at 7-day and 14-day intervals. The two replicates from a single concentration were added together to determine a live count for the thirty worms initially subjected to the concentration. Then using the five concentrations for a particular sample, the LC-50 was calculated for each sample. The results for the earthworm toxicity analysis on the four aged windrows and S-001 Day 26 un-aged samples are summarized in Table 2-1. The values reported represent the concentration of compost which resulted in the mortality of 50% of the earthworms.

In addition to the compost sample vessels, a positive control and a negative control was analyzed to demonstrate that the earthworms for this test reacted similar to other earthworms. The positive control utilized potassium chloride (KCl) as a reference toxicant. The LC-50 for KCl was 6,372.8 parts per million (ppm) at Day 7 and 5,747.6 ppm at Day 14, which is comparable to the published guideline of 6,340 mg/L. Mean survival of the negative control was 97%, which equates to a mortality rate that is less than the 10% mortality rate permitted by the method.

TABLE 2-1
EARTHWORM TOXICITY RESULTS (%)

	Windrow # and Age				
	S-001 Day 26	S-178 3 months	S-159 6 months	S-096 15 months	S-001 2.5 years
7 Day LC50	36.8	58.8	> 100	> 100	28.1
14 Day LC50	33.0	57.3	> 100	> 100	27.8

2.3 DATA QUALITY CONTROL

All data from the earthworm toxicity analysis were verified, and at least 10% of the samples were validated by TolTest Inc. (TT) personnel per the procedures outlined in Section 9.0 of the *FS-QAPP* [MK, 1998]. Data were compared with field and laboratory quality control (QC) sample data to assess its usability for supporting operational decisions. The results of data verification and validation are presented in this section.

Data associated with the earthworm toxicity were verified by reviewing chain-of-custody forms, sample preservation records, analytical holding times, requested turnaround times, and sample data in comparison to analytical quality assurance objectives. In addition, at least 10% of the samples were validated by performing a thorough review of the analytical data utilizing laboratory analytical records to assess laboratory performance in relation to the quality control criteria and procedural requirements. All samples were received by the laboratory in good condition (i.e., there were no broken containers, and custody seals were intact) and at a recorded temperature of 8°C.

To monitor the conditions in which this analysis took place, the pH of the testing vessels was monitored. Initially, and at the completion of the analysis, the pH of the testing material was recorded. The pH of the compost samples ranged from 6.6 to 8.6 standard units (su). Recommended test conditions for the earthworm are between 4 and 10 su. These values are considered acceptable for the test organisms and are not likely to have caused any adverse reactions.

The temperature of the testing vessels was monitored daily during analysis. Temperatures did not show fluctuations on any day of analysis. Temperature data logs are not available for 11/15/00 and 11/16/00, the first and second day of testing, due to an oversight by ASI. The laboratory manager for ASI concluded that this oversight did not affect the outcome of the test (refer to the ASI letter in Appendix C).

The laboratory recommended test temperature is 20°C $\pm$ 2°C with fluctuation not to exceed more than 3°C on any day of analysis. The highest temperature level recorded was 24.0°C and the lowest was 17.0°C. Although these temperatures exceeded the target temperatures for this test, it is not believed to have affected the outcome of the test.

The laboratory performed method blank, laboratory control sample (LCS) and replicate analyses to evaluate accuracy and precision. A laboratory method blank was prepared from the artificial soil prepared in the laboratory, which was utilized as a dilutant to the compost mixture. This blank was prepared and analyzed with the samples in order to evaluate potential interference from laboratory equipment as well as to determine if the earthworms met established laboratory criteria. Two blanks were analyzed during this test; one showed 0% mortality of the earthworms in the artificial soil and the other showed 3% mortality. Both blanks were less than the 10% blank mortality rate defined for this project. Results of the method blanks are acceptable for all analysis.

The LCS is a sample prepared in the laboratory, consisting of artificial soil spiked with known amounts of target analytes, which is processed through the same preparation as field samples. In this analysis, KCl was used as a reference toxicant. The KCl was utilized as a positive control to evaluate the sensitivity of each batch of organisms. Varying concentrations of KCl contaminated soil were prepared to determine the LC-50 of the KCl contaminated soil. The LC-50 for the KCl was calculated to be 6,372.8 milligrams per liter (mg/L) of KCl for the 7-day test period and 5,747.6 mg/L for the 14-day testing period. This value represents the concentration of KCl, which results in 50% mortality of the earthworms. This value is comparable with published guideline of 6,340 mg/L of KCl, as well as previous laboratory data and verifies that the earthworms reacted at similar sensitivities as other batches of *Eisenia foetida.* Temperature and pH monitoring of the KCl are provided in Appendix A. The accuracy of this LCS meets established acceptance limits for this procedure.

The laboratory SOP specifies that the number of replicates analyzed for this series should be three, but due to an oversight by the laboratory, only two replicates were tested. The laboratory manager for ASI concluded that this oversight did not affect the outcome of the test (refer to the ASI letter in Appendix C).

The consistency between the three vessels created for each compost concentration was evaluated to determine the precision of this analysis. A linear correlation should be seen in the dose responses and the observed mortality for the test samples. This would be demonstrated by an increased mortality as a higher concentration of compost is utilized in the testing vessels. This correlation is not observed in the sample results. There is actually a slight increase in survivability in S-001/S-001FD (2.5 years) as the concentration increases from 12.5% to 25%. The survivability then drops to zero at 50% and 100% concentrations. The survivability of S-096 (15 months) and S-159 (6 months) varies little throughout the test, and indeed the LC50 is calculated to be >100%. S-178 (3 months) exhibits similar characteristics to S-001 and complete extinction is not observed until the concentration reaches 100%.

The QC data demonstrate that analyses exhibit acceptable accuracy and precision when compared to the project's data quality objectives specified in Appendix G of the *FS-QAPP* [MK, 1998]. Acceptable values for both positive and negative controls as well as consistent values between replicates demonstrate that project data quality objectives have been met for the earthworm analysis. The data meets the data quality objectives established for this project and are, therefore, considered usable to support project decisions.

2.4 SUMMARY

The data from Table 2-1 suggests that the toxicity of compost decreases with age, as indicated by the lower LC-50 in the un-aged S-001 Day 26 samples than in progressively older, aged samples. However this dose response was not observed in the oldest sample, Windrow S-001 aged 2.5 years at 50% and 100% concentrations. A potential cause for this apparent reversal in dose response may be the leaching process. Windrow S-001 was placed at the bottom of a berm and was buried under as much as 15 feet of compost. This windrow would therefore have received leachate from the windrows above it, which may have caused an increase in toxicity.

3.0 MICROTOX® ANALYSIS

3.1 TEST METHOD DESCRIPTION

In this analysis, the marine bacterium *Photobacterium phosphoreum* was exposed to various concentrations of elutriate from compost for 5 and 15 minutes according to the SOP in FS-QAPP Appendix G page A-11. However, the SOP for preparation of the elutriate found in the FS-QAPP is appropriate for use on sediments but not on compost. This discrepancy is addressed in a letter from ASI's laboratory manager, presented in Appendix C. The correct SOP, which the laboratory used in this and previous toxicity testing, is provided in Appendix D. Sections 1.7 through 1.9 of this SOP are applicable to preparation of the elutriate from compost. Field Change Request (FCR) FS-032, presented in Appendix E, is a request to replace the old, incorrect SOP for use on sediment, with the correct SOP for use on compost. This FCR has been submitted and approved by the U.S. EPA.

The elutriate was prepared by adding 50 grams dry weight of compost to 500 milliliter (ml) of deionized water which was agitated in the dark for 48 hours at 20± 2°C. After agitation, the suspension was centrifuged and the elutriate fraction was decanted and used to prepare the test solutions.

Test organisms were obtained from Azur Environmental in a freeze-dried culture. The organisms were reconstituted and maintained in a reagent well at a temperature of 5°C for a period of less than two hours prior to analysis. During that time, volumes of organisms were transferred to test cuvettes and acclimated to Mircotox® diluent at the test temperature of 15°C for 15 minutes prior to test initiation. The test began as the organisms were introduced to four elutriate test concentrations of 5.63%, 11.25%, 22.5%, and 45.0% and a blank. Observations of light output for each sample were made five and fifteen minutes after test initiation using a Model 500 Microtox® Unit.

3.2 TEST RESULTS

The results of the Microtox® Toxicity Analysis performed by ASI are summarized in Table 3-1. The raw data from ASI is provided in Appendix A. The values reported represent the effective concentration of compost which resulted in a 50% reduction in the light output (EC-50) of the marine bacterium *Photobacterium phosphoreum*.

Table 3-1
Microtox® Results (%)

	Windrow # and Age				
	S-001 Day 26	S-178 3 months	S-159 6 months	S-096 15 months	S-001 2.5 years
5 Min. EC-50	36.0	>45	>45	>45	>45
15 Min. EC-50	37.8	>45	>45	>45	>45

3.3 DATA QUALITY CONTROL

All data from the Microtox® Toxicity Analysis were verified, and at least 10% of the samples were validated by TT personnel per the procedures outlined in Section 9.0 of the *FS-QAPP* [MK, 1998]. All data were compared with field and laboratory QC sample data to assess its usability for supporting operational decisions. The results of data verification and validation are presented in this section.

Data associated with the Microtox® toxicity were verified by reviewing chain-of-custody forms, sample preservation records, analytical holding times, requested turnaround times, and sample data in comparison to analytical quality assurance objectives. In addition, at least 10% of the samples were validated by performing a thorough review of the analytical data utilizing laboratory analytical records to assess laboratory performance in relation to the quality control criteria and procedural requirements. All samples were received by the laboratory in good condition (i.e., there were no broken containers, and custody seals were intact) and at a recorded temperature of 8°C. This temperature would not have adversely affected either the Microtox analysis since it was performed at 20°C.

Laboratory method blanks consisting of dilutant water were analyzed with each sample. Blank ratios were calculated by dividing the initial blank reading by the blank reading at the appropriate time interval. Blank ratios for the 5-minute interval ranged from 1.00 1.44. Blank ratios for the 15-minute interval ranged from 1.02 to 1.57. These values demonstrate consistent readings between analyses and also meet method criteria for blank ratios which should be greater than 0.75.

The results of all Microtox® EC-50 values fell outside the range of the test concentrations. Concentrations up to 45% elutriate were analyzed during this analysis. An approximated value of greater than 45% was reported by the laboratory for all samples.

The quality control performed for the Microtox® analysis has met method requirements for completion and acceptable precision for this analysis. The data meets the data quality objectives established in Appendix G of the *FS-QAPP* [MK, 1998] for this project and are therefore, considered usable to support project decisions.

3.4 SUMMARY

Federal guidelines have not been established for evaluating EC-50 values. The only comparison which can be made is between the S-001 Day 26 sample results and the current sample results. The results of this testing indicate that aging of the compost, even for a short period of time, has a marked influence on the toxicity to this marine bacterium.

4.0 PATHOGEN TESTING AND ANALYSIS

4.1 TEST METHOD DESCRIPTION

4.1.1 Salmonella Analysis

Salmonella analysis was performed according to the Pure Earth Environmental Laboratory, Incorporated SOP located in Appendix G of the FS-QAPP. For the salmonella analysis, each sample was prepared with three dilution series. Each dilution consisted of a series of five replicate tubes for analysis for a total of 15 tubes for each sample. Tubes were incubated for 24 hours in a water bath at 35.0°C after which time they were examined for turbidity and/or gas production, which would indicate a positive result for salmonella.

4.1.2 Fecal Coliform Analysis

Fecal Coliform analysis was performed according to the Pure Earth Environmental Laboratory, Incorporated SOP located in Appendix G of the FS-QAPP. In the fecal coliform procedure, four dilutions were performed and a series of five replicate tubes were prepared for each dilution for a total of 20 tubes for each sample. Tubes were incubated for 24 hours in a water bath at 44.5°C after which time they were examined for turbidity and/or gas production, which would indicate a positive result for fecal coliform.

4.2 TEST RESULTS

The analytical results from Pure Earth Environmental Lab are summarized in Table 4-1. The raw data is included in Appendix B. The value of the fecal coliform analyses for Windrow S-001 Day 26 samples were initially reported as less than 1,000 MPN per gram of dry solid however positive values for fecal coliform were reported in the four aged windrow samples.

Table 4-1
PATHOGEN ANALYSIS

	Windrow #				
	S-001 Day 26	S-178 3 months	S-159 6 months	S-096 15 months	S-001 2.5 years
Salmonella	<3	<0.117	<0.125	<0.129	<0.109
Fecal Coliform	<1,000	19	371	806	<2.73

4.3 DATA QUALITY CONTROL

All data from the pathogen analysis were verified by TolTest personnel per the procedures outlined in Section 9.0 of the *FS-QAPP* [MK, 1998]. Data was compared with field and laboratory QC sample data to assess its usability for supporting operational decisions. The results of data verification are presented in this section.

Data associated with the pathogen analysis were verified by reviewing chain-of-custody forms, sample preservation records, analytical holding times, requested turnaround times, and sample data in comparison to analytical quality assurance objectives. All samples were received by the laboratory in good condition (i.e., there were no broken containers, and custody seals were intact) and at a recorded temperature of 4°C $\pm$ 2°C.

Other quality control testing performed for both pathogen tests include the analysis of replicates through the use of dilution series. All replicates showed no presence of salmonella or fecal coliform, which demonstrates acceptable precision for this analysis.

4.4 SUMMARY

Pathogen tests were performed to evaluate the compost against “503 Class A” sludge. The 40 CFR 503.32 has established standards for pathogenic bacteria in sewage sludge for both salmonella and fecal coliform of less than 3 MPN per 4 grams dry solid and less than 1,000 MPN per 1 gram dry solids, respectively. The compost samples obtained for this study have met the established criteria for salmonella and fecal coliform.

5.0 CONCLUSION

Acute toxicity testing was performed on aged compost generated from the NSWC Crane BioFacility to determine its toxicity relative to un-aged compost. This was determined using two toxicity methods: Earthworm and Microtox® Toxicity; and two pathogen tests: fecal coliform and salmonella.

The earthworm toxicity analyses suggests that the toxicity of compost decreases with age as indicated by the lower LC-50 in the un-aged Windrow S-001 Day 26 samples than in progressively older samples. However this dose response in not observed at 50% and 100% compost concentrations in the oldest compost sample from Windrow S-001 aged 2.5 years. A potential cause for this may include the leaching process. After processing, Windrow S-001 was placed at the bottom of a berm and buried under as much as 15 feet of compost. This windrow would therefore have received leachate from the windrows above it which may have caused an increase in toxicity. To investigate compost effects to groundwater, ammonia and nitrate will be sampled for at MFA and MFB during the RCRA Facility Investigation to be conducted at MFA, MFB, Cast High Explosives/B-146 Incinerator, and Pyrotechnic Test Area (TtNUS, 2002). Nitrate will also be sampled in surface water for both MFA and MFB.

The Microtox® results were less remarkable in that all aged compost was shown to be less toxic to the marine bacterium used in this test than the freshly processed compost.

The results of the two pathogen tests meet the specifications pertaining to the disposal and use of sewage sludge for both fecal coliform and salmonella for all samples, regardless of age. Fecal coliform results were less than 1,000 MPN per gram of solid and salmonella results were less than three MPN per four grams of solid for all samples.

The composting process has demonstrated that the bioremediation technology is a safe and effective treatment alternative for detoxifying soil contaminated with explosive compounds. The composted soil has been shown, over a period of time, to support the re-establishment of plants (e.g. grass) in land applications. The compost is suitable for recycling and reuse in accordance with 40 CFR 503.32, and it meets the same requirements as sewage sludge. Therefore the composted soil should be considered acceptable for use as backfill or a top soil in approved land application locations.

6.0 REFERENCES

MK, 1998 *Quality Assurance Project Plan for Full-Scale Operations,* Soils Bioremediation Facility, NSWC Crane, Crane, Indiana. Delivery Order Number 0009, Contract Number N62467-93-D-1106. Prepared by Morrison Knudsen Corporation, March 12, 1998.

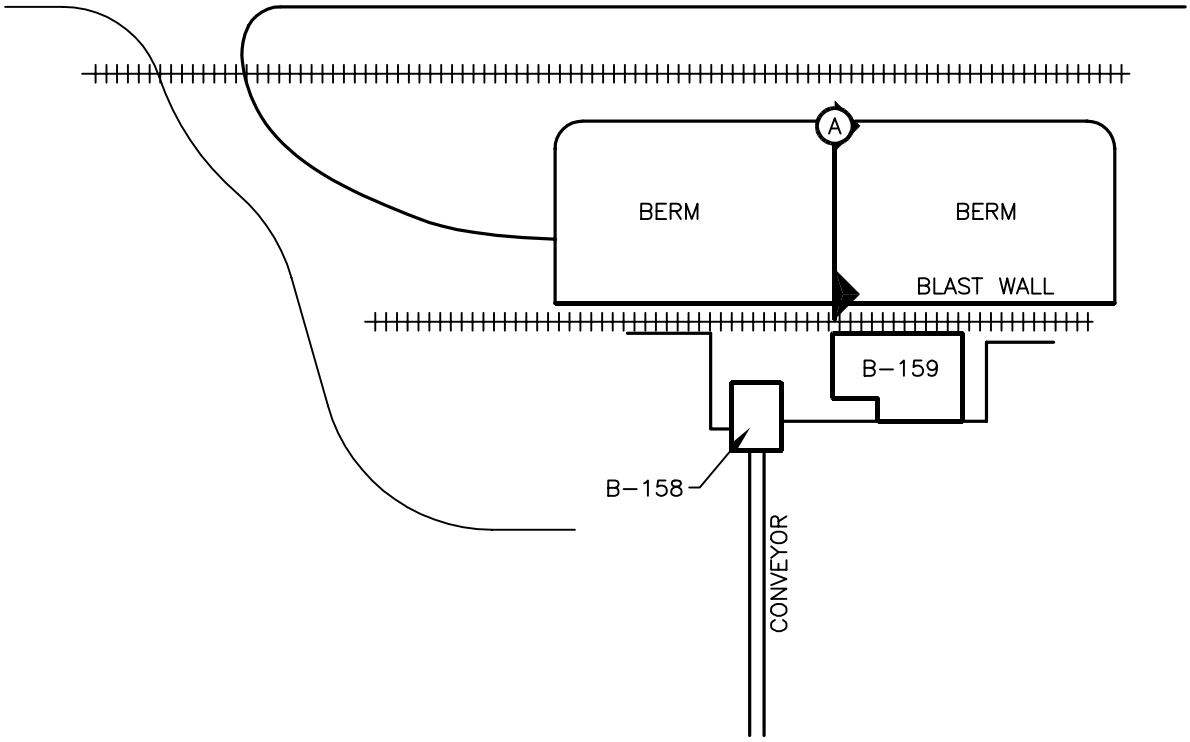
MK, 1999 Toxicity Report, Full-Scale Bioremediation, NSWC Crane, Crane, Indiana. Morrison Knudsen Corp., February 1999.

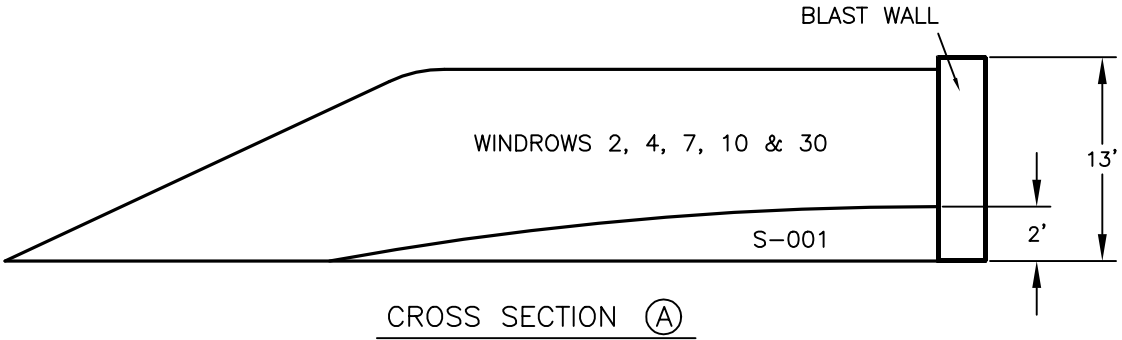
MK, 2000 Sampling and Analysis Plan for Supplemental Toxicity Sampling of Composted Material from Mine Fill A and Mine Fill B, NSWC Crane, Crane, Indiana. Morrison Knudsen Corp., June 2000.

TtNUS, 2002 *Quality Assurance Project Plan for Mine Fill A, Mine Fill B, Cast High Explosives Fill/B-146 Incinerator, and Pyrotechnic Test Area RCRA Facility Investigation*, NSWC Crane, Crane, Indiana. Contract Task Order Number 0166, Contract Number N62467-94-D-0888. Prepared by Tetra Tech, NUS, July 2002 (or revised).

FIGURES

BUILDING 158





CROSS SECTION (A)

MEASUREMENTS ARE APPROXIMATE
NOT TO SCALE

N

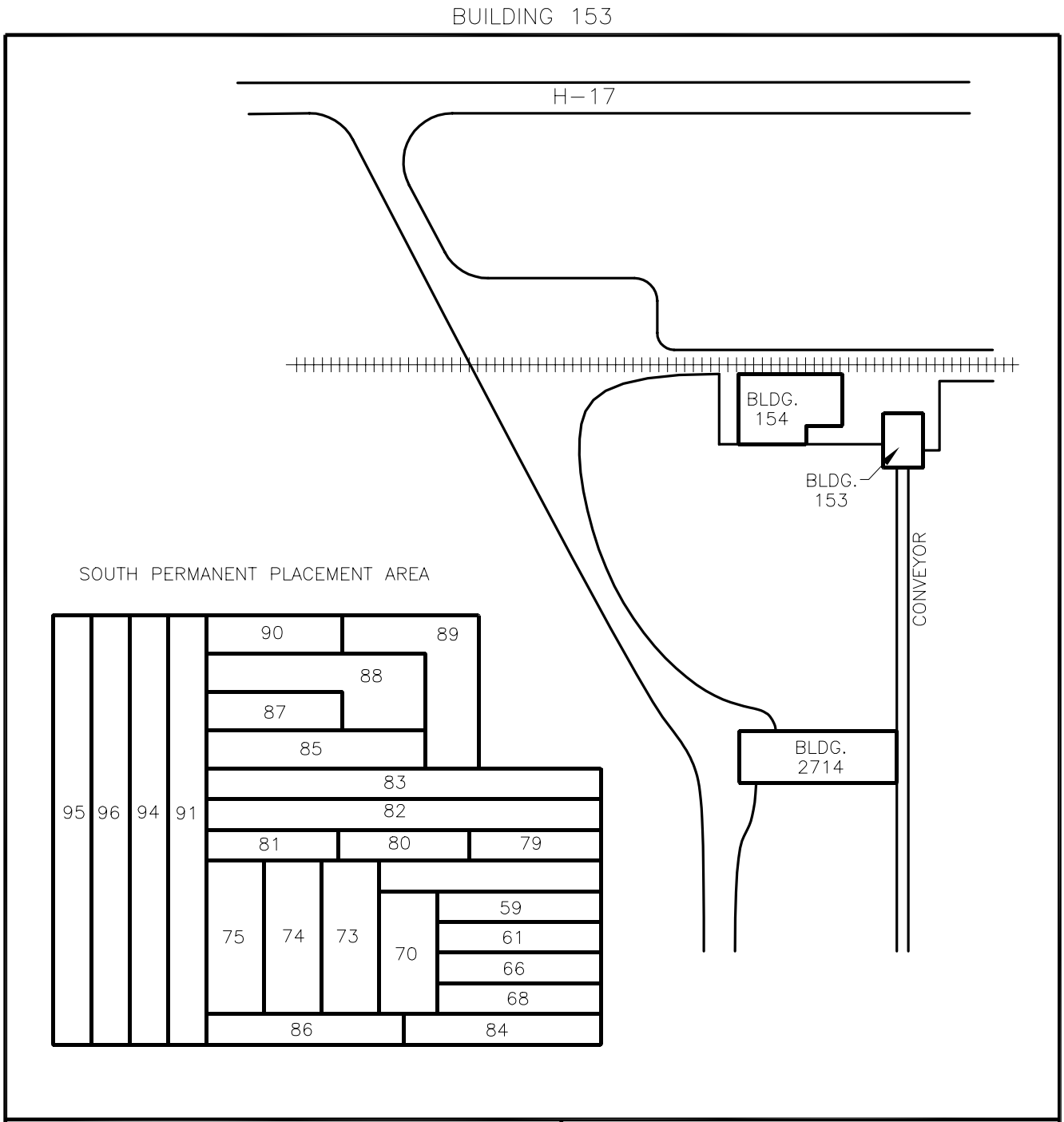
SUPPLEMENTAL TOXICITY REPORT

FIGURE 1.0
WINDROW LOCATION MAP
WINDROW: #1
MFA, B–158
NAVAL SURFACE WARFARE CENTER
CRANE, INDIANA

PREPARED FOR

NAVAL FACILITIES ENGINEERING COMMAND
NSWC CRANE, IN

DRAWN MRC\3–5–01	DRAWING NO.: 37324–01	
REVISED	CHKD:	APPR:
JOB NO.: 37324.11	TOLTEST, INC.	
SHEET NUMBER 1 of 4		



MEASUREMENTS ARE APPROXIMATE
NOT TO SCALE

N

SUPPLEMENTAL TOXICITY REPORT

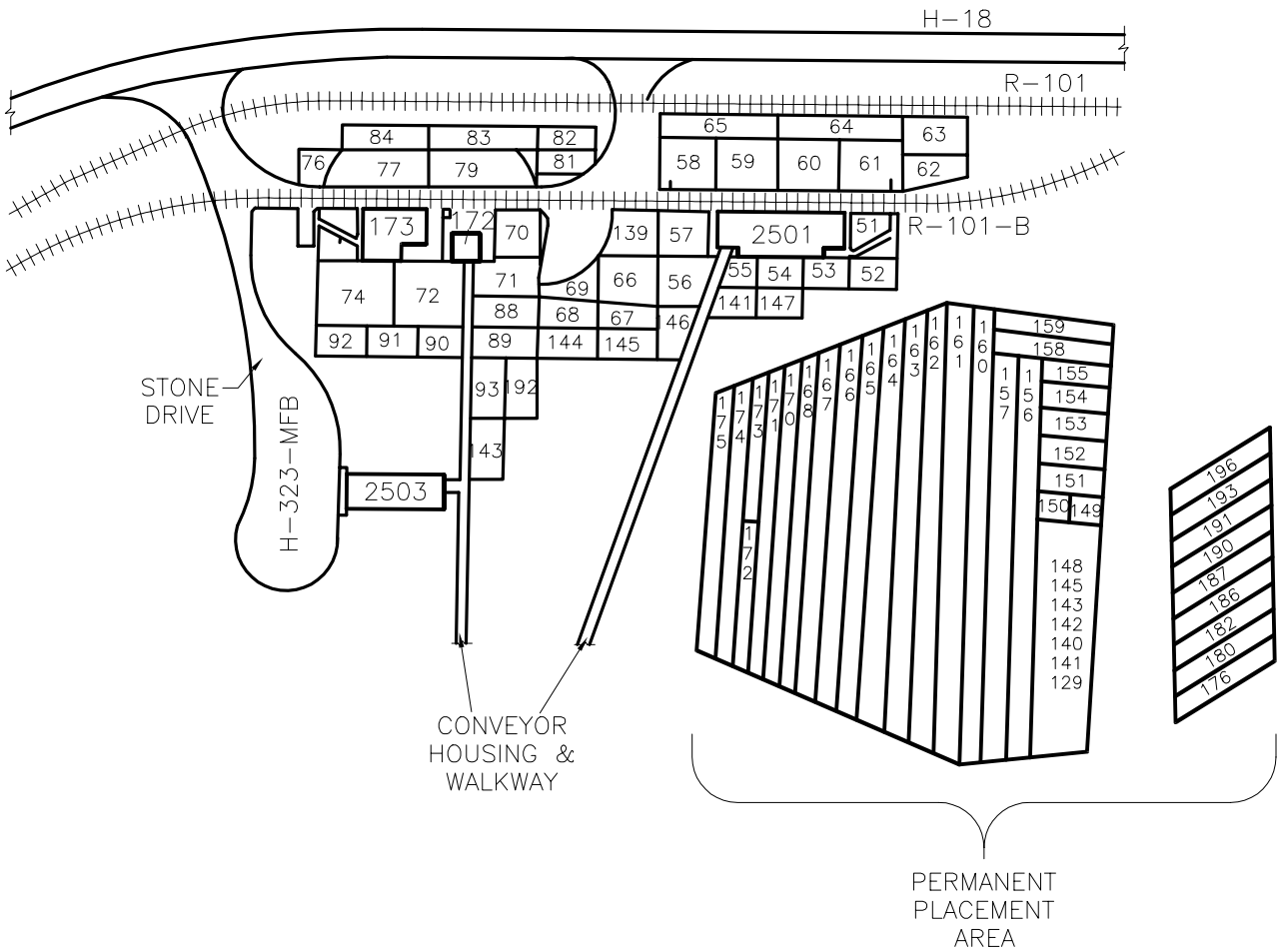
FIGURE 2.0
WINDROW LOCATION MAP

WINDROW: #96
MFA SOUTH PERMANENT PLACEMENT AREA
NAVAL SURFACE WARFARE CENTER
CRANE, INDIANA

PREPARED FOR

NAVAL FACILITIES ENGINEERING COMMAND
NSWC CRANE, IN

DRAWN MRC\11-29-00	DRAWING NO.: 37324-02	
REVISED	CHKD:	APPR:
JOB NO.: 37324.11	TOLTEST, INC.	
SHEET NUMBER 2 of 4		



MEASUREMENTS ARE APPROXIMATE
NOT TO SCALE

N

SUPPLEMENTAL TOXICITY REPORT

FIGURE 3.0
WINDROW LOCATION MAP

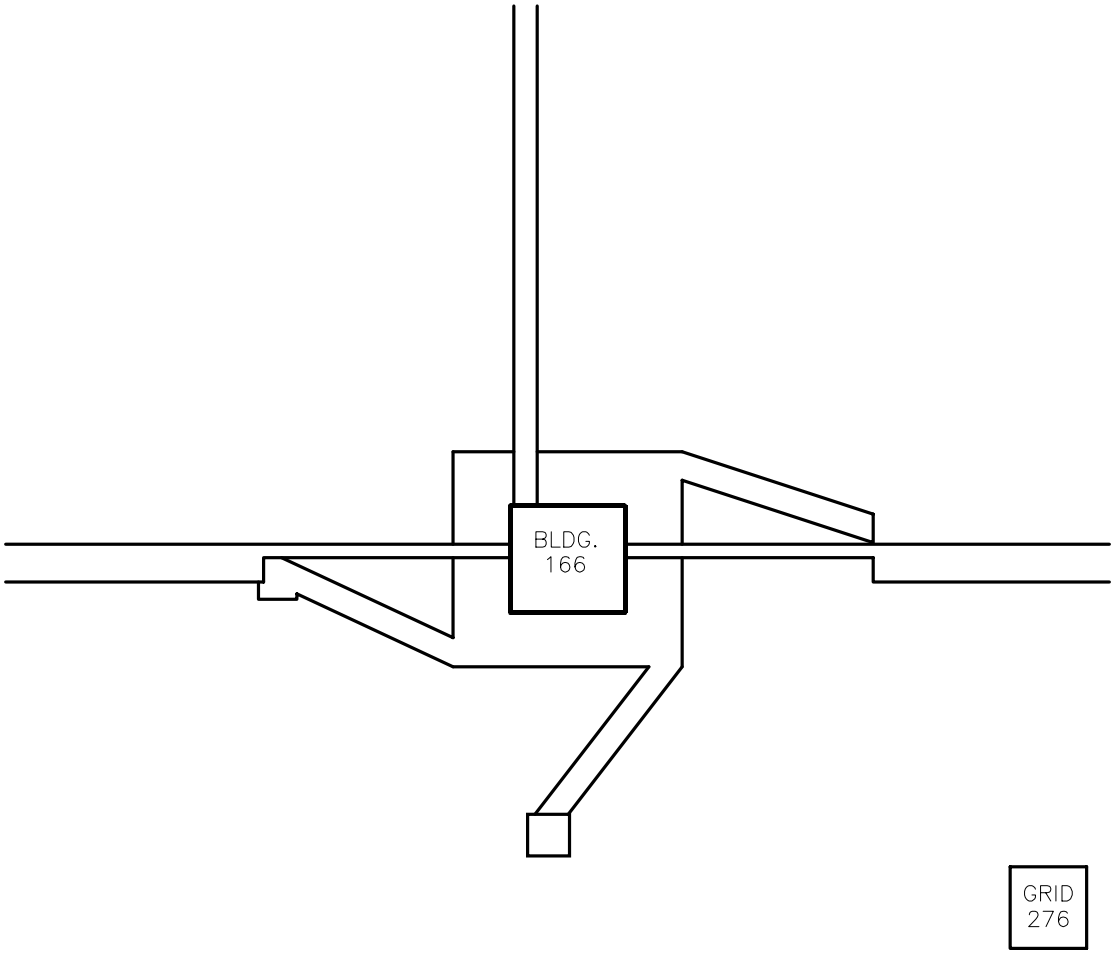
WINDROW: #159
MINE FILL B – PERMANENT PLACEMENT AREA
NAVAL SURFACE WARFARE CENTER
CRANE, INDIANA

PREPARED FOR

NAVAL FACILITIES ENGINEERING COMMAND
NSWC CRANE, IN

DRAWN MRC\3–2–01	DRAWING NO.: 37324–03	
REVISED	CHKD:	APPR:
JOB NO.: 37324.11	TOLTEST, INC.	
SHEET NUMBER 3 of 4		

BUILDING 166



MEASUREMENTS ARE APPROXIMATE
NOT TO SCALE

N

SUPPLEMENTAL TOXICITY REPORT

FIGURE 4.0
WINDROW LOCATION MAP
GRID: #276; WINDROW: #178
NAVAL SURFACE WARFARE CENTER
BUILDING 166, MINE FILL B
CRANE, INDIANA

PREPARED FOR

NAVAL FACILITIES ENGINEERING COMMAND
NSWC CRANE, IN

DRAWN MRC\3-2-01	DRAWING NO.: 37324-04	
REVISED	CHKD:	APPR:
JOB NO.: 37324.11	TOLTEST, INC.	
SHEET NUMBER 4 of 4		

APPENDIX A

Microtox® and Earthworm Toxicity Report, Aqua Survey, Inc.

Aqua Survey, Inc.

FINAL REPORT

MICROTOX AND EARTHWORM TOXICITY
OF SOIL/COMPOST MIX
FOR PROJECT #37324
(NSWC CRANE BIOFACILITY)

12/27/00

STUDY # 20-475

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1. Raw Data *E. foetida* Toxicity Test
2. Raw Data: Microtox Test

MICROTOX AND EARTHWORM TOXICITY TESTING OF SOIL/COMPOST MIX FOR PROJECT #37324 (NSWC CRANE BIOFACILITY)

DATA REQUIREMENT

Microtox -Proprietary Method
Earthworm Toxicity - EPA 600/3-88/029

STUDY COMPLETION DATE

12/27/2000

PERFORMING LABORATORIES

Aqua Survey, Inc.
499 Point Breeze Road
Flemington, New Jersey 08822

SPONSOR

Toltest, Inc.
300 Highway 361, NSWC CTR-12
Crane, IN 47522

LABORATORY PROJECT ID

STUDY #20-475

MICROTOX AND EARTHWORM TOXICITY TESTING OF
SOIL/COMPOST MIX FOR PROJECT #37324
(NSWC CRANE BIOFACILITY)

I. SUMMARY

Five (5) samples of soil/compost mix were received by this laboratory (ASI) for Microtox and Earthworm toxicity testing. For microtox testing, test organisms were exposed to four (4) concentrations of elutriate prepared by adding deionized water to the soil/compost mix. Earthworms were exposed to five (5) concentrations of the soil/compost mix. Exposure concentrations used throughout this report and in all endpoint calculations are nominal concentrations as percent elutriate for microtox testing or percent soil/compost mix for the earthworm toxicity testing. Exposure concentrations were 5.63, 11.25, 22.5 and 45 percent and 6.25, 12.5, 25, 50 and 100 percent for the microtox and earthworm test, respectively. The results are as follows:

Table 1: Summary of Results

Sample ID	ASI #	Earthworm Toxicity (%)		Microtox (%)	
		7-Day LC_{50}	14-Day LC_{50}	5-minute EC_{50}	15-minute EC_{50}
PCS-001	22044	28.1	27.8	>45	>45
PCS-002	22045	33.0	27.1	>45	>45
PCS-003	22046	>100	>100	>45	>45
PCS-004	22047	>100	>100	>45	>45
PCS-005	22048	58.8	57.3	>45	>45

II. INTRODUCTION

The marine bacterium, *Photobacterium phosphoreum* was exposed to concentrations of elutriate of soil/compost mix or the soil/compost mix for 15 minutes and the earthworm *Eisenia foetida*was exposed to concentrations of a soil/compost mix for14 days in order to permit a more accurate and complete assessment of its environmental impact. Test organisms used for testing were chosen on the basis of their ecological importance. The objectives of the test were:

1) To determine if acute exposure to concentrations of elutriate or soil/compost mix would adversely affect *Photobacterium phosphoreum* or *Eisenia foetida*.

2) If appropriate, provide an estimate of the five (5) and 15 minute EC_{50} for *Photobacterium phosphoreum* and seven (7) and 14-day LC_{50} for *Eisenia foetida*.

For the purpose of calculating or estimating an EC_{50} or LC_{50} a reduction in light levels or mortality would serve as the requisite end point.

III. TEST ADMINISTRATION

A. Sponsor

Toltest, Inc.
300 Highway 361, NSWC CTR-12
Crane, IN 47522

B. Testing Facility

Aqua Survey, Inc.
499 Point Breeze Road
Flemington, NJ 08822

C. Dates of Experiment

Sample ID	ASI #	Collection Date	Microtox	Earthworm
PCS-001	22044	11/13/00	11/21/00	11/15/00
PCS-002	22045	11/13/00	11/21/00	11/15/00
PCS-003	22046	11/13/00	11/21/00	11/15/00
PCS-004	22047	11/13/00	11/21/00	11/15/00
PCS-005	22048	11/13/00	11/21/00	11/15/00

D. Study Participants

Thomas Dolce
Robert Fristrom
G. Stephen Hornberger
Michelle Thomas
Matthew Stengel
Chris Doyle
Jane Norvell
Cathy Chizek
York Terrell

IV. TEST AND CONTROL SUBSTANCES

A. Test Substance

The soil/compost samples used in this test were received by Aqua Survey on November 14, 2000. Samples were received in coolers containing ice. The temperature of the environment in the cooler was 8° C. Two plastic containers of each sample were received. The samples were identified as follows and assigned the following ASI sample numbers:

Sample ID #	ASI Sample ID #
PCS-001	22044
PCS-002	22045
PCS-003	22046
PCS-004	22047
PCS-005	22048

B. Control Substance(s)

Negative Control
Microtox: Diluent Control
Earthworm: Control Soil

C. Reference Toxicant

Earthworm: Potassium Chloride (KCl)

V. MATERIALS AND METHODS

A. Test System

The Microtox test system utilizes the marine bacterium, *Photobacterium phosphoreum*. These organisms were obtained from Azur Environmental, F.O.B., Carlsbad, California USA.

The earthworms utilized in these tests were adult *Eisenia foetida* obtained from Carolina Biological Supply Company, Burlington, North Carolina 27215-3398.

B. Source of Diluent/Control Soil

Microtox diluent is a 2% NaCl solution, used for diluting the samples and reagent. All Microtox diluent was obtained from Azur Environmental, Carlsbad, CA.

The control soil used to dilute test soil samples for the earthworm toxicity test was artificial soil prepared by this laboratory (ASI), and consisted of, by weight 10% (approximately 2.5 mm screened) sphagnum peat moss, 20% colloidal Kaolinite Clay, and 70% grade 70 silica sand.

C. Acclimation Procedure

The Microtox Reagent (organisms) is a freeze-dried culture of a specially developed strain of the marine bacterium, *Photobacterium phosphoreum.* One vial of reagent contains roughly one hundred million test organisms. Organisms were reconstituted in one ml of diluent, and placed in the reagent well with the temperature maintained at 5° C. The sensitivity of the reagent remains essentially unchanged for 1-2 hours after reconstitution at this temperature. A 10 µl volume of organisms was transferred to each test cuvette via a pipette and acclimated to Microtox diluent and test temperature (15° C) for 15 minutes prior to test initiation.
Earthworms were acclimated to test conditions (i.e. temperature and control soil) for one day prior to testing.

D. Diet

E. foetida were fed Magic Worm Food® during holding, and were not fed throughout the duration of testing.

E. Apparatus and Test Conditions

The Microtox Toxicity Test was conducted using a Model 500 Microtox Unit. Organisms were exposed in 2.5 ml cuvettes containing 1 ml of test solution and the test temperature was 15°C.

The Earthworm Toxicity Test was conducted in one-quart canning jars with screw-top lids with 1/16 inch diameter holes for air. The test was conducted under continuous illumination, The test temperature was 20±2°C.

F. Preparation of Test Solution and Concentrations

The elutriate used for Microtox testing was prepared by adding 50 grams dry weight of test soil/compost mix to 500 ml of deionized water. Test samples were agitated for 48 hours at 20±2° C in total darkness. After agitation was complete, the suspension was poured into centrifuge bottles and centrifuged at approximately 4200 rpm for approximately 20 minutes. The elutriate fraction was decanted and used to prepare the test solutions.

Test solutions were prepared by adding appropriate volumes of elutriate to Microtox diluent in test cuvettes. Test concentrations were 5.63, 11.25, 22.5, and 45.0%.

The concentrations for the Earthworm Toxicity test were prepared by determining the moisture fractions and water holding capacity of the soil/compost mix as well as the control/diluent soil (e.g., artificial soil). Appropriate amounts of test soil were added to artificial soil to prepare 700 grams of a geometric series of test soil concentrations (e.g., 6.25, 12.5, 25.0, 50.0, and 100.0% dry weight.) An artificial soil (only) control was also prepared. All test concentrations as well as controls were homogenized using a blender. After homogenization, 200 grams (dry weight) of each control and test concentration was placed in each of three replicate vessels for each concentration, at which time all replicate concentrations were hydrated to 75% of its respective water holding capacity using deionized water.

G. Test Procedure

The procedures used for these tests were based on accepted methodologies (1-4). Observation for light output (bioluminescence) of the Microtox organisms were made at five and fifteen minutes after test initiation. The test was initiated when the test organisms were challenged with each of four-test concentrations plus diluent control.

Observation of earthworm survival was made on days seven and fourteen after test initiation. The pH of the soil was measured at test initiation on day 0

and upon test termination, on day 14 in the 100% concentration or the highest test concentration in which organisms survived. The temperature of the test room environment was measured continuously for the duration of the test. The test started when ten test organisms were placed into each of three replicate test and control vessels. In addition, ten organisms were placed into each of two replicates for each of five concentrations of a reference toxicant (KCl) to determine the sensitivity of the test organisms.

H. EC_{50} and LC_{50} Calculations

The Microtox system is most frequently used to find the effective concentration (EC_{50}) of a sample at which the light output of the reagent is reduced by a specified percentage (i.e., the EC_{50} is the effect concentration of a sample causing a 50% decrease in the Microtox Reagent light output under defined conditions of exposure time). A computer program supplied by Microbics corporation (Azur Environmental) was used to compute point and interval (i.e., confidence interval) estimate of the EC_{50} (see Appendix Two). The color of the elutriate from three samples ASI # 22044, 22045 and 22048 was so dark, that a color correction was needed for the calculation of an EC_{50}. A program was provided by Azur Environmental that enabled this to be accomplished.

A computer program developed by C.E. Stephans and ASTM was used to compute point and interval (confidence) estimate of the LC_{50} for earthworms. The program requires the following data: the concentration of the test substance; the number of organisms exposed; and the number of organisms that died (see Appendix One). In this test, the LC_{50} is the concentration of test substance, calculated from experimentally-derived mortality that is lethal to 50% of the test population during continuous exposure over a specified period of time.

VI. Test Results

The EC_{50} value for Microtox and LC_{50} value for earthworms are summarized in Table 1. Mortality and pH for the earthworm Toxicity Tests are summarized in Tables 3-7. Raw data and LC_{50} calculations for the earthworm test are presented in Appendix One. Raw data and EC_{50} calculations for the Microtox test are presented in Appendix Two.

VII. Test Validity

The following criteria for a valid test were met during the study:

A. Mean survival for the earthworm controls was 97%.
B. No abnormal occurrences (i.e., laboratory accidents) that might have influenced the outcome of the test were noted.

VIII. Discussion

During Microtox testing, observation for light output was made at five and fifteen minutes. Nothing noteworthy was observed.

Earthworms were observed for mortality at days seven and fourteen. A dose response was observed for mortality for all test samples with the exception of sample number PCS-003 and PCS-004. After fourteen days, 20, 3, 30, 10, and 13% mortality was observed in sample PCS-003 and 17, 30, 27, 13, and 17% mortality in sample PCs-004 in the 6.25, 12.5, 25, 50, and 100% test concentrations, respectively. No explanation is provided for this dose response. The pH of soil samples (including the control) measured at test initiation and at day fourteen ranged from 6.6 to 8.4. These values are considered to be acceptable for these organisms (1) and are not likely to have caused any adverse effects. The temperature of the test room was recorded continuously (hourly) for the duration of the test. On several occasions the temperature dropped below the test temperature of 20±2° C, with the extreme being 17.0° C. Although this temperature was lower than the target temperature for this test, it is not believed to have affected the outcome of the test.

IX. References

1. United States Environmental Protection Agency. 1988. Protocols For Short Term Toxicity Screening of Hazardous Waste Sites. EPA/600/3-88/029.

2. American Society for Testing and Materials (ASTM). Annual Book of ASTM Standards. 1995 Volume 11.04 "Pesticides, Resource Recovery, Hazardous Substances and Oil Spill Responses, Waste Disposal, Biological Effects. Standard Guide for Conducting a Laboratory Soil Toxicity Test with Lumbricoid Earthworm, *Eisenia foetida.*

3. United States Environmental Protection Agency. Federal Register, 40 CFR Part 503.32.

4. Microtox Manual. A Toxicity Testing Handbook. 1992. Microbics Corporation (Azur Environmental), 2232 Rutherford Road, Carlsbad, CA 92008-8883.

5. Stephan, D.E. 1977. Method for Calculating an LC_{50}. In: F.L. Mayer and J. L. Hamelink, Eds., Aquatic Toxicology and Hazard Evaluation, Spec. Tech. Publ. No. 634, American Society for Testing and Materials, Philadelphia, Pennsylvania, pp. 65-84.

6. American Society for Testing and Materials. 1988. Proposed New Standard Practice for Using Probit Analysis. ASTM Subcommittee E-47.07. Draft #4, June, 1988.

Results of Toxicity Testing with *Eisenia foetida*

All tests were stocked with 2 replicates per concentration, 10 organisms per replicate.

Table 2: Standard Reference Toxicant Test Results: *E. foetida*

Sample # 80890 Concentration KCl	7-day Total Live Count	14-day Total Live Count
Control	20	20
1250 ppm	20	20
2500 ppm	19	19
5000 ppm	18	16
10000 ppm	0	0
20000 ppm	0	0
LC_{50}	6372.8 ppm	5747.6 ppm

Table 3: Summary of *E. foetida* % Survival

Conc. %	PCS-001 % Survival		PCS-002 % Survival		PCS-003 % Survival		PCS-004 % Survival		PCS-005 % Survival	
	7-Day	14-Day	7-Day	14-Day	7-Day	14-Day	7-Day	14-Day	7-Day	14-Day
Control	100	97	100	97	100	97	100	97	100	97
6.25	90	83	100	93	90	80	97	83	100	90
12.5	90	73	93	67	100	97	90	70	97	93
25	97	77	97	90	97	70	90	73	100	93
50	0	0	0	0	97	90	93	87	77	70
100	0	0	0	0	93	87	93	83	0	0
LC_{50} (%)	28.1	27.8	33.0	27.1	>100	>100	>100	>100	58.8	57.3

Results of Microtox Testing with *Photobacterium phosphoreum*

Table 4: Results of Microtox Testing

Sample	ASI #	5 minute EC_{50}	15-minute EC_{50}
PCs-001	22044	>45	>45
PCS-002	22045	>45	>45
PCS-003	22046	>45	>45
PCS-004	22047	>45	>45
PCS-005	22048	>45	>45

SIGNATURE PAGE

MICROTOX AND EARTHWORM TOXICITY
OF SOIL/COMPOST MIX FOR PROJECT # 37324
(NSWC CRANE BIOFACILITY)

This report as well as all records and raw data were audited and found to be an accurate reflection of the study. Copies of raw data will be maintained by Aqua Survey, Inc, 499 Point Breeze Road, Flemington, New Jersey, 08822.

Joanne DerPilbosian — 12/27/00
Quality Assurance Officer — Date

Thomas J. Dolce — 12/27/00
Study Director — Date

James M. Todd — 12/27/00
Vice President — Date

APPENDIX 1

E. foetida Toxicity Test

Raw Data

AQUA SURVEY, INC.
PERCENT MOISTURE & HYDROSCOPIC CORRECTION FACTOR
BENCHSHEET

Balance: Sartorious Calibration: (Yes) No Client: TDL

Drying Oven: QL Model 40 Temperature: degrees C 105 Job #: 20-475

	Sample #	A	B	C	D	E	% Moisture*	HMCF**
CONTROL	92654	76.7	274.5		270.7		1.92	
	22044	62.3	309.3		243.6		26.60	
	22045	65.9	301.4		239.6		26.24	
	22046	65.0	664.5		398.4		44.39	
	22047	69.4	597.3		417.5		34.06	
	22048	65.8	477.8		352.6		30.39	
Initials		TD	TD					
Date		11/14/00	11/14/00					

A = Pan Weight (g)

B = Wet Sample + Pan (g)

C = Air Dry Sample + Pan Weight (g)

D = First Oven Dry Sample + Pan Weight (g)

E = Second Oven Dry Weight + Pan Weight (g)

$$* \% \text{ Moisture} = \frac{B - E \times 100}{B - A}$$

** HMCF = (E -A)/ (C-A)

Determination of Water Holding Capacity of Soils and Sediments

ASI #	Initial Dry Wt. (g) A	Funnel Wt. (g) B	Total Wt. (g) C	Water added (mL) D	Funnel Wt. after 3 hs. E	Water holding capacity F
92654	100.0	157.5	257.5	108.0	④ ~~320.5~~	~~53.0~~
22044	100.2	168.5	268.7	110.0	326.6	57.9
22045	100.2	167.9	268.1	110.0	318.5	50.4
22046	100.0	168.5	268.5	110.0	333.9	65.4
22047	100.1	168.9	269.0	110.0	334.4	65.4
22048	100.0	168.6	268.6	110.0	345.4	76.8

③ 307.0 49.5 TD 11/10/00

A = Dry weight of soil

B = Funnel weight including wet filter paper

C = Total weight of dry soil and funnel including weight of filter paper (A + B)

D = Volume of deionized water added to dry soil (A)

E = Total weight of funnel containing wet soil after 3-hours (~~A + B + C~~) N/A.

F = Water holding capacity mL/100g (E - C)

20-475 Toltest - 14 Day Acute, E. foetida

Random	Samp No	Concen	ASI ID	Replic
26	1.1	Control	92654	A
14	1.2		*	B
53	1.3		*	C
43	2.1	6.25	22044	A
31	2.2		*	B
42	2.3		*	C
57	3.1	12.5	22044	A
62	3.2		*	B
47	3.3		*	C
52	4.1	25	22044	A
61	4.2		*	B
13	4.3		*	C
65	5.1	50	22044	A
17	5.2		*	B
11	5.3		*	C
68	6.1	100	22044	A
40	6.2		*	B
27	6.3		*	C
67	7.1	6.25	22045	A
22	7.2		*	B
12	7.3		*	C
64	8.1	12.5	22045	A
48	8.2		*	B
58	8.3		*	C
2	9.1	25	22045	A
59	9.2		*	B
41	9.3		*	C
45	10.1	50	22045	A
25	10.2		*	B
49	10.3		*	C
28	11.1	100	22045	A
54	11.2		*	B
70	11.3		*	C
33	12.1	6.25	22046	A
39	12.2		*	B
23	12.3		*	C
44	13.1	12.5	22046	A
50	13.2		*	B
76	13.3		*	C
19	14.1	25	22046	A
35	14.2		*	B
30	14.3		*	C
16	15.1	50	22046	A
72	15.2		*	B
34	15.3		*	C
29	16.1	100	22046	A
10	16.2		*	B
63	16.3		*	C
18	17.1	6.25	22047	A
4	17.2		*	B
71	17.3		*	C
73	18.1	12.5	22047	A
21	18.2		*	B
69	18.3		*	C
37	19.1	25	22047	A
78	19.2		*	B
77	19.3		*	C

20-475 Toltest - 14 Day Acute, E. foetida

Random	Samp No	Concen	ASI ID	Replic
3	20.1	50	22047	A
8	20.2		*	B
36	20.3		*	C
66	21.1	100	22047	A
55	21.2		*	B
75	21.3		*	C
32	22.1	6.25	22048	A
20	22.2		*	B
46	22.3		*	C
24	23.1	12.5	22048	A
7	23.2		*	B
74	23.3		*	C
38	24.1	25	22048	A
1	24.2		*	B
5	24.3		*	C
56	25.1	50	22048	A
6	25.2		*	B
15	25.3		*	C
51	26.1	100	22048	A
60	26.2			B
9	26.3			C

Aqua Survey, Inc.

Client: TOL

Test Start Date: 11/15/00

Job #: 20-475

Organism: *E. foetida*

Test Chamber #	Initial Live Count	24 Hour Observations	Day 7 Live Count	Day 8 Observations	Day 14 Live Count
1	10	B	10	B	10
2		B	10	B	9
3		B	9	B	7
4		B	9	B	9
5		B	10	B	9
6		B	10	B	10
7		B	10	B	10
8		B	9	B	9
9		several D	0		—
10		B	8	B	8
11		S/A	0		—
12		B	10	B	~~8~~ ①
13		B	10	B	7
14		B	10	B	10
15		B	8	B	6
16		B	10	B	10
17		S/A	0		—
18		B	10	B	8
19		B	10	B	7
20		B	10	B	8
Date	11/15/00	11/16/00	11/22/00	11/23/00	11/29/00
Initials	SH	SH	JN MGS	CC	TD

① 9 TD 11/29/00

Initial pH	22044	22045	22046	22047	22048	92654
	8.4	8.2	7.6	8.2	7.6	6.6
Final pH	8.6 at 25%	8.3 at 25%	8.1	8.2	7.8 at 50%	6.9

B = Burrowed S = on surface A = Avoidance of substrate

D = Dead

Aqua Survey, Inc.

Client: TOL

Test Start Date: 11/15/00

Job #: 20-475

Organism: *E. foetida*

Test Chamber #	Initial Live Count	24 Hour Observations	Day 7 Live Count	Day 8 Observations	Day 14 Live Count
21	10	B	9	B	8
22	↓	B	10	B	10
23		B	8	B	7
24		B	10	B	10
25		B	0	B	—
26		B	10	B	10
27		S	0		—
28		S/A/D	0		—
29		B	10	B	8
30		B	10	B	7
31		B	9	B	8
32		B	10	B	9
33		B	9	B	9
34		B	10	B	9
35		B	9	B	7
36		B	10	B	10
37		B	9	B	7
38		B	10	B	9
39		B	10	B	8
40		several D/S	0		—
Date	11/15/00	11/16/00	11/22/00	11/23/00	11/29/00
Initials	AA	AA	JN ALS	CC	TD

Aqua Survey, Inc.

Client: TOL

Test Start Date: 11/15/00

Job #: 20-475

Organism: *E. foetida*

Test Chamber #	Initial Live Count	24 Hour Observations	Day 7 Live Count	Day 8 Observations	Day 14 Live Count
41	10	B	10	B	9
42		B	9	B	8
43		B	9	B	9
44		B	10	B	10
45		S/A	~~10~~ 0 m		—
46		B	10	B	10
47		B	9	B	7
48		B	9	B	5
49		S/A	0		—
50		B	10	B	9
51		several D/s	0		—
52		B	9	B	8
53		B	10	B	9
54		several D/s	0		—
55		B	9	B	9
56		S/A	5+1 small piece	B	5
57		B	9	B	7
58		B	9	B	7
59		B	9	B	9
60		several D/s	0		—
Date	11/15/00	11/16/00	11/22/0	11/23/00	11/29/00
Initials	AA	AA	m/ JN MW	CC	TP

Aqua Survey, Inc.

Client: TOL

Test Start Date: 11/15/00

Job #: 20-475

Organism: *E. foetida*

Test Chamber #	Initial Live Count	24 Hour Observations	Day 7 Live Count	Day 8 Observations	Day 14 Live Count
61	10	B	10	B	8
62	↓	B/S	9	B	8
63	↓	B	10	B	10
64	↓	B	10	B	8
65	↓	B/S	0		—
66	↓	B	10	B	8
67	↓	B	10	B	9
68	↓	several D/S	0		—
69	↓	B	9	B	6
70	↓	several S	0		—
71	↓	B	10	B	8
72	↓	B	9	B	8
73	↓	B	9	B	7
74	↓	B	9	B	8
75	↓	B	9	B	8
76	↓	B	11	B	10
77	↓	B	8	B	7
78	↓	B	10	B	8
79					
80					
Date	11/15/00	11/16/00	11/22/00	11/23/00	11/29/00
Initials	[illegible]	[illegible]	[illegible] JP MGS	"	[illegible]

SPEARMAN-KARBER

TRIM: 7.78%
LC50: 34.337
95% CONFIDENCE LIMITS
ARE UNRELIABLE.

CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB.(%)
6.25	30.	3.	10.00	.4215D-03
12.50	30.	3.	10.00	.4215D-03
25.00	30.	1.	3.33	.2887D-05
50.00	30.	30.	100.00	.9313D-07
100.00	30.	30.	100.00	.9313D-07

THE BINOMIAL TEST SHOWS THAT 25.00 AND 50.00 CAN BE USED AS STATISTICALLY SOUND CONSERVATIVE 95 PERCENT CONFIDENCE LIMITS SINCE THE ACTUAL CONFIDENCE LEVEL ASSOCIATED WITH THESE LIMITS IS 100.0000 PERCENT.
AN APPROXIMATE LC50 FOR THIS DATA SET IS 34.130

RESULTS USING MOVING AVERAGE

SPAN	G	LC50	95% CONFIDENCE LIMIT	
4	.049	28.05	22.90	34.78

****** RESULTS CALCULATED BY PROBIT METHOD

ITERATIONS	G	H	GOODNESS OF FIT
8	2.976	16.57	.00

A PROBABILITY OF 0 MEANS LESS THAN 0.001

SLOPE = 3.52
95% CONFIDENCE LIMITS: -2.55 AND 9.58

LC50= 28.28
95% CONFIDENCE LIMITS: 0 AND + INFINITY

LC1 = 6.16
95% CONFIDENCE LIMITS: 0 AND 21.87

DATE: 11/15/00 TEST NUMBER: 22044 DURATION: 7 days
SAMPLE: 22044 SPECIES: E. foetida

METHOD	LC50	CONFIDENCE LIMITS LOWER	UPPER	SPAN
BINOMIAL	34.130	25.000	50.000	25.000
MAA	28.054	22.899	34.775	11.876
PROBIT	28.275	*******	*******	*******
SPEARMAN	34.337	*******	*******	*******

NOTE: MORTALITY PROPORTIONS WERE NOT MONOTONICALLY INCREASING.
ADJUSTMENTS WERE MADE PRIOR TO SPEARMAN-KARBER ESTIMATION.

**** = LIMIT DOES NOT EXIST

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

SPEARMAN-KARBER

TRIM:	16.67%
LC50:	27.793
95% LOWER CONFIDENCE:	21.856
95% UPPER CONFIDENCE:	35.342

CONC. %	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB.(%)
6.25	30.	5.	16.67	.1625D-01
12.50	30.	8.	26.67	.8062D+00
25.00	30.	7.	23.33	.2611D+00
50.00	30.	30.	100.00	.9313D-07
100.00	30.	30.	100.00	.9313D-07

THE BINOMIAL TEST SHOWS THAT 25.00 AND 50.00 CAN BE USED AS STATISTICALLY SOUND CONSERVATIVE 95 PERCENT CONFIDENCE LIMITS SINCE THE ACTUAL CONFIDENCE LEVEL ASSOCIATED WITH THESE LIMITS IS 99.7389 PERCENT.
AN APPROXIMATE LC50 FOR THIS DATA SET IS 30.371

RESULTS USING MOVING AVERAGE

SPAN	G	LC50	95% CONFIDENCE LIMIT	
4	.058	19.68	15.34	24.52

****** RESULTS CALCULATED BY PROBIT METHOD

ITERATIONS	G	H	GOODNESS OF FIT
7	1.527	8.44	.00

A PROBABILITY OF 0 MEANS LESS THAN 0.001

SLOPE = 2.79
95% CONFIDENCE LIMITS: -.66 AND 6.24

LC50= 21.21
95% CONFIDENCE LIMITS: 0 AND + INFINITY

LC1 = 3.12
95% CONFIDENCE LIMITS: 0 AND 11.27

DATE: 11/15/00 TEST NUMBER: 22044 DURATION: 14 days
SAMPLE: 22044 SPECIES: E. foetida

METHOD	LC50	CONFIDENCE LIMITS LOWER	UPPER	SPAN
BINOMIAL	30.371	25.000	50.000	25.000
MAA	19.677	15.336	24.520	9.184
PROBIT	21.209	*******	*******	*******
SPEARMAN	27.793	21.856	35.342	13.485

NOTE: MORTALITY PROPORTIONS WERE NOT MONOTONICALLY INCREASING.
ADJUSTMENTS WERE MADE PRIOR TO SPEARMAN-KARBER ESTIMATION.

**** = LIMIT DOES NOT EXIST

SPEARMAN-KARBER

TRIM:	.00%
LC50:	32.988
95% LOWER CONFIDENCE:	30.512
95% UPPER CONFIDENCE:	35.664

CONC. %	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB.(%)
6.25	30.	0.	.00	.9313D-07
12.50	30.	2.	6.67	.4340D-04
25.00	30.	1.	3.33	.2887D-05
50.00	30.	30.	100.00	.9313D-07
100.00	30.	30.	100.00	.9313D-07

THE BINOMIAL TEST SHOWS THAT 25.00 AND 50.00 CAN BE USED AS STATISTICALLY SOUND CONSERVATIVE 95 PERCENT CONFIDENCE LIMITS SINCE THE ACTUAL CONFIDENCE LEVEL ASSOCIATED WITH THESE LIMITS IS 100.0000 PERCENT.
AN APPROXIMATE LC50 FOR THIS DATA SET IS 34.130

RESULTS USING MOVING AVERAGE

SPAN	G	LC50	95% CONFIDENCE LIMIT	
4	.033	30.07	25.48	35.93

****** RESULTS CALCULATED BY PROBIT METHOD

ITERATIONS	G	H	GOODNESS OF FIT
11	4.058	13.51	.00

A PROBABILITY OF 0 MEANS LESS THAN 0.001

SLOPE = 6.61
95% CONFIDENCE LIMITS: -6.70 AND 19.92

LC50= 31.53
95% CONFIDENCE LIMITS: 0 AND + INFINITY

LC1 = 14.01
95% CONFIDENCE LIMITS: 0 AND 30.66

DATE: 11/15/00 TEST NUMBER: 22045 DURATION: 7 days
SAMPLE: 22045 SPECIES: E.foetida

METHOD	LC50	CONFIDENCE LIMITS LOWER	UPPER	SPAN
BINOMIAL	34.130	25.000	50.000	25.000
MAA	30.071	25.483	35.930	10.447
PROBIT	31.527	*******	*******	*******
SPEARMAN	32.988	30.512	35.664	5.152

NOTE: MORTALITY PROPORTIONS WERE NOT MONOTONICALLY INCREASING.
ADJUSTMENTS WERE MADE PRIOR TO SPEARMAN-KARBER ESTIMATION.

**** = LIMIT DOES NOT EXIST

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

SPEARMAN-KARBER

TRIM:	6.67%
LC50:	27.143
95% LOWER CONFIDENCE:	22.815
95% UPPER CONFIDENCE:	32.292

CONC. %	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB.(%)
6.25	30.	2.	6.67	.4340D-04
12.50	30.	10.	33.33	.4937D+01
25.00	30.	3.	10.00	.4215D-03
50.00	30.	30.	100.00	.9313D-07
100.00	30.	30.	100.00	.9313D-07

THE BINOMIAL TEST SHOWS THAT 6.25 AND 50.00 CAN BE USED AS STATISTICALLY SOUND CONSERVATIVE 95 PERCENT CONFIDENCE LIMITS SINCE THE ACTUAL CONFIDENCE LEVEL ASSOCIATED WITH THESE LIMITS IS 100.0000 PERCENT.
AN APPROXIMATE LC50 FOR THIS DATA SET IS 32.749

RESULTS USING MOVING AVERAGE

SPAN	G	LC50	95% CONFIDENCE LIMIT	
4	.044	22.45	18.31	27.24

****** RESULTS CALCULATED BY PROBIT METHOD

ITERATIONS	G	H	GOODNESS OF FIT
6	1.933	11.06	.00

A PROBABILITY OF 0 MEANS LESS THAN 0.001

SLOPE = 3.14
95% CONFIDENCE LIMITS: -1.23 AND 7.50

LC50= 23.90
95% CONFIDENCE LIMITS: 0 AND + INFINITY

LC1 = 4.34
95% CONFIDENCE LIMITS: 0 AND 14.91

DATE: 11/15/00 TEST NUMBER: 22045 DURATION: 14 days
SAMPLE: 22045 SPECIES: E.foetida

METHOD	LC50	CONFIDENCE LIMITS LOWER	UPPER	SPAN
BINOMIAL	32.749	6.250	50.000	43.750
MAA	22.449	18.315	27.244	8.929
PROBIT	23.899	*******	*******	*******
SPEARMAN	27.143	22.815	32.292	9.477

NOTE: MORTALITY PROPORTIONS WERE NOT MONOTONICALLY INCREASING.
ADJUSTMENTS WERE MADE PRIOR TO SPEARMAN-KARBER ESTIMATION.

**** = LIMIT DOES NOT EXIST

SPEARMAN-KARBER

TRIM:	.00%
LC50:	58.777
95% LOWER CONFIDENCE:	52.317
95% UPPER CONFIDENCE:	66.036

CONC. %	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB.(%)
6.25	30.	0.	.00	.9313D-07
12.50	30.	1.	3.33	.2887D-05
25.00	30.	0.	.00	.9313D-07
50.00	30.	7.	23.33	.2611D+00
100.00	30.	30.	100.00	.9313D-07

THE BINOMIAL TEST SHOWS THAT 50.00 AND 100.00 CAN BE USED AS STATISTICALLY SOUND CONSERVATIVE 95 PERCENT CONFIDENCE LIMITS SINCE THE ACTUAL CONFIDENCE LEVEL ASSOCIATED WITH THESE LIMITS IS 99.7389 PERCENT.
AN APPROXIMATE LC50 FOR THIS DATA SET IS 60.743

THE MOVING AVERAGE METHOD CANNOT BE USED WITH THIS DATA SET BECAUSE NO SPAN WHICH PRODUCES AVERAGE ANGLES BRACKETING 45 DEGREES ALSO USES TWO PERCENT DEAD BETWEEN 0 AND 100 PERCENT.

NO CONVERGENCE IN 25 ITERATIONS. PROBIT METHOD PROBABLY CAN NOT BE USE WITH THIS SET OF DATA.

DATE: 11/15/00 TEST NUMBER: 22048 DURATION: 7 days
SAMPLE: 22048 SPECIES: E. foetida

METHOD	LC50	CONFIDENCE LIMITS LOWER	UPPER	SPAN
BINOMIAL	60.743	50.000	100.000	50.000
MAA	*******	*******	*******	*******
PROBIT	*******	*******	*******	*******
SPEARMAN	58.777	52.317	66.036	13.720

NOTE: MORTALITY PROPORTIONS WERE NOT MONOTONICALLY INCREASING.
ADJUSTMENTS WERE MADE PRIOR TO SPEARMAN-KARBER ESTIMATION.

**** = LIMIT DOES NOT EXIST

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

SPEARMAN-KARBER

TRIM:	7.78%
LC50:	57.272
95% LOWER CONFIDENCE:	49.677
95% UPPER CONFIDENCE:	66.029

CONC. %	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB.(%)
6.25	30.	3.	10.00	.4215D-03
12.50	30.	2.	6.67	.4340D-04
25.00	30.	2.	6.67	.4340D-04
50.00	30.	9.	30.00	.2139D+01
100.00	30.	30.	100.00	.9313D-07

THE BINOMIAL TEST SHOWS THAT 50.00 AND 100.00 CAN BE USED AS STATISTICALLY SOUND CONSERVATIVE 95 PERCENT CONFIDENCE LIMITS SINCE THE ACTUAL CONFIDENCE LEVEL ASSOCIATED WITH THESE LIMITS IS 97.8613 PERCENT.
AN APPROXIMATE LC50 FOR THIS DATA SET IS 58.336

RESULTS USING MOVING AVERAGE

SPAN	G	LC50	95% CONFIDENCE LIMIT	
2	.044	53.01	46.69	60.52

****** RESULTS CALCULATED BY PROBIT METHOD

ITERATIONS	G	H	GOODNESS OF FIT
6	2.807	11.97	.00

A PROBABILITY OF 0 MEANS LESS THAN 0.001

SLOPE = 2.48
95% CONFIDENCE LIMITS: -1.67 AND 6.62

LC50= 49.51
95% CONFIDENCE LIMITS: 0 AND + INFINITY

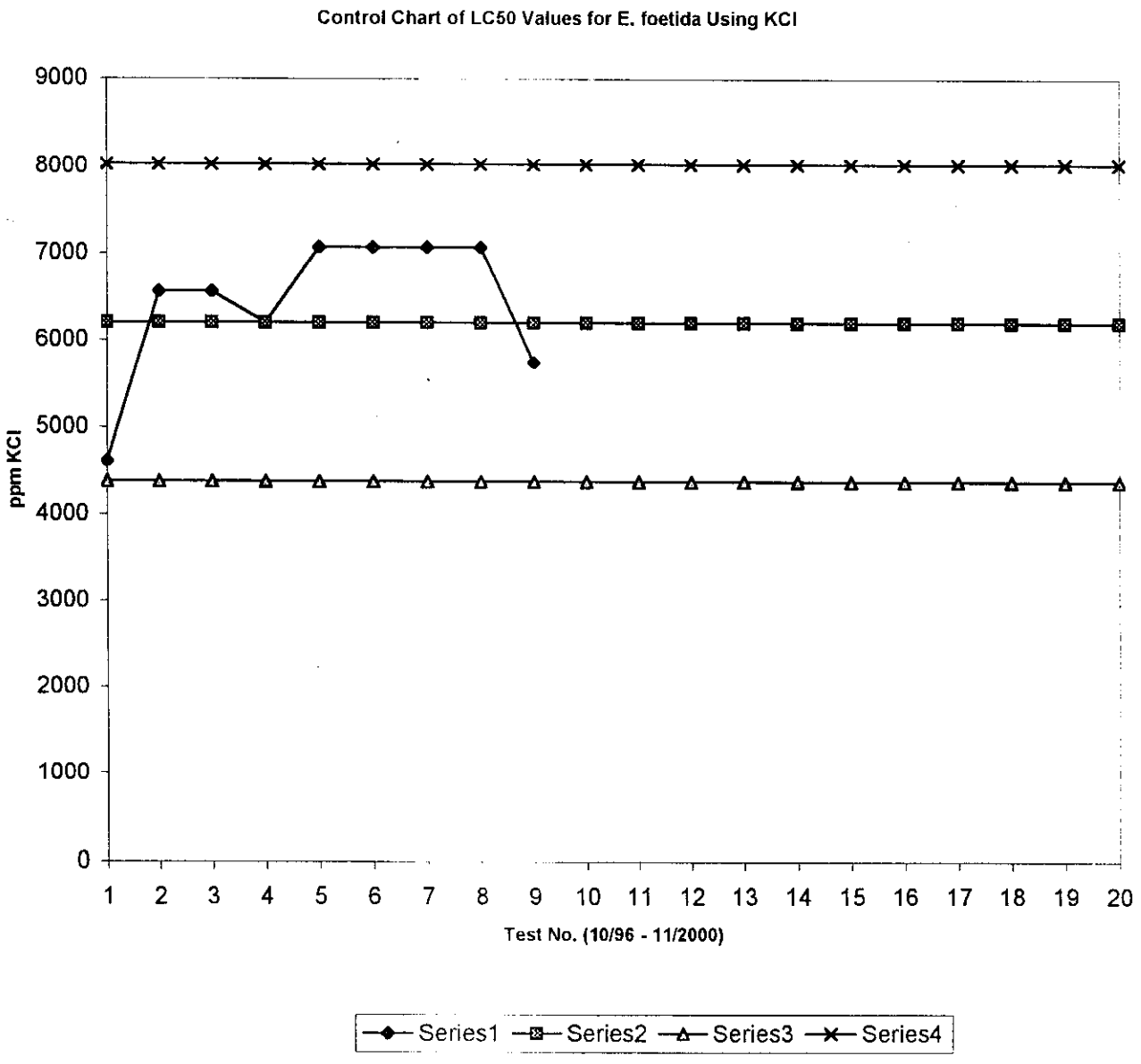
LC1 = 5.69
95% CONFIDENCE LIMITS: 0 AND 25.04

DATE: 11/15/00 TEST NUMBER: 22048 DURATION: 14 days
SAMPLE: 22048 SPECIES: E. foetida

METHOD	LC50	CONFIDENCE LIMITS LOWER	UPPER	SPAN
BINOMIAL	58.336	50.000	100.000	50.000
MAA	53.011	46.689	60.516	13.827
PROBIT	49.512	*******	*******	*******
SPEARMAN	57.272	49.677	66.029	16.353

NOTE: MORTALITY PROPORTIONS WERE NOT MONOTONICALLY INCREASING.
ADJUSTMENTS WERE MADE PRIOR TO SPEARMAN-KARBER ESTIMATION.

**** = LIMIT DOES NOT EXIST


Control Chart of LC50 Values for E. foetida Using KCl
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
ppm KCl
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Test No. (10/96 - 11/2000)
Series1
Series2
Series3
Series4

Control Chart of LC50 values for E. foetida using KCl

Date	Test No	ppm LC50	Mean LC50	SD	Lower 95% CL	Upper 95% CL
10/21/1996	1	4613	6200.8	912.80	4375.201	8026.40
2/19/1997		6559	6200.8		4375.201	8026.40
10/16/1998	3	6559	6200.8		4375.201	8026.40
3/5/1999		6202	6200.8		4375.201	8026.40
4/16/1999	5	7071	6200.8		4375.201	8026.40
9/13/1999		7071	6200.8		4375.201	8026.40
10/25/1999	7	7071	6200.8		4375.201	8026.40
11/16/1999		7071	6200.8		4375.201	8026.40
11/28/2000	9	5748	6200.8		4375.201	8026.40
			6200.8		4375.201	8026.40
	11		6200.8		4375.201	8026.40
			6200.8		4375.201	8026.40
	13		6200.8		4375.201	8026.40
			6200.8		4375.201	8026.40
	15		6200.8		4375.201	8026.40
			6200.8		4375.201	8026.40
	17		6200.8		4375.201	8026.40
			6200.8		4375.201	8026.40
	19		6200.8		4375.201	8026.40
			6200.8		4375.201	8026.40

ACUTE 14 DAY STANDARD REFERENCE TOXICANT

Stock and Treatments Preparation Sheet
**** ALL UNITS ARE MG/L UNLESS OTHERWISE SPECIFIED****

Source of Dilution Water: Species: *E. foetida or L. terrestris*
Date: Location: ASI Flemington, NJ

TOXICANT: Potassium chloride Source/Lot No.:

Prepare Stock Solution (mg/L) by adding
50 g to 500 ml volumetric flask with DI water

Conc. ppm	*E. foetida* ml Stock solution	*L. terrestis* ml of Stock solution	Total Volume, ml
0	0	0	Hydration volume
1250	2.5	6.25	35 70 TD 11/28/00
2500	5.0	12.5	
5000	10.0	25.0	
10000	20.0	50.0	
20000	40.0	100.0	

Each volume of stock solution is added as part of total hydration water, which is then added to 200 g dry weight of artificial soil for each *E. foetida* replicate, and 500 g dry weight of artificial soil for *L. terrestis* replicate.

Prepared by: TD

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

SPEARMAN-KARBER

TRIM: .00%
LC50: 637.280
95% LOWER CONFIDENCE: 568.081
95% UPPER CONFIDENCE: 714.909

CONC. ppt	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB.(%)
125.00	20.	0.	.00	.9537D-04
250.00	20.	1.	5.00	.2003D-02
500.00	20.	2.	10.00	.2012D-01
1000.00	20.	20.	100.00	.9537D-04
2000.00	20.	20.	100.00	.9537D-04

THE BINOMIAL TEST SHOWS THAT 500.00 AND 1000.00 CAN BE USED AS STATISTICALLY SOUND CONSERVATIVE 95 PERCENT CONFIDENCE LIMITS SINCE THE ACTUAL CONFIDENCE LEVEL ASSOCIATED WITH THESE LIMITS IS 99.9798 PERCENT.
AN APPROXIMATE LC50 FOR THIS DATA SET IS 655.926

RESULTS USING MOVING AVERAGE

SPAN	G	LC50	95% CONFIDENCE LIMIT	
4	.051	576.63	468.19	721.22

****** RESULTS CALCULATED BY PROBIT METHOD

ITERATIONS	G	H	GOODNESS OF FIT
10	2.848	5.98	.00

A PROBABILITY OF 0 MEANS LESS THAN 0.001

SLOPE = 7.00
95% CONFIDENCE LIMITS: -4.81 AND 18.81

LC50= 612.34
95% CONFIDENCE LIMITS: 0 AND + INFINITY

LC1 = 284.85
95% CONFIDENCE LIMITS: 0 AND 544.59

DATE: 11/28/00 TEST NUMBER: SRT DURATION: 7 days
SAMPLE: KCl SPECIES: E. foetida

METHOD	LC50	CONFIDENCE LIMITS LOWER	UPPER	SPAN
BINOMIAL	655.926	500.000	*******	500.000
MAA	576.626	468.190	721.223	253.033
PROBIT	612.336	*******	*******	*******
SPEARMAN	637.280	568.081	714.909	146.828

**** = LIMIT DOES NOT EXIST

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

SPEARMAN-KARBER

TRIM:	.00%
LC50:	5946.036
95% LOWER CONFIDENCE:	5163.011
95% UPPER CONFIDENCE:	6847.814

BBM

CONC. ppm	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB.(%)
1250.00	20.	0.	.00	.9537D-04
2500.00	20.	1.	5.00	.2003D-02
5000.00	20.	4.	20.00	.5909D+00
*******	20.	20.	100.00	.9537D-04
*******	20.	20.	100.00	.9537D-04

THE BINOMIAL TEST SHOWS THAT 5000.00 AND ******* CAN BE USED AS STATISTICALLY SOUND CONSERVATIVE 95 PERCENT CONFIDENCE LIMITS SINCE THE ACTUAL CONFIDENCE LEVEL ASSOCIATED WITH THESE LIMITS IS 99.4090 PERCENT.
AN APPROXIMATE LC50 FOR THIS DATA SET IS 6202.378

RESULTS USING MOVING AVERAGE

SPAN	G	LC50	95% CONFIDENCE LIMIT	
4	.051	5394.09	4372.38	6709.43

****** RESULTS CALCULATED BY PROBIT METHOD

ITERATIONS	G	H	GOODNESS OF FIT
9	.177	1.00	.06

SLOPE = 6.69
95% CONFIDENCE LIMITS: 3.87 AND 9.50

LC50= 5747.58
95% CONFIDENCE LIMITS: 4821.77 AND 6852.24

LC1 = 2579.51
95% CONFIDENCE LIMITS: 1390.15 AND 3390.30

DATE: 11/28/00 TEST NUMBER: 20-475SR DURATION: 14 days
SAMPLE: KCl SPECIES: E. foetida

METHOD	LC50	CONFIDENCE LIMITS LOWER	UPPER	SPAN
BINOMIAL	*******	*******	*******	*******
MAA	*******	*******	*******	*******
PROBIT	*******	*******	*******	*******
SPEARMAN	*******	*******	*******	*******

**** = LIMIT DOES NOT EXIST

12/13/00

AQUA SURVEY, INC.
EARTHWORM LIVE COUNT

Start Date: 11/28/00

Start Time: 1500

Job #: 20-475

Sample ID: N/A

Sample ID	Rep	0	DAY 7	14
Control	1	10	10	10
	2	10	10	10
	3			
pH		6.6	xx	xx
1,250	1	10	10	10
	2	10	10	10
pH			xx	xx
2,500	1	10	9	9
	2	10	MS 12-5-00 ~~6~~ 10	10
pH			xx	xx
5,000	1	10	10	10
	2	10	8	6 2
pH			xx	xx
10,000	1	10	0 10	—
	2	10	0 10	—
pH			xx	xx
20,000	1	10	0 10	—
	2	10	0 10	—
pH			xx	xx
Initials		TD	MS	TD
Date		11/28/00	12-5-00	12/2/00

~~TNCollector~~ TD 12/2/00

	Temperature	Initials
Day 0:	20	TD
Day 1:		
Day 2:		
Day 3:		
Day 4:		
Day 5:		
Day 6:		
Day 7:		
Day 8:		
Day 9:		
Day 10:		
Day 11:		
Day 12:		
Day 13:		
Day 14:	20	TD

Notes:

AQUA SURVEY, INC.

CULTURE LAB DISTRIBUTION FORM

DATE: 11/15/00

TEST JOB#: SRT CLIENT: In House

TEST LOCATION: IN-LAB [x] FIELD [ ]

TEST SPECIES: E. foetida

TOTAL NUMBER ORGANISMS TRANSFERRED: 180+

AQUA SURVEY, INC. CULTURE LAB INVESTIGATORS: CC/CD

A. ORGANISMS

1. ASI CULTURE/HOLDING UNIT: Holding Tray
2. RECEIVING LOG #: 20-053 Carolina Bio
3. CULTURE LOG #: 20-0336
4. AGE/SIZE INFORMATION: adult

B. HOLDING [x] CULTURE [ ] WATER PARAMETERS

1. TEMPERATURE: 20.7°C
2. SALINITY: N/A
3. WATER SOURCE: N/A

C. TRANSFER CUSTODY & TRANSFER

1. LIVESTOCK RELINQUISHMENT DATE: 11/15/00
   TIME: 1030hrs
   BY: CC

2. LIVESTOCK RECEIVING DATE: 11/15/00
   TIME: 1030hrs
   BY: CD

3. CULTURE SUPERVISOR OR SENIOR TECH. INITIALS: _____

REMARKS: _____

AQUA SURVEY, INC.

CULTURE LABORATORY RECEIVING FORM

RECEIVING LOG #: 20-053 DATE: 11/14/00

SHIPPING CARRIER: Fed Ex. CARRIER LOG #: N/A

SPECIES: E. foetida NUMBER SHIPPED: 1600+

LIVESTOCK SOURCE/SHIPPER: Carolina Bio Supply

SHIPPER INVOICE #: 1651173 PACKER'S NAME: N/A

ASI ORDER REF. DATE: 11/10/00 ASI REF. INITIALS: CD

AGE/CHARACTERISTICS: adults

TAXONOMIC VERIFICATION LOG #: N/A DATE: N/A

RECEIVING/WATER QUALITY PARAMETERS

D.O: * TEMP: 20.5°C NH_3/NO_2: *

SALINITY/HARDNESS: * ALK: * pH: *

WATER - CLEAR/CLOUDY CONTAINER SIZE/NUMBER: 1 pint cups/16

OF BLUE ICE®: Ø TYPE OF PACKING: Styrofoam box

OBSERVATION/CONDITION OF LIVESTOCK: Appear healthy. * shipped in moist sediment. added directly to holding tray on arrival.

RECEIVING TECH. INIT.: CD SUPERVISORS'S INIT.: CD

Date	11/10/00
Time	16:19
Page	1

PACKING LIST

IF APPLICABLE NOTIFY YOUR PAYING OFFICE ON RECEIPT OF MERCHANDISE.

FROM: CAROLINA BIOLOGICAL SUPPLY COMPANY
2700 YORK ROAD
BURLINGTON, NC 27215-3398

Tel: 800-334-5551
Fax: 336-584-3399

BILL TO: 7099886
ACCOUNTS PAYABLE
AQUA SURVEY
499 POINT BREEZE RD
FLEMINGTON NJ 08822

SHIP TO: 8
CHRIS . DOYLE
AQUA SURVEY INC
499 POINT BREEZE RD
FLEMINGTON NJ 08822

Dept 3767

Quote No.	Pick List No.	Requested Delivery Date	Ship Date	Ship Method	Our Order No.	Customer Purchase Order No.
	67		11/13/00	FES	1651173	1110CD

Line	Ctn No.	Ordered	Shipped	B/O	Catalog No.	Description	Unit	Price	Extension
1		16	16		AA 141650	L409-REDWORMS	EACH		
2		1	1		AA 141672	L399B-MAGIC WORM FOOD	EACH		

AQUA SURVEY, INC.

CULTURE LAB DISTRIBUTION FORM

DATE: 11/15/00

TEST JOB#: 20.475 CLIENT: TDL

TEST LOCATION: IN-LAB [x] FIELD [ ]

TEST SPECIES: E. foetida

TOTAL NUMBER ORGANISMS TRANSFERRED: 780+

AQUA SURVEY, INC. CULTURE LAB INVESTIGATORS: CC/CD

A. ORGANISMS

1. ASI CULTURE/HOLDING UNIT: Holding Tray
2. RECEIVING LOG #: 20.053 Carolina Bio
3. CULTURE LOG #: 20.0737
4. AGE/SIZE INFORMATION: adult

B. HOLDING [x] CULTURE [ ] WATER PARAMETERS

1. TEMPERATURE: 20.5°C
2. SALINITY: N/A
3. WATER SOURCE: N/A

C. TRANSFER CUSTODY & TRANSFER

1. LIVESTOCK RELINQUISHMENT DATE: 11/15/00
   TIME: 1030hrs
   BY: CC

2. LIVESTOCK RECEIVING DATE: 11/15/00
   TIME: 1030hrs
   BY: TP

3. CULTURE SUPERVISOR OR SENIOR TECH. INITIALS: _____

REMARKS: _____

AQUA SURVEY, INC.

CULTURE LABORATORY RECEIVING FORM

RECEIVING LOG #: 20-053 DATE: 11/14/00

SHIPPING CARRIER: Fed Ex. CARRIER LOG #: N/A

SPECIES: E. foetida NUMBER SHIPPED: 1600+

LIVESTOCK SOURCE/SHIPPER: Carolina Bio Supply

SHIPPER INVOICE #: 165173 PACKER'S NAME: N/A

ASI ORDER REF. DATE: 11/10/00 ASI REF. INITIALS: CD

AGE/CHARACTERISTICS: adults

TAXONOMIC VERIFICATION LOG #: N/A DATE: N/A

RECEIVING/WATER QUALITY PARAMETERS

D.O: * TEMP: 20.5°C NH_3/NO_2: *

SALINITY/HARDNESS: * ALK: * pH: *

WATER - CLEAR/CLOUDY CONTAINER SIZE/NUMBER: 1 pint ups/16

OF BLUE ICE®: Ø TYPE OF PACKING: Styrofoam box

OBSERVATION/CONDITION OF LIVESTOCK: Appears healthy. * shipped in moist sediment. added directly to holding tray on arrival.

RECEIVING TECH. INIT.: CD SUPERVISORS'S INIT.: CD

Date	11/10/00
Time	16:19
Page	1

PACKING LIST

IF APPLICABLE NOTIFY YOUR PAYING OFFICE ON RECEIPT OF MERCHANDISE.

FROM: CAROLINA BIOLOGICAL SUPPLY COMPANY
2700 YORK ROAD
BURLINGTON, NC 27215-3398

Tel: 800-334-5551
Fax: 336-584-3399

BILL TO: 7099886
ACCOUNTS PAYABLE
AQUA SURVEY
499 POINT BREEZE RD
FLEMINGTON NJ 08822

SHIP TO: 8
CHRIS DOYLE
AQUA SURVEY INC
499 POINT BREEZE RD
FLEMINGTON NJ 08822

Dept 3767

Quote No.	Pick List No.	Requested Delivery Date	Ship Date	Ship Method	Our Order No.	Customer Purchase Order No.
	67		11/13/00	FES	1651173	1110CD

Line	Cin No.	Ordered	Shipped	B/O	Catalog No.	Description	Unit	Price	Extension
1		16	16		AA 141650	L409-REDWORMS	EACH		
2		1	1		AA 141672	L399B-MAGIC WORM FOOD	EACH		

ASI, INC.
SAMPLE RECEIVING FORM

Client: TDL

Shipped Via: FED EX | # of Shipping Containers: 3

Type of Shipping Container: Cooler | Custody Seal Present X Absent _ Broken _ | Condition of Shipping Container: Acceptable X Unacceptable _

	ASI #	Sample ID	Type of Container	Number of Containers	Condition of Sample†	Temp. °C	Ice +	Type of Sample*
1.	22044	PCS-001	plastic	2	A	8°C	I	S
2.	22045	PCS-002	↓	↓	↓	↓	↓	↓
3.	22046	PCS-003	↓	↓	↓	↓	↓	↓
4.	22047	PCS-004	↓	↓	↓	↓	↓	↓
5.	22048	PCS-005	↓	↓	↓	↓	↓	↓
6.								
7.								
8.								
9.								
10.								

Notes: (Discrepancies Between Sample Label and COC Record)

Opened/Received by: Tom Dolce | Date/Time: 7/14/00 1110

* S - Soil
Sd - Sediment
Sl - Sludge
W - Water
E - Effluent

† A - Acceptable
U - Unusable or Contaminated

+ I - Ice
D - Dry Ice
B - Blue Ice
N - None

7/96

Reporting time: Wednesday, December 13, 2000, 17:53

Recorder ID: 7005768 Deploy No: 19
State: Run
Span: 26 days, 10 hours
Interval: one hour
Samples: 633
Delay: 0 seconds
Start: 11/17/00 9:28:43 AM
Recover: 12/13/00 17:52
Data source: Unit '7005768'
Trip Average: 70.7°F= 21.5°C
Trip Std Dev: 2.7°F= 1.5°C
Window: 64.4°F= 18.0°C 71.6°F= 22.0°C
Extremes: 62.6°F= 17.0°C 75.2°F= 24.0°C
Description: 11/17/00 08:25 20-475 Toltest, E. foetida, Sma
ll Waterbath Room

Notes:

Daily summary

Date	Samples	Min	Max	Under	Over	Daily Average
11/17/00	14	65.3°F= 18.5°C	66.2°F= 19.0°C	0	0	66.2°F= 19.0°C
11/18/00	24	63.5°F= 17.5°C	66.2°F= 19.0°C	4	0	64.4°F= 18.0°C
11/19/00	24	62.6°F= 17.0°C	65.3°F= 18.5°C	12	0	64.4°F= 18.0°C
11/20/00	24	65.3°F= 18.5°C	70.7°F= 21.5°C	0	0	67.1°F= 19.5°C
11/21/00	24	66.2°F= 19.0°C	71.6°F= 22.0°C	0	0	69.8°F= 21.0°C
11/22/00	24	71.6°F= 22.0°C	73.4°F= 23.0°C	0	23	72.5°F= 22.5°C
11/23/00	24	72.5°F= 22.5°C	73.4°F= 23.0°C	0	24	72.5°F= 22.5°C
11/24/00	24	72.5°F= 22.5°C	73.4°F= 23.0°C	0	24	72.5°F= 22.5°C
11/25/00	24	72.5°F= 22.5°C	73.4°F= 23.0°C	0	24	72.5°F= 22.5°C
11/26/00	24	72.5°F= 22.5°C	73.4°F= 23.0°C	0	24	73.4°F= 23.0°C
11/27/00	24	72.5°F= 22.5°C	73.4°F= 23.0°C	0	24	73.4°F= 23.0°C
11/28/00	24	69.8°F= 21.0°C	72.5°F= 22.5°C	0	4	71.6°F= 22.0°C
11/29/00	24	68.0°F= 20.0°C	71.6°F= 22.0°C	0	0	69.8°F= 21.0°C — test
11/30/00	24	68.9°F= 20.5°C	70.7°F= 21.5°C	0	0	69.8°F= 21.0°C — End.
12/1/00	24	66.2°F= 19.0°C	70.7°F= 21.5°C	0	0	68.9°F= 20.5°C
12/2/00	24	70.7°F= 21.5°C	70.7°F= 21.5°C	0	0	70.7°F= 21.5°C
12/3/00	24	70.7°F= 21.5°C	71.6°F= 22.0°C	0	0	70.7°F= 21.5°C
12/4/00	24	70.7°F= 21.5°C	70.7°F= 21.5°C	0	0	70.7°F= 21.5°C
12/5/00	24	68.9°F= 20.5°C	71.6°F= 22.0°C	0	0	69.8°F= 21.0°C
12/6/00	24	67.1°F= 19.5°C	71.6°F= 22.0°C	0	0	68.9°F= 20.5°C
12/7/00	24	71.6°F= 22.0°C	73.4°F= 23.0°C	0	21	72.5°F= 22.5°C
12/8/00	24	72.5°F= 22.5°C	74.3°F= 23.5°C	0	24	73.4°F= 23.0°C
12/9/00	24	72.5°F= 22.5°C	73.4°F= 23.0°C	0	24	73.4°F= 23.0°C
12/10/00	24	72.5°F= 22.5°C	75.2°F= 24.0°C	0	24	73.4°F= 23.0°C
12/11/00	24	72.5°F= 22.5°C	73.4°F= 23.0°C	0	24	72.5°F= 22.5°C
12/12/00	24	68.0°F= 20.0°C	72.5°F= 22.5°C	0	1	70.7°F= 21.5°C
12/13/00	19	64.4°F= 18.0°C	73.4°F= 23.0°C	0	4	68.0°F= 20.0°C

Readings

Sample	Date	Time	°F	°C	Sample	Date	Time	°F	°C
1	11/17/00	09:28:43	65.3	18.5	51	11/19/00	11:28:43	63.5	17.5
2	11/17/00	10:28:43	66.2	19.0	52	11/19/00	12:28:43	63.5	17.5
3	11/17/00	11:28:43	66.2	19.0	53	11/19/00	13:28:43	63.5	17.5
4	11/17/00	12:28:43	66.2	19.0	54	11/19/00	14:28:43	64.4	18.0
5	11/17/00	13:28:43	66.2	19.0	55	11/19/00	15:28:43	64.4	18.0
6	11/17/00	14:28:43	66.2	19.0	56	11/19/00	16:28:43	64.4	18.0
7	11/17/00	15:28:43	66.2	19.0	57	11/19/00	17:28:43	65.3	18.5
8	11/17/00	16:28:43	66.2	19.0	58	11/19/00	18:28:43	65.3	18.5
9	11/17/00	17:28:43	66.2	19.0	59	11/19/00	19:28:43	65.3	18.5
10	11/17/00	18:28:43	66.2	19.0	60	11/19/00	20:28:43	65.3	18.5
11	11/17/00	19:28:43	66.2	19.0	61	11/19/00	21:28:43	65.3	18.5
12	11/17/00	20:28:43	66.2	19.0	62	11/19/00	22:28:43	65.3	18.5
13	11/17/00	21:28:43	66.2	19.0	63	11/19/00	23:28:43	65.3	18.5
14	11/17/00	22:28:43	66.2	19.0	64	11/20/00	00:28:43	65.3	18.5
15	11/17/00	23:28:43	66.2	19.0	65	11/20/00	01:28:43	65.3	18.5
16	11/18/00	00:28:43	65.3	18.5	66	11/20/00	02:28:43	65.3	18.5
17	11/18/00	01:28:43	65.3	18.5	67	11/20/00	03:28:43	65.3	18.5
18	11/18/00	02:28:43	65.3	18.5	68	11/20/00	04:28:43	65.3	18.5
19	11/18/00	03:28:43	65.3	18.5	69	11/20/00	05:28:43	66.2	19.0
20	11/18/00	04:28:43	64.4	18.0	70	11/20/00	06:28:43	66.2	19.0
21	11/18/00	05:28:43	64.4	18.0	71	11/20/00	07:28:43	66.2	19.0
22	11/18/00	06:28:43	64.4	18.0	72	11/20/00	08:28:43	66.2	19.0
23	11/18/00	07:28:43	63.5	17.5	73	11/20/00	09:28:43	66.2	19.0
24	11/18/00	08:28:43	63.5	17.5	74	11/20/00	10:28:43	66.2	19.0
25	11/18/00	09:28:43	63.5	17.5	75	11/20/00	11:28:43	67.1	19.5
26	11/18/00	10:28:43	63.5	17.5	76	11/20/00	12:28:43	67.1	19.5
27	11/18/00	11:28:43	64.4	18.0	77	11/20/00	13:28:43	67.1	19.5
28	11/18/00	12:28:43	64.4	18.0	78	11/20/00	14:28:43	67.1	19.5
29	11/18/00	13:28:43	64.4	18.0	79	11/20/00	15:28:43	67.1	19.5
30	11/18/00	14:28:43	64.4	18.0	80	11/20/00	16:28:43	68.0	20.0
31	11/18/00	15:28:43	65.3	18.5	81	11/20/00	17:28:43	68.9	20.5
32	11/18/00	16:28:43	65.3	18.5	82	11/20/00	18:28:43	69.8	21.0
33	11/18/00	17:28:43	65.3	18.5	83	11/20/00	19:28:43	70.7	21.5
34	11/18/00	18:28:43	65.3	18.5	84	11/20/00	20:28:43	70.7	21.5
35	11/18/00	19:28:43	65.3	18.5	85	11/20/00	21:28:43	70.7	21.5
36	11/18/00	20:28:43	65.3	18.5	86	11/20/00	22:28:43	70.7	21.5
37	11/18/00	21:28:43	64.4	18.0	87	11/20/00	23:28:43	70.7	21.5
38	11/18/00	22:28:43	64.4	18.0	88	11/21/00	00:28:43	70.7	21.5
39	11/18/00	23:28:43	64.4	18.0	89	11/21/00	01:28:43	69.8	21.0
40	11/19/00	00:28:43	64.4	18.0	90	11/21/00	02:28:43	68.9	20.5
41	11/19/00	01:28:43	64.4	18.0	91	11/21/00	03:28:43	68.0	20.0
42	11/19/00	02:28:43	63.5	17.5	92	11/21/00	04:28:43	68.0	20.0
43	11/19/00	03:28:43	63.5	17.5	93	11/21/00	05:28:43	67.1	19.5
44	11/19/00	04:28:43	63.5	17.5	94	11/21/00	06:28:43	67.1	19.5
45	11/19/00	05:28:43	63.5	17.5	95	11/21/00	07:28:43	66.2	19.0
46	11/19/00	06:28:43	63.5	17.5	96	11/21/00	08:28:43	66.2	19.0
47	11/19/00	07:28:43	62.6	17.0	97	11/21/00	09:28:43	66.2	19.0
48	11/19/00	08:28:43	62.6	17.0	98	11/21/00	10:28:43	68.0	20.0
49	11/19/00	09:28:43	63.5	17.5	99	11/21/00	11:28:43	68.9	20.5
50	11/19/00	10:28:43	63.5	17.5	100	11/21/00	12:28:43	69.8	21.0

Sample	Date	Time	°F	°C
101	11/21/00	13:28:43	69.8	21.0
102	11/21/00	14:28:43	70.7	21.5
103	11/21/00	15:28:43	70.7	21.5
104	11/21/00	16:28:43	70.7	21.5
105	11/21/00	17:28:43	71.6	22.0
106	11/21/00	18:28:43	71.6	22.0
107	11/21/00	19:28:43	71.6	22.0
108	11/21/00	20:28:43	71.6	22.0
109	11/21/00	21:28:43	71.6	22.0
110	11/21/00	22:28:43	71.6	22.0
111	11/21/00	23:28:43	71.6	22.0
112	11/22/00	00:28:43	72.5	22.5
113	11/22/00	01:28:43	72.5	22.5
114	11/22/00	02:28:43	72.5	22.5
115	11/22/00	03:28:43	72.5	22.5
116	11/22/00	04:28:43	72.5	22.5
117	11/22/00	05:28:43	72.5	22.5
118	11/22/00	06:28:43	72.5	22.5
119	11/22/00	07:28:43	72.5	22.5
120	11/22/00	08:28:43	73.4	23.0
121	11/22/00	09:28:43	73.4	23.0
122	11/22/00	10:28:43	73.4	23.0
123	11/22/00	11:28:43	73.4	23.0
124	11/22/00	12:28:43	73.4	23.0
125	11/22/00	13:28:43	73.4	23.0
126	11/22/00	14:28:43	73.4	23.0
127	11/22/00	15:28:43	73.4	23.0
128	11/22/00	16:28:43	73.4	23.0
129	11/22/00	17:28:43	73.4	23.0
130	11/22/00	18:28:43	72.5	22.5
131	11/22/00	19:28:43	72.5	22.5
132	11/22/00	20:28:43	72.5	22.5
133	11/22/00	21:28:43	72.5	22.5
134	11/22/00	22:28:43	72.5	22.5
135	11/22/00	23:28:43	72.5	22.5
136	11/23/00	00:28:43	72.5	22.5
137	11/23/00	01:28:43	72.5	22.5
138	11/23/00	02:28:43	72.5	22.5
139	11/23/00	03:28:43	72.5	22.5
140	11/23/00	04:28:43	72.5	22.5
141	11/23/00	05:28:43	72.5	22.5
142	11/23/00	06:28:43	72.5	22.5
143	11/23/00	07:28:43	72.5	22.5
144	11/23/00	08:28:43	72.5	22.5
145	11/23/00	09:28:43	73.4	23.0
146	11/23/00	10:28:43	73.4	23.0
147	11/23/00	11:28:43	73.4	23.0
148	11/23/00	12:28:43	73.4	23.0
149	11/23/00	13:28:43	73.4	23.0
150	11/23/00	14:28:43	73.4	23.0
151	11/23/00	15:28:43	73.4	23.0
152	11/23/00	16:28:43	73.4	23.0
153	11/23/00	17:28:43	73.4	23.0
154	11/23/00	18:28:43	73.4	23.0
155	11/23/00	19:28:43	73.4	23.0
156	11/23/00	20:28:43	72.5	22.5
157	11/23/00	21:28:43	72.5	22.5
158	11/23/00	22:28:43	72.5	22.5
159	11/23/00	23:28:43	72.5	22.5
160	11/24/00	00:28:43	72.5	22.5
161	11/24/00	01:28:43	72.5	22.5
162	11/24/00	02:28:43	72.5	22.5
163	11/24/00	03:28:43	72.5	22.5
164	11/24/00	04:28:43	72.5	22.5
165	11/24/00	05:28:43	72.5	22.5
166	11/24/00	06:28:43	72.5	22.5
167	11/24/00	07:28:43	73.4	23.0
168	11/24/00	08:28:43	73.4	23.0
169	11/24/00	09:28:43	73.4	23.0
170	11/24/00	10:28:43	73.4	23.0
171	11/24/00	11:28:43	73.4	23.0
172	11/24/00	12:28:43	73.4	23.0
173	11/24/00	13:28:43	73.4	23.0
174	11/24/00	14:28:43	73.4	23.0
175	11/24/00	15:28:43	73.4	23.0
176	11/24/00	16:28:43	73.4	23.0
177	11/24/00	17:28:43	73.4	23.0
178	11/24/00	18:28:43	72.5	22.5
179	11/24/00	19:28:43	72.5	22.5
180	11/24/00	20:28:43	72.5	22.5
181	11/24/00	21:28:43	72.5	22.5
182	11/24/00	22:28:43	72.5	22.5
183	11/24/00	23:28:43	72.5	22.5
184	11/25/00	00:28:43	72.5	22.5
185	11/25/00	01:28:43	72.5	22.5
186	11/25/00	02:28:43	72.5	22.5
187	11/25/00	03:28:43	72.5	22.5
188	11/25/00	04:28:43	72.5	22.5
189	11/25/00	05:28:43	72.5	22.5
190	11/25/00	06:28:43	72.5	22.5
191	11/25/00	07:28:43	72.5	22.5
192	11/25/00	08:28:43	72.5	22.5
193	11/25/00	09:28:43	73.4	23.0
194	11/25/00	10:28:43	73.4	23.0
195	11/25/00	11:28:43	73.4	23.0
196	11/25/00	12:28:43	73.4	23.0
197	11/25/00	13:28:43	73.4	23.0
198	11/25/00	14:28:43	73.4	23.0
199	11/25/00	15:28:43	73.4	23.0
200	11/25/00	16:28:43	73.4	23.0

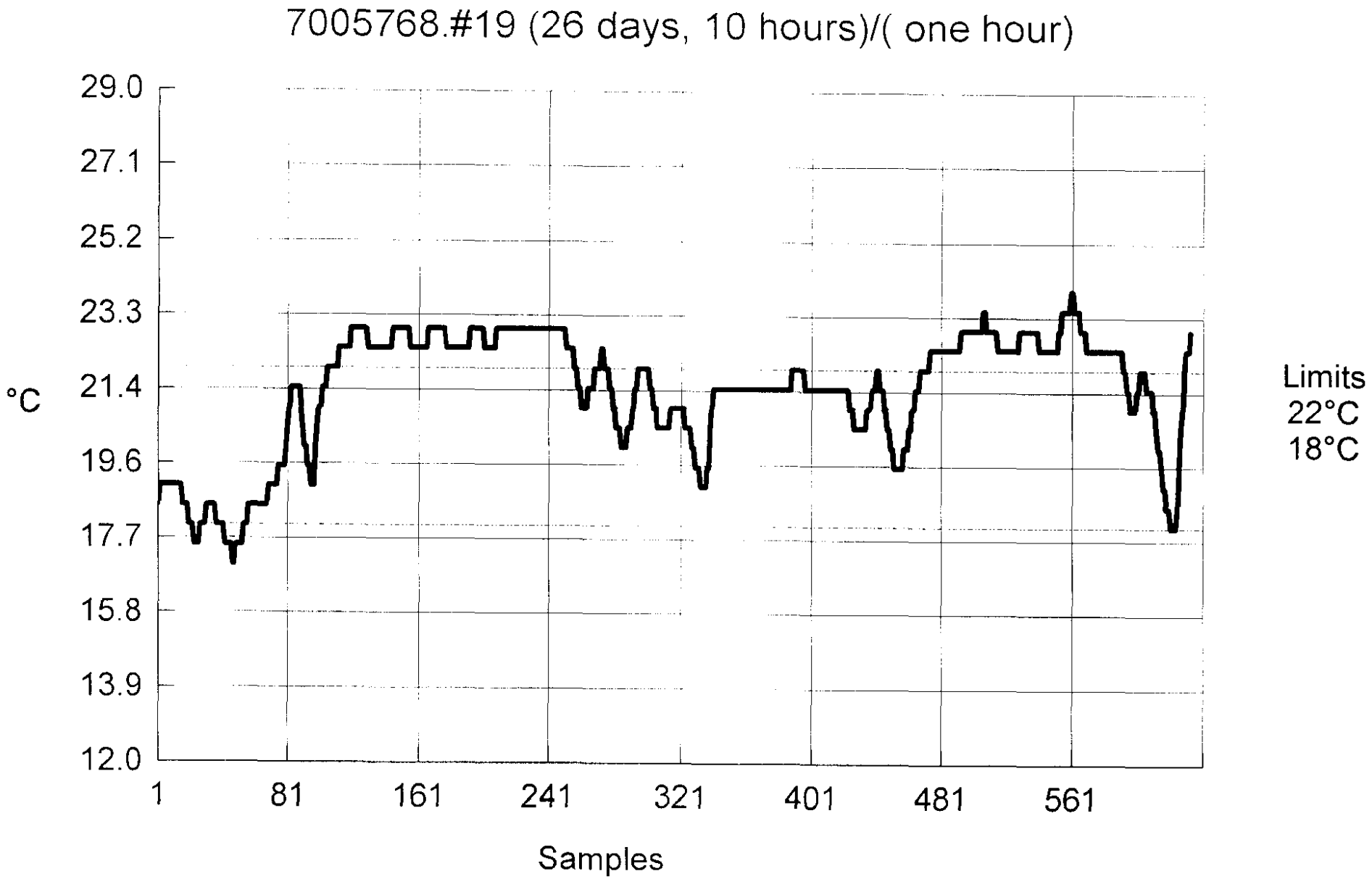
Sample	Date	Time	°F	°C	Sample	Date	Time	°F	°C
201	11/25/00	17:28:43	73.4	23.0	251	11/27/00	19:28:43	73.4	23.0
202	11/25/00	18:28:43	72.5	22.5	252	11/27/00	20:28:43	72.5	22.5
203	11/25/00	19:28:43	72.5	22.5	253	11/27/00	21:28:43	72.5	22.5
204	11/25/00	20:28:43	72.5	22.5	254	11/27/00	22:28:43	72.5	22.5
205	11/25/00	21:28:43	72.5	22.5	255	11/27/00	23:28:43	72.5	22.5
206	11/25/00	22:28:43	72.5	22.5	256	11/28/00	00:28:43	72.5	22.5
207	11/25/00	23:28:43	72.5	22.5	257	11/28/00	01:28:43	71.6	22.0
208	11/26/00	00:28:43	72.5	22.5	258	11/28/00	02:28:43	71.6	22.0
209	11/26/00	01:28:43	73.4	23.0	259	11/28/00	03:28:43	70.7	21.5
210	11/26/00	02:28:43	73.4	23.0	260	11/28/00	04:28:43	70.7	21.5
211	11/26/00	03:28:43	73.4	23.0	261	11/28/00	05:28:43	69.8	21.0
212	11/26/00	04:28:43	73.4	23.0	262	11/28/00	06:28:43	69.8	21.0
213	11/26/00	05:28:43	73.4	23.0	263	11/28/00	07:28:43	69.8	21.0
214	11/26/00	06:28:43	73.4	23.0	264	11/28/00	08:28:43	69.8	21.0
215	11/26/00	07:28:43	73.4	23.0	265	11/28/00	09:28:43	70.7	21.5
216	11/26/00	08:28:43	73.4	23.0	266	11/28/00	10:28:43	70.7	21.5
217	11/26/00	09:28:43	73.4	23.0	267	11/28/00	11:28:43	70.7	21.5
218	11/26/00	10:28:43	73.4	23.0	268	11/28/00	12:28:43	70.7	21.5
219	11/26/00	11:28:43	73.4	23.0	269	11/28/00	13:28:43	71.6	22.0
220	11/26/00	12:28:43	73.4	23.0	270	11/28/00	14:28:43	71.6	22.0
221	11/26/00	13:28:43	73.4	23.0	271	11/28/00	15:28:43	71.6	22.0
222	11/26/00	14:28:43	73.4	23.0	272	11/28/00	16:28:43	71.6	22.0
223	11/26/00	15:28:43	73.4	23.0	273	11/28/00	17:28:43	72.5	22.5
224	11/26/00	16:28:43	73.4	23.0	274	11/28/00	18:28:43	72.5	22.5
225	11/26/00	17:28:43	73.4	23.0	275	11/28/00	19:28:43	71.6	22.0
226	11/26/00	18:28:43	73.4	23.0	276	11/28/00	20:28:43	71.6	22.0
227	11/26/00	19:28:43	73.4	23.0	277	11/28/00	21:28:43	71.6	22.0
228	11/26/00	20:28:43	73.4	23.0	278	11/28/00	22:28:43	70.7	21.5
229	11/26/00	21:28:43	73.4	23.0	279	11/28/00	23:28:43	70.7	21.5
230	11/26/00	22:28:43	73.4	23.0	280	11/29/00	00:28:43	69.8	21.0
231	11/26/00	23:28:43	73.4	23.0	281	11/29/00	01:28:43	69.8	21.0
232	11/27/00	00:28:43	73.4	23.0	282	11/29/00	02:28:43	68.9	20.5
233	11/27/00	01:28:43	73.4	23.0	283	11/29/00	03:28:43	68.9	20.5
234	11/27/00	02:28:43	73.4	23.0	284	11/29/00	04:28:43	68.9	20.5
235	11/27/00	03:28:43	73.4	23.0	285	11/29/00	05:28:43	68.0	20.0
236	11/27/00	04:28:43	73.4	23.0	286	11/29/00	06:28:43	68.0	20.0
237	11/27/00	05:28:43	73.4	23.0	287	11/29/00	07:28:43	68.0	20.0
238	11/27/00	06:28:43	73.4	23.0	288	11/29/00	08:28:43	68.0	20.0
239	11/27/00	07:28:43	73.4	23.0	289	11/29/00	09:28:43	68.9	20.5
240	11/27/00	08:28:43	73.4	23.0	290	11/29/00	10:28:43	68.9	20.5
241	11/27/00	09:28:43	73.4	23.0	291	11/29/00	11:28:43	68.9	20.5
242	11/27/00	10:28:43	73.4	23.0	292	11/29/00	12:28:43	69.8	21.0
243	11/27/00	11:28:43	73.4	23.0	293	11/29/00	13:28:43	70.7	21.5
244	11/27/00	12:28:43	73.4	23.0	294	11/29/00	14:28:43	70.7	21.5
245	11/27/00	13:28:43	73.4	23.0	295	11/29/00	15:28:43	71.6	22.0
246	11/27/00	14:28:43	73.4	23.0	296	11/29/00	16:28:43	71.6	22.0
247	11/27/00	15:28:43	73.4	23.0	297	11/29/00	17:28:43	71.6	22.0
248	11/27/00	16:28:43	73.4	23.0	298	11/29/00	18:28:43	71.6	22.0
249	11/27/00	17:28:43	73.4	23.0	299	11/29/00	19:28:43	71.6	22.0
250	11/27/00	18:28:43	73.4	23.0	300	11/29/00	20:28:43	71.6	22.0

Sample	Date	Time	°F	°C	Sample	Date	Time	°F	°C
301	11/29/00	21:28:43	71.6	22.0	351	12/1/00	23:28:43	70.7	21.5
302	11/29/00	22:28:43	70.7	21.5	352	12/2/00	00:28:43	70.7	21.5
303	11/29/00	23:28:43	70.7	21.5	353	12/2/00	01:28:43	70.7	21.5
304	11/30/00	00:28:43	69.8	21.0	354	12/2/00	02:28:43	70.7	21.5
305	11/30/00	01:28:43	69.8	21.0	355	12/2/00	03:28:43	70.7	21.5
306	11/30/00	02:28:43	69.8	21.0	356	12/2/00	04:28:43	70.7	21.5
307	11/30/00	03:28:43	68.9	20.5	357	12/2/00	05:28:43	70.7	21.5
308	11/30/00	04:28:43	68.9	20.5	358	12/2/00	06:28:43	70.7	21.5
309	11/30/00	05:28:43	68.9	20.5	359	12/2/00	07:28:43	70.7	21.5
310	11/30/00	06:28:43	68.9	20.5	360	12/2/00	08:28:43	70.7	21.5
311	11/30/00	07:28:43	68.9	20.5	361	12/2/00	09:28:43	70.7	21.5
312	11/30/00	08:28:43	68.9	20.5	362	12/2/00	10:28:43	70.7	21.5
313	11/30/00	09:28:43	68.9	20.5	363	12/2/00	11:28:43	70.7	21.5
314	11/30/00	10:28:43	68.9	20.5	364	12/2/00	12:28:43	70.7	21.5
315	11/30/00	11:28:43	69.8	21.0	365	12/2/00	13:28:43	70.7	21.5
316	11/30/00	12:28:43	69.8	21.0	366	12/2/00	14:28:43	70.7	21.5
317	11/30/00	13:28:43	69.8	21.0	367	12/2/00	15:28:43	70.7	21.5
318	11/30/00	14:28:43	69.8	21.0	368	12/2/00	16:28:43	70.7	21.5
319	11/30/00	15:28:43	69.8	21.0	369	12/2/00	17:28:43	70.7	21.5
320	11/30/00	16:28:43	69.8	21.0	370	12/2/00	18:28:43	70.7	21.5
321	11/30/00	17:28:43	69.8	21.0	371	12/2/00	19:28:43	70.7	21.5
322	11/30/00	18:28:43	69.8	21.0	372	12/2/00	20:28:43	70.7	21.5
323	11/30/00	19:28:43	69.8	21.0	373	12/2/00	21:28:43	70.7	21.5
324	11/30/00	20:28:43	68.9	20.5	374	12/2/00	22:28:43	70.7	21.5
325	11/30/00	21:28:43	68.9	20.5	375	12/2/00	23:28:43	70.7	21.5
326	11/30/00	22:28:43	68.9	20.5	376	12/3/00	00:28:43	70.7	21.5
327	11/30/00	23:28:43	68.9	20.5	377	12/3/00	01:28:43	70.7	21.5
328	12/1/00	00:28:43	68.0	20.0	378	12/3/00	02:28:43	70.7	21.5
329	12/1/00	01:28:43	68.0	20.0	379	12/3/00	03:28:43	70.7	21.5
330	12/1/00	02:28:43	67.1	19.5	380	12/3/00	04:28:43	70.7	21.5
331	12/1/00	03:28:43	67.1	19.5	381	12/3/00	05:28:43	70.7	21.5
332	12/1/00	04:28:43	67.1	19.5	382	12/3/00	06:28:43	70.7	21.5
333	12/1/00	05:28:43	66.2	19.0	383	12/3/00	07:28:43	70.7	21.5
334	12/1/00	06:28:43	66.2	19.0	384	12/3/00	08:28:43	70.7	21.5
335	12/1/00	07:28:43	66.2	19.0	385	12/3/00	09:28:43	70.7	21.5
336	12/1/00	08:28:43	66.2	19.0	386	12/3/00	10:28:43	70.7	21.5
337	12/1/00	09:28:43	67.1	19.5	387	12/3/00	11:28:43	70.7	21.5
338	12/1/00	10:28:43	67.1	19.5	388	12/3/00	12:28:43	70.7	21.5
339	12/1/00	11:28:43	68.9	20.5	389	12/3/00	13:28:43	71.6	22.0
340	12/1/00	12:28:43	69.8	21.0	390	12/3/00	14:28:43	71.6	22.0
341	12/1/00	13:28:43	70.7	21.5	391	12/3/00	15:28:43	71.6	22.0
342	12/1/00	14:28:43	70.7	21.5	392	12/3/00	16:28:43	71.6	22.0
343	12/1/00	15:28:43	70.7	21.5	393	12/3/00	17:28:43	71.6	22.0
344	12/1/00	16:28:43	70.7	21.5	394	12/3/00	18:28:43	71.6	22.0
345	12/1/00	17:28:43	70.7	21.5	395	12/3/00	19:28:43	71.6	22.0
346	12/1/00	18:28:43	70.7	21.5	396	12/3/00	20:28:43	71.6	22.0
347	12/1/00	19:28:43	70.7	21.5	397	12/3/00	21:28:43	70.7	21.5
348	12/1/00	20:28:43	70.7	21.5	398	12/3/00	22:28:43	70.7	21.5
349	12/1/00	21:28:43	70.7	21.5	399	12/3/00	23:28:43	70.7	21.5
350	12/1/00	22:28:43	70.7	21.5	400	12/4/00	00:28:43	70.7	21.5

Sample	Date	Time	°F	°C	Sample	Date	Time	°F	°C
401	12/4/00	01:28:43	70.7	21.5	451	12/6/00	03:28:43	68.0	20.0
402	12/4/00	02:28:43	70.7	21.5	452	12/6/00	04:28:43	67.1	19.5
403	12/4/00	03:28:43	70.7	21.5	453	12/6/00	05:28:43	67.1	19.5
404	12/4/00	04:28:43	70.7	21.5	454	12/6/00	06:28:43	67.1	19.5
405	12/4/00	05:28:43	70.7	21.5	455	12/6/00	07:28:43	67.1	19.5
406	12/4/00	06:28:43	70.7	21.5	456	12/6/00	08:28:43	67.1	19.5
407	12/4/00	07:28:43	70.7	21.5	457	12/6/00	09:28:43	67.1	19.5
408	12/4/00	08:28:43	70.7	21.5	458	12/6/00	10:28:43	68.0	20.0
409	12/4/00	09:28:43	70.7	21.5	459	12/6/00	11:28:43	68.0	20.0
410	12/4/00	10:28:43	70.7	21.5	460	12/6/00	12:28:43	68.0	20.0
411	12/4/00	11:28:43	70.7	21.5	461	12/6/00	13:28:43	68.9	20.5
412	12/4/00	12:28:43	70.7	21.5	462	12/6/00	14:28:43	68.9	20.5
413	12/4/00	13:28:43	70.7	21.5	463	12/6/00	15:28:43	69.8	21.0
414	12/4/00	14:28:43	70.7	21.5	464	12/6/00	16:28:43	69.8	21.0
415	12/4/00	15:28:43	70.7	21.5	465	12/6/00	17:28:43	70.7	21.5
416	12/4/00	16:28:43	70.7	21.5	466	12/6/00	18:28:43	70.7	21.5
417	12/4/00	17:28:43	70.7	21.5	467	12/6/00	19:28:43	70.7	21.5
418	12/4/00	18:28:43	70.7	21.5	468	12/6/00	20:28:43	71.6	22.0
419	12/4/00	19:28:43	70.7	21.5	469	12/6/00	21:28:43	71.6	22.0
420	12/4/00	20:28:43	70.7	21.5	470	12/6/00	22:28:43	71.6	22.0
421	12/4/00	21:28:43	70.7	21.5	471	12/6/00	23:28:43	71.6	22.0
422	12/4/00	22:28:43	70.7	21.5	472	12/7/00	00:28:43	71.6	22.0
423	12/4/00	23:28:43	70.7	21.5	473	12/7/00	01:28:43	71.6	22.0
424	12/5/00	00:28:43	69.8	21.0	474	12/7/00	02:28:43	72.5	22.5
425	12/5/00	01:28:43	69.8	21.0	475	12/7/00	03:28:43	72.5	22.5
426	12/5/00	02:28:43	69.8	21.0	476	12/7/00	04:28:43	72.5	22.5
427	12/5/00	03:28:43	68.9	20.5	477	12/7/00	05:28:43	72.5	22.5
428	12/5/00	04:28:43	68.9	20.5	478	12/7/00	06:28:43	72.5	22.5
429	12/5/00	05:28:43	68.9	20.5	479	12/7/00	07:28:43	72.5	22.5
430	12/5/00	06:28:43	68.9	20.5	480	12/7/00	08:28:43	72.5	22.5
431	12/5/00	07:28:43	68.9	20.5	481	12/7/00	09:28:43	72.5	22.5
432	12/5/00	08:28:43	68.9	20.5	482	12/7/00	10:28:43	72.5	22.5
433	12/5/00	09:28:43	68.9	20.5	483	12/7/00	11:28:43	72.5	22.5
434	12/5/00	10:28:43	68.9	20.5	484	12/7/00	12:28:43	72.5	22.5
435	12/5/00	11:28:43	69.8	21.0	485	12/7/00	13:28:43	72.5	22.5
436	12/5/00	12:28:43	69.8	21.0	486	12/7/00	14:28:43	72.5	22.5
437	12/5/00	13:28:43	69.8	21.0	487	12/7/00	15:28:43	72.5	22.5
438	12/5/00	14:28:43	70.7	21.5	488	12/7/00	16:28:43	72.5	22.5
439	12/5/00	15:28:43	70.7	21.5	489	12/7/00	17:28:43	72.5	22.5
440	12/5/00	16:28:43	70.7	21.5	490	12/7/00	18:28:43	72.5	22.5
441	12/5/00	17:28:43	71.6	22.0	491	12/7/00	19:28:43	72.5	22.5
442	12/5/00	18:28:43	71.6	22.0	492	12/7/00	20:28:43	72.5	22.5
443	12/5/00	19:28:43	70.7	21.5	493	12/7/00	21:28:43	73.4	23.0
444	12/5/00	20:28:43	70.7	21.5	494	12/7/00	22:28:43	73.4	23.0
445	12/5/00	21:28:43	70.7	21.5	495	12/7/00	23:28:43	73.4	23.0
446	12/5/00	22:28:43	69.8	21.0	496	12/8/00	00:28:43	73.4	23.0
447	12/5/00	23:28:43	69.8	21.0	497	12/8/00	01:28:43	73.4	23.0
448	12/6/00	00:28:43	68.9	20.5	498	12/8/00	02:28:43	73.4	23.0
449	12/6/00	01:28:43	68.9	20.5	499	12/8/00	03:28:43	73.4	23.0
450	12/6/00	02:28:43	68.0	20.0	500	12/8/00	04:28:43	73.4	23.0

Sample	Date	Time	°F	°C
501	12/8/00	05:28:43	73.4	23.0
502	12/8/00	06:28:43	73.4	23.0
503	12/8/00	07:28:43	73.4	23.0
504	12/8/00	08:28:43	73.4	23.0
505	12/8/00	09:28:43	73.4	23.0
506	12/8/00	10:28:43	73.4	23.0
507	12/8/00	11:28:43	74.3	23.5
508	12/8/00	12:28:43	74.3	23.5
509	12/8/00	13:28:43	73.4	23.0
510	12/8/00	14:28:43	73.4	23.0
511	12/8/00	15:28:43	73.4	23.0
512	12/8/00	16:28:43	73.4	23.0
513	12/8/00	17:28:43	73.4	23.0
514	12/8/00	18:28:43	73.4	23.0
515	12/8/00	19:28:43	73.4	23.0
516	12/8/00	20:28:43	72.5	22.5
517	12/8/00	21:28:43	72.5	22.5
518	12/8/00	22:28:43	72.5	22.5
519	12/8/00	23:28:43	72.5	22.5
520	12/9/00	00:28:43	72.5	22.5
521	12/9/00	01:28:43	72.5	22.5
522	12/9/00	02:28:43	72.5	22.5
523	12/9/00	03:28:43	72.5	22.5
524	12/9/00	04:28:43	72.5	22.5
525	12/9/00	05:28:43	72.5	22.5
526	12/9/00	06:28:43	72.5	22.5
527	12/9/00	07:28:43	72.5	22.5
528	12/9/00	08:28:43	72.5	22.5
529	12/9/00	09:28:43	73.4	23.0
530	12/9/00	10:28:43	73.4	23.0
531	12/9/00	11:28:43	73.4	23.0
532	12/9/00	12:28:43	73.4	23.0
533	12/9/00	13:28:43	73.4	23.0
534	12/9/00	14:28:43	73.4	23.0
535	12/9/00	15:28:43	73.4	23.0
536	12/9/00	16:28:43	73.4	23.0
537	12/9/00	17:28:43	73.4	23.0
538	12/9/00	18:28:43	73.4	23.0
539	12/9/00	19:28:43	73.4	23.0
540	12/9/00	20:28:43	73.4	23.0
541	12/9/00	21:28:43	72.5	22.5
542	12/9/00	22:28:43	72.5	22.5
543	12/9/00	23:28:43	72.5	22.5
544	12/10/00	00:28:43	72.5	22.5
545	12/10/00	01:28:43	72.5	22.5
546	12/10/00	02:28:43	72.5	22.5
547	12/10/00	03:28:43	72.5	22.5
548	12/10/00	04:28:43	72.5	22.5
549	12/10/00	05:28:43	72.5	22.5
550	12/10/00	06:28:43	72.5	22.5

Sample	Date	Time	°F	°C
551	12/10/00	07:28:43	72.5	22.5
552	12/10/00	08:28:43	72.5	22.5
553	12/10/00	09:28:43	73.4	23.0
554	12/10/00	10:28:43	73.4	23.0
555	12/10/00	11:28:43	74.3	23.5
556	12/10/00	12:28:43	74.3	23.5
557	12/10/00	13:28:43	74.3	23.5
558	12/10/00	14:28:43	74.3	23.5
559	12/10/00	15:28:43	74.3	23.5
560	12/10/00	16:28:43	75.2	24.0
561	12/10/00	17:28:43	75.2	24.0
562	12/10/00	18:28:43	74.3	23.5
563	12/10/00	19:28:43	74.3	23.5
564	12/10/00	20:28:43	74.3	23.5
565	12/10/00	21:28:43	74.3	23.5
566	12/10/00	22:28:43	73.4	23.0
567	12/10/00	23:28:43	73.4	23.0
568	12/11/00	00:28:43	73.4	23.0
569	12/11/00	01:28:43	73.4	23.0
570	12/11/00	02:28:43	72.5	22.5
571	12/11/00	03:28:43	72.5	22.5
572	12/11/00	04:28:43	72.5	22.5
573	12/11/00	05:28:43	72.5	22.5
574	12/11/00	06:28:43	72.5	22.5
575	12/11/00	07:28:43	72.5	22.5
576	12/11/00	08:28:43	72.5	22.5
577	12/11/00	09:28:43	72.5	22.5
578	12/11/00	10:28:43	72.5	22.5
579	12/11/00	11:28:43	72.5	22.5
580	12/11/00	12:28:43	72.5	22.5
581	12/11/00	13:28:43	72.5	22.5
582	12/11/00	14:28:43	72.5	22.5
583	12/11/00	15:28:43	72.5	22.5
584	12/11/00	16:28:43	72.5	22.5
585	12/11/00	17:28:43	72.5	22.5
586	12/11/00	18:28:43	72.5	22.5
587	12/11/00	19:28:43	72.5	22.5
588	12/11/00	20:28:43	72.5	22.5
589	12/11/00	21:28:43	72.5	22.5
590	12/11/00	22:28:43	72.5	22.5
591	12/11/00	23:28:43	72.5	22.5
592	12/12/00	00:28:43	71.6	22.0
593	12/12/00	01:28:43	71.6	22.0
594	12/12/00	02:28:43	70.7	21.5
595	12/12/00	03:28:43	70.7	21.5
596	12/12/00	04:28:43	69.8	21.0
597	12/12/00	05:28:43	69.8	21.0
598	12/12/00	06:28:43	69.8	21.0
599	12/12/00	07:28:43	69.8	21.0
600	12/12/00	08:28:43	70.7	21.5


7005768.#19 (26 days, 10 hours)/(one hour)
29.0
27.1
25.2
23.3
21.4
19.6
17.7
15.8
13.9
12.0
°C
1
81
161
241
321
401
481
561
Samples
Limits
22°C
18°C

ARD
2/13/02

Sample	Date	Time	°F	°C
601	12/12/00	09:28:43	70.7	21.5
602	12/12/00	10:28:43	71.6	22.0
603	12/12/00	11:28:43	71.6	22.0
604	12/12/00	12:28:43	71.6	22.0
605	12/12/00	13:28:43	71.6	22.0
606	12/12/00	14:28:43	70.7	21.5
607	12/12/00	15:28:43	70.7	21.5
608	12/12/00	16:28:43	70.7	21.5
609	12/12/00	17:28:43	70.7	21.5
610	12/12/00	18:28:43	69.8	21.0
611	12/12/00	19:28:43	69.8	21.0
612	12/12/00	20:28:43	68.9	20.5
613	12/12/00	21:28:43	68.0	20.0
614	12/12/00	22:28:43	68.0	20.0
615	12/12/00	23:28:43	67.1	19.5
616	12/13/00	00:28:43	66.2	19.0
617	12/13/00	01:28:43	66.2	19.0
618	12/13/00	02:28:43	65.3	18.5
619	12/13/00	03:28:43	65.3	18.5
620	12/13/00	04:28:43	65.3	18.5
621	12/13/00	05:28:43	64.4	18.0
622	12/13/00	06:28:43	64.4	18.0
623	12/13/00	07:28:43	64.4	18.0
624	12/13/00	08:28:43	64.4	18.0
625	12/13/00	09:28:43	65.3	18.5
626	12/13/00	10:28:43	67.1	19.5
627	12/13/00	11:28:43	68.9	20.5
628	12/13/00	12:28:43	69.8	21.0
629	12/13/00	13:28:43	71.6	22.0
630	12/13/00	14:28:43	72.5	22.5
631	12/13/00	15:28:43	72.5	22.5
632	12/13/00	16:28:43	72.5	22.5
633	12/13/00	17:28:43	73.4	23.0

FedEx USA Airbill — FedEx Tracking Number 824134233865

Form #3JAG 0215

RECIPIENT: PEEL HERE

1 From This portion can be removed for Recipient's records. 824134233865

Date 11/13/00 FedEx Tracking Number

Sender's Name Peter Chevalier Phone 812 854-8941

Company TOL.TEST

Address 300 HWY 361 NSWC-CTR-12 Dept./Floor/Suite/Room

City CRANE State IN ZIP 47522

2 Your Internal Billing Reference

3 To

Recipient's Name James Todd Phone 908 788-8700

Company Aqua Survey

Address 449 Point Breeze Rd

To "HOLD" at FedEx location, print FedEx address. We cannot deliver to P.O. boxes or P.O. ZIP codes.

Dept./Floor/Suite/Room

City Flemington State NJ ZIP 08822

8241 3423 3865

0156124830

4a Express Package Service — *Packages up to 150 lbs.* Delivery commitment may be later in some areas

- [X] FedEx Priority Overnight — Next business morning
- [ ] FedEx Standard Overnight — Next business afternoon
- [ ] FedEx First Overnight — Earliest next business morning delivery to select locations
- [ ] FedEx 2Day* — Second business day
- [ ] FedEx Express Saver* — Third business day

* FedEx Envelope/Letter Rate not available. Minimum charge: One-pound rate

4b Express Freight Service — *Packages over 150 lbs.* Delivery commitment may be later in some areas

- [ ] FedEx 1Day Freight* — Next business day
- [ ] FedEx 2Day Freight — Second business day
- [ ] FedEx 3Day Freight — Third business day

* Call for Confirmation. * Declared value limit $500

5 Packaging

- [ ] FedEx Envelope/Letter*
- [ ] FedEx Pak*
- [X] Other Pkg. — Includes FedEx Box, FedEx Tube, and customer pkg.

6 Special Handling — Include FedEx address in Section 3.

- [ ] **SATURDAY Delivery** — Available for FedEx Priority Overnight and FedEx 2Day to select ZIP codes
- [ ] **SUNDAY Delivery** — Available for FedEx Priority Overnight to select ZIP codes
- [ ] **HOLD Weekday** at FedEx Location — Not available with FedEx First Overnight
- [ ] **HOLD Saturday** at FedEx Location — Available for FedEx Priority Overnight and FedEx 2Day to select locations

Does this shipment contain dangerous goods? One box must be checked.

- [X] No
- [ ] Yes — As per attached Shipper's Declaration
- [ ] Yes — Shipper's Declaration not required
- [ ] Dry Ice — Dry Ice, 9, UN 1845 x kg
- [ ] Cargo Aircraft Only

Dangerous Goods cannot be shipped in FedEx packaging.

7 Payment *Bill to:* Enter FedEx Acct. No. or Credit Card No. below.

- [X] Sender — Acct. No. in Section 1 will be billed.
- [ ] Recipient
- [ ] Third Party
- [ ] Credit Card
- [ ] Cash/Check
- [ ] Obtain Recip. Acct. No.

Total Packages	Total Weight	Total Charges
1	60	

Credit Card Auth.

†Our liability is limited to $100 unless you declare a higher value. See the *FedEx Service Guide* for details.

8 Release Signature *Sign to authorize delivery without obtaining signature*

By signing you authorize us to deliver this shipment without obtaining a signature and agree to indemnify and hold us harmless from any resulting claims.

Questions? Call 1·800·Go·FedEx (800 463-3339)

Visit our Web site at www.fedex.com

GRFE 9/00

402

TOLTEST, INC. Fed Ex 824134233843 BIO-4/6

1915 N. 12th St., P.O. Box 2186, Toledo, OH 43603-2186; Voice (419) 241-7175, Fax (419) 321-6259

Ship To Address: ATTN: RECEIVING LAB, 1810 N. 12th St., Toledo, OH 43624-1304; Voice (419) 241-7175, Fax (419) 241-1808

Sent From: ☐ Corporate ☐ Plymouth ☐ Pittsburgh ☐ Other _____

Quad Survey

Chain of Custody Record

31884 Page 1 of 1

Project No.: 37324

Client:

P.O. No.:

Project/Location: NSWC Crane Bio-facility

Project Mgr.:

Sampler's Name: Peter J. Chevalier

Phone No.

Sampler's Signature: [signature]

Item No.	Sample I.D.	Date Sampled	Time Sampled	Type	Matrix	Sample Location	Total No. of Containers	Parameters: Eq. Thermo 0239	Parameters: EPA 6010/3-84	Parameters: MICrobio	Parameters	Parameters	Parameters	Parameters	Preserved Yes/No	LAB USE ONLY Lab #
1	PCS-001	11/13/00	0825	C	compost	S-001 (22044)	2		✓	✓						
2	PCS-002FD	11/13/00	0825	C	compost	S-001 Field dup. (22045)	2		✓	✓						
3																
4																
5																
6																
7																
8																
9																
10																

Item No.	Relinquished By:	Date	Time	Received By:	Date	Time
	[signature]	11/13/00	1530	Tom Dake	11/14/00	1110

LAB USE ONLY

Were samples delivered ☐ in person ☐ by courier

Were samples preserved ☐ in field ☐ in lab ☐ N/A

Temp of samples _____ °C

Did samples arrive intact and sealed? ☐ yes ☐ no ☐ N/A

Were proper containers used? ☐ yes ☐ no

Was container labeled properly for contents? ☐ yes ☐ no

Were samples packaged properly for type of material? ☐ yes ☐ no

Was shipping label completed properly per regulations? (49 CFR 170, etc.) ☐ yes ☐ no

Comments: _____

TAT _____

Distribution: Original plus one accompanies shipment (white and yellow); copy to coordinator field files (pink)

Rev. 4/99

TOLTEST, INC. FedEx 824134 233854

1915 N. 12th St., P.O. Box 2186, Toledo, OH 43603-2186; Voice (419) 241-7175, Fax (419) 321-6259 BIG - 417

Ship To Address: ATTN: RECEIVING LAB, 1810 N. 12th St., Toledo, OH 43624-1304; Voice (419) 241-7175, Fax (419) 241-1808

Sent From: ☐ Corporate ☐ Plymouth ☐ Pittsburgh ☐ Other _____

Chain of Custody Record

31885 Page 1 of 1

Project No.: 37324	Client:
P.O. No.:	Project/Location: NSWC Crane Bio Facility
Project Mgr.:	Sampler's Name: Peter J. Chevalier
Phone No.	Sampler's Signature: Peter J. Chevalier

Item No.	Sample I.D.	Date Sampled	Time Sampled	Type	Matrix	Sample Location	Total No. of Containers	Parameters: Eas Metals EPA	Gas/BTEX/Lead	Microtox				Preserved Yes/No	LAB USE ONLY Lab #
1	ACS-003	11/13/00	0930	C	compost	S-096 (22046)	2		✓	✓					
2	ACS-004	11/13/00	1015	C	compost	S-159 (22047)	2		✓	✓					
3															
4															
5															
6															
7															
8															
9															
10															

Item No.	Relinquished By:	Date / Time	Received By:	Date / Time
	Peter J. Chevalier	11/13/00 1530	Tom Dolce	11/14/00 1110

LAB USE ONLY

Were samples delivered ☐ in person ☐ by courier

Were samples preserved ☐ in field ☐ in lab ☐ N/A

Temp of samples _____ °C

Did samples arrive intact and sealed? ☐ yes ☐ no ☐ N/A

Were proper containers used? ☐ yes ☐ no

Was container labeled properly for contents? ☐ yes ☐ no

Were samples packaged properly for type of material? ☐ yes ☐ no

Was shipping label completed properly per regulations? (49 CFR 170, etc.) ☐ yes ☐ no

Comments: _____

TAT

Distribution: Original plus one accompanies shipment (white and yellow); copy to coordinator field files (pink)

Rev. 4/99

TOLTEST, INC. Fe2Ex 824134233865

1915 N. 12th St., P.O. Box 2186, Toledo, OH 43603-2186; Voice (419) 241-7175, Fax (419) 321-6259 BJU-418

Ship To Address: ATTN: RECEIVING LAB, 1810 N. 12th St., Toledo, OH 43624-1304; Voice (419) 241-7175, Fax (419) 241-1808

Sent From: ☐ Corporate ☐ Plymouth ☐ Pittsburgh ☐ Other _____

Chain of Custody Record

31888 Page 1 of 1

Project No.: 37324 | Client:

P.O. No.: | Project/Location: NSWC Crane Big facility

Project Mgr.: | Sampler's Name: Peter Chevalier

Phone No. | Sampler's Signature: Peter Chevalier

Item No.	Sample I.D.	Date Sampled	Time Sampled	Type	Matrix	Sample Location	Total No. of Containers	Parameters: Eas Mercury EPA 6010/3-88	6010	Mercury					Preserved Yes/No	LAB USE ONLY Lab #
1	RCS-005	11/13/00	1055	C	compost	S-178 (22048)	2		/	/						
2																
3																
4																
5																
6																
7																
8																
9																
10																

Item No.	Relinquished By:	Date / Time	Received By:	Date / Time
	Peter Chevalier	11/13/00 1530	Tom Dolce	11/14/00 1110
Item No.	Relinquished By:	Date / Time	Received By:	Date / Time
Item No.	Relinquished By:	Date / Time	Received By:	Date / Time
Item No.	Relinquished By:	Date / Time	Received By:	Date / Time

LAB USE ONLY

Were samples delivered ☐ in person ☐ by courier

Were samples preserved ☐ in field ☐ in lab ☐ N/A

Temp of samples _____°C

Did samples arrive intact and sealed? ☐ yes ☐ no ☐ N/A

Were proper containers used? ☐ yes ☐ no

Was container labeled properly for contents? ☐ yes ☐ no

Were samples packaged properly for type of material? ☐ yes ☐ no

Was shipping label completed properly per regulations? (49 CFR 170, etc.) ☐ yes ☐ no

Comments: _____

TAT _____

Distribution: Original plus one accompanies shipment (white and yellow); copy to coordinator field files (pink)

Rev. 4/99

TOLTEST INC. Fed Ex 824134233843 BIO-4/6

1915 N. 12th St., P.O. Box 2186, Toledo, OH 43603-2186; Voice (419) 241-7175, Fax (419) 321-6259

Ship To Address: ATTN: RECEIVING LAB, 1810 N. 12th St., Toledo, OH 43624-1304; Voice (419) 241-7175, Fax (419) 241-1808

Sent From: ☐ Corporate ☐ Plymouth ☐ Pittsburgh ☐ Other _____

AQua Survey

Chain of Custody Record

31884 Page 1 of 1

Project No.: 37324 | Client: | Project/Location: NSWC Crane Bio-facility

P.O. No.: | Project Mgr.: | Sampler's Name: Peter J. Chevalier

Phone No. | Sampler's Signature: Peter J. Chevalier

Item No.	Sample I.D.	Date Sampled	Time Sampled	Type	Matrix	Sample Location	Total No. of Containers	Eco Analysis EPA 600/3-82/029	Mercury				Preserved Yes/No	LAB USE ONLY Lab #
1	PCS-001	11/13/00	0825	C	compost	S-001 (22044)	2	✓	✓					
2	PCS-002 (FD)	11/13/00	0825	C	compost	S-001 field dup. (22045)	2	✓	✓					
3														
4														
5														
6														
7														
8														
9														
10														

Item No.	Relinquished By:	Date	Time	Received By:	Date	Time
	Peter J. Chevalier	11/13/00	1530			

LAB USE ONLY

Were samples delivered ☐ in person ☐ by courier

Were samples preserved ☐ in field ☐ in lab ☐ N/A

Temp of samples _____ °C

Did samples arrive intact and sealed? ☐ yes ☐ no ☐ N/A

Were proper containers used? ☐ yes ☐ no

Was container labeled properly for contents? ☐ yes ☐ no

Were samples packaged properly for type of material? ☐ yes ☐ no

Was shipping label completed properly per regulations? (49 CFR 170, etc.) ☐ yes ☐ no

Comments: _____

TAT

Distribution: Original plus one accompanies shipment (white and yellow); copy to coordinator field files (pink)

11/13/2000 14:55 8128540944 TOLTEST PAGE 02

TOLTEST INC. FedEx 824134 233854

1915 N. 12th St., P.O. Box 2166, Toledo, OH 43603-2166; Voice (419) 241-7175, Fax (419) 321-6259 B/U - 417

Ship To Address: ATTN: RECEIVING LAB, 1810 N. 12th St., Toledo, OH 43624-1304; Voice (419) 241-7175, Fax (419) 241-1808

Sent From: ☐ Corporate ☐ Plymouth ☐ Pittsburgh ☐ Other _____

Chain of Custody Record

31885 Page 1 of 1

11/13/2000 14:55 8128540944 TOLTEST PAGE 03

Project No.: 37324	Client:
P.O. No.:	Project/Location: NSWC Crane Bio Facility
Project Mgr.:	Sampler's Name: Mark Chevalier
Phone No.	Sampler's Signature: Peter Ouli

Item No.	Sample I.D.	Date Sampled	Time Sampled	Type	Matrix	Sample Location	Total No. of Containers	Parameters: Explosives EPA 8330/8095	Parameters: Microbes	Preserved Yes/No	LAB USE ONLY Lab #
1	AS-003	11/13/00	0930	C	compost	S-096 (22046)	2	✓	✓		
2	AS-004	11/13/00	1015	C	compost	S-159 (22047)	2	✓	✓		
3											
4											
5											
6											
7											
8											
9											
10											

Item No.	Relinquished By:	Date / Time	Received By:	Date / Time
	Peter Ouli	11/13/00 1530		
Item No.	Relinquished By:	Date / Time	Received By:	Date / Time
Item No.	Relinquished By:	Date / Time	Received By:	Date / Time
Item No.	Relinquished By:	Date / Time	Received By:	Date / Time

LAB USE ONLY

Were samples delivered ☐ in person ☐ by courier

Were samples preserved ☐ in field ☐ in lab ☐ N/A

Temp of samples _____ °C

Did samples arrive intact and sealed? ☐ yes ☐ no ☐ N/A

Were proper containers used? ☐ yes ☐ no

Was container labeled properly for contents? ☐ yes ☐ no

Were samples packaged properly for type of material? ☐ yes ☐ no

Was shipping label completed properly per regulations? (49 CFR 170, etc.) ☐ yes ☐ no

Comments: _____

TAT

Distribution: Original plus one accompanies shipment (white and yellow); copy to coordinator field files (pink)

TOLTEST, INC. Fe2Br 8241342338 6S

1915 N. 12th St., P.O. Box 2186, Toledo, OH 43603-2186; Voice (419) 241-7175, Fax (419) 321-6259 B/U - 418

Ship To Address: ATTN: RECEIVING LAB, 1810 N. 12th St., Toledo, OH 43624-1304; Voice (419) 241-7175, Fax (419) 241-1808

Sent From: ☐ Corporate ☐ Plymouth ☐ Pittsburgh ☐ Other _____

Chain of Custody Record

31888 Page 1 of 1

11/13/2000 14:55 8128540944 TOLTEST PAGE 04

Project No.: 37324	Client:
P.O. No.:	Project/Location: NSWC Crane Bioffacility
Project Mgr.:	Sampler's Name: Peter Chevalier
Phone No.	Sampler's Signature: Peter Chevalier

Item No.	Sample I.D.	Date Sampled	Time Sampled	Type	Matrix	Sample Location	Total No. of Containers	Parameters: Eas Mercury EPA 60/3-86 Pbg	Mercury					Preserved Yes/No	LAB USE ONLY Lab #
1	RS-105	11/13/00	1055	C	Compost	S-178 (22048)	2	/	/						
2															
3															
4															
5															
6															
7															
8															
9															
10															

Item No.	Relinquished By:	Date / Time	Received By:	Date / Time
	Peter Chevalier	11/13/00 1530		
Item No.	Relinquished By:	Date / Time	Received By:	Date / Time
Item No.	Relinquished By:	Date / Time	Received By:	Date / Time
Item No.	Relinquished By:	Date / Time	Received By:	Date / Time

LAB USE ONLY

Were samples delivered ☐ in person ☐ by courier

Were samples preserved ☐ in field ☐ in lab ☐ N/A

Temp of samples _____ °C

Did samples arrive intact and sealed? ☐ yes ☐ no ☐ N/A

Were proper containers used? ☐ yes ☐ no

Was container labeled properly for contents? ☐ yes ☐ no

Were samples packaged properly for type of material? ☐ yes ☐ no

Was shipping label completed properly per regulations? (49 CFR 170, etc.) ☐ yes ☐ no

Comments: _____

TAT

Distribution: Original plus one accompanies shipment (white and yellow); copy to coordinator field files (pink)

Calculation of Hydration Water For Soil Tests Job # 20-475 Sample # 92654
Just replace the soil characteristics and the concentrations
in the shaded areas and the spreadsheet will do the rest!

NOTE: Hydration Water is for 100 gm, adjust accordingly!!!

Water Holding Capacity of Test Soil =	49.5 mL/100 gm
Water Holding Capacity of Control Soil =	49.5 mL/100 gm
Moisture Fraction of Test Soil =	1.92 mL/100 gm
Moisture Fraction of Control Soil =	1.92 mL/100 gm
Fraction of Hydration Needed =	0.75

(0.85 for lettuce, 0.75 for earthworms)

Concentration Series Needed	Hydration Water Needed (mLs/100gm)
0 percent	35
6.25 percent	35
12.5 percent	35
25 percent	35
50 percent	35
100 percent	35

700

	TEST	CONTROL
6.25	43.75	656.25
12.5	87.5	612.5
25	175	525
50	350	350
100	700	0

200

	TEST	CONTROL
6.25	12.5	187.5 (191)
12.5	25	175 (178)
25	50	150 (153)
50	100	100 (102)
100	200	0

700g DRY WEIGHT

2x
350 350

204g in each control

			EACH REP 200 DRY WT
	22044	CONTROL	
6.25	60	669	208
12.5	119	624	212
25	238.4	535	221
50	477.3	357	238
100	954	0	272
	22045		
6.25	59	669	208
12.5	119	624	212
25	237	535	221
50	474	357	238
100	949	0	271
	22046		
6.25	79	669	214
12.5	158	624	223
25	315	535	243
50	~~629.5~~ 630	357	282
100	1259	0	360
	22047		
6.25	66	669	210
12.5	133	624	216
25	266	535	229
50	531	357	254
100	1062	0	303
	22048		
6.25	63	669	209
12.5	126	624	214
	251	535	225
	503	357	246
			287

Calculation of Hydration Water For Soil Tests

Job # 20-47 Sample # 22044

Just replace the soil characteristics and the concentrations in the shaded areas and the spreadsheet will do the rest!

NOTE: Hydration Water is for 100 gm, adjust accordingly!!!

Water Holding Capacity of Test Soil =	57.9 mL/100 gm
Water Holding Capacity of Control Soil =	49.5 mL/100 gm
Moisture Fraction of Test Soil =	26.6 mL/100 gm
Moisture Fraction of Control Soil =	1.92 mL/100 gm
Fraction of Hydration Needed = (0.85 for lettuce, 0.75 for earthworms)	0.75

Concentration Series Needed	Hydration Water Needed (mLs/100gm)	
0 percent	35	70
6.25 percent	34	68
12.5 percent	33	66
25 percent	31	62
50 percent	26	52
100 percent	17	34

Calculation of Hydration Water For Soil Tests

Job # 20-47 Sample # 22045

Just replace the soil characteristics and the concentrations in the shaded areas and the spreadsheet will do the rest!

NOTE: Hydration Water is for 100 gm, adjust accordingly!!!

Water Holding Capacity of Test Soil =	50.4 mL/100 gm
Water Holding Capacity of Control Soil =	49.5 mL/100 gm
Moisture Fraction of Test Soil =	26.24 mL/100 gm
Moisture Fraction of Control Soil =	1.92 mL/100 gm
Fraction of Hydration Needed = (0.85 for lettuce, 0.75 for earthworms)	0.75

Concentration Series Needed	Hydration Water Needed (mLs/100gm)
0 percent	35 70
6.25 percent	34 68
12.5 percent	32 64
25 percent	29 58
50 percent	23 46
100 percent	12 24

Calculation of Hydration Water For Soil Tests

Job # 20-47 Sample # 22046

Just replace the soil characteristics and the concentrations in the shaded areas and the spreadsheet will do the rest!

NOTE: Hydration Water is for 100 gm, adjust accordingly!!!

Water Holding Capacity of Test Soil =	65.4 mL/100 gm
Water Holding Capacity of Control Soil =	49.5 mL/100 gm
Moisture Fraction of Test Soil =	44.39 mL/100 gm
Moisture Fraction of Control Soil =	1.92 mL/100 gm
Fraction of Hydration Needed = (0.85 for lettuce, 0.75 for earthworms)	0.75

Concentration Series Needed	Hydration Water Needed (mLs/100gm)	
0 percent	35	70
6.25 percent	33	66
12.5 percent	31	62
25 percent	28	56
50 percent	20	40
100 percent	5	10

Calculation of Hydration Water For Soil Tests Job # 20-475 Sample #: 22047

Just replace the soil characteristics and the concentrations
in the shaded areas and the spreadsheet will do the rest!

NOTE: Hydration Water is for 100 gm, adjust accordingly!!!

Water Holding Capacity of Test Soil =	65.4	mL/100 gm
Water Holding Capacity of Control Soil =	49.5	mL/100 gm
Moisture Fraction of Test Soil =	34.06	mL/100 gm
Moisture Fraction of Control Soil =	1.92	mL/100 gm
Fraction of Hydration Needed =	0.75	
(0.85 for lettuce, 0.75 for earthworms)		

Concentration Series Needed	Hydration Water Needed (mLs/100gm)	
0 percent	35	70
6.25 percent	34	68
12.5 percent	33	66
25 percent	30	60
50 percent	25	50
100 percent	15	30

Calculation of Hydration Water For Soil Tests Job # 20-475 Sample #: 22048

Just replace the soil characteristics and the concentrations
in the shaded areas and the spreadsheet will do the rest!

NOTE: Hydration Water is for 100 gm, adjust accordingly!!!

Water Holding Capacity of Test Soil =	76.8	mL/100 gm
Water Holding Capacity of Control Soil =	49.5	mL/100 gm
Moisture Fraction of Test Soil =	30.39	mL/100 gm
Moisture Fraction of Control Soil =	1.92	mL/100 gm
Fraction of Hydration Needed =	0.75	
(0.85 for lettuce, 0.75 for earthworms)		

Concentration Series Needed	Hydration Water Needed (mLs/100gm)	
0 percent	35	70
6.25 percent	35	70
12.5 percent	34	68
25 percent	33	66
50 percent	31	62
100 percent	27	54

APPENDIX 2

Microtox Raw Data

G

PST MicroTox
Color correction
11/27/00 using Spec 20

ANY Questions call
Bud Walbourn
800-642-7629

PST #22044 22045

0		
5.6	0.245	0.231
11.3	0.512	0.480
22.5	1.0~~35~~ 20	0.908
45	OFFscale	1.820

22048

0	
5.6	.148
11.3	.290
22.5	.585
45	1.119

Microtox Data Sheet

Client: PST Toltest JN

Job #: 20-474 5 JN

Date Sample Collected: _____ Received: _____ Tested: 11/21/00

Osmotic Adjustment	Sample #	Light Reading	Blank	5.6	11.3	22.5	45	Initial
No ___	22044	Initial (1,0)	94	94	93	92	99	
Yes X		5 minute (1,5)	68	58	45	31	19	KF
		15 minute (1,15)	64	53	41	28	18	
No ___	Sample #	Light Reading	Blank	5.6	11.3	22.5	45	Initial
Yes X	22045	Initial (1,0)	91	98	94	92	92	
		5 minute (1,5)	63	65	50	34	19	KF
		15 minute (1,15)	58	59	46	31	18	
No ___	Sample #	Light Reading	Blank	5.6	11.3	22.5	45	Initial
Yes X	22046	Initial (1,0)	91	104	92	92	88	
		5 minute (1,5)	65	79	71	72	62	KF
		15 minute (1,15)	61	75	67	69	60	
No ___	Sample #	Light Reading	Blank					Initial
Yes X	22047	Initial (1,0)						
		5 minute (1,5)						KF
		15 minute (1,15)						
No ___	Sample #	Light Reading	Blank					Initial
Yes X	22048	Initial (1,0)						
		5 minute (1,5)						KF
		15 minute (1,15)						
No ___	Sample #	Light Reading	Blank					Initial
Yes ___		Initial (1,0)						
		5 minute (1,5)						
		15 minute (1,15)						
No ___	Sample #	Light Reading	Blank					Initial
Yes ___		Initial (1,0)						
		5 minute (1,5)						
		15 minute (1,15)						

Microtox Data Sheet

Client: PST Tolles JN Job #: 20-47445 JN.

Date Sample Collected: _____ Received: _____ Tested: 11/21/00

Osmotic Adjustment

Sample #	Light Reading	Blank	5.6	11.3	22.5	45	Initial
22047	Initial (1,0)	94	92	101	91	88	
	5 minute (1,5)	94	103	105	85	63	
	15 minute (1,15)	90	96	98	79	60	

No ___ Yes X

Sample #	Light Reading	Blank	5.6	11.3	22.5	45	Initial
22048	Initial (1,0)	88	89	86	84	83	
	5 minute (1,5)	88	85	70	51	32	
	15 minute (1,15)	86	80	66	48	30	

No ___ Yes X

Sample #	Light Reading	Blank					Initial
	Initial (1,0)						
	5 minute (1,5)						
	15 minute (1,15)						

No ___ Yes ___

Sample #	Light Reading	Blank					Initial
	Initial (1,0)						
	5 minute (1,5)						
	15 minute (1,15)						

No ___ Yes ___

Sample #	Light Reading	Blank					Initial
	Initial (1,0)						
	5 minute (1,5)						
	15 minute (1,15)						

No ___ Yes ___

Sample #	Light Reading	Blank					Initial
	Initial (1,0)						
	5 minute (1,5)						
	15 minute (1,15)						

No ___ Yes ___

Sample #	Light Reading	Blank					Initial
	Initial (1,0)						
	5 minute (1,5)						
	15 minute (1,15)						

No ___ Yes ___

MICROTOX DATA REPORT
Basic Test

FILE: 22044.K5
PST Sample

Test Time: 5 minutes Osmotic Adjustment:yes

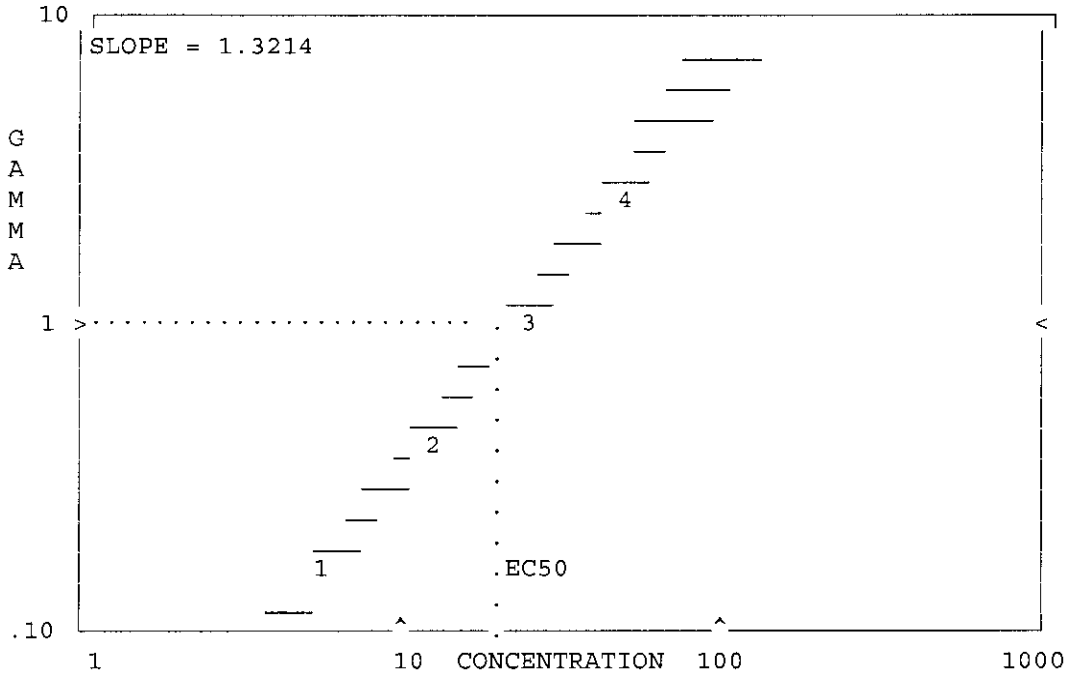
NUMBER	I0/IT	CONC.	CR/GAMMA	% EFFECT
Control	94.00/ 68.00	0.0	0.7234 #	
1	94.00/ 58.00	5.6000	0.172 #	14.7
2	93.00/ 45.00	11.3000	0.495 #	33.1
3	92.00/ 31.00	22.5000	1.147 #	53.4
4	99.00/ 19.00	45.0000	2.769 #	73.5

CR = Control RatioCORRECTION FACTOR = 0.7234
# Used for calculations

EC50 20.36 % (95% CONFIDENCE RANGE:18.13 TO 22.86)

Signature _____ TEST DATE:_____
TIME:_____

These samples color corrected



ESTIMATING EQUATION: LOG C = 0.7551 x LOG Γ +1.3087
95% CONFIDENCE FACTOR: 1.12283 FOR EC50
COEFFICIENT OF DETERMINATION: R^2 = 0.99781

MICROTOX DATA REPORT
Basic Test

FILE: 22044.K15
PST Sample

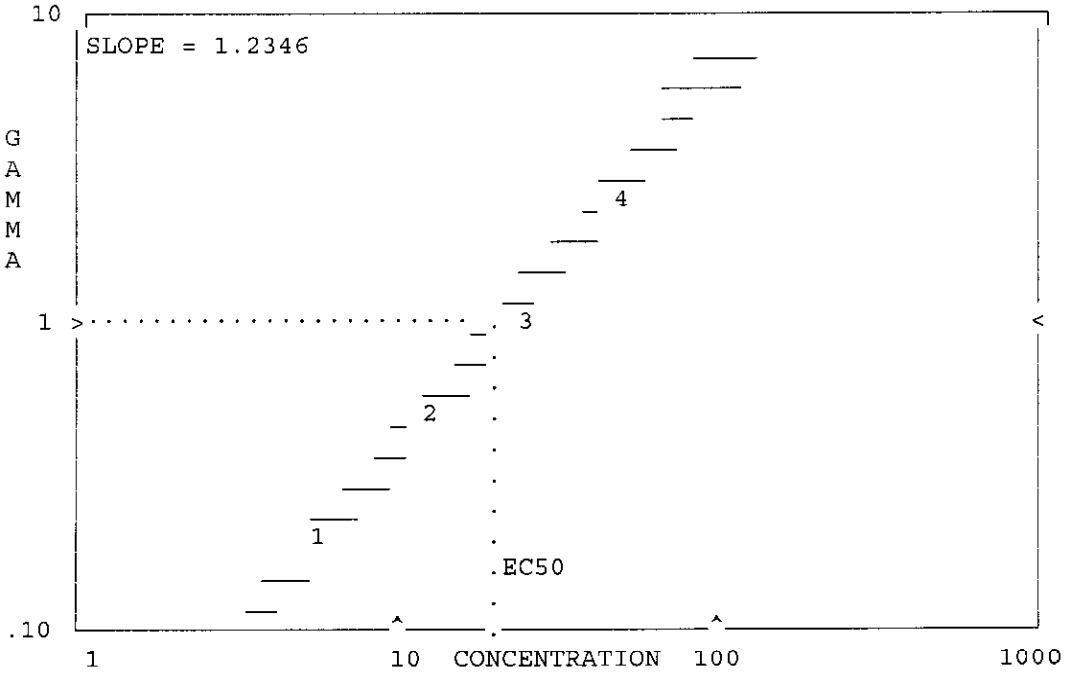
Test Time: 15 minutes Osmotic Adjustment:yes

NUMBER	I0/IT	CONC.	CR/GAMMA	% EFFECT
Control	94.00/ 64.00	0.0	0.6809 #	
1	94.00/ 53.00	5.6000	0.208 #	17.2
2	93.00/ 41.00	11.3000	0.544 #	35.2
3	92.00/ 28.00	22.5000	1.237 #	55.3
4	99.00/ 18.00	45.0000	2.745 #	73.3

CR = Control RatioCORRECTION FACTOR = 0.6809
# Used for calculations

EC50 19.31 % (95% CONFIDENCE RANGE:17.42 TO 21.40)

Signature _____ TEST DATE:_____
TIME:_____



ESTIMATING EQUATION: LOG C = 0.8086 x LOG Γ +1.2858
95% CONFIDENCE FACTOR: 1.10849 FOR EC50
COEFFICIENT OF DETERMINATION: R^2 = 0.99821

MICROTOX DATA REPORT
Basic Test

FILE: 22045.K5
PST Sample

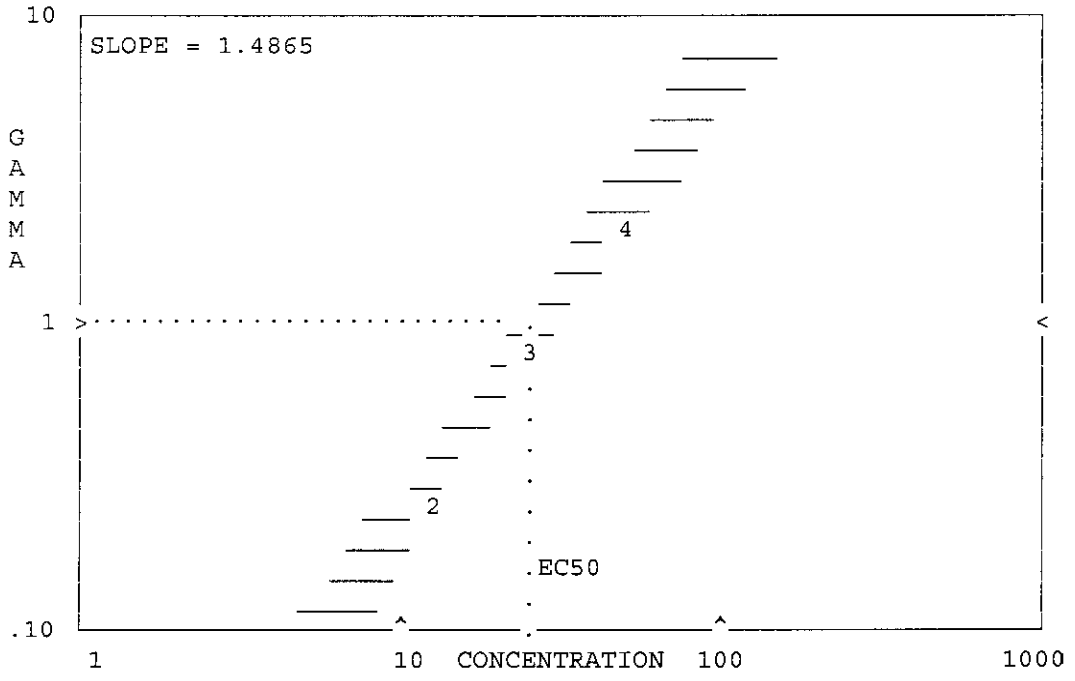
Test Time: 5 minutes Osmotic Adjustment:yes

NUMBER	I0/IT	CONC.	CR/GAMMA	% EFFECT
Control	91.00/ 63.00	0.0	0.6923 #	
1	98.00/ 65.00	5.6000	0.044 *	
2	94.00/ 50.00	11.3000	0.302 #	23.2
3	92.00/ 34.00	22.5000	0.873 #	46.6
4	92.00/ 19.00	45.0000	2.352 #	70.2

CR = Control RatioCORRECTION FACTOR = 0.6923
# Used for calculations * Invalid data or controls

EC50 25.09 % (95% CONFIDENCE RANGE:21.33 TO 29.50)

Signature _____ TEST DATE:_____
TIME:_____



ESTIMATING EQUATION: LOG C = 0.6724 x LOG Γ +1.3994
95% CONFIDENCE FACTOR: 1.17600 FOR EC50
COEFFICIENT OF DETERMINATION: R^2 = 0.99951

MICROTOX DATA REPORT
Basic Test

FILE: 22045.K15
PST Sample

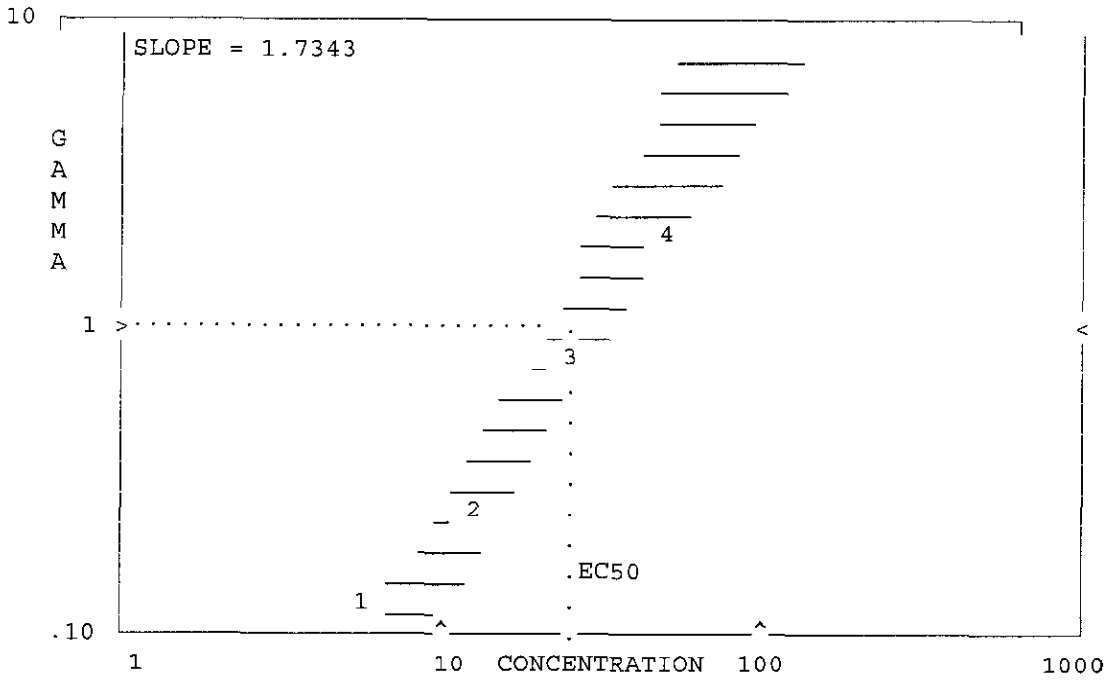
Test Time: 15 minutes Osmotic Adjustment:yes

NUMBER	I0/IT	CONC.	CR/GAMMA	% EFFECT
Control	91.00/ 58.00	0.0	0.6374 #	
1	98.00/ 59.00	5.6000	0.059 #	5.5
2	94.00/ 46.00	11.3000	0.302 #	23.2
3	92.00/ 31.00	22.5000	0.892 #	47.1
4	92.00/ 18.00	45.0000	2.258 #	69.3

CR = Control RatioCORRECTION FACTOR = 0.6374
# Used for calculations

EC50 25.51 % (95% CONFIDENCE RANGE:17.71 TO 36.74)

Signature _____ TEST DATE:_____
TIME:_____



ESTIMATING EQUATION: LOG C = 0.5666 x LOG Γ +1.4067
95% CONFIDENCE FACTOR: 1.44044 FOR EC50
COEFFICIENT OF DETERMINATION: R^2 = 0.98264

MICROTOX DATA REPORT
Basic Test

FILE: 22048.K15
TOLTEST SAMPLE: 20-475

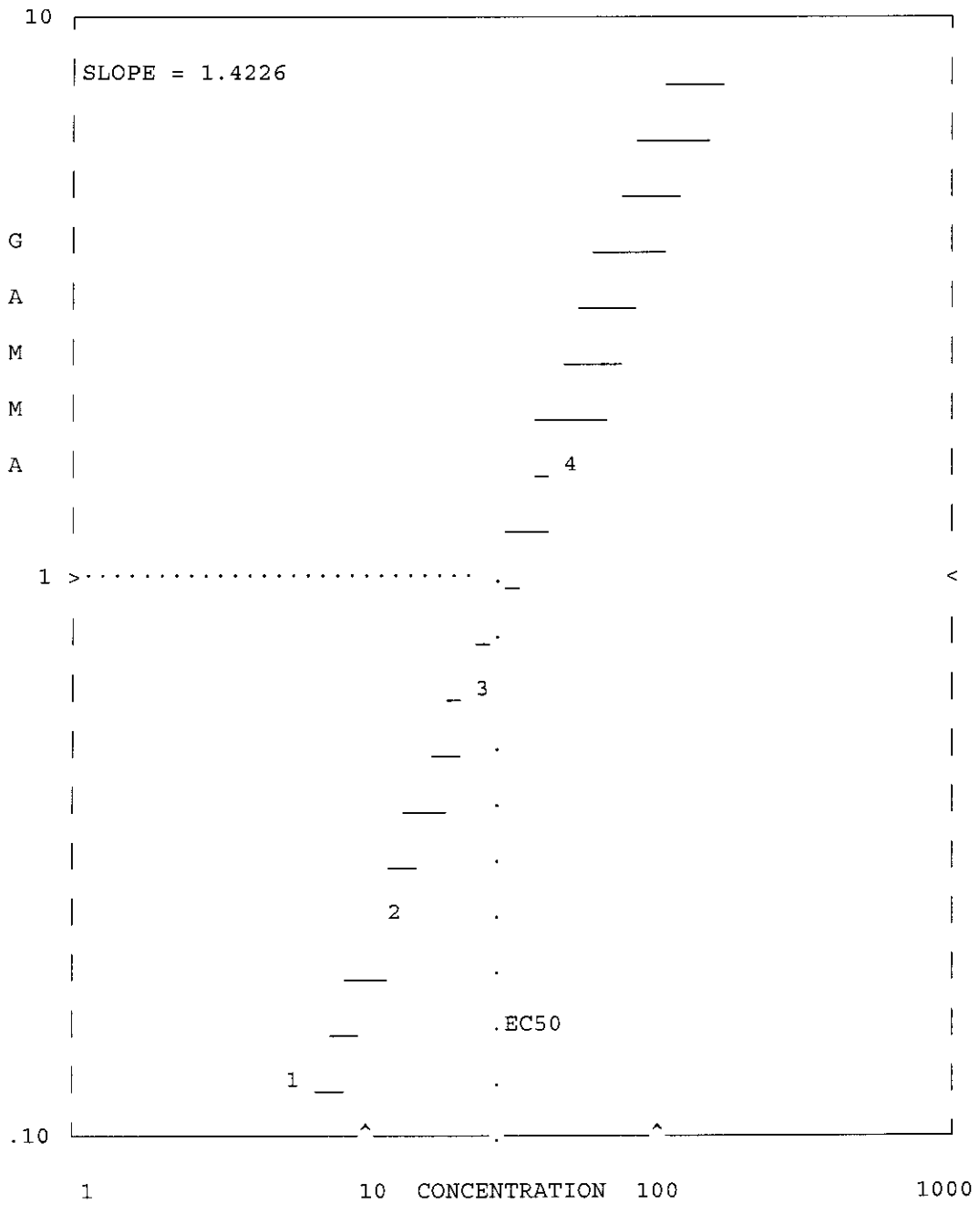
Test Time: 15 minutes Osmotic Adjustment:yes

NUMBER	I0/IT	CONC.	CR/GAMMA %	EFFECT
Control	88.00/ 86.00	0.0	0.9773 #	
1	89.00/ 80.00	5.6000	0.087 #	8.0
2	86.00/ 66.00	11.3000	0.273 #	21.5
3	84.00/ 48.00	22.5000	0.710 #	41.5
4	83.00/ 30.00	45.0000	1.704 #	63.0

CR = Control RatioCORRECTION FACTOR = 0.9773
# Used for calculations

EC50 29.60 % (95% CONFIDENCE RANGE:24.82 TO 35.31)

Signature _____ TEST DATE:_____
TIME:_____



ESTIMATING EQUATION: LOG C = 0.7006 x LOG Γ +1.4713
95% CONFIDENCE FACTOR: 1.19273 FOR EC50
COEFFICIENT OF DETERMINATION: R^2 = 0.99661

MICROTOX DATA REPORT
Basic Test

FILE: 22048.K5
TOLTEST SAMPLE: 20-475

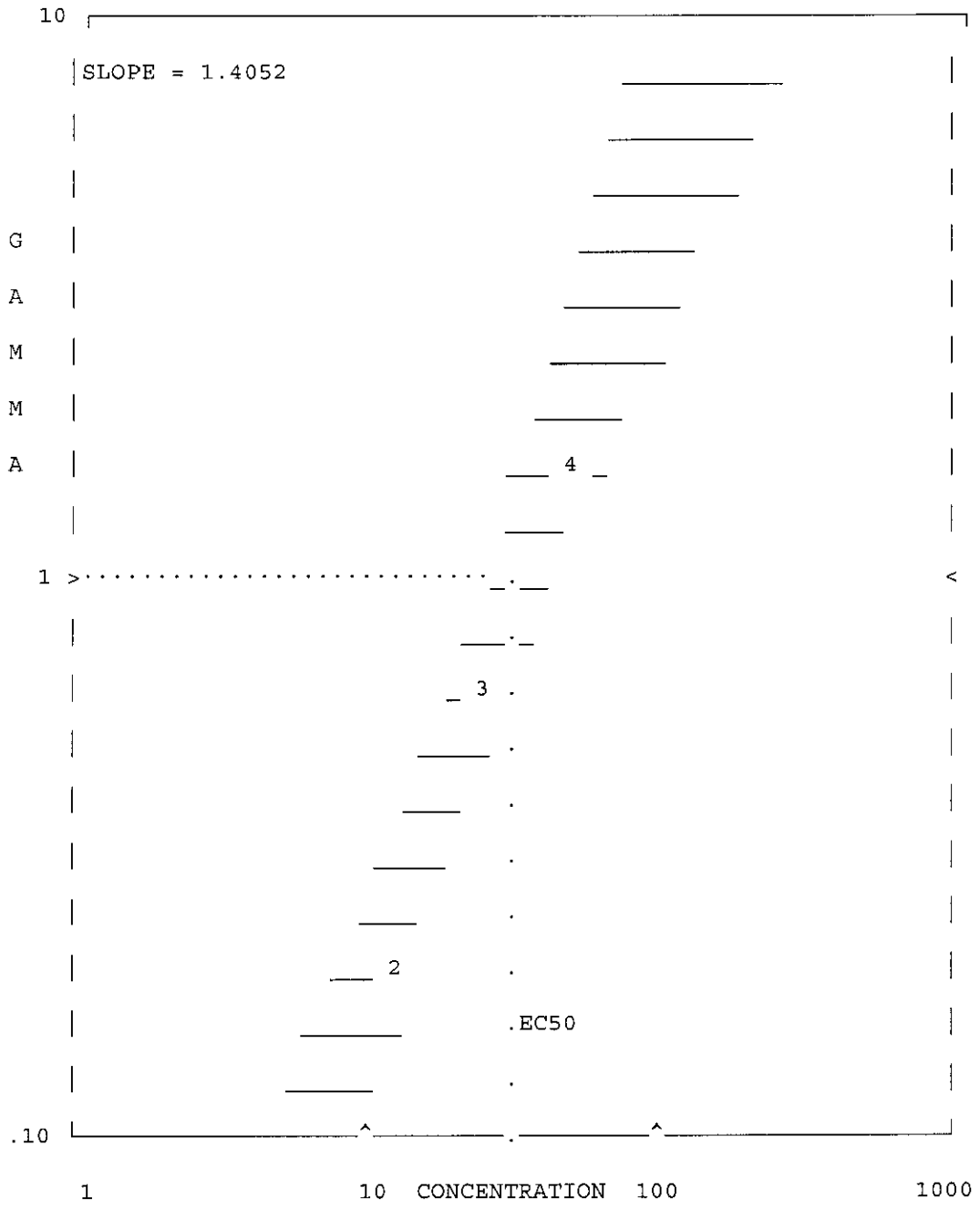
Test Time: 5 minutes
Osmotic Adjustment:yes

EFFECT	NUMBER	I0/IT	CONC.	CR/GAMMA %	
	Control	88.00/ 88.00	0.0	1.0000 #	
	1	89.00/ 85.00	5.6000	0.047 *	
	2	86.00/ 70.00	11.3000	0.229 #	18.6
	3	84.00/ 51.00	22.5000	0.647 #	39.3
	4	83.00/ 32.00	45.0000	1.594 #	61.4

CR = Control RatioCORRECTION FACTOR = 1.0000
# Used for calculations * Invalid data or controls

EC50 31.73 % (95% CONFIDENCE RANGE:22.09 TO 45.57)

Signature _____ TEST DATE:_____
TIME:_____



ESTIMATING EQUATION: LOG C = 0.7103 x LOG Γ +1.5014
95% CONFIDENCE FACTOR: 1.43636 FOR EC50
COEFFICIENT OF DETERMINATION: R^2 = 0.99814

MICROTOX DATA REPORT
Basic Test

FILE: 22048.K15
TOLTEST SAMPLE: 20-475

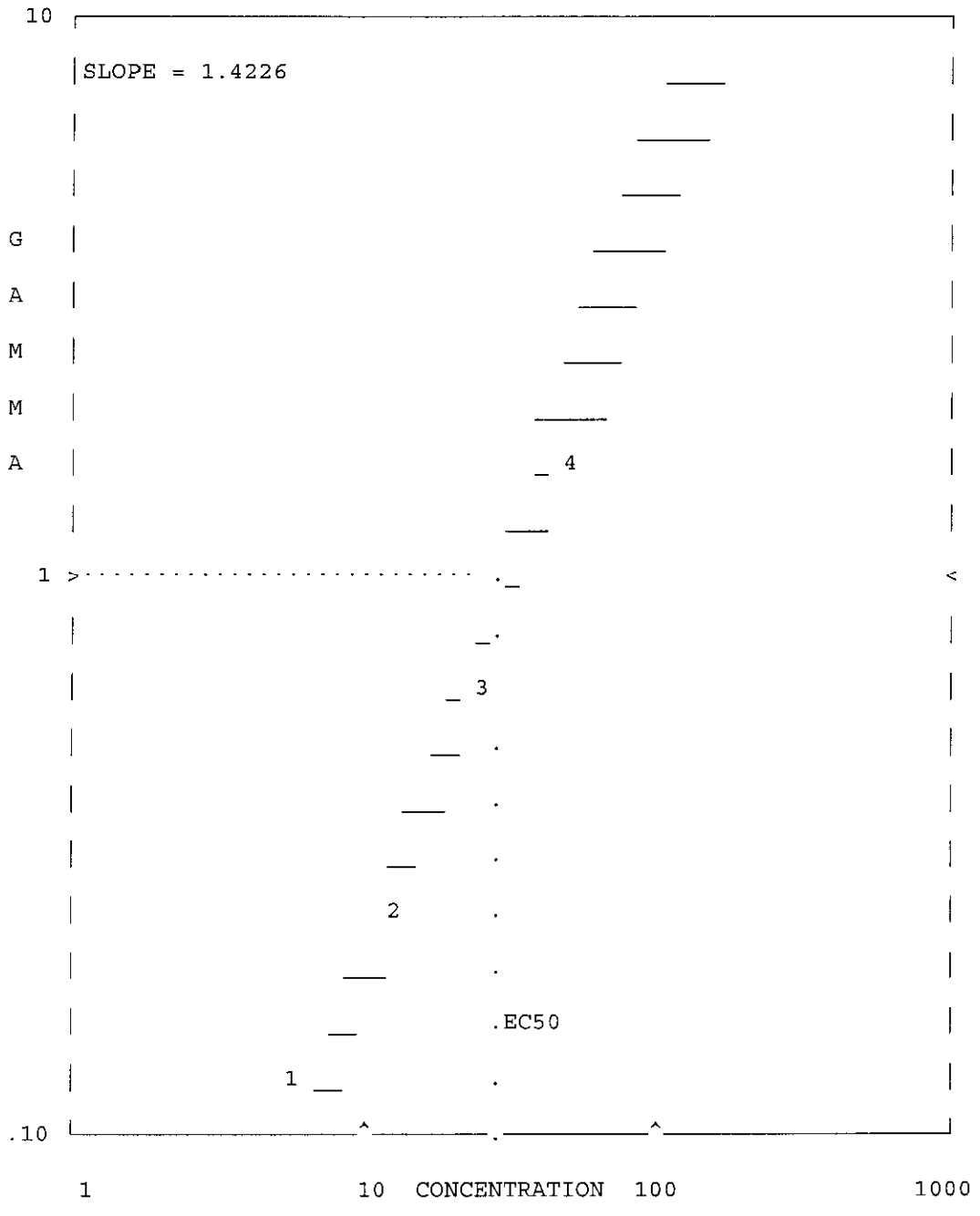
Test Time: 15 minutes Osmotic Adjustment:yes

NUMBER	I0/IT	CONC.	CR/GAMMA %	EFFECT
Control	88.00/ 86.00	0.0	0.9773 #	
1	89.00/ 80.00	5.6000	0.087 #	8.0
2	86.00/ 66.00	11.3000	0.273 #	21.5
3	84.00/ 48.00	22.5000	0.710 #	41.5
4	83.00/ 30.00	45.0000	1.704 #	63.0

CR = Control RatioCORRECTION FACTOR = 0.9773
# Used for calculations

EC50 29.60 % (95% CONFIDENCE RANGE:24.82 TO 35.31)

Signature _____ TEST DATE:_____
TIME:_____



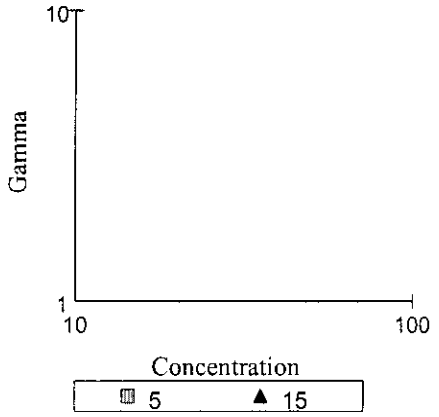
ESTIMATING EQUATION: LOG C = 0.7006 x LOG Γ +1.4713
95% CONFIDENCE FACTOR: 1.19273 FOR EC50
COEFFICIENT OF DETERMINATION: R^2 = 0.99661

MicrotoxOmni Test Report - 22044

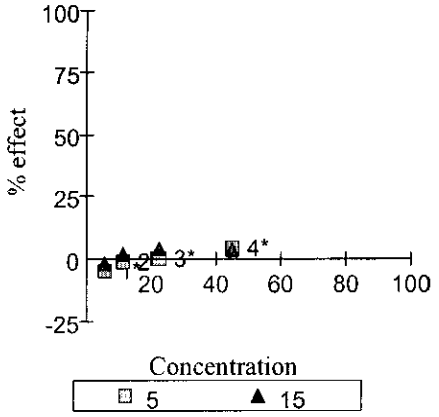
Date: 12/14/2000 02:39 PM

Test Protocol: Basic Test
Sample: 22044
Toxicant: ELUTRIATE
Reagent Lot no.:
Test description: TOLTEST SAMPLE 22044
Data File: Untitled Data File

Plot of Gamma vs Concentration



Plot of %Effect vs Concentration



			5 Mins Data:			15 Mins Data:			
Sample	Conc	Io	It	Gamma	% effect	It	Gamma	% effect	ABSx
Control	0.000	94.00	68.00	0.7234 #		64.00	0.6809 #		
1	5.625	94.00	58.00	-0.0465 *	-4.882%	53.00	-0.0179 *	-1.830%	0.2450
2	11.25	93.00	45.00	-0.0125 *	-1.270%	41.00	0.0200 *	1.965%	0.5120
3	22.50	92.00	31.00	0.0009 *	0.0916%	28.00	0.0429 *	4.120%	1.020
4	45.00	99.00	19.00	0.0444 *	4.254%	18.00	0.0376 *	3.624%	2.000

- used in calculation; * - invalid data; D - deleted from calcs.
Autocalc has been used.

Satistical calculations could not be performed on the 5 Mins data.
Recommend re-testing at lower initial concentration or with additional dilutions.
Hormesis detected.
Lowest % effect: -4.882%

Satistical calculations could not be performed on the 15 Mins data.
Recommend re-testing at lower initial concentration or with additional dilutions.
Hormesis detected.
Lowest % effect: -1.830%

There is no QA data available for this test.

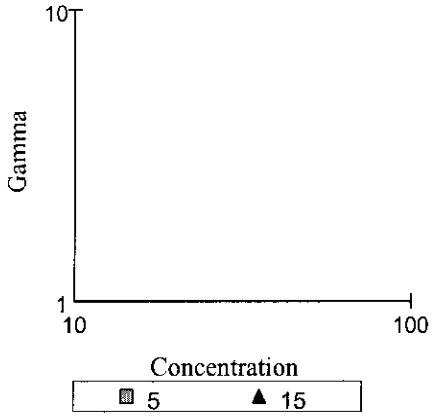
Signature:_____

MicrotoxOmni Test Report - 22045

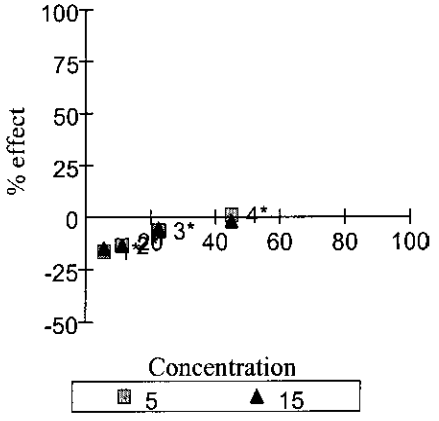
Date: 12/14/2000 02:48 PM

Test Protocol: Basic Test
Sample: 22045
Toxicant: ELUTRIATE
Reagent Lot no.:
Test description: TOLTEST SAMPLE 22045
Data File: Untitled Data File

Plot of Gamma vs Concentration



Plot of %Effect vs Concentration



			5 Mins Data:			15 Mins Data:			
Sample	Conc	Io	It	Gamma	% effect	It	Gamma	% effect	ABSx
Control	0.000	91.00	63.00	0.6923 #		58.00	0.6374 #		
1	5.625	98.00	65.00	-0.1414 *	-16.47%	59.00	-0.1292 *	-14.83%	0.2310
2	11.25	94.00	50.00	-0.1195 *	-13.57%	46.00	-0.1189 *	-13.49%	0.4800
3	22.50	92.00	34.00	-0.0617 *	-6.579%	31.00	-0.0526 *	-5.553%	0.9080
4	45.00	92.00	19.00	0.0089 *	0.8874%	18.00	-0.0195 *	-1.991%	1.820

- used in calculation; * - invalid data; D - deleted from calcs.
Autocalc has been used.

Satistical calculations could not be performed on the 5 Mins data.
Recommend re-testing at lower initial concentration or with additional dilutions.
Hormesis detected.
Lowest % effect: -16.47%

Satistical calculations could not be performed on the 15 Mins data.
Recommend re-testing at lower initial concentration or with additional dilutions.
Hormesis detected.
Lowest % effect: -14.83%

There is no QA data available for this test.

Signature:_____

MICROTOX DATA REPORT
Basic Test

FILE: 22046.K5
PST SAMPLE, 20-474

Test Time: 5 minutes Osmotic Adjustment:yes

NUMBER	I0/IT	CONC.	CR/GAMMA	% EFFECT
Control	91.00/ 65.00	0.0	0.7143 #	
1	104.00/ 79.00	5.6000	-0.060 *	
2	92.00/ 71.00	11.3000	-0.074 *	
3	92.00/ 72.00	22.5000	-0.087 *	
4	88.00/ 62.00	45.0000	0.014 *	

CR = Control Ratio CORRECTION FACTOR = 0.7143
* Invalid data or controls

EC50 IS GREATER THAN HIGHEST CONCENTRATION

Signature _____ TEST DATE:_____
TIME:_____

MICROTOX DATA REPORT
Basic Test

FILE: 22046.K15
PST SAMPLE, 20-474

Test Time: 15 minutes Osmotic Adjustment:yes

NUMBER	I0/IT	CONC.	CR/GAMMA	% EFFECT
Control	91.00/ 61.00	0.0	0.6703 #	
1	104.00/ 75.00	5.6000	-0.070 *	
2	92.00/ 67.00	11.3000	-0.080 *	
3	92.00/ 69.00	22.5000	-0.106 *	
4	88.00/ 60.00	45.0000	-0.017 *	

CR = Control Ratio CORRECTION FACTOR = 0.6703
* Invalid data or controls

EC50 IS GREATER THAN HIGHEST CONCENTRATION

Signature _____ TEST DATE:_____
TIME:_____

MICROTOX DATA REPORT
Basic Test

FILE: 22047.K5
TOLTEST SAMPLE: 20-475

Test Time: 5 minutes Osmotic Adjustment:yes

EFFECT%	NUMBER	I0/IT	CONC.	CR/GAMMA	
	Control	94.00/ 94.00	0.0	1.0000 #	
	1	92.00/103.00	5.6000	-0.107 *	
	2	101.00/105.00	11.3000	-0.038 *	
	3	91.00/ 85.00	22.5000	0.071	0.0
	4	88.00/ 63.00	45.0000	0.397	0.0

CR = Control RatioCORRECTION FACTOR = 1.0000
* Invalid data or controls

EC50 IS GREATER THAN HIGHEST CONCENTRATION

Signature _____ TEST DATE:_____
TIME:_____

MICROTOX DATA REPORT
Basic Test

FILE: 22047.K15
TOLTEST SAMPLE: 20-475

Test Time: 15 minutes Osmotic Adjustment:yes

EFFECT	NUMBER	I0/IT	CONC.	CR/GAMMA%	
	Control	94.00/ 90.00	0.0	0.9574 #	
	1	92.00/ 96.00	5.6000	-0.082 *	
	2	101.00/ 98.00	11.3000	-0.013 *	
	3	91.00/ 79.00	22.5000	0.103	0.0
	4	88.00/ 60.00	45.0000	0.404	0.0

CR = Control RatioCORRECTION FACTOR = 0.9574
* Invalid data or controls

EC50 IS GREATER THAN HIGHEST CONCENTRATION

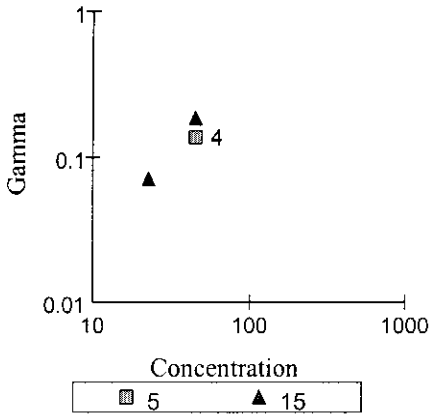
Signature _____ TEST DATE:_____
TIME:_____

MicrotoxOmni Test Report - 22048

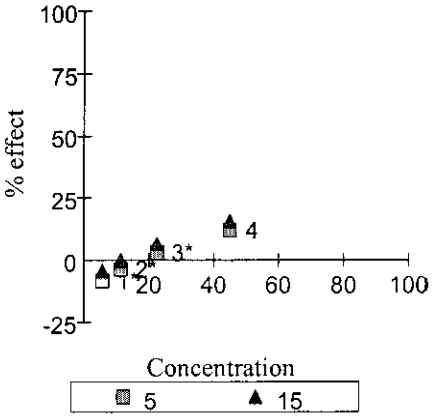
Date: 12/14/2000 02:52 PM

Test Protocol: Basic Test
Sample: 22048
Toxicant: ELUTRIATE
Reagent Lot no.:
Test description: TOLTEST SAMPLE
Data File: Untitled Data File

Plot of Gamma vs Concentration



Plot of %Effect vs Concentration



			5 Mins Data:			15 Mins Data:			
Sample	Conc	Io	It	Gamma	% effect	It	Gamma	% effect	ABSx
Control	0.000	88.00	88.00	1.000 #		86.00	0.9773 #		
1	5.625	89.00	85.00	-0.0775 *	-8.407%	80.00	-0.0421 *	-4.403%	0.1480
2	11.25	86.00	70.00	-0.0365 *	-3.789%	66.00	-0.0013 *	-0.1339%	0.2900
3	22.50	84.00	51.00	0.0308 *	2.995%	48.00	0.0704 #	6.578%	0.5850
4	45.00	83.00	32.00	0.1376	12.10%	30.00	0.1859 #	15.68%	1.119

- used in calculation; * - invalid data; D - deleted from calcs.
Autocalc has been used.

Satistical calculations could not be performed on the 5 Mins data.
Recommend re-testing sample at a higher initial concentration.
Highest % effect: 12.10%

Calculations on 15 Mins data:
EC50 Concentration:149.6%
Calculated from two data points, therefore no confidence range given.
Estimating Equation:LOG C =0.7140 x LOG G +2.175
Slope: 1.401
Correction Factor: 0.9773

There is no QA data available for this test.

APPENDIX B

Pathogen Testing Results, Pure Earth Environmental Lab, Inc.

PURE EARTH ENVIRONMENTAL LAB., INC.

7184 North Park Drive
Pennsauken, NJ 08110
Phone: (856) 486-1177
FAX: (856) 486-0005

T.J. Passon JR., PH.D.
LABORATORY DIRECTOR

LABORATORY REPORT

Toltest, Inc.
1915 N. 12TH ST.
PO BOX 2186

TOLEDO OH 43603-2186

(419) 241-7175

Job Number: 00113307
Accession No.: 333043
Date Collected 11/13/00
Date Received: 11/14/00

Toltest, Inc.
NSWC CRANE BIOFACILI
PCS-001

FECAL COLI/BIOSOLIDS

FECAL COLIFORM/GRAM SOLID	<2.73	MPN/g
Method:		
40 CFR PART 503;		
18TH ED STANDARD METHODS		
9221E.1, 9221 C		
Allowable Limits:		
<1000 MPN/g TOTAL DRY WEIGHT		
TOTAL SOLIDS % DRY WEIGHT	73.2	%

Report Date/Time 12/05/00 10:02:41

REPORT AMENDED
C. Farm
12/15/00
corrected FC result - switched w/ Salmonella

C. Farm
Supervisor

PURE EARTH ENVIRONMENTAL LAB., INC.

7184 North Park Drive
Pennsauken, NJ 08110
Phone: (856) 486-1177
FAX: (856) 486-0005

T.J. Passon JR., PH.D.
LABORATORY DIRECTOR

LABORATORY REPORT

Toltest, Inc.
1915 N. 12TH ST.
PO BOX 2186

TOLEDO OH 43603-2186

(419) 241-7175

Job Number: 00113307
Accession No.: 333043
Date Collected 11/13/00
Date Received: 11/14/00

Toltest, Inc.
NSWC CRANE BIOFACILI
PCS-001

SALMONELLA SP

SALMONELLA sp	<0.109	MPN/g

Method:
40 CFR PART 503; 18TH ED
STANDARD METHODS 9260D.1
Allowable Limits:
CLASS A NOT TO EXCEED
3 MPN/4g TOTAL DRY WEIGHT

Report Date/Time 12/05/00 10:03:20

REPORT AMMENDED
ANALYST C. Sorrm
DATE 12/05/00
REASON Changed SAL. RESULT switched w/FC

C. Sorrm
Supervisor

PURE EARTH ENVIRONMENTAL LAB., INC.

7184 North Park Drive
Pennsauken, NJ 08110
Phone: (856) 486-1177
FAX: (856) 486-0005

T.J. Passon JR., PH.D.
LABORATORY DIRECTOR

LABORATORY REPORT

Toltest, Inc.
1915 N. 12TH ST.
PO BOX 2186

TOLEDO OH 43603-2186

(419) 241-7175

Job Number: 00113307
Accession No.: 333043
Date Collected 11/13/00
Date Received: 11/14/00

Toltest, Inc.
NSWC CRANE BIOFACILI
PCS-001

TOTAL SOLIDS

TOTAL SOLID % DRY WEIGHT	73.2	%

Report Date/Time 12/05/00 10:03:50

REPORT AMENDED
ANALYST C. Sam
DATE 12/5/00
REASON corrected ts result

Supervisor

PURE EARTH ENVIRONMENTAL LAB., INC.

7184 North Park Drive
Pennsauken, NJ 08110
Phone: (856) 486-1177
FAX: (856) 486-0005

T.J. Passon JR., PH.D.
LABORATORY DIRECTOR

LABORATORY REPORT

Job Number: 00113307
Accession No.: 333044
Date Collected 11/13/00
Date Received: 11/14/00

Toltest, Inc.
1915 N. 12TH ST.
PO BOX 2186

TOLEDO OH 43603-2186

(419) 241-7175

Toltest, Inc.
NSWC CRANE BIOFACILI
PCS-002FD

FECAL COLI/BIOSOLIDS

FECAL COLIFORM/GRAM SOLID	<2.68	MPN/g

Method:
40 CFR PART 503;
18TH ED STANDARD METHODS
9221E.1, 9221 C
Allowable Limits:
<1000 MPN/g TOTAL DRY WEIGHT

TOTAL SOLIDS % DRY WEIGHT	74.5	%

Report Date/Time 12/05/00 10:04:24

REPORT AMMENDED
ANALYST
DATE 12/8/00
REA Changed FC result switched w/SAL

Supervisor

PURE EARTH ENVIRONMENTAL LAB., INC.

7184 North Park Drive
Pennsauken, NJ 08110
Phone: (856) 486-1177
FAX: (856) 486-0005

T.J. Passon JR., PH.D.
LABORATORY DIRECTOR

LABORATORY REPORT

Job Number: 00113307
Accession No.: 333044
Date Collected 11/13/00
Date Received: 11/14/00

Toltest, Inc.
1915 N. 12TH ST.
PO BOX 2186

TOLEDO OH 43603-2186

(419) 241-7175

Toltest, Inc.
NSWC CRANE BIOFACILI
PCS-002FD

SALMONELLA SP

SALMONELLA sp <0.107 MPN/g
Method:
40 CFR PART 503; 18TH ED
STANDARD METHODS 9260D.1
Allowable Limits:
CLASS A NOT TO EXCEED
3 MPN/4g TOTAL DRY WEIGHT

Report Date/Time 12/05/00 10:04:56

REPORT AMENDED
ANALYST C. Farm
DATE 12/5/00
REASON Changed SAL result switched w/FC

C. Farm
Supervisor

PURE EARTH ENVIRONMENTAL LAB., INC.

7184 North Park Drive
Pennsauken, NJ 08110
Phone: (856) 486-1177
FAX: (856) 486-0005

T.J. Passon JR., PH.D.
LABORATORY DIRECTOR

LABORATORY REPORT

Toltest, Inc.
1915 N. 12TH ST.
PO BOX 2186

TOLEDO OH 43603-2186

(419) 241-7175

Job Number: 00113307
Accession No.: 333044
Date Collected: 11/13/00
Date Received: 11/14/00

Toltest, Inc.
NSWC CRANE BIOFACILI
PCS-002FD

TOTAL SOLIDS

TOTAL SOLID % DRY WEIGHT	74.5	%

Theodore J. Passon, Jr., PhD
Laboratory Director

PURE EARTH ENVIRONMENTAL LAB., INC.

7184 North Park Drive
Pennsauken, NJ 08110
Phone: (856) 486-1177
FAX: (856) 486-0005

T.J. Passon JR., PH.D.
LABORATORY DIRECTOR

LABORATORY REPORT

Toltest, Inc.
1915 N. 12TH ST.
PO BOX 2186

TOLEDO OH 43603-2186

(419) 241-7175

Job Number: 00113307
Accession No.: 333045
Date Collected: 11/13/00
Date Received: 11/14/00

Toltest, Inc.
NSWC CRANE BIOFACILI
PCS-003

FECAL COLI/BIOSOLIDS

FECAL COLIFORM/GRAM SOLID	806	MPN/g

Method:
40 CFR PART 503;
18TH ED STANDARD METHODS
9221E.1, 9221 C
Allowable Limits:
<1000 MPN/g TOTAL DRY WEIGHT

TOTAL SOLIDS % DRY WEIGHT	62	%

Theodore J. Passon JR. PhD
Laboratory Director

PURE EARTH ENVIRONMENTAL LAB., INC.

7184 North Park Drive
Pennsauken, NJ 08110
Phone: (856) 486-1177
FAX: (856) 486-0005

T.J. Passon JR., PH.D.
LABORATORY DIRECTOR

LABORATORY REPORT

Toltest, Inc.
1915 N. 12TH ST.
PO BOX 2186

TOLEDO OH 43603-2186

(419) 241-7175

Job Number: 00113307
Accession No.: 333045
Date Collected: 11/13/00
Date Received: 11/14/00

Toltest, Inc.
NSWC CRANE BIOFACILI
PCS-003

SALMONELLA SP

SALMONELLA sp (0.129 MPN/g
Method:
40 CFR PART 503; 18TH ED
STANDARD METHODS 9260D.1

Allowable Limits:
CLASS A NOT TO EXCEED
3 MPN/4g TOTAL DRY WEIGHT

Thomas J. Passon, PhD
Laboratory Director

PURE EARTH ENVIRONMENTAL LAB., INC.

7184 North Park Drive
Pennsauken, NJ 08110
Phone: (856) 486-1177
FAX: (856) 486-0005

T.J. Passon JR., PH.D.
LABORATORY DIRECTOR

LABORATORY REPORT

Toltest, Inc.
1915 N. 12TH ST.
PO BOX 2186

TOLEDO OH 43603-2186

(419) 241-7175

Job Number: 00113307
Accession No.: 333045
Date Collected: 11/13/00
Date Received: 11/14/00

Toltest, Inc.
NSWC CRANE BIOFACILI
PCS-003

TOTAL SOLIDS

TOTAL SOLID % DRY WEIGHT	62.0	%

Theodore J. Passon, Ph.D.
Labora...

PURE EARTH ENVIRONMENTAL LAB., INC.

7184 North Park Drive
Pennsauken, NJ 08110
Phone: (856) 486-1177
FAX: (856) 486-0005

T.J. Passon JR., PH.D.
LABORATORY DIRECTOR

LABORATORY REPORT

Toltest, Inc.
1915 N. 12TH ST.
PO BOX 2186

TOLEDO OH 43603-2186

(419) 241-7175

Job Number: 00113307
Accession No.: 333046
Date Collected: 11/13/00
Date Received: 11/14/00

Toltest, Inc.
NSWC CRANE BIOFACILI
PCS-004

FECAL COLI/BIOSOLIDS

FECAL COLIFORM/GRAM SOLID	371	MPN/g

Method:
40 CFR PART 503;
18TH ED STANDARD METHODS
9221E.1, 9221 C
Allowable Limits:
<1000 MPN/g TOTAL DRY WEIGHT

TOTAL SOLIDS % DRY WEIGHT	64.7	%

Theodore J. Passon JR. PhD
Laboratory Director

PURE EARTH ENVIRONMENTAL LAB., INC.

7184 North Park Drive
Pennsauken, NJ 08110
Phone: (856) 486-1177
FAX: (856) 486-0005

T.J. Passon JR., PH.D.
LABORATORY DIRECTOR

LABORATORY REPORT

Toltest, Inc.
1915 N. 12TH ST.
PO BOX 2186

TOLEDO OH 43603-2186

(419) 241-7175

Job Number: 00113307
Accession No.: 333046
Date Collected: 11/13/00
Date Received: 11/14/00

Toltest, Inc.
NSWC CRANE BIOFACILI
PCS-004

SALMONELLA SP

SALMONELLA sp <0.124 MPN/g
Method:
40 CFR PART 503; 18TH ED
STANDARD METHODS 9260D.1

Allowable Limits:
CLASS A NOT TO EXCEED
3 MPN/4g TOTAL DRY WEIGHT

Theodore J. Passon, Ph.D.
Laboratory Director

PURE EARTH ENVIRONMENTAL LAB., INC.

7184 North Park Drive
Pennsauken, NJ 08110
Phone: (856) 486-1177
FAX: (856) 486-0005

T.J. Passon JR., PH.D.
LABORATORY DIRECTOR

LABORATORY REPORT

Toltest, Inc.
1915 N. 12TH ST.
PO BOX 2186

TOLEDO OH 43603-2186

(419) 241-7175

Job Number: 00113307
Accession No.: 333046
Date Collected: 11/13/00
Date Received: 11/14/00

Toltest, Inc.
NSWC CRANE BIOFACILI
PCS-004

TOTAL SOLIDS

TOTAL SOLID % DRY WEIGHT	64.7	%

Theodore J. Passon, Ph.D
Laboratory Director

PURE EARTH ENVIRONMENTAL LAB., INC.

7184 North Park Drive
Pennsauken, NJ 08110
Phone: (856) 486-1177
FAX: (856) 486-0005

T.J. Passon JR., PH.D.
LABORATORY DIRECTOR

LABORATORY REPORT

Toltest, Inc.
1915 N. 12TH ST.
PO BOX 2186

TOLEDO OH 43603-2186

(419) 241-7175

Job Number: 00113307
Accession No.: 333047
Date Collected: 11/13/00
Date Received: 11/14/00

Toltest, Inc.
NSWC CRANE BIOFACILI
PCS-005

FECAL COLI/BIOSOLIDS

FECAL COLIFORM/GRAM SOLID	19	MPN/g

Method:
40 CFR PART 503;
18TH ED STANDARD METHODS
9221E.1, 9221 C
Allowable Limits:
<1000 MPN/g TOTAL DRY WEIGHT

TOTAL SOLIDS % DRY WEIGHT	68.1	%

Theodore J Passon Jr. Ph.D
Laboratory Director

PURE EARTH ENVIRONMENTAL LAB., INC.

7184 North Park Drive
Pennsauken, NJ 08110
Phone: (856) 486-1177
FAX: (856) 486-0005

T.J. Passon JR., PH.D.
LABORATORY DIRECTOR

LABORATORY REPORT

Toltest, Inc.
1915 N. 12TH ST.
PO BOX 2186

TOLEDO OH 43603-2186

(419) 241-7175

Job Number: 00113307
Accession No.: 333047
Date Collected: 11/13/00
Date Received: 11/14/00

Toltest, Inc.
NSWC CRANE BIOFACILI
PCS-005

SALMONELLA SP

SALMONELLA sp	<0.117	MPN/g

Method:
40 CFR PART 503; 18TH ED
STANDARD METHODS 9260D.1

Allowable Limits:
CLASS A NOT TO EXCEED
3 MPN/4g TOTAL DRY WEIGHT

Laboratory Director

PURE EARTH ENVIRONMENTAL LAB., INC.

7184 North Park Drive
Pennsauken, NJ 08110
Phone: (856) 486-1177
FAX: (856) 486-0005

T.J. Passon JR., PH.D.
LABORATORY DIRECTOR

LABORATORY REPORT

Toltest, Inc.
1915 N. 12TH ST.
PO BOX 2186

TOLEDO OH 43603-2186

(419) 241-7175

Job Number: 00113307
Accession No.: 333047
Date Collected: 11/13/00
Date Received: 11/14/00

Toltest, Inc.
NSWC CRANE BIOFACILI
PCS-005

TOTAL SOLIDS

TOTAL SOLID % DRY WEIGHT	68.1	%

Report Date/Time 11/30/00 13:38:50

Laboratory Director

TOLTEST, INC. FEDEX 824134233876 BIO-419

1915 N. 12th St., P.O. Box 2186, Toledo, OH 43603-2186; Voice (419) 241-71.. Fax (419) 321-6259

Ship To Address: ATTN: RECEIVING LAB, 1810 N. 12th St., Toledo, OH 43624-1304; Voice (419) 241-7175, Fax (419) 241-1808

Sent From: ☐ Corporate ☐ Plymouth ☐ Pittsburgh ☐ Other _____

Chain of Custody Record

31886 Page 1 of 1

Project No.: 37324 | Client:

P.O. No.: | Project/Location: NSWC Crane Bio Facility

Project Mgr.: | Sampler's Name: Peter Chevalier

Phone No. | Sampler's Signature: Peter Chevalier

Item No.	Sample I.D.	Date Sampled	Time Sampled	Type	Matrix	Sample Location	Total No. of Containers	Parameters: PAHs	418.1	8270	EFCLWB	ESLW	ETSOL				Preserved Yes/No	LAB USE ONLY Lab #
1	RS-001	11/13/00	0825	C	compost	S-001	2		✓									
2	RS-002FD	11/13/00	0825	C	compost	S-001 field dup.	2		✓									
3	RS-003	11/13/00	0930	C	compost	S-096	2		✓									
4	RS-004	11/13/00	1015	C	compost	S-159	2		✓									
5	RS-005	11/13/00	1055	C	compost	S-178	2		✓									
6																		
7																		
8																		
9																		
10																		

Item No.	Relinquished By:	Date / Time	Received By:	Date / Time
	Peter Chevalier	11/13/00 1530	L. Tamulevich	11/14/00 10:00 AM

LAB USE ONLY

Were samples delivered ☐ in person ☐ by courier

Were samples preserved ☐ in field ☐ in lab ☐ N/A

Temp of samples _____ °C

Did samples arrive intact and sealed? ☐ yes ☐ no ☐ N/A

Were proper containers used? ☐ yes ☐ no

Was container labeled properly for contents? ☐ yes ☐ no

Were samples packaged properly for type of material? ☐ yes ☐ no

Was shipping label completed properly per regulations? (49 CFR 170, etc.) ☐ yes ☐ no

Comments: _____

TAT _____

APPENDIX C

Letter From Aqua Survey Inc.'s Laboratory Manager

May 1, 2001

Mr. Peter Chevalier
Toltest, Inc.

RE: NSWC Crane Biofacility(Job # 20-475)

Dear Mr. Chevalier:

This letter is a response to some deviations found in the test report to the above reference. The following is a list of those deviations:

1) Acclimation procedure for earthworm toxicity test.
2) Temperature probe setting for earthworm test.
3) Replicates in reference toxicity test for earthworms.
4) Elutriate procedure for microtox test.

In response to the acclimation of the earthworms, Aqua Survey Inc.(ASI) had ordered organisms from a culture facility and found out organisms had never been shipped. ASI, knowing the sampling was underway quickly ordered earthworms from another culture facility. We were able to get one day of acclimation after the situation was controlled. Having been involved with several earthworm projects in the past few years, I believe the organisms were healthy. There were no dead worms on arrival or upon test initiation, they exhibited good coloration and they were fully clitellate adults. These organisms also arrived at test temperature(20.5 degrees C) and the results of the Standard Reference Toxicant(SRT) test fell within our control chart. With these facts in mind and good control survival this deviation should not effect the results of the test.

In response to the temperature probe not being setup upon initiation of the test, ASI personnel simply forgot to initiate one until a couple of days later when they realized there was not one there. Again with the results of good control survival I believe the temperatures at the beginning of the test were not extraordinary and would have changed the results of the test.

The replicates for the earthworm Standard Reference Toxicant (SRT) test were supposed to be three. ASI ran two replicates and it was an oversight of the SOP/Protocol. ASI has run the last six SRT's(1998-2000) prior to this one with two replicates and the control chart indicates that this recent test has fallen within our limits. Since this control chart has been in place for a few years, this is a good argument for a representative SRT. This deviation should not effect the results of this test report.

The elutriate SOP that was sent to Toltest is the wrong SOP. That SOP describes a procedure for sediment. The procedure ASI used was for soil and can be found in our SOP/SED/202. This procedure references EPA's Protocols for Short Term Toxicity Screening of Hazardous Waste Sites EPA/600/3-88/029. This SOP can be furnished upon request. The history behind this deviation stems from back in 1998 with prior tests being run. The same test procedures were run back than as was done this round. After the test were completed in 1998 there was a request for our Standard Operating Procedures(SOP's). These were submitted and some changes were made and approved by the regulators(EPA). At that time we had sent the SOP for the sediment elutriate procedure. We never picked up the mistake that we sent the wrong SOP and we also did not get flagged for it that we did not follow our SOP. It was only until this recent test that an issue was made about not following the SOP. We followed the SOP/SED/202 for soil as we did back in 1998.

If you have any questions, please feel free to call me at (908) 788-8700.

Sincerely,

Thomas J. Dolce

Thomas J. Dolce
Laboratory Manager

APPENDIX D

Aqua Survey Inc.'s SOP/SEP/202

STANDARD OPERATING PROCEDURE SOP/SED/202

STATIC NON-RENEWAL TEST FOR DETERMINING ACUTE TOXICITY OF AQUEOUS WASTES AND SOIL AND SOLID WASTE ELUTRIATES TO THE SEEDLINGS OF TERRESTRIAL PLANTS

OBJECTIVE

The objective of this procedure is to determine the acute toxicity of aqueous wastes and soil and solid waste elutriates to the seedlings of terrestrial plants.

For purposes of uniformity and practicality, this procedure is designed for use with the seeds of the specific domestic cultivar, "Buttercrunch", of the common lettuce, *Lactuca sativa*, but may be applied with equal effect to the seeds other species, both domestic and wild.

MATERIALS

1. Untreated seeds, of a single lot of the year, of *Lactuca sativa* var "Buttercrunch"
2. Wire mesh screens:
   - 1/6-in x 1/28-in
   - 1/6-in x 1/30-in
   - 1/6-in x 1/32-in
   - 1/6-in x 1/3-in
3. Triple-beam balance
4. 500-mL HDPE screw-cap bottles
5. 1-L screw-cap centrifuge bottles
6. 250-mL borosilicate glass beakers
7. 5-mL, 10-mL and 25-mL disposable syringes
8. Whatman® grade 3, 9-cm (100-mm qualitative cellulose) filter paper
9. 100-mm x 15-mm plastic petri dishes with covers
10. Forceps
11. Incubation chamber
12. Thermometer
13. pH meter
14. Metric ruler

PROCEDURE

1. Preparation

   1.3 Carefully inspect the lot of seeds and remove any trash, empty seed hulls and damaged seeds. Grade the seeds by size as follows:

1.3.1 Nest the wire mesh screens, in descending mesh size order from top to bottom, with a bottom pan beneath.

1.3.2 Pour the seeds onto the top screen and gently agitate the set of screens until all seed has been completely distributed according to size, remaining on one of the screens or having passed through to the bottom pan.

1.3.3 Collect for testing that size class containing the greatest quantity of seed.

1.4 Store the remaining seed fractions, in packets according to size, in airtight, waterproof containers at 4° C.

1.5 Calibrate the triple-beam balance as per SOP/INS/000.

1.6 Determine the moisture fraction (MF) of the test sample as per SOP/GEN/010.

1.7 Prepare the sample elutriate as follows:

1.7.1 From the moisture fraction (MF) determination, calculate the total wet weight of sample equivalent to 50 g dry weight:

· Wet Wt Equivalent (g) = [50 g dry sample] + [MF x 50 g dry sample]

1.7.2 Using the triple-beam balance, weigh the wet weight equivalent of 50 g dry weight of test sample into a 500-mL HDPE bottle.

1.7.3 Calculate the volume of deionized water to add to the sample:

· Volume Water (mL) = [500 mL] - [MF x 50 g dry sample]

1.7.4 Measure the volume of deionized water required into the 500-mL bottle.

1.8 Agitate the hydrated sample for 48 hours at 20 ± 2° C in total darkness. Secure the bottle to a mechanical end-over-end shaker and set to mix. Alternatively, if an end-over-end shaker is not available, secure the bottle to the mechanical shaker and set to agitate vigorously. Remove the bottle from the shaker twice daily during the 48-h period and thoroughly mix manually, end-over-end, for several minutes to ensure adequate interaction of the water with the sample.

1.9 After agitation is complete, pour the suspension into a centrifuge bottle and centrifuge at 4200 rpm for 13 min. Carefully decant the elutriate fraction into a 250-mL beaker.

1.10 Calibrate the thermometer (SOP/INS/002) and pH meter (SOP/INS/004).

STATIC NON-RENEWAL TEST FOR DETERMINING ACUTE TOXICITY OF AQUEOUS WASTES AND SOIL AND SOLID WASTE ELUTRIATES TO THE SEEDLINGS OF TERRESTRIAL PLANTS

OBJECTIVE

The objective of this procedure is to determine the acute toxicity of aqueous wastes and soil and solid waste elutriates to the seedlings of terrestrial plants.

For purposes of uniformity and practicality, this procedure is designed for use with the seeds of the specific domestic cultivar, "Buttercrunch", of the common lettuce, *Lactuca sativa*, but may be applied with equal effect to the seeds other species, both domestic and wild.

MATERIALS

1. Untreated seeds, of a single lot of the year, of *Lactuca sativa* var "Buttercrunch"
2. Wire mesh screens:
   - 1/6-in x 1/28-in
   - 1/6-in x 1/30-in
   - 1/6-in x 1/32-in
   - 1/6-in x 1/3-in
3. Triple-beam balance
4. 500-mL HDPE screw-cap bottles
5. 1-L screw-cap centrifuge bottles
6. 250-mL borosilicate glass beakers
7. 5-mL, 10-mL and 25-mL disposable syringes
8. Whatman® grade 3, 9-cm (100-mm qualitative cellulose) filter paper
9. 100-mm x 15-mm plastic petri dishes with covers
10. Forceps
11. Incubation chamber
12. Thermometer
13. pH meter
14. Metric ruler

PROCEDURE

1. Preparation

   1.3 Carefully inspect the lot of seeds and remove any trash, empty seed hulls and damaged seeds. Grade the seeds by size as follows:

1.3.1 Nest the wire mesh screens, in descending mesh size order from top to bottom, with a bottom pan beneath.

1.3.2 Pour the seeds onto the top screen and gently agitate the set of screens until all seed has been completely distributed according to size, remaining on one of the screens or having passed through to the bottom pan.

1.3.3 Collect for testing that size class containing the greatest quantity of seed.

1.4 Store the remaining seed fractions, in packets according to size, in airtight, waterproof containers at 4° C.

1.5 Calibrate the triple-beam balance as per SOP/INS/000.

1.6 Determine the moisture fraction (MF) of the test sample as per SOP/GEN/010.

1.7 Prepare the sample elutriate as follows:

1.7.1 From the moisture fraction (MF) determination, calculate the total wet weight of sample equivalent to 50 g dry weight:

· Wet Wt Equivalent (g) = [50 g dry sample] + [MF x 50 g dry sample]

1.7.2 Using the triple-beam balance, weigh the wet weight equivalent of 50 g dry weight of test sample into a 500-mL HDPE bottle.

1.7.3 Calculate the volume of deionized water to add to the sample:

· Volume Water (mL) = [500 mL] - [MF x 50 g dry sample]

1.7.4 Measure the volume of deionized water required into the 500-mL bottle.

1.8 Agitate the hydrated sample for 48 hours at 20 ± 2° C in total darkness. Secure the bottle to a mechanical end-over-end shaker and set to mix. Alternatively, if an end-over-end shaker is not available, secure the bottle to the mechanical shaker and set to agitate vigorously. Remove the bottle from the shaker twice daily during the 48-h period and thoroughly mix manually, end-over-end, for several minutes to ensure adequate interaction of the water with the sample.

1.9 After agitation is complete, pour the suspension into a centrifuge bottle and centrifuge at 4200 rpm for 13 min. Carefully decant the elutriate fraction into a 250-mL beaker.

1.10 Calibrate the thermometer (SOP/INS/002) and pH meter (SOP/INS/004).

1.11 Adjust the elutriate temperature to 24 ± 2° C.

1.12 Using disposable syringes, prepare the elutriate dilutions by volume, using deionized water, to result in 70 mL of each of a geometric series of sample concentrations (i.e., 6.25, 12.5, 25, 50 and 100 percent elutriate plus a deionized water control).

1.13 Monitor and record the pH, alkalinity and hardness for each test dilution and the control.

1.14 Prepare and label three replicate petri dishes with covers for each test treatment and the control.

1.15 Place a sheet of Whatman No. 3 filter paper in each replicate petri dish. Working from the control to the highest concentration, and using a 5-mL disposable syringe, dispense 4 mL of test solution to each replicate so as to thoroughly wet the entire filter paper.

2. Test Initiation

2.1 Choose 5 seeds at random from the test lot and place them in one replicate petri dish, spacing the seeds equally in a circle on the filter paper, equidistant from the edge to the center. Repeat for each replicate.

2.2 Place a petri dish cover over each replicate and randomly distribute the replicates at random in the incubation chamber.

3. Monitoring and Maintenance

3.1 Incubate the test replicates at 24 ± 2° C in total darkness for 120 hours.

3.2 Monitor and record the temperature of the incubation chamber at test initiation and at each 24-h interval thereafter.

4. Test Termination

4.1 The test is terminated at 120 ± 0.5 hours for *Lactuca sativa*; exposure time will vary if other species are used.

4.2 Remove the petri dishes from the incubation chamber.

4.3 Working with one replicate at a time, determine and record the number of germinated and ungerminated seeds.

4.4 Determine the root length for each replicate.

- Remove the seeds from the filter paper to a clean work surface and measure and record the root length, to the nearest millimeter, for each germinated seed.
- Measurements are made from the transition point between the hypocotyl and the primary root to the apex of the root.
- At the transition point, the axis may exhibit a slight swelling, a slight crook, or a noticeable change in size.

APPENDIX E

Field Change Request FS-032

Crane Naval Surface Warfare Center	EJOC Contract N622467-96-D-0052
TolTest, Inc.	

FIELD CLARIFICATION REQUEST (FCR)

Delivery Order No.:	Subcontract No.:	FCR No.:
FC03	N/A	FCO3-FCR-FS032 **Rev. 0**
SOP for Elutriate Preparation for Microtox Testing		Page 1 of 1

Reference Documents:

Quality Assurance Project Plan for Full-Scale Operations Soils Bioremediation Facility, March 1998 Rev. 2

Problem / Change Description:

The approved standard operating procedure SOP/PRP/005, found on page A-3d of Appendix G to the Biofacility QAPP, is not the appropriate SOP for preparation of elutriate used in toxicity testing. This SOP describes a procedure used on sediment samples, not soil samples. Although this is the approved SOP, the contract laboratory performing toxicity analysis used the more appropriate SOP, SOP/SED/202 (attached), in previous toxicity sampling events.

Initiated by TolTest Env. Spec.	Signature: Peter J. Chevalier	Organization: TolTest, Inc.	Date: 5/18/2001

Resolution:

Replace SOP/PRP/005 with SOP/SED/202. The applicable sections of SOP/SED/202 for preparation of the elutriate are 1.7, 1.8, and 1.9. The remaining sections of this SOP are not applicable.

Approval by TolTest, PM	Signature: Lance Parsons	Date: 5/18/01	Approval by ROICC/NTR or RPM	Signature: Brent Robertson	Date 5/22/01
Approval by TolTest QC/SHSO	Signature: John Lyttle	Date: 5-18-01	Approval by EPD ECOTR:	Signature Christine Freeman	Date 5/21/01

Regulator Approval/Notification Recommended:
Yes ☐ No ☐

5/22/01