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Final

Baseline Ecological Risk Assessment
Site 47

Naval Support Facility, Indian Head
Indian Head, Maryland

Contract Task Order 066

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Contents

Acronyms and Abbreviations ..... **v**

1 Introduction **1-1**
1.1 Site Background 1-1
1.2 Results of Steps 1-3A of the Ecological Risk Assessment 1-3
1.3 Chemicals, Media, and Areas of Focus for the BERA 1-3

2 BERA Problem Formulation **2-1**
2.1 Toxicity Evaluation 2-1
2.1.1 Inorganics 2-1
2.1.2 Polycyclic Aromatic Hydrocarbons 2-5
2.2 Conceptual Site Model 2-6
2.2.1 Transport and Exposure Pathways 2-6
2.2.2 Assessment Endpoints 2-7
2.2.3 Risk Hypotheses 2-8
2.2.4 Measurement Endpoints 2-8

3 BERA Investigation Activities **3-1**
3.1 Soil Invertebrate Community 3-1
3.2 Upper-Trophic-Level Receptors 3-2
3.3 Benthic Invertebrates 3-2
3.4 Water Column Organisms 3-2
3.5 Reference Samples 3-3

4 BERA Investigation Results **4-1**
4.1 Soil Toxicity 4-1
4.2 Earthworm Tissue 4-3
4.3 Sediment Toxicity 4-3
4.4 Surface Water 4-6

5 Risk Characterization **5-1**
5.1 Assessment Endpoints 5-1
5.2 Uncertainty 5-2
5.3 Conclusions 5-3
5.4 Risk Management 5-3

6 References **6-1**

Appendixes

A Site 47 Chemistry Results: Soil, Sediment, Surface Water, and Tissue
B Soil Toxicity Testing Report
C Grain Size Data
D Sediment Toxicity Testing Report
E Work Plan for Supplemental BERA Investigation
F Supplemental BERA Investigation Results

Tables

Table 1-1 Media, COCs, and Ecological Receptors Identified for the BERA.....1-4

Table 2-1 Assessment and Measurement Endpoints for Site 47.....2-9

Table 4-1 Grain Size and TOC data for Surface Soil Samples.....4-1
Table 4-2 Surface Soil Toxicity Test Results for Earthworm Growth.....4-2
Table 4-3 Results of Exposure Calculations for Upper Trophic Level Receptors 4-3
Table 4-4 Sediment Grain Size and TOC Data.....4-4
Table 4-5 Summary of Sediment Toxicity Test Results.....4-5
Table 4-6 Aluminum and Iron Concentrations in the Reference and Site Samples.....4-6
Table 4-7 Comparison of Surface Water Results with Ecological Screening Values 4-6
Table 4-8 Aluminum, Iron, and Manganese Concentrations in Site Sediment and Soil Compared with Background Concentrations 4-7

Figures (Figures are located at the end of each section.)

1-1 Site Location Map
1-2 Previous Sample Locations

2-1 Conceptual Site Model

3-1 Soil Toxicity Test Locations
3-2 Sediment Toxicity Test Locations
3-3 Reference Toxicity Test Locations

4-1 Soil Toxicity Test Results – Survival
4-2 Soil Toxicity Test Results – Growth
4-3 Sediment Toxicity Test Results – Survival
4-4 Sediment Toxicity Test Results – Growth
4-5 Sediment Toxicity Test Results – Reproduction
4-6 Metal Concentrations in Site Sediments

Acronyms and Abbreviations

BERA	Baseline Ecological Risk Assessment
CLEAN	Comprehensive Long-Term Environmental Action Navy
CNO	Chief of Naval Operations
COC	Chemical of Concern
CSM	Conceptual Site Model
EC50	Effects Concentration 50 Percent
HQ	Hazard Quotient
IR	Installation Restoration
LANTDIV	Naval Facilities Engineering Command, Atlantic Division
LC50	Lethal Concentration 50 Percent
LOAEL	Lowest Observed Adverse Effect Level
MDE	Maryland Department of the Environment
Navy	U.S. Department of the Navy
NOAEL	No Observed Adverse Effects Level
NSF-IH	Naval Support Facility, Indian Head
PAH	Polycyclic Aromatic Hydrocarbons
RI	Remedial Investigation
SERA	Screening Ecological Risk Assessment
SVOC	Semi-Volatile Organic Compound
TOC	Total Organic Carbon
USEPA	United States Environmental Protection Agency

SECTION 1

Introduction

Naval Support Facility, Indian Head (NSF-IH) is a Navy facility located in northwestern Charles County, Maryland, approximately 25 miles southwest of Washington, District of Columbia. This report presents the results of a Baseline Ecological Risk Assessment (BERA) for Site 47 at NSF-IH. Figure 1-1 shows the location of Site 47.

This BERA report was prepared by CH2M HILL under the U.S. Department of the Navy (Navy), Naval Facilities Engineering Command, Atlantic Division (LANTDIV), Comprehensive Long-Term Environmental Action Navy (CLEAN) II Contract N62470-95-D-6007, Contract Task Order 0066. This BERA has been submitted to the Naval Facilities Engineering Command Washington, NSF-IH, The United States Environmental Protection Agency (USEPA), and the Maryland Department of the Environment (MDE). The activities described herein are part of the overall Installation Restoration (IR) Program being implemented at NSF-IH.

This document was prepared in accordance with USEPA guidance (USEPA, 1997 and USEPA, 1998) and Chief of Naval Operations (CNO) policy (CNO, 1999).

The document is organized as follows:

- Section 1: Introduction
- Section 2: BERA Problem Formulation
- Section 3: BERA Investigation Activities
- Section 4: BERA Investigation Results
- Section 5: Risk Characterization
- Section 6: References

1.1 Site Background

This section provides a summary of the background information for Site 47. Detailed site background information is provided in the *Final Remedial Investigation Report Site 47 – Mercuric Nitrate Disposal Area* (herein referred to as RI report) (CH2M HILL, 2003).

Site 47 (Mercuric Nitrate Disposal Area) is in the northwest-central part of the facility and is an upland area that gently slopes to the southeast (Figure 1-1). The vegetation at the site is maintained as mowed grass. Mercuric nitrate was used in Building 856 as a catalyst in the production of the missile propellant hydrazinium nitroformate and was disposed of at a location near the southeastern corner of the building, near the approximate location of sample SA05 (Figure 1-2). The disposal area consisted of about 24 square feet (4 ft by 6 ft) near the drainage ditch that begins near the southeastern corner of the building. The disposal site was covered with limestone chips to provide neutralization for nitric acid, which contained the spent catalyst. An estimated 274 pounds of mercuric nitrate were disposed of at the site between 1957 and 1965 (NEESA, 1988). There is no visual evidence of the disposal area at present. Additionally, the floors and the drainage trenches (that

processed the wastewater to Buildings 856A, 856B, and 856C) were lined with leaded flooring. The lead that lined the trenches located outside of Building 856 was removed before the 1999 Remedial Investigation (RI) sampling. Lead in the surface soil at Site 47 may have originated from the leaded floor and lead-lined drainage trenches of Building 856 or from paint on the building.

Drainage in the ditch adjoining the former disposal location flows generally southward. Water in the ditch eventually flows to Mattawoman Creek, about one-half-mile south of the site. At its beginning, the ditch is approximately 1 foot to 2 feet wide with mowed grassy banks. The substrate of the ditch is soil with no wetland vegetation present for most of its length. About 200 feet north of Caffee Road, the ditch joins an intermittent stream with marginal habitat where shallow water is usually present, but with little flow except during and after precipitation events. The drainage ditch between the mercuric nitrate disposal area and its confluence with the intermittent stream conveys runoff only during and after precipitation events.

A 300-foot section of stream, immediately downstream of Caffee Road, was excavated in 1994 as part of the remediation for Site 8 (Mercury contamination from Building 766). Mercury was the contaminant of concern in the soil and sediment at Site 8. Mercury was used in laboratory tests in Building 766 from 1953 to 1981 and disposed of through a drainpipe into the stream. Approximately 440 cubic yards of mercury-contaminated soil/sediment were removed from Site 8 and the stream. The removal action was based on a 10 mg/kg action level for mercury. Confirmatory sampling indicated that the removal action was successful (Haliburton NUS, 1995). After the removal action, excavated stream areas were backfilled with 12-inch lifts of common fill, and erosion and sediment control measures were installed (OHM, 1995).

Downstream of Site 8, the stream flows through a forested area and then into the Site 12 Pond, an impounded 8-acre water body adjacent to Town Gut Landfill (Site 12). Water released from this impoundment enters Mattawoman Creek via a tidal marsh. Much of the Site 12 Pond has been investigated as part of RI activities for Town Gut Landfill (Site 12) and Sites 8 and 56. Site 56, referred to as Industrial Wastewater Outfall 87, discharged to the stream downstream of Site 8. Site 56 was remediated for lead-contaminated sediments in the pipe and at the discharge point. A biomonitoring program was initiated in the Site 12 Pond in 1992 to determine the effect of mercury and lead on biota in the pond. The results of the biomonitoring showed no adverse effects on biota in the pond (Brown and Root, 1996).

Historical information obtained subsequent to the initial investigation indicates other potential releases to the environment at and around Site 47 have occurred, including a barium slurry reportedly deposited in a pit on the east side of Building 856; nitroglycerin stored or used at the site and detected in a stormwater manhole; and volatile organic compounds such as carbon tetrachloride and trichloroethene, which were used or stored at the site and have been detected in groundwater at the site. The BERA addresses only potential risk from chemicals in the surface soil, sediment, and surface water at Site 47 because there are no complete exposure pathways for ecological receptors to come in contact with groundwater at Site 47.

1.2 Results of Steps 1-3A of the Ecological Risk Assessment

A screening ecological risk assessment (SERA) was completed for Site 47 as part of the Final RI for the site (CH2M HILL, 2003). The results of the SERA suggested that the potential for unacceptable ecological risk exists at the site. For all endpoints, there were multiple chemicals that were associated with hazard quotients (HQs) in excess of 1. HQs for mercury were greater than 100 for all endpoints, with the exception of carnivorous terrestrial mammals.

The results of the Step 3A evaluation in the SERA revealed that several metals and polycyclic aromatic hydrocarbons (PAHs) posed potential risk to soil invertebrates. Based on a review of the spatial distribution of the chemicals of concern (COCs), the distribution of the majority of the metals with concentrations above screening values appeared to be widespread over the entire site. Aluminum, chromium, iron, and vanadium were found to be present in site surface soil at concentrations consistent with background levels, while lead, mercury, silver, and zinc were found to be present in site surface soils at concentrations substantially higher than background levels.

Two metals (mercury and silver) and one semi-volatile organic compound (phenanthrene) were identified as COCs for the sediments at Site 47. The area where concentrations of these chemicals were above the screening values was limited to the upper part of the main drainage ditch (i.e., samples IS47SS16, IS47SS17, and IS47SD05) (Figure 1-2). The sample collected from the small drainage ditch below the bunkers (IS47SS18) and the furthest downgradient sample (IS47SD06) did not contain mercury or silver, and the concentration of phenanthrene was below the screening value. Therefore, the potential risk to the benthic invertebrate community from these chemicals was found to be limited to the upper part of the drainage ditch, a stretch of approximately 250 feet.

Four metals—aluminum, iron, manganese, and zinc—were identified as COCs for surface water in the stream. The surface water samples were collected at locations IS47SW01 and IS47SW02, shown on Figure 1-2. The surface water data were total, unfiltered concentrations. These exceedances might be representative of the local geological conditions, but the potential risk to the water column community could not be dismissed because local background surface water concentrations have not been established.

Based on food web modeling, three metals (lead, mercury, and zinc) were identified as posing a potential risk to upper-trophic-level receptors. Lead was identified as a COC for insectivorous and herbivorous birds, while mercury was identified as a COC for omnivorous mammals and insectivorous birds, and zinc was identified as a COC for insectivorous birds. No risks were identified for semi-aquatic mammals from chemicals in the sediment and surface water of the intermittent stream.

1.3 Chemicals, Media, and Areas of Focus for the BERA

The driver COCs identified for Site 47 after Step 3A, which are present above background levels and are likely site-related, are shown in Table 1-1 below.

TABLE 1-1
Media, COCs, and Ecological Receptors Identified for the BERA

Site 47 Surface Soil		Sediment and Surface Water in the Intermittent Stream	
Soil Invertebrates	**Upper Trophic Level Receptors**	**Benthic Invertebrates**	**Water Column Receptors (Invertebrates and Amphibians)**
Lead	Lead	Mercury	Aluminum
Mercury	Mercury	Silver	Iron
Silver	Zinc	Phenanthrene	Manganese
Zinc			Zinc
Acenaphthylene			
Anthracene			
Benzo(a)anthracene			
Benzo(a)pyrene			
Benzo(b)fluoranthene			
Benzo(g,h,i)perylene			
Benzo(k)fluoranthene			
Chrysene			
Dibenz(a,h)anthracene			
Fluoranthene			
Indeno(1,2,3-cd)pyrene			
Naphthalene			
Phenanthrene			
Pyrene			

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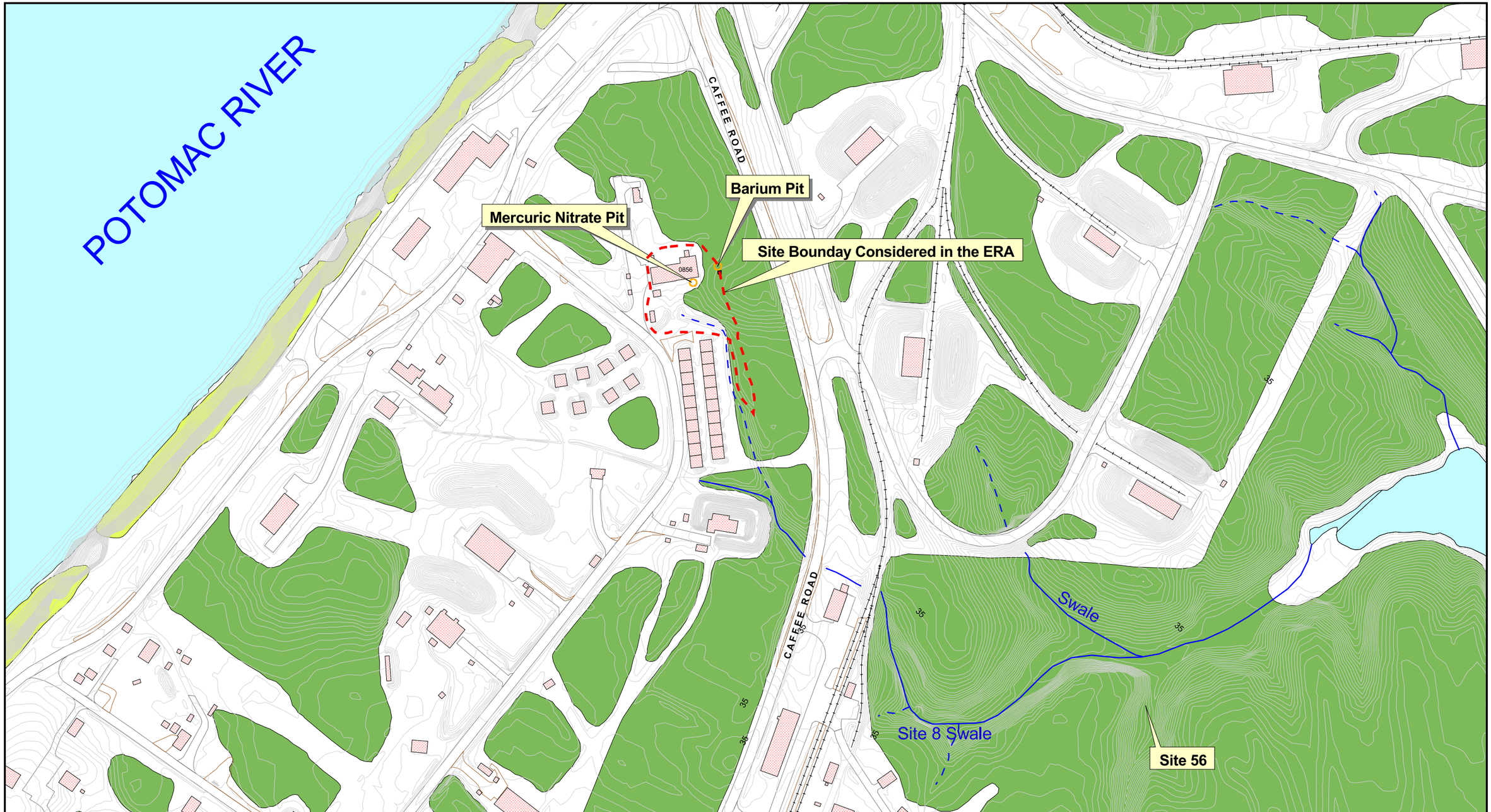

LEGEND

- Perennial Swale
- Intermittent Swale
- Railroads
- Buildings
- 1 Foot Elevation Contours (feet above mean sea level)
- Asphalt Road
- Dirt Road
- Gravel Road
- Vegetation

N

0 200 400 Feet

1" = 200ft

Figure 1-1
Site Location Map
Site 47 BERA
NSF-IH, Indian Head, Maryland

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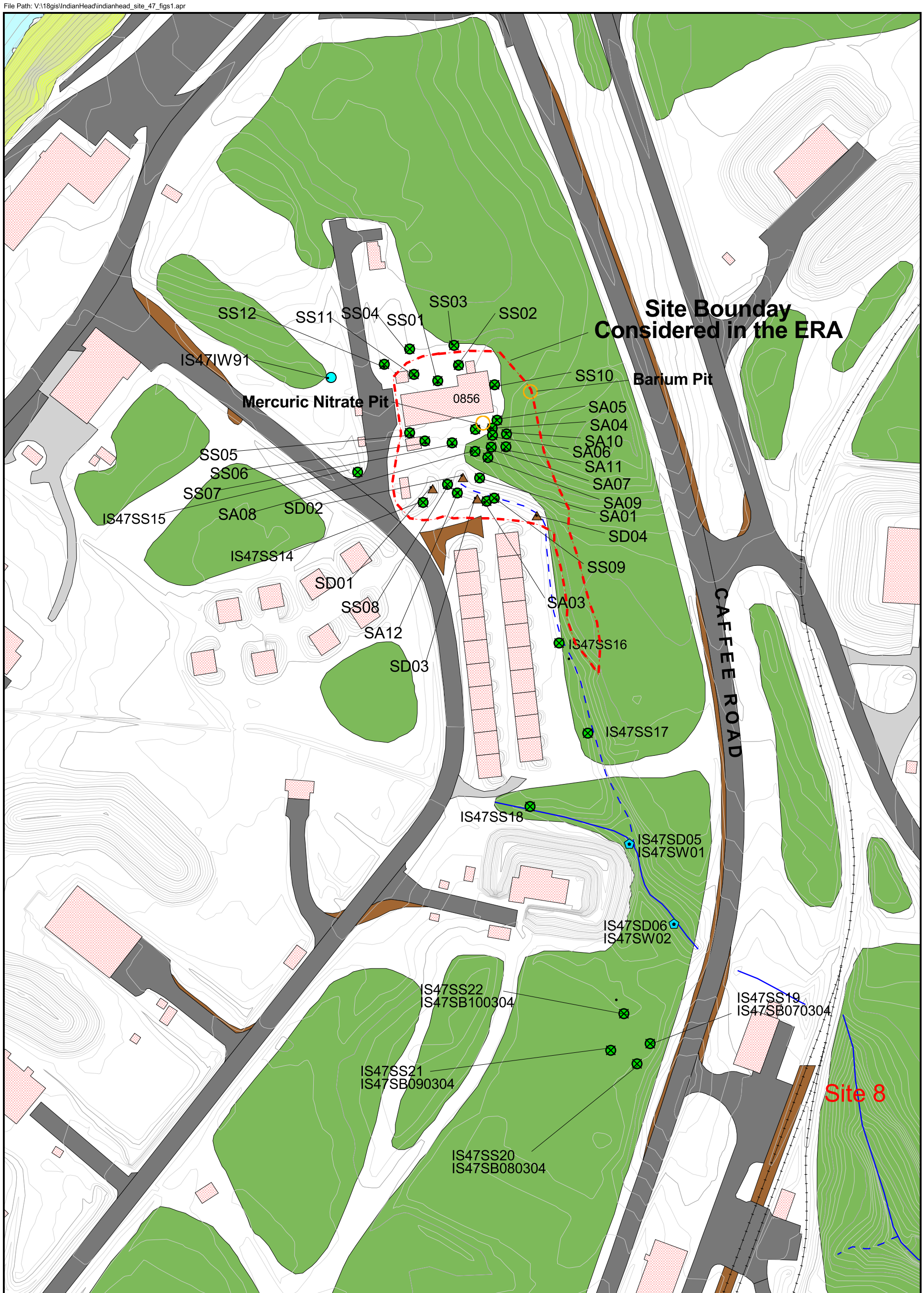

LEGEND

- Surface Soil Sample Location
- Surface Water and Sediment Sample Locations
- Sediment Sample Location
- Industrial Wastewater Manhole
- Water Bodies

Note: Samples labeled with an "SA" are from the SI Report (1994); all other samples are from the RI Report (2003).

N

50 0 50 100 Feet

1" = 100 ft

Figure 1-2
Previous Sample Locations
Site 47 BERA
NSF-IH, Indian Head, Maryland

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SECTION 2

BERA Problem Formulation

The BERA problem formulation is a revision of the previous problem formulation from the SERA and focuses the BERA on the key chemicals, exposure pathways, and receptors that were identified in previous steps of the assessment. This revised problem formulation consists of an evaluation of the toxicity of COCs and a refined conceptual model. The conceptual model includes a discussion of exposure pathways, assessment endpoints, and risk hypotheses.

2.1 Toxicity Evaluation

The COCs selected include inorganics and PAHs. Based on the Step 3A results, lead, mercury, silver, zinc, and PAHs may pose a risk to the soil invertebrate community at Site 47. Additionally, lead, mercury, and zinc in the surface soil may pose a risk to upper-trophic-level receptors. In the downgradient stream, the Step 3A results suggest COCs in a portion of the stream pose a potential risk to the benthic invertebrate and water column communities. The potential risk is primarily from mercury, silver, and one PAH (phenanthrene) in the sediments and possibly a few metals in the surface water. Toxicity evaluations for inorganics and PAHs are presented below, with emphasis on the media for which they were identified as COCs.

2.1.1 Inorganics

Aluminum

Aluminum is the third most abundant element in the earth's crust and it naturally occurs primarily as a component of insoluble complex minerals (Freeman and Everhart, 1971). However, it can also be highly toxic to aquatic organisms under certain water conditions. Aluminum's toxicity is dependent on the pH, hardness, and organic content of the water. Aluminum is more soluble under both acidic and alkaline conditions than it is under neutral conditions (Freeman and Everhart, 1971). However, aluminum's toxicity at a given concentration may be substantially lower than is suggested by the dissolved aluminum concentrations alone, because of its complexation with humic and fulvic acids (Sample et al., 1997). Aluminum concentrations in surface water typically range from 0.007 to 4.4 mg/L (Maidment, 1993).

For aquatic organisms, aluminum bioavailability and toxicity are intimately related to ambient pH; changes in ambient acidity may affect solubility, dissolved aluminum speciation, and organism sensitivity to aluminum. At moderate acidity (pH 5.5 to 7.0), fish and invertebrates may be stressed due to aluminum adsorption onto gill surfaces and subsequent asphyxiation. At pH 4.5 to 5.5, aluminum can impair ion regulation. In general, aquatic invertebrates are less sensitive to aluminum toxicity than are fish. Fish may be affected by asphyxiation at moderate acidic conditions or electrolyte imbalances at lower pH. In amphibians, embryos and young larvae are typically more sensitive than older larvae

(Yokel and Golub, 1997). Reported chronic toxicity values for aluminum in circumneutral water to water column invertebrates range from 0.74 to 38.2 mg/L for *Daphnia magna* and from 1.9 to 36.9 mg/L for *Ceriodaphnia sp*. (USEPA, 1988). In *Daphnia magna*, aluminum interferes with salt regulation and can lead to death when sodium and chlorine concentrations are reduced (Havas, 1985). Several studies have also shown that aluminum may inhibit the enzyme involved with the hatching of amphibian eggs (Sample et al., 1997).

Iron

Iron is the fourth most abundant element in the earth's crust. Iron may be present in surface water in varying quantities depending on the geology of the area and the chemistry of the water. Iron is an essential trace element required by both plants and animals. Ferrous (Fe^{2+}) and ferric (Fe^{3+}) iron are the primary forms of concern in aquatic environments. In most bodies of water, iron is present largely in the form of suspended particles, although small amounts of dissolved iron may occur as ferrous or ferric ions, and inorganic and organic complexes of both.

Dissolved iron is generally more toxic to aquatic invertebrates than it is to fish, as evidenced by the 96-hour lethal concentration 50 Percent (LC_{50}) values of 0.32 mg/L for mayflies, stoneflies, and caddisflies (Warnick and Bell, 1969) compared with the lethal concentration of 1 to 2 mg/L for pike (*Esox lucius*) found by Doudoroff and Katz (1953). In addition to direct toxicity, iron ions can combine with oxygen to form ferric oxide, which precipitates as a floc. Iron floc is detrimental to aquatic life because it settles to the bottom and smothers benthic invertebrates, plants, and fish eggs.

Lead

Because of the strong absorption of lead to soil organic matter, the bioavailability of lead is commonly limited. Organic compounds of lead are more bioavailable than inorganic lead. Among inorganic lead complexes, lead sulfate is relatively soluble compared to lead carbonate, and likely to be more bioavailable. Lead can be bioaccumulated by plants and animals. The primary route of lead exposure to plants is through root uptake, though translocation to shoots is limited (Wallace et al., 1977). Biomagnification of lead has not been reported. Earthworms may bioaccumulate lead (Beyer, 1990; Roberts and Dorough, 1984), and high concentrations of lead may be toxic to earthworms, affecting both survival and rate of reproduction. Earthworm (*Eisenia fetida*) growth and survival have been shown to be reduced following exposure to soil-associated lead [as $Pb(NO_3)_2$] for 8 weeks (Spurgeon et al., 1994). In this study, the LC_{50} and effects concentration 50 Percent (EC_{50}) (cocoon production) values for *E. fetida* were 3,760 and 1,940 mg/kg, respectively. The 14-day LC_{50} value for adult *E. fetid*a exposed to lead [as $Pb(NO_3)$] in artificial soil was 5,941 mg/kg (Neuhauser et al., 1985). A 4-month study was carried out to determine the effects of lead to the earthworm (*Dendrobaena rubida*) at varying soil pH (Bengtsson et al., 1986). Following exposure to 500 mg/kg lead in soil with a pH of 4.5, the number of cocoons produced per worm, hatchlings per cocoon, and percent hatched cocoons were reduced by 75, 100, and 100 percent, respectively. No adverse effects were noted with exposure to 100 mg/kg lead at pH 4.5, 5.5, or 6.5.

Manganese

In surface water, manganese is typically present at concentrations ranging from 0.001 to 0.04 mg/L (Rouleau et al., 1995, cited in Sample et al., 1997). Manganese toxicity values for *Daphnia magna,* cited in Sample et al. (1997), range from 4.1 mg/L (16 percent reproductive impairment) to 19.4 mg/L (LC_{50}). Manganese toxicity values reported for other aquatic organisms include: 16.0 mg/L (LC_{50}) for frog (*Microhyla ornata*), 28.0 mg/L (LC_{50}) for crayfish (*Austropotamobius pallipes*), 38.7 mg/L (LC_{50}) for rotifer (*Brachionus calyciflorus*), and 130 mg/L (LC_{50}) for longfin dace (*Agosia chrysogaster*).

Mercury

The majority of mercury in soil is immobilized in the organic soil horizon (Lindquist et al., 1991; Steinnes, 1990). Ionic forms of mercury are bound tightly to soil by forming complexes with organic matter in the upper soil horizon (Lindquist et al., 1991). Schuster (1991) found that under acidic conditions organic matter sorbs mercury, and Lodenius (1990) found that solid organic matter in acidified soil decreases leaching of mercury by 300 percent. The dominant mercury species in soil are gaseous elemental mercury (Hg^0) and the mercuric ion (Hg^{2+}), with small amounts of monomethyl and dimethylmercury (CH_3Hg^+; $(CH_3)_2Hg$) (Revis et al., 1989; Steinnes, 1990; Schuster, 1991). The mercuric ion rarely occurs in the free ionic form under natural conditions because of its strong complexation with organic matter (Steinnes, 1990).

Survival and cocoon production in the earthworm *Octochaetus pattoni* were reduced by 65 and 40 percent, respectively, following exposure to 0.5 mg/kg mercury (Abbasi and Soni, 1983). However, exposure did not affect the number of juveniles produced. Studies have shown the effect of methylmercury to survivorship and segment regeneration in the earthworm (*Eisenia fetida*) (Beyer et al., 1985). A concentration of 12.5 mg/kg mercury reduced survival by 21 percent, and the ability to regenerate excised segments was reduced by 69 percent. Furthermore, exposure to 2.5 mg/kg methylmercury had no effect). A slug species (*Arion ater*) was used to determine the effect of mercury (as $HgCl_2$) on terrestrial mollusks (Marigomez et al., 1986). After 27 days of dietary exposure, *A. ater* displayed a 26 percent decrease in growth at 1,000 mg/kg mercury, while 300 mg/kg had no effect.

In aquatic systems, sediments serve as the primary reservoir of mercury because of the strong particle reactivity of mercury. In freshwater sediments, mercury can become methylated by sulfate-reducing bacteria, particularly under anoxic conditions (Gilmour et al., 1992). Once methylated, mercury is readily taken up by organisms and is slowly depurated. Early developmental stages of organisms are the most sensitive to mercury poisoning. Methylmercury, the organic form of mercury, is the most toxic.

Silver

Silver can exist as silver nitrate, chloride, sulfide or oxide, but primarily exists in the sulfide form (ATSDR, 1990). Subsequently, transport in the environment depends on its particular compound form. Silver adheres strongly to clay particles found in suspended particulates and sediments. In aquatic environments the most commonly occurring forms of silver are silver (I) (soluble form), bicarbonate and sulfate salts, or complexes with particulates (ATSDR, 1990). In soils, silver tends to form complexes with inorganic chemicals and humic substances. As pH increases, silver solubility increases and subsequently mobility increases.

Silver is toxic to microbial communities and inhibits bacterial enzymes; therefore, biotransformation is not expected to be significant (ATSDR, 1990).

In aquatic systems, the impact of silver is most likely to occur in the sediment/water interface. It is acutely toxic to scuds (small freshwater crustaceans) at <6 μg/L and midges (fly larvae that inhabit freshwater sediments) at <5 μg/L. Aquatic invertebrates, such as various water flea species (*Daphnia magna* and *Daphnia pulex*) have displayed adverse effects from acute silver exposure. Following 2 days of exposure, the LC_{50} value for *D. magna* was 9.5 μg/L (Chapman et al., 1980), and the LC_{50} value for *D. pulex* was 14.0 μg/L (Mount and Norberg, 1984). Currently, there are no established sediment quality guidelines for silver in freshwater sediments, except for the upper effects threshold of 4.5 mg/kg that is based on the results of *Hyalella azteca* bioassays (Buchman, 1999).

Zinc

In the environment, the most common form of zinc is in the +2 oxidation state. Zinc is highly reactive in soils and can be adsorbed to clay minerals or metallic oxides (Sachdev et al., 1992). The active zinc species in the adsorbed state is the singly charged zinc hydroxide species [i.e., $Zn(OH)^+$] (Sanders and El Kherbawy, 1987). This metal forms stable complexes with organic substances such as humic and fulvic acids. Metallic zinc is insoluble, but the solubilities of zinc compounds range from insoluble (oxides, carbonates, phosphates, silicates) to extremely soluble (sulphates and chlorides) (Environment Canada, 1996).

Zinc solubility and mobility increases with decreasing soil pH. In soils with pH > 7.7, $Zn(OH)_2$ becomes the dominant form and solubility is very low. Zinc in a soluble form, such as zinc sulfate, is fairly mobile in most soils. However, relatively little zinc in most soils is in soluble form, and mobility is, therefore, limited by a slow rate of dissolution. Low pH (<7) and high ionic strength of the leaching solution favor desorption (USEPA, 1987; Saeed and Fox, 1977).

Eisenia fetida exposed to zinc (as zinc nitrate) exhibited lethal and sublethal (e.g., growth effects) effects (Spurgeon and Hopkin, 1995). Zinc exposure resulted in estimated LC_{50} and EC_{50} (growth) values of 216 and 400 mg/kg, respectively. Further studies evaluating the effects of zinc (as zinc acetate) in horse manure to *E. fetida* showed reduced cocoon production (Malecki et al., 1982). Following an 8-week exposure, 2,000 mg/kg resulted in a 36 percent decrease in cocoon production, while 1,000 mg/kg had no effects. Following a 20-week exposure, 5,000 mg/kg resulted in a 53 percent reduction in cocoon production, while 2,500 mg/kg had no effect. Following zinc exposure in soil, the terrestrial isopod, *Porcellio scaber* exhibited prolonged molting (Drobne and Strus, 1996). The no observed adverse effects level (NOAEL) for *P. scaber* molting was 250 mg/kg.

Zinc toxicity to earthworms (*Eisenia fetid*a) was evaluated through studies with a range of artificial soils having varying organic content and pH (Spurgeon and Hopkin, 1996). In general, mortality increased as zinc concentrations increased, and a decrease in pH and organic matter (i.e., within the range tested) tended to decrease zinc toxicity. Depending on soil chemistry, the estimated EC_{50} values (cocoon production) for this study ranged from 136 to 592 mg/kg. Studies in which adult earthworms *(E. fetid*a) were exposed to zinc [as $Zn(NO_3)$] in artificial soil (pH 6) were used to estimate LC_{50} values (Neuhauser et al., 1985). Following 14 days of exposure, an LC_{50} value of 662 mg/kg was calculated.

In aquatic systems, low alkalinity, low hardness, and high pH promote the formation of bioavailable species of zinc (Paulauskis and Winner, 1988; Schubauer-Berigan et al., 1993). Zinc is an essential trace element to both plants and animals. The amount of bioavailable zinc will be determined by the amount of zinc present, and in what form it exists (e.g., soluble or insoluble). Zinc is more bioavailable in acidic soil conditions, particularly at pH less than 5 (Duquette and Henershot, 1990).

Studies using a variety of benthic macroinvertebrates species have been used to document the effects of zinc exposure in the aquatic environment. Two water flea species were exposed to zinc for 2 days and have shown somewhat varying sensitivities. The 2-day LC_{50} values for *Ceriodaphnia dubia* and *Daphnia magna* were 0.13 (Belanger and Cheery, 1990) and 1.59 mg/L (Kazlauskiene et al., 1994), respectively. In a 3-day study where common toad (*Bufo arenarum*) tadpoles were exposed to a range of zinc levels (i.e., 4-32 mg/L), 65 percent mortality resulted at the 32 mg/L exposure level (Herkovits and Perez-Coll, 1991). Twenty-four hours of exposure to 39 mg/L zinc resulted in 100 percent mortality for Western toad (*Bufo boreas*) larvae, while all larvae still metamorphosed following exposure to 0.1 mg/L over the same time period (Porter and Hakanson, 1976). Exposure to 15 mg/L of $ZnSO_4$ yielded no toxicity for African clawed frog (*Xenopus laevis*) tadpoles (Woodall et al., 1988), while exposure to 20 mg/L resulted in 4–15 percent mortality.

2.1.2 Polycyclic Aromatic Hydrocarbons

Polycyclic aromatic hydrocarbons were identified as COCs in surface soil near Building 856 and at the suspected chemical disposal area. An individual PAH (phenanthrene) was also identified as a COC in the stream sediments.

Most animals and microorganisms can metabolize and transform PAHs to breakdown products that may ultimately experience complete degradation, though possibly at environmentally slow rates. PAHs with high molecular weights are degraded slowly by microbes and readily by multicellular organisms. Biodegradation probably occurs more slowly in aquatic systems than in soil.

Polycyclic aromatic hydrocarbons of all sizes show little tendency for long-term bioaccumulation despite their high lipid solubility, probably because most PAHs are rapidly and extensively metabolized. Bioaccumulation is thus not considered an important fate in most multicellular organisms because it is usually a temporary process. Large interspecies differences in the ability to absorb and assimilate PAHs from food have been reported for aquatic organisms. In all cases where assimilation of ingested PAHs has been demonstrated, metabolism and excretion of PAHs was rapid. Thus, little potential exists for the accumulation of PAHs in food webs, at least in aquatic systems.

Polycyclic aromatic hydrocarbons are moderately persistent in the environment and therefore may potentially cause significant effects to vegetation and wildlife. The carcinogenicity of individual PAHs differs. Some lower-weight compounds such as naphthalene, fluorenes, phenanthrenes, and anthracenes exhibit acute toxicity and other adverse effects to some organisms, but are non-carcinogenic. In contrast, the higher molecular weight compounds are significantly less acutely toxic, but many are demonstrably carcinogenic, mutagenic, or teratogenic to a wide variety of organisms, including fish and other aquatic life, amphibians, birds, and mammals.

In aquatic environments, PAHs rapidly become adsorbed to organic and inorganic particulate materials and are deposited in sediments (Neff, 1985). Once adsorbed to sediment, PAHs have limited bioavailability to aquatic organisms (Neff, 1985). However, PAHs deposited in sediments can be toxic to benthic invertebrates. In sediment toxicity tests with the tubificid *Limnodrilus hoffmeisteri*, Lotufo and Fleeger (1996) observed a median lethal phenanthrene level of 298 mg/kg (sediment organic carbon content = 0.7 percent). Decreases in tubificid reproduction were observed at much lower levels; IC_{25} (concentration associated with a 25 percent inhibition in measured endpoint relative to control) of 40.5 mg/kg for phenanthrene.

In aquatic environments, exposure to ultraviolet light can result in photomodification of some PAHs to products with increased polarity, water solubility, and toxicity compared to the parent compound (Duxbury et al., 1997). Ireland et al. (1996) showed that the photo-induced toxicity of PAHs to the daphnid *Ceriodaphnia dubia* occurred frequently during low-flow conditions and wet weather runoff, and was reduced in turbid conditions. In studies on the marine amphipod, *Rhepoxynius abronius*, ultraviolet radiation exposure enhanced the toxicity of fluoranthene and pyrene in sediments, but did not affect the toxicity of phenanthrene (Swartz et al., 1997).

2.2 Conceptual Site Model

Figure 2-1 presents the Conceptual Site Model (CSM) for ecological receptors at Site 47. The CSM integrates information regarding the physical characteristics of the site, potentially exposed receptors, sources of contamination, and contaminant mobility (fate and transport) to identify exposure routes, receptors, and endpoints. A well-defined CSM allows for a better understanding of the risks at a site and aids in the identification of the potential need for remediation.

2.2.1 Transport and Exposure Pathways

Chemical sources at this site include historical chemical releases in the vicinity of Building 856. Potentially impaired abiotic media include surface water and sediment in the drainage ditch and downgradient discharge point and soil at Site 47. Receptors include soil invertebrates and terrestrial wildlife in the upland portion of the site and benthic invertebrates, and water column invertebrates and amphibians in the downgradient intermittent stream,. Receptors may be exposed to chemicals via direct contact with abiotic media, ingestion, or trophic transfer through the foodchain.

The data gathered to date suggest that concentrations of lead, mercury, silver, zinc, and PAHs are elevated in surface soils at Site 47, possibly because of past disposal activities. The data further suggest that some contaminant transport has occurred through erosion of Site 47 soil resulting in surface runoff along the main drainage ditch and into the stream downgradient of the site, as identified by the elevated concentrations of mercury and silver in the stream sediments. Additional evidence of possible contaminant migration is the concentrations of zinc measured in surface water from the stream. The extent of contaminant migration appears to be limited, however, because the concentrations of COCs in the furthest downgradient sample were below risk screening levels.

2.2.2 Assessment Endpoints

Assessment endpoints for the BERA are as follows:

- **Survival and growth of soil invertebrates.** Soil invertebrates serve as a forage base for many terrestrial species. The soils at the site will support fewer birds and mammals if chemical concentrations are limiting the survival, growth, and reproduction of soil invertebrates.
- **Survival, growth, and reproduction of benthic invertebrates.** Healthy, viable benthic invertebrate communities are necessary for a well-developed and balanced aquatic ecosystem. Benthic invertebrates influence nutrient cycling and availability and sediment condition. By serving as prey species for many upper-trophic predators, they are critical to the sustenance of the communities of upper-trophic-level species.
- **Survival, growth, and reproduction of larval amphibians and water column invertebrates.** Larval amphibians and water column invertebrates are susceptible to direct chemical exposure. Water column invertebrates are an important part of aquatic food webs, providing a link between primary production and upper-trophic levels of the food web. Amphibians are a vital component to a balanced aquatic ecosystem.
- **Survival, growth, and reproduction of insectivorous birds.** These receptors are second-order consumers (i.e., animals that eat first-order consumers) and are thus more susceptible to bioaccumulative chemicals, especially those that have the potential to biomagnify. American robin (*Turdus migratorius*) was chosen to represent this endpoint. Robins live in a variety of habitats, including woodlands, swamps, suburbs, and parks. They forage on the ground in open areas, along edge habitats, or along the edges of streams. Robins forage for ground-dwelling invertebrates and search for fruit and foliage-dwelling insects in low tree branches (Malmborg and Willson, 1988). Because robins forage for soil invertebrates, their exposure to soil contamination would likely be significant.
- **Survival, growth, and reproduction of herbivorous birds.** These receptors are first-order consumers (i.e., organisms that eat plants) that are susceptible to chemicals that bioaccumulate in plants, and to chemicals adsorbed to soil particles. The mourning dove (*Zenaida macroura*) was chosen to represent this endpoint. The mourning dove is common in open grassland habitats and feeds almost exclusively on cereal grains, forbs, and grasses. Similar to the robin, the mourning dove is expected to have significant contact with soil. Lead was the only COC identified as posing a potential risk to herbivorous birds. Because potential risk from lead to insectivorous birds is being evaluated in the BERA and insectivorous birds are at a higher trophic level than are herbivorous birds, it is assumed that the measurement endpoint selected for insectivorous birds will allow an adequate evaluation of potential risk to herbivorous birds as well.

- **Survival, growth, and reproduction of omnivorous terrestrial mammals.** These receptors are second-order consumers and are thus more susceptible to bioaccumulative chemicals, especially those that have the potential to biomagnify. The white-footed mouse (*Peromyscus leucopus*) was chosen to represent this endpoint. The white-footed mouse inhabits nearly all types of dry-land habitats within their range (Burt and Grossenheider, 1980). They are opportunistic feeders and eat seeds, arthropods, some green vegetation, roots, and fruit.

2.2.3 Risk Hypotheses

Risk hypotheses are questions about how assessment endpoints could be affected. Risk hypotheses clarify and articulate relationships that are possible through consideration of available data, information from the scientific literature, and the best professional judgement of risk assessors. The risk hypotheses/questions associated with the assessment endpoints are:

1. Are the concentrations of lead, mercury, silver, zinc, and PAHs in surface soil at Site 47 potentially impairing the survival and growth of soil invertebrate communities to the extent that the prey base to support terrestrial insectivores has been adversely affected?
2. Are the concentrations of mercury, silver, and phenanthrene in the sediment impairing the survival, growth, or reproduction of benthic invertebrates in the stream independent of the limitations of the marginal habitat?
3. Are the concentrations of aluminum, iron, manganese, and zinc in surface water high enough to cause adverse effects to water column invertebrates or larval amphibians in the stream?
4. Is lead, mercury, or zinc in the surface soil at Site 47 bioaccumulating in soil invertebrates to the extent that the growth, survival, or reproduction of omnivorous terrestrial mammals and insectivorous and herbivorous birds that forage at the site may be impaired?

2.2.4 Measurement Endpoints

Measurement endpoints are measures of biological effects (e.g., laboratory toxicity test results) that are related to each respective assessment endpoint (USEPA, 1997). Table 2-1 shows the measurement endpoints associated with each assessment endpoint for the areas of concern at Site 47.

TABLE 2-1
Assessment and Measurement Endpoints for Site 47

Assessment Endpoints	Measurement Endpoints
Survival and growth of soil invertebrate communities.	Comparison of results of 28-day soil toxicity tests (survival and growth) with the earthworm *Eisenia foetida* using site, reference, and control soils. Existence of significant correlations between laboratory toxicity test results and concentrations of COCs in site soil.
Survival, growth, and reproduction of benthic invertebrate communities.	Comparison of results of 42-day sediment laboratory toxicity tests (growth, survival, and reproduction) with the amphipod *Hyalella azteca* using site, reference, and control sediment. Existence of significant correlation (alpha = 0.05) between laboratory toxicity test results and concentrations of COCs in site sediments.
Survival, growth, and reproduction of water column receptors.	Comparison of the ratio between mean concentrations of COCs (from filtered samples) and Ambient Water Quality Criteria to a reference HQ of 1.0.
Survival, growth, and reproduction of birds and mammals that feed on soil invertebrates at the site.	Comparison of estimated exposure dose to toxicity reference value using site-specific bioaccumulation data obtained from lead, mercury, and zinc concentrations in earthworm tissue (from soil bioassays) to a reference HQ of 1.0.

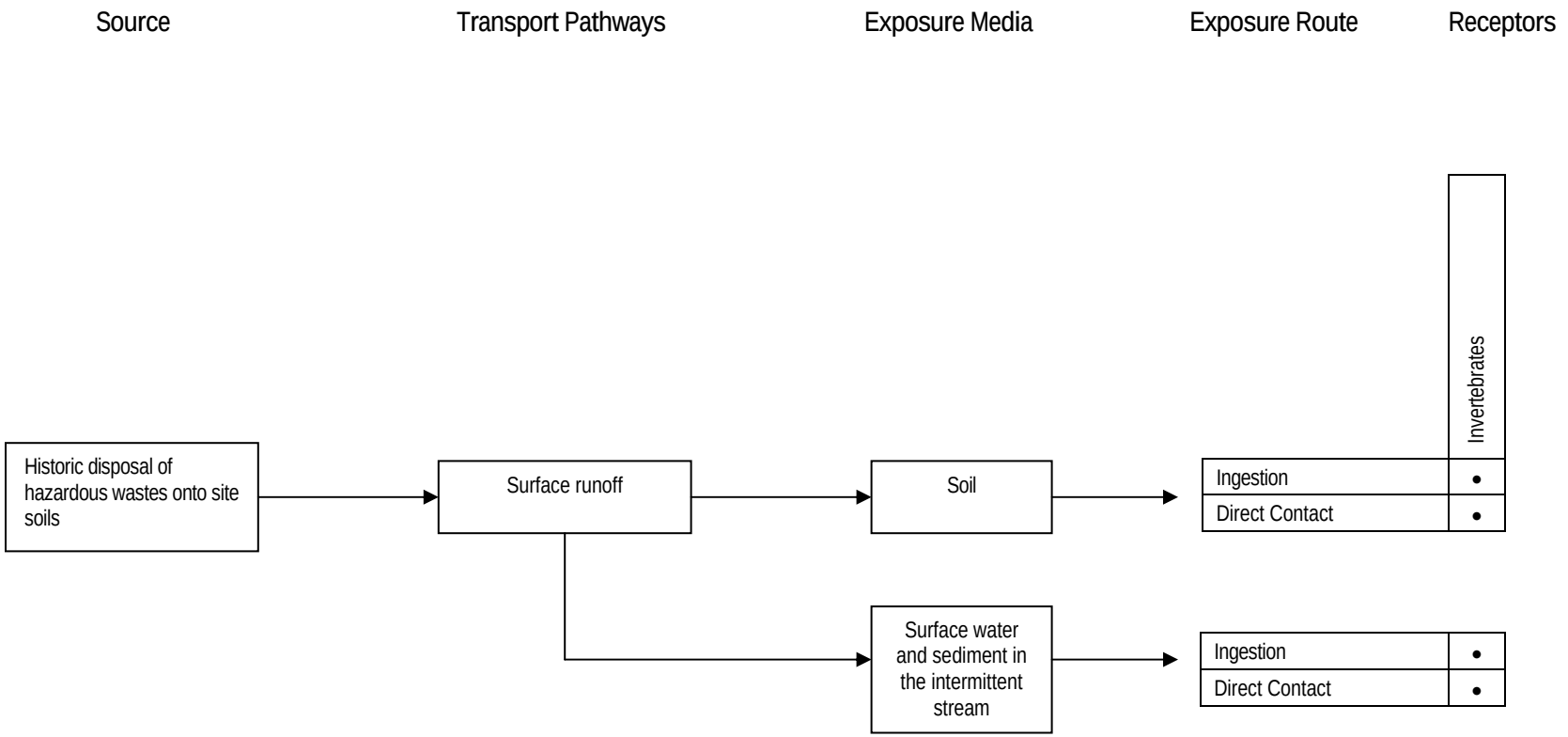

Figure 2-1
Conceptual Site Model
Site 47 BERA
NSF-IH, Indian Head, Maryland

SECTION 3

BERA Investigation Activities

Investigation activities for the BERA were conducted at Site 47 in August 2004 in accordance with the approved Final *Work Plan for Baseline Ecological Risk Assessment Site 47* (CH2M HILL, 2004). The sampling strategy was designed to assist further characterization of risk at specific areas identified as driving average contaminant concentrations above screening values and to ensure good spatial coverage in the BERA sampling effort. The following sections discuss sampling procedures and laboratory analyses for the various media. Data are presented in Appendixes A through D.

3.1 Soil Invertebrate Community

Surface soil samples were collected at Site 47 (Figure 3-1) on August 9 and 10, 2004. Sample locations were identified using a Global Positioning System. To evaluate direct toxicity to soil invertebrates, laboratory toxicity tests were conducted on split samples from soil sampling locations. At each location, sufficient sample volume to conduct the tests was collected and mixed to a consistent color and texture in the field prior to filling bottles for chemical and toxicological analyses. Soil was collected for the toxicity testing from a depth of 0 to 6 inches to capture the bulk of the biologically active zone because the O and A soil horizons (the upper soil horizons that contain decaying organic matter) at the site are thin and not well developed.

Eisenia foetida (*E. foetida*) (earthworm) was used as the test organism for the toxicity testing. The toxicity tests were conducted for 28 days with growth and survival as test endpoints. The growth and survival of test organisms in site soil were statistically compared with the results of these parameters from reference and control soil. An alpha level of 0.05 was used in the statistical comparisons. An alpha level of 0.05 corresponds to a five percent chance of incorrectly concluding that the response of the site samples is statistically equivalent to the reference or control samples, when in fact they are statistically different.

The spatial distribution of screening value exceedances for each COC was evaluated to determine the locations for laboratory toxicity tests with site soils. Based on this evaluation, 10 surface soil sample locations were identified for soil toxicity testing to characterize the potential risk to the soil invertebrate community in the vicinity of Building 856. The 10 locations for soil toxicity testing were chosen to develop an exposure-response gradient (see the BERA Work Plan for further discussion; CH2M HILL, 2004). The locations were selected so that a range of COC concentrations, from the areas with the highest exceedances to areas with minimal to no screening value exceedances. The intent was to identify: (1) if there is a significant difference in survival or growth in site soils relative to reference and control soils, and (2) if there is a significant difference, can a toxic threshold concentration be identified for a given COC or mixture of COCs that can be used to aid in future risk management decisions for the site.

3.2 Upper-Trophic-Level Receptors

To more accurately characterize the potential risk to birds and mammals that might consume soil invertebrates from Site 47, the test earthworms were analyzed for lead, mercury, and zinc at the conclusion of the soil toxicity tests. The earthworms were analyzed in an undepurated state to account for possible exposure to COCs in any soil in the gut content of the earthworms. The COC tissue concentrations were used to estimate exposure to insectivorous birds and omnivorous mammals.

The same ingestion-based exposure model used in the SERA and Step 3A (CH2M HILL, 2003) was used to estimate exposure, but with actual site-specific bioaccumulation data from the earthworm bioassays replacing the literature-derived bioaccumulation factors used in the SERA and Step 3A. Unacceptable risk was constituted by exceedance of Lowest Observed Adverse Effect Level (LOAEL)-based reference toxicity values for these receptors. The risk estimate for insectivorous birds was considered applicable for herbivorous birds as well because they are lower trophic level receptors than are insectivorous birds and thus are likely less exposed to lead than are birds that feed on soil invertebrates.

3.3 Benthic Invertebrates

Surface sediment samples were collected at Site 47 (Figure 3-2) on August 10, 2004. To evaluate direct toxicity to benthic invertebrates, laboratory toxicity tests were conducted on split samples from sediment sampling locations. At each location, sufficient sample volume to conduct the tests was collected and mixed to a consistent color and texture in the field prior to filling bottles for chemical and toxicological analysis. Sediment was collected for the toxicity testing from a depth of 0 to 6 in. below the sediment/water interface to ensure that the bulk of the biologically active zone is captured.

Hyallela azteca (H. azteca) (amphipod) was used as the test organism for the toxicity testing. The toxicity tests were conducted for 42 days with growth, survival, and reproduction as test endpoints. The growth, survival, and reproduction of test organisms in site sediment were statistically compared (alpha level of 0.05) with the results of these parameters from reference and control sediment.

3.4 Water Column Organisms

To further evaluate the potential risk posed by metals in the surface water at the site, surface water in the intermittent stream was sampled again and analyzed for both total and dissolved metals. Filtered and unfiltered surface water samples were collected at the confluence of the drainage ditch and the intermittent stream on August 13, 2004. It is possible that the previous water samples were collected under disturbed conditions with increased suspended solids, thus leading to an overestimation of potential risk. It is likely that the potential risk identified for aluminum, iron, and manganese is reflective of background geologic conditions because none of these were identified as COCs for the upland soils. However, the potential risk identified for zinc may be related to elevated zinc concentrations in the soils at Site 47.

3.5 Reference Samples

Surface soil and sediment reference samples were collected (Figure 3-3) on August 10, 2004. The response of organisms to reference soil and sediment were statistically compared to the response of organisms exposed to site soil and sediment. The response of organisms to control soil and sediment were also compared with the response to site and reference soil and sediment in evaluating the results of the toxicity tests. Care was taken to collect reference soil and sediment that has similar physical characteristics as the soil and sediment at the site.

The soil reference site was one of the sampling locations used in the Indian Head Background Soil Investigation Report for NSF-IH (Tetra Tech NUS, 2002). The reference sampling location (BGDSSTX03) corresponded to sample BGDSS03 in the background report and was located in an undeveloped, wooded area approximately 3,500-ft southwest of Site 47. Soil from the reference site was analyzed for the same parameters as the site samples. The reference soil had similar physical characteristics as the soil at Site 47.

The sediment reference location was one of the freshwater sediment sampling locations used in the Indian Head Background Investigation Report (Tetra Tech NUS, 2002). The reference sampling location (IS47RSD01) corresponded to sample BGSSD06 in the Indian Head Background Investigation Report. The reference sample was collected from a perennial stream with a predominantly sand substrate, approximately 150ft downstream of the road shown on Figure 3-3. The reference sample was collected from a depositional area of good quality habitat with frogs and fish observed at the location.

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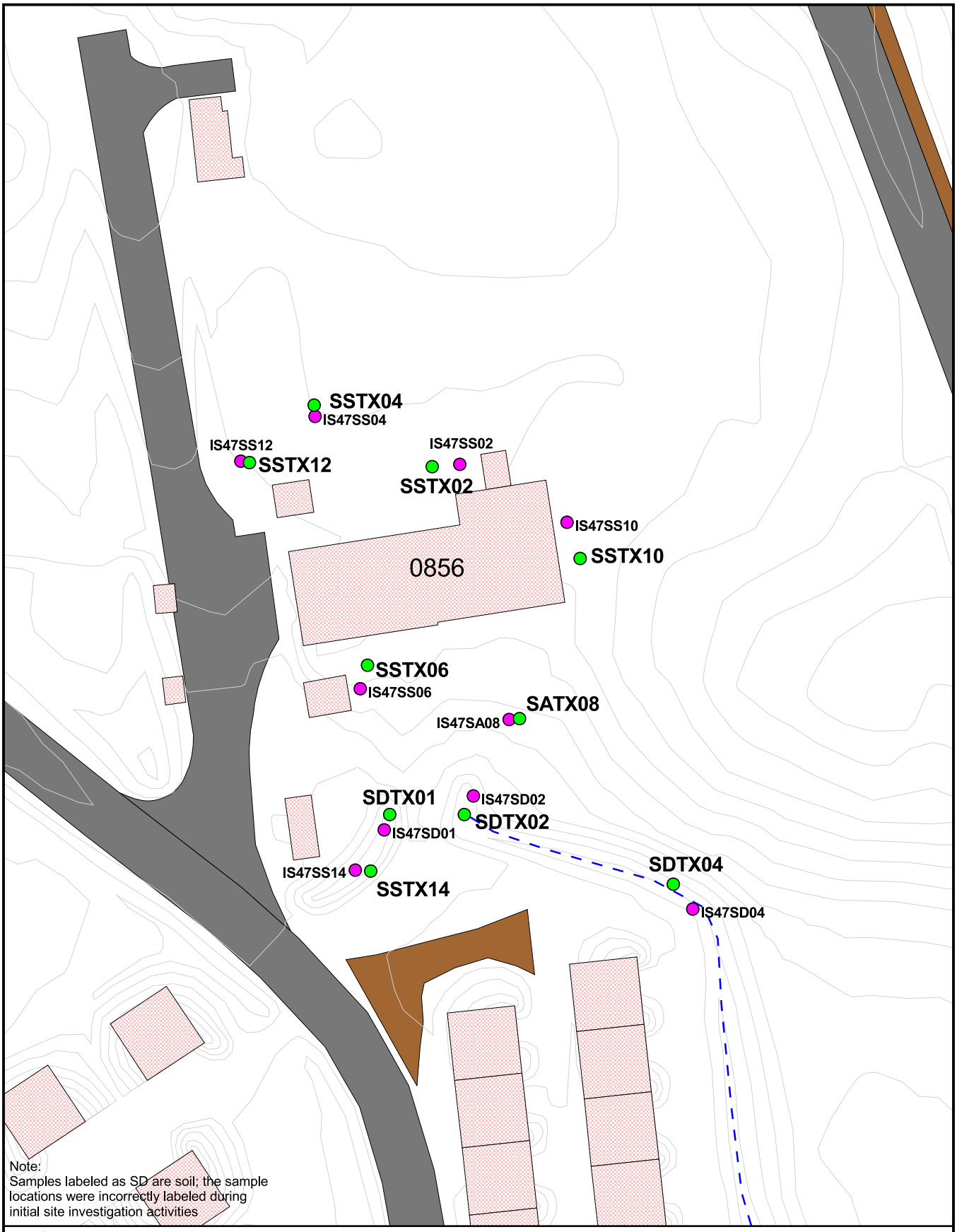

LEGEND

- Historical Sample Location
- BERA Sample Location
- Buildings
- 1 Foot Contours
- Drainage Ditch
- Asphalt

N

0 25 50 Feet

1" = 50ft

Figure 3-1
Soil Toxicity Test Locations
Site 47 BERA
NSF-IH, Indian Head, Maryland

CH2MHILL

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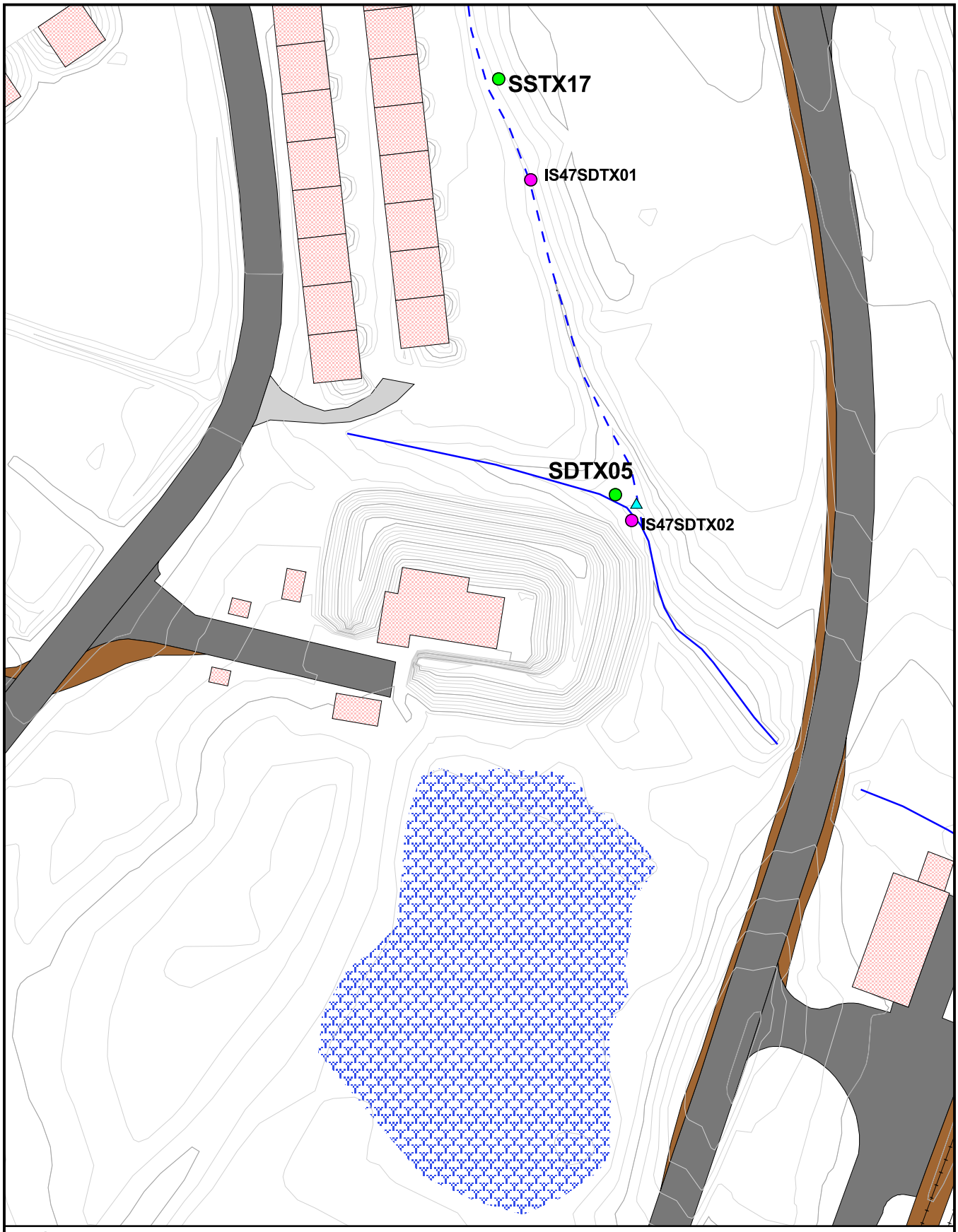

LEGEND

- Historical Sample Location
- BERA Sample Locations
- Buildings
- 1 Foot Contours
- Drainage Ditch
- Asphalt
- Surface water sample location
- Wetlands

N

0 35 70 Feet

1" = 70ft

Figure 3-2
Sediment Toxicity Test Locations
Site 47 BERA
NSF-IH, Indian Head, Maryland

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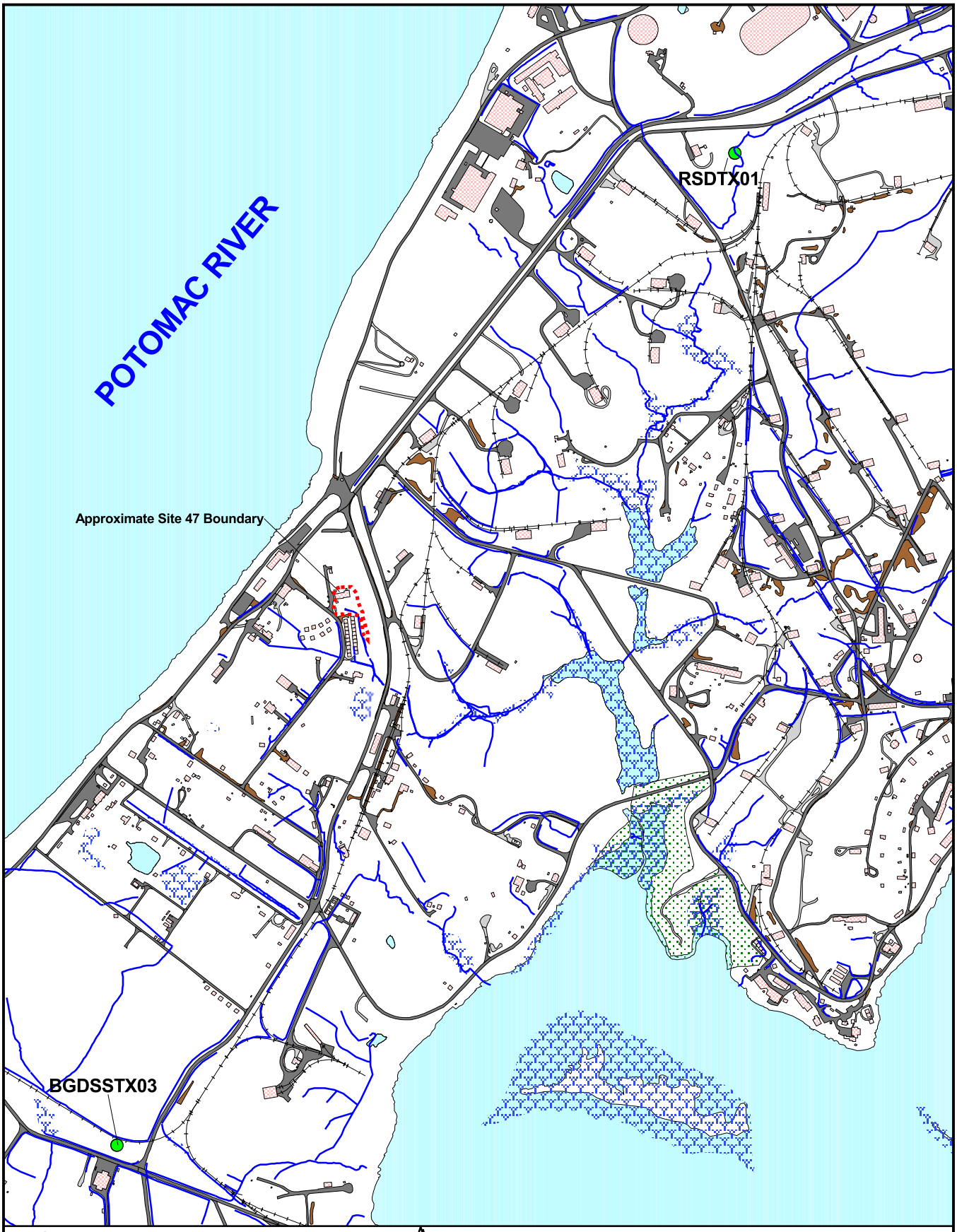

LEGEND

- BERA Reference Sample Location
- Buildings
- 1 Foot Contours
- Drainage Ditch
- Asphalt
- Wetlands

N

0 450 900 Feet

1" = 900ft

Figure 3-3
Reference Toxicity Test Locations
Site 47 BERA
NSF-IH, Indian Head, Maryland

CH2MHILL

SECTION 4

BERA Investigation Results

Potential risk to the soil invertebrate community was evaluated using soil toxicity tests. Potential risk to the benthic invertebrate community was evaluated using sediment toxicity tests. Potential risk to birds and mammals that might forage for soil invertebrates at Site 47 was refined by estimating exposure using the concentrations of COCs in earthworm tissue obtained at the conclusion of the soil toxicity tests.

4.1 Soil Toxicity

Toxicity tests were conducted with earthworms (*E. foetida*), exposed to soil collected from 10 locations at Site 47 and one reference soil sample. The toxicity tests were conducted for 28 days with survival and growth as test endpoints. The soil toxicity testing report, including raw data, summary tables, and statistical analyses, is provided in Appendix B.

Grain size distribution curves for the soil samples are included in Appendix C. The distribution curves reflect variability between the reference sample and site samples and within the site samples as shown in Table 4-1 below. In general, the reference sample contained more silt and clay than the site samples. The majority of the site samples comprised medium and fine sand. The total organic carbon (TOC) content of the reference sample (26,000 mg/kg) was within the range measured in the site samples (2,300 to 43,000 mg/kg) (Table 4-1).

TABLE 4-1
Grain Size and TOC data for Surface Soil Samples

Sample	% Silt and Clay	% Fine Sand	% Medium Sand	% Coarse Sand	% Gravel	TOC (mg/kg)
Reference (BGDSS03)	82	14	2	2	0	26,000
IS47SATX08	35	23	42	<1	0	17,000
IS47SDTX01	72	15	10	1.5	1.5	43,000
IS47SDTX02	34	26	37	1	2	2,300
IS47SDTX04	38	23	36	1	2	17,000
IS47SSTX02	27	25	45	2	1	7,300
IS47SSTX04	12	27	47	4	10	3,900
IS47SSTX06	17	32	47	2	2	13,000
IS47SSTX10	1	18	33	41	7	13,000
IS47SSTX12	19	35	42	3	1	6,500
IS47SSTX14	80	14	5	1	0	25,000

The mean survival for *E. foetida* in the control sample was 97.5 percent. This value was above the minimum level of 80 percent specified by the protocol (Appendix B). Mean survival in the reference sample was 100 percent, and mean survival in the site samples ranged from 92.5 to 100 percent. There were no significant differences between survival of earthworms exposed to site soil, compared with reference or control soil (Figure 4-1).

Test results for growth are presented in Figure 4-2 and summarized in Table 4-2 below.

TABLE 4-2
Surface Soil Toxicity Test Results for Earthworm Growth

Sample	Day 28 Growth (mean wt. per worm)	Significantly less than Reference	Significantly less than Control
Control	190	-	-
Reference	243	-	No
SDTX04	180	Yes	No
SSTX14	235	No	No
SDTX01	180	Yes	No
SDTX02	178	Yes	No
SATX08	248	No	No
SSTX06	183	Yes	No
SSTX12	200	No	No
SSTX04	233	No	No
SSTX02	233	No	No
SSTX10	238	No	No

Although the earthworms in four of the site samples showed significantly less growth than the earthworms in the reference sample, none of the growth results were significantly less than the results for the control organisms. The mean growth results of the four samples that performed worse than the reference sample were all within seven percent of the mean growth in the control sample. Therefore, these results show that earthworms exposed to site soils displayed growth similar to that of the laboratory control and therefore the COCs in site soils do not appear to pose unacceptable risk to the soil invertebrate community.

The difference is growth rates observed between the reference sample and the site samples could be related to the larger percentage of silt and clay in the reference sample (82 percent), which could have provided more food to support an increased growth rate. The artificial soil prepared for the laboratory control consisted of 10 percent sphagnum peat moss, 20 percent kaolinite clay, and 70 percent fine sand. The earthworms were not fed during the testing; therefore, the lower growth rate observed in the control sample relative to the reference and some of the site samples are likely related to differences in the amount of food material in the soils at the beginning of the tests.

4.2 Earthworm Tissue

The earthworm COC tissue concentrations were used to refine the risk estimate for birds and mammals that might forage at Site 47. The American robin and white-footed mouse were chosen as the surrogate species to represent these receptor groups. The same ingestion-based exposure model used in the SERA and Step 3A (CH2M HILL, 2003) was used to refine the risk estimate for these receptors. Moisture content of 84 percent was assumed (Sample and Suter, 1994) to convert the earthworm tissue data from wet weight to dry weight for the exposure calculations. Calculated LOAEL-based HQs for the American robin and white-footed mouse are presented in Table 4-3 below.

TABLE 4-3
Results of Exposure Calculations for Upper Trophic Level Receptors

COC	Mean Concentration in Earthworm Tissue (µg/g, wet wt.)	Hazard Quotient (American Robin)	Hazard Quotient (White-footed Mouse)
Lead	20.1	0.09	<0.01
Mercury	0.50	0.14	0.35
Zinc	21.3	0.10	0.01

As shown in Table 4-3, all LOAEL-based HQs were less than 1 for these receptors, indicating that the COCs are not accumulating in soil invertebrates to the extent that they pose an unacceptable risk to birds and mammals at Site 47.

4.3 Sediment Toxicity

Toxicity tests were conducted with the amphipod *Hyalella azteca* exposed to sediment collected from two locations at Site 47 and one reference sediment sample. The toxicity tests were conducted for 42 days with survival, growth, and reproduction as test endpoints. The sediment toxicity testing report, including raw data, summary tables and statistical analyses, is provided in Appendix D.

Grain size distribution curves for the sediment samples are included in Appendix C. The distribution curve for the reference sample reflects mostly medium-grained sand (72 percent). Site sample IS47SD05 consisted mostly of fine-grained sand (41 percent), and site sample IS47SD17 consisted mostly of fines (44.5 percent) and medium-grained sand (36 percent). The TOC content of the reference sample is less than the TOC measured in the site samples by approximately a factor of 3. Table 4-4 provides a summary of the grain size distribution and TOC for all samples.

TABLE 4-4
Sediment Grain Size and TOC Data

Sample	% Silt and Clay	% Fine Sand	% Medium Sand	% Coarse Sand	% Fine Gravel	TOC (mg/kg)
Reference (IS47RSD01)	6	13	72	8	1	960
IS47SD05	19	41	33	5	2	3,100
IS47SD17	44.5	19	36	0.5	0	2,600

Sediment toxicity test results for survival, growth, and reproduction are presented in Figures 4-3 through 4-5 and summarized in Table 4-5. The mean 28-day survival for *H. azteca* in the control sample was 90 percent. This value was above the minimum level of 80 percent specified by the protocol (Appendix D). Mean survival in the reference sample was 88.3 percent and mean survival in the site samples was 68.3 (IS47SD05) and 83.3 (IS47SD17) percent. The sediment toxicity tests were designed to assess survival, growth, and reproduction. As discussed in the following paragraphs, the toxicity tests indicate that exposure to sediment from Site 47 could impact amphipod growth and survival. The results for each of these measurement endpoints are summarized below:

Reproduction measurement endpoint: One sample collected from the site (IS47SD05) showed a statistically significant impact on reproduction compared to the laboratory control. However, the toxicity tests did not show evidence of an impact on reproduction (Appendix D, Sections 3.2 and 3.3) for the site samples compared to the reference sample.

Survival measurement endpoint: The sample collected from IS47SD17 exhibited a mean survival percentage of 83.3 percent, statistically similar to that of the reference sample (88.3 percent). The analytical results show that sample IS47SD17 contained higher concentrations of the COCs (mercury, silver, and phenanthrene) than did the sample collected at IS47SD05 (Table A-3). Furthermore, no PAH compounds were detected in sample IS47SD05.

Growth measurement endpoint: The toxicity tests showed that the organisms exposed to the sediment from the reference and both site locations exhibited statistically significant adverse effects on growth of test organisms, relative to the laboratory control sample. This should be considered when making conclusions about the growth results. Although both site samples displayed significant adverse growth effects, the sample with the greatest impact (IS47SD05 with mean weight 0.175 mg) contained lower concentrations of the COCs than the other site sample (IS47SD17 with a mean weight of 0.229 mg). Furthermore, since exposure to all three samples (reference and both site samples) displayed a statistically significant effect on growth, it is possible that these growth impacts are driven by exposure to anthropogenic influences in this region, such as the historical use of organochlorine pesticides or other agents. Specifically identifying the potential cause(s) of the growth impacts is beyond the scope of this investigation.

TABLE 4-5
Summary of Sediment Toxicity Test Results

Sample	Day 28 Survival (mean percent)	Day 28 Growth (mean wt., mg)	Day 42 Reproduction (mean number juveniles/female)
Control	90.0	0.389	6.16
Reference (IS47RSD01)	88.3	0.304	4.97
IS47SD17	83.3	0.229	3.11
IS47SD05	68.3	0.175	0.86

The results of the sediment toxicity testing suggest that site sediments may be toxic to benthic invertebrates, but the causal agent for the observed toxicity is unknown and does not seem to be related to the COCs identified at Site 47. No PAH compounds were detected in the sediment samples and the concentrations of inorganic COCs in the sediment samples were generally less than or equal to the reference location, Indian Head background conditions, and/or ecological screening criteria.

Figure 4-6 shows the concentrations of the metals (except for aluminum and iron) detected in the site sediment samples and the reference sediment sample. As the figure shows, the concentrations of the inorganic COCs at Site 47 (lead, mercury, silver, and zinc) are generally consistent with the reference station concentrations. Sample IS47SD05 contained slightly higher concentrations of lead and zinc than did the reference sample; however, the concentrations were well below the ecological screening values for these metals (46.7 and 150 mg/kg, respectively). Lead and zinc were not identified as sediment COCs, but were evaluated here to determine whether off-site migration might have resulted in increased concentrations of in site sediments. Although, aluminum and iron were not identified as sediment COCs either, the concentrations of these metals in the site samples and reference sample are shown in Table 4-6 below to show that the concentrations of these metals are consistent with background conditions. Aluminum and iron concentrations in sample IS47SD17 are similar to the reference sample concentrations, while the concentrations in IS47SD05 are higher, but well below the average background concentrations for these metals at Indian Head of 7,540 and 13,000 mg/kg, respectively (Tetra Tech NUS, 2002). Therefore, the COCs identified for Site 47 (both sediment and soil COCs) do not appear to be responsible for the toxicity observed in the Site 47 sediments.

TABLE 4-6
Aluminum and Iron Concentrations in the Reference and Site Samples

	Reference (IS47RSD01)	Average Background*	IS47SD05	IS47SD17
Aluminum	1,060	4,393	4,640	1,960
Iron	4,010	13,202	5,490	1,440

* Background sediment concentrations taken from Tetra Tech NUS, 2002

Although site and reference concentrations of COCs are similar, the pH of site sediments (pH of 4.9 and 5.5) was lower than the pH in the reference sediment (pH of 6.4). The slightly more acidic nature of the site sediment could possibly cause toxicity of one of more of the COCs by liberating ionic forms of the metals from the sediments. However, the pH of the overlying water in the bioassay test chambers was similar during the bioassays (pH of approximately 7 for all treatments). Therefore, it is unlikely that the pH difference contributed to the observed toxic response in the site samples.

4.4 Surface Water

The results of the surface water sampling are shown in Table 4-7 below. The concentrations of aluminum, iron, and manganese exceeded the ecological screening values in both the total and dissolved samples, suggesting that these metals pose a potential risk to water column organisms. The concentrations of zinc in both the total and dissolved samples were below the ecological screening values, suggesting that zinc does not pose a risk to water column organisms.

TABLE 4-7
Comparison of Surface Water Results with Ecological Screening Values

	Total Concentration (μg/L)	Dissolved Concentration (μg/L)	Screening Value	Total Hazard Quotient	Dissolved Hazard Quotient
Aluminum	393	131	87 [a]	4.52	1.51
Iron	2,490	1,610	1,000 [a]	2.49	1.61
Manganese	163	160	120 [b]	1.36	1.33
Zinc	29.6	26.0	36.5 [a]	0.81	0.71

[a] Ambient Water Quality Criteria

[b] USEPA Region III Screening Value (October 2004)

Although the concentrations of aluminum, iron, and manganese exceeded the surface water screening values, it is likely that the concentrations of these metals in the surface water are unrelated to chemical releases at Site 47. Instead, the presence of these metals in the surface water is likely related to the natural background levels of these metals in soils at NSF-IH. This is evident when the average concentrations of these metals in the surface soil and

sediment samples collected at Site 47 are compared with the average soil background concentrations of these metals (Table 4-8).

TABLE 4-8
Aluminum, Iron, and Manganese Concentrations in Site Sediment and Soil Compared with Background Concentrations

	Site Average Sediment Concentration (mg/kg)	Site Average Soil Concentration (mg/kg)	Background [a] Average Surface Soil Concentration (mg/kg)	Background [a] Average Sediment Concentration (mg/kg)
Aluminum	3,300	6,017	7,540	4,393
Iron	3,465	8,873	13,000	13,202
Manganese	18	140	227	162

[a] Background surface soil concentrations from Tetra Tech NUS, 2002

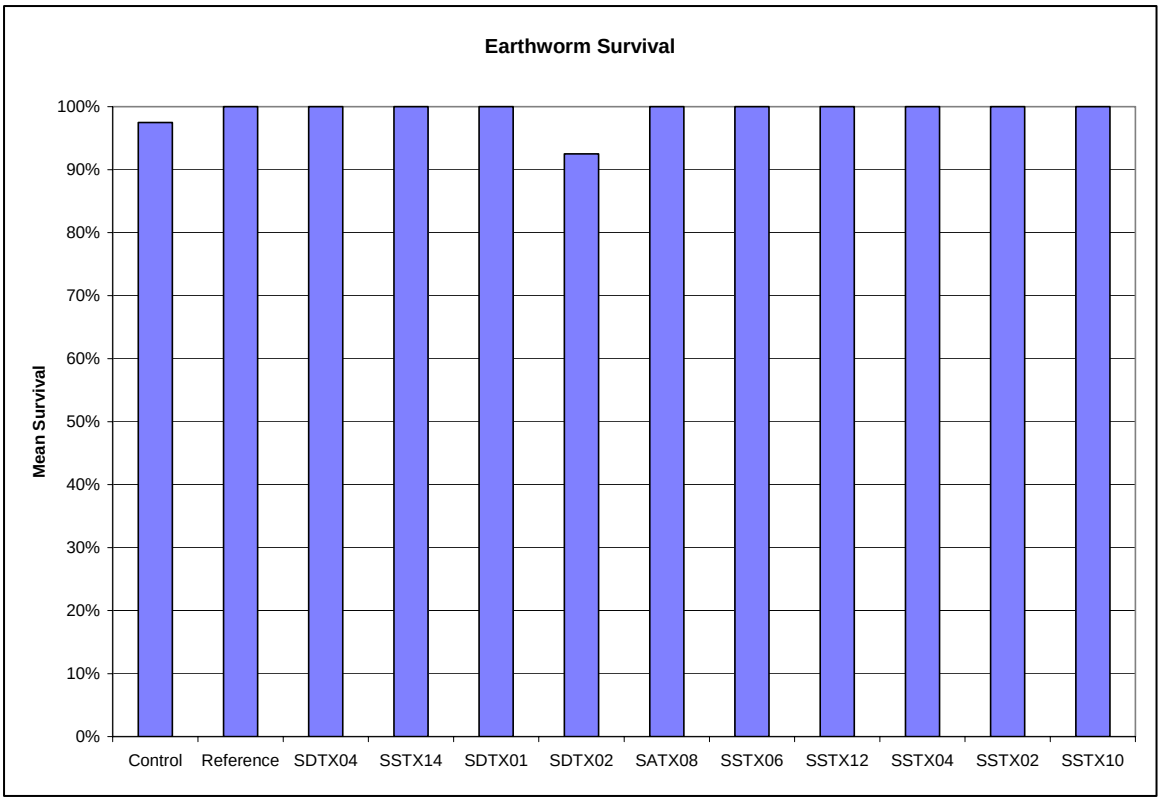

Figure 4-1
Soil Toxicity Test Results – Survival
Site 47 BERA
NSF-IH, Indian Head, Maryland

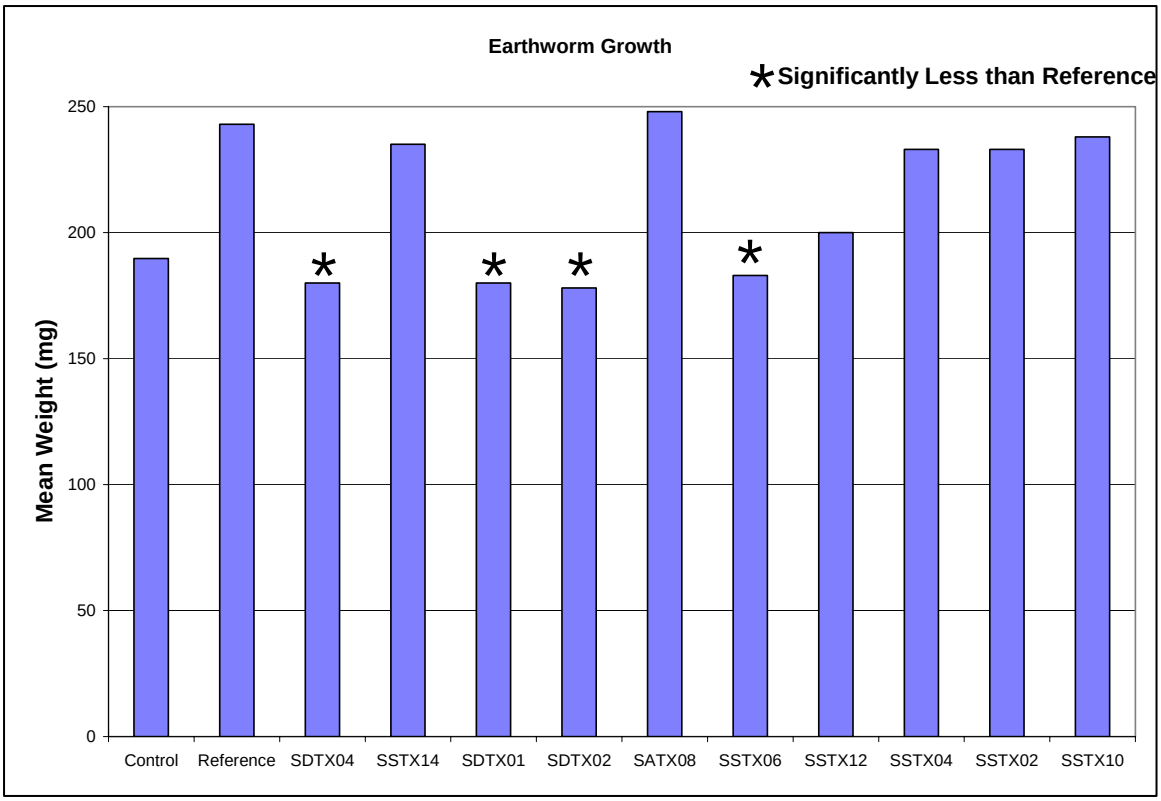

Figure 4-2
Soil Toxicity Test Results – Growth
Site 47 BERA
NSF-IH, Indian Head, Maryland

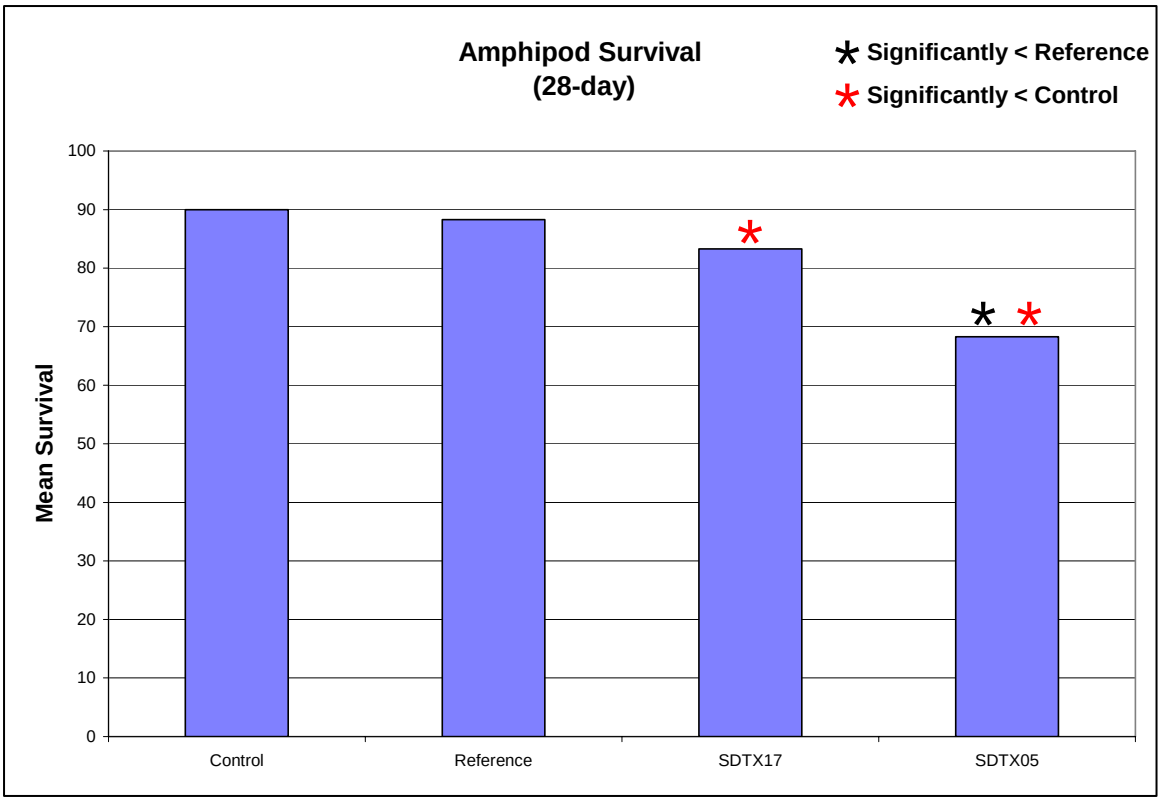

Figure 4-3
Sediment Toxicity Test Results – Survival
Site 47 BERA
NSF-IH, Indian Head, Maryland

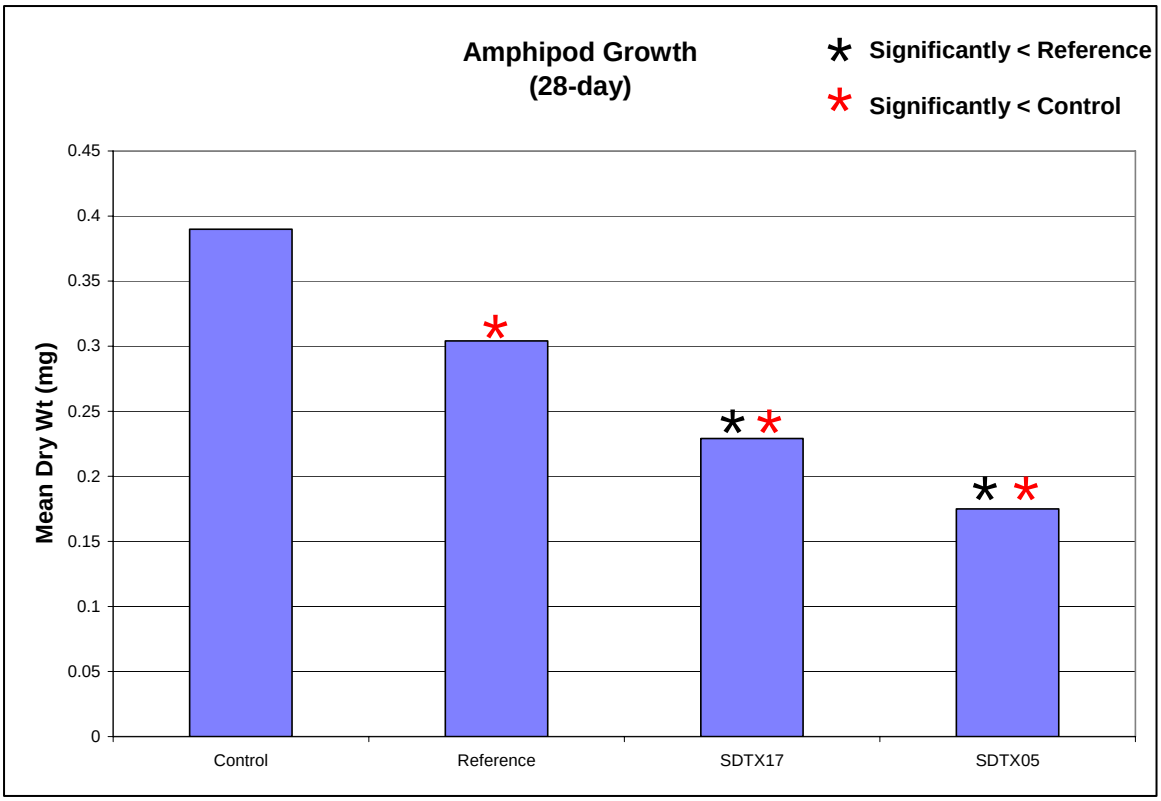

Figure 4-4
Sediment Toxicity Test Results – Growth
Site 47 BERA
NSF-IH, Indian Head, Maryland

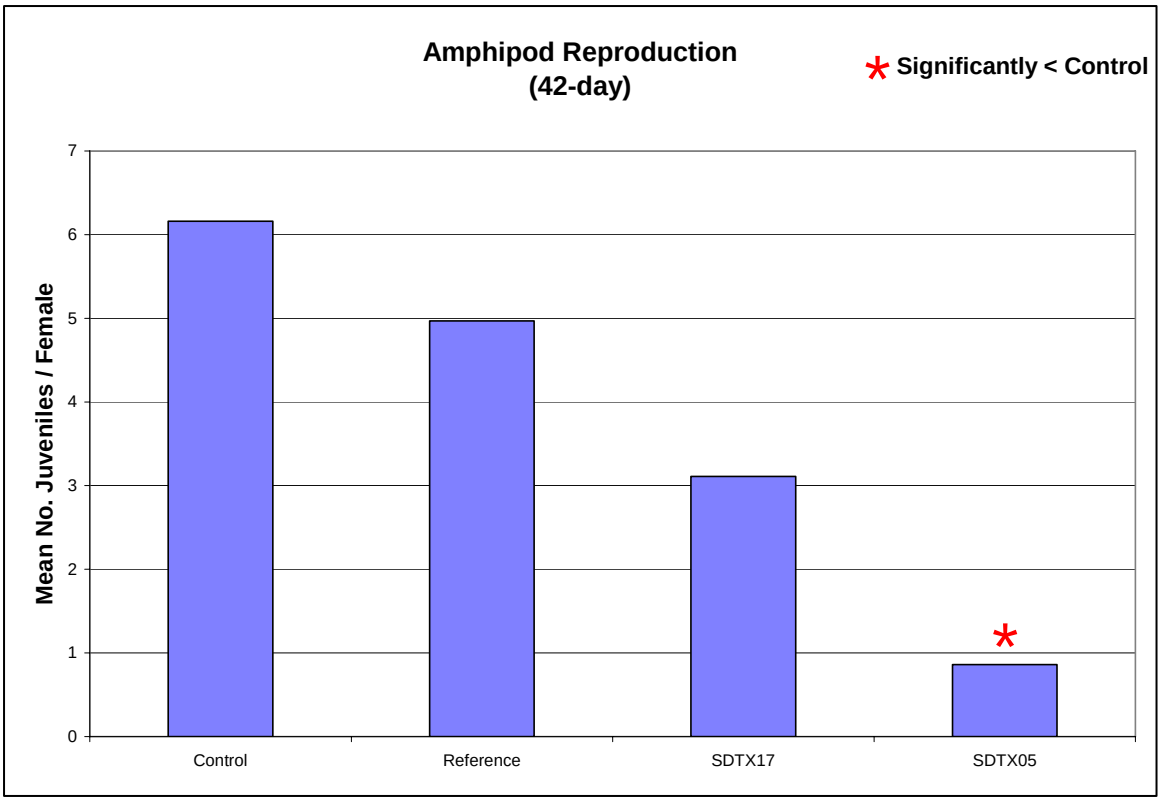

Figure 4-5
Sediment Toxicity Test Results – Reproduction
Site 47 BERA
NSF-IH, Indian Head, Maryland

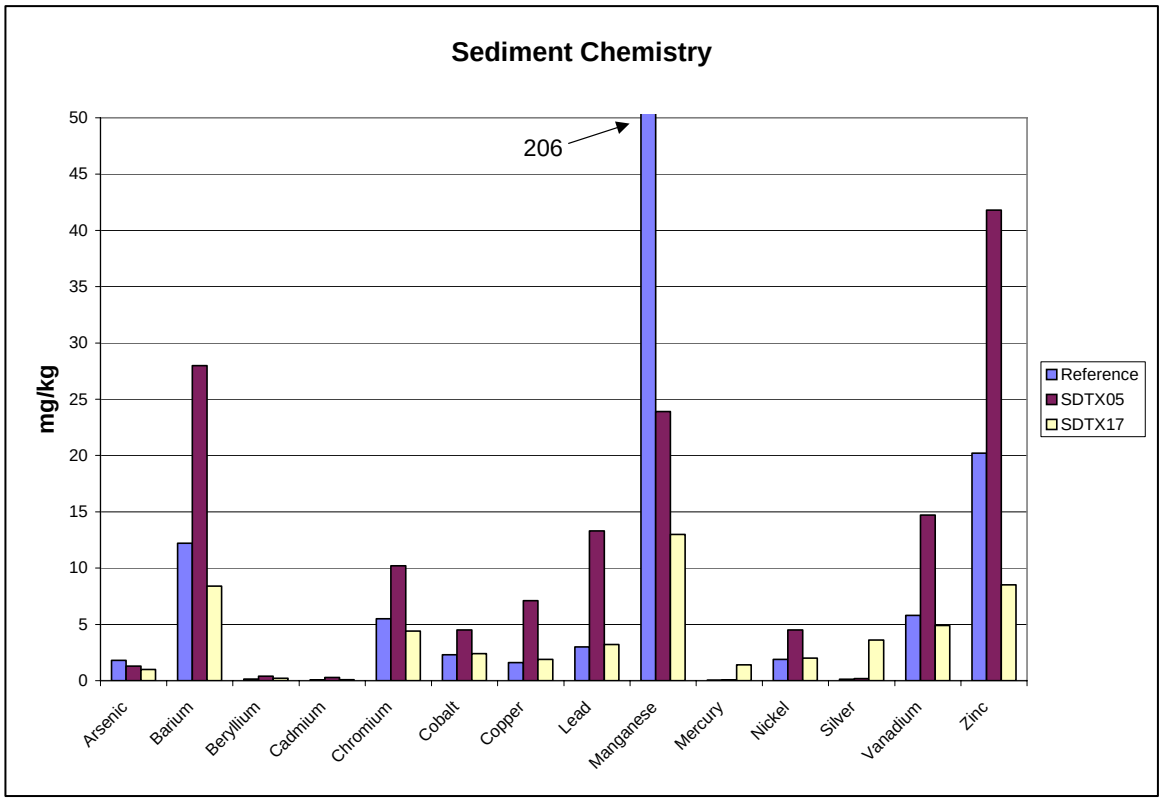

Figure 4-6
Metal Concentrations in Site Sediments
Site 47 BERA
NSF-IH, Indian Head, Maryland

SECTION 5

Risk Characterization

5.1 Assessment Endpoints

Risk for each of the assessment endpoints is characterized as follows:

- **Survival and growth of soil invertebrates –** The results of the soil toxicity testing indicate that contaminants in the soil at Site 47 do not pose unacceptable risk to soil invertebrates.
- **Survival, growth, and reproduction of benthic invertebrates -** The results of the sediment toxicity testing indicate that the sediments at Site 47 are toxic to benthic invertebrates. Therefore, although the sediments were shown to be toxic to benthic invertebrates, the toxicity may not be solely related to metals or PAHs associated with Site 47.
- It is possible that the observed toxicity could be attributable to pesticide residues from historical spraying on the base. Pesticides were detected in 50 percent of Indian Head background freshwater sediment samples. Background concentrations of 4,4-DDT and its derivatives are present in surface sediments at NSF-IH at average concentrations ranging from 4.8 to 17.1 µg/kg (TetraTech NUS, 2002). These concentrations exceed the USEPA Region III screening value of 1.58 µg/kg for these compounds, thus indicating that background levels of pesticide residues pose potential risk to sediment invertebrates.
- **Protection of larval amphibians and water column invertebrates from adverse effects of aluminum, iron, manganese, and zinc –** The results of the surface water sampling suggest that aluminum, iron, and manganese are present at concentrations that could pose potentially unacceptable risk to larval amphibians and water column invertebrates. The concentrations of zinc in the surface water do not pose an unacceptable risk to these receptors. Although aluminum, iron, and manganese pose a potential risk to these receptors, the risk is likely equivalent to background risk levels because the concentrations of these metals in the soils and sediments at the site are consistent with background levels of these metals. The pH of Site 47 surface soil ranged from 4.4 to 7.1, which was higher than the pH value of the of the reference surface soil (pH of 4.1). Thus, there is no reason to suspect that the site conditions have increased the leaching rate of these metals from site soils, relative to background conditions.
- **Survival, growth, and reproduction of insectivorous birds** – The results of the earthworm tissue analyses and exposure calculations for insectivorous birds indicate that these receptors are not at unacceptable risk from COCs in surface soils at the site.
- **Survival, growth, and reproduction of herbivorous birds** - Lead was the only COC identified as posing a potential risk to herbivorous birds. Because potential risk from lead to insectivorous birds was evaluated in the BERA and insectivorous birds are at a

higher trophic level than are herbivorous birds, it was assumed that the measurement endpoint selected for insectivorous birds would be protective of herbivorous birds as well. Therefore, because insectivorous birds are not exposed to unacceptable risk, neither are herbivorous birds.

- **Survival, growth, and reproduction of omnivorous terrestrial mammals –** The results of the earthworm tissue analyses and exposure calculations for omnivorous terrestrial mammals indicate that the risks to these receptors from COCs in surface soils at the site are within ranges considered presumptively acceptable.

5.2 Uncertainty

There is uncertainty in the causal agent behind the toxicity observed in the sediment bioassays. The sediment chemistry suggests that the toxicity may not be solely related to the soil and sediment COCs identified in the BERA work plan (CH2M HILL, 2004). It is possible that some unidentified chemical either from anthropogenic or naturally occurring sources is responsible for the toxicity observed in the sediment bioassays. It would be difficult to establish a preliminary remediation goal for the site contaminants of concern based upon the bioassay results.

Toxicity in sediment bioassays can often be caused by natural factors or "confounding factors" such as ammonia, sulfide, grain size, dissolved oxygen, or pH rather than chemicals in the sediment. In this case however, ammonia was monitored weekly for the duration of the testing, but was never detected. Therefore, ammonia was not considered a confounding factor to the observed toxicity. Dissolved oxygen and pH were monitored daily and were found to be within the protocol criteria throughout the duration of the tests. Therefore, dissolved oxygen and pH were not considered potential confounding factors to the observed toxicity. Sulfide was not measured in test sediments and may have contributed to the observed toxicity. This represents a source of uncertainty in interpreting the results of the sediment bioassays. Sulfide is produced by anaerobic decomposition of organic matter and can be abundant in some sediments. The biological effects of sulfides in sediment are poorly understood, but sulfide can be directly toxic to aquatic organisms or can reduce metal aqueous concentrations and therefore toxicity by forming insoluble metal sulfide complexes (Wang and Chapman, 1999). However, considering that abundant dissolved oxygen was maintained in the overlying water in the test chambers and that sulfide is formed under anoxic conditions, it is possible that sulfide may not have been created and therefore not have contributed to the observed toxicity. Differences in physical and chemical (non-contaminant) properties of the sediments can also add confounding effects. The test sediments contained more fine-grained material than did the reference and control sediments, but all contained similar TOC concentrations. It is possible that the physical mixing of the site sediments during field collection may have caused disassociation of chemicals from the sediment, thus increasing their bioavailability and toxicity. Thus, several potential sources of uncertainty surround the observed toxicity, which may or may not be attributable to these confounding factors.

The toxicity evaluation presented in Section 2.1.1 indicated that there is the potential for reduced reproduction in earthworms exposed to low concentrations of mercury, silver, and lead. However, reproduction was not included in the assessment endpoint for the soil

invertebrate community because reliable data cannot be obtained for this endpoint using the standard soil bioassay protocols. Qualitative data for reproduction were measured during the bioassays (Table 7, Appendix B). These data showed evidence of reproduction in 8 of the 10 site samples, with a range of 1 to 6 cocoons produced per replicate. Cocoon production in the reference and control samples were 1.25 and 2.0 cocoons per replicate, respectively. Given the weight of evidence of the high survival rates and the small relative percent difference in growth rates, combined with the qualitative reproduction data, the weight of evidence does not suggest significant adverse effects to the soil invertebrate community.

5.3 Conclusions

The COCs in the surface soil at Site 47 do not pose unacceptable risk to soil invertebrates, birds, and mammals that inhabit the site. Therefore, further action to address ecological risks related to surface soils at the site is not warranted.

The sediment at the site appears to be toxic to benthic invertebrates; however, the cause of the toxicity does not seem to be related to COCs identified in the sediment, surface soil, or groundwater at the site. Therefore, no further action is recommended to address ecological risks related to sediment at the site.

Zinc in the surface water at the site does not pose an unacceptable risk to larval amphibians or water column organisms.

The concentrations of aluminum, iron, and manganese in the surface water at the site could pose an unacceptable risk to larval amphibians or water column organisms; however, the presence of these metals appears to be related to the natural background levels of these metals in soils and groundwater at NSF-IH. Therefore, no further action is recommended to address ecological risks related to surface water at the site.

5.4 Risk Management

Section 1.2 presents a summary of the SERA that was completed for Site 47 as part of the Final RI. The potential risks from sediment were identified as associated mainly from mercury, silver, and phenanthrene. The area where concentrations of these chemicals were above the screening values was limited to the upper part of the main drainage ditch at locations IS47SS16, IS47SS17, and IS47SD05 (Figure 1-2). Samples from locations IS47SS18 and IS47SD06 did not contain mercury, silver, or phenanthrene at concentrations above their screening values. The RI concluded that the potential risk to the benthic invertebrate community from these chemicals was limited to the upper part of the drainage ditch, a stretch of approximately 250 feet.

As presented in Section 4, bioassays indicated that the sediments were potentially toxic to benthic invertebrates. Mean survival in the site samples was 68.3 and 83.3 percent, compared with 88.3 and 90.0 percent survival in the reference and control samples, respectively. One site sample (IS47SD05) showed a statistically significant impact on reproduction compared to the laboratory control, but not compared to the reference sample. The tests results also showed that the organisms exposed to the site and reference sediments exhibited statistically significant adverse effects on growth, relative to the laboratory control

sample. Growth results for the site samples were 0.175 mg and 0.229 mg mean weight, compared to 0.304 mg in the reference sample and 0.389 mg in the control sample.

The concentrations of the three COCs (mercury, silver, and phenanthrene) identified in the SERA were relatively low (i.e., below ecological screening values) suggesting that these chemicals are not individually related to the observed toxicity though it is possible that there may be an additive or synergistic effect. It also was speculated that some other chemical(s) (e.g. organochlorine pesticides were used in the past for pest control at the facility) might be present in the sediments of the stream that may or may not be site-related and could be contributing to the toxicity observed in the bulk sediment samples. Pesticides and PCBs had never been analyzed for in site media because there is no history of their use at the site.

Following the BERA, a supplemental sampling and chemical analysis of site sediments was conducted because of the uncertainty surrounding the cause of the toxicity observed in the laboratory bioassays and the potential lack of a connection between the toxicity and site-related chemicals, as described in Section 4.3. To address this uncertainty and aid in risk management for the site, five additional sediment samples were collected from the drainage ditch and analyzed for a full suite of analytical parameters. Appendix E provides the work plan for the supplemental investigation. Appendix F presents a technical memorandum with the results of the supplemental investigation. Four pesticide compounds (4,4'-DDD, 4,4'-DDE, 4,4'-DDT, and endrin ketone) were detected in the sediment samples at concentrations that exceeded their ecological screening values. The detected concentrations were relatively low and do not reflect concentrations expected from potential releases from Site 47. These results suggest that pesticides may be the causal agents or group of chemicals responsible for the observed toxicity. It is also possible that there may another causal agent that has not been measured.

The supplemental investigation results, in conjunction with the BERA investigation results, suggest that the sediment COCs (mercury, silver, and phenanthrene) identified in the SERA may not be the causal agent or the risk-driving chemicals responsible for the toxicity observed at locations IS47SD05 and IS47SD17. Toxicity may be due to non site-related chemicals, such as pesticides or an unmeasured contaminant. In summary, risks to potential receptors have been identified in sediment in the drainage ditch; however, these risks are difficult to directly relate to contaminants from Site 47 and it would be difficult to establish contaminant based preliminary remediation goals. Moreover, the drainage ditch is relatively small and of low quality aquatic and terrestrial habitat. Based on overall risk management considerations, Site 47 is proposed for no further action in regards to ecological risk.

SECTION 6

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Appendix A
Site 47 Chemistry Results: Soil, Sediment, Surface Water, and Tissue

Table A-1
Analytical results for Surface Soil Samples
Site 47 BERA
NSF-IH, Indian Head, Maryland

Station ID	BGDSS03	IS47SA08	IS47SD01	IS47SD02	IS47SD04	IS47SS02		IS47SS04	IS47SS06	IS47SS10	IS47SS12	IS47SS14
Sample ID	BGDSS03-0804	IS47SA08-0804	IS47SD01-0804	IS47SD02-0804	IS47SD04-0804	IS47SS02-0804	IS47SS40-0804	IS47SS04-0804	IS47SS06-0804	IS47SS10-0804	IS47SS12-0804	IS47SS14-0804
	Reference						Duplicate					
Sample Date	08/10/04	08/10/04	08/09/04	08/09/04	08/09/04	08/10/04	08/10/04	08/10/04	08/10/04	08/10/04	08/10/04	08/09/04
Chemical Name												
Semi-volatile Organic Compounds (UG/KG)												
Acenaphthene	8.1	7.2 U	11 U	8.4 U	9.9 U	46	39	7.2 U	84	570	42	9.4 U
Acenaphthylene	24	14	14	15	9.9 U	67	55	18	19	160	44	10
Anthracene	26	28	23	34	17	180	130	29	190	1,500	150	16
Benzo(a)anthracene	58	130	100	150	55	400	390	150	630	3,400	640	54
Benzo(a)pyrene	63	120	100 J	150	49	440	420	130	550	2,400	540	59
Benzo(b)fluoranthene	140	240	130 J	240	87	650	630	180	810 J	3,500	760	94
Benzo(g,h,i)perylene	32	47	11 UJ	130	45	190	340	100	170 J	1,100	200	27
Benzo(k)fluoranthene	43	85	120 J	73	19	240	200	71	350 J	1,400	310	33
Chrysene	71	150	110	120	52	350	390	130	550	2,500	470	75
Dibenz(a,h)anthracene	7.7 U	17	11 UJ	40	14	59	93	7.2 U	70 J	470	70	9.4 U
Fluoranthene	150	310	150	180	91	760	920	310	1,100	7,100	1,200	120
Fluorene	7.7 U	7.2	11 U	8.4 U	9.9 U	37	34	7.2 U	63	630	40	9.4 U
Indeno(1,2,3-cd)pyrene	33	50	11 UJ	120	42	190	340	91	200 J	1,100	220	30
Naphthalene	7.7 U	7.2 U	11 U	8.4 U	9.9 U	58	47	7.2 U	20	160	9.9	9.4 U
Phenanthrene	61	91	36	49	27	460	490	100	680	5,800	570	36
Pyrene	110	190	140	130	68	650	680	250	890	5,200	980	83
Total Metals (MG/KG)												
Aluminum	9,030 J	3,020 J	16,500	2,480	9,670	3,680 J	3,680 J	4,210 J	2,210 J	6,130 J	3,910 J	10,700 J
Antimony	0.81 UL	0.72 UL	1.1 U	0.79 U	0.95 U	0.8 UL	0.74 UL	0.79 UL	0.76 UL	0.88 L	0.76 UL	0.82 UL
Arsenic	5.2	2.4	3.9 B	0.9 U	2	3.3	2.8	2.1	1 J	4.2	2.5	3 B
Barium	57.7	26.1 J	73.4	13.6 J	41.2	19.7 J	20.6 J	18.4 J	20.3 J	35.8	25.6 J	58.7
Beryllium	0.67 J	0.22 B	0.59 J	0.08 B	0.44 J	0.24 J	0.25 J	0.24 B	0.13 B	0.31 J	0.25 B	0.39 J
Boron	2.4 U	2.1 U	3.6	2.3 U	2.8 U	2.4 U	2.2 U	2.3 U	2.2 U	2.6 U	2.2 U	2.4 U
Cadmium	0.27 J	0.2 J	0.74 B	0.073 U	0.34 J	1.1	0.93	0.12 J	0.8	1.4	0.22 J	0.55 B
Calcium	145 J	174 J	1,890	219 J	348 J	397 J	308 J	440 J	504 J	1,540	233 J	1,890
Chromium	15.7	6.6	28.5	4.4	15.3	10.4	9.8	9.3	8.4	23.6	11.3	19.5
Cobalt	15.8	2.3 J	5.6 J	0.62 J	6.5 J	3.7 J	4.2 J	4 J	1.5 J	4.5 J	5 J	3.8 J
Copper	15.5	5.1	40.6	3.3 J	11.1	15	7.5	5.9	6	21.1	7.2	15.3
Iron	11,800	5,880	18,000	1,510	6,500	8,360	8,960	7,820	4,810	14,400	9,160	12,200
Lead	39.4 K	17.9 K	103	6.8	24.2	83.6 K	67.2 K	17.6 K	583 K	131 K	58.1 K	83.3 K
Magnesium	654 J	262 J	1,790	268 J	814 J	451 J	463 J	609 J	732 J	852 J	493 J	1,210 J
Manganese	1,100 K	86 K	85.7	10	32.5	173 K	172 K	116 K	81.8 K	516 K	201 K	60.4 K
Mercury	0.073 K	0.36	2.3	0.27	1.3	0.6	0.38	0.1	2.8	3	0.15	1.6
Molybdenum	0.71 B	0.58 B	16.4	0.38 B	1.8 B	0.57 B	0.68 B	0.42 B	0.37 B	0.85 B	0.43 B	1.9
Nickel	8.8	3.4 J	16.8	2.5 J	11.5	5 J	4.6 J	5.5 J	6.1	10	5.3 J	12.2
Potassium	449 J	140 J	1,150	249 J	628 J	314 J	325 J	339 J	226 J	387 J	303 J	638 J
Selenium	1 B	0.51 B	0.73 B	0.29 U	0.41 B	0.3 U	0.73 B	0.3 U	0.28 U	0.49 B	0.66 B	0.61 B

Table A-1
Analytical results for Surface Soil Samples
Site 47 BERA
NSF-IH, Indian Head, Maryland

Station ID	BGDSS03	IS47SA08	IS47SD01	IS47SD02	IS47SD04	IS47SS02		IS47SS04	IS47SS06	IS47SS10	IS47SS12	IS47SS14
Sample ID	BGDSS03-0804	IS47SA08-0804	IS47SD01-0804	IS47SD02-0804	IS47SD04-0804	IS47SS02-0804	IS47SS40-0804	IS47SS04-0804	IS47SS06-0804	IS47SS10-0804	IS47SS12-0804	IS47SS14-0804
	Reference						Duplicate					
Sample Date	08/10/04	08/10/04	08/09/04	08/09/04	08/09/04	08/10/04	08/10/04	08/10/04	08/10/04	08/10/04	08/10/04	08/09/04
Chemical Name												
Silver	0.15 U	2 K	230	54.2	9.3	5.1 K	3.5 K	0.57 K	116 K	7.6 K	2.1 K	425 K
Sodium	117 U	107 J	152 U	114 U	137 U	116 U	107 U	115 U	110 U	126 U	110 U	133 J
Thallium	1.2 U	1 U	1.5 U	1.1 U	1.4 U	1.2 U	1.1 U	1.2 U	1.1 U	1.3 U	1.1 U	1.2 U
Vanadium	42.3	15.5	40.9	6.2 J	22.5	14.3	13.7	13.8	10.3	22.7	17.3	29.3
Zinc	28.4 J	19.4 J	178	11.2	79.3	59 J	45.4 J	18.1 J	129 J	219 J	32.5 J	127 J
Wet Chemistry												
% Solids	87	93	63	79	67	96	96	93	92	91	91	71
Total organic carbon (TOC) (MG/KG)	26,000	17,000	43,000	2,300	17,000	7,300	5,800	3,900	13,000	13,000	6,500	25,000
pH	4.1	4.6	5.7	5.9	4.4	5.9	5.5	7.1	5.7	6.1	4.9	6.1

Notes
NA - Not analyzed
B - Analyte not detected above associated blank
J - Reported value is estimated
K - Reported value may be biased high
L - Reported value may be biased low
R - Unreliable result
U - Analyte not detected
UJ - Not detected; reporting limit is estimated
UL - Not detected; reporting limit is biased low
A shaded cell indicates the parameter is detected.

Table A-2
Dection in Soil Samples
Site 47 BERA
NSF-IH, Indian Head, Maryland

Station ID	BGDSS03	IS47SA08	IS47SD01	IS47SD02	IS47SD04	IS47SS02		IS47SS04	IS47SS06	IS47SS10	IS47SS12	IS47SS14
Sample ID	BGDSS03-0804	IS47SA08-0804	IS47SD01-0804	IS47SD02-0804	IS47SD04-0804	IS47SS02-0804	IS47SS40-0804	IS47SS04-0804	IS47SS06-0804	IS47SS10-0804	IS47SS12-0804	IS47SS14-0804
	Reference						Duplicate					
Sample Date	08/10/04	08/10/04	08/09/04	08/09/04	08/09/04	08/10/04	08/10/04	08/10/04	08/10/04	08/10/04	08/10/04	08/09/04
Chemical Name												
Semi-volatile Organic Compounds (UG/KG)												
Acenaphthene	8.1	7.2 U	11 U	8.4 U	9.9 U	46	39	7.2 U	84	570	42	9.4 U
Acenaphthylene	24	14	14	15	9.9 U	67	55	18	19	160	44	10
Anthracene	26	28	23	34	17	180	130	29	190	1,500	150	16
Benzo(a)anthracene	58	130	100	150	55	400	390	150	630	3,400	640	54
Benzo(a)pyrene	63	120	100 J	150	49	440	420	130	550	2,400	540	59
Benzo(b)fluoranthene	140	240	130 J	240	87	650	630	180	810 J	3,500	760	94
Benzo(g,h,i)perylene	32	47	11 UJ	130	45	190	340	100	170 J	1,100	200	27
Benzo(k)fluoranthene	43	85	120 J	73	19	240	200	71	350 J	1,400	310	33
Chrysene	71	150	110	120	52	350	390	130	550	2,500	470	75
Dibenz(a,h)anthracene	7.7 U	17	11 UJ	40	14	59	93	7.2 U	70 J	470	70	9.4 U
Fluoranthene	150	310	150	180	91	760	920	310	1,100	7,100	1,200	120
Fluorene	7.7 U	7.2	11 U	8.4 U	9.9 U	37	34	7.2 U	63	630	40	9.4 U
Indeno(1,2,3-cd)pyrene	33	50	11 UJ	120	42	190	340	91	200 J	1,100	220	30
Naphthalene	7.7 U	7.2 U	11 U	8.4 U	9.9 U	58	47	7.2 U	20	160	9.9	9.4 U
Phenanthrene	61	91	36	49	27	460	490	100	680	5,800	570	36
Pyrene	110	190	140	130	68	650	680	250	890	5,200	980	83
Total Metals (MG/KG)												
Aluminum	9,030 J	3,020 J	16,500	2,480	9,670	3,680 J	3,680 J	4,210 J	2,210 J	6,130 J	3,910 J	10,700 J
Antimony	0.81 UL	0.72 UL	1.1 U	0.79 U	0.95 U	0.8 UL	0.74 UL	0.79 UL	0.76 UL	0.88 L	0.76 UL	0.82 UL
Arsenic	5.2	2.4	3.9 B	0.9 U	2	3.3	2.8	2.1	1 J	4.2	2.5	3 B
Barium	57.7	26.1 J	73.4	13.6 J	41.2	19.7 J	20.6 J	18.4 J	20.3 J	35.8	25.6 J	58.7
Beryllium	0.67 J	0.22 B	0.59 J	0.08 B	0.44 J	0.24 J	0.25 J	0.24 B	0.13 B	0.31 J	0.25 B	0.39 J
Boron	2.4 U	2.1 U	3.6	2.3 U	2.8 U	2.4 U	2.2 U	2.3 U	2.2 U	2.6 U	2.2 U	2.4 U
Cadmium	0.27 J	0.2 J	0.74 B	0.073 U	0.34 J	1.1	0.93	0.12 J	0.8	1.4	0.22 J	0.55 B
Calcium	145 J	174 J	1,890	219 J	348 J	397 J	308 J	440 J	504 J	1,540	233 J	1,890
Chromium	15.7	6.6	28.5	4.4	15.3	10.4	9.8	9.3	8.4	23.6	11.3	19.5
Cobalt	15.8	2.3 J	5.6 J	0.62 J	6.5 J	3.7 J	4.2 J	4 J	1.5 J	4.5 J	5 J	3.8 J
Copper	15.5	5.1	40.6	3.3 J	11.1	15	7.5	5.9	6	21.1	7.2	15.3
Iron	11,800	5,880	18,000	1,510	6,500	8,360	8,960	7,820	4,810	14,400	9,160	12,200
Lead	39.4 K	17.9 K	103	6.8	24.2	83.6 K	67.2 K	17.6 K	583 K	131 K	58.1 K	83.3 K
Magnesium	654 J	262 J	1,790	268 J	814 J	451 J	463 J	609 J	732 J	852 J	493 J	1,210 J
Manganese	1,100 K	86 K	85.7	10	32.5	173 K	172 K	116 K	81.8 K	516 K	201 K	60.4 K
Mercury	0.073 K	0.36	2.3	0.27	1.3	0.6	0.38	0.1	2.8	3	0.15	1.6
Molybdenum	0.71 B	0.58 B	16.4	0.38 B	1.8 B	0.57 B	0.68 B	0.42 B	0.37 B	0.85 B	0.43 B	1.9
Nickel	8.8	3.4 J	16.8	2.5 J	11.5	5 J	4.6 J	5.5 J	6.1	10	5.3 J	12.2
Potassium	449 J	140 J	1,150	249 J	628 J	314 J	325 J	339 J	226 J	387 J	303 J	638 J
Silver	0.15 U	2 K	230	54.2	9.3	5.1 K	3.5 K	0.57 K	116 K	7.6 K	2.1 K	425 K

Table A-2
Dection in Soil Samples
Site 47 BERA
NSF-IH, Indian Head, Maryland

Station ID	BGDSS03	IS47SA08	IS47SD01	IS47SD02	IS47SD04	IS47SS02		IS47SS04	IS47SS06	IS47SS10	IS47SS12	IS47SS14
Sample ID	BGDSS03-0804	IS47SA08-0804	IS47SD01-0804	IS47SD02-0804	IS47SD04-0804	IS47SS02-0804	IS47SS40-0804	IS47SS04-0804	IS47SS06-0804	IS47SS10-0804	IS47SS12-0804	IS47SS14-0804
	Reference						Duplicate					
Sample Date	08/10/04	08/10/04	08/09/04	08/09/04	08/09/04	08/10/04	08/10/04	08/10/04	08/10/04	08/10/04	08/10/04	08/09/04
Chemical Name												
Sodium	117 U	107 J	152 U	114 U	137 U	116 U	107 U	115 U	110 U	126 U	110 U	133 J
Vanadium	42.3	15.5	40.9	6.2 J	22.5	14.3	13.7	13.8	10.3	22.7	17.3	29.3
Zinc	28.4 J	19.4 J	178	11.2	79.3	59 J	45.4 J	18.1 J	129 J	219 J	32.5 J	127 J
Wet Chemistry (MG/KG)												
% Solids	87	93	63	79	67	96	96	93	92	91	91	71
Total organic carbon (TOC)	26,000	17,000	43,000	2,300	17,000	7,300	5,800	3,900	13,000	13,000	6,500	25,000
pH	4.1	4.6	5.7	5.9	4.4	5.9	5.5	7.1	5.7	6.1	4.9	6.1

Notes
NA - Not analyzed
B - Analyte not detected above associated blank
J - Reported value is estimated
K - Reported value may be biased high
L - Reported value may be biased low
R - Unreliable result
U - Analyte not detected
UJ - Not detected; reporting limit is estimated
UL - Not detected; reporting limit is biased low
A shaded cell indicates the parameter is detected.

Table A-3
Analytical Results for Sediment
Site 47 BERA
NSF-IH, Indian Head, Maryland

Station ID	IS47RSD01	IS47SD05	IS47SD17
Sample ID	IS47RSD01-0804	IS47SD05-0804	IS47SD17-0804
	Refrerence	|	|
Sample Date	08/10/04	08/10/04	08/10/04
Chemical Name			
Semi-volatile Organic Compounds (UG/KG)			
Acenaphthene	23	9.1 U	8.8 U
Acenaphthylene	48	9.1 U	8.8 U
Anthracene	140	9.1 U	8.8 U
Benzo(a)anthracene	200	9.1 U	29
Benzo(a)pyrene	140	9.1 U	22
Benzo(b)fluoranthene	190	9.1 U	44
Benzo(g,h,i)perylene	26	9.1 U	18
Benzo(k)fluoranthene	56	9.1 U	12
Chrysene	160	9.1 U	28
Dibenz(a,h)anthracene	7.7 U	9.1 U	8.8 U
Fluoranthene	450	9.1 U	53
Fluorene	71	9.1 U	8.8 U
Indeno(1,2,3-cd)pyrene	32	9.1 U	17
Naphthalene	7.7 U	9.1 U	8.8 U
Phenanthrene	490	9.1 U	19
Pyrene	360	9.1 U	34
Total Metals (MG/KG)			
Aluminum	1,060	4,640	1,960 J
Antimony	0.72 U	0.87 U	0.89 UL
Arsenic	1.8	1.3 J	1 U
Barium	12.2 J	28 J	8.4 J
Beryllium	0.14 J	0.4 J	0.21 J
Boron	2.1 U	2.6 U	2.6 U
Cadmium	0.071 J	0.28 J	0.082 U
Calcium	88.5 J	224 J	126 J
Chromium	5.5	10.2	4.4
Cobalt	2.3 J	4.5 J	2.4 J
Copper	1.6 J	7.1	1.9 J
Iron	4,010	5,490	1,440
Lead	3	13.3	3.2 K
Magnesium	93.3 J	397 J	134 J
Manganese	206	23.9	13 K
Mercury	0.039	0.065	1.4 K
Molybdenum	0.2 B	0.49 B	0.51 B
Nickel	1.9 J	4.5 J	2 J
Potassium	69.8 J	354 J	163 J
Selenium	0.3 B	0.33 U	0.33 U
Silver	0.13 U	0.18 J	3.6 K
Sodium	104 U	126 U	129 U
Thallium	1 U	1.3 U	1.3 U
Vanadium	5.8 J	14.7	4.9 J
Zinc	20.2	41.8	8.5 J
Wet Chemistry			
% Solids	87	74	76
Total organic carbon (TOC) (MG/KG)	960	3,100	2,600
pH	6.4	4.9	5.5

Notes
NA - Not analyzed
B - Analyte not detected above associated blank
J - Reported value is estimated
K - Reported value may be biased high
R - Unreliable result
U - Analyte not detected
UL - Not detected; reporting limit is biased low
A shaded cell indicates the parameter is detected.

Table A-4
Detections in Sediment Samples
Site 47 BERA
NSF-IH, Indian Head, Maryland

Station ID	IS47RSD01	IS47SD05	IS47SD17
Sample ID	IS47RSD01-0804	IS47SD05-0804	IS47SD17-0804
	Reference		
Sample Date	08/10/04	08/10/04	08/10/04
Chemical Name			
Semi-volatile Organic Compounds (UG/KG)			
Acenaphthene	23	9.1 U	8.8 U
Acenaphthylene	48	9.1 U	8.8 U
Anthracene	140	9.1 U	8.8 U
Benzo(a)anthracene	200	9.1 U	29
Benzo(a)pyrene	140	9.1 U	22
Benzo(b)fluoranthene	190	9.1 U	44
Benzo(g,h,i)perylene	26	9.1 U	18
Benzo(k)fluoranthene	56	9.1 U	12
Chrysene	160	9.1 U	28
Fluoranthene	450	9.1 U	53
Fluorene	71	9.1 U	8.8 U
Indeno(1,2,3-cd)pyrene	32	9.1 U	17
Phenanthrene	490	9.1 U	19
Pyrene	360	9.1 U	34
Total Metals (MG/KG)			
Aluminum	1,060	4,640	1,960 J
Arsenic	1.8	1.3 J	1 U
Barium	12.2 J	28 J	8.4 J
Beryllium	0.14 J	0.4 J	0.21 J
Cadmium	0.071 J	0.28 J	0.082 U
Chromium	5.5	10.2	4.4
Cobalt	2.3 J	4.5 J	2.4 J
Copper	1.6 J	7.1	1.9 J
Iron	4,010	5,490	1,440
Lead	3	13.3	3.2 K
Magnesium	93.3 J	397 J	134 J
Manganese	206	23.9	13 K
Mercury	0.039	0.065	1.4 K
Nickel	1.9 J	4.5 J	2 J
Potassium	69.8 J	354 J	163 J
Silver	0.13 U	0.18 J	3.6 K
Vanadium	5.8 J	14.7	4.9 J
Zinc	20.2	41.8	8.5 J
Wet Chemistry			
% Solids	87	74	76
Total organic carbon (TOC) (MG/KG)	960	3,100	2,600
pH	6.4	4.9	5.5

Notes

NA - Not analyzed

B - Analyte not detected above associated blank

J - Reported value is estimated

K - Reported value may be biased high

R - Unreliable result

U - Analyte not detected

UL - Not detected; reporting limit is biased low

A shaded cell indicates the parameter is detected.

Table A-5
Analytical Results for Surface Water Sample
Site 47 BERA
NSF-IH, Indian Head, Maryland

Station ID	IS47SW02
Sample ID	IS47SW02-0804
Sample Date	08/13/04
Chemical Name	
Total Metals (UG/L)	
Aluminum	393
Antimony	1.9 UL
Arsenic	6.2 U
Barium	40.7 J
Beryllium	0.16 J
Boron	33.3
Cadmium	0.5 J
Calcium	5,620
Chromium	2.4 U
Cobalt	6.8 J
Copper	5.7 J
Iron	2,490
Lead	2 K
Magnesium	1,980 J
Manganese	163
Mercury	0.1 U
Molybdenum	2.1 U
Nickel	18 J
Potassium	1,550 J
Selenium	4.4 U
Silver	1.7 U
Sodium	14,600
Thallium	2.9 U
Vanadium	2 J
Zinc	29.6 B
Dissolved Metals (UG/L)	
Aluminum	131 J
Antimony	1.9 U
Arsenic	6.2 U
Barium	38.4 J
Beryllium	0.091 U
Boron	34.9
Cadmium	0.39 U
Calcium	5,540
Chromium	2.4 U
Cobalt	6 J
Copper	2.1 J
Iron	1,610
Lead	1.7 U
Magnesium	1,940 J
Manganese	160
Mercury	0.1 U
Molybdenum	2.1 U
Nickel	3.6 J
Potassium	1,530 J
Selenium	4.4 U
Silver	1.7 U
Sodium	14,800
Thallium	2.9 U
Vanadium	0.82 J
Zinc	26
Wet Chemistry	
Dissolved organic carbon (MG/L)	8
pH	5.9

Notes
NA - Not analyzed
B - Analyte not detected above associated blank
J - Reported value is estimated
K - Reported value may be biased high
U - Analyte not detected
UL - Not detected; reporting limit is biased low
A shaded cell indicates the parameter is detected.

Table A-6
Detections in Surface Water Sample
Site 47 BERA
NSF-IH, Indian Head, Maryland

Station ID **Sample ID** **Sample Date**	IS47SW02 IS47SW02-0804 08/13/04
Chemical Name	
Total Metals (UG/L)	
Aluminum	393
Barium	40.7 J
Beryllium	0.16 J
Boron	33.3
Cadmium	0.5 J
Calcium	5,620
Cobalt	6.8 J
Copper	5.7 J
Iron	2,490
Lead	2 K
Magnesium	1,980 J
Manganese	163
Nickel	18 J
Potassium	1,550 J
Sodium	14,600
Vanadium	2 J
Dissolved Metals (UG/L)	
Aluminum	131 J
Barium	38.4 J
Boron	34.9
Calcium	5,540
Cobalt	6 J
Copper	2.1 J
Iron	1,610
Magnesium	1,940 J
Manganese	160
Nickel	3.6 J
Potassium	1,530 J
Sodium	14,800
Vanadium	0.82 J
Zinc	26
Wet Chemistry	
Dissolved organic carbon (mg/L)	8
pH	5.9

Notes
NA - Not analyzed
B - Analyte not detected above associated blank
J - Reported value is estimated
K - Reported value may be biased high
U - Analyte not detected
UL - Not detected; reporting limit is biased low
A shaded cell indicates the parameter is detected.

Table A-7
Analytical Results for Earthworm Tissue
Site 47 BERA
NSF-IH, Indian Head, Maryland

PARAMETER	UNITS	Lab Control 12571-001		IS47SDTX04 12571-002		IS47SSTX14 12571-003		IS47SDTX01 12571-004		IS47SDTX02 12571-005		IS47SATX08 12571-006	
		Result	Quant Limit	Result	Quant Limit	Result	Quant Limit	Result	Quant Limit	Result	Quant Limit	Result	Quant Limit
Aluminum, total	ug/g	180	0.2	330	0.2	840	0.1	1100	0.2	180	0.2	590	0.3
Antimony, total	ug/g	ND	0.09	ND	0.09	ND	0.07	ND	0.09	ND	0.1	ND	0.1
Arsenic, total	ug/g	3.2	0.09	2.1	0.09	1.3	0.07	0.84	0.09	4	0.1	0.45	0.1
Barium, total	ug/g	0.71	0.02	2.1	0.02	3.9	0.01	4	0.02	1.9	0.02	5.1	0.03
Beryllium, total	ug/g	ND	0.02	ND	0.02	0.028	0.01	0.032	0.02	ND	0.02	0.031	0.03
Cadmium, total	ug/g	0.21	0.02	0.3	0.02	1.1	0.01	0.88	0.02	0.37	0.02	2.2	0.03
Calcium, total	ug/g	760	0.5	470	0.5	520	0.3	570	0.4	490	0.5	500	0.6
Chromium, total	ug/g	0.25	0.04	0.71	0.04	1.4	0.03	1.9	0.03	0.38	0.04	1.2	0.05
Cobalt, total	ug/g	0.85	0.09	1.3	0.09	1.1	0.07	1.1	0.09	0.95	0.1	0.97	0.1
Copper, total	ug/g	1.4	0.04	1.6	0.04	1.7	0.03	2.5	0.03	2	0.04	1.6	0.05
Iron, total	ug/g	16	0.09	350	0.09	630	0.07	920	0.09	54	0.1	700	0.1
Lead, total	ug/g	0.26	0.09	1.5	0.09	4.3	0.07	6	0.09	0.81	0.1	5.5	0.1
Magnesium, total	ug/g	370	0.5	150	0.5	170	0.3	190	0.4	120	0.5	120	0.6
Manganese, total	ug/g	1.2	0.09	6.6	0.09	3.9	0.07	4.8	0.09	1.3	0.1	27	0.1
Mercury, total	ug/g	ND	0.07	0.087	0.07	0.078	0.07	0.15	0.07	0.1	0.07	0.23	0.07
Nickel, total	ug/g	0.15	0.05	0.43	0.05	1	0.03	1	0.04	0.45	0.05	0.97	0.06
Potassium, total	ug/g	1300	5	1200	5	1100	3	1300	4	1200	5	990	6
Selenium, total	ug/g	2.1	0.09	ND	0.09	ND	0.07	ND	0.09	1.5	0.1	ND	0.1
Silver, total	ug/g	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4
Sodium, total	ug/g	860	9	700	9	800	7	820	9	740	10	660	10
Thallium, total	ug/g	ND	0.09	ND	0.09	ND	0.07	ND	0.09	ND	0.1	ND	0.1
Vanadium, total	ug/g	1.1	0.5	1.5	0.5	3	0.3	3.6	0.4	0.81	0.5	3.3	0.6
Zinc, total	ug/g	14	0.04	14	0.04	18	0.03	22	0.03	14	0.04	16	0.05

Notes
ND - Not Detected

Table A-7
Analytical Results for Earthworm Tissue
Site 47 BERA
NSF-IH, Indian Head, Maryland

PARAMETER	UNITS	IS47SSTX06 12571-007		IS47SSTX12 12571-008		IS47SSTX04 12571-009		IS47SSTX02 12571-010		IS47SSTX10 12571-011		BGDSSTX03 12571-012	
		Result	Quant Limit	Result	Quant Limit	Result	Quant Limit	Result	Quant Limit	Result	Quant Limit	Result	Quant Limit
Aluminum, total	ug/g	210	0.2	680	0.2	750	0.1	700	0.1	970	0.1	720	0.3
Antimony, total	ug/g	ND	0.09	ND	0.08	ND	0.07	ND	0.07	ND	0.06	ND	0.1
Arsenic, total	ug/g	2.6	0.09	1.6	0.08	2	0.07	0.81	0.07	ND	0.06	0.6	0.1
Barium, total	ug/g	3.4	0.02	3.8	0.02	3	0.01	5.3	0.01	4.3	0.01	4.9	0.03
Beryllium, total	ug/g	ND	0.02	0.036	0.02	0.031	0.01	0.037	0.01	0.036	0.01	0.044	0.03
Cadmium, total	ug/g	0.83	0.02	0.85	0.02	0.84	0.01	4.7	0.01	4.1	0.01	0.45	0.03
Calcium, total	ug/g	530	0.4	390	0.4	400	0.3	420	0.3	530	0.3	390	0.7
Chromium, total	ug/g	0.95	0.04	1.6	0.03	1.1	0.03	1.7	0.03	2.9	0.03	1	0.05
Cobalt, total	ug/g	1	0.09	1.6	0.08	2.8	0.07	1.5	0.07	1.2	0.06	2.1	0.1
Copper, total	ug/g	1.4	0.04	1.7	0.03	1.3	0.03	1.7	0.03	4.2	0.03	1.4	0.05
Iron, total	ug/g	250	0.09	1000	0.08	370	0.07	1000	0.07	1400	0.06	620	0.1
Lead, total	ug/g	120	0.09	22	0.08	4.9	0.07	15	0.07	21	0.06	5.4	0.1
Magnesium, total	ug/g	210	0.4	150	0.4	150	0.3	160	0.3	200	0.3	130	0.7
Manganese, total	ug/g	8.4	0.09	26	0.08	3.2	0.07	38	0.07	42	0.06	77	0.1
Mercury, total	ug/g	1.9	0.07	ND	0.07	ND	0.07	0.76	0.07	1.6	0.07	ND	0.07
Nickel, total	ug/g	1	0.04	0.7	0.04	1	0.03	0.87	0.03	1.1	0.03	0.84	0.07
Potassium, total	ug/g	1300	4	940	4	1100	3	960	3	1000	3	1000	7
Selenium, total	ug/g	ND	0.09	ND	0.08	ND	0.07	ND	0.07	ND	0.06	ND	0.1
Silver, total	ug/g	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4
Sodium, total	ug/g	680	9	610	8	750	7	620	7	700	6	710	10
Thallium, total	ug/g	ND	0.09	ND	0.08	ND	0.07	ND	0.07	ND	0.06	ND	0.1
Vanadium, total	ug/g	1.4	0.4	3.1	0.4	2.3	0.3	3	0.3	4.2	0.3	3.5	0.7
Zinc, total	ug/g	28	0.04	18	0.03	17	0.03	21	0.03	45	0.03	13	0.05

Notes
ND - Not Detected

Appendix B
Soil Toxicity Testing Report

ESI

EnviroSystems, Inc.
One Lafayette Road
P.O. Box 778
Hampton, N.H. 03843-0778
(603) 926-3345 • (603) 926-3521 Fax
www.envirosystems.com

November 17, 2004

Mr. John Burgess
CH2M Hill, Incorporated
25 New Chardon Street, Ste. 300
Boston, MA 01224

Dear Mr. Burgess:

Please find attached two copies, one bound, one unbound, of our final report covering the CTO-066 Site 47 Ecological Risk Assessment. The 28 day survival and growth evaluation was conducted using the earthworm species *E. fetida*..

Please call me or Brian Buzby should you have any questions.

Sincerely,

EnviroSystems, Incorporated

Ken Simon

Kenneth A. Simon
President

KAS:bcb
Attachment
Report: 12415-04-08
Copies: 1 unbound
1 bound

TOXICOLOGICAL EVALUATION OF SOIL SAMPLES

Eisenia fetida Survival, Growth, Reproduction, and Bioaccumulation Soil Toxicity Tests CTO-066 Site 47 Ecological Risk Assessment

Prepared For

CH2M Hill, Incorporated
13921 Park Center Road
Herndon, Virginia 20171

By

EnviroSystems, Incorporated
1 Lafayette Road
Hampton, New Hampshire 03842

September 2004
Reference Number 12415-04-08

TABLE OF CONTENTS

1.0 INTRODUCTION 3

2.0 MATERIAL AND METHODS 3

2.1 General Methods, Biological Evaluations 3
2.2 Test Samples 3
2.3 Test Species 4
2.4 *Eisenia fetida* 28 Day Survival and Growth Assay 4
2.5 Trace Metals Analysis 5
2.6 Statistical Analysis 5
2.7 Quality Control 5
2.8 Protocol Deviations 5

3.0 RESULTS AND DISCUSSION 5

3.1 *Eisenia fetida* 28 Day Survival and Growth Assay 6
3.2 Summary 6

4.0 REFERENCES 6

LIST OF TABLES

Table 1. Summary of Sample Collection Information. 7
Table 2. Summary of Soil Characteristics 7
Table 3. Summary of Day 28 *E. fetida* Survival *vs* Laboratory Control 8
Table 4. Summary of Day 28 *E. fetida* Survival *vs* Reference Soil 8
Table 5. Summary of Day 28 *E. fetida* Growth *vs* Laboratory Control 9
Table 6. Summary of Day 28 *E. fetida* Growth *vs* Reference Soil 9
Table 7. Summary of Day 28 *E. fetida* Reproduction 10
Table 8. Summary of Reference Toxicant Data 10
Table 9. Summary of *E. fetida* Bioaccumulation Data 11

APPENDIX A: RAW DATA & SUPPORT 15

TOXICOLOGICAL EVALUATION OF SOIL SAMPLES SEPTEMBER 2004

CTO-066 Site 47 Ecological Risk Assessment *E. fetida* 28 Day Soil Evaluation

1.0 INTRODUCTION

Toxicity tests expose groups of organisms to environmental samples and laboratory controls for a specified period to assess potential impacts. Endpoints evaluated as part of the assays may include survival, growth, and/or reproduction. Analysis of variance techniques are used to determine if differences in a measured endpoint for organisms exposed to a test sample are significantly different from responses obtained from organisms exposed to field reference site or laboratory control materials.

This report presents the results of chronic toxicity tests conducted on eleven soil samples collected from CTO-066 Site 47. The soil samples were provided by CH2M Hill staff from the Herndon, Virginia office. Testing was based on programs and protocols developed by the ASTM (2001) and US EPA (1989). The toxicity of the samples was assessed by conducting 28 day exposure assays with the earthworm, *Eisenia fetida*. Assays were performed at EnviroSystems, Incorporated (ESI), Hampton, New Hampshire.

2.0 MATERIALS AND METHODS

2.1 General Methods, Biological Evaluations

Toxicological and analytical protocols used in this program follow procedures outlined in *Standard Methods for the Examination of Water and Wastewater*, 20th Edition (APHA 1998), *Standard Guide For Conductiong Laboratory Soil Toxicity or Bioaccumulation Tests With the Lumbricid Earthworm Eisenia Fetida*, *Aquatic Toxicology and Risk Assessment: Volume 11.05* (ASTM 2001), and *Protocol for Short Term Toxicity Screening of Hazardous Waste Sites* (EPA 1989). These protocols provide standard approaches for physical and chemical analysis and for the evaluation of toxicological effects of soils on terrestrial organisms.

2.2 Test Samples

Eleven soil samples collected from CTO-066 Site 47 for *E. fetida* testing were received at ESI on August 10-11, 2004. One of these samples, BGDSSTX03 (ESI -11) was identified by CH2M Hill staff as a reference sample. Upon arrival at the laboratory, the samples were given an internal sample control number and logged into the project sample control system. Prior to testing, samples were placed in a secure refrigerator and stored at a temperature of 2-4°C until test initiation. Sample identification, collection and receipt information is summarized in Table 1.

2.3 Test Species

E. fetida were obtained from a single commercial supply source, Smith's Worm Supply, Boston, Georgia. Earthworms were held for a minimum of 24 hours in organic compost. Temperature during the holding period was maintained at approximately 20°C. Worms used in the assays were adults with a well-developed clitellum.

2.4 *Eisenia fetida* 28 Day Survival and Growth Assay

The assays were carried out following protocol provided by ASTM (2001). The 28 day earthworm assay was conducted in static exposure mode. Endpoints for the assay were survival, growth, expressed as mean wet weight per surviving worm, and reproduction, expressed as juvenile/cocoon production.

Samples were sieved through a 12-mm stainless steel screen to remove large stones, sticks, roots, and man-made material. Prior to testing, moisture content, total organic content and pH were determined for each sample. Target moisture content for the samples was 35%. If necessary, samples were either dried, at room temperature, or hydrated, using deionized water to achieve the target moisture content. As received soil moisture ranged from 9.4 to 25.0%. Soil pH ranged from 5.13 to 7.75 SU; soils were not pH adjusted prior to testing.

Soil used as a laboratory control in the earthworm assay was an artificial soil prepared according to protocol developed by the EPA (1989). The soil consisted of 10% sphagnum peat moss, 20% kaolinite clay and 70% fine silica sand (200 mesh) by dry weight. The peat moss was blended and screened prior to use to break-up clods and remove any large sticks and twigs. The moisture content of the control soil was adjusted to approximately 35% using deionized water. The pH of the control soil was checked to insure values were within the range of 7.0±0.5 SU (ASTM 2001).

The assay utilized 4 replicates with 10 worms per replicate. Approximately 500 g of soil was added to each 500 mL glass jar. The jars were covered with laboratory film with a small hole in the top to allow ventilation. Containers were placed in an incubator at 20 ±2°C. Lighting was set at 24 hours illumination. Light intensity was approximately 50 foot candles. During the exposure period, incubator temperature was checked daily for the duration of the assay. Temperature was also monitored on a hourly basis using a data logger housed in a surrogate test vessel. The worms were not fed during the assay.

After 28 days exposure, chambers were uncovered and the contents removed onto trays. Living worms were removed from the soil and counted. Juvenile worms and cocoons recovered from the soil were enumerated. Once counted, the worms were rinsed with deionized water to remove soil particles, blotted dry, and weighed. Weight data was used for statistical comparison of growth. After weight data was recorded the worms from each sample were composited and transferred to glass vials and stored frozen at approximately -18°C.

2.5 Trace Metals Analysis

Frozen tissue samples were thawed and homogenized using a tissue blender. After homogenization, an aliquot was removed and placed in a tared glass reaction vessel. The aliquot was weighed to the nearest 0.01 gram and prepared for digestion. Equal amounts of nitric and

sulfuric acid were added to the tissue sample. The tissue and acids were heated in a closed reaction vessel and allowed to digest until all material was in solution. Additional acid was added to the reaction vessel during the digestion process. Sample volume was reduced to <2 mL; samples were not allowed to evaporate to dryness. After digestion was complete, the digestate was diluted to final volume with 5% nitric acid. Sample analysis was completed using inductively coupled plasma (ICP) spectrometry. Trace metals analysis reports are available in Appendix A.

2.6 Statistical Analysis

Survival and growth data were analyzed using CETIS® software to determine significant differences between the test sediments and the laboratory control and the test sediments and the reference sites. Survival and growth data were evaluated to determine homogeneity of sample variances and normality of distribution using Shapiro-Wilk's Test for Normality and the F-Test for Equality of Two Variances, respectively. Data sets were subsequently evaluated using the appropriate parametric or non-parametric Analysis of Variance (ANOVA) statistic. Pair-wise comparisons were based on the 2 sample t-Test. Statistical difference was evaluated at $\alpha=0.05$. In cases where survival or growth in a site-related treatment was equal to or greater than that observed in the laboratory control or reference soil, no statistical evaluation was conducted.

2.7 Quality Control

As part of the laboratory quality control program, reference toxicant evaluations are conducted on a regular basis by ESI for the test species. These results provide relative health and response data while allowing for comparison with historic data collected from ESI-conducted reference toxicity tests. Results of these tests are presented in Table 8.

2.8 Protocol Deviations

Review of data generated during these assays indicated no areas where methods or results deviated from standard protocols.

3.0 RESULTS AND DISCUSSION

Table 1 provides sample collection and receipt information. A summary of the physical and chemical characteristics of the soils is provided in Table 2. Survival data from the *E. fetida* assay is summarized in Tables 3 and 4. Tables 5 and 6 provide a summary of *E. fetida* growth data. Table 7 provides a summary of worm reproduction data. Table 8 provides historic reference toxicant data for *E. fetida*. Support data including laboratory bench sheets and trace metals analysis reports are included in Appendix A.

3.1 *Eisenia fetida* 28 Day Survival and Growth Assay

At the end of the 28 day exposure period, the mean worm survival in the laboratory control soil was 97.5%. Worms recovered from the laboratory control soil had a mean wet weight of 190 mg/surviving worm. Worms from the laboratory control soil did exhibit signs of reproduction. The minimum acceptable criteria for survival in the laboratory control is 90%. These data indicate that the organisms were healthy and not stressed by handling. Survival in the reference soil, BGDSSTX03, was 100%. Mean wet weight in the reference soil was 243 mg/worm. Worms from the reference soil exhibited signs of reproduction.

Daily temperature records indicate that values ranged from 19-22°C during the assay, within the acceptable range of 20 ±2°C. Additional temperature date from the hourly data logger is available in Appendix A.

Tables 3-4 and 5-6 provide a summary of survival and growth data, respectively, for the laboratory control, reference and project sites.

3.2 Summary

Review of survival data, as compared to laboratory control survival, indicates that none of the soils exhibited a significant negative impact on worm survival. No soils exhibited a significant negative impact on worm survival when compared to survival in reference soil BGDSSTX03.

Review of *E. fetida* growth data, as compared to laboratory control growth, indicates that none of the soils exhibited a significant negative impact on worm growth. Soils IS47SDTX04, IS47SDTX01, IS47SDTX02, and IS47SSTX06 exhibited a significant negative impact on worm growth when compared to reference soil BGDSSTX03.

Review of *E. fetida* reproduction data indicates that nine of the eleven tested soils, including the reference soil, indicated signs of reproduction (juvenile or cocoon production). See Table 7 for specific details.

4.0 REFERENCES

APHA. 1998. *Standard Methods for the Examination of Water and Wastewater,* 20th Edition.

ASTM. 2001. Volume 11.05. *Standard Guide for Conducting Laboratory Soil Toxicity or Bioaccumulation Tests With the Lumbricid Earthworm Eisenia Fetida.* E1676-97

US EPA. 1989. *Protocol for Short Term Toxicity Screening of Hazardous Waste Sites.* EPA/600/3-88/029.

TABLE 1. Summary of Sample Collection Information. *E. fetida* Soil Evaluation. CTO-066 Site 47 Ecological Risk Assessment. CH2M Hill. September 2004.

Sample Identification	ESI ID	Sample Type	Sample Collection		Sample Receipt
			Date	Time	Date
IS47SDTX04	-1	Soil	08/09/04	1445	08/10/04
IS47SSTX14	-2	Soil	08/09/04	1530	08/10/04
IS47SDTX01	-3	Soil	08/09/04	1555	08/10/04
IS47SDTX02	-4	Soil	08/09/04	1615	08/10/04
IS47SATX08	-5	Soil	08/10/04	0830	08/11/04
IS47SSTX06	-6	Soil	08/10/04	0845	08/11/04
IS47SSTX12	-7	Soil	08/10/04	0900	08/11/04
IS47SSTX04	-8	Soil	08/10/04	0915	08/11/04
IS47SSTX02	-9	Soil	08/10/04	0930	08/11/04
IS47SSTX10	-10	Soil	08/10/04	0945	08/11/04
BGDSSTX03	-11	Soil	08/10/04	1330	08/11/04

TABLE 2. Summary of Soil Characteristics. *E. fetida* Soil Evaluation. CTO-066 Site 47 Ecological Risk Assessment. CH2M Hill. September 2004.

Sample	ESI ID	pH	Soil Moisture	Total Organic Content
IS47SDTX04	-1	7.84	5.3	0.8
IS47SSTX14	-2	6.76	32.2	6.9
IS47SDTX01	-3	6.33	31.4	9.0
IS47SDTX02	-4	6.54	12.7	0.3
IS47SATX08	-5	5.61	6.6	2.9
IS47SSTX06	-6	6.20	6.0	1.4
IS47SSTX12	-7	5.79	9.7	2.2
IS47SSTX04	-8	4.62	24.8	3.5
IS47SSTX02	-9	6.26	4.3	2.1
IS47SSTX10	-10	6.61	9.8	4.8
BGDSSTX03	-11	4.61	12.6	7.1

TABLE 3. Summary of Day 28 *E. fetida* Survival *vs* Laboratory Control. CTO-066 Site 47 Ecological Risk Assessment. CH2M Hill. September 2004.

Sample Description	ESI ID	Mean Survival %	Normal Distribution	Homogeneous Variance	t-Statistics			Statistically Significant Difference in Survival
					t Value	Critical t Value	p Value	
Lab Control	Lab	97.5	-	-	-	-	-	-
IS47SDTX04	-1	100.0	-	-	-	-	-	NO
IS47SSTX14	-2	100.0	-	-	-	-	-	NO
IS47SDTX01	-3	100.0	-	-	-	-	-	NO
IS47SDTX02	-4	92.5	Normal	Equal	0.9072	1.9432	0.1996	NO
IS47SATX08	-5	100.0	-	-	-	-	-	NO
IS47SSTX06	-6	100.0	-	-	-	-	-	NO
IS47SSTX12	-7	100.0	-	-	-	-	-	NO
IS47SSTX04	-8	100.0	-	-	-	-	-	NO
IS47SSTX02	-9	100.0	-	-	-	-	-	NO
IS47SSTX10	-10	100.0	-	-	-	-	-	NO
BGDSSTX03	-11	100.0	-	-	-	-	-	NO

TABLE 4. Summary of Day 28 *E. fetida* Survival *vs* Reference Soil BGDSSTX03. CTO-066 Site 47 Ecological Risk Assessment. CH2M Hill. September 2004.

Sample Description	ESI ID	Mean Survival %	Normal Distribution	Homogeneous Variance	t-Statistics			Statistically Significant Difference in Survival
					t Value	Critical t Value	p Value	
Lab Control	Lab	97.5	-	-	-	-	-	-
IS47SDTX04	-1	100.0	-	-	-	-	-	NO
IS47SSTX14	-2	100.0	-	-	-	-	-	NO
IS47SDTX01	-3	100.0	-	-	-	-	-	NO
IS47SDTX02	-4	92.5	Normal	Equal	1.5918	1.9432	0.0813	NO
IS47SATX08	-5	100.0	-	-	-	-	-	NO
IS47SSTX06	-6	100.0	-	-	-	-	-	NO
IS47SSTX12	-7	100.0	-	-	-	-	-	NO
IS47SSTX04	-8	100.0	-	-	-	-	-	NO
IS47SSTX02	-9	100.0	-	-	-	-	-	NO
IS47SSTX10	-10	100.0	-	-	-	-	-	NO
BGDSSTX03	-11	100.0	-	-	-	-	-	-

Note: Statistical significance evaluated at α=0.05; in cases were the evaluated endpoint was equal to or greater that experienced in the reference soil, no statistical analysis was conducted.

TABLE 5. Summary of Day 28 *E. fetida* Growth *vs* Laboratory Control. CTO-066 Site 47 Ecological Risk Assessment. CH2MHill. September 2004.

Sample Description	ESI ID	Mean Growth (mg/worm)	Normal Distribution	Homogeneous Variance	t-Statistics			Statistically Significant Difference in Growth
					t Value	Critical t Value	p Value	
Lab Control	Lab	190	-	-	-	-	-	-
IS47SDTX04	-1	180	Normal	Equal	1.9872	1.9432	0.0713	No
IS47SSTX14	-2	235	-	-	-	-	-	No
IS47SDTX01	-3	180	Normal	Equal	0.8442	1.9432	0.2155	No
IS47SDTX02	-4	178	Normal	Equal	1.0679	1.9432	0.1633	No
IS47SATX08	-5	248	-	-	-	-	-	No
IS47SSTX06	-6	183	Normal	Equal	0.4388	1.9432	0.3381	No
IS47SSTX12	-7	200	-	-	-	-	-	No
IS47SSTX04	-8	233	-	-	-	-	-	No
IS47SSTX02	-9	233	-	-	-	-	-	No
IS47SSTX10	-10	238	-	-	-	-	-	No
BGDSSTX03	-11	243	-	-	-	-	-	No

TABLE 6. Summary of Day 28 *E. fetida* Growth *vs* Reference Soil BGDSSTX03. CTO-066 Site 47 Ecological Risk Assessment. CH2M Hill. September 2004.

Sample Description	ESI ID	Mean Growth (mg/worm)	Normal Distribution	Homogeneous Variance	t-Statistics			Statistically Significant Difference in Growth
					t Value	Critical t Value	p Value	
Lab Control	Lab	190	-	-	-	-	-	-
IS47SDTX04	-1	180	Normal	Equal	2.4398	1.9432	0.0252	YES
IS47SSTX14	-2	235	Normal	Equal	0.2683	1.9432	0.3987	NO
IS47SDTX01	-3	180	Normal	Equal	2.2727	1.9432	0.0317	YES
IS47SDTX02	-4	178	Normal	Equal	2.3626	1.9432	0.0280	YES
IS47SATX08	-5	248	-	-	-	-	-	NO
IS47SSTX06	-6	183	Normal	Equal	2.0047	1.9432	0.0459	YES
IS47SSTX12	-7	200	Normal	Equal	1.5455	1.9432	0.0866	NO
IS47SSTX04	-8	233	Normal	Equal	0.3341	1.9432	0.3748	NO
IS47SSTX02	-9	233	Normal	Equal	0.3885	1.9432	0.3555	NO
IS47SSTX10	-10	238	Normal	Equal	0.1873	1.9432	0.4288	NO
BGDSSTX03	-11	243	-	-	-	-	-	-

Note: Statistical significance evaluated at α=0.05; in cases were the evaluated endpoint was equal to or greater that experienced in the reference soil, no statistical analysis was conducted.

TABLE 7. Summary of Day 28 *E. fetida* Reproduction Data. CTO-066 Site 47 Ecological Risk Assessment. CH2M Hill. September 2004.

Sample Description	ESI ID	Juveniles (Mean/replicate)	Cocoons (Mean/replicate)	Indication of Reproduction
Lab Control	Lab	0	2.00	Yes
IS47SDTX04	-1	0	1.00	Yes
IS47SSTX14	-2	0	0	No
IS47SDTX01	-3	0	3.25	Yes
IS47SDTX02	-4	0	0	No
IS47SATX08	-5	0	1.75	Yes
IS47SSTX06	-6	0	0.25	Yes
IS47SSTX12	-7	0	1.00	Yes
IS47SSTX04	-8	0	2.75	Yes
IS47SSTX02	-9	0	6.00	Yes
IS47SSTX10	-10	0.75	3.25	Yes
BGDSSTX03	-11	0	1.25	Yes

TABLE 8. Summary of Reference Toxicant Data. CTO-066 Site 47 Ecological Risk Assessment. CH2M Hill. September 2004.

Results are Expressed as ppm Cadmium

Species	Date	Endpoint	Result	Historic Mean	Number of Tests	±1 STD Deviation	±2 STD Deviations
E. fetida	08/23/04	LC-50	2818	1668	23	1385	2771

Note: Reference toxicant testing was conducted at ESI. The historic mean for *E. fetida* survival represents the mean determined from the ESI-conducted reference toxicant testing database.

TABLE 9a. Summary of Day 28 *E. fetida* Bioaccumulation Data. CTO-066 Site 47 Ecological Risk Assessment. CH2M Hill. September 2004.

PARAMETER	UNITS	Lab Control 12571-001		IS47SDTX04 12571-002		IS47SSTX14 12571-003	
		Result	Quant Limit	Result	Quant Limit	Result	Quant Limit
Aluminum, total	µg/g	180	0.2	330	0.2	840	0.1
Antimony, total	µg/g	ND	0.09	ND	0.09	ND	0.07
Arsenic, total	µg/g	3.2	0.09	2.1	0.09	1.3	0.07
Barium, total	µg/g	0.71	0.02	2.1	0.02	3.9	0.01
Beryllium, total	µg/g	ND	0.02	ND	0.02	0.028	0.01
Cadmium, total	µg/g	0.21	0.02	0.30	0.02	1.1	0.01
Calcium, total	µg/g	760	0.5	470	0.5	520	0.3
Chromium, total	µg/g	0.25	0.04	0.71	0.04	1.4	0.03
Cobalt, total	µg/g	0.85	0.09	1.3	0.09	1.1	0.07
Copper, total	µg/g	1.4	0.04	1.6	0.04	1.7	0.03
Iron, total	µg/g	16	0.09	350	0.09	630	0.07
Lead, total	µg/g	0.26	0.09	1.5	0.09	4.3	0.07
Magnesium, total	µg/g	370	0.5	150	0.5	170	0.3
Manganese, total	µg/g	1.2	0.09	6.6	0.09	3.9	0.07
Mercury, total	µg/g	ND	0.07	0.087	0.07	0.078	0.07
Nickel, total	µg/g	0.15	0.05	0.43	0.05	1.0	0.03
Potassium, total	µg/g	1300	5	1200	5	1100	3
Selenium, total	µg/g	2.1	0.09	ND	0.09	ND	0.07
Silver, total	µg/g	ND	0.4	ND	0.4	ND	0.4
Sodium, total	µg/g	860	9	700	9	800	7
Thallium, total	µg/g	ND	0.09	ND	0.09	ND	0.07
Vanadium, total	µg/g	1.1	0.5	1.5	0.5	3.0	0.3
Zinc, total	µg/g	14	0.04	14	0.04	18	0.03

TABLE 9b. Summary of Day 28 *E. fetida* Bioaccumulation Data. CTO-066 Site 47 Ecological Risk Assessment. CH2M Hill. September 2004.

PARAMETER	UNITS	IS47SDTX01 12571-004		IS47SDTX02 12571-005		IS47SATX08 12571-006	
		Result	Quant Limit	Result	Quant Limit	Result	Quant Limit
Aluminum, total	µg/g	1100	0.2	180	0.2	590	0.3
Antimony, total	µg/g	ND	0.09	ND	0.1	ND	0.1
Arsenic, total	µg/g	0.84	0.09	4.0	0.1	0.45	0.1
Barium, total	µg/g	4.0	0.02	1.9	0.02	5.1	0.03
Beryllium, total	µg/g	0.032	0.02	ND	0.02	0.031	0.03
Cadmium, total	µg/g	0.88	0.02	0.37	0.02	2.2	0.03
Calcium, total	µg/g	570	0.4	490	0.5	500	0.6
Chromium, total	µg/g	1.9	0.03	0.38	0.04	1.2	0.05
Cobalt, total	µg/g	1.1	0.09	0.95	0.1	0.97	0.1
Copper, total	µg/g	2.5	0.03	2.0	0.04	1.6	0.05
Iron, total	µg/g	920	0.09	54	0.1	700	0.1
Lead, total	µg/g	6.0	0.09	0.81	0.1	5.5	0.1
Magnesium, total	µg/g	190	0.4	120	0.5	120	0.6
Manganese, total	µg/g	4.8	0.09	1.3	0.1	27	0.1
Mercury, total	µg/g	0.15	0.07	0.1	0.07	0.23	0.07
Nickel, total	µg/g	1.0	0.04	0.45	0.05	0.97	0.06
Potassium, total	µg/g	1300	4	1200	5	990	6
Selenium, total	µg/g	ND	0.09	1.5	0.1	ND	0.1
Silver, total	µg/g	ND	0.4	ND	0.4	ND	0.4
Sodium, total	µg/g	820	9	740	10	660	10
Thallium, total	µg/g	ND	0.09	ND	0.1	ND	0.1
Vanadium, total	µg/g	3.6	0.4	0.81	0.5	3.3	0.6
Zinc, total	µg/g	22	0.03	14	0.04	16	0.05

TABLE 9. Summary of Day 28 *E. fetida* Bioaccumulation Data. CTO-066 Site 47 Ecological Risk Assessment. CH2M Hill. September 2004.

PARAMETER	UNITS	IS47SSTX06 12571-007		IS47SSTX12 12571-008		IS47SSTX04 12571-009	
		Result	Quant Limit	Result	Quant Limit	Result	Quant Limit
Aluminum, total	µg/g	210	0.2	680	0.2	750	0.1
Antimony, total	µg/g	ND	0.09	ND	0.08	ND	0.07
Arsenic, total	µg/g	2.6	0.09	1.6	0.08	2.0	0.07
Barium, total	µg/g	3.4	0.02	3.8	0.02	3.0	0.01
Beryllium, total	µg/g	ND	0.02	0.036	0.02	0.031	0.01
Cadmium, total	µg/g	0.83	0.02	0.85	0.02	0.84	0.01
Calcium, total	µg/g	530	0.4	390	0.4	400	0.3
Chromium, total	µg/g	0.95	0.04	1.6	0.03	1.1	0.03
Cobalt, total	µg/g	1.0	0.09	1.6	0.08	2.8	0.07
Copper, total	µg/g	1.4	0.04	1.7	0.03	1.3	0.03
Iron, total	µg/g	250	0.09	1000	0.08	370	0.07
Lead, total	µg/g	120	0.09	22	0.08	4.9	0.07
Magnesium, total	µg/g	210	0.4	150	0.4	150	0.3
Manganese, total	µg/g	8.4	0.09	26	0.08	3.2	0.07
Mercury, total	µg/g	1.9	0.07	ND	0.07	ND	0.07
Nickel, total	µg/g	1.0	0.04	0.7	0.04	1.0	0.03
Potassium, total	µg/g	1300	4	940	4	1100	3
Selenium, total	µg/g	ND	0.09	ND	0.08	ND	0.07
Silver, total	µg/g	ND	0.4	ND	0.4	ND	0.4
Sodium, total	µg/g	680	9	610	8	750	7
Thallium, total	µg/g	ND	0.09	ND	0.08	ND	0.07
Vanadium, total	µg/g	1.4	0.4	3.1	0.4	2.3	0.3
Zinc, total	µg/g	28	0.04	18	0.03	17	0.03

TABLE 9d. Summary of Day 28 *E. fetida* Bioaccumulation Data. CTO-066 Site 47 Ecological Risk Assessment. CH2M Hill. September 2004.

PARAMETER	UNITS	IS47SSTX02 12571-010		IS47SSTX10 12571-011		BGDSSTX03 12571-012	
		Result	Quant Limit	Result	Quant Limit	Result	Quant Limit
Aluminum, total	µg/g	700	0.1	970	0.1	720	0.3
Antimony, total	µg/g	ND	0.07	ND	0.06	ND	0.1
Arsenic, total	µg/g	0.81	0.07	ND	0.06	0.60	0.1
Barium, total	µg/g	5.3	0.01	4.3	0.01	4.9	0.03
Beryllium, total	µg/g	0.037	0.01	0.036	0.01	0.044	0.03
Cadmium, total	µg/g	4.7	0.01	4.1	0.01	0.45	0.03
Calcium, total	µg/g	420	0.3	530	0.3	390	0.7
Chromium, total	µg/g	1.7	0.03	2.9	0.03	1.0	0.05
Cobalt, total	µg/g	1.5	0.07	1.2	0.06	2.1	0.1
Copper, total	µg/g	1.7	0.03	4.2	0.03	1.4	0.05
Iron, total	µg/g	1000	0.07	1400	0.06	620	0.1
Lead, total	µg/g	15	0.07	21	0.06	5.4	0.1
Magnesium, total	µg/g	160	0.3	200	0.3	130	0.7
Manganese, total	µg/g	38	0.07	42	0.06	77	0.1
Mercury, total	µg/g	0.76	0.07	1.6	0.07	ND	0.07
Nickel, total	µg/g	0.87	0.03	1.1	0.03	0.84	0.07
Potassium, total	µg/g	960	3	1000	3	1000	7
Selenium, total	µg/g	ND	0.07	ND	0.06	ND	0.1
Silver, total	µg/g	ND	0.4	ND	0.4	ND	0.4
Sodium, total	µg/g	620	7	700	6	710	10
Thallium, total	µg/g	ND	0.07	ND	0.06	ND	0.1
Vanadium, total	µg/g	3.0	0.3	4.2	0.3	3.5	0.7
Zinc, total	µg/g	21	0.03	45	0.03	13	0.05

APPENDIX A
RAW DATA AND STATISTICAL SUPPORT

Contents	Number of Pages
E. fetida Daily Temperature and Observations	1
E. fetida 28 Day Survival Bench Sheets	4
Survival Summary	1
Reproduction Summary	1
Survival Statistics	23
E. fetida 28 Day Wet Weight Bench Sheet	2
E. fetida Initial Worm Weight	1
Growth Summary	1
Growth Statistics	23
Soil pH	1
Total Organic Content Data Sheets	2
Percent Moisture Data Sheets	2
Temperature Recorder Data	1
Trace Metals Report Data	18
Sample Receipt Record	2
Chain of Custody	2
Total Pages	85

Eisenia fetida Survival Assay

STUDY NUMBER: 12415 Indian Head **CLIENT:** CH2MHill
START DATE: 08/23/04

DAY	DATE	TEMP (°C) INC # 1	INITIALS	GENERAL OBSERVATIONS
0	8/23/04	22	BB	
1	8/24/04	20	✓	
2	8/25/04	20	PS	
3	8/26/04	19	BB	
4	8/27/04	19	PS	
5 8/28	~~8/27/04~~	19	CW	
6 8/29	~~8/28/04~~	19	✓	
7	8/30/04	19	BB	
8	8/31/04	20	BB	
9	9/1/04	20	BB	
10	9/02/04	20	PS	
11	9/03/04	20	PS	
12	9/04/04	20	CW	
13	9/5/04	20	LM	
14	9/6/04	Not	Recorded - Holiday	
15	9/7/04	20	BB	
16	9/08/04	20	PS	
17	9/9/04	20	✓	
18	9/10/04	20	PS	
19	9/11/04	20	CW	
20	9/12/04	20	BB	
21	9/13/04	20	PS	
22	9/14/04	20	BB	
23	9/15/04	20	BB	
24	9/16/04	20	✓	
25	9/17/04	20	PS	
26	9/18/04	20	CW	
27	9/19/04	20	LM	
28	9/20/04	20	✓	

NOTES:
Value recorded here is incubator temperature. "Telatemp" unit is continuously recording vessel temperature.

Eisenia fetida Survival Assay

STUDY NUMBER: 12415 CLIENT: CH2MHill Indian Head

DAY 28

SAMPLE ID	TIME	# LIVE	JUVENILE	COCOON	COMMENTS
LAB A	0958	10		4	
LAB B	1012	10		III 3	
LAB C	1023	III 10		0	
LAB D	1032	III 9		1	
1 A	1043	~~IIII~~ ~~IIII~~ 10		I 1	
1 B	1052	10		1	
1 C	1103	10		2	
1 D	1110	10		0	
4 A	1124	8		0	
4 B	1135	9		0	
4 C	1144	~~IIII~~ ~~IIII~~ 10		0	
4 D	1151	10		0	
6 A	1203	III 10		0	
6 B	1212	10		0	
6 C	1219	10		1	
6 D	1225	~~IIII~~ 10		0	

ANALYST: PS

DATE: 9/20/04

Eisenia fetida Survival Assay

STUDY NUMBER: 12415 **CLIENT:** CH2MHill Indian Head

DAY 28

SAMPLE ID	TIME	# LIVE	JUVENILE	COCOON	COMMENTS
-2A	1103	10			
-2B	1057	10			
-2C	1053	10			
-2D	1107	10			
-3A	1118	10		2	
-3B	1126	10		3	
-3C	1137	10		3	
-3D	1143	10		5	
-5A	1200	10		4	
-5B	1232	10		1	
-5C	1238	10			
-5D	1243	10		2	
-7A	1256	10		1	
-7B	1308	10		2	
-7C	1316	10			
-7D	1322	10		1	

ANALYST: _____

DATE: 9/20/04

Eisenia fetida Survival Assay

STUDY NUMBER: 12415 **CLIENT:** CH2MHill Indian Head

DAY 28

SAMPLE ID	TIME	# LIVE	JUVENILE	COCOON	COMMENTS
-9A	1330	10		5	
-9B	1337	10			
-9C	1346	10		6	

ANALYST: [illegible]
DATE: 9/20/24

Eisenia fetida Survival Assay

STUDY NUMBER: 12415 **CLIENT:** CH2MHill Indian Head

DAY 28

SAMPLE ID	TIME	# LIVE	JUVENILE	COCOON	COMMENTS
8A	1:25	10	0	3	
8B	1:50	10	0	2	
8C	2:10	10	0	2	
8D	2:20	10	0	4	
9D	2:34	10	0	13	
10A	2:44	10	0	2	
10B	2:51	10	0	4	
10C	3:02	10	3	4	
10D	3:11	10	0	3	
11A	3:19	10	0	3	
11B	3:27	10	0	2	
11C	3:36	10	0	0	
11D	3:44	10	0	0	

ANALYST: Brent Arbogast BA

DATE: 9/20/04

STUDY: 12415
CLIENT: CH2M Hill
PROJECT: Indian Head - CTO-066 Site 47 Evaluation
TASK: Eisenia fetida 28-day Exposure Assay
DATA: Survival Data
START DATE: 08/23/04

Sample Site	ESI Ref	Rep	Number Recovered	Percent Recovery	Mean Recovery	Compared Against	Distribution	Variance	t Value	Critical t Value	p Value	Significant Difference In Survival (Less Than)
Lab Control	0	A	10	100%	97.5%	LAB	-	-	-	-	-	
		B	10	100%								
		C	10	100%								
		D	9	90%								
IS47SDTX04	-1	A	10	100%	100.0%	LAB	Non-Normal	Equal	6.0000	-	0.6571	NO
		B	10	100%		BGDSSTX03	-	Unequal	8.0000	-	0.4429	NO
		C	10	100%								
		D	10	100%								
IS47SSTX14	-2	A	10	100%	100.0%	LAB	Non-Normal	Equal	6.0000	-	0.6571	NO
		B	10	100%		BGDSSTX03	-	Unequal	8.0000	-	0.4429	NO
		C	10	100%								
		D	10	100%								
IS47SDTX01	-3	A	10	100%	100.0%	LAB	Non-Normal	Equal	6.0000	-	0.6571	NO
		B	10	100%		BGDSSTX03	-	Unequal	8.0000	-	0.4429	NO
		C	10	100%								
		D	10	100%								
IS47SDTX02	-4	A	8	80%	92.5%	LAB	Normal	Equal	0.9072	1.9432	0.1996	NO
		B	9	90%		BGDSSTX03	Normal	Equal	1.5918	1.9432	0.0813	NO
		C	10	100%								
		D	10	100%								
IS47SATX08	-5	A	10	100%	100.0%	LAB	Non-Normal	Equal	6.0000	-	0.6571	NO
		B	10	100%		BGDSSTX03	-	Unequal	8.0000	-	0.4429	NO
		C	10	100%								
		D	10	100%								
IS47SSTX06	-6	A	10	100%	100.0%	LAB	Non-Normal	Equal	6.0000	-	0.6571	NO
		B	10	100%		BGDSSTX03	-	Unequal	8.0000	-	0.4429	NO
		C	10	100%								
		D	10	100%								
IS47SSTX12	-7	A	10	100%	100.0%	LAB	Non-Normal	Equal	6.0000	-	0.6571	NO
		B	10	100%		BGDSSTX03	-	Unequal	8.0000	-	0.4429	NO
		C	10	100%								
		D	10	100%								
IS47SSTX04	-8	A	10	100%	100.0%	LAB	Non-Normal	Equal	6.0000	-	0.6571	NO
		B	10	100%		BGDSSTX03	-	Unequal	8.0000	-	0.4429	NO
		C	10	100%								
		D	10	100%								
IS47SSTX02	-9	A	10	100%	100.0%	LAB	Non-Normal	Equal	6.0000	-	0.6571	NO
		B	10	100%		BGDSSTX03	-	Unequal	8.0000	-	0.4429	NO
		C	10	100%								
		D	10	100%								
IS47SSTX10	-10	A	10	100%	100.0%	LAB	Non-Normal	Equal	6.0000	-	0.6571	NO
		B	10	100%		BGDSSTX03	-	Unequal	8.0000	-	0.4429	NO
		C	10	100%								
		D	10	100%								
BGDSSTX03	-11	A	10	100%	100.0%	LAB	Non-Normal	Equal	6.0000		0.6571	NO
		B	10	100%								
		C	10	100%								
		D	10	100%								

STUDY: 12415
CLIENT: CH2M Hill
PROJECT: Indian Head - CTO-066 Site 47 Evaluation
TASK: Eisenia fetida 28-day Exposure Assay
DATA: Reproduction Data
START DATE: 08/23/04

Sample Site	ESI Ref	Rep	Juveniles	Mean	Cocoons	Mean	Sign of Reproduction
Lab Control	0	A	0	0.00	4	2.00	Yes
		B	0		3		
		C	0		0		
		D	0		1		
IS47SDTX04	-1	A	0	0.00	1	1.00	Yes
		B	0		1		
		C	0		2		
		D	0		0		
IS47SSTX14	-2	A	0	0.00	0	0.00	No
		B	0		0		
		C	0		0		
		D	0		0		
IS47SDTX01	-3	A	0	0.00	2	3.25	Yes
		B	0		3		
		C	0		3		
		D	0		5		
IS47SDTX02	-4	A	0	0.00	0	0.00	No
		B	0		0		
		C	0		0		
		D	0		0		
IS47SATX08	-5	A	0	0.00	4	1.75	Yes
		B	0		1		
		C	0		0		
		D	0		2		
IS47SSTX06	-6	A	0	0.00	0	0.25	Yes
		B	0		0		
		C	0		1		
		D	0		0		
IS47SSTX12	-7	A	0	0.00	1	1.00	No
		B	0		2		
		C	0		0		
		D	0		1		
IS47SSTX04	-8	A	0	0.00	3	2.75	Yes
		B	0		2		
		C	0		2		
		D	0		4		
IS47SSTX02	-9	A	0	0.00	5	6.00	Yes
		B	0		0		
		C	0		6		
		D	0		13		
IS47SSTX10	-10	A	0	0.75	2	3.25	Yes
		B	0		4		
		C	3		4		
		D	0		3		
BGDSSTX03	-11	A	0	0.00	3	1.25	No
		B	0		2		
		C	0		0		
		D	0		0		

CETIS Test Summary

Report Date: 09 Nov-04 10:19 AM
Link: 09-7231-5738

Eisenia 28-d Survival and Growth Soil Test — **EnviroSystems, Inc.**

Test No:	16-0459-1726	**Test Type:**	Survival-Growth	**Duration:**	28d 0h
Start Date:	23 Aug-04 12:00 PM	**Protocol:**	EPA/600/R-92/183 (1992)	**Species:**	Eisenia fetida
Ending Date:	20 Sep-04 12:00 PM	**Dil Water:**	Not Applicable	**Source:**	In-House Culture
Setup Date:	23 Aug-04 12:00 PM	**Brine:**	Not Applicable		

Sample No:	01-8612-5475	**Material:**	Soil	**Client:**	CH2M Hill
Sample Date:		**Code:**	12415-00	**Project:**	Ecologcal Risk Assessment
Receive Date:		**Source:**	Indian Head Site 47 - CTO-066		
Sample Age:	N/A	**Station:**	Lab Control / 12415-00		
Sample No:	04-2012-2455	**Material:**	Soil	**Client:**	CH2M Hill
Sample Date:	10 Aug-04	**Code:**	12415-01	**Project:**	Ecologcal Risk Assessment
Receive Date:	11 Aug-04	**Source:**	Indian Head Site 47 - CTO-066		
Sample Age:	13d 12h (4 °C)	**Station:**	IS47SDTX04 / 12415-01		
Sample No:	10-1333-4070	**Material:**	Soil	**Client:**	CH2M Hill
Sample Date:	10 Aug-04	**Code:**	12415-02	**Project:**	Ecologcal Risk Assessment
Receive Date:	11 Aug-04	**Source:**	Indian Head Site 47 - CTO-066		
Sample Age:	13d 12h (4 °C)	**Station:**	IS47SSTX14 / 12415-02		
Sample No:	10-2943-4655	**Material:**	Soil	**Client:**	CH2M Hill
Sample Date:	10 Aug-04	**Code:**	12415-03	**Project:**	Ecologcal Risk Assessment
Receive Date:	11 Aug-04	**Source:**	Indian Head Site 47 - CTO-066		
Sample Age:	13d 12h (4 °C)	**Station:**	IS47SDTX01 / 12415-03		
Sample No:	01-9987-0246	**Material:**	Soil	**Client:**	CH2M Hill
Sample Date:	10 Aug-04	**Code:**	12415-04	**Project:**	Ecologcal Risk Assessment
Receive Date:	11 Aug-04	**Source:**	Indian Head Site 47 - CTO-066		
Sample Age:	13d 12h (4 °C)	**Station:**	IS47SDTX02 / 12415-04		
Sample No:	08-8019-8138	**Material:**	Soil	**Client:**	CH2M Hill
Sample Date:	10 Aug-04	**Code:**	12415-05	**Project:**	Ecologcal Risk Assessment
Receive Date:	11 Aug-04	**Source:**	Indian Head Site 47 - CTO-066		
Sample Age:	13d 12h (4 °C)	**Station:**	IS47SATX08 / 12415-05		
Sample No:	11-7638-4246	**Material:**	Soil	**Client:**	CH2M Hill
Sample Date:	10 Aug-04	**Code:**	12415-06	**Project:**	Ecologcal Risk Assessment
Receive Date:	11 Aug-04	**Source:**	Indian Head Site 47 - CTO-066		
Sample Age:	13d 12h (4 °C)	**Station:**	IS47SSTX06 / 12415-06		
Sample No:	05-7396-0742	**Material:**	Soil	**Client:**	CH2M Hill
Sample Date:	10 Aug-04	**Code:**	12415-07	**Project:**	Ecologcal Risk Assessment
Receive Date:	11 Aug-04	**Source:**	Indian Head Site 47 - CTO-066		
Sample Age:	13d 12h (4 °C)	**Station:**	IS47SSTX12 / 12415-07		
Sample No:	01-8587-9061	**Material:**	Soil	**Client:**	CH2M Hill
Sample Date:	10 Aug-04	**Code:**	12415-08	**Project:**	Ecologcal Risk Assessment
Receive Date:	11 Aug-04	**Source:**	Indian Head Site 47 - CTO-066		
Sample Age:	13d 12h (4 °C)	**Station:**	IS47SSTX04 / 12415-08		
Sample No:	10-2211-1073	**Material:**	Soil	**Client:**	CH2M Hill
Sample Date:	10 Aug-04	**Code:**	12415-09	**Project:**	Ecologcal Risk Assessment
Receive Date:	11 Aug-04	**Source:**	Indian Head Site 47 - CTO-066		
Sample Age:	13d 12h (4 °C)	**Station:**	IS47SSTX02 / 12415-09		
Sample No:	08-1742-4032	**Material:**	Soil	**Client:**	CH2M Hill
Sample Date:	10 Aug-04	**Code:**	12415-10	**Project:**	Ecologcal Risk Assessment
Receive Date:	11 Aug-04	**Source:**	Indian Head Site 47 - CTO-066		
Sample Age:	13d 12h (4 °C)	**Station:**	IS47SSTX10 / 12415-10		

CETIS Test Summary

Report Date: 09 Nov-04 10:19 AM
Link: 09-7231-5738

Sample No:	09-6964-5923	**Material:**	Soil	**Client:**	CH2M Hill
Sample Date:	10 Aug-04	**Code:**	12415-11	**Project:**	Ecologcal Risk Assessment
Receive Date:	11 Aug-04	**Source:**	Indian Head Site 47 - CTO-066		
Sample Age:	13d 12h (4 °C)	**Station:**	BGDSSTX03 / 12415-11		

Proportion Survived Summary

Sample Code	Reps	Mean	Minimum	Maximum	SE	SD	CV
12415-00	4	0.97500	0.90000	1.00000	0.02500	0.05000	5.13%
12415-11	4	1.00000	1.00000	1.00000	0.00000	0.00000	0.00%
12415-01	4	1.00000	1.00000	1.00000	0.00000	0.00000	0.00%
12415-02	4	1.00000	1.00000	1.00000	0.00000	0.00000	0.00%
12415-03	4	1.00000	1.00000	1.00000	0.00000	0.00000	0.00%
12415-04	4	0.92500	0.80000	1.00000	0.04787	0.09574	10.35%
12415-05	4	1.00000	1.00000	1.00000	0.00000	0.00000	0.00%
12415-06	4	1.00000	1.00000	1.00000	0.00000	0.00000	0.00%
12415-07	4	1.00000	1.00000	1.00000	0.00000	0.00000	0.00%
12415-08	4	1.00000	1.00000	1.00000	0.00000	0.00000	0.00%
12415-09	4	1.00000	1.00000	1.00000	0.00000	0.00000	0.00%
12415-10	4	1.00000	1.00000	1.00000	0.00000	0.00000	0.00%

Proportion Survived Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
12415-00	1.00000	1.00000	1.00000	0.90000
12415-11	1.00000	1.00000	1.00000	1.00000
12415-01	1.00000	1.00000	1.00000	1.00000
12415-02	1.00000	1.00000	1.00000	1.00000
12415-03	1.00000	1.00000	1.00000	1.00000
12415-04	0.80000	0.90000	1.00000	1.00000
12415-05	1.00000	1.00000	1.00000	1.00000
12415-06	1.00000	1.00000	1.00000	1.00000
12415-07	1.00000	1.00000	1.00000	1.00000
12415-08	1.00000	1.00000	1.00000	1.00000
12415-09	1.00000	1.00000	1.00000	1.00000
12415-10	1.00000	1.00000	1.00000	1.00000

CETIS Analysis Detail

Eisenia 28-d Survival and Growth Soil Test — **EnviroSystems, Inc.**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Proportion Survived	Comparison	09-7231-5738	09-7231-5738	09 Nov-04 10:13 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Mann-Whitney U	C > T	Angular (Corrected)				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Modified Levene	1.00000	13.74502	0.35592	Equal Variances
Distribution	Shapiro-Wilk W	0.70640	0.74935	0.00324	Non-normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.0033199	0.0033199	1	1.00	0.35592	Non-Significant Effect
Error	0.0199195	0.0033199	6			
Total	0.02323941	0.0066398	7			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	Ties	Decision(0.05)
12415-00		12415-11	6		0.6571	1	Non-Significant Effect

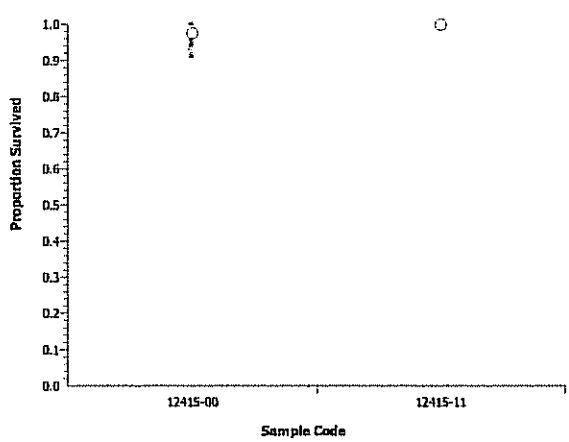
Data Summary

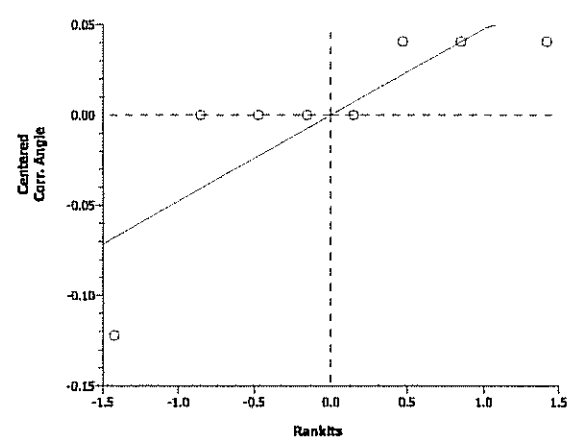
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-00	4	0.97500	0.90000	1.00000	0.05000	1.37127	1.24905	1.41202	0.08149
12415-11	4	1.00000	1.00000	1.00000	0.00000	1.41202	1.41202	1.41202	0.00027

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-00	1.00000	1.00000	1.00000	0.90000						
12415-11	1.00000	1.00000	1.00000	1.00000						

Graphics





CETIS Analysis Detail

Eisenia 28-d Survival and Growth Soil Test — **EnviroSystems, Inc.**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Proportion Survived	Comparison	09-7231-5738	09-7231-5738	09 Nov-04 10:14 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Mann-Whitney U	C > T	Angular (Corrected)				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Modified Levene	1.00000	13.74502	0.35592	Equal Variances
Distribution	Shapiro-Wilk W	0.70640	0.74935	0.00324	Non-normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.0033199	0.0033199	1	1.00	0.35592	Non-Significant Effect
Error	0.0199195	0.0033199	6			
Total	0.02323941	0.0066398	7			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	Ties	Decision(0.05)
12415-00		12415-01	6		0.6571	1	Non-Significant Effect

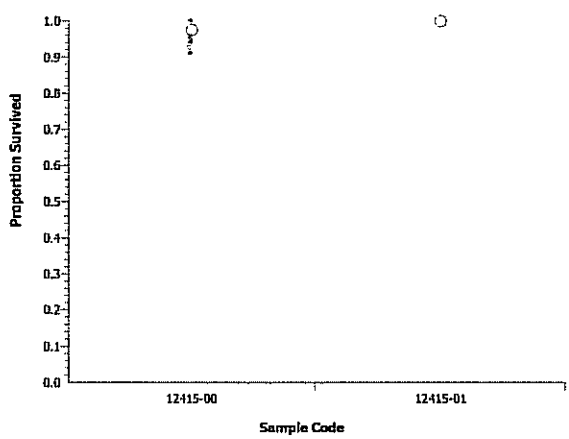
Data Summary

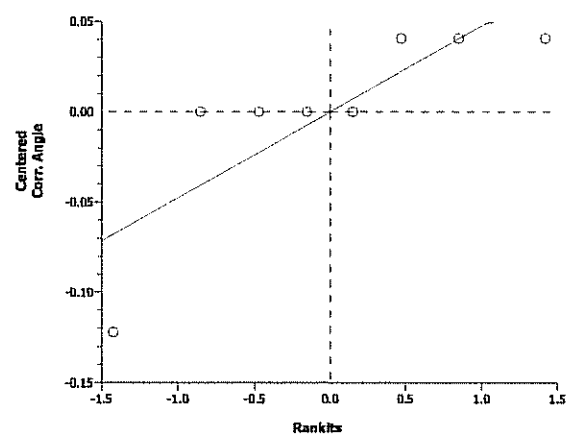
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-00	4	0.97500	0.90000	1.00000	0.05000	1.37127	1.24905	1.41202	0.08149
12415-01	4	1.00000	1.00000	1.00000	0.00000	1.41202	1.41202	1.41202	0.00027

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-00	1.00000	1.00000	1.00000	0.90000						
12415-01	1.00000	1.00000	1.00000	1.00000						

Graphics





CETIS Analysis Detail

Eisenia 28-d Survival and Growth Soil Test — **EnviroSystems, Inc.**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Proportion Survived	Comparison	09-7231-5738	09-7231-5738	09 Nov-04 10:14 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Mann-Whitney U	C > T	Angular (Corrected)				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Modified Levene	1.00000	13.74502	0.35592	Equal Variances
Distribution	Shapiro-Wilk W	0.70640	0.74935	0.00324	Non-normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.0033199	0.0033199	1	1.00	0.35592	Non-Significant Effect
Error	0.0199195	0.0033199	6			
Total	0.02323941	0.0066398	7			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	Ties	Decision(0.05)
12415-00		12415-02	6		0.6571	1	Non-Significant Effect

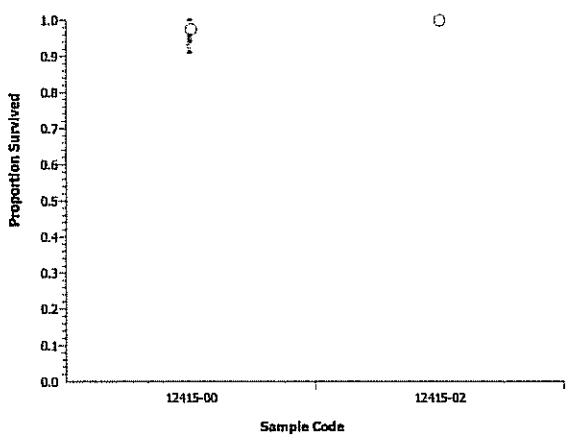
Data Summary

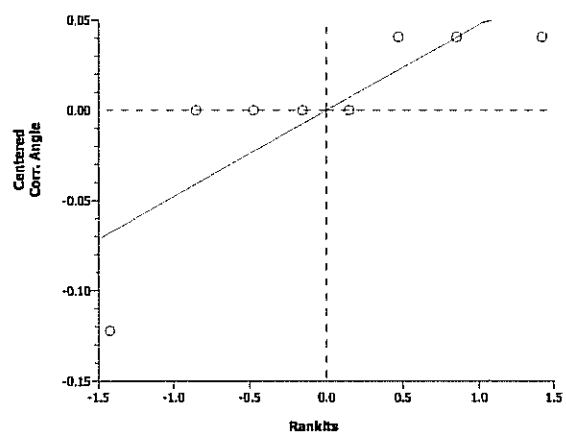
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-00	4	0.97500	0.90000	1.00000	0.05000	1.37127	1.24905	1.41202	0.08149
12415-02	4	1.00000	1.00000	1.00000	0.00000	1.41202	1.41202	1.41202	0.00027

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-00	1.00000	1.00000	1.00000	0.90000						
12415-02	1.00000	1.00000	1.00000	1.00000						

Graphics





CETIS Analysis Detail

Eisenia 28-d Survival and Growth Soil Test — **EnviroSystems, Inc.**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Proportion Survived	Comparison	09-7231-5738	09-7231-5738	09 Nov-04 10:14 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Mann-Whitney U	C > T	Angular (Corrected)				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Modified Levene	1.00000	13.74502	0.35592	Equal Variances
Distribution	Shapiro-Wilk W	0.70640	0.74935	0.00324	Non-normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.0033199	0.0033199	1	1.00	0.35592	Non-Significant Effect
Error	0.0199195	0.0033199	6			
Total	0.02323941	0.0066398	7			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	Ties	Decision(0.05)
12415-00		12415-03	6		0.6571	1	Non-Significant Effect

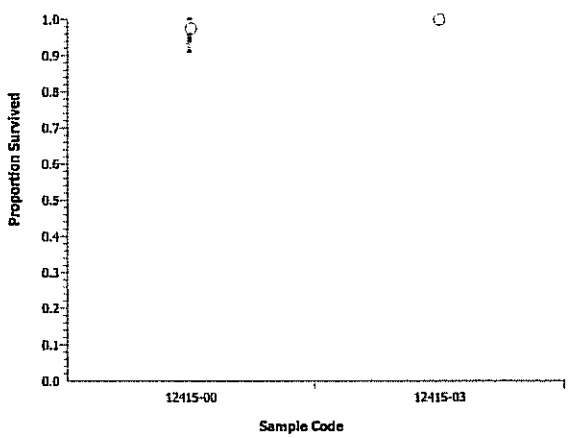
Data Summary

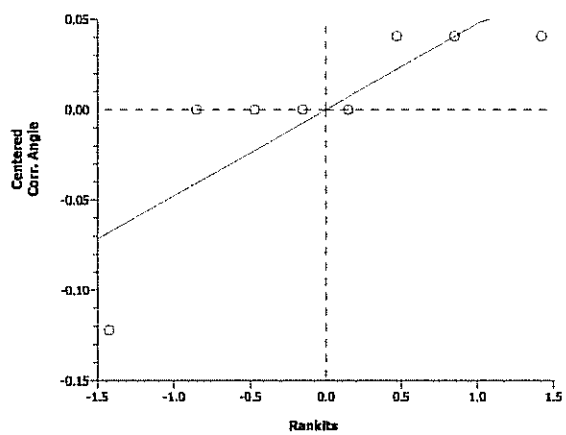
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-00	4	0.97500	0.90000	1.00000	0.05000	1.37127	1.24905	1.41202	0.08149
12415-03	4	1.00000	1.00000	1.00000	0.00000	1.41202	1.41202	1.41202	0.00027

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-00	1.00000	1.00000	1.00000	0.90000						
12415-03	1.00000	1.00000	1.00000	1.00000						

Graphics





CETIS Analysis Detail

Eisenia 28-d Survival and Growth Soil Test — **EnviroSystems, Inc.**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Proportion Survived	Comparison	09-7231-5738	09-7231-5738	09 Nov-04 10:14 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Equal Variance t	C > T	Angular (Corrected)				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	3.25236	47.46723	0.35862	Equal Variances
Distribution	Shapiro-Wilk W	0.89479	0.74935	0.24720	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.0116180	0.0116180	1	0.82	0.39928	Non-Significant Effect
Error	0.0847049	0.0141175	6			
Total	0.09632294	0.0257355	7			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-00		12415-04	0.90717	1.94318	0.1996	0.16326	Non-Significant Effect

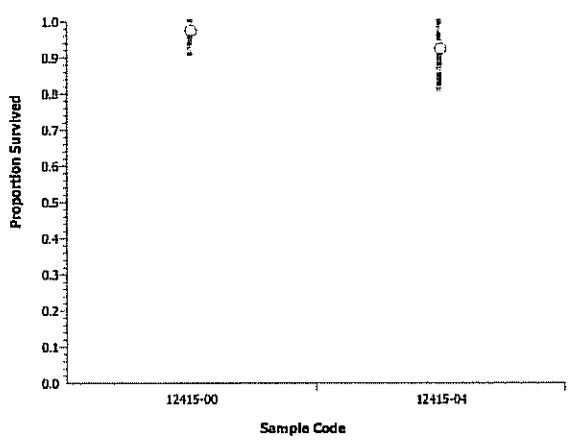
Data Summary

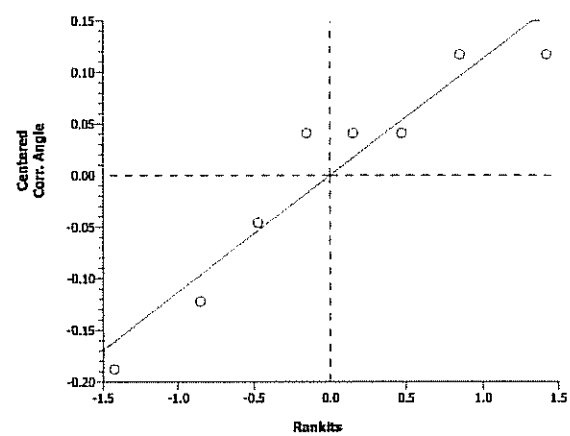
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-00	4	0.97500	0.90000	1.00000	0.05000	1.37127	1.24905	1.41202	0.08149
12415-04	4	0.92500	0.80000	1.00000	0.09574	1.29506	1.10715	1.41202	0.14695

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-00	1.00000	1.00000	1.00000	0.90000						
12415-04	0.80000	0.90000	1.00000	1.00000						

Graphics





CETIS Analysis Detail

Eisenia 28-d Survival and Growth Soil Test — **EnviroSystems, Inc.**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Proportion Survived	Comparison	09-7231-5738	09-7231-5738	09 Nov-04 10:14 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Mann-Whitney U	C > T	Angular (Corrected)				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Modified Levene	1.00000	13.74502	0.35592	Equal Variances
Distribution	Shapiro-Wilk W	0.70640	0.74935	0.00324	Non-normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.0033199	0.0033199	1	1.00	0.35592	Non-Significant Effect
Error	0.0199195	0.0033199	6			
Total	0.02323941	0.0066398	7			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	Ties	Decision(0.05)
12415-00		12415-05	6		0.6571	1	Non-Significant Effect

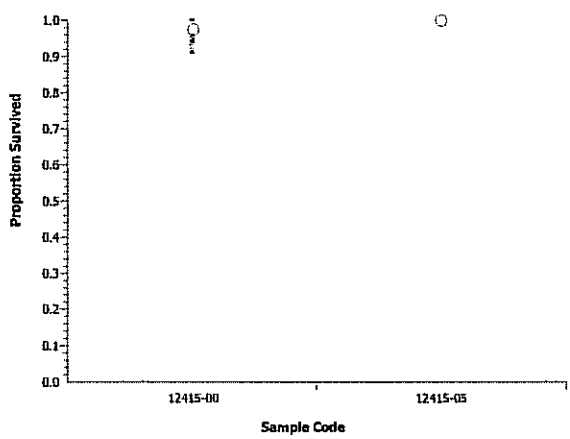
Data Summary

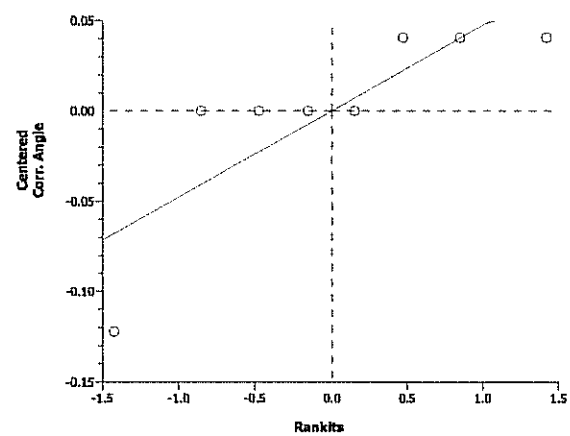
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-00	4	0.97500	0.90000	1.00000	0.05000	1.37127	1.24905	1.41202	0.08149
12415-05	4	1.00000	1.00000	1.00000	0.00000	1.41202	1.41202	1.41202	0.00027

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-00	1.00000	1.00000	1.00000	0.90000						
12415-05	1.00000	1.00000	1.00000	1.00000						

Graphics





CETIS Analysis Detail

Eisenia 28-d Survival and Growth Soil Test — **EnviroSystems, Inc.**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Proportion Survived	Comparison	09-7231-5738	09-7231-5738	09 Nov-04 10:14 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Mann-Whitney U	C > T	Angular (Corrected)				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Modified Levene	1.00000	13.74502	0.35592	Equal Variances
Distribution	Shapiro-Wilk W	0.70640	0.74935	0.00324	Non-normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.0033199	0.0033199	1	1.00	0.35592	Non-Significant Effect
Error	0.0199195	0.0033199	6			
Total	0.02323941	0.0066398	7			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	Ties	Decision(0.05)
12415-00		12415-06	6		0.6571	1	Non-Significant Effect

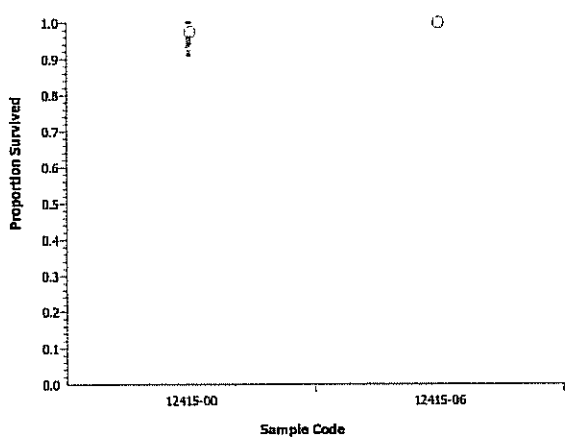
Data Summary

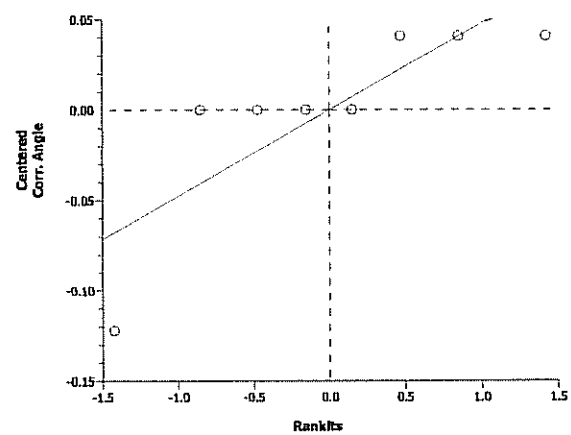
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-00	4	0.97500	0.90000	1.00000	0.05000	1.37127	1.24905	1.41202	0.08149
12415-06	4	1.00000	1.00000	1.00000	0.00000	1.41202	1.41202	1.41202	0.00027

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-00	1.00000	1.00000	1.00000	0.90000						
12415-06	1.00000	1.00000	1.00000	1.00000						

Graphics





CETIS Analysis Detail

Eisenia 28-d Survival and Growth Soil Test — **EnviroSystems, Inc.**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Proportion Survived	Comparison	09-7231-5738	09-7231-5738	09 Nov-04 10:14 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Mann-Whitney U	C > T	Angular (Corrected)				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Modified Levene	1.00000	13.74502	0.35592	Equal Variances
Distribution	Shapiro-Wilk W	0.70640	0.74935	0.00324	Non-normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.0033199	0.0033199	1	1.00	0.35592	Non-Significant Effect
Error	0.0199195	0.0033199	6			
Total	0.02323941	0.0066398	7			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	Ties	Decision(0.05)
12415-00		12415-08	6		0.6571	1	Non-Significant Effect

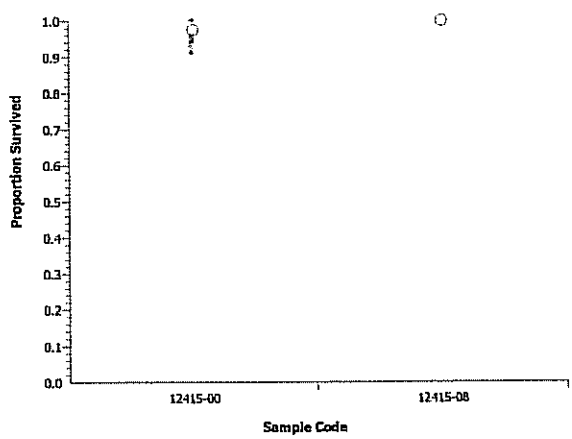
Data Summary

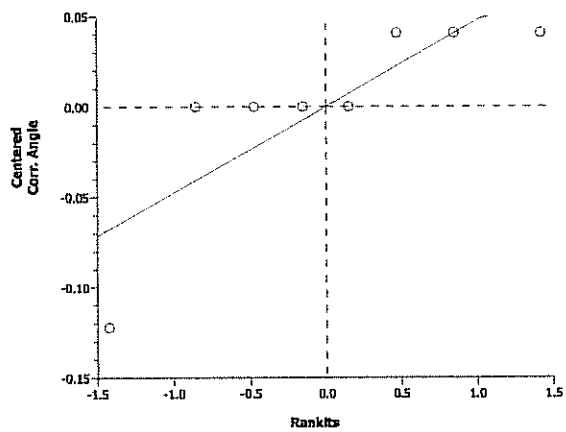
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-00	4	0.97500	0.90000	1.00000	0.05000	1.37127	1.24905	1.41202	0.08149
12415-08	4	1.00000	1.00000	1.00000	0.00000	1.41202	1.41202	1.41202	0.00027

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-00	1.00000	1.00000	1.00000	0.90000						
12415-08	1.00000	1.00000	1.00000	1.00000						

Graphics





CETIS Analysis Detail

Eisenia 28-d Survival and Growth Soil Test — **EnviroSystems, Inc.**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Proportion Survived	Comparison	09-7231-5738	09-7231-5738	09 Nov-04 10:14 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Mann-Whitney U	C > T	Angular (Corrected)				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Modified Levene	1.00000	13.74502	0.35592	Equal Variances
Distribution	Shapiro-Wilk W	0.70640	0.74935	0.00324	Non-normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.0033199	0.0033199	1	1.00	0.35592	Non-Significant Effect
Error	0.0199195	0.0033199	6			
Total	0.02323941	0.0066398	7			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	Ties	Decision(0.05)
12415-00		12415-09	6		0.6571	1	Non-Significant Effect

Data Summary

		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-00	4	0.97500	0.90000	1.00000	0.05000	1.37127	1.24905	1.41202	0.08149
12415-09	4	1.00000	1.00000	1.00000	0.00000	1.41202	1.41202	1.41202	0.00027

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-00	1.00000	1.00000	1.00000	0.90000						
12415-09	1.00000	1.00000	1.00000	1.00000						

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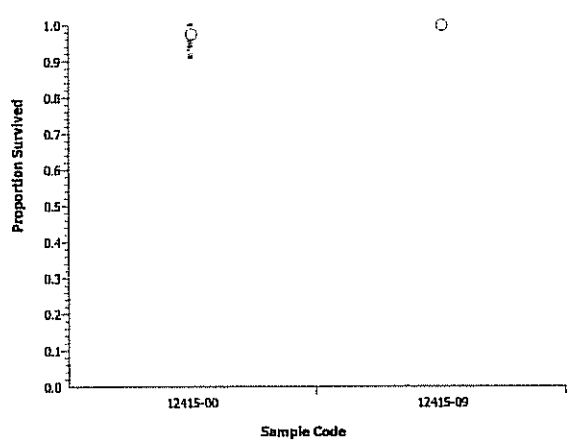
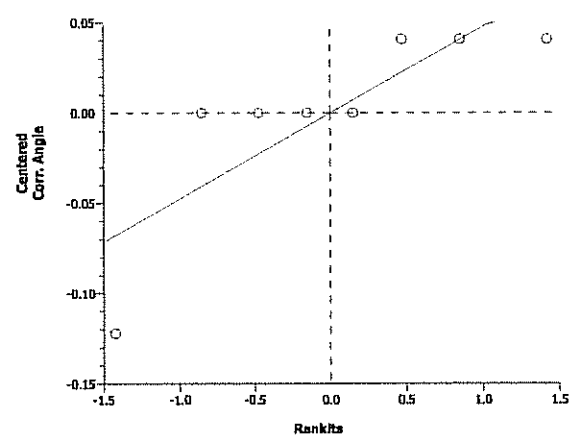




CETIS Analysis Detail

Eisenia 28-d Survival and Growth Soil Test — EnviroSystems, Inc.

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Proportion Survived	Comparison	09-7231-5738	09-7231-5738	09 Nov-04 10:14 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Mann-Whitney U	C > T	Angular (Corrected)				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Modified Levene	1.00000	13.74502	0.35592	Equal Variances
Distribution	Shapiro-Wilk W	0.70640	0.74935	0.00324	Non-normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.0033199	0.0033199	1	1.00	0.35592	Non-Significant Effect
Error	0.0199195	0.0033199	6			
Total	0.02323941	0.0066398	7			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	Ties	Decision(0.05)
12415-00		12415-10	6		0.6571	1	Non-Significant Effect

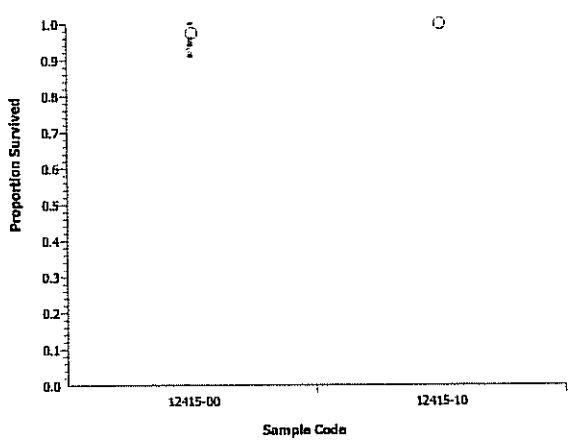
Data Summary

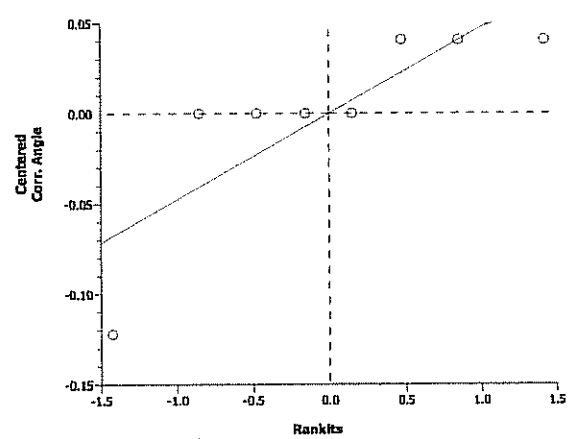
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-00	4	0.97500	0.90000	1.00000	0.05000	1.37127	1.24905	1.41202	0.08149
12415-10	4	1.00000	1.00000	1.00000	0.00000	1.41202	1.41202	1.41202	0.00027

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-00	1.00000	1.00000	1.00000	0.90000						
12415-10	1.00000	1.00000	1.00000	1.00000						

Graphics





CETIS Analysis Detail

Eisenia 28-d Survival and Growth Soil Test — **EnviroSystems, Inc.**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Proportion Survived	Comparison	09-7231-5738	09-7231-5738	09 Nov-04 10:14 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Mann-Whitney U	C > T	Angular (Corrected)				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Modified Levene	65535.00000	13.74502	0.00000	Unequal Variances

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0	0	1	65535.0	0.00000	Significant Effect
Error	0	0	6			
Total	0	0	7			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	Ties	Decision(0.05)
12415-11		12415-01	8		0.4429	1	Non-Significant Effect

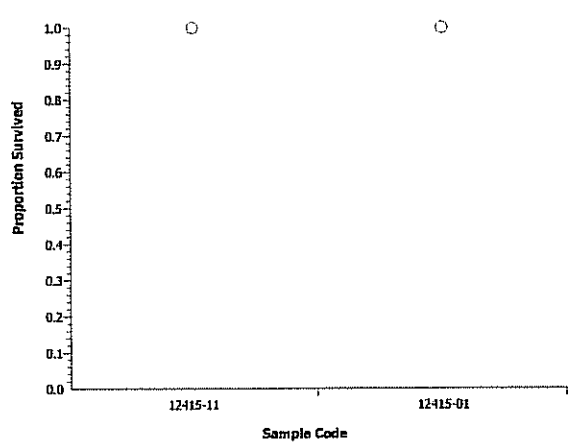
Data Summary

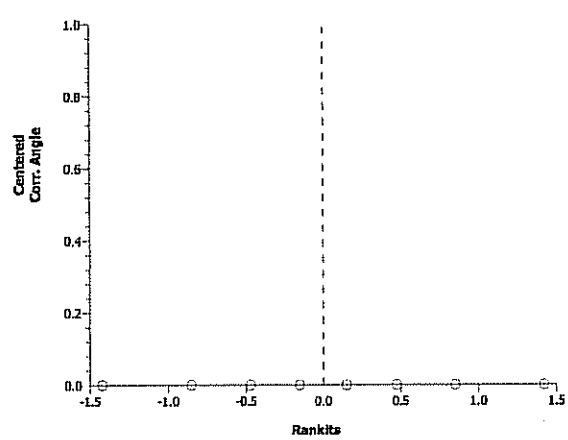
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-11	4	1.00000	1.00000	1.00000	0.00000	1.41202	1.41202	1.41202	0.00027
12415-01	4	1.00000	1.00000	1.00000	0.00000	1.41202	1.41202	1.41202	0.00027

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-11	1.00000	1.00000	1.00000	1.00000						
12415-01	1.00000	1.00000	1.00000	1.00000						

Graphics





CETIS Analysis Detail

Eisenia 28-d Survival and Growth Soil Test — EnviroSystems, Inc.

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Proportion Survived	Comparison	09-7231-5738	09-7231-5738	09 Nov-04 10:15 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Mann-Whitney U	C > T	Angular (Corrected)				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Modified Levene	65535.00000	13.74502	0.00000	Unequal Variances

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0	0	1	65535.0	0.00000	Significant Effect
Error	0	0	6			
Total	0	0	7			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	Ties	Decision(0.05)
12415-11		12415-02	8		0.4429	1	Non-Significant Effect

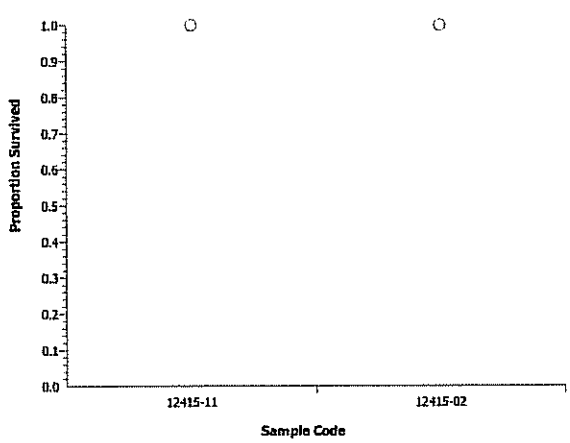
Data Summary

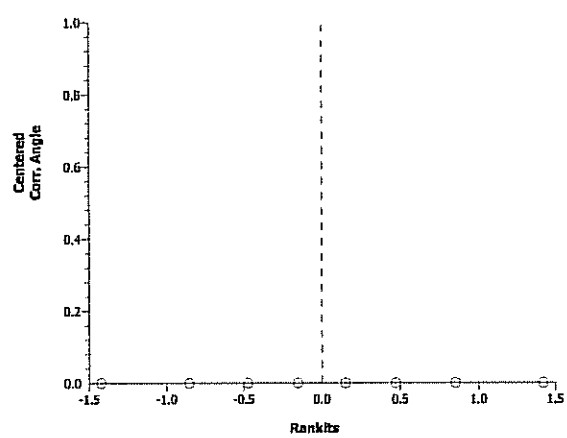
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-11	4	1.00000	1.00000	1.00000	0.00000	1.41202	1.41202	1.41202	0.00027
12415-02	4	1.00000	1.00000	1.00000	0.00000	1.41202	1.41202	1.41202	0.00027

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-11	1.00000	1.00000	1.00000	1.00000						
12415-02	1.00000	1.00000	1.00000	1.00000						

Graphics





CETIS Analysis Detail

Eisenia 28-d Survival and Growth Soil Test — EnviroSystems, Inc.

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Proportion Survived	Comparison	09-7231-5738	09-7231-5738	09 Nov-04 10:15 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Mann-Whitney U	C > T	Angular (Corrected)				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Modified Levene	65535.00000	13.74502	0.00000	Unequal Variances

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0	0	1	65535.0	0.00000	Significant Effect
Error	0	0	6			
Total	0	0	7			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	Ties	Decision(0.05)
12415-11		12415-03	8		0.4429	1	Non-Significant Effect

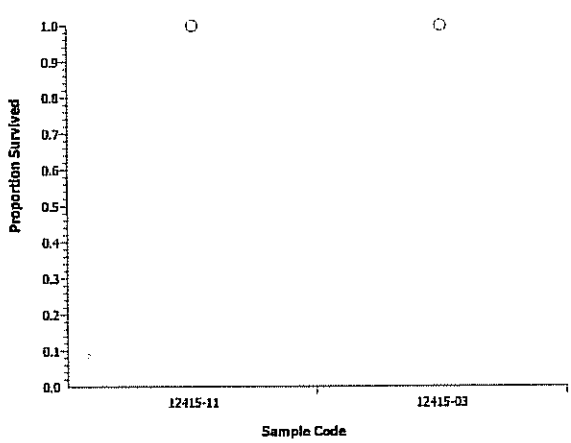
Data Summary

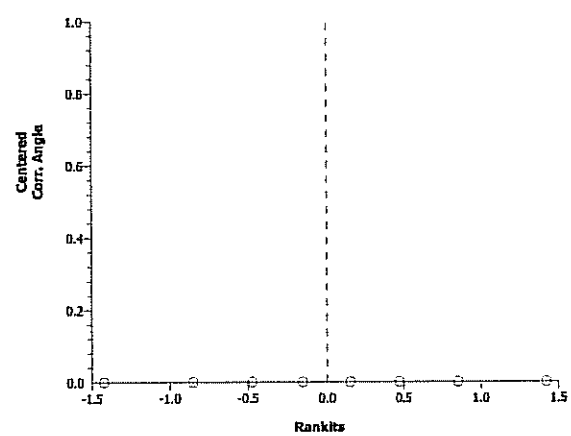
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-11	4	1.00000	1.00000	1.00000	0.00000	1.41202	1.41202	1.41202	0.00027
12415-03	4	1.00000	1.00000	1.00000	0.00000	1.41202	1.41202	1.41202	0.00027

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-11	1.00000	1.00000	1.00000	1.00000						
12415-03	1.00000	1.00000	1.00000	1.00000						

Graphics





CETIS Analysis Detail

Eisenia 28-d Survival and Growth Soil Test — **EnviroSystems, Inc.**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Proportion Survived	Comparison	09-7231-5738	09-7231-5738	09 Nov-04 10:15 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Equal Variance t	C > T	Angular (Corrected)				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Modified Levene	10.87036	13.74502	0.01647	Equal Variances
Distribution	Shapiro-Wilk W	0.86021	0.74935	0.12247	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.0273590	0.0273590	1	2.53	0.16254	Non-Significant Effect
Error	0.0647854	0.0107976	6			
Total	0.09214444	0.0381566	7			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-11		12415-04	1.5918	1.94318	0.0813	0.14278	Non-Significant Effect

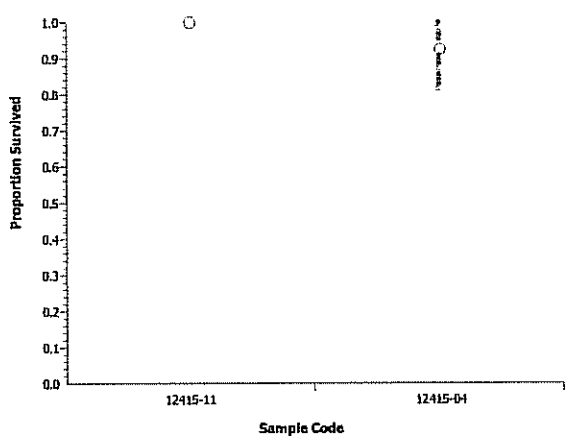
Data Summary

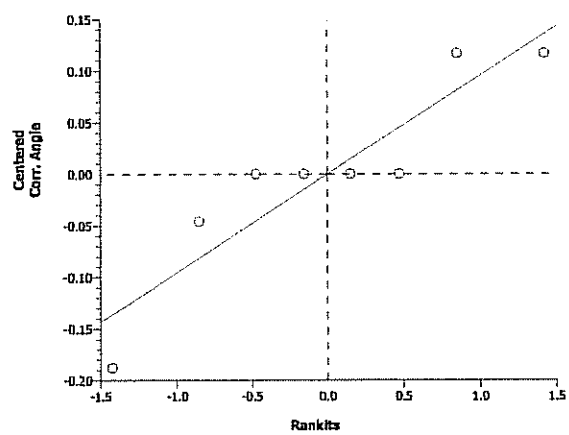
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-11	4	1.00000	1.00000	1.00000	0.00000	1.41202	1.41202	1.41202	0.00027
12415-04	4	0.92500	0.80000	1.00000	0.09574	1.29506	1.10715	1.41202	0.14695

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-11	1.00000	1.00000	1.00000	1.00000						
12415-04	0.80000	0.90000	1.00000	1.00000						

Graphics





CETIS Analysis Detail

Eisenia 28-d Survival and Growth Soil Test — EnviroSystems, Inc.

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Proportion Survived	Comparison	09-7231-5738	09-7231-5738	09 Nov-04 10:15 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Mann-Whitney U	C > T	Angular (Corrected)				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Modified Levene	65535.00000	13.74502	0.00000	Unequal Variances

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0	0	1	65535.0	0.00000	Significant Effect
Error	0	0	6			
Total	0	0	7			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	Ties	Decision(0.05)
12415-11		12415-05	8		0.4429	1	Non-Significant Effect

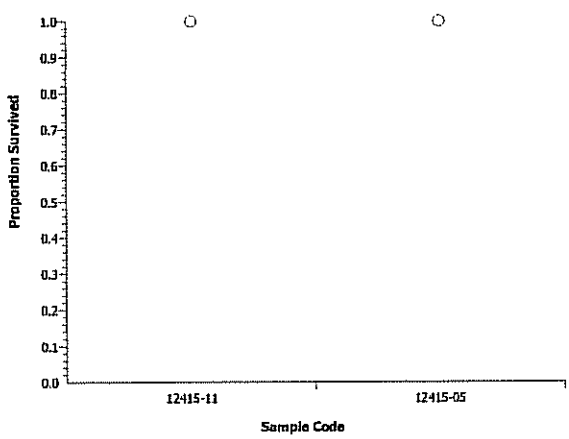
Data Summary

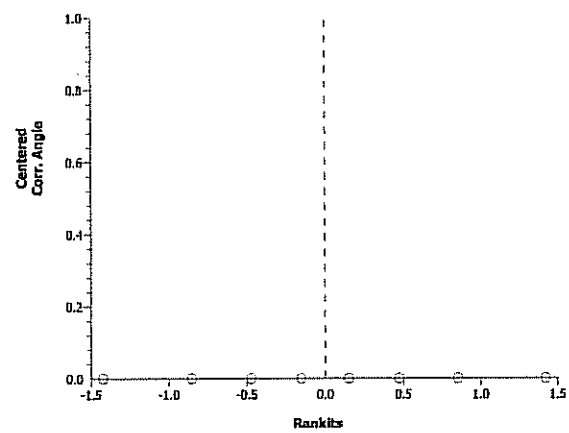
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-11	4	1.00000	1.00000	1.00000	0.00000	1.41202	1.41202	1.41202	0.00027
12415-05	4	1.00000	1.00000	1.00000	0.00000	1.41202	1.41202	1.41202	0.00027

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-11	1.00000	1.00000	1.00000	1.00000						
12415-05	1.00000	1.00000	1.00000	1.00000						

Graphics





CETIS Analysis Detail

Eisenia 28-d Survival and Growth Soil Test — **EnviroSystems, Inc.**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Proportion Survived	Comparison	09-7231-5738	09-7231-5738	09 Nov-04 10:15 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Mann-Whitney U	C > T	Angular (Corrected)				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Modified Levene	65535.00000	13.74502	0.00000	Unequal Variances

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0	0	1	65535.0	0.00000	Significant Effect
Error	0	0	6			
Total	0	0	7			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	Ties	Decision(0.05)
12415-11		12415-06	8		0.4429	1	Non-Significant Effect

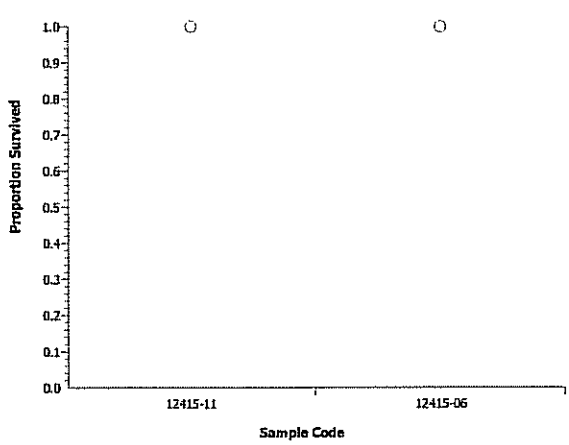
Data Summary

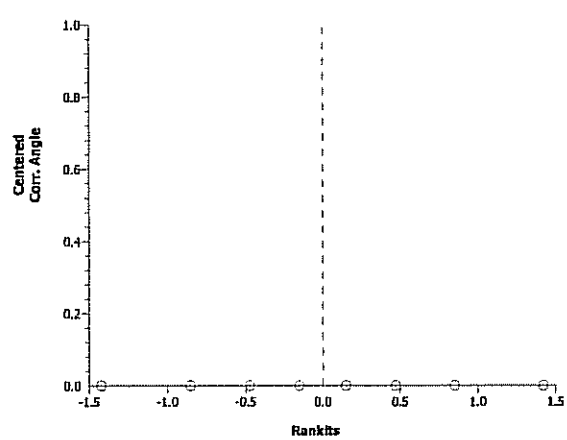
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-11	4	1.00000	1.00000	1.00000	0.00000	1.41202	1.41202	1.41202	0.00027
12415-06	4	1.00000	1.00000	1.00000	0.00000	1.41202	1.41202	1.41202	0.00027

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-11	1.00000	1.00000	1.00000	1.00000						
12415-06	1.00000	1.00000	1.00000	1.00000						

Graphics





CETIS Analysis Detail

Eisenia 28-d Survival and Growth Soil Test — **EnviroSystems, Inc.**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Proportion Survived	Comparison	09-7231-5738	09-7231-5738	09 Nov-04 10:15 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Mann-Whitney U	C > T	Angular (Corrected)				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Modified Levene	65535.00000	13.74502	0.00000	Unequal Variances

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0	0	1	65535.0	0.00000	Significant Effect
Error	0	0	6			
Total	0	0	7			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	Ties	Decision(0.05)
12415-11		12415-07	8		0.4429	1	Non-Significant Effect

Data Summary

		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-11	4	1.00000	1.00000	1.00000	0.00000	1.41202	1.41202	1.41202	0.00027
12415-07	4	1.00000	1.00000	1.00000	0.00000	1.41202	1.41202	1.41202	0.00027

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-11	1.00000	1.00000	1.00000	1.00000						
12415-07	1.00000	1.00000	1.00000	1.00000						

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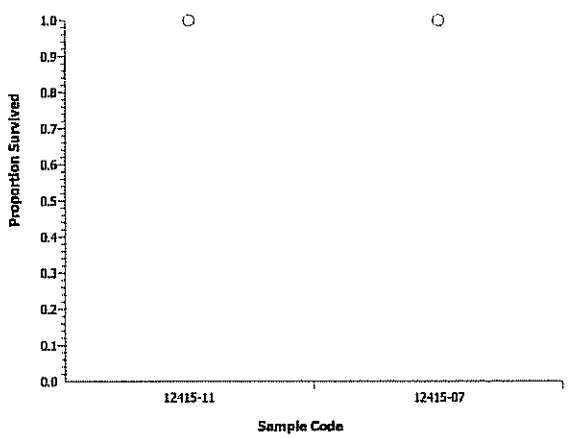
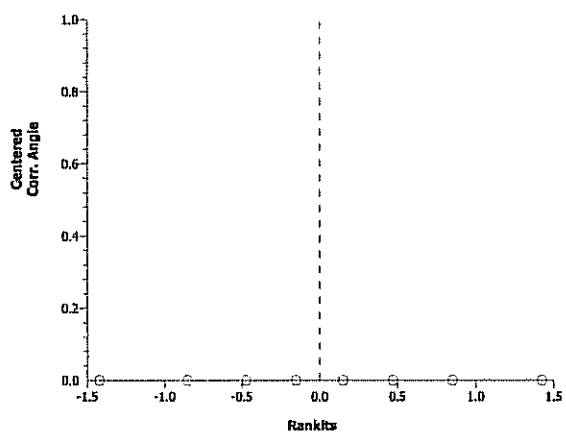




CETIS Analysis Detail

Eisenia 28-d Survival and Growth Soil Test — **EnviroSystems, Inc.**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Proportion Survived	Comparison	09-7231-5738	09-7231-5738	09 Nov-04 10:15 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Mann-Whitney U	C > T	Angular (Corrected)				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Modified Levene	65535.00000	13.74502	0.00000	Unequal Variances

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0	0	1	65535.0	0.00000	Significant Effect
Error	0	0	6			
Total	0	0	7			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	Ties	Decision(0.05)
12415-11		12415-08	8		0.4429	1	Non-Significant Effect

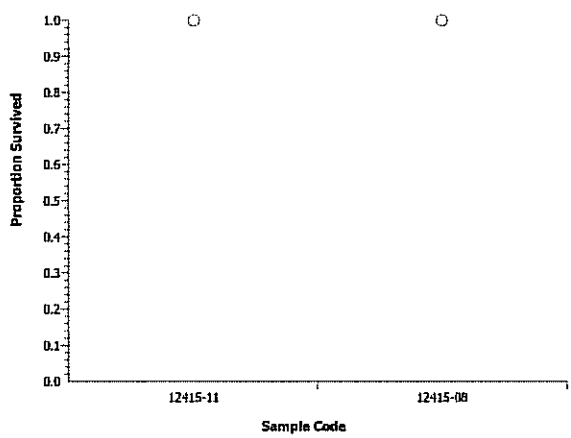
Data Summary

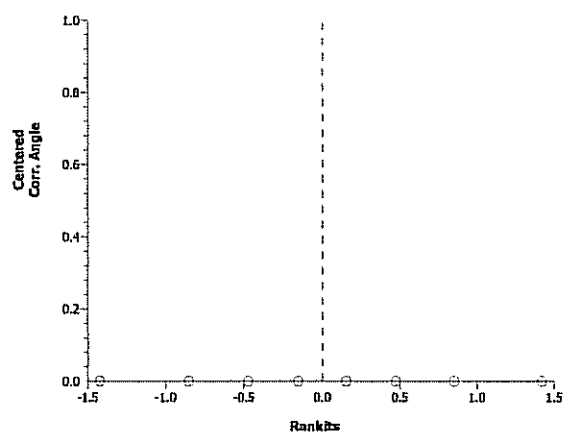
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-11	4	1.00000	1.00000	1.00000	0.00000	1.41202	1.41202	1.41202	0.00027
12415-08	4	1.00000	1.00000	1.00000	0.00000	1.41202	1.41202	1.41202	0.00027

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-11	1.00000	1.00000	1.00000	1.00000						
12415-08	1.00000	1.00000	1.00000	1.00000						

Graphics





CETIS Analysis Detail

Eisenia 28-d Survival and Growth Soil Test — **EnviroSystems, Inc.**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Proportion Survived	Comparison	09-7231-5738	09-7231-5738	09 Nov-04 10:15 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Mann-Whitney U	C > T	Angular (Corrected)				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Modified Levene	65535.00000	13.74502	0.00000	Unequal Variances

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0	0	1	65535.0	0.00000	Significant Effect
Error	0	0	6			
Total	0	0	7			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	Ties	Decision(0.05)
12415-11		12415-09	8		0.4429	1	Non-Significant Effect

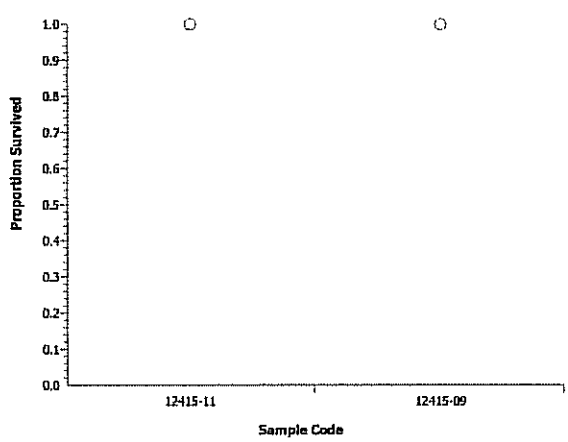
Data Summary

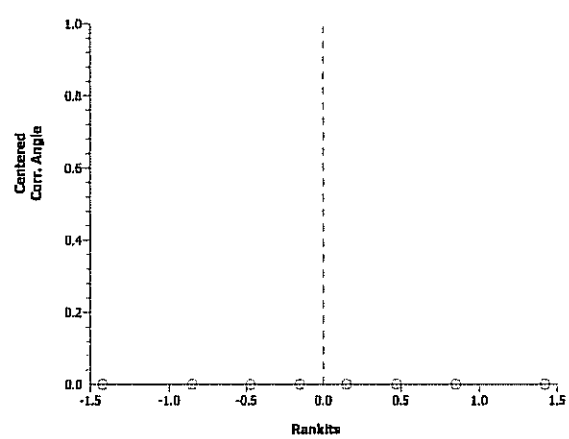
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-11	4	1.00000	1.00000	1.00000	0.00000	1.41202	1.41202	1.41202	0.00027
12415-09	4	1.00000	1.00000	1.00000	0.00000	1.41202	1.41202	1.41202	0.00027

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-11	1.00000	1.00000	1.00000	1.00000						
12415-09	1.00000	1.00000	1.00000	1.00000						

Graphics





CETIS Analysis Detail

Eisenia 28-d Survival and Growth Soil Test — **EnviroSystems, Inc.**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Proportion Survived	Comparison	09-7231-5738	09-7231-5738	09 Nov-04 10:15 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Mann-Whitney U	C > T	Angular (Corrected)				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Modified Levene	65535.00000	13.74502	0.00000	Unequal Variances

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0	0	1	65535.0	0.00000	Significant Effect
Error	0	0	6			
Total	0	0	7			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	Ties	Decision(0.05)
12415-11		12415-10	8		0.4429	1	Non-Significant Effect

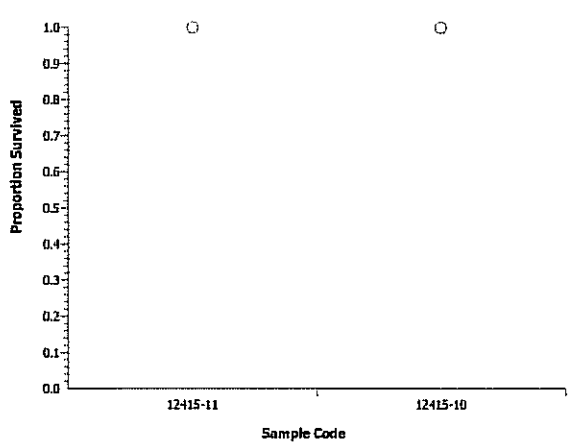
Data Summary

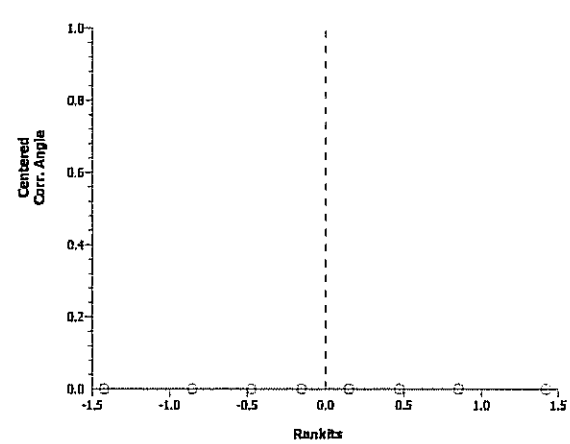
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-11	4	1.00000	1.00000	1.00000	0.00000	1.41202	1.41202	1.41202	0.00027
12415-10	4	1.00000	1.00000	1.00000	0.00000	1.41202	1.41202	1.41202	0.00027

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-11	1.00000	1.00000	1.00000	1.00000						
12415-10	1.00000	1.00000	1.00000	1.00000						

Graphics





Eisenia fetida Survival Assay

STUDY NUMBER: 12415 **CLIENT:** CH2MHill Indian Head

WEIGHT DATA:

SAMPLE IDENTIFICATION	REP	WEIGHT (g) 28 Days
-2	A	2.7
	B	2.2
	C	2.3
	D	2.2
-5	A	2.3
	B	2.7
	C	2.6
	D	2.3
-3	A	1.9
	B	1.5
	C	2.0
	D	1.8
-7	A	2.2
	B	2.0
	C	1.7
	D	2.1
LAB	A	2.0
	B	1.9
	C	1.8
	D	1.7
-6	A	1.5
	B	2.1
	C	1.6
	D	2.1
-9	A	2.4
	B	2.3
	C	2.2
	D	2.4
RECORDED BY:		
DATE:		9/20/04

NOTES:

Eisenia fetida Survival Assay

STUDY NUMBER: 12415 **CLIENT:** CH2MHill Indian Head

WEIGHT DATA:

SAMPLE IDENTIFICATION	REP	WEIGHT (g) 28 Days
-1	A	1.9
	B	1.8
	C	1.8
	D	1.7
-8	A	~~2.2~~ 2.8
	B	2.2
	C	2.1
	D	2.2
-4	A	1.5
	B	1.4
	C	1.7
	D	2.0
-10	A	2.3
	B	2.6
	C	2.2
	D	2.4
-11	A	2.6
	B	2.3
	C	3.0
	D	1.8
	A	
	B	
	C	
	D	
	A	
	B	
	C	
	D	
RECORDED BY:		
DATE:		9/20/04

NOTES:

Eisenia fetida Assay
28 DAY SURVIVAL & GROWTH DATA

STUDY NUMBER: 12415 **CLIENT:** CH2M

PROJECT: Inlrsan Ltd **START DATE:** 8/23/04

ESI SAMPLE ID	REP	WET WEIGHT (G)
Start Worms	A	2.5
	B	2.7
	C	2.4
	D	3.2
RECORDED BY:		BB
DATE:		8/24/04

NOTES:

Number Worms per Replicate: 10

Average wet weight per worm: 0.27 Grams

Average wet weight per replicate: 2.7 Grams

Average wet weight of soil per replicate: 400 Grams

Loading rate (g worm/kg soil): 6.75 Grams Worm / Kg Soil

STUDY: 12415
CLIENT: CH2M Hill
PROJECT: Indian Head - CTO-066 Site 47 Evaluation
TASK: Eisenia fetida 28-day Exposure Assay
DATA: Growth Data Wet Weight (g)
START DATE: 08/23/04

Sample Site	ESI Ref	Rep	Wet Weight (Grams)	Mean Wet Wt per worm (mg)	Site Mean (mg)	Compared Against	Distribution	Variance	t Value	Critical t Value	p Value	Significant Difference in Growth (Less Than)
Lab Control	0	A	2.0	200	190	LAB	-	-	-	-	-	-
		B	1.9	190								
		C	1.8	180								
		D	1.7	189								
IS47SDTX04	-1	A	1.9	190	180	LAB	Normal	Equal	1.9872	1.9432	0.0713	NO
		B	1.8	180		BGDSSTX03	Normal	Equal	2.4398	1.9432	0.0252	YES
		C	1.8	180								
		D	1.7	170								
IS47SSTX14	-2	A	2.7	270	235	LAB	Normal	Equal	-0.3595	1.9432	0.9943	NO
		B	2.2	220		BGDSSTX03	Normal	Equal	0.2683	1.9432	0.3987	NO
		C	2.3	230								
		D	2.2	220								
IS47SDTX01	-3	A	1.9	190	180	LAB	Normal	Equal	0.8442	1.9432	0.2155	NO
		B	1.5	150		BGDSSTX03	Normal	Equal	2.2727	1.9432	0.0317	YES
		C	2.0	200								
		D	1.8	180								
IS47SDTX02	-4	A	1.5	188	178	LAB	Normal	Equal	1.0679	1.9432	0.1633	NO
		B	1.4	156		BGDSSTX03	Normal	Equal	2.3626	1.9432	0.0280	YES
		C	1.7	170								
		D	2.0	200								
IS47SATX08	-5	A	2.3	230	248	LAB	Normal	Equal	-5.2076	1.9432	0.9990	NO
		B	2.7	270		BGDSSTX03	Normal	Equal	-0.1831	1.9432	0.5696	NO
		C	2.6	260								
		D	2.3	230								
IS47SSTX06	-6	A	1.5	150	183	LAB	Normal	Equal	0.4388	1.9432	0.3381	NO
		B	2.1	210		BGDSSTX03	Normal	Equal	2.0047	1.9432	0.0459	YES
		C	1.6	160								
		D	2.1	210								
IS47SSTX12	-7	A	2.2	220	200	LAB	Normal	Equal	-0.0888	1.9432	0.7955	NO
		B	2.0	200		BGDSSTX03	Normal	Equal	1.5455	1.9432	0.0866	NO
		C	1.7	170								
		D	2.1	210								
IS47SSTX04	-8	A	2.8	280	233	LAB	Normal	Equal	-2.5874	1.9432	0.9793	NO
		B	2.2	220		BGDSSTX03	Normal	Equal	0.3341	1.9432	0.3748	NO
		C	2.1	210								
		D	2.2	220								
IS47SSTX02	-9	A	2.4	240	233	LAB	Normal	Equal	-6.7895	1.9432	0.9998	NO
		B	2.3	230		BGDSSTX03	Normal	Equal	0.3885	1.9432	0.3555	NO
		C	2.2	220								
		D	2.4	240								
IS47SSTX10	-10	A	2.3	230	238	LAB	Normal	Equal	-5.0432	1.9432	0.9988	NO
		B	2.6	260		BGDSSTX03	Normal	Equal	0.1873	1.9432	0.4288	NO
		C	2.2	220								
		D	2.4	240								
BGDSSTX03	-11	A	2.6	260	243	LAB	Normal	Equal	-2.0591	1.9432	0.9574	NO
		B	2.3	230								
		C	3.0	300								
		D	1.8	180								

CETIS Test Summary

Report Date: 09 Nov-04 10:18 AM
Link: 09-7231-5738

Eisenia 28-d Survival and Growth Soil Test — **EnviroSystems, Inc.**

Test No:	16-0459-1726	**Test Type:**	Survival-Growth	**Duration:**	28d 0h
Start Date:	23 Aug-04 12:00 PM	**Protocol:**	EPA/600/R-92/183 (1992)	**Species:**	Eisenia fetida
Ending Date:	20 Sep-04 12:00 PM	**Dil Water:**	Not Applicable	**Source:**	In-House Culture
Setup Date:	23 Aug-04 12:00 PM	**Brine:**	Not Applicable		

Sample No:	01-8612-5475	**Material:**	Soil	**Client:**	CH2M Hill
Sample Date:		**Code:**	12415-00	**Project:**	Ecologcal Risk Assessment
Receive Date:		**Source:**	Indian Head Site 47 - CTO-066		
Sample Age:	N/A	**Station:**	Lab Control / 12415-00		
Sample No:	04-2012-2455	**Material:**	Soil	**Client:**	CH2M Hill
Sample Date:	10 Aug-04	**Code:**	12415-01	**Project:**	Ecologcal Risk Assessment
Receive Date:	11 Aug-04	**Source:**	Indian Head Site 47 - CTO-066		
Sample Age:	13d 12h (4 °C)	**Station:**	IS47SDTX04 / 12415-01		
Sample No:	10-1333-4070	**Material:**	Soil	**Client:**	CH2M Hill
Sample Date:	10 Aug-04	**Code:**	12415-02	**Project:**	Ecologcal Risk Assessment
Receive Date:	11 Aug-04	**Source:**	Indian Head Site 47 - CTO-066		
Sample Age:	13d 12h (4 °C)	**Station:**	IS47SSTX14 / 12415-02		
Sample No:	10-2943-4655	**Material:**	Soil	**Client:**	CH2M Hill
Sample Date:	10 Aug-04	**Code:**	12415-03	**Project:**	Ecologcal Risk Assessment
Receive Date:	11 Aug-04	**Source:**	Indian Head Site 47 - CTO-066		
Sample Age:	13d 12h (4 °C)	**Station:**	IS47SDTX01 / 12415-03		
Sample No:	01-9987-0246	**Material:**	Soil	**Client:**	CH2M Hill
Sample Date:	10 Aug-04	**Code:**	12415-04	**Project:**	Ecologcal Risk Assessment
Receive Date:	11 Aug-04	**Source:**	Indian Head Site 47 - CTO-066		
Sample Age:	13d 12h (4 °C)	**Station:**	IS47SDTX02 / 12415-04		
Sample No:	08-8019-8138	**Material:**	Soil	**Client:**	CH2M Hill
Sample Date:	10 Aug-04	**Code:**	12415-05	**Project:**	Ecologcal Risk Assessment
Receive Date:	11 Aug-04	**Source:**	Indian Head Site 47 - CTO-066		
Sample Age:	13d 12h (4 °C)	**Station:**	IS47SATX08 / 12415-05		
Sample No:	11-7638-4246	**Material:**	Soil	**Client:**	CH2M Hill
Sample Date:	10 Aug-04	**Code:**	12415-06	**Project:**	Ecologcal Risk Assessment
Receive Date:	11 Aug-04	**Source:**	Indian Head Site 47 - CTO-066		
Sample Age:	13d 12h (4 °C)	**Station:**	IS47SSTX06 / 12415-06		
Sample No:	05-7396-0742	**Material:**	Soil	**Client:**	CH2M Hill
Sample Date:	10 Aug-04	**Code:**	12415-07	**Project:**	Ecologcal Risk Assessment
Receive Date:	11 Aug-04	**Source:**	Indian Head Site 47 - CTO-066		
Sample Age:	13d 12h (4 °C)	**Station:**	IS47SSTX12 / 12415-07		
Sample No:	01-8587-9061	**Material:**	Soil	**Client:**	CH2M Hill
Sample Date:	10 Aug-04	**Code:**	12415-08	**Project:**	Ecologcal Risk Assessment
Receive Date:	11 Aug-04	**Source:**	Indian Head Site 47 - CTO-066		
Sample Age:	13d 12h (4 °C)	**Station:**	IS47SSTX04 / 12415-08		
Sample No:	10-2211-1073	**Material:**	Soil	**Client:**	CH2M Hill
Sample Date:	10 Aug-04	**Code:**	12415-09	**Project:**	Ecologcal Risk Assessment
Receive Date:	11 Aug-04	**Source:**	Indian Head Site 47 - CTO-066		
Sample Age:	13d 12h (4 °C)	**Station:**	IS47SSTX02 / 12415-09		
Sample No:	08-1742-4032	**Material:**	Soil	**Client:**	CH2M Hill
Sample Date:	10 Aug-04	**Code:**	12415-10	**Project:**	Ecologcal Risk Assessment
Receive Date:	11 Aug-04	**Source:**	Indian Head Site 47 - CTO-066		
Sample Age:	13d 12h (4 °C)	**Station:**	IS47SSTX10 / 12415-10		

CETIS Test Summary

Report Date: 09 Nov-04 10:18 AM
Link: 09-7231-5738

Sample No:	09-6964-5923	**Material:**	Soil	**Client:**	CH2M Hill
Sample Date:	10 Aug-04	**Code:**	12415-11	**Project:**	Ecologcal Risk Assessment
Receive Date:	11 Aug-04	**Source:**	Indian Head Site 47 - CTO-066		
Sample Age:	13d 12h (4 °C)	**Station:**	BGDSSTX03 / 12415-11		

Mean Dry Weight-mg Summary

Sample Code	Reps	Mean	Minimum	Maximum	SE	SD	CV
12415-00	4	189.75	180	200	4.09013	8.18026	4.31%
12415-11	4	242.5	180	300	25.29	50.58	20.86%
12415-01	4	180	170	190	4.08248	8.16497	4.54%
12415-02	4	235	220	270	11.9024	23.8048	10.13%
12415-03	4	180	150	200	10.8012	21.6025	12.00%
12415-04	4	178.5	156	200	9.70824	19.4165	10.88%
12415-05	4	247.5	230	270	10.3078	20.6155	8.33%
12415-06	4	182.5	150	210	16.0078	32.0156	17.54%
12415-07	4	200	170	220	10.8012	21.6025	10.80%
12415-08	4	232.5	210	280	16.0078	32.0156	13.77%
12415-09	4	232.5	220	240	4.78714	9.57427	4.12%
12415-10	4	237.5	220	260	8.53913	17.0783	7.19%

Mean Dry Weight-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
12415-00	200	190	180	189
12415-11	260	230	300	180
12415-01	190	180	180	170
12415-02	270	220	230	220
12415-03	190	150	200	180
12415-04	188	156	170	200
12415-05	230	270	260	230
12415-06	150	210	160	210
12415-07	220	200	170	210
12415-08	280	220	210	220
12415-09	240	230	220	240
12415-10	230	260	220	240

CETIS Analysis Detail

Eisenia 28-d Survival and Growth Soil Test — **EnviroSystems, Inc.**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Mean Dry Weight-mg	Comparison	09-7231-5738	09-7231-5738	09 Nov-04 10:15 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Equal Variance t	C > T	Untransformed				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	38.23163	47.46723	0.01371	Equal Variances
Distribution	Shapiro-Wilk W	0.93163	0.74935	0.49625	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	5565.125	5565.125	1	4.24	0.08517	Non-Significant Effect
Error	7875.75	1312.625	6			
Total	13440.875	6877.75	7			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-00		12415-11	-2.0591	1.94318	0.9574	49.7816	Non-Significant Effect

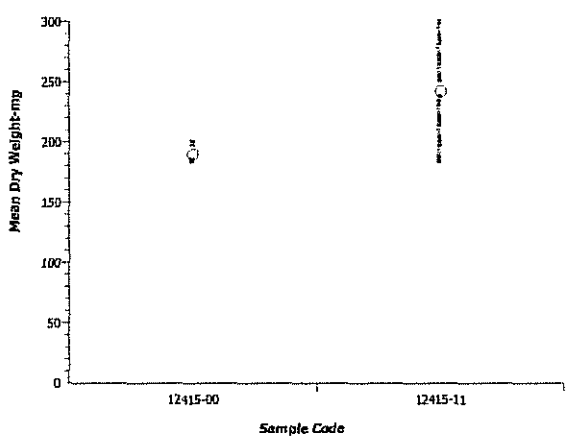
Data Summary

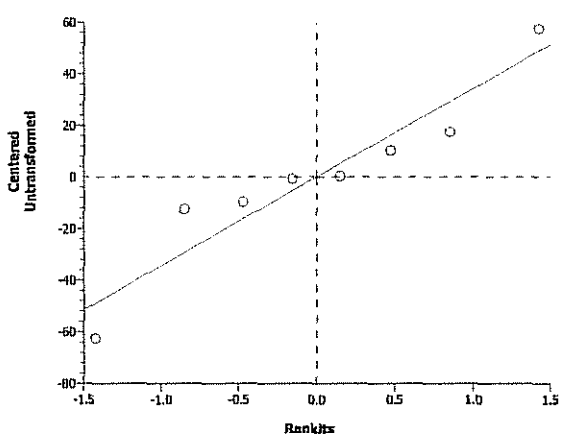
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-00	4	189.75	180	200	8.18026				
12415-11	4	242.5	180	300	50.58				

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-00	200	190	180	189						
12415-11	260	230	300	180						

Graphics





CETIS Analysis Detail

Eisenia 28-d Survival and Growth Soil Test — *EnviroSystems, Inc.*

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Mean Dry Weight-mg	Comparison	09-7231-5738	09-7231-5738	09 Nov-04 10:15 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Equal Variance t	C > T	Untransformed				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	1.00375	47.46723	0.99762	Equal Variances
Distribution	Shapiro-Wilk W	0.87058	0.74935	0.15175	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	190.125	190.125	1	2.85	0.14254	Non-Significant Effect
Error	400.75	66.79166	6			
Total	590.875	256.91666	7			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-00		12415-01	1.68717	1.94318	0.0713	11.2295	Non-Significant Effect

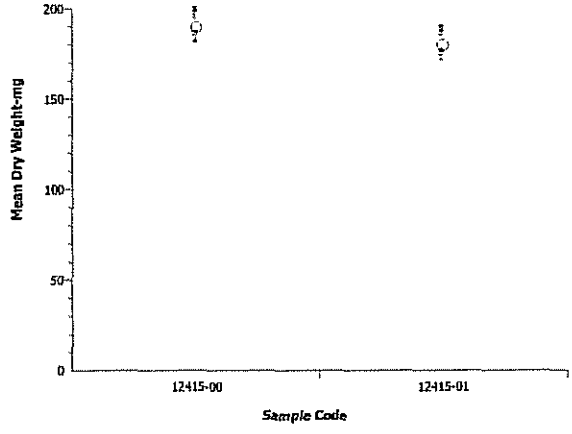
Data Summary

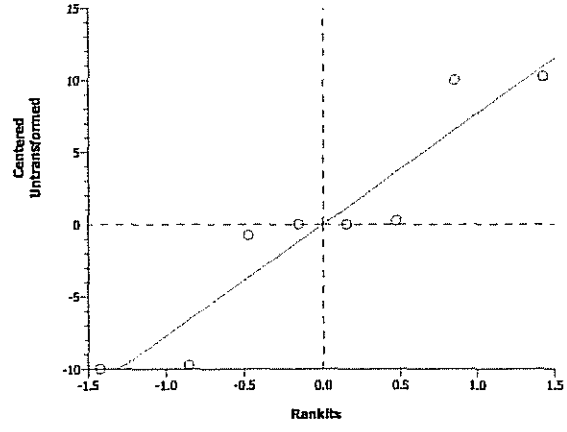
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-00	4	189.75	180	200	8.18026				
12415-01	4	180	170	190	8.16497				

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-00	200	190	180	189						
12415-01	190	180	180	170						

Graphics





CETIS Analysis Detail

Eisenia 28-d Survival and Growth Soil Test — **EnviroSystems, Inc.**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Mean Dry Weight-mg	Comparison	09-7231-5738	09-7231-5738	09 Nov-04 10:16 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Equal Variance t	C > T	Untransformed				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	8.46824	47.46723	0.11277	Equal Variances
Distribution	Shapiro-Wilk W	0.85150	0.74935	0.10209	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	4095.125	4095.125	1	12.93	0.01143	Significant Effect
Error	1900.75	316.7917	6			
Total	5995.875	4411.9167	7			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-00		12415-02	-3.5954	1.94318	0.9943	24.456	Non-Significant Effect

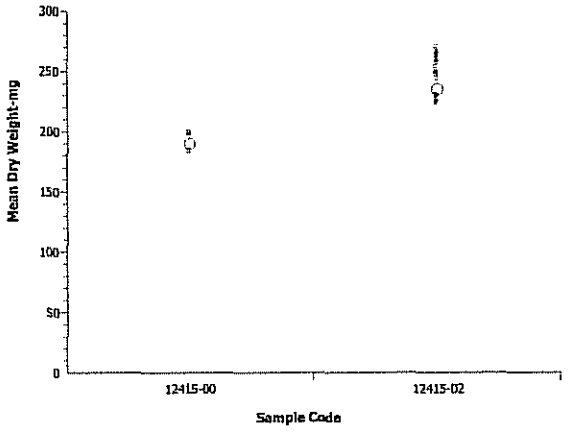
Data Summary

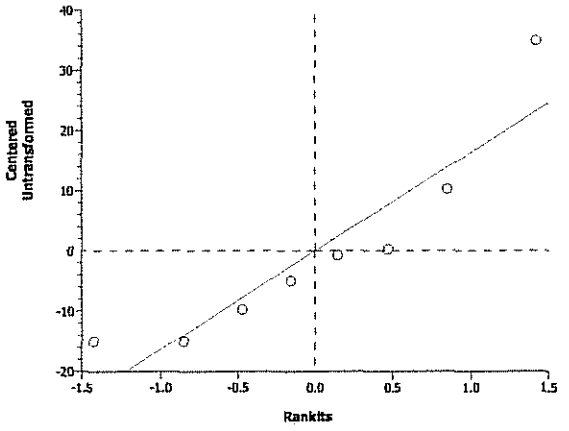
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-00	4	189.75	180	200	8.18026				
12415-02	4	235	220	270	23.8048				

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-00	200	190	180	189						
12415-02	270	220	230	220						

Graphics





CETIS Analysis Detail

Eisenia 28-d Survival and Growth Soil Test — EnviroSystems, Inc.

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Mean Dry Weight-mg	Comparison	09-7231-5738	09-7231-5738	09 Nov-04 10:16 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Equal Variance t	C > T	Untransformed				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	6.97385	47.46723	0.14498	Equal Variances
Distribution	Shapiro-Wilk W	0.92481	0.74935	0.43875	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	190.125	190.125	1	0.71	0.43094	Non-Significant Effect
Error	1600.75	266.7917	6			
Total	1790.875	456.91666	7			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-00		12415-03	0.84418	1.94318	0.2155	22.4432	Non-Significant Effect

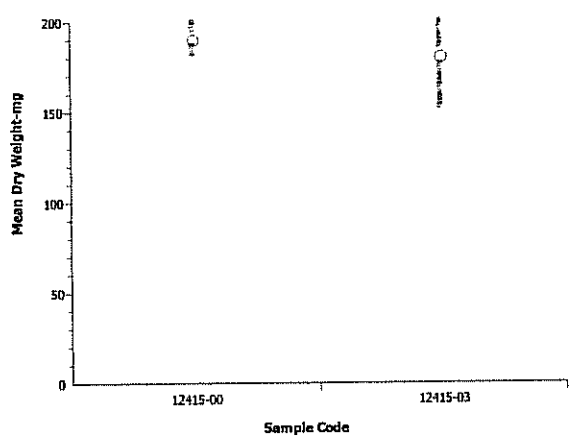
Data Summary

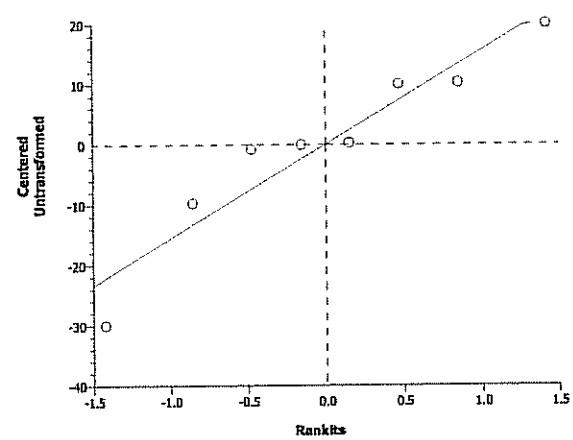
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-00	4	189.75	180	200	8.18026				
12415-03	4	180	150	200	21.6025				

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-00	200	190	180	189						
12415-03	190	150	200	180						

Graphics





CETIS Analysis Detail

Eisenia 28-d Survival and Growth Soil Test — EnviroSystems, Inc.

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Mean Dry Weight-mg	Comparison	09-7231-5738	09-7231-5738	09 Nov-04 10:16 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Equal Variance t	C > T	Untransformed				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	5.63387	47.46723	0.18947	Equal Variances
Distribution	Shapiro-Wilk W	0.98130	0.74935	0.96724	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	253.125	253.125	1	1.14	0.32664	Non-Significant Effect
Error	1331.75	221.9583	6			
Total	1584.875	475.08333	7			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-00		12415-04	1.06790	1.94318	0.1633	20.4708	Non-Significant Effect

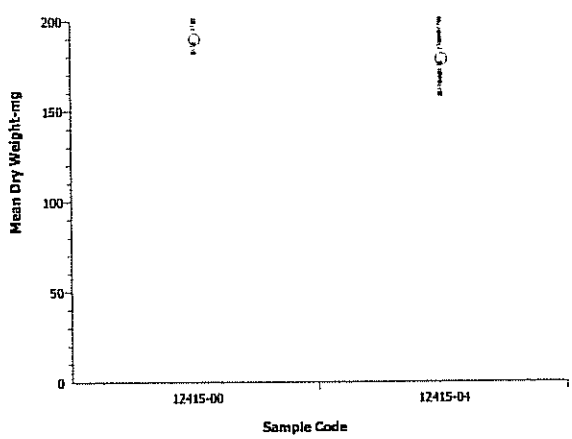
Data Summary

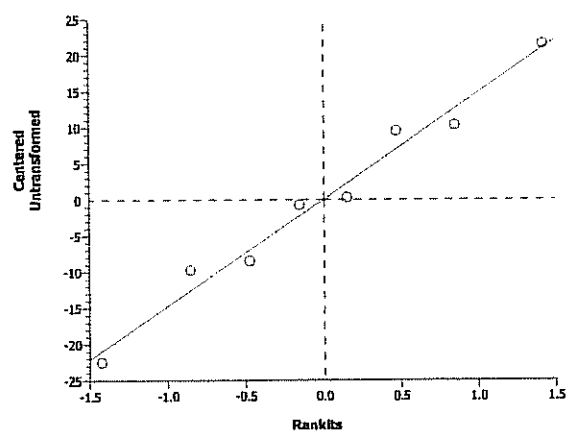
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-00	4	189.75	180	200	8.18026				
12415-04	4	178.5	156	200	19.4165				

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-00	200	190	180	189						
12415-04	188	156	170	200						

Graphics





CETIS Analysis Detail

Eisenia 28-d Survival and Growth Soil Test — **EnviroSystems, Inc.**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Mean Dry Weight-mg	Comparison	09-7231-5738	09-7231-5738	09 Nov-04 10:16 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Equal Variance t	C > T	Untransformed				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	6.35118	47.46723	0.16322	Equal Variances
Distribution	Shapiro-Wilk W	0.93984	0.74935	0.57233	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	6670.125	6670.125	1	27.12	0.00200	Significant Effect
Error	1475.75	245.9583	6			
Total	8145.875	6916.0833	7			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-00		12415-05	-5.2076	1.94318	0.9990	21.5491	Non-Significant Effect

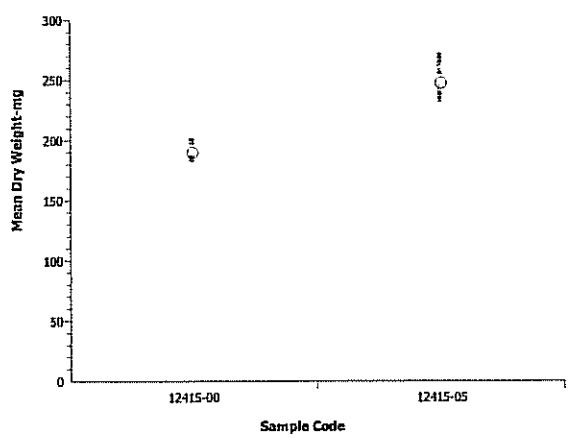
Data Summary

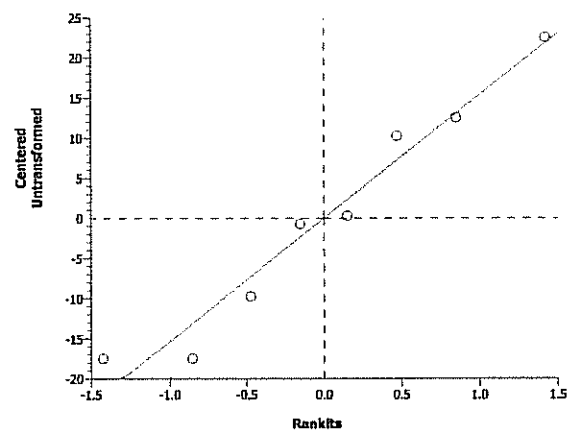
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-00	4	189.75	180	200	8.18026				
12415-05	4	247.5	230	270	20.6155				

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-00	200	190	180	189						
12415-05	230	270	260	230						

Graphics





CETIS Analysis Detail

Eisenia 28-d Survival and Growth Soil Test — **EnviroSystems, Inc.**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Mean Dry Weight-mg	Comparison	09-7231-5738	09-7231-5738	09 Nov-04 10:16 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Equal Variance t	C > T	Untransformed				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	15.31756	47.46723	0.05055	Equal Variances
Distribution	Shapiro-Wilk W	0.94623	0.74935	0.63611	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	105.125	105.125	1	0.19	0.67616	Non-Significant Effect
Error	3275.75	545.9583	6			
Total	3380.875	651.08331	7			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-00		12415-06	0.43881	1.94318	0.3381	32.1054	Non-Significant Effect

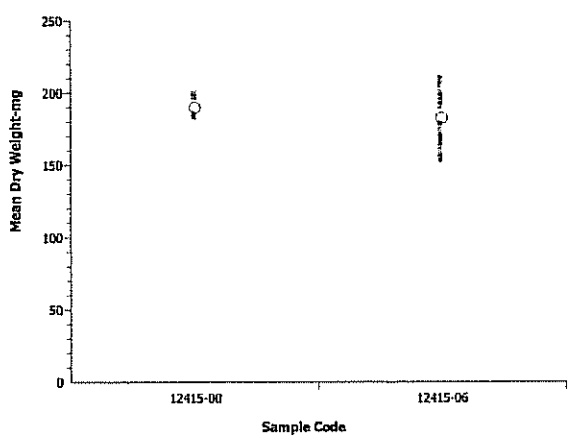
Data Summary

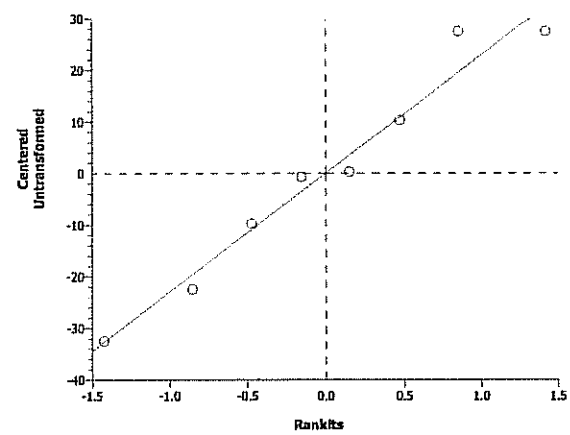
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-00	4	189.75	180	200	8.18026				
12415-06	4	182.5	150	210	32.0156				

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-00	200	190	180	189						
12415-06	150	210	160	210						

Graphics





CETIS Analysis Detail

Eisenia 28-d Survival and Growth Soil Test — **EnviroSystems, Inc.**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Mean Dry Weight-mg	Comparison	09-7231-5738	09-7231-5738	09 Nov-04 10:16 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Equal Variance t	C > T	Untransformed				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	6.97385	47.46723	0.14498	Equal Variances
Distribution	Shapiro-Wilk W	0.92481	0.74935	0.43875	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	210.125	210.125	1	0.79	0.40899	Non-Significant Effect
Error	1600.75	266.7917	6			
Total	1810.875	476.91666	7			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-00		12415-07	-0.8875	1.94318	0.7955	22.4432	Non-Significant Effect

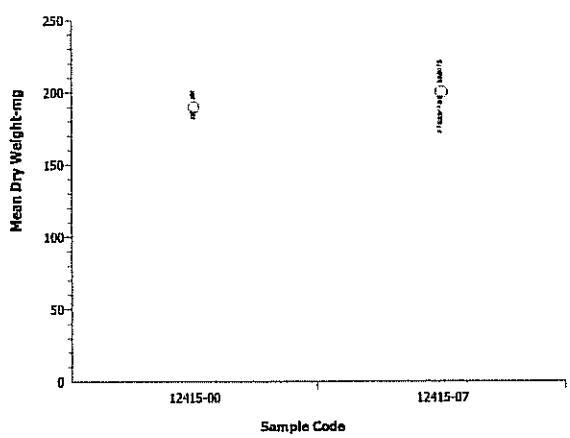
Data Summary

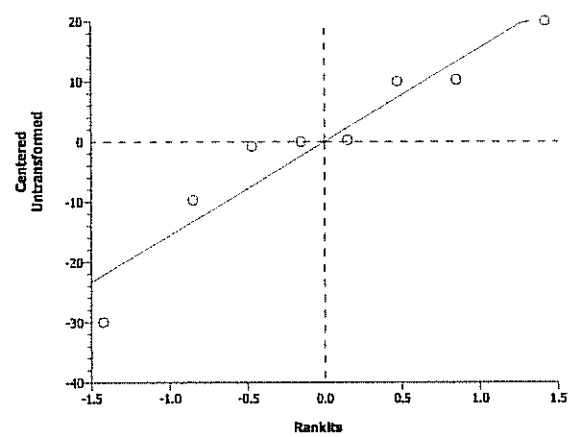
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-00	4	189.75	180	200	8.18026				
12415-07	4	200	170	220	21.6025				

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-00	200	190	180	189						
12415-07	220	200	170	210						

Graphics





CETIS Analysis Detail

Eisenia 28-d Survival and Growth Soil Test — EnviroSystems, Inc.

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Mean Dry Weight-mg	Comparison	09-7231-5738	09-7231-5738	09 Nov-04 10:16 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Equal Variance t	C > T	Untransformed				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	15.31756	47.46723	0.05055	Equal Variances
Distribution	Shapiro-Wilk W	0.83467	0.74935	0.07136	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	3655.125	3655.125	1	6.69	0.04135	Significant Effect
Error	3275.75	545.9583	6			
Total	6930.875	4201.0833	7			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-00		12415-08	-2.5874	1.94318	0.9793	32.1054	Non-Significant Effect

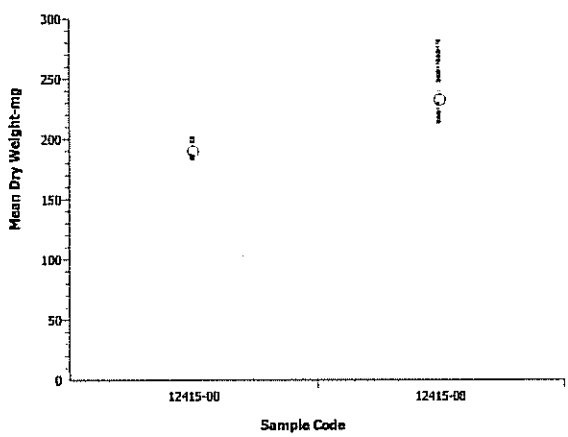
Data Summary

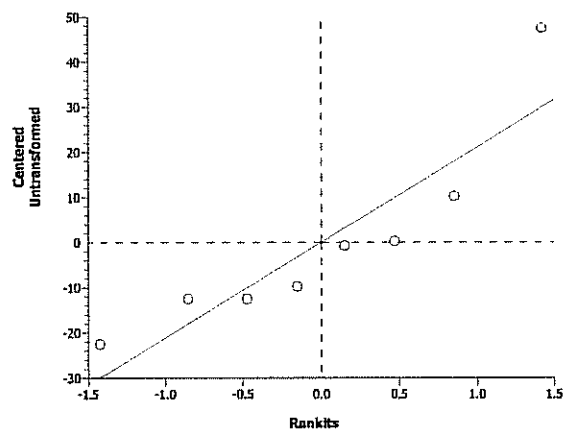
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-00	4	189.75	180	200	8.18026				
12415-08	4	232.5	210	280	32.0156				

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-00	200	190	180	189						
12415-08	280	220	210	220						

Graphics





CETIS Analysis Detail

Eisenia 28-d Survival and Growth Soil Test — EnviroSystems, Inc.

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Mean Dry Weight-mg	Comparison	09-7231-5738	09-7231-5738	09 Nov-04 10:16 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Equal Variance t	C > T	Untransformed				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	1.36986	47.46723	0.80210	Equal Variances
Distribution	Shapiro-Wilk W	0.92919	0.74935	0.47507	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	3655.125	3655.125	1	46.10	0.00050	Significant Effect
Error	475.75	79.29166	6			
Total	4130.875	3734.4167	7			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-00		12415-09	-6.7895	1.94318	0.9998	12.2352	Non-Significant Effect

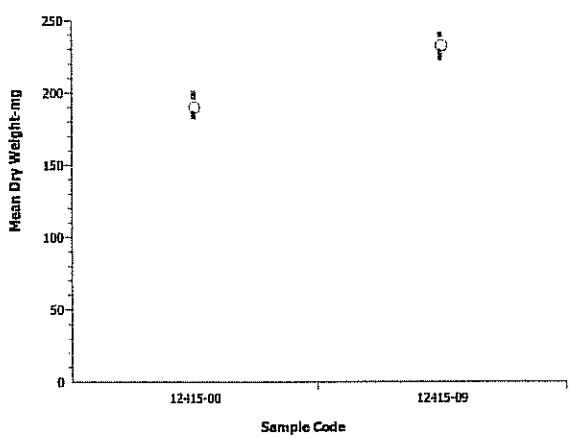
Data Summary

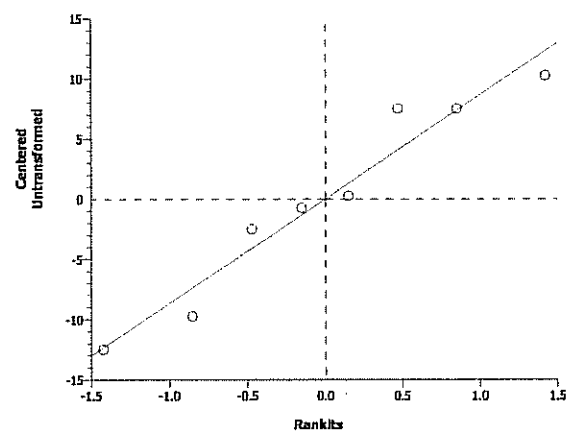
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-00	4	189.75	180	200	8.18026				
12415-09	4	232.5	220	240	9.57427				

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-00	200	190	180	189						
12415-09	240	230	220	240						

Graphics





CETIS Analysis Detail

Eisenia 28-d Survival and Growth Soil Test — **EnviroSystems, Inc.**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Mean Dry Weight-mg	Comparison	09-7231-5738	09-7231-5738	09 Nov-04 10:16 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Equal Variance t	C > T	Untransformed				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	4.35865	47.46723	0.25784	Equal Variances
Distribution	Shapiro-Wilk W	0.97193	0.74935	0.89942	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	4560.125	4560.125	1	25.43	0.00235	Significant Effect
Error	1075.75	179.2917	6			
Total	5635.875	4739.4167	7			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-00		12415-10	-5.0432	1.94318	0.9988	18.3983	Non-Significant Effect

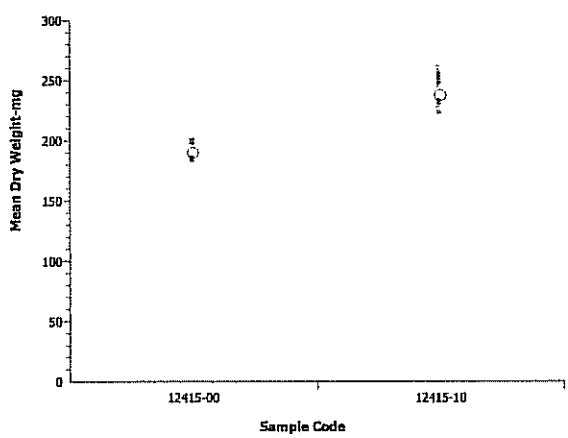
Data Summary

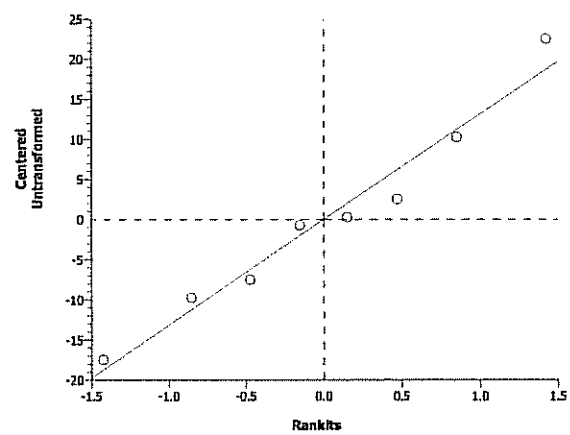
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-00	4	189.75	180	200	8.18026				
12415-10	4	237.5	220	260	17.0783				

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-00	200	190	180	189						
12415-10	230	260	220	240						

Graphics





CETIS Analysis Detail

Eisenia 28-d Survival and Growth Soil Test — **EnviroSystems, Inc.**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Mean Dry Weight-mg	Comparison	09-7231-5738	09-7231-5738	09 Nov-04 10:17 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Equal Variance t	C > T	Untransformed				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	38.37500	47.46723	0.01364	Equal Variances
Distribution	Shapiro-Wilk W	0.93050	0.74935	0.48635	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	7812.5	7812.5	1	5.95	0.05049	Non-Significant Effect
Error	7875	1312.5	6			
Total	15687.5	9125	7			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-11		12415-01	2.43975	1.94318	0.0252	49.7792	Significant Effect

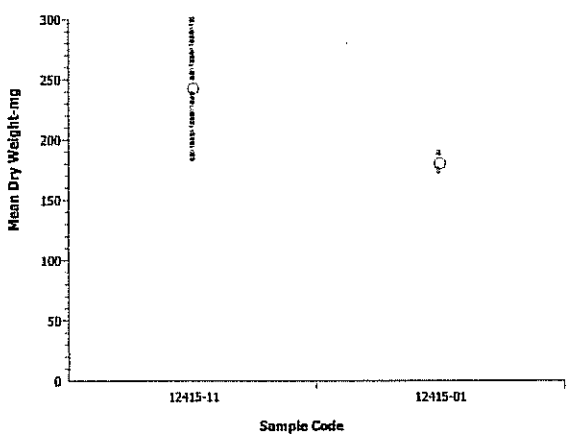
Data Summary

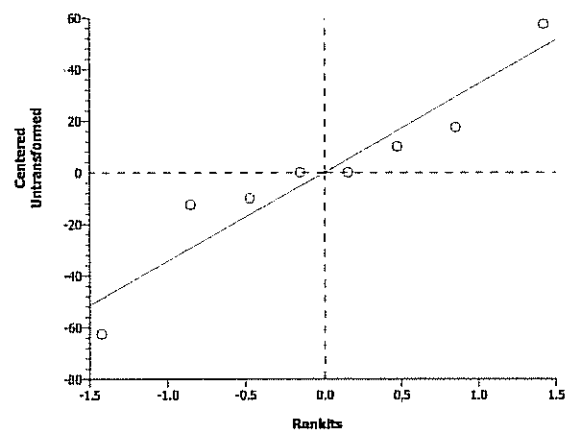
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-11	4	242.5	180	300	50.58				
12415-01	4	180	170	190	8.16497				

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-11	260	230	300	180						
12415-01	190	180	180	170						

Graphics





CETIS Analysis Detail

Eisenia 28-d Survival and Growth Soil Test — **EnviroSystems, Inc.**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Mean Dry Weight-mg	Comparison	09-7231-5738	09-7231-5738	09 Nov-04 10:17 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Equal Variance t	C > T	Untransformed				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	4.51471	47.46723	0.24742	Equal Variances
Distribution	Shapiro-Wilk W	0.95315	0.74935	0.70860	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	112.5	112.5	1	0.07	0.79743	Non-Significant Effect
Error	9375	1562.5	6			
Total	9487.5	1675	7			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-11		12415-02	0.26833	1.94318	0.3987	54.3135	Non-Significant Effect

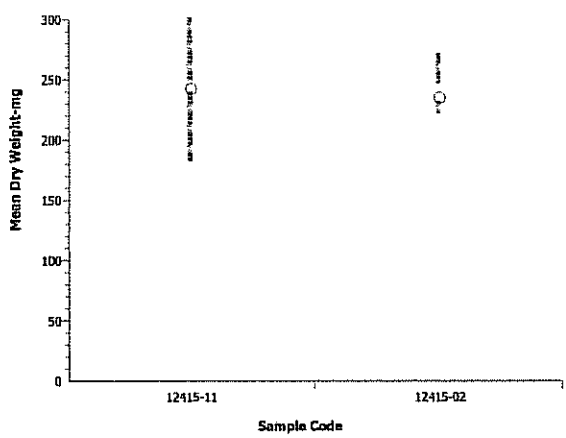
Data Summary

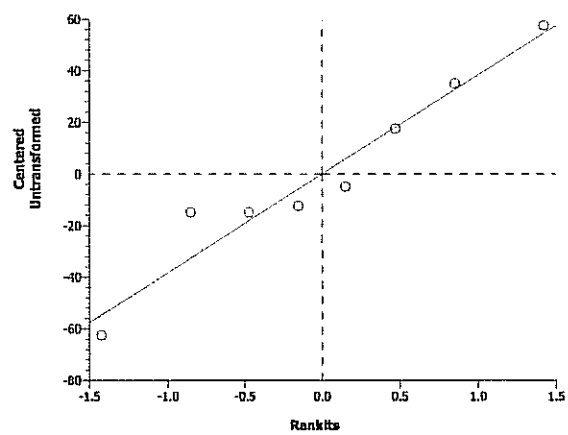
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-11	4	242.5	180	300	50.58				
12415-02	4	235	220	270	23.8048				

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-11	260	230	300	180						
12415-02	270	220	230	220						

Graphics





CETIS Analysis Detail

Eisenia 28-d Survival and Growth Soil Test — **EnviroSystems, Inc.**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Mean Dry Weight-mg	Comparison	09-7231-5738	09-7231-5738	09 Nov-04 10:17 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Equal Variance t	C > T	Untransformed				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	5.48214	47.46723	0.19593	Equal Variances
Distribution	Shapiro-Wilk W	0.97852	0.74935	0.95056	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	7812.5	7812.5	1	5.17	0.06343	Non-Significant Effect
Error	9075	1512.5	6			
Total	16887.5	9325	7			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-11		12415-03	2.27273	1.94318	0.0317	53.4375	Significant Effect

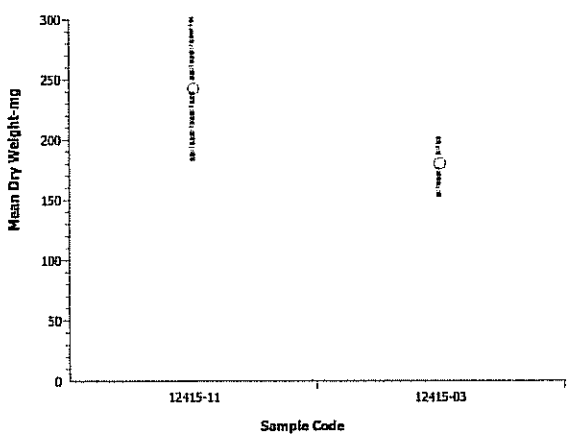
Data Summary

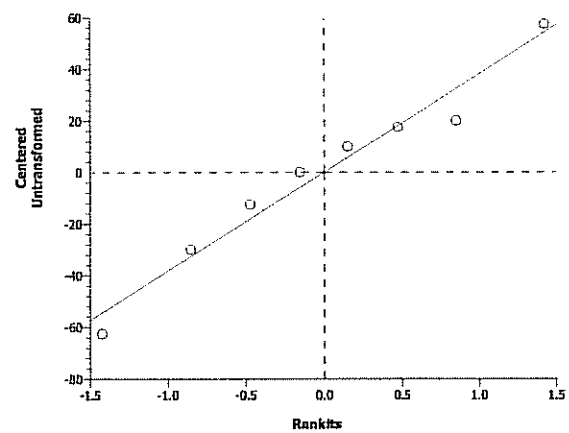
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-11	4	242.5	180	300	50.58				
12415-03	4	180	150	200	21.6025				

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-11	260	230	300	180						
12415-03	190	150	200	180						

Graphics





CETIS Analysis Detail

Eisenia 28-d Survival and Growth Soil Test — **EnviroSystems, Inc.**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Mean Dry Weight-mg	Comparison	09-7231-5738	09-7231-5738	09 Nov-04 10:17 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Equal Variance t	C > T	Untransformed				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	6.78603	47.46723	0.15011	Equal Variances
Distribution	Shapiro-Wilk W	0.97762	0.74935	0.94451	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	8192	8192	1	5.58	0.05609	Non-Significant Effect
Error	8806	1467.667	6			
Total	16998	9659.6666	7			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-11		12415-04	2.36255	1.94318	0.0280	52.6395	Significant Effect

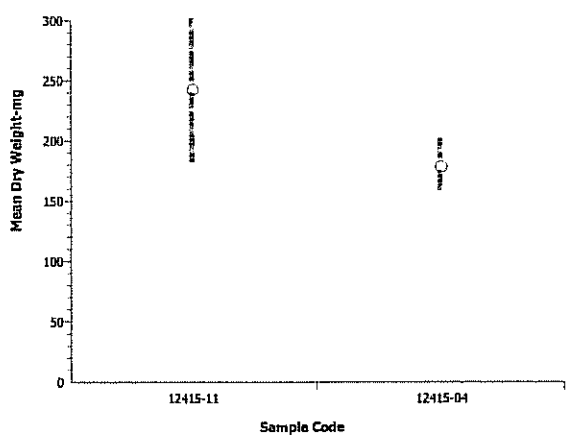
Data Summary

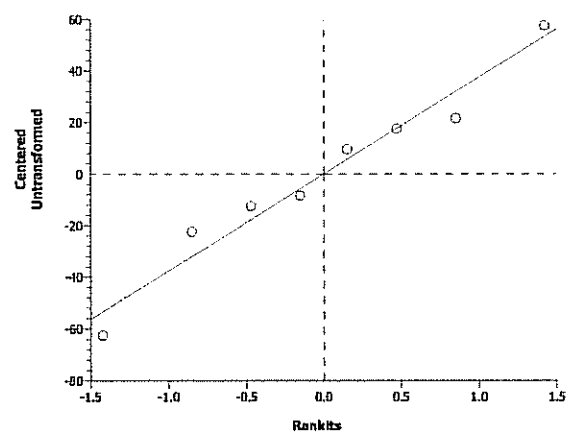
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-11	4	242.5	180	300	50.58				
12415-04	4	178.5	156	200	19.4165				

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-11	260	230	300	180						
12415-04	188	156	170	200						

Graphics





CETIS Analysis Detail

Eisenia 28-d Survival and Growth Soil Test — EnviroSystems, Inc.

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Mean Dry Weight-mg	Comparison	09-7231-5738	09-7231-5738	09 Nov-04 10:17 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Equal Variance t	C > T	Untransformed				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	6.01961	47.46723	0.17455	Equal Variances
Distribution	Shapiro-Wilk W	0.96186	0.74935	0.80096	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	50	50	1	0.03	0.86076	Non-Significant Effect
Error	8950	1491.667	6			
Total	9000	1541.6666	7			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-11		12415-05	-0.1831	1.94318	0.5696	53.0682	Non-Significant Effect

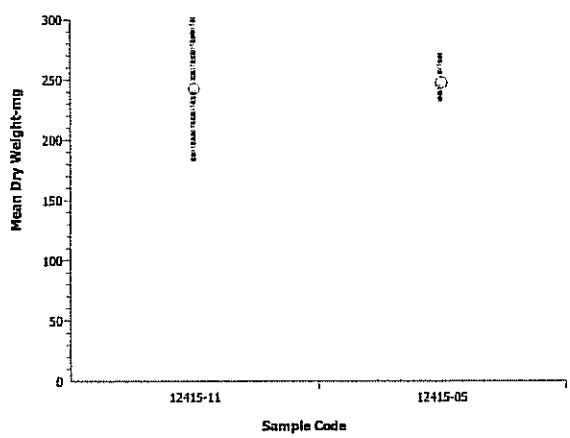
Data Summary

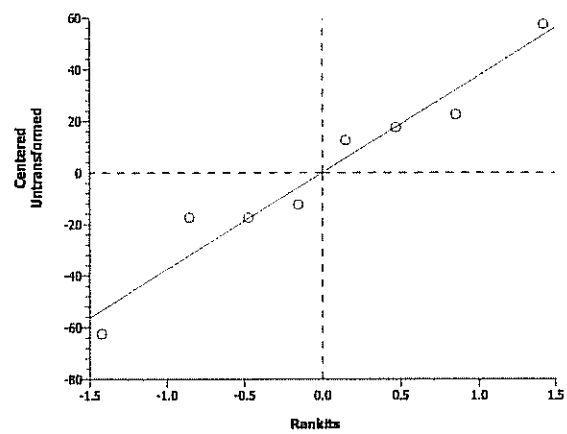
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-11	4	242.5	180	300	50.58				
12415-05	4	247.5	230	270	20.6155				

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-11	260	230	300	180						
12415-05	230	270	260	230						

Graphics





CETIS Analysis Detail

Eisenia 28-d Survival and Growth Soil Test — **EnviroSystems, Inc.**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Mean Dry Weight-mg	Comparison	09-7231-5738	09-7231-5738	09 Nov-04 10:17 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Equal Variance t	C > T	Untransformed				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	2.49593	47.46723	0.47229	Equal Variances
Distribution	Shapiro-Wilk W	0.96793	0.74935	0.86229	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	7200	7200	1	4.02	0.09183	Non-Significant Effect
Error	10750	1791.667	6			
Total	17950	8991.6666	7			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-11		12415-06	2.00465	1.94318	0.0459	58.1603	Significant Effect

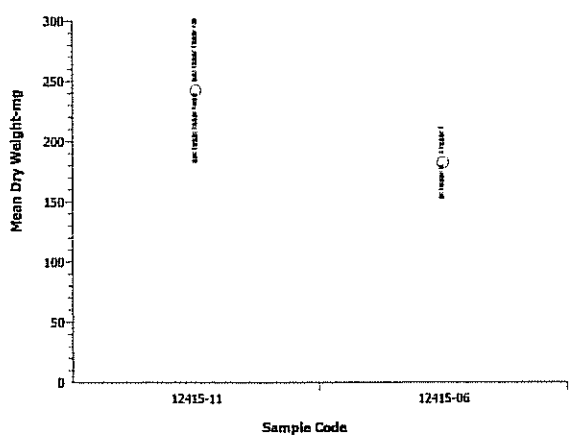
Data Summary

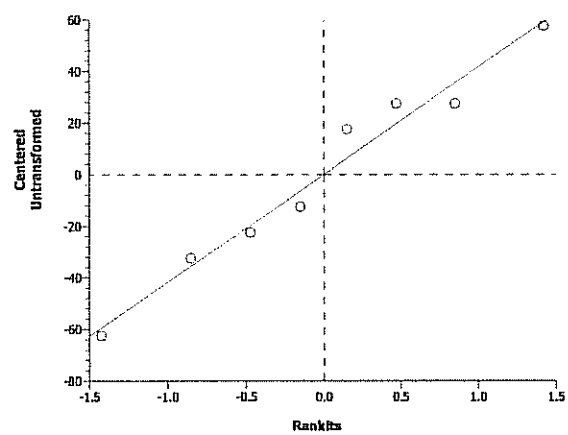
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-11	4	242.5	180	300	50.58				
12415-06	4	182.5	150	210	32.0156				

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-11	260	230	300	180						
12415-06	150	210	160	210						

Graphics





CETIS Analysis Detail

Eisenia 28-d Survival and Growth Soil Test — **EnviroSystems, Inc.**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Mean Dry Weight-mg	Comparison	09-7231-5738	09-7231-5738	09 Nov-04 10:17 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Equal Variance t	C > T	Untransformed				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	5.48214	47.46723	0.19593	Equal Variances
Distribution	Shapiro-Wilk W	0.97852	0.74935	0.95056	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	3612.5	3612.5	1	2.39	0.17319	Non-Significant Effect
Error	9075	1512.5	6			
Total	12687.5	5125	7			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-11		12415-07	1.54546	1.94318	0.0866	53.4375	Non-Significant Effect

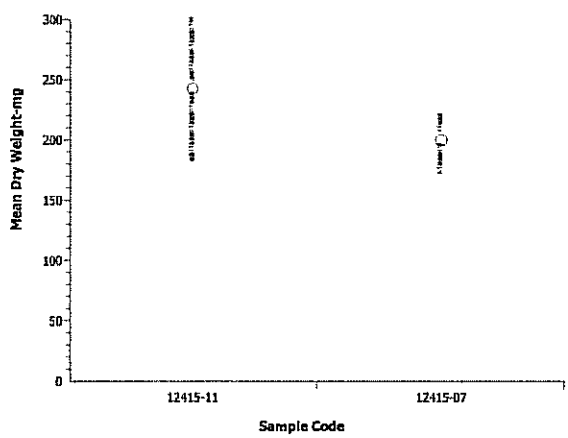
Data Summary

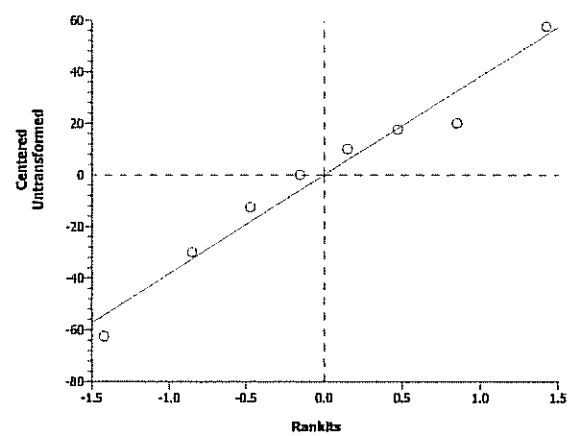
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-11	4	242.5	180	300	50.58				
12415-07	4	200	170	220	21.6025				

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-11	260	230	300	180						
12415-07	220	200	170	210						

Graphics





CETIS Analysis Detail

Eisenia 28-d Survival and Growth Soil Test — **EnviroSystems, Inc.**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Mean Dry Weight-mg	Comparison	09-7231-5738	09-7231-5738	09 Nov-04 10:17 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Equal Variance t	C > T	Untransformed				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	2.49593	47.46723	0.47229	Equal Variances
Distribution	Shapiro-Wilk W	0.93025	0.74935	0.48418	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	200	200	1	0.11	0.74967	Non-Significant Effect
Error	10750	1791.667	6			
Total	10950	1991.6666	7			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-11		12415-08	0.33411	1.94318	0.3748	58.1603	Non-Significant Effect

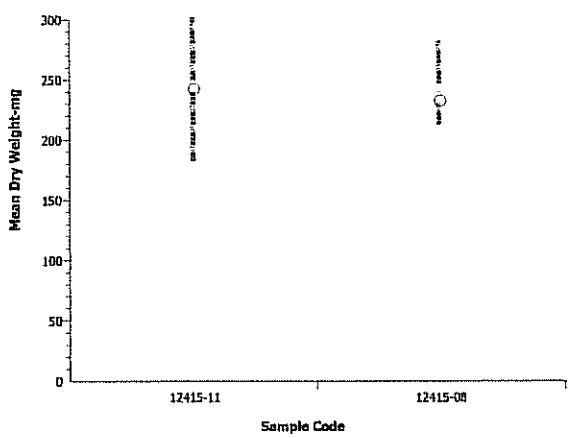
Data Summary

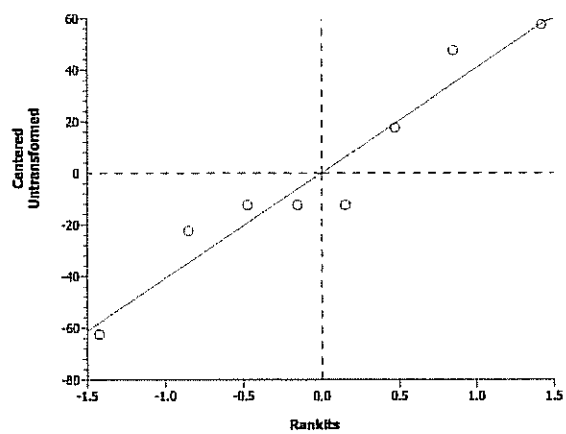
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-11	4	242.5	180	300	50.58				
12415-08	4	232.5	210	280	32.0156				

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-11	260	230	300	180						
12415-08	280	220	210	220						

Graphics





CETIS Analysis Detail

Eisenia 28-d Survival and Growth Soil Test — **EnviroSystems, Inc.**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Mean Dry Weight-mg	Comparison	09-7231-5738	09-7231-5738	09 Nov-04 10:17 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Equal Variance t	C > T	Untransformed				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	27.90909	47.46723	0.02162	Equal Variances
Distribution	Shapiro-Wilk W	0.93384	0.74935	0.51602	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	200	200	1	0.15	0.71105	Non-Significant Effect
Error	7950	1325	6			
Total	8150	1525	7			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-11		12415-09	0.38851	1.94318	0.3555	50.0157	Non-Significant Effect

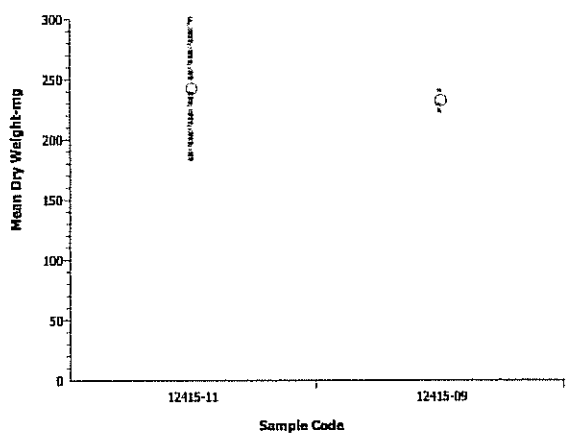
Data Summary

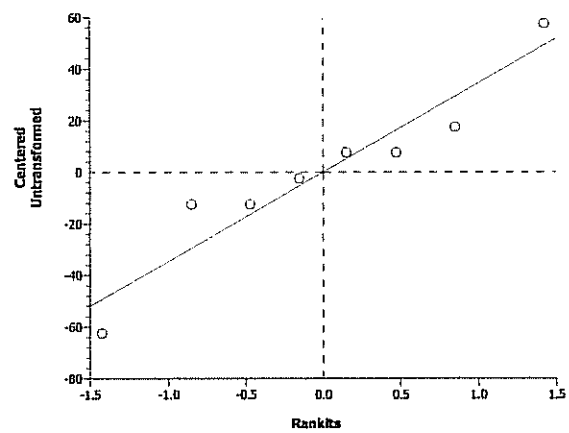
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-11	4	242.5	180	300	50.58				
12415-09	4	232.5	220	240	9.57427				

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-11	260	230	300	180						
12415-09	240	230	220	240						

Graphics





CETIS Analysis Detail

Eisenia 28-d Survival and Growth Soil Test — **EnviroSystems, Inc.**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Mean Dry Weight-mg	Comparison	09-7231-5738	09-7231-5738	09 Nov-04 10:17 AM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Equal Variance t	C > T	Untransformed				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	8.77143	47.46723	0.10768	Equal Variances
Distribution	Shapiro-Wilk W	0.97003	0.74935	0.88220	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	50	50	1	0.04	0.85759	Non-Significant Effect
Error	8550	1425	6			
Total	8600	1475	7			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-11		12415-10	0.18732	1.94318	0.4288	51.8687	Non-Significant Effect

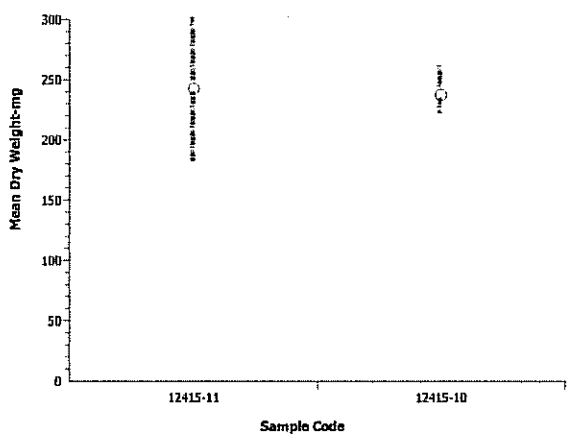
Data Summary

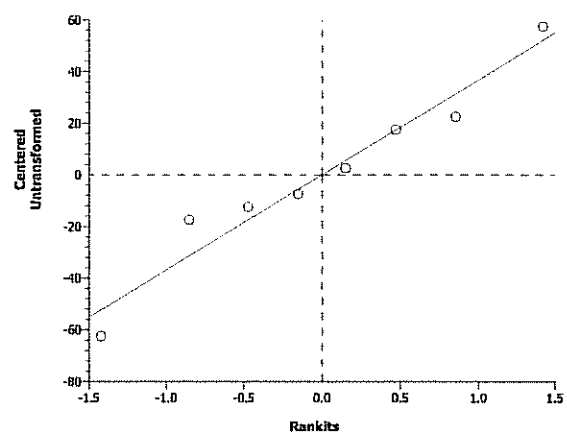
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-11	4	242.5	180	300	50.58				
12415-10	4	237.5	220	260	17.0783				

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-11	260	230	300	180						
12415-10	230	260	220	240						

Graphics





99

SOIL pH

STUDY NUMBER: 12415 **CLIENT:** CH2MHill Indian Head

	As Rec'd pH	*E. fetida* Adjusted pH
Sample ID	pH	pH
Artificial Soil	—	—
-1	7.84	
-2	6.76	
-3	6.33	
-4	6.54	
-5	5.61	
-6	6.20	
-7	5.79	
-8	4.62	
-9	6.26	
-10	6.61	
-11	4.61	
RECORDED BY:	DAB	
DATE:	8/20/04	

8/20/04

NOTES: pH meter used: Probe #39

ESI#: 12415
Date: 08/24/04

Sample ID	Crucible ID	Crucible Wt(g)	Crucible + Pre Ignition Wt (g)	Crucible + Post Ignition Wt (g)	Total LOI %
-1	1H	28.3774	30.9134	30.8943	0.8
-2	20	26.7988	33.1136	32.6803	6.9
-3	am	29.1752	39.0241	38.1365	9.0
-4	AS	25.9637	29.9988	29.9877	0.3
-5	1B	28.4389	31.9042	31.8041	2.9
-6	114	30.3272	33.1075	33.0675	1.4
-7	7	27.6616	30.3224	30.2631	2.2
-8	8	28.8729	34.1025	33.9199	3.5
-9	86	27.7921	30.2751	30.2230	2.1
-10	8C	29.0194	31.8251	31.6894	4.8
-11	1F	30.4324	31.8125	31.7151	7.1
-11 DUP	8H	28.4495	30.0807	29.9566	7.6
Blank	2C	29.8767	31.4714	31.4713	0.0

TOTAL ORGANIC CARBON BY LOSS ON IGNITION

CLIENT: CH2MHill **ESI #:** 12415

ESI Sample ID	ESI Beaker ID	Crucible ID	Crucible Weight (g)	Crucible + Pre-Ignition Weight (g)	Crucible + Post-Ignition Weight (g) #1	Total Loss on Ignition (g lost per sample)
-1	1	1H	28.3774	30.9134	30.8943	
-2	35	20	26.7988	33.1136	32.6803	
-3	33	8E am	29.1752	39.0241	38.1365	
-4	44	A5	25.9637	29.9988	29.9877	
-5	5	1B	28.4389	31.9042	31.8041	
-6	51	114	30.3272	33.1075	33.0675	
-7	45	7	27.6616	30.3224	30.2631	
-8	19	8	28.8729	34.1025	33.9199	
-9	9	86	27.7921	30.2751	30.2230	
-10	10	-8C	29.0194	31.8251	31.6894	
-11	37	1F	30.4324	31.8125	31.7151	
-11D	21	-8H	28.4495	30.0807	29.9566	
Blank	47	2C	29.8767	31.4714	31.4713	
		Date & Initials	PLS 8/22	PLS 8/22	PLS 8/24	

Net Ignition Weight = (Crucible + Pre-Ignition Weight) - (Crucible + Post-Ignition Weight)

Total Loss on Ignition = $\frac{\text{Net Ignition Weight}}{\text{Soil Weight}}$

Soil weight = (Crucible + Pre-Ignition Weight) - Crucible Weight

PERCENT MOISTURE DETERMINATIONS
CLIENT___ CH2MHill ESI STUDY NUMBER 12415

DATE____08/22/04___

ESI Sample ID	Beaker ID	Beaker Weight (g)	Weight Beaker + Wet Soil	(A) Soil Wet Weight (g)	Dry Wt. #1 (g)	Dry Wt. #2 (g)	Mean Dry Weight w/Beaker	(B) Soil Dry Weight (g)	% Moisture
-1	1	29.3640	32.0403	2.6763	31.8992		31.8992	2.5352	5.3%
-2	35	29.7291	39.0357	9.3066	36.0422		36.0422	6.3131	32.2%
-3	33	29.5315	43.8798	14.3483	39.3773		39.3773	9.8458	31.4%
-4	44	29.5677	34.1871	4.6194	33.6027		33.6027	4.0350	12.7%
-5	5	29.2502	32.9800	3.7298	32.7348		32.7348	3.4846	6.6%
-6	51	29.6539	32.6130	2.9591	32.4347		32.4347	2.7808	6.0%
-7	45	29.4388	32.3839	2.9451	32.0987		32.0987	2.6599	9.7%
-8	19	29.1833	36.1324	6.9491	34.4108		34.4108	5.2275	24.8%
-9	9	29.4582	32.0625	2.6043	31.9500		31.95	2.4918	4.3%
-10	10	28.9842	32.0949	3.1107	31.7887		31.7887	2.8045	9.8%
-11	37	29.5340	31.1318	1.5978	30.9311		30.9311	1.3971	12.6%
-11 DUP	21	30.0094	31.9113	1.9019	31.6604		31.6604	1.6510	13.2%
Blank	47	29.6904	31.2854	1.5950	31.2852		31.2852	1.5948	0.0%

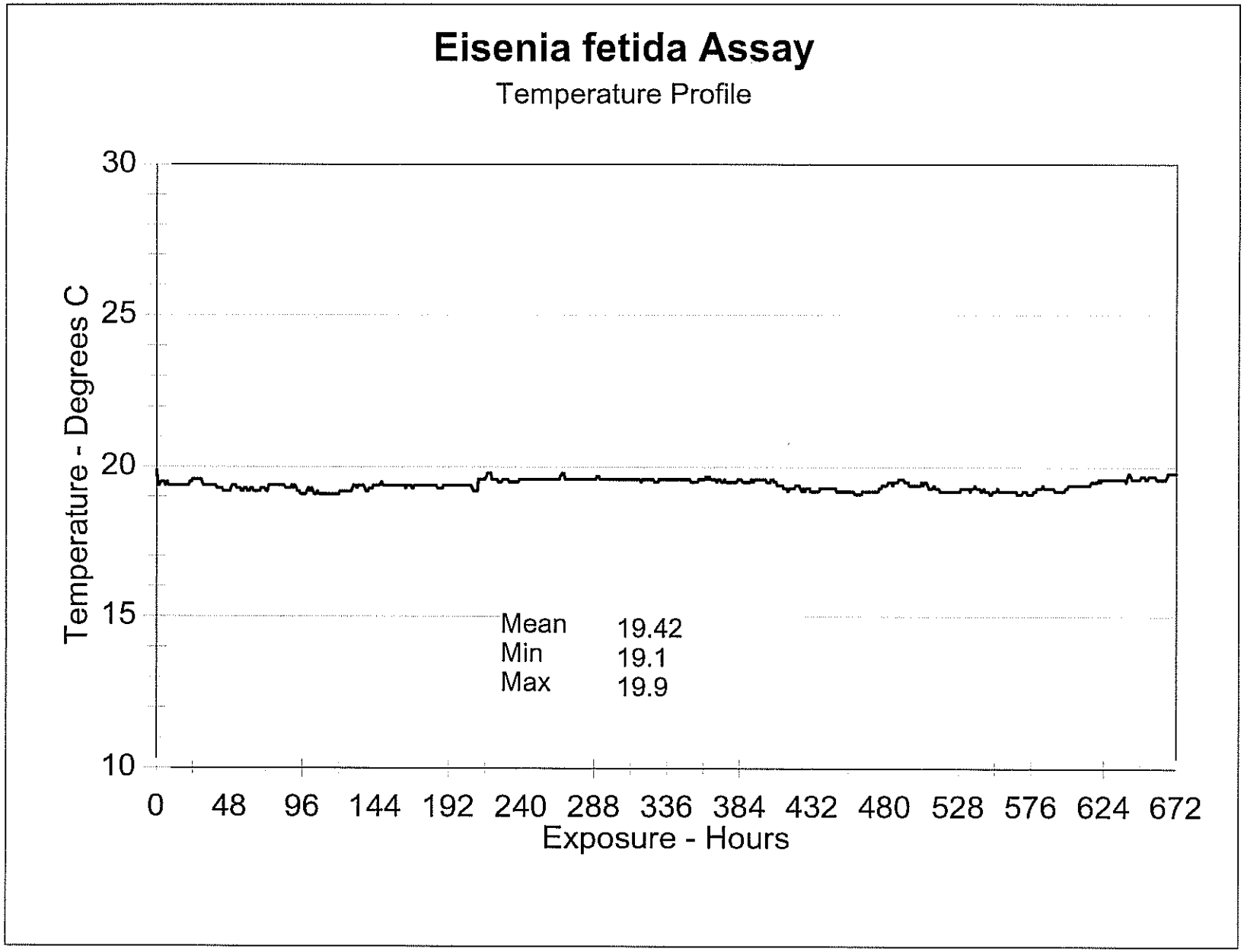
PERCENT MOISTURE DATA

CLIENT: CH2MHill Indian Head **ESI STUDY NUMBER:** 12415

ESI Sample ID	Beaker ID	Beaker Weight (g)	Weight Beaker + Wet Soil	Dry Wt. #1 (g)	Dry Wt. #2 (g)	Dry Wt. #3 (g)
-1	1	29.3640	32.0403	31.8992		
-2	35	29.7291	39.0357	36.0422		
-3	33	29.5315	43.8798	39.3773		
-4	44	29.5677	34.1871	33.6027		
-5	5	29.2502	32.9800	32.7348		
-6	51	29.6539	32.6130	32.4347		
-7	45	29.4388	32.3839	32.0987		
-8	19	29.1933	36.1324	34.4108		
-9	9	29.4582	32.0625	31.9500		
-10	10	28.9842	32.0949	31.7887		
-11	37	29.5340	31.1318	30.9311		
-11D	21	30.0094	31.9113	31.6604		
Blank	47	29.6904	31.2854	31.2852		
Date & Initials	8/18 PCS	8/18 PCS	8/18 PCS	8/22 PCS		

COMMENTS:

$$\frac{(A) - (B)}{(A)} \times 100 = \%\ \text{moisture}$$


Eisenia fetida Assay
Temperature Profile
Temperature - Degrees C
30
25
20
15
10
Mean 19.42
Min 19.1
Max 19.9
0 48 96 144 192 240 288 336 384 432 480 528 576 624 672
Exposure - Hours

STUDY: 12415
CLIENT: CH2M Hill
PROJECT: Indian Head - CTO-066 Site 47 Evaluation
TASK: Eisenia fetida 28-day Exposure Assay
DATA: Tissue Body Burden Summary
START DATE: 08/23/04

PARAMETER	UNITS	Lab Control 12571-001		IS47SDTX04 12571-002		IS47SSTX14 12571-003		IS47SDTX01 12571-004		IS47SDTX02 12571-005		IS47SATX08 12571-006	
		Result	Quant Limit	Result	Quant Limit	Result	Quant Limit	Result	Quant Limit	Result	Quant Limit	Result	Quant Limit
Aluminum, total	ug/g	180	0.2	330	0.2	840	0.1	1100	0.2	180	0.2	590	0.3
Antimony, total	ug/g	ND	0.09	ND	0.09	ND	0.07	ND	0.09	ND	0.1	ND	0.1
Arsenic, total	ug/g	3.2	0.09	2.1	0.09	1.3	0.07	0.84	0.09	4	0.1	0.45	0.1
Barium, total	ug/g	0.71	0.02	2.1	0.02	3.9	0.01	4	0.02	1.9	0.02	5.1	0.03
Beryllium, total	ug/g	ND	0.02	ND	0.02	0.028	0.01	0.032	0.02	ND	0.02	0.031	0.03
Cadmium, total	ug/g	0.21	0.02	0.3	0.02	1.1	0.01	0.88	0.02	0.37	0.02	2.2	0.03
Calcium, total	ug/g	760	0.5	470	0.5	520	0.3	570	0.4	490	0.5	500	0.6
Chromium, total	ug/g	0.25	0.04	0.71	0.04	1.4	0.03	1.9	0.03	0.38	0.04	1.2	0.05
Cobalt, total	ug/g	0.85	0.09	1.3	0.09	1.1	0.07	1.1	0.09	0.95	0.1	0.97	0.1
Copper, total	ug/g	1.4	0.04	1.6	0.04	1.7	0.03	2.5	0.03	2	0.04	1.6	0.05
Iron, total	ug/g	16	0.09	350	0.09	630	0.07	920	0.09	54	0.1	700	0.1
Lead, total	ug/g	0.26	0.09	1.5	0.09	4.3	0.07	6	0.09	0.81	0.1	5.5	0.1
Magnesium, total	ug/g	370	0.5	150	0.5	170	0.3	190	0.4	120	0.5	120	0.6
Manganese, total	ug/g	1.2	0.09	6.6	0.09	3.9	0.07	4.8	0.09	1.3	0.1	27	0.1
Mercury, total	ug/g	ND	0.07	0.087	0.07	0.078	0.07	0.15	0.07	0.1	0.07	0.23	0.07
Nickel, total	ug/g	0.15	0.05	0.43	0.05	1	0.03	1	0.04	0.45	0.05	0.97	0.06
Potassium, total	ug/g	1300	5	1200	5	1100	3	1300	4	1200	5	990	6
Selenium, total	ug/g	2.1	0.09	ND	0.09	ND	0.07	ND	0.09	1.5	0.1	ND	0.1
Silver, total	ug/g	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4
Sodium, total	ug/g	860	9	700	9	800	7	820	9	740	10	660	10
Thallium, total	ug/g	ND	0.09	ND	0.09	ND	0.07	ND	0.09	ND	0.1	ND	0.1
Vanadium, total	ug/g	1.1	0.5	1.5	0.5	3	0.3	3.6	0.4	0.81	0.5	3.3	0.6
Zinc, total	ug/g	14	0.04	14	0.04	18	0.03	22	0.03	14	0.04	16	0.05

IS47SSTX06 12571-007		IS47SSTX12 12571-008		IS47SSTX04 12571-009		IS47SSTX02 12571-010		IS47SSTX10 12571-011		BGDSSTX03 12571-012	
Result	Quant Limit	Result	Quant Limit	Result	Quant Limit	Result	Quant Limit	Result	Quant Limit	Result	Quant Limit
210	0.2	680	0.2	750	0.1	700	0.1	970	0.1	720	0.3
ND	0.09	ND	0.08	ND	0.07	ND	0.07	ND	0.06	ND	0.1
2.6	0.09	1.6	0.08	2	0.07	0.81	0.07	ND	0.06	0.6	0.1
3.4	0.02	3.8	0.02	3	0.01	5.3	0.01	4.3	0.01	4.9	0.03
ND	0.02	0.036	0.02	0.031	0.01	0.037	0.01	0.036	0.01	0.044	0.03
0.83	0.02	0.85	0.02	0.84	0.01	4.7	0.01	4.1	0.01	0.45	0.03
530	0.4	390	0.4	400	0.3	420	0.3	530	0.3	390	0.7
0.95	0.04	1.6	0.03	1.1	0.03	1.7	0.03	2.9	0.03	1	0.05
1	0.09	1.6	0.08	2.8	0.07	1.5	0.07	1.2	0.06	2.1	0.1
1.4	0.04	1.7	0.03	1.3	0.03	1.7	0.03	4.2	0.03	1.4	0.05
250	0.09	1000	0.08	370	0.07	1000	0.07	1400	0.06	620	0.1
120	0.09	22	0.08	4.9	0.07	15	0.07	21	0.06	5.4	0.1
210	0.4	150	0.4	150	0.3	160	0.3	200	0.3	130	0.7
8.4	0.09	26	0.08	3.2	0.07	38	0.07	42	0.06	77	0.1
1.9	0.07	ND	0.07	ND	0.07	0.76	0.07	1.6	0.07	ND	0.07
1	0.04	0.7	0.04	1	0.03	0.87	0.03	1.1	0.03	0.84	0.07
1300	4	940	4	1100	3	960	3	1000	3	1000	7
ND	0.09	ND	0.08	ND	0.07	ND	0.07	ND	0.06	ND	0.1
ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4	ND	0.4
680	9	610	8	750	7	620	7	700	6	710	10
ND	0.09	ND	0.08	ND	0.07	ND	0.07	ND	0.06	ND	0.1
1.4	0.4	3.1	0.4	2.3	0.3	3	0.3	4.2	0.3	3.5	0.7
28	0.04	18	0.03	17	0.03	21	0.03	45	0.03	13	0.05

Report No: 12571
Project: 12415 CH2M Hill Indian Head

Sample ID: Artificial Soil Lab Control
Matrix: Tissue

Parameter	Lab ID	Result	Quant Limit	Units	Date Sampled	Date of Analysis	Method/Reference
Aluminum, total	12571-001	180	0.2	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Antimony, total	12571-001	ND	0.09	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Arsenic, total	12571-001	3.2	0.09	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Barium, total	12571-001	0.71	0.02	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Beryllium, total	12571-001	ND	0.02	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Cadmium, total	12571-001	0.21	0.02	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Calcium, total	12571-001	760	0.5	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Chromium, total	12571-001	0.25	0.04	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Cobalt, total	12571-001	0.85	0.09	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Copper, total	12571-001	1.4	0.04	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Iron, total	12571-001	16	0.09	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Lead, total	12571-001	0.26	0.09	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Magnesium, total	12571-001	370	0.5	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Manganese, total	12571-001	1.2	0.09	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Mercury, total	12571-001	ND	0.07	ug/g	09/20/04	10/06/04	SW846 3rd Ed. 6010
Nickel, total	12571-001	0.15	0.05	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Potassium, total	12571-001	1300	5	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Selenium, total	12571-001	2.1	0.09	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Silver, total	12571-001	ND	0.4	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Sodium, total	12571-001	860	9	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Thallium, total	12571-001	ND	0.09	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Vanadium, total	12571-001	1.1	0.5	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Zinc, total	12571-001	14	0.04	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010

Report No: 12571
Project: 12415 CH2M Hill Indian Head

Sample ID: IS47SDTX04
Matrix: Tissue

Parameter	Lab ID	Result	Quant Limit	Units	Date Sampled	Date of Analysis	Method/Reference
Aluminum, total	12571-002	330	0.2	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Antimony, total	12571-002	ND	0.09	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Arsenic, total	12571-002	2.1	0.09	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Barium, total	12571-002	2.1	0.02	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Beryllium, total	12571-002	ND	0.02	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Cadmium, total	12571-002	0.3	0.02	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Calcium, total	12571-002	470	0.5	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Chromium, total	12571-002	0.71	0.04	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Cobalt, total	12571-002	1.3	0.09	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Copper, total	12571-002	1.6	0.04	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Iron, total	12571-002	350	0.09	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Lead, total	12571-002	1.5	0.09	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Magnesium, total	12571-002	150	0.5	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Manganese, total	12571-002	6.6	0.09	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Mercury, total	12571-002	0.087	0.07	ug/g	09/20/04	10/06/04	SW846 3rd Ed. 6010
Nickel, total	12571-002	0.43	0.05	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Potassium, total	12571-002	1200	5	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Selenium, total	12571-002	ND	0.09	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Silver, total	12571-002	ND	0.4	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Sodium, total	12571-002	700	9	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Thallium, total	12571-002	ND	0.09	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Vanadium, total	12571-002	1.5	0.5	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Zinc, total	12571-002	14	0.04	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010

Report No: 12571
Project: 12415 CH2M Hill Indian Head

Sample ID: IS47SSTX14
Matrix: Tissue

Parameter	Lab ID	Result	Quant Limit	Units	Date Sampled	Date of Analysis	Method/Reference
Aluminum, total	12571-003	840	0.1	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Antimony, total	12571-003	ND	0.07	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Arsenic, total	12571-003	1.3	0.07	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Barium, total	12571-003	3.9	0.01	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Beryllium, total	12571-003	0.028	0.01	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Cadmium, total	12571-003	1.1	0.01	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Calcium, total	12571-003	520	0.3	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Chromium, total	12571-003	1.4	0.03	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Cobalt, total	12571-003	1.1	0.07	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Copper, total	12571-003	1.7	0.03	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Iron, total	12571-003	630	0.07	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Lead, total	12571-003	4.3	0.07	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Magnesium, total	12571-003	170	0.3	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Manganese, total	12571-003	3.9	0.07	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Mercury, total	12571-003	0.078	0.07	ug/g	09/20/04	10/06/04	SW846 3rd Ed. 6010
Nickel, total	12571-003	1	0.03	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Potassium, total	12571-003	1100	3	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Selenium, total	12571-003	ND	0.07	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Silver, total	12571-003	ND	0.4	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Sodium, total	12571-003	800	7	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Thallium, total	12571-003	ND	0.07	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Vanadium, total	12571-003	3	0.3	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Zinc, total	12571-003	18	0.03	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010

Report No: 12571
Project: 12415 CH2M Hill Indian Head

Sample ID: IS47SDTX01
Matrix: Tissue

Parameter	Lab ID	Result	Quant Limit	Units	Date Sampled	Date of Analysis	Method/Reference
Aluminum, total	12571-004	1100	0.2	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Antimony, total	12571-004	ND	0.09	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Arsenic, total	12571-004	0.84	0.09	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Barium, total	12571-004	4	0.02	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Beryllium, total	12571-004	0.032	0.02	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Cadmium, total	12571-004	0.88	0.02	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Calcium, total	12571-004	570	0.4	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Chromium, total	12571-004	1.9	0.03	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Cobalt, total	12571-004	1.1	0.09	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Copper, total	12571-004	2.5	0.03	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Iron, total	12571-004	920	0.09	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Lead, total	12571-004	6	0.09	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Magnesium, total	12571-004	190	0.4	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Manganese, total	12571-004	4.8	0.09	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Mercury, total	12571-004	0.15	0.07	ug/g	09/20/04	10/06/04	SW846 3rd Ed. 6010
Nickel, total	12571-004	1	0.04	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Potassium, total	12571-004	1300	4	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Selenium, total	12571-004	ND	0.09	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Silver, total	12571-004	ND	0.4	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Sodium, total	12571-004	820	9	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Thallium, total	12571-004	ND	0.09	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Vanadium, total	12571-004	3.6	0.4	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Zinc, total	12571-004	22	0.03	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010

Report No: 12571
Project: 12415 CH2M Hill Indian Head

Sample ID: IS47SDTX02
Matrix: Tissue

Parameter	Lab ID	Result	Quant Limit	Units	Date Sampled	Date of Analysis	Method/Reference
Aluminum, total	12571-005	180	0.2	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Antimony, total	12571-005	ND	0.1	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Arsenic, total	12571-005	4	0.1	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Barium, total	12571-005	1.9	0.02	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Beryllium, total	12571-005	ND	0.02	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Cadmium, total	12571-005	0.37	0.02	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Calcium, total	12571-005	490	0.5	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Chromium, total	12571-005	0.38	0.04	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Cobalt, total	12571-005	0.95	0.1	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Copper, total	12571-005	2	0.04	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Iron, total	12571-005	54	0.1	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Lead, total	12571-005	0.81	0.1	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Magnesium, total	12571-005	120	0.5	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Manganese, total	12571-005	1.3	0.1	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Mercury, total	12571-005	0.1	0.07	ug/g	09/20/04	10/06/04	SW846 3rd Ed. 6010
Nickel, total	12571-005	0.45	0.05	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Potassium, total	12571-005	1200	5	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Selenium, total	12571-005	1.5	0.1	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Silver, total	12571-005	ND	0.4	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Sodium, total	12571-005	740	10	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Thallium, total	12571-005	ND	0.1	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Vanadium, total	12571-005	0.81	0.5	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Zinc, total	12571-005	14	0.04	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010

Report No: 12571
Project: 12415 CH2M Hill Indian Head

Sample ID: IS47SATX08
Matrix: Tissue

Parameter	Lab ID	Result	Quant Limit	Units	Date Sampled	Date of Analysis	Method/Reference
Aluminum, total	12571-006	590	0.3	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Antimony, total	12571-006	ND	0.1	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Arsenic, total	12571-006	0.45	0.1	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Barium, total	12571-006	5.1	0.03	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Beryllium, total	12571-006	0.031	0.03	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Cadmium, total	12571-006	2.2	0.03	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Calcium, total	12571-006	500	0.6	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Chromium, total	12571-006	1.2	0.05	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Cobalt, total	12571-006	0.97	0.1	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Copper, total	12571-006	1.6	0.05	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Iron, total	12571-006	700	0.1	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Lead, total	12571-006	5.5	0.1	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Magnesium, total	12571-006	120	0.6	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Manganese, total	12571-006	27	0.1	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Mercury, total	12571-006	0.23	0.07	ug/g	09/20/04	10/06/04	SW846 3rd Ed. 6010
Nickel, total	12571-006	0.97	0.06	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Potassium, total	12571-006	990	6	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Selenium, total	12571-006	ND	0.1	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Silver, total	12571-006	ND	0.4	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Sodium, total	12571-006	660	10	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Thallium, total	12571-006	ND	0.1	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Vanadium, total	12571-006	3.3	0.6	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Zinc, total	12571-006	16	0.05	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010

Report No: 12571
Project: 12415 CH2M Hill Indian Head

Sample ID: IS47SSTX06
Matrix: Tissue

Parameter	Lab ID	Result	Quant Limit	Units	Date Sampled	Date of Analysis	Method/Reference
Aluminum, total	12571-007	210	0.2	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Antimony, total	12571-007	ND	0.09	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Arsenic, total	12571-007	2.6	0.09	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Barium, total	12571-007	3.4	0.02	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Beryllium, total	12571-007	ND	0.02	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Cadmium, total	12571-007	0.83	0.02	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Calcium, total	12571-007	530	0.4	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Chromium, total	12571-007	0.95	0.04	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Cobalt, total	12571-007	1	0.09	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Copper, total	12571-007	1.4	0.04	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Iron, total	12571-007	250	0.09	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Lead, total	12571-007	120	0.09	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Magnesium, total	12571-007	210	0.4	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Manganese, total	12571-007	8.4	0.09	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Mercury, total	12571-007	1.9	0.07	ug/g	09/20/04	10/06/04	SW846 3rd Ed. 6010
Nickel, total	12571-007	1	0.04	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Potassium, total	12571-007	1300	4	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Selenium, total	12571-007	ND	0.09	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Silver, total	12571-007	ND	0.4	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Sodium, total	12571-007	680	9	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Thallium, total	12571-007	ND	0.09	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Vanadium, total	12571-007	1.4	0.4	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Zinc, total	12571-007	28	0.04	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010

Report No: 12571
Project: 12415 CH2M Hill Indian Head

Sample ID: IS47SSTX12
Matrix: Tissue

Parameter	Lab ID	Result	Quant Limit	Units	Date Sampled	Date of Analysis	Method/Reference
Aluminum, total	12571-008	680	0.2	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Antimony, total	12571-008	ND	0.08	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Arsenic, total	12571-008	1.6	0.08	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Barium, total	12571-008	3.8	0.02	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Beryllium, total	12571-008	0.036	0.02	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Cadmium, total	12571-008	0.85	0.02	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Calcium, total	12571-008	390	0.4	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Chromium, total	12571-008	1.6	0.03	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Cobalt, total	12571-008	1.6	0.08	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Copper, total	12571-008	1.7	0.03	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Iron, total	12571-008	1000	0.08	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Lead, total	12571-008	22	0.08	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Magnesium, total	12571-008	150	0.4	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Manganese, total	12571-008	26	0.08	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Mercury, total	12571-008	ND	0.07	ug/g	09/20/04	10/06/04	SW846 3rd Ed. 6010
Nickel, total	12571-008	0.7	0.04	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Potassium, total	12571-008	940	4	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Selenium, total	12571-008	ND	0.08	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Silver, total	12571-008	ND	0.4	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Sodium, total	12571-008	610	8	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Thallium, total	12571-008	ND	0.08	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Vanadium, total	12571-008	3.1	0.4	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Zinc, total	12571-008	18	0.03	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010

Report No: 12571
Project: 12415 CH2M Hill Indian Head

Sample ID: IS47SSTX04
Matrix: Tissue

Parameter	Lab ID	Result	Quant Limit	Units	Date Sampled	Date of Analysis	Method/Reference
Aluminum, total	12571-009	750	0.1	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Antimony, total	12571-009	ND	0.07	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Arsenic, total	12571-009	2	0.07	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Barium, total	12571-009	3	0.01	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Beryllium, total	12571-009	0.031	0.01	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Cadmium, total	12571-009	0.84	0.01	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Calcium, total	12571-009	400	0.3	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Chromium, total	12571-009	1.1	0.03	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Cobalt, total	12571-009	2.8	0.07	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Copper, total	12571-009	1.3	0.03	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Iron, total	12571-009	370	0.07	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Lead, total	12571-009	4.9	0.07	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Magnesium, total	12571-009	150	0.3	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Manganese, total	12571-009	3.2	0.07	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Mercury, total	12571-009	ND	0.07	ug/g	09/20/04	10/06/04	SW846 3rd Ed. 6010
Nickel, total	12571-009	1	0.03	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Potassium, total	12571-009	1100	3	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Selenium, total	12571-009	ND	0.07	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Silver, total	12571-009	ND	0.4	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Sodium, total	12571-009	750	7	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Thallium, total	12571-009	ND	0.07	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Vanadium, total	12571-009	2.3	0.3	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Zinc, total	12571-009	17	0.03	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010

Report No: 12571
Project: 12415 CH2M Hill Indian Head

Sample ID: IS47SSTX02
Matrix: Tissue

Parameter	Lab ID	Result	Quant Limit	Units	Date Sampled	Date of Analysis	Method/Reference
Aluminum, total	12571-010	700	0.1	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Antimony, total	12571-010	ND	0.07	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Arsenic, total	12571-010	0.81	0.07	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Barium, total	12571-010	5.3	0.01	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Beryllium, total	12571-010	0.037	0.01	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Cadmium, total	12571-010	4.7	0.01	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Calcium, total	12571-010	420	0.3	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Chromium, total	12571-010	1.7	0.03	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Cobalt, total	12571-010	1.5	0.07	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Copper, total	12571-010	1.7	0.03	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Iron, total	12571-010	1000	0.07	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Lead, total	12571-010	15	0.07	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Magnesium, total	12571-010	160	0.3	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Manganese, total	12571-010	38	0.07	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Mercury, total	12571-010	0.76	0.07	ug/g	09/20/04	10/06/04	SW846 3rd Ed. 6010
Nickel, total	12571-010	0.87	0.03	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Potassium, total	12571-010	960	3	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Selenium, total	12571-010	ND	0.07	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Silver, total	12571-010	ND	0.4	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Sodium, total	12571-010	620	7	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Thallium, total	12571-010	ND	0.07	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Vanadium, total	12571-010	3	0.3	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Zinc, total	12571-010	21	0.03	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010

Report No: 12571
Project: 12415 CH2M Hill Indian Head

Sample ID: IS47SSTX10
Matrix: Tissue

Parameter	Lab ID	Result	Quant Limit	Units	Date Sampled	Date of Analysis	Method/Reference
Aluminum, total	12571-011	970	0.1	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Antimony, total	12571-011	ND	0.06	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Arsenic, total	12571-011	ND	0.06	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Barium, total	12571-011	4.3	0.01	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Beryllium, total	12571-011	0.036	0.01	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Cadmium, total	12571-011	4.1	0.01	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Calcium, total	12571-011	530	0.3	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Chromium, total	12571-011	2.9	0.03	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Cobalt, total	12571-011	1.2	0.06	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Copper, total	12571-011	4.2	0.03	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Iron, total	12571-011	1400	0.06	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Lead, total	12571-011	21	0.06	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Magnesium, total	12571-011	200	0.3	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Manganese, total	12571-011	42	0.06	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Mercury, total	12571-011	1.6	0.07	ug/g	09/20/04	10/06/04	SW846 3rd Ed. 6010
Nickel, total	12571-011	1.1	0.03	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Potassium, total	12571-011	1000	3	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Selenium, total	12571-011	ND	0.06	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Silver, total	12571-011	ND	0.4	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Sodium, total	12571-011	700	6	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Thallium, total	12571-011	ND	0.06	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Vanadium, total	12571-011	4.2	0.3	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Zinc, total	12571-011	45	0.03	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010

Report No: 12571
Project: 12415 CH2M Hill Indian Head

Sample ID: BGDSSTX03
Matrix: Tissue

Parameter	Lab ID	Result	Quant Limit	Units	Date Sampled	Date of Analysis	Method/Reference
Aluminum, total	12571-012	720	0.3	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Antimony, total	12571-012	ND	0.1	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Arsenic, total	12571-012	0.6	0.1	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Barium, total	12571-012	4.9	0.03	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Beryllium, total	12571-012	0.044	0.03	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Cadmium, total	12571-012	0.45	0.03	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Calcium, total	12571-012	390	0.7	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Chromium, total	12571-012	1	0.05	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Cobalt, total	12571-012	2.1	0.1	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Copper, total	12571-012	1.4	0.05	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Iron, total	12571-012	620	0.1	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Lead, total	12571-012	5.4	0.1	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Magnesium, total	12571-012	130	0.7	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Manganese, total	12571-012	77	0.1	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Mercury, total	12571-012	ND	0.07	ug/g	09/20/04	10/06/04	SW846 3rd Ed. 6010
Nickel, total	12571-012	0.84	0.07	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Potassium, total	12571-012	1000	7	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Selenium, total	12571-012	ND	0.1	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Silver, total	12571-012	ND	0.4	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Sodium, total	12571-012	710	10	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Thallium, total	12571-012	ND	0.1	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Vanadium, total	12571-012	3.5	0.7	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Zinc, total	12571-012	13	0.05	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010

Report No: 12571
Project: 12415 CH2M Hill Indian Head
Batch: B017S
Sample ID: Laboratory Blank
Matrix: Tissue

Parameter	Lab ID	Result	Quant Limit	Units	Date Sampled	Date of Analysis	Method/Reference
Aluminum, total	PB017S	2.38	0.33	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Antimony, total	PB017S	ND	0.17	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Arsenic, total	PB017S	ND	0.17	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Barium, total	PB017S	ND	0.03	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Beryllium, total	PB017S	ND	0.03	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Cadmium, total	PB017S	ND	0.03	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Calcium, total	PB017S	ND	0.83	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Chromium, total	PB017S	ND	0.07	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Cobalt, total	PB017S	ND	0.17	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Copper, total	PB017S	ND	0.07	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Iron, total	PB017S	ND	0.17	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Lead, total	PB017S	ND	0.17	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Magnesium, total	PB017S	ND	0.83	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Manganese, total	PB017S	ND	0.17	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Mercury, total	PB017S	ND	0.07	ug/g	09/20/04	10/06/04	SW846 3rd Ed. 6010
Nickel, total	PB017S	ND	0.08	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Potassium, total	PB017S	ND	8.33	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Selenium, total	PB017S	ND	0.20	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Silver, total	PB017S	ND	0.40	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Sodium, total	PB017S	ND	16.67	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Thallium, total	PB017S	ND	0.17	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Vanadium, total	PB017S	ND	0.83	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010
Zinc, total	PB017S	0.12	0.07	ug/g	09/20/04	10/07/04	SW846 3rd Ed. 6010

Report No: 12571
Project: 12415 CH2M Hill Indian Head
Sample ID: Laboratory Control Sample
Matrix: Tissue

Parameter	Lab ID	Result (ug/g)	Quant Limit	True Value	Units	Percent Recovery	Date of Analysis	Method/Reference
Aluminum, total	LCS017S	33.9	0.33	33.3	ug/g	102	10/07/04	200.7/SW846 3rd Ed. 6010
Antimony, total	LCS017S	14.0	0.17	16.7	ug/g	84	10/07/04	200.7/SW846 3rd Ed. 6010
Arsenic, total	LCS017S	15.5	0.17	16.7	ug/g	93	10/07/04	200.7/SW846 3rd Ed. 6010
Barium, total	LCS017S	32.6	0.03	33.3	ug/g	98	10/07/04	200.7/SW846 3rd Ed. 6010
Beryllium, total	LCS017S	0.8	0.03	0.8	ug/g	97	10/07/04	200.7/SW846 3rd Ed. 6010
Cadmium, total	LCS017S	8.4	0.03	8.3	ug/g	101	10/07/04	200.7/SW846 3rd Ed. 6010
Calcium, total	LCS017S	90.8	0.83	83.3	ug/g	109	10/07/04	200.7/SW846 3rd Ed. 6010
Chromium, total	LCS017S	3.3	0.07	3.3	ug/g	99	10/07/04	200.7/SW846 3rd Ed. 6010
Cobalt, total	LCS017S	8.4	0.17	8.3	ug/g	101	10/07/04	200.7/SW846 3rd Ed. 6010
Copper, total	LCS017S	4.0	0.07	4.2	ug/g	97	10/07/04	200.7/SW846 3rd Ed. 6010
Iron, total	LCS017S	16.7	0.17	16.7	ug/g	100	10/07/04	200.7/SW846 3rd Ed. 6010
Lead, total	LCS017S	16.5	0.17	16.7	ug/g	99	10/07/04	200.7/SW846 3rd Ed. 6010
Magnesium, total	LCS017S	86.9	0.83	83.3	ug/g	104	10/07/04	200.7/SW846 3rd Ed. 6010
Manganese, total	LCS017S	8.4	0.17	8.3	ug/g	101	10/07/04	200.7/SW846 3rd Ed. 6010
Mercury, total	LCS017S	2.8	0.07	3.3	ug/g	83	10/06/04	200.7/SW846 3rd Ed. 6010
Nickel, total	LCS017S	8.1	0.08	8.3	ug/g	98	10/07/04	200.7/SW846 3rd Ed. 6010
Potassium, total	LCS017S	68.8	8.33	83.3	ug/g	83	10/07/04	200.7/SW846 3rd Ed. 6010
Selenium, total	LCS017S	14.7	0.17	16.7	ug/g	88	10/07/04	200.7/SW846 3rd Ed. 6010
Silver, total	LCS017S	5.3	0.03	4.2	ug/g	126	10/07/04	200.7/SW846 3rd Ed. 6010
Sodium, total	LCS017S	80.9	16.67	83.3	ug/g	97	10/07/04	200.7/SW846 3rd Ed. 6010
Thallium, total	LCS017S	15.9	0.17	16.7	ug/g	96	10/07/04	200.7/SW846 3rd Ed. 6010
Vanadium, total	LCS017S	8.3	0.83	8.3	ug/g	99	10/07/04	200.7/SW846 3rd Ed. 6010
Zinc, total	LCS017S	8.5	0.07	8.3	ug/g	102	10/07/04	200.7/SW846 3rd Ed. 6010

Report No: 12571
Project: 12415 CH2M Hill Indian Head
Sample ID: Laboratory Duplicate
Matrix: Tissue
Lab ID: 12571-006

Parameter	Lab ID	Duplicate Result	Sample Result	Quant Limit	Units	Percent Relative Range	Date Analyzed	Method/Reference
Aluminum, total	12571-006D	680	590	0.48	ug/g	14	10/01/04	200.7/SW846 3rd Ed. 6010
Antimony, total	12571-006D	ND	ND	0.24	ug/g	NC	10/01/04	200.7/SW846 3rd Ed. 6010
Arsenic, total	12571-006D	0.8	0.5	0.20	ug/g	NC	10/01/04	200.7/SW846 3rd Ed. 6010
Barium, total	12571-006D	6.5	5.1	0.05	ug/g	25	10/01/04	200.7/SW846 3rd Ed. 6010
Beryllium, total	12571-006D	ND	ND	0.05	ug/g	NC	10/01/04	200.7/SW846 3rd Ed. 6010
Cadmium, total	12571-006D	2.9	2.2	0.05	ug/g	27	10/01/04	200.7/SW846 3rd Ed. 6010
Calcium, total	12571-006D	743	500	1.21	ug/g	39	10/01/04	200.7/SW846 3rd Ed. 6010
Chromium, total	12571-006D	1.5	1.2	0.10	ug/g	25	10/01/04	200.7/SW846 3rd Ed. 6010
Cobalt, total	12571-006D	1.3	1.0	0.24	ug/g	NC	10/01/04	200.7/SW846 3rd Ed. 6010
Copper, total	12571-006D	2.2	1.6	0.10	ug/g	32	10/01/04	200.7/SW846 3rd Ed. 6010
Iron, total	12571-006D	831	702	0.24	ug/g	17	10/01/04	200.7/SW846 3rd Ed. 6010
Lead, total	12571-006D	7.1	5.5	0.24	ug/g	25	10/01/04	200.7/SW846 3rd Ed. 6010
Magnesium, total	12571-006D	160	124	1.21	ug/g	26	10/01/04	200.7/SW846 3rd Ed. 6010
Manganese, total	12571-006D	35.1	27.4	0.24	ug/g	25	10/01/04	200.7/SW846 3rd Ed. 6010
Mercury, total	12571-006D	ND	ND	0.08	ug/g	NC	10/06/04	200.7/SW846 3rd Ed. 6010
Nickel, total	12571-006D	1.3	1.0	0.12	ug/g	30	10/01/04	200.7/SW846 3rd Ed. 6010
Potassium, total	12571-006D	1309	986	12.08	ug/g	28	10/01/04	200.7/SW846 3rd Ed. 6010
Selenium, total	12571-006D	ND	ND	0.24	ug/g	NC	10/01/04	200.7/SW846 3rd Ed. 6010
Silver, total	12571-006D	1.8	1.3	0.40	ug/g	NC	10/01/04	200.7/SW846 3rd Ed. 6010
Sodium, total	12571-006D	837	662	24.15	ug/g	23	10/01/04	200.7/SW846 3rd Ed. 6010
Thallium, total	12571-006D	ND	ND	0.24	ug/g	NC	10/01/04	200.7/SW846 3rd Ed. 6010
Vanadium, total	12571-006D	4.0	3.3	1.21	ug/g	NC	10/01/04	200.7/SW846 3rd Ed. 6010
Zinc, total	12571-006D	20.3	15.6	0.10	ug/g	27	10/01/04	200.7/SW846 3rd Ed. 6010

NC = Not calculated due to one or both values below five times the reporting limit.

Report No: 12571
Project: 12415 CH2M Hill Indian Head
Sample ID: Matrix Spike
Matrix: Tissue
Lab ID: 12571-006

Parameter	Lab ID	Spike Result	Amount Added	Sample Result	Units	Percent Recovery	Date Analyzed	Method/Reference
Aluminum, total	12571-006S	683.3	46.1	594.3	ug/g	SNR	10/07/04	200.7/SW846 3rd Ed. 6010
Antimony, total	12571-006S	2.4	23.0	ND	ug/g	11	10/07/04	200.7/SW846 3rd Ed. 6010
Arsenic, total	12571-006S	19.6	23.0	0.5	ug/g	83	10/07/04	200.7/SW846 3rd Ed. 6010
Barium, total	12571-006S	44.6	46.1	5.1	ug/g	86	10/07/04	200.7/SW846 3rd Ed. 6010
Beryllium, total	12571-006S	1.0	1.2	0.03	ug/g	83	10/07/04	200.7/SW846 3rd Ed. 6010
Cadmium, total	12571-006S	12.4	11.5	2.2	ug/g	88	10/07/04	200.7/SW846 3rd Ed. 6010
Calcium, total	12571-006S	673.8	115.2	500.4	ug/g	SNR	10/07/04	200.7/SW846 3rd Ed. 6010
Chromium, total	12571-006S	5.0	4.6	1.2	ug/g	83	10/07/04	200.7/SW846 3rd Ed. 6010
Cobalt, total	12571-006S	11.0	11.5	1.0	ug/g	87	10/07/04	200.7/SW846 3rd Ed. 6010
Copper, total	12571-006S	6.8	5.8	1.6	ug/g	91	10/07/04	200.7/SW846 3rd Ed. 6010
Iron, total	12571-006S	818.5	23.0	702.3	ug/g	SNR	10/07/04	200.7/SW846 3rd Ed. 6010
Lead, total	12571-006S	26.3	23.0	5.5	ug/g	90	10/07/04	200.7/SW846 3rd Ed. 6010
Magnesium, total	12571-006S	243.2	115.2	123.7	ug/g	104	10/07/04	200.7/SW846 3rd Ed. 6010
Manganese, total	12571-006S	42.1	11.5	27.4	ug/g	128	10/07/04	200.7/SW846 3rd Ed. 6010
Mercury, total	12571-012S	3.7	5.0	ND	ug/g	74	10/06/04	200.7/SW846 3rd Ed. 6010
Nickel, total	12571-006S	10.6	11.5	1.0	ug/g	84	10/07/04	200.7/SW846 3rd Ed. 6010
Potassium, total	12571-006S	1386.8	115.2	985.6	ug/g	SNR	10/07/04	200.7/SW846 3rd Ed. 6010
Selenium, total	12571-006S	8.7	23.0	ND	ug/g	38	10/07/04	200.7/SW846 3rd Ed. 6010
Silver, total	12571-006S	7.7	5.8	1.3	ug/g	110	10/07/04	200.7/SW846 3rd Ed. 6010
Sodium, total	12571-006S	908.2	115.2	662.3	ug/g	SNR	10/07/04	200.7/SW846 3rd Ed. 6010
Thallium, total	12571-006S	18.6	23.0	ND	ug/g	81	10/07/04	200.7/SW846 3rd Ed. 6010
Vanadium, total	12571-006S	13.0	11.5	3.3	ug/g	85	10/07/04	200.7/SW846 3rd Ed. 6010
Zinc, total	12571-006S	29.5	11.5	15.6	ug/g	121	10/07/04	200.7/SW846 3rd Ed. 6010

NC = Not calculated due to sample value over five times the spike amount.

GPL LABORATORIES, LLLP

7210A Corporate Court
Frederick, MD 21703
(301) 694-5310
Fax (301) 620-0731

Contract #/Billing Reference: 145185. AR.ER

Project: Indian Head Site 47
Client: CH2M HILL
Send Results To: John Burgess / CH2M HILL
Address: 25 New Chardon St., Ste. 300
Boston, MA 02114
Phone: 617.523.2002 x224

Turnaround Time	
# of Containers	1
Container Type	bucket
Preservative Used	None
Type of Analysis	Soil toxicity test

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	Soil toxicity test	Lab Cooler No.	CLIENT COMMENTS
1S47SDTX04	8/9/04	1445	SS	SB	X		4 buckets total
1S47SDTX14	8/9/04	1530	SS	SB	X		
1S47SDTX01	8/9/04	1555	SS	SB	X		
1S47SDTX02	8/9/04	1615	SS	SB	X		

Relinquished By:	Date/Time	Received By:	Relinquished By:	Received for Laboratory By:	Date/Time
[illegible]	8/9/04 1745	USA	fedex	[illegible]	8/10/04 1130

Relinquished By:	Date/Time	Received By:	Date/Time	Shipper:	Airbill No.:

Relinquished By:	Date/Time	Received By:	Lab Comments:	Temp:

G.P. W.O. _____

ESI Lab

~~GPL LABORATORIES, LLP~~

7210A Corporate Court
Frederick, MD 21703
(301) 694-5310
Fax (301) 620-0731

Contract #/Billing Reference

1 of 1 Pgs.

Project: NDW Indian Head Site 47

Client: CH2M HILL

Send Results To: John Burgess

Address: 25 New Chardon St, Ste 300
Boston, MA 02114

Phone: 617-523-2002 x224

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	Soil Toxicity										CLIENT COMMENTS
Turnaround Time															
# of Containers															
Container Type															
Preservative Used															
Type of Analysis															Lab Cooler No.
IS475ATX08	8/10	0830	Soil	SB	1										
IS475STX06	8/10	0845		SB	1										
IS475STX12	8/10	0900		SB	1										
IS475STX04	8/10	0915		SB	1										
IS475STX02	8/10	0930		SB	1										
IS475STX10	8/10	0945		SB	1										
IS475STX17	8/10	1440		SB	1										
RGDSSTX03	8/10	1330		SB	1										
IS475DTX05	8/10	1500		SB	1										
IS47RSDTX01	8/10	1610		SB	1										

Relinquished By:	Date/Time	Received By:	Relinquished By:	Received for Laboratory By:	Date/Time
[signature]	8/10/04 1800			[signature]	8/11/04 1040

Relinquished By:	Date/Time	Received By:	Date/Time	Shipper:	Airbill No.:

Relinquished By:	Date/Time	Received By:	Lab Comments:	Temp:

G.P. W.O. _____

Appendix C
Grain Size Data

GEOTECHNICAL DATA

GPL Laboratories, LLLP

GEOTECHNICAL LOG

Method: ASTM D422
Date: 08/13/04

Client: CH2M HILL

Review by/date: (N) 08/21/04
Analyst: J.O.E

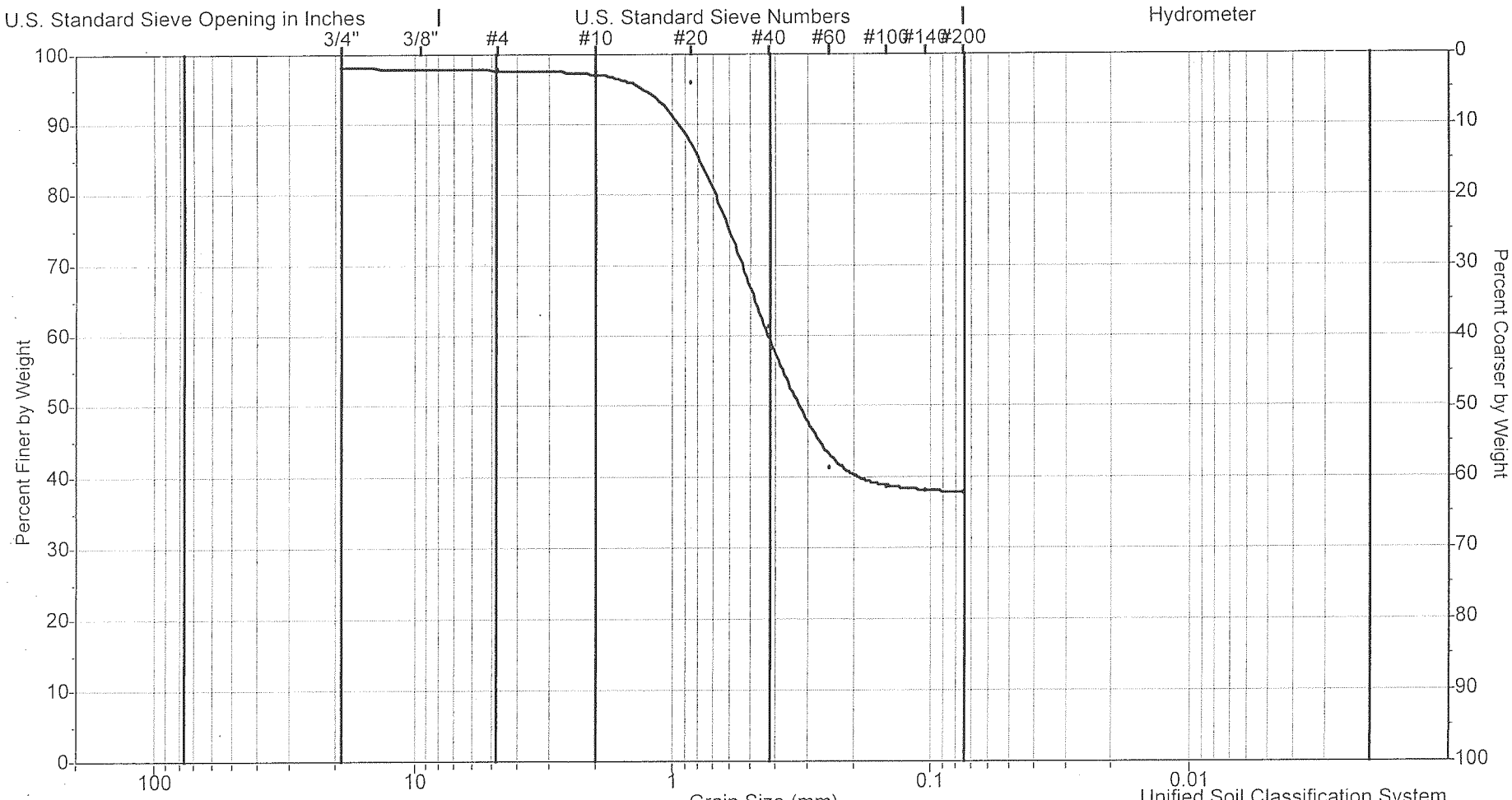
Project Name: CTO 066 - Indian Head.

Lab ID	Frac.	Client ID	Wet Weight (g)	Air Dry Weight (g)	Cont Wt (g)	Weight Retained Sieve Size # 3/4	# 3/8	# 4	# 10	# 20	# 40	# 60	# 100	# 140	# 200
408065	001	1547-SD04-0804	1053.0	875.0	9.7	16.1	0.0	2.2	2.0	13.5	300.0	173.8	23.8	5.0	2.0
	002	1547SS14 -0804	1061.0	780.0	9.7	0.0	0.0	3.0	2.8	5.5	32.4	78.0	24.1	6.7	1.7
	003	1547SD01-0804	911.0	752.0	9.7	0.6	2.0	8.0	10.6	12.2	62.0	94.0	15.4	3.0	1.2
	004	1547SD02-0804	977.6	865.0	9.7	0.0	19.0	5.6	1.6	10.0	310.0	172.3	35.8	7.5	4.2
	005	1547SA08-0804	846.6	820.0	9.7	0.6	0.6	0.0	3.0	23.4	313.0	149.0	28.0	6.5	2.0
	006	1547SS06-0804	758.0	732.6	9.7	0.0	13.4	7.0	10.0	20.0	312.0	190.4	33.5	6.8	3.3
	007	1547SS12-0804	754.0	722.3	9.7	0.6	5.0	15.0	8.3	20.2	281.3	163.4	63.0	14.0	6.0
	008	1547SS04-0804	731.8	705.3	9.7	0.0	67.0	19.0	11.2	20.0	303.0	147.0	34.7	8.5	3.6
	009	1547SS02-0804	738.4	708.9	9.7	0.0	0.0	5.0	7.5	28.0	289.0	144.0	27.0	6.2	2.5
	010	1547SS40-0804	800.0	763.2	9.7	13.0	38.2	8.00	30.0	48.0	200.5	100.0	29.1	5.3	1.9
	012	BGD-SS03-0804	678.0	630.6	9.7	0.0	0.0	2.0	7.3	10.6	6.9	55.0	24.5	5.2	1.3
	013	1547SS17-0804	1000.0	873.4	9.7	0.0	0.0	1.0	1.4	12.2	300.0	124.6	30.6	6.2	3.0
	014	1547SD05-0804	858.3	600.0	9.7	0.0	14.0	14.0	17.0	22.1	174.0	182.2	48.0	8.7	2.3
	015	1547RSD01-0804	1067.0	860.0	9.7	0.0	10.0	38.4	29.2	100.0	511.0	93.9	14.7	2.1	0.5
	009D	1547SS02--0804	738.5	708.7	9.7	0.0	0.0	4.8	7.2	28.0	288.0	142.0	27.6	6.0	2.4

Comments:

GPL Laboratories	Sample No. 408065-001	Project Name: CTO066, INDIAN HEAD
	Client: CH2M HILL	ASTM 422, Grain Size Distribution Graph
	Location: IS447SD04-0804	Test Date: 8/13/04

Symbol	Sample No.	% Clay	% Silt	% Fine Sand	% Medium Sand	% Coarse Sand	% Fine Gravel	% Coarse Gravel	% Cobbles
.	408065-001	< 0	< 0	59	38	0.63	0.42	0	0



Unified Soil Classification System

	GRAVEL		SAND			SILT or CLAY	
	coarse	fine	coarse	medium	fine	Silt	Clay

Project: 408065
Borehole ID:
Sample ID: 408065-001
Test ID: D422
Test Date: 8/13/04

Client: CH2M HILL
Description:
Location: IS447SD04-0804
Source:
Northing: 0
Easting: 0
Collected By:
User Defined:

Wet Sample Weight: 1053
Dry Sample Weight: 875
Pan Weight: 9.7
Split Sample: No
Oven Dried Weight: 866
Air Dried Weight: 1044
Hydrometer Sample Weight: 0
Hydrometer Pan Weight: 0
Hydrometer Weight Retained: 0
Specific Gravity: 2.5
Hydrometer Type: 151H
User Defined:

Sieve Size Data

Sieve	Size (mm)	Weight Retained	Cumulative Weight
3/4"	19	16.1	16.1
3/8"	9.5	0	16.1
#4	4.75	2.2	18.3
#10	2	2	20.3
#20	0.85	13.5	33.8
#40	0.425	300	333.8
#60	0.25	173.8	507.6
#100	0.15	23.8	531.4
#140	0.106	5	536.4
#200	0.075	2	538.4

Hydrometer Data

Time	Reading	Temperature
0	0	0
1	0	0
2	0	0
5	0	0
15	0	0

30	0	0
60	0	0
250	0	0
1440	0	0

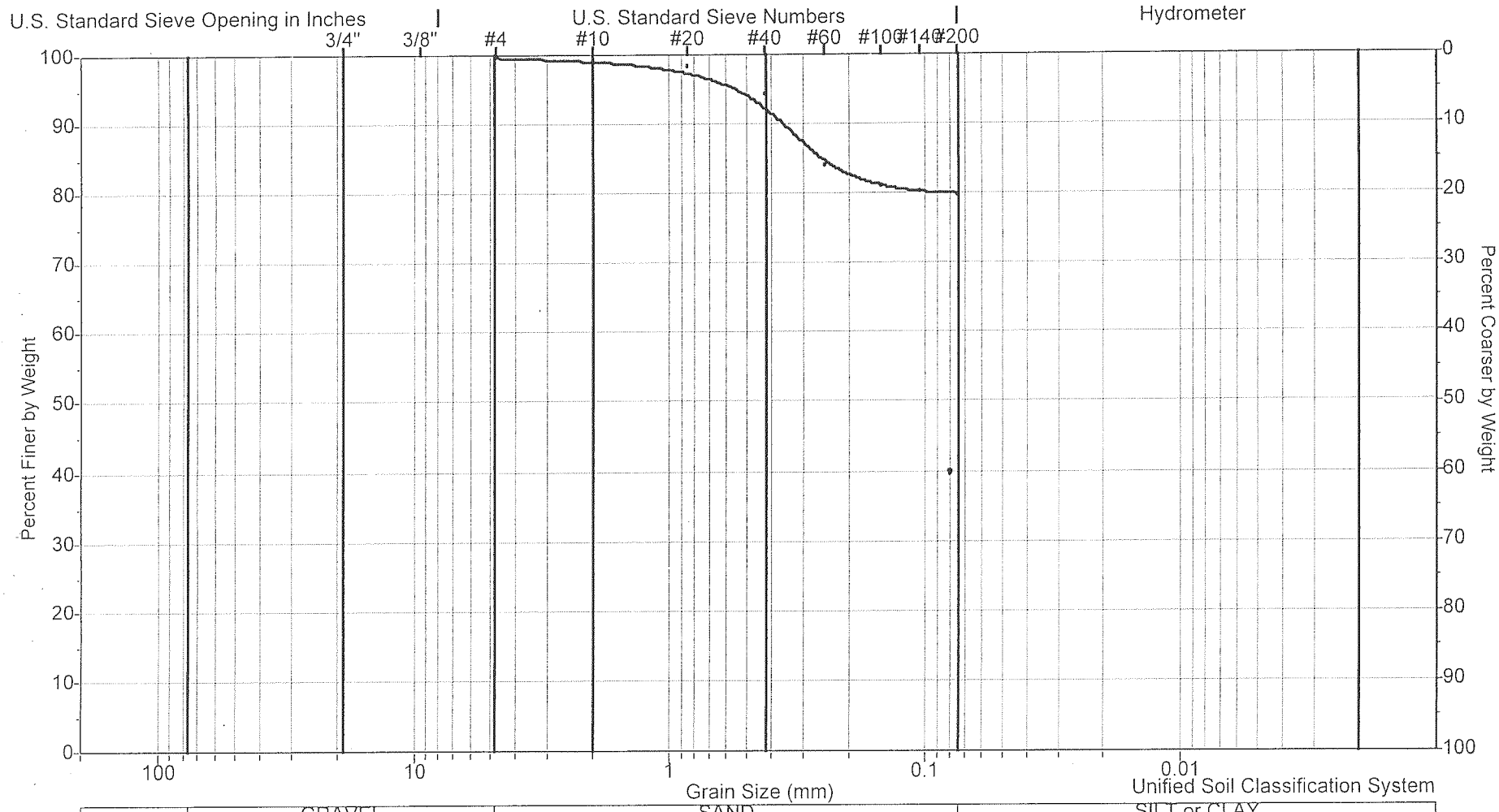
Results

Size (mm)	Percent Passing
19	98.1
4.75	97.8
2	97.6
0.85	96
0.425	61.4
0.25	41.3
0.15	38.5
0.106	38
0.075	37.7

4006

GPL Laboratories	Sample No. 408065-002	Project Name: CTO066, INDIAN HEAD
	Client: CH2M HILL	ASTM 422, Grain Size Distribution Graph
	Location: IS47SS14-0804	Test Date: 8/13/04

Symbol	Sample No.	% Clay	% Silt	% Fine Sand	% Medium Sand	% Coarse Sand	% Fine Gravel	% Coarse Gravel	% Cobbles
.	408065-002	< 0	< 0	92	7	0.68	0	0	0



Project: 408065
Borehole ID:
Sample ID: 408065-002
Test ID: D422
Test Date: 8/13/04

Client: CH2M HILL
Description:
Location: IS47SS14-0804
Source:
Northing: 0
Easting: 0
Collected By:
User Defined:

Wet Sample Weight: 1061
Dry Sample Weight: 780
Pan Weight: 9.7
Split Sample: No
Oven Dried Weight: 771
Air Dried Weight: 1052
Hydrometer Sample Weight: 0
Hydrometer Pan Weight: 0
Hydrometer Weight Retained: 0
Specific Gravity: 2.5
Hydrometer Type: 151H
User Defined:

Sieve Size Data

Sieve	Size (mm)	Weight Retained	Cumulative Weight
3/4"	19	0	0
3/8"	9.5	0	0
#4	4.75	3	3
#10	2	2.8	5.8
#20	0.85	5.5	11.3
#40	0.425	32.4	43.7
#60	0.25	78	121.7
#100	0.15	24.1	145.8
#140	0.106	6.7	152.5
#200	0.075	1.7	154.2

Hydrometer Data

Time	Reading	Temperature
0	0	0
1	0	0
2	0	0
5	0	0
15	0	0

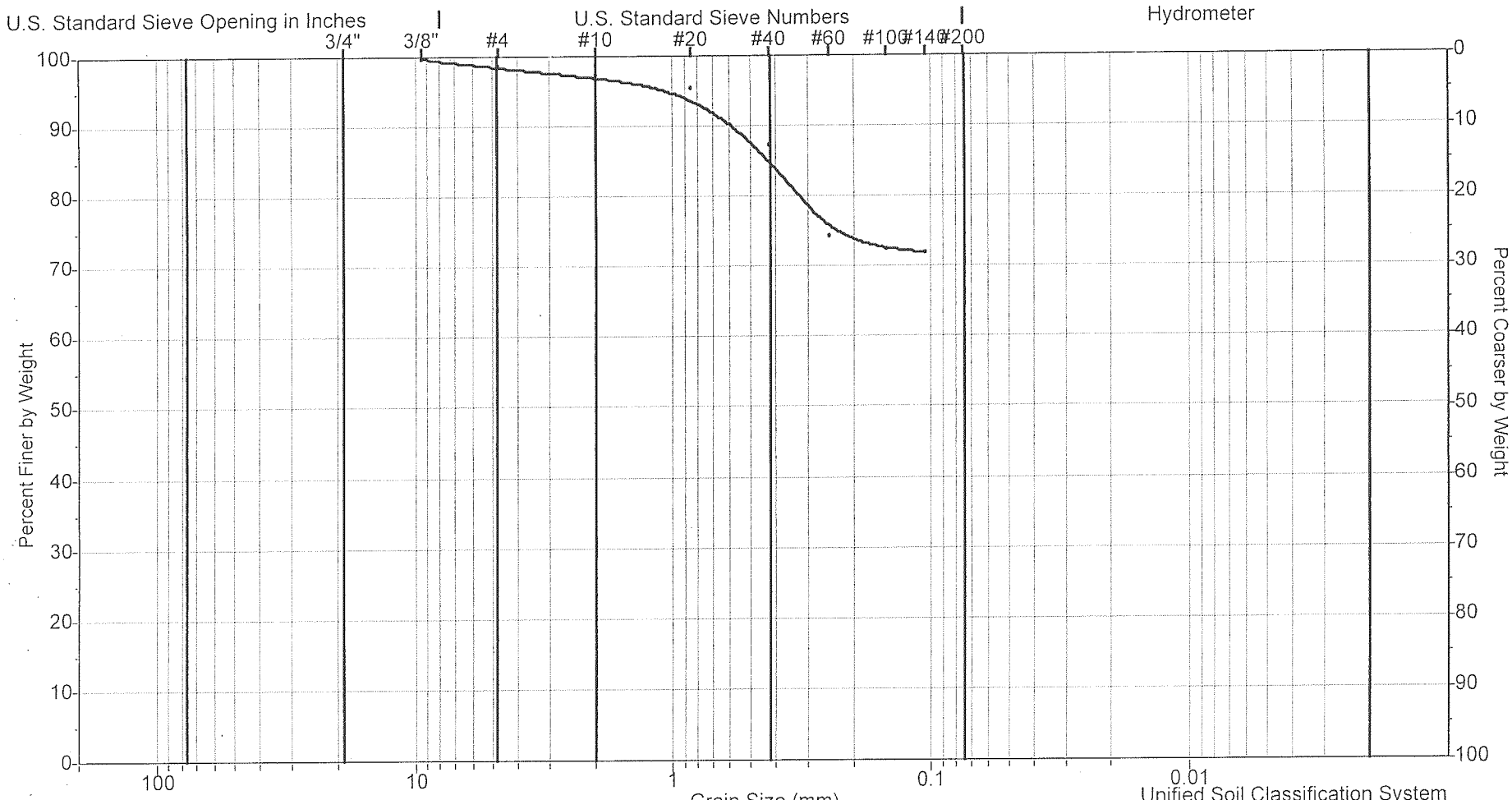
30	0	0
60	0	0
250	0	0
1440	0	0

Results

Size (mm)	Percent Passing
4.75	99.6
2	99.2
0.85	98.5
0.425	94.3
0.25	84.2
0.15	81
0.106	80.2
0.075	79.9

GPL Laboratories	Sample No. 408065-003	Project Name: CTO066, INDIAN HEAD
	Client: CH2M HILL	ASTM 422, Grain Size Distribution Graph
	Location: IS477SD01-0804	Test Date: 8/13/04

Symbol	Sample No.	% Clay	% Silt	% Fine Sand	% Medium Sand	% Coarse Sand	% Fine Gravel	% Coarse Gravel	% Cobbles
.	408065-003	< 0	< 0	84	12	1.5	1.3	0	0



Unified Soil Classification System

	GRAVEL		SAND			SILT or CLAY	
	coarse	fine	coarse	medium	fine	Silt	Clay

Project: 408065
Borehole ID:
Sample ID: 408065-003
Test ID: D422
Test Date: 8/13/04

Client: CH2M HILL
Description:
Location: IS477SD01-0804
Source:
Northing: 0
Easting: 0
Collected By:
User Defined:

Wet Sample Weight: 911
Dry Sample Weight: 752
Pan Weight: 9.7
Split Sample: No
Oven Dried Weight: 743
Air Dried Weight: 902
Hydrometer Sample Weight: 0
Hydrometer Pan Weight: 0
Hydrometer Weight Retained: 0
Specific Gravity: 2.5
Hydrometer Type: 151H
User Defined:

Sieve Size Data

Sieve	Size (mm)	Weight Retained	Cumulative Weight
3/4"	19	0	0
3/8"	9.5	2	2
#4	4.75	8	10
#10	2	10.6	20.6
#20	0.85	12.2	32.8
#40	0.425	62	94.8
#60	0.25	94	188.8
#100	0.15	15.4	204.2
#140	0.106	3	207.2
#200	0.075	0	207.2

Hydrometer Data

Time	Reading	Temperature
0	0	0
1	0	0
2	0	0
5	0	0
15	0	0

30	0	0
60	0	0
250	0	0
1440	0	0

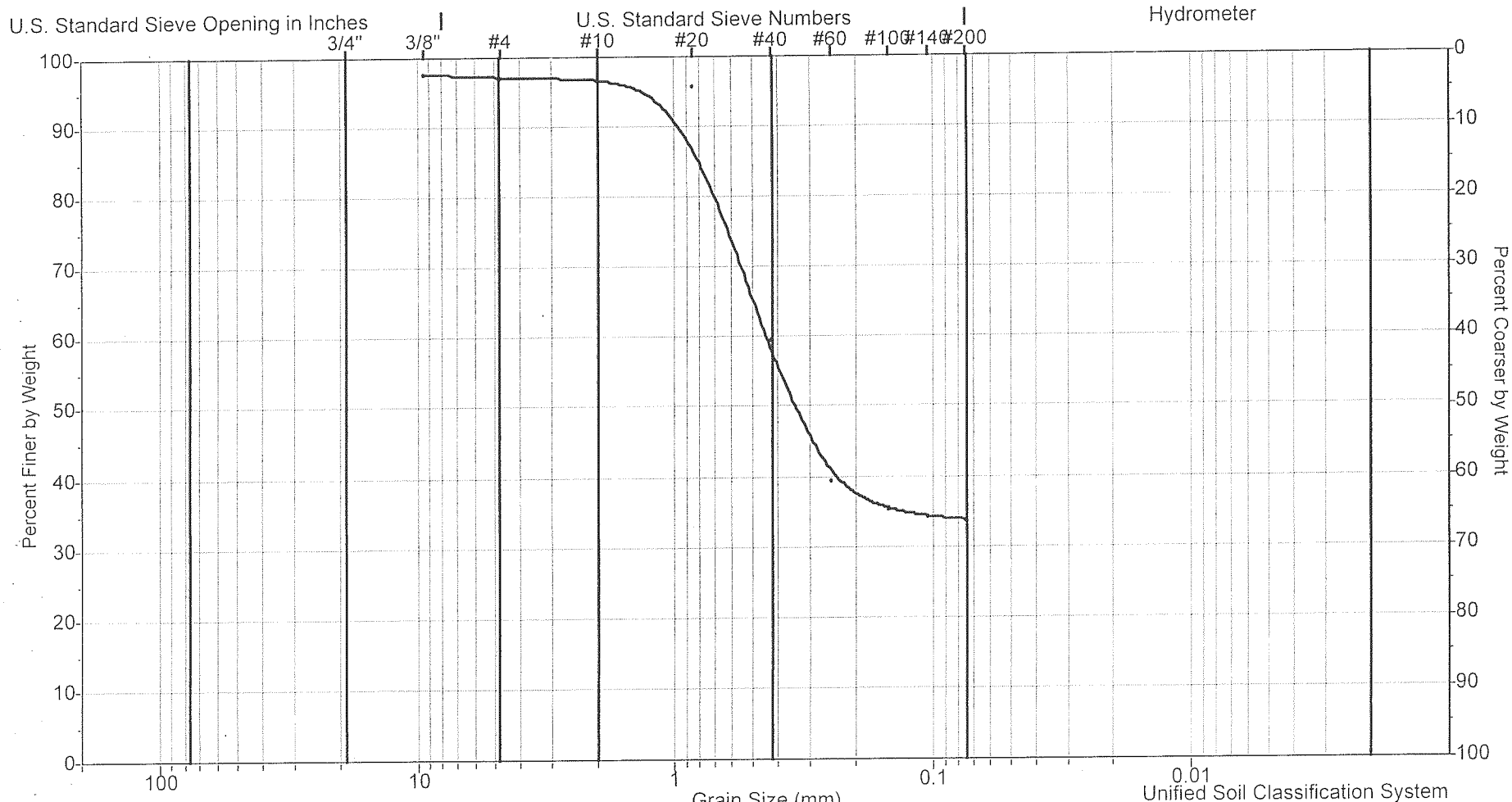
Results

Size (mm)	Percent Passing
9.5	99.7
4.75	98.6
2	97.2
0.85	95.5
0.425	87.2
0.25	74.5
0.15	72.4
0.106	72

GPL Laboratories

Sample No. 408065-004	Project Name: CTO066, INDIAN HEAD
Client: CH2M HILL	ASTM 422, Grain Size Distribution Graph
Location: IS47SD02-0804	Test Date: 8/13/04

Symbol	Sample No.	% Clay	% Silt	% Fine Sand	% Medium Sand	% Coarse Sand	% Fine Gravel	% Coarse Gravel	% Cobbles
.	408065-004	< 0	< 0	57	40	0.57	0.57	0	0



Unified Soil Classification System

	GRAVEL		SAND			SILT or CLAY	
	coarse	fine	coarse	medium	fine	Silt	Clay

Project: 408065
Borehole ID:
Sample ID: 408065-004
Test ID: D422
Test Date: 8/13/04

Client: CH2M HILL
Description:
Location: IS47SD02-0804
Source:
Northing: 0
Easting: 0
Collected By:
User Defined:

Wet Sample Weight: 977.6
Dry Sample Weight: 865
Pan Weight: 9.7
Split Sample: No
Oven Dried Weight: 856
Air Dried Weight: 968.6
Hydrometer Sample Weight: 0
Hydrometer Pan Weight: 0
Hydrometer Weight Retained: 0
Specific Gravity: 2.5
Hydrometer Type: 151H
User Defined:

Sieve Size Data

Sieve	Size (mm)	Weight Retained	Cumulative Weight
3/4"	19	0	0
3/8"	9.5	19	19
#4	4.75	5	24
#10	2	1.6	25.6
#20	0.85	10	35.6
#40	0.425	310	345.6
#60	0.25	172.3	517.9
#100	0.15	35.8	553.7
#140	0.106	7.5	561.2
#200	0.075	4.2	565.4

Hydrometer Data

Time	Reading	Temperature
0	0	0
1	0	0
2	0	0
5	0	0
15	0	0

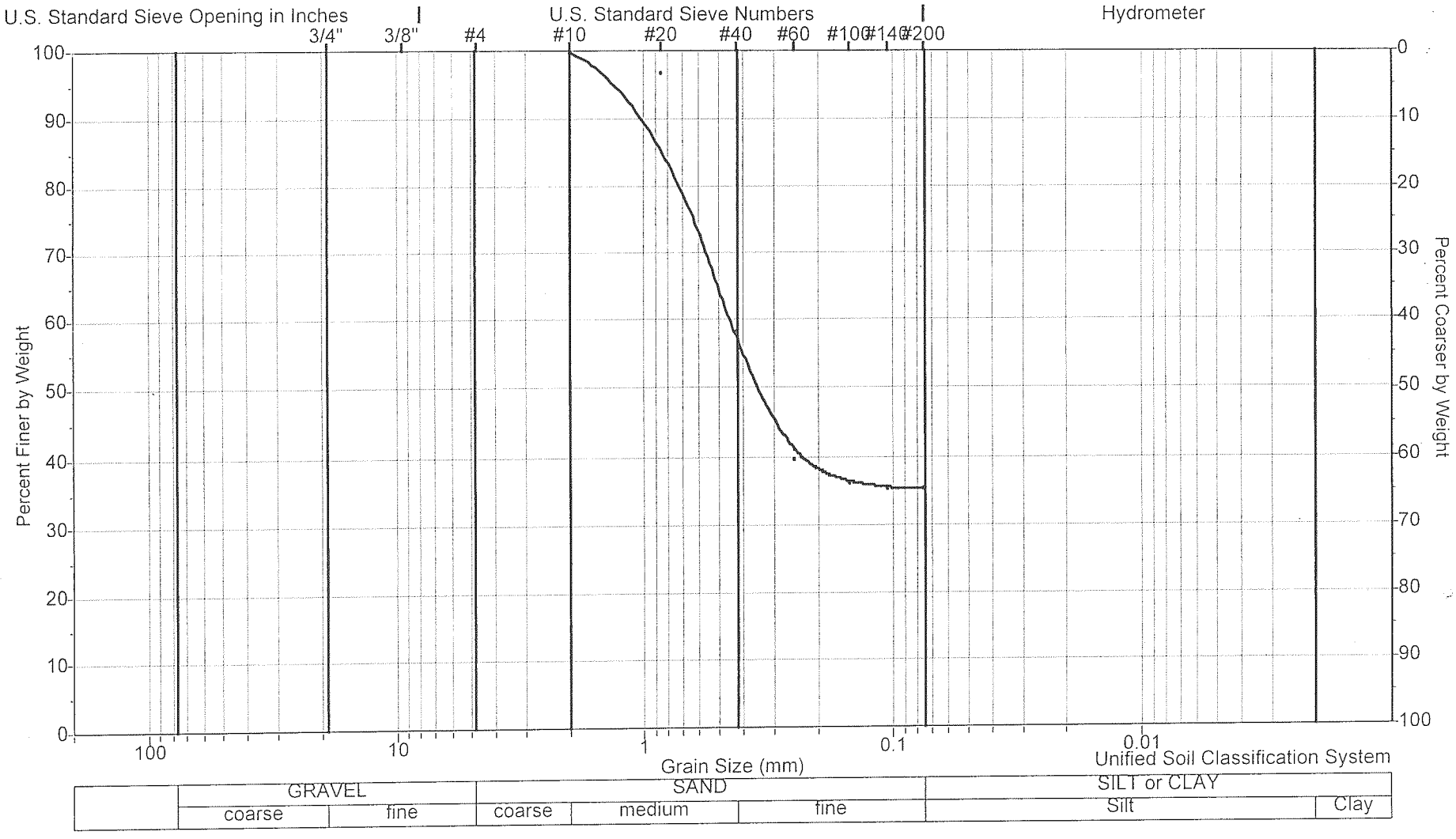
30	0	0
60	0	0
250	0	0
1440	0	0

Results

Size (mm)	Percent Passing
9.5	97.7
4.75	97.1
2	97
0.85	95.8
0.425	59.5
0.25	39.4
0.15	35.2
0.106	34.3
0.075	33.8

GPL Laboratories	Sample No. 408065-005	Project Name: CTO066, INDIAN HEAD
	Client: CH2M HILL	ASTM 422, Grain Size Distribution Graph
	Location: IS47SA08-0804	Test Date: 8/13/04

Symbol	Sample No.	% Clay	% Silt	% Fine Sand	% Medium Sand	% Coarse Sand	% Fine Gravel	% Coarse Gravel	% Cobbles
.	408065-005	< 0	< 0	56	43	0	0	0	0



Project: 408065
Borehole ID:
Sample ID: 408065-005
Test ID: D422
Test Date: 8/13/04

Client: CH2M HILL
Description:
Location: IS47SA08-0804
Source:
Northing: 0
Easting: 0
Collected By:
User Defined:

Wet Sample Weight: 846
Dry Sample Weight: 820
Pan Weight: 9.7
Split Sample: No
Oven Dried Weight: 811
Air Dried Weight: 837
Hydrometer Sample Weight: 0
Hydrometer Pan Weight: 0
Hydrometer Weight Retained: 0
Specific Gravity: 2.5
Hydrometer Type: 151H
User Defined:

Sieve Size Data

Sieve	Size (mm)	Weight Retained	Cumulative Weight
3/4"	19	0	0
3/8"	9.5	0	0
#4	4.75	0	0
#10	2	3	3
#20	0.85	23.4	26.4
#40	0.425	313	339.4
#60	0.25	149	488.4
#100	0.15	28	516.4
#140	0.106	6.5	522.9
#200	0.075	2	524.9

Hydrometer Data

Time	Reading	Temperature
0	0	0
1	0	0
2	0	0
5	0	0
15	0	0

30	0	0
60	0	0
250	0	0
1440	0	0

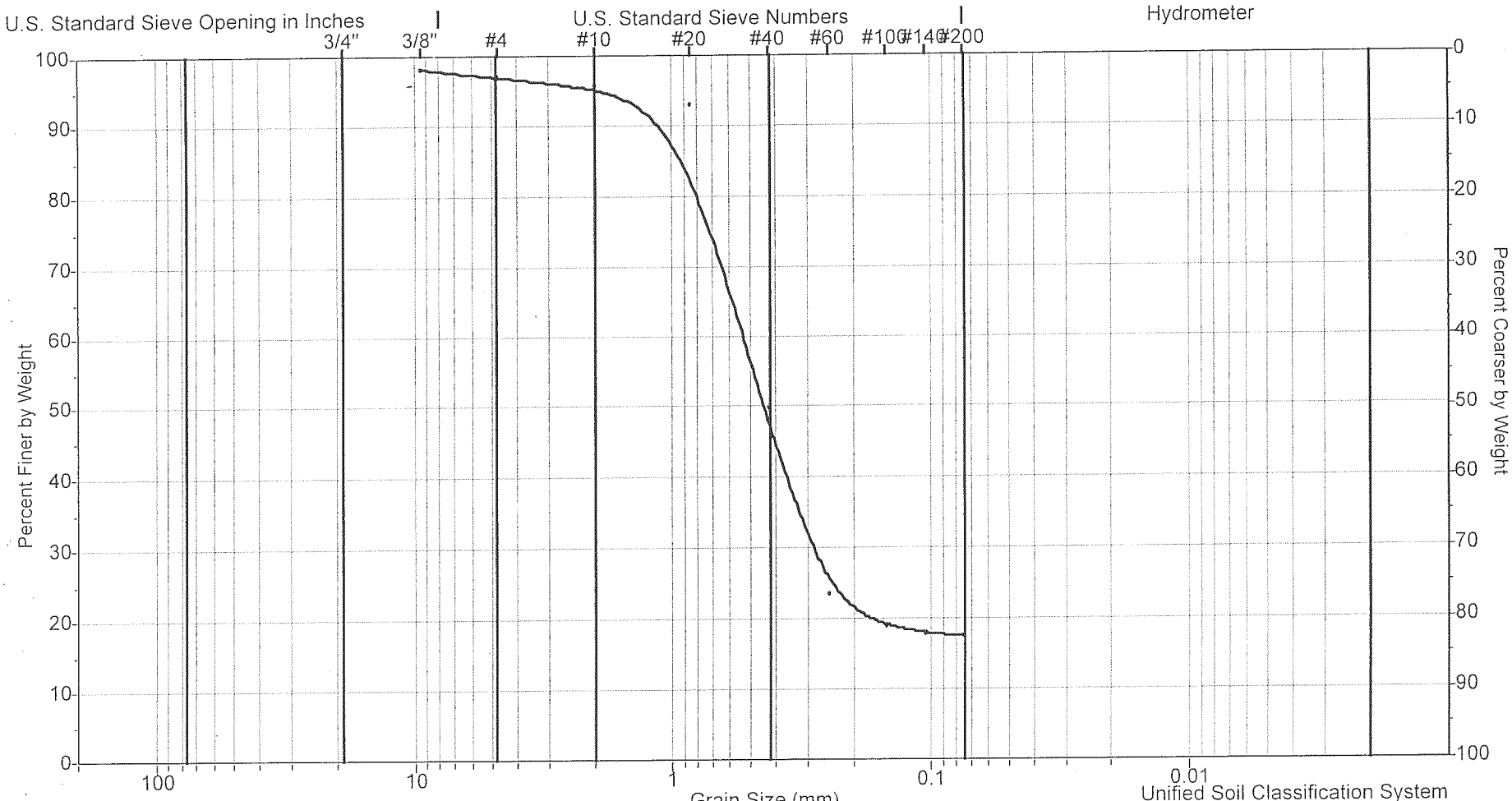
Results

Size (mm)	Percent Passing
2	99.6
0.85	96.7
0.425	58.1
0.25	39.7
0.15	36.2
0.106	35.4
0.075	35.2

4018

GPL Laboratories	Sample No. 408065-006	Project Name: CTO066, INDIAN HEAD
	Client: CH2M HILL	ASTM 422, Grain Size Distribution Graph
	Location: IS47SS06-0804	Test Date: 8/13/04

Symbol	Sample No.	% Clay	% Silt	% Fine Sand	% Medium Sand	% Coarse Sand	% Fine Gravel	% Coarse Gravel	% Cobbles
.	408065-006	< 0	< 0	46	49	1.9	1.3	0	0



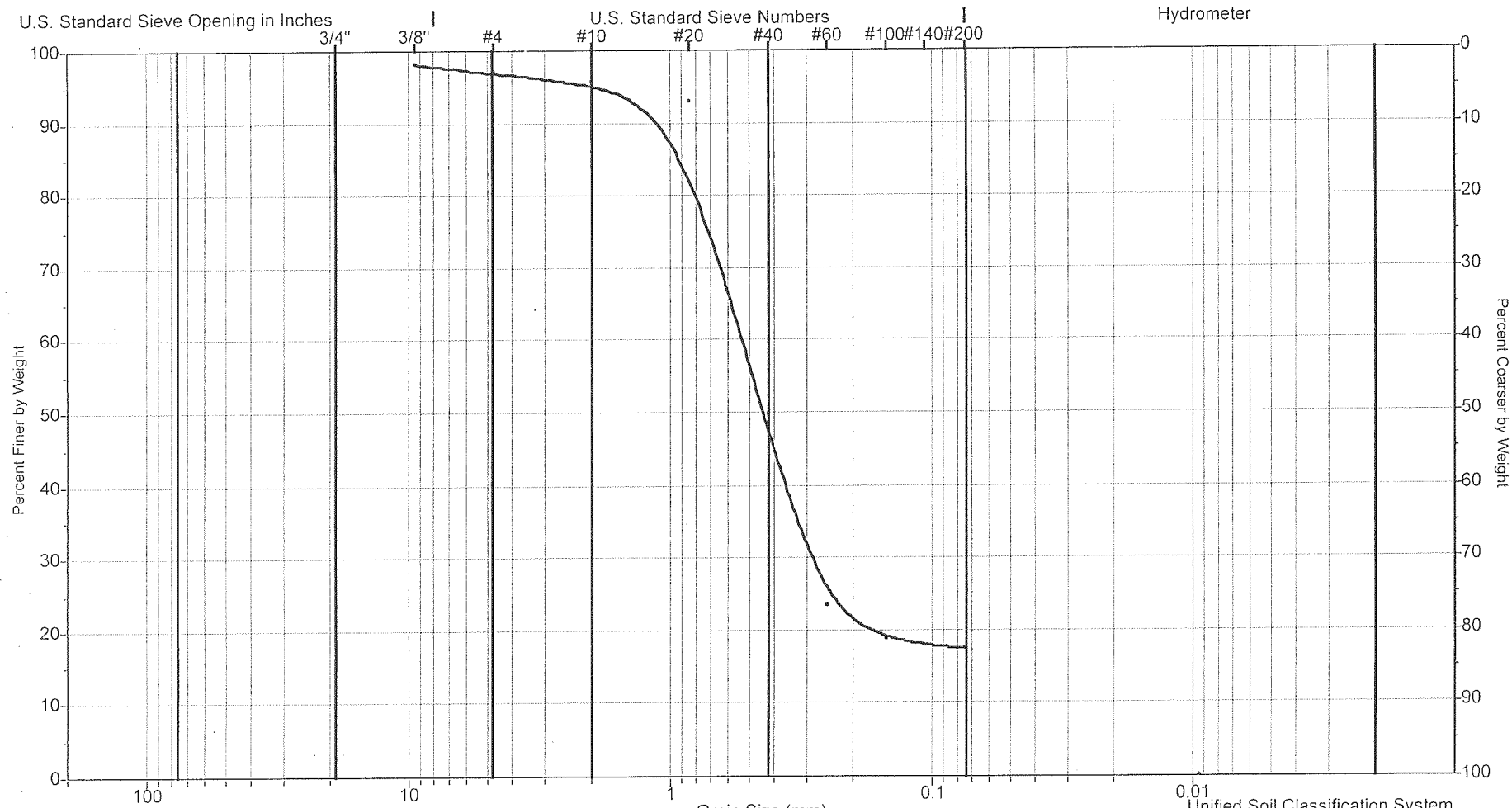
Unified Soil Classification System

	GRAVEL		SAND			SILT or CLAY	
	coarse	fine	coarse	medium	fine	Silt	Clay

GPL Laboratories

Sample No. 408065-006	Project Name: CTO066, INDIAN HEAD
Client: CH2M HILL	ASTM 422, Grain Size Distribution Graph
Location: IS47SS06-0804	Test Date: 8/13/04

Symbol	Sample No.	% Clay	% Silt	% Fine Sand	% Medium Sand	% Coarse Sand	% Fine Gravel	% Coarse Gravel	% Cobbles
•	408065-006	< 0	< 0	46	49	1.9	1.3	0	0



Unified Soil Classification System

	GRAVEL		SAND			SILT or CLAY	
	coarse	fine	coarse	medium	fine	Silt	Clay

Project: 408065
Borehole ID:
Sample ID: 408065-006
Test ID: D422
Test Date: 8/13/04

Client: CH2M HILL
Description:
Location: IS47SS06-0804
Source:
Northing: 0
Easting: 0
Collected By:
User Defined:

Wet Sample Weight: 758
Dry Sample Weight: 732.6
Pan Weight: 9.7
Split Sample: No
Oven Dried Weight: 723.6
Air Dried Weight: 749
Hydrometer Sample Weight: 0
Hydrometer Pan Weight: 0
Hydrometer Weight Retained: 0
Specific Gravity: 2.5
Hydrometer Type: 151H
User Defined:

Sieve Size Data

Sieve	Size (mm)	Weight Retained	Cumulative Weight
3/4"	19	0	0
3/8"	9.5	13.4	13.4
#4	4.75	7	20.4
#10	2	10	30.4
#20	0.85	20	50.4
#40	0.425	312	362.4
#60	0.25	190.4	552.8
#100	0.15	33.5	586.3
#140	0.106	6.8	593.1
#200	0.075	3.3	596.4

Hydrometer Data

Time	Reading	Temperature
0	0	0
1	0	0
2	0	0
5	0	0
15	0	0

30	0	0
60	0	0
250	0	0
1440	0	0

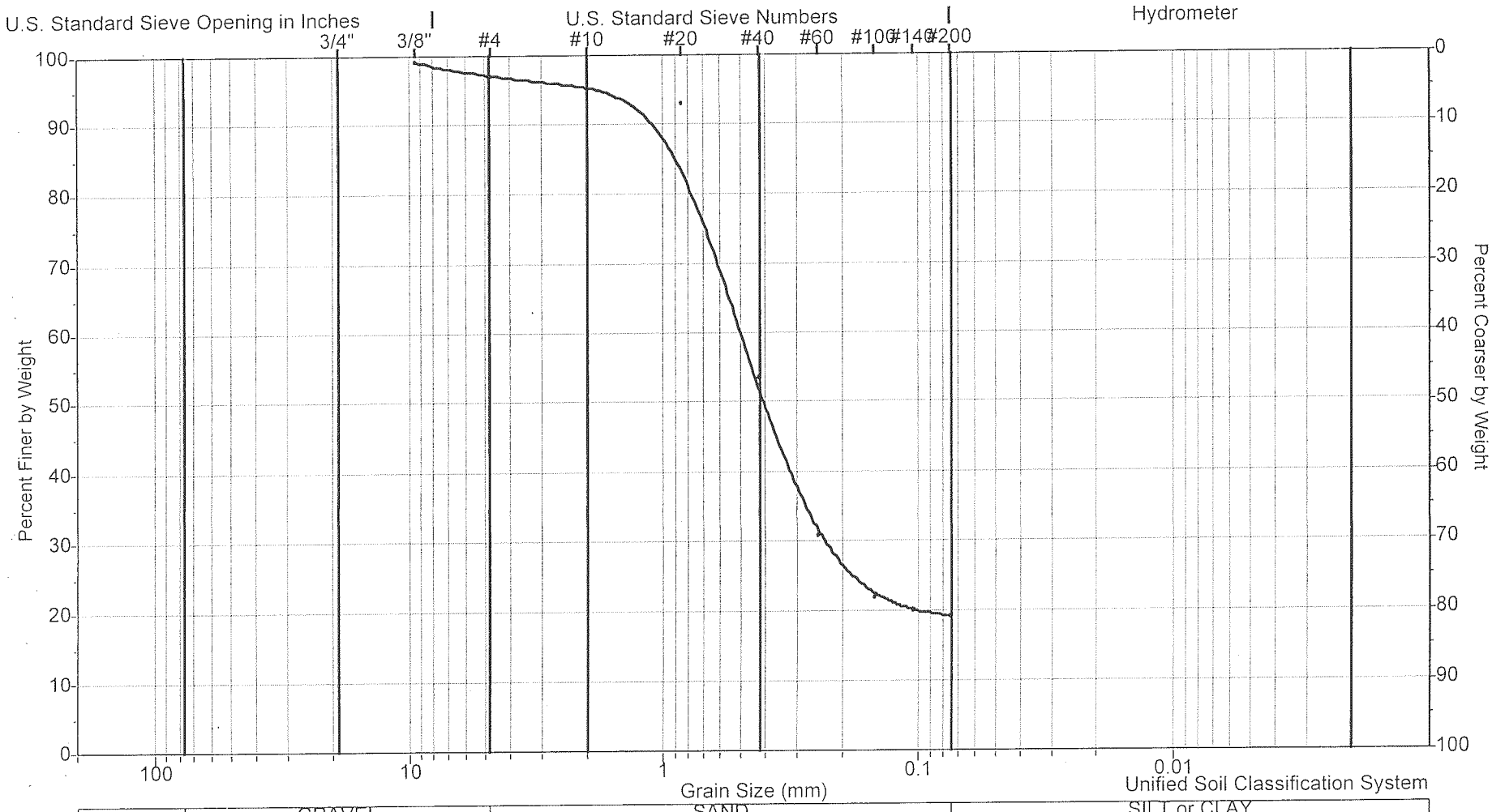
Results

Size (mm)	Percent Passing
9.5	98.1
4.75	97.1
2	95.7
0.85	93
0.425	49.8
0.25	23.5
0.15	18.8
0.106	17.9
0.075	17.4

4022

GPL Laboratories	Sample No. 408065-007	Project Name: CTO066, INDIAN HEAD
	Client: CH2M HILL	ASTM 422, Grain Size Distribution Graph
	Location: IS47SS12-0804	Test Date: 8/13/04

Symbol	Sample No.	% Clay	% Silt	% Fine Sand	% Medium Sand	% Coarse Sand	% Fine Gravel	% Coarse Gravel	% Cobbles
.	408065-007	< 0	< 0	51	45	1.9	2.2	0	0



Project: 408065
Borehole ID:
Sample ID: 408065-007
Test ID: D422
Test Date: 8/13/04

Client: CH2M HILL
Description:
Location: IS47SS12-0804
Source:
Northing: 0
Easting: 0
Collected By:
User Defined:

Wet Sample Weight: 754
Dry Sample Weight: 722.3
Pan Weight: 9.7
Split Sample: No
Oven Dried Weight: 713.3
Air Dried Weight: 745
Hydrometer Sample Weight: 0
Hydrometer Pan Weight: 0
Hydrometer Weight Retained: 0
Specific Gravity: 2.5
Hydrometer Type: 151H
User Defined:

Sieve Size Data

Sieve	Size (mm)	Weight Retained	Cumulative Weight
3/4"	19	0	0
3/8"	9.5	5	5
#4	4.75	15	20
#10	2	8.3	28.3
#20	0.85	20.2	48.5
#40	0.425	281.3	329.8
#60	0.25	163.4	493.2
#100	0.15	63	556.2
#140	0.106	14	570.2
#200	0.075	6	576.2

Hydrometer Data

Time	Reading	Temperature
0	0	0
1	0	0
2	0	0
5	0	0
15	0	0

30	0	0
60	0	0
250	0	0
1440	0	0

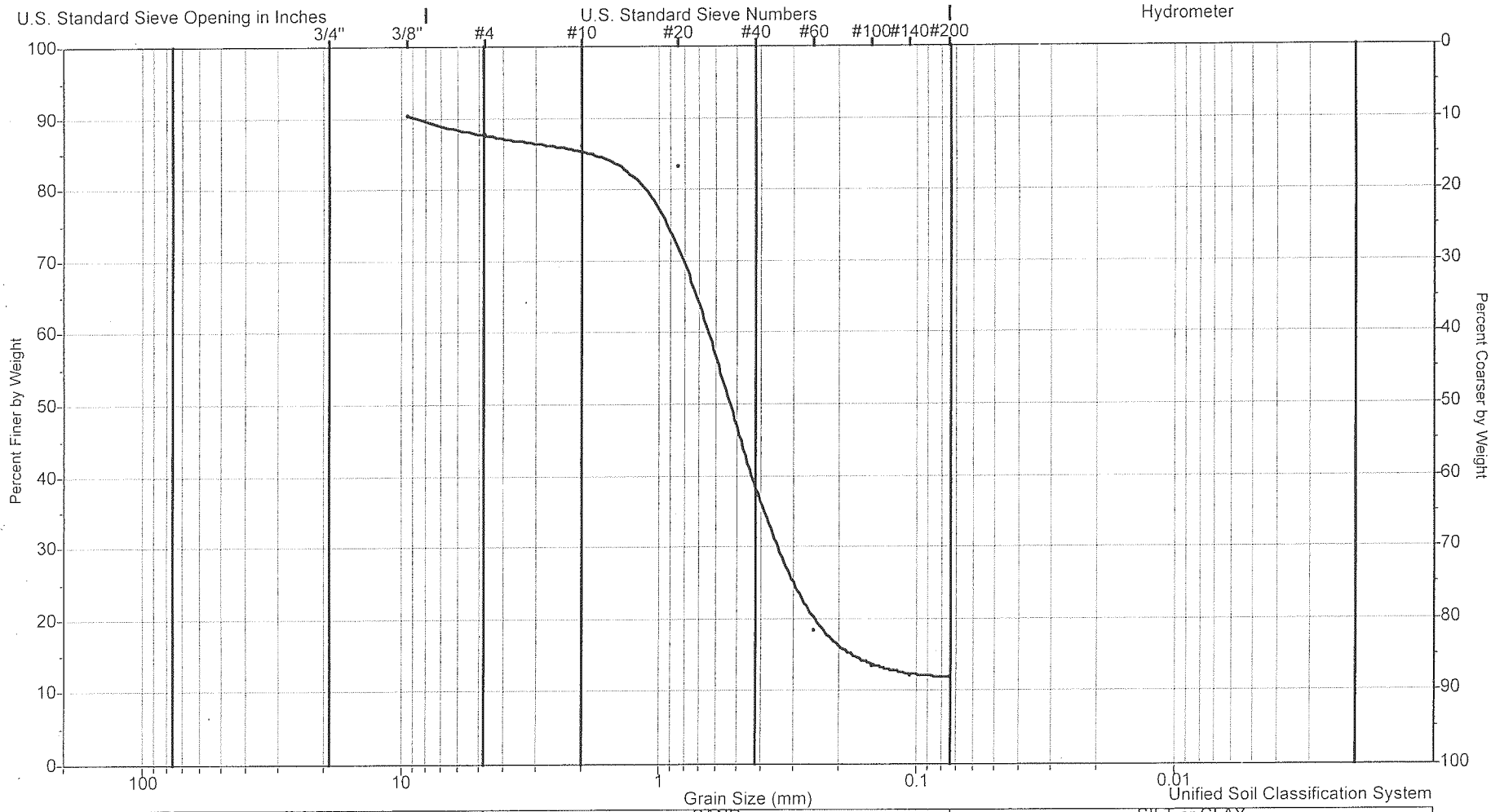
Results

Size (mm)	Percent Passing
9.5	99.2
4.75	97.1
2	96
0.85	93.1
0.425	53.7
0.25	30.7
0.15	21.9
0.106	19.9
0.075	19.1

GPL Laboratories

Sample No. 408065-008	Project Name: CTO066, INDIAN HEAD
Client: CH2M HILL	ASTM 422, Grain Size Distribution Graph
Location: IS47SS04-0804	Test Date: 8/13/04

Symbol	Sample No.	% Clay	% Silt	% Fine Sand	% Medium Sand	% Coarse Sand	% Fine Gravel	% Coarse Gravel	% Cobbles
.	408065-008	< 0	< 0	37	48	2.3	2.8	0	0



Unified Soil Classification System

	GRAVEL		SAND			SILT or CLAY	
	coarse	fine	coarse	medium	fine	Silt	Clay

Project: 408065
Borehole ID:
Sample ID: 408065-008
Test ID: D422
Test Date: 8/13/04

Client: CH2M HILL
Description:
Location: IS47SS04-0804
Source:
Northing: 0
Easting: 0
Collected By:
User Defined:

Wet Sample Weight: 731.8
Dry Sample Weight: 705.3
Pan Weight: 9.7
Split Sample: No
Oven Dried Weight: 696.3
Air Dried Weight: 722.8
Hydrometer Sample Weight: 0
Hydrometer Pan Weight: 0
Hydrometer Weight Retained: 0
Specific Gravity: 2.5
Hydrometer Type: 151H
User Defined:

Sieve Size Data

Sieve	Size (mm)	Weight Retained	Cumulative Weight
3/4"	19	0	0
3/8"	9.5	67	67
#4	4.75	19	86
#10	2	11.2	97.2
#20	0.85	20	117.2
#40	0.425	303	420.2
#60	0.25	147	567.2
#100	0.15	34.7	601.9
#140	0.106	8.5	610.4
#200	0.075	3	613.4

Hydrometer Data

Time	Reading	Temperature
0	0	0
1	0	0
2	0	0
5	0	0
15	0	0

30	0	0
60	0	0
250	0	0
1440	0	0

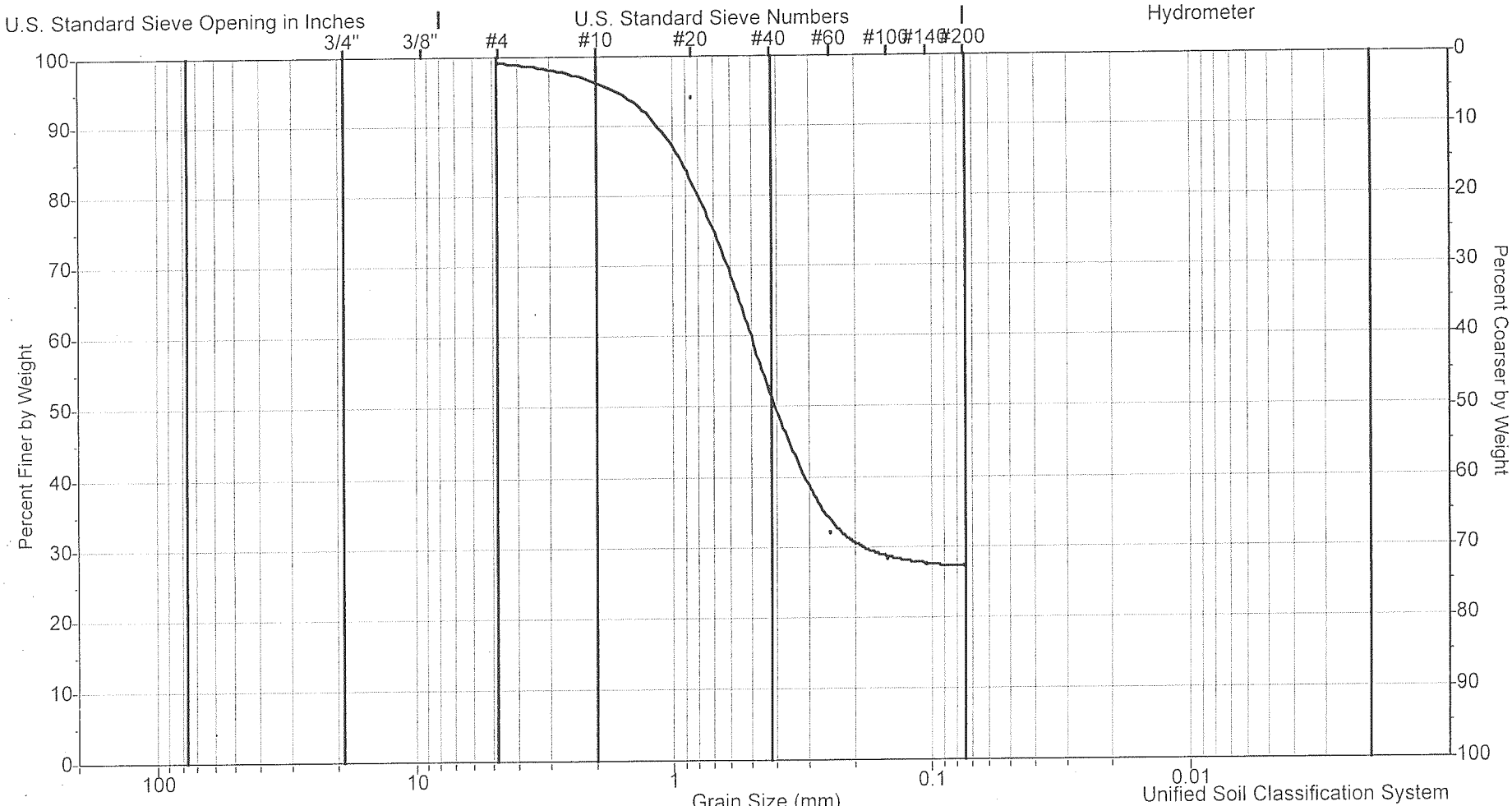
Results

Size (mm)	Percent Passing
9.5	90.3
4.75	87.6
2	86
0.85	83.1
0.425	39.5
0.25	18.4
0.15	13.4
0.106	12.2
0.075	11.8

4028

GPL Laboratories	Sample No. 408065-009	Project Name: CTO066, INDIAN HEAD
	Client: CH2M HILL	ASTM 422, Grain Size Distribution Graph
	Location: IS47SS02--0804	Test Date: 8/13/04

Symbol	Sample No.	% Clay	% Silt	% Fine Sand	% Medium Sand	% Coarse Sand	% Fine Gravel	% Coarse Gravel	% Cobbles
.	408065-009	< 0	< 0	51	45	3.1	0	0	0



	GRAVEL		SAND			SILT or CLAY	
	coarse	fine	coarse	medium	fine	Silt	Clay

Unified Soil Classification System

Project: 408065
Borehole ID:
Sample ID: 408065-009
Test ID: D422
Test Date: 8/13/04

Client: CH2M HILL
Description: 0804
Location: IS47SS02--0804
Source:
Northing: 0
Easting: 0
Collected By:
User Defined:

Wet Sample Weight: 738.4
Dry Sample Weight: 708.9
Pan Weight: 9.7
Split Sample: No
Oven Dried Weight: 699.9
Air Dried Weight: 729.4
Hydrometer Sample Weight: 0
Hydrometer Pan Weight: 0
Hydrometer Weight Retained: 0
Specific Gravity: 2.5
Hydrometer Type: 151H
User Defined:

Sieve Size Data

Sieve	Size (mm)	Weight Retained	Cumulative Weight
3/4"	19	0	0
3/8"	9.5	0	0
#4	4.75	5	5
#10	2	7.5	12.5
#20	0.85	28	40.5
#40	0.425	289	329.5
#60	0.25	144	473.5
#100	0.15	27	500.5
#140	0.106	6.2	506.7
#200	0.075	2.5	509.2

Hydrometer Data

Time	Reading	Temperature
0	0	0
1	0	0
2	0	0
5	0	0
15	0	0

30	0	0
60	0	0
250	0	0
1440	0	0

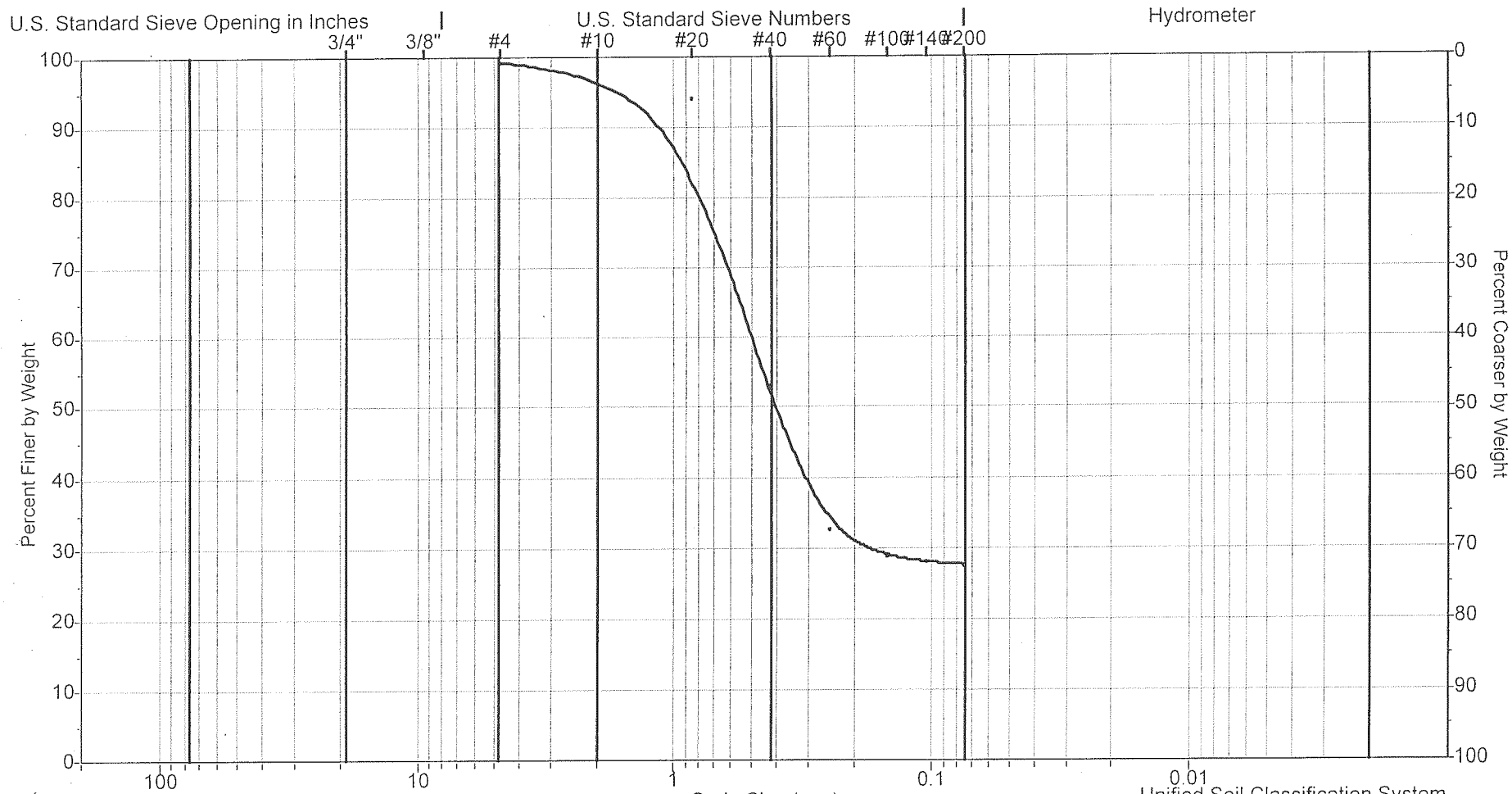
Results

Size (mm)	Percent Passing
4.75	99.2
2	98.2
0.85	94.2
0.425	52.8
0.25	32.2
0.15	28.4
0.106	27.5
0.075	27.1

4031

GPL Laboratories	Sample No. 408065-009D	Project Name: CTO066, INDIAN HEAD
	Client: CH2M HILL	ASTM 422, Grain Size Distribution Graph
	Location: IS47SS02-0804	Test Date: 8/13/04

Symbol	Sample No.	% Clay	% Silt	% Fine Sand	% Medium Sand	% Coarse Sand	% Fine Gravel	% Coarse Gravel	% Cobbles
.	408065-009D	< 0	< 0	51	45	3.2	0	0	0



Project: 408065
Borehole ID:
Sample ID: 408065-009D
Test ID: D422
Test Date: 8/13/04

Client: CH2M HILL
Description:
Location: IS47SS02-0804
Source:
Northing: 0
Easting: 0
Collected By:
User Defined:

Wet Sample Weight: 738.5
Dry Sample Weight: 708.7
Pan Weight: 9.7
Split Sample: No
Oven Dried Weight: 699.7
Air Dried Weight: 729.5
Hydrometer Sample Weight: 0
Hydrometer Pan Weight: 0
Hydrometer Weight Retained: 0
Specific Gravity: 2.5
Hydrometer Type: 151H
User Defined:

Sieve Size Data

Sieve	Size (mm)	Weight Retained	Cumulative Weight
3/4"	19	0	0
3/8"	9.5	0	0
#4	4.75	4.8	4.8
#10	2	7.2	12
#20	0.85	28	40
#40	0.425	288	328
#60	0.25	142	470
#100	0.15	27	497
#140	0.106	6	503
#200	0.075	2.4	505.4

Hydrometer Data

Time	Reading	Temperature
0	0	0
1	0	0
2	0	0
5	0	0
15	0	0

30	0	0
60	0	0
250	0	0
1440	0	0

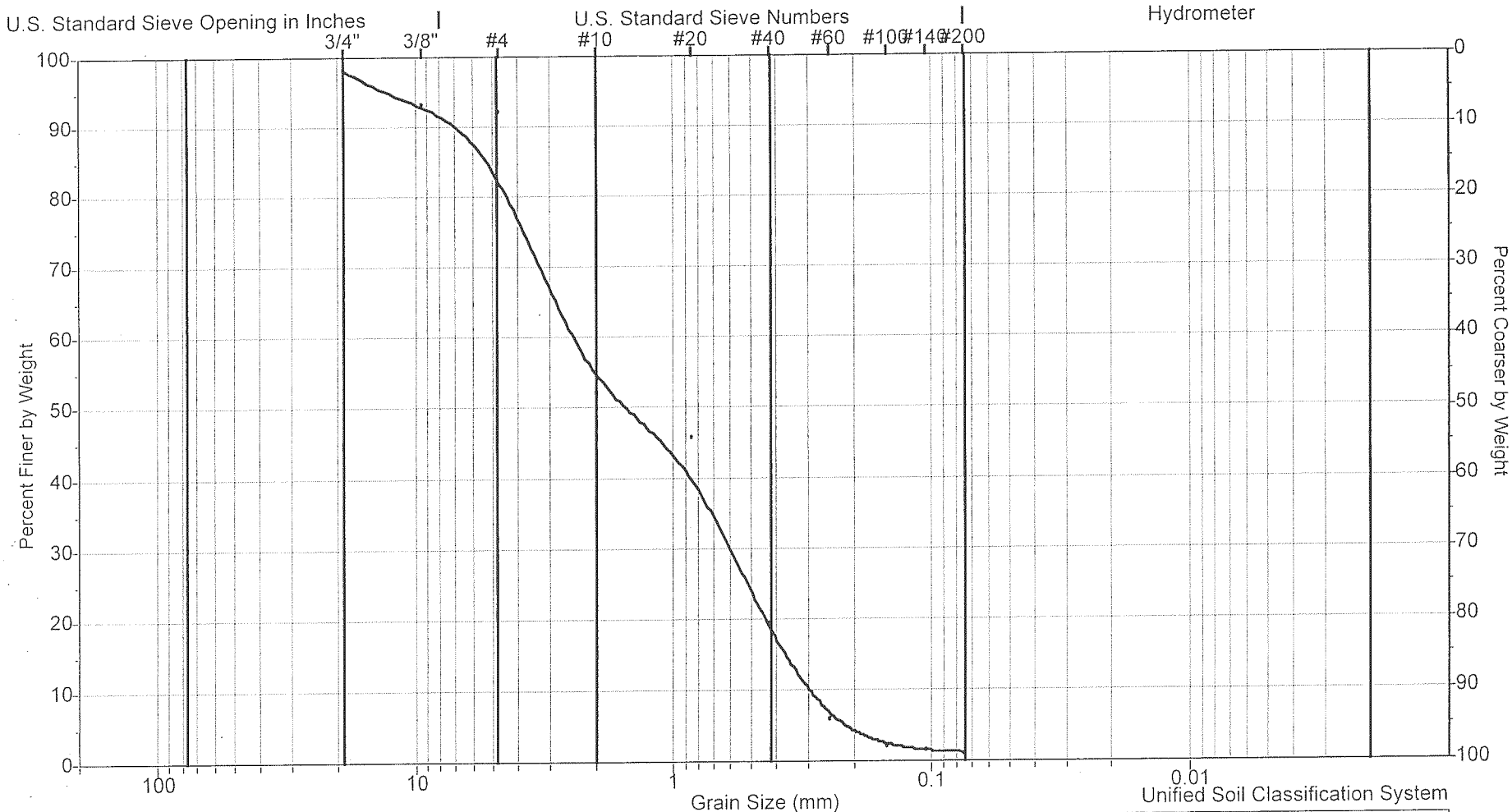
Results

Size (mm)	Percent Passing
4.75	99.3
2	98.2
0.85	94.2
0.425	53
0.25	32.7
0.15	28.8
0.106	28
0.075	27.6

4034

GPL Laboratories	Sample No. 408065-010	Project Name: CTO066, INDIAN HEAD
	Client: CH2M HILL	ASTM 422, Grain Size Distribution Graph
	Location: IS47SS40-0804	Test Date: 8/13/04

Symbol	Sample No.	% Clay	% Silt	% Fine Sand	% Medium Sand	% Coarse Sand	% Fine Gravel	% Coarse Gravel	% Cobbles
.	408065-010	< 0	< 0	18	37	27	16	0	0



Unified Soil Classification System

	GRAVEL		SAND			SILT or CLAY	
	coarse	fine	coarse	medium	fine	Silt	Clay

Sieve Data Sheet

Project: 408065
Borehole ID:
Sample ID: 408065-010
Test ID: D422
Test Date: 8/13/04

Client: CH2M HILL
Description:
Location: IS47SS40-0804
Source:
Northing: 0
Easting: 0
Collected By:
User Defined:

Wet Sample Weight: 800
Dry Sample Weight: 763.2
Pan Weight: 9.7
Split Sample: No
Oven Dried Weight: 754.2
Air Dried Weight: 791
Hydrometer Sample Weight: 0
Hydrometer Pan Weight: 0
Hydrometer Weight Retained: 0
Specific Gravity: 2.5
Hydrometer Type: 151H
User Defined:

Sieve Size Data

Sieve	Size (mm)	Weight Retained	Cumulative Weight
3/4"	19	13	13
3/8"	9.5	38.2	51.2
#4	4.75	8	59.2
#10	2	300	359.2
#20	0.85	48	407.2
#40	0.425	200.5	607.7
#60	0.25	100	707.7
#100	0.15	29.1	736.8
#140	0.106	5.3	742.1
#200	0.075	1.9	744

Hydrometer Data

Time	Reading	Temperature
0	0	0
1	0	0
2	0	0
5	0	0
15	0	0

30	0	0
60	0	0
250	0	0
1440	0	0

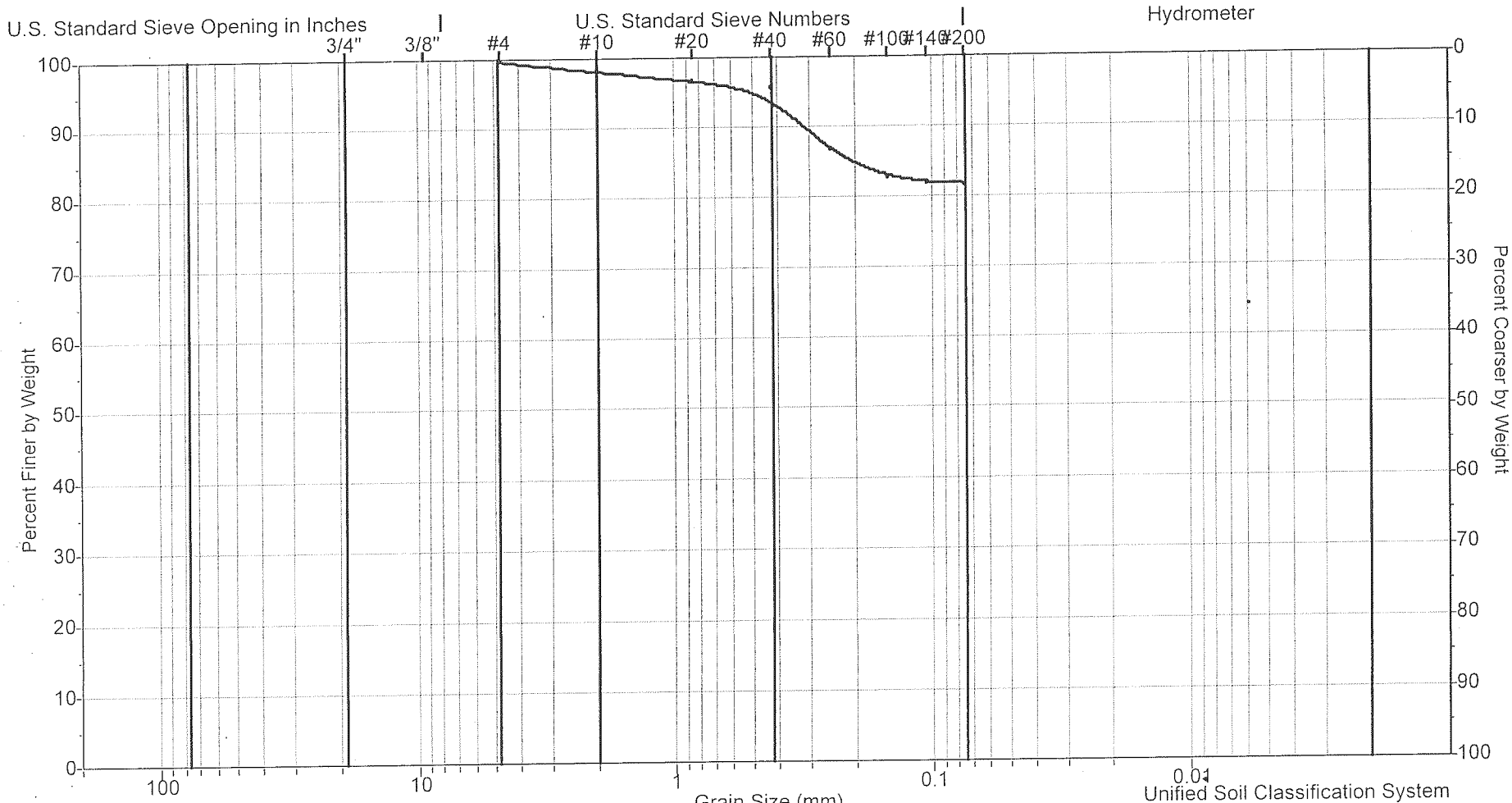
Results

Size (mm)	Percent Passing
19	98.2
9.5	93.2
4.75	92.1
2	52.3
0.85	45.9
0.425	19.3
0.25	6
0.15	2.2
0.106	1.5
0.075	1.2

GPL Laboratories

Sample No. 408065-012	Project Name: CTO066, INDIAN HEAD
Client: CH2M HILL	ASTM 422, Grain Size Distribution Graph
Location: BGD-SS03-0804	Test Date: 8/13/04

Symbol	Sample No.	% Clay	% Silt	% Fine Sand	% Medium Sand	% Coarse Sand	% Fine Gravel	% Coarse Gravel	% Cobbles
.	408065-012	< 0	< 0	93	4.8	1.6	0	0	0



Project: 408065
Borehole ID:
Sample ID: 408065-012
Test ID: D422
Test Date: 8/13/04

Client: CH2M HILL
Description:
Location: BGD-SS03-0804
Source:
Northing: 0
Easting: 0
Collected By:
User Defined:

Wet Sample Weight: 678
Dry Sample Weight: 630.6
Pan Weight: 9.7
Split Sample: No
Oven Dried Weight: 621.6
Air Dried Weight: 669
Hydrometer Sample Weight: 0
Hydrometer Pan Weight: 0
Hydrometer Weight Retained: 0
Specific Gravity: 2.5
Hydrometer Type: 151H
User Defined:

Sieve Size Data

Sieve	Size (mm)	Weight Retained	Cumulative Weight
3/4"	19	0	0
3/8"	9.5	0	0
#4	4.75	2	2
#10	2	7.3	9.3
#20	0.85	10.6	19.9
#40	0.425	6.9	26.8
#60	0.25	55	81.8
#100	0.15	24.5	106.3
#140	0.106	5.2	111.5
#200	0.075	1.3	112.8

Hydrometer Data

Time	Reading	Temperature
0	0	0
1	0	0
2	0	0
5	0	0
15	0	0

30	0	0
60	0	0
250	0	0
1440	0	0

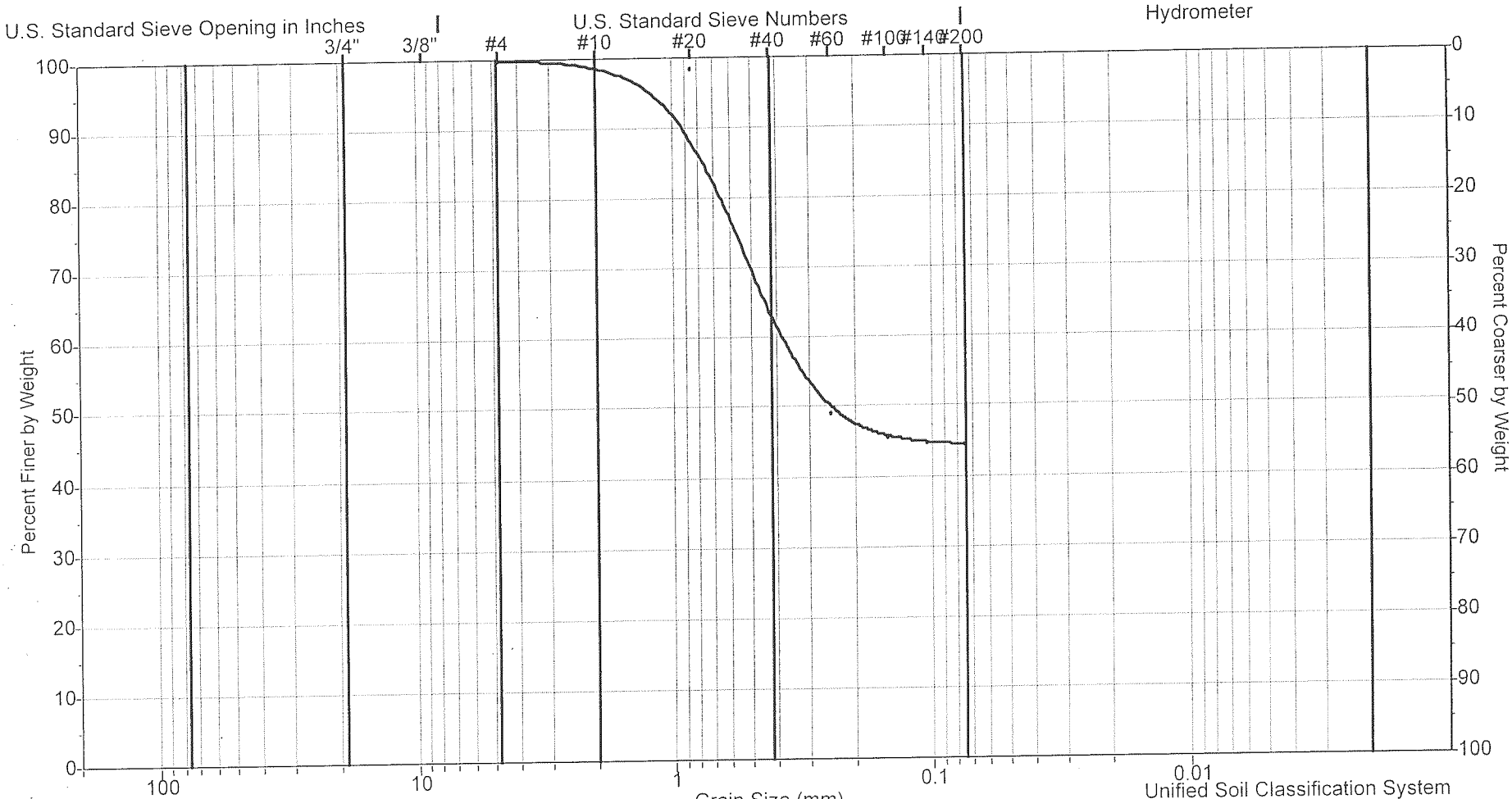
Results

Size (mm)	Percent Passing
4.75	99.6
2	98.5
0.85	96.7
0.425	95.6
0.25	86.8
0.15	82.8
0.106	82
0.075	81.8

4040

GPL Laboratories	Sample No. 408065-013	Project Name: CTO066, INDIAN HEAD
	Client: CH2M HILL	ASTM 422, Grain Size Distribution Graph
	Location: IS47SS17-0804	Test Date: 8/13/04

Symbol	Sample No.	% Clay	% Silt	% Fine Sand	% Medium Sand	% Coarse Sand	% Fine Gravel	% Coarse Gravel	% Cobbles
.	408065-013	< 0	< 0	63	36	1.4	0	0	0



Unified Soil Classification System

	GRAVEL		SAND			SILT or CLAY	
	coarse	fine	coarse	medium	fine	Silt	Clay

Project: 408065
Borehole ID:
Sample ID: 408065-013
Test ID: D422
Test Date: 8/13/04

Client: CH2M HILL
Description:
Location: IS47SS17-0804
Source:
Northing: 0
Easting: 0
Collected By:
User Defined:

Wet Sample Weight: 1000
Dry Sample Weight: 873.4
Pan Weight: 9.7
Split Sample: No
Oven Dried Weight: 864.4
Air Dried Weight: 991
Hydrometer Sample Weight: 0
Hydrometer Pan Weight: 0
Hydrometer Weight Retained: 0
Specific Gravity: 2.5
Hydrometer Type: 151H
User Defined:

Sieve Size Data

Sieve	Size (mm)	Weight Retained	Cumulative Weight
3/4"	19	0	0
3/8"	9.5	0	0
#4	4.75	1	1
#10	2	1.4	2.4
#20	0.85	12.2	14.6
#40	0.425	300	314.6
#60	0.25	124.6	439.2
#100	0.15	30.6	469.8
#140	0.106	6.2	476
#200	0.075	3	479

Hydrometer Data

Time	Reading	Temperature
0	0	0
1	0	0
2	0	0
5	0	0
15	0	0

30	0	0
60	0	0
250	0	0
1440	0	0

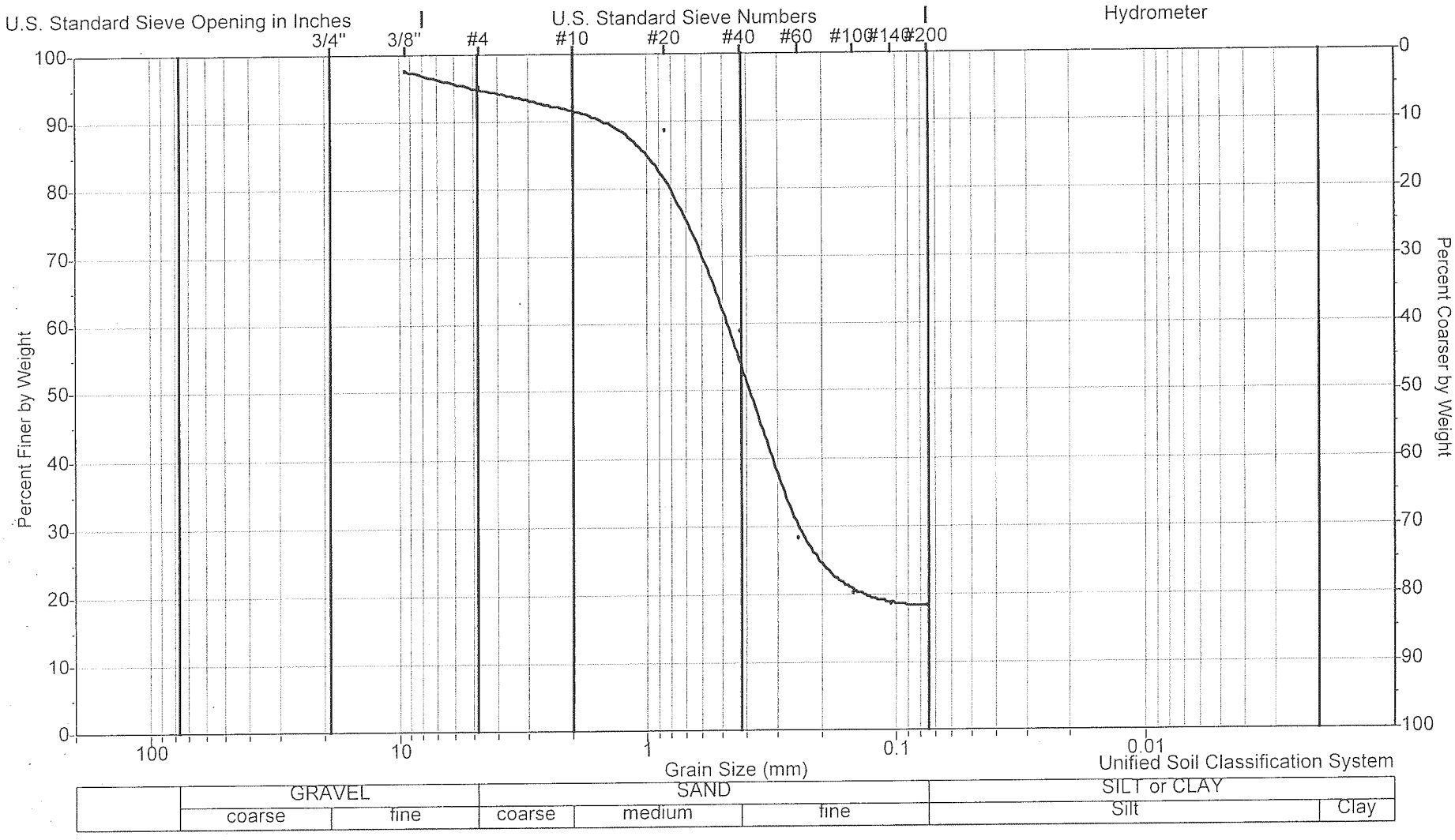
Results

Size (mm)	Percent Passing
4.75	99.8
2	99.7
0.85	98.3
0.425	63.5
0.25	49.1
0.15	45.6
0.106	44.8
0.075	44.5

4043

GPL Laboratories	Sample No. 408065-014	Project Name: CTO066, INDIAN HEAD
	Client: CH2M HILL	ASTM 422, Grain Size Distribution Graph
	Location: IS47SD05-0804	Test Date: 8/13/04

Symbol	Sample No.	% Clay	% Silt	% Fine Sand	% Medium Sand	% Coarse Sand	% Fine Gravel	% Coarse Gravel	% Cobbles
.	408065-014	< 0	< 0	53	38	3.3	2.9	0	0



Project: 408065
Borehole ID:
Sample ID: 408065-014
Test ID: D422
Test Date: 8/13/04

Client: CH2M HILL
Description:
Location: IS47SD05-0804
Source:
Northing: 0
Easting: 0
Collected By:
User Defined:

Wet Sample Weight: 858.3
Dry Sample Weight: 600
Pan Weight: 9.7
Split Sample: No
Oven Dried Weight: 591
Air Dried Weight: 849.3
Hydrometer Sample Weight: 0
Hydrometer Pan Weight: 0
Hydrometer Weight Retained: 0
Specific Gravity: 2.5
Hydrometer Type: 151H
User Defined:

Sieve Size Data

Sieve	Size (mm)	Weight Retained	Cumulative Weight
3/4"	19	0	0
3/8"	9.5	14	14
#4	4.75	14	28
#10	2	17	45
#20	0.85	22.1	67.1
#40	0.425	174	241.1
#60	0.25	182.2	423.3
#100	0.15	48	471.3
#140	0.106	8.7	480
#200	0.075	2.3	482.3

Hydrometer Data

Time	Reading	Temperature
0	0	0
1	0	0
2	0	0
5	0	0
15	0	0

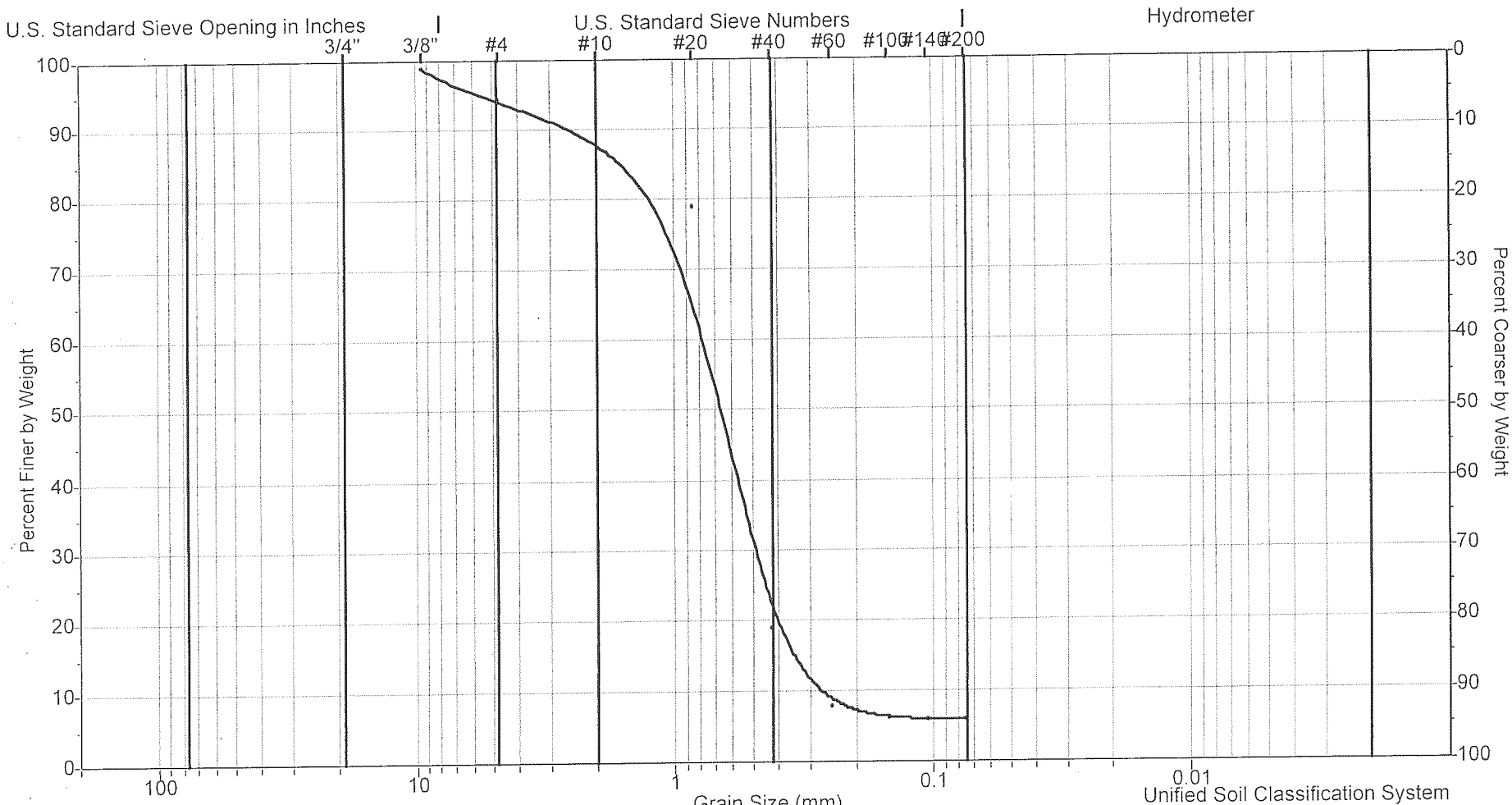
30	0	0
60	0	0
250	0	0
1440	0	0

Results

Size (mm)	Percent Passing
9.5	97.6
4.75	95.2
2	92.3
0.85	88.6
0.425	59.1
0.25	28.2
0.15	20.1
0.106	18.6
0.075	18.2

GPL Laboratories	Sample No. 4708065-015	Project Name: CTO066, INDIAN HEAD
	Client: CH2M HIL	ASTM 422, Grain Size Distribution Graph
	Location: IS47RSD05-0804	Test Date: 8/13/04

Symbol	Sample No.	% Clay	% Silt	% Fine Sand	% Medium Sand	% Coarse Sand	% Fine Gravel	% Coarse Gravel	% Cobbles
.	4708065-015	< 0	< 0	21	66	6.3	5	0	0



Unified Soil Classification System							
	GRAVEL		SAND			SILT or CLAY	
	coarse	fine	coarse	medium	fine	Silt	Clay

Project: 408065
Borehole ID:
Sample ID: 4708065-015
Test ID: D422
Test Date: 8/13/04

Client: CH2M HIL
Description:
Location: IS47RSD05-0804
Source:
Northing: 0
Easting: 0
Collected By:
User Defined:

Wet Sample Weight: 1067
Dry Sample Weight: 860
Pan Weight: 9.7
Split Sample: No
Oven Dried Weight: 851
Air Dried Weight: 1058
Hydrometer Sample Weight: 0
Hydrometer Pan Weight: 0
Hydrometer Weight Retained: 0
Specific Gravity: 2.5
Hydrometer Type: 151H
User Defined:

Sieve Size Data

Sieve	Size (mm)	Weight Retained	Cumulative Weight
3/4"	19	0	0
3/8"	9.5	10	10
#4	4.75	38.4	48.4
#10	2	29.2	77.6
#20	0.85	100	177.6
#40	0.425	511	688.6
#60	0.25	93.9	782.5
#100	0.15	14.7	797.2
#140	0.106	2.1	799.3
#200	0.075	0.5	799.8

Hydrometer Data

Time	Reading	Temperature
0	0	0
1	0	0
2	0	0
5	0	0
15	0	0

30	0	0
60	0	0
250	0	0
1440	0	0

Results

Size (mm)	Percent Passing
9.5	98.8
4.75	94.3
2	90.8
0.85	79.1
0.425	19
0.25	7.9
0.15	6.2
0.106	5.9
0.075	5.9

Appendix D
Sediment Toxicity Testing Report

TOXICOLOGICAL EVALUATION OF SEDIMENT SAMPLES

Hyalella azteca Survival, Growth and Reproduction Sediment Toxicity Tests
Naval District Washington, Indian Head CTO-066, Site 47 Sediment Evaluation
Indian Head, Maryland

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September 2004
Reference Number 12414-04-09

TABLE OF CONTENTS

1.0 INTRODUCTION 3

2.0 MATERIAL AND METHODS 3

2.1 General Methods, Biological Evaluations 3
2.2 Test Species 3
2.3 Test Sample and Laboratory Control Sediment 3
2.4 *Hyalella azteca* Survival, Growth, and Reproduction Toxicity Tests 4
2.5 Statistical Analysis 5
2.6 Quality Control 6
2.7 Protocol Deviations 6

3.0 RESULTS AND DISCUSSION 6

3.1 *Hyalella azteca* 28 Day Survival and Growth Evaluation 6
3.2 *Hyalella azteca* Reproduction Evaluation 7
3.3 Summary 7

4.0 REFERENCES 7

LIST OF TABLES

Table 1. Summary of Sample Collection Information. 8

Table 2. Summary of Endpoints 8

Table 3. Summary of Day 28 Survival Data 9

Table 4. Summary of Day 28 Growth Data 10

Table 5. Summary of Day 42 Survival Data 11

Table 6. Summary of Day 42 Reproduction Data 12

Table 7. Summary of Water Qualities 13

Table 8. Reference Toxicant Evaluation 14

Appendix A: Raw Data and Statistical Support 15

TOXICOLOGICAL EVALUATION OF SEDIMENT SAMPLES

Hyalella azteca Survival, Growth and Reproduction Sediment Toxicity Tests Naval District Washington, Indian Head CTO-066, Site 47 Sediment Evaluation Indian Head, Maryland

1.0 INTRODUCTION

Toxicity tests expose groups of organisms to environmental samples, a laboratory control and/or a field reference site for a specified period to assess potential impacts on a variety of endpoints, such as survival, growth or reproduction. Analysis of variance techniques are used to determine the relative toxicity of the samples as compared to the laboratory control and/or field reference site.

This report presents the results of chronic exposure survival and reproduction toxicity tests conducted on twenty-four sediment samples collected from the Naval District Washington, Indian Head project site, CTO-066 Site 47. The samples were provided by CH2M Hill, Incorporated, Boston, Massachusetts. Testing was based on programs and protocols developed by the ASTM (2001) and US EPA (2000). The toxicity of the samples was assessed by conducting long term survival, growth, and reproduction toxicity tests using the freshwater amphipod, *Hyalella azteca*. Toxicity tests and supporting analyses were performed at EnviroSystems, Incorporated (ESI), Hampton, New Hampshire.

2.0 MATERIALS AND METHODS

2.1 General Methods, Biological Evaluations

Toxicological and analytical protocols used in this program follow procedures outlined in *Test Methods for Measuring the Toxicity of Sediment-Associated Contaminants with Freshwater Invertebrates* (ASTM 2001), *Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates* (US EPA 2000) and *Standard Methods for the Examination of Water and Wastewater*, 20th Edition (APHA 1998). These protocols provide standard approaches for physical and chemical analysis and for the evaluation of toxicological effects of sediments on aquatic invertebrates.

2.2 Test Species

H. azteca were obtained from Aquatic Research Organisms, Hampton, New Hampshire. Organisms were approximately 10 days old at the start of the assay.

2.3 Test Samples and Laboratory Control Sediment

A total of three sediment samples from the Indian Head project site were received at ESI on August 11, 2004. Once received, samples were inspected, to determine integrity, given unique sample numbers and logged into the laboratory sample management database. Once logged into the sample management database samples were placed in a secure refrigerated, 2 - 4 °C, storage area until required. A listing of sample sites, sample collection, and receipt information is summarized in Table 1.

The control substrate was an artificial sediment consisting primarily of silica sand, with approximately 1-2% organic material by weight (EnviroSystems SOP QA-1466). Organic matter consisted of fine detritus collected from a surface water impoundment in Hampton Falls, New Hampshire. The water in the container was changed daily.

Overlying water for the sediment toxicity tests was a mixture of natural surface water, collected from Bow Lake, Strafford, New Hampshire, and moderately hard reconstituted water. Use of natural surface water mixed with artificial reconstituted water is recommended by the protocol (EPA 2000, ASTM 2001).

2.4 *Hyalella azteca* Survival, Growth, and Reproduction Toxicity Tests

The 42 day amphipod survival and reproduction test is divided into two exposure periods: an initial 28 day survival and growth evaluation followed by 14 day reproduction evaluation. Sediment tests were conducted according to ASTM Method E 1706-95 (2001) and EPA methods (EPA 2000). Endpoints of the initial 28 day exposure were survival and growth, measured as dry weight. Endpoints for the additional 14 day exposure included survival and juvenile production. The assays were started on September 1, the initial growth and survival portion of the assay was terminated on September 29 and the reproduction portion of the assay was terminated on October 13, 2004.

The site sediment and laboratory control sediment treatments consisted of 12 replicates with 10 organisms/replicate. Test vessels were 400 mL glass beakers containing approximately 100 mL of sediment and 250 mL of overlying water. The overlying water volume to sediment surface area ratio was approximately 7:1. Test vessels were drilled at a consistent height above their bases and the hole covered with Nytex® screen. The screened hole facilitated water exchange without compromising organisms. Vessels were maintained in a water bath during the assay. Depth of the water in the bath was set to be approximately 1 cm below the drain hole in the test vessel to eliminate flow of water from the bath into the test vessel. The water bath was maintained in a limited-access temperature controlled room. Temperatures in the room and water bath were independently maintained at 23 ±1°C. The photoperiod in the test chamber was set at 16:8 hour light:dark. Light was provided by cool white flourescent bulbs.

One day prior to test initiation (Day -1), control and test sediments were sieved using a 2 mm sieve to remove rocks, twigs, and other debris. Sediments were placed in the test vessels. Overlying water was immediately added, and the vessels were left undisturbed overnight to settle. Floating detritus was removed the next morning. The next day (Day 0), organisms were added to test. Organisms were added below the water surface at test initiation, using a large-bore glass pipet.

Overlying water in each replicate was renewed daily after collection of water quality data. The volume of water added to each test chamber was approximately 500 mL or two volumes. Water exchanges were facilitated by use of a distribution system designed to provide equal, regulated, flow to each chamber. The system was activated manually by the addition of water during the assay.

Prior to the daily overlying water renewal, temperature, specific conductance, pH, and dissolved oxygen were measured in one replicate of each treatment. Alkalinity, ammonia, and hardness of the overlying water were measured weekly from test initiation until day 28. Water quality data collected at the start and end of the assay are summarized in Table 7. Daily overlying water quality records and weekly alkalinity, ammonia and hardness data are provided in Appendix A. Each replicate was fed 1.0 mL of a yeast/trout chow/alfalfa suspension after the daily renewal.

After 28 days exposure, all replicates of each test treatment were terminated to collect data for initial survival. Each test chamber was gently swirled to loosen the sediments and the test material was dumped into an 8" stainless steel sieve with a 0.35 mm mesh screen. The sediments were washed through the sieve using synthetic, moderately hard reconstituted water and material left on the screen was sorted to recover of the organisms. This process was continued until the entire sample was evaluated. Organisms collected from the first four replicates were set aside to determine growth. Organisms from the remaining eight replicates of each treatment were returned to test vessels containing overlying water and a piece of Nytex® screen.

Surviving amphipods from the four replicates identified for 28 day survival and growth analysis were counted and placed on tared weighing pans. Pans were dried overnight at 70°C to obtain dry weight to the nearest 0.01 mg. The mean dry weight of surviving organisms was determined to assess growth.

Surviving amphipods from the remaining eight replicates were enumerated and then returned to test chambers, containing a 2x4 cm piece of Nytex® screen as a substrate, filled with a 50:50 mix of natural surface water and moderately hard reconstituted water. The test vessels were returned to the water bath for the additional 14 day exposure. During the 14 day period water quality monitoring, water exchanges and feeding were conducted in the same manner as during the initial 28 day exposure. Survival was monitored on Days 35 and 42, and was calculated as the percentage of organisms alive in the remaining eight replicates of each test treatment. Survival data for Days 35 and 42 is presented in Table 2. Reproduction was monitored on Days 35 and 42.

2.5 Statistical Analysis

Survival, growth and juvenile production data were analyzed using CETIS® software to determine significant differences between the test sediments and both the associated laboratory control and reference sediments. Data sets were evaluated to determine normality of distribution and homogeneity of sample variance. Data sets were subsequently evaluated using the appropriate parametric or non-parametric Analysis of Variance (ANOVA) statistic. Pair-wise comparisons were made using the appropriate statistical evaluation, including the t-Test and Mann-Whitney U tests. Statistical difference was evaluated at $\alpha=0.05$.

2.6 Quality Control

As part of the laboratory quality control program, reference toxicant evaluations are conducted by ESI on a regular basis for each test species. These results provide relative health and response data while allowing for comparison with historic data sets. The 96 hour *H. azteca* reference toxicant was conducted during September 2004, using cadmium chloride as the reference toxicant. Results were within one standard deviation of ESI's historic mean for the species. Results are summarized in Table 8.

2.7 Protocol Deviations

Review of data collected during this assay indicates one area where methods or results deviated from mandated or suggested protocols. Temperature data collected by the data logger documented 18 out of over 1000 temperature readings, 1.7%, were at 19.5°C. No temperatures varied above the maximum protocol temperature of 26°C. None of the readings made during the daily water quality monitoring sessions fell below the protocol's lower limit of 20°C.

It is the opinion of the Study Director that these deviations did not affect the outcome of the tests.

3.0 TESTING RESULTS AND DISCUSSION

Table 1 provides a summary of sample collection and receipt information. Table 2 provides a summary of survival, growth, and reproduction endpoints. Survival and growth data from the initial 28 day exposure are summarized in Tables 3 and 4, respectively. Tables 5 and 6 summarize day 42 survival and reproduction data. Water quality data collected during the assays is summarized in Table 7. Reference toxicant data is summarized in Table 8. Support data, including copies of laboratory bench sheets, statistical analyses and individual endpoint summaries, are provided in Appendix A.

3.1 *Hyalella azteca* Initial 28 Day Survival and Growth Evaluation

At the end of the initial 28 day exposure period, mean survival in Laboratory Control sediment was 90.0%. Survival in the individual replicates ranged from 70% to 100%. Amphipods recovered from Laboratory Control sediment had a mean dry weight of 0.390 mg/amphipod with dry weights in the individual replicates ranging from 0.320 to 0.447 mg/amphipod. The dry weight of a representative group of amphipods at the start of the assay was 0.024 mg/individual. The minimum test acceptability criteria for survival in the laboratory control is 80%. The minimum acceptable criteria for growth is a demonstration of increased dry weight after 28 days exposure. These data indicate that the organisms were healthy and not stressed by handling.

Temperature data collected in a surrogate test chamber during the 42 day exposure period documented a mean temperature of 22.9°C, with values ranging from 19.5 to 26.0°C. Temperature data collected during the daily water quality monitoring indicated values ranging from 20 to 24°C. Test acceptability criteria requires a mean temperature of 23±1°C, with maximum temporary fluctuations of 23±3°C.

On Day 28, mean survival in the project reference site sediment, IS47RSDTX01, was 88.3%, with survival in individual replicates ranging from 60% to 100%. Mean dry weight of surviving amphipods, collected from the 28 day growth replicates, was 0.304 mg/amphipod.

Survival and growth data for the individual project site sediment samples are summarized in Tables 3 and 4, respectively.

3.2 *Hyalella azteca* Reproduction Evaluation

Data collected during the additional 14 day exposure period was used to assess impacts on amphipod survival and reproduction. Survival data collected on Days 35 and 42 are presented in Table 2. Summaries of survival and reproduction data collected on Day 42 of the tests are presented in Tables 5 and 6, respectively. In cases where juveniles but no live females were recovered the replicates were removed from the statistical analysis data set for juveniles per female amphipod. Also, replicates discovered without any surviving males at Day 42, and without juveniles were removed from the data set. Detailed survival and reproduction data for day 35 is provided the data appendix.

Review of juvenile production in the laboratory control treatment showed a mean production of 6.16 juvenile per surviving female between days 29 and 42 of the assay. Mean production in the project reference site, IS47RSDTX01, sediment during the 14 day period was 4.97 juveniles per surviving female.

3.3 Summary

Review of endpoints indicates that both of the sediment samples evaluated had a significant impact on survival, and /or growth of the amphipod, *H. azteca,* when compared to the corresponding reference site IS47RSDTX01. The sediments had no impact on reproduction.

When endpoints were evaluated against the corresponding laboratory control sediment, both test sediments and the reference sediment, IS47RSDTX01, had a significant impact on survival and/or growth of the amphipod, *H. azteca*. Reproduction data analysis indicates that one of the sediments, IS47SDTX05, had a significant impact on reproduction based on the number of juveniles produced per female amphipod alive at Day 42.

4.0 REFERENCES

APHA. 1998. *Standard Methods for the Examination of Water and Wastewater*, 20th Edition. Washington D.C.

ASTM. 2001. Annual Book of ASTM Standards. Volume 11.05. *Test Methods for Measuring the Toxicity of sediment-Associated Contaminants with Freshwater Invertebrates*. E 1706-00. ASTM, Philadelphia.

U.S. EPA. 2000. *Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates*. Second Edition. EPA/600-R-99/064.

EnviroSystems SOP QA-1466: 42 Day Assessment Toxicity of Sediments To The Amphipod, *Hyalella azteca* based on Survival and Growth.

TABLE 1. Summary of Sample Collection Information. Naval District Washington, Indian Head CTO-066, Site 47 Sediment Evaluation. September - October 2004.

Project Site	Project Sample ID	ESI Reference	Matrix	Collection Date	Collection Time	Receipt Date	Receipt Time
Site 47	IS47SDTX17	12415-001	Sediment	08/10/04	1440	08/11/04	1040
Site 47	IS47SDTX05	12415-002	Sediment	08/10/04	1500	08/11/04	1040
Site 47	IS47RSDTX01 (Reference)	12415-003	Sediment	08/10/04	1610	08/11/04	1040

TABLE 2. Summary of Endpoints: *H. azteca* Survival, Growth and Reproduction Sediment Toxicity Tests. Naval District Washington, Indian Head CTO-066, Site 47 Sediment Evaluation. September - October 2004.

		DAY 28 ENDPOINTS		DAY 42 ENDPOINTS			
		Mean Survival	Mean Dry Weight	Mean Survival Day 35	Mean Survival Day 42	Mean # Juveniles per Amphipod	Mean # Juveniles per ♀Amphipod
	UNITS	(%)	(mg)	(%)	(%)	At Day 35	At Day 42
	Test Acceptability Performance Criteria:	80%	>Start Weight (0.024 mg/org)	Protocol Does Not Specify Test Acceptability Criteria for Day 35 and Day 42 Endpoints			
	Specification Level:	Must	Must				
PROJECT SITE	ESI ID						
Laboratory Control	000	90.0	0.390	86.3	61.3	0.72	6.16
IS47RSDTX01 (Reference)	003	88.3	**0.304**	82.5	**23.8**	0.44	4.97
IS47SDTX17	001	**83.3**	**0.229**	74.2	55.5	0.68	3.11
IS47SDTX05	002	**68.3**	**0.175**	**58.8**	55.0	0.03	**0.86**

Values in **BOLD** type face are statistically different, less than, ~~than observed for the~~ laboratory control and/or project reference site.

TABLE 3. Summary of Day 28 Survival Data: *H. azteca*. Naval District Washington, Indian Head CTO-066, Site 47 Sediment Evaluation. September - October 2004.

Sample Site	ESI Ref	Mean Recovery	Distribution	Variance	t Value	Critical t Value	p Value	Statistically Significant Difference ‡
Statistical Comparisons Against Laboratory Control Treatment								
Lab Control	000	90.0%						
IS47RSDTX01	003	88.3%	Normal	Equal	0.3180	1.7171	0.3767	NO
IS47SDTX17	001	83.3%	Normal	Equal	2.1162	1.7171	0.0229	YES
IS47SDTX05	002	68.3%	Normal	Equal	3.9847	1.7171	0.0003	YES
Statistical Comparisons Against Reference Site								
IS47RSDTX01	003	88.3%						
IS47SDTX17	001	83.3%	Normal	Equal	1.4110	1.7171	0.0861	NO
IS47SDTX05	002	68.3%	Normal	Equal	3.3563	1.7171	0.0014	YES

NOTES:

‡ Statistical significance evaluated at $\alpha = 0.05$.

TABLE 4. Summary of Day 28 Growth Data: *H. azteca*. Naval District Washington, Indian Head CTO-066, Site 47 Sediment Evaluation. September - October 2004.

Sample Site	ESI Ref	Mean Dry Wt (mg)	Distribution	Variance	t Value	Critical t Value	p Value	Statistically Significant Difference ‡
Statistical Comparisons Against Laboratory Control Treatment								
Lab Control	000	0.390						
IS47RSDTX01	003	0.304	Normal	Equal	2.4130	1.9432	0.0262	YES
IS47SDTX17	001	0.229	Normal	Equal	2.1242	1.9432	0.0027	YES
IS47SDTX05	002	0.175	Normal	Equal	4.5567	1.9432	0.0019	YES
Statistical Comparisons Against Reference Site								
IS47RSDTX01	003	0.304						
IS47SDTX17	001	0.229	Normal	Equal	2.1242	1.9432	0.0389	YES
IS47SDTX05	002	0.175	Normal	Equal	2.8650	1.9432	0.0143	YES

NOTES:
‡ Statistical significance evaluated at $\alpha = 0.05$.

TABLE 5. Summary of Day 42 Survival Data: *H. azteca*. Naval District Washington, Indian Head CTO-066, Site 47 Sediment Evaluation. September - October 2004.

Sample Site	ESI Ref	Mean Survival	Distribution	Variance	t Value	Critical t Value	p Value	Statistically Significant Difference ‡
Statistical Comparisons Against Laboratory Control Treatment								
Lab	000	61.3%						
IS47RSDTX01	003	23.8%	Normal	Equal	4.4608	1.7613	0.0003	YES
IS47SDTX17	001	55.5%	Normal	Equal	0.1123	1.7613	0.4561	NO
IS47SDTX05	002	55.0%	Normal	Equal	0.7913	1.7613	0.2210	NO
Statistical Comparisons Against Reference Site								
IS47RSDTX01	003	23.8%						
IS47SDTX17	001	55.5%	Normal	Equal	-3.4970	1.7613	0.9982	NO
IS47SDTX05	002	55.0%	Normal	Equal	-3.4429	1.7613	0.9980	NO

NOTES:

‡ Statistical significance evaluated at $\propto = 0.05$.

Table 6. Summary of Day 42 Reproduction Data: *H. azteca*. Naval District Washington, Indian Head CTO-066, Site 47 Sediment Evaluation. September - October 2004.

Sample Site	ESI Ref	Mean No. Juveniles/ Female	Distribution	Variance	t Value	Critical t Value	p Value	Statistically Significant Difference ‡
Statistical Comparisons Against Laboratory Control Treatment								
Lab	00	6.16						
IS47RSDTX01	003	4.97	Normal	Equal	0.4544	1.7823	0.3288	NO
IS47SDTX17	001	3.11	Normal	Equal	1.5952	1.7709	0.0673	NO
IS47SDTX05	002	0.86	Normal	Unequal	3.0336	1.8946	0.0095	YES
Statistical Comparisons Against Reference Site								
IS47RSDTX01	003	4.97						
IS47SDTX17	001	3.11	Normal	Equal	0.8571	1.7959	0.2048	NO
IS47SDTX05	002	0.86	Normal	Unequal	1.7743	2.0151	0.0681	NO

NOTES:

Data is inclusive of Day 35 and Day 42 reproduction observations and is based on Day 42 female survival.

All replicates with no surviving females omitted from statistical analysis.

‡ Statistical significance evaluated at $\propto = 0.05$.

TABLE 7. Summary of Water Qualities. Naval District Washington, Indian Head CTO-066, Site 47 Sediment Evaluation. September - October 2004.

Sample Site	ESI REF	Day	Alkalinity (mg/L)	Ammonia (mg/L)	Hardness (mg/L)	Conductivity (µmhos/cm)	pH (SU)
MHR/POND	-	0	11	ND	41	-	-
		28	39	ND	52	-	-
		42	32	ND	50	-	-
LAB	000	0	ND	ND	39	141	6.83
		28	35	ND	59	212	7.12
IS47RSDTX01	003	0	18	ND	43	156	6.89
		28	37	ND	64	220	7.18
IS47SDTX17	001	0	ND	ND	40	140	6.51
		28	36	ND	60	213	7.10
IS47SDTX05	002	0	ND	0.2	37	145	6.42
		28	39	ND	60	205	7.12

Notes:
ND - Not detected.

Method Reporting limits for Ammonia = 0.1 mg/L
Alkalinity = 10 mg/L

Additional water quality data can be found in Appendix A.

TABLE 8. Reference Toxicant Evaluation: *H. azteca*. Naval District Washington, Indian Head CTO-066, Site 47 Sediment Evaluation. September - October 2004.

REFERENCE TOXICANT EVALUATION
(Results are expressed as ppm Cadmium)

Species	Start	LC-50	Historic	Number	±1 Std	±2 Std
H. azteca	09/01/04	0.001	0.015	38	0.031	0.062

Note: Reference toxicant testing was conducted at ESI. The historic mean for *H. azteca* survival represents the mean determined from the ESI-conducted reference toxicant testing database.

APPENDIX A
RAW DATA
STATISTICAL SUPPORT

Contents	Number of Pages
H. azteca Survival and Reproduction Sediment Toxicity Tests	
Daily Water Quality Bench Sheets	4
Temperature Profile	1
Day 28 Survival Summary	1
Day 28 Organism Recovery Bench Sheets	5
Day 28 Survival Statistical Analysis	6
Day 0 and Day 28 Dry Weight Summary	2
Day 0 Start Dry Weight Bench Sheet	1
Day 28 Dry Weight Data Bench Sheets	1
Day 28 Growth Statistical Analysis	6
Day 35 Survival Summary Sheets	1
Day 35 Survival Bench Sheets	2
Day 35 Survival Statistical Analysis	6
Day 42 Survival Summary Sheets	1
Day 42 Survival Statistical Analysis	7
Day 42 Reproduction Summary Sheets	2
Day 42 Survival and Reproduction Bench Sheets	3
Day 42 Reproduction Statistical Analysis	6
Analytical Data Print out	5
Organism History Record	1
Sample Receipt Logs and Chain of Custody Records	2
	63

H. azteca SEDIMENT ASSAY
Daily Water Quality Measurements & Feeding Record

STUDY #: 12414	Client: CH2MHill	Overlying Water: MHR/Pond	START DATE: 9/1/04

DAY	Lab				-1				Water Quality Station #	S/C Meter #	ΔH2O fed	DATE	INIT
	D.O. (mg/L)	Cond. (µMHOS/cm)	pH (SU)	Temp. (°C)	D.O. (mg/L)	Cond. (µMHOS/cm)	pH (SU)	TEMP (°C)					
0	9.0	141.3	6.83	21	9.1	139.8	6.51	21	2	330i	✓	9/1/04	DHB
1	8.2	146.7	6.83	20	7.8	143.0	7.02	20	1	330i	✓	9/2/04	DHB
2	7.9	148.0	6.84	20	8.0	144.4	6.76	20	2	330i	✓	9/3/04	DHB
3	8.0	144.2	6.91	20	8.2	145.1	6.88	20	1	330I	✓	9/4	CW
4	7.8	149	7.26	20	8.0	146	7.15	20	1	330i	✓	9/5	m
5		~~[illegible]~~		~~[illegible]~~		~~[illegible]~~		~~[illegible]~~					
6	8.2	162.7	7.01	21	7.9	163.3	6.90	20	2	330i	✓	9/7/04	DHB
7	7.5	158.9	6.97	20	7.6	159.4	6.96	20	2	330i	✓	9/8/04	DHB
8	7.5	165.5	7.00	20	7.5	162.5	6.98	20	2	330i	✓	9/9/04	DHB
9	7.3	166.1	6.88	21	7.5	163.4	6.97	20	1	330i	✓	9/10/04	DHB
10	7.2	171.3	6.90	20	7.3	167.3	6.93	20	1	330I	✓	9/11/04	CW
11	7.3	155	6.94	21	7.6	155	6.98	21	1	330i	✓	9/12/04	BB
12	8.0	165.5	6.94	24	8.1	163.8	7.09	24	2	330i	✓	9/13/04	DHB
13	7.9	175	7.20	23	8.0	166	7.23	23	1	330i	✓	9/14/04	DHB
14	8.2	177	6.98	22	8.3	169	7.19	22	2	330i	✓	9/15/04	DHB
15	7.0	182	7.10	21	7.4	172	7.09	21	1	330i	✓	9/16/04	DHB
16	~~[illegible]~~	180	7.18	22	7.7	168	7.12	22	2	330i	✓	9/17/04	DHB
17	7.6	176	7.18	21	7.6	174	7.06	21	1	330i	✓	9/18	KK
18	7.5	185	7.14	23	7.6	171	7.18	23	1	330i	✓	9/19	m
19	7.4	191	6.96	22	7.4	180	6.93	22	2	330i	✓	9/20/04	BB
20	7.6	195	7.23	23	7.8	188	7.20	22	1	330i	✓	9/21/04	DHB
21	7.9	192	7.29	23	8.0	188	7.27	22	2	330i	✓	9/22/04	DHB
22	7.6	196	6.95	22	7.7	191	7.01	22	2	330i	✓	9/23/04	DHB
23	7.8	198	6.95	22	7.7	196	7.02	22	2	330i	✓	9/24/04	DHB
24	8.1	203	6.99	22	8.2	202	7.03	22	2	330i	✓	9/25/04	BB
25	6.7	195	7.22	23	7.2	194	7.23	22	1	330i	✓	9/26/04	DHB
26	8.2	203	7.08	23	8.0	205	7.05	22	2	330i	✓	9/27/04	✓
27	6.8	201	7.17	23	6.8	201	7.16	22	1	330i	✓	9/28/04	✓
28	7.0	212	7.12	24	7.1	213	7.10	24	2	330i	✓	9/29/04	BB

Pull Alkalinity, Hardness, Ammonia Day 0, 7, 14, 21, 28
23° C
Feed 1 mL of YCT/Replicate Daily
Two Volume Additions Daily

Hyalella azteca 42-Day CHRONIC EXPOSURE SEDIMENT ASSAY

Daily Water Quality Measurements & Feeding Record

STUDY #12414	CLIENT: CH2MHill	OVERLYING WATER: MHR/Pond	START DATE: 09/01/04

DAY	Lab				— 1				Water Quality Station#	S/C Meter #	ΔH₂O fed	Date	INITIAL
	D.O. (mg/L)	Cond. (µMHOS/cm)	pH (SU)	TEMP °C	D.O. (mg/L)	Cond. (µMHOS/cm)	pH (SU)	TEMP °C					
29	8.7	217	7.84	23	8.7	190	7.83	23	2	330i	✓	9/30/04	BB
30	7.6	232	7.53	24	7.9	229	7.65	24	2	330i	✓	10/1/04	DHB
31	7.8	230	7.32	25	7.6	227	7.44	25	2	330I	✓	10/2	CW
32	7.8	216	7.60	25	8.0	212	7.55	25	2	330i	✓	10/3	CW
33	7.4	220	7.38	24	7.6	218	7.48	24	1	330i	✓	10/4/04	BB
34	8.2	223	7.58	24	8.2	219	7.67	24	1	330i	✓	10/5/04	DHB
35	8.2	216	7.57	25	8.0	216	7.60	24	1	330i	✓	10/6/04	DHB
36	7.5	212	7.50	24	7.6	210	7.51	24	1	330i	✓	10/7/04	DHB
37	7.2	227	7.43	22	7.5	225	7.45	23	2	330i	✓	10/8/04	DHB
38	7.2	235	7.27	23	7.5	236	7.44	24	1	330I	✓	10/9	CW
39	7.8	239	7.85	26	7.9	244	7.88	25	1	330i	✓	10/10	CW
40	7.6	243	7.33	25	7.9	248	7.57	25	2	330i	✓	10/11/04	DHB
41	7.8	229	7.25	25	7.8	236	7.42	25	2	330i	✓	10/12/04	DHB
42	7.7	232	7.50	24	7.9	237	7.54	24	2	330I	✓	10/13/04	DHB

Feed YCT daily at a rate of 1 mL per vessel 23 °C Aerate if DO is below 2.5 mg/L Two volume additions daily

NOTES:

H. azteca SEDIMENT ASSAY
Daily Water Quality Measurements & Feeding Record

STUDY #: 12414	Client: CH2MHill	Overlying Water: MHR/Pond	START DATE: 9/1/04

DAY	-2				-3				Water Quality Station #	S/C Meter #	ΔH2O fed	DATE	INIT
	D.O. (mg/L)	Cond. (µMHOS/cm)	pH (SU)	Temp. (°C)	D.O. (mg/L)	Cond. (µMHOS/cm)	pH (SU)	TEMP (°C)					
0	8.6	144.8	6.42	21	9.1	155.5	6.89	21	2	330i	✓	9/1/04	DHB
1	7.8	162.3	6.70	20	8.0	168.4	7.01	20	1	330i	✓	9/2/04	DHB
2	7.9	160.2	6.70	20	8.0	161.4	6.96	20	2	330i	✓	9/3/04	DHB
3	7.4	160.9	6.85	20	8.0	163.2	6.49	20	1	330I	✓	9/4	CW
4	7.7	185	6.61	19	8.0	167	7.02	19	1	330i	✓	9/5	CW
5													
6	7.8	189.4	6.55	20	7.8	179.7	6.97	20	2	330i	✓	9/7/04	DHB
7	7.6	174.7	6.70	20	7.5	172.2	6.92	20	2	330i	✓	9/8/04	DHB
8	7.4	171.7	6.87	20	7.6	176.4	7.01	20	2	330i	✓	9/9/04	DHB
9	7.8	167.5	6.78	20	7.7	176.0	7.06	20	1	330i	✓	9/10/04	DHB
10	7.9	166.3	6.76	20	7.7	175.9	6.97	20	1	330I	✓	9/11	CW
11	7.7	159	6.88	21	7.7	167	6.99	21	1	330i	✓	9/12/04	BB
12	8.1	165.0	7.09	23	8.1	174.5	7.21	23	2	330i	✓	9/13/04	DHB
13	8.0	165	7.18	22	8.0	176	7.32	23	1	330i	✓	9/14/04	DHB
14	8.4	167	7.20	21	8.3	180	7.28	22	2	330i	✓	9/15/04	DHB
15	7.2	169	6.97	21	7.1	183	7.03	21	1	330i	✓	9/16/04	DHB
16	7.3	168	7.00	22	7.3	180	6.99	22	2	330i	✓	9/17/04	DHB
17	7.4	164	7.01	21	7.2	176	7.10	21	1	330i	✓	9/18	KC
18	7.7	165	7.16	22	7.6	194	7.25	22	1	330i	✓	9/19	[illegible]
19	7.4	173	6.90	22	7.4	198	6.93	22	2	330i	✓	9/20/04	BB
20	7.6	179	7.18	22	7.6	202	7.22	22	1	330i	✓	9/21/04	DHB
21	7.9	179	7.24	21	8.1	199	7.34	22	2	330i	✓	9/22/04	DHB
22	7.5	195	7.20	22	7.5	203	7.15	22	2	330i	✓	9/23/04	DHB
23	7.6	191	7.04	21	7.6	210	7.08	21	2	330i	✓	9/24/04	DHB
24	8.2	196	7.00	22	8.3	214	6.97	22	2	330i	✓	9/25/04	DB
25	7.5	188	7.26	22	7.6	212	7.38	22	1	330i	✓	9/26/04	DHB
26	7.7	198	7.06	22	7.8	215	7.11	22	2	330i	✓	9/27/04	✓
27	6.4	197	7.17	22	6.6	210	7.16	22	1	330i	✓	9/28/04	✓
28	7.1	205	7.12	24	7.1	220	7.18	24	2	330i	✓	9/29/04	BB

Pull Alkalinity, Hardness, Ammonia Day 0, 7, 14, 21, 28
23° C
Feed 1 mL of YCT/Replicate Daily
Two Volume Additions Daily

Hyalella azteca 42-Day CHRONIC EXPOSURE SEDIMENT ASSAY

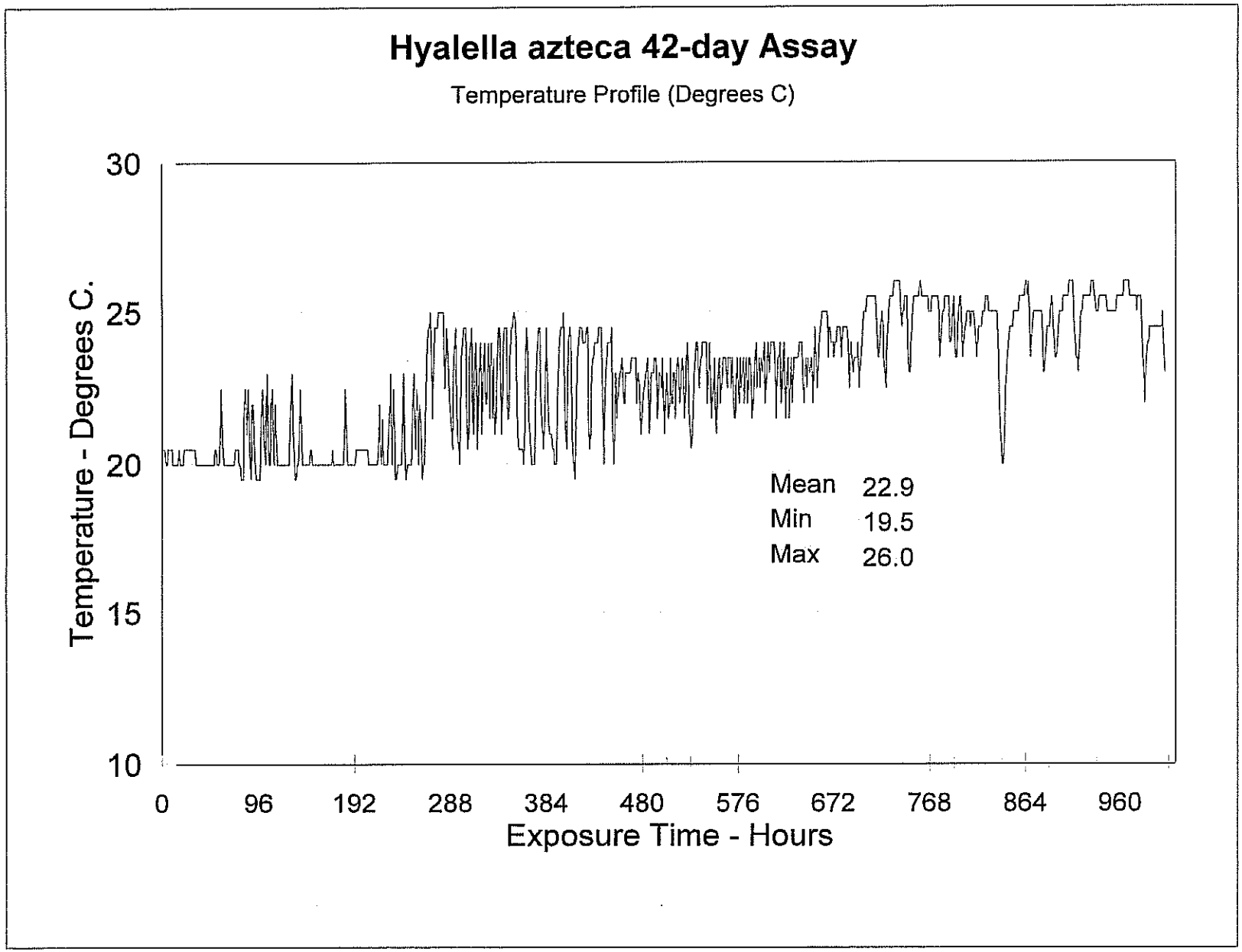
Daily Water Quality Measurements & Feeding Record

STUDY #12414	CLIENT: CH2MHill	OVERLYING WATER: MHR/Pond	START DATE: 09/01/04

DAY	-2				-3				Water Quality Station#	S/C Meter #	ΔH2O fed	Date	INITIAL
	D.O. (mg/L)	Cond. (µMHOS/cm)	pH (SU)	TEMP °C	D.O. (mg/L)	Cond. (µMHOS/cm)	pH (SU)	TEMP °C					
29	8.6	192	7.84	23	8.7	192	7.84	23	2	330i	✓	9/30/04	BB
30	7.9	218	7.64	24	7.8	219	7.65	24	2	330i	✓	10/1/04	DAB
31	7.4	221	7.57	25	7.7	220	7.57	25	2	330I	✓	10/2	CW
32	8.0	206	7.65	25	7.5	206	7.56	25	2	330J	✓	10/3	m
33	7.6	216	7.57	24	7.5	215	7.54	24	1	330i	✓	10/4/04	BB
34	8.0	218	7.68	24	8.1	216	7.68	24	1	330i	✓	10/5/04	DAB
35	8.0	214	7.55	24	7.8	212	7.56	24	1	330i	✓	10/6/04	DAB
36	7.4	206	7.49	25	7.6	203	7.51	25	1	330i	✓	10/7/04	DAB
37	7.5	224	7.46	23	7.5	214	7.39	23	2	330i	✓	10/8/04	DAB
38	7.1	235	7.50	24	7.0	228	7.49	24	1	330I	✓	10/9	CW
39	8.0	244	7.68	25	7.7	237	7.73	25	1	330i	✓	10/10	m
40	7.8	246	7.61	25	7.5	245	7.56	25	2	330i	✓	10/11/04	DAB
41	7.9	228	7.50	25	8.0	228	7.49	25	2	330i	✓	10/12/04	DAB
42	7.8	232	7.54	24	7.7	231	7.49	24	2	330i	✓	10/13/04	DAB

Feed YCT daily at a rate of 1 mL per vessel 23 °C Aerate if DO is below 2.5 mg/L Two volume additions daily

NOTES:


Hyalella azteca 42-day Assay
Temperature Profile (Degrees C)
Temperature - Degrees C.
30
25
20
15
10
0
96
192
288
384
480
576
672
768
864
960
Exposure Time - Hours
Mean 22.9
Min 19.5
Max 26.0

STUDY: 12415
CLIENT: CH2M Hill
PROJECT: Indian Head - CTO-066 Site 47 Evaluation
TASK: Hyalella azteca 42 Day Assay
DATA: Day 28 Survival
START DATE: 09/01/04
END DATE: 09/29/04

Sample Site	ESI Ref	Rep	Number Recoverec	Percent Recovery	Mean Recovery	Std Dev	CV	Distribution	Variance	t Value	Critical t Value	p Value	Statistically Significant Difference	As Compared To
Lab Control	0	A	9	90%	90.0%	0.0853	9.5%							
	0	B	9	90%										
	0	C	10	100%										
	0	D	9	90%										
	0	E	9	90%										
	0	F	9	90%										
	0	G	7	70%										
	0	H	8	80%										
	0	I	9	90%										
	0	J	10	100%										
	0	K	10	100%										
	0	L	9	90%										
IS47RSDTX01	3	A	6	60%	88.3%	0.1193	13.5%	Normal	Equal	0.3180	1.7171	0.3767	NO	LAB
	3	B	10	100%										
	3	C	8	80%										
	3	D	10	100%										
	3	E	8	80%										
	3	F	9	90%										
	3	G	9	90%										
	3	H	8	80%										
	3	I	9	90%										
	3	J	10	100%										
	3	K	10	100%										
	3	L	9	90%										
IS47SDTX17	1	A	9	90%	83.3%	0.0778	9.3%	Normal	Equal	2.1162	1.7171	0.0229	YES	LAB
	1	B	9	90%				Normal	Equal	1.4110	1.7171	0.0861	NO	IS47RSDTX01
	1	C	9	90%										
	1	D	8	80%										
	1	E	9	90%										
	1	F	8	80%										
	1	G	8	80%										
	1	H	9	90%										
	1	I	9	90%										
	1	J	7	70%										
	1	K	7	70%										
	1	L	8	80%										
IS47SDTX05	2	A	7	70%	68.3%	0.1749	25.6%	Normal	Equal	3.9847	1.7171	0.0003	YES	LAB
	2	B	6	60%				Normal	Equal	3.3563	1.7171	0.0014	YES	IS47RSDTX01
	2	C	4	40%										
	2	D	7	70%										
	2	E	7	70%										
	2	F	8	80%										
	2	G	4	40%										
	2	H	6	60%										
	2	I	9	90%										
	2	J	6	60%										
	2	K	9	90%										
	2	L	9	90%										

ESI STUDY# 12414 CH2M Hill
H. azteca SEDIMENT ASSAY

DAY 28:

SAMPLE ID	TIME	#LIVE	COMMENTS
LabA	9:30	9	
LabB	9:35	9	
LabC	9:38	10	
Lab D	9:42	9	
LabE	9:45	9	
Lab F	9:52	9	
Lab G	9:58	7	
Lab H	10:03	8	
Lab I	10:07	9	
Lab J	10:11	10	
Lab K	10:14	10	
Lab L	10:19	9	
-5A	10:40	8	
-5B	10:53	9	
-5C	10:57	7	
-5D	11:00	9	

ANALYST: B. Anbogast

DATE: 9/29/04

ESI STUDY# 12414 CH2M Hill
***H. azteca* SEDIMENT ASSAY**

DAY 28:

SAMPLE ID	TIME	#LIVE	COMMENTS
-1A	1000	9	
-1B	1003	9	
-1C	1006	9	
-1D	1010	8	
-1H	1012	9	
-1I	1015	9	
-1L	1018	8	
-3A	1020	6	
-3B	1022	10	
-3C	1024	8	
-3D	1025	10	
-3E	1026	8	
-3F	1028	9	
-3G	1029	9	
-3H	1031	8	
-3I	1033	9	

ANALYST: [illegible]
DATE: 9/29/04

ESI STUDY# 12414 CH2M Hill
H. azteca SEDIMENT ASSAY

DAY 28:

SAMPLE ID	TIME	#LIVE	COMMENTS
3J	1036	10	
3K	1038	10	
3L	1039	9	
-4A	1043	7	
-4B	1047	8	
-4C	1055	7	
-4D	1058	9	
-4E	1101	7 8 ES 9/29	
-4F	1107	10	
-4J	1110	6	
-6A	1116	8	
-6B	1117	10	
-6C	1118	10	
-6D	1120	9	
-6E	1121	9	
-6F	1123	8	

ANALYST: dH
DATE: 9/29/04

ESI STUDY# 12414 CH2M Hill
H. azteca SEDIMENT ASSAY

DAY 28:

SAMPLE ID	TIME	#LIVE	COMMENTS
-2D	1127	7	
-11E	1215	7	
-11F	1220	7	

ANALYST: BB
DATE: 9/29/04

ESI STUDY# 12414 CH2M Hill
H. azteca SEDIMENT ASSAY

DAY 28:

SAMPLE ID	TIME	#LIVE	COMMENTS
-1E	0958	9	
-1F	1004	8	
-1G	1008	8	
-1J	1014	7	
-1K	1020	7	
-2E	1026	7	
-2F	1032	8	
-2G	1040	4	
-2H	1045	6	
-2I	1050	9	
-2J	1058	6	
-2K	1102	9	
-2L	1106	9	
-2A	1110	7	
-2B	1115	6	
-2C	1122	4	

ANALYST: BB
DATE: 9/29/04

CETIS Test Summary

Report Date: 21 Oct-04 11:00 PM
Link: 13-5709-1036

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Test No:	06-5526-2399	**Test Type:**	Hyalella (42d)	**Duration:**	43d 0h
Start Date:	01 Sep-04 12:00 PM	**Protocol:**	EPA/600/R-99/064 (2000)	**Species:**	Hyalella azteca
Ending Date:	14 Oct-04 12:00 PM	**Dil Water:**	50/50 Mix of Surface Water and MHR	**Source:**	
Setup Date:	01 Sep-04 12:00 PM	**Brine:**	Not Applicable		

Sample No:	20-5692-5932	**Material:**	Freshwater Sedment	**Client:**	CH2M Hill
Sample Date:	01 Sep-04	**Code:**	12415-000	**Project:**	Ecologcal Risk Assessment
Receive Date:	01 Sep-04	**Source:**	Indian Head Site 47 - CTO-066		
Sample Age:	12h (4 °C)	**Station:**	Lab Control -000		
Sample No:	15-9102-5801	**Material:**	Freshwater Sedment	**Client:**	CH2M Hill
Sample Date:	10 Aug-04 02:40 PM	**Code:**	12415-001	**Project:**	Ecologcal Risk Assessment
Receive Date:	11 Aug-04 10:40 AM	**Source:**	Indian Head Site 47 - CTO-066		
Sample Age:	21d 21h (4 °C)	**Station:**	IS47SDTX17 - 001		
Sample No:	03-2741-3714	**Material:**	Freshwater Sedment	**Client:**	CH2M Hill
Sample Date:	10 Aug-04 03:00 PM	**Code:**	12415-002	**Project:**	Ecologcal Risk Assessment
Receive Date:	11 Aug-04 10:40 AM	**Source:**	Indian Head Site 47 - CTO-066		
Sample Age:	21d 21h (4 °C)	**Station:**	IS47SDTX05 - 002		
Sample No:	13-0047-3626	**Material:**	Freshwater Sedment	**Client:**	CH2M Hill
Sample Date:	10 Aug-04 04:10 PM	**Code:**	12415-003	**Project:**	Ecologcal Risk Assessment
Receive Date:	11 Aug-04 10:40 AM	**Source:**	Indian Head Site 47 - CTO-066		
Sample Age:	21d 19h (4 °C)	**Station:**	IS47RSDTX01 - 003		

28d Proportion Survived Summary

Sample Code	Reps	Mean	Minimum	Maximum	SE	SD	CV
12415-000	12	0.90000	0.70000	1.00000	0.02462	0.08528	9.48%
12415-003	12	0.88333	0.60000	1.00000	0.03445	0.11934	13.51%
12415-001	12	0.83333	0.70000	0.90000	0.02247	0.07785	9.34%
12415-002	12	0.68333	0.40000	0.90000	0.05050	0.17495	25.60%

28d Proportion Survived Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-000	0.90000	0.90000	1.00000	0.90000	0.90000	0.90000	0.70000	0.80000	0.90000	1.00000
	1.00000	0.90000								
12415-003	0.60000	1.00000	0.80000	1.00000	0.80000	0.90000	0.90000	0.80000	0.90000	1.00000
	1.00000	0.90000								
12415-001	0.90000	0.90000	0.90000	0.80000	0.90000	0.80000	0.80000	0.90000	0.90000	0.70000
	0.70000	0.80000								
12415-002	0.70000	0.60000	0.40000	0.70000	0.70000	0.80000	0.40000	0.60000	0.90000	0.60000
	0.90000	0.90000								

CETIS Analysis Detail

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — EnviroSystems, Inc.

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
28d Proportion Survived	Comparison	13-5709-1036	13-5709-1036	21 Oct-04 10:33 PM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Equal Variance t	C > T	Angular (Corrected)				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	1.79182	5.31967	0.34770	Equal Variances
Distribution	Shapiro-Wilk W	0.88771	0.88421	0.01193	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.0021263	0.0021263	1	0.10	0.75346	Non-Significant Effect
Error	0.4624865	0.0210221	22			
Total	0.46461288	0.0231485	23			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-000		12415-003	0.31804	1.71714	0.3767	0.10164	Non-Significant Effect

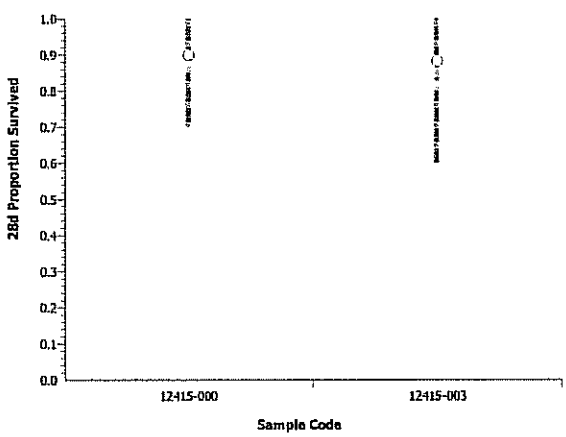
Data Summary

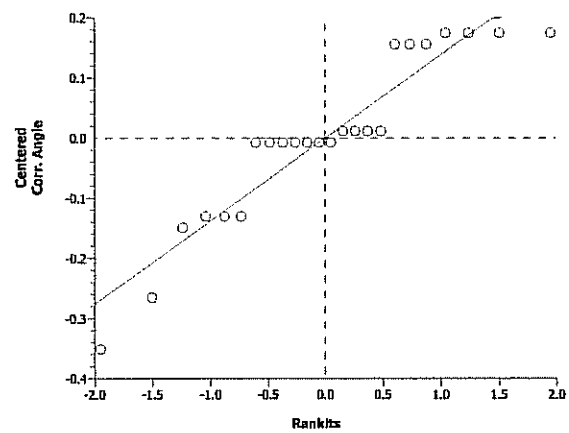
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-000	12	0.90000	0.70000	1.00000	0.08528	1.25647	0.99116	1.41202	0.12272
12415-003	12	0.88333	0.60000	1.00000	0.11934	1.23765	0.88608	1.41202	0.16427

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-000	0.90000	0.90000	1.00000	0.90000	0.90000	0.90000	0.70000	0.80000	0.90000	1.00000
	1.00000	0.90000								
12415-003	0.60000	1.00000	0.80000	1.00000	0.80000	0.90000	0.90000	0.80000	0.90000	1.00000
	1.00000	0.90000								

Graphics





CETIS Analysis Detail

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — EnviroSystems, Inc.

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
28d Proportion Survived	Comparison	13-5709-1036	13-5709-1036	21 Oct-04 10:34 PM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Equal Variance t	C > T	Angular (Corrected)				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	1.43122	5.31967	0.56212	Equal Variances
Distribution	Shapiro-Wilk W	0.92251	0.88421	0.07004	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.0572807	0.0572807	1	4.48	0.04588	Significant Effect
Error	0.2814035	0.0127911	22			
Total	0.33868415	0.0700717	23			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-000		12415-001	2.11617	1.71714	0.0229	0.07928	Significant Effect

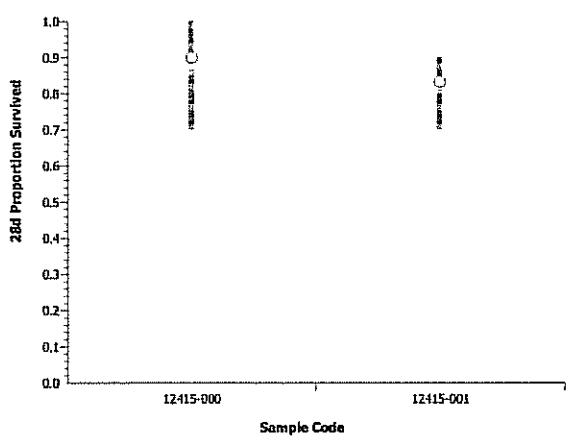
Data Summary

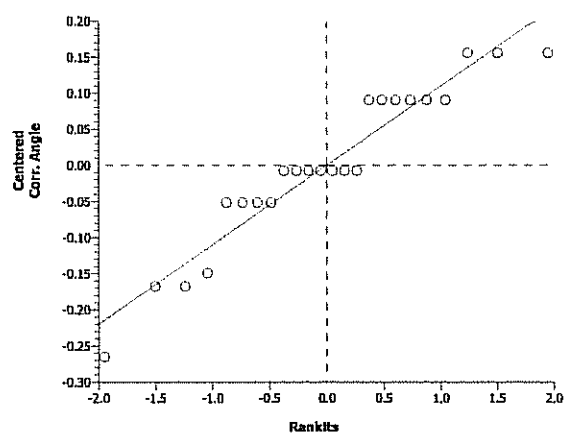
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-000	12	0.90000	0.70000	1.00000	0.08528	1.25647	0.99116	1.41202	0.12272
12415-001	12	0.83333	0.70000	0.90000	0.07785	1.15877	0.99116	1.24905	0.10258

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-000	0.90000	0.90000	1.00000	0.90000	0.90000	0.90000	0.70000	0.80000	0.90000	1.00000
	1.00000	0.90000								
12415-001	0.90000	0.90000	0.90000	0.80000	0.90000	0.80000	0.80000	0.90000	0.90000	0.70000
	0.70000	0.80000								

Graphics





CETIS Analysis Detail

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
28d Proportion Survived	Comparison	13-5709-1036	13-5709-1036	21 Oct-04 10:34 PM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Equal Variance t	C > T	Angular (Corrected)				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	2.61856	5.31967	0.12539	Equal Variances
Distribution	Shapiro-Wilk W	0.92249	0.88421	0.06997	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.4326202	0.4326202	1	15.88	0.00063	Significant Effect
Error	0.5994419	0.0272474	22			
Total	1.03206217	0.4598676	23			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-000		12415-002	3.98466	1.71714	0.0003	0.11572	Significant Effect

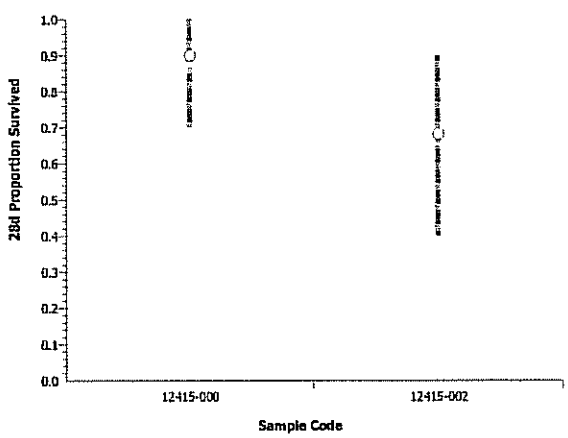
Data Summary

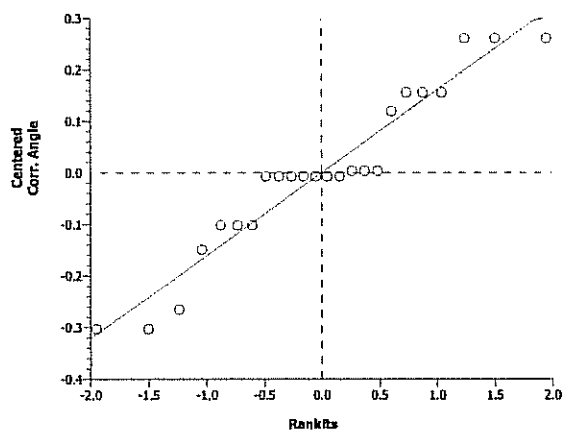
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-000	12	0.90000	0.70000	1.00000	0.08528	1.25647	0.99116	1.41202	0.12272
12415-002	12	0.68333	0.40000	0.90000	0.17495	0.98795	0.68472	1.24905	0.19858

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-000	0.90000	0.90000	1.00000	0.90000	0.90000	0.90000	0.70000	0.80000	0.90000	1.00000
	1.00000	0.90000								
12415-002	0.70000	0.60000	0.40000	0.70000	0.70000	0.80000	0.40000	0.60000	0.90000	0.60000
	0.90000	0.90000								

Graphics





CETIS Analysis Detail

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — EnviroSystems, Inc.

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
28d Proportion Survived	Comparison	13-5709-1036	13-5709-1036	21 Oct-04 10:34 PM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Equal Variance t	C > T	Angular (Corrected)				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	2.56449	5.31967	0.13350	Equal Variances
Distribution	Shapiro-Wilk W	0.92740	0.88421	0.08989	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.0373346	0.0373346	1	1.99	0.17224	Non-Significant Effect
Error	0.4125747	0.0187534	22			
Total	0.44990923	0.0560879	23			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-003		12415-001	1.41096	1.71714	0.0861	0.096	Non-Significant Effect

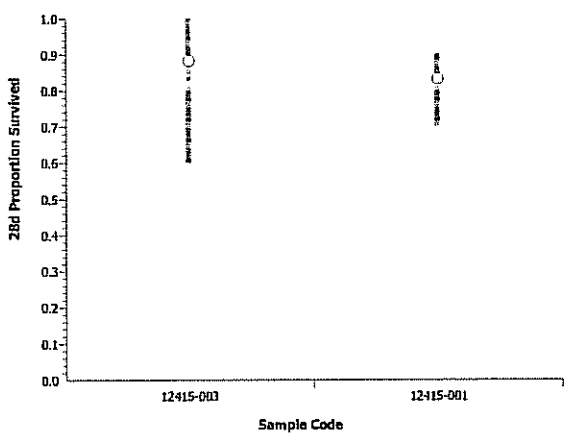
Data Summary

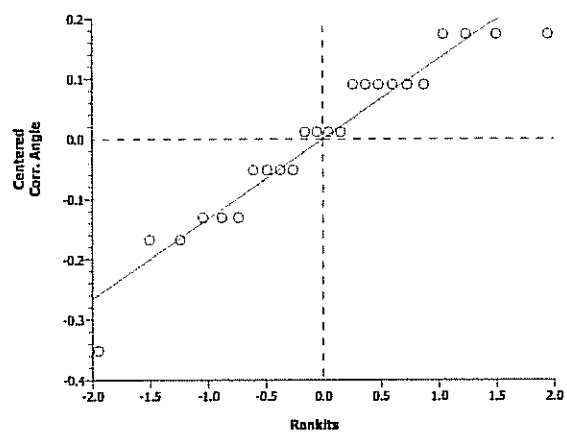
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-003	12	0.88333	0.60000	1.00000	0.11934	1.23765	0.88608	1.41202	0.16427
12415-001	12	0.83333	0.70000	0.90000	0.07785	1.15877	0.99116	1.24905	0.10258

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-003	0.60000	1.00000	0.80000	1.00000	0.80000	0.90000	0.90000	0.80000	0.90000	1.00000
	1.00000	0.90000								
12415-001	0.90000	0.90000	0.90000	0.80000	0.90000	0.80000	0.80000	0.90000	0.90000	0.70000
	0.70000	0.80000								

Graphics





CETIS Analysis Detail

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — EnviroSystems, Inc.

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
28d Proportion Survived	Comparison	13-5709-1036	13-5709-1036	21 Oct-04 10:35 PM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Equal Variance t	C > T	Angular (Corrected)				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	1.46140	5.31967	0.53971	Equal Variances
Distribution	Shapiro-Wilk W	0.93539	0.88421	0.13491	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.3740869	0.3740869	1	11.26	0.00285	Significant Effect
Error	0.7306131	0.0332097	22			
Total	1.10469997	0.4072965	23			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-003		12415-002	3.35625	1.71714	0.0014	0.12775	Significant Effect

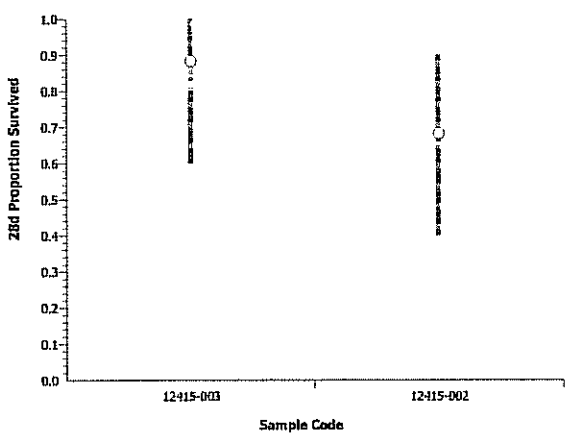
Data Summary

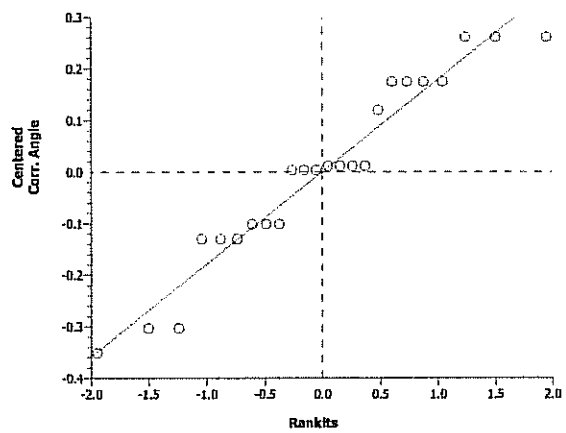
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-003	12	0.88333	0.60000	1.00000	0.11934	1.23765	0.88608	1.41202	0.16427
12415-002	12	0.68333	0.40000	0.90000	0.17495	0.98795	0.68472	1.24905	0.19858

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-003	0.60000	1.00000	0.80000	1.00000	0.80000	0.90000	0.90000	0.80000	0.90000	1.00000
	1.00000	0.90000								
12415-002	0.70000	0.60000	0.40000	0.70000	0.70000	0.80000	0.40000	0.60000	0.90000	0.60000
	0.90000	0.90000								

Graphics





STUDY: 12415
CLIENT: CH2M Hill
PROJECT: Indian Head - CTO-066 Site 47 Evaluation
TASK: Hyalella azteca 42 Day Assay
DATA: Day 28 Dry Weight Data
START DATE: 09/01/04
END DATE: 09/29/04

Start Dry Weight: 0.024

Sample Site	ESI Ref	Rep	Tare Wt (Grams)	Final Wt (Grams)	Net Dry Wt	Number Recovered	Mean Dry Wt (mg)	Site Mean Dry Wt	Distribution	Variance	t Value	Critical t Value	p Value	Statistically Significant Difference	As Compared To
Lab Control	0	A	0.21236	0.21638	0.00402	9	0.447	0.389							-
	0	B	0.20938	0.21306	0.00368	9	0.409								-
	0	C	0.20783	0.21165	0.00382	10	0.382								
	0	D	0.20568	0.20856	0.00288	9	0.320								
IS47RSDTX01	3	A	0.21201	0.21410	0.00209	6	0.348	0.304	Normal	Equal	2.4130	1.9432	0.0262	YES	LAB
	3	B	0.21180	0.21496	0.00316	10	0.316								
	3	C	0.21053	0.21304	0.00251	8	0.314								
	3	D	0.21012	0.21251	0.00239	10	0.239								
IS47SDTX17	1	A	0.20915	0.21189	0.00274	9	0.304	0.229	Normal	Equal	4.2417	1.9432	0.0027	YES	LAB
	1	B	0.20604	0.20788	0.00184	9	0.204		Normal	Equal	2.1242	1.9432	0.0389	YES	IS47RSDTX01
	1	C	0.21288	0.21493	0.00205	9	0.228								
	1	D	0.21085	0.21230	0.00145	8	0.181								
IS47SDTX05	2	A	0.20596	0.20729	0.00133	7	0.190	0.175	Normal	Equal	4.5567	1.9432	0.0019	YES	LAB
	2	B	0.20617	0.20783	0.00166	6	0.277		Normal	Equal	2.8650	1.9432	0.0143	YES	IS47RSDTX01
	2	C	0.21057	0.21097	0.00040	4	0.100								
	2	D	0.20942	0.21035	0.00093	7	0.133								

STUDY: 12414
CLIENT: CH2M Hill
PROJECT: Indian Head
TASK: Hyalella azteca 42 Day Assay
DATA: Day 0 Dry Weight Data
START DATE: 09/01/04

Sample Site	ESI Ref	Rep	Tare Wt (Grams)	Final Wt (Grams)	Net Dry Wt (Grams)	Number Weighed	Mean Dry Wt (mg)	Site Mean Dry Wt	Std Dev	CV
Lab	0	A	0.20599	0.20627	0.00028	10	0.028	0.024	0.0034	14.53%
	0	B	0.20902	0.20924	0.00022	10	0.022			
	0	C	0.20869	0.20893	0.00024	10	0.024			
	0	D	0.20929	0.20949	0.00020	10	0.020			

Hyalella azteca Sediment Evaluation

STUDY NUMBER: 12414 **CLIENT:** CH2M Hill

PROJECT: Indian Head **START DATE:** 9/1/04

	REP	TARE WEIGHT (G)	*H. azteca*+ FOIL (G)	NET WEIGHT (mg)	# *H. azteca*	MEAN DRY WEIGHT PER Individual (mg)
START ORGANISMS	A	0.20599	0.20627			
	B	0.20902	0.20924			
	C	0.20869	0.20893			
	D	0.20929	0.20949			
RECORDED BY:		[illegible]	[illegible]			
DATE:		9/2/04	9/3/04			

NOTES: Use 10 Amphipods per replicate to set start weight

H.azteca DRY WEIGHTS

CLIENT: CH2M Hill TEST END DATE: 09/29/04

STUDY #: 12414 SPECIES: *H. azteca*

CONC	REP	TARE WT (g)	*H. azteca* + FOIL(g)
LAB	A	0.21236	0.21638
	B	0.20938	0.21306
	C	0.20783	0.21165
	D	0.20568	0.20856
1	A	0.20915	0.21189
	B	0.20604	0.20788
	C	0.21288	0.21493
	D	0.21085	0.21230
2	A	0.20596	0.20729
	B	0.20617	0.20783
	C	0.21057	0.21097
	D	0.20942	0.21035
3	A	0.21201	0.21410
	B	0.21180	0.21496
	C	0.21053	0.21304
	D	0.21012	0.21251
4	A	0.20784	0.21085
	B	0.20999	0.21191
	C	0.21005	0.21268
	D	0.20799	0.21090
5	A	0.20957	0.21165
	B	0.20616	0.20858
	C	0.21250	0.21570
	D	0.20898	0.21130
6	A	0.21159	0.21443
	B	0.21358	0.21667
	C	0.21086	0.21425
	D	0.20768	0.21191
7	A	0.21026	0.21235
	B	0.21019	0.21326
	C	0.21429	0.21717
	D	0.21249	0.21536
DATE:		9/29/04	9/30/04
TIME:		1035	0950
INIT:		[illegible]	[illegible]

CETIS Test Summary

Report Date: 21 Oct-04 11:07 PM
Link: 13-5709-1036

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — EnviroSystems, Inc.

Test No:	06-5526-2399	**Test Type:**	Hyalella (42d)	**Duration:**	43d 0h
Start Date:	01 Sep-04 12:00 PM	**Protocol:**	EPA/600/R-99/064 (2000)	**Species:**	Hyalella azteca
Ending Date:	14 Oct-04 12:00 PM	**Dil Water:**	50/50 Mix of Surface Water and MHR	**Source:**	
Setup Date:	01 Sep-04 12:00 PM	**Brine:**	Not Applicable		

Sample No:	20-5692-5932	**Material:**	Freshwater Sedment	**Client:**	CH2M Hill
Sample Date:	01 Sep-04	**Code:**	12415-000	**Project:**	Ecologcal Risk Assessment
Receive Date:	01 Sep-04	**Source:**	Indian Head Site 47 - CTO-066		
Sample Age:	12h (4 °C)	**Station:**	Lab Control -000		
Sample No:	15-9102-5801	**Material:**	Freshwater Sedment	**Client:**	CH2M Hill
Sample Date:	10 Aug-04 02:40 PM	**Code:**	12415-001	**Project:**	Ecologcal Risk Assessment
Receive Date:	11 Aug-04 10:40 AM	**Source:**	Indian Head Site 47 - CTO-066		
Sample Age:	21d 21h (4 °C)	**Station:**	IS47SDTX17 - 001		
Sample No:	03-2741-3714	**Material:**	Freshwater Sedment	**Client:**	CH2M Hill
Sample Date:	10 Aug-04 03:00 PM	**Code:**	12415-002	**Project:**	Ecologcal Risk Assessment
Receive Date:	11 Aug-04 10:40 AM	**Source:**	Indian Head Site 47 - CTO-066		
Sample Age:	21d 21h (4 °C)	**Station:**	IS47SDTX05 - 002		
Sample No:	13-0047-3626	**Material:**	Freshwater Sedment	**Client:**	CH2M Hill
Sample Date:	10 Aug-04 04:10 PM	**Code:**	12415-003	**Project:**	Ecologcal Risk Assessment
Receive Date:	11 Aug-04 10:40 AM	**Source:**	Indian Head Site 47 - CTO-066		
Sample Age:	21d 19h (4 °C)	**Station:**	IS47RSDTX01 - 003		

28d Mean Dry Weight Summary

Sample Code	Reps	Mean	Minimum	Maximum	SE	SD	CV
12415-000	12	0.38950	0.32000	0.44700	0.02673	0.05346	13.72%
12415-003	12	0.30425	0.23900	0.34800	0.02310	0.04621	15.19%
12415-001	12	0.22925	0.18100	0.30400	0.02670	0.05340	23.29%
12415-002	12	0.17500	0.10000	0.27700	0.03875	0.07750	44.28%

28d Mean Dry Weight Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-000	0.44700	0.40900	0.38200	0.32000	N/A	N/A	N/A	N/A	N/A	N/A
	N/A	N/A								
12415-003	0.34800	0.31600	0.31400	0.23900	N/A	N/A	N/A	N/A	N/A	N/A
	N/A	N/A								
12415-001	0.30400	0.20400	0.22800	0.18100	N/A	N/A	N/A	N/A	N/A	N/A
	N/A	N/A								
12415-002	0.19000	0.27700	0.10000	0.13300	N/A	N/A	N/A	N/A	N/A	N/A
	N/A	N/A								

CETIS Analysis Detail

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
28d Mean Dry Weight	Comparison	13-5709-1036	13-5709-1036	21 Oct-04 11:06 PM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Equal Variance t	C > T	Untransformed				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	1.33854	47.46723	0.81633	Equal Variances
Distribution	Shapiro-Wilk W	0.90098	0.74935	0.27915	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.0145351	0.0145351	1	5.82	0.05236	Non-Significant Effect
Error	0.0149778	0.0024963	6			
Total	0.02951288	0.0170314	7			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-000		12415-003	2.41302	1.94318	0.0262	0.06865	Significant Effect

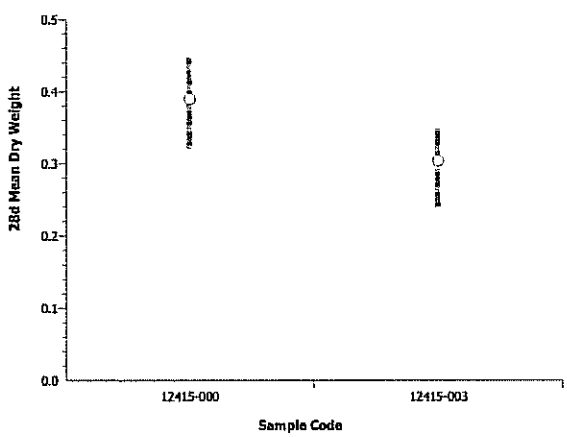
Data Summary

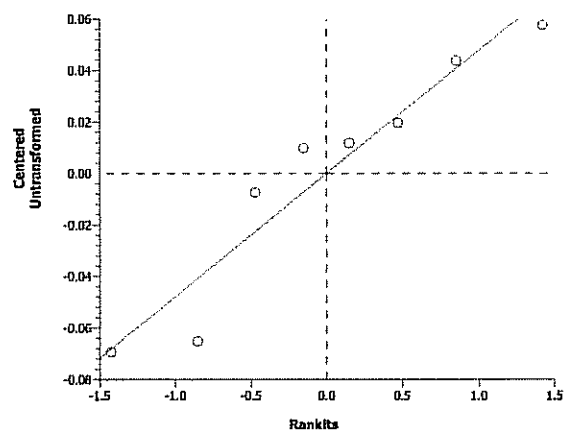
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-000	4	0.38950	0.32000	0.44700	0.05346				
12415-003	4	0.30425	0.23900	0.34800	0.04621				

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-000	0.44700	0.40900	0.38200	0.32000						
12415-003	0.34800	0.31600	0.31400	0.23900						

Graphics





CETIS Analysis Detail

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — EnviroSystems, Inc.

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
28d Mean Dry Weight	Comparison	13-5709-1036	13-5709-1036	21 Oct-04 11:06 PM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Equal Variance t	C > T	Untransformed				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	1.00213	47.46723	0.99864	Equal Variances
Distribution	Shapiro-Wilk W	0.97023	0.74935	0.88402	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.0513601	0.0513601	1	17.99	0.00543	Significant Effect
Error	0.0171278	0.0028546	6			
Total	0.06848788	0.0542148	7			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-000		12415-001	4.24169	1.94318	0.0027	0.07341	Significant Effect

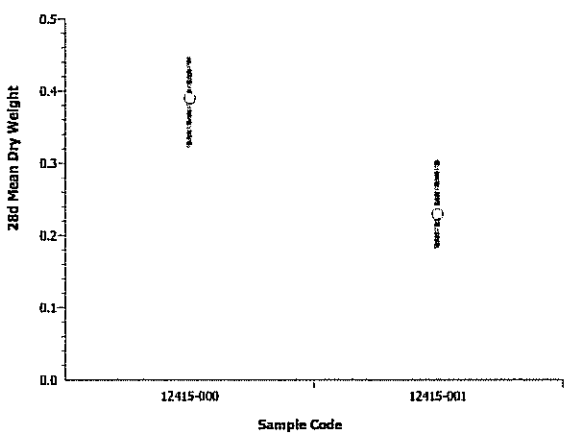
Data Summary

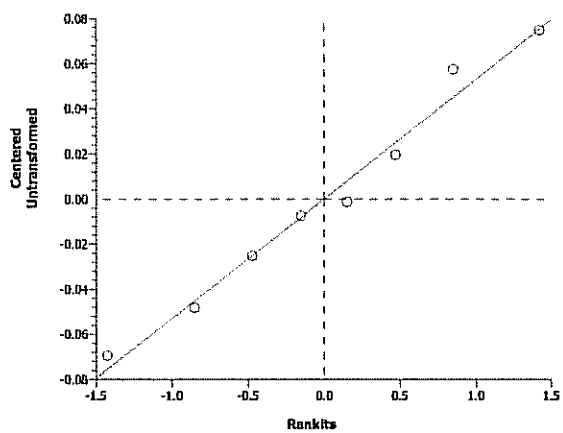
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-000	4	0.38950	0.32000	0.44700	0.05346				
12415-001	4	0.22925	0.18100	0.30400	0.05340				

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-000	0.44700	0.40900	0.38200	0.32000						
12415-001	0.30400	0.20400	0.22800	0.18100						

Graphics





CETIS Analysis Detail

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
28d Mean Dry Weight	Comparison	13-5709-1036	13-5709-1036	21 Oct-04 11:06 PM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Equal Variance t	C > T	Untransformed				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	2.10171	47.46723	0.55745	Equal Variances
Distribution	Shapiro-Wilk W	0.95415	0.74935	0.71913	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.0920205	0.0920205	1	20.76	0.00386	Significant Effect
Error	0.026591	0.0044318	6			
Total	0.1186115	0.0964523	7			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-000		12415-002	4.55670	1.94318	0.0019	0.09147	Significant Effect

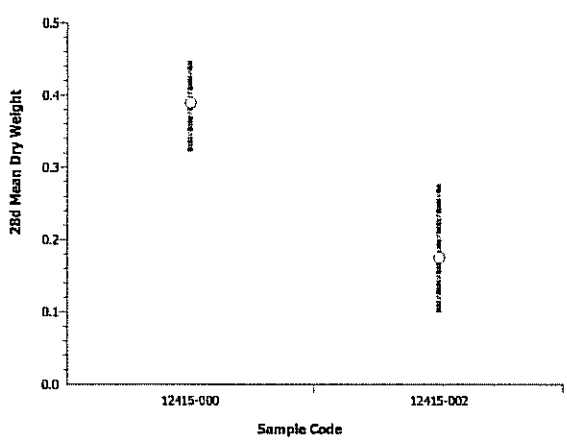
Data Summary

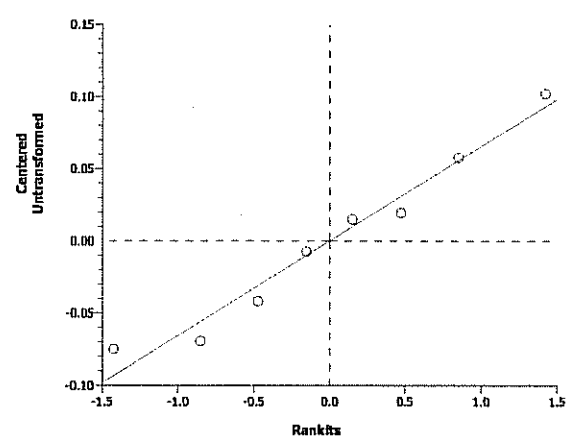
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-000	4	0.38950	0.32000	0.44700	0.05346				
12415-002	4	0.17500	0.10000	0.27700	0.07750				

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-000	0.44700	0.40900	0.38200	0.32000						
12415-002	0.19000	0.27700	0.10000	0.13300						

Graphics





CETIS Analysis Detail

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
28d Mean Dry Weight	Comparison	13-5709-1036	13-5709-1036	21 Oct-04 11:06 PM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Equal Variance t	C > T	Untransformed				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	1.33569	47.46723	0.81764	Equal Variances
Distribution	Shapiro-Wilk W	0.97714	0.74935	0.94112	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.01125	0.01125	1	4.51	0.07783	Non-Significant Effect
Error	0.0149595	0.0024933	6			
Total	0.02620950	0.0137433	7			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-003		12415-001	2.12419	1.94318	0.0389	0.06861	Significant Effect

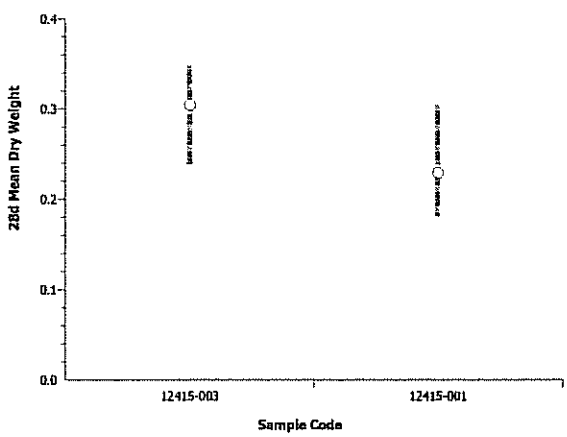
Data Summary

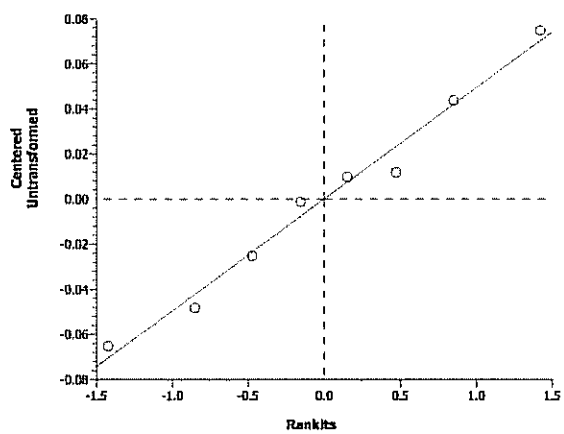
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-003	4	0.30425	0.23900	0.34800	0.04621				
12415-001	4	0.22925	0.18100	0.30400	0.05340				

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-003	0.34800	0.31600	0.31400	0.23900						
12415-001	0.30400	0.20400	0.22800	0.18100						

Graphics





CETIS Analysis Detail

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
28d Mean Dry Weight	Comparison	13-5709-1036	13-5709-1036	21 Oct-04 11:06 PM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Equal Variance t	C > T	Untransformed				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	2.81322	47.46723	0.41822	Equal Variances
Distribution	Shapiro-Wilk W	0.94172	0.74935	0.59067	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.0334111	0.0334111	1	8.21	0.02861	Significant Effect
Error	0.0244228	0.0040705	6			
Total	0.05783387	0.0374816	7			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-003		12415-002	2.865	1.94318	0.0143	0.08766	Significant Effect

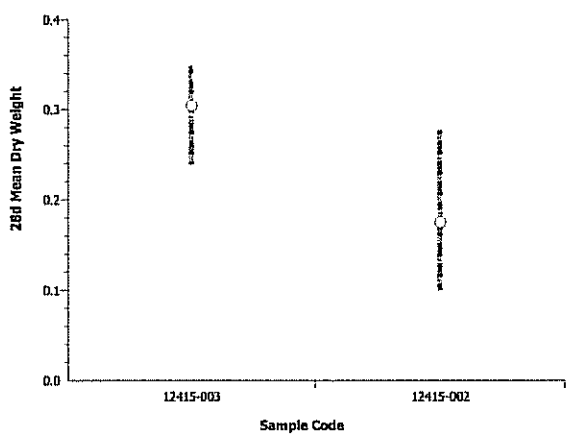
Data Summary

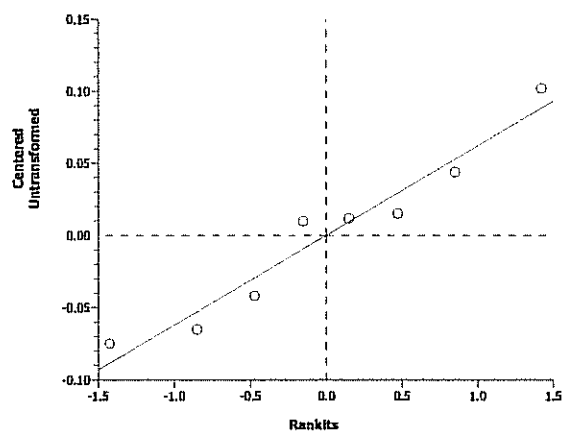
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-003	4	0.30425	0.23900	0.34800	0.04621				
12415-002	4	0.17500	0.10000	0.27700	0.07750				

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-003	0.34800	0.31600	0.31400	0.23900						
12415-002	0.19000	0.27700	0.10000	0.13300						

Graphics





STUDY: 12415
CLIENT: CH2M Hill
PROJECT: Indian Head - CTO-066 Site 47 Evaluation
TASK: Hyalella azteca 42 Day Assay
DATA: Day 35 Survival
START DATE: 09/01/04
END DATE: 10/06/04

Sample Site	ESI Ref	Rep	Number Recovered	Percent Recovery	Mean		Distribution	Variance	t Value	Critical t Value	p Value	Statistically Significant Difference	
Lab	0	E	9	90%	86.3%	Day 35							
	0	F	9	90%									
	0	G	7	70%									
	0	H	8	80%									
	0	I	8	80%									
	0	J	10	100%									
	0	K	9	90%									
	0	L	9	90%									
IS47RSDTX01	3	E	8	80%	82.5%	Day 35	Normal	Equal	0.9926	1.7613	0.1689	NO	LAB
	3	F	8	80%									
	3	G	9	90%									
	3	H	7	70%									
	3	I	9	90%									
	3	J	9	90%									
	3	K	8	80%									
	3	L	8	80%									
IS47SDTX17	1	E	9	90%	74.2%	Day 35	Normal	Equal	1.6715	1.7613	0.0584	NO	LAB
	1	F	7	64%			Normal	Equal	1.0718	1.7613	0.1510	NO	IS47RSDTX01
	1	G	8	80%									
	1	H	9	90%									
	1	I	9	90%									
	1	J	4	40%									
	1	K	7	70%									
	1	L	7	70%									
IS47SDTX05	2	E	5	50%	58.8%	Day 35	Normal	Equal	3.8770	1.7613	0.0008	YES	LAB
	2	F	5	50%			Normal	Equal	3.4508	1.7613	0.0019	YES	IS47RSDTX01
	2	G	4	40%									
	2	H	6	60%									
	2	I	9	90%									
	2	J	5	50%									
	2	K	5	50%									
	2	L	8	80%									

ESI STUDY # 12414 CH2M Hill
***H. azteca* SEDIMENT ASSAY**

DAY 35:

SAMPLE ID	TIME	#LIVE ADULTS	# LIVE JUVENILES	COMMENTS
Lab E	0945	9	III 3	
F		9	~~IIII~~ ~~IIII~~ 10	
G		7	0	
H		8	I 1	
I		8	~~IIII~~ 5	
J		10	~~IIII~~ IIII 9	
K		9	~~IIII~~ II ~~IIII~~ ~~IIII~~ 17	
L	1020	9	~~IIII~~ II 7	
-1 E	1030	9	~~IIII~~ II ~~IIII~~ ~~IIII~~ 17	
F		7	II 2	
G		8	III 3	
H		9	~~IIII~~ ~~IIII~~ ~~IIII~~ I 17	
I		9	IIII 4	
J		4	0	
K		7	IIII 4	
L	1055	7	0	

ANALYST: BB
DATE: 10/6/04

ESI STUDY # 12414 CH2M Hill
***H. azteca* SEDIMENT ASSAY**

DAY 35:

SAMPLE ID	TIME	#LIVE ADULTS	# LIVE JUVENILES	COMMENTS
-2 E	1100	5	0	
F		5	0	
G		4	0	
H		6	0	
I		9	0	
J		5	0	
K		5	0	
L	1120	8	2	
-3 E	1125	8	0	
F		8	0	
G		9	~~IIII~~ III 8	
H		7	0	
I		9	IIII 4	
J		9	~~IIII~~ ~~IIII~~ I 11	
K		8	~~IIII~~ II 7	
L	1145	8	I 1	

ANALYST: BB
DATE: 10/6/04

CETIS Test Summary

Report Date: 23 Oct-04 11:40 PM
Link: 13-5709-1036

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Test No:	06-5526-2399	**Test Type:**	Hyalella (42d)	**Duration:**	43d 0h
Start Date:	01 Sep-04 12:00 PM	**Protocol:**	EPA/600/R-99/064 (2000)	**Species:**	Hyalella azteca
Ending Date:	14 Oct-04 12:00 PM	**Dil Water:**	50/50 Mix of Surface Water and MHR	**Source:**	
Setup Date:	01 Sep-04 12:00 PM	**Brine:**	Not Applicable		

Sample No:	20-5692-5932	**Material:**	Freshwater Sedment	**Client:**	CH2M Hill
Sample Date:	01 Sep-04	**Code:**	12415-000	**Project:**	Ecologcal Risk Assessment
Receive Date:	01 Sep-04	**Source:**	Indian Head Site 47 - CTO-066		
Sample Age:	12h (4 °C)	**Station:**	Lab Control -000		

Sample No:	15-9102-5801	**Material:**	Freshwater Sedment	**Client:**	CH2M Hill
Sample Date:	10 Aug-04 02:40 PM	**Code:**	12415-001	**Project:**	Ecologcal Risk Assessment
Receive Date:	11 Aug-04 10:40 AM	**Source:**	Indian Head Site 47 - CTO-066		
Sample Age:	21d 21h (4 °C)	**Station:**	IS47SDTX17 - 001		

Sample No:	03-2741-3714	**Material:**	Freshwater Sedment	**Client:**	CH2M Hill
Sample Date:	10 Aug-04 03:00 PM	**Code:**	12415-002	**Project:**	Ecologcal Risk Assessment
Receive Date:	11 Aug-04 10:40 AM	**Source:**	Indian Head Site 47 - CTO-066		
Sample Age:	21d 21h (4 °C)	**Station:**	IS47SDTX05 - 002		

Sample No:	13-0047-3626	**Material:**	Freshwater Sedment	**Client:**	CH2M Hill
Sample Date:	10 Aug-04 04:10 PM	**Code:**	12415-003	**Project:**	Ecologcal Risk Assessment
Receive Date:	11 Aug-04 10:40 AM	**Source:**	Indian Head Site 47 - CTO-066		
Sample Age:	21d 19h (4 °C)	**Station:**	IS47RSDTX01 - 003		

35d Proportion Survived Summary

Sample Code	Reps	Mean	Minimum	Maximum	SE	SD	CV
12415-000	12	0.86250	0.70000	1.00000	0.03239	0.09161	10.62%
12415-003	12	0.82500	0.70000	0.90000	0.02500	0.07071	8.57%
12415-001	12	0.75000	0.40000	0.90000	0.05976	0.16903	22.54%
12415-002	12	0.58750	0.40000	0.90000	0.06105	0.17269	29.39%

35d Proportion Survived Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-000	0.90000	0.90000	0.70000	0.80000	0.80000	1.00000	0.90000	0.90000	N/A	N/A
	N/A	N/A								
12415-003	0.80000	0.80000	0.90000	0.70000	0.90000	0.90000	0.80000	0.80000	N/A	N/A
	N/A	N/A								
12415-001	0.90000	0.70000	0.80000	0.90000	0.90000	0.40000	0.70000	0.70000	N/A	N/A
	N/A	N/A								
12415-002	0.50000	0.50000	0.40000	0.60000	0.90000	0.50000	0.50000	0.80000	N/A	N/A
	N/A	N/A								

CETIS Analysis Detail

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
35d Proportion Survived	Comparison	13-5709-1036	13-5709-1036	23 Oct-04 11:40 PM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Equal Variance t	C > T	Angular (Corrected)				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	1.86535	8.88539	0.42962	Equal Variances
Distribution	Shapiro-Wilk W	0.96549	0.84420	0.72716	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.0124749	0.0124749	1	0.99	0.33777	Non-Significant Effect
Error	0.1772771	0.0126627	14			
Total	0.18975199	0.0251376	15			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-000		12415-003	0.99256	1.76131	0.1689	0.0991	Non-Significant Effect

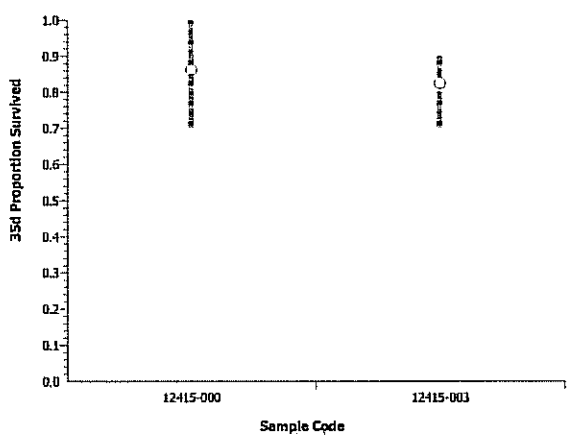
Data Summary

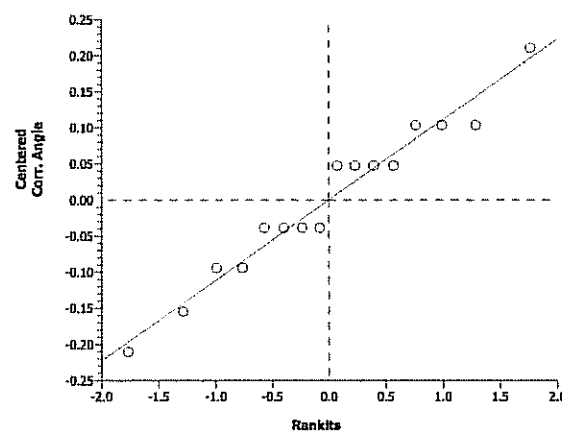
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-000	8	0.86250	0.70000	1.00000	0.09161	1.20171	0.99116	1.41202	0.12840
12415-003	8	0.82500	0.70000	0.90000	0.07071	1.14586	0.99116	1.24905	0.09401

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-000	0.90000	0.90000	0.70000	0.80000	0.80000	1.00000	0.90000	0.90000		
12415-003	0.80000	0.80000	0.90000	0.70000	0.90000	0.90000	0.80000	0.80000		

Graphics





CETIS Analysis Detail

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
35d Proportion Survived	Comparison	13-5709-1036	13-5709-1036	23 Oct-04 11:40 PM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Equal Variance t	C > T	Angular (Corrected)				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	2.29066	8.88539	0.29645	Equal Variances
Distribution	Shapiro-Wilk W	0.91547	0.84420	0.14241	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.0757871	0.0757871	1	2.79	0.11682	Non-Significant Effect
Error	0.3797678	0.0271263	14			
Total	0.45555487	0.1029134	15			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-000		12415-001	1.67149	1.76131	0.0584	0.14504	Non-Significant Effect

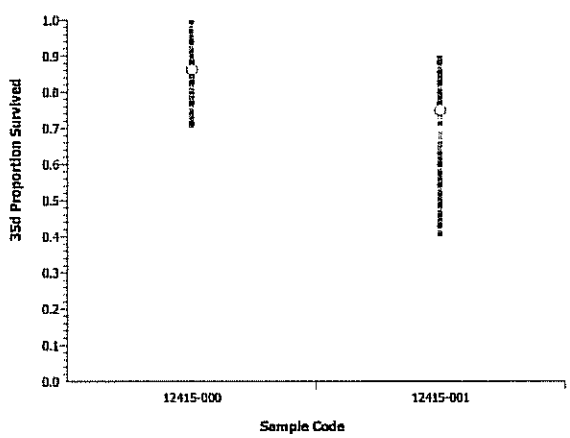
Data Summary

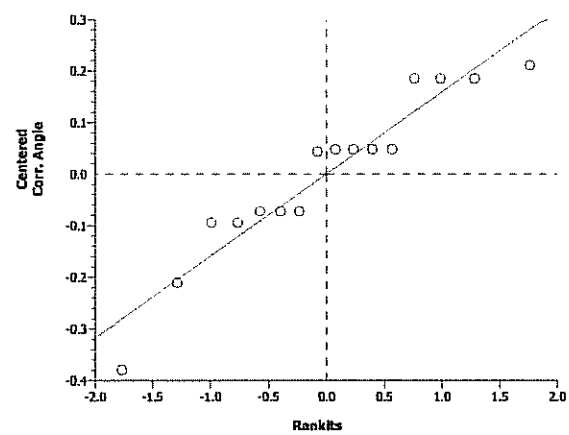
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-000	8	0.86250	0.70000	1.00000	0.09161	1.20171	0.99116	1.41202	0.12840
12415-001	8	0.75000	0.40000	0.90000	0.16903	1.06406	0.68472	1.24905	0.19433

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-000	0.90000	0.90000	0.70000	0.80000	0.80000	1.00000	0.90000	0.90000		
12415-001	0.90000	0.70000	0.80000	0.90000	0.90000	0.40000	0.70000	0.70000		

Graphics





CETIS Analysis Detail

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
35d Proportion Survived	Comparison	13-5709-1036	13-5709-1036	23 Oct-04 11:40 PM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Equal Variance t	C > T	Angular (Corrected)				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	2.26725	8.88539	0.30232	Equal Variances
Distribution	Shapiro-Wilk W	0.89892	0.84420	0.07741	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.4048363	0.4048363	1	15.03	0.00168	Significant Effect
Error	0.3770665	0.0269333	14			
Total	0.78190279	0.4317696	15			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-000		12415-002	3.87699	1.76131	0.0008	0.14453	Significant Effect

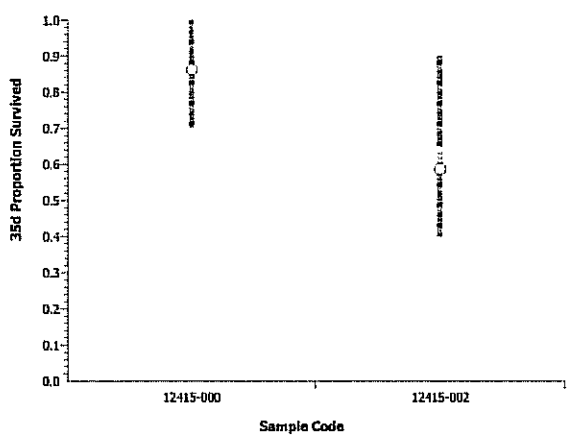
Data Summary

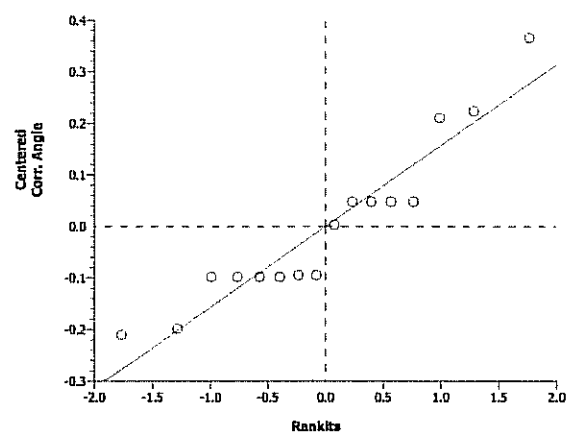
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-000	8	0.86250	0.70000	1.00000	0.09161	1.20171	0.99116	1.41202	0.12840
12415-002	8	0.58750	0.40000	0.90000	0.17269	0.88357	0.68472	1.24905	0.19334

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-000	0.90000	0.90000	0.70000	0.80000	0.80000	1.00000	0.90000	0.90000		
12415-002	0.50000	0.50000	0.40000	0.60000	0.90000	0.50000	0.50000	0.80000		

Graphics





CETIS Analysis Detail

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
35d Proportion Survived	Comparison	13-5709-1036	13-5709-1036	23 Oct-04 11:40 PM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Equal Variance t	C > T	Angular (Corrected)				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	4.27288	8.88539	0.07447	Equal Variances
Distribution	Shapiro-Wilk W	0.89660	0.84420	0.07101	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.0267661	0.0267661	1	1.15	0.30196	Non-Significant Effect
Error	0.3262293	0.0233021	14			
Total	0.35299542	0.0500682	15			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-003		12415-001	1.07175	1.76131	0.1510	0.13443	Non-Significant Effect

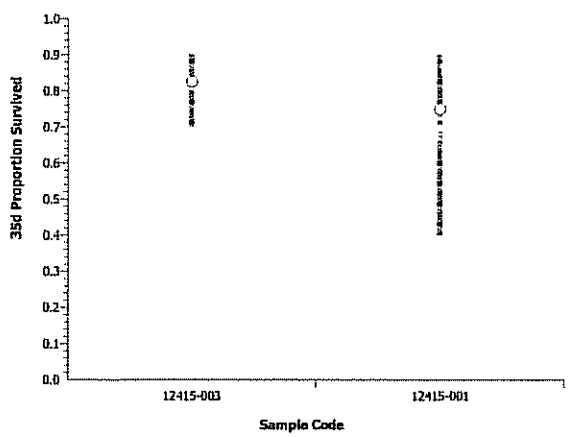
Data Summary

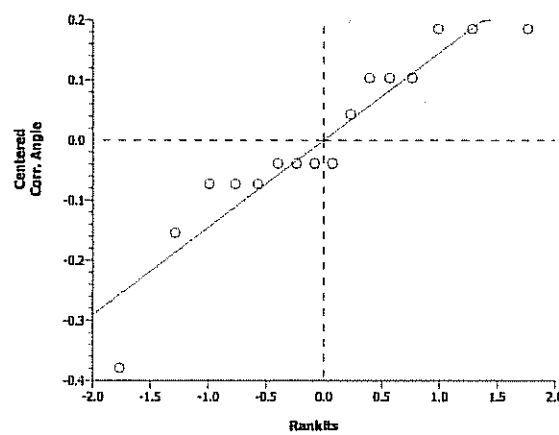
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-003	8	0.82500	0.70000	0.90000	0.07071	1.14586	0.99116	1.24905	0.09401
12415-001	8	0.75000	0.40000	0.90000	0.16903	1.06406	0.68472	1.24905	0.19433

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-003	0.80000	0.80000	0.90000	0.70000	0.90000	0.90000	0.80000	0.80000		
12415-001	0.90000	0.70000	0.80000	0.90000	0.90000	0.40000	0.70000	0.70000		

Graphics





CETIS Analysis Detail

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
35d Proportion Survived	Comparison	13-5709-1036	13-5709-1036	23 Oct-04 11:40 PM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Equal Variance t	C > T	Angular (Corrected)				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	4.22922	8.88539	0.07640	Equal Variances
Distribution	Shapiro-Wilk W	0.89744	0.84420	0.07326	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.2751803	0.2751803	1	11.91	0.00390	Significant Effect
Error	0.3235281	0.0231092	14			
Total	0.59870836	0.2982895	15			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-003		12415-002	3.45078	1.76131	0.0019	0.13387	Significant Effect

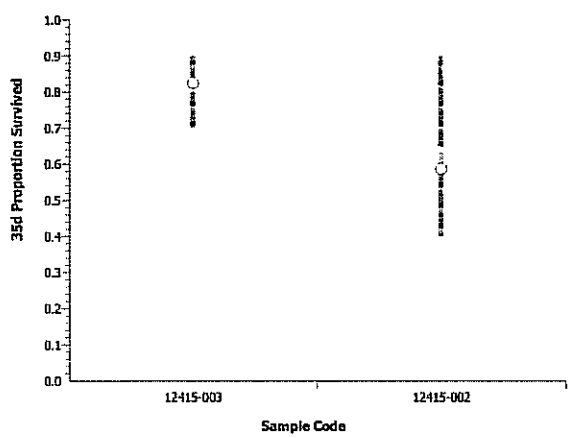
Data Summary

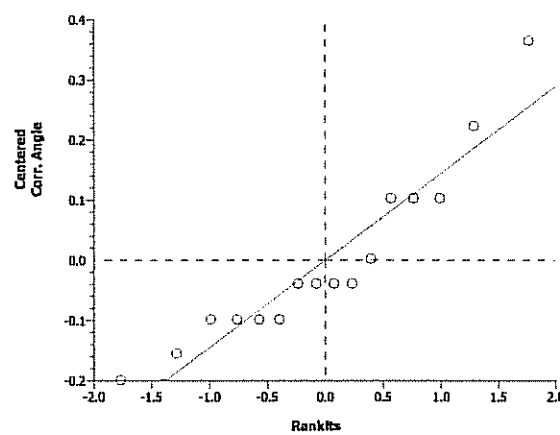
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-003	8	0.82500	0.70000	0.90000	0.07071	1.14586	0.99116	1.24905	0.09401
12415-002	8	0.58750	0.40000	0.90000	0.17269	0.88357	0.68472	1.24905	0.19334

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-003	0.80000	0.80000	0.90000	0.70000	0.90000	0.90000	0.80000	0.80000		
12415-002	0.50000	0.50000	0.40000	0.60000	0.90000	0.50000	0.50000	0.80000		

Graphics





STUDY: 12415
CLIENT: CH2M Hill
PROJECT: Indian Head - CTO-066 Site 47 Evaluation
TASK: Hyalella azteca 42 Day Assay
DATA: Day 42 Survival
START DATE: 09/01/04
END DATE: 10/13/04

Sample Site	ESI Ref	Rep	Number Recovered	Percent Recovery	Mean	Distribution	Variance	t Value	Critical t Value	p Value	Statistically Significant Difference	As Compared To
Lab	0	E	4	40%	61.3%							
	0	F	6	60%								
	0	G	6	60%								
	0	H	6	60%								
	0	I	7	70%								
	0	J	7	70%								
	0	K	5	50%								
	0	L	8	80%								
IS47RSDTX01	3	E	2	20%	23.8%	Normal	Equal	4.4608	1.7613	0.0003	YES	LAB
	3	F	1	10%								
	3	G	2	20%								
	3	H	0	0%								
	3	I	6	60%								
	3	J	1	10%								
	3	K	4	40%								
	3	L	3	30%								
IS47SDTX17	1	E	8	80%	55.5%	Normal	Equal	0.1123	1.7613	0.4561	NO	LAB
	1	F	7	64%		Normal	Equal	-3.4970	1.7613	0.9982	NO	IS47RSDTX01
	1	G	8	80%								
	1	H	8	80%								
	1	I	4	40%								
	1	J	3	30%								
	1	K	5	50%								
	1	L	2	20%								
IS47SDTX05	2	E	5	50%	55.0%	Normal	Equal	0.7913	1.7613	0.2210	NO	LAB
	2	F	5	50%		Normal	Equal	-3.4429	1.7613	0.9980	NO	IS47RSDTX01
	2	G	3	30%								
	2	H	5	50%								
	2	I	8	80%								
	2	J	5	50%								
	2	K	5	50%								
	2	L	8	80%								

CETIS Test Summary

Report Date: 21 Oct-04 11:08 PM
Link: 13-5709-1036

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — EnviroSystems, Inc.

Test No:	06-5526-2399	**Test Type:**	Hyalella (42d)	**Duration:**	43d 0h
Start Date:	01 Sep-04 12:00 PM	**Protocol:**	EPA/600/R-99/064 (2000)	**Species:**	Hyalella azteca
Ending Date:	14 Oct-04 12:00 PM	**Dil Water:**	50/50 Mix of Surface Water and MHR	**Source:**	
Setup Date:	01 Sep-04 12:00 PM	**Brine:**	Not Applicable		

Sample No:	20-5692-5932	**Material:**	Freshwater Sedment	**Client:**	CH2M Hill
Sample Date:	01 Sep-04	**Code:**	12415-000	**Project:**	Ecologcal Risk Assessment
Receive Date:	01 Sep-04	**Source:**	Indian Head Site 47 - CTO-066		
Sample Age:	12h (4 °C)	**Station:**	Lab Control -000		

Sample No:	15-9102-5801	**Material:**	Freshwater Sedment	**Client:**	CH2M Hill
Sample Date:	10 Aug-04 02:40 PM	**Code:**	12415-001	**Project:**	Ecologcal Risk Assessment
Receive Date:	11 Aug-04 10:40 AM	**Source:**	Indian Head Site 47 - CTO-066		
Sample Age:	21d 21h (4 °C)	**Station:**	IS47SDTX17 - 001		

Sample No:	03-2741-3714	**Material:**	Freshwater Sedment	**Client:**	CH2M Hill
Sample Date:	10 Aug-04 03:00 PM	**Code:**	12415-002	**Project:**	Ecologcal Risk Assessment
Receive Date:	11 Aug-04 10:40 AM	**Source:**	Indian Head Site 47 - CTO-066		
Sample Age:	21d 21h (4 °C)	**Station:**	IS47SDTX05 - 002		

Sample No:	13-0047-3626	**Material:**	Freshwater Sedment	**Client:**	CH2M Hill
Sample Date:	10 Aug-04 04:10 PM	**Code:**	12415-003	**Project:**	Ecologcal Risk Assessment
Receive Date:	11 Aug-04 10:40 AM	**Source:**	Indian Head Site 47 - CTO-066		
Sample Age:	21d 19h (4 °C)	**Station:**	IS47RSDTX01 - 003		

28d Mean Dry Weight Summary

Sample Code	Reps	Mean	Minimum	Maximum	SE	SD	CV
12415-000	12	0.38950	0.32000	0.44700	0.02673	0.05346	13.72%
12415-003	12	0.30425	0.23900	0.34800	0.02310	0.04621	15.19%
12415-001	12	0.22925	0.18100	0.30400	0.02670	0.05340	23.29%
12415-002	12	0.17500	0.10000	0.27700	0.03875	0.07750	44.28%

42d Proportion Survived Summary

Sample Code	Reps	Mean	Minimum	Maximum	SE	SD	CV
12415-000	12	0.61250	0.40000	0.80000	0.04407	0.12464	20.35%
12415-003	12	0.23750	0.00000	0.60000	0.06797	0.19226	80.95%
12415-001	12	0.60000	0.20000	0.80000	0.07792	0.22039	36.73%
12415-002	12	0.55000	0.30000	0.80000	0.05976	0.16903	30.73%

CETIS Test Summary

Report Date: 21 Oct-04 11:08 PM
Link: 13-5709-1036

28d Mean Dry Weight Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-000	0.44700	0.40900	0.38200	0.32000	N/A	N/A	N/A	N/A	N/A	N/A
	N/A	N/A								
12415-003	0.34800	0.31600	0.31400	0.23900	N/A	N/A	N/A	N/A	N/A	N/A
	N/A	N/A								
12415-001	0.30400	0.20400	0.22800	0.18100	N/A	N/A	N/A	N/A	N/A	N/A
	N/A	N/A								
12415-002	0.19000	0.27700	0.10000	0.13300	N/A	N/A	N/A	N/A	N/A	N/A
	N/A	N/A								

42d Proportion Survived Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-000	0.40000	0.60000	0.60000	0.60000	0.70000	0.70000	0.50000	0.80000	N/A	N/A
	N/A	N/A								
12415-003	0.20000	0.10000	0.20000	0.00000	0.60000	0.10000	0.40000	0.30000	N/A	N/A
	N/A	N/A								
12415-001	0.80000	0.70000	0.80000	0.80000	0.40000	0.60000	0.50000	0.20000	N/A	N/A
	N/A	N/A								
12415-002	0.50000	0.50000	0.30000	0.50000	0.80000	0.50000	0.50000	0.80000	N/A	N/A
	N/A	N/A								

CETIS Analysis Detail

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — EnviroSystems, Inc.

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
42d Proportion Survived	Comparison	13-5709-1036	13-5709-1036	21 Oct-04 10:44 PM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Equal Variance t	C > T	Angular (Corrected)				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	3.09775	8.88539	0.15887	Equal Variances
Distribution	Shapiro-Wilk W	0.97009	0.84420	0.80571	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.696306	0.696306	1	19.90	0.00054	Significant Effect
Error	0.4898902	0.0349922	14			
Total	1.18619618	0.7312981	15			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-000		12415-003	4.46082	1.76131	0.0003	0.16474	Significant Effect

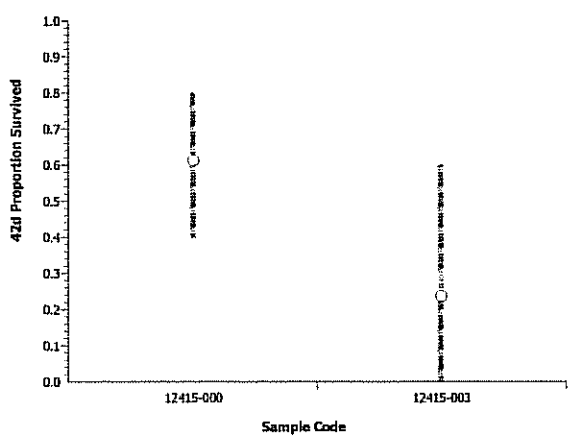
Data Summary

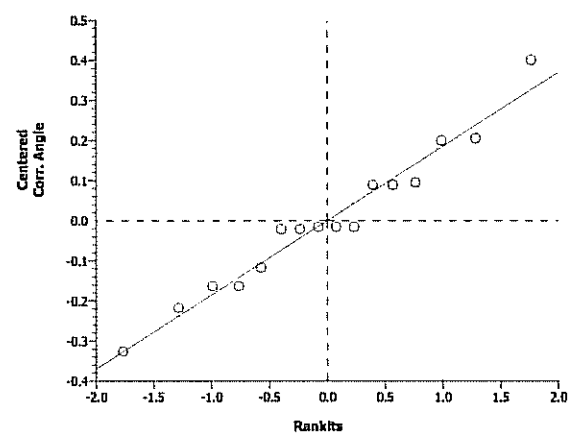
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-000	8	0.61250	0.40000	0.80000	0.12464	0.90223	0.68472	1.10715	0.13069
12415-003	8	0.23750	0.00000	0.60000	0.19226	0.48500	0.15878	0.88608	0.23001

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-000	0.40000	0.60000	0.60000	0.60000	0.70000	0.70000	0.50000	0.80000		
12415-003	0.20000	0.10000	0.20000	0.00000	0.60000	0.10000	0.40000	0.30000		

Graphics





CETIS Analysis Detail

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
42d Proportion Survived	Comparison	13-5709-1036	13-5709-1036	21 Oct-04 10:44 PM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Equal Variance t	C > T	Angular (Corrected)				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	3.23333	8.88539	0.14438	Equal Variances
Distribution	Shapiro-Wilk W	0.92309	0.84420	0.18768	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.0004555	0.0004555	1	0.01	0.91222	Non-Significant Effect
Error	0.5060984	0.0361499	14			
Total	0.50655391	0.0366053	15			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-000		12415-001	0.11225	1.76131	0.4561	0.16744	Non-Significant Effect

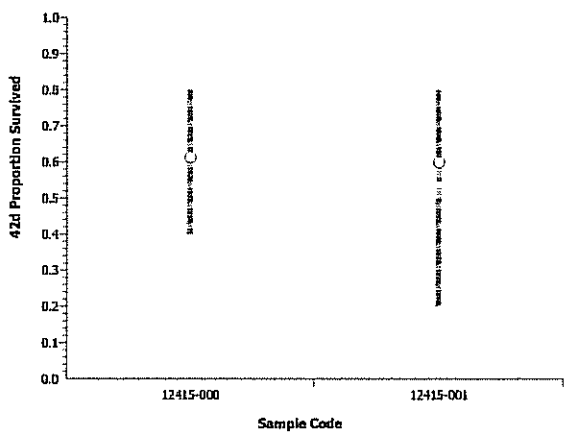
Data Summary

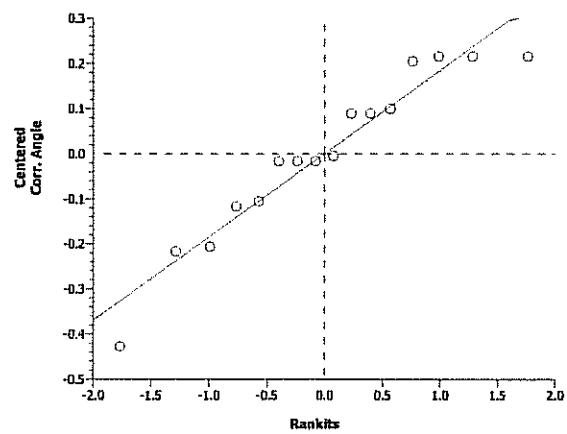
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-000	8	0.61250	0.40000	0.80000	0.12464	0.90223	0.68472	1.10715	0.13069
12415-001	8	0.60000	0.20000	0.80000	0.22039	0.89156	0.46365	1.10715	0.23499

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-000	0.40000	0.60000	0.60000	0.60000	0.70000	0.70000	0.50000	0.80000		
12415-001	0.80000	0.70000	0.80000	0.80000	0.40000	0.60000	0.50000	0.20000		

Graphics





CETIS Analysis Detail

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — EnviroSystems, Inc.

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
42d Proportion Survived	Comparison	13-5709-1036	13-5709-1036	21 Oct-04 10:45 PM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Equal Variance t	C > T	Angular (Corrected)				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	1.88565	8.88539	0.42178	Equal Variances
Distribution	Shapiro-Wilk W	0.91813	0.84420	0.15687	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.0154308	0.0154308	1	0.63	0.44195	Non-Significant Effect
Error	0.344982	0.0246416	14			
Total	0.36041274	0.0400723	15			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-000		12415-002	0.79133	1.76131	0.2210	0.13824	Non-Significant Effect

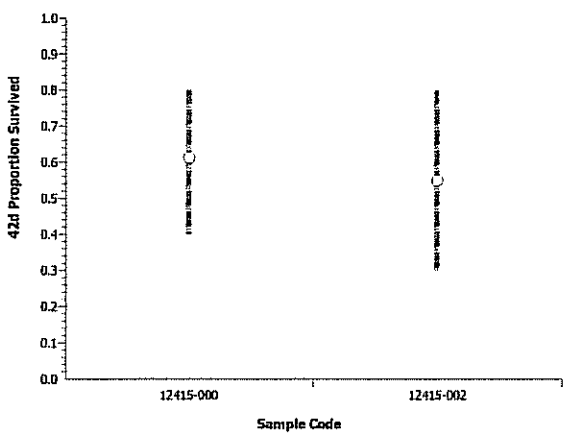
Data Summary

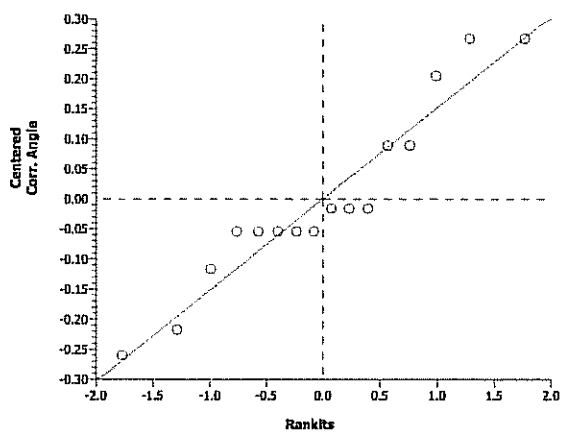
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-000	8	0.61250	0.40000	0.80000	0.12464	0.90223	0.68472	1.10715	0.13069
12415-002	8	0.55000	0.30000	0.80000	0.16903	0.84012	0.57964	1.10715	0.17946

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-000	0.40000	0.60000	0.60000	0.60000	0.70000	0.70000	0.50000	0.80000		
12415-002	0.50000	0.50000	0.30000	0.50000	0.80000	0.50000	0.50000	0.80000		

Graphics





CETIS Analysis Detail

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — EnviroSystems, Inc.

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
42d Proportion Survived	Comparison	13-5709-1036	13-5709-1036	21 Oct-04 10:45 PM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Equal Variance t	C > T	Angular (Corrected)				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	1.04377	8.88539	0.95639	Equal Variances
Distribution	Shapiro-Wilk W	0.97202	0.84420	0.83686	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.6611447	0.6611447	1	12.23	0.00356	Significant Effect
Error	0.7568868	0.0540633	14			
Total	1.41803151	0.7152081	15			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-003		12415-001	-3.4970	1.76131	0.9982	0.20477	Non-Significant Effect

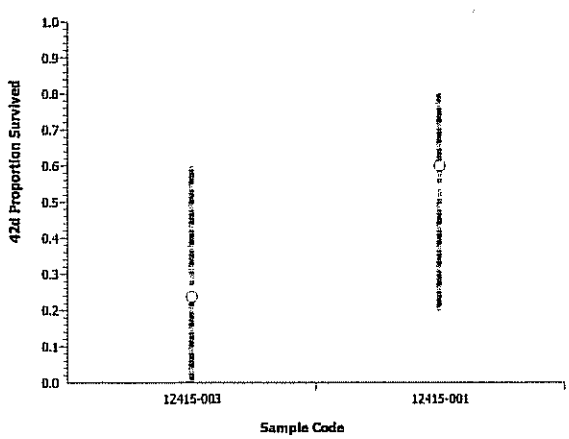
Data Summary

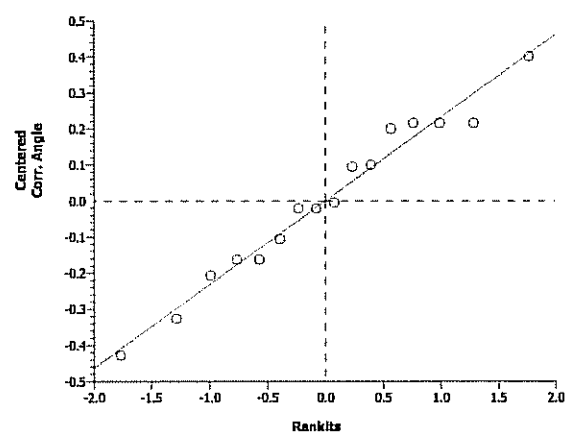
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-003	8	0.23750	0.00000	0.60000	0.19226	0.48500	0.15878	0.88608	0.23001
12415-001	8	0.60000	0.20000	0.80000	0.22039	0.89156	0.46365	1.10715	0.23499

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-003	0.20000	0.10000	0.20000	0.00000	0.60000	0.10000	0.40000	0.30000		
12415-001	0.80000	0.70000	0.80000	0.80000	0.40000	0.60000	0.50000	0.20000		

Graphics





CETIS Analysis Detail

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — EnviroSystems, Inc.

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
42d Proportion Survived	Comparison	13-5709-1036	13-5709-1036	21 Oct-04 10:45 PM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Equal Variance t	C > T	Angular (Corrected)				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	1.64281	8.88539	0.52828	Equal Variances
Distribution	Shapiro-Wilk W	0.93679	0.84420	0.30426	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	0.504425	0.504425	1	11.85	0.00396	Significant Effect
Error	0.5957703	0.0425550	14			
Total	1.10019529	0.5469800	15			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-003		12415-002	-3.4429	1.76131	0.9980	0.18167	Non-Significant Effect

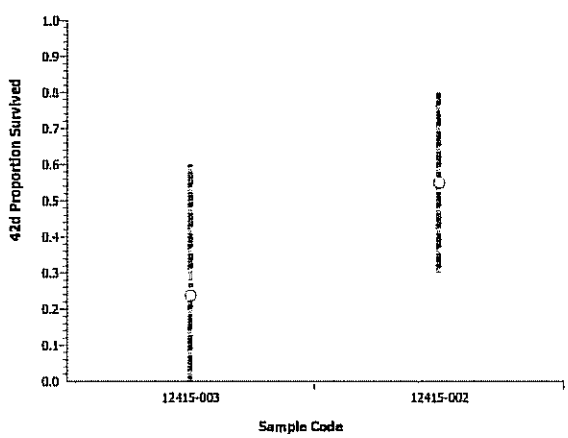
Data Summary

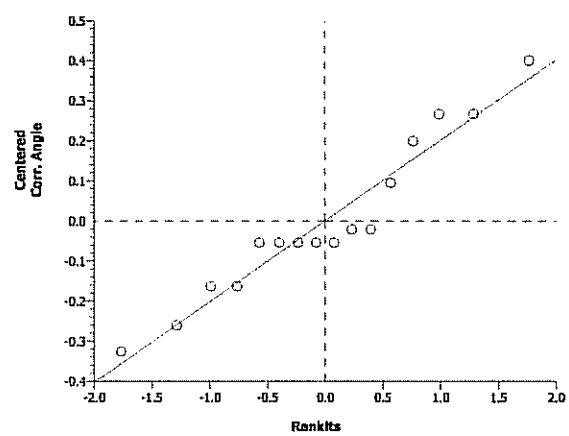
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-003	8	0.23750	0.00000	0.60000	0.19226	0.48500	0.15878	0.88608	0.23001
12415-002	8	0.55000	0.30000	0.80000	0.16903	0.84012	0.57964	1.10715	0.17946

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-003	0.20000	0.10000	0.20000	0.00000	0.60000	0.10000	0.40000	0.30000		
12415-002	0.50000	0.50000	0.30000	0.50000	0.80000	0.50000	0.50000	0.80000		

Graphics





STUDY: 12415
CLIENT: CH2M Hill
PROJECT: Indian Head - CTO-066 Site 47 Evaluation
TASK: Hyalella azteca 42 Day Assay
DATA: Day 35 & 42 Reproduction
START DATE: 09/01/04
END DATE: 10/13/04

								Day 35			DAY 42 Reproduction			DAY 42 Statistical Analysis						
Sample Site	ESI Ref	Rep	# Juveniles Day 35	# Juveniles Day 42	Total # Juveniles	Number Females	Number Males	Mean No. Juvenile/ Amph.	Mean No. Juvenile/ Amph. D42	Mean No. Juveniles/ Female	Mean No. Juveniles/ Female D42	Mean No. Juvenile/ Amph.	Mean No. Juvenile/ Amph. D42	Distribution	Variance	t Value	Critical t Value	p Value	Statistically Significant Difference	As Compared To
Lab	0	E	3	4	7	1	3	0.33	0.72	7.00	6.16	0.8	1.4							
	0	F	10	4	14	4	2	1.11		3.50		1.6								
	0	G	0	0	0	2	4	0.00		0.00		0.0								
	0	H	1	8	9	3	3	0.13		3.00		1.1								
	0	I	5	8	13	2	5	0.63		6.50		1.6								
	0	J	9	5	14	1	6	0.90		14.00		1.4								
	0	K	17	5	22	2	3	1.89		11.00		2.4								
	0	L	7	10	17	4	4	0.78		4.25		1.9								
IS47RSDTX01	3	E	0	0	0	1	1	0.00	0.44	0.00	4.97	0.0	0.6	Normal	Equal	0.4544	1.7823	0.3288	NO	LAB
	3	F	0	0	0	0	1	0.00				0.0								
	3	G	8	4	12	1	1	0.89		12.00		1.3								
	3	H	0	0	0	0	0	0.00				0.0								
	3	I	4	6	10	4	2	0.44		2.50		1.1								
	3	J	11	0	11	1	0	1.22		11.00		1.2								
	3	K	7	3	10	3	1	0.88		3.33		1.3								
	3	L	1	0	1	1	2	0.13		1.00		0.1								
IS47SDTX17	1	E	17	14	31	5	3	1.89	0.68	6.20	3.11	3.4	1.2	Normal	Equal	1.5952	1.7709	0.0673	NO	LAB
	1	F	2	1	3	4	3	0.29		0.75		0.4		Normal	Equal	0.8571	1.7959	0.2048	NO	IS47RSDTX01
	1	G	3	3	6	5	3	0.38		1.20		0.8								
	1	H	17	7	24	5	3	1.89		4.80		2.7								
	1	I	4	3	7	3	1	0.44		2.33		0.8								
	1	J	0	1	1	1	2	0.00		1.00		0.3								
	1	K	4	7	11	2	3	0.57		5.50		1.6								
	1	L	0	0	0	0	2	0.00				0.0								
IS47SDTX05	2	E	0	3	3	4	1	0.00	0.03	0.75	0.86	0.6	0.5	Normal	Unequal	3.0336	1.8946	0.0095	YES	LAB
	2	F	0	0	0	2	3	0.00		0.00		0.0		Normal	Unequal	1.7743	2.0151	0.0681	NO	IS47RSDTX01
	2	G	0	0	0	1	2	0.00		0.00		0.0								
	2	H	0	0	0	3	2	0.00		0.00		0.0								
	2	I	0	7	7	4	4	0.00		1.75		0.8								
	2	J	0	7	7	4	1	0.00		1.75		1.4								
	2	K	0	3	3	3	2	0.00		1.00		0.6								
	2	L	2	3	5	3	5	0.25		1.67		0.6								

ESI STUDY # 12414 CH2M Hill
***H. azteca* SEDIMENT ASSAY**

DAY 42: 10/14/04

SAMPLE ID	TIME	#LIVE ADULTS	# LIVE JUVENILES	# Female SH	COMMENTS
LAB E	1040	4	4	1	IIII
LAB F	1044	6	~~0~~ 4	4	IIII
LAB G	1047	6	0	2	
LAB H	1052	6	8	3	~~IIII~~ III
LAB I	1059	~~6~~ 7	8	2	~~IIII~~ III
LAB J	1104	7	~~4~~ 5	1	~~IIII~~
LAB K	1109	5	5	2	~~IIII~~
LAB L	1117	8	10	4	~~IIII~~ ~~IIII~~
-1 E	1134	8	14	5	~~IIII~~ ~~IIII~~ IIII
-1 F	1141	~~6~~ 7	1	4	I
-1 G	1147	8	3	5	III
-1 H	1151	8	7	5	~~IIII~~ II
-1 I	1155	4	3	3	III
-1 J	1200	3	1	1	I
-1 K	1300	5	7	2	~~IIII~~ II
-1 L	1303	2	0	0	

ANALYST: [illegible]
DATE: 10/13/04

ESI STUDY # 12414 CH2M Hill
***H. azteca* SEDIMENT ASSAY**

DAY 42:

SAMPLE ID	TIME	#LIVE ADULTS	# LIVE JUVENILES	AH 10/14 # Female	COMMENTS
-2E	1309	5	3	4	III
-2F	1312	5	0	2	
-2G	1315	3	0	1	
-2H	1318	5	0	3	
-2I	1325	8	7	~~3~~ 4	~~IIII~~ II
-2J	1331	5	7	4	~~IIII~~ II
-2K	1336	5	3	3	III
-2L	1341	8	3	3	III
-4E	1351	7	7	3	~~IIII~~ I
-4F	1400	9	13	2	~~IIII~~ ~~IIII~~ III
-4G	1403	3	0	2	
-4H	1406	4	0	2	
-4I	1412	6	8	2	~~IIII~~ III
-4J	1418	6	8	3	~~IIII~~ III
-4K	1422	7	16	3	~~IIII~~ ~~IIII~~ ~~IIII~~ I
-4L	1427	7	8	7	~~IIII~~ III

ANALYST: _____
DATE: 10/13/04

ESI STUDY # 12414 CH2M Hill
***H. azteca* SEDIMENT ASSAY**

DAY 42:

SAMPLE ID	TIME	#LIVE ADULTS	# LIVE JUVENILES	10/14 AH # Female	COMMENTS
-3E	1324	~~1~~ 2	0	1	
-3F	1327	1	0	0	
3G	1329	2	4	1	
3H	1332	0	0	–	
3I	1335	6	6	4	
3J	1339	1	0	1	
3K	1341	4	3	3	
3L	1344	3	0	1	
5E	1350	9	10	8	
5F	1354	8	7	4	
5G	1358	8	13	6	
5H	1401	6	1	3	
5I	1405	7	11	2	
5J	1409	9	4	3	
5K	1412	5	4	3	
5L	1417	9	12	3	

ANALYST: m
DATE: 10/13/04

CETIS Test Summary

Report Date: 21 Oct-04 11:22 PM
Link: 13-5709-1036

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — EnviroSystems, Inc.

Test No:	06-5526-2399	**Test Type:**	Hyalella (42d)	**Duration:**	43d 0h
Start Date:	01 Sep-04 12:00 PM	**Protocol:**	EPA/600/R-99/064 (2000)	**Species:**	Hyalella azteca
Ending Date:	14 Oct-04 12:00 PM	**Dil Water:**	50/50 Mix of Surface Water and MHR	**Source:**	
Setup Date:	01 Sep-04 12:00 PM	**Brine:**	Not Applicable		

Sample No:	20-5692-5932	**Material:**	Freshwater Sedment	**Client:**	CH2M Hill
Sample Date:	01 Sep-04	**Code:**	12415-000	**Project:**	Ecologcal Risk Assessment
Receive Date:	01 Sep-04	**Source:**	Indian Head Site 47 - CTO-066		
Sample Age:	12h (4 °C)	**Station:**	Lab Control -000		
Sample No:	15-9102-5801	**Material:**	Freshwater Sedment	**Client:**	CH2M Hill
Sample Date:	10 Aug-04 02:40 PM	**Code:**	12415-001	**Project:**	Ecologcal Risk Assessment
Receive Date:	11 Aug-04 10:40 AM	**Source:**	Indian Head Site 47 - CTO-066		
Sample Age:	21d 21h (4 °C)	**Station:**	IS47SDTX17 - 001		
Sample No:	03-2741-3714	**Material:**	Freshwater Sedment	**Client:**	CH2M Hill
Sample Date:	10 Aug-04 03:00 PM	**Code:**	12415-002	**Project:**	Ecologcal Risk Assessment
Receive Date:	11 Aug-04 10:40 AM	**Source:**	Indian Head Site 47 - CTO-066		
Sample Age:	21d 21h (4 °C)	**Station:**	IS47SDTX05 - 002		
Sample No:	13-0047-3626	**Material:**	Freshwater Sedment	**Client:**	CH2M Hill
Sample Date:	10 Aug-04 04:10 PM	**Code:**	12415-003	**Project:**	Ecologcal Risk Assessment
Receive Date:	11 Aug-04 10:40 AM	**Source:**	Indian Head Site 47 - CTO-066		
Sample Age:	21d 19h (4 °C)	**Station:**	IS47RSDTX01 - 003		

42 d Juveniles per Female Summary

Sample Code	Reps	Mean	Minimum	Maximum	SE	SD	CV
12415-000	12	6.15625	0	14	1.60561	4.54135	73.77%
12415-003	12	4.97222	0	12	2.12150	5.1966	104.51
12415-001	12	3.11190	0.75	6.2	0.87816	2.32341	74.66%
12415-002	12	1.14583	0	3	0.38728	1.0954	95.60%

42 d Juveniles per Female Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-000	7	3.5	0	3	6.5	14	11	4.25	N/A	N/A
	N/A	N/A								
12415-003	0	12	2.5	11	3.33333	1	N/A	N/A	N/A	N/A
	N/A	N/A								
12415-001	6.2	0.75	1.2	4.8	2.33333	1	5.5	N/A	N/A	N/A
	N/A	N/A								
12415-002	3	0	0	0	1.75	1.75	1	1.66667	N/A	N/A
	N/A	N/A								

CETIS Analysis Detail

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — EnviroSystems, Inc.

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
42 d Juveniles per Female	Comparison	13-5709-1036	13-5709-1036	21 Oct-04 11:21 PM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Equal Variance t	C > T	Untransformed				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	1.30939	9.52206	0.71816	Equal Variances
Distribution	Shapiro-Wilk W	0.90256	0.82506	0.12898	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	4.806589	4.806589	1	0.21	0.65768	Non-Significant Effect
Error	279.3904	23.28253	12			
Total	284.196939	28.089117	13			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-000		12415-003	0.45436	1.78229	0.3288	4.64447	Non-Significant Effect

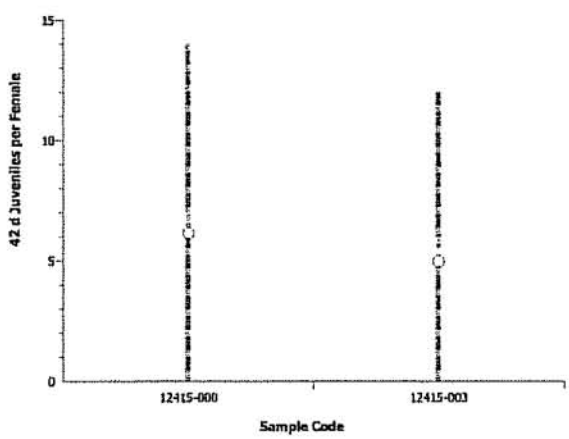
Data Summary

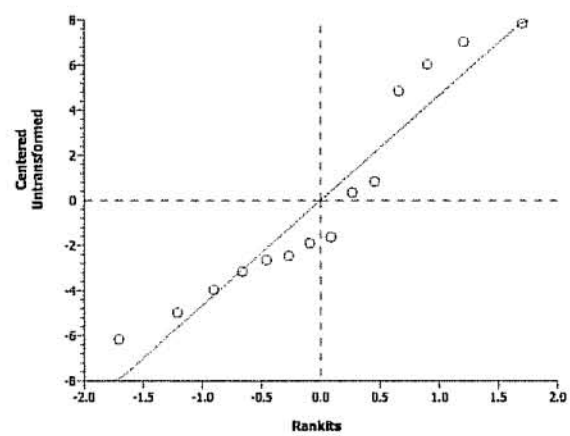
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-000	8	6.15625	0	14	4.54135				
12415-003	6	4.97222	0	12	5.1966				

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-000	7	3.5	0	3	6.5	14	11	4.25		
12415-003	0	12	2.5	11	3.33333	1				

Graphics





CETIS Analysis Detail

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — EnviroSystems, Inc.

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
42 d Juveniles per Female	Comparison	13-5709-1036	13-5709-1036	21 Oct-04 11:21 PM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Equal Variance t	C > T	Untransformed				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	3.82050	10.78592	0.12316	Equal Variances
Distribution	Shapiro-Wilk W	0.96114	0.83526	0.68113	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	34.60067	34.60067	1	2.54	0.13467	Non-Significant Effect
Error	176.7565	13.59665	13			
Total	211.357143	48.197326	14			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-000		12415-001	1.59524	1.77093	0.0673	3.37964	Non-Significant Effect

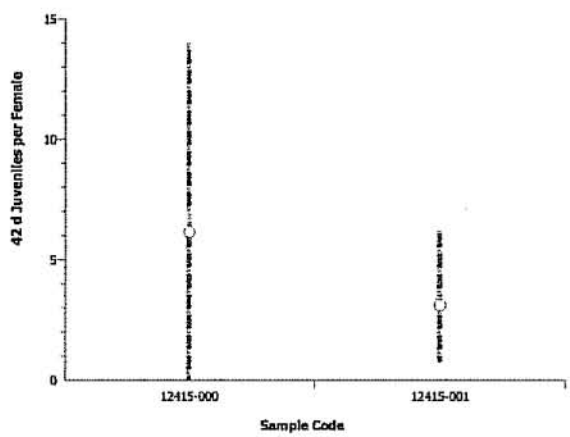
Data Summary

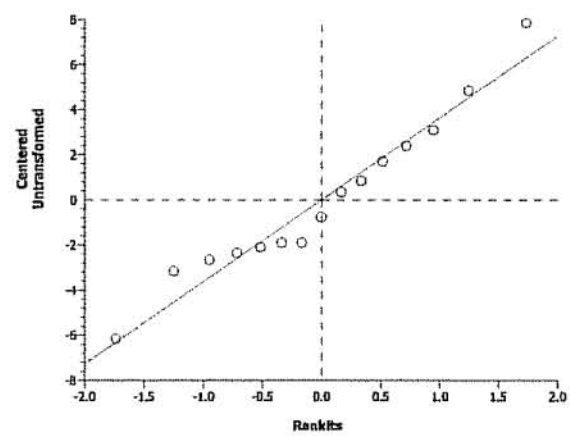
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-000	8	6.15625	0	14	4.54135				
12415-001	7	3.11190	0.75	6.2	2.32341				

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-000	7	3.5	0	3	6.5	14	11	4.25		
12415-001	6.2	0.75	1.2	4.8	2.33333	1	5.5			

Graphics





CETIS Analysis Detail

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — EnviroSystems, Inc.

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
42 d Juveniles per Female	Comparison	13-5709-1036	13-5709-1036	21 Oct-04 11:22 PM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Unequal Variance t	C > T	Untransformed				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	17.18799	8.88539	0.00130	Unequal Variances
Distribution	Shapiro-Wilk W	0.92981	0.84420	0.23856	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	100.4171	100.4171	1	9.20	0.00894	Significant Effect
Error	152.7665	10.91189	14			
Total	253.183594	111.32899	15			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-000		12415-002	3.03357	1.89458	0.0095	3.1292	Significant Effect

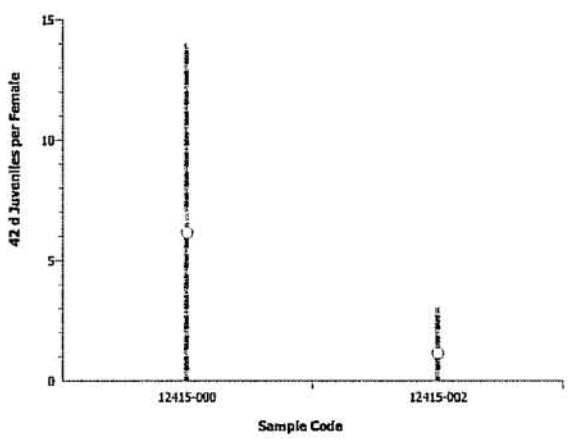
Data Summary

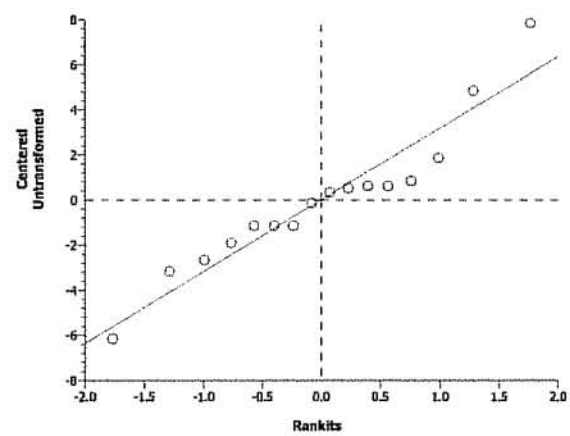
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-000	8	6.15625	0	14	4.54135				
12415-002	8	1.14583	0	3	1.0954				

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-000	7	3.5	0	3	6.5	14	11	4.25		
12415-002	3	0	0	0	1.75	1.75	1	1.66667		

Graphics





CETIS Analysis Detail

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — EnviroSystems, Inc.

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
42 d Juveniles per Female	Comparison	13-5709-1036	13-5709-1036	21 Oct-04 11:22 PM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Equal Variance t	C > T	Untransformed				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	5.00251	11.46370	0.07518	Equal Variances
Distribution	Shapiro-Wilk W	0.91645	0.81445	0.22913	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	11.18098	11.18098	1	0.73	0.40966	Non-Significant Effect
Error	167.4124	15.21931	11			
Total	178.593414	26.400296	12			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-003		12415-001	0.85712	1.79589	0.2048	3.89783	Non-Significant Effect

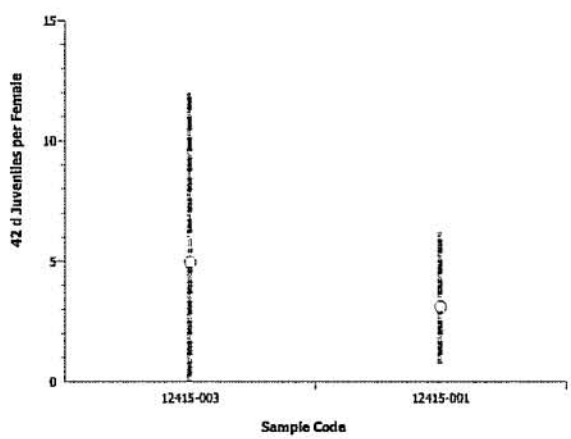
Data Summary

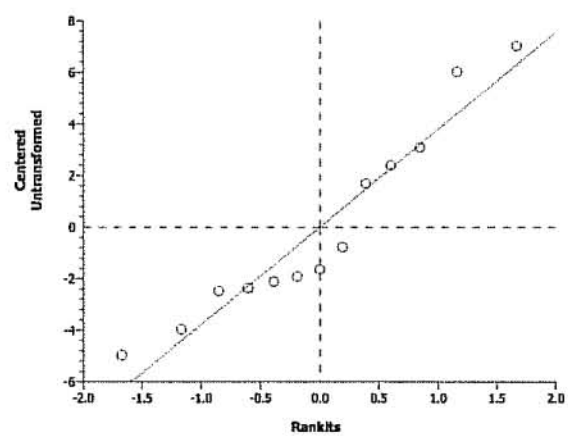
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-003	6	4.97222	0	12	5.1966				
12415-001	7	3.11190	0.75	6.2	2.32341				

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-003	0	12	2.5	11	3.33333	1				
12415-001	6.2	0.75	1.2	4.8	2.33333	1	5.5			

Graphics





CETIS Analysis Detail

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — EnviroSystems, Inc.

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
42 d Juveniles per Female	Comparison	13-5709-1036	13-5709-1036	21 Oct-04 11:22 PM	CETISv1.025

Method	Alt H	Data Transform	Z	NOEL	LOEL	Toxic Units	ChV	MSDp
Unequal Variance t	C > T	Untransformed				N/A		

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P Level	Decision(0.01)
Variances	Variance Ratio	22.50572	9.52206	0.00070	Unequal Variances
Distribution	Shapiro-Wilk W	0.91408	0.82506	0.18624	Normal Distribution

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P Level	Decision(0.05)
Between	50.19858	50.19858	1	4.20	0.06294	Non-Significant Effect
Error	143.4225	11.95187	12			
Total	193.621033	62.150449	13			

Group Comparisons

Sample	vs	Sample	Statistic	Critical	P Level	MSD	Decision(0.05)
12415-003		12415-002	1.77430	2.01505	0.0681	4.34558	Non-Significant Effect

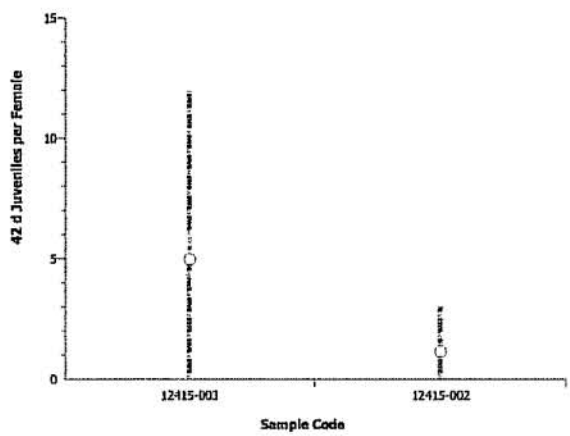
Data Summary

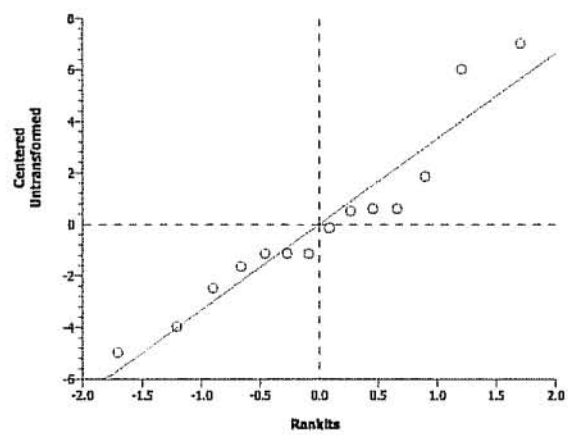
		Original Data				Transformed Data			
Sample Code	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
12415-003	6	4.97222	0	12	5.1966				
12415-002	8	1.14583	0	3	1.0954				

Data Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
12415-003	0	12	2.5	11	3.33333	1				
12415-002	3	0	0	0	1.75	1.75	1	1.66667		

Graphics





Report No: 12414
Project: CH2MHill - Indian Head Project

Sample ID: LAB
Matrix: Water

Day	Parameter	Lab ID	Result	Quant Limit	Units	Date Sampled	Date of Analysis	Method/Reference
0	Alkalinity	12414-013	ND	10	mg/L as CaCO3	09/01/04	09/15/04 1046	EPA 310.2
7	Alkalinity	12414-052	15	10	mg/L as CaCO3	09/08/04	09/15/04 1048	EPA 310.2
14	Alkalinity	12414-091	27	10	mg/L as CaCO3	09/15/04	09/15/04 1251	EPA 310.2
21	Alkalinity	12414-130	30	10	mg/L as CaCO3	09/22/04	09/23/04 1603	EPA 310.2
28	Alkalinity	12414-169	35	10	mg/L as CaCO3	09/29/04	10/04/04 1238	EPA 310.2
0	Ammonia-N	12414-039	ND	0.1	mg/L as N	09/01/04	09/03/04 1032	APHA 4500-NH3 G
7	Ammonia-N	12414-078	0.6	0.1	mg/L as N	09/08/04	09/13/04 1322	APHA 4500-NH3 G
14	Ammonia-N	12414-117	ND	0.1	mg/L as N	09/15/04	09/17/04 1058	APHA 4500-NH3 G
21	Ammonia-N	12414-156	ND	0.1	mg/L as N	09/22/04	09/29/04 1148	APHA 4500-NH3 G
28	Ammonia-N	12414-195	ND	0.1	mg/L as N	09/29/04	09/29/04 1202	APHA 4500-NH3 G
0	Hardness as CaCO3	12414-026	39	0.3	mg/L	09/01/04	09/02/04	200.7 EPA 600/R-94/111
7	Hardness as CaCO3	12414-065	47	0.3	mg/L	09/08/04	09/09/04	200.7 EPA 600/R-94/111
14	Hardness as CaCO3	12414-104	52	0.3	mg/L	09/15/04	09/16/04	200.7 EPA 600/R-94/111
21	Hardness as CaCO3	12414-143	58	0.3	mg/L	09/22/04	09/29/04	200.7 EPA 600/R-94/111
28	Hardness as CaCO3	12414-182	59	0.3	mg/L	09/29/04	10/01/04	200.7 EPA 600/R-94/111

NOTES:
ND - Not detected

Report No: 12414
Project: CH2MHill - Indian Head Project

Sample ID: MHR/POND
Matrix: *Water*

Day	Parameter	Lab ID	Result	Quant Limit	Units	Date Sampled	Date of Analysis	Method/Reference
0	Alkalinity	12414-012	11	10	mg/L as CaCO3	09/01/04	09/02/04 1018	EPA 310.2
7	Alkalinity	12414-051	17	10	mg/L as CaCO3	09/08/04	09/15/04 1047	EPA 310.2
14	Alkalinity	12414-090	23	10	mg/L as CaCO3	09/15/04	09/15/04 1251	EPA 310.2
21	Alkalinity	12414-129	33	10	mg/L as CaCO3	09/22/04	09/23/04 1602	EPA 310.2
28	Alkalinity	12414-168	39	10	mg/L as CaCO3	09/29/04	10/04/04 1237	EPA 310.2
35	Alkalinity	12414-207	37	10	mg/L as CaCO3	10/06/04	10/12/04 1158	EPA 310.2
42	Alkalinity	12414-210	32	10	mg/L as CaCO3	10/13/04	10/18/04 1421	EPA 310.2
0	Ammonia-N	12414-038	ND	0.1	mg/L as N	09/01/04	09/03/04 1029	APHA 4500-NH3 G
7	Ammonia-N	12414-077	ND	0.1	mg/L as N	09/08/04	09/13/04 1321	APHA 4500-NH3 G
14	Ammonia-N	12414-116	ND	0.1	mg/L as N	09/15/04	09/17/04 1055	APHA 4500-NH3 G
21	Ammonia-N	12414-155	ND	0.1	mg/L as N	09/22/04	09/29/04 1144	APHA 4500-NH3 G
28	Ammonia-N	12414-194	ND	0.1	mg/L as N	09/29/04	09/29/04 1201	APHA 4500-NH3 G
35	Ammonia-N	12414-209	ND	0.1	mg/L as N	10/06/04	10/08/04 1339	APHA 4500-NH3 G
42	Ammonia-N	12414-212	ND	0.1	mg/L as N	10/13/04	10/15/04 1128	APHA 4500-NH3 G
0	Hardness as CaCO3	12414-025	41	0.3	mg/L	09/01/04	09/02/04	200.7 EPA 600/R-94/111
7	Hardness as CaCO3	12414-064	51	0.3	mg/L	09/08/04	09/09/04	200.7 EPA 600/R-94/111
14	Hardness as CaCO3	12414-103	51	0.3	mg/L	09/15/04	09/16/04	200.7 EPA 600/R-94/111
21	Hardness as CaCO3	12414-142	55	0.3	mg/L	09/22/04	09/29/04	200.7 EPA 600/R-94/111
28	Hardness as CaCO3	12414-181	52	0.3	mg/L	09/29/04	10/01/04	200.7 EPA 600/R-94/111
35	Hardness as CaCO3	12414-208	58	0.3	mg/L	10/06/04	10/13/04	200.7 EPA 600/R-94/111
42	Hardness as CaCO3	12414-211	50	0.3	mg/L	10/13/04	10/14/04	200.7 EPA 600/R-94/111

NOTES:
ND - Not detected

Report No: 12414
Project: CH2MHill - Indian Head Project

Sample ID: -001
Matrix: Water

Day	Parameter	Lab ID	Result	Quant Limit	Units	Date Sampled	Date of Analysis	Method/Reference
0	Alkalinity	12414-014	ND	10	mg/L as CaCO3	09/01/04	09/02/04 1019	EPA 310.2
7	Alkalinity	12414-053	12	10	mg/L as CaCO3	09/08/04	09/15/04 1049	EPA 310.2
14	Alkalinity	12414-092	19	10	mg/L as CaCO3	09/15/04	09/15/04 1252	EPA 310.2
21	Alkalinity	12414-131	17	10	mg/L as CaCO3	09/22/04	09/23/04 1603	EPA 310.2
28	Alkalinity	12414-170	36	10	mg/L as CaCO3	09/29/04	10/04/04 1239	EPA 310.2
0	Ammonia-N	12414-040	ND	0.1	mg/L as N	09/01/04	09/03/04 1033	APHA 4500-NH3 G
7	Ammonia-N	12414-079	0.8	0.1	mg/L as N	09/08/04	09/13/04 1323	APHA 4500-NH3 G
14	Ammonia-N	12414-118	0.7	0.1	mg/L as N	09/15/04	09/17/04 1059	APHA 4500-NH3 G
21	Ammonia-N	12414-157	ND	0.1	mg/L as N	09/22/04	09/29/04 1149	APHA 4500-NH3 G
28	Ammonia-N	12414-196	ND	0.1	mg/L as N	09/29/04	09/29/04 1203	APHA 4500-NH3 G
0	Hardness as CaCO3	12414-027	40	0.3	mg/L	09/01/04	09/02/04	200.7 EPA 600/R-94/111
7	Hardness as CaCO3	12414-066	44	0.3	mg/L	09/08/04	09/09/04	200.7 EPA 600/R-94/111
14	Hardness as CaCO3	12414-105	45	0.3	mg/L	09/15/04	09/16/04	200.7 EPA 600/R-94/111
21	Hardness as CaCO3	12414-144	54	0.3	mg/L	09/22/04	09/29/04	200.7 EPA 600/R-94/111
28	Hardness as CaCO3	12414-183	60	0.3	mg/L	09/29/04	10/01/04	200.7 EPA 600/R-94/111

NOTES:
ND - Not detected

Report No: 12414
Project: CH2MHill - Indian Head Project

Sample ID: -002
Matrix: Water

Day	Parameter	Lab ID	Result	Quant Limit	Units	Date Sampled	Date of Analysis	Method/Reference
0	Alkalinity	12414-015	ND	10	mg/L as CaCO3	09/01/04	09/02/04 1019	EPA 310.2
7	Alkalinity	12414-054	ND	10	mg/L as CaCO3	09/08/04	09/15/04 1050	EPA 310.2
14	Alkalinity	12414-093	21	10	mg/L as CaCO3	09/15/04	09/15/04 1254	EPA 310.2
21	Alkalinity	12414-132	17	10	mg/L as CaCO3	09/22/04	09/23/04 1605	EPA 310.2
28	Alkalinity	12414-171	39	10	mg/L as CaCO3	09/29/04	10/04/04 1240	EPA 310.2
0	Ammonia-N	12414-041	0.2	0.1	mg/L as N	09/01/04	09/03/04 1034	APHA 4500-NH3 G
7	Ammonia-N	12414-080	0.7	0.1	mg/L as N	09/08/04	09/13/04 1324	APHA 4500-NH3 G
14	Ammonia-N	12414-119	0.6	0.1	mg/L as N	09/15/04	09/17/04 1102	APHA 4500-NH3 G
21	Ammonia-N	12414-158	ND	0.1	mg/L as N	09/22/04	09/29/04 1150	APHA 4500-NH3 G
28	Ammonia-N	12414-197	ND	0.1	mg/L as N	09/29/04	09/29/04 1204	APHA 4500-NH3 G
0	Hardness as CaCO3	12414-028	37	0.3	mg/L	09/01/04	09/02/04	200.7 EPA 600/R-94/111
7	Hardness as CaCO3	12414-067	50	0.3	mg/L	09/08/04	09/09/04	200.7 EPA 600/R-94/111
14	Hardness as CaCO3	12414-106	48	0.3	mg/L	09/15/04	09/16/04	200.7 EPA 600/R-94/111
21	Hardness as CaCO3	12414-145	49	0.3	mg/L	09/22/04	09/29/04	200.7 EPA 600/R-94/111
28	Hardness as CaCO3	12414-184	60	0.3	mg/L	09/29/04	10/01/04	200.7 EPA 600/R-94/111

NOTES:
ND - Not detected

Report No: 12414
Project: CH2MHill - Indian Head Project

Sample ID: -003
Matrix: Water

Day	Parameter	Lab ID	Result	Quant Limit	Units	Date Sampled	Date of Analysis	Method/Reference
0	Alkalinity	12414-016	18	10	mg/L as CaCO3	09/01/04	09/02/04 1020	EPA 310.2
7	Alkalinity	12414-055	16	10	mg/L as CaCO3	09/08/04	09/15/04 1050	EPA 310.2
14	Alkalinity	12414-094	20	10	mg/L as CaCO3	09/15/04	09/15/04 1254	EPA 310.2
21	Alkalinity	12414-133	26	10	mg/L as CaCO3	09/22/04	09/23/04 1605	EPA 310.2
28	Alkalinity	12414-172	37	10	mg/L as CaCO3	09/29/04	10/04/04 1241	EPA 310.2
0	Ammonia-N	12414-042	ND	0.1	mg/L as N	09/01/04	09/03/04 1035	APHA 4500-NH3 G
7	Ammonia-N	12414-081	ND	0.1	mg/L as N	09/08/04	09/13/04 1325	APHA 4500-NH3 G
14	Ammonia-N	12414-120	ND	0.1	mg/L as N	09/15/04	09/17/04 1103	APHA 4500-NH3 G
21	Ammonia-N	12414-159	ND	0.1	mg/L as N	09/22/04	09/29/04 1151	APHA 4500-NH3 G
28	Ammonia-N	12414-198	ND	0.1	mg/L as N	09/29/04	09/29/04 1205	APHA 4500-NH3 G
0	Hardness as CaCO3	12414-029	43	0.3	mg/L	09/01/04	09/02/04	200.7 EPA 600/R-94/111
7	Hardness as CaCO3	12414-068	52	0.3	mg/L	09/08/04	09/09/04	200.7 EPA 600/R-94/111
14	Hardness as CaCO3	12414-107	52	0.3	mg/L	09/15/04	09/16/04	200.7 EPA 600/R-94/111
21	Hardness as CaCO3	12414-146	59	0.3	mg/L	09/22/04	09/29/04	200.7 EPA 600/R-94/111
28	Hardness as CaCO3	12414-185	64	0.3	mg/L	09/29/04	10/01/04	200.7 EPA 600/R-94/111

NOTES:
ND - Not detected

Aquatic Research Organisms

DATA SHEET

I. Organism History

Species: Hyalella azteca

Source: Lab reared X Hatchery reared ____ Field collected ____

Hatch date 8/25/04 Receipt date ____

Lot number 082504HA Strain ARO F2

Brood Origination US FWS MO

II. Water Quality

Temperature 23 °C Salinity <1 ppt DO 7.8

pH 7.6 Hardness ≈150 ppm

III. Culture Conditions

System: FW static renewal

Diet: Flake Food X Phytoplankton ____ Trout Chow X

Brine Shrimp ____ Rotifers ____ Other ____

Prophylactic Treatments: ____

Comments: ____

IV. Shipping Information

Client: ESI # of Organisms: 1600

Carrier: Pick-up Date Shipped: 9/1/04

Biologist: [signature]

1 - 800 - 927 - 1650

PO Box 1271 • One Lafayette Road • Hampton, NH 03842 • (603) 926-1650

ESI LAB

~~GPI LABORATORIES, LLP~~

7210A Corporate Court
Frederick, MD 21703
(301) 694-5310
Fax (301) 620-0731

Contract #/Billing Reference

1 of 1 Pgs.

Project: ~~CH2~~ NDW Indian Head Site 47

Client: CH2M HILL

Send Results To: John Burgess

Address: 25 New Chardon St, Ste 300
Boston, MA 02114

Phone: 617-523-2002 x224

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	Soil Toxicity										CLIENT COMMENTS
Turnaround Time															
# of Containers															
Container Type															
Preservative Used															
Type of Analysis															Lab Cooler No.
IS475ATX08	8/10	0830	Soil	SB	1										
IS475STX06	8/10	0845		SB	1										
IS475STX12	8/10	0900		SB	1										
IS475STX04	8/10	0915		SB	1										
IS475STX02	8/10	0930		SB	1										
IS475STX10	8/10	0945		SB	1										
IS475STX17	8/10	1440		SB	1										
RGDSSTX03	8/10	1330		SB	1										
IS475DTX05	8/10	1500		SB	1										
IS47RSDTX01	8/10	1610		SB	1										

Relinquished By:	Date/Time	Received By:	Relinquished By:	Received for Laboratory By:	Date/Time
[signature]	8/10/04 1800			[signature]	8/11/04 1040

Relinquished By:	Date/Time	Received By:	Date/Time	Shipper:	Airbill No.:

Relinquished By:	Date/Time	Received By:	Lab Comments:	Temp:

G.P. W.O. _____

GPL LABORATORIES, LLLP

7210A Corporate Court
Frederick, MD 21703
(301) 694-5310
Fax (301) 620-0731

Contract #/Billing Reference: 145185. AR. ER

Project: Indian Head Site 47
Client: CH2M HILL
Send Results To: John Burgess / CH2M HILL
Address: 25 New Chardon St., Ste. 300
Boston, MA 02114
Phone: 617.523.2002 x224

Turnaround Time
# of Containers: 1
Container Type: bucket
Preservative Used: None
Type of Analysis: Soil toxicity test

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	Soil toxicity test	Lab Cooler No.	CLIENT COMMENTS
1S47SDTX04	8/9/04	1445	SS	SB	X		4 buckets total
1S47SDTX14	8/9/04	1530	SS	SB	X		
1S47SDTX01	8/9/04	1555	SS	SB	X		
1S47SDTX02	8/9/04	1615	SS	SB	X		

Relinquished By:	Date/Time	Received By:	Relinquished By:	Received for Laboratory By:	Date/Time
[illegible]	8/9/04 1745	USPS	fedex	[illegible]	8/10/04 1130

Relinquished By:	Date/Time	Received By:	Date/Time	Shipper:	Airbill No.:

Relinquished By:	Date/Time	Received By:	Lab Comments:	Temp:

G.P. W.O. _____

Appendix E
Work Plan for Supplemental BERA Investigation

Scope of Work for Supplemental Sampling in Support of the Baseline Ecological Risk Assessment for Site 47, Naval Support Facility, Indian Head

PREPARED FOR: Jeff Morris/NAVFAC Washington
Joe Rail/NAVFAC Washington
Shawn Jorgensen/NDWIH
Dennis Orenshaw/EPA
Curtis DeTore/MDE

PREPARED BY: John Burgess/CH2MHILL

COPIES: Margaret Kasim/CH2M HILL
Scott Saroff/CH2M HILL
Simeon Hahn/BTAG
Bruce Pluta/BTAG

DATE: February 10, 2006

This memorandum presents a brief scope of work for additional sediment sampling at Site 47 (Mercuric Nitrate Disposal Area), Naval Support Facility, Indian Head. The approach outlined in this memorandum was developed based on the consensus met during the Indian Head Installation Restoration Team (IHIRT) Partnering meeting on December 8, 2005 and input from the U.S. Environmental Protection Agency Region III's Biological Technical Assistance Group (BTAG)[1]. The additional sediment samples will aid in risk management decisions for the site. Potential ecological risks were identified for the site, which led to the initiation of a baseline ecological risk assessment (BERA) in 2005 to develop site-specific risk estimates for the site.

The initial results of the BERA investigation revealed that site-related chemicals in surface soils at the site do not pose unacceptable risks to ecological receptors. However, the results for the aquatic portion of the site were inconclusive. Three chemicals of potential concern (COPCs) (mercury, silver, and phenanthrene) were identified for sediments in the intermittent stream at the site. Bioassays conducted with the amphipod (*Hyallela azteca*) revealed that the sediments were potentially toxic to benthic invertebrates. However, the concentrations of the three COPCs in subset of the sediment samples used for the bioassays were relatively low (i.e., below ecological screening values) suggesting that these chemicals were not related to the observed toxicity. Therefore, it is possible that some other chemical(s) (e.g. organochlorine pesticides were used in the past for pest control at the facility) might be present in the sediments of the stream that may or may not be site-related and could be contributing to the toxicity observed in the bulk sediment samples (e.g., organochlorine pesticides were used in the past for pest control at the facility). Pesticides

[1] Via email dated December 13, 2005.

and PCBs have never been analyzed for in site media because there is no history of their use at the site.

As agreed to by the Indian Head Installation Restoration Team at the December 8, 2005 meeting, this supplemental sampling will be conducted to aid in identifying potential chemicals in the sediments that might be contributing to the observed toxicity of site sediments. The sampling approach consists of collection of five sediment samples from 0 to 6 inches below the sediment-water interface (Figure 1). All samples, as well as the appropriate number of quality assurance/quality control (QA/QC) samples will be analyzed for the following constituents:

- Target compound list (TCL) volatile organic compounds (VOCs)
- TCL semivolatile organic compounds (SVOCs)
- TCL pesticides/polychlorinated biphenyls (PCBs)
- Target analyte list (TAL) metals/cyanide
- Acid volatile sulfide/simultaneously extractable metals (AVS/SEM)
- Explosives [nitroaromatics/nitramines plus pentaerytharitol tetranitrate (PETN), nitrocellulose, nitroglycerin, and nitroguanadine]
- Perchlorate
- Total organic carbon
- Grain size.

The samples will be analyzed on a standard turnaround time (28 days) and the results will be validated by an independent third party validator. The data will be presented in a technical memorandum that will be submitted to the IHIRT and BTAG.

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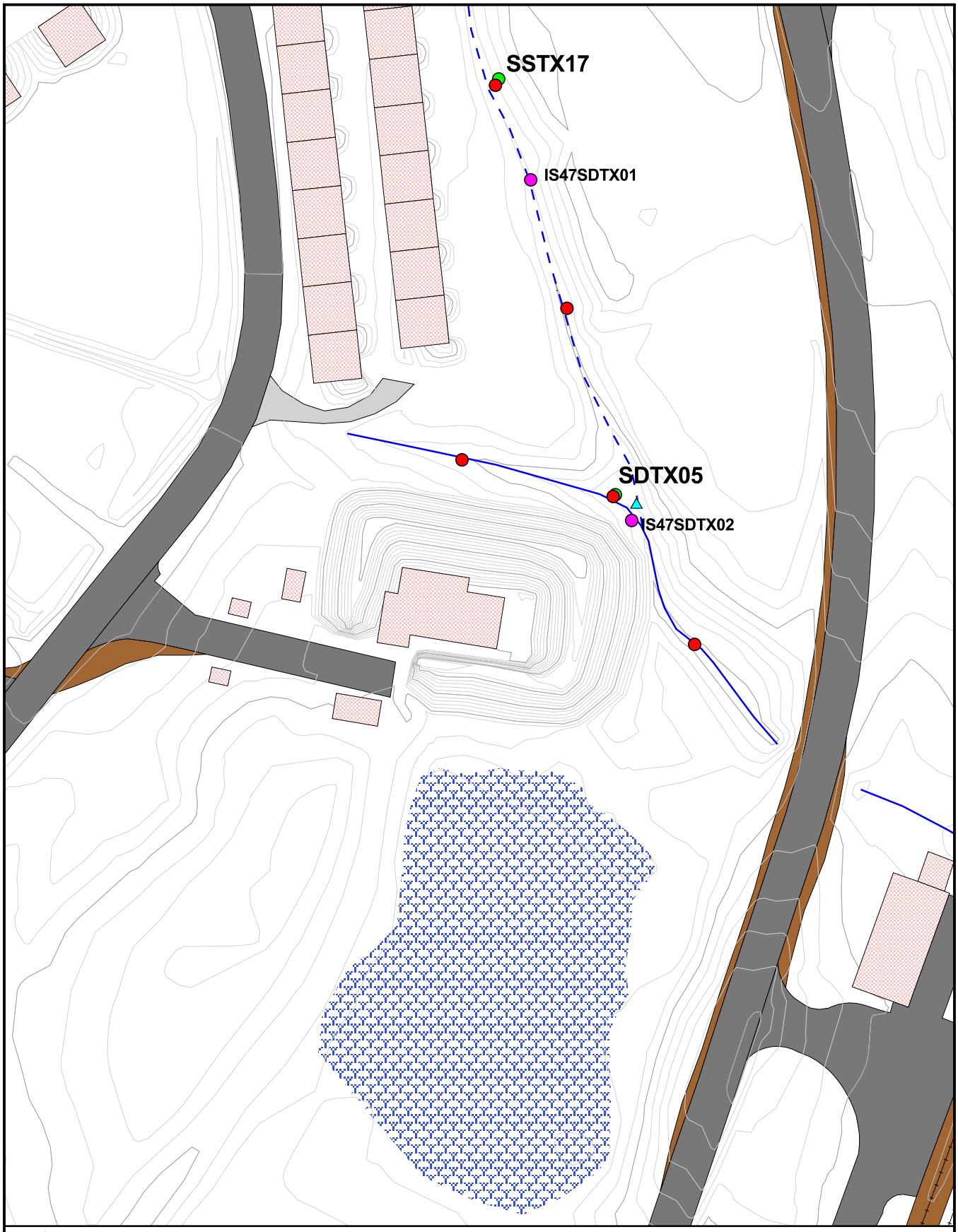

LEGEND

- Historical Sample Location
- BERA Sample Locations
- Proposed Sediment Sample Locations
- Surface Water Sample Location
- 1 Foot Contours
- Drainage Ditch
- Wetlands
- Buildings
- Asphalt

N

0 35 70 Feet

1" = 70ft

Figure 1
Proposed Sediment Sample Locations
Site 47 Additional BERA Investigation
NSF-IH, Indian Head, Maryland

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Appendix F
Supplemental BERA Investigation Results

Site 47 Supplemental Baseline Ecological Risk Assessment Investigation Results, Naval Support Facility, Indian Head

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DATE: July 27, 2006

Background

This memorandum presents the results of a supplemental sediment sampling conducted at Site 47 (Mercuric Nitrate Disposal Area), Naval Support Facility, Indian Head (NSF-IH) in Indian Head, Maryland. The approach and rationale for the sampling was presented in a technical memorandum to the Indian Head Installation Restoration Team (IHIRT) dated February 10, 2006. The additional sediment samples were collected to aid the team in making risk management decisions for the site. Potential ecological risks were identified for the site during the remedial investigation, which led to the initiation of a baseline ecological risk assessment (BERA) to develop site-specific risk estimates for the site.

The initial results of the BERA investigation revealed that site-related chemicals in surface soils at the site do not pose unacceptable risks to ecological receptors. However, the results for the aquatic portion of the site were inconclusive. Three chemicals of potential concern (COPCs) (mercury, silver, and phenanthrene) were identified for sediments in the intermittent stream at the site. Bioassays conducted with the amphipod (*Hyalella azteca*) revealed that the sediments were potentially toxic to benthic invertebrates. However, the concentrations of the three COPCs in a subset of the sediment samples used for the bioassays were relatively low (that is, below ecological screening values), suggesting that the chemicals were not related to the observed toxicity. Therefore, it is possible that some other chemical(s) (for example, organochlorine pesticides were used in the past for pest control at the facility) might be present in the sediments of the stream that may or may not be site-related and could be contributing to the toxicity observed in the bulk sediment samples. Pesticides and polychlorinated biphenyls (PCBs) had never been analyzed in site media because there was no history of their use at the site.

The sampling approach consisted of collecting five sediment samples from 0 to 6 inches below the sediment-water interface (Figure 1). All samples were analyzed for the full suite of

compounds: target compound list (TCL) volatile organic compounds (VOCs), TCL semivolatile organic compounds (SVOCs), TCL pesticides/PCBs, target analyte list (TAL) metals/cyanide, acid volatile sulfide/simultaneously extractable metals (AVS/SEM), explosives (nitroaromatics/nitramines plus pentaerytharitol tetranitrate, nitrocellulose, nitroglycerin, and nitroguanidine), perchlorate, total organic carbon, and grain size.

Results

Five sediments samples were collected from stations IS47SD05, IS47SD07, IS47SD08, IS47SD09, and IS47SD17, shown in Figure 1. The figure also shows the 10 surface soil sample locations and 2 sediment sample locations from which samples were collected during the 2004 BERA investigation (herein referred to as BERA investigation) (CH2M HILL, 2005). Locations IS47SD05 and IS47SD17 were sampled during the 2004 BERA investigation and this supplemental investigation.

Table 1 presents the raw and detected data for this sampling event. A shaded cell indicates that the constituent was detected. Detected constituent concentrations exceeding their respective ecological screening values are shown on Table 2. U.S. Environmental Protection Agency (USEPA) Region 3 screening values were used where available and supplemented with other applicable screening values for constituents without Region 3 values. The discussion below is based on the sediment analytical results for this sampling event.

VOCs

Several VOCs were detected in one or more sediment samples. These include 2-butanone, acetone, carbon disulphide, carbon tetrachloride, chloroform, styrene, tetrachloroethene, and trichloroethane. Most of these compounds were also detected in groundwater at Site 47. A comparison of the results to the screening values revealed that acetone and chloroform exceeded their screening values.

Acetone exceeded the screening value of 19.1 micrograms per kilogram (µg/kg) in three of five samples. It was detected in the other two samples at levels comparable to the laboratory blank Acetone is a common laboratory contaminant. Chloroform exceeded the screening value of 48.4 µg/kg in one of five samples. It was detected in the upgradient sample collected from location IS47SD17 (60 µg/kg), but was not detected at the sample location (IS47SD05) where the greatest toxicity was observed in the BERA investigation. Both acetone and chloroform have been found in groundwater at Site 47. However, given the volatile nature of these compounds, it is not expected that they would remain present in sediment for long once groundwater discharges to surface water. Although these chemicals were detected in the sediment, it is unlikely that they are the primary chemicals responsible for the observed toxicity, considering the concentrations detected and the expected lack of persistence of the compounds in sediments due to their volatile nature.

SVOCs

For this group of compounds, analyses were performed using the contract laboratory program (CLP) (OLM04) and selective ion monitoring (SIM) methodologies. The CLP (OLM04) method was used for SVOC analysis, whereas SIM, a lower concentration method, was used for polynuclear aromatic hydrocarbon (PAH) analysis. Because phenanthrene was identified as a COC during the remedial investigation, it was deemed necessary to analyze the samples for PAH analysis using the SIM method. Consequently, the PAH discussion will focus on the results obtained from the SIM method.

Eighteen compounds were detected and all were PAHs. Nine of the detected PAHs exceeded their screening values: acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(b)fluoranthene, chrysene, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene. The magnitude of the exceedences is relatively low. Only pyrene (30 µg/kg) exceeded its screening value of 13 µg/kg in samples from locations IS47SD05 and IS47SD17 where toxicity was observed during the BERA investigation. Additionally, location IS47SD05, which exhibited the greatest toxicity, does not have any PAH compounds exceeding the screening values. Though phenanthrene was detected in all samples, it exceeded the screening value at only location, IS47SD08. Overall, it is unlikely that PAH compounds are the cause for the toxicity observed in the BERA investigation samples.

Pesticides and PCBs

Four pesticide compounds (4,4'-DDD, 4,4'-DDE, 4,4'-DDT, and endrin ketone) were detected in the sediment samples and all four compounds exceeded their ecological screening values. Pesticide compound 4,4'-DDD was detected in samples SD05 (14 J µg/kg) and SD07 (5.9 J µg/kg) at concentrations exceeding the screening value of 4.9 µg/kg. Pesticide compounds 4,4'-DDE (7.1 J µg/kg) and 4,4'-DDT (9.9 J µg/kg) were detected only in sample SD07 at concentrations exceeding the screening values of 3.2 µg/kg and 4.2 µg/kg, respectively. Endrin ketone, which is a breakdown product of endrin, was detected in all five samples at concentrations (ranging from 4 J µg/kg to 6 J µg/kg) exceeding the screening value of 2.2 µg/kg.

The highest pesticide concentration of 14 J µg/kg (4,4'-DDD) was detected at location IS47SD05, which is the location of greatest toxicity observed from the BERA investigation. The four compounds were all detected in the sample from location IS47SD07 and they all exceeded their respective screening criterion. Considering the persistence of these pesticide compounds in the environment, their widespread presence at the site (at least one pesticide compound in each sample), and the fact that the highest pesticide concentration coincided with the location that exhibited the greatest toxic response during the BERA investigation, it is likely that the toxicity observed in the BERA toxicity testing can be attributed primarily to these compounds.

Explosives

Only one explosive compound, nitroguanidine, was detected at a concentration of 45 µg/kg in the sample from location IS47SD09. There is no screening value available to evaluate the potential risk posed by this compound. Explosive compounds were not detected at the locations (IS47SD05 and IS47SD17) where toxicity was observed in the BERA toxicity testing. Based on these results, it is unlikely that explosives are the cause for the observed toxicity.

Metals

Of the 17 metals detected in the samples, only 3 (mercury, silver, and zinc) exceeded their screening values in one or more samples. The concentrations of mercury and silver exceeded the screening value in three of the samples (IS47-SD05-0306, IS47-SD07-0306, and IS47-SD17-0306), and the concentration of zinc exceeded the screening value in one sample (IS47-SD09-0306). Mercury and silver were both COPCs identified in the remedial investigation and a focus of the BERA investigation; therefore, these metals might be linked to the observed toxicity at locations IS47SD05 and IS47SD17. Zinc did not exceed the screening value at either location IS47SD05 or location IS47SD17 and, therefore, is unlikely to be a causal agent for the observed toxicity.

AVS/SEM

The AVS/SEM results were evaluated to provide additional information on the bioavailability of the SEM group of metals, which include mercury and silver. The AVS/SEM analysis provides a means to measure the pool of AVS available to bind free metal ions that would otherwise be bioavailable for uptake by organisms. If the molar sum of the SEM metals is less than the molar sum of AVS, then all free metal ions should be bound as metal sulfide complexes, and, thus, be unavailable for uptake. Conversely, if the molar sum of SEM is greater than the molar sum of AVS, then a portion of the metals with the largest sulfide solubility would exist as free metal and potentially cause toxicity (USEPA, 2005). The affinity of the SEM metals for AVS should be silver>copper>lead>cadmium>zinc>nickel. Silver exists predominantly in the monovalent form. This means that silver monosulfide (Ag_2S) will bind two moles of silver for each mole of AVS. Sediments with AVS > 0 will not cause adverse biological effects due to silver (USEPA, 2005).

The SEM group of metals analyzed included cadmium, copper, lead, mercury, nickel, silver, and zinc. The results of these metals and sulfide (for AVS) are provided in Table 1. Table 2 presents the SEM molar sum for each sample.

A comparison of the SEM molar sum to the AVS molar sum for all samples indicated that only sample SD08 has an excess pool of AVS (2.3 micromoles/gram [µmole/g]). The other four samples have SEM molar sums higher than the AVS molar sums. In general, the molar concentrations of cadmium, mercury, and silver were lower compared to the other SEM metals in each sample. Of the locations where toxicity was observed, AVS was detected in the SD05 sample (0.2 µmole/g), but not in the SD17 sample (0.02 U µmole/g). Considering the low concentrations of mercury and silver in the AVS/SEM samples, and the affinity of silver for AVS, it is unlikely that these metals are bioavailable in the sediments to the extent to cause the adverse effects observed in the BERA investigation.

Conclusion

These results, in conjunction with the BERA investigation results, confirm that the COCs (mercury, silver, and phenanthrene) identified during the remedial investigation and for which the BERA investigation was conducted are not the cause of the toxicity observed at locations IS47SD05 and IS47SD17 during the BERA investigation. The results, in general, show that VOCs, though present in groundwater, SVOCs, explosives, PCBs, and metals are unlikely the cause for the observed toxicity. It is, therefore, possible that the toxicity could be due to the presence of the organochlorine pesticide residues in the sediments.

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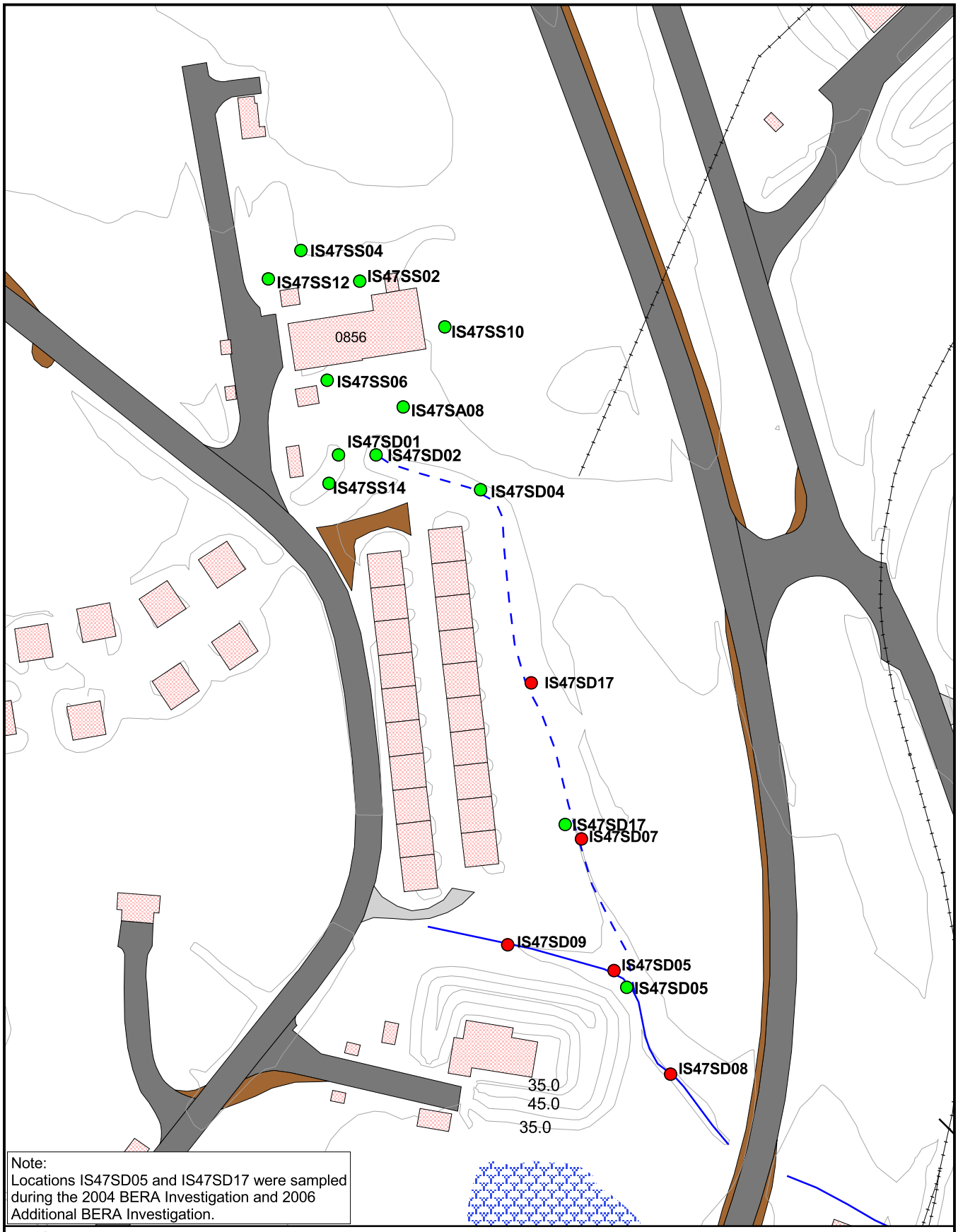

Note:
Locations IS47SD05 and IS47SD17 were sampled during the 2004 BERA Investigation and 2006 Additional BERA Investigation.

LEGEND

- BERA Sample Locations (2004)
- BERA Sediment Sample Locations (2006)
- 5 Foot Contours
- Drainage Ditch
- Asphalt
- Wetlands
- Buildings

N

0 50 100 Feet

1" = 100ft

Figure 1
Sediment Sample Locations
Site 47 Additional BERA Investigation Results
NSF-IH, Indian Head, Maryland

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Table 1
Raw and Detected Constituents in Sediment Samples (March 2006)
Site 47 Supplemental BERA Investigation Results
NSF-IH, Indian Head, MD

Station ID	IS47SD05		IS47SD07		IS47SD08		IS47SD09		IS47SD17	
Sample ID	IS47-SD05-0306[1]	IS47-SD05-0306-PAH[1]	IS47-SD07-0306	IS47-SD07-0306-PAH	IS47-SD08-0306	IS47-SD08-0306-PAH	IS47-SD09-0306	IS47-SD09-0306-PAH	IS47-SD17-0306	IS47-SD17-0306-PAH
Sample Date	03/09/06	03/09/06	03/09/06	03/09/06	03/09/06	03/09/06	03/09/06	03/09/06	03/09/06	03/09/06
Chemical Name										
Volatile Organic Compounds (UG/KG)										
1,1,1-Trichloroethane	14 U	NA	16 U	NA	14 U	NA	15 U	NA	19 U	NA
1,1,2,2-Tetrachloroethane	14 U	NA	16 U	NA	14 U	NA	15 U	NA	19 U	NA
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-11	14 U	NA	16 U	NA	14 U	NA	15 U	NA	19 U	NA
1,1,2-Trichloroethane	14 U	NA	16 U	NA	14 U	NA	15 U	NA	19 U	NA
1,1-Dichloroethane	14 U	NA	16 U	NA	14 U	NA	15 U	NA	19 U	NA
1,1-Dichloroethene	14 U	NA	16 U	NA	14 U	NA	15 U	NA	19 U	NA
1,2,4-Trichlorobenzene	14 U	NA	16 U	NA	14 U	NA	15 U	NA	19 U	NA
1,2-Dibromo-3-chloropropane	15 R	NA	16 R	NA	14 R	NA	15 R	NA	19 R	NA
1,2-Dibromoethane	14 U	NA	16 U	NA	14 U	NA	15 U	NA	19 U	NA
1,2-Dichlorobenzene	14 U	NA	16 U	NA	14 U	NA	15 U	NA	19 U	NA
1,2-Dichloroethane	14 U	NA	16 U	NA	14 U	NA	15 U	NA	19 U	NA
1,2-Dichloropropane	14 U	NA	16 U	NA	14 U	NA	15 U	NA	19 U	NA
1,3-Dichlorobenzene	14 U	NA	16 U	NA	14 U	NA	15 U	NA	19 U	NA
1,4-Dichlorobenzene	14 U	NA	16 U	NA	14 U	NA	15 U	NA	19 U	NA
2-Butanone	14 U	NA	16 U	NA	22	NA	15 U	NA	19 U	NA
2-Hexanone	14 U	NA	16 U	NA	14 U	NA	15 U	NA	19 U	NA
4-Methyl-2-pentanone	14 U	NA	16 U	NA	14 U	NA	15 U	NA	19 U	NA
Acetone	110	NA	110	NA	90	NA	7.6 B	NA	43 B	NA
Benzene	14 U	NA	16 U	NA	14 U	NA	15 U	NA	19 U	NA
Bromodichloromethane	14 U	NA	16 U	NA	14 U	NA	15 U	NA	19 U	NA
Bromoform	14 U	NA	16 U	NA	14 U	NA	15 U	NA	19 U	NA
Bromomethane	14 U	NA	16 U	NA	14 U	NA	15 U	NA	19 U	NA
Carbon disulfide	14 U	NA	16 U	NA	1.5 J	NA	15 U	NA	19 U	NA
Carbon tetrachloride	14 U	NA	16 U	NA	14 U	NA	15 U	NA	13 J	NA
Chlorobenzene	14 U	NA	16 U	NA	14 U	NA	15 U	NA	19 U	NA
Chloroethane	14 U	NA	16 U	NA	14 U	NA	15 U	NA	19 U	NA
Chloroform	14 U	NA	16 U	NA	14 U	NA	15 U	NA	60	NA
Chloromethane	14 U	NA	16 U	NA	14 U	NA	15 U	NA	19 U	NA
Cumene	14 U	NA	16 U	NA	14 U	NA	15 U	NA	19 U	NA
Cyclohexane	14 U	NA	16 U	NA	14 U	NA	15 U	NA	19 U	NA
Dibromochloromethane	14 U	NA	16 U	NA	14 U	NA	15 U	NA	19 U	NA
Dichlorodifluoromethane (Freon-12)	14 U	NA	16 U	NA	14 U	NA	15 U	NA	19 U	NA
Ethylbenzene	14 U	NA	16 U	NA	14 U	NA	15 U	NA	19 U	NA
Methyl acetate	14 U	NA	16 U	NA	14 U	NA	15 U	NA	19 U	NA
Methyl-tert-butyl ether (MTBE)	14 U	NA	16 U	NA	14 U	NA	15 U	NA	19 U	NA
Methylcyclohexane	14 U	NA	16 U	NA	14 U	NA	15 U	NA	19 U	NA
Methylene chloride	5.9 B	NA	7.5 B	NA	8.6 B	NA	4.5 B	NA	6.3 B	NA
Styrene	30	NA	7 J	NA	14 U	NA	15 U	NA	19 U	NA
Tetrachloroethene	3.8 J	NA	42	NA	14 U	NA	15 U	NA	31	NA
Toluene	14 U	NA	16 U	NA	14 U	NA	15 U	NA	19 U	NA
Trichloroethene	14 U	NA	5.2 J	NA	14 U	NA	15 U	NA	19 U	NA
Trichlorofluoromethane(Freon-11)	14 U	NA	16 U	NA	14 U	NA	15 U	NA	19 U	NA
Vinyl chloride	14 U	NA	16 U	NA	14 U	NA	15 U	NA	19 U	NA
Xylene, total	14 U	NA	16 U	NA	14 U	NA	15 U	NA	19 U	NA
cis-1,2-Dichloroethene	14 U	NA	16 U	NA	14 U	NA	15 U	NA	19 U	NA

Table 1
Raw and Detected Constituents in Sediment Samples (March 2006)
Site 47 Supplemental BERA Investigation Results
NSF-IH, Indian Head, MD

Station ID	IS47SD05		IS47SD07		IS47SD08		IS47SD09		IS47SD17	
Sample ID	IS47-SD05-0306[1]	IS47-SD05-0306-PAH[1]	IS47-SD07-0306	IS47-SD07-0306-PAH	IS47-SD08-0306	IS47-SD08-0306-PAH	IS47-SD09-0306	IS47-SD09-0306-PAH	IS47-SD17-0306	IS47-SD17-0306-PAH
Sample Date	03/09/06	03/09/06	03/09/06	03/09/06	03/09/06	03/09/06	03/09/06	03/09/06	03/09/06	03/09/06
Chemical Name										
cis-1,3-Dichloropropene	14 U	NA	16 U	NA	14 U	NA	15 U	NA	19 U	NA
trans-1,2-Dichloroethene	14 U	NA	16 U	NA	14 U	NA	15 U	NA	19 U	NA
trans-1,3-Dichloropropene	14 U	NA	16 U	NA	14 U	NA	15 U	NA	19 U	NA
Semi-volatile Organic Compounds (UG/KG)										
1,1-Biphenyl	520 U	NA	550 U	NA	490 U	NA	560 U	NA	670 U	NA
1-Methylnaphthalene	NA	5.2 U	NA	3.4 J	NA	5	NA	5.8 U	NA	2.6 J
2,4,5-Trichlorophenol	520 U	NA	550 U	NA	490 U	NA	560 U	NA	670 U	NA
2,4,6-Trichlorophenol	520 U	NA	550 U	NA	490 U	NA	560 U	NA	670 U	NA
2,4-Dichlorophenol	520 U	NA	550 U	NA	490 U	NA	560 U	NA	670 U	NA
2,4-Dimethylphenol	520 U	NA	550 U	NA	490 U	NA	560 U	NA	670 U	NA
2,4-Dinitrophenol	2,100 U	NA	2,200 U	NA	2,000 U	NA	2,200 U	NA	2,700 U	NA
2,4-Dinitrotoluene	520 U	NA	550 U	NA	490 U	NA	560 U	NA	670 U	NA
2,6-Dinitrotoluene	520 U	NA	550 U	NA	490 U	NA	560 U	NA	670 U	NA
2-Chloronaphthalene	520 U	NA	550 U	NA	490 U	NA	560 U	NA	670 U	NA
2-Chlorophenol	520 U	NA	550 U	NA	490 U	NA	560 U	NA	670 U	NA
2-Methylnaphthalene	520 U	5.2 U	550 U	5.5 U	490 U	6	560 U	5.8 U	670 U	6.8 U
2-Methylphenol	520 U	NA	550 U	NA	490 U	NA	560 U	NA	670 U	NA
2-Nitroaniline	520 U	NA	550 U	NA	490 U	NA	560 U	NA	670 U	NA
2-Nitrophenol	520 U	NA	550 U	NA	490 U	NA	560 U	NA	670 U	NA
3,3'-Dichlorobenzidine	520 U	NA	550 U	NA	490 U	NA	560 U	NA	670 U	NA
3-Nitroaniline	520 U	NA	550 U	NA	490 U	NA	560 U	NA	670 U	NA
4,6-Dinitro-2-methylphenol	1,000 U	NA	1,100 U	NA	980 U	NA	1,100 U	NA	1,300 U	NA
4-Bromophenyl-phenylether	520 U	NA	550 U	NA	490 U	NA	560 U	NA	670 U	NA
4-Chloro-3-methylphenol	520 U	NA	550 U	NA	490 U	NA	560 U	NA	670 U	NA
4-Chloroaniline	520 U	NA	550 U	NA	490 U	NA	560 U	NA	670 U	NA
4-Chlorophenyl-phenylether	520 U	NA	550 U	NA	490 U	NA	560 U	NA	670 U	NA
4-Methylphenol	520 U	NA	550 U	NA	490 U	NA	560 U	NA	670 U	NA
4-Nitroaniline	520 U	NA	550 U	NA	490 U	NA	560 U	NA	670 U	NA
4-Nitrophenol	520 U	NA	550 U	NA	490 U	NA	560 U	NA	670 U	NA
Acenaphthene	520 U	5.2 U	550 U	5.5 U	490 U	20	560 U	5.8 U	670 U	6.8 U
Acenaphthylene	520 U	5.2 U	550 U	5.5 U	490 U	3.4 J	560 U	6.8	670 U	3 J
Acetophenone	520 U	NA	550 U	NA	490 U	NA	560 U	NA	670 U	NA
Anthracene	520 U	5.2 U	550 U	9.2	490 U	63	560 U	10	670 U	9.1
Atrazine	520 U	NA	550 U	NA	490 U	NA	560 U	NA	670 U	NA
Benzaldehyde	520 U	NA	550 U	NA	490 U	NA	560 U	NA	670 U	NA
Benzo(a)anthracene	520 U	5.1 J	550 U	29 J	310 J	210 J	560 U	43	670 U	18
Benzo(a)pyrene	520 U	5.4 UJ	550 U	5.5 UJ	220 J	150	560 U	44	670 U	42
Benzo(b)fluoranthene	520 U	16	550 U	55 J	260 J	200	560 U	89	670 U	44
Benzo(g,h,i)perylene	520 U	5.4 UJ	550 U	5.5 UJ	490 U	73	560 U	25	670 U	6.8 U
Benzo(k)fluoranthene	520 U	13 J	550 U	27 J	230 J	120	560 U	67	670 U	6.8 U
Butylbenzylphthalate	480 J	NA	550 U	NA	490 U	NA	630	NA	470 J	NA
Caprolactam	520 U	NA	550 U	NA	490 U	NA	560 U	NA	670 U	NA
Carbazole	520 U	NA	550 U	NA	490 U	NA	560 U	NA	670 U	NA
Chrysene	520 U	9.9	550 U	35 J	400 J	210 J	560 U	190	670 U	6.8 U
Di-n-butylphthalate	520 U	NA	550 U	NA	490 U	NA	560 U	NA	670 U	NA
Di-n-octylphthalate	520 U	NA	550 U	NA	490 U	NA	560 U	NA	670 U	NA

Table 1
Raw and Detected Constituents in Sediment Samples (March 2006)
Site 47 Supplemental BERA Investigation Results
NSF-IH, Indian Head, MD

Station ID	IS47SD05		IS47SD07		IS47SD08		IS47SD09		IS47SD17	
Sample ID	IS47-SD05-0306[1]	IS47-SD05-0306-PAH[1]	IS47-SD07-0306	IS47-SD07-0306-PAH	IS47-SD08-0306	IS47-SD08-0306-PAH	IS47-SD09-0306	IS47-SD09-0306-PAH	IS47-SD17-0306	IS47-SD17-0306-PAH
Sample Date	03/09/06	03/09/06	03/09/06	03/09/06	03/09/06	03/09/06	03/09/06	03/09/06	03/09/06	03/09/06
Chemical Name										
Dibenz(a,h)anthracene	520 U	5.4 UJ	550 U	5.5 UJ	490 U	4.7 U	560 U	5.8 U	670 U	6.8 U
Dibenzofuran	520 U	NA	550 U	NA	490 U	NA	560 U	NA	670 U	NA
Diethylphthalate	520 U	NA	550 U	NA	490 U	NA	560 U	NA	670 U	NA
Dimethyl phthalate	520 U	NA	550 U	NA	490 U	NA	560 U	NA	670 U	NA
Fluoranthene	520 U	12	550 U	41	780	420	560 U	220	670 U	25
Fluorene	520 U	5.2 U	550 U	5.5 U	490 U	30	560 U	5.8 U	670 U	6.8 U
Hexachlorobenzene	520 U	NA	550 U	NA	490 U	NA	560 U	NA	670 U	NA
Hexachlorobutadiene	520 U	NA	550 U	NA	490 U	NA	560 U	NA	670 U	NA
Hexachlorocyclopentadiene	520 U	NA	550 U	NA	490 U	NA	560 U	NA	670 U	NA
Hexachloroethane	520 U	NA	550 U	NA	490 U	NA	560 U	NA	670 U	NA
Indeno(1,2,3-cd)pyrene	520 U	5.4 UJ	550 U	5.5 UJ	490 U	85	560 U	34	670 U	6.8 U
Isophorone	520 U	NA	550 U	NA	490 U	NA	560 U	NA	670 U	NA
Naphthalene	520 U	5.2 U	550 U	5.5 U	490 U	7.2	560 U	5.8 U	670 U	6.8 U
Nitrobenzene	520 U	NA	550 U	NA	490 U	NA	560 U	NA	670 U	NA
Pentachlorophenol	520 U	NA	550 U	NA	490 U	NA	560 U	NA	670 U	NA
Phenanthrene	520 U	6	550 U	17	560	240	560 U	60	670 U	15
Phenol	520 U	NA	550 U	NA	490 U	NA	560 U	NA	670 U	NA
Pyrene	520 U	12	550 U	47 J	640	530 J	560 U	220	670 U	30
bis(2-Chloro-1-methylethyl) ether	520 U	NA	550 U	NA	490 U	NA	560 U	NA	670 U	NA
bis(2-Chloroethoxy)methane	520 U	NA	550 U	NA	490 U	NA	560 U	NA	670 U	NA
bis(2-Chloroethyl)ether	520 U	NA	550 U	NA	490 U	NA	560 U	NA	670 U	NA
bis(2-Ethylhexyl)phthalate	520 U	NA	550 U	NA	490 U	NA	560 U	NA	670 U	NA
n-Nitroso-di-n-propylamine	520 U	NA	550 U	NA	490 U	NA	560 U	NA	670 U	NA
n-Nitrosodiphenylamine	520 U	NA	550 U	NA	490 U	NA	560 U	NA	670 U	NA
Pesticide/Polychlorinated Biphenyls (UG/KG)										
4,4'-DDD	14 J	NA	5.9 J	NA	4.9 UJ	NA	5.6 UJ	NA	6.9 UJ	NA
4,4'-DDE	5 UJ	NA	7.1 J	NA	4.9 UJ	NA	5.6 UJ	NA	6.9 UJ	NA
4,4'-DDT	5 UJ	NA	9.9 J	NA	4.9 UJ	NA	5.6 UJ	NA	6.9 UJ	NA
Aldrin	2.5 UJ	NA	2.8 UJ	NA	2.4 UJ	NA	2.8 UJ	NA	3.5 UJ	NA
Aroclor-1016	50 UJ	NA	56 UJ	NA	49 UJ	NA	56 UJ	NA	69 UJ	NA
Aroclor-1221	100 UJ	NA	110 UJ	NA	98 UJ	NA	110 UJ	NA	140 UJ	NA
Aroclor-1232	50 UJ	NA	56 UJ	NA	49 UJ	NA	56 UJ	NA	69 UJ	NA
Aroclor-1242	50 UJ	NA	56 UJ	NA	49 UJ	NA	56 UJ	NA	69 UJ	NA
Aroclor-1248	50 UJ	NA	56 UJ	NA	49 UJ	NA	56 UJ	NA	69 UJ	NA
Aroclor-1254	50 UJ	NA	56 UJ	NA	49 UJ	NA	56 UJ	NA	69 UJ	NA
Aroclor-1260	50 UJ	NA	56 UJ	NA	49 UJ	NA	56 UJ	NA	69 UJ	NA
Dieldrin	5 UJ	NA	5.6 UJ	NA	4.9 UJ	NA	5.6 UJ	NA	6.9 UJ	NA
Endosulfan I	2.5 UJ	NA	2.8 UJ	NA	2.4 UJ	NA	2.8 UJ	NA	3.5 UJ	NA
Endosulfan II	5 UJ	NA	5.6 UJ	NA	4.9 UJ	NA	5.6 UJ	NA	6.9 UJ	NA
Endosulfan sulfate	5 UJ	NA	5.6 UJ	NA	4.9 UJ	NA	5.6 UJ	NA	6.9 UJ	NA
Endrin	5 UJ	NA	5.6 UJ	NA	4.9 UJ	NA	5.6 UJ	NA	6.9 UJ	NA
Endrin aldehyde	5 UJ	NA	5.6 UJ	NA	4.9 UJ	NA	5.6 UJ	NA	6.9 UJ	NA
Endrin ketone	4.5 J	NA	4 J	NA	5.5 J	NA	5.6 J	NA	6 J	NA
Heptachlor	2.5 UJ	NA	2.8 UJ	NA	2.4 UJ	NA	2.8 UJ	NA	3.5 UJ	NA
Heptachlor epoxide	2.5 UJ	NA	2.8 UJ	NA	2.4 UJ	NA	2.8 UJ	NA	3.5 UJ	NA
Methoxychlor	25 UJ	NA	28 UJ	NA	24 UJ	NA	28 UJ	NA	35 UJ	NA

Table 1
Raw and Detected Constituents in Sediment Samples (March 2006)
Site 47 Supplemental BERA Investigation Results
NSF-IH, Indian Head, MD

Station ID	IS47SD05		IS47SD07		IS47SD08		IS47SD09		IS47SD17	
Sample ID	IS47-SD05-0306[1]	IS47-SD05-0306-PAH[1]	IS47-SD07-0306	IS47-SD07-0306-PAH	IS47-SD08-0306	IS47-SD08-0306-PAH	IS47-SD09-0306	IS47-SD09-0306-PAH	IS47-SD17-0306	IS47-SD17-0306-PAH
Sample Date	03/09/06	03/09/06	03/09/06	03/09/06	03/09/06	03/09/06	03/09/06	03/09/06	03/09/06	03/09/06
Chemical Name										
Toxaphene	250 UJ	NA	280 UJ	NA	240 UJ	NA	280 UJ	NA	350 UJ	NA
alpha-BHC	2.5 UJ	NA	2.8 UJ	NA	2.4 UJ	NA	2.8 UJ	NA	3.5 UJ	NA
alpha-Chlordane	2.5 UJ	NA	2.8 UJ	NA	2.4 UJ	NA	2.8 UJ	NA	3.5 UJ	NA
beta-BHC	2.5 UJ	NA	2.8 UJ	NA	2.4 UJ	NA	2.8 UJ	NA	3.5 UJ	NA
delta-BHC	2.5 UJ	NA	2.8 UJ	NA	2.4 UJ	NA	2.8 UJ	NA	3.5 UJ	NA
gamma-BHC (Lindane)	2.5 UJ	NA	2.8 UJ	NA	2.4 UJ	NA	2.8 UJ	NA	3.5 UJ	NA
technical-Chlordane	2.5 UJ	NA	2.8 UJ	NA	2.4 UJ	NA	2.8 UJ	NA	3.5 UJ	NA
Explosives (UG/KG)										
1,3,5-Trinitrobenzene	250 U	NA	250 U	NA	250 U	NA	250 U	NA	240 U	NA
1,3-Dinitrobenzene	250 U	NA	250 U	NA	250 U	NA	250 U	NA	240 U	NA
2,4,6-Trinitrotoluene	250 U	NA	250 U	NA	250 U	NA	250 U	NA	240 U	NA
2,4-Dinitrotoluene	250 U	NA	250 U	NA	250 U	NA	250 U	NA	240 U	NA
2,6-Dinitrotoluene	250 U	NA	250 U	NA	250 U	NA	250 U	NA	240 U	NA
2-Amino-4,6-dinitrotoluene	250 U	NA	250 U	NA	250 U	NA	250 U	NA	240 U	NA
2-Nitrotoluene	250 U	NA	250 U	NA	250 U	NA	250 U	NA	240 U	NA
3-Nitrotoluene	250 U	NA	250 U	NA	250 U	NA	250 U	NA	240 U	NA
4-Amino-2,6-dinitrotoluene	250 U	NA	250 U	NA	250 U	NA	250 U	NA	240 U	NA
4-Nitrotoluene	250 U	NA	250 U	NA	250 U	NA	250 U	NA	240 U	NA
HMX	250 U	NA	250 U	NA	250 U	NA	250 U	NA	240 U	NA
Nitrobenzene	250 U	NA	250 U	NA	250 U	NA	250 U	NA	240 U	NA
Nitroglycerin	20,000 U	NA	20,000 U	NA	20,000 U	NA	20,000 U	NA	19,000 U	NA
Nitroguanidine	100 U	NA	100 U	NA	98 U	NA	45 J	NA	98 U	NA
PETN	5,000 U	NA	5,000 U	NA	5,000 U	NA	5,000 U	NA	4,800 U	NA
RDX	250 U	NA	250 U	NA	250 U	NA	250 U	NA	240 U	NA
Tetryl	250 U	NA	250 U	NA	250 U	NA	250 U	NA	240 U	NA
Nitrocellulose	1 UL	NA	0.98 UL	NA	1 UL	NA	0.98 UL	NA	1 UL	NA
Perchlorate	0.15 U	NA	0.13 U	NA	0.11 U	NA	0.11 U	NA	0.096 U	NA
Total Metals (MG/KG)										
Aluminum	3,620 K	NA	14,500 K	NA	2,020 K	NA	11,900 K	NA	14,400 K	NA
Antimony	3.1 UL	NA	2.7 UL	NA	3 UL	NA	3.4 UL	NA	3.2 UL	NA
Arsenic	2.1 J	NA	6.1	NA	0.9 U	NA	3.3 J	NA	1.5 J	NA
Barium	24.2 J	NA	66.6	NA	16 J	NA	57.7 J	NA	52.2 J	NA
Beryllium	0.81 J	NA	1.3 J	NA	0.3 U	NA	0.81 J	NA	1 J	NA
Cadmium	0.51 J	NA	0.38 J	NA	0.3 U	NA	0.76 J	NA	0.32 U	NA
Calcium	581 J	NA	365 J	NA	265 J	NA	1,130 J	NA	501 J	NA
Chromium	4.6	NA	30.9	NA	5.5	NA	20.6	NA	18.2	NA
Cobalt	5.8 J	NA	11.3 J	NA	3.7 J	NA	5.6 J	NA	31.4	NA
Copper	7.3 J	NA	17.4 J	NA	13.7 J	NA	16.4 J	NA	10.3 J	NA
Cyanide	0.2 U	NA	0.24 J	NA	0.18 U	NA	0.22 U	NA	0.2 U	NA
Iron	8,040 J	NA	14,700 J	NA	4,080 J	NA	12,300 J	NA	6,730 J	NA
Lead	11.8 J	NA	18.8 J	NA	29.2 J	NA	20.3 J	NA	16.2 J	NA
Magnesium	314 J	NA	1,320 J	NA	241 J	NA	1,040 J	NA	783 J	NA
Manganese	52.6 J	NA	44.6 J	NA	32.1 J	NA	72.1 J	NA	259 J	NA
Mercury	0.53	NA	0.4	NA	0.11	NA	0.058	NA	0.74	NA
Nickel	6.2 J	NA	15	NA	3.1 J	NA	9.9 J	NA	10.3 J	NA

Table 1
Raw and Detected Constituents in Sediment Samples (March 2006)
Site 47 Supplemental BERA Investigation Results
NSF-IH, Indian Head, MD

Station ID	IS47SD05		IS47SD07		IS47SD08		IS47SD09		IS47SD17	
Sample ID	IS47-SD05-0306[1]	IS47-SD05-0306-PAH[1]	IS47-SD07-0306	IS47-SD07-0306-PAH	IS47-SD08-0306	IS47-SD08-0306-PAH	IS47-SD09-0306	IS47-SD09-0306-PAH	IS47-SD17-0306	IS47-SD17-0306-PAH
Sample Date	03/09/06	03/09/06	03/09/06	03/09/06	03/09/06	03/09/06	03/09/06	03/09/06	03/09/06	03/09/06
Chemical Name										
Potassium	251 J	NA	1,160 J	NA	228 J	NA	854 J	NA	755 J	NA
Selenium	0.93 U	NA	0.82 U	NA	0.9 U	NA	1 U	NA	0.97 U	NA
Silver	7.4	NA	1.9 J	NA	0.81 J	NA	0.34 U	NA	5.6	NA
Sodium	155 U	NA	159 J	NA	151 U	NA	171 U	NA	162 U	NA
Thallium	0.93 U	NA	0.82 U	NA	0.9 U	NA	1 U	NA	1.3 U	NA
Vanadium	12 J	NA	48.8	NA	9 J	NA	34.9	NA	19.6	NA
Zinc	46.3 J	NA	53 J	NA	32.8 J	NA	137 J	NA	43.4 J	NA
Wet Chemistry (MG/KG)										
% Solids	49	NA	58	NA	68	NA	70	NA	76	NA
pH	4.9	NA	4.6	NA	4.1	NA	5.5	NA	4.8	NA
Total organic carbon (TOC)	12,000	NA	47,700	NA	23,100	NA	18,100	NA	9,260	NA
Acid Volatile Sulfide/Simultaneously Extractable Metals (UMOLE/G)										
Cadmium	0.004	NA	0.0026	NA	0.0022	NA	0.0038	NA	0.0012 B	NA
Copper	0.082	NA	0.13	NA	0.067	NA	0.1	NA	0.04	NA
Lead	0.04	NA	0.064	NA	0.09	NA	0.048	NA	0.032	NA
Mercury	3.90E-05 B	NA	5.90E-05	NA	1.60E-05 B	NA	4.60E-05 B	NA	6.70E-05	NA
Nickel	0.067	NA	0.076	NA	0.035	NA	0.023 B	NA	0.029	NA
Silver	0.02		0.0036		0.00052 J		0.00039		0.021	
Sulfide	0.21	NA	0.019 U	NA	2.3	NA	0.026 U	NA	0.024 U	NA
Zinc	0.65	NA	0.29	NA	0.44	NA	0.46	NA	0.19	NA

Notes:

B - Analyte not detected above associated blank
J - Reported value is estimated
K - Analyte present. Reported value may be biased high. Actual value is expected to be lower
NA - Not Analyzed for analyte
R - Unreliable result
U - Analyte not detected
UJ - Not detected, quantitation limit may be inaccurate
UL - Not detected, quantitation limit may be higher
[1] - A duplicate was collected, and the most conservative value is reported
For each staation ID, two sample IDs are shown. The difference between the two sample IDs is that PAH analysis using the SIMs method was used to measure PAHs at a lower concentration. Hence, the sample ID ending in "PAH."

Table 2
Screening of Detecetd Constituents
Site 47 Supplemental BERA Investigation Results
NSF-IH, Indian Head, MD

Station ID	**Ecological**	**Screening**	IS47SD05	IS47SD07	IS47SD08	IS47SD09	IS47SD17
Sample ID	**Screening**	**Value**	IS47-SD05-0306	IS47-SD07-0306	IS47-SD08-0306	IS47-SD09-0306	IS47-SD17-0306
Sample Date	**Value**	**Source**	03/09/06	03/09/06	03/09/06	03/09/06	03/09/06
Volatile Organic Compounds (µg/kg)							
2-Butanone	594	ORNL[1]	14 U	16 U	22	15 U	19 U
Acetone	19.1	ORNL[1]	**110**	**110**	**90**	7.6 B	43 B
Carbon disulfide	0.851	EPA Region 3	14 U	16 U	1.5 J	15 U	19 U
Carbon tetrachloride	64.2	EPA Region 3	14 U	16 U	14 U	15 U	13 J
Chloroform	48.4	ORNL[1]	14 U	16 U	14 U	15 U	**60**
Styrene	559	EPA Region 3	30	7 J	14 U	15 U	19 U
Tetrachloroethene	468	EPA Region 3	3.8 J	42	14 U	15 U	31
Trichloroethene	96.9	EPA Region 3	14 U	5.2 J	14 U	15 U	19 U
Semi-volatile Organic Compounds (µg/kg)							
1-Methylnaphthalene[2]	20.2	EPA Region 3	5.2 U	3.4 J	5	5.8 U	2.6 J
2-Methylnaphthalene	20.2	EPA Region 3	5.2 U	5.5 U	6	5.8 U	6.8 U
Acenaphthene	6.7	EPA Region 3	5.2 U	5.5 U	**20**	5.8 U	6.8 U
Acenaphthylene	5.9	EPA Region 3	5.2 U	5.5 U	3.4 J	**6.8**	3 J
Anthracene	57.2	EPA Region 3	5.2 U	9.2	**63**	10	9.1
Benzo(a)anthracene	108	EPA Region 3	5.1 J	29 J	**210** J	43	18
Benzo(a)pyrene	150	EPA Region 3	5.4 UJ	5.5 UJ	150	44	42
Benzo(b)fluoranthene	27.2	EPA Region 3	16	**55** J	**200**	**89**	44
Benzo(g,h,i)perylene	170	EPA Region 3	5.4 UJ	5.5 UJ	73	25	6.8 U
Benzo(k)fluoranthene	240	EPA Region 3	13 J	27 J	120	67	6.8 U
Butylbenzylphthalate	10900	EPA Region 3	480 J	550 U	490 U	630	470 J
Chrysene	166	EPA Region 3	9.9	35 J	**210** J	**190**	6.8 U
Fluoranthene	423	EPA Region 3	12	41	420	220	25
Fluorene	77.4	EPA Region 3	5.2 U	5.5 U	30	5.8 U	6.8 U
Indeno(1,2,3-cd)pyrene	17	EPA Region 3	5.2 U	5.5 UJ	**85**	**34**	6.8 U
Naphthalene	176	EPA Region 3	5.2 U	5.5 U	7.2	5.8 U	6.8 U
Phenanthrene	204	EPA Region 3	6	17	**240**	60	15
Pyrene	13	EPA Region 3	12	**47** J	**530** J	**220**	**30**

Table 2
Screening of Detecetd Constituents
Site 47 Supplemental BERA Investigation Results
NSF-IH, Indian Head, MD

Station ID	**Ecological**	**Screening**	IS47SD05	IS47SD07	IS47SD08	IS47SD09	IS47SD17
Sample ID	**Screening**	**Value**	IS47-SD05-0306	IS47-SD07-0306	IS47-SD08-0306	IS47-SD09-0306	IS47-SD17-0306
Sample Date	**Value**	**Source**	03/09/06	03/09/06	03/09/06	03/09/06	03/09/06
Pesticide/Polychlorinated Biphenyls (µg/kg)							
4,4'-DDD	4.88	EPA Region 3	**14** J	**5.9** J	4.9 UJ	5.6 UJ	6.9 UJ
4,4'-DDE	3.16	EPA Region 3	5 UJ	**7.1** J	4.9 UJ	5.6 UJ	6.9 UJ
4,4'-DDT	4.16	EPA Region 3	5 UJ	**9.9** J	4.9 UJ	5.6 UJ	6.9 UJ
Endrin ketone[3]	2.22	EPA Region 3	**4.5** J	**4** J	**5.5** J	**5.6** J	**6** J
Explosives (µg/kg)							
Nitroguanidine	NSV		100 U	100 U	98 U	45 J	98 U
Total Metals (mg/kg)							
Aluminum	25500	NOAA	3,620 K	14,500 K	2,020 K	11,900 K	14,400 K
Arsenic	9.8	EPA Region 3	2.1 J	6.1	0.9 U	3.3 J	1.5 J
Barium	NSV		24.2 J	66.6	16 J	57.7 J	52.2 J
Beryllium	NSV		0.81 J	1.3 J	0.3 U	0.81 J	1 J
Cadmium	0.99	EPA Region 3	0.51 J	0.38 J	0.3 U	0.76 J	0.32 U
Chromium	43.4	EPA Region 3	7.1	30.9	5.5	20.6	18.2
Cobalt	50	EPA Region 3	5.8 J	11.3 J	3.7 J	5.6 J	31.4
Copper	31.6	EPA Region 3	7.3 J	17.4 J	13.7 J	16.4 J	10.3 J
Cyanide	NSV		0.2 U	0.24 J	0.18 U	0.22 U	0.2 U
Iron	20000	EPA Region 3	8,040 J	14,700 J	4,080 J	12,300 J	6,730 J
Lead	35.8	EPA Region 3	11.8 J	18.8 J	29.2 J	20.3 J	16.2 J
Manganese	460	EPA Region 3	52.6 J	44.6 J	32.1 J	72.1 J	259 J
Mercury	0.18	EPA Region 3	**0.53**	**0.4**	0.11	0.058	**0.74**
Nickel	22.7	EPA Region 3	6.2 J	15	3.1 J	9.9 J	10.3 J
Silver	1	EPA Region 3	**7.4**	**1.9** J	0.81 J	0.34 U	**5.6**
Vanadium	NSV		12 J	48.8	9 J	34.9	19.6
Zinc	121	EPA Region 3	46.3 J	53 J	32.8 J	**137** J	43.4 J

Table 2
Screening of Detecetd Constituents
Site 47 Supplemental BERA Investigation Results
NSF-IH, Indian Head, MD

Station ID	**Ecological**	**Screening**	IS47SD05	IS47SD07	IS47SD08	IS47SD09	IS47SD17
Sample ID	**Screening**	**Value**	IS47-SD05-0306	IS47-SD07-0306	IS47-SD08-0306	IS47-SD09-0306	IS47-SD17-0306
Sample Date	**Value**	**Source**	03/09/06	03/09/06	03/09/06	03/09/06	03/09/06
Wet Chemistry (mg/kg)							
% Solids			66	58	68	70	76
Total organic carbon (TOC)			12,000	47,700	23,100	18,100	9,260
pH			4.9	4.6	4.1	5.5	4.8
Acid Volatile Sulfide/Simultaneously Extractable Metals (μmole/g)							
Cadmium			0.004	0.0026	0.0022	0.0038	0.0012 B
Copper			0.082	0.13	0.067	0.1	0.04
Lead			0.04	0.064	0.09	0.048	0.032
Mercury			0.000039 B	0.000059	0.000016 B	0.000046 B	0.000067
Nickel			0.067	0.076	0.035	0.023 B	0.029
Silver			0.02	0.0036	0.00052 J	0.00039	0.021
Zinc			0.65	0.29	0.44	0.46	0.19
Sulfide (from AVS)			0.21	0.019 U	2.3	0.026 U	0.024 U
SEM-AVS (Molar Sum)			0.7	0.5	-1.7	0.6	0.3

Notes:

Values in bold text exceed screening values

B - Analyte not detected above associated blank

J - Reported value is estimated

K - Analyte present. Reported value may be biased high. Actual value is expected to be lower

NA - Not Analyzed for analyte

R - Unreliable result

U - Analyte not detected

UJ - Not detected, quantitation limit may be inaccurate

UL - Not detected, quantitation limit may be higher

NSV - No screening value

ORNL - Oak Ridge National Laboratory

[1] - Value adjusted for average TOC of 2.2 percent

[2] NSV (Value for 2-Methylnaphthalene used as surrogate)

[3] NSV (Value for endrin used as surrogate)

SEM molar sum is the difference between the sum of metal concentration and the sulfide (from AVS) concentration.