AECOM Environment

Submitted by:
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March 5, 2010

Evaluation of Data Collected Under the Yard 520 Sampling and Analysis Plan

Pines Area of Investigation
AOC II
Docket No. V-W-'04-C-784

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Disclaimer

This document is a document prepared under a federal administrative order on consent and revised based on comments received from the U.S. Environmental Protection Agency (USEPA). This document has been approved by the USEPA, and is the final version of the document.

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List of Acronyms

AOC II	Administrative Order on Consent, 2004; Docket No. V-W-'04-C-784
CCB	Coal Combustion By-Product
DUA	Data Usability Assessment
EEQ	Environmental Effects Quotient
EMPC	Estimated Maximum Possible Concentration
EPRI	Electric Power Research Institue
ESL	Ecological Screening Level
EqP	Equilibrium Partitioning
FCM	Food Chain Model
FSP	Field Sampling Plan
IDEM	Indiana Department of Environmental Management
Koc	Organic-Carbon Partition Coefficient
NIPSCO	Northern Indiana Public Service Company
ORNL	Oak Ridge National Laboratory
PAH	Polycyclic Aromatic Hydrocarbon
PCDD	Polychlorinated Dibenzo-p-dioxin
PCDF	Polychlorinated Dibenzofuran
PRG	Preliminary Remediation Goal
QC	Quality Control
RI	Remedial Investigation
RI/FS	Remedial Investigation and Feasibility Study
SAP	Sampling and Analysis Plan
SMS	Site Management Strategy
SOW	Statement of Work
TCDD	Tetrachlorodibenzo-p-dioxin
TEF	Toxicity Equivalency Factor
TEQ	Toxic Equivalent
TL-4	Trophic Level-4
TOC	Total Organic Carbon
TRV	Toxicity Reference Value

USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
WHO	World Health Organization

1.0 Introduction

In April 2004, the United States Environmental Protection Agency (USEPA) and the Respondents (Brown Inc., Ddalt Corp., Bulk Transport Corp., and Northern Indiana Public Service Company (NIPSCO)) signed an Administrative Order on Consent (AOC II) (Docket No. V-W-'04-C-784) to conduct a Remedial Investigation and Feasibility Study (RI/FS) at the Pines Area of Investigation, as set forth in Exhibit I to AOC II, located in the environs of the Town of Pines, Indiana. AOC II (Sections VII. 20 and 21) and its attachment, the Statement of Work (SOW) (Tasks 2 and 3), require the Respondents to develop a RI/FS Work Plan to conduct a Remedial Investigation (RI) as components of the RI/FS process. One of the components of the RI/FS Work Plan is the development of the analytical program for the RI.

The Site Management Strategy (SMS) (ENSR, 2005a) and the RI Report (AECOM, 2010) provide details on the location, description and the historical background for the Area of Investigation. The purpose of the RI is to evaluate the presence of constituents in environmental media within the Area of Investigation that may be derived from coal combustion by-products (CCBs). Because of their nature, the primary CCB-derived constituents are metals. As documented in the SMS (ENSR, 2005a), a literature review indicates that other parameters, such as polycyclic aromatic hydrocarbons (PAHs), polychlorinated dibenzodioxins (PCDDs), polychlorinated dibenzofurans (PCDFs), and radionuclides are not typically present in CCBs at concentrations of concern to human or ecological receptors. However, in response to the USEPA request for site-specific confirmation, ten samples and a duplicate were collected in September 2005 from the Type III (South) Area of Yard 520 and were analyzed for PAHs, PCDDs/PCDFs, and radionuclides under the USEPA-approved Yard 520 Sampling and Analysis Plan (SAP) (ENSR, 2005b). In addition to the radionuclide analysis, uranium was also analyzed using SW846 3050B/6020. The purpose of this work was to determine if these analyte groups should be included in the RI. In addition, the Yard 520 SAP included the sampling plan for the collection of background surface soil samples for laboratory analysis.

A draft report "Evaluation of Polycyclic Aromatic Hydrocarbon, and Polychlorinated Dibenzodioxin/ Polychlorinated Dibenzofuran Data from Yard 520" (ENSR, 2006) was submitted to the USEPA on April 25, 2006 (referenced herein as the "Draft Yard 520 Data Report"). USEPA provided comments on that report on June 8, 2006 (see Attachment B). Additional correspondence between the USEPA and the Respondents relating to the Draft Yard 520 Data Report is referred to in the sections that follow and is provided in Attachment B. This report is a revision to the Draft Yard 520 Data Report based on that correspondence.

The samples collected for analysis in September 2005 from the Type III (South) Area of Yard 520 are representative of CCBs placed in Yard 520 rather than native soils. The concentrations of PAHs, PCDDs/PCDFs, and radionuclides in the samples reflect worst-case concentrations of these parameters in CCBs that may be present within the Area of Investigation.

A risk-based evaluation of the sample data for PAHs and PCDDs/PCDFs is presented in this document. Sample data were compared to available screening levels using the methods described in the USEPA-approved RI/FS Work Plan (ENSR, 2005c) Volume 5 (Human Health Risk Assessment Work Plan) and Volume 6 (Ecological Risk Assessment Work Plan). The sources of screening levels are discussed in the appropriate sections below.

Section 2 provides a summary of the field investigations. Section 3 provides a summary of the validation of the analytical data.

PAHs are discussed in Section 4. As described in Section 4, based on correspondence between the USEPA and the Respondents, no additional sampling for PAHs was required by USEPA for the RI. PCDDs/PCDFs are discussed in Section 5. Based on correspondence between the USEPA and the Respondents, USEPA required the collection of samples from Brown Ditch for analysis of PCDDs/PCDFs (and radionuclides). The results are presented in Section 5. Based on these results, no additional sampling for PCDDs/PCDFs was required by USEPA in the RI. Literature reviews were also conducted and are presented in the applicable sections; these reviews were also published in the SMS (ENSR, 2005a).

The radionuclide data are presented in Section 6, and the background surface soil data are presented in Section 7. Evaluation of the radionuclide data for samples collected from Yard 520 (and for samples collected from USEPA-approved sediment locations in Brown Ditch and background soil locations), and evaluation of the background surface soil data for metals will be included in the Human Health Risk Assessment Report and the Ecological Risk Assessment Report, to be submitted, per AOC II, 60 days after approval of the RI Report (AECOM, 2010). Conclusions are presented in Section 8, and references are provided in Section 9.

2.0 Field Investigation

The field investigation included the collection of samples of CCBs from the Type III (South) Area of Yard 520, the collection of samples of sediment from Brown Ditch, and the collection of samples of surface soil from background locations within and around the Area of Investigation.

2.1 Yard 520 Type III (South) Area Sampling

Samples were collected from 10 borings located in the Type III (South) Area of Yard 520 in September 2005. The boring logs prepared in the field for these ten borings were misplaced. Therefore, based on discussions with USEPA, four of the borings were redrilled in September 2006 to record soil classification information only; no soil samples were collected. Two of the borings (GP005 and GP006) were advanced in the same locations as the previous borings. The remaining two borings (GP009A and GP012A) had to be moved a short distance from the original locations due to refusal. Each boring was logged on field forms in accordance with ENSR SOP Number 7116 Pines as referenced in the Yard 520 SAP (ENSR, 2005b), the Unified Soil Classification System (USCS) protocols, and Indiana Department of Environmental Management (IDEM) guidance. Figure 1 shows the locations of the borings. The boring logs are provided in Attachment A.

The samples from the original 10 borings plus one duplicate from the Yard 520 borings were submitted for laboratory analysis of PAHs, PCDDs/PCDFs, radionuclides, and total uranium. The analytical results are presented and discussed by parameter group in Sections 4, 5 and 6.

2.2 Brown Ditch Sediment Sampling

Sediment samples were collected from 5 locations within the West Branch of Brown Ditch (see Figure 2). This sampling was conducted during the October 2006 round of sampling for the RI program (AECOM, 2010). Two surface (0 – 0.5 foot) sediment samples were collected from locations upgradient of Yard 520 (SW001 and SW020), and three surface sediment samples and a duplicate were collected from locations at or downgradient of Yard 520 (SW022, SW023, and SW024). Two deeper (0.5 – 1 foot) sediment samples were collected at locations SW022 and SW023, per the RI/FS Work Plan (ENSR, 2005c). Sediment samples were submitted for laboratory analysis of PCDDs/PCDFs, radionuclides, and total uranium. Sediment sample locations are shown on Figure 2. The sediment sample collection records are presented in the RI Report (AECOM, 2010). The analytical results are presented and discussed by parameter group in Sections 5 and 6.

2.3 Background Surface Soil Sampling

Surface soil samples were collected on April 30 and May 1, 2007 from the 25 USEPA-approved background locations, including 15 samples of granular soils and 10 samples of organic soils. At each location, the soil material was inspected to ensure suspected CCBs were not present. Details of the sample collection are provided in Section 2.6 of the RI Report (AECOM, 2010). Background samples were analyzed for metals (including total uranium), sulfur, and radionuclides. Background sample locations are shown on Figure 3. The analytical results are presented and discussed in Sections 2 and 4, and in the RI Report (AECOM, 2010).

3.0 Data Validation

Validation of the data collected under the Yard 520 SAP included the review of analytical procedures, quality control (QC), calibration, data reduction, and completeness of the laboratory data package as specified in the Yard 520 SAP (ENSR, 2005b). A Data Usability Assessment (DUA) was prepared for the data collected under the Yard 520 SAP. The DUA describes the procedures used to evaluate the acceptability of the data collected. The primary objective of the data review and usability evaluation was to ensure that appropriate data were used in the evaluation of these results. The DUA for the data collected under the Yard 520 SAP, including the sediment samples collected from Brown Ditch, is provided in Attachment C. The data validation reports are presented in Attachment D. The DUA for the background samples is presented in the RI Report (AECOM, 2010).

4.0 PAHs

The PAH analytical data for the CCB samples collected from the Type III (South) Area of Yard 520 are presented on Table 1. The Data Usability Assessment is presented in Attachment C. These data were presented in the Draft Yard 520 Data Evaluation Report (ENSR, 2006). USEPA submitted comments on the report dated June 8, 2006 (see Attachment B). Based on the Respondents' September 8, 2006 response to comments (see Attachment B), USEPA concluded that no further sampling for PAHs was required for the RI in an email dated October 10, 2006 (see Attachment B).

4.1 Data Evaluation

As identified in the Work Plan, Volume 5 (ENSR, 2005c) and in USEPA Region 5 guidance (USEPA, 1998a), applicable human health screening levels for PAHs are USEPA Region 9 Preliminary Remediation Goals (PRGs) (USEPA, 2004) for residential soil. PRGs are risk-based concentrations in soil corresponding to a cancer risk level of 1x10-6 and a hazard index of 1. PRGs for residential soil assume daily contact by an adult and a child and assume incidental ingestion, dermal contact, and inhalation of soil-derived dusts and vapors over a 30-year exposure duration. Human health screening levels for PAHs are listed in Table 1. All sample results for PAHs are below human health screening levels, as presented in Table 1.

As identified in the Work Plan, Volume 6 (ENSR, 2005c), applicable ecological screening levels for PAHs are USEPA Region 5 Ecological Screening Levels (ESLs) (USEPA, 2003a); these values are also listed in Table 1. USEPA requested that individual and total PAH concentrations also be compared to ESLs for sediment. Region 5 does not have a sediment ESL for Total PAHs. However, USEPA Region 4 has a sediment screening level for Total PAHs (1.684 mg/kg; USEPA, 2001). The sediment ESLs are also provided in Table 1. All detected sample results for PAHs are below ecological screening levels, as presented in Table 1. Although several of the detection limits for acenaphthene, acenaphthylene and fluorene are slightly above the individual Region 5 PAH ESLs, half the detection limit for each of these samples (a common surrogate used for risk calculations) is not. Moreover, as can be seen in the table, the total PAH concentration for each sample location is below the USEPA Region 4 Total PAH screening level.

4.2 Literature Review

PAHs were not included as constituents of potential concern in the USEPA Groundwater Pathway Risk Assessment for the Technical Background Document for the Supplemental Report to Congress on Remaining Fossil Fuel Combustion Wastes (USEPA, 1998b) based on a review of available data. In its document responding to comments (Report to Congress: Wastes from the Combustion of Fossil Fuels, USEPA, 2000), USEPA concluded:

> "…that organic constituents, including PAHs, are infrequently present in [fossil fuel combustion] wastes at levels above analytical detection limits. This conclusion is consistent with the expectation that organics are destroyed in the combustion process or pass out the stack. Given this conclusion, the Agency did not consider organics in its risk assessment. EPA also did not include a detailed summary of the organics

characterization data from these sources in the docket, because any such summary would consist primarily of non-detects."

The Electric Power Research Institute (EPRI) published a literature review in 1987 (Inorganic and Organic Constituents in Fossil Fuel Combustion Residues. Volume 1: A Critical Review) that summarized data on inorganics and organics in fossil fuel combustion residues (EPRI, 1987). The report summarized several publications regarding PAHs in fly ash and fly ash extract.

- Results of extract data from Illinois basin coal fly ash indicated that less than 1 mg/L of phenanthrene, pyrene, and chrysene were detected (Roy, et al., 1984, as cited in EPRI, 1987).
- In a study of over 100 organic compounds in wet scrubber and electrostatic precipitator ash, pyrene was detected at a concentration of 20 ug/L in extracts (Harrison, et al., 1985, as cited in EPRI, 1987). Naphthalene was also found in extracts of both fly ash types.
- Based on the partitioning coefficient for naphthalene, all PAH compounds identified in the two ash types were determined to "pose little concern for potential groundwater contamination," with concentrations less than in some drinking water samples (Harrison, et al., 1985, as cited in EPRI, 1987).
- PAH concentrations in fly ash samples ranged from trace to 0.9 ug/kg (total PAHs of 4 ug/kg) in a study of electrostatic precipitator hopper ash (Griest and Guerin, 1979, as cited in EPRI, 1987). A second study of PAHs in fly ash reported concentrations ranging from 8 ug/kg (benzo(a)pyrene) to 200 ug/kg (2-methylchrysene), with the total of 10 PAHs reported at 833 ug/kg. Four PAHs (2-methylchrysene, chrysene, 3-methylpyrene, and 2-methylphenanthrene) accounted for over 70% of the total PAH concentration (Tomkins, et al., 1983, as cited in EPRI, 1987).

In several other studies of coal fly ash, total PAH concentrations were detected at low levels, generally less than 10 mg/kg, with many reporting levels less than 1 mg/kg (Ariditsoglou, et al., 2004; Sear, et al., 2003; Voutsa, et al., 2004). According to Ariditsoglou, et al. (2004), five- and six-ring PAHs contribute the least to total PAH concentration, which is of interest given this group includes five of the potentially carcinogenic PAHs (benzo(a)anathracene, benzo(b)fluoranthene, benzo(a)pyrene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene). Another study reported that phenanthrene, pyrene, and fluoranthene were the dominant PAHs in coal fly ash (Voutsa, et al., 2004).

The literature review indicates that concentrations of PAHs in CCBs are expected to be below risk-based standards. The data evaluation presented in Section 2.1 is consistent with this conclusion.

5.0 PCDDs/PCDFs

The PCDD/PCDF results for the 10 CCB samples (and one duplicate) collected from the Type III (South) Area of Yard 520 were presented in the Yard 520 Data Evaluation Report (ENSR, 2006). USEPA submitted comments on the April 2006 Draft Yard 520 Data Evaluation Report on June 8, 2006 (see Attachment B). The Respondents submitted responses to those comments to the Agency on September 8, 2006 (see Attachment B). USEPA submitted responses to those comments on October 10, 2006 (see Attachment B) in which they requested further sampling for PCDDs/PCDFs in sediments. The Respondents submitted a work plan for the additional sediment sampling to the Agency on October 13, 2006 (see Attachment B), and the Agency approved the work plan on October 17, 2006 (see Attachment B).

The requested sediment sampling was conducted in October 2006 concurrent with the RI sampling program. On February 16, 2007, the Respondents submitted a memo to USEPA with the PCDD/PCDF results for the sediment samples (see Attachment B). On March 7, 2007, the Respondents submitted a memorandum to the agency with recommendations for the RI sampling program (see Attachment B). On April 16, 2007, the USEPA submitted comments on the recommendations, and indicated that no further sampling would be required for PCDDs/PCDFs (see Attachment B).

Section 5.1 describes the sampling for PCDDs/PCDFs. Section 5.2 provides an overview of the use of toxic equilvalency factors to evaluate PCDD/PCDF data. Section 5.3 provides the human health risk-based evaluation of the PCDD/PCDF data. Section 5.4 provides the ecological risk-based evaluation of the PCDD/PCDF data. Section 5.5 provides a summary of the results, and a review of the literature on the occurrence of PCDDs/PCDFs in CCBs is presented in Section 5.6, which is essentially unchanged from the April 2006 Yard 520 Data Evaluation Report.

5.1 Sampling for PCDDs/PCDFs

Ten samples of CCBs were collected from the Type III (South) Area of Yard 520 in September 2005 and analyzed for PCDDs/PCDFs (see Figure 1). The sediment sampling required by USEPA for PCDDs/PCDFs was conducted during October 2006 concurrent with the RI sampling program. A map of the six locations where the eight sediment samples were collected and submitted for PCDD/PCDF analysis is presented in Figure 2. The Data Usability Assessment for these data is presented in Attachment C.

5.2 Use of Toxic Equivalency Factors (TEFs)

As presented in the Work Plan, Volume 5 and Volume 6 (ENSR, 2005c), the screening levels for PCDDs/PCDFs apply to 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) on a toxic equivalence basis. Toxic equivalency factors (TEFs) are fractions that equate the potential toxicity of each congener to that of 2,3,7,8-TCDD. The World Health Organization (WHO) has assigned a TEF to each of the

applicable PCDD/PCDF congeners for humans/mammals (Van den Berg, et al., 2006) and birds and fish (Van den Berg, et al., 1998). The human/mammal, bird and fish TEFs are listed in Table 2. The concentration for each PCDD/PCDF congener is then multiplied by its TEF, resulting in a TCDD toxic equivalent concentration (TCDD-TEQ). The TCDD-TEQ values for each of the congeners are then added together to derive a TCDD-TEQ for each sample for human/mammal, bird and fish receptors.

5.3 Human Health Evaluation

The human health screening level for TCDD-TEQ (as presented in the Work Plan) is 1,000 ng/kg (USEPA, 1998c).

PCDD/PCDF sample results for the samples collected from Yard 520 as well as the TCDD-TEQ values for human health for each sample are presented in Table 3. All human health TCDD-TEQ values are significantly below (less than 0.2% of) the human health screening level of 1,000 ng/kg.

PCDD/PCDF sample results for the samples collected from Brown Ditch in October 2006 as well as the TCDD-TEQ values for human health for each sample are presented in Table 4. All human health TCDD-TEQ values are significantly below (less than 0.1% of) the human health screening level of 1,000 ng/kg.

Based on these results, and the ecological screening results presented below, USEPA indicated in correspondence dated April 16, 2007 (see Attachment B) that further sampling for PCDDs/PCDFs was not required for the RI program.

5.4 Ecological Evaluation

A discussion of the ecological screening levels for TCDD-TEQ is presented in Section 5.4.1 for soils and Section 5.4.2 for sediments. The sample results are discussed in Section 5.4.3.

5.4.1 TCDD-TEQ Screening Levels for Soil

The ecological screening level for soil for TCDD-TEQ is the USEPA Region 5 ESL of 0.199 ng/kg (USEPA, 2003a). The USEPA Region 5 ESL was derived based on a small mammal (the masked shrew (Sorex cinerus)) and may not be applicable to evaluating impacts to birds. No avian-based soil screening values for TCDDs were identified based on a review of USEPA, Oak Ridge National Laboratory (ORNL), and other literature sources. USEPA wildlife toxicity reference values (TRVs) developed for 2,3,7,8-TCDD indicate that birds are less sensitive to PCDDs/PCDFs than mammals (USEPA, 1999). The TRV developed for birds is an order of magnitude higher than for mammals. Applying this relationship to the USEPA Region 5 ESL, would result in an avian screening level of 1.99 ng/kg TCDD-TEQ.

ORNL has used food web modeling to derive PRGs for birds and mammals exposed to TCDD in the soil (Sample, et al., 1997). These PRGs represent concentrations of constituents in soil intended to correspond to minimal and acceptable levels of effect. The most conservative TCDD PRGs derived for

birds for was 15.8 ng/kg for the American woodcock (*Scolopax minor*) and for TCDDs for mammals was 3.15 ng/kg for the short-tailed shrew (*Blarina brevicauda*). The woodcock and the shrew are both insectivores likely to maximize the soil ingestion pathway.

In addition, in USEPA's National Dioxin Study (USEPA, 2003b), even background locations not expected to have TCDDs present had measured concentrations of 2,3,7,8-TCDD up to 11.2 ng/kg. Levels of octa-, hepta-, and hexa-chlorodibenzo-p-dioxins were also detected up to 3,300 ng/kg, 640 ng/kg, and 99 ng/kg, respectively, in semi-rural portions of Minnesota (ATSDR, 1998). This study indicated that PCDDs/PCDFs are found throughout the United States.

These soil screening levels were originally presented in the April 2006 Draft Yard 520 Data Evaluation Report, and provide a context within which to evaluate the Yard 520 sample results, as summarized below:

- The USEPA Region 5 ESL of 0.199 ng/kg (USEPA, 2003a)
- An alternative avian screening level of 1.99 ng/kg based on the USEPA Region 5 ESL and the USEPA TRV relationship between mammalian and avian receptors
- An ORNL avian PRG of 15.8 ng/kg for the American woodcock (*Scolopax minor*)
- An ORNL mammalian PRG of 3.15 ng/kg for the short-tailed shrew (*Blarina brevicauda*)

5.4.2 TCDD-TEQ Screening Levels for Sediment

The USEPA Region 5 sediment ESL for TCDD-TEQ is 0.121 ng/kg, which is based on the Equilibrium Partitioning (EqP) theory for deriving sediment screening values. This level is discussed below in the context of the application of site-specific factors when considering and interpreting the results of the sediment sampling. Alternative sediment screening levels that may be more appropriate for the Area of Investigation are also discussed. The information in this section was originally submitted to the Agency in a memorandum dated February 16, 2007 (see Attachment B).

Application of Site-Specific Factors

The basis of the EqP theory for deriving sediment screening values is that partitioning of constituents between solid and aqueous phases occurs in sediments. The surface water screening level, the organic carbon partition coefficient (Koc), and the fraction of organic carbon in the sediment are used to derive the sediment screening level. The USEPA Region 5 sediment ESL was derived from a wildlife-based surface water screening level using the EqP approach and an assumption of 1% total organic carbon (TOC) in sediment. Therefore, a site-specific sediment screening level can also be derived through application of a site-specific TOC value.

Based on a discussion with the Respondents, USEPA (E. Karecki) investigated the use of site-specific factors such as sediment TOC to establish the sediment screening level. Mr. Karecki confirmed the

appropriateness of the approach as indicated by the information in the footnotes of the Region 5 ESL table, in an e-mail communication dated January 10, 2007 (see Attachment B).

Accordingly, based on recent USEPA guidance (USEPA, 1999; USEPA, 2005), a default sediment TOC level of 4% was applied to the Region 5 sediment ESL to derive a site-specific sediment screening value of 0.480 ng/kg, for application to the Yard 520 TCDD-TEQ sample results. The 4% TOC value is used based on the mid-point of the range of values for bottom sediments (3% to 5% TOC) identified in a literature search by USEPA (1993). USEPA (1998d) states that the organic carbon content in bottom sediments is higher than the organic carbon content in soils because (1) erosion favors finer-grained soils with higher organic carbon contents, and (2) bottom sediments are partially comprised of detritus materials (e.g., fall leaf litter). The use of this default TOC value is supported by field observations made during the field reconnaissance conducted on November 1, 2005 attended by USEPA, and documented in the RI Report (AECOM, 2010). Visual observations of sediments (obtained with the Russian peat borer) within Brown Ditch downgradient of Yard 520 indicate that sediment material is often found to a depth of greater than 10 inches. Also, several locations were described as highly organic (see notes regarding sediment depth and composition in "Sediment Sample Locations 11-2005" document sent to Tim Drexler on November 18, 2005; see Attachment B). These more highly organic sediments reduce the bioavailable fraction of organic compounds such as PCDDs/PCDFs and warrant an increase in the associated ecological screening levels. Note that the field reconnaissance and the TOC evaluation presented above took place prior to Brown Ditch sediment sample collection and analysis.

Alternative Sediment Screening Levels

A review, as discussed below, of the source of the Region 5 sediment ESL of 0.121 ng/kg (USEPA, 2003a) indicates that it is likely too conservative for application to Brown Ditch. Therefore, appropriate sediment screening levels other than the Region 5 sediment ESL were identified.

The surface water screening level (3×10^{-9} ug/L) used in derivation of the Region 5 sediment ESL was developed to be protective of piscivorous avian and mammalian wildlife and considered impacts to eagle, kingfisher, herring gull, mink, and otter. The ESL documentation does not indicate which species the surface water screening level applies to, but the Indiana Water Quality Standards in the Indiana Administrative Code (327 IAC 2-1.5-15) indicate that the lower of the geometric means of the values for birds and mammals is selected. This methodology is consistent with the Michigan Water Quality Standards (MCL R 323.1041-1117) which is considered the source document for this methodology.

Application of values based on these receptors, while appropriate for the Great Lakes open water environment, is too conservative for Brown Ditch. For example, the diet assumed for three of these receptors (otter, herring gull, and eagle) includes consumption of 18 to 20% trophic level four (TL-4) fish. Brown Ditch provides *de minimis* habitat to TL-4 fish (i.e., piscivorous predators like lake trout, walleye or largemouth bass). TL-4 fish will experience a larger fraction of a bioaccumulative constituent (like PCDDs/PCDFs) due to a greater food chain multiplier (FCM) than fish actually found in Brown Ditch, and so the resulting assumed exposure is conservative for Brown Ditch. In addition, the potentially

impacted sediments within Brown Ditch represent only a small fraction of the potential home range of the piscivorous wildlife receptors considered in the derivation of the sediment ESL.

An applicable reference for potential impacts to benthic receptors is in the USEPA's Interim Report on Data and Methods for Assessment of 2,3,7,8-Tetrachlorodibenzo-p-dioxin Risks to Aquatic Life and Associated Wildlife (USEPA, 1993), which is listed as a source of benchmarks on Region 5's website (http://www.epa.gov/region5/superfund/ecology/html/screenguide.htm#tcdd). This document presents fish- and wildlife-based sediment concentrations that are derived from no-effect thresholds for reproductive effects. The sediment screening level for avian receptors is 21 ng/kg, the screening level for mammalian receptors is 2.5 ng/kg, and the screening level for fish is 60 ng/kg.

Lastly, USEPA (1999) derived a sediment screening level for 2,3,7,8-TCDD from a fish-based surface water screening level using the EqP approach and an assumption of 4% TOC. The surface water screening level (3.8×10^{-6} ug/L) was based on a chronic low observed effect concentration for rainbow trout; assuming a 4% TOC results in a fish-based sediment screening level of 410 ng/kg (USEPA, 1999).

Summary of Ecological PCDD/PCDF Screening Levels for Sediment

The screening evaluation of PCDD/PCDF data for Brown Ditch sediments uses the site-specific screening level and the alternative screening levels as summarized below:

- The USEPA Region 5 sediment ESL of 0.121 ng/kg (USEPA, 2003a).
- A site-specific sediment screening level of 0.480 ng/kg, based on the application of a 4% TOC level.
- A sediment screening level for avian receptors of 21 ng/kg (USEPA, 1993).
- A sediment screening level for mammalian receptors of 2.5 ng/kg (USEPA, 1993).
- A sediment screening level for fish of 60 ng/kg (USEPA, 1993).
- A sediment screening level for fish (rainbow trout) of 410 ng/kg (USEPA, 1999).

5.4.3 Ecological Screening Results

A comparison of the Yard 520 sample results to screening levels for soil and sediment is presented below, followed by a comparison of the Brown Ditch sample results to screening levels for sediment.

Yard 520 CCB Sample Results

Table 5 presents the PCDD/PCDF results for the samples collected in September 2005 from Yard 520 and compares them to the ecological screening levels for TCDD-TEQ in soil. All but two of the eleven Yard 520 TCDD-TEQ values for mammals and birds are below the ESL of 0.199 ng/kg for TCDD-TEQ in soil. TCDD-TEQ values for the samples collected at locations GP012 and GP013 are above the ESL,

but the concentration for GP013 is above the screening level of 0.199 ng/kg by only a very small amount (above by 0.031 ng/kg (bird) and above by 0.191 ng/kg (mammal)). The concentrations in all samples are below the TRV-adjusted ESL of 1.99 ng/kg for avian receptors. The detected concentrations in GP012 and GP013 are below both the ORNL avian PRG (15.8 ng/kg) and the mammalian PRG (3.15 ng/kg). These PRGs confirm that the application of the mammalian USEPA Region 5 ESL to assess risks to birds is extremely conservative, as the avian PRG is three times greater than the mammalian PRG. The levels of PCDDs/PCDFs detected in these two samples are consistent with the observed levels found throughout the US, particularly those downwind of industrialized areas, as noted above (ATSDR, 1998). The TCDD-TEQ values for GP012 and GP013 are all well below the ORNL PRGs, indicating that impacts to avian and mammalian communities are highly unlikely.

Table 6 presents the PCDD/PCDF results for the samples collected in September 2005 from Yard 520 and compares them to the ecological screening levels for TCDD-TEQ in sediment. All but four of the eleven Yard 520 TCDD-TEQ values for mammals and birds are below the TOC-unadjusted ESL of 0.121 ng/kg for TCDD-TEQ in sediment. Only for one sample, GP012, are the TCDD-TEQ values for mammals and birds above the 4% TOC-adjusted ESL of 0.48 ng/kg. All of the Yard 520 TCDD-TEQs were well below all of the sediment screening levels presented by USEPA (1993) and USEPA (1999). The results in Table 5 and Table 6 indicate that ecological receptors are unlikely to be at risk due to exposure to PCDDs/PCDFs.

Brown Ditch Sediment Sample Results

In addition to the evaluation of the TCDD-TEQ results for CCBs collected from yard 520, Brwon Ditch sediment samples were collected and analyzed for PCDDs/PCDFs. Table 7 presents the PCDD/PCDF results for the samples collected in October 2006 from Brown Ditch and compares them to the ecological screening levels for TCDD-TEQ in sediment. Sample locations are shown on Figure 2.

Based on the site-specific TOC data for these Brown Ditch sediment samples, TOC-adjusted sediment screening levels were derived on a sample-by-sample basis for samples from the West Branch of Brown Ditch at locations both upgradient and downgradient of Yard 520. The TOC content in surficial samples from the West Branch of Brown Ditch ranged from 0.91 to 4.66% (Table 8), reflecting the range of sandy to peaty conditions in these samples. The corresponding TOC-adjusted USEPA Region 5 sediment screening levels range from 0.11 to 0.56 ng/kg for the sample-specific TOC values.

Table 7 also presents each of the alternative sediment screening levels for TCDD-TEQ identified above. Comparison of these low risk screening levels to the sediment concentrations shows that none of the TCDD-TEQ concentrations upgradient or downgradient of Yard 520 are above them.

Table 8 provides a simplified version of the data and summarizes the sample-specific TOC-adjusted PCDD/PCDF ecological screening levels for sediment, based on application of the sample-specific TOC to the USEPA Region 5 ESL. The data are arranged in order of upgradient to downgradient in the West Branch of Brown Ditch for the surficial sediments (i.e., 0-0.5 foot) (see Figure 2). The surficial sediments were considered because they are the ecologically appropriate media to use to estimate exposure for

wildlife receptors. Data for the deeper (sub-surficial, 0.5-1 foot) sediments were also considered, but the surficial sediments generally have the higher concentrations of constituents of interest.

In Table 8, the TCDD-TEQ for the surficial sediments have been compared to the ESLs to derive Environmental Effects Quotients (EEQs) for avians and mammals. The EEQ is calculated by dividing an estimated environmental concentration (i.e., the TCDD-TEQ concentration) by the site-specific TOC-adjusted screening level, using the equation shown below:

EEQ (unitless) = Estimated Environmental Concentration (ng/kg) / Screening Level (ng/kg)

An EEQ below one indicates that the environmental concentration is below the screening level. An EEQ above one indicates that the environmental concentration is above the screening level.

Several important conclusions can be made from the data presented in Table 8. First, none of the surficial sediment EEQs for avain receptors were above one. Second, there are only two EEQs for mammalian receptors above one. The largest of the two was at SW001 (EEQ = 1.7), an upgradient location; and the second, smaller one was at SW022 (EEQ = 1.3), a downgradient location (see Figure 2). Of the two sediment sample locations where the EEQ is above one, the largest EEQ is at the upgradient location. Also, these results do not show a pattern of increased risk due to PCDDs/PCDFs in sediments at downgradient locations. Of the three locations where the EEQ is below one, the EEQ for the upgradient location is greater than or equal to the EEQs for the two downgradient locations.

The data for the two deep (0.5-1 foot) sediment samples collected in October 2006 were also reviewed. One of these deep samples (SW023) has higher EEQ values (2.2 for avians and 4.4 for mammals). However, these values are not indicative of increased PCDD/PCDF concentrations at SW023, but rather reflect the extremely low TOC value (0.21%) at this location resulting in an extremely low TOC-adjusted ESL. Neither the other deep sample (SW022) nor the overlying surficial sample located at SW023 has an EEQ greater than 1.0.

5.5 Screening Results Summary

The screening results for the Yard 520 and Brown Ditch samples analyzed for PCDDs/PCDFs indicate that these constituents do not pose a risk to human or ecological receptors.

5.6 Literature Review

USEPA conducted a Groundwater Pathway Risk Assessment (USEPA, 1998b) in order to characterize potential risks to human health and the environment from certain wastes, including coal-fired utility co-mingled wastes, oil-fired utility wastes, fluidized bed combustion wastes, and non-utility fossil fuel combustion wastes. PCDDs and PCDFs were excluded from the risk assessment based on a literature review of available data regarding PCDDs and PCDFs in coal fly ash. A detailed summary of the review is published in Appendix L of the risk assessment (USEPA, 1998b). Sixteen publications were reviewed by USEPA during the first two phases. The third phase consisted of a review of a report by EPRI (1998).

Of the 16 publications reviewed during the first two phases of the USEPA assessment (USEPA, 1998b), eight contained information on PCDDs and PCDFs in samples of coal fly ash. The remaining eight summarized laboratory experiments, flue gas data, and theoretical information on the potential for PCDDs and PCDFs to form during the coal combustion process. According to the assessment, three of the eight publications (cited in USEPA, 1998b) reporting on PCDDs and PCDFs indicated that these parameters were not detected. The remaining five publications reported very low levels of PCDDs and/or PCDFs. Reported concentrations (as cited in USEPA, 1998b), converted to micrograms per kilogram (ug/kg), are presented below. When combined with current TEFs (Van den Berg, et al., 2006), relating the toxicity of each congener to that of 2,3,7,8-TCDD, the TEQs are well below the USEPA human health screening level for TCDD-TEQ in residential soil of 1 ug/kg (USEPA, 1998c).

Reported concentrations and TCDD-TEQs are listed below:

- American Electric Power Service Corporation, 1994:
    - 0.0003 ug/kg 2,3,4,6,7,8-HexaCDF (TEF = 0.1, TEQ = 0.00003 ug/kg)
    - 0.0014 ug/kg 1,2,3,4,6,7,8-HeptaCDD (TEF = 0.01, TEQ = 0.000014 ug/kg)
- Chiu, et al., 1983:
    - 0.000001 to 0.00032 ug/kg (congeners not listed, so TEQs cannot be calculated)
- Czuczwa, 1984:
    - 0.000002 to 0.000004 ug/kg OctaCDD (TEF = 0.0003, TEQ = 6×10^{-10} to 1.2×10^{-9} ug/kg)
- Kuykendal, et al., 1989:
    - 0.01 to 0.07 ug/kg OctaCDD (TEF = 0.0001, TEQ = 0.000003 to 0.000021 ug/kg)
    - 0.01 to 0.2 ug/kg unspecified HexaCDF (TEFs all = 0.1, TEQ = 0.001 to 0.02 ug/kg)
    - 0.01 to 0.2 ug/kg unspecified HeptaCDF (TEFs all = 0.01, TEQ = 0.0001 to 0.002 ug/kg)

The eight publications reviewed by USEPA that did not include fly ash data support the conclusion that appreciable levels of PCDDs and PCDFs are not formed during the coal combustion process. The temperature used to burn coal in a coal-fired power plant differs significantly from the temperature used in waste incinerators and does not promote the formation of PCDDs and PCDFs. In addition, the sulfur dioxide found in coal inhibits the formation of PCDDs and PCDFs.

A review of EPRI (1998) was included in USEPA's assessment. The EPRI (1998) report was also reviewed independently for this analysis. This report summarized the results of 15 samples of CCBs collected from 11 disposal sites which were analyzed for PCDDs and PCDFs. In addition, a sample of ash from a municipal waste incinerator was analyzed as a reference.

The results of the EPRI (1998) sampling indicated that PCDDs and PCDFs were either not detected or detected at very low concentrations in the CCB samples. Detection limits ranged from 0.0001 to 0.0031 ug/kg, with the higher detection limits being for congeners with low TEFs (OctaCDD and OctaCDF).

2,3,7,8-TCDD was not detected in any of the samples, and detection limits for this congener were less than 0.001 ug/kg. TCDD-TEQs were calculated in several different ways for each sample, using full detection limits, one-half detection limits, or zero for congeners reported as not detected, and using either full or one-half values for congeners reported with Estimated Maximum Possible Concentrations (EMPCs). EMPCs are listed when there is evidence that a congener is present, but there is not enough evidence to satisfy all the criteria for listing it as a true detected response.

Calculated TCDD-TEQ concentrations for the EPRI CCB samples ranged from non-detect to 0.0021 ug/kg. The maximum calculated concentration of 0.0021 ug/kg, which was calculated using full detection limits and EMPC values and, therefore, represents the most conservative calculation method, is well below the USEPA screening level for residential soil of 1 ug/kg (USEPA, 1998c). It should be noted that the TEFs used to calculate the TEQ concentrations have been updated (Van den Berg, et al., 2006) since the publication of the EPRI report. The TEFs for 14 of the 17 congeners are the same. TEFs for OctaCDD and OctaCDF have decreased by a factor of three, such that TEQ concentrations calculated using the updated TEFs would be lower than those presented in the report. The TEF for 1,2,3,7,8-PentaCDD has increased from 0.5 to 1; however, this congener was not detected in any of the CCB samples, thus there would be no change in the TEQ concentrations.

The review of the EPRI (1998) report published in USEPA (1998b) concluded that while there may be some limitations in the data analysis and validation, the conclusions of the report are supported by the data. The reviewers concluded that the TCDD-TEQ concentrations calculated assuming zero for non-detects and full EMPC values were the most valid, and these TCDD-TEQ concentrations ranged from 0 to 0.000064 ug/kg, well below the USEPA human health residential screening level of 1 ug/kg.

Several additional studies have shown that PCDD/PCDF concentrations in coal fly ash are less than 1 ug/kg on a TEQ basis, and are similar to background concentrations in soils (Sear, et al., 2003; Ling and Hou, 1998; Voutsa, et al., 2004).

The literature review indicates that concentrations of PCDDs/PCDFs in CCBs are expected to be below risk-based standards. The PCDD/PCDF data for CCB samples collected at Yard 520 are consistent with the literature findings.

6.0 Radionuclides

The analytical data for the radionuclides for the samples collected from Yard 520 Type III (South) Area are presented on Table 9. The Data Usability Assessment is presented in Attachment C. USEPA submitted comments on the April 2006 Draft Yard 520 Data Evaluation Report on June 8, 2006 (see Attachment B). The Respondents submitted responses to those comments to the Agency on September 8, 2006 (see Attachment B). USEPA submitted responses to those comments on October 10, 2006 (see Attachment B) in which they requested further sampling for radionuclides in sediments. The Respondents submitted a work plan for the additional sediment sampling to the Agency on October 13, 2006 (see Attachment B), and the Agency approved the work plan on October 17, 2006 (see Attachment B). The requested sediment sampling was conducted during the October 2006 round of the RI sampling program. The analytical data for the radionuclides for the sediment samples are presented on Table 12. On February 1, 2008, USEPA requested that the background surface soil samples be analyzed for radionuclides (see Attachment B); these data are presented in Section 7. The data originally presented in the Draft Yard 520 Data Evaluation Report, and the data presented here will be further evaluated in the Human Health Risk Assessment and the Ecological Risk Assessment.

7.0 Background Soil Sample Results

The Yard 520 SAP (ENSR, 2006) included the collection of background surface soil samples from 25 locations known to not contain suspected CCBs to determine site-specific background conditions. The background soil sample locations were approved by USEPA in correspondence dated April 16, 2007 (see Attachment B). Background samples were collected in April and May of 2007 and were analyzed for metals. USEPA requested that the samples be analyzed for radionuclides in correspondence dated February 1, 2008 (see Attachment B).

All of the CCB-derived constituents under investigation at the Area of Investigation are also present naturally in many geologic materials. Therefore, to appropriately evaluate impacts associated with CCB-derived constituents, it is necessary to understand the background levels (natural and anthropogenic) of these constituents in soils. The background soil sampling was conducted to provide these data.

Background surface soil samples were collected in areas known not to contain suspected CCBs to determine typical background exposure point concentrations within the Area of Investigation. Samples were collected from native soils, including two general soil types: granular soils (typically sand, but also including silt and clay) and organic soils (present in lowland and wetland areas). The background soil sample locations were approved by USEPA in correspondence dated April 16, 2007 (see Attachment B). Additionally, USEPA was present during the sampling, and adjusted some of the sample locations in the field. The final background soil sample locations are shown on Figure 3.

Surface soil samples were collected on April 30 and May 1, 2007 from the 25 approved background locations. At each location, the soil material was inspected to ensure suspected CCBs were not present. Details of the sample collection are provided in Section 2.6 of the RI Report (AECOM, 2010). Analytical results for the background surface soil samples are provided in Table 10 (metals and inorganic parameters) and Table 11 (radionuclides).

Results of the background sampling are discussed in Section 4.2 of the RI Report (AECOM, 2010). The background data will be used in the Human Health Risk Assessment and the Ecological Risk Assessment.

8.0 Summary and Conclusions

PAH concentrations present in Yard 520 are below both human health and ecological screening levels, as presented in Table 1. These data indicate that PAHs in CCBs are below levels of human health and ecological concern. A literature review indicates that levels of PAHs in CCBs are expected to be low. Therefore, no further sampling or evaluation of PAHs is recommended. USEPA confirmed that no additional sampling of PAHs was required in a communication dated October 10, 2006 (see Attachment B).

PCDD/PCDF concentrations in Yard 520 and in Brown Ditch sediments are below the human health screening level, as presented in Tables 3 and 4, respectively. A detailed evaluation of the Yard 520 data and Brown Ditch sediment data with respect to ecological risk-based screening levels indicates that the majority of the sample results are below ecological risk-based screening levels with a few exceptions. The samples with concentrations above ecological risk-based screening levels are evaluated in detail in Section 5, with the conclusion that impacts to avian and mammalian communities are unlikely. A literature review indicates that levels of PCDDs/PCDFs in CCBs are expected to be low. Therefore, no further sampling or evaluation of PCDDs/PCDFs is recommended. USEPA confirmed that no additional sampling of PCDDs/PCDFs was required in a communication dated April 16, 2007 (see Attachment B).

Further evaluation of the radionuclide data for the samples collected from Yard 520, and the radionuclide and metals data for the background surface soil samples will be presented in the Human Health Risk Assessment Report and the Ecological Risk Assessment Report, to be submitted, per AOC II, 60 days after approval of the RI Report (AECOM, 2010).

This report incorporates responses to comments received from USEPA on August 22, 2008 (see Appendix E). In addition, final responses to comments on this report (as well as the RI Report) were received on November 3, 2009. Only one additional comment was provided on this report, in which no changes were necessary. Copies of the comments are provided in Appendix DD of the RI Report (AECOM, 2010).

9.0 References

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Tables

TABLE 1
VALIDATED PAH RESULTS FOR YARD 520 SAMPLES
COMPARED TO SCREENING LEVELS
YARD 520 DATA EVALUATION REPORT
PINES AREA OF INVESTIGATION

ENSR | AECOM

CAS No.	Chemical Name	Human Health Screening Level for Soil/Sediment (a) mg/kg	Ecological Screening Level for Soil (f) mg/kg	Ecological Screening Level for Sediment (g) mg/kg	GP004 9/23/2005 GP004ICB092305S CCB mg/kg	GP005 9/23/2005 GP005ICB092305S CCB mg/kg	GP006 9/23/2005 GP006ICB092305S CCB mg/kg
91-57-6	2-Methylnaphthalene	56 (b)	3.24	0.0202	0.0049 UJ	0.007 UJ	0.0047 UJ
83-32-9	Acenaphthene	3700	682	0.00671	0.0088 UJ	0.0089 UJ	0.0095 UJ
208-96-8	Acenaphthylene	3700 (c)	682	0.00587	0.0088 UJ	0.003 J	0.0095 UJ
120-12-7	Anthracene	22000	1480	0.0572	0.0045 J	0.0042 J	0.0095 UJ
56-55-3	Benz(a)anthracene	0.62	5.21	0.108	0.0091 J	0.009 J	0.0047 UJ
50-32-8	Benzo(a)pyrene	0.062	1.52	0.15	0.0084 J	0.0099 J	0.0095 UJ
205-99-2	Benzo(b)fluoranthene	0.62	59.8	10.4	0.013 J	0.013 J	0.0095 UJ
191-24-2	Benzo(g,h,i)perylene	2300 (d)	119	0.1702	0.0075 J	0.0089 J	0.0095 UJ
207-08-9	Benzo(k)fluoranthene	6.2	148	0.24	0.0045 J	0.0054 J	0.0095 UJ
218-01-9	Chrysene	62	4.73	0.166	0.011 J	0.011 J	0.0095 UJ
53-70-3	Dibenz(a,h)anthracene	0.062	18.4	0.033	0.0088 UJ	0.0089 UJ	0.0095 UJ
206-44-0	Fluroanthene	2300	122	0.423	0.023 J	0.022 J	0.0095 UJ
86-73-7	Fluorene	2700	122	0.00774	0.0088 UJ	0.0089 UJ	0.0095 UJ
193-39-5	Indeno(1,2,3-cd)pyrene	0.62	109	0.2	0.0059 J	0.0069 J	0.0095 UJ
91-20-3	Naphthalene	56	0.0994	0.176	0.0088 UJ	0.0089 UJ	0.0095 UJ
85-01-8	Phenanthrene	22000 (e)	45.7	0.204	0.015 J	0.013 J	0.0095 UJ
129-00-0	Pyrene	2300	78.5	0.195	0.016 J	0.018 J	0.0095 UJ
	Total PAHs (b)	NA	NA	1.684 (h)	0.1179	0.1243	0.04985

Notes:

CAS - Chemical Abstracts Service.

CCB - Coal Combustion By-Product.

NA - Not Applicable.

PAH - Polycyclic Aromatic Hydrocarbon.

J - The result is an estimated quantity; the associated numerical value is the approximate concentration of the analyte.

U - The analyte was analyzed for, but was not detected above the sample reporting limit.

UJ - The analyte was not detected above the sample reporting limit; and the reporting limit is approximate.

(a) - USEPA, 2004a. Preliminary Remediation Goals (PRGs). October 1, 2004. Value for Residential Soil.
http://www.epa.gov/region09/waste/sfund/prg/index.html

(b) - No PRG available. Due to structural similarities, the value for naphthalene was used.

(c) - No PRG available. Due to structural similarities, the value for acenaphthene was used.

(d) - No PRG available. Due to structural similarities, the value for pyrene was used.

(e) - No PRG available. Due to structural similarities, the value for anthracene was used.

(f) - USEPA Region 5 Ecological Screening Level. Updated August 22, 2003.
(http://www.epa.gov/reg5rcra/ca/ESL.pdf)

(g) - USEPA Region 5 Ecological Screening Level for Sediment. Updated August 22, 2003.
(http://www.epa.gov/reg5rcra/ca/ESL.pdf)

(h) - USEPA Region 4 Screening Value for Sediment. Updated November 30, 2001.
(http://www.epa.gov/region4/waste/ots/ecolbul.htm)

Highlighting indicates that detected concentration is greater than the screening level.

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COMPARED TO SCREENING LEVELS
YARD 520 DATA EVALUATION REPORT
PINES AREA OF INVESTIGATION

ENSR | AECOM

CAS No.	Chemical Name	Human Health Screening Level for Soil/Sediment (a) mg/kg	Ecological Screening Level for Soil (f) mg/kg	Ecological Screening Level for Sediment (g) mg/kg	GP007 9/23/2005 GP007ICB092305S CCB mg/kg	GP008 9/23/2005 GP008ICB092305S CCB mg/kg	GP008 9/23/2005 GP008ICB092305D CCB mg/kg
91-57-6	2-Methylnaphthalene	56 (b)	3.24	0.0202	0.0052 UJ	0.0048 UJ	0.0048 UJ
83-32-9	Acenaphthene	3700	682	0.00671	0.01 UJ	0.0096 UJ	0.0095 UJ
208-96-8	Acenaphthylene	3700 (c)	682	0.00587	0.01 UJ	0.0096 UJ	0.0095 UJ
120-12-7	Anthracene	22000	1480	0.0572	0.01 UJ	0.0096 UJ	0.0095 UJ
56-55-3	Benz(a)anthracene	0.62	5.21	0.108	0.0052 UJ	0.0048 UJ	0.0048 UJ
50-32-8	Benzo(a)pyrene	0.062	1.52	0.15	0.0041 J	0.0096 UJ	0.0095 UJ
205-99-2	Benzo(b)fluoranthene	0.62	59.8	10.4	0.0052 J	0.0096 UJ	0.0095 UJ
191-24-2	Benzo(g,h,i)perylene	2300 (d)	119	0.1702	0.0039 J	0.0096 UJ	0.0095 UJ
207-08-9	Benzo(k)fluoranthene	6.2	148	0.24	0.01 UJ	0.0096 UJ	0.0095 UJ
218-01-9	Chrysene	62	4.73	0.166	0.0038 J	0.0096 UJ	0.0095 UJ
53-70-3	Dibenz(a,h)anthracene	0.062	18.4	0.033	0.01 UJ	0.0096 UJ	0.0095 UJ
206-44-0	Fluroanthene	2300	122	0.423	0.01 UJ	0.0096 UJ	0.0095 UJ
86-73-7	Fluorene	2700	122	0.00774	0.01 UJ	0.0096 UJ	0.0095 UJ
193-39-5	Indeno(1,2,3-cd)pyrene	0.62	109	0.2	0.01 UJ	0.0096 UJ	0.0095 UJ
91-20-3	Naphthalene	56	0.0994	0.176	0.01 UJ	0.0096 UJ	0.0095 UJ
85-01-8	Phenanthrene	22000 (e)	45.7	0.204	0.01 UJ	0.0096 UJ	0.0095 UJ
129-00-0	Pyrene	2300	78.5	0.195	0.01 UJ	0.0096 UJ	0.0095 UJ
	Total PAHs (b)	NA	NA	1.684 (h)	0.0496	0.0499	0.0504

Notes:

CAS - Chemical Abstracts Service.

CCB - Coal Combustion By-Product.

NA - Not Applicable.

PAH - Polycyclic Aromatic Hydrocarbon.

J - The result is an estimated quantity; the associated numerical value is the approximate concentration of the analyte.

U - The analyte was analyzed for, but was not detected above the sample reporting limit.

UJ - The analyte was not detected above the sample reporting limit; and the reporting limit is approximate.

(a) - USEPA, 2004a. Preliminary Remediation Goals (PRGs). October 1, 2004. Value for Residential Soil.
http://www.epa.gov/region09/waste/sfund/prg/index.html

(b) - No PRG available. Due to structural similarities, the value for naphthalene was used.

(c) - No PRG available. Due to structural similarities, the value for acenaphthene was used.

(d) - No PRG available. Due to structural similarities, the value for pyrene was used.

(e) - No PRG available. Due to structural similarities, the value for anthracene was used.

(f) - USEPA Region 5 Ecological Screening Level. Updated August 22, 2003.
(http://www.epa.gov/reg5rcra/ca/ESL.pdf)

(g) - USEPA Region 5 Ecological Screening Level for Sediment. Updated August 22, 2003.
(http://www.epa.gov/reg5rcra/ca/ESL.pdf)

(h) - USEPA Region 4 Screening Value for Sediment. Updated November 30, 2001.
(http://www.epa.gov/region4/waste/ots/ecolbul.htm)

Highlighting indicates that detected concentration is greater than the screening level.

TABLE 1
VALIDATED PAH RESULTS FOR YARD 520 SAMPLES
COMPARED TO SCREENING LEVELS
YARD 520 DATA EVALUATION REPORT
PINES AREA OF INVESTIGATION

ENSR | AECOM

CAS No.	Chemical Name	Human Health Screening Level for Soil/Sediment (a) mg/kg	Ecological Screening Level for Soil (f) mg/kg	Ecological Screening Level for Sediment (g) mg/kg	GP009 9/23/2005 GP009ICB092305S CCB mg/kg	GP010 9/23/2005 GP010ICB092305S CCB mg/kg	GP011 9/23/2005 GP011ICB092305S CCB mg/kg
91-57-6	2-Methylnaphthalene	56 (b)	3.24	0.0202	0.0054 UJ	0.0069 UJ	0.014 UJ
83-32-9	Acenaphthene	3700	682	0.00671	0.011 UJ	0.011 UJ	0.027 UJ
208-96-8	Acenaphthylene	3700 (c)	682	0.00587	0.011 UJ	0.0038 J	0.027 UJ
120-12-7	Anthracene	22000	1480	0.0572	0.011 UJ	0.0066 J	0.027 UJ
56-55-3	Benz(a)anthracene	0.62	5.21	0.108	0.0054 UJ	0.012 J	0.017 J
50-32-8	Benzo(a)pyrene	0.062	1.52	0.15	0.0042 J	0.0091 J	0.015 J
205-99-2	Benzo(b)fluoranthene	0.62	59.8	10.4	0.0068 J	0.011 J	0.019 J
191-24-2	Benzo(g,h,i)perylene	2300 (d)	119	0.1702	0.0042 J	0.0066 J	0.012 J
207-08-9	Benzo(k)fluoranthene	6.2	148	0.24	0.011 UJ	0.011 UJ	0.027 UJ
218-01-9	Chrysene	62	4.73	0.166	0.0052 J	0.011 J	0.017 J
53-70-3	Dibenz(a,h)anthracene	0.062	18.4	0.033	0.011 UJ	0.011 UJ	0.027 UJ
206-44-0	Fluroanthene	2300	122	0.423	0.011 J	0.028 J	0.04 J
86-73-7	Fluorene	2700	122	0.00774	0.011 UJ	0.003 J	0.027 UJ
193-39-5	Indeno(1,2,3-cd)pyrene	0.62	109	0.2	0.0036 J	0.0054 J	0.027 UJ
91-20-3	Naphthalene	56	0.0994	0.176	0.011 UJ	0.011 UJ	0.027 UJ
85-01-8	Phenanthrene	22000 (e)	45.7	0.204	0.011 UJ	0.023 J	0.027 UJ
129-00-0	Pyrene	2300	78.5	0.195	0.0075 J	0.023 J	0.028 J
	Total PAHs (b)	NA	NA	1.684 (h)	0.0562	0.1425	0.1615

Notes:

CAS - Chemical Abstracts Service.

CCB - Coal Combustion By-Product.

NA - Not Applicable.

PAH - Polycyclic Aromatic Hydrocarbon.

J - The result is an estimated quantity; the associated numerical value is the approximate concentration of the analyte.

U - The analyte was analyzed for, but was not detected above the sample reporting limit.

UJ - The analyte was not detected above the sample reporting limit; and the reporting limit is approximate.

(a) - USEPA, 2004a. Preliminary Remediation Goals (PRGs). October 1, 2004. Value for Residential Soil.
http://www.epa.gov/region09/waste/sfund/prg/index.html

(b) - No PRG available. Due to structural similarities, the value for naphthalene was used.

(c) - No PRG available. Due to structural similarities, the value for acenaphthene was used.

(d) - No PRG available. Due to structural similarities, the value for pyrene was used.

(e) - No PRG available. Due to structural similarities, the value for anthracene was used.

(f) - USEPA Region 5 Ecological Screening Level. Updated August 22, 2003.
(http://www.epa.gov/reg5rcra/ca/ESL.pdf)

(g) - USEPA Region 5 Ecological Screening Level for Sediment. Updated August 22, 2003.
(http://www.epa.gov/reg5rcra/ca/ESL.pdf)

(h) - USEPA Region 4 Screening Value for Sediment. Updated November 30, 2001.
(http://www.epa.gov/region4/waste/ots/ecolbul.htm)

Highlighting indicates that detected concentration is greater than the screening level.

TABLE 1
VALIDATED PAH RESULTS FOR YARD 520 SAMPLES
COMPARED TO SCREENING LEVELS
YARD 520 DATA EVALUATION REPORT
PINES AREA OF INVESTIGATION

ENSR | AECOM

CAS No.	Chemical Name	Human Health Screening Level for Soil/Sediment (a) mg/kg	Ecological Screening Level for Soil (f) mg/kg	Ecological Screening Level for Sediment (g) mg/kg	GP012 9/23/2005 GP012ICB092305S CCB mg/kg	GP013 9/23/2005 GP013ICB092305S CCB mg/kg
91-57-6	2-Methylnaphthalene	56 (b)	3.24	0.0202	0.015 UJ	0.0096 UJ
83-32-9	Acenaphthene	3700	682	0.00671	0.0097 UJ	0.019 UJ
208-96-8	Acenaphthylene	3700 (c)	682	0.00587	0.0097 UJ	0.019 UJ
120-12-7	Anthracene	22000	1480	0.0572	0.0097 UJ	0.019 UJ
56-55-3	Benz(a)anthracene	0.62	5.21	0.108	0.0058 J	0.01 J
50-32-8	Benzo(a)pyrene	0.062	1.52	0.15	0.0044 J	0.008 J
205-99-2	Benzo(b)fluoranthene	0.62	59.8	10.4	0.0056 J	0.011 J
191-24-2	Benzo(g,h,i)perylene	2300 (d)	119	0.1702	0.0041 J	0.007 J
207-08-9	Benzo(k)fluoranthene	6.2	148	0.24	0.0097 UJ	0.019 UJ
218-01-9	Chrysene	62	4.73	0.166	0.0069 J	0.012 J
53-70-3	Dibenz(a,h)anthracene	0.062	18.4	0.033	0.0097 UJ	0.019 UJ
206-44-0	Fluroanthene	2300	122	0.423	0.0096 J	0.016 J
86-73-7	Fluorene	2700	122	0.00774	0.0097 UJ	0.019 UJ
193-39-5	Indeno(1,2,3-cd)pyrene	0.62	109	0.2	0.0097 UJ	0.019 UJ
91-20-3	Naphthalene	56	0.0994	0.176	0.0097 UJ	0.019 UJ
85-01-8	Phenanthrene	22000 (e)	45.7	0.204	0.018 J	0.019 UJ
129-00-0	Pyrene	2300	78.5	0.195	0.0093 J	0.012 J
	Total PAHs (b)	NA	NA	1.684 (h)	0.07825	0.0855

Notes:

CAS - Chemical Abstracts Service.

CCB - Coal Combustion By-Product.

NA - Not Applicable.

PAH - Polycyclic Aromatic Hydrocarbon.

J - The result is an estimated quantity; the associated numerical value is the approximate concentration of the analyte.

U - The analyte was analyzed for, but was not detected above the sample reporting limit.

UJ - The analyte was not detected above the sample reporting limit; and the reporting limit is approximate.

(a) - USEPA, 2004a. Preliminary Remediation Goals (PRGs). October 1, 2004. Value for Residential Soil.
http://www.epa.gov/region09/waste/sfund/prg/index.html

(b) - No PRG available. Due to structural similarities, the value for naphthalene was used.

(c) - No PRG available. Due to structural similarities, the value for acenaphthene was used.

(d) - No PRG available. Due to structural similarities, the value for pyrene was used.

(e) - No PRG available. Due to structural similarities, the value for anthracene was used.

(f) - USEPA Region 5 Ecological Screening Level. Updated August 22, 2003.
(http://www.epa.gov/reg5rcra/ca/ESL.pdf)

(g) - USEPA Region 5 Ecological Screening Level for Sediment. Updated August 22, 2003.
(http://www.epa.gov/reg5rcra/ca/ESL.pdf)

(h) - USEPA Region 4 Screening Value for Sediment. Updated November 30, 2001.
(http://www.epa.gov/region4/waste/ots/ecolbul.htm)

Highlighting indicates that detected concentration is greater than the screening level.

TABLE 2
TEFs FOR PCDDs AND PCDFs
YARD 520 DATA EVALUATION REPORT
PINES AREA OF INVESTIGATION

ENSR | AECOM

Chemical Name	CAS NO.	Human/Mammalian TEF (a)	Bird TEF (b)	Fish TEF (b)
PCDDs				
2,3,7,8-TetraCDD	1746-01-6	1	1	1
1,2,3,7,8-PentaCDD	40321-76-4	1	1	1
1,2,3,4,7,8-HexaCDD	39227-28-6	0.1	0.05	0.5
1,2,3,6,7,8-HexaCDD	57653-85-7	0.1	0.01	0.01
1,2,3,7,8,9-HexaCDD	19408-74-3	0.1	0.1	0.01
1,2,3,4,6,7,8-HeptaCDD	35822-46-9	0.01	0.001	0.001
OctaCDD	3268-87-9	0.0003	0.001	0.0001
PCDFs				
2,3,7,8-TetraCDF	51207-31-9	0.1	1	0.05
1,2,3,7,8-PentaCDF	57117-41-6	0.03	0.1	0.05
2,3,4,7,8-PentaCDF	57117-31-4	0.3	1	0.5
1,2,3,4,7,8-HexaCDF	70648-26-9	0.1	0.1	0.1
1,2,3,6,7,8-HexaCDF	57117-44-9	0.1	0.1	0.1
1,2,3,7,8,9-HexaCDF	72918-21-9	0.1	0.1	0.1
2,3,4,6,7,8-HexaCDF	60851-34-5	0.1	0.1	0.1
1,2,3,4,6,7,8-HeptaCDF	67562-39-4	0.01	0.01	0.01
1,2,3,4,7,8,9-HeptaCDF	55673-89-7	0.01	0.01	0.01
OctaCDF	39001-02-0	0.0003	0.0001	0.0001

Notes:
CAS - Chemical Abstracts Service.
CDD - Chorodibenzo-p-dioxin.
CDF - Chlorodibenzofuran.
PCDD- Polychlorinated Dibenzo-p-dioxin.
PCDF - Polychlorinated Dibenzofuran.
TEF - Toxic Equivalency Factor.
(a) - "The 2005 World Health Organization Reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like Compounds." Van den Berg, et al. 2006.
(b) - "Toxic Equivalency Factors for PCBs, PCDDs, PCDFs for Humans and Wildlife." Van den Berg, et al. 1998.

TABLE 3
VALIDATED PCDD/PCDF RESULTS FOR YARD 520 SAMPLES
COMPARED TO HUMAN HEALTH SCREENING LEVELS
YARD 520 DATA EVALUATION REPORT
PINES AREA OF INVESTIGATION

ENSR | AECOM

CAS No.	Chemical Name		GP004 9/23/2005 GP004ICB092305S CCB ng/kg		GP005 9/23/2005 GP005ICB092305S CCB ng/kg		GP006 9/23/2005 GP006ICB092305S CCB ng/kg		GP007 9/23/2005 GP007ICB092305S CCB ng/kg		GP008 9/23/2005 GP008ICB092305S CCB ng/kg		GP008 9/23/2005 GP008ICB092305D CCB ng/kg	
35822-46-9	1,2,3,4,6,7,8-HEPTACHLORODIBENZO-P-DIOXIN		1.915	J	2.551	J	1.696	J	1.271	J	3.545	J	0.644	J
67562-39-4	1,2,3,4,6,7,8-HpCDF		0.266	J	0.266	J	0.057	U	0.264	J	0.247	JK	0.128	JK
55673-89-7	1,2,3,4,7,8,9-HpCDF		0.044	U	0.08	U	0.074	U	0.08	U	0.091	U	0.049	U
39227-28-6	1,2,3,4,7,8-HEXACHLORODIBENZO-P-DIOXIN		0.048	U	0.033	U	0.064	U	0.046	U	0.063	U	0.048	U
70648-26-9	1,2,3,4,7,8-HxCDF		0.142	J	0.088	JK	0.148	J	0.218	J	0.159	J	0.124	J
57653-85-7	1,2,3,6,7,8-HEXACHLORODIBENZO-P-DIOXIN		0.043	U	0.03	U	0.057	U	0.041	U	0.06	U	0.047	U
57117-44-9	1,2,3,6,7,8-HxCDF		0.036	U	0.017	U	0.022	U	0.033	U	0.038	U	0.03	U
19408-74-3	1,2,3,7,8,9-HEXACHLORODIBENZO-P-DIOXIN		0.044	U	0.031	U	0.059	U	0.043	U	0.06	U	0.046	U
72918-21-9	1,2,3,7,8,9-HxCDF		0.042	U	0.021	U	0.026	U	0.039	U	0.047	U	0.036	U
57117-41-6	1,2,3,7,8-PENTACHLORODIBENZOFURAN		0.021	U	0.025	U	0.038	U	0.038	U	0.031	U	0.033	U
40321-76-4	1,2,3,7,8-PENTACHLORODIBENZO-P-DIOXIN		0.029	U	0.029	U	0.044	U	0.041	U	0.041	U	0.049	U
60851-34-5	2,3,4,6,7,8-HxCDF		0.071	J	0.019	U	0.023	U	0.035	U	0.041	U	0.032	U
57117-31-4	2,3,4,7,8-PeCDF		0.02	U	0.023	U	0.036	U	0.035	U	0.03	U	0.032	U
1746-01-6	2,3,7,8-TCDD		0.032	U	0.031	U	0.043	U	0.039	U	0.056	U	0.055	U
51207-31-9	2,3,7,8-TETRACHLORODIBENZOFURAN		0.056	U	0.051	U	0.064	U	0.064	U	0.076	U	0.099	U
3268-87-9	OCDD		22.643	U	66.103		15.822	U	5.28	U	24.665	UJ	4.273	UJ
39001-02-0	OCDF		0.483	J	0.443	J	0.46	J	0.355	J	0.58	JK	0.395	JK
		Human Health												
		Screening Level												
		ng/kg												
	TCDD-TEQ - Human Health (a,b)	1000	0.05		0.05		0.04		0.05		0.07		0.03	

Notes:
CAS - Chemical Abstracts Service.
CCB - Coal Combustion By-Product.
J - The result is an estimated quantity; the associated numerical value is the approximate concentration.
K - Estimated Maximum Potential Concentration.
U - The analyte was analyzed for, but was not detected above the sample reporting limit.
UJ - The analyte was not detected above the sample reporting limit; and the reporting limit is approximate.
PCDD - Polychlorinated Dibenzo-p-dioxin.
PCDF - Polychlorinated Dibenzofuran.
TCDD-TEQ - 2,3,7,8-tetrachlorodibenzo-p-dioxin toxic equivalent concentration.
(a) - Calculated per Human Health and/or Ecological Work Plan using
"The 2005 World Health Organization Reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like Compounds."
Van den Berg, et al. 2006.
(b) - Compared to 1000 ng/kg. USEPA, 1998c. Approach for Addressing Dioxin in Soil at CERCLA and RCRA Sites. Value for dioxins. [OSWER Directive 9200.4-26].
Highlighting indicates that TCDD-TEQ is above the screening level.

TABLE 3
VALIDATED PCDD/PCDF RESULTS FOR YARD 520 SAMPLES
COMPARED TO HUMAN HEALTH SCREENING LEVELS
YARD 520 DATA EVALUATION REPORT
PINES AREA OF INVESTIGATION

ENSR | AECOM

CAS No.	Chemical Name		GP009 9/23/2005 GP009ICB092305S CCB ng/kg		GP010 9/23/2005 GP010ICB092305S CCB ng/kg		GP011 9/23/2005 GP011ICB092305S CCB ng/kg		GP012 9/23/2005 GP012ICB092305S CCB ng/kg		GP013 9/23/2005 GP013ICB092305S CCB ng/kg	
35822-46-9	1,2,3,4,6,7,8-HEPTACHLORODIBENZO-P-DIOXIN		10.509		2.358	J	3.683	J	87.582		19.079	
67562-39-4	1,2,3,4,6,7,8-HpCDF		0.099	U	0.129	U	0.33	J	5.142		1.904	J
55673-89-7	1,2,3,4,7,8,9-HpCDF		0.128	U	0.167	U	0.077	U	0.487	JK	0.082	U
39227-28-6	1,2,3,4,7,8-HEXACHLORODIBENZO-P-DIOXIN		0.069	U	0.076	U	0.166	J	1.015	J	0.225	J
70648-26-9	1,2,3,4,7,8-HxCDF		0.054	U	0.064	U	0.162	J	0.432	J	0.193	J
57653-85-7	1,2,3,6,7,8-HEXACHLORODIBENZO-P-DIOXIN		0.397	J	0.068	U	0.251	J	3.222		0.79	J
57117-44-9	1,2,3,6,7,8-HxCDF		0.054	U	0.064	U	0.022	U	0.25	JK	0.061	U
19408-74-3	1,2,3,7,8,9-HEXACHLORODIBENZO-P-DIOXIN		0.25	J	0.071	U	0.313	J	2.475	JK	0.421	JK
72918-21-9	1,2,3,7,8,9-HxCDF		0.064	U	0.076	U	0.031	U	0.13	U	0.075	U
57117-41-6	1,2,3,7,8-PENTACHLORODIBENZOFURAN		0.04	U	0.076	U	0.039	U	0.059	U	0.039	U
40321-76-4	1,2,3,7,8-PENTACHLORODIBENZO-P-DIOXIN		0.114	U	0.134	U	0.055	U	0.08	U	0.063	U
60851-34-5	2,3,4,6,7,8-HxCDF		0.057	U	0.068	U	0.026	U	0.112	U	0.065	U
57117-31-4	2,3,4,7,8-PeCDF		0.037	U	0.071	U	0.04	U	0.06	U	0.037	U
1746-01-6	2,3,7,8-TCDD		0.112	U	0.106	U	0.05	U	0.078	U	0.066	U
51207-31-9	2,3,7,8-TETRACHLORODIBENZOFURAN		0.132	U	0.123	U	0.059	U	0.105	U	0.11	U
3268-87-9	OCDD		25.926	UJ	11.459	UJ	58.181	J	424.803	J	108.247	
39001-02-0	OCDF		0.238	UJ	0.281	UJ	0.647	J	9.944	J	1.615	J
		Human Health										
		Screening Level										
		ng/kg										
	TCDD-TEQ - Human Health (a,b)	1000	0.18		0.05		0.14		1.72		0.39	

Notes:
CAS - Chemical Abstracts Service.
CCB - Coal Combustion By-Product.
J - The result is an estimated quantity; the associated numerical value is the approximate concentration.
K - Estimated Maximum Potential Concentration.
U - The analyte was analyzed for, but was not detected above the sample reporting limit.
UJ - The analyte was not detected above the sample reporting limit; and the reporting limit is approximate.
PCDD - Polychlorinated Dibenzo-p-dioxin.
PCDF - Polychlorinated Dibenzofuran.
TCDD-TEQ - 2,3,7,8-tetrachlorodibenzo-p-dioxin toxic equivalent concentration.
(a) - Calculated per Human Health and/or Ecological Work Plan using
"The 2005 World Health Organization Reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like Compounds."
Van den Berg, et al. 2006.
(b) - Compared to 1000 ng/kg. USEPA, 1998c. Approach for Addressing Dioxin in Soil at CERCLA and RCRA Sites. Value for dioxins. [OSWER Directive 9200.4-26].
Highlighting indicates that TCDD-TEQ is above the screening level.

TABLE 4
VALIDATED PCDD/PCDF RESULTS FOR BROWN DITCH SEDIMENT
COMPARED TO HUMAN HEALTH SCREENING LEVELS
YARD 520 DATA EVALUATION REPORT
PINES AREA OF INVESTIGATION

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Chemical Name		Unit	Upstream SW001 0 - 0.5 ft 10/13/2006	Upstream SW020 0 - 0.5 ft 10/25/2006	Downstream SW022 0 - 0.5 ft 10/24/2006	Downstream SW023 0 - 0.5 ft 10/24/2006	Downstream SW023 duplicate 0 - 0.5 ft 10/24/2006	Downstream SW024 0 - 0.5 ft 10/24/2006	Deeper SW022 0.5 - 1 ft 10/24/2006	Deeper SW023 0.5 - 1 ft 10/24/2006
1,2,3,4,6,7,8-HEPTACHLORODIBENZO-P-DIOXIN		ng/kg	10.646	0.691 U	14.12 U	1.185 U	2.993 U	0.297 U	6.077 U	4.521 U
1,2,3,4,6,7,8-HpCDF		ng/kg	3.718	0.252 UJK	3.735 U	0.244 U	0.831 UJK	0.068 U	1.514 U	0.922 U
1,2,3,4,7,8,9-HpCDF		ng/kg	0.154 U	0.1 U	0.228 U	0.103 U	0.096 U	0.096 U	0.169 U	0.072 U
1,2,3,4,7,8-HEXACHLORODIBENZO-P-DIOXIN		ng/kg	0.058 U	0.069 U	0.112 U	0.064 U	0.094 U	0.052 U	0.091 U	0.054 U
1,2,3,4,7,8-HxCDF		ng/kg	0.33 U	0.048 U	0.486 U	0.035 U	0.13 U	0.035 U	0.26 U	0.124 UJK
1,2,3,6,7,8-HEXACHLORODIBENZO-P-DIOXIN		ng/kg	0.509 J	0.063 U	0.537 J	0.058 U	0.086 U	0.048 U	0.18 JK	0.171 JK
1,2,3,6,7,8-HxCDF		ng/kg	0.1 U	0.045 U	0.276 J	0.033 U	0.071 U	0.033 U	0.115 U	0.055 U
1,2,3,7,8,9-HEXACHLORODIBENZO-P-DIOXIN		ng/kg	0.057 U	0.067 U	0.413 J	0.062 U	0.091 U	0.051 U	0.231 J	0.053 U
1,2,3,7,8,9-HxCDF		ng/kg	0.157 U	0.064 U	0.235 U	0.047 U	0.101 U	0.047 U	0.165 U	0.079 U
1,2,3,7,8-PENTACHLORODIBENZOFURAN		ng/kg	0.042 U	0.041 U	0.188 J	0.048 U	0.049 U	0.033 U	0.08 U	0.035 U
1,2,3,7,8-PENTACHLORODIBENZO-P-DIOXIN		ng/kg	0.059 U	0.066 U	0.342 J	0.049 U	0.057 U	0.055 U	0.101 U	0.048 U
2,3,4,6,7,8-HxCDF		ng/kg	0.12 U	0.052 U	0.247 J	0.039 U	0.097 J	0.039 U	0.135 U	0.065 U
2,3,4,7,8-PeCDF		ng/kg	0.041 U	0.04 U	0.087 U	0.047 U	0.048 U	0.032 U	0.078 U	0.034 U
2,3,7,8-TCDD		ng/kg	0.028 U	0.032 U	0.06 U	0.032 U	0.036 U	0.031 U	0.044 U	0.023 U
2,3,7,8-TETRACHLORODIBENZOFURAN		ng/kg	0.056 U	0.048 U	1.332 U	0.088 U	0.088 U	0.059 U	0.127 U	0.582 U
OCDD		ng/kg	75.499 J	8.342 U	400.768	15.423 U	46.484 U	4.038 U	213.514	109.461
OCDF		ng/kg	9.657 J	0.35 J	8.173 J	0.653 JK	2.207 J	0.128 U	3.298 J	2.105 J
	Human Health									
	Screening Level									
TCDD-TEQ - Human Health (a,b)	1000	ng/kg	0.26	0.051	0.71	0.044	0.078	0.039	0.21	0.11

Notes:
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U - The analyte was analyzed for, but was not detected above the sample reporting limit.
UJ - The analyte was not detected above the sample reporting limit; and the reporting limit is approximate.
PCDD- Polychlorinated Dibenzo-p-dioxin.
PCDF - Polychlorinated Dibenzofuran.
TCDD-TEQ - 2,3,7,8-tetrachlorodibenzo-p-dioxin toxic equivalent concentration.
(a) - Calculated per Human Health and/or Ecological Work Plan using
"The 2005 World Health Organization Reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like Compounds."
Van den Berg, et al. 2006.
(b) - Compared to 1000 ng/kg. USEPA, 1998c. Approach for Addressing Dioxin in Soil at CERCLA and RCRA Sites. Value for dioxins. [OSWER Directive 9200.4-26].
Highlighting indicates that TCDD-TEQ is above the screening level.

TABLE 5
VALIDATED PCDD/PCDF RESULTS FOR YARD 520 SAMPLES
COMPARED TO ECOLOGICAL SCREENING LEVELS FOR SOILS
YARD 520 DATA EVALUATION REPORT
PINES AREA OF INVESTIGATION

ENSR | AECOM

CAS No.	Chemical Name		GP004 9/23/2005 GP004ICB092305S CCB ng/kg		GP005 9/23/2005 GP005ICB092305S CCB ng/kg		GP006 9/23/2005 GP006ICB092305S CCB ng/kg		GP007 9/23/2005 GP007ICB092305S CCB ng/kg		GP008 9/23/2005 GP008ICB092305S CCB ng/kg	
35822-46-9	1,2,3,4,6,7,8-HEPTACHLORODIBENZO-P-DIOXIN		1.915	J	2.551	J	1.696	J	1.271	J	3.545	J
67562-39-4	1,2,3,4,6,7,8-HpCDF		0.266	J	0.266	J	0.057	U	0.264	J	0.247	JK
55673-89-7	1,2,3,4,7,8,9-HpCDF		0.044	U	0.08	U	0.074	U	0.08	U	0.091	U
39227-28-6	1,2,3,4,7,8-HEXACHLORODIBENZO-P-DIOXIN		0.048	U	0.033	U	0.064	U	0.046	U	0.063	U
70648-26-9	1,2,3,4,7,8-HxCDF		0.142	J	0.088	JK	0.148	J	0.218	J	0.159	J
57653-85-7	1,2,3,6,7,8-HEXACHLORODIBENZO-P-DIOXIN		0.043	U	0.03	U	0.057	U	0.041	U	0.06	U
57117-44-9	1,2,3,6,7,8-HxCDF		0.036	U	0.017	U	0.022	U	0.033	U	0.038	U
19408-74-3	1,2,3,7,8,9-HEXACHLORODIBENZO-P-DIOXIN		0.044	U	0.031	U	0.059	U	0.043	U	0.06	U
72918-21-9	1,2,3,7,8,9-HxCDF		0.042	U	0.021	U	0.026	U	0.039	U	0.047	U
57117-41-6	1,2,3,7,8-PENTACHLORODIBENZOFURAN		0.021	U	0.025	U	0.038	U	0.038	U	0.031	U
40321-76-4	1,2,3,7,8-PENTACHLORODIBENZO-P-DIOXIN		0.029	U	0.029	U	0.044	U	0.041	U	0.041	U
60851-34-5	2,3,4,6,7,8-HxCDF		0.071	J	0.019	U	0.023	U	0.035	U	0.041	U
57117-31-4	2,3,4,7,8-PeCDF		0.02	U	0.023	U	0.036	U	0.035	U	0.03	U
1746-01-6	2,3,7,8-TCDD		0.032	U	0.031	U	0.043	U	0.039	U	0.056	U
51207-31-9	2,3,7,8-TETRACHLORODIBENZOFURAN		0.056	U	0.051	U	0.064	U	0.064	U	0.076	U
3268-87-9	OCDD		22.643	U	66.103		15.822	U	5.28	U	24.665	UJ
39001-02-0	OCDF		0.483	J	0.443	J	0.46	J	0.355	J	0.58	JK
		Ecological Screening Level (ng/kg)										
	TCDD-TEQ - Bird (a)	0.199		(b)	0.05		0.08		0.04		0.04		0.06
	TCDD-TEQ - Mammal (a)	0.199		(b)	0.05		0.05		0.05		0.05		0.07
	TCDD-TEQ - Bird (a)	1.99		(c)	0.05		0.08		0.04		0.04		0.06
	TCDD-TEQ - Bird (a)	15.8		(d)	0.05		0.08		0.04		0.04		0.06
	TCDD-TEQ - Mammal (a)	3.15		(e)	0.05		0.05		0.05		0.05		0.07

Notes:
CAS - Chemical Abstracts Service.
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K - Estimated Maximum Potential Concentration.
U - The analyte was analyzed for, but was not detected above the sample reporting limit.
UJ - The analyte was not detected above the sample reporting limit; and the reporting limit is approximate.
PCDD - Polychlorinated Dibenzo-p-dioxin.
PCDF - Polychlorinated Dibenzofuran.
TCDD-TEQ - 2,3,7,8-tetrachlorodibenzo-p-dioxin toxic equivalent concentration.
(a) - Calculated per Human Health and/or Ecological Work Plan using "The 2005 World Health Organization Reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like Compounds." Van den Berg, et al. 2006.
(b) - USEPA. 2003. USEPA Region 5 Ecological Screening Level for Soil. Updated August 22, 2003.(http://www.epa.gov/reg5rcra/ca/ESL.pdf) Soil screening value based on impacts to the masked shrew.
(c) - Avian screening level based on USEPA Region 5 Ecological Screening Level for Soil and adjustment factor based on relationship between avian and mammalian toxicity reference values developed by USEPA (1999).
(d) - Preliminary Remediation Goal for birds (Sample, et al., 1997)
(e) - Preliminary Remediation Goal for birds (Sample, et al., 1997)
Highlighting indicates that TCDD-TEQ is above the screening level.

TABLE 5
VALIDATED PCDD/PCDF RESULTS FOR YARD 520 SAMPLES
COMPARED TO ECOLOGICAL SCREENING LEVELS FOR SOILS
YARD 520 DATA EVALUATION REPORT
PINES AREA OF INVESTIGATION

ENSR | AECOM

CAS No.	Chemical Name		GP008 9/23/2005 GP008ICB092305D CCB ng/kg		GP009 9/23/2005 GP009ICB092305S CCB ng/kg		GP010 9/23/2005 GP010ICB092305S CCB ng/kg		GP011 9/23/2005 GP011ICB092305S CCB ng/kg		GP012 9/23/2005 GP012ICB092305S CCB ng/kg		GP013 9/23/2005 GP013ICB092305S CCB ng/kg	
35822-46-9	1,2,3,4,6,7,8-HEPTACHLORODIBENZO-P-DIOXIN		0.644	J	10.509		2.358	J	3.683	J	87.582		19.079	
67562-39-4	1,2,3,4,6,7,8-HpCDF		0.128	JK	0.099	U	0.129	U	0.33	J	5.142		1.904	J
55673-89-7	1,2,3,4,7,8,9-HpCDF		0.049	U	0.128	U	0.167	U	0.077	U	0.487	JK	0.082	U
39227-28-6	1,2,3,4,7,8-HEXACHLORODIBENZO-P-DIOXIN		0.048	U	0.069	U	0.076	U	0.166	J	1.015	J	0.225	J
70648-26-9	1,2,3,4,7,8-HxCDF		0.124	J	0.054	U	0.064	U	0.162	J	0.432	J	0.193	J
57653-85-7	1,2,3,6,7,8-HEXACHLORODIBENZO-P-DIOXIN		0.047	U	0.397	J	0.068	U	0.251	J	3.222		0.79	J
57117-44-9	1,2,3,6,7,8-HxCDF		0.03	U	0.054	U	0.064	U	0.022	U	0.25	JK	0.061	U
19408-74-3	1,2,3,7,8,9-HEXACHLORODIBENZO-P-DIOXIN		0.046	U	0.25	J	0.071	U	0.313	J	2.475	JK	0.421	JK
72918-21-9	1,2,3,7,8,9-HxCDF		0.036	U	0.064	U	0.076	U	0.031	U	0.13	U	0.075	U
57117-41-6	1,2,3,7,8-PENTACHLORODIBENZOFURAN		0.033	U	0.04	U	0.076	U	0.039	U	0.059	U	0.039	U
40321-76-4	1,2,3,7,8-PENTACHLORODIBENZO-P-DIOXIN		0.049	U	0.114	U	0.134	U	0.055	U	0.08	U	0.063	U
60851-34-5	2,3,4,6,7,8-HxCDF		0.032	U	0.057	U	0.068	U	0.026	U	0.112	U	0.065	U
57117-31-4	2,3,4,7,8-PeCDF		0.032	U	0.037	U	0.071	U	0.04	U	0.06	U	0.037	U
1746-01-6	2,3,7,8-TCDD		0.055	U	0.112	U	0.106	U	0.05	U	0.078	U	0.066	U
51207-31-9	2,3,7,8-TETRACHLORODIBENZOFURAN		0.099	U	0.132	U	0.123	U	0.059	U	0.105	U	0.11	U
3268-87-9	OCDD		4.273	UJ	25.926	UJ	11.459	UJ	58.181	J	424.803	J	108.247	
39001-02-0	OCDF		0.395	JK	0.238	UJ	0.281	UJ	0.647	J	9.944	J	1.615	J
		Ecological Screening Level (ng/kg)												
	TCDD-TEQ - Bird (a)	0.199 (b)	0.03		0.08		0.03		0.13		**0.97**		**0.23**	
	TCDD-TEQ - Mammal (a)	0.199 (b)	0.03		0.19		0.05		0.14		**1.72**		**0.39**	
	TCDD-TEQ - Bird (a)	1.99 (c)	0.03		0.08		0.03		0.13		0.97		0.23	
	TCDD-TEQ - Bird (a)	15.8 (d)	0.03		0.08		0.03		0.13		0.97		0.23	
	TCDD-TEQ - Mammal (a)	3.15 (e)	0.03		0.19		0.05		0.14		1.72		0.39	

Notes:
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PCDD - Polychlorinated Dibenzo-p-dioxin.
PCDF - Polychlorinated Dibenzofuran.
TCDD-TEQ - 2,3,7,8-tetrachlorodibenzo-p-dioxin toxic equivalent concentration.
(a) - Calculated per Human Health and/or Ecological Work Plan using "The 2005 World Health Organization Reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like Compounds." Van den Berg, et al. 2006.
(b) - USEPA. 2003. USEPA Region 5 Ecological Screening Level for Soil. Updated August 22, 2003.(http://www.epa.gov/reg5rcra/ca/ESL.pdf) Soil screening value based on impacts to the masked shrew.
(c) - Avian screening level based on USEPA Region 5 Ecological Screening Level for Soil and adjustment factor based on relationship between avian and mammalian toxicity reference values developed by USEPA (1999).
(d) - Preliminary Remediation Goal for birds (Sample, et al., 1997)
(e) - Preliminary Remediation Goal for birds (Sample, et al., 1997)
Highlighting indicates that TCDD-TEQ is above the screening level.

TABLE 6
VALIDATED PCDD/PCDF RESULTS FOR YARD 520 SAMPLES
COMPARED TO ECOLOGICAL SCREENING LEVELS FOR SEDIMENT
YARD 520 DATA EVALUATION REPORT
PINES AREA OF INVESTIGATION

ENSR | AECOM

CAS No.	Chemical Name		GP004 9/23/2005 GP004ICB092305S CCB ng/kg		GP005 9/23/2005 GP005ICB092305S CCB ng/kg		GP006 9/23/2005 GP006ICB092305S CCB ng/kg		GP007 9/23/2005 GP007ICB092305S CCB ng/kg		GP008 9/23/2005 GP008ICB092305S CCB ng/kg	
35822-46-9	1,2,3,4,6,7,8-HEPTACHLORODIBENZO-P-DIOXIN		1.915	J	2.551	J	1.696	J	1.271	J	3.545	J
67562-39-4	1,2,3,4,6,7,8-HpCDF		0.266	J	0.266	J	0.057	U	0.264	J	0.247	JK
55673-89-7	1,2,3,4,7,8,9-HpCDF		0.044	U	0.08	U	0.074	U	0.08	U	0.091	U
39227-28-6	1,2,3,4,7,8-HEXACHLORODIBENZO-P-DIOXIN		0.048	U	0.033	U	0.064	U	0.046	U	0.063	U
70648-26-9	1,2,3,4,7,8-HxCDF		0.142	J	0.088	JK	0.148	J	0.218	J	0.159	J
57653-85-7	1,2,3,6,7,8-HEXACHLORODIBENZO-P-DIOXIN		0.043	U	0.03	U	0.057	U	0.041	U	0.06	U
57117-44-9	1,2,3,6,7,8-HxCDF		0.036	U	0.017	U	0.022	U	0.033	U	0.038	U
19408-74-3	1,2,3,7,8,9-HEXACHLORODIBENZO-P-DIOXIN		0.044	U	0.031	U	0.059	U	0.043	U	0.06	U
72918-21-9	1,2,3,7,8,9-HxCDF		0.042	U	0.021	U	0.026	U	0.039	U	0.047	U
57117-41-6	1,2,3,7,8-PENTACHLORODIBENZOFURAN		0.021	U	0.025	U	0.038	U	0.038	U	0.031	U
40321-76-4	1,2,3,7,8-PENTACHLORODIBENZO-P-DIOXIN		0.029	U	0.029	U	0.044	U	0.041	U	0.041	U
60851-34-5	2,3,4,6,7,8-HxCDF		0.071	J	0.019	U	0.023	U	0.035	U	0.041	U
57117-31-4	2,3,4,7,8-PeCDF		0.02	U	0.023	U	0.036	U	0.035	U	0.03	U
1746-01-6	2,3,7,8-TCDD		0.032	U	0.031	U	0.043	U	0.039	U	0.056	U
51207-31-9	2,3,7,8-TETRACHLORODIBENZOFURAN		0.056	U	0.051	U	0.064	U	0.064	U	0.076	U
3268-87-9	OCDD		22.643	U	66.103		15.822	U	5.28	U	24.665	UJ
39001-02-0	OCDF		0.483	J	0.443	J	0.46	J	0.355	J	0.58	JK
		Ecological Screening Level (ng/kg)										
	TCDD-TEQ - Bird (a)	0.121 (b)	0.05		0.08		0.04		0.04		0.06	
	TCDD-TEQ - Mammal (a)	0.121 (b)	0.05		0.05		0.05		0.05		0.07	
	TCDD-TEQ - Bird (a)	0.48 (c)	0.05		0.08		0.04		0.04		0.06	
	TCDD-TEQ - Mammal (a)	0.48 (c)	0.05		0.05		0.05		0.05		0.07	
	TCDD-TEQ - Bird (a)	21 (d)	0.05		0.08		0.04		0.04		0.06	
	TCDD-TEQ - Mammal (a)	2.5 (d)	0.05		0.05		0.05		0.05		0.07	
	TCDD-TEQ - Fish (a)	60 (d)	0.04		0.03		0.04		0.04		0.04	
	TCDD-TEQ - Fish (a)	410 (e)	0.04		0.03		0.04		0.04		0.04	

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UJ - The analyte was not detected above the sample reporting limit; and the reporting limit is approximate.
PCDD - Polychlorinated Dibenzo-p-dioxin.
PCDF - Polychlorinated Dibenzofuran.
TCDD-TEQ - 2,3,7,8-tetrachlorodibenzo-p-dioxin toxic equivalent concentration.
(a) - Calculated per Human Health and/or Ecological Work Plan using "The 2005 World Health Organization Reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like Compounds." Van den Berg, et al. 2006.
(b) - USEPA. 2003. USEPA Region 5 Ecological Screening Level for Sediment Updated August 22, 2003.(http://www.epa.gov/reg5rcra/ca/ESL.pdf) Sediment screening value based on surface water impacts to wildlife.
(c) - USEPA Region 5 Ecological Screening Level for Sediment adjusted to 4% Total Organic Carbon.
(d) - USEPA low risk sediment concentration (USEPA, 1993) presented in the Interim Report on Data and Methods for Assessment of 2,3,7,8-Tetrachlorodibenzo-p-dioxin Risks to Aquatic Life and Associated Wildlife.
(e) - USEPA sediment screening value based on impacts to rainbow trout (USEPA, 1999).
Highlighting indicates that TCDD-TEQ is above the screening level.

TABLE 6
VALIDATED PCDD/PCDF RESULTS FOR YARD 520 SAMPLES
COMPARED TO ECOLOGICAL SCREENING LEVELS FOR SEDIMENT
YARD 520 DATA EVALUATION REPORT
PINES AREA OF INVESTIGATION

ENSR | AECOM

CAS No.	Chemical Name			GP008 9/23/2005 GP008ICB092305D CCB ng/kg		GP009 9/23/2005 GP009ICB092305S CCB ng/kg		GP010 9/23/2005 GP010ICB092305S CCB ng/kg		GP011 9/23/2005 GP011ICB092305S CCB ng/kg		GP012 9/23/2005 GP012ICB092305S CCB ng/kg		GP013 9/23/2005 GP013ICB092305S CCB ng/kg	
35822-46-9	1,2,3,4,6,7,8-HEPTACHLORODIBENZO-P-DIOXIN			0.644	J	10.509		2.358	J	3.683	J	87.582		19.079	
67562-39-4	1,2,3,4,6,7,8-HpCDF			0.128	JK	0.099	U	0.129	U	0.33	J	5.142		1.904	J
55673-89-7	1,2,3,4,7,8,9-HpCDF			0.049	U	0.128	U	0.167	U	0.077	U	0.487	JK	0.082	U
39227-28-6	1,2,3,4,7,8-HEXACHLORODIBENZO-P-DIOXIN			0.048	U	0.069	U	0.076	U	0.166	J	1.015	J	0.225	J
70648-26-9	1,2,3,4,7,8-HxCDF			0.124	J	0.054	U	0.064	U	0.162	J	0.432	J	0.193	J
57653-85-7	1,2,3,6,7,8-HEXACHLORODIBENZO-P-DIOXIN			0.047	U	0.397	J	0.068	U	0.251	J	3.222		0.79	J
57117-44-9	1,2,3,6,7,8-HxCDF			0.03	U	0.054	U	0.064	U	0.022	U	0.25	JK	0.061	U
19408-74-3	1,2,3,7,8,9-HEXACHLORODIBENZO-P-DIOXIN			0.046	U	0.25	J	0.071	U	0.313	J	2.475	JK	0.421	JK
72918-21-9	1,2,3,7,8,9-HxCDF			0.036	U	0.064	U	0.076	U	0.031	U	0.13	U	0.075	U
57117-41-6	1,2,3,7,8-PENTACHLORODIBENZOFURAN			0.033	U	0.04	U	0.076	U	0.039	U	0.059	U	0.039	U
40321-76-4	1,2,3,7,8-PENTACHLORODIBENZO-P-DIOXIN			0.049	U	0.114	U	0.134	U	0.055	U	0.08	U	0.063	U
60851-34-5	2,3,4,6,7,8-HxCDF			0.032	U	0.057	U	0.068	U	0.026	U	0.112	U	0.065	U
57117-31-4	2,3,4,7,8-PeCDF			0.032	U	0.037	U	0.071	U	0.04	U	0.06	U	0.037	U
1746-01-6	2,3,7,8-TCDD			0.055	U	0.112	U	0.106	U	0.05	U	0.078	U	0.066	U
51207-31-9	2,3,7,8-TETRACHLORODIBENZOFURAN			0.099	U	0.132	U	0.123	U	0.059	U	0.105	U	0.11	U
3268-87-9	OCDD			4.273	UJ	25.926	UJ	11.459	UJ	58.181	J	424.803	J	108.247	
39001-02-0	OCDF			0.395	JK	0.238	UJ	0.281	UJ	0.647	J	9.944	J	1.615	J
		Ecological Screening Level (ng/kg)													
	TCDD-TEQ - Bird (a)	0.121	(b)	0.03		0.08		0.03		**0.13**		**0.97**		**0.23**	
	TCDD-TEQ - Mammal (a)	0.121	(b)	0.03		**0.19**		0.05		**0.14**		**1.72**		**0.39**	
	TCDD-TEQ - Bird (a)	0.48	(c)	0.03		0.08		0.03		0.13		**0.97**		0.23	
	TCDD-TEQ - Mammal (a)	0.48	(c)	0.03		0.19		0.05		0.14		**1.72**		0.39	
	TCDD-TEQ - Bird (a)	21	(d)	0.03		0.08		0.03		0.13		0.97		0.23	
	TCDD-TEQ - Mammal (a)	2.5	(d)	0.03		0.19		0.05		0.14		1.72		0.39	
	TCDD-TEQ - Fish (a)	60	(d)	0.03		0.04		0.03		0.12		0.83		0.20	
	TCDD-TEQ - Fish (a)	410	(e)	0.03		0.04		0.03		0.12		0.83		0.20	

Notes:
CAS - Chemical Abstracts Service.
CCB - Coal Combustion By-Product.
J - The result is an estimated quantity; the associated numerical value is the approximate concentration.
K - Estimated Maximum Potential Concentration.
U - The analyte was analyzed for, but was not detected above the sample reporting limit.
UJ - The analyte was not detected above the sample reporting limit; and the reporting limit is approximate.
PCDD - Polychlorinated Dibenzo-p-dioxin.
PCDF - Polychlorinated Dibenzofuran.
TCDD-TEQ - 2,3,7,8-tetrachlorodibenzo-p-dioxin toxic equivalent concentration.
(a) - Calculated per Human Health and/or Ecological Work Plan using
"The 2005 World Health Organization Reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like Compounds."
Van den Berg, et al. 2006.
(b) - USEPA. 2003. USEPA Region 5 Ecological Screening Level for Sediment
Updated August 22, 2003.(http://www.epa.gov/reg5rcra/ca/ESL.pdf)
Sediment screening value based on surface water impacts to wildlife.
(c) - USEPA Region 5 Ecological Screening Level for Sediment
adjusted to 4% Total Organic Carbon.
(d) - USEPA low risk sediment concentration (USEPA, 1993) presented in the
Interim Report on Data and Methods for Assessment of 2,3,7,8-
Tetrachlorodibenzo-p-dioxin Risks to Aquatic Life and Associated Wildlife.
(e) - USEPA sediment screening value based on impacts to rainbow trout (USEPA, 1999).
Highlighting indicates that TCDD-TEQ is above the screening level.

TABLE 7
VALIDATED PCDD/PCDF RESULTS FOR BROWN DITCH
COMPARED TO ECOLOGICAL SCREENING LEVELS FOR SEDIMENT
YARD 520 DATA EVALUATION REPORT
PINES AREA OF INVESTIGATION

ENSR | AECOM

CAS No.	Chemical Name	Upstream SW001 10/13/2006 SW001ASD102306S 0 - 0.5 ft ng/kg		Upstream SW020 10/25/2006 SW020ASD102506S 0 - 0.5 ft ng/kg		Downstream SW022 10/24/2006 SW022ASD102406S 0 - 0.5 ft ng/kg		Downstream SW023 10/24/2006 SW023ASD102406S 0 - 0.5 ft ng/kg		Downstream SW023 duplicate 10/24/2006 SW023ASD102406D 0 - 0.5 ft ng/kg		Downstream SW024 10/24/2006 SW024ASD102406S 0 - 0.5 ft ng/kg		Deeper SW022 10/24/2006 SW022BSD102406S 0.5 - 1 ft ng/kg		Deeper SW023 10/24/2006 SW023BSD102406S 0.5 - 1 ft ng/kg	
35822-46-9	1,2,3,4,6,7,8-HEPTACHLORODIBENZO-P-DIOXIN	10.646		0.691	U	14.12	U	1.185	U	2.993	U	0.297	U	6.077	U	4.521	U
67562-39-4	1,2,3,4,6,7,8-HpCDF	3.718		0.252	UJK	3.735	U	0.244	U	0.831	UJK	0.068	U	1.514	U	0.922	U
55673-89-7	1,2,3,4,7,8,9-HpCDF	0.154	U	0.1	U	0.228	U	0.103	U	0.096	U	0.096	U	0.169	U	0.072	U
39227-28-6	1,2,3,4,7,8-HEXACHLORODIBENZO-P-DIOXIN	0.058	U	0.069	U	0.112	U	0.064	U	0.094	U	0.052	U	0.091	U	0.054	U
70648-26-9	1,2,3,4,7,8-HxCDF	0.33	U	0.048	U	0.486	U	0.035	U	0.13	U	0.035	U	0.26	U	0.124	UJK
57653-85-7	1,2,3,6,7,8-HEXACHLORODIBENZO-P-DIOXIN	0.509	J	0.063	U	0.537	J	0.058	U	0.086	U	0.048	U	0.18	JK	0.171	JK
57117-44-9	1,2,3,6,7,8-HxCDF	0.1	U	0.045	U	0.276	J	0.033	U	0.071	U	0.033	U	0.115	U	0.055	U
19408-74-3	1,2,3,7,8,9-HEXACHLORODIBENZO-P-DIOXIN	0.057	U	0.067	U	0.413	J	0.062	U	0.091	U	0.051	U	0.231	J	0.053	U
72918-21-9	1,2,3,7,8,9-HxCDF	0.157	U	0.064	U	0.235	U	0.047	U	0.101	U	0.047	U	0.165	U	0.079	U
57117-41-6	1,2,3,7,8-PENTACHLORODIBENZOFURAN	0.042	U	0.041	U	0.188	J	0.048	U	0.049	U	0.033	U	0.08	U	0.035	U
40321-76-4	1,2,3,7,8-PENTACHLORODIBENZO-P-DIOXIN	0.059	U	0.066	U	0.342	J	0.049	U	0.057	U	0.055	U	0.101	U	0.048	U
60851-34-5	2,3,4,6,7,8-HxCDF	0.12	U	0.052	U	0.247	J	0.039	U	0.097	J	0.039	U	0.135	U	0.065	U
57117-31-4	2,3,4,7,8-PeCDF	0.041	U	0.04	U	0.087	U	0.047	U	0.048	U	0.032	U	0.078	U	0.034	U
1746-01-6	2,3,7,8-TCDD	0.028	U	0.032	U	0.06	U	0.032	U	0.036	U	0.031	U	0.044	U	0.023	U
51207-31-9	2,3,7,8-TETRACHLORODIBENZOFURAN	0.056	U	0.048	U	1.332	U	0.088	U	0.088	U	0.059	U	0.127	U	0.582	U
3268-87-9	OCDD	75.499	J	8.342	U	400.768		15.423	U	46.484	U	4.038	U	213.514		109.461	
39001-02-0	OCDF	9.657	J	0.35	J	8.173	J	0.653	JK	2.207	J	0.128	U	3.298	J	2.105	J
	TOTAL ORGANIC CARBON (TOC) (%)	1.21		1.15		4.66		3.68		--		0.909		3.50		0.208	
	Sample-specific TOC- adjusted Region 5 ESL (b)	0.15		0.14		0.56		0.44		0.44		0.11		0.42		0.025	
	TCDD-TEQ - Bird (a)	0.11		0.046		0.53		0.037		0.057		0.036		0.12		**0.054**	
	TCDD-TEQ - Mammal (a)	**0.26**		0.051		**0.71**		0.044		0.078		0.039		0.21		**0.11**	
	Ecological Screening Level																
	TCDD-TEQ - Bird (a) 21 (c)	0.11		0.046		0.53		0.037		0.057		0.036		0.12		0.054	
	TCDD-TEQ - Mammal (a) 2.5 (c)	0.26		0.051		0.71		0.044		0.078		0.039		0.21		0.11	

Notes:

CAS - Chemical Abstracts Service.

J - The result is an estimated quantity; the associated numerical value is the approximate concentration.

K - Estimated Maximum Potential Concentration.

U - The analyte was analyzed for, but was not detected above the sample reporting limit.

UJ - The analyte was not detected above the sample reporting limit; and the reporting limit is approximate.

PCDD- Polychlorinated Dibenzo-p-dioxin.

PCDF - Polychlorinated Dibenzofuran.

TCDD-TEQ - 2,3,7,8-tetrachlorodibenzo-p-dioxin toxic equivalent concentration.

(a) - Calculated per Human Health and/or Ecological Work Plan using
"The 2005 World Health Organization Reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like Compounds."
Van den Berg, et al. 2006.

(b) - USEPA Region 5 Ecological Screening Level for Sediment (0.12 ng/kg; USEPA, 2003) adjusted to sample-specific TOC.

(c) - USEPA low risk sediment concentration (USEPA, 1993) presented in the Interim Report on Data and Methods for Assessment of 2,3,7,8-Tetrachlorodibenzo-p-dioxin Risks to Aquatic Life and Associated Wildlife.

Highlighting indicates that TCDD-TEQ is above the screening level.

TABLE 8
SUMMARY OF TCDD-TEQ EEQS FOR BROWN DITCH SEDIMENT
YARD 520 DATA EVALUATION REPORT
PINES AREA OF INVESTIGATION

ENSR | AECOM

Parameter	Upstream SW-001	Upstream SW-020	Downstream SW-022	Downstream SW-023 [1]	Downstream SW-024
TOC (%)	1.21	1.15	4.66	3.68	0.91
Sample-specific TOC- adjusted Region 5 ESL (ng/kg)	0.15	0.14	0.56	0.44	0.11
TCDD-TEQ - Bird (ng/kg) (a)	0.11	0.048	0.53	0.037	0.036
TCDD-TEQ - Mammal (ng/kg) (a)	0.26	0.051	0.71	0.044	0.039
Avian TCDD-TEQ EEQ:	0.73	0.33	0.95	0.11	0.33
Mammalian TCDD-TEQ EEQ:	1.7	0.36	1.3	0.14	0.36

Notes:

[1] Duplicate results averaged.

EEQ - Ecological Effects Quotient = (TCDD-TEQ)/ESL.

ESL - Ecological Screening Level.

TCDD-TEQ - 2,3,7,8-tetrachlorodibenzo-p-dioxin toxic equivalent concentration.

TOC - Total Organic Carbon.

(a) - See Table 7.

Highlighting indicates that the EEQ is above 1.

TABLE 9
VALIDATED RESULTS OF YARD 520 SAMPLING FOR RADIONUCLIDES
YARD 520 DATA EVALUATION REPORT
PINES AREA OF INVESTIGATION

ENSR | AECOM

		Location ID:	GP004		GP005		GP006		GP007		GP008		GP008	
		Sample Date:	09/23/2005		09/23/2005		09/23/2005		09/23/2005		09/23/2005		09/23/2005	
		Sample ID:	GP004ICB092305S		GP005ICB092305S		GP006ICB092305S		GP007ICB092305S		GP008ICB092305S		GP008ICB092305D	
		Sample Matrix:	CCB		CCB		CCB		CCB		CCB		CCB (Duplicate)	
CAS Number	**Chemical Name**	**Unit**	**Result**	**Unc (±)**	**Result**	**Unc (±)**	**Result**	**Unc (±)**	**Result**	**Unc (±)**	**Result**	**Unc (±)**	**Result**	**Unc (±)**
14952-40-0	ACTINIUM-227	pCi/g	-0.0952 U	0.24	0.289 U	0.206	-0.0537 U	0.216	0.0474 U	0.276	0.0408 U	0.277	-0.0341 U	0.198
14255-04-0	LEAD-210	pCi/g	2.13 U	1.81	3.22 U	4.64	4.21	0.638	5.61	0.885	2.1 U	3.37	4.55	2.3
13981-52-7	POLONIUM-210	pCi/g	2.13 U	1.81	3.22 U	4.64	4.21	0.615	5.61	0.857	2.1 U	3.37	4.55	2.3
14331-85-2	PROTACTINIUM-231	pCi/g	0.107 U	0.829	-0.642 U	0.709	-0.475 U	0.848	-0.598 U	1.08	0.175 U	0.77	-0.637 U	0.712
13982-63-3	RADIUM-226	pCi/g	2.19	0.255	3.23	0.102	3.49	0.327	4.22	0.399	3.06	0.108	3.25	0.118
15262-20-1	RADIUM-228	pCi/g	1.41	0.236	2.59	0.131	3	0.374	2.87	0.399	2.29	0.176	2.52	0.18
14274-82-9	THORIUM-228	pCi/g	1.63	0.149	2.63	0.0649	2.92	0.305	3.21	0.338	2.34	0.0669	2.42	0.0664
14269-63-7	THORIUM-230	pCi/g	2.19	0.255	3.23	0.102	3.49	0.327	4.22	0.399	3.06	0.108	3.25	0.118
7440-29-1	THORIUM-232	pCi/g	1.59	0.145	2.56	0.0634	2.85	0.297	3.14	0.331	2.28	0.0651	2.37	0.065
13966-29-5	URANIUM-234	pCi/g	2.55	0.283	3.66	0.127	3.94	0.442	4.71	0.547	3.49	0.132	3.4	0.136
15117-96-1	URANIUM-235	pCi/g	0.272	0.191	0.238	0.162	0.246	0.169	0.337	0.224	0.146 U	0.16	0.282	0.146
7440-61-1	URANIUM-238	pCi/g	2.53	1.26	2.86	0.971	4.14	0.893	4.17	0.966	3.1	1.03	2.2	1.33
15117-96-1M	URANIUM-235	mg/kg	0.0445 J-	--	0.0745 J-	--	0.0785 J-	--	0.0991 J-	--	0.105 J-	--	0.0931 J-	--
7440-61-1M	URANIUM-238	mg/kg	6.09 J-	--	10.4 J-	--	11.0 J-	--	13.9 J-	--	14.5 J-	--	12.8 J-	--
TURANIUM	URANIUM-TOTAL	mg/kg	6.14 J-	--	10.4 J-	--	11.1 J-	--	14.0 J-	--	14.6 J-	--	12.9 J-	--

Notes:

CAS - Chemical Abstract Service.

pCi/g - pico Curie per gram.

SuspectCCB - Suspected Coal Combustion By-Product.

J - The result is an estimated quantity; the associated numerical value is the approximate concentration, result may be biased low.

U: The analyte was analyzed for, but not detected.

Unc (±) - Uncertainty reported by laboratory in radiological counts.

TABLE 9
VALIDATED RESULTS OF YARD 520 SAMPLING FOR RADIONUCLIDES
YARD 520 DATA EVALUATION REPORT
PINES AREA OF INVESTIGATION

ENSR | AECOM

		Location ID:	GP009		GP010		GP011		GP012		GP013	
		Sample Date:	09/23/2005		09/23/2005		09/23/2005		09/23/2005		09/23/2005	
		Sample ID:	GP009ICB092305S		GP010ICB092305S		GP011ICB092305S		GP012ICB092305S		GP013ICB092305S	
		Sample Matrix:	CCB		CCB		CCB		CCB		CCB	
CAS Number	Chemical Name	Unit	Result	Unc (±)	Result	Unc (±)	Result	Unc (±)	Result	Unc (±)	Result	Unc (±)
14952-40-0	ACTINIUM-227	pCi/g	0 U	0.254	0.0565 U	0.254	0.0985 U	0.228	0.0479 U	0.163	-0.0503 U	0.172
14255-04-0	LEAD-210	pCi/g	6.81	4.63	2.81 U	5.2	2.88	0.511	2.27	1.48	1.55 U	2.22
13981-52-7	POLONIUM-210	pCi/g	6.81	4.62	2.81 U	5.2	2.88	0.498	2.27	1.47	1.55 U	2.22
14331-85-2	PROTACTINIUM-231	pCi/g	-0.57 U	1.13	0.298 U	0.875	0.442 U	0.814	0.772 U	0.571	-0.205 U	0.606
13982-63-3	RADIUM-226	pCi/g	4.63	0.475	3.4	0.314	2.43	0.253	3.23	0.348	1.7	0.0809
15262-20-1	RADIUM-228	pCi/g	2.63	0.371	2.56	0.387	2.17	0.288	2.12	0.27	1.49	0.127
14274-82-9	THORIUM-228	pCi/g	2.85	0.296	2.65	0.248	2.07	0.192	2.13	0.179	1.56	0.0521
14269-63-7	THORIUM-230	pCi/g	4.63	0.475	3.4	0.314	2.43	0.253	3.23	0.348	1.7	0.0809
7440-29-1	THORIUM-232	pCi/g	2.79	0.29	2.58	0.241	2.03	0.187	2.07	0.174	1.53	0.0508
13966-29-5	URANIUM-234	pCi/g	5.38	0.597	3.95	0.423	2.65	0.295	3.68	0.355	2.06	0.119
15117-96-1	URANIUM-235	pCi/g	0.347	0.192	0.223	0.193	0.203	0.198	0.267	0.132	0.0774 U	0.128
7440-61-1	URANIUM-238	pCi/g	4.77	1.68	3.79	1.8	2.58	0.745	2.62	0.962	2.3	0.851
15117-96-1M	URANIUM-235	mg/kg	0.100 J-	--	0.070 J-	--	0.0513 J-	--	0.075 J-	--	0.0601 J-	--
7440-61-1M	URANIUM-238	mg/kg	14.0 J-	--	9.73 J-	--	7.31 J-	--	10.4 J-	--	8.45 J-	--
TURANIUM	URANIUM-TOTAL	mg/kg	14.1 J-	--	9.80 J-	--	7.36 J-	--	10.5 J-	--	8.51 J-	--

Notes:

CAS - Chemical Abstract Service.

pCi/g - pico Curie per gram.

SuspectCCB - Suspected Coal Combustion By-Product.

J - The result is an estimated quantity; the associated numerical value is the approximate concentration, result may be biased low.

U: The analyte was analyzed for, but not detected.

Unc (±) - Uncertainty reported by laboratory in radiological counts.

TABLE 10
VALIDATED BACKGROUND SURFACE SOIL SAMPLING RESULTS
FOR INORGANICS
YARD 520 DATA EVALUATION REPORT
PINES AREA OF INVESTIGATION

		Location ID	SS001	SS002	SS003	SS004	SS005	SS006
		Sample Date	5/1/2007	4/30/2007	4/30/2007	4/30/2007	4/30/2007	4/30/2007
		Sample ID	SS001ASS050107S	SS002ASS043007S	SS003ASS043007S	SS004ASS043007S	SS005ASS043007S	SS006ASS043007S
		Sample Matrix	Soil	Soil	Soil	Soil	Soil	Soil
		Depth Interval (feet)	0- 0.5	0- 0.5	0- 0.5	0- 0.5	0- 0.5	0- 0.5
		Sample Type	Sample	Sample	Sample	Sample	Sample	Sample
CAS Number	**Chemical Name**	**Unit**						
METALS								
7429-90-5	ALUMINUM	mg/kg	3460	2340	4320	2970	4280	4080
7440-36-0	ANTIMONY	mg/kg	0.60 U	0.55 U	1.8 UJ	0.54 U	0.76 U	0.53 U
7440-38-2	ARSENIC	mg/kg	1.6	1.4	4.5	1.2	4.8	1.8
7440-39-3	BARIUM	mg/kg	31.6	10.6	65.0	19.7	41.4	36.8
7440-41-7	BERYLLIUM	mg/kg	0.63 U	0.58 U	0.58 U	0.57 U	0.80 U	0.55 U
7440-42-8	BORON	mg/kg	2.5 J	0.925 U	3.2 J	0.918 U	1.5 J	1.7 J
7440-43-9	CADMIUM	mg/kg	0.20 J	0.09 U	1.2	0.21 J	0.23 J	0.19 J
7440-70-2	CALCIUM	mg/kg	3460	386	2380	825	1150	1730
7440-47-3	CHROMIUM	mg/kg	6.2	4.0	7.9	4.1	6.3	5.4
7440-48-4	COBALT	mg/kg	6.3 U	5.8 U	5.8 U	5.7 U	8.0 U	5.5 U
7440-50-8	COPPER	mg/kg	8.9	3.9 J+	39.3	7.7	8.0 J+	16.7
7439-89-6	IRON	mg/kg	4920	3440	6880	3020	9660	4310
7439-92-1	LEAD	mg/kg	21.6	31.4	153	31.7	21.6	42.5
7439-95-4	MAGNESIUM	mg/kg	1670	292	679	349	368	626
7439-96-5	MANGANESE	mg/kg	118	61.6	173	84.7	200	278
7439-97-6	MERCURY	mg/kg	0.04 U	0.04 U	0.13	0.04 U	0.06	0.04 U
7439-98-7	MOLYBDENUM	mg/kg	3.2 U	2.9 U	2.9 U	2.8 U	4.0 U	2.8 U
7440-02-0	NICKEL	mg/kg	5.1 U	4.6 U	5.6	4.5 U	6.4 U	4.4 U
7440-09-7	POTASSIUM	mg/kg	381	232 U	293	243	321 U	270
7782-49-2	SELENIUM	mg/kg	0.97 J	0.91 J	0.59 J	0.69 J	1.6 J	0.75 J
7440-21-3	SILICON	mg/kg	730 J-	725 J-	839 J-	750 J-	1240 J-	910 J-
7440-22-4	SILVER	mg/kg	1.3 U	1.2 U	1.2 U	1.1 U	1.6 U	1.1 U
7440-23-5	SODIUM	mg/kg	136	116 U	117	114 U	162	177
7440-24-6	STRONTIUM	mg/kg	12.7 U	11.6 U	11.5 U	11.4 U	16.1 U	11.1 U
7440-28-0	THALLIUM	mg/kg	0.64 J	0.38 J	0.48 J	0.39 J	0.64 J	0.63 J
TURANIUM	URANIUM-TOTAL	mg/kg	0.19	0.14	0.25	0.17	0.3	0.17
7440-62-2	VANADIUM	mg/kg	8.6	5.7 J	8.1	4.7 J	12.9	7.1
7440-66-6	ZINC	mg/kg	76.4	20.7	167	33.0	42.2	64.1
OTHER INORGANIC PARAMETERS								
TSOLIDS	SOLIDS, TOTAL (%)	%	76.7	83.7	83.5	84.7	62.3	88.4
7704-34-9	SULFUR	mg/kg	21.1	18.4	24.4	13.1	44.6	10.4

Notes and definitions provided at end of table.

TABLE 10
VALIDATED BACKGROUND SURFACE SOIL SAMPLING RESULTS
FOR INORGANICS
YARD 520 DATA EVALUATION REPORT
PINES AREA OF INVESTIGATION

		Location ID	SS007	SS008	SS009	SS009	SS010	SS011
		Sample Date	5/1/2007	5/1/2007	4/30/2007	4/30/2007	5/1/2007	5/1/2007
		Sample ID	SS007ASS050107S	SS008ASS050107S	SS009ASS043007S	SS009ASS043007D	SS010ASS050107S	SS011ASS050107S
		Sample Matrix	Soil	Soil	Soil	Soil	Soil	Soil
		Depth Interval (feet)	0- 0.5	0- 0.5	0- 0.5	0- 0.5	0- 0.5	0- 0.5
		Sample Type	Sample	Sample	Sample	Duplicate	Sample	Sample
CAS Number	**Chemical Name**	**Unit**						
METALS								
7429-90-5	ALUMINUM	mg/kg	3720	7690	6340	6530	4810	4060
7440-36-0	ANTIMONY	mg/kg	0.55 U	0.97 U	0.62 U	0.56 UJ	0.50 U	0.59 U
7440-38-2	ARSENIC	mg/kg	1.2	4.6	2.6	3.1	2.3	1.8
7440-39-3	BARIUM	mg/kg	10.7	44.2	37.5	40.7	19.9	12.9
7440-41-7	BERYLLIUM	mg/kg	0.57 U	1.0 U	0.65 U	0.59 U	0.53 U	0.62 U
7440-42-8	BORON	mg/kg	0.897 U	2.5 J	3.3 J	3.4 J+	0.865 U	1.01 U
7440-43-9	CADMIUM	mg/kg	0.09 U	0.57 J	0.10 U	0.11 J	0.08 U	0.10 U
7440-70-2	CALCIUM	mg/kg	115 U	701	1730	1960	307	433
7440-47-3	CHROMIUM	mg/kg	3.3	8.9	8.0	8.5	5.3	3.8
7440-48-4	COBALT	mg/kg	5.7 U	10.2 U	6.5 U	5.9 U	5.3 U	6.2 U
7440-50-8	COPPER	mg/kg	2.3 U	12.9	6.4 J+	6.5	3.3 J+	3.1 J+
7439-89-6	IRON	mg/kg	3420	6120	6270	7230	5810	3410
7439-92-1	LEAD	mg/kg	9.0	73.8	17.8	19.8	32.2	17.6
7439-95-4	MAGNESIUM	mg/kg	250	467	1160	1340	603	276
7439-96-5	MANGANESE	mg/kg	16.8	32.4	120	141	205	80.7
7439-97-6	MERCURY	mg/kg	0.04 U	0.07	0.04 U	0.04 U	0.04 U	0.04 U
7439-98-7	MOLYBDENUM	mg/kg	2.9 U	5.1 U	3.3 U	3.0 U	2.6 U	3.1 U
7440-02-0	NICKEL	mg/kg	4.6 U	8.2 U	5.8	6.8	4.2 U	5.0 U
7440-09-7	POTASSIUM	mg/kg	230 U	475	779	791	228	249 U
7782-49-2	SELENIUM	mg/kg	0.38 U	1.3 J	0.44 J	0.51 UJ	0.70 J	0.72 J
7440-21-3	SILICON	mg/kg	993 J-	2630 J-	1210 J-	718 J-	869 J-	873 J-
7440-22-4	SILVER	mg/kg	1.1 U	2.0 U	1.3 U	1.2 U	1.1 U	1.2 U
7440-23-5	SODIUM	mg/kg	130	224	130 U	118 U	106 U	125 U
7440-24-6	STRONTIUM	mg/kg	11.5 U	20.4 U	13.0 U	11.8 U	10.6 U	12.5 U
7440-28-0	THALLIUM	mg/kg	0.36 U	0.64 U	0.49 J	0.61 J	0.65 J	0.39 U
TURANIUM	URANIUM-TOTAL	mg/kg	0.12	1	0.440 J	0.450 J	0.18	0.15
7440-62-2	VANADIUM	mg/kg	6.6	12.3	11.4	11.9	9.6	5.4 J
7440-66-6	ZINC	mg/kg	10.5	42.2	34.4	35.4	27.9	31.3
OTHER INORGANIC PARAMETERS								
TSOLIDS	SOLIDS, TOTAL (%)	%	87.1	48.1	76.8	84.7	90.0	79.5
7704-34-9	SULFUR	mg/kg	11.5	67.4	18.4	19.2	16.0	28.7

Notes and definitions provided at end of table.

TABLE 10
VALIDATED BACKGROUND SURFACE SOIL SAMPLING RESULTS
FOR INORGANICS
YARD 520 DATA EVALUATION REPORT
PINES AREA OF INVESTIGATION

		Location ID	SS012	SS012	SS013	SS014	SS015	SS016
		Sample Date	4/30/2007	4/30/2007	4/30/2007	5/1/2007	4/30/2007	4/30/2007
		Sample ID	SS012ASS043007S	SS012ASS043007D	SS013ASS043007S	SS014ASS050107S	SS015ASS043007S	SS016ASS043007S
		Sample Matrix	Soil	Soil	Soil	Soil	Soil	Soil
		Depth Interval (feet)	0- 0.5	0- 0.5	0- 0.5	0- 0.5	0- 0.5	0- 0.5
		Sample Type	Sample	Duplicate	Sample	Sample	Sample	Sample
CAS Number	**Chemical Name**	**Unit**						
METALS								
7429-90-5	ALUMINUM	mg/kg	3210	2750	1280	5450	6910	12600
7440-36-0	ANTIMONY	mg/kg	0.66 U	0.69 U	1.0 U	0.54 U	2.1 U	1.4 U
7440-38-2	ARSENIC	mg/kg	2.2	1.9	1.7 J	1.8	4.7	29.5
7440-39-3	BARIUM	mg/kg	19.9	16.7	16.7	28.1	126	167
7440-41-7	BERYLLIUM	mg/kg	0.7 U	0.73 U	1.1 U	0.57 U	2.2 U	1.5 U
7440-42-8	BORON	mg/kg	1.19 U	1.15 U	1.68 U	3.2 J	7.2 J+	12.2
7440-43-9	CADMIUM	mg/kg	0.11 U	0.11 U	0.20 J	0.09 J	0.96 J	1.5 J
7440-70-2	CALCIUM	mg/kg	989	964	1030	3190	14300	11200
7440-47-3	CHROMIUM	mg/kg	5.6	4.9	4.5	6.4	12.2	26.0
7440-48-4	COBALT	mg/kg	7.0 U	7.3 U	10.8 U	5.7 U	21.8 U	23.8
7440-50-8	COPPER	mg/kg	2.9	2.9 U	5.6	3.6	22.5	20.2
7439-89-6	IRON	mg/kg	5730	4760	3330	6300	8910	30500
7439-92-1	LEAD	mg/kg	13.2	11.7	41.5	11.4	95.8	63.2
7439-95-4	MAGNESIUM	mg/kg	265	248	252	2040	1800	2770
7439-96-5	MANGANESE	mg/kg	40.0	37.8	32.5	96.7	129	645
7439-97-6	MERCURY	mg/kg	0.05 U	0.05 U	0.10	0.04 U	0.15	0.11
7439-98-7	MOLYBDENUM	mg/kg	3.5 U	3.6 U	5.4 U	2.9 U	10.9 U	7.4 U
7440-02-0	NICKEL	mg/kg	5.6 U	5.8 U	8.6 U	5.1	17.4 U	26.5
7440-09-7	POTASSIUM	mg/kg	278 U	292 U	430 U	658	871 U	1030
7782-49-2	SELENIUM	mg/kg	1.0 UJ	0.78 UJ	1.2 UJ	0.62 UJ	3.5 UJ	4.8 UJ
7440-21-3	SILICON	mg/kg	976 J-	886 J-	1350 J-	810 J-	3490 J-	2200 J-
7440-22-4	SILVER	mg/kg	1.4 U	1.5 U	2.2 U	1.1 U	4.4 U	3.0 U
7440-23-5	SODIUM	mg/kg	172	157	215 U	114 U	452	380
7440-24-6	STRONTIUM	mg/kg	13.9 U	14.6 U	21.5 U	11.4 U	84.4	57.5
7440-28-0	THALLIUM	mg/kg	0.44 U	0.46 U	0.68 U	0.40 J	1.4 U	1.9 J
TURANIUM	URANIUM-TOTAL	mg/kg	0.2	0.21	0.16	0.29	0.65	0.960 J
7440-62-2	VANADIUM	mg/kg	11.3	9.7	4.3 J	10.4	12.0 J	24.7
7440-66-6	ZINC	mg/kg	20.2	18.3	27.7	31.6	107	383
OTHER INORGANIC PARAMETERS								
TSOLIDS	SOLIDS, TOTAL (%)	%	68.5	66.6	46.5	85.9	22.3	33.0
7704-34-9	SULFUR	mg/kg	19.6	22.5	61.9	9.32	222	101

Notes and definitions provided at end of table.

TABLE 10
VALIDATED BACKGROUND SURFACE SOIL SAMPLING RESULTS
FOR INORGANICS
YARD 520 DATA EVALUATION REPORT
PINES AREA OF INVESTIGATION

		Location ID	SS017	SS018	SS019	SS020	SS021	SS021
		Sample Date	5/1/2007	5/1/2007	5/1/2007	5/1/2007	5/1/2007	5/1/2007
		Sample ID	SS017ASS050107S	SS018ASS050107S	SS019ASS050107S	SS020ASS050107S	SS021ASS050107S	SS021ASS050107D
		Sample Matrix	Soil	Soil	Soil	Soil	Soil	Soil
		Depth Interval (feet)	0- 0.5	0- 0.5	0- 0.5	0- 0.5	0- 0.5	0- 0.5
		Sample Type	Sample	Sample	Sample	Sample	Sample	Duplicate
CAS Number	**Chemical Name**	**Unit**						
METALS								
7429-90-5	ALUMINUM	mg/kg	2920	7760	3750	3290	11600	12100
7440-36-0	ANTIMONY	mg/kg	0.94 U	1.3 U	0.51 U	0.57 U	0.80 U	0.77 U
7440-38-2	ARSENIC	mg/kg	1.2 J	4.2	1.5	1.6	3.9	3.6
7440-39-3	BARIUM	mg/kg	29.3	52.4	27.1	39.3	80.7	81.2
7440-41-7	BERYLLIUM	mg/kg	0.99 U	1.4 U	0.53 U	0.60 U	0.84 U	0.82 U
7440-42-8	BORON	mg/kg	3.8 J+	13.3	0.86 U	1.9 J	9.2	7.4
7440-43-9	CADMIUM	mg/kg	0.20 J	0.53 J	0.10 J	0.23 J	0.23 J	0.26 J
7440-70-2	CALCIUM	mg/kg	1950	12900	468	2280	5860	7190
7440-47-3	CHROMIUM	mg/kg	5.4	18.5	4.3	4.4	16.3	16.9
7440-48-4	COBALT	mg/kg	9.9 U	14.2 U	5.3 U	6.0 U	8.4 U	8.2 U
7440-50-8	COPPER	mg/kg	5.9	14.6	2.5	4.5	23.0	24.8
7439-89-6	IRON	mg/kg	3280	7090	4300	4110	12300	11700
7439-92-1	LEAD	mg/kg	26.8	56.0	11.9	32.3	28.0	27.0
7439-95-4	MAGNESIUM	mg/kg	598	2030	424	587	2630	2960
7439-96-5	MANGANESE	mg/kg	44.4	264	163	180	216	206
7439-97-6	MERCURY	mg/kg	0.08	0.20	0.04 U	0.04 U	0.06 U	0.05 U
7439-98-7	MOLYBDENUM	mg/kg	5.0 U	7.1 U	2.7 U	3.0 U	4.2 U	4.1 U
7440-02-0	NICKEL	mg/kg	7.9 U	11.3 U	4.3 U	4.8 U	10.5	10.5
7440-09-7	POTASSIUM	mg/kg	476	674	282	275	1330	1420
7782-49-2	SELENIUM	mg/kg	1.6 UJ	4.8 U	0.38 UJ	0.74 UJ	1.2 UJ	1.6 UJ
7440-21-3	SILICON	mg/kg	2150 J-	2680 J-	699 J-	939 J-	1190 J-	1090 J-
7440-22-4	SILVER	mg/kg	2.0 U	2.8 U	1.1 U	1.2 U	1.7 U	1.6 U
7440-23-5	SODIUM	mg/kg	198 U	1170	119	131	188	246
7440-24-6	STRONTIUM	mg/kg	19.8 U	37.5	10.7 U	11.9 U	22.7	24.5
7440-28-0	THALLIUM	mg/kg	0.63 U	1.0 J	0.44 J	0.49 J	0.92 J	0.95 J
TURANIUM	URANIUM-TOTAL	mg/kg	0.2	6.1	0.18	0.19	0.980 J	1
7440-62-2	VANADIUM	mg/kg	6.1 J	18.9	7.1	6.1	23.3	24.4
7440-66-6	ZINC	mg/kg	37.3	76.7	27.8	53.4	74.1	75.2
OTHER INORGANIC PARAMETERS								
TSOLIDS	SOLIDS, TOTAL (%)	%	49.4	34.9	91.0	81.4	58.8	58.4
7704-34-9	SULFUR	mg/kg	67.4	229	7.95	19.8	50.2 J	77.2 J

Notes and definitions provided at end of table.

TABLE 10
VALIDATED BACKGROUND SURFACE SOIL SAMPLING RESULTS
FOR INORGANICS
YARD 520 DATA EVALUATION REPORT
PINES AREA OF INVESTIGATION

		Location ID	SS022	SS023	SS024	SS025
		Sample Date	5/1/2007	4/30/2007	4/30/2007	4/30/2007
		Sample ID	SS022ASS050107S	SS023ASS043007S	SS024ASS043007S	SS025ASS043007S
		Sample Matrix	Soil	Soil	Soil	Soil
		Depth Interval (feet)	0- 0.5	0- 0.5	0- 0.5	0- 0.5
		Sample Type	Sample	Sample	Sample	Sample
CAS Number	**Chemical Name**	**Unit**				
METALS						
7429-90-5	ALUMINUM	mg/kg	8750	5150	5800	5620
7440-36-0	ANTIMONY	mg/kg	0.95 U	0.56 U	0.57 U	2.2 U
7440-38-2	ARSENIC	mg/kg	14.4	3.0	2.1	14.7
7440-39-3	BARIUM	mg/kg	81.8	21.4	49.3	242
7440-41-7	BERYLLIUM	mg/kg	1.0 U	0.59 U	0.71	2.3 U
7440-42-8	BORON	mg/kg	5.1 J	1.1 J	6.8	15.5
7440-43-9	CADMIUM	mg/kg	0.16 U	0.10 J	0.56 J	0.90 J
7440-70-2	CALCIUM	mg/kg	972	3350	11000	25600
7440-47-3	CHROMIUM	mg/kg	14.4	5.4	17.1	12.5
7440-48-4	COBALT	mg/kg	10.0 U	5.9 U	6.0 U	23.5 U
7440-50-8	COPPER	mg/kg	11.0	4.9	15.4	21.2
7439-89-6	IRON	mg/kg	52000	4480	8220	29700
7439-92-1	LEAD	mg/kg	39.1	20.6	121	61.7
7439-95-4	MAGNESIUM	mg/kg	1040	1050	3360	2610
7439-96-5	MANGANESE	mg/kg	145	141	511	4160
7439-97-6	MERCURY	mg/kg	0.10	0.04 U	0.05	0.26
7439-98-7	MOLYBDENUM	mg/kg	7.6	3.0 U	3.0 U	11.7 U
7440-02-0	NICKEL	mg/kg	8.3	4.8 U	6.4	18.8 U
7440-09-7	POTASSIUM	mg/kg	620	238 U	503	938 U
7782-49-2	SELENIUM	mg/kg	1.2 UJ	0.83 UJ	1.0 UJ	8.8 U
7440-21-3	SILICON	mg/kg	1510 J-	2340 J-	1500 J-	3470 J-
7440-22-4	SILVER	mg/kg	2.0 U	1.2 U	1.2 U	4.7 U
7440-23-5	SODIUM	mg/kg	200 U	121	493	856
7440-24-6	STRONTIUM	mg/kg	20.0 U	11.9 U	25.0	114
7440-28-0	THALLIUM	mg/kg	0.63 U	0.46 J	1.1 J	7.1
TURANIUM	URANIUM-TOTAL	mg/kg	1.9 J	0.21	0.37	0.69
7440-62-2	VANADIUM	mg/kg	21.5	11.5	15.5	25.1
7440-66-6	ZINC	mg/kg	48.9	29.8	137	182
OTHER INORGANIC PARAMETERS						
TSOLIDS	SOLIDS, TOTAL (%)	%	49.0	80.1	82.8	20.7
7704-34-9	SULFUR	mg/kg	673	20.1	37.0	286

Notes and definitions provided at end of table.

TABLE 10
VALIDATED BACKGROUND SURFACE SOIL SAMPLING RESULTS
FOR INORGANICS
YARD 520 DATA EVALUATION REPORT
PINES AREA OF INVESTIGATION

Notes:

CAS - Chemical Abstract Service
ID - Identifier
mg/kg - milligram per kilogram
J - The result is an estimated quantity; the associated numerical value is the approximate concentration of the analyte in the sample
J+ - The result is an estimated quantity, but the result may be biased high
J- - The result is an estimated quantity, but the result may be biased low
U - The analyte was analyzed for, but was not detected above the sample reporting limit
UJ - The analyte was not detected above the sample reporting limit; and the reporting limit is approximate
R - The data are unusable. The sample result is rejected due to serious deficiencies. The presence or absence of the analyte cannot be verified.

TABLE 11
VALIDATED BACKGROUND SURFACE SOIL SAMPLING RESULTS
FOR RADIONUCLIDES
YARD 520 DATA EVALUATION REPORT
PINES AREA OF INVESTIGATION

		Location ID:	SS001		SS002		SS003		SS004		SS005	
		Sample Date:	05/01/2007		04/30/2007		04/30/2007		04/30/2007		04/30/2007	
		Sample ID:	SS001ASS050107S		SS002ASS043007S		SS003ASS043007S		SS004ASS043007S		SS005ASS043007S	
		Sample Matrix:	Soil		Soil		Soil		Soil		Soil	
		Depth Interval (feet)	0 - 0.5		0 - 0.5		0 - 0.5		0 - 0.5		0 - 0.5	
		Sample Type:	Sample		Sample		Sample		Sample		Sample	
CAS Number	**Chemical Name**	**Unit**	**Result**	**Unc (±)**	**Result**	**Unc (±)**	**Result**	**Unc (±)**	**Result**	**Unc (±)**	**Result**	**Unc (±)**
RADIOLOGICAL PARAMETERS												
14952-40-0	ACTINIUM-227	pCi/g	0.029 U	0.0816	0.0523 U	0.124	0.0477 U	0.0803	-0.0454 U	0.147	-0.0436 U	0.0984
14255-04-0	LEAD-210	pCi/g	0.669 U	0.855	1.21	1.16	0.48 U	0.753	0.520	0.287	1.23	0.222
13981-52-7	POLONIUM-210	pCi/g	0.669 U	0.855	1.21	1.16	0.48 U	0.752	0.520	0.286	1.23	0.216
14331-85-2	PROTACTINIUM-231	pCi/g	-0.0955 U	0.242	-0.169 U	0.330	0.128 U	0.323	0.198 U	0.393	-0.0517 U	0.398
13982-63-3	RADIUM-226	pCi/g	0.142	0.0292	0.140	0.0285	0.224	0.0391	0.138	0.0469	0.264	0.0506
15262-20-1	RADIUM-228	pCi/g	0.236	0.0561	0.138	0.0559	0.232	0.0704	0.135	0.0996	0.272	0.0874
14274-82-9	THORIUM-228	pCi/g	0.251	0.0283	0.187	0.0308	0.298	0.0382	0.213	0.0397	0.272	0.0397
14269-63-7	THORIUM-230	pCi/g	0.142	0.0292	0.140	0.0285	0.223	0.039	0.138	0.0469	0.264	0.0505
7440-29-1	THORIUM-232	pCi/g	0.187	0.0211	0.139	0.023	0.222	0.0284	0.159	0.0295	0.202	0.0296
13966-29-5	URANIUM-234	pCi/g	0.132	0.0634	0.129	0.0493	0.262	0.0595	0.192	0.0781	0.240	0.0525
15117-96-1	URANIUM-235	pCi/g	0.0304 U	0.0474	0.0306 U	0.0539	0.0949	0.0738	0.0128 U	0.0852	0.0226 U	0.0466
7440-61-1	URANIUM-238	pCi/g	0.221 U	0.335	0.161 U	0.359	-0.316 U	0.294	0.188 U	0.318	0.342	0.166

Notes:

CAS - Chemical Abstract Service

ID - Identifier

pCi/g - picoCuries per gram

J - The result is an estimated quantity; the associated numerical value is the approximate concentration of the analyte in the sample.

U - The analyte was analyzed for, but was not detected above the sample reporting limit.

Unc (±) - Uncertainty reported by laboratory in radiological counts.

TABLE 11
VALIDATED BACKGROUND SURFACE SOIL SAMPLING RESULTS
FOR RADIONUCLIDES
YARD 520 DATA EVALUATION REPORT
PINES AREA OF INVESTIGATION

		Location ID:	SS006		SS007		SS008		SS009		SS009	
		Sample Date:	04/30/2007		05/01/2007		05/01/2007		04/30/2007		04/30/2007	
		Sample ID:	SS006ASS043007S		SS007ASS050107S		SS008ASS050107S		SS009ASS043007S		SS009ASS043007D	
		Sample Matrix:	Soil		Soil		Soil		Soil		Soil	
		Depth Interval (feet)	0 - 0.5		0 - 0.5		0 - 0.5		0 - 0.5		0 - 0.5	
		Sample Type:	Sample		Sample		Sample		Sample		Duplicate	
CAS Number	**Chemical Name**	**Unit**	**Result**	**Unc (±)**	**Result**	**Unc (±)**	**Result**	**Unc (±)**	**Result**	**Unc (±)**	**Result**	**Unc (±)**
RADIOLOGICAL PARAMETERS												
14952-40-0	ACTINIUM-227	pCi/g	-0.00623 U	0.0936	0.0459 U	0.0711	0.0103 U	0.108	0.0408 U	0.105	0.0855 U	0.0792
14255-04-0	LEAD-210	pCi/g	-0.0258 U	1.85	0.607 U	0.638	3.13	1.81	0.759	0.314	0 U	0.945
13981-52-7	POLONIUM-210	pCi/g	-0.0258 U	1.85	0.607 U	0.638	3.13	1.81	0.759	0.313	0 U	0.944
14331-85-2	PROTACTINIUM-231	pCi/g	-0.121 U	0.327	-0.0844 U	0.291	-0.347 U	0.433	0.0837 U	0.454	-0.224 U	0.342
13982-63-3	RADIUM-226	pCi/g	0.195	0.034	0.135	0.0307	0.233	0.0523	0.258	0.0468	0.285	0.0405
15262-20-1	RADIUM-228	pCi/g	0.261	0.0704	0.144	0.0624	0.484	0.104	0.346	0.104	0.317	0.0794
14274-82-9	THORIUM-228	pCi/g	0.241	0.0343	0.205	0.0294	0.503	0.053	0.460	0.0572	0.478	0.0439
14269-63-7	THORIUM-230	pCi/g	0.195	0.034	0.135	0.0307	0.233	0.0523	0.258	0.0467	0.284	0.0405
7440-29-1	THORIUM-232	pCi/g	0.180	0.0256	0.152	0.0219	0.376	0.0395	0.343	0.0426	0.356	0.0327
13966-29-5	URANIUM-234	pCi/g	0.184	0.0669	0.177	0.0468	0.219 J	0.0679	0.294	0.0778	0.332	0.0502
15117-96-1	URANIUM-235	pCi/g	-0.0346 U	0.0622	0.00892 U	0.0554	0.0845 U	0.0966	-0.00126 U	0.0749	0.0178 U	0.0661
7440-61-1	URANIUM-238	pCi/g	0.158 U	0.518	0.0879 U	0.350	0.689	0.602	0.325	0.263	0.591	0.345

Notes:

CAS - Chemical Abstract Service

ID - Identifier

pCi/g - picoCuries per gram

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U - The analyte was analyzed for, but was not detected above the sample reporting limit.

Unc (±) - Uncertainty reported by laboratory in radiological counts.

TABLE 11
VALIDATED BACKGROUND SURFACE SOIL SAMPLING RESULTS
FOR RADIONUCLIDES
YARD 520 DATA EVALUATION REPORT
PINES AREA OF INVESTIGATION

		Location ID:	SS010		SS011		SS012		SS012		SS013	
		Sample Date:	05/01/2007		05/01/2007		04/30/2007		04/30/2007		04/30/2007	
		Sample ID:	SS010ASS050107S		SS011ASS050107S		SS012ASS043007D		SS012ASS043007S		SS013ASS043007S	
		Sample Matrix:	Soil		Soil		Soil		Soil		Soil	
		Depth Interval (feet)	0 - 0.5		0 - 0.5		0 - 0.5		0 - 0.5		0 - 0.5	
		Sample Type:	Sample		Sample		Duplicate		Sample		Sample	
CAS Number	**Chemical Name**	**Unit**	**Result**	**Unc (±)**	**Result**	**Unc (±)**	**Result**	**Unc (±)**	**Result**	**Unc (±)**	**Result**	**Unc (±)**
RADIOLOGICAL PARAMETERS												
14952-40-0	ACTINIUM-227	pCi/g	-0.0303 U	0.0961	-0.103 U	0.139	0.0192 U	0.0697	0.012 U	0.0812	-0.00269 U	0.0843
14255-04-0	LEAD-210	pCi/g	0 U	0.270	0.909	0.309	0.481 U	0.685	1.62 U	1.28	3.10	0.818
13981-52-7	POLONIUM-210	pCi/g	0 U	0.270	0.909	0.307	0.481 U	0.685	1.62 U	1.28	3.10	0.808
14331-85-2	PROTACTINIUM-231	pCi/g	-0.142 U	0.384	-0.303 U	0.391	0.0369 U	0.275	0.0663 U	0.377	0.0663 U	0.330
13982-63-3	RADIUM-226	pCi/g	0.196	0.0445	0.184	0.0547	0.198	0.0309	0.214	0.0314	0.134	0.0357
15262-20-1	RADIUM-228	pCi/g	0.303	0.096	0.104	0.094	0.257	0.0608	0.325	0.0644	0.157	0.0654
14274-82-9	THORIUM-228	pCi/g	0.326	0.0452	0.232	0.0418	0.327	0.0357	0.385	0.0447	0.277	0.0384
14269-63-7	THORIUM-230	pCi/g	0.195	0.0445	0.184	0.0547	0.198	0.0308	0.213	0.0313	0.134	0.0357
7440-29-1	THORIUM-232	pCi/g	0.244	0.0338	0.174	0.0313	0.243	0.0266	0.287	0.0333	0.206	0.0286
13966-29-5	URANIUM-234	pCi/g	0.222 J	0.0598	0.136 J	0.068	0.224	0.0463	0.220	0.0563	0.177	0.0585
15117-96-1	URANIUM-235	pCi/g	0.0486 U	0.0701	0.0306 U	0.0961	0.0254 U	0.0592	0.0299 U	0.0521	0.00466 U	0.0726
7440-61-1	URANIUM-238	pCi/g	0.125 U	0.235	0.208 U	0.308	-0.124 U	0.245	0.00 U	0.428	0.149 U	0.314

Notes:

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pCi/g - picoCuries per gram

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Unc (±) - Uncertainty reported by laboratory in radiological counts.

TABLE 11
VALIDATED BACKGROUND SURFACE SOIL SAMPLING RESULTS
FOR RADIONUCLIDES
YARD 520 DATA EVALUATION REPORT
PINES AREA OF INVESTIGATION

		Location ID:	SS014		SS015		SS016		SS017		SS018	
		Sample Date:	05/01/2007		04/30/2007		04/30/2007		05/01/2007		05/01/2007	
		Sample ID:	SS014ASS050107S		SS015ASS043007S		SS016ASS043007S		SS017ASS050107S		SS018ASS050107S	
		Sample Matrix:	Soil		Soil		Soil		Soil		Soil	
		Depth Interval (feet)	0 - 0.5		0 - 0.5		0 - 0.5		0 - 0.5		0 - 0.5	
		Sample Type:	Sample		Sample		Sample		Sample		Sample	
CAS Number	**Chemical Name**	**Unit**	**Result**	**Unc (±)**	**Result**	**Unc (±)**	**Result**	**Unc (±)**	**Result**	**Unc (±)**	**Result**	**Unc (±)**
RADIOLOGICAL PARAMETERS												
14952-40-0	ACTINIUM-227	pCi/g	-0.0222 U	0.0801	0.0668 U	0.172	-0.0108 U	0.216	0.079 U	0.101	0.037 U	0.124
14255-04-0	LEAD-210	pCi/g	0.622	0.147	7.37	2.75	5.17	0.829	1.94 U	2.96	2.51	1.09
13981-52-7	POLONIUM-210	pCi/g	0.622	0.144	7.37	2.73	5.17	0.801	1.94 U	2.96	2.51	1.08
14331-85-2	PROTACTINIUM-231	pCi/g	-0.0149 U	0.326	-0.316 U	0.726	-0.0371 U	0.886	0.105 U	0.388	-0.123 U	0.410
13982-63-3	RADIUM-226	pCi/g	0.233	0.0417	0.416	0.0808	0.472	0.126	0.153	0.0408	0.499	0.0635
15262-20-1	RADIUM-228	pCi/g	0.290	0.0908	0.333	0.138	0.632	0.227	0.261	0.0709	0.423	0.101
14274-82-9	THORIUM-228	pCi/g	0.330	0.0373	0.556	0.0725	0.785	0.101	0.259	0.041	0.532	0.0528
14269-63-7	THORIUM-230	pCi/g	0.233	0.0416	0.416	0.0807	0.472	0.126	0.153	0.0408	0.499	0.0635
7440-29-1	THORIUM-232	pCi/g	0.247	0.0279	0.414	0.054	0.585	0.0751	0.193	0.0306	0.398	0.0395
13966-29-5	URANIUM-234	pCi/g	0.264 J	0.0515	0.399	0.124	0.383	0.163	0.176	0.0587	0.589 J	0.0725
15117-96-1	URANIUM-235	pCi/g	0.00 U	0.0579	0.131 U	0.154	0.0369 U	0.189	-0.0103 U	0.0787	0.144	0.117
7440-61-1	URANIUM-238	pCi/g	0.338	0.161	0.457 U	0.882	0.00 U	0.650	0.2 U	0.872	1.95	0.606

Notes:

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Unc (±) - Uncertainty reported by laboratory in radiological counts.

TABLE 11
VALIDATED BACKGROUND SURFACE SOIL SAMPLING RESULTS
FOR RADIONUCLIDES
YARD 520 DATA EVALUATION REPORT
PINES AREA OF INVESTIGATION

		Location ID:	SS019		SS020		SS021		SS021		SS022	
		Sample Date:	05/01/2007		05/01/2007		05/01/2007		05/01/2007		05/01/2007	
		Sample ID:	SS019ASS050107S		SS020ASS050107S		SS021ASS050107D		SS021ASS050107S		SS022ASS050107S	
		Sample Matrix:	Soil		Soil		Soil		Soil		Soil	
		Depth Interval (feet)	0 - 0.5		0 - 0.5		0 - 0.5		0 - 0.5		0 - 0.5	
		Sample Type:	Sample		Sample		Duplicate		Sample		Sample	
CAS Number	**Chemical Name**	**Unit**	**Result**	**Unc (±)**	**Result**	**Unc (±)**	**Result**	**Unc (±)**	**Result**	**Unc (±)**	**Result**	**Unc (±)**
RADIOLOGICAL PARAMETERS												
14952-40-0	ACTINIUM-227	pCi/g	0.0478 U	0.0854	-0.0645 U	0.0804	-0.0215 U	0.131	0.0531 U	0.133	0.0719 U	0.106
14255-04-0	LEAD-210	pCi/g	0.0379 U	1.37	1.22	0.649	1.77	0.383	1.61	0.358	1.74	1.47
13981-52-7	POLONIUM-210	pCi/g	0.0379 U	1.37	1.22	0.647	1.77	0.376	1.61	0.352	1.74	1.47
14331-85-2	PROTACTINIUM-231	pCi/g	-0.131 U	0.347	0.0695 U	0.330	-0.0898 U	0.613	0.15 U	0.493	-0.171 U	0.445
13982-63-3	RADIUM-226	pCi/g	0.208	0.0419	0.185	0.0351	0.720	0.0933	0.656	0.0866	0.445	0.0555
15262-20-1	RADIUM-228	pCi/g	0.300	0.0782	0.269	0.0772	0.960	0.167	0.856	0.150	0.511	0.104
14274-82-9	THORIUM-228	pCi/g	0.338	0.0459	0.340	0.0397	1.18	0.121	1.02	0.0901	0.603	0.0601
14269-63-7	THORIUM-230	pCi/g	0.208	0.0419	0.185	0.0351	0.720	0.0933	0.656	0.0866	0.445	0.0555
7440-29-1	THORIUM-232	pCi/g	0.253	0.0343	0.254	0.0297	0.879	0.090	0.760	0.0674	0.451	0.0449
13966-29-5	URANIUM-234	pCi/g	0.278 J	0.052	0.207 J	0.0617	0.808 J	0.116	0.613 J	0.0891	0.438 J	0.0731
15117-96-1	URANIUM-235	pCi/g	0.017 U	0.0681	0.0138 U	0.0644	0.0546 U	0.0995	0.00607 U	0.0918	0.0687 U	0.084
7440-61-1	URANIUM-238	pCi/g	0.467 U	0.501	0.196 U	0.304	0.935	0.343	0.938	0.388	0.493 U	0.524

Notes:

CAS - Chemical Abstract Service

ID - Identifier

pCi/g - picoCuries per gram

J - The result is an estimated quantity; the associated numerical value is the approximate concentration of the analyte in the sample.

U - The analyte was analyzed for, but was not detected above the sample reporting limit.

Unc (±) - Uncertainty reported by laboratory in radiological counts.

TABLE 11
VALIDATED BACKGROUND SURFACE SOIL SAMPLING RESULTS
FOR RADIONUCLIDES
YARD 520 DATA EVALUATION REPORT
PINES AREA OF INVESTIGATION

		Location ID:	SS023		SS024		SS025	
		Sample Date:	04/30/2007		04/30/2007		04/30/2007	
		Sample ID:	SS023ASS043007S		SS024ASS043007S		SS025ASS043007S	
		Sample Matrix:	Soil		Soil		Soil	
		Depth Interval (feet)	0 - 0.5		0 - 0.5		0 - 0.5	
		Sample Type:	Sample		Sample		Sample	
CAS Number	**Chemical Name**	**Unit**	**Result**	**Unc (±)**	**Result**	**Unc (±)**	**Result**	**Unc (±)**
RADIOLOGICAL PARAMETERS								
14952-40-0	ACTINIUM-227	pCi/g	0.0809 U	0.100	0.0369 U	0.0674	0.0277 U	0.169
14255-04-0	LEAD-210	pCi/g	0.231 U	0.873	0.919	0.730	7.65	1.93
13981-52-7	POLONIUM-210	pCi/g	0.231 U	0.873	0.919	0.729	7.65	1.90
14331-85-2	PROTACTINIUM-231	pCi/g	0.0964 U	0.455	0.0923 U	0.269	-0.162 U	0.897
13982-63-3	RADIUM-226	pCi/g	0.173	0.0412	0.265	0.0392	0.481	0.0896
15262-20-1	RADIUM-228	pCi/g	0.215	0.0784	0.311	0.0635	0.397	0.143
14274-82-9	THORIUM-228	pCi/g	0.258	0.0455	0.321	0.0337	0.492	0.0691
14269-63-7	THORIUM-230	pCi/g	0.173	0.0412	0.265	0.0392	0.481	0.0896
7440-29-1	THORIUM-232	pCi/g	0.192	0.0339	0.239	0.0251	0.367	0.0515
13966-29-5	URANIUM-234	pCi/g	0.148	0.0595	0.274	0.0485	0.536	0.121
15117-96-1	URANIUM-235	pCi/g	-0.00668 U	0.0816	0.0563 U	0.0477	0.0252 U	0.130
7440-61-1	URANIUM-238	pCi/g	0.346 U	0.428	0.222 U	0.264	-0.477 U	0.693

Notes:

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Unc (±) - Uncertainty reported by laboratory in radiological counts.

AECOM

TABLE 12
VALIDATED SEDIMENT SAMPLING RESULTS
FOR RADIONUCLIDES
YARD 520 DATA EVALUATION REPORT
PINES AREA OF INVESTIGATION

			Location ID:		SW001		SW020		SW022		SW022		SW023		SW023		SW023		SW024	
			Sample Date:		10/23/2006		10/25/2006		10/24/2006		10/24/2006		10/24/2006		10/24/2006		10/24/2006		10/24/2006	
			Sample ID:		SW001ASD102306S		SW020ASD102506S		SW022ASD102406S		SW022BSD102406S		SW023ASD102406S		SW023ASD102406D		SW023BSD102406S		SW024ASD102406S	
			Sample Matrix:		Sediment		Sediment		Sediment		Sediment		Sediment		Sediment		Sediment		Sediment	
			Depth Interval (feet):		0 - 0.5		0 - 0.5		0 - 0.5		0.5 - 1.0		0 - 0.5		0 - 0.5		0.5 - 1.0		0 - 0.5	
			Sample Type:		Sample		Sample		Sample		Sample		Sample		Duplicate		Sample		Sample	
CAS Number	**Chemical Name**	**Unit**	**Result**	**Unc (±)**	**Result**	**Unc (±)**	**Result**	**Unc (±)**	**Result**	**Unc (±)**	**Result**	**Unc (±)**	**Result**	**Unc (±)**	**Result**	**Unc (±)**	**Result**	**Unc (±)**	**Result**	**Unc (±)**
RADIOLOGICAL PARAMETERS																				
14952-40-0	ACTINIUM-227	pCi/g	-0.0376 U	0.0765	0.0189 U	0.0694	-0.0197 U	0.152	-0.0875 U	0.151	0.0419 U	0.117	0.115 U	0.174	0.0206 U	0.0647	-0.0413 U	0.0991		
14255-04-0	LEAD-210	pCi/g	0.362	0.210	0.569 U	1.06	0.795 U	3.26	0 U	4.98	2.39 U	2.22	1.16	0.334	0.0524 U	0.748	0.752	0.227		
13981-52-7	POLONIUM-210	pCi/g	0.362	0.210	0.569 U	1.06	0.795 U	3.26	0 U	4.98	2.39 U	2.22	1.16	0.334	0.0524 U	0.748	0.752	0.227		
14331-85-2	PROTACTINIUM-231	pCi/g	-0.295 U	0.305	-0.0799 U	0.277	0.306 U	0.559	-0.354 U	0.601	-0.303 U	0.402	0.220 U	0.457	-0.19 U	0.258	0.0634 U	0.350		
13982-63-3	RADIUM-226	pCi/g	0.357	0.0407	0.176	0.0349	1.32	0.0758	1.44	0.0727	0.844	0.049	0.847	0.109	0.183	0.030	0.447	0.042		
15262-20-1	RADIUM-228	pCi/g	0.317	0.0743	0.212	0.0675	0.910	0.122	0.917	0.125	0.857	0.0862	0.966	0.162	0.262	0.0554	0.439	0.0739		
14274-82-9	THORIUM-228	pCi/g	0.261	0.0224	0.243	0.0292	1.02	0.0461	1.12	0.0477	0.958	0.0319	0.942	0.111	0.243	0.0198	0.435	0.0262		
14269-63-7	THORIUM-230	pCi/g	0.357	0.0407	0.176	0.0349	1.32	0.0758	1.44	0.0727	0.844	0.049	0.846	0.109	0.183	0.030	0.447	0.042		
7440-29-1	THORIUM-232	pCi/g	0.257	0.022	0.237	0.0285	1.00	0.0453	1.10	0.0469	0.941	0.0314	0.919	0.108	0.239	0.0195	0.428	0.0257		
13966-29-5	URANIUM-234	pCi/g	0.398	0.0646	0.209	0.051	1.53	0.125	1.62	0.122	0.984	0.0722	0.944	0.144	0.249	0.0468	0.503	0.0748		
15117-96-1	URANIUM-235	pCi/g	0.0299 U	0.0385	0.0162 U	0.0638	0.0594 U	0.114	0.163	0.128	0.0451 U	0.0963	0.0625 U	0.0765	0.0406 U	0.0366	0.0548 U	0.0618		
7440-61-1	URANIUM-238	pCi/g	0.164 U	0.201	0.347 U	0.308	0.659 U	1.13	1.11	1.03	0.863	0.735	0.703	0.329	0.135 U	0.384	0.198 U	0.234		

Notes:

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ID - Identifier

pCi/g - picoCuries per gram

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Unc (±) - Uncertainty reported by laboratory in radiological counts.

Figures

YARD 520

BROWN DITCH

GP004
GP005
GP006
GP007
GP008
GP009
GP009A
GP010
GP011
GP012
GP012A
GP013

Legend

- September 2005 - Analytical Sample Location
- September 2006 - Geologic Logging Only
- September 2005 - Analytical Sample Location and September 2006 - Geologic Logging Location
- Roads
- Railroads
- Surface Water
- Topographic Contours (2-Ft Interval)
- Buildings

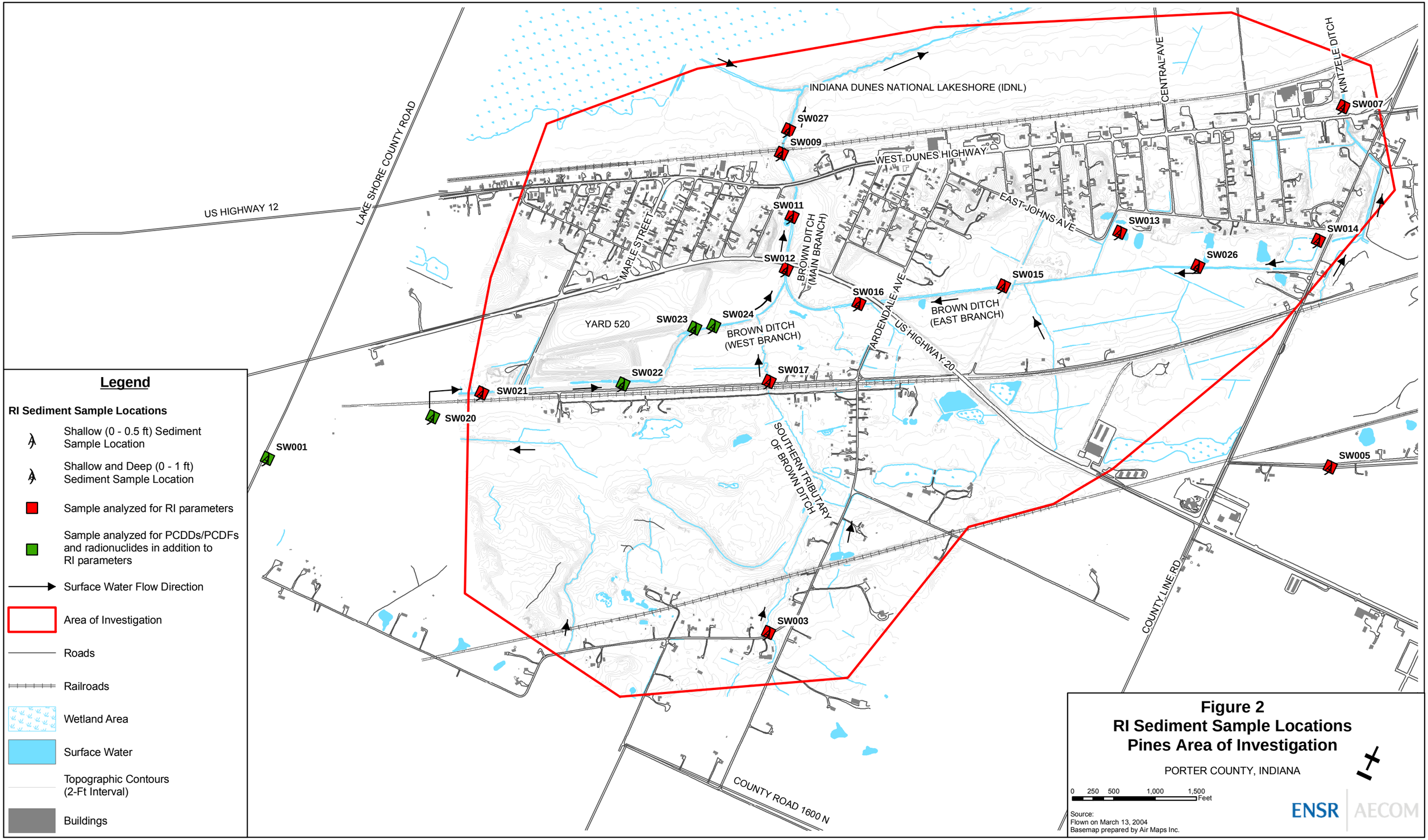
Figure 1
Yard 520 Type III (South) Area
Boring Locations
Pines Area of Investigation

PORTER COUNTY, INDIANA

0 50 100 200 300 Feet

Source:
Flown on March 13, 2004
Basemap prepared by Air Maps Inc.

ENSR | AECOM



Legend

RI Sediment Sample Locations

- Shallow (0 - 0.5 ft) Sediment Sample Location
- Shallow and Deep (0 - 1 ft) Sediment Sample Location
- Sample analyzed for RI parameters
- Sample analyzed for PCDDs/PCDFs and radionuclides in addition to RI parameters
- Surface Water Flow Direction
- Area of Investigation
- Roads
- Railroads
- Wetland Area
- Surface Water
- Topographic Contours (2-Ft Interval)
- Buildings

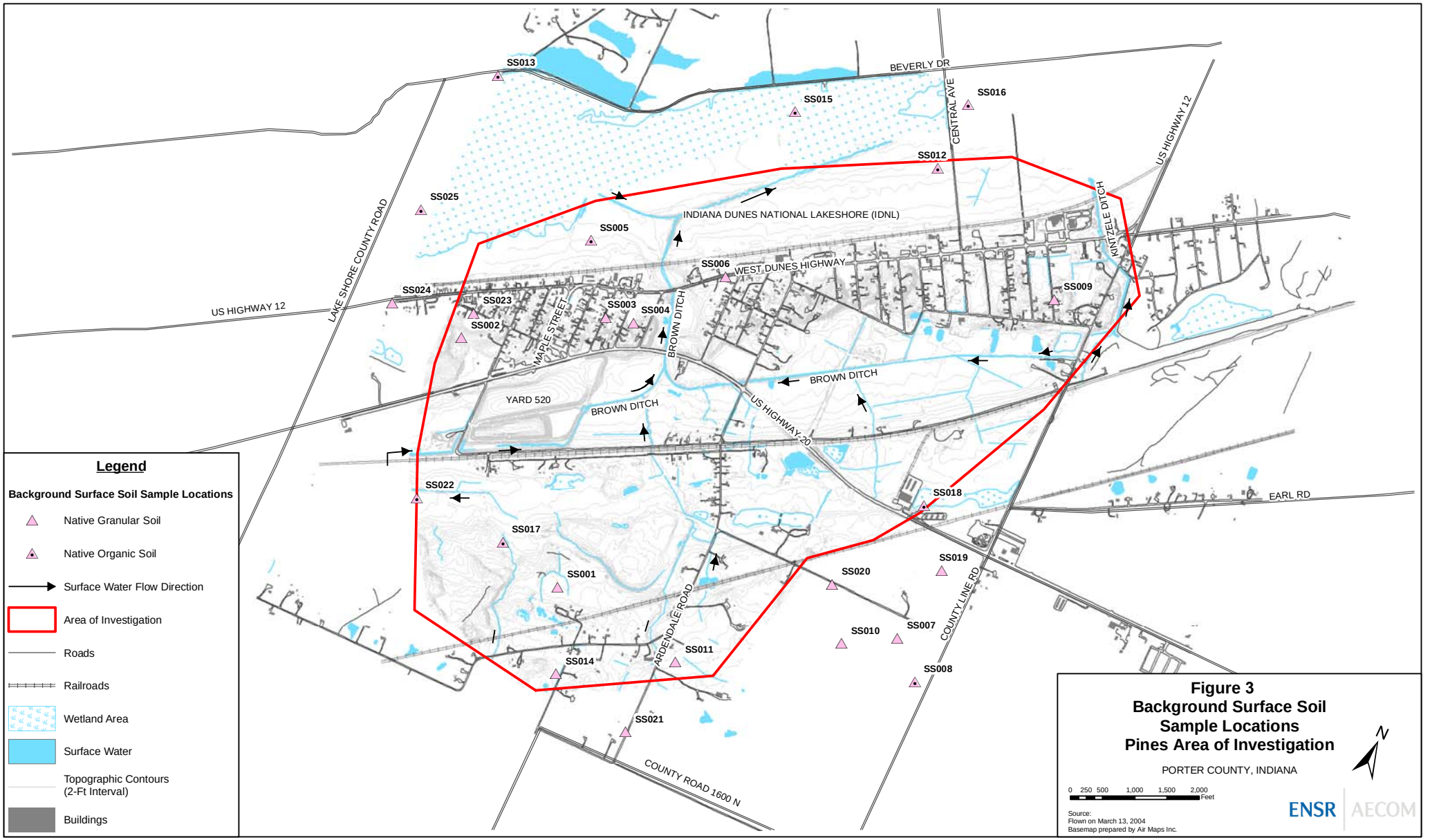
Figure 2
RI Sediment Sample Locations
Pines Area of Investigation

PORTER COUNTY, INDIANA

0 250 500 1,000 1,500 Feet

Source:
Flown on March 13, 2004
Basemap prepared by Air Maps Inc.

ENSR | AECOM


SS013
BEVERLY DR
SS015
SS016
CENTRAL AVE
US HIGHWAY 12
SS012
SS025
INDIANA DUNES NATIONAL LAKESHORE (IDNL)
KINTZELE DITCH
SS005
SS006
WEST DUNES HIGHWAY
SS009
LAKE SHORE COUNTY ROAD
US HIGHWAY 12
SS024
SS023
SS002
SS003
SS004
MAPLE STREET
BROWN DITCH
BROWN DITCH
YARD 520
BROWN DITCH
US HIGHWAY 20
SS022
SS018
EARL RD
SS017
SS019
SS001
SS020
COUNTY LINE RD
ARDENDALE ROAD
SS007
SS010
SS011
SS014
SS008
SS021
COUNTY ROAD 1600 N
Legend
Background Surface Soil Sample Locations
Native Granular Soil
Native Organic Soil
Surface Water Flow Direction
Area of Investigation
Roads
Railroads
Wetland Area
Surface Water
Topographic Contours (2-Ft Interval)
Buildings
Figure 3
Background Surface Soil Sample Locations
Pines Area of Investigation
PORTER COUNTY, INDIANA
N
0 250 500 1,000 1,500 2,000 Feet
Source:
Flown on March 13, 2004
Basemap prepared by Air Maps Inc.
ENSR
AECOM

Attachment A

Yard 520 Type III (South) Area Boring Logs

ENSR | AECOM	PROJECT NAME: Pines Area of Investigation	**Boring ID: GP005**
	PROJECT NUMBER: 01776-033-100	
	TOWNSHIP: Pine	

BORING LOCATION:	Yard 520	DATE STARTED:	09/05/06	SHEET:	1 of 2
DRILLING CONTRACTOR:	Enviro-Dynamics	DATE FINISHED:	09/05/06	DATUM:	Ground Surface
DRILLING METHOD:	Geoprobe	DEPTH TO WATER (FEET):	NE	COMPLETION DEPTH (FEET):	12
SAMPLING METHOD:	Dual Tube	LOGGED BY:	C. Buckman	APPROVED BY:	E. Perry
EASTING: 2986854.22	NORTHING: 2341836.16	COORDINATE SYSTEM AND UNITS:	US State Plane - IN State Plane (ft) NAD 83		

SAMPLES USCS	SAMPLES Sample Interval	SAMPLES Recov. (ft)	DEPTH (BGS)	**Description:** color, size, range, main and minor components, moisture content, structure, angularity, maximum grain size, odor, and Geologic Unit (If Known).	REMARKS
CL	0-4 ft	3.4	0.0 – 4.0	Light gray to brown CLAY (CL). Dry to moist. Low to medium Plasticity.Trace silt. Trace roots/grass. (Clay Cover)	
CL	4-8 ft	3.2	4.0 – 8.0	Light brown to tan CLAY (CL). Dry with low plasticity and trace silt. (COAL COMBUSTION BYPRODUCT (CCB) Material and/or other Fill)	
CL	8-12 ft	3.8	8.0 – 10.0	SAME AS ABOVE. (CCB Material and/or other Fill)	

ENSR | AECOM	PROJECT NAME:	Pines Area of Investigation	**Boring ID:**
	PROJECT NUMBER:	01776-033-100	**GP005**
	TOWNSHIP:	Pine	

BORING LOCATION:	Yard 520		DATE STARTED:	09/05/06	SHEET: 2 of 2
DRILLING CONTRACTOR:	Enviro-Dynamics		DATE FINISHED:	09/05/06	DATUM: Ground Surface
DRILLING METHOD:	Geoprobe		DEPTH TO WATER (FEET):	NE	COMPLETION DEPTH (FEET): 12
SAMPLING METHOD:	Dual Tube		LOGGED BY:	C. Buckman	APPROVED BY: E. Perry
EASTING:	2986854.22	NORTHING: 2341836.16	COORDINATE SYSTEM AND UNITS:	US State Plane - IN State Plane (ft) NAD 83	

SAMPLES			DEPTH (BGS)	**Description:** color, size, range, main and minor components, moisture content, structure, angularity, maximum grain size, odor, and Geologic Unit (If Known).	REMARKS
USCS	Sample Interval	Recov. (ft)			
SP			11.0	Light gray to gray SANDY SILT (SP) with trace clay. Medium plasticity. Refusal at 10.4 feet bgs. (CCB Material and/or other Fill)	
			12.0		

ENSR | AECOM	PROJECT NAME: Pines Area of Investigation	Boring ID: GP006
	PROJECT NUMBER: 01776-033-100	
	TOWNSHIP: Pine	

BORING LOCATION:	Yard 520	DATE STARTED:	09/05/06	SHEET:	1 of 2
DRILLING CONTRACTOR:	Enviro-Dynamics	DATE FINISHED:	09/05/06	DATUM:	Ground Surface
DRILLING METHOD:	Geoprobe	DEPTH TO WATER (FEET):	NE	COMPLETION DEPTH (FEET):	12
SAMPLING METHOD:	Dual Tube	LOGGED BY:	C. Buckman	APPROVED BY:	E. Perry
EASTING: 2986628.82	NORTHING: 2341789.86	COORDINATE SYSTEM AND UNITS:	US State Plane - IN State Plane (ft) NAD 83		

SAMPLES USCS	Sample Interval	Recov. (ft)	DEPTH (BGS)	Description: color, size, range, main and minor components, moisture content, structure, angularity, maximum grain size, odor, and Geologic Unit (If Known).	REMARKS
CL	0-4 ft	3.4	0.0 – 2.0	Light gray to gray CLAY (CL). Dry to moist. Low to medium Plasticity.Trace silt. Trace roots/grass. (Clay Cover)	
ML			2.0 – 4.0	Light brown to brown dry SILTY CLAY (ML). Trace angular gravel. Low plasticity. (COAL COMBUSTION BYPRODUCT (CCB) Material and/or other Fill)	
ML	4-8 ft	3	4.0 – 8.0	SAME AS ABOVE. Trace dry clay clasts <0.5 in. in diameter. (CCB Material and/or other Fill)	
SM	8-12 ft	3.6	8.0 – 9.0	Light brown SILTY SAND (SM). Poorly sorted. Moist to wet. (CCB Material and/or other Fill)	
GC			9.0 – 10.0	Light brown gravelly CLAY (GC). Poorly sorted. Moist. (CCB Material and/or other Fill)	

ENSR | AECOM	PROJECT NAME:	Pines Area of Investigation	**Boring ID:**
	PROJECT NUMBER:	01776-033-100	**GP006**
	TOWNSHIP:	Pine	

BORING LOCATION:	Yard 520		DATE STARTED:	09/05/06	SHEET: 2 of 2
DRILLING CONTRACTOR:	Enviro-Dynamics		DATE FINISHED:	09/05/06	DATUM: Ground Surface
DRILLING METHOD:	Geoprobe		DEPTH TO WATER (FEET):	NE	COMPLETION DEPTH (FEET): 12
SAMPLING METHOD:	Dual Tube		LOGGED BY:	C. Buckman	APPROVED BY: E. Perry
EASTING:	2986628.82	NORTHING: 2341789.86	COORDINATE SYSTEM AND UNITS:	US State Plane - IN State Plane (ft) NAD 83	

SAMPLES			DEPTH (BGS)	**Description:** color, size, range, main and minor components, moisture content, structure, angularity, maximum grain size, odor, and Geologic Unit (If Known).	REMARKS
USCS	Sample Interval	Recov. (ft)			
ML			11.0	Light brown to brown SILTY CLAY (ML). Trace moisture. Refusal at 12.0 feet bgs. (CCB Material and/or other Fill)	
			12.0		

ENSR | AECOM	PROJECT NAME: Pines Area of Investigation	**Boring ID: GP009A**
	PROJECT NUMBER: 01776-033-100	
	TOWNSHIP: Pine	

BORING LOCATION:	Yard 520	DATE STARTED:	09/05/06	SHEET:	1 of 2
DRILLING CONTRACTOR:	Enviro-Dynamics	DATE FINISHED:	09/05/06	DATUM:	Ground Surface
DRILLING METHOD:	Geoprobe	DEPTH TO WATER (FEET):	NE	COMPLETION DEPTH (FEET):	20
SAMPLING METHOD:	Dual Tube	LOGGED BY:	C. Buckman	APPROVED BY:	E. Perry
EASTING: 2986333.89	NORTHING: 2341650.58	COORDINATE SYSTEM AND UNITS:	US State Plane - IN State Plane (ft) NAD 83		

SAMPLES USCS	SAMPLES Sample Interval	SAMPLES Recov. (ft)	DEPTH (BGS)	**Description:** color, size, range, main and minor components, moisture content, structure, angularity, maximum grain size, odor, and Geologic Unit (If Known).	REMARKS
OL			0.0	Black TOPSOIL. Trace silt/roots. Moist. (Clay Cover)	
CL	0-4 ft	1.5	1.0 – 4.0	Light gray to gray moist CLAY (CL). Trace roots/coarse sand. Poorly sorted. (COAL COMBUSTION BYPRODUCT (CCB) Material and/or other Fill)	
ML	4-8 ft	3.7	4.0 – 8.0	Light brown to brown SILTY CLAY (ML). Moisture varies with depth. Trace black sand. (CCB Material and/or other Fill)	
ML	8-12 ft	2.8	8.0 – 10.0	SAME AS ABOVE. Coarse gravel at 9.0 feet bgs. Moisture decreases with depth. (CCB Material and/or other Fill)	

ENSR | AECOM	PROJECT NAME:	Pines Area of Investigation	**Boring ID: GP009A**
	PROJECT NUMBER:	01776-033-100	
	TOWNSHIP:	Pine	

BORING LOCATION:	Yard 520	DATE STARTED:	09/05/06	SHEET:	2 of 2
DRILLING CONTRACTOR:	Enviro-Dynamics	DATE FINISHED:	09/05/06	DATUM:	Ground Surface
DRILLING METHOD:	Geoprobe	DEPTH TO WATER (FEET):	NE	COMPLETION DEPTH (FEET):	20
SAMPLING METHOD:	Dual Tube	LOGGED BY:	C. Buckman	APPROVED BY:	E. Perry
EASTING: 2986333.89	NORTHING: 2341650.58	COORDINATE SYSTEM AND UNITS:	US State Plane - IN State Plane (ft) NAD 83		

SAMPLES USCS	Sample Interval	Recov. (ft)	DEPTH (BGS)	Description: color, size, range, main and minor components, moisture content, structure, angularity, maximum grain size, odor, and Geologic Unit (If Known).	REMARKS
			11.0		
			12.0		
			13.0		
ML	12-16 ft	4	14.0	SAME AS ABOVE. Moist. (CCB Material and/or other Fill)	
			15.0		
			16.0		
			17.0		
ML	16-20 ft	4	18.0	SAME AS ABOVE. (CCB Material and/or other Fill)	
			19.0		
			20.0		

ENSR | AECOM	PROJECT NAME:	Pines Area of Investigation	**Boring ID: GP012A**
	PROJECT NUMBER:	01776-033-100	
	TOWNSHIP:	Pine	

BORING LOCATION:	Yard 520	DATE STARTED:	09/05/06	SHEET:	1 of 2
DRILLING CONTRACTOR:	Enviro-Dynamics	DATE FINISHED:	09/05/06	DATUM:	Ground Surface
DRILLING METHOD:	Geoprobe	DEPTH TO WATER (FEET):	NE	COMPLETION DEPTH (FEET):	16
SAMPLING METHOD:	Dual Tube	LOGGED BY:	C. Buckman	APPROVED BY:	E. Perry
EASTING: 2986069.98	NORTHING: 2341433.10	COORDINATE SYSTEM AND UNITS:	US State Plane - IN State Plane (ft) NAD 83		

SAMPLES USCS	SAMPLES Sample Interval	SAMPLES Recov. (ft)	DEPTH (BGS)	**Description:** color, size, range, main and minor components, moisture content, structure, angularity, maximum grain size, odor, and Geologic Unit (If Known).	REMARKS
CL	0-4 ft	3.8	0.0 – 2.0	Gray CLAY (CL). Low plasticity. Dry to moist. (Clay Cover)	
CL			2.0 – 4.0	Brown CLAY (CL). Moist to wet. (COAL COMBUSTION BYPRODUCT (CCB) Material and/or other Fill)	
CL	4-8 ft	3.4	4.0 – 8.0	SAME AS ABOVE. Dry. Poorly sorted. Trace silty clay. (CCB Material and/or other Fill)	
CL	8-12 ft	3	8.0 – 10.0	SAME AS ABOVE. Light brown to gray. Dry. Poorly sorted. Trace medium gravel. (CCB Material and/or other Fill)	

ENSR | AECOM	PROJECT NAME:	Pines Area of Investigation	**Boring ID: GP012A**
	PROJECT NUMBER:	01776-033-100	
	TOWNSHIP:	Pine	

BORING LOCATION:	Yard 520	DATE STARTED:	09/05/06	SHEET:	2 of 2
DRILLING CONTRACTOR:	Enviro-Dynamics	DATE FINISHED:	09/05/06	DATUM:	Ground Surface
DRILLING METHOD:	Geoprobe	DEPTH TO WATER (FEET):	NE	COMPLETION DEPTH (FEET):	16
SAMPLING METHOD:	Dual Tube	LOGGED BY:	C. Buckman	APPROVED BY:	E. Perry
EASTING: 2986069.98	NORTHING: 2341433.10	COORDINATE SYSTEM AND UNITS:	US State Plane - IN State Plane (ft) NAD 83		

SAMPLES			DEPTH (BGS)	**Description:** color, size, range, main and minor components, moisture content, structure, angularity, maximum grain size, odor, and Geologic Unit (If Known).	REMARKS
USCS	Sample Interval	Recov. (ft)			
			11.0		
			12.0		
CL	12-16 ft	3.6	13.0 14.0 15.0	SAME AS ABOVE. (CCB Material and/or other Fill)	
			16.0		

Attachment B

Agency Correspondence

Attachment B1

November 18, 2005

Perry, Elizabeth

From: Mitchell, Dave

Sent: Friday, November 18, 2005 1:24 PM

To: ' Drexler.Timothy@epamail.epa.gov'; Karecki.Edward@epamail.epa.gov

Cc: 'Dan Sullivan/NiSource'; 'Gabe Rodriguez/NiSource'; 'Joe Ferry/NiSource'; Perry, Elizabeth; 'Val Blumenfeld/Brown'; Groves, Matthew; Bradley, Lisa; Gleason, Shannon; 'Josh More'; 'Lou Rundio/Brown'

Subject: Brown Ditch Field Reconnaissance Follow-up - Table and Figure

Attachments: Sediment_sample_locations_11-2005.pdf; Brown Ditch Sed.Sample.Loc.ID.11.05.pdf

Dear Tim,
It was good to have a chance to meet you and your team at the Pines AOI for the Brown Ditch field reconnaissance conducted earlier this month. We certainly lucked out on some pleasant weather and working conditions. Overall, I thought the field investigation of potential sampling locations on Brown Ditch and its tributaries resulted in a much clearer understanding of the waterbody and its sediment characteristics. I was pleased that we were able to arrive at consensus regarding placement of the sediment sampling locations.

As a follow-up to our field reconnaissance, I am providing three attachments: (1) a table (adapted from Table 3-1 in FSP Vol. 6. Ecological Risk Assessment Workplan) that summarizes the sediment depth, composition, and type of sample (shallow vs shallow + deep); (2) a figure which locates the samples transcribed from GPS coordinates (note we use a numeric identifier for sample locations on figure - see table for reference to letter code); and (3) a set of photographs taken at each sediment sampling location. The last will come as a separate e-mail due to the size.

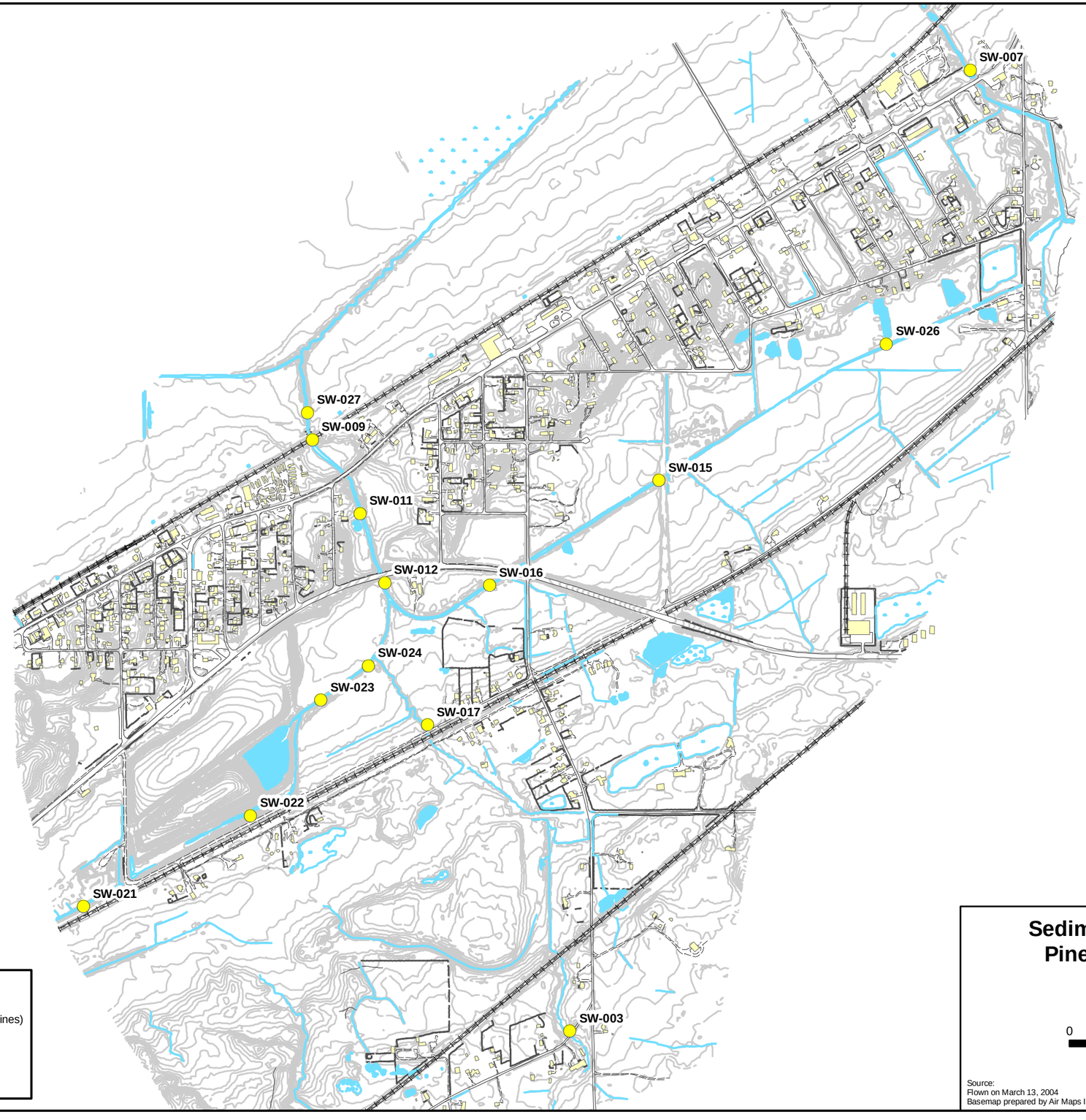
Please have your team review these materials and provide any comments or clarification as need. Once we have resolved any comments, I would like to request an email indicated consensus with and/or approval of sediment sampling locations.

Regards,

David F. Mitchell, Ph.D.

2 Technology Park Drive
Westford, MA 01886
Telephone: 978-589-3077; Fax: 978-589-3282

11 Phelp's Way
Willington, CT 06279-0506
Telephone: 860-429-5323, x-231; Fax: 860-429-5378



N

Legend

- Sediment Sampling Locations
- Topographic Contours (2-Ft Interval)
- Buildings
- Surface Water (lines)
- Surface Water
- Railroads

Sediment Sampling Locations
Pines Area of Investigation

PORTER COUNTY, INDIANA

0 500 1,000 2,000 Feet

Source:
Flown on March 13, 2004
Basemap prepared by Air Maps Inc.

ENSR INTERNATIONAL

Table 1.
Identified Sediment Sample Locations based on Brown Ditch stream reconnaissance (11/1-2/05)
Pines RI/FS Phase I Sampling
Pines Area of Investigation, Indiana

Location Code	FSP ID Number	Tributary System	Sediment Depth / Composition	Sample Types	Description/Location	Rationale
C	SW-003	South Branch Brown Ditch	Approximately 5" fine sand, more clayey at bottom	Shallow	▪ Upstream of Pines landfill area on SB-2 ▪ Downstream of road crossing	▪ Used as reference surface water and sediment sample
G	SW-007	Kintzele Ditch	Approximately 4" Rocky substrate w/ fine silt & sand	Shallow	▪ Kintzele Ditch just downstream of Route 12 crossing	▪ Used as regional reference surface water and sediment sample ▪ Comparison to H
H	SW-009	Brown Ditch Main Channel	Greater than 18" Highly organic with woody debris	Shallow & Deep	▪ Brown Ditch just upstream of IDNL at power easement / Calumet Trail	▪ Downstream limit of Brown Ditch prior to entry onto IDNL property
I	SW-011	Brown Ditch Main Channel	Greater than 18" Organic with sand layers	Shallow & Deep	▪ Brown Ditch, midway between Route 12 and 20 ▪ Near small pond to west and upstream of low beaver dam	▪ Captures influence of Route 20 crossing and within ecological habitat (large wetland area)
J	SW-012	Brown Ditch Main Channel	Greater than 18" Highly organic	Shallow & Deep	▪ Brown Ditch, upstream of Route 20 crossing and downstream of confluence of EB and WB	▪ Downstream of confluence of EB and WB
K	SW-013	Man-made Pond	Not sampled	To be determined	▪ Located in one of the man-made ponds near the eastern end of the EB	▪ To evaluate potential “attractive nuisance” area ▪ Potential overlap with HHRA
L Man-made	SW-014	Pond	Not sampled	To be determined	▪ Located in one of the man-made ponds adjacent to EB ▪ South of Carolina Ave.	▪ Same rationale as for K
M	SW-015	East Branch Brown Ditch	Approximately 6" Sand with fine silt covering	Shallow	▪ EB, upstream of unpaved road crossing (extension of Illinois Ave) ▪ Accessible off unpaved road	▪ Downstream of old town “dump” and small tributary from south ▪ Downstream of suspected CCBs encountered in utility trenches
N	SW-016	East Branch Brown Ditch	Greater than 18" Organic with sand layers	Shallow & Deep	▪ EB, downstream of Route 20 crossing near Ardendale Ave. ▪ Downstream of disturbed channel (crash site)	▪ Influence of roadway crossings ▪ Downstream of area of notable duckweed bloom (nutrients?)

Table 1.
Identified Sediment Sample Locations based on Brown Ditch stream reconnaissance (11/1-2/05)
Pines RI/FS Phase I Sampling
Pines Area of Investigation, Indiana

Location Code	FSP ID Number	Tributary System	Sediment Depth / Composition	Sample Types	Description/Location	Rationale
O	SW-017	South Branch Brown Ditch	Approximately 3" Fine sand	Shallow	▪ SB-2, downstream of RR and Railroad Ave. crossing	▪ Downstream of Pines Landfill and RR crossing
S	SW-021	West Branch Brown Ditch	Approximately 7" Fine silt, clay, slightly organic	Shallow	▪ WB, upstream of Birch Ave., in “new” WB channel; upstream of slight sheen. ▪ Access via RR right-of-way	▪ Located in vicinity of existing Yard 520 staff gage
T	SW-022	West Branch Brown Ditch	Greater than 15" Highly organic	Shallow & Deep	▪ WB, south of Yard 520 along Railroad Ave. in current WB channel ▪ Heavy vegetation with access to open channel closer to landfill	▪ Located slightly upstream from Yard 520. ▪ Located in vicinity of existing monitoring well cluster
U	SW-023	West Branch Brown Ditch	Greater than 10" Layers of fine silt and organic with sandy materials	Shallow & Deep	▪ WB, east of Yard 520 Det. Basin in current WB channel ▪ Bank erosion heavy, mostly sandy substrate with pockets of deeper materialsl	▪ Adjacent to Yard 520 near detention basin ▪ Located downstream of beaver dam
V	SW-024	West Branch Brown Ditch	Approximately 6" Fine sand	Shallow	▪ WB, east of Yard 520 Basin in former WB channel ▪ Upstream of SB-2	▪ Downstream of Yard 520 ▪ Located upstream of beaver dam
X	SW-026	East Branch Brown Ditch	Greater than 15" Highly organic	Shallow & Deep	▪ EB, south of Central Ave. ▪ Just downgradient from long (N-S) man-made pond	▪ Channel has considerable depth ▪ Upstream of old town “dump"
Y	SW-027	Brown Ditch Main Channel	Greater than 15" Highly organic	Shallow & Deep	▪ Brown Ditch just downstream of IDNL at power easement / Calumet Trail	▪ Deep organic deposits in shallow stream ▪ Downstream of covered bridge on Calumet Trail; access near H

Bradley, Lisa

From: Drexler.Timothy@epamail.epa.gov
Sent: Monday, December 12, 2005 9:35 AM
To: Mitchell, Dave
Cc: Bradley, Lisa
Subject: Re: Reminder about Pines Field Reconnaissance map and table.

Hi Dave:

Sorry for the delay. Our only comment is that the sample to be collected from the center of the Yard 520 pond is not on the map or table you sent. A shallow and deep sample will be needed at that location. Other than that, all of the information is as we agreed.

Thanks for the work. Please call if you have any questions.

Tim Drexler
Remedial Project Manager
Superfund Division
United States Environmental Protection Agency
77 W. Jackson Blvd., SR-5J
Chicago, Illinois 60604-3590

phone: 312.353.4367
fax: 312.886.7191

Attachment B2

June 8, 2006

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

June 8, 2006

Lisa Bradley
ENSR International
2 Technology Park Drive
Westford, Massachusetts 01886

Subject: Comments on April 25, 2006 Data Report Entitled Yard 520 Evaluation of PAHs, Dioxins, Furans, and Radionuclides

Dear Ms. Bradley:

US EPA and IDEM have reviewed the data report and have the following comments.

General Comments:

1. Based on sampling results, further general characterization of radionuclides in soil, sediment, and groundwater is required. In addition, based on screening level exceedences and generally lower screening levels in sediments, a limited number of sediment samples for dioxin and PAH analyses are warranted at the Pines site downstream of Yard 520. Based on the results of these sediment samples, a decision can be made on the need for more sampling.

2. A site map showing sample locations and well logs showing sample depth and location of the saturated zone should be included with this document.

Specific Comments:

1. Section 2.0
The screening levels for sediment PAHs are generally lower than for soils. Sediment sampling and analysis cannot be excluded based on a soil screening number. Total PAH concentrations in each sample need to be evaluated against total PAH screening values.

2. Section 3.1, third paragraph
According to Table 3, the TCDD-TEQ in sample GP013 exceeds the bird screen by 0.031 ng/kg, not 0.31 as stated here.

3. Section 4.1.1
Comparing the UCL for the various radionuclides from the Yard 520 CCB samples to the upper range of the concentration of that analyte in the background samples is not a scientifically

justifiable means of determining if the radionuclides in the CCBs exceed background concentrations. If ENSR means to compare the Yard 520 results to "background" a valid statistical method (ex. a T-test) should be employed. In addition, the appropriate foundation for the test should be provided (demonstration of a parametric distribution for both datasets, assign appropriate confidence limit and Null hypothesis).

A preliminary comparison of the data indicate that the radionuclide concentrations in the CCBs from Yard 520 exceed "background" radionuclide concentrations.

- Both the minimum detected concentration and the mean concentration for every radionuclide analyzed in the Yard 520 CCBs (save U-235 metal) exceeds the mean concentration in the "background" values reported in table 5.
- The maximum concentration in the Yard 520 samples also exceeds the maximum "background" value for several radionuclides.

Because most, if not all, radionuclide concentrations in the CCBs from Yard 520 are elevated relative to "background" concentrations, radionuclide contamination is indicated. If ENSR wishes to state that radionuclide concentrations in the area CCBs are consistent with background concentrations, a site-specific background value should be obtained.

2. Section 4.1.2
Mean concentrations in the samples from Yard 520 exceed the residential PRG for Pb-210, Ra-226, Ra-228, and U-235. The maximum detected concentration and/or the 95 UCL exceeds the PRG for these isotopes, Th-230, Th-232, U-234, and U-238. Additionally, ecological criteria for U and U-238 metals appear to be exceeded for all samples.

3. Section 4.1.3
This sentence is not correct. Samples at this site exceeded the risk based screening level for bird and mammal values.

4. Section 4.1.3
Oak Ridge National Lab has a Uranium plant screening benchmark of 5mg/kg. EPA Region 4 also uses 5 mg/kg as a soil screening benchmark. This should be stated in this section.

5. Section 5.0
PAH sampling should continue based on the reasons stated in comment 2 above.

6. Section 5.0
PCDDs/PCDF concentrations were detected above ecological risk screening levels. Sediment screening levels are generally lower than soil screening levels. Sampling and evaluation should continue to better evaluate the extent of contamination.

7. Section 5.0
Uranium was detected above background and above ecological risk screening levels. Sampling and analysis of radionuclides should continue in order to evaluate the extent of contamination.

Please revise the document to include these edits and resubmit them to EPA. If you have any questions and would like to discuss these comments, please contact me at drexler.timothy@epa.gov or 312-353-4367.

Sincerely,

Tim Drexler
Remedial Project Manager

cc: K. Herron, IDEM
S. Hicks, NPS

Attachment B3

September 8, 2006

ENSR
2 Technology Park Drive, Westford, Massachusetts 01886-3140
T 978.589.3000 F 978.589.3100 www.ensr.aecom.com

Memorandum

Date: 9/8/06

To: Tim Drexler/USEPA Region 5

Lisa JN Bradley, Ph.D., DABT
Christine Archer
Dave Mitchell, Ph.D.

From: Kelly Vosnakis

Subject: Response to the June 8, 2006 USEPA Comments on the April 25, 2006 Data Report Entitled Yard 520 Evaluation of PAHs, Dioxins, Furans, and Radionuclides; Pines Area of Investigation

Distribution: DSullivan/NiSource VBlumenfeld/Brown Inc.

Preliminary responses to the USEPA comments dated June 8, 2006 USEPA Comments on the April 25, 2006 Data Report Entitled "Yard 520 Evaluation of PAHs, Dioxins, Furans, and Radionuclides" for the Pines Area of Investigation are provided below. Per our conversation, the preliminary responses focus on the PAH and dioxin comments. Responses to the human health risk-based radionuclide comments will be provided separately. For ease of your review, the comments have been reproduced here (some have been renumbered: x [y]) and the responses are in italics and indented after the header "***Response***".

General Comments:

1. Based on sampling results, further general characterization of radionuclides in soil, sediment, and groundwater is required. In addition, based on screening level exceedences and generally lower screening levels in sediments, a limited number of sediment samples for dioxin and PAH analyses are warranted at the Pines site downstream of Yard 520. Based on the results of these sediment samples, a decision can be made on the need for more sampling.

> ***Response:*** *Based on the responses provided below, further sampling of PAHs and dioxins are not warranted.*

2. A site map showing sample locations and well logs showing sample depth and location of the saturated zone should be included with this document.

> ***Response:*** *A sample location map and boring logs will be included in the revised document. Note that the original boring logs were misplaced by ENSR. Based on discussion with Tim Drexler/USEPA Region 5, ENSR remobilized on September 5, 2006 and completed and logged the three borings in the north area and 4 of the borings in the South Area, under USEPA and IDEM supervision.*

ENSR
2 Technology Park Drive, Westford, Massachusetts 01886-3140
T 978.589.3000 F 978.589.3100 www.ensr.aecom.com

Specific Comments:

1. Section 2.0

The screening levels for sediment PAHs are generally lower than for soils. Sediment sampling and analysis cannot be excluded based on a soil screening number. Total PAH concentrations in each sample need to be evaluated against total PAH screening values.

> ***Response:*** *A comparison of the individual PAH results against the Region 5 sediment ESLs indicates that there are no detected PAHs present at levels above the associated sediment ESL. Region 5 does not have a sediment ESL for Total PAHs. However, USEPA Region 4 has a sediment screening value for Total PAHs (1.684 mg/kg; USEPA, 2001). An additional table has been prepared to present this screening against sediment benchmarks. This table is presented as Table 1 in this document and will be incorporated into the revised Yard 520 Data Evaluation Report. Although several of the detection limits for acenaphthene, acenaphthylene and fluorene are slightly above the individual Region 5 PAH ESLs, half the detection limit for each of these samples (the surrogate used for risk calculations) is not. Moreover, as can be seen in the table, the total PAH concentration for each sample location is below the USEPA Region 4 total PAH screening level. Therefore, it is concluded that no further sampling of PAHs is warranted.*
>
> *USEPA. 2001. Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment. Originally published November 1995. Website version last updated November 30, 2001: http://www.epa.gov/region4/waste/ots/ecolbul.htm*

2. Section 3.1, third paragraph

According to Table 3, the TCDD-TEQ in sample GP013 exceeds the bird screen by 0.031 ng/kg, not 0.31 as stated here.

> ***Response:*** *The text will be revised to state that the TCDD-TEQ in sample GP013 exceeds the bird screen by 0.031 ng/kg.*

3. Section 4.1.1

Comparing the UCL for the various radionuclides from the Yard 520 CCB samples to the upper range of the concentration of that analyte in the background samples is not a scientifically justifiable means of determining if the radionuclides in the CCBs exceed background concentrations. If ENSR means to compare the Yard 520 results to "background" a valid statistical method (ex. a T-test) should be employed. In addition, the appropriate foundation for the test should be provided (demonstration of a parametric distribution for both datasets, assign appropriate confidence limit and Null hypothesis).

A preliminary comparison of the data indicate that the radionuclide concentrations in the CCBs from Yard 520 exceed "background" radionuclide concentrations.

- Both the minimum detected concentration and the mean concentration for every radionuclide analyzed in the Yard 520 CCBs (save U-235 metal) exceeds the mean concentration in the "background" values reported in table 5.
- The maximum concentration in the Yard 520 samples also exceeds the maximum "background" value for several radionuclides.

Because most, if not all, radionuclide concentrations in the CCBs from Yard 520 are elevated relative to "background" concentrations, radionuclide contamination is indicated. If ENSR wishes to state that

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radionuclide concentrations in the area CCBs are consistent with background concentrations, a site-specific background value should be obtained.

Response: *[To be provided in a separate submission.]*

2 [4]. Section 4.1.2

Mean concentrations in the samples from Yard 520 exceed the residential PRG for Pb-210, Ra-226, Ra-228, and U-235. The maximum detected concentration and/or the 95 UCL exceeds the PRG for these isotopes, Th-230, Th-232, U-234, and U-238. Additionally, ecological criteria for U and U-238 metals appear to be exceeded for all samples.

Response: *Re: the comparison to ecological criteria, Section 4.1.3 indicates that the concentrations of naturally occurring uranium and its Uranium-238 component are greater than the phytotoxicity-based benchmark of 5 mg/kg. However, this benchmark is based on only one study conducted in 1983. More recent uranium toxicity data is currently available and is also discussed in Section 4.1.3. This more recent data indicates that effects to earthworms and plants are unlikely at the concentrations observed in the Yard 520 samples (Predicted No-Effect Concentrations of 100 mg/kg and 250 mg/kg, respectively).*

3 [5]. Section 4.1.3

This sentence is not correct. Samples at this site exceeded the risk based screening level for bird and mammal values.

Response: *Section 4.1.3 refers to the ecological evaluation of the radionuclide data which do not have bird- and mammal-based screening values. The document will be reviewed to confirm that benchmark exceedences are properly noted.*

4 [6]. Section 4.1.3

Oak Ridge National Lab has a Uranium plant screening benchmark of 5mg/kg. EPA Region 4 also uses 5 mg/kg as a soil screening benchmark. This should be stated in this section.

Response: *Section 4.1.3 and Table 5 include the 5 mg/kg Uranium screening value. The text will be revised to indicate that this value was developed by ORNL and is used by Region 4 as a screening value. However, see response to comment #2 [4] above.*

5 [7]. Section 5.0

PAH sampling should continue based on the reasons stated in comment 2 above.

Response: *All detected PAHs are below human health screening levels and below both soil and sediment based ecological screening levels (see Table 1). Therefore, it is concluded that no further sampling of PAHs is warranted.*

6 [8]. Section 5.0

PCDDs/PCDF concentrations were detected above ecological risk screening levels. Sediment screening levels are generally lower than soil screening levels. Sampling and evaluation should continue to better evaluate the extent of contamination.

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Response: *An additional table has been prepared to present the screening against sediment benchmarks. This table is presented as Table 2 in this document and will be incorporated into the revised Yard 520 Data Evaluation Report.*

The avian and mammalian TCDD-TEQs calculated for two of the ten sampling locations exceeded the USEPA Region 5 soil ESLs. Table 2 indicates that the USEPA Region 5 sediment ESL is exceeded by the avian and mammalian TCDD-TEQs calculated for one sampling location. These wildlife-based screening values are very conservative (as was discussed in detail in Section 3.1 of the report for the soil ESL). The application of a sediment ESL in a habitat with no permanent aquatic communities is especially conservative. In addition, the Yard 520 stormwater retention area has been formally covered and closed. A review of other ecological screening levels and the literature discussing PCDDs/PCDFs, indicates that it is unlikely there is any significant risk to ecological receptors.

The USEPA Region 5 sediment ESL was derived from a wildlife-based surface water screening value using the theory of Equilibrium Partitioning (EqP) and an assumption of 1% total organic carbon (TOC). Based on recent USEPA guidance (USEPA, 1999; USEPA, 2005) a default sediment TOC level of 4% was applied to the Region 5 sediment ESL to derive a sediment screening level of 0.48 ng/kg. This default TOC value is based on the mid-point of the range of values for bottom sediments (3% to 5% TOC) identified in a literature search by USEPA (1993a). USEPA (1998) states that the organic carbon content in bottom sediments is higher than the organic carbon content in soils because (1) erosion favors lighter-textured soils with higher organic carbon contents, and (2) bottom sediments are partially comprised of detritus materials. The use of this default TOC value is supported by field observations made during the stream investigation conducted on November 1, 2005 attended by USEPA. Visual observations of sediments (obtained with the Russian peat borer) within Brown Ditch downstream of Yard 520 indicate that sediment material is often found to a depth of greater than 10 inches and several locations were described as highly organic (see notes regarding sediment depth and composition in Sediment Sample Locations 11-2005 pdf document sent to Tim Drexler on November 18, 2005). These more highly organic sediments reduce the bioavailable fraction of organic compounds such as dioxins and furans and elevate the associated ecological screening values.

The basis of the EqP approach for deriving sediment screening values is that partitioning occurs in sediments between solid and aqueous phases. The surface water screening value, the carbon matter partition coefficient (K_{oc}), and the fraction organic carbon in the sediment are used to derive the sediment screening value. The surface water screening value (3×10^{-9} ug/L) used in the Region 5 sediment ESL was developed to be protective of piscivorous avian and mammalian wildlife and considered impacts to eagle, kingfisher, herring gull, mink, and otter. The ESL documentation does not indicate which species the surface water screening values applies to, but the Indiana Water Quality Standards in the Indiana Administrative Code (327 IAC 2-1.5-15) indicates that the lower of the geometric means of the values for birds and mammals is selected. In addition, the potentially impacted locations within Brown Ditch represent only a small fraction of the home range of the piscivorous wildlife receptors considered in the derivation of the sediment ESL.

A comparison of the TCDD-TEQ values to the TOC-adjusted sediment ESL (presented in Table 2) indicates an exceedence for only one of the ten samples; this sample, GP012 had an exceedence of both the bird and mammal TCDD-TEQ values.

As an additional evaluation of potential impacts to aquatic ecological receptors, values presented in the USEPA's Interim Report on Data and Methods for Assessment of 2,3,7,8-

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Tetrachlorodibenzo-p-dioxin Risks to Aquatic Life and Associated Wildlife (USEPA, 1993b) were considered. This document is listed as a source of benchmarks on USEPA Region 5's website (http://www.epa.gov/region5/superfund/ecology/html/screenguide.htm#tcdd) and presents fish- and wildlife-based sediment concentrations that are derived from no-effect thresholds for reproductive effects. These values were compared against the avian, mammalian and fish TCDD-TEQs in Table 2. All of the Yard 520 TCDD-TEQs are well below all of the sediment concentrations presented by USEPA (1993b) indicating that ecological receptors are unlikely to be at risk due to exposure to dioxins and furans.

A secondary comparison of the fish TEQ against a fish-based sediment screening value also indicates that aquatic receptors are unlikely to be at risk. USEPA guidance (1999) derived a sediment screening value for 2,3,7,8-TCDD from a fish-based surface water screening value using EqP and an assumption of 4% total organic carbon. The surface water screening value (3.8×10^{-6} ug/L) was based on a chronic low observed effect concentration for rainbow trout. All fish TEQs were well below the USEPA (1999) fish-based sediment screening level, indicating that impacts to aquatic receptors are unlikely.

Considering:

- *The Region 5 ESL soil and/or sediment based screening value exceedances in the two of ten samples were generally minimal,*
- *The lack of exceedances in comparisons against alternative TCDD screening values (i.e., ORNL values for soil and USEPA values for sediment),*
- *The lack of any exceedances for the fish-based sediment screening levels,*
- *The likelihood of TOC levels at greater than 1%, and*
- *The inherent uncertainties and conservative assumptions in the food web modeling used as the basis of the Region 5 ESLs (e.g., large home ranges, piscivorous receptors),*

it is unlikely there is any significant risk to ecological receptors. Therefore, no further sampling of PCDDs/PCDFs is warranted.

USEPA. 1993a. "Addendum to the Methodology for Assessing Heath Risks Associated with Indirect Exposure to Combustor Emissions." Working Group Recommendations. Office of Solid Waste. ORD. Washington D.C. September 24.

USEPA. 1993b. Interim Report on Data and Methods for Assessment of 2,3,7,8-Tetrachlorodibenzo-p-dioxin Risks to Aquatic Life and Associated Wildlife. Office of Research and Development. EPA/600/R-93/055.

USEPA. 1998. Methodology for Assessing Health Risks Associated with Multiple Pathways of Exposure to Combustor Emissions (MPE). Update to EPA/600/6-90/003. Office of Research and Development, National Center for Environmental Assessment, U.S. EPA. EPA/600/R-98/137. December.

USEPA, 1999. Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities. EPA/530/D-99/001A. December, 1999.

USEPA. 2005. Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities. EPA/530/R-05/006. September, 2005.

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7 [9]. Section 5.0

Uranium was detected above background and above ecological risk screening levels. Sampling and analysis of radionuclides should continue in order to evaluate the extent of contamination.

> ***Response:*** *As indicated in the Response to comments 2 [4] and 4 [6] above, and in Section 4.1.3, although the uranium concentrations are above the 5 mg/kg plant-based screening value for uranium developed by ORNL in 1997, the concentrations do not exceed recent effects data for uranium impacts to earthworms or plants, indicating that additional sampling is not warranted.*

TABLE 1
VALIDATED RESULTS OF YARD 520 SAMPLING FOR
POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)
COMPARED TO SEDIMENT-BASED ECOLOGICAL SCREENING VALUES

CAS No	Chemical Name	Ecological Screening Value (a) mg/kg	GP004 9/23/2005 GP004ICB092305S CCB mg/kg		GP005 9/23/2005 GP005ICB092305S CCB mg/kg		GP006 9/23/2005 GP006ICB092305S CCB mg/kg		GP007 9/23/2005 GP007ICB092305S CCB mg/kg	
91-57-6	2-Methylnaphthalene	0.0202	0.0049	UJ	0.007	UJ	0.0047	UJ	0.0052	UJ
83-32-9	Acenaphthene	0.00671	0.0088	UJ	0.0089	UJ	0.0095	UJ	0.01	UJ
208-96-8	Acenaphthylene	0.00587	0.0088	UJ	0.003	J	0.0095	UJ	0.01	UJ
120-12-7	Anthracene	0.0572	0.0045	J	0.0042	J	0.0095	UJ	0.01	UJ
56-55-3	Benz(a)anthracene	0.108	0.0091	J	0.009	J	0.0047	UJ	0.0052	UJ
50-32-8	Benzo(a)pyrene	0.15	0.0084	J	0.0099	J	0.0095	UJ	0.0041	J
205-99-2	Benzo(b)fluoranthene	10.4	0.013	J	0.013	J	0.0095	UJ	0.0052	J
191-24-2	Benzo(g,h,i)perylene	0.1702	0.0075	J	0.0089	J	0.0095	UJ	0.0039	J
207-08-9	Benzo(k)fluoranthene	0.24	0.0045	J	0.0054	J	0.0095	UJ	0.01	UJ
218-01-9	Chrysene	0.166	0.011	J	0.011	J	0.0095	UJ	0.0038	J
53-70-3	Dibenz(a,h)anthracene	0.033	0.0088	UJ	0.0089	UJ	0.0095	UJ	0.01	UJ
206-44-0	Fluroanthene	0.423	0.023	J	0.022	J	0.0095	UJ	0.01	UJ
86-73-7	Fluorene	0.00774	0.0088	UJ	0.0089	UJ	0.0095	UJ	0.01	UJ
193-39-5	Indeno(1,2,3-cd)pyrene	0.2	0.0059	J	0.0069	J	0.0095	UJ	0.01	UJ
91-20-3	Naphthalene	0.176	0.0088	UJ	0.0089	UJ	0.0095	UJ	0.01	UJ
85-01-8	Phenanthrene	0.204	0.015	J	0.013	J	0.0095	UJ	0.01	UJ
129-00-0	Pyrene	0.195	0.016	J	0.018	J	0.0095	UJ	0.01	UJ
	Total PAHs (b)	1.684	0.1179		0.1243		0.04985		0.0496	

Notes:
CCB -Coal Combustion By-Product.
U: The analyte was analyzed for, but not detected.
J: Estimated Value.
(a) - USEPA Region 5 Ecological Screening Level for Sediment
Updated August 22, 2003.
(http://www.epa.gov/reg5rcra/ca/ESL.pdf)
(b) - USEPA Region 4 Screening Value for Sediment
Updated November 30, 2001.
(http://www.epa.gov/region4/waste/ots/ecolbul.htm)
Highlighting indicates that detected concentration
is greater than the screening level.

TABLE 1
VALIDATED RESULTS OF YARD 520 SAMPLING FOR
POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)
COMPARED TO SEDIMENT-BASED ECOLOGICAL SCREENING VALUES

CAS No	Chemical Name	Ecological Screening Value (a) mg/kg	GP008 9/23/2005 GP008ICB092305S CCB mg/kg		GP008 9/23/2005 GP008ICB092305D CCB mg/kg		GP009 9/23/2005 GP009ICB092305S CCB mg/kg		GP010 9/23/2005 GP010ICB092305S CCB mg/kg	
91-57-6	2-Methylnaphthalene	0.0202	0.0048	UJ	0.0048	UJ	0.0054	UJ	0.0069	UJ
83-32-9	Acenaphthene	0.00671	0.0096	UJ	0.0095	UJ	0.011	UJ	0.011	UJ
208-96-8	Acenaphthylene	0.00587	0.0096	UJ	0.0095	UJ	0.011	UJ	0.0038	J
120-12-7	Anthracene	0.0572	0.0096	UJ	0.0095	UJ	0.011	UJ	0.0066	J
56-55-3	Benz(a)anthracene	0.108	0.0048	UJ	0.0048	UJ	0.0054	UJ	0.012	J
50-32-8	Benzo(a)pyrene	0.15	0.0096	UJ	0.0095	UJ	0.0042	J	0.0091	J
205-99-2	Benzo(b)fluoranthene	10.4	0.0096	UJ	0.0095	UJ	0.0068	J	0.011	J
191-24-2	Benzo(g,h,i)perylene	0.1702	0.0096	UJ	0.0095	UJ	0.0042	J	0.0066	J
207-08-9	Benzo(k)fluoranthene	0.24	0.0096	UJ	0.0095	UJ	0.011	UJ	0.011	UJ
218-01-9	Chrysene	0.166	0.0096	UJ	0.0095	UJ	0.0052	J	0.011	J
53-70-3	Dibenz(a,h)anthracene	0.033	0.0096	UJ	0.0095	UJ	0.011	UJ	0.011	UJ
206-44-0	Fluroanthene	0.423	0.0096	UJ	0.0095	UJ	0.011	J	0.028	J
86-73-7	Fluorene	0.00774	0.0096	UJ	0.0095	UJ	0.011	UJ	0.003	J
193-39-5	Indeno(1,2,3-cd)pyrene	0.2	0.0096	UJ	0.0095	UJ	0.0036	J	0.0054	J
91-20-3	Naphthalene	0.176	0.0096	UJ	0.0095	UJ	0.011	UJ	0.011	UJ
85-01-8	Phenanthrene	0.204	0.0096	UJ	0.0095	UJ	0.011	UJ	0.023	J
129-00-0	Pyrene	0.195	0.0096	UJ	0.0095	UJ	0.0075	J	0.023	J
	Total PAHs (b)	1.684	0.0499		0.0504		0.0562		0.1425	

Notes:
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(a) - USEPA Region 5 Ecological Screening Level for Sediment
Updated August 22, 2003.
(http://www.epa.gov/reg5rcra/ca/ESL.pdf)
(b) - USEPA Region 4 Screening Value for Sediment
Updated November 30, 2001.
(http://www.epa.gov/region4/waste/ots/ecolbul.htm)
Highlighting indicates that detected concentration
is greater than the screening level.

TABLE 1
VALIDATED RESULTS OF YARD 520 SAMPLING FOR
POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)
COMPARED TO SEDIMENT-BASED ECOLOGICAL SCREENING VALUES

CAS No	Chemical Name	Ecological Screening Value (a) mg/kg	GP011 9/23/2005 GP011ICB092305S CCB mg/kg		GP012 9/23/2005 GP012ICB092305S CCB mg/kg		GP013 9/23/2005 GP013ICB092305S CCB mg/kg	
91-57-6	2-Methylnaphthalene	0.0202	0.014	UJ	0.015	UJ	0.0096	UJ
83-32-9	Acenaphthene	0.00671	0.027	UJ	0.0097	UJ	0.019	UJ
208-96-8	Acenaphthylene	0.00587	0.027	UJ	0.0097	UJ	0.019	UJ
120-12-7	Anthracene	0.0572	0.027	UJ	0.0097	UJ	0.019	UJ
56-55-3	Benz(a)anthracene	0.108	0.017	J	0.0058	J	0.01	J
50-32-8	Benzo(a)pyrene	0.15	0.015	J	0.0044	J	0.008	J
205-99-2	Benzo(b)fluoranthene	10.4	0.019	J	0.0056	J	0.011	J
191-24-2	Benzo(g,h,i)perylene	0.1702	0.012	J	0.0041	J	0.007	J
207-08-9	Benzo(k)fluoranthene	0.24	0.027	UJ	0.0097	UJ	0.019	UJ
218-01-9	Chrysene	0.166	0.017	J	0.0069	J	0.012	J
53-70-3	Dibenz(a,h)anthracene	0.033	0.027	UJ	0.0097	UJ	0.019	UJ
206-44-0	Fluroanthene	0.423	0.04	J	0.0096	J	0.016	J
86-73-7	Fluorene	0.00774	0.027	UJ	0.0097	UJ	0.019	UJ
193-39-5	Indeno(1,2,3-cd)pyrene	0.2	0.027	UJ	0.0097	UJ	0.019	UJ
91-20-3	Naphthalene	0.176	0.027	UJ	0.0097	UJ	0.019	UJ
85-01-8	Phenanthrene	0.204	0.027	UJ	0.018	J	0.019	UJ
129-00-0	Pyrene	0.195	0.028	J	0.0093	J	0.012	J
	Total PAHs (b)	1.684	0.1615		0.07825		0.0855	

Notes:
CCB -Coal Combustion By-Product.
U: The analyte was analyzed for, but not detected.
J: Estimated Value.
(a) - USEPA Region 5 Ecological Screening Level for Sediment
Updated August 22, 2003.
(http://www.epa.gov/reg5rcra/ca/ESL.pdf)
(b) - USEPA Region 4 Screening Value for Sediment
Updated November 30, 2001.
(http://www.epa.gov/region4/waste/ots/ecolbul.htm)
Highlighting indicates that detected concentration
is greater than the screening level.

TABLE 2
VALIDATED RESULTS OF YARD 520 SAMPLING FOR DIOXINS AND FURANS
COMPARED TOSEDIMENT-BASED ECOLOGICAL SCREENING VALUES

CAS No	Chemical Name		GP004 9/23/2005 GP004ICB092305S CCB ng/kg		GP005 9/23/2005 GP005ICB092305S CCB ng/kg		GP006 9/23/2005 GP006ICB092305S CCB ng/kg		GP007 9/23/2005 GP007ICB092305S CCB ng/kg		GP008 9/23/2005 GP008ICB092305S CCB ng/kg	
35822-46-9	1,2,3,4,6,7,8-HEPTACHLORODIBENZO-P-DIOXIN		1.915	J	2.551	J	1.696	J	1.271	J	3.545	J
67562-39-4	1,2,3,4,6,7,8-HpCDF		0.266	J	0.266	J	0.057	U	0.264	J	0.247	JK
55673-89-7	1,2,3,4,7,8,9-HpCDF		0.044	U	0.08	U	0.074	U	0.08	U	0.091	U
39227-28-6	1,2,3,4,7,8-HEXACHLORODIBENZO-P-DIOXIN		0.048	U	0.033	U	0.064	U	0.046	U	0.063	U
70648-26-9	1,2,3,4,7,8-HxCDF		0.142	J	0.088	JK	0.148	J	0.218	J	0.159	J
57653-85-7	1,2,3,6,7,8-HEXACHLORODIBENZO-P-DIOXIN		0.043	U	0.03	U	0.057	U	0.041	U	0.06	U
57117-44-9	1,2,3,6,7,8-HxCDF		0.036	U	0.017	U	0.022	U	0.033	U	0.038	U
19408-74-3	1,2,3,7,8,9-HEXACHLORODIBENZO-P-DIOXIN		0.044	U	0.031	U	0.059	U	0.043	U	0.06	U
72918-21-9	1,2,3,7,8,9-HxCDF		0.042	U	0.021	U	0.026	U	0.039	U	0.047	U
57117-41-6	1,2,3,7,8-PENTACHLORODIBENZOFURAN		0.021	U	0.025	U	0.038	U	0.038	U	0.031	U
40321-76-4	1,2,3,7,8-PENTACHLORODIBENZO-P-DIOXIN		0.029	U	0.029	U	0.044	U	0.041	U	0.041	U
60851-34-5	2,3,4,6,7,8-HxCDF		0.071	J	0.019	U	0.023	U	0.035	U	0.041	U
57117-31-4	2,3,4,7,8-PeCDF		0.02	U	0.023	U	0.036	U	0.035	U	0.03	U
1746-01-6	2,3,7,8-TCDD		0.032	U	0.031	U	0.043	U	0.039	U	0.056	U
51207-31-9	2,3,7,8-TETRACHLORODIBENZOFURAN		0.056	U	0.051	U	0.064	U	0.064	U	0.076	U
3268-87-9	OCDD		22.643	U	66.103		15.822	U	5.28	U	24.665	UJ
39001-02-0	OCDF		0.483	J	0.443	J	0.46	J	0.355	J	0.58	JK
		Ecological										
		Screening										
		Value										
		(ng/kg										
	TCDD-TEQ - Bird (a)	0.48 (b)	0.04		0.08		0.03		0.04		0.04	
	TCDD-TEQ - Mammal (a)	0.48 (b)	0.05		0.05		0.04		0.05		0.07	
	TCDD-TEQ - Bird (a)	21 (c)	0.04		0.08		0.03		0.04		0.04	
	TCDD-TEQ - Mammal (a)	2.5 (c)	0.05		0.05		0.04		0.05		0.07	
	TCDD-TEQ - Fish (a)	60 (c)	0.04		0.03		0.04		0.04		0.04	

Notes:
CCB -Coal Combustion By-Product.
U: The analyte was analyzed for, but not detected.
J: Estimated value.
B: Analyte found in associated blank.
K: Estimated Matximum Potential Concentration.
TCDD-TEQ - 2,3,7,8-tetrachlorodibenzo-p-dioxin toxic equivalence concentration.
(a) - Calculated per Human Health and/or Ecological Work Plan.
(b) - USEPA Region 5 Ecological Screening Level for Sediment
Updated August 22, 2003. (http://www.epa.gov/reg5rcra/ca/ESL.pdf)
Sediment screening value based on surface water impacts to wildlife.
Wildlife based surface water screening value converted to sediment screening
and adjusted to 4% TOC.
(c) - USEPA low risk sediment concentration (USEPA, 1993)
presented in Interim Report on Data and Methods for
Assessment of 2,3,7,8-Tetrachlorodibenzo-p-dioxin Risks to Aquatic Life
and Associated Wildlife

Highlighting indicates that TCDD-TEQ is greater than the screening level.

TABLE 2
VALIDATED RESULTS OF YARD 520 SAMPLING FOR DIOXINS AND FURANS
COMPARED TOSEDIMENT-BASED ECOLOGICAL SCREENING VALUES

CAS No	Chemical Name		GP008 9/23/2005 GP008ICB092305D CCB ng/kg		GP009 9/23/2005 GP009ICB092305S CCB ng/kg		GP010 9/23/2005 GP010ICB092305S CCB ng/kg		GP011 9/23/2005 GP011ICB092305S CCB ng/kg		GP012 9/23/2005 GP012ICB092305S CCB ng/kg		GP013 9/23/2005 GP013ICB092305S CCB ng/kg	
35822-46-9	1,2,3,4,6,7,8-HEPTACHLORODIBENZO-P-DIOXIN		0.644	J	10.509		2.358	J	3.683	J	87.582		19.079	
67562-39-4	1,2,3,4,6,7,8-HpCDF		0.128	JK	0.099	U	0.129	U	0.33	J	5.142		1.904	J
55673-89-7	1,2,3,4,7,8,9-HpCDF		0.049	U	0.128	U	0.167	U	0.077	U	0.487	JK	0.082	U
39227-28-6	1,2,3,4,7,8-HEXACHLORODIBENZO-P-DIOXIN		0.048	U	0.069	U	0.076	U	0.166	J	1.015	J	0.225	J
70648-26-9	1,2,3,4,7,8-HxCDF		0.124	J	0.054	U	0.064	U	0.162	J	0.432	J	0.193	J
57653-85-7	1,2,3,6,7,8-HEXACHLORODIBENZO-P-DIOXIN		0.047	U	0.397	J	0.068	U	0.251	J	3.222		0.79	J
57117-44-9	1,2,3,6,7,8-HxCDF		0.03	U	0.054	U	0.064	U	0.022	U	0.25	JK	0.061	U
19408-74-3	1,2,3,7,8,9-HEXACHLORODIBENZO-P-DIOXIN		0.046	U	0.25	J	0.071	U	0.313	J	2.475	JK	0.421	JK
72918-21-9	1,2,3,7,8,9-HxCDF		0.036	U	0.064	U	0.076	U	0.031	U	0.13	U	0.075	U
57117-41-6	1,2,3,7,8-PENTACHLORODIBENZOFURAN		0.033	U	0.04	U	0.076	U	0.039	U	0.059	U	0.039	U
40321-76-4	1,2,3,7,8-PENTACHLORODIBENZO-P-DIOXIN		0.049	U	0.114	U	0.134	U	0.055	U	0.08	U	0.063	U
60851-34-5	2,3,4,6,7,8-HxCDF		0.032	U	0.057	U	0.068	U	0.026	U	0.112	U	0.065	U
57117-31-4	2,3,4,7,8-PeCDF		0.032	U	0.037	U	0.071	U	0.04	U	0.06	U	0.037	U
1746-01-6	2,3,7,8-TCDD		0.055	U	0.112	U	0.106	U	0.05	U	0.078	U	0.066	U
51207-31-9	2,3,7,8-TETRACHLORODIBENZOFURAN		0.099	U	0.132	U	0.123	U	0.059	U	0.105	U	0.11	U
3268-87-9	OCDD		4.273	UJ	25.926	UJ	11.459	UJ	58.181	J	424.803	J	108.247	
39001-02-0	OCDF		0.395	JK	0.238	UJ	0.281	UJ	0.647	J	9.944	J	1.615	J
		Ecological Screening Value (ng/kg												
	TCDD-TEQ - Bird (a)	0.48 (b)	0.02		0.06		0.03		0.13		**0.97**		0.23	
	TCDD-TEQ - Mammal (a)	0.48 (b)	0.03		0.18		0.05		0.14		**1.72**		0.39	
	TCDD-TEQ - Bird (a)	21 (c)	0.02		0.06		0.03		0.13		0.97		0.23	
	TCDD-TEQ - Mammal (a)	2.5 (c)	0.03		0.18		0.05		0.14		1.72		0.39	
	TCDD-TEQ - Fish (a)	60 (c)	0.03		0.04		0.03		0.12		0.83		0.20	

Notes:
CCB -Coal Combustion By-Product.
U: The analyte was analyzed for, but not detected.
J: Estimated value.
B: Analyte found in associated blank.
K: Estimated Matximum Potential Concentration.
TCDD-TEQ - 2,3,7,8-tetrachlorodibenzo-p-dioxin toxic equivalence conc
(a) - Calculated per Human Health and/or Ecological Work Plan.
(b) - USEPA Region 5 Ecological Screening Level for Sediment
Updated August 22, 2003. (http://www.epa.gov/reg5rcra/ca/ESL.pdf)
Sediment screening value based on surface water impacts to wildlife
Wildlife based surface water screening value converted to sediment
and adjusted to 4% TOC.
(c) - USEPA low risk sediment concentration (USEPA, 1993)
presented in Interim Report on Data and Methods for
Assessment of 2,3,7,8-Tetrachlorodibenzo-p-dioxin Risks to Aquatic
and Associated Wildlife

Highlighting indicates that TCDD-TEQ is greater than the screening leve

Attachment B4

October 10, 2006

Bradley, Lisa

From: Drexler.Timothy@epamail.epa.gov
Sent: Tuesday, October 10, 2006 10:33 AM
To: Bradley, Lisa
Cc: Perry, Elizabeth; Karecki.Edward@epamail.epa.gov; kay.bob@epamail.epa.gov; Johnson.Mark@epamail.epa.gov; kherron@idem.in.gov; scott_hicks@nps.gov; Bob_Daum@nps.gov
Subject: Response to Yard 520

Hi Lisa:

After a review of your September 8, 2006 email regarding our comments on the Yard 520 sampling document, we have the following response.

A phased approach for sampling and analysis was agreed upon by all parties. As agreed, exceedances of screening values result in continued sampling for those parameters. EPA agrees that PAH can be removed from further sampling based on the results from the Yard 520 sampling effort. However, uranium and dioxins have exceeded screening values and should, therefore, continue to be analyzed for in sampling. Further limited characterization of: 1) dioxins in sediment and 2) radionuclides in soil, sediment, and water is required during this field season. Please submit a plan for this additional sampling as soon as possible. Please call me to discuss the modifications to the sampling plan that this will require.

Thanks, Lisa. Talk to you soon.

Tim Drexler
Remedial Project Manager
Superfund Division
United States Environmental Protection Agency
77 W. Jackson Blvd., SR-6J
Chicago, Illinois 60604-3590

phone: 312.353.4367
fax: 312.886.4071

Attachment B5

October 13, 2006

ENSR
2 Technology Park Drive, Westford, Massachusetts, 01886-3140
T 978.589.3000 F 978.589.3100 www.ensr.aecom.com

Memorandum

Date: October 13, 2006

To: Tim Drexler, USEPA
Kevin Herron, IDEM

From: A. Elizabeth Perry, P.G.

Subject: Amendment to Yard 520 Sampling and Analysis Plan
Sediment Sampling Program
Pines Area of Investigation

Distribution: 0177 6-020

This memorandum represents an amendment to the USEPA-approved Yard 520 Sampling and Analysis Plan (Yard 520 SAP, September 2005) for the Pines Area of Investigation. This amendment is being prepared in response to a request by USEPA in an e-mail dated October 10, 2006, to include dioxin/furan and radionuclide analyses of sediment samples collected from selected locations. Sediment sampling under the USEPA-approved Field Sampling Plan (FSP, September 2005), a component of the Remedial Investigation/Feasibility Study Work Plan for the Pines Area of Investigation, is scheduled to start on October 23, 2006. This memorandum presents the specific locations and detailed parameter list for the additional requested analyses.

Sediment Sample Locations

Sediment samples from five locations will be analyzed for dioxins/furans and radionuclides. These include upstream/background locations (SW001, SW020), and locations adjacent to and downgradient/downstream from Yard 520 (SW022, SW023, SW024). The locations of all sediment samples to be collected under the FSP, including these five, are shown on the attached map. Note that this map reflects the sediment sample locations and depths identified by consensus with agency and ENSR personnel during the field reconnaissance conducted in November 2005 with the USEPA.

At two of these locations (SW022, SW023), both shallow and deeper sediment samples will be collected. Therefore, both the shallow and deeper samples will also be analyzed for dioxins/furans and radionuclides.

Therefore, a total of seven sediment samples will be analyzed for these additional parameters. QA/QC samples will also be collected at the frequencies specified in the Yard 520 Quality Assurance Project Plan (QAPP, Appendix C of the Yard 520 SAP).

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Analytical Parameters

The specific parameter lists for the dioxins/furans and radionuclides are those specified in the Yard 520 SAP and its associated QAPP (Appendix C of the Yard 520 SAP). A copy of Appendix A of the Yard 520 SAP, which lists the individual parameters, is attached to this memorandum for reference. The project-specific DQLs and selected analytical methods are provided in the QAPP for the Yard 520 SAP.

As specified in the Yard 520 SAP, sediment samples to be analyzed for dioxins/furans will be submitted to Columbia Analytical Services (CAS) in Houston, TX:

Columbia Analytical Services
10655 Richmond Avenue
Suite 130A
Houston, TX 77042
713-266-1599
Contact: Karen Verschoor

Sediment samples to be analyzed for radionuclides will be submitted to General Engineering Laboratory (GEL), in Charleston, SC:

General Engineering Laboratories, LLC
2040 Savage Road
Charleston, SC 29417
843-769-7385
Contact: Edith Kent

Laboratory SOPs and other information about the laboratories are provided in the Yard 520 SAP.

Table 1 attached lists the sediment samples and what parameters each sample is to be analyzed for. This is intended to update the information provided in Table 2-1 of the FSP for the RI/FS.

Sampling Methods

The methods for collecting the sediment samples are specified in the FSP for the RI/FS. Associated bottleware and method hold-times are specified in the Yard 520 SAP, and are also provided on Table 1 attached. No changes or adjustments are proposed in these methods.

References

ENSR. 2005a. Yard 520 Sampling and Analysis Plan, Pines Area of Investigation. September 2, 2005.

ENSR. 2005b. RI/FS Work Plan, Pines Area of Investigation, Volume 2: Field Sampling Plan. September 16, 2005.

TABLE 1
UPDATED SEDIMENT SAMPLING PROGRAM
PINES AREA OF INVESTIGATION

Analytical Parameters	Sediment Sample Locations	Containers (a, b, f)	Preservation	Holding Time (c)
Metals (d)	All (approx 19)	Wide-mouth 500-ml plastic jar (e)	Cool 4°C	180 days; mercury 28 days
Sulfur (S)	All (approx 19)	Wide-mouth 500-ml plastic jar	Cool 4°C	28 days
Grain Size Distribution	All (approx 19)	Wide-mouth glass	Cool 4°C	None
Bulk Density	All (approx 19)	500-ml plastic or glass jar	Cool 4°C	None
TOC	All (approx 19)	Glass jar	Cool 4°C	14 days
Dioxins/Furans (g)	SW001, SW020, SW022, SW023, SW024	1 250-ml glass with Teflon-lined cap	Cool 4°C	30 days to extraction; 45 days from extraction to analysis
Radionuclides (g)	SW001, SW020, SW022, SW023, SW024	1 1-l amber glass with Teflon-lined cap	Cool 4°C	6 months

Notes:
(a) Additional volume will be collected for MS/MSD samples.
(b) Laboratory may provide alternative containers as long as the containers meet the requirements of the method and allow the collection of sufficient volume to perform the analyses.
(c) Holding times begin at the date and time of sample collection.
(d) Specific analytes provided in Table 2-1 of the FSP and the QAPP for the RI/FS.
(e) If glass containers are used, they must be certified clean for boron and silicon.
(f) Aqueous samples in glass containers are to be placed in zipper-lock bags prior to shipping.
(g) Specific analytes are provided in Appendix A of the Yard 520 SAP, a copy of which is included with the memorandum.
TOC - total organic carbon
QAPP - Quality Assurance Project Plan
MS/MSD - matrix spike/matrix spike duplicate

Specific Analytical Parameters			
Inorganic Constituents	**PAHs**	**Dioxins**	**Radiological**
Aluminum	2-Methylnaphthalene	2,3,7,8-TetraCDD	Ac-227
Antimony	Acenaphthene	1,2,3,7,8-PentaCDD	Pa-231
Arsenic	Acenaphthylene	1,2,3,4,7,8-HexaCDD	Pb-210
Barium	Anthracene	1,2,3,6,7,8-HexaCDD	Po-210
Beryllium	Benz[a]anthracene	1,2,3,7,8,9-HexaCDD	Ra-226
Boron	Benzo(g,h,i)perylene	1,2,3,4,6,7,8-HeptaCDD	Ra-228
Cadmium	Benzo[a]pyrene	OctaCDD	Th-228
Calcium	Benzo[b]fluoranthene	2,3,7,8-TetraCDF	Th-230
Chromium (total)	Benzo[k]fluoranthene	1,2,3,7,8-PentaCDF	Th-232
Cobalt	Chrysene	2,3,4,7,8-PentaCDF	U-234
Copper	Dibenz[ah]anthracene	1,2,3,4,7,8-HexaCDF	U-235
Iron	Fluoranthene	1,2,3,6,7,8-HexaCDF	U-238
Lead	Fluorene	1,2,3,7,8,9-HexaCDF	
Magnesium	Indeno[1,2,3-cd]pyrene	2,3,4,6,7,8-HexaCDF	
Manganese	Naphthalene	1,2,3,4,6,7,8-HeptaCDF	
Mercury	Phenanthrene	1,2,3,4,7,8,9-HeptaCDF	
Molybdenum	Pyrene	OctaCDF	
Nickel			
Potassium			
Selenium			
Silicon			
Silver			
Sodium			
Sulfur			
Thallium			
Vanadium			
Zinc			

Perry, Elizabeth

From: Drexler.Timothy@epamail.epa.gov
Sent: Tuesday, October 17, 2006 3:03 PM
To: Perry, Elizabeth
Cc: kay.bob@epamail.epa.gov; Bradley, Lisa; kherron@idem.in.gov; Bob_Daum@nps.gov; scott_hicks@nps.gov; Karecki.Edward@epamail.epa.gov
Subject: Acceptance of Amendment to Yard 520 SAP, Revised Sediment Sampling dated Oct. 13, 2006

Attachments: ENSR_rad_diox_samp_101306.pdf

ENSR_rad_diox_samp_101306.pdf ...

Dear Elizabeth:

This email message is EPA's acceptance of your October 13, 2006 revised sediment sampling program with the addition of radionuclide and dioxin/furan analyses in the selected locations listed. This addition reflects our agreement for an adaptive sampling program, based on results.

Tim Drexler
Remedial Project Manager
Superfund Division
United States Environmental Protection Agency
77 W. Jackson Blvd., SR-6J
Chicago, Illinois 60604-3590

phone: 312.353.4367
fax: 312.886.4071

(See attached file: ENSR_rad_diox_samp_101306.pdf)

Attachment B6

October 17, 2006

Bradley, Lisa

From: Drexler.Timothy@epamail.epa.gov
Sent: Tuesday, October 17, 2006 3:03 PM
To: Perry, Elizabeth
Cc: kay.bob@epamail.epa.gov; Bradley, Lisa; kherron@idem.in.gov; Bob_Daum@nps.gov; scott_hicks@nps.gov; Karecki.Edward@epamail.epa.gov
Subject: Acceptance of Amendment to Yard 520 SAP, Revised Sediment Sampling dated Oct. 13, 2006

Attachments: ENSR_rad_diox_samp_101306.pdf

ENSR_rad_diox_samp_101306.pdf ...

Dear Elizabeth:

This email message is EPA's acceptance of your October 13, 2006 revised sediment sampling program with the addition of radionuclide and dioxin/furan analyses in the selected locations listed. This addition reflects our agreement for an adaptive sampling program, based on results.

Tim Drexler
Remedial Project Manager
Superfund Division
United States Environmental Protection Agency
77 W. Jackson Blvd., SR-6J
Chicago, Illinois 60604-3590

phone: 312.353.4367
fax: 312.886.4071

(See attached file: ENSR_rad_diox_samp_101306.pdf)

Attachment B7

January 10, 2007

Bradley, Lisa

From: Karecki.Edward@epamail.epa.gov
Sent: Wednesday, January 10, 2007 3:47 PM
To: Mitchell, Dave
Cc: Drexler.Timothy@epamail.epa.gov
Subject: RE: Use of site-specific TOC for dioxin sediment benchmarks.

Dave

I hope that your holidays were pleasant and that 2007 is off to a good start.

Here is the information that I received from Dan:

I reviewed the Region 5 RCRA ESL value for dioxin in sediment and found it is correct. For 2,3,7,8 TCDD (dioxin), the sediment ESL was based on an equilibrium partitioning equation referenced as footnote "s" on the ESL table and shown as follows: ESL = Koc x Water ESL x 0.01 = 1.21 E-4 ug/kg
where Koc = 4,036,825
Water ESL = 3 E-9 ug/L (Michigan Water Criteria based on wildlife exposure)
TOC = 1% = 0.01

At this time, the factor that can influence the dioxin sediment ESL is the Koc value which is based on the Kow value as follows:
log Koc = 0.989 Log Kow + 0.00028

Please note that the following EPA Dioxin Fact Sheet shows a Kow value of 6.8
http://www.epa.gov/OGWDW/dwh/t-soc/dioxin.html

If this Kow value of 6.8 were used, the Koc would become 2,873,756 and the dioxin sediment ESL would be 8.62 E-5 ug/kg (lower than the current value). I don't plan to change the ESL value for dioxin in sediment without additional input from EPA's Office of Research and Development (ORD).

We can continue to use the agreed upon screening number and adjust it for TOC once we have the site specific sediment information.
Please let me know if you wish to discuss anything.

Ed

312-353-3202

Attachment B8

February 16, 2007

ENSR
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Memorandum

Date: February 16, 2007

To: Tim Drexler and Ed Karecki/USEPA

From: Dave Mitchell, Ph.D., and Christine Archer

Subject: Pines Area of Investigation
Dioxin/Furan Screening Levels

Distribution: Lisa Bradley/ENSR, Dan Sullivan / NiSource, Val Blumenfeld / Brown Inc.

This memo is a follow-up to the discussion held on December 6, 2006 between USEPA Region 5 (T. Drexler, E. Karecki) and ENSR risk assessors (L. Bradley, D. Mitchell, C. Archer) regarding appropriate sediment screening levels for dioxins/furans for assessing sediment quality in Brown Ditch and other relevant aquatic habitats within the Pines (IN) Area of Investigation. As part of that discussion, ENSR agreed to prepare a technical memorandum recommending dioxin/furan screening values for USEPA review. This memorandum would potentially be incorporated as an addendum to the Pines RI/FS workplan - Vol. 6 Ecological Risk Workplan [Pines AOC II for RI/FS Docket No. V-W-'04-C-784].

This issue was first identified in USEPA comments on the ENSR April 2006 draft report entitled Evaluation of Polycyclic Aromatic Hydrocarbon, Polychlorinated Dibenzodioxin/Polychlorinated Dibenzofuran, and Radionuclide Data from Yard 520 ("Yard 520 Evaluation draft report"). Specifically, dioxin/furan concentrations in two of the ten samples containing coal combustion byproducts (CCBs) taken from Yard 520 exceeded the USEPA Region 5 soil ecological screening level (ESL) of 0.199 ng/kg. In response to USEPA comments, the Respondents agreed to collect sediment samples from the West Branch of Brown Ditch both upstream and downstream of Yard 520 and analyze them for dioxins and furans. They also indicated their intention to (1) apply site-specific factors when considering and interpreting the results of this sediment sampling with regard to further investigation of dioxin at the Pines Area of Investigation, and (2) present USEPA with appropriate sediment screening values other than the Region 5 sediment ESL value of 0.121 ng/kg. Both of these matters are discussed below.

Application of Site-specific Factors

The basis of the Equilibrium Partitioning (EqP) theory for deriving sediment screening values is that partitioning between solid and aqueous phases occurs in sediments. The surface water screening value, the carbon matter partition coefficient (K_{oc}), and the fraction organic carbon in the sediment are used to derive the sediment screening value. The USEPA Region 5 sediment ESL was derived from a wildlife-based surface water screening value using EqP approach and an assumption of 1% total organic carbon (TOC). Therefore, a site-specific sediment screening value can be derived through application of a site-specific TOC value.

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Following the December 6, 2006 teleconference, USEPA (E. Karecki) investigated the use of site-specific factors such as sediment total organic carbon (TOC) to establish the sediment screening value. Mr. Karecki confirmed the appropriateness of the approach in an e-mail communication dated January 10, 2007, as indicated by the information in the footnotes of the Region 5 ESL table.

Accordingly, based on recent USEPA guidance (USEPA, 1999; USEPA, 2005), a default sediment TOC level of 4% was applied to the Region 5 sediment ESL to derive a site-specific sediment screening value of 0.480 ng/kg. The 4% TOC value is used based on the mid-point of the range of values for bottom sediments (3% to 5% TOC) identified in a literature search by USEPA (1993a). USEPA (1998) states that the organic carbon content in bottom sediments is higher than the organic carbon content in soils because (1) erosion favors lighter-textured soils with higher organic carbon contents, and (2) bottom sediments are partially comprised of detritus materials. The use of this default TOC value is supported by field observations made during the field investigation conducted on November 1, 2005 attended by USEPA. Visual observations of sediments (obtained with the Russian peat borer) within Brown Ditch downstream of Yard 520 indicate that sediment material is often found to a depth of greater than 10 inches. Also, several locations were described as highly organic (See notes regarding sediment depth and composition in *Sediment Sample Locations 11-2005* pdf document sent to Tim Drexler on November 18, 2005). These more highly organic sediments reduce the bioavailable fraction of organic compounds such as dioxins and furans and warrant an increase in the associated ecological screening values.

Alternative Sediment Screening Levels

A review of the source of the Region 5 sediment ESL of 0.121 ng/kg indicates that it is likely too conservative for application to Brown Ditch. Therefore, appropriate sediment screening values other than the Region 5 sediment ESL were identified.

The surface water screening value (3×10^{-9} ug/L) used in derivation of the Region 5 sediment ESL was developed to be protective of piscivorous avian and mammalian wildlife and considered impacts to eagle, kingfisher, herring gull, mink, and otter. The ESL documentation does not indicate which species the surface water screening values applies to, but the Indiana Water Quality Standards in the Indiana Administrative Code (327 IAC 2-1.5-15) indicate that the lower of the geometric means of the values for birds and mammals is selected. This methodology is consistent with the Michigan Water Quality Standards (MCL R 323.1041-1117) which is considered the source document for this methodology.

Application of values based on these receptors, while appropriate for the Great Lakes open water environment, is too conservative for Brown Ditch. For example, the diet assumed for three of these receptors (otter, herring gull, and eagle) include consumption of from 18-20% trophic level four (TL-4) fish. Brown Ditch provides *de minimis* habitat to TL-4 fish (i.e., piscivorous predators like lake trout, walleye or largemouth bass). TL-4 fish will experience a larger fraction of a bioaccumulative constituent (like dioxin) due to a greater food chain multiplier (FCM) than fish actually found in Brown Ditch, and so the resulting assumed exposure is conservative for Brown Ditch. In addition, the potentially impacted sediments within Brown Ditch represent only a small fraction of the potential home range of the piscivorous wildlife receptors considered in the derivation of the sediment ESL.

An applicable reference for potential impacts to benthic receptors in the USEPA's *Interim Report on Data and Methods for Assessment of 2,3,7,8-Tetrachlorodibenzo-p-dioxin Risks to Aquatic Life and Associated Wildlife* (USEPA, 1993), which is listed as a source of benchmarks on Region 5's website (http://www.epa.gov/region5/superfund/ecology/html/screenguide.htm#tcdd). This document presents fish- and wildlife-based sediment concentrations that are derived from no-effect thresholds for reproductive effects. These values were compared against the avian, mammalian, and fish TCDD-TEQs. All of the Yard 520 TCDD-TEQs were well below all of the sediment concentrations presented

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by USEPA (1993) indicating that ecological receptors are unlikely to be at risk due to exposure to dioxins and furans (See Table 2, attached).

Comparison of the fish TEQ against a fish-based sediment screening value also indicates that aquatic receptors are unlikely to be at risk. USEPA guidance (1999) derived a sediment screening value for 2,3,7,8-TCDD from a fish-based surface water screening value using the EqP approach and an assumption of 4% total organic carbon. The surface water screening value (3.8×10^{-6} ug/L) was based on a chronic low observed effect concentration for rainbow trout. All fish TEQs were well below the USEPA (1999) fish-based sediment screening level of 410 ng/kg, indicating that potential impacts to aquatic receptors are unlikely (see Table 2).

Conclusions

The screening evaluation of sediment dioxin data for Brown Ditch should utilize the site-specific screening level and the alternative screening levels presented in this memo. The findings of this memorandum are summarized below:

- Based on consensus with USEPA Region 5, the application of a 4% TOC to establish a site-specific sediment screening level for Brown Ditch is appropriate. This would result in a site-specific screening level of 0.480 ng/kg;
- The food web modeling used as the basis of the USEPA Region 5 surface water ESL, which in turn is the basis of the sediment ESL, includes inherent uncertainties and conservative assumptions (e.g., large home ranges, top-level piscivorous receptors) which are not appropriate for Brown Ditch;
- Alternative TCDD screening values are available (i.e., USEPA values for sediment) that are more applicable for screening for potential sediment risk to the receptors in Brown Ditch.
- The screening of sediments in Brown Ditch should take into account the entire spectrum of available and appropriate screening levels.

REFERENCES

USEPA. 1993. Interim Report on Data and Methods for Assessment of 2,3,7,8-Tetrachlorodibenzo-p-dioxin Risks to Aquatic Life and Associated Wildlife. Office of Research and Development. EPA/600/R-93/055.

USEPA. 1998. Methodology for Assessing Health Risks Associated with Multiple Pathways of Exposure to Combustor Emissions (MPE). Update to EPA/600/6-90/003. Office of Research and Development, National Center for Environmental Assessment, U.S. EPA. EPA/600/R-98/137. December.

USEPA, 1999. Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities. EPA/530/D-99/001A. December, 1999.

USEPA. 2005. Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities. EPA/530/R-05/006. September, 2005.

TABLE 2
VALIDATED RESULTS OF YARD 520 SAMPLING FOR DIOXINS AND FURANS
COMPARED TOSEDIMENT-BASED ECOLOGICAL SCREENING VALUES

CAS No	Chemical Name		GP004 9/23/2005 GP004ICB092305S CCB ng/kg		GP005 9/23/2005 GP005ICB092305S CCB ng/kg		GP006 9/23/2005 GP006ICB092305S CCB ng/kg		GP007 9/23/2005 GP007ICB092305S CCB ng/kg		GP008 9/23/2005 GP008ICB092305S CCB ng/kg	
35822-46-9	1,2,3,4,6,7,8-HEPTACHLORODIBENZO-P-DIOXIN		1.915	J	2.551	J	1.696	J	1.271	J	3.545	J
67562-39-4	1,2,3,4,6,7,8-HpCDF		0.266	J	0.266	J	0.057	U	0.264	J	0.247	JK
55673-89-7	1,2,3,4,7,8,9-HpCDF		0.044	U	0.08	U	0.074	U	0.08	U	0.091	U
39227-28-6	1,2,3,4,7,8-HEXACHLORODIBENZO-P-DIOXIN		0.048	U	0.033	U	0.064	U	0.046	U	0.063	U
70648-26-9	1,2,3,4,7,8-HxCDF		0.142	J	0.088	JK	0.148	J	0.218	J	0.159	J
57653-85-7	1,2,3,6,7,8-HEXACHLORODIBENZO-P-DIOXIN		0.043	U	0.03	U	0.057	U	0.041	U	0.06	U
57117-44-9	1,2,3,6,7,8-HxCDF		0.036	U	0.017	U	0.022	U	0.033	U	0.038	U
19408-74-3	1,2,3,7,8,9-HEXACHLORODIBENZO-P-DIOXIN		0.044	U	0.031	U	0.059	U	0.043	U	0.06	U
72918-21-9	1,2,3,7,8,9-HxCDF		0.042	U	0.021	U	0.026	U	0.039	U	0.047	U
57117-41-6	1,2,3,7,8-PENTACHLORODIBENZOFURAN		0.021	U	0.025	U	0.038	U	0.038	U	0.031	U
40321-76-4	1,2,3,7,8-PENTACHLORODIBENZO-P-DIOXIN		0.029	U	0.029	U	0.044	U	0.041	U	0.041	U
60851-34-5	2,3,4,6,7,8-HxCDF		0.071	J	0.019	U	0.023	U	0.035	U	0.041	U
57117-31-4	2,3,4,7,8-PeCDF		0.02	U	0.023	U	0.036	U	0.035	U	0.03	U
1746-01-6	2,3,7,8-TCDD		0.032	U	0.031	U	0.043	U	0.039	U	0.056	U
51207-31-9	2,3,7,8-TETRACHLORODIBENZOFURAN		0.056	U	0.051	U	0.064	U	0.064	U	0.076	U
3268-87-9	OCDD		22.643	U	66.103		15.822	U	5.28	U	24.665	UJ
39001-02-0	OCDF		0.483	J	0.443	J	0.46	J	0.355	J	0.58	JK
		Ecological										
		Screening										
		Value										
		(ng/kg										
	TCDD-TEQ - Bird (a)	0.48 (b)	0.04		0.08		0.03		0.04		0.04	
	TCDD-TEQ - Mammal (a)	0.48 (b)	0.05		0.05		0.04		0.05		0.07	
	TCDD-TEQ - Bird (a)	21 (c)	0.04		0.08		0.03		0.04		0.04	
	TCDD-TEQ - Mammal (a)	2.5 (c)	0.05		0.05		0.04		0.05		0.07	
	TCDD-TEQ - Fish (a)	60 (c)	0.04		0.03		0.04		0.04		0.04	

Notes:
CCB -Coal Combustion By-Product.
U: The analyte was analyzed for, but not detected.
J: Estimated value.
B: Analyte found in associated blank.
K: Estimated Matximum Potential Concentration.
TCDD-TEQ - 2,3,7,8-tetrachlorodibenzo-p-dioxin toxic equivalence concentration.
(a) - Calculated per Human Health and/or Ecological Work Plan.
(b) - USEPA Region 5 Ecological Screening Level for Sediment
Updated August 22, 2003. (http://www.epa.gov/reg5rcra/ca/ESL.pdf)
Sediment screening value based on surface water impacts to wildlife.
Wildlife based surface water screening value converted to sediment screening
and adjusted to 4% TOC.
(c) - USEPA low risk sediment concentration (USEPA, 1993)
presented in Interim Report on Data and Methods for
Assessment of 2,3,7,8-Tetrachlorodibenzo-p-dioxin Risks to Aquatic Life
and Associated Wildlife

Highlighting indicates that TCDD-TEQ is greater than the screening level.

TABLE 2
VALIDATED RESULTS OF YARD 520 SAMPLING FOR DIOXINS AND FURANS
COMPARED TOSEDIMENT-BASED ECOLOGICAL SCREENING VALUES

CAS No	Chemical Name		GP008 9/23/2005 GP008ICB092305D CCB ng/kg		GP009 9/23/2005 GP009ICB092305S CCB ng/kg		GP010 9/23/2005 GP010ICB092305S CCB ng/kg		GP011 9/23/2005 GP011ICB092305S CCB ng/kg		GP012 9/23/2005 GP012ICB092305S CCB ng/kg		GP013 9/23/2005 GP013ICB092305S CCB ng/kg	
35822-46-9	1,2,3,4,6,7,8-HEPTACHLORODIBENZO-P-DIOXIN		0.644	J	10.509		2.358	J	3.683	J	87.582		19.079	
67562-39-4	1,2,3,4,6,7,8-HpCDF		0.128	JK	0.099	U	0.129	U	0.33	J	5.142		1.904	J
55673-89-7	1,2,3,4,7,8,9-HpCDF		0.049	U	0.128	U	0.167	U	0.077	U	0.487	JK	0.082	U
39227-28-6	1,2,3,4,7,8-HEXACHLORODIBENZO-P-DIOXIN		0.048	U	0.069	U	0.076	U	0.166	J	1.015	J	0.225	J
70648-26-9	1,2,3,4,7,8-HxCDF		0.124	J	0.054	U	0.064	U	0.162	J	0.432	J	0.193	J
57653-85-7	1,2,3,6,7,8-HEXACHLORODIBENZO-P-DIOXIN		0.047	U	0.397	J	0.068	U	0.251	J	3.222		0.79	J
57117-44-9	1,2,3,6,7,8-HxCDF		0.03	U	0.054	U	0.064	U	0.022	U	0.25	JK	0.061	U
19408-74-3	1,2,3,7,8,9-HEXACHLORODIBENZO-P-DIOXIN		0.046	U	0.25	J	0.071	U	0.313	J	2.475	JK	0.421	JK
72918-21-9	1,2,3,7,8,9-HxCDF		0.036	U	0.064	U	0.076	U	0.031	U	0.13	U	0.075	U
57117-41-6	1,2,3,7,8-PENTACHLORODIBENZOFURAN		0.033	U	0.04	U	0.076	U	0.039	U	0.059	U	0.039	U
40321-76-4	1,2,3,7,8-PENTACHLORODIBENZO-P-DIOXIN		0.049	U	0.114	U	0.134	U	0.055	U	0.08	U	0.063	U
60851-34-5	2,3,4,6,7,8-HxCDF		0.032	U	0.057	U	0.068	U	0.026	U	0.112	U	0.065	U
57117-31-4	2,3,4,7,8-PeCDF		0.032	U	0.037	U	0.071	U	0.04	U	0.06	U	0.037	U
1746-01-6	2,3,7,8-TCDD		0.055	U	0.112	U	0.106	U	0.05	U	0.078	U	0.066	U
51207-31-9	2,3,7,8-TETRACHLORODIBENZOFURAN		0.099	U	0.132	U	0.123	U	0.059	U	0.105	U	0.11	U
3268-87-9	OCDD		4.273	UJ	25.926	UJ	11.459	UJ	58.181	J	424.803	J	108.247	
39001-02-0	OCDF		0.395	JK	0.238	UJ	0.281	UJ	0.647	J	9.944	J	1.615	J
		Ecological Screening Value (ng/kg												
	TCDD-TEQ - Bird (a)	0.48 (b)	0.02		0.06		0.03		0.13		**0.97**		0.23	
	TCDD-TEQ - Mammal (a)	0.48 (b)	0.03		0.18		0.05		0.14		**1.72**		0.39	
	TCDD-TEQ - Bird (a)	21 (c)	0.02		0.06		0.03		0.13		0.97		0.23	
	TCDD-TEQ - Mammal (a)	2.5 (c)	0.03		0.18		0.05		0.14		1.72		0.39	
	TCDD-TEQ - Fish (a)	60 (c)	0.03		0.04		0.03		0.12		0.83		0.20	

Notes:
CCB -Coal Combustion By-Product.
U: The analyte was analyzed for, but not detected.
J: Estimated value.
B: Analyte found in associated blank.
K: Estimated Matximum Potential Concentration.
TCDD-TEQ - 2,3,7,8-tetrachlorodibenzo-p-dioxin toxic equivalence conc
(a) - Calculated per Human Health and/or Ecological Work Plan.
(b) - USEPA Region 5 Ecological Screening Level for Sediment
Updated August 22, 2003. (http://www.epa.gov/reg5rcra/ca/ESL.pdf)
Sediment screening value based on surface water impacts to wildlife
Wildlife based surface water screening value converted to sediment
and adjusted to 4% TOC.
(c) - USEPA low risk sediment concentration (USEPA, 1993)
presented in Interim Report on Data and Methods for
Assessment of 2,3,7,8-Tetrachlorodibenzo-p-dioxin Risks to Aquatic
and Associated Wildlife

Highlighting indicates that TCDD-TEQ is greater than the screening leve

Attachment B9

March 7, 2007

ENSR
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Memorandum

Date:	March 7, 2007	
To:	Tim Drexler, USEPA Kevin Herron, IDEM	
From:	A. Elizabeth Perry, P.G.	
Subject:	Proposed Adjustments to Field Sampling Plan Pines Area of Investigation	
Distribution:	L. Bradley, ENSR	01776-020

On February 20, 2007, a meeting was conducted with USEPA and its agency partners, the Respondents (NIPSCO, Brown) and ENSR. During the meeting, preliminary findings of the RI were reviewed (e.g., sampling results from August 2006), and certain suggestions for completing the RI were discussed. This memorandum documents those suggestions so they can be formally evaluated by the USEPA.

Specific recommendations associated with the RI include:

- Eliminating of the southern portion of the Area of Investigation from further evaluation under the RI
- Eliminating the groundwater flow modeling as it is no longer needed to meet the RI objectives
- Modifying the water sampling parameter list for the April 2007 sampling event
- Modifying the background soil sample locations
- Finalizing the parameter list for the background soil sample locations

Each of these is briefly discussed below.

Southern Portion of Area of Investigation

Section 2.1.8 of the FSP presented the hypothesis that the Mo concentrations greater than 10 ug/l detected in certain private wells in the southern portion of the Area of Investigation might be associated with deep groundwater, and not with CCBs. The FSP proposed compiling geologic, hydrogeologic, and chemical information to evaluate this hypothesis. A synthesis of this information was presented to the USEPA on February 20, 2007, with the following conclusions:

- Geologic information from multiple sources indicates that the surficial aquifer pinches out against the Valpairaso Moraine to the south. Therefore, in the southern portion of the Area of Investigation, the surficial aquifer is either not present or does not provide a sufficient source of drinking water.

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- Because private wells are screened in the deeper confined aquifers, there is no complete pathway for drinking water from the surficial aquifer, and so there are no receptors for the surficial groundwater in the southern portion of the Area of Investigation.
- The visual inspections of suspected CCBs (Section 2.1.5 of the FSP) have been completed in this area. No suspected CCBs have been identified to the south of county Rd 1675N.

Therefore, we recommend that no further evaluation of this area is necessary under the RI. Specifically, no additional sampling will be conducted at the three private wells that are part of the sampling program (PW009, PW012, PW013). Bottled water that is provided to residents in this area (south of the intersection of Ardendale and county Rd 1675 N) by the Respondents is no longer needed.

Groundwater Modeling

Groundwater flow modeling was included in Section 2.2.6 of the FSP. The stated objectives of the modeling included: to quantify the rates and directions of groundwater flow, to quantify the rates of discharge from groundwater to surface water, and to support the risk assessments.

The following changes in the conceptual model have been made based on actual data from the Area of Investigation and recent changes in risk-based screening levels:

- The distribution of B in groundwater at levels above current risk-based screening levels is very limited.
- The distribution of B in surface water at levels above current risk-based screening levels is very limited.
- Groundwater flow is towards Brown Ditch.
- There is no migration of B at elevated levels in groundwater northward towards IDNL.

Based on these changes in the conceptual model, a numerical groundwater flow model is no longer needed to meet the objectives listed in the FSP. Where quantitative evaluations are needed, for example, to estimate local rates of groundwater discharge, analytical models (e.g., Darcy's Law) may be used.

Water Sampling Parameter Lists

As described in sections 2.4.3 and 2.4.4 of the FSP, the parameter lists for water sampling (groundwater and surface water) may be modified after the third sampling event. The third sampling event was conducted in January 2007. A formal request will be submitted to the USEPA before the end of March with recommendations for specific changes to the parameter list to be implemented in the fourth sampling event in April 2007.

Ecological Risk-Based Screening Levels

Prior to the meeting on February 20, 2007, three memoranda were provided to the EPA. These memoranda discussed the corrected ecological screening level for B, and proposed modified screening levels for dioxins/furans, and uranium. We would like USEPA review of these memoranda.

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With the agreed ecological screening levels, the evaluation of data obtained under the Yard 520 SAP can proceed. In addition, finalization of the screening levels is important for the identification of the parameter list for the background surface soil sampling to be conducted under the Yard 520 SAP (see below).

Background Sampling under the Yard 520 SAP

A map identifying revised background surface soil locations was provided at the February 20, 2007 meeting. The locations of a few of the samples have been modified based on initial feedback received at the meeting, specifically:

- Sample locations SS005 and SS012 (organic soils) have been moved from locations that could potentially be in the floodplain of Brown Ditch, and SS013 (organic soils) has been moved as it could also potentially be affected by run-off from Railroad Avenue. They have been moved to locations within IDNL.

- Sample location SS023 (granular soil) was moved from along US Highway 20 to a much less heavily trafficked location on Pine St.

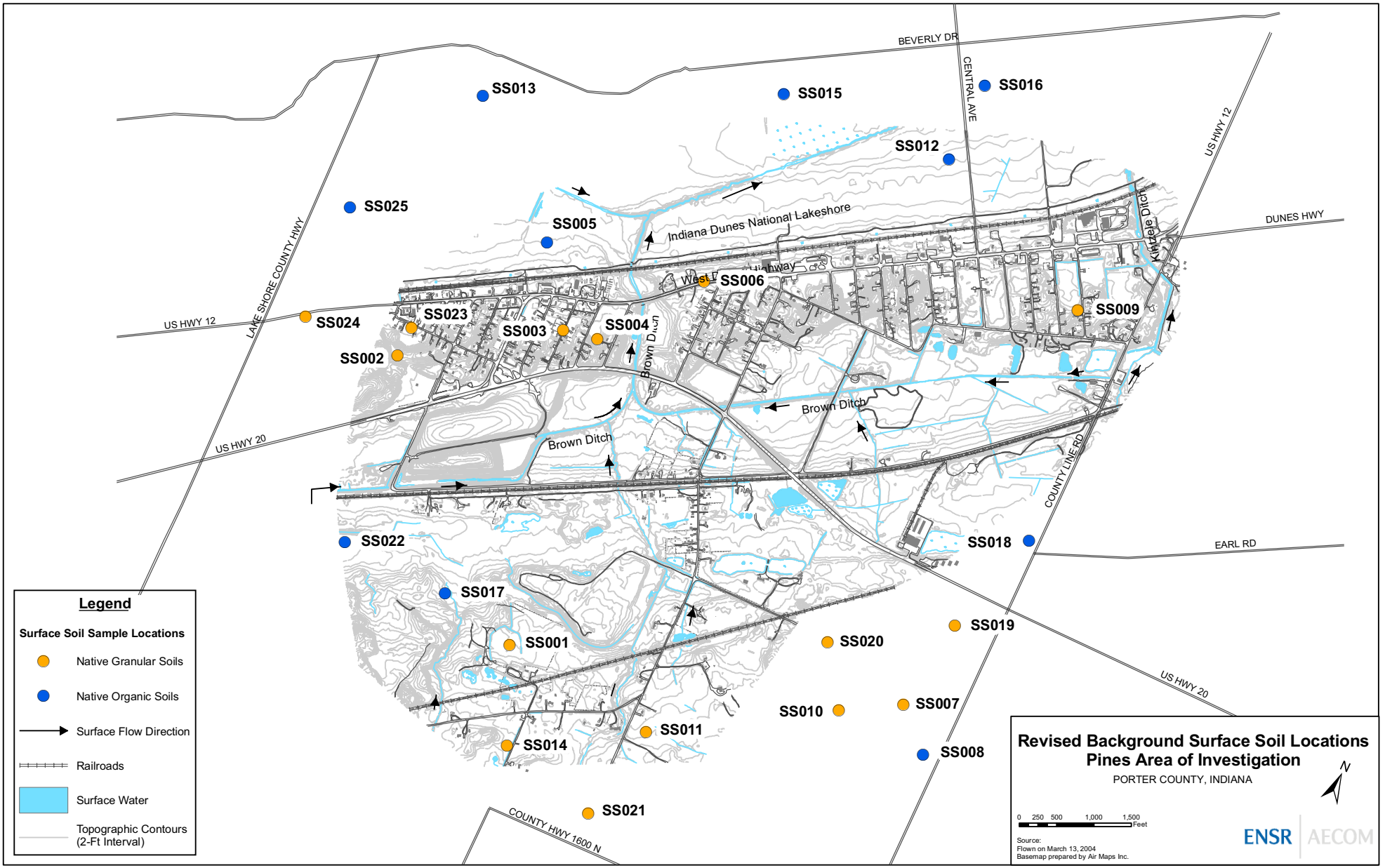
A revised map of the proposed background sampling locations is attached. We would like to have the locations finalized and access agreements obtained as soon as possible so that the sampling can be conducted before the water sampling in April 2007.

The proposed analyte list for the background sampling includes: TAL metals plus boron, molybdenum, sulfur and silicon.

References

ENSR. 2005a. Yard 520 Sampling and Analysis Plan, Pines Area of Investigation. September 2, 2005.

ENSR. 2005b. RI/FS Work Plan, Pines Area of Investigation, Volume 2: Field Sampling Plan. September 16, 2005.



SurfaceSoilLocations.mxd March 2007

April 16, 2007

Ms. Lisa Bradley
ENSR, International
2 Technology Park Drive
Westford, Massachusetts 01886-3140

RE: U.S. EPA Response to ENSR Requests to Amend the Remedial Investigation at The Pines Site, Town of Pines, Indiana

Dear Ms. Bradley:

The following paragraphs reflect EPA's response to requests from the potentially responsible parties to modify the requirements of the Remedial Investigation for the Pines Site in Town of Pines, Indiana. Most requests were made verbally during a meeting held in Chicago on February 20, 2007. Written requests were then received by EPA on March 6, 2007.

1. Elimination of Study Area South of 1675 North:
EPA agrees that no additional sampling be required at private wells PW009, PW012, and PW013 due to pinching out of the surficial aquifer and the screening of these wells in deeper confined aquifers. However, the elimination of bottled water to those residents may require a modification to the Administrative Order on Consent signed by EPA and the potentially responsible parties. I will evaluate this and reply at a later date.

2. Elimination of Groundwater Flow Model Requirement:
ENSR's proposal for the elimination of groundwater flow modeling due to anticipated changes in the human health screening values for boron and molybdenum is not approved. EPA does not agree with ENSR's proposed change to the boron human health screening level (see #8).

3. Background Soil Sampling Locations:
The locations of the background soil samples are acceptable provided that no sample location have any indication of CCBs and that all samples collected near roadways are located a minimum of distance of 15 feet from the nearest roadway.

For the purposes of the risk assessment, EPA will accept either a soil radionuclide background value concentration of 2.1 pCi/g based on national data or the collection of background soil samples that are representative in terms of soil type, soil depth, etc. If

you choose to collect background samples it is important that the samples be collected in non-impacted areas. In addition, background soil samples must not be collected from any creek/ditch floodplain down-gradient of CCB-disposal areas. Guidance on background sampling can be found in Section 4.5 of the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM).

4. Ecological Radionuclide Issues: 3) A February 16, 2007 memo from Dave Mitchell of ENST proposed that the ecological screening level for radionuclides should be (a) 92 mg/kg in soils and (b) 100 mg/kg in sediment. EPA does not agree with the change. The 5mg/kg Uranium soil screening value will be retained since it represents a benchmark for screening potential impacts to sensitive plants. EPA Region 5 and 6 have adopted this value as a soil screening benchmark. Oak Ridge National Lab has also adopted this value. The Sheppard 2005 paper, referenced in the memo form ENSR, indicates that in sandy-sandy loam soil a toxic response to Uranium by a plant was observed at 0.5 mg/kg. This study met the data acceptance criteria of this paper but is below background in some areas. The presence of the IDNL warrants the use of a sensitive value and the original value 5 mg/kg is suitable. This value can also be used for an aquatic plant-based sediment benchmark for uranium. These numbers can be re-evaluated if site-specific background is shown to be above this level.

5. Human Health Radionuclide Issues:

EPA has the following comments with regard to the March 6, 2007 Memo from Lisa Bradley:

Section 2.1; Page 3: The basis for the residential soil PRG is described, but one risk pathway not included is indoor radon, a pathway unique to radon isotopes and their parent radionuclides.

Section 2.1; Page 4: Regarding Table 2, the means of the summary statistics for the individual radionuclide contaminants are generally 3 times higher than the documented background means. Documented background values should be used in the absence of Site-specific background information. MARSSIM advises establishing a background reference area when contaminants of concern are present in background.

Section 2.1; Page 4: The stated comparison of sample results to documented background values is generally arbitrary and statistically non-defensible. EPA's MARSSIM guidance provides statistical methods that can be used to compare the sample results from survey areas to background reference areas, when background reference area results are available.

Section 2.2.1; Page 5: Scenario #1 in the human health screening risk assessment does not appear to represent the Site RME based on previous visual inspections of at least one residence at East Johns and Idaho where volumes considerably more than 200m^2 were allegedly used as yard fill. Before exposure calculations can be accepted, they must reference a percentage of CCBs that reflects actual sampling of the most impacted yards.

The exposure scenarios should be reviewed to assure they are relevant to site-specific conditions. In Scenario 1 for example, it is not appropriate to disregard exposure indoors considering that a receptor could track contaminants indoors. Elimination of gardens should be assessed, as well as the time spent outside.

Section 2.2.4; Page 6: It is premature to discuss clean-up levels. However, U.S. EPA's risk range for radionuclide sites does not extend up to $3x10^{-4}$. Refer to "Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination" (OSWER Directive 9200.4-18) dated August 22, 1997. EPA generally sets site-specific remediation levels for carcinogens at a level that represents an excess upper bound lifetime cancer risk to an individual between 10^{-4} to 10^{-6}. Guidance that provides for cleanups outside this risk range is not protective under CERCLA and shouldn't be used to establish cleanup levels. OSWER Directive 9200.4-18 (U.S. EPA 1997a) specifies that cleanup levels for radioactive contamination at CERCLA sites should be established as they would for any chemical that poses an unacceptable risk and the risks should be characterized in standard Agency risk language consistent with CERCLA guidance. Cleanup levels not based on an ARAR should be based on the carcinogenic risk range (generally 10^{-4} to 10^{-6}, with 10^{-6} as the point of departure and 1×10^{-6} used for PRGs) and expressed in terms of risk ($\# \times 10^{-\#}$). While the upper end of the risk range is not a discrete line at 1×10^{-4}, EPA generally uses 1×10^{-4} in making risk management decisions. A specific risk estimate around 10^{-4} may be considered acceptable if based on site-specific circumstances.

Section 3.1; Page 6: The literature review disregards current EPA Superfund guidance for radiation site cleanups (see http://www.epa.gov/superfund/resources/radiation/radarars.htm), as well as the unique nature of radium isotopes, their radon decay products, and the cancer risk associated with the accumulation of radon inside homes.

Section 3.2; Page 7: The background evaluation seems to highlight the more insignificant qualities of the individual radionuclides in the uranium-238, thorium-232, and uranium-235 decay series, neglecting that these are primarily ingestion and inhalation hazards, especially in the case of radon isotopes in these decay series.

Section 3.2; Page 8: U.S. EPA's risk range for radionuclide sites does not extend up to $3x10^{-4}$. Refer to "Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination" (OSWER Directive 9200.4-18) dated August 22, 1997. EPA generally sets site-specific remediation levels for carcinogens at a level that represents an excess upper bound lifetime cancer risk to an individual between 10^{-4} to 10^{-6}. Guidance that provides for cleanups outside this risk range is not protective under CERCLA and shouldn't be used to establish cleanup levels.

6. Dioxin/Furan Ecological Sediment Screening Levels: 2) A February 16, 2007 message from Dave Mitchell, of ENSR requests that: (a) the application of a 4% TOC is

appropriate for the Site, resulting in a dioxin TEQ value of 0.48 ng/kg screening level, or (b) that the surface water screening value used for the derivation of the sediment number is wrong because there aren't any appropriate fish in Brown Ditch, or (c) that the TCDD screening values for sediment should take into account other references for screening values. A subsequent memorandum from David Mitchell was emailed to EPA on April 12, 2007, with Site specific TOC data for the collected sediment samples.

Based on the low values recorded in the sediment sampling results, EPA will not require additional sampling for dioxin/furans in support of the risk assessment. No significant concentrations were recovered from the sample collection sites.

7. Ecological Screening Levels for Boron in Surface Water: In a February 16, 2007 message from Dave Mitchell with ENSR, a change in the ecological screening level for boron was requested because of a computational error in the original calculation. It appears that the initial boron surface water screening level of 1.6 ug/L was miscalculated. The corrected value is 1,100 ug/L. This places it above other more conservative screening values. A conservative value is appropriate because we are at the screening stage and because the IDNL contains sensitive environments. A value of 750 ug/L, is therefore acceptable. This is the USEPA Region 4 chronic surface water screening benchmark.

8. Request for Changes to Human Health Screening Levels for Boron and Molybdenum:

ENSR requests that, based on USEPA Region 9 PRGs, the screening levels for boron and molybdenum be adjusted to 7300 ug/L and 180 ug/L respectively. According to USEPA guidance (U.S. EPA 1993) and policy, screening levels for multiple chemicals in the context of a Remedial Investigation use an HQ of 0.1 and not 1.0 for each contaminant. Using HQ = 0.1 results in screening levels for boron and molybdenum of 730 ug/L and 18 ug/L respectively. Since, in the general hierarchy in the approved RI/FS Workplan, the U.S. EPA RALs are to be used before the PRGs, the RALs will remain the screening level numbers. Once all COPCs have been established in the risk assessment, the HQ can be adjusted accordingly.

9. Request for the Removal of Certain Analytes from Groundwater/Surface Water Analyses

In a March 27, 2006 request to EPA, Elizabeth Perry, with ENSR, requested that cadmium, chromium, copper, nickel, lead, thorium, zinc, and anionic surfactants, be removed from the list of analytes for groundwater and surface water sampling. EPA accepts the reasoning and agrees with the request.

REFERENCES

U.S. EPA 1993. *Selecting Exposure Routes and Contaminants of Concern by Risk-Based Screening.* Region III Technical Guidance Manual. Prepared by Roy L. Smith, PhD. Office of RCRA Technical and Program Support Branch. Philadelphia, Pennsylvania. January 1993.

Nuclear Regulatory Commission NUREG-1575. Environmental Protection Agency EPA 402-R97-016. *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM).* December 1997.

Please feel free to call me if you have any questions regarding these responses at (312) 353-4367.

Sincerely,

Tim Drexler
Remedial Project Manager

Cc: V. Blumenfeld, Brown, Inc.
D. Sullivan, NIPSCO
K. Herron, IDEM
B. Kay, USGS
S. Hicks, NPS
D. Karecki, USFWS

Attachment B10

April 12, 2007

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Memorandum

Date: April 12, 2007

Ed Karecki, USFWS

To: Tim Drexler, USEPA

From: David Mitchell

Subject: Application of Sediment-Specific Dioxin Screening Levels, Pines Area of Investigation

Distribution: L Bradley; DSullivan / NIPSCO; VBlumenfeld / Brown Inc.

This memorandum has been prepared in response to your call of April 5, 2007 regarding the details of the February 2007 Dioxin/Furan Screening Levels Memo; specifically, the use of a value of 4% total organic carbon (TOC) to derive TOC-adjusted sediment screening values. The 4% value is the midpoint of a range (i.e., 3-5%) identified in a literature review referenced in a U.S. EPA ecological risk guidance document (1999). If you recall, ENSR used the 4% value because the memo addressed just the Yard 520 soil samples and these soil samples were not analyzed for TOC.

As we discussed, site-specific TOC data for sediments in Brown Ditch are now available from the second round of sampling. Therefore, we are able to derive and apply TOC-adjusted sediment screening values on a sample-by-sample basis, for samples from the West Branch of Brown Ditch at locations both upstream and downstream of Yard 520. Attachment 1 presents the congener data and TEQs for the surficial and deeper (sub-surficial) sediment dioxin samples collected in October 2006.

Table 1 provides a simplified version of the data and summarizes the sample-specific TOC-adjusted dioxin ecological screening levels for sediment, based on application of the sample-specific TOC to the U.S. EPA Region 5 ESL. The data are arranged in order of upstream to downstream in the West Branch of Brown Ditch (BD-WB) for the surficial sediments (i.e., 0-6 inches). The surficial sediments were considered because they are the ecologically appropriate media to use to estimate exposure to wildlife receptors. We also presented the deeper (sub-surficial) sediments. The surficial sediments generally have the higher concentrations of constituents of interest.

The TOC content in surficial samples from BD-WB ranges from 0.91 to 4.66% (Table 1), reflecting the range of sandy to peaty conditions in these samples. The corresponding TOC-adjusted U.S. EPA Region 5 sediment screening values range from 0.11 to 0.56 ng/kg for the sample-specific TOC values.

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Table 1. Summary Table of EEQs for Brown Ditch – West Branch surficial sediment locations.

	Upstream SW-001	Upstream SW-020	Downstream SW-022	Downstream SW-023 [1]	Downstream SW-024
TOC (%)	1.21	1.15	4.66	3.68	0.91
Region 5 TOC-adj. ESL (ng/kg):	0.15	0.14	0.56	0.44	0.11
Avian TCDD-TEQ (ng/kg) :	0.11	0.048	0.53	0.037	0.036
Mammalian TCDD-TEQ (ng/kg):	0.26	0.051	0.71	0.044	0.039
Avian TCDD-TEQ EEQ:	0.73	0.33	0.95	0.11	0.33
Mammalian TCDD-TEQ EEQ:	1.7	0.36	1.3	0.14	0.36

[1] **Duplicate results averaged**

In addition, we have compared the cumulative 2,3,7,8-tetrachlorodibenzo-p-dioxin toxic equivalence concentrations (TCDD-TEQ) for the surficial sediment concentrations to the ESLs to derive Environmental Effects Quotients (EEQs) for avians and mammals. The EEQ is calculated by dividing an estimated environmental concentration (i.e., the TCDD-TEQ concentration) by the site-specific TOC-adjusted screening value, using the equation shown below:

EEQ (unitless) = Estimated Environmental Concentration (ng/kg) / Screening Value (ng/kg)

Table 1 presents several important conclusions from the data. First, none of the surficial sediment samples exceeded the avian screening value. Second, for the mammalian screening values, there were two EEQs greater than one. The largest of the two was at SW001 (EEQ = 1.7), an upstream location; and the second, smaller one was at SW022 (EEQ = 1.3), a downstream location. Of the two sediment sample locations where the EEQ is higher, the largest EEQ is at the upstream location. Also, these results do not show a pattern of increased risk due to dioxin in sediments at downstream locations. Of the three locations were the EEQ is low, the EEQ for the upstream location is greater than or equal to the EEQs for the two downstream locations.

We also reviewed the data for the two deep (0.5 – 1ft) sediment samples collected in October 2006. One of these deep samples (SW023) has higher EEQ values (2.2 for avians and 4.4 for mammals). However, these values are not indicative of increased dioxin concentrations at SW023, but rather reflect the extremely low TOC value (0.21%) at this location resulting in an extremely low TOC-adjusted ESL. Neither the other deep sample (SW022) nor the overlying surficial sample located at SW-023 has an EEQ greater than 1.0.

The attached spreadsheet also contains the alternative sediment screening values for dioxin recommended by ENSR (i.e., low risk sediment concentrations (U.S. EPA, 1993)), and described in the February 2007 memo. These low risk sediment screening values are presented in the left hand column in the bottom two rows of the spreadsheet. Comparing these low risk screening values to the sediment concentrations show that none of the dioxin concentrations upstream or downstream exceed them.

Overall, these results are consistent with the prior presentation and evaluation of the Yard 520 soils provided earlier this year. We believe these results fully support the removal of dioxin as a constituent of potential ecological concern for further sampling and ecological risk assessment. We would be happy to discuss these results further with you.

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Attachment 1. Dioxin Data for Brown Ditch- West Branch samples.

Chemical Name	Unit	Upstream SW001 0 - 0.5 ft 10/13/2006	Upstream SW020 0 - 0.5 ft 10/25/2006	Downstream SW022 0 - 0.5 ft 10/24/2006	Downstream SW023 0 - 0.5 ft 10/24/2006	Downstream SW023 duplicate 0 - 0.5 ft 10/24/2006	Downstream SW024 0 - 0.5 ft 10/24/2006	Deeper SW022 0.5 - 1 ft 10/24/2006	Deeper SW023 0.5 - 1 ft 10/24/2006
1,2,3,4,6,7,8-HEPTACHLORODIBENZO-P-DIOXIN	ng/kg	10.646	0.691 U	14.12 U	1.185 U	2.993 U	0.297 U	6.077 U	4.521 U
1,2,3,4,6,7,8-HpCDF	ng/kg	3.718	0.252 UJK	3.735 U	0.244 U	0.831 UJK	0.068 U	1.514 U	0.922 U
1,2,3,4,7,8,9-HpCDF	ng/kg	0.154 U	0.1 U	0.228 U	0.103 U	0.096 U	0.096 U	0.169 U	0.072 U
1,2,3,4,7,8-HEXACHLORODIBENZO-P-DIOXIN	ng/kg	0.058 U	0.069 U	0.112 U	0.064 U	0.094 U	0.052 U	0.091 U	0.054 U
1,2,3,4,7,8-HxCDF	ng/kg	0.33 U	0.048 U	0.486 U	0.035 U	0.13 U	0.035 U	0.26 U	0.124 UJK
1,2,3,6,7,8-HEXACHLORODIBENZO-P-DIOXIN	ng/kg	0.509 J	0.063 U	0.537 J	0.058 U	0.086 U	0.048 U	0.18 JK	0.171 JK
1,2,3,6,7,8-HxCDF	ng/kg	0.1 U	0.045 U	0.276 J	0.033 U	0.071 U	0.033 U	0.115 U	0.055 U
1,2,3,7,8,9-HEXACHLORODIBENZO-P-DIOXIN	ng/kg	0.057 U	0.067 U	0.413 J	0.062 U	0.091 U	0.051 U	0.231 J	0.053 U
1,2,3,7,8,9-HxCDF	ng/kg	0.157 U	0.064 U	0.235 U	0.047 U	0.101 U	0.047 U	0.165 U	0.079 U
1,2,3,7,8-PENTACHLORODIBENZOFURAN	ng/kg	0.042 U	0.041 U	0.188 J	0.048 U	0.049 U	0.033 U	0.08 U	0.035 U
1,2,3,7,8-PENTACHLORODIBENZO-P-DIOXIN	ng/kg	0.059 U	0.066 U	0.342 J	0.049 U	0.057 U	0.055 U	0.101 U	0.048 U
2,3,4,6,7,8-HxCDF	ng/kg	0.12 U	0.052 U	0.247 J	0.039 U	0.097 J	0.039 U	0.135 U	0.065 U
2,3,4,7,8-PeCDF	ng/kg	0.041 U	0.04 U	0.087 U	0.047 U	0.048 U	0.032 U	0.078 U	0.034 U
2,3,7,8-TCDD	ng/kg	0.028 U	0.032 U	0.06 U	0.032 U	0.036 U	0.031 U	0.044 U	0.023 U
2,3,7,8-TETRACHLORODIBENZOFURAN	ng/kg	0.056 U	0.048 U	1.332 U	0.088 U	0.088 U	0.059 U	0.127 U	0.582 U
OCDD	ng/kg	75.499 J	8.342 U	400.768	15.423 U	46.484 U	4.038 U	213.514	109.461
OCDF	ng/kg	9.657 J	0.35 J	8.173 J	0.653 JK	2.207 J	0.128 U	3.298 J	2.105 J
TOTAL ORGANIC CARBON (TOC)	%	1.21	1.15	4.66	3.68	--	0.909	3.50	0.208
Sample-specific TOC- adjusted R5 ESL (b)	ng/kg	0.15	0.14	0.56	0.44	0.44	0.11	0.42	0.025
TCDD-TEQ - Bird (a)	ng/kg	0.11	0.046	0.53	0.037	0.057	0.036	0.12	**0.054**
TCDD-TEQ - Mammal (a)	ng/kg	**0.26**	0.051	**0.71**	0.044	0.078	0.039	0.21	**0.11**
U.S. EPA Ecological Screening Values									
TCDD-TEQ - Bird (a) 21 (c)	ng/kg	0.11	0.046	0.53	0.037	0.057	0.036	0.12	0.054
TCDD-TEQ - Mammal (a) 2.5 (c)	ng/kg	0.26	0.051	0.71	0.044	0.078	0.039	0.21	0.11

Notes:
TCDD-TEQ - 2,3,7,8-tetrachlorodibenzo-p-dioxin toxic equivalence concentration.
Highlighting indicates that TCDD-TEQ is greater than the screening level.
(a) - Calculated per Human Health and/or Ecological Work Plan, using updated TEFs for mammals (Van den Berg, 2005).
(b) - USEPA Region 5 Ecological Screening Level for Sediment (0.12 ng/kg; U.S. EPA, 2003) adjusted to sample-specific TOC.
(c) - USEPA low risk sediment concentration (U.S. EPA, 1993)

Attachment B11

April 16, 2007

April 16, 2007

Ms. Lisa Bradley
ENSR, International
2 Technology Park Drive
Westford, Massachusetts 01886-3140

RE: U.S. EPA Response to ENSR Requests to Amend the Remedial Investigation at The Pines Site, Town of Pines, Indiana

Dear Ms. Bradley:

The following paragraphs reflect EPA's response to requests from the potentially responsible parties to modify the requirements of the Remedial Investigation for the Pines Site in Town of Pines, Indiana. Most requests were made verbally during a meeting held in Chicago on February 20, 2007. Written requests were then received by EPA on March 6, 2007.

1. Elimination of Study Area South of 1675 North:
EPA agrees that no additional sampling be required at private wells PW009, PW012, and PW013 due to pinching out of the surficial aquifer and the screening of these wells in deeper confined aquifers. However, the elimination of bottled water to those residents may require a modification to the Administrative Order on Consent signed by EPA and the potentially responsible parties. I will evaluate this and reply at a later date.

2. Elimination of Groundwater Flow Model Requirement:
ENSR's proposal for the elimination of groundwater flow modeling due to anticipated changes in the human health screening values for boron and molybdenum is not approved. EPA does not agree with ENSR's proposed change to the boron human health screening level (see #8).

3. Background Soil Sampling Locations:
The locations of the background soil samples are acceptable provided that no sample location have any indication of CCBs and that all samples collected near roadways are located a minimum of distance of 15 feet from the nearest roadway.

For the purposes of the risk assessment, EPA will accept either a soil radionuclide background value concentration of 2.1 pCi/g based on national data or the collection of background soil samples that are representative in terms of soil type, soil depth, etc. If

you choose to collect background samples it is important that the samples be collected in non-impacted areas. In addition, background soil samples must not be collected from any creek/ditch floodplain down-gradient of CCB-disposal areas. Guidance on background sampling can be found in Section 4.5 of the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM).

4. Ecological Radionuclide Issues: 3) A February 16, 2007 memo from Dave Mitchell of ENST proposed that the ecological screening level for radionuclides should be (a) 92 mg/kg in soils and (b) 100 mg/kg in sediment. EPA does not agree with the change. The 5mg/kg Uranium soil screening value will be retained since it represents a benchmark for screening potential impacts to sensitive plants. EPA Region 5 and 6 have adopted this value as a soil screening benchmark. Oak Ridge National Lab has also adopted this value. The Sheppard 2005 paper, referenced in the memo form ENSR, indicates that in sandy-sandy loam soil a toxic response to Uranium by a plant was observed at 0.5 mg/kg. This study met the data acceptance criteria of this paper but is below background in some areas. The presence of the IDNL warrants the use of a sensitive value and the original value 5 mg/kg is suitable. This value can also be used for an aquatic plant-based sediment benchmark for uranium. These numbers can be re-evaluated if site-specific background is shown to be above this level.

5. Human Health Radionuclide Issues:

EPA has the following comments with regard to the March 6, 2007 Memo from Lisa Bradley:

Section 2.1; Page 3: The basis for the residential soil PRG is described, but one risk pathway not included is indoor radon, a pathway unique to radon isotopes and their parent radionuclides.

Section 2.1; Page 4: Regarding Table 2, the means of the summary statistics for the individual radionuclide contaminants are generally 3 times higher than the documented background means. Documented background values should be used in the absence of Site-specific background information. MARSSIM advises establishing a background reference area when contaminants of concern are present in background.

Section 2.1; Page 4: The stated comparison of sample results to documented background values is generally arbitrary and statistically non-defensible. EPA's MARSSIM guidance provides statistical methods that can be used to compare the sample results from survey areas to background reference areas, when background reference area results are available.

Section 2.2.1; Page 5: Scenario #1 in the human health screening risk assessment does not appear to represent the Site RME based on previous visual inspections of at least one residence at East Johns and Idaho where volumes considerably more than $200m^2$ were allegedly used as yard fill. Before exposure calculations can be accepted, they must reference a percentage of CCBs that reflects actual sampling of the most impacted yards.

The exposure scenarios should be reviewed to assure they are relevant to site-specific conditions. In Scenario 1 for example, it is not appropriate to disregard exposure indoors considering that a receptor could track contaminants indoors. Elimination of gardens should be assessed, as well as the time spent outside.

Section 2.2.4; Page 6: It is premature to discuss clean-up levels. However, U.S. EPA's risk range for radionuclide sites does not extend up to $3x10^{-4}$. Refer to "Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination" (OSWER Directive 9200.4-18) dated August 22, 1997. EPA generally sets site-specific remediation levels for carcinogens at a level that represents an excess upper bound lifetime cancer risk to an individual between 10^{-4} to 10^{-6}. Guidance that provides for cleanups outside this risk range is not protective under CERCLA and shouldn't be used to establish cleanup levels. OSWER Directive 9200.4-18 (U.S. EPA 1997a) specifies that cleanup levels for radioactive contamination at CERCLA sites should be established as they would for any chemical that poses an unacceptable risk and the risks should be characterized in standard Agency risk language consistent with CERCLA guidance. Cleanup levels not based on an ARAR should be based on the carcinogenic risk range (generally 10^{-4} to 10^{-6}, with 10^{-6} as the point of departure and 1×10^{-6} used for PRGs) and expressed in terms of risk ($\# \times 10^{-\#}$). While the upper end of the risk range is not a discrete line at 1×10^{-4}, EPA generally uses 1×10^{-4} in making risk management decisions. A specific risk estimate around 10^{-4} may be considered acceptable if based on site-specific circumstances.

Section 3.1; Page 6: The literature review disregards current EPA Superfund guidance for radiation site cleanups (see http://www.epa.gov/superfund/resources/radiation/radarars.htm), as well as the unique nature of radium isotopes, their radon decay products, and the cancer risk associated with the accumulation of radon inside homes.

Section 3.2; Page 7: The background evaluation seems to highlight the more insignificant qualities of the individual radionuclides in the uranium-238, thorium-232, and uranium-235 decay series, neglecting that these are primarily ingestion and inhalation hazards, especially in the case of radon isotopes in these decay series.

Section 3.2; Page 8: U.S. EPA's risk range for radionuclide sites does not extend up to $3x10^{-4}$. Refer to "Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination" (OSWER Directive 9200.4-18) dated August 22, 1997. EPA generally sets site-specific remediation levels for carcinogens at a level that represents an excess upper bound lifetime cancer risk to an individual between 10^{-4} to 10^{-6}. Guidance that provides for cleanups outside this risk range is not protective under CERCLA and shouldn't be used to establish cleanup levels.

6. Dioxin/Furan Ecological Sediment Screening Levels: 2) A February 16, 2007 message from Dave Mitchell, of ENSR requests that: (a) the application of a 4% TOC is

appropriate for the Site, resulting in a dioxin TEQ value of 0.48 ng/kg screening level, or (b) that the surface water screening value used for the derivation of the sediment number is wrong because there aren't any appropriate fish in Brown Ditch, or (c) that the TCDD screening values for sediment should take into account other references for screening values. A subsequent memorandum from David Mitchell was emailed to EPA on April 12, 2007, with Site specific TOC data for the collected sediment samples.

Based on the low values recorded in the sediment sampling results, EPA will not require additional sampling for dioxin/furans in support of the risk assessment. No significant concentrations were recovered from the sample collection sites.

7. Ecological Screening Levels for Boron in Surface Water: In a February 16, 2007 message from Dave Mitchell with ENSR, a change in the ecological screening level for boron was requested because of a computational error in the original calculation. It appears that the initial boron surface water screening level of 1.6 ug/L was miscalculated. The corrected value is 1,100 ug/L. This places it above other more conservative screening values. A conservative value is appropriate because we are at the screening stage and because the IDNL contains sensitive environments. A value of 750 ug/L, is therefore acceptable. This is the USEPA Region 4 chronic surface water screening benchmark.

8. Request for Changes to Human Health Screening Levels for Boron and Molybdenum:

ENSR requests that, based on USEPA Region 9 PRGs, the screening levels for boron and molybdenum be adjusted to 7300 ug/L and 180 ug/L respectively. According to USEPA guidance (U.S. EPA 1993) and policy, screening levels for multiple chemicals in the context of a Remedial Investigation use an HQ of 0.1 and not 1.0 for each contaminant. Using HQ = 0.1 results in screening levels for boron and molybdenum of 730 ug/L and 18 ug/L respectively. Since, in the general hierarchy in the approved RI/FS Workplan, the U.S. EPA RALs are to be used before the PRGs, the RALs will remain the screening level numbers. Once all COPCs have been established in the risk assessment, the HQ can be adjusted accordingly.

9. Request for the Removal of Certain Analytes from Groundwater/Surface Water Analyses

In a March 27, 2006 request to EPA, Elizabeth Perry, with ENSR, requested that cadmium, chromium, copper, nickel, lead, thorium, zinc, and anionic surfactants, be removed from the list of analytes for groundwater and surface water sampling. EPA accepts the reasoning and agrees with the request.

REFERENCES

U.S. EPA 1993. *Selecting Exposure Routes and Contaminants of Concern by Risk-Based Screening.* Region III Technical Guidance Manual. Prepared by Roy L. Smith, PhD. Office of RCRA Technical and Program Support Branch. Philadelphia, Pennsylvania. January 1993.

Nuclear Regulatory Commission NUREG-1575. Environmental Protection Agency EPA 402-R97-016. *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM).* December 1997.

Please feel free to call me if you have any questions regarding these responses at (312) 353-4367.

Sincerely,

Tim Drexler
Remedial Project Manager

Cc: V. Blumenfeld, Brown, Inc.
D. Sullivan, NIPSCO
K. Herron, IDEM
B. Kay, USGS
S. Hicks, NPS
D. Karecki, USFWS

Attachment B12

February 1, 2008

Bradley, Lisa

From: Drexler.Timothy@epamail.epa.gov
Sent: Friday, February 01, 2008 4:06 PM
To: Bradley, Lisa
Cc: alanmurray5@comcast.net; peggy@tory.adsnet.com; silvestri@ameritech.net; budprast@comcast.net; pakysel@hotmail.com; helenmolinaro@comcast.net; Perry, Elizabeth; pete_penoyer@nps.gov; kherron@idem.in.gov; Bob_Daum@nps.gov; scott_hicks@nps.gov; dale_engquist@nps.gov; dsullivan@nisource.com; vblumenfeld@bibtc.com; Jablonowski.Eugene@epamail.epa.gov
Subject: Re: Extension of Pines RI Due Date

Hi Lisa:

This message confirms our phone conversation yesterday regarding additional background sample analysis. The due date for the RI Report is extended 30 days from the original April 17, 2008 date in order for the background soil samples to be analyzed to establish Site-specific radiological background. EPA had offered to perform the analyses at no charge. The Pines Site PRPs have decided that they will utilize their own laboratory and perform the analysis in accordance with the Site's approved QAPP. EPA has no objection.

I look forward to the RI Report.

Tim Drexler
Remedial Project Manager
Superfund Division
United States Environmental Protection Agency
77 W. Jackson Blvd., SR-6J
Chicago, Illinois 60604-3590

phone: 312.353.4367
fax: 312.886.4071

"Perry, Elizabeth" <EPerry@ensr.aecom.com>
01/18/2008 03:08 PM

To: Timothy Drexler/R5/USEPA/US@EPA, <kherron@idem.in.gov>
cc: "Bradley, Lisa" <lbradley@ensr.aecom.com>
Subject: Pines RI

Tim and Kevin - This is to let you know we finished the visual

inspections of suspected CCBs in the Pines Area of Investigation today. Based on the schedules in AOC II and the RI/FS Work Plan, the draft RI Report is due to you in 90 days, or April 17, 2008.

Please feel free to call if you have any questions!
Elizabeth

A. Elizabeth Perry, P.G.
Senior Hydrogeologist
ENSR
Westford, MA, USA
tel: 978-589-3167
fax: 978-589-3100

Attachment C

Data Usability Assessment

DATA USABILITY ASSESSMENT
YARD 520
PINES AREA OF INVESTIGATION

The investigation conducted under the Yard 520 Sampling and Analysis Plan (SAP) (ENSR, 2005b) in the Pines Area of Investigation focused on the collection of samples of coal combustion by-products (CCBs) in Yard 520, samples of sediment adjacent to and upgradient of Yard 520, and samples of background soils. The analytes for the CCB samples were polycyclic aromatic hydrocarbons (PAHs), polychlorinated dibenzo-p-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs), and radionuclides. Based on these results and correspondence with the U.S. Environmental Protection Agency (USEPA), the analytes for the sediment samples were PCDDs/PCDFs and radionuclides. Based on the results of these samples and correspondence with USEPA, the background samples were analyzed for radionuclides (inorganic analyses of the background samples are addressed in the Remedial Investigation Report (ENSR, 2008)). The purpose of the sampling is to determine if PAHs, PCDDs/PCDFs, and radionuclides are present in CCBs at concentrations that may have an affected on human and ecological health.

This Data Usability Assessment (DUA) discusses the analytical laboratories, analytical parameters, analytical methodologies, data validation approach, and the usability of the analytical results, based on the results of the data validation process. The primary objective of the data review and usability evaluation was to determine that appropriate data were used in the evaluation of the investigation results.

Laboratories

Analyses of all samples collected were performed by the laboratories indicated in the table below. The analyses were performed in accordance with USEPA-approved analytical protocols as specified in Appendix C - Quality Assurance Project Plan (QAPP) of the Yard 520 SAP (ENSR, 2005b). The table below indicates the laboratories used for the project and analyses performed at each laboratory.

Sampling Event Laboratory and Location	Parameter
September 2005 Coal Combustion By-Product (CCB) Sampling	
Columbia Analytical Services Rochester, NY (CAS-Rochester)	Polycyclic aromatic hydrocarbons (PAHs)
General Engineering Laboratories (GEL) Charleston, SC	Total uranium (U), U-235, and U-238 by Inductively Coupled Plasma-Mass Spectrometry (ICP-MS); Various radionuclides by gamma spectrometry
Columbia Analytical Services Houston, TX (CAS-Houston)	Polychlorinated dibenzo-p-dioxins/Polychlorinated dibenzofurans (PCDDs/PCDFs)
October 2006 Sediment Sampling	
Columbia Analytical Services Houston, TX (CAS-Houston)	PCDDs/PCDFs
GEL Charleston, SC	Total U by ICP-MS; Various radionuclides by gamma spectrometry
April/May 2007 Background Soil Sampling	
GEL Charleston, SC	Total U by ICP-MS; Various radionuclides by gamma spectrometry

Overall quality of sample results is a function of proper sample management. Management of samples began at the time of collection and continued throughout the analysis process. Established industry standards for sample collection were followed to ensure that samples were collected, managed properly and consistently, and to optimize the likelihood that the resultant data were valid and representative.

Data Validation

Data validation was performed by ENSR to assess that the collected analytical data were scientifically defensible, properly documented, of known quality, and met project objectives. Data validation included the verification and validation of analytical procedures, quality control (QC), calibration, and data reduction.

The data packages received full validation or limited validation. The full validation incorporated reviewing the summary forms and raw data, whereas the limited validation was performed using information presented on summary forms only. The following table indicates the QC parameters evaluated for the full and limited validations, where applicable to the method:

QC Parameter	Full Validation	Limited
Completeness of deliverable	√	√
Agreement of analyses conducted with chain-of-custody (COC) requests	√	√
Holding times and sample preservation	√	√
Initial and continuing calibrations	√	
Instrument tuning	√	
Chemical yield (tracers and carriers)	√	√
Laboratory and field blank contamination	√	√
Field and laboratory duplicates	√	√
Matrix spike/matrix spike duplicate (MS/MSD) recoveries and relative percent differences (RPDs)	√	√
Post-digestion spike (PDS) recoveries	√	
Laboratory control sample (LCS) and laboratory control sample duplicate (LCSD) recoveries	√	√
Internal standard performance	√	
ICP serial dilution results	√	
ICP interference check sample (ICS) results	√	
Calculation and transcription verifications (*i.e.*, verifying summary data against raw data)	√	
Compound Identification (*i.e.,* verifying spectrum/chromatograms)	√	

The analytical data were evaluated with reference to the following validation guidelines/documents:

- USEPA Contract Laboratory Program *National Functional Guidelines for Inorganic Data Review* (February 1994 and October 2004),
- Department of Energy *Evaluation of Radiochemical Data Usability (1997),*
- *Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP),* July 2004,
- USEPA Analytical Services Branch (ASB) *National Functional Guidelines for Chlorinated Dibenzo-p-Dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs) Data Review*, EPA-540-R-05-001 (September 2005),
- USEPA Contract Laboratory Program *National Functional Guidelines for Organic Data Review* (October 1999),
- Region 5 *Standard Operating Procedure for Validation of CLP Organic Data* (USEPA Region 5 Superfund Technical Support Section, February 1997).

In addition, the QC criteria specified in the analytical method and/or the Yard 520 QAPP (Appendix C of ENSR, 2005b) were used to evaluate the analytical data. Where necessary, the data validation protocols were modified to reflect differences in analytical methodology and to incorporate the project-specific acceptance criteria defined in the Yard 520 QAPP or the method criteria, whichever was more stringent.

Validation reports were prepared for each data package validated. The reports summarize the samples reviewed, parameters reviewed, nonconformances with the established criteria, and validation actions (including application of data qualifiers). Data qualifiers were consistent with the above referenced USEPA, DOE, and/or MARLAP validation guidelines/documents, and consisted of the following:

Qualifier	Definition
J	The result is an estimated quantity; the associated numerical value is the approximate concentration of the analyte in the sample.
J+	The result is an estimated quantity, but the result may be biased high.
J-	The result is an estimated quantity, but the result may be biased low.
U	The analyte was analyzed for, but was not detected above the sample reporting limit.
UJ	The analyte was not detected above the sample reporting limit; and the reporting limit is approximate.
R	The data are unusable. The sample result is rejected due to serious deficiencies. The presence or absence of the analyte cannot be verified.
B	The result may be a false positive (totally attributed to blank contamination) (for radiochemical data only).
JB	The result may be biased high (partially attributed to blank contamination) (for radiochemical data only).
JK	Estimated, tentative identification (for PCDD/PCDF data only).
UJK	Estimated nondetect, tentative identification (for PCDD/PCDF data only).

According to the Yard 520 QAPP (Appendix C of ENSR, 2005b), a minimum of ten percent of the routine chemical and radionuclide data were to be subjected to full validation and the remainder was to receive limited validation. In addition, the percentage of data selected for full validation was to be representative of

all matrices and analyses. Since only one or two data packages were submitted by the laboratory per parameter group, the majority of the data received full validation.

The table below indicates the distribution of data subjected to full validation by matrix and analysis:

Percentage of Data Subjected to Full Validation			
Analysis	**Percentage**	**Analysis**	**Percentage**
Radiochemical	81%	U-235, U-238, and Total U by ICP/MS	86%
PCDDs/PCDFs	100%	PAHs	100%

The remaining data for the above parameters were subjected to a limited review, using QC summary forms. The associated data validation reports are included in Attachment D.

Data Usability Assessment

This section describes the procedures used to evaluate the acceptability of data for use in the Yard 520 investigation. The data discussed in this data usability assessment consist of data for PAHs, PCDDs, PCDFs, radionuclides by gamma spectrometry, and U-235, U238, and total U by ICP/MS. The data are from 15 CCB soil locations sampled in September 2005, 8 sediment samples from October 2006, and 33 background surface soil locations sampled in April/May 2007 (see Yard 520 SAP, ENSR, 2005b).

The evaluation of the quality of the data gathered for this project can be defined in terms of the following elements: completeness, sensitivity, representativeness, precision, and accuracy. The basics of these elements are discussed below.

The data gathered have both a field and a laboratory component. Environmental samples were collected in the field and were sent to a laboratory for analysis. Therefore, the data usability assessment reviews both the field and laboratory components of each data usability element, as applicable.

Completeness has both a field and a laboratory component. The purpose of this element is to determine whether all of the samples specified for collection in the project plans (e.g., the Yard 520 SAP) were collected in the field, whether the specified analytical measurements were performed on those samples by the laboratory, and then whether the data were determined to be valid during the data validation process.

Sensitivity is an element that applies only to the laboratory analysis of the environmental sample. The purpose of this element is to determine whether the laboratory was able to meet the target reporting limits (RLs) specified in the QAPP. As one of the end uses of the data is for risk assessment, the target RLs are selected in part on the project data quality levels (DQLs), which are both human health and ecological risk-based levels. Efforts were made in the development of the QAPP to identify analytical methods that could achieve the DQLs.

Representativeness applies to both the sampling and analytical programs. With regards to the sampling program, representativeness is an estimation of the extent to which the sampling program design adequately reflects the environmental conditions of Yard 520. The Yard 520 SAP addresses the sampling

program design aspect of representativeness. Another aspect of representativeness is whether the samples are reflective of the media being sampled. With regards to the analytical program, representativeness is dependent upon the use of established and approved procedures for sample handling, preservation, and storage; adherence to approved and appropriate analytical techniques; and conformance to sample holding times.

Precision is a measure of the degree to which two or more measurements are in agreement with each other. Field precision is assessed through the collection and analysis of field duplicate samples. Laboratory precision is assessed through the analysis of laboratory duplicates. Comparison of the results provides an estimate of the precision of the sample collection and analytical methods.

Accuracy is a measure of the degree of agreement between the measured value and an accepted reference or true value. Accuracy is a laboratory assessment element, and is evaluated based on the use of internal laboratory QC samples and standards.

The individual elements used to evaluate the quality of the data gathered for this project are discussed in detail below.

Completeness

As defined in the Yard 520 QAPP (Appendix C of ENSR, 2005b), field completeness is evaluated to determine whether all of the samples specified for collection in the project plans were collected and submitted for laboratory analysis. It is a measure of the amount of valid samples obtained during all sampling for the project. The field completeness objective, as specified in the Yard 520 QAPP, was greater than 90%, and was met for the program in that all samples that were collected and designated for analysis were valid and were analyzed and reported by the laboratory. (Note that changes to the original SAP were documented and approved by USEPA, and are not considered to affect the completeness of the work.)

Laboratory completeness is the ratio of the number of valid measurements compared to all the measurements taken in the project. The laboratory completeness objective as specified in the Yard 520 QAPP was greater than 95%. The overall laboratory completeness for the September 2005, October 2006, and April/May 2007 sampling events was greater than the QAPP requirement of 95%. Thus, the data generated were found to meet the completeness objectives and to be reliable and acceptable for use.

Sensitivity

Sensitivity of analytical data is demonstrated by the laboratory RLs. The target RLs were selected in part by consideration of the DQLs to be achieved and in part by consideration of the likelihood of detectable concentrations above the DQL, as in the case of PCDDs/PCDFs, the actual ability of the laboratory to attain reporting limits at the DQLs and the cost-effectiveness of implementing additional, more sensitive methods in the initial stage of the investigation. The laboratories used their most recent detection limit study results to report analytical results.

As per the Yard 520 SAP, equipment blanks associated with the collected field samples were collected and submitted for analysis. Based on the Yard 520 QAPP requirements, positive results were reported between the method detection limits (MDLs) and project reporting limits (RLs) for all analytes. The laboratory

assigned “B” or “J” qualifiers to results below the project RLs. These “B” and “J” qualifiers were replaced with “J” qualifiers as a result of the data validation to indicate the results were estimated due to uncertainty below the RL. In addition, the laboratory assigned “K” and “JK” qualifiers to PCDDs/PCDFs data for results that were considered to be “Estimated Maximum Potential Concentrations” (EMPCs) because not all the identification QC criteria were met. The “K” and “JK’ qualifiers were retained during data validation to indicate the positive results were estimated. Approximately 9% of the positive results were qualified as estimated (flagged as “J” or “JK”) during validation because the results were detected at concentrations below the project RLs and or did not meet all the identification criteria.

The RLs met the project DQLs for all the analytes in September 2005, October 2006, and April/May 2007 sampling events.

Representativeness

The sampling program design and the sampling activities were conducted according to the objectives of the project SAP. Deviations or modifications from the USEPA-approved sampling plan were documented and approved by USEPA.

With regards to the analytical program, representativeness is dependent upon the use of established and approved procedures for sample handling, preservation, and storage; adherence to approved and appropriate analytical techniques; and conformance to sample holding times. No data were rejected on the basis of representativeness. However, the holding time was exceeded for the PAH analyses, and the cooler temperatures were exceeded for the U-235, U-238, and total U analyses by ICP-MS. Therefore, all detected and nondetected PAH results, and U-235, U-238, and total U results by ICP-MS from the September 2005 sampling event, which represents 13% of the overall Yard 520 data, were estimated (flagged as “J” or “UJ”).

No other issues related to sample handling and analyses, which could adversely affect data quality, were noted. The PAH and U results by ICP-MS are considered usable for the project objectives.

Precision

Precision is a measure of the degree to which two or more measurements are in agreement. Field precision was assessed through the collection and measurement of field duplicates at a rate of one duplicate per ten field samples. The field precision objective, measured through the calculation of relative percent difference (RPD), was 30% RPD for U by ICP-MS, PCDD/PCDF analysis, and radionuclide analysis, and was 50% RPD for PAH analysis. RPDs for all analyses met the criteria, with the exception the radionuclide data. Approximately 1% of the data collected during the Yard 520 sampling events were qualified as estimated (“J” or “UJ”) due to field duplicate precision nonconformances. The affected parameters were two nondetected octachlorinated dibenzodioxins (OCDD) data points, and six detected U-238 and six detected total uranium data points.

Precision in the laboratory was assessed through the calculation of RPD for duplicate samples, either as matrix spike/matrix spike duplicates (MS/MSDs) or as laboratory duplicates, depending on the parameter. Approximately 1% of the data collected during the Yard 520 sampling events were qualified as estimated

("J") due to laboratory duplicate precision nonconformances. The affected data were ten detected U-234 data points.

Overall, precision objectives for the program were met, except for approximately 2% of the data. Data affected by precision nonconformances are considered estimated and are usable for project objectives.

Accuracy

Accuracy is the degree of agreement between the observed value and an accepted reference or true value. Accuracy was assessed by evaluating instrument tuning/calibration; internal standards; cleanup standards; serial dilutions; ICP ICS results; recoveries of spiked samples such as MS/MSDs, LCSs, and PDSs; and by evaluating field blank (i.e., equipment) and laboratory blank (i.e., method/preparation, instrument) contamination including instrument drift.

All data were determined to be valid, with select results (approximately 9% of the total number of data points) being qualified based on blank contamination, calibration, matrix spike, or internal standard QC issues. Data affected by accuracy nonconformances are considered usable for project objectives.

Blanks associated with the samples included laboratory blanks (e.g., method/preparation, instrument) and blanks related to field activities (equipment). Equipment blanks, which were analyzed for the same parameters as their associated samples, were free of contaminants.

Laboratory blanks were free of contamination, except for PAHs and PCDDs/PCDFs. Approximately 5% of the Yard 520 data were considered to be false positives due to laboratory blank contamination; however, approximately half of the affected data points were low level results (i.e., results detected at concentrations below the RL). These results were considered to be nondetect results (flagged as "U" or "UJ") at the RL or at the reported concentrations due to laboratory blank contamination.

Approximately 4% of the data points were qualified as estimated (flagged as "J", "J-", or "UJ") on the basis of nonconformances that included calibration issues, internal standard results, and/or MS recoveries that fell outside the established control limits.

Conclusions

The quality objectives specified in the SAP were achieved and all the CCB and background soil data were determined to be valid, and considered to be usable and reliable for decision-making. There were no rejected CCB, sediment, or background soil data points.

Attachment D

Data Validation Reports

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Privileged and Confidential
Attorney-Client Work Product

Memorandum

Date: January 30, 2006
Revised October 18, 2007

To: Lisa Bradley/Westford

From: Lisa Krowitz/Westford

Subject: Data Validation
Radiological Analyses
Yard 520
Pines Area of Investigation, Indiana
GEL SDG Number 146464

Distribution: D. Simmons/Westford

01776-022-106
PI013rad.rev.doc

SUMMARY

Full validation was performed on the data for 11 soil samples and one equipment blank analyzed for Actinium-227 (Ac-227), Lead-210 (Pb-210), Polonium-210 (Po-210), Protactinium-231 (Pa-231), Radium-226 (Ra-226), Radium-228 (Ra-228), Thorium-228 (Th-228), Thorium-230 (Th-230), Thorium-232 (Th-232), Uranium-234 (U-234), Uranium-235 (U-235), and Uranium-238 (U-238) by DOE EML HASL-300 (soil samples) and EPA 901.1 (aqueous sample). The samples were collected at Yard 520 Pines Area of Investigation in Pines, Indiana on September 23, 2005 and submitted to General Engineering Laboratories (GEL) in Charleston, South Carolina for analysis. GEL processed these samples under sample delivery group (SDG) number 146464. The analytical data were evaluated with reference to the Department of Energy "Evaluation of Radiochemical Data Usability" (1997) and the quality control (QC) criteria specified in the analytical method and/or the Yard 520 Quality Assurance Project Plan (QAPP).

In general, the data are valid as reported and may be used for decision making purposes. No data were rejected or qualified as estimated.

SAMPLES

The samples included in this review are listed below.

Sample IDs	Sample IDs
GP004ICB092305B (equipment blank)	GP008ICB092305D (field duplicate of GP008ICB092305S)
GP004ICB092305S	GP009ICB092305S
GP005ICB092305S	GP010ICB092305S

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Sample IDs	Sample IDs
GP007ICB092305S	GP012ICB092305S
GP008ICB092305S	GP013ICB092305S

REVIEW ELEMENTS

Sample data were reviewed for the following parameters:

- Agreement of analyses conducted with chain-of-custody (COC) requests
- Holding times/sample preservation
- Calibrations
- Laboratory method blanks/equipment blanks
- Matrix spike (MS) results
- Laboratory control sample (LCS) results
- Laboratory duplicate results
- Field duplicate results
- Sample quantitation/detection limit results

DISCUSSION

Agreement of Analyses Conducted With COC Requests

Sample reports were reviewed against the analytical requests as designated on the chain-of-custody (COC) and subsequent communications between ENSR and the laboratory. No discrepancies were noted.

Holding Times/Sample Preservation

All samples were prepared and analyzed within the method-specified holding times. No issues with sample preservation were noted upon receipt in the laboratory.

Calibrations

All criteria were met for energy and efficiency calibrations and instrument backgrounds.

Laboratory Method Blanks/Equipment Blanks

Sample GP004ICB092305B was submitted as the equipment blank with this data set. There were no contaminants detected above the minimum detectable concentrations (MDCs)/detection limits (DLs) for all the parameters in the laboratory method and equipment blank.

MS Results

The MS analysis was performed on a non-Pines aqueous sample. Note that MS analysis is not applicable to soil samples analyzed by gamma spectroscopy. The MS was spiked with Am-241, Cs-

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137, and Co-60. The percent recoveries (%Rs) met the QC acceptance criteria of 75-125% for all MS parameters.

LCS Results

LCSs were analyzed for both the aqueous and soil matrices. The LCS was spiked with Am-241, Cs-137, and Co-60. All LCSs %Rs met the acceptance criteria for all parameters.

Laboratory Duplicate Results

Laboratory duplicate analyses were performed on an aqueous non-Pines sample and on soil sample GP0011ICB092305S.

The relative percent differences (RPDs) met the QC acceptance criteria of 20% RPD for aqueous samples and 35% RPD for soil samples (if both results are greater than five times the MDC/DL). The laboratory duplicate results were either not detected or detected at concentration less than 5x the MDC/DL for all parameters. Precision was deemed acceptable.

Field Duplicate Results

The field duplicate pair submitted with this data set was GP008ICB092305S and GP008ICB092305D. The following table summarizes the RPDs of the detected nuclides in the field duplicate pair.

Nuclide	GP008ICB092305S (pCi/g)	GP008ICB092305 (pCi/g)	% RPD
Pb-210	2.10 ± 3.37 U	4.55 ± 2.30	NC
Po-210	2.10 ± 3.37 U	4.55 ± 2.30	NC
Ra-226	3.06 ± 0.108	3.25 ± 0.118	10
Th-230	3.06 ± 0.108	3.25 ± 0.118	10
Ra-228	2.29 ± 0.176	2.52 ± 0.180	10
Th-228	2.34 ± 0.067	2.42 ± 0.066	3
Th-232	2.28 ± 0.065	2.37 ± 0.065	4
U-234	3.49 ± 0.132	3.40 ± 0.136	3
U-235	0.146 ± 0.160 U	0.282 ± 0.146	NC
U-238	3.10 ± 1.03	2.20 ± 1.33	34

NC – Not calculated since one result was not detected.

The RPDs (where calculated) for all the nuclides met the QC acceptance criteria of + 50% for a soil matrix. These results are considered usable.

For Pb-210, Po-210, and U-235, the field duplicate results were less than 10 times the MDC/DL and the differences were less than 8 times the MDC/DL. Therefore, no qualifications were required for the Pb-210, Po-210, and U-235 results. These results are considered usable.

Sample Quantitation/Detection Limit Results

The results for Pb-210, Po-210, Ra-226, and Th-230 were reported as individual values on the GEL Certificate of Analysis sheets.

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Negative and zero results were reported for some samples, but were flagged with a "U" by GEL as being not detected. These results were reported as not detected (U) at the value reported by the laboratory.

Results reported below the MDC were flagged with a "U" by GEL as being not detected. These results were reported as not detected (U) at the value reported by the laboratory.

Positive results were reported below the project RL, but above the MDC. These results were reported as positive at the value reported by the laboratory.

The following table summarizes the samples for which the laboratory MDCs/DLs were greater than the RLs, and the results were not detected above the MDCs/DLs. These results were reported as not detected (U) at the value reported by the laboratory

Sample ID	Nuclide	Sample Result	MDC/DL (pCi/g)	RL (pCi/g)
GP005ICB092305S	Ac-227	0.289 U	0.296	0.160
	Pb-210	3.22 U	4.86	3.00
	Po-210	3.22 U	4.86	3.00
GP008ICB092305S	U-238	0.146 U	0.185	0.100
GP012ICB092305S	Pa-231	0.772 U	0.977	0.500

The laboratory indicated in the case narrative that these samples did not meet the required reporting limit due to receipt of small sample aliquots.

The laboratory qualified the following sample results with "UI" to indicate "uncertain identification for gamma spectroscopy". This qualifier was removed and the following actions taken.

Sample ID	Analyte	Qualifier Reason	Action
GP004ICB092305B	Thorium-228	No valid peak	Report nondetect at MDC/DL
	Thorium-232	No valid peak	Report nondetect at MDC/DL
GP009ICB092305S	Actinium-227	Low abundance	Report nondetect at MDC/DL

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Certificate of Analysis

Company : ENSR International
Address : 2 Technology Park Drive
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Report Date: October 22, 2005

Contact: Ms. Debra L. McGrath
Project: **Indiana Pines Yard 520**

Client Sample ID:	GP004ICB092305B	Project:	ENSR00205
Sample ID:	146464012	Client ID:	ENSR003
Matrix:	Water		
Collect Date:	23-SEP-05 09:45		
Receive Date:	26-SEP-05		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Liquid (Long List)											
Actinium-227	U	-26.3	+/-35.1	59.5		pCi/L		MJH1 10/20/05	2209	470456	1
Lead-210	U	305	+/-898	1440	750	pCi/L					
Polonium-210	U	305	+/-898	1440		pCi/L					
Protactinium-231	U	14.6	+/-145	254		pCi/L					
Radium-226	U	8.48	+/-12.3	13.6		pCi/L					
Radium-228	U	12.1	+/-16.4	22.3	20.0	pCi/L					
Thorium-228	UU	0.00	+/-8.98	8.92		pCi/L					
Thorium-230	U	8.48	+/-12.3	13.6	20.0	pCi/L					
Thorium-232	UU	0.00	+/-8.74	8.68		pCi/L					
Uranium-234	U	11.4	+/-12.4	22.5		pCi/L					
Uranium-235	U	11.6	+/-28.1	37.5	50.0	pCi/L					
Uranium-238	U	161	+/-346	347	250	pCi/L					

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EPA 901.1	

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Report Date: October 22, 2005

Contact: Ms. Debra L. McGrath
Project: **Indiana Pines Yard 520**

Client Sample ID:	GP004ICB092305S	Project:	ENSR00205
Sample ID:	146464001	Client ID:	ENSR003
Matrix:	Soil		
Collect Date:	23–SEP–05 09:30		
Receive Date:	26–SEP–05		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Solid (Long List)											
Actinium–227	U	–0.0952	+/–0.240	0.369	0.160	pCi/g		MJH1 10/17/05	1027	467582	1
Lead–210	U	2.13	+/–1.81	2.39	3.00	pCi/g					
Polonium–210	U	2.13	+/–1.81	2.39	3.00	pCi/g					
Protactinium–231	U	0.107	+/–0.829	1.47	0.500	pCi/g					
Radium–226		2.19	+/–0.255	0.0613	0.200	pCi/g					
Radium–228		1.41	+/–0.236	0.113	0.300	pCi/g					
Thorium–228		1.63	+/–0.149	0.0528	0.400	pCi/g					
Thorium–230		2.19	+/–0.255	0.0613	0.500	pCi/g					
Thorium–232		1.59	+/–0.145	0.0515	0.400	pCi/g					
Uranium–234		2.55	+/–0.283	0.129	3.00	pCi/g					
Uranium–235		0.272	+/–0.191	0.206	0.100	pCi/g					
Uranium–238		2.53	+/–1.26	1.08	0.500	pCi/g					

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL–RAD–A–021	AXP2	09/27/05	2107	466662

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

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Report Date: October 22, 2005

Contact: Ms. Debra L. McGrath
Project: **Indiana Pines Yard 520**

Client Sample ID: GP005ICB092305S
Sample ID: 146464002
Matrix: Soil
Collect Date: 23-SEP-05 10:30
Receive Date: 26-SEP-05
Collector: Client

Project: ENSR00205
Client ID: ENSR003

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Solid (Long List)											
Actinium-227	U	0.289	+/-0.206	0.296	0.160	pCi/g		MJH1 10/17/05	1045	467582	1
Lead-210	U	3.22	+/-4.64	4.86	3.00	pCi/g					
Polonium-210	U	3.22	+/-4.64	4.86	3.00	pCi/g					
Protactinium-231	U	-0.642	+/-0.709	1.12	0.500	pCi/g					
Radium-226		3.23	+/-0.102	0.0478	0.200	pCi/g					
Radium-228		2.59	+/-0.131	0.0838	0.300	pCi/g					
Thorium-228		2.63	+/-0.0649	0.050	0.400	pCi/g					
Thorium-230		3.23	+/-0.102	0.0478	0.500	pCi/g					
Thorium-232		2.56	+/-0.0634	0.0488	0.400	pCi/g					
Uranium-234		3.66	+/-0.127	0.0956	3.00	pCi/g					
Uranium-235		0.238	+/-0.162	0.167	0.100	pCi/g					
Uranium-238		2.86	+/-0.971	1.19	0.500	pCi/g					

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	AXP2	09/27/05	2107	466662

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

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Certificate of Analysis

Company : ENSR International
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Report Date: October 22, 2005

Contact: Ms. Debra L. McGrath
Project: **Indiana Pines Yard 520**

Client Sample ID:	GP006ICB092305S	Project:	ENSR00205
Sample ID:	146464003	Client ID:	ENSR003
Matrix:	Soil		
Collect Date:	23–SEP–05 10:50		
Receive Date:	26–SEP–05		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Solid (Long List)											
Actinium–227	U	–0.0537	+/–0.216	0.371	0.160	pCi/g		MJH1 10/17/05	1116	467582	1
Lead–210		4.21	+/–0.638	0.470	3.00	pCi/g					
Polonium–210		4.21	+/–0.615	0.470	3.00	pCi/g					
Protactinium–231	U	–0.475	+/–0.848	1.44	0.500	pCi/g					
Radium–226		3.49	+/–0.327	0.0672	0.200	pCi/g					
Radium–228		3.00	+/–0.374	0.120	0.300	pCi/g					
Thorium–228		2.92	+/–0.305	0.0517	0.400	pCi/g					
Thorium–230		3.49	+/–0.327	0.0672	0.500	pCi/g					
Thorium–232		2.85	+/–0.297	0.0504	0.400	pCi/g					
Uranium–234		3.94	+/–0.442	0.125	3.00	pCi/g					
Uranium–235		0.246	+/–0.169	0.197	0.100	pCi/g					
Uranium–238		4.14	+/–0.893	0.534	0.500	pCi/g					

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL–RAD–A–021	AXP2	09/27/05	2108	466662

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

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Company : ENSR International
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Report Date: October 22, 2005

Contact: Ms. Debra L. McGrath
Project: **Indiana Pines Yard 520**

Client Sample ID:	GP007ICB092305S	Project:	ENSR00205
Sample ID:	146464004	Client ID:	ENSR003
Matrix:	Soil		
Collect Date:	23-SEP-05 11:20		
Receive Date:	26-SEP-05		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Solid (Long List)											
Actinium-227	U	0.0474	+/-0.276	0.461	0.160	pCi/g		MJH1 10/14/05	2153	467582	1
Lead-210		5.61	+/-0.885	0.572	3.00	pCi/g					
Polonium-210		5.61	+/-0.857	0.572	3.00	pCi/g					
Protactinium-231	U	-0.598	+/-1.08	1.78	0.500	pCi/g					
Radium-226		4.22	+/-0.399	0.0814	0.200	pCi/g					
Radium-228		2.87	+/-0.399	0.148	0.300	pCi/g					
Thorium-228		3.21	+/-0.338	0.0627	0.400	pCi/g					
Thorium-230		4.22	+/-0.399	0.0814	0.500	pCi/g					
Thorium-232		3.14	+/-0.331	0.0614	0.400	pCi/g					
Uranium-234		4.71	+/-0.547	0.167	3.00	pCi/g					
Uranium-235		0.337	+/-0.224	0.238	0.100	pCi/g					
Uranium-238		4.17	+/-0.966	0.670	0.500	pCi/g					

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	AXP2	09/27/05	2108	466662

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

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Certificate of Analysis

Company : ENSR International
Address : 2 Technology Park Drive
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Report Date: October 22, 2005

Contact: Ms. Debra L. McGrath
Project: **Indiana Pines Yard 520**

Client Sample ID:	GP008ICB092305S	Project:	ENSR00205
Sample ID:	146464005	Client ID:	ENSR003
Matrix:	Soil		
Collect Date:	23-SEP-05 11:55		
Receive Date:	26-SEP-05		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Solid (Long List)											
Actinium-227	U	0.0408	+/-0.277	0.333	0.160	pCi/g		MJH1 10/20/05	2031	467582	1
Lead-210	U	2.10	+/-3.37	3.49	3.00	pCi/g					
Polonium-210	U	2.10	+/-3.37	3.49	3.00	pCi/g					
Protactinium-231	U	0.175	+/-0.770	1.32	0.500	pCi/g					
Radium-226		3.06	+/-0.108	0.054	0.200	pCi/g					
Radium-228		2.29	+/-0.176	0.102	0.300	pCi/g					
Thorium-228		2.34	+/-0.0669	0.0477	0.400	pCi/g					
Thorium-230		3.06	+/-0.108	0.054	0.500	pCi/g					
Thorium-232		2.28	+/-0.0651	0.0464	0.400	pCi/g					
Uranium-234		3.49	+/-0.132	0.108	3.00	pCi/g					
Uranium-235	U	0.146	+/-0.160	0.185	0.100	pCi/g					
Uranium-238		3.10	+/-1.03	1.15	0.500	pCi/g					

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	AXP2	09/27/05	2108	466662

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

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Report Date: October 22, 2005

Contact: Ms. Debra L. McGrath
Project: **Indiana Pines Yard 520**

Client Sample ID:	GP008ICB092305D	Project:	ENSR00205
Sample ID:	146464010	Client ID:	ENSR003
Matrix:	Soil		
Collect Date:	23–SEP–05 11:55		
Receive Date:	26–SEP–05		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Solid (Long List)											
Actinium–227	U	–0.0341	+/–0.198	0.296	0.160	pCi/g		MJH1 10/14/05	2224	467582	1
Lead–210		4.55	+/–2.30	3.15	3.00	pCi/g					
Polonium–210		4.55	+/–2.30	3.15	3.00	pCi/g					
Protactinium–231	U	–0.637	+/–0.712	1.18	0.500	pCi/g					
Radium–226		3.25	+/–0.118	0.0521	0.200	pCi/g					
Radium–228		2.52	+/–0.180	0.097	0.300	pCi/g					
Thorium–228		2.42	+/–0.0664	0.0416	0.400	pCi/g					
Thorium–230		3.25	+/–0.118	0.0521	0.500	pCi/g					
Thorium–232		2.37	+/–0.065	0.0407	0.400	pCi/g					
Uranium–234		3.40	+/–0.136	0.097	3.00	pCi/g					
Uranium–235		0.282	+/–0.146	0.157	0.100	pCi/g					
Uranium–238		2.20	+/–1.33	0.964	0.500	pCi/g					

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL–RAD–A–021	AXP2	09/27/05	2108	466662

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

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Report Date: October 22, 2005

Contact: Ms. Debra L. McGrath
Project: **Indiana Pines Yard 520**

Client Sample ID: GP009ICB092305S
Sample ID: 146464006
Matrix: Soil
Collect Date: 23–SEP–05 14:20
Receive Date: 26–SEP–05
Collector: Client

Project: ENSR00205
Client ID: ENSR003

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Solid (Long List)											
Actinium–227	UJ	0.00	+/–0.254	0.458	0.160	pCi/g		MJH1 10/14/05	2154	467582	1
Lead–210		6.81	+/–4.63	5.31	3.00	pCi/g					
Polonium–210		6.81	+/–4.62	5.31	3.00	pCi/g					
Protactinium–231	U	–0.57	+/–1.13	1.87	0.500	pCi/g					
Radium–226		4.63	+/–0.475	0.0822	0.200	pCi/g					
Radium–228		2.63	+/–0.371	0.153	0.300	pCi/g					
Thorium–228		2.85	+/–0.296	0.0665	0.400	pCi/g					
Thorium–230		4.63	+/–0.475	0.0822	0.500	pCi/g					
Thorium–232		2.79	+/–0.290	0.065	0.400	pCi/g					
Uranium–234		5.38	+/–0.597	0.154	3.00	pCi/g					
Uranium–235		0.347	+/–0.192	0.242	0.100	pCi/g					
Uranium–238		4.77	+/–1.68	1.54	0.500	pCi/g					

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL–RAD–A–021	AXP2	09/27/05	2108	466662

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

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Report Date: October 22, 2005

Contact: Ms. Debra L. McGrath
Project: **Indiana Pines Yard 520**

Client Sample ID:	GP010ICB092305S	Project:	ENSR00205
Sample ID:	146464007	Client ID:	ENSR003
Matrix:	Soil		
Collect Date:	23-SEP-05 14:00		
Receive Date:	26-SEP-05		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Solid (Long List)											
Actinium-227	U	0.0565	+/-0.254	0.370	0.160	pCi/g		MJH1 10/20/05	2035	467582	1
Lead-210	U	2.81	+/-5.20	7.66	3.00	pCi/g					
Polonium-210	U	2.81	+/-5.20	7.66	3.00	pCi/g					
Protactinium-231	U	0.298	+/-0.875	1.43	0.500	pCi/g					
Radium-226		3.40	+/-0.314	0.0605	0.200	pCi/g					
Radium-228		2.56	+/-0.387	0.114	0.300	pCi/g					
Thorium-228		2.65	+/-0.248	0.0547	0.400	pCi/g					
Thorium-230		3.40	+/-0.314	0.0605	0.500	pCi/g					
Thorium-232		2.58	+/-0.241	0.0533	0.400	pCi/g					
Uranium-234		3.95	+/-0.423	0.124	3.00	pCi/g					
Uranium-235		0.223	+/-0.193	0.195	0.100	pCi/g					
Uranium-238		3.79	+/-1.80	1.53	0.500	pCi/g					

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	AXP2	09/27/05	2108	466662

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

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Company : ENSR International
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Report Date: October 22, 2005

Contact: Ms. Debra L. McGrath
Project: **Indiana Pines Yard 520**

Client Sample ID:	GP011ICB092305S	Project:	ENSR00205
Sample ID:	146464008	Client ID:	ENSR003
Matrix:	Soil		
Collect Date:	23–SEP–05 12:45		
Receive Date:	26–SEP–05		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Solid (Long List)											
Actinium–227	U	0.0985	+/–0.228	0.354	0.160	pCi/g		MJH1 10/17/05	1123	467582	1
Lead–210		2.88	+/–0.511	0.453	3.00	pCi/g					
Polonium–210		2.88	+/–0.498	0.453	3.00	pCi/g					
Protactinium–231	U	0.442	+/–0.814	1.42	0.500	pCi/g					
Radium–226		2.43	+/–0.253	0.0638	0.200	pCi/g					
Radium–228		2.17	+/–0.288	0.118	0.300	pCi/g					
Thorium–228		2.07	+/–0.192	0.053	0.400	pCi/g					
Thorium–230		2.43	+/–0.253	0.0638	0.500	pCi/g					
Thorium–232		2.03	+/–0.187	0.0517	0.400	pCi/g					
Uranium–234		2.65	+/–0.295	0.128	3.00	pCi/g					
Uranium–235		0.203	+/–0.198	0.182	0.100	pCi/g					
Uranium–238		2.58	+/–0.745	0.517	0.500	pCi/g					

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL–RAD–A–021	AXP2	09/27/05	2108	466662

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

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Report Date: October 22, 2005

Contact: Ms. Debra L. McGrath
Project: **Indiana Pines Yard 520**

Client Sample ID:	GP012ICB092305S	Project:	ENSR00205
Sample ID:	146464009	Client ID:	ENSR003
Matrix:	Soil		
Collect Date:	23–SEP–05 13:10		
Receive Date:	26–SEP–05		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Solid (Long List)											
Actinium–227	U	0.0479	+/–0.163	0.249	0.160	pCi/g		MJH1 10/20/05	2116	467582	1
Lead–210		2.27	+/–1.48	1.62	3.00	pCi/g					
Polonium–210		2.27	+/–1.47	1.62	3.00	pCi/g					
Protactinium–231	U	0.772	+/–0.571	0.977	0.500	pCi/g					
Radium–226		3.23	+/–0.348	0.0418	0.200	pCi/g					
Radium–228		2.12	+/–0.270	0.070	0.300	pCi/g					
Thorium–228		2.13	+/–0.179	0.0353	0.400	pCi/g					
Thorium–230		3.23	+/–0.348	0.0418	0.500	pCi/g					
Thorium–232		2.07	+/–0.174	0.0344	0.400	pCi/g					
Uranium–234		3.68	+/–0.355	0.0821	3.00	pCi/g					
Uranium–235		0.267	+/–0.132	0.138	0.100	pCi/g					
Uranium–238		2.62	+/–0.962	0.735	0.500	pCi/g					

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL–RAD–A–021	AXP2	09/27/05	2108	466662

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

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Company : ENSR International
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Report Date: October 22, 2005

Contact: Ms. Debra L. McGrath
Project: **Indiana Pines Yard 520**

Client Sample ID:	GP013ICB092305S •	Project:	ENSR00205
Sample ID:	146464011	Client ID:	ENSR003
Matrix:	Soil		
Collect Date:	23–SEP–05 13:30		
Receive Date:	26–SEP–05		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Solid (Long List)											
Actinium–227	U	–0.0503	+/–0.172	0.255	0.160	pCi/g		MJH1 10/18/05	0748	467582	1
Lead–210	U	1.55	+/–2.22	2.72	3.00	pCi/g					
Polonium–210	U	1.55	+/–2.22	2.72	3.00	pCi/g					
Protactinium–231	U	–0.205	+/–0.606	1.00	0.500	pCi/g					
Radium–226		1.70	+/–0.0809	0.0465	0.200	pCi/g					
Radium–228		1.49	+/–0.127	0.0812	0.300	pCi/g					
Thorium–228		1.56	+/–0.0521	0.0375	0.400	pCi/g					
Thorium–230		1.70	+/–0.0809	0.0465	0.500	pCi/g					
Thorium–232		1.53	+/–0.0508	0.0366	0.400	pCi/g					
Uranium–234		2.06	+/–0.119	0.0886	3.00	pCi/g					
Uranium–235	U	0.0774	+/–0.128	0.137	0.100	pCi/g					
Uranium–238		2.30	+/–0.851	0.829	0.500	pCi/g					

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL–RAD–A–021	AXP2	09/27/05	2108	466662

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

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Certificate of Analysis Report
for

ENSR003 ENSR International

Client SDG: 146464 GEL Work Order: 146464

The Qualifiers in this report are defined as follows:

** Indicates the analyte is a surrogate compound.
< Result is less than amount reported.
> Result is greater than amount reported.
B Target analyte was detected in the sample as well as the associated blank.
BD Results below the MDC or low tracer recovery.
E Concentration of the target analyte exceeds the instrument calibration range.
H Analytical holding time exceeded.
J Indicates an estimated value.
P The response between the confirmation and the primary columns is >40% Different.
R Sample results are rejected.
U Target analyte was analyzed for but not detected above the MDL or LOD.
UI Uncertain identification for gamma spectroscopy.
X Lab-specific qualifier-please see case narrative, data summary package or contact your project manager for details.
Y QC Samples were not spiked with this compound.
Z Paint Filter qualifier: Particulates passed through the filter. No free liquids were observed.
d The 2:1 depletion requirement was not met for this sample
h Sample preparation or preservation holding time exceeded.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the Certificate of Analysis.
** Indicates the analyte is a surrogate compound.
This data report has been prepared and reviewed in accordance with General Engineering Laboratories, LLC standard operating procedures. Please direct any questions to your Project Manager, Edith Kent.

Reviewed by

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Memorandum

Date: February 7, 2006

To: Lisa Bradley/Westford

From: Linda Sulkowski/Westford

Subject: Data Validation
Inorganic Analyses
Yard 520 sampling
Pines Area of Investigation, Indiana
CAS Submission Number R2527896

Distribution: D. McGrath/Westford

01776-022-106 File
PI014.doc

SUMMARY

Limited validation was performed on the data for four soil samples analyzed for Target Analyte List (TAL) metals plus boron, molybdenum, and silicon according to SW-846 methods 6010B, 7471A and 7841 and for sulfur according to EPA method 300.0, modified. The samples were collected at the Pines Area of Investigation in Indiana on September 20, 2005 and submitted to Columbia Analytical Services (CAS) in Rochester, New York for analysis. CAS processed these samples under submission number R2527896. The analytical data were evaluated with reference to the "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review" (October 2004 and February 1994) and the quality control (QC) criteria specified in the analytical method and/or Yard 520 Sampling and Analysis Plan (SAP). Modification of the Functional Guidelines was performed to accommodate the non-CLP methodologies.

In general, the data are valid as reported and may be used for decision making purposes. No data were rejected. Selected data points were qualified due to nonconformances of certain QC criteria (see discussion below).

SAMPLES

The samples included in this review are listed below.

Sample IDs
GP001ICB092005S
GP002MCB092005S
GP002MCB092005D (field duplicate of GP002MCB092005S)
GP003ICB092005S

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REVIEW ELEMENTS

Sample data were reviewed for the following parameters:

- Agreement of analyses conducted with chain-of-custody (COC) requests
- Holding times/sample preservation
- Calibrations
- Laboratory blanks/equipment blanks/field blanks
- ICP Interference sample results
- Matrix spike (MS) results
- Laboratory duplicate results
- Field duplicate results
- Laboratory control sample (LCS) results
- ICP serial dilution results
- Sample quantitation/detection limit results

DISCUSSION

Agreement of Analyses Conducted With COC Requests

Sample reports were reviewed against the analytical requests as designated on the chain-of-custody (COC) and subsequent communications between ENSR and the laboratory. The following discrepancy was noted. Strontium was inadvertently requested on the COC. The laboratory correctly analyzed the soil samples for silver as requested on the task sampling plan. No validation was taken other than this notation.

Holding Times/Sample Preservation

All samples were digested and analyzed within the method-specified holding times.

The cooler temperature was 4°C upon receipt at the laboratory, which was within the acceptance criteria of 4 ± 2°C.

Calibrations

All criteria were met for the calibration curves and the initial and continuing calibration verification (ICV/CCV) standards.

Although the analysis of a low level check standard is not required by SW-846 methods, the laboratory chose to analyze low-level check standards containing analytes at concentrations 1-10x the laboratory's practical quantitation limit (PQL). An acceptance limit of 100 ± 50 percent recovery (%R) for antimony, lead and thallium, and 100 ± 30 %R for the remaining metals were used to evaluate these standards. The standards met recovery criteria for all analytes.

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Laboratory Blanks/Equipment Blanks/Field Blanks

All sample and laboratory blank results were reported down to the instrument detection limit (IDL) and nondetects were reported at the IDL. The validator chose to apply blank actions based on the February 1994 National Functional Guidelines rather than the 2004 guidelines since all nondetect results were reported at the IDL.

Field and equipment rinsate blank samples were not collected with this sample set. Several metals were detected in the laboratory preparation blanks, initial calibration blanks (ICBs), and continuing calibration blanks (CCBs) associated with these samples. The presence of blank contamination indicates that false positive results or false negative results (for negative blanks) may exist for these analytes in the associated samples. An Action Level (AL) was established for each analyte at 5x the highest concentration detected and was used to qualify sample data. The following tables summarize these ALs and the associated samples.

Type of Blank	Analyte	Maximum Blank Concentration (µg/L)	AL* (mg/Kg)
ICB/CCB	Aluminum	-20.2	- 10.1
	Antimony	14.2	7.1
	Barium	9.4	4.7
	Boron	43.9	22.0
	Copper	7.7	3.9
	Molybdenum	1.9	0.95
	Thallium	2.4	1.2
Associated samples: All samples in this data set. *Adjusted for sample preparation factors and moisture content.			

Type of Blank	Analyte	Maximum Blank Concentration (mg/kg)	AL* (mg/Kg)
Preparation	Aluminum	2.3	11.5
	Calcium	13.0	65.0
	Chromium	0.21	1.1
	Iron	3.5	17.5
	Manganese	0.66	3.3
	Potassium	- 8.1	- 40.5
	Sodium	7.2	36.0
	Zinc	1.7	8.5
Associated samples: All samples in this data set. *Adjusted for sample preparation factors and moisture content.			

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Sample results were qualified as follows:

For positive blank contamination:

- Positive sample results □ the positive AL were qualified as nondetect (U) at the reported concentration.
- Positive sample results > AL and nondetects were accepted unqualified.

For negative blank contamination:

- Positive sample results ≤ the absolute value of the negative AL were qualified as estimated (J).
- Nondetects were qualified as estimated (UJ).
- Positive sample results > the absolute value of the AL were accepted unqualified.

For negative and positive contamination:

- Sample results < the positive AL and < the absolute value of the negative AL were qualified as estimated nondetects (UJ) at the reported concentration.
- Sample results > the positive AL but < the absolute value of the negative AL were qualified as estimated (J) at the reported concentration.
- Sample results > the positive AL and > the absolute value of the negative AL were accepted unqualified.

ICP Interference Results

All criteria were met for the analyses of the ICS AB solutions. Various analytes were detected in the ICS A solutions that should not be present. Arsenic, cadmium, lead, molybdenum, selenium, and vanadium were detected as positive interference in the ICS A solution associated with all samples. Antimony, copper, manganese, silicon, and zinc were detected as negative interference in the ICS A solution associated with all samples. The presence of ICS A interference indicates that false positives and false negatives may exist for these analytes in the associated samples. Estimated interferences were calculated for these analytes in these samples where the concentration of an interfering element (iron) was greater than 50% of that found in the ICS A solutions. These estimated interferences were used to qualify sample result as follows:

For positive interference:

- If an element was detected > IDL but should not be present in the ICS A and the sample concentration of the interferents are > those found in the ICS A, estimate detected results as biased high (J+) and accept nondetects.
- If sample result is a nondetected value, report sample quantitation limit (SQL) unqualified.
- If sample result was previously qualified as nondetect (U) due to blank contamination, the nondetected value was not qualified further.

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For negative interference, compare the absolute value of the estimated interference:

- If an element was detected as negative interference but should not be present in the ICS A and sample concentrations of the interferents are > than those found in the ICS A, estimate detected results < 10x the absolute value of the affected element as biased low (J-) and nondetects (UJ).
- If sample result was previously qualified as nondetect (U) due to blank contamination, the nondetected value was further qualified as estimated (UJ).

A summary of the affected analytes and validation actions is provided below:

Sample ID	Analyte	Actions
GP001ICB092005S	Cadmium Molybdenum Lead Selenium	Qualify positive result as estimated biased high (J+)
	Silicon	Qualify non-detected result as estimated biased low (J-)
GP002MCB092005S	Arsenic Cadmium Lead Molybdenum Selenium Vanadium	Qualify positive result as estimated biased high (J+)
	Antimony	Result qualified as non-detected at SQL due to blank contamination. Non-detected result further qualified as estimated (UJ)
GP002MCB092005D	Arsenic Cadmium Lead Molybdenum Selenium Vanadium	Qualify positive result as estimated biased high (J+)
	Antimony	Result qualified as non-detected at SQL due to blank contamination. Non-detected result further qualified as estimated (UJ)
GP003ICB092005S	Arsenic Cadmium Lead Molybdenum Selenium Vanadium	Qualify positive result as estimated biased high (J+)
	Antimony	Qualify positive result as estimated biased low (J-)

MS Results

The MS analysis was performed on sample GP002MCB092005S for metals and sulfur. The matrix spike %Rs met the QC acceptance criteria except as noted below

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Analyte	MS %R	QC Acceptance Range	Actions
Antimony	72.1	75-125%	Qualify positive and nondetect results as estimated biased low (J- and UJ, respectively).
Silicon	17.5	75-125%	Qualify positive results as estimated biased low (J-) and reject (R) nondetects.
Sodium	131	75-125%	Qualify positive results as estimated biased high (J+) and accept nondetects unqualified.
Thallium	64.0	75-125%	Qualify positive and nondetect results as estimated biased low (J- and UJ, respectively).
Samples affected: All samples in this data set.			

Laboratory Duplicate Results

Laboratory duplicate analyses were performed on sample GP002MCB092005S for metals and sulfur. The relative percent differences (RPDs) met the QC acceptance criteria of 35% relative percent difference (RPD) [only applicable if both results are >5x SQL].

Field Duplicate Results

Samples GP002MCB092005S and GP002MCB092005D were submitted as the field duplicate pair. The following table summarizes the RPDs of the detected analytes. The RPD for silver was not calculable (NC) due to a nondetect sample result. The field duplicate result for silver was ≤5x SQL; therefore precision for this analyte was deemed acceptable. The RPDs of all other analytes were within the acceptance criteria.

Analyte	GP002MCB092005S (mg/Kg)	GP002MCB092005D (mg/Kg)	RPD (%)
Aluminum	14500	13400	8
Antimony	5.7	5.8	2
Arsenic	529	411	25
Barium	112	86.6	26
Beryllium	1.4	1.2	15
Boron	321	209	42
Cadmium	4.1	3.6	13
Calcium	3630	3520	3
Chromium	60.6	52.3	15
Cobalt	14.2	12.4	14
Copper	65.3	56.0	15
Iron	47300	42900	10
Lead	312	251	22
Magnesium	1200	1110	8
Manganese	60.7	56.3	8

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Analyte	GP002MCB092005S (mg/Kg)	GP002MCB092005D (mg/Kg)	RPD (%)
Mercury	0.15	0.12	22
Molybdenum	12.7	12.7	0
Nickel	66.5	56.0	17
Potassium	2610	2210	17
Selenium	6.3	6.2	2
Silicon	915	895	2
Silver	0.10 U	0.18	NC
Sodium	660	560	16
Thallium	10	8.6	15
Vanadium	85.2	62.7	30
Zinc	496	403	21
Sulfur	397	441	11
Criteria: RPD <50% if both results are >5x SQL.			

LCS Results

All LCSs analyzed for metals met the vendor's QC acceptance limits. The %Rs met the QC acceptance criteria for the LCS analyses for sulfur.

ICP Serial Dilution Results

Serial dilution analyses were performed on sample GP002MCB092005S for metals. The percent differences (%Ds) met the QC acceptance criteria of <10% for sample results for all analytes except antimony (16%) and boron (21%). Accuracy was deemed acceptable for antimony and boron since the sample results were <50x the IDL.

Sample Quantitation/Detection Limit Results

Sample results were spot-checked. There were no discrepancies noted.

Positive results were reported from the diluted analyses for the samples listed below due to elevated concentrations of these analytes present in the samples.

Sample ID	Analyte	Dilution Factor
GP001ICB092005S	Sulfur	400
	Calcium Chromium Iron Vanadium Zinc	10
GP002MCB092005S	Sulfur	10
	Boron Arsenic Iron Thallium	5

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Sample ID	Analyte	Dilution Factor
	Zinc	
GP002MCB092005D	Sulfur	10
	Iron Thallium Zinc	5
GP003ICB092005S	Sulfur	10
	Boron Iron Thallium Zinc	5

The positive results for metals analyzed by methods SW-846 6010B, 7841, and 7471A were reported to the IDL. Nondetect results were reported as "U" at the IDL. The results for sulfur analyzed by EPA method 300.0, modified, were reported to the SQL; nondetected results for sulfur were reported at the SQL and flagged with a "U".

METALS

-1-

INORGANIC ANALYSIS DATA SHEET

SAMPLE NO.: GP001ICB092005S

Contract: R2527896

Lab Code: Case No.: SAS No.: SDG NO.: GP001ICB0920

Matrix (soil/water): SOIL/SEDIMENT Lab Sample ID: 843912

Level (low/med): LOW Date Received: 09/21/05

% Solids: 49.9 1.01

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M	
7429-90-5	Aluminum	2420			P	
7440-36-0	Antimony	190		N	P	J-
7440-38-2	Arsenic	0.63	U		P	
7440-39-3	Barium	90.3			P	
7440-41-7	Beryllium	0.03	U		P	
7440-42-8	Boron	28.7	B		P	UJ
7440-43-9	Cadmium	2.5			P	J+
7440-70-2	Calcium	113000			P	
7440-47-3	Chromium	6270			P	
7440-48-4	Cobalt	6.8	B	J	P	
7440-50-8	Copper	130			P	
7439-89-6	Iron	187000			P	
7439-92-1	Lead	78.8			P	J+
7439-95-4	Magnesium	2880			P	
7439-96-5	Manganese	994			P	
7439-97-6	Mercury	0.29			CV	
7439-98-7	Molybdenum	13.8			P	J+
7440-02-0	Nickel	89.5			P	
7440-09-7	Potassium	169	B	J	P	
7782-49-2	Selenium	6.2			P	J+
7440-21-5	Silicon	920		N	P	J-
7440-22-4	Silver	0.17	U		P	
7440-23-5	Sodium	159		N	P	J+
7440-28-0	Thallium	0.24	B	N	F	UJ
7440-62-2	Vanadium	2.2	U		P	
7440-66-6	Zinc	627			P	

Color Before: BLACK Clarity Before: Texture:

Color After: Clarity After: Artifacts:

Comments:

METALS

-1-

INORGANIC ANALYSIS DATA SHEET

SAMPLE NO.: GP002MCB092005D

Contract: R2527896

Lab Code: | Case No.: | SAS No.: | SDG NO.: GP001ICB0920

Matrix (soil/water): SOIL/SEDIMENT | Lab Sample ID: 843914

Level (low/med): LOW | Date Received: 09/21/05

% Solids: 83.6 1.028

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M	
7429-90-5	Aluminum	13400			P	
7440-36-0	Antimony	5.8	B	N	P	UJ
7440-38-2	Arsenic	411			P	J+
7440-39-3	Barium	86.6			P	
7440-41-7	Beryllium	1.2			P	
7440-42-8	Boron	209			P	
7440-43-9	Cadmium	3.6			P	J+
7440-70-2	Calcium	3520			P	
7440-47-3	Chromium	52.3			P	
7440-48-4	Cobalt	12.4			P	
7440-50-8	Copper	56.0			P	
7439-89-6	Iron	42900			P	
7439-92-1	Lead	251			P	J+
7439-95-4	Magnesium	1110			P	
7439-96-5	Manganese	56.3			P	
7439-97-6	Mercury	0.12			CV	
7439-98-7	Molybdenum	12.7			P	J+
7440-02-0	Nickel	56.0			P	
7440-09-7	Potassium	2210			P	
7782-49-2	Selenium	6.2			P	J+
7440-21-5	Silicon	895		N	P	J-
7440-22-4	Silver	0.18	B	J	P	
7440-23-5	Sodium	560		N	P	J+
7440-28-0	Thallium	8.6		N	F	J-
7440-62-2	Vanadium	62.7			P	J+
7440-66-6	Zinc	403			P	

Color Before: BROWN | Clarity Before: | Texture: MEDIUM

Color After: YELLOW | Clarity After: CLEAR | Artifacts:

Comments:

METALS

-1-

INORGANIC ANALYSIS DATA SHEET

SAMPLE NO.: GP002MCB092005S

Contract: R2527896

Lab Code: Case No.: SAS No.: SDG NO.: GP001ICB0920

Matrix (soil/water): SOIL/SEDIMENT Lab Sample ID: 843913

Level (low/med): LOW Date Received: 09/21/05

% Solids: 83.9 1.00

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M	
7429-90-5	Aluminum	14500			P	
7440-36-0	Antimony	5.7	B	N	P	UJ
7440-38-2	Arsenic	529			P	J+
7440-39-3	Barium	112			P	
7440-41-7	Beryllium	1.4			P	
7440-42-8	Boron	321			P	
7440-43-9	Cadmium	4.1			P	J+
7440-70-2	Calcium	3630			P	
7440-47-3	Chromium	60.6			P	
7440-48-4	Cobalt	14.2			P	
7440-50-8	Copper	65.3			P	
7439-89-6	Iron	47300			P	
7439-92-1	Lead	312			P	J+
7439-95-4	Magnesium	1200			P	
7439-96-5	Manganese	60.7			P	
7439-97-6	Mercury	0.15			CV	
7439-98-7	Molybdenum	12.7			P	J+
7440-02-0	Nickel	66.5			P	
7440-09-7	Potassium	2610			P	
7782-49-2	Selenium	6.3			P	J+
7440-21-5	Silicon	915		N	P	J-
7440-22-4	Silver	0.10	U		P	
7440-23-5	Sodium	660		N	P	J+
7440-28-0	Thallium	10.0		N	F	J-
7440-62-2	Vanadium	85.2			P	J+
7440-66-6	Zinc	496			P	

Color Before: BROWN Clarity Before: Texture: MEDIUM

Color After: YELLOW Clarity After: CLEAR Artifacts:

Comments:

METALS

-1-

INORGANIC ANALYSIS DATA SHEET

SAMPLE NO.

GP003ICB092005S

Contract: R2527896

Lab Code: Case No.: SAS No.: SDG NO.: GP001ICB0920

Matrix (soil/water): SOIL/SEDIMENT Lab Sample ID: 843915

Level (low/med): LOW Date Received: 09/21/05

% Solids: 75.0 1.07

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M	
7429-90-5	Aluminum	21000			P	
7440-36-0	Antimony	9.2		N	P	J-
7440-38-2	Arsenic	210			P	J+
7440-39-3	Barium	157			P	
7440-41-7	Beryllium	0.74			P	
7440-42-8	Boron	922			P	
7440-43-9	Cadmium	5.2			P	J+
7440-70-2	Calcium	8360			P	
7440-47-3	Chromium	165			P	
7440-48-4	Cobalt	16.3			P	
7440-50-8	Copper	71.8			P	
7439-89-6	Iron	44600			P	
7439-92-1	Lead	139			P	J+
7439-95-4	Magnesium	1360			P	
7439-96-5	Manganese	86.1			P	
7439-97-6	Mercury	0.04			CV	
7439-98-7	Molybdenum	69.5			P	J+
7440-02-0	Nickel	70.6			P	
7440-09-7	Potassium	3140			P	
7782-49-2	Selenium	9.7			P	J+
7440-21-5	Silicon	1170		N	P	J-
7440-22-4	Silver	0.11	U		P	
7440-23-5	Sodium	1410		N	P	J+
7440-28-0	Thallium	8.1		N	F	J-
7440-62-2	Vanadium	194			P	J+
7440-66-6	Zinc	576			P	

Color Before: BROWN Clarity Before: Texture: MEDIUM

Color After: YELLOW Clarity After: CLEAR Artifacts:

Comments:

COLUMBIA ANALYTICAL SERVICES

Reported: 11/03/05

ENSR International
Project Reference: PINES AREA OF INVESTIGATION PROJECT #01776-020
Client Sample ID : GP001ICB092005S

Date Sampled : 09/20/05 09:45 **Order #:** 843912 **Sample Matrix:** SOIL/SEDIMENT
Date Received: 09/21/05 **Submission #:** R2527896

ANALYTE	METHOD	PQL	RESULT	DRY WEIGHT UNITS	DATE ANALYZED	TIME ANALYZED	DILUTION
PERCENT SOLIDS	160.3M	1.0	49.9	%	10/04/05	10:30	1.0
SULFUR	300.0	2.67	33700	MG/KG	10/10/05	15:38	400.0

COLUMBIA ANALYTICAL SERVICES

Reported: 11/03/05

ENSR International
Project Reference: PINES AREA OF INVESTIGATION PROJECT #01776-020
Client Sample ID : GP002MCB092005S

Date Sampled : 09/20/05 11:30 **Order #:** 843913 **Sample Matrix:** SOIL/SEDIMENT
Date Received: 09/21/05 **Submission #:** R2527896

ANALYTE	METHOD	PQL	RESULT	DRY WEIGHT UNITS	DATE ANALYZED	TIME ANALYZED	DILUTION
PERCENT SOLIDS	160.3M	1.0	83.9	%	10/04/05	10:30	1.0
SULFUR	300.0	2.67	397	MG/KG	10/10/05	12:32	10.0

COLUMBIA ANALYTICAL SERVICES

Reported: 11/03/05

ENSR International
Project Reference: PINES AREA OF INVESTIGATION PROJECT #01776-020
Client Sample ID : GP002MCB092005D

Date Sampled : 09/20/05 11:30 **Order #:** 843914 **Sample Matrix:** SOIL/SEDIMENT
Date Received: 09/21/05 **Submission #:** R2527896

ANALYTE	METHOD	PQL	RESULT	DRY WEIGHT UNITS	DATE ANALYZED	TIME ANALYZED	DILUTION
PERCENT SOLIDS	160.3M	1.0	83.6	%	10/04/05	10:30	1.0
SULFUR	300.0	2.67	441	MG/KG	10/10/05	12:15	10.0

COLUMBIA ANALYTICAL SERVICES

Reported: 11/03/05

ENSR International
Project Reference: PINES AREA OF INVESTIGATION PROJECT #01776-020
Client Sample ID : GP003ICB092005S

Date Sampled : 09/20/05 13:50 **Order #:** 843915 **Sample Matrix:** SOIL/SEDIMENT
Date Received: 09/21/05 **Submission #:** R2527896

ANALYTE	METHOD	PQL	RESULT	DRY WEIGHT UNITS	DATE ANALYZED	TIME ANALYZED	DILUTION
PERCENT SOLIDS	160.3M	1.0	75.0	%	10/04/05	10:30	1.0
SULFUR	300.0	2.67	635	MG/KG	10/10/05	11:58	10.0

ENSR

PRIVILEGED AND CONFIDENTIAL - ATTORNEY CLIENT WORK PRODUCT

MEMORANDUM

To: Lisa Bradley/Westford

From: Paula DiMattei/Westford

RE: Data Validation
PCDD/PCDF Analyses
Yard 520
Pines Area of Investigation, Indiana
CAS SDG E0500690

Date: December 29, 2005

File: PI015 doc
01776-022-106

CC: D. McGrath/Westford

SUMMARY

Full validation was performed on the data for eleven soil samples and one aqueous equipment blank analyzed for polychlorinated dibenzodioxins (PCDD) and polychlorinated dibenzofurans (PCDF) by SW-846 method 8290. The samples were collected at the Pines Area of Investigation in Indiana on September 23, 2005 and submitted to Columbia Analytical Services (CAS) in Rochester, NY. CAS-Rochester contracted the analyses to their facility in Houston, TX. CAS-Houston processed and reported these samples under sample delivery group (SDG) E0500690. The analytical data were evaluated with reference to the "USEPA Analytical Services Branch (ASB) National Functional Guidelines for Chlorinated Dibenzo-p-Dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs) Data Review", EPA-540-R-05-001 (September 2005) and the quality control (QC) criteria specified in the analytical method and/or the Yard 520 site specific Quality Assurance Project Plan (QAPP). Modification of the Functional Guidelines was performed to accommodate the SW-846 methodology.

In general, the data are valid as reported and may be used for decision making purposes. No data were rejected. Selected data points were qualified due to nonconformances of certain QC criteria (see discussion below).

SAMPLES

The samples included in this review are listed below.

Sample IDs	Sample IDs
GP004ICB092305S	GP009ICB092305S
GP005ICB092305S	GP010ICB092305S
GP006ICB092305S	GP011ICB092305S
GP007ICB092305S	GP012ICB092305S
GP008ICB092305S	GP013ICB092305S
GP008ICB092305D (Field duplicate of GP008ICB092305S)	GP004ICB092305B (Equipment blank)

REVIEW ELEMENTS

Sample data were reviewed for the following parameters:

- Agreement of analyses conducted with chain-of-custody (COC) requests
- Holding times/sample preservation
- Initial and continuing calibrations
- Laboratory blanks/equipment blanks/field blanks
- Matrix spike/matrix spike duplicate (MS/MSD) results
- Internal and clean-up standard recoveries
- Field duplicate results
- Laboratory control sample/laboratory control sample duplicate (LCS/LCSD) results
- Sample quantitation/detection limit results

DISCUSSION

Agreement of Analyses Conducted With COC Requests

Sample reports were reviewed against the analytical requests as designated on the chain-of-custody (COC) and subsequent communications between ENSR and the laboratory. It should be noted that the laboratory initially incorrectly substituted the sample ID character listed as the letter I (per the COC) with the number 1. For example sample GP004ICB092305S was listed as GP0041CB092305S. The laboratory submitted corrected Analysis Data Sheets for all samples. No other discrepancies were noted.

Holding Times/Sample Preservation

All samples were extracted and analyzed within the method specified holding time criteria.

The cooler temperature was 8°C upon receipt at CAS-Rochester, which exceeded the acceptance criteria of 4 ± 2°C. No validation action was taken for this slight nonconformance. Cooler temperatures were within criteria upon receipt at CAS-Houston.

Initial and Continuing Calibrations

The percent relative standard deviations of all target compounds were within the QC acceptance criteria for the initial calibrations associated with the sample analyses. All target compounds met the relative ion abundance criteria and signal-to-noise ratio QC acceptance criteria specified in the method.

The percent differences of all target compounds were within the QC acceptance criteria in the continuing calibrations associated with the sample analyses. All target compounds met the relative ion abundance criteria and signal-to-noise ratio QC acceptance criteria specified in the method.

The chromatographic separation between 2,3,7,8-TCDD and the other unlabeled TCDD isomers was resolved with a valley of ≤25% in all window defining mixture analyses.

Laboratory Blanks/Equipment Blanks/Field Blanks

The presence of blank contamination indicates that false positives may exist for these compounds in the associated samples. The following table summarizes the maximum level of blank contamination detected in the aqueous laboratory method blank associated with the aqueous equipment blank; action level; and actions taken. Actions taken were based on the National Functional Guidelines (September 2005). Where the National Functional Guidelines stipulate professional judgment to qualify sample results reported at concentrations greater than the quantitation limit (lowest calibration standard), Action Levels (ALs) for the common contaminants (OCDD and OCDF) were established at 10x the concentration detected and ALs for the remaining contaminants were established at 5x the concentration detected.

Compound	Maximum Concentration (pg/L)	Action Level (pg/L)	Actions
1,2,3,4,6,7,8-HpCDD	5.24	26.2	Qualify the result as nondetect (U) at the reported concentration in equipment blank sample GP004ICB092305B.
OCDD	17.64	176	Qualify the result as nondetect (U) at the reported concentration in equipment blank sample GP004ICB092305B.
1,2,3,4,6,7,8-HpCDF	1.89	9.45	Qualify the result as nondetect (U) at the reported concentration in equipment blank sample GP004ICB092305B.
OCDF	4.83	48.3	Qualify the result as nondetect (U) at the reported concentration in equipment blank sample GP004ICB092305B.
Total HpCDD	6.10	30.5	Qualify the result as nondetect (U) at the reported concentration in equipment blank sample GP004ICB092305B.

The following table summarizes the maximum level of blank contamination detected in the soil laboratory method blank and aqueous equipment blank associated with the soil samples; action level; and actions taken. Blank actions were consistent with those described above.

Compound (Blank Type)	Maximum Concentration (units)	Action Level (units)	Actions
OCDD (method blank)	3.48 ng/Kg	34.8 ng/Kg	Qualify the result as nondetect (U) at the reported concentration in soil samples GP004ICB092305S, GP006ICB092305S, GP007ICB092305S, GP008ICB092305S, GP009ICB092305S, GP010ICB092305S, and GP008ICB092305D.
Total HpCDF (GP004ICB092305B)	1.28 pg/L	0.640 ng/Kg	Qualify the result as nondetect (U) at the reported concentration in soil samples GP004ICB092305S, GP005ICB092305S, GP007ICB092305S, and GP011ICB092305S.

MS/MSD Results

The MS/MSD analysis was performed on sample GP011ICB092305S. The percent recovery (%R) and relative percent difference (RPD) for all target compounds met the QC acceptance criteria with the following exceptions.

Compound	MSD %R	RPD	Actions
1,2,3,4,6,7,8-HpCDD	640	140	Estimate (J) the positive result in sample GP011ICB092305S.
OCDD	1166	143	Estimate (J) the positive result in sample GP011ICB092305S.
1,2,3,4,7,8,9-HpCDF	153	met	Not detected in sample GP011ICB092305S; no validation action required.
QC Criteria	**50-150**	**30**	

Internal and Clean-up Standard Recoveries

Internal standard and clean-up standard %Rs were within QC acceptance criteria for all sample analyses with the following exceptions.

Sample	Internal Standard	% R	Action
GP009ICB092305S	$13C_{12}$-OCDD	37	Qualify as estimated (J/UJ) the positive and nondetect OCDF and OCDD results.
GP010ICB092305S	$13C_{12}$-OCDD	37	Qualify as estimated (J/UJ) the positive and nondetect OCDF and OCDD results.
GP012ICB092305S	$13C_{12}$-OCDD	32	Qualify as estimated (J) the positive OCDF and OCDD results.

Field Duplicate Results

Samples GP008ICB092305S and GP008ICB092305D were submitted as the field duplicate pair with this data set. The following table summarizes the field duplicate precision and actions taken. The RPD for total HxCDD was not calculable (NC) due to non-detect result in the duplicate sample.

Compound	GP008ICB092305S (ng/Kg)	GP008ICB092305D (ng/Kg)	RPD	Actions
1,2,3,4,6,7,8-HpCDD	3.545	0.644	138	Estimate (J) the positive results in samples GP008ICB092305S and GP008ICB092305D.

Compound	GP008ICB092305S (ng/Kg)	GP008ICB092305D (ng/Kg)	RPD	Actions
OCDD	24.66	4.273	141	Estimate (J) the positive results in samples GP008ICB092305S and GP008ICB092305D.
1,2,3,4,7,8-HxCDF	0.159	0.124	25	Criterion met; no actions required.
1,2,3,4,6,7,8-HpCDF	0.247	0.128	63	Estimate (J) the positive results in samples GP008ICB092305S and GP008ICB092305D.
OCDF	0.580	0.395	22	Criterion met; no actions required.
Total HxCDD	0.618	0.047 U	NC	Criterion met; no actions required.
Total HpCDD	6.94	0.644	166	Estimate (J) the positive results in samples GP008ICB092305S and GP008ICB092305D.
Total HxCDF	0.295	0.124	82	Estimate (J) the positive results in samples GP008ICB092305S and GP008ICB092305D.
QC Criteria:	**RPD <30 when both results ≥ 5x the sample quantitation limit. RPD < 60 when both results are <5x the sample quantitation limit.**			

LCS/LCSD Results

The %Rs of all spiked compounds were within the QC acceptance criteria for the soil and aqueous LCS and/or LCSD. The RPDs were within the QC acceptance criteria for the aqueous LCS/LCSD.

Sample Quantitation/Detection Limit Results

Dilutions were not performed on any samples in this data set.

The following compounds in the samples listed were qualified as (K) by the laboratory to signify that these values are Estimated Maximum Possible Concentrations (EMPCs):

GP005ICB092305S: 1,2,3,4,7,8-HxCDF
GP008ICB092305S: 1,2,3,4,6,7,8-HpCDF; OCDF
GP012ICB092305S: 1,2,3,7,8,9-HxCDD; 1,2,3,6,7,8-HxCDF; 1,2,3,4,7,8,9-HpCDF
GP008ICB092305D: OCDF
GP013ICB092305S: 1,2,3,7,8,9-HxCDD
GP004ICB092305B: OCDF

The 1,2,3,4,6,7,8-HpCDF result in sample GP008ICB092305D was an EMPC, yet it was not qualified as "K" on the PCDD/PCDF Analysis Data Sheet. The laboratory confirmed that this result should have been flagged with a "K"; this qualifier was manually entered by the validator.

It should be noted that the OCDF result for sample GP004ICB092305B was qualified as estimated (J) by the laboratory due to quantitation of the result at a concentration less than the lowest calibration standard but greater than the estimated detection limit (EDL). However, due to the hierarchy of the validation qualifiers established by the data validation guidelines, this (J) qualifier was replaced due to blank contamination actions (see Laboratory Blanks/Equipment Blanks/Field Blanks, above).

The following compounds in the samples listed were flagged as estimated (J) by the laboratory due to quantitation of the results at concentrations less than the lowest calibration standard but greater than the EDL; no further validation action was necessary:

GP004ICB092305S:	1,2,3,4,6,7,8-HpCDD; 1,2,3,4,7,8-HxCDF; 2,3,4,6,7,8-HxCDF; 1,2,3,4,6,7,8-HpCDF; OCDF
GP005ICB092305S:	1,2,3,4,6,7,8-HpCDD; 1,2,3,4,7,8-HxCDF; 1,2,3,4,6,7,8-HpCDF; OCDF
GP006ICD092305S:	1,2,3,4,6,7,8-HpCDD; 1,2,3,4,7,8-HxCDF; OCDF
GP007ICB092305S:	1,2,3,4,6,7,8-HpCDD; 1,2,3,4,7,8-HxCDF; 1,2,3,4,6,7,8-HpCDF; OCDF
GP008ICB092305S:	1,2,3,4,6,7,8-HpCDD; 1,2,3,4,7,8-HxCDF; 1,2,3,4,6,7,8-HpCDF; OCDF
GP009ICD092305S:	1,2,3,6,7,8-HxCDD; 1,2,3,7,8,9-HxCDD
GP010ICB092305S:	1,2,3,4,6,7,8-HpCDD
GP011ICB092305S:	1,2,3,4,7,8-HxCDD; 1,2,3,6,7,8-HxCDD, 1,2,3,7,8,9-HxCDD; 1,2,3,4,7,8-HxCDF; 1,2,3,4,6,7,8-HpCDF; OCDF
GP012ICB092305S:	1,2,3,4,7,8-HxCDD; 1,2,3,7,8,9-HxCDD; 1,2,3,4,7,8-HxCDF; 1,2,3,6,7,8-HxCDF; 1,2,3,4,7,8,9-HpCDF
GP008ICB092305D:	1,2,3,4,6,7,8-HpCDD; 1,2,3,4,7,8-HxCDF; 1,2,3,4,6,7,8-HpCDF; OCDF
GP013ICB092305S:	1,2,3,4,7,8-HxCDD; 1,2,3,6,7,8-HxCDD; 1,2,3,7,8,9-HxCDD; 1,2,3,4,7,8-HxCDF; 1,2,3,4,6,7,8-HpCDF; OCDF

The positive total results in several samples were qualified as estimated (J) by the validator due to quantitation of the results at concentrations less than the lowest calibration standard but greater than the EDL.

GP004ICB092305S:	total HxCDD; total HxCDF
GP005ICB092305S:	total HxCDD; total HxCDF
GP006ICD092305S:	total HpCDD; total HxCDF
GP007ICB092305S:	total HpCDD; total HxCDF
GP008ICB092305S:	total HxCDD; total HxCDF
GP009ICD092305S:	total HxCDD
GP011ICB092305S:	total TCDD; total HxCDF
GP012ICB092305S:	total PeCDD; total PeCDF
GP008ICB092305D:	total HpCDD; total HxCDF
GP013ICB092305S:	total HxCDD; total HxCDF; total HpCDF
GP004ICB092305B:	total HpCDF

Form 1

CLIENT ID.

PCDD/PCDF ANALYSIS DATA SHEET
Use for Sample and Blank Results GP004ICB092305S

Lab Name: Columbia Analytical Services Episode No.:

Lab Code: CAS SDG No.: Method: 8290 Lab Sample ID: E0500690-001.01

Client Name: ENSR/PINE AREA Sample Wt/Vol: 11.588 g or mL: g

Matrix (Aqueous/Solid/Leachate): Solid Initial Calibration Date: 11/04/04

Sample Receipt Date: 09/27/05 Instrument ID: AutoSpec-Ultima

Ext. Date: 09/29/05 GC Column:DB-5

Ext. Vol(ul):20.0 Inj. Vol(ul):1.0 Sample Data Filename: U23487#1

Analysis Date: 6-OCT-05 Time: 14:39:40 Blank Data Filename: C14325#2

Dilution Factor: 1 Cal. Ver. Data Filename: U23484#1

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture/Lipid: 22.39

ANALYTE	CONCENTRATION FOUND	DETECTION LIMIT	Qual. (1)	ION ABUND. RATIO (2)	RRT (2)	MEAN RRF
2,3,7,8-TCDD	*	0.032	U	*	*	0.96
1,2,3,7,8-PeCDD	*	0.029	U	*	*	0.97
1,2,3,4,7,8-HxCDD	*	0.048	U	*	*	1.08
1,2,3,6,7,8-HxCDD	*	0.043	U	*	*	1.20
1,2,3,7,8,9-HxCDD	*	0.044	U	*	*	1.16
1,2,3,4,6,7,8-HpCDD	1.915	0.038	J	1.06	1.000	1.03
OCDD	22.643	0.157	J	0.91	1.000	1.11
2,3,7,8-TCDF	*	0.056	U	*	*	0.97
1,2,3,7,8-PeCDF	*	0.021	U	*	*	1.00
2,3,4,7,8-PeCDF	*	0.020	U	*	*	1.07
1,2,3,4,7,8-HxCDF	0.142	0.036	J	1.31	1.000	1.29
1,2,3,6,7,8-HxCDF	*	0.036	U	*	*	1.31
1,2,3,7,8,9-HxCDF	*	0.042	U	*	*	1.09
2,3,4,6,7,8-HxCDF	0.071	0.038	J	1.18	1.021	1.22
1,2,3,4,6,7,8-HpCDF	0.266	0.034	J	1.08	1.000	1.56
1,2,3,4,7,8,9-HpCDF	*	0.044	U	*	*	1.21
OCDF	0.483	0.075	J	0.89	1.003	1.39
Total Tetra-Dioxins	*	0.032	U			
Total Penta-Dioxins	*	0.029	U			
Total Hexa-Dioxins	0.961	0.043	J			
Total Hepta-Dioxins	7.481	0.038	J			
Total Tetra-Furans	*	0.056	U			
Total Penta-Furans	*	0.020	U			
Total Hexa-Furans	0.347	0.036	J			
Total Hepta-Furans	0.644	0.034	J			

(1) Qualifiers: See flag definitions.

(2) RRTs and ion ratios are specified in Tables 11 and 8, Method 8290. 8290F1

FORM 2

PCDD/PCDF LABELED COMPOUND AND CLEANUP STANDARD RECOVERIES

CLIENT ID.
GP004ICB092305S

Lab Name: Columbia Analytical Services Episode No.:

Lab Code: CAS SDG No.: Method: 8290 Lab Sample ID: E0500690-001.01

Client Name: ENSR/PINE AREA Sample Wt/Vol: 11.588 g or mL: g

Matrix (Aqueous/Solid/Leachate): Solid Initial Calibration Date: 11/04/04

Sample Receipt Date: 09/27/05 Instrument ID: AutoSpec-Ultima

Ext. Date: 09/29/05 GC Column: DB-5

Ext. Vol(ul): 20.0 Inj. Vol(ul): 1.0 Sample Data Filename: U23487#1

Analysis Date: 6-OCT-05 Time: 14:39:40 Blank Data Filename: C14325#2

Dilution Factor: 1 Cal. Ver. Data Filename: U23484#1

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture/Lipid: 22.39

LABELED COMPOUNDS	SPIKE CONC. (pg)	CONCENT. FOUND (pg)	RECOV. %	Q	ION ABUND. RATIO (2)	RRT (2)	MEAN RRF
13C-2,3,7,8-TCDD	1000	731.75	73.18		0.78	1.014	1.07
13C-1,2,3,7,8-PeCDD	1000	740.17	74.02		1.60	1.269	1.01
13C-1,2,3,6,7,8-HxCDD	2500	1928.16	77.13		1.33	0.991	0.98
13C-1,2,3,4,6,7,8-HpCDD	2500	1495.71	59.83		1.07	1.075	1.01
13C-OCDD	5000	3154.33	63.09		0.93	1.146	1.04
13C-2,3,7,8-TCDF	1000	694.43	69.44		0.79	0.972	1.48
13C-1,2,3,7,8-PeCDF	1000	748.78	74.88		1.61	1.212	1.51
13C-1,2,3,4,7,8-HxCDF	2500	2190.19	87.61		0.55	0.965	1.42
13C-1,2,3,4,6,7,8-HpCDF	2500	1794.94	71.80		0.45	1.050	1.17
CLEANUP STANDARD							
37Cl-2,3,7,8-TCDD	800	772.37	96.55			1.015	

(1) Contract-required limits for percent recovery are 40%-135% (section 8.4, Method 8290).

(2) Contract-required Reference Attributions for RRTs and ion abundance ratios are specified in Tables 11 and 8, respectively, Method 8290.

NOTE: There is no ion abundance ratio for 37C14-2378-TCDD (cleanup standard).

8290F2

Form 3

PCDD/PCDF TOXICITY EQUIVALENCE SUMMARY
Use for Sample and Blank Results

CLIENT ID.
GP004ICB092305S

Lab Name: Columbia Analytical Services
Episode No.:

Lab Code: CAS Method: 8290
Lab Sample ID: E0500690-001.01

Client Name: ENSR/PINE AREA
Sample Wt/Vol: 11.588 g or mL: g

Matrix (aqueous/solid/leachate): Solid
Initial Calibration Date: 11/04/04

Sample Receipt Date: 09/27/05
Instrument ID: AutoSpec-Ultima

Ext. Date: 09/29/05
GC Column ID: DB-5

Ext. Vol(ul):20.0 Inj. Vol(ul):1.0
Sample Data Filename: U23487#1

Analysis Date: 6-OCT-05 Time: 14:39:40
Blank Data Filename: C14325#2

Dilution Factor: 1
Cal. Ver. Data Filename: U23484#1

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture: 22.39

	CONCENTRATION	TEF(1)	TEF-ADJUSTED CONCENTRATION
2,3,7,8-TCDD	*	X 1.0	*
1,2,3,7,8-PeCDD	*	X 0.5	*
1,2,3,4,7,8-HxCDD	*	X 0.1	*
1,2,3,6,7,8-HxCDD	*	X 0.1	*
1,2,3,7,8,9-HxCDD	*	X 0.1	*
1,2,3,4,6,7,8-HpCDD	1.915	X 0.01	1.92e-02
OCDD	22.643	X 0.001	2.26e-02
2,3,7,8-TCDF	*	X 0.1	*
1,2,3,7,8-PeCDF	*	X 0.05	*
2,3,4,7,8-PeCDF	*	X 0.5	*
1,2,3,4,7,8-HxCDF	0.142	X 0.1	1.42e-02
1,2,3,6,7,8-HxCDF	*	X 0.1	*
1,2,3,7,8,9-HxCDF	*	X 0.1	*
2,3,4,6,7,8-HxCDF	0.071	X 0.1	7.10e-03
1,2,3,4,6,7,8-HpCDF	0.266	X 0.01	2.66e-03
1,2,3,4,7,8,9-HpCDF	*	X 0.01	*
OCDF	0.483	X 0.001	4.83e-04
		Total:	6.62e-02

(1) Taken from 'Interim Procudures for Estimating Risks Associated with Exposures to Mixtures of Chlorinated Dibenzo-p-Dioxin and -Dibenzofurans (CDDs and CDFs)' and 1989 Update(EPA/625/3-89/016, March 1989.)

6/90

Form 1

PCDD/PCDF ANALYSIS DATA SHEET
Use for Sample and Blank Results

CLIENT ID.
GP005ICB092305S

Lab Name: Columbia Analytical Services Episode No.:

Lab Code: CAS SDG No.: Method: 8290 Lab Sample ID: E0500690-002.01

Client Name: ENSR/PINE AREA Sample Wt/Vol: 11.399 g or mL: g

Matrix (Aqueous/Solid/Leachate): Solid Initial Calibration Date: 11/04/04

Sample Receipt Date: 09/27/05 Instrument ID: AutoSpec-Ultima

Ext. Date: 09/29/05 GC Column:DB-5

Ext. Vol(ul):20.0 Inj. Vol(ul):1.0 Sample Data Filename: U23488#1

Analysis Date: 6-OCT-05 Time: 15:25:43 Blank Data Filename: C14325#2

Dilution Factor: 1 Cal. Ver. Data Filename: U23484#1

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture/Lipid: 29.81

ANALYTE	CONCENTRATION FOUND	DETECTION LIMIT	Qual. (1)	ION ABUND. RATIO (2)	RRT (2)	MEAN RRF
2,3,7,8-TCDD	*	0.031	U	*	*	0.96
1,2,3,7,8-PeCDD	*	0.029	U	*	*	0.97
1,2,3,4,7,8-HxCDD	*	0.033	U	*	*	1.08
1,2,3,6,7,8-HxCDD	*	0.030	U	*	*	1.20
1,2,3,7,8,9-HxCDD	*	0.031	U	*	*	1.16
1,2,3,4,6,7,8-HpCDD	2.551	0.086	J	1.08	1.000	1.03
OCDD	66.103	0.091		0.91	1.000	1.11
2,3,7,8-TCDF	*	0.051	U	*	*	0.97
1,2,3,7,8-PeCDF	*	0.025	U	*	*	1.00
2,3,4,7,8-PeCDF	*	0.023	U	*	*	1.07
1,2,3,4,7,8-HxCDF	0.088	0.018	JK	0.97	1.000	1.29
1,2,3,6,7,8-HxCDF	*	0.017	U	*	*	1.31
1,2,3,7,8,9-HxCDF	*	0.021	U	*	*	1.09
2,3,4,6,7,8-HxCDF	*	0.019	U	*	*	1.22
1,2,3,4,6,7,8-HpCDF	0.266	0.062	J	1.14	1.000	1.56
1,2,3,4,7,8,9-HpCDF	*	0.080	U	*	*	1.21
OCDF	0.443	0.075	J	0.93	1.002	1.39
Total Tetra-Dioxins	*	0.031	U			
Total Penta-Dioxins	*	0.029	U			
Total Hexa-Dioxins	0.567	0.030	J			
Total Hepta-Dioxins	6.664	0.086	J			
Total Tetra-Furans	*	0.051	U			
Total Penta-Furans	*	0.023	U			
Total Hexa-Furans	0.223	0.018	J			
Total Hepta-Furans	0.560	0.062	U			

(1) Qualifiers: See flag definitions.

(2) RRTs and ion ratios are specified in Tables 11 and 8, Method 8290. 8290F1

FORM 2

PCDD/PCDF LABELED COMPOUND AND CLEANUP STANDARD RECOVERIES

CLIENT ID.
GP005ICB092305S

Lab Name: Columbia Analytical Services Episode No.:

Lab Code: CAS SDG No.: Method: 8290 Lab Sample ID: E0500690-002.01

Client Name: ENSR/PINE AREA Sample Wt/Vol: 11.399 g or mL: g

Matrix (Aqueous/Solid/Leachate): Solid Initial Calibration Date: 11/04/04

Sample Receipt Date: 09/27/05 Instrument ID: AutoSpec-Ultima

Ext. Date: 09/29/05 GC Column: DB-5

Ext. Vol(ul): 20.0 Inj. Vol(ul): 1.0 Sample Data Filename: U23488#1

Analysis Date: 6-OCT-05 Time: 15:25:43 Blank Data Filename: C14325#2

Dilution Factor: 1 Cal. Ver. Data Filename: U23484#1

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture/Lipid: 29.81

	SPIKE CONC.(pg)	CONCENT. FOUND(pg)	RECOV. %	Q	ION ABUND. RATIO(2)	RRT (2)	MEAN RRF
LABELED COMPOUNDS							
13C-2,3,7,8-TCDD	1000	749.30	74.93		0.80	1.013	1.07
13C-1,2,3,7,8-PeCDD	1000	752.19	75.22		1.59	1.268	1.01
13C-1,2,3,6,7,8-HxCDD	2500	2228.54	89.14		1.28	0.991	0.98
13C-1,2,3,4,6,7,8-HpCDD	2500	1468.00	58.72		1.04	1.075	1.01
13C-OCDD	5000	2989.37	59.79		0.93	1.146	1.04
13C-2,3,7,8-TCDF	1000	709.56	70.96		0.80	0.971	1.48
13C-1,2,3,7,8-PeCDF	1000	770.65	77.06		1.61	1.211	1.51
13C-1,2,3,4,7,8-HxCDF	2500	2385.20	95.41		0.54	0.965	1.42
13C-1,2,3,4,6,7,8-HpCDF	2500	1818.74	72.75		0.45	1.050	1.17
CLEANUP STANDARD							
37Cl-2,3,7,8-TCDD	800	804.08	100.51			1.014	

(1) Contract-required limits for percent recovery are 40%-135% (section 8.4, Method 8290).

(2) Contract-required Reference Attributions for RRTs and ion abundance ratios are specified in Tables 11 and 8, respectively, Method 8290.

NOTE: There is no ion abundance ratio for 37C14-2378-TCDD (cleanup standard).

8290F2

Form 3

CLIENT ID.

PCDD/PCDF TOXICITY EQUIVALENCE SUMMARY
Use for Sample and Blank Results

GP005ICB092305S

Lab Name: Columbia Analytical Services Episode No.:

Lab Code: CAS Method: 8290 Lab Sample ID: E0500690-002.01

Client Name: ENSR/PINE AREA Sample Wt/Vol: 11.399 g or mL: g

Matrix (aqueous/solid/leachate): Solid Initial Calibration Date: 11/04/04

Sample Receipt Date: 09/27/05 Instrument ID: AutoSpec-Ultima

Ext. Date: 09/29/05 GC Column ID: DB-5

Ext. Vol(ul):20.0 Inj. Vol(ul):1.0 Sample Data Filename: U23488#1

Analysis Date: 6-OCT-05 Time: 15:25:43 Blank Data Filename: C14325#2

Dilution Factor: 1 Cal. Ver. Data Filename: U23484#1

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture: 29.81

	CONCENTRATION	TEF(1)	TEF-ADJUSTED CONCENTRATION
2,3,7,8-TCDD	*	X 1.0	*
1,2,3,7,8-PeCDD	*	X 0.5	*
1,2,3,4,7,8-HxCDD	*	X 0.1	*
1,2,3,6,7,8-HxCDD	*	X 0.1	*
1,2,3,7,8,9-HxCDD	*	X 0.1	*
1,2,3,4,6,7,8-HpCDD	2.551	X 0.01	2.55e-02
OCDD	66.103	X 0.001	6.61e-02
2,3,7,8-TCDF	*	X 0.1	*
1,2,3,7,8-PeCDF	*	X 0.05	*
2,3,4,7,8-PeCDF	*	X 0.5	*
1,2,3,4,7,8-HxCDF	0.088	X 0.1	8.81e-03
1,2,3,6,7,8-HxCDF	*	X 0.1	*
1,2,3,7,8,9-HxCDF	*	X 0.1	*
2,3,4,6,7,8-HxCDF	*	X 0.1	*
1,2,3,4,6,7,8-HpCDF	0.266	X 0.01	2.67e-03
1,2,3,4,7,8,9-HpCDF	*	X 0.01	*
OCDF	0.443	X 0.001	4.43e-04
		Total:	1.04e-01

(1) Taken from 'Interim Procudures for Estimating Risks Associated with Exposures to Mixtures of Chlorinated Dibenzo-p-Dioxin and -Dibenzofurans (CDDs and CDFs)' and 1989 Update(EPA/625/3-89/016, March 1989.)

6/90

Form 1

PCDD/PCDF ANALYSIS DATA SHEET
Use for Sample and Blank Results

CLIENT ID.
GP006ICB092305S

Lab Name: Columbia Analytical Services Episode No.:

Lab Code: CAS SDG No.: Method: 8290 Lab Sample ID: E0500690-003.01

Client Name: ENSR/PINE AREA Sample Wt/Vol: 11.391 g or mL: g

Matrix (Aqueous/Solid/Leachate): Solid Initial Calibration Date: 11/04/04

Sample Receipt Date: 09/27/05 Instrument ID: AutoSpec-Ultima

Ext. Date: 09/29/05 GC Column:DB-5

Ext. Vol(ul):20.0 Inj. Vol(ul):1.0 Sample Data Filename: U23489#1

Analysis Date: 6-OCT-05 Time: 16:11:47 Blank Data Filename: C14325#2

Dilution Factor: 1 Cal. Ver. Data Filename: U23484#1

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture/Lipid: 51.32

ANALYTE	CONCENTRATION FOUND	DETECTION LIMIT	Qual. (1)	ION ABUND. RATIO (2)	RRT (2)	MEAN RRF
2,3,7,8-TCDD	*	0.043	U	*	*	0.96
1,2,3,7,8-PeCDD	*	0.044	U	*	*	0.97
1,2,3,4,7,8-HxCDD	*	0.064	U	*	*	1.08
1,2,3,6,7,8-HxCDD	*	0.057	U	*	*	1.20
1,2,3,7,8,9-HxCDD	*	0.059	U	*	*	1.16
1,2,3,4,6,7,8-HpCDD	1.696	0.070	J	1.00	1.000	1.03
OCDD	15.822	0.180	J U ✓	0.87	1.000	1.11
2,3,7,8-TCDF	*	0.064	U	*	*	0.97
1,2,3,7,8-PeCDF	*	0.038	U	*	*	1.00
2,3,4,7,8-PeCDF	*	0.036	U	*	*	1.07
1,2,3,4,7,8-HxCDF	0.148	0.022	J	1.18	1.001	1.29
1,2,3,6,7,8-HxCDF	*	0.022	U	*	*	1.31
1,2,3,7,8,9-HxCDF	*	0.026	U	*	*	1.09
2,3,4,6,7,8-HxCDF	*	0.023	U	*	*	1.22
1,2,3,4,6,7,8-HpCDF	*	0.057	U	*	*	1.56
1,2,3,4,7,8,9-HpCDF	*	0.074	U	*	*	1.21
OCDF	0.460	0.123	J	0.94	1.002	1.39
Total Tetra-Dioxins	*	0.043	U			
Total Penta-Dioxins	*	0.044	U			
Total Hexa-Dioxins	*	0.057	U			
Total Hepta-Dioxins	3.661	0.070	J			
Total Tetra-Furans	*	0.064	U			
Total Penta-Furans	*	0.036	U			
Total Hexa-Furans	0.148	0.022	J			
Total Hepta-Furans	*	0.057	U			

(1) Qualifiers: See flag definitions.

(2) RRTs and ion ratios are specified in Tables 11 and 8, Method 8290. 8290F1

Form 3

CLIENT ID.

PCDD/PCDF TOXICITY EQUIVALENCE SUMMARY
Use for Sample and Blank Results

GP006ICB092305S

Lab Name: Columbia Analytical Services | Episode No.:

Lab Code: CAS Method: 8290 | Lab Sample ID: E0500690-003.01

Client Name: ENSR/PINE AREA | Sample Wt/Vol: 11.391 g or mL: g

Matrix (aqueous/solid/leachate): Solid | Initial Calibration Date: 11/04/04

Sample Receipt Date: 09/27/05 | Instrument ID: AutoSpec-Ultima

Ext. Date: 09/29/05 | GC Column ID: DB-5

Ext. Vol(ul):20.0 Inj. Vol(ul):1.0 | Sample Data Filename: U23489#1

Analysis Date: 6-OCT-05 Time: 16:11:47 | Blank Data Filename: C14325#2

Dilution Factor: 1 | Cal. Ver. Data Filename: U23484#1

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture: 51.32

	CONCENTRATION	TEF(1)	TEF-ADJUSTED CONCENTRATION
2,3,7,8-TCDD	*	X 1.0	*
1,2,3,7,8-PeCDD	*	X 0.5	*
1,2,3,4,7,8-HxCDD	*	X 0.1	*
1,2,3,6,7,8-HxCDD	*	X 0.1	*
1,2,3,7,8,9-HxCDD	*	X 0.1	*
1,2,3,4,6,7,8-HpCDD	1.696	X 0.01	1.70e-02
OCDD	15.822	X 0.001	1.58e-02
2,3,7,8-TCDF	*	X 0.1	*
1,2,3,7,8-PeCDF	*	X 0.05	*
2,3,4,7,8-PeCDF	*	X 0.5	*
1,2,3,4,7,8-HxCDF	0.148	X 0.1	1.48e-02
1,2,3,6,7,8-HxCDF	*	X 0.1	*
1,2,3,7,8,9-HxCDF	*	X 0.1	*
2,3,4,6,7,8-HxCDF	*	X 0.1	*
1,2,3,4,6,7,8-HpCDF	*	X 0.01	*
1,2,3,4,7,8,9-HpCDF	*	X 0.01	*
OCDF	0.460	X 0.001	4.60e-04
		Total:	4.81e-02

(1) Taken from 'Interim Procudures for Estimating Risks Associated with Exposures to Mixtures of Chlorinated Dibenzo-p-Dioxin and -Dibenzofurans (CDDs and CDFs)' and 1989 Update(EPA/625/3-89/016, March 1989.)

6/90

FORM 2

PCDD/PCDF LABELED COMPOUND AND CLEANUP STANDARD RECOVERIES

CLIENT ID.
GP006ICB092305S

Lab Name: Columbia Analytical Services Episode No.:

Lab Code: CAS SDG No.: Method: 8290 Lab Sample ID: E0500690-003.01

Client Name: ENSR/PINE AREA Sample Wt/Vol: 11.391 g or mL: g

Matrix (Aqueous/Solid/Leachate): Solid Initial Calibration Date: 11/04/04

Sample Receipt Date: 09/27/05 Instrument ID: AutoSpec-Ultima

Ext. Date: 09/29/05 GC Column: DB-5

Ext. Vol(ul): 20.0 Inj. Vol(ul): 1.0 Sample Data Filename: U23489#1

Analysis Date: 6-OCT-05 Time: 16:11:47 Blank Data Filename: C14325#2

Dilution Factor: 1 Cal. Ver. Data Filename: U23484#1

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture/Lipid: 51.32

LABELED COMPOUNDS	SPIKE CONC.(pg)	CONCENT. FOUND(pg)	RECOV. %	Q	ION ABUND. RATIO(2)	RRT (2)	MEAN RRF
13C-2,3,7,8-TCDD	1000	799.52	79.95		0.80	1.014	1.07
13C-1,2,3,7,8-PeCDD	1000	806.66	80.67		1.59	1.268	1.01
13C-1,2,3,6,7,8-HxCDD	2500	2555.37	102.22		1.29	0.991	0.98
13C-1,2,3,4,6,7,8-HpCDD	2500	1788.87	71.55		1.07	1.075	1.01
13C-OCDD	5000	3606.70	72.13		0.93	1.146	1.04
13C-2,3,7,8-TCDF	1000	798.18	79.82		0.80	0.971	1.48
13C-1,2,3,7,8-PeCDF	1000	830.42	83.04		1.58	1.211	1.51
13C-1,2,3,4,7,8-HxCDF	2500	2631.29	105.25		0.54	0.965	1.42
13C-1,2,3,4,6,7,8-HpCDF	2500	2141.62	85.66		0.46	1.050	1.17
CLEANUP STANDARD							
37Cl-2,3,7,8-TCDD	800	857.69	107.21			1.014	

(1) Contract-required limits for percent recovery are 40%-135% (section 8.4, Method 8290).

(2) Contract-required Reference Attributions for RRTs and ion abundance ratios are specified in Tables 11 and 8, respectively, Method 8290.

NOTE: There is no ion abundance ratio for 37C14-2378-TCDD (cleanup standard).

8290F2

Form 1

CLIENT ID.

PCDD/PCDF ANALYSIS DATA SHEET
Use for Sample and Blank Results GP007ICB092305S

Lab Name: Columbia Analytical Services Episode No.:

Lab Code: CAS SDG No.: Method: 8290 Lab Sample ID: E0500690-004.01

Client Name: ENSR/PINE AREA Sample Wt/Vol: 11.241 g or mL: g

Matrix (Aqueous/Solid/Leachate): Solid Initial Calibration Date: 11/04/04

Sample Receipt Date: 09/27/05 Instrument ID: AutoSpec-Ultima

Ext. Date: 09/29/05 GC Column:DB-5

Ext. Vol(ul):20.0 Inj. Vol(ul):1.0 Sample Data Filename: U23490#1

Analysis Date: 6-OCT-05 Time: 16:57:50 Blank Data Filename: C14325#2

Dilution Factor: 1 Cal. Ver. Data Filename: U23484#1

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture/Lipid: 37.53

ANALYTE	CONCENTRATION FOUND	DETECTION LIMIT	Qual. (1)	ION ABUND. RATIO (2)	RRT (2)	MEAN RRF
2,3,7,8-TCDD	*	0.039	U	*	*	0.96
1,2,3,7,8-PeCDD	*	0.041	U	*	*	0.97
1,2,3,4,7,8-HxCDD	*	0.046	U	*	*	1.08
1,2,3,6,7,8-HxCDD	*	0.041	U	*	*	1.20
1,2,3,7,8,9-HxCDD	*	0.043	U	*	*	1.16
1,2,3,4,6,7,8-HpCDD	1.271	0.078	J	1.04	1.000	1.03
OCDD	5.280	0.105	J	0.92	1.000	1.11
2,3,7,8-TCDF	*	0.064	U	*	*	0.97
1,2,3,7,8-PeCDF	*	0.038	U	*	*	1.00
2,3,4,7,8-PeCDF	*	0.035	U	*	*	1.07
1,2,3,4,7,8-HxCDF	0.218	0.033	J	1.28	1.000	1.29
1,2,3,6,7,8-HxCDF	*	0.033	U	*	*	1.31
1,2,3,7,8,9-HxCDF	*	0.039	U	*	*	1.09
2,3,4,6,7,8-HxCDF	*	0.035	U	*	*	1.22
1,2,3,4,6,7,8-HpCDF	0.264	0.062	J	1.05	1.000	1.56
1,2,3,4,7,8,9-HpCDF	*	0.080	U	*	*	1.21
OCDF	0.355	0.099	J	0.92	1.003	1.39
Total Tetra-Dioxins	*	0.039	U			
Total Penta-Dioxins	*	0.041	U			
Total Hexa-Dioxins	*	0.041	U			
Total Hepta-Dioxins	2.402	0.078	J			
Total Tetra-Furans	*	0.064	U			
Total Penta-Furans	*	0.035	U			
Total Hexa-Furans	0.218	0.033	J			
Total Hepta-Furans	0.264	0.062	U			

(1) Qualifiers: See flag definitions.

(2) RRTs and ion ratios are specified in Tables 11 and 8, Method 8290. 8290F1

FORM 2

PCDD/PCDF LABELED COMPOUND AND CLEANUP STANDARD RECOVERIES

CLIENT ID.
GP007ICB092305S

Lab Name: Columbia Analytical Services Episode No.:

Lab Code: CAS SDG No.: Method: 8290 Lab Sample ID: E0500690-004.01

Client Name: ENSR/PINE AREA Sample Wt/Vol: 11.241 g or mL: g

Matrix (Aqueous/Solid/Leachate): Solid Initial Calibration Date: 11/04/04

Sample Receipt Date: 09/27/05 Instrument ID: AutoSpec-Ultima

Ext. Date: 09/29/05 GC Column: DB-5

Ext. Vol(ul): 20.0 Inj. Vol(ul): 1.0 Sample Data Filename: U23490#1

Analysis Date: 6-OCT-05 Time: 16:57:50 Blank Data Filename: C14325#2

Dilution Factor: 1 Cal. Ver. Data Filename: U23484#1

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture/Lipid: 37.53

	SPIKE CONC.(pg)	CONCENT. FOUND(pg)	RECOV. %	Q	ION ABUND. RATIO(2)	RRT (2)	MEAN RRF
LABELED COMPOUNDS							
13C-2,3,7,8-TCDD	1000	688.91	68.89		0.81	1.013	1.07
13C-1,2,3,7,8-PeCDD	1000	703.77	70.38		1.59	1.268	1.01
13C-1,2,3,6,7,8-HxCDD	2500	2313.83	92.55		1.33	0.991	0.98
13C-1,2,3,4,6,7,8-HpCDD	2500	1651.73	66.07		1.07	1.075	1.01
13C-OCDD	5000	3405.96	68.12		0.93	1.146	1.04
13C-2,3,7,8-TCDF	1000	695.52	69.55		0.80	0.972	1.48
13C-1,2,3,7,8-PeCDF	1000	725.50	72.55		1.60	1.212	1.51
13C-1,2,3,4,7,8-HxCDF	2500	2435.10	97.40		0.52	0.965	1.42
13C-1,2,3,4,6,7,8-HpCDF	2500	1909.89	76.40		0.46	1.050	1.17
CLEANUP STANDARD							
37Cl-2,3,7,8-TCDD	800	819.25	102.41			1.015	

(1) Contract-required limits for percent recovery are 40%-135% (section 8.4, Method 8290).

(2) Contract-required Reference Attributions for RRTs and ion abundance ratios are specified in Tables 11 and 8, respectively, Method 8290.

NOTE: There is no ion abundance ratio for 37C14-2378-TCDD (cleanup standard).

8290F2

Form 3

PCDD/PCDF TOXICITY EQUIVALENCE SUMMARY
Use for Sample and Blank Results

CLIENT ID.
GP007ICB092305S

Lab Name: Columbia Analytical Services
Episode No.:

Lab Code: CAS Method: 8290
Lab Sample ID: E0500690-004.01

Client Name: ENSR/PINE AREA
Sample Wt/Vol: 11.241 g or mL: g

Matrix (aqueous/solid/leachate): Solid
Initial Calibration Date: 11/04/04

Sample Receipt Date: 09/27/05
Instrument ID: AutoSpec-Ultima

Ext. Date: 09/29/05
GC Column ID: DB-5

Ext. Vol(ul):20.0 Inj. Vol(ul):1.0
Sample Data Filename: U23490#1

Analysis Date: 6-OCT-05 Time: 16:57:50
Blank Data Filename: C14325#2

Dilution Factor: 1
Cal. Ver. Data Filename: U23484#1

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture: 37.53

	CONCENTRATION		TEF(1)	TEF-ADJUSTED CONCENTRATION
2,3,7,8-TCDD	*	X	1.0	*
1,2,3,7,8-PeCDD	*	X	0.5	*
1,2,3,4,7,8-HxCDD	*	X	0.1	*
1,2,3,6,7,8-HxCDD	*	X	0.1	*
1,2,3,7,8,9-HxCDD	*	X	0.1	*
1,2,3,4,6,7,8-HpCDD	1.271	X	0.01	1.27e-02
OCDD	5.280	X	0.001	5.28e-03
2,3,7,8-TCDF	*	X	0.1	*
1,2,3,7,8-PeCDF	*	X	0.05	*
2,3,4,7,8-PeCDF	*	X	0.5	*
1,2,3,4,7,8-HxCDF	0.218	X	0.1	2.18e-02
1,2,3,6,7,8-HxCDF	*	X	0.1	*
1,2,3,7,8,9-HxCDF	*	X	0.1	*
2,3,4,6,7,8-HxCDF	*	X	0.1	*
1,2,3,4,6,7,8-HpCDF	0.264	X	0.01	2.64e-03
1,2,3,4,7,8,9-HpCDF	*	X	0.01	*
OCDF	0.355	X	0.001	3.55e-04
			Total:	4.28e-02

(1) Taken from 'Interim Procudures for Estimating Risks Associated with Exposures to Mixtures of Chlorinated Dibenzo-p-Dioxin and -Dibenzofurans (CDDs and CDFs)' and 1989 Update(EPA/625/3-89/016, March 1989.)

6/90

Form 1

PCDD/PCDF ANALYSIS DATA SHEET
Use for Sample and Blank Results

CLIENT ID.
GP008ICB092305S

Lab Name: Columbia Analytical Services Episode No.:

Lab Code: CAS SDG No.: Method: 8290 Lab Sample ID: E0500690-005.01

Client Name: ENSR/PINE AREA Sample Wt/Vol: 11.426 g or mL: g

Matrix (Aqueous/Solid/Leachate): Solid Initial Calibration Date: 09/16/04

Sample Receipt Date: 09/27/05 Instrument ID: AutoSpec-Ultima

Ext. Date: 09/29/05 GC Column:DB-5

Ext. Vol(ul):20.0 Inj. Vol(ul):1.0 Sample Data Filename: U12921#1

Analysis Date: 11-OCT-05 Time: 13:51:29 Blank Data Filename: C14325#2

Dilution Factor: 1 Cal. Ver. Data Filename: U12917#1

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture/Lipid: 33.51

ANALYTE	CONCENTRATION FOUND	DETECTION LIMIT	Qual. (1)	ION ABUND. RATIO (2)	RRT (2)	MEAN RRF
2,3,7,8-TCDD	*	0.056	U	*	*	0.98
1,2,3,7,8-PeCDD	*	0.041	U	*	*	0.91
1,2,3,4,7,8-HxCDD	*	0.063	U	*	*	1.00
1,2,3,6,7,8-HxCDD	*	0.060	U	*	*	1.04
1,2,3,7,8,9-HxCDD	*	0.060	U	*	*	1.06
1,2,3,4,6,7,8-HpCDD	3.545	0.034	J ✓ ✓	1.12	1.000	0.92
OCDD	24.665	0.071	J	0.91	1.000	0.99
2,3,7,8-TCDF	*	0.076	U	*	*	0.82
1,2,3,7,8-PeCDF	*	0.031	U	*	*	0.84
2,3,4,7,8-PeCDF	*	0.030	U	*	*	0.87
1,2,3,4,7,8-HxCDF	0.159	0.037	J	1.33	1.000	1.13
1,2,3,6,7,8-HxCDF	*	0.038	U	*	*	1.08
1,2,3,7,8,9-HxCDF	*	0.047	U	*	*	0.88
2,3,4,6,7,8-HxCDF	*	0.041	U	*	*	1.01
1,2,3,4,6,7,8-HpCDF	0.247	0.065	JK ✓	1.23	1.000	1.36
1,2,3,4,7,8,9-HpCDF	*	0.091	U	*	*	0.97
OCDF	0.580	0.079	JK ✓	1.07	1.003	0.95
Total Tetra-Dioxins	*	0.056	U			
Total Penta-Dioxins	*	0.041	U			
Total Hexa-Dioxins	0.618	0.060	J			
Total Hepta-Dioxins	6.940	0.034	J ✓			
Total Tetra-Furans	*	0.076	U			
Total Penta-Furans	*	0.030	U			
Total Hexa-Furans	0.295	0.037	J ✓			
Total Hepta-Furans	*	0.065	U			

(1) Qualifiers: See flag definitions.

(2) RRTs and ion ratios are specified in Tables 11 and 8, Method 8290. 8290F1

FORM 2

PCDD/PCDF LABELED COMPOUND AND CLEANUP STANDARD RECOVERIES

CLIENT ID.

GP008ICB092305S

Lab Name: Columbia Analytical Services Episode No.:

Lab Code: CAS SDG No.: Method: 8290 Lab Sample ID: E0500690-005.01

Client Name: ENSR/PINE AREA Sample Wt/Vol: 11.426 g or mL: g

Matrix (Aqueous/Solid/Leachate): Solid Initial Calibration Date: 09/16/04

Sample Receipt Date: 09/27/05 Instrument ID: AutoSpec-Ultima

Ext. Date: 09/29/05 GC Column: DB-5

Ext. Vol(ul): 20.0 Inj. Vol(ul): 1.0 Sample Data Filename: U12921#1

Analysis Date: 11-OCT-05 Time: 13:51:29 Blank Data Filename: C14325#2

Dilution Factor: 1 Cal. Ver. Data Filename: U12917#1

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture/Lipid: 33.51

LABELED COMPOUNDS	SPIKE CONC.(pg)	CONCENT. FOUND(pg)	RECOV. %	Q	ION ABUND. RATIO(2)	RRT (2)	MEAN RRF
13C-2,3,7,8-TCDD	1000	719.14	71.91		0.80	1.011	1.10
13C-1,2,3,7,8-PeCDD	1000	799.80	79.98		1.55	1.196	1.01
13C-1,2,3,6,7,8-HxCDD	2500	1881.14	75.25		1.22	0.992	0.98
13C-1,2,3,4,6,7,8-HpCDD	2500	1806.95	72.28		1.03	1.067	0.95
13C-OCDD	5000	3285.89	65.72		0.90	1.142	0.97
13C-2,3,7,8-TCDF	1000	638.44	63.84		0.77	0.975	1.52
13C-1,2,3,7,8-PeCDF	1000	748.76	74.88		1.58	1.152	1.41
13C-1,2,3,4,7,8-HxCDF	2500	1727.35	69.09		0.50	0.970	1.22
13C-1,2,3,4,6,7,8-HpCDF	2500	1590.27	63.61		0.42	1.045	0.96
CLEANUP STANDARD							
37Cl-2,3,7,8-TCDD	800	812.06	101.51			1.011	

(1) Contract-required limits for percent recovery are 40%-135% (section 8.4, Method 8290).

(2) Contract-required Reference Attributions for RRTs and ion abundance ratios are specified in Tables 11 and 8, respectively, Method 8290.

NOTE: There is no ion abundance ratio for 37C14-2378-TCDD (cleanup standard).

8290F2

Form 3

PCDD/PCDF TOXICITY EQUIVALENCE SUMMARY
Use for Sample and Blank Results

CLIENT ID.
GP008ICB092305S

Lab Name: Columbia Analytical Services Episode No.:

Lab Code: CAS Method: 8290 Lab Sample ID: E0500690-005.01

Client Name: ENSR/PINE AREA Sample Wt/Vol: 11.426 g or mL: g

Matrix (aqueous/solid/leachate): Solid Initial Calibration Date: 09/16/04

Sample Receipt Date: 09/27/05 Instrument ID: AutoSpec-Ultima

Ext. Date: 09/29/05 GC Column ID: DB-5

Ext. Vol(ul):20.0 Inj. Vol(ul):1.0 Sample Data Filename: U12921#1

Analysis Date: 11-OCT-05 Time: 13:51:29 Blank Data Filename: C14325#2

Dilution Factor: 1 Cal. Ver. Data Filename: U12917#1

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture: 33.51

	CONCENTRATION	TEF(1)	TEF-ADJUSTED CONCENTRATION
2,3,7,8-TCDD	*	X 1.0	*
1,2,3,7,8-PeCDD	*	X 0.5	*
1,2,3,4,7,8-HxCDD	*	X 0.1	*
1,2,3,6,7,8-HxCDD	*	X 0.1	*
1,2,3,7,8,9-HxCDD	*	X 0.1	*
1,2,3,4,6,7,8-HpCDD	3.545	X 0.01	3.55e-02
OCDD	24.665	X 0.001	2.47e-02
2,3,7,8-TCDF	*	X 0.1	*
1,2,3,7,8-PeCDF	*	X 0.05	*
2,3,4,7,8-PeCDF	*	X 0.5	*
1,2,3,4,7,8-HxCDF	0.159	X 0.1	1.59e-02
1,2,3,6,7,8-HxCDF	*	X 0.1	*
1,2,3,7,8,9-HxCDF	*	X 0.1	*
2,3,4,6,7,8-HxCDF	*	X 0.1	*
1,2,3,4,6,7,8-HpCDF	0.247	X 0.01	2.47e-03
1,2,3,4,7,8,9-HpCDF	*	X 0.01	*
OCDF	0.580	X 0.001	5.80e-04
		Total:	7.90e-02

(1) Taken from 'Interim Procudures for Estimating Risks Associated with Exposures to Mixtures of Chlorinated Dibenzo-p-Dioxin and -Dibenzofurans (CDDs and CDFs)' and 1989 Update(EPA/625/3-89/016, March 1989.)

6/90

Form 1

CLIENT ID.

PCDD/PCDF ANALYSIS DATA SHEET
Use for Sample and Blank Results GP009ICB092305S

Lab Name: Columbia Analytical Services Episode No.:

Lab Code: CAS SDG No.: Method: 8290 Lab Sample ID: E0500690-006.01

Client Name: ENSR/PINE AREA Sample Wt/Vol: 11.693 g or mL: g

Matrix (Aqueous/Solid/Leachate): Solid Initial Calibration Date: 11/04/04

Sample Receipt Date: 09/27/05 Instrument ID: AutoSpec-Ultima

Ext. Date: 09/29/05 GC Column:DB-5

Ext. Vol(ul):20.0 Inj. Vol(ul):1.0 Sample Data Filename: U23492#1

Analysis Date: 6-OCT-05 Time: 19:43:11 Blank Data Filename: C14325#2

Dilution Factor: 1 Cal. Ver. Data Filename: U23484#1

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture/Lipid: 36.65

ANALYTE	CONCENTRATION FOUND	DETECTION LIMIT	Qual. (1)	ION ABUND. RATIO (2)	RRT (2)	MEAN RRF
2,3,7,8-TCDD	*	0.112	U	*	*	0.96
1,2,3,7,8-PeCDD	*	0.114	U	*	*	0.97
1,2,3,4,7,8-HxCDD	*	0.069	U	*	*	1.08
1,2,3,6,7,8-HxCDD	0.397	0.062	J	1.29	1.000	1.20
1,2,3,7,8,9-HxCDD	0.250	0.064	J	1.29	1.010	1.16
1,2,3,4,6,7,8-HpCDD	10.509	0.114		1.03	1.000	1.03
OCDD	25.926	0.362	BUJ	0.90	1.000	1.11
2,3,7,8-TCDF	*	0.132	U	*	*	0.97
1,2,3,7,8-PeCDF	*	0.040	U	*	*	1.00
2,3,4,7,8-PeCDF	*	0.037	U	*	*	1.07
1,2,3,4,7,8-HxCDF	*	0.054	U	*	*	1.29
1,2,3,6,7,8-HxCDF	*	0.054	U	*	*	1.31
1,2,3,7,8,9-HxCDF	*	0.064	U	*	*	1.09
2,3,4,6,7,8-HxCDF	*	0.057	U	*	*	1.22
1,2,3,4,6,7,8-HpCDF	*	0.099	U	*	*	1.56
1,2,3,4,7,8,9-HpCDF	*	0.128	U	*	*	1.21
OCDF	*	0.238	UJ	*	*	1.39
Total Tetra-Dioxins	*	0.112	U			
Total Penta-Dioxins	*	0.114	UJ			
Total Hexa-Dioxins	2.343	0.062	J			
Total Hepta-Dioxins	17.500	0.114				
Total Tetra-Furans	*	0.132	U			
Total Penta-Furans	*	0.037	UJ			
Total Hexa-Furans	*	0.054	U			
Total Hepta-Furans	*	0.099	U			

(1) Qualifiers: See flag definitions.

(2) RRTs and ion ratios are specified in Tables 11 and 8, Method 8290. 8290F1

FORM 2

PCDD/PCDF LABELED COMPOUND AND CLEANUP STANDARD RECOVERIES

CLIENT ID.

GP009ICB092305S

Lab Name: Columbia Analytical Services Episode No.:

Lab Code: CAS SDG No.: Method: 8290 Lab Sample ID: E0500690-006.01

Client Name: ENSR/PINE AREA Sample Wt/Vol: 11.693 g or mL: g

Matrix (Aqueous/Solid/Leachate): Solid Initial Calibration Date: 11/04/04

Sample Receipt Date: 09/27/05 Instrument ID: AutoSpec-Ultima

Ext. Date: 09/29/05 GC Column: DB-5

Ext. Vol(ul): 20.0 Inj. Vol(ul): 1.0 Sample Data Filename: U23492#1

Analysis Date: 6-OCT-05 Time: 19:43:11 Blank Data Filename: C14325#2

Dilution Factor: 1 Cal. Ver. Data Filename: U23484#1

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture/Lipid: 36.65

LABELED COMPOUNDS	SPIKE CONC.(pg)	CONCENT. FOUND(pg)	RECOV. %	Q	ION ABUND. RATIO(2)	RRT (2)	MEAN RRF
13C-2,3,7,8-TCDD	1000	564.18	56.42		0.80	1.014	1.07
13C-1,2,3,7,8-PeCDD	1000	596.32	59.63		1.54	1.269	1.01
13C-1,2,3,6,7,8-HxCDD	2500	1594.11	63.76		1.26	0.991	0.98
13C-1,2,3,4,6,7,8-HpCDD	2500	1320.20	52.81		1.04	1.075	1.01
13C-OCDD	5000	1861.56	37.23	Y	0.89	1.146	1.04
13C-2,3,7,8-TCDF	1000	538.10	53.81		0.79	0.972	1.48
13C-1,2,3,7,8-PeCDF	1000	586.95	58.70		1.57	1.212	1.51
13C-1,2,3,4,7,8-HxCDF	2500	1542.23	61.69		0.52	0.965	1.42
13C-1,2,3,4,6,7,8-HpCDF	2500	1177.23	47.09		0.44	1.050	1.17
CLEANUP STANDARD							
37Cl-2,3,7,8-TCDD	800	821.56	102.69			1.015	

(1) Contract-required limits for percent recovery are 40%-135% (section 8.4, Method 8290).

(2) Contract-required Reference Attributions for RRTs and ion abundance ratios are specified in Tables 11 and 8, respectively, Method 8290.

NOTE: There is no ion abundance ratio for 37C14-2378-TCDD (cleanup standard).

8290F2

Form 3

PCDD/PCDF TOXICITY EQUIVALENCE SUMMARY
Use for Sample and Blank Results

CLIENT ID.
GP009ICB092305S

Lab Name: Columbia Analytical Services Episode No.:

Lab Code: CAS Method: 8290 Lab Sample ID: E0500690-006.01

Client Name: ENSR/PINE AREA Sample Wt/Vol: 11.693 g or mL: g

Matrix (aqueous/solid/leachate): Solid Initial Calibration Date: 11/04/04

Sample Receipt Date: 09/27/05 Instrument ID: AutoSpec-Ultima

Ext. Date: 09/29/05 GC Column ID: DB-5

Ext. Vol(ul):20.0 Inj. Vol(ul):1.0 Sample Data Filename: U23492#1

Analysis Date: 6-OCT-05 Time: 19:43:11 Blank Data Filename: C14325#2

Dilution Factor: 1 Cal. Ver. Data Filename: U23484#1

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture: 36.65

	CONCENTRATION	TEF(1)	TEF-ADJUSTED CONCENTRATION
2,3,7,8-TCDD	*	X 1.0	*
1,2,3,7,8-PeCDD	*	X 0.5	*
1,2,3,4,7,8-HxCDD	*	X 0.1	*
1,2,3,6,7,8-HxCDD	0.397	X 0.1	3.97e-02
1,2,3,7,8,9-HxCDD	0.250	X 0.1	2.50e-02
1,2,3,4,6,7,8-HpCDD	10.509	X 0.01	1.05e-01
OCDD	25.926	X 0.001	2.59e-02
2,3,7,8-TCDF	*	X 0.1	*
1,2,3,7,8-PeCDF	*	X 0.05	*
2,3,4,7,8-PeCDF	*	X 0.5	*
1,2,3,4,7,8-HxCDF	*	X 0.1	*
1,2,3,6,7,8-HxCDF	*	X 0.1	*
1,2,3,7,8,9-HxCDF	*	X 0.1	*
2,3,4,6,7,8-HxCDF	*	X 0.1	*
1,2,3,4,6,7,8-HpCDF	*	X 0.01	*
1,2,3,4,7,8,9-HpCDF	*	X 0.01	*
OCDF	*	X 0.001	*
		Total:	1.96e-01

(1) Taken from 'Interim Procudures for Estimating Risks Associated with Exposures to Mixtures of Chlorinated Dibenzo-p-Dioxin and -Dibenzofurans (CDDs and CDFs)' and 1989 Update(EPA/625/3-89/016, March 1989.)

6/90

Form 1

PCDD/PCDF ANALYSIS DATA SHEET
Use for Sample and Blank Results

CLIENT ID.
GP010ICB092305S

Lab Name: Columbia Analytical Services Episode No.:

Lab Code: CAS SDG No.: Method: 8290 Lab Sample ID: E0500690-007.01

Client Name: ENSR/PINE AREA Sample Wt/Vol: 11.692 g or mL: g

Matrix (Aqueous/Solid/Leachate): Solid Initial Calibration Date: 11/04/04

Sample Receipt Date: 09/27/05 Instrument ID: AutoSpec-Ultima

Ext. Date: 09/29/05 GC Column:DB-5

Ext. Vol(ul):20.0 Inj. Vol(ul):1.0 Sample Data Filename: U23493#1

Analysis Date: 6-OCT-05 Time: 20:29:17 Blank Data Filename: C14325#2

Dilution Factor: 1 Cal. Ver. Data Filename: U23484#1

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture/Lipid: 49.44

ANALYTE	CONCENTRATION FOUND	DETECTION LIMIT	Qual. (1)	ION ABUND. RATIO (2)	RRT (2)	MEAN RRF
2,3,7,8-TCDD	*	0.106	U	*	*	0.96
1,2,3,7,8-PeCDD	*	0.134	U	*	*	0.97
1,2,3,4,7,8-HxCDD	*	0.076	U	*	*	1.08
1,2,3,6,7,8-HxCDD	*	0.068	U	*	*	1.20
1,2,3,7,8,9-HxCDD	*	0.071	U	*	*	1.16
1,2,3,4,6,7,8-HpCDD	2.358	0.109	J	1.00	1.001	1.03
OCDD	11.459	0.306	BJ	0.87	1.000	1.11
2,3,7,8-TCDF	*	0.123	U	*	*	0.97
1,2,3,7,8-PeCDF	*	0.076	U	*	*	1.00
2,3,4,7,8-PeCDF	*	0.071	U	*	*	1.07
1,2,3,4,7,8-HxCDF	*	0.064	U	*	*	1.29
1,2,3,6,7,8-HxCDF	*	0.064	U	*	*	1.31
1,2,3,7,8,9-HxCDF	*	0.076	U	*	*	1.09
2,3,4,6,7,8-HxCDF	*	0.068	U	*	*	1.22
1,2,3,4,6,7,8-HpCDF	*	0.129	U	*	*	1.56
1,2,3,4,7,8,9-HpCDF	*	0.167	U	*	*	1.21
OCDF	*	0.281	U	*	*	1.39
Total Tetra-Dioxins	*	0.106	U			
Total Penta-Dioxins	*	0.134	U			
Total Hexa-Dioxins	*	0.068	U			
Total Hepta-Dioxins	4.610	0.109	J			
Total Tetra-Furans	*	0.123	U			
Total Penta-Furans	*	0.071	U			
Total Hexa-Furans	*	0.064	U			
Total Hepta-Furans	*	0.129	U			

(1) Qualifiers: See flag definitions.

(2) RRTs and ion ratios are specified in Tables 11 and 8, Method 8290. 8290F1

FORM 2

PCDD/PCDF LABELED COMPOUND AND CLEANUP STANDARD RECOVERIES

CLIENT ID.
GP010ICB092305S

Lab Name: Columbia Analytical Services Episode No.:

Lab Code: CAS SDG No.: Method: 8290 Lab Sample ID: E0500690-007.01

Client Name: ENSR/PINE AREA Sample Wt/Vol: 11.692 g or mL: g

Matrix (Aqueous/Solid/Leachate): Solid Initial Calibration Date: 11/04/04

Sample Receipt Date: 09/27/05 Instrument ID: AutoSpec-Ultima

Ext. Date: 09/29/05 GC Column: DB-5

Ext. Vol(ul): 20.0 Inj. Vol(ul): 1.0 Sample Data Filename: U23493#1

Analysis Date: 6-OCT-05 Time: 20:29:17 Blank Data Filename: C14325#2

Dilution Factor: 1 Cal. Ver. Data Filename: U23484#1

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture/Lipid: 49.44

LABELED COMPOUNDS	SPIKE CONC.(pg)	CONCENT. FOUND(pg)	RECOV. %	Q	ION ABUND. RATIO(2)	RRT (2)	MEAN RRF
13C-2,3,7,8-TCDD	1000	616.33	61.63		0.79	1.013	1.07
13C-1,2,3,7,8-PeCDD	1000	631.26	63.13		1.58	1.268	1.01
13C-1,2,3,6,7,8-HxCDD	2500	1671.60	66.86		1.25	0.991	0.98
13C-1,2,3,4,6,7,8-HpCDD	2500	1291.40	51.66		1.05	1.075	1.01
13C-OCDD	5000	1846.43	36.93	Y	0.91	1.146	1.04
13C-2,3,7,8-TCDF	1000	571.30	57.13		0.77	0.971	1.48
13C-1,2,3,7,8-PeCDF	1000	638.09	63.81		1.56	1.212	1.51
13C-1,2,3,4,7,8-HxCDF	2500	1613.82	64.55		0.53	0.965	1.42
13C-1,2,3,4,6,7,8-HpCDF	2500	1204.96	48.20		0.44	1.050	1.17
CLEANUP STANDARD							
37Cl-2,3,7,8-TCDD	800	817.40	102.17			1.015	

(1) Contract-required limits for percent recovery are 40%-135% (section 8.4, Method 8290).

(2) Contract-required Reference Attributions for RRTs and ion abundance ratios are specified in Tables 11 and 8, respectively, Method 8290.

NOTE: There is no ion abundance ratio for 37C14-2378-TCDD (cleanup standard).

8290F2

Form 3

PCDD/PCDF TOXICITY EQUIVALENCE SUMMARY
Use for Sample and Blank Results

CLIENT ID.
GP010ICB092305S

Lab Name: Columbia Analytical Services Episode No.:

Lab Code: CAS Method: 8290 Lab Sample ID: E0500690-007.01

Client Name: ENSR/PINE AREA Sample Wt/Vol: 11.692 g or mL: g

Matrix (aqueous/solid/leachate): Solid Initial Calibration Date: 11/04/04

Sample Receipt Date: 09/27/05 Instrument ID: AutoSpec-Ultima

Ext. Date: 09/29/05 GC Column ID: DB-5

Ext. Vol(ul):20.0 Inj. Vol(ul):1.0 Sample Data Filename: U23493#1

Analysis Date: 6-OCT-05 Time: 20:29:17 Blank Data Filename: C14325#2

Dilution Factor: 1 Cal. Ver. Data Filename: U23484#1

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture: 49.44

	CONCENTRATION	TEF(1)	TEF-ADJUSTED CONCENTRATION
2,3,7,8-TCDD	*	X 1.0	*
1,2,3,7,8-PeCDD	*	X 0.5	*
1,2,3,4,7,8-HxCDD	*	X 0.1	*
1,2,3,6,7,8-HxCDD	*	X 0.1	*
1,2,3,7,8,9-HxCDD	*	X 0.1	*
1,2,3,4,6,7,8-HpCDD	2.358	X 0.01	2.36e-02
OCDD	11.459	X 0.001	1.15e-02
2,3,7,8-TCDF	*	X 0.1	*
1,2,3,7,8-PeCDF	*	X 0.05	*
2,3,4,7,8-PeCDF	*	X 0.5	*
1,2,3,4,7,8-HxCDF	*	X 0.1	*
1,2,3,6,7,8-HxCDF	*	X 0.1	*
1,2,3,7,8,9-HxCDF	*	X 0.1	*
2,3,4,6,7,8-HxCDF	*	X 0.1	*
1,2,3,4,6,7,8-HpCDF	*	X 0.01	*
1,2,3,4,7,8,9-HpCDF	*	X 0.01	*
OCDF	*	X 0.001	*
		Total:	3.50e-02

(1) Taken from 'Interim Procudures for Estimating Risks Associated with Exposures to Mixtures of Chlorinated Dibenzo-p-Dioxin and -Dibenzofurans (CDDs and CDFs)' and 1989 Update(EPA/625/3-89/016, March 1989.)

6/90

Form 1

CLIENT ID.

PCDD/PCDF ANALYSIS DATA SHEET
Use for Sample and Blank Results GP011ICB092305S

Lab Name: Columbia Analytical Services Episode No.:

Lab Code: CAS SDG No.: Method: 8290 Lab Sample ID: E0500690-008.01

Client Name: ENSR/PINE AREA Sample Wt/Vol: 11.389 g or mL: g

Matrix (Aqueous/Solid/Leachate): Solid Initial Calibration Date: 11/04/04

Sample Receipt Date: 09/27/05 Instrument ID: AutoSpec-Ultima

Ext. Date: 09/29/05 GC Column:DB-5

Ext. Vol(ul):20.0 Inj. Vol(ul):1.0 Sample Data Filename: U23473#1

Analysis Date: 5-OCT-05 Time: 13:30:13 Blank Data Filename: C14325#2

Dilution Factor: 1 Cal. Ver. Data Filename: U23470#1

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture/Lipid: 23.78

ANALYTE	CONCENTRATION FOUND	DETECTION LIMIT	Qual. (1)	ION ABUND. RATIO (2)	RRT (2)	MEAN RRF
2,3,7,8-TCDD	*	0.050	U	*	*	0.90
1,2,3,7,8-PeCDD	*	0.055	U	*	*	0.89
1,2,3,4,7,8-HxCDD	0.166	0.069	J	1.23	0.998	0.89
1,2,3,6,7,8-HxCDD	0.251	0.051	J	1.36	1.000	1.19
1,2,3,7,8,9-HxCDD	0.313	0.058	J	1.40	1.009	1.05
1,2,3,4,6,7,8-HpCDD	3.683	0.075	J ✓	1.04	1.000	0.95
OCDD	58.181	0.165	~~U~~ J ✓	0.86	1.000	1.00
2,3,7,8-TCDF	*	0.059	U	*	*	0.86
1,2,3,7,8-PeCDF	*	0.039	U	*	*	0.92
2,3,4,7,8-PeCDF	*	0.040	U	*	*	0.91
1,2,3,4,7,8-HxCDF	0.162	0.027	J	1.14	1.000	1.12
1,2,3,6,7,8-HxCDF	*	0.022	U	*	*	1.38
1,2,3,7,8,9-HxCDF	*	0.031	U	*	*	0.98
2,3,4,6,7,8-HxCDF	*	0.026	U	*	*	1.13
1,2,3,4,6,7,8-HpCDF	0.330	0.059	J	1.08	1.000	1.45
1,2,3,4,7,8,9-HpCDF	*	0.077	U	*	*	1.12
OCDF	0.647	0.122	J	0.85	1.002	1.12
Total Tetra-Dioxins	0.302	0.050	J			
Total Penta-Dioxins	*	0.055	U ~~J~~			
Total Hexa-Dioxins	2.965	0.051	~~J~~			
Total Hepta-Dioxins	9.217	0.075				
Total Tetra-Furans	*	0.059	U			
Total Penta-Furans	*	0.040	U ~~J~~			
Total Hexa-Furans	0.162	0.027	J			
Total Hepta-Furans	0.689	0.059	U ✓			

(1) Qualifiers: See flag definitions.

(2) RRTs and ion ratios are specified in Tables 11 and 8, Method 8290. 8290F1

FORM 2

PCDD/PCDF LABELED COMPOUND AND CLEANUP STANDARD RECOVERIES

CLIENT ID.
GP011ICB092305S

Lab. Name: Columbia Analytical Services Episode No.:

Lab Code: CAS SDG No.: Method: 8290 Lab Sample ID: E0500690-008.01

Client Name: ENSR/PINE AREA Sample Wt/Vol: 11.389 g or mL: g

Matrix (Aqueous/Solid/Leachate): Solid Initial Calibration Date: 11/04/04

Sample Receipt Date: 09/27/05 Instrument ID: AutoSpec-Ultima

Ext. Date: 09/29/05 GC Column: DB-5

Ext. Vol(ul): 20.0 Inj. Vol(ul): 1.0 Sample Data Filename: U23473#1

Analysis Date: 5-OCT-05 Time: 13:30:13 Blank Data Filename: C14325#2

Dilution Factor: 1 Cal. Ver. Data Filename: U23470#1

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture/Lipid: 23.78

LABELED COMPOUNDS	SPIKE CONC. (pg)	CONCENT. FOUND (pg)	RECOV. %	Q	ION ABUND. RATIO (2)	RRT (2)	MEAN RRF
13C-2,3,7,8-TCDD	1000	685.64	68.56		0.80	1.014	1.07
13C-1,2,3,7,8-PeCDD	1000	689.81	68.98		1.54	1.267	0.99
13C-1,2,3,6,7,8-HxCDD	2500	1621.05	64.84		1.22	0.991	1.06
13C-1,2,3,4,6,7,8-HpCDD	2500	1246.11	49.84		1.06	1.075	0.97
13C-OCDD	5000	2087.47	41.75		0.91	1.146	0.90
13C-2,3,7,8-TCDF	1000	602.72	60.27		0.76	0.971	1.48
13C-1,2,3,7,8-PeCDF	1000	705.80	70.58		1.54	1.210	1.37
13C-1,2,3,4,7,8-HxCDF	2500	1786.65	71.47		0.51	0.966	1.28
13C-1,2,3,4,6,7,8-HpCDF	2500	1333.70	53.35		0.44	1.050	0.98
CLEANUP STANDARD							
37Cl-2,3,7,8-TCDD	800	736.12	92.01			1.015	

(1) Contract-required limits for percent recovery are 40%-135% (section 8.4, Method 8290).

(2) Contract-required Reference Attributions for RRTs and ion abundance ratios are specified in Tables 11 and 8, respectively, Method 8290.

NOTE: There is no ion abundance ratio for 37C14-2378-TCDD (cleanup standard).

8290F2

Form 3

PCDD/PCDF TOXICITY EQUIVALENCE SUMMARY
Use for Sample and Blank Results

CLIENT ID.
GP011ICB092305S

Lab Name: Columbia Analytical Services
Episode No.:

Lab Code: CAS Method: 8290
Lab Sample ID: E0500690-008.01

Client Name: ENSR/PINE AREA
Sample Wt/Vol: 11.389 g or mL: g

Matrix (aqueous/solid/leachate): Solid
Initial Calibration Date: 11/04/04

Sample Receipt Date: 09/27/05
Instrument ID: AutoSpec-Ultima

Ext. Date: 09/29/05
GC Column ID: DB-5

Ext. Vol(ul):20.0 Inj. Vol(ul):1.0
Sample Data Filename: U23473#1

Analysis Date: 5-OCT-05 Time: 13:30:13
Blank Data Filename: C14325#2

Dilution Factor: 1
Cal. Ver. Data Filename: U23470#1

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture: 23.78

	CONCENTRATION	TEF(1)	TEF-ADJUSTED CONCENTRATION
2,3,7,8-TCDD	*	X 1.0	*
1,2,3,7,8-PeCDD	*	X 0.5	*
1,2,3,4,7,8-HxCDD	0.166	X 0.1	1.66e-02
1,2,3,6,7,8-HxCDD	0.251	X 0.1	2.51e-02
1,2,3,7,8,9-HxCDD	0.313	X 0.1	3.13e-02
1,2,3,4,6,7,8-HpCDD	3.683	X 0.01	3.68e-02
OCDD	58.181	X 0.001	5.82e-02
2,3,7,8-TCDF	*	X 0.1	*
1,2,3,7,8-PeCDF	*	X 0.05	*
2,3,4,7,8-PeCDF	*	X 0.5	*
1,2,3,4,7,8-HxCDF	0.162	X 0.1	1.62e-02
1,2,3,6,7,8-HxCDF	*	X 0.1	*
1,2,3,7,8,9-HxCDF	*	X 0.1	*
2,3,4,6,7,8-HxCDF	*	X 0.1	*
1,2,3,4,6,7,8-HpCDF	0.330	X 0.01	3.30e-03
1,2,3,4,7,8,9-HpCDF	*	X 0.01	*
OCDF	0.647	X 0.001	6.47e-04
		Total:	1.88e-01

(1) Taken from 'Interim Procudures for Estimating Risks Associated with Exposures to Mixtures of Chlorinated Dibenzo-p-Dioxin and -Dibenzofurans (CDDs and CDFs)' and 1989 Update(EPA/625/3-89/016, March 1989.)

6/90

Form 1

PCDD/PCDF ANALYSIS DATA SHEET
Use for Sample and Blank Results

CLIENT ID.
GP012ICB092305S

Lab Name: Columbia Analytical Services Episode No.:

Lab Code: CAS SDG No.: Method: 8290 Lab Sample ID: E0500690-009.01

Client Name: ENSR/PINE AREA Sample Wt/Vol: 11.570 g or mL: g

Matrix (Aqueous/Solid/Leachate): Solid Initial Calibration Date: 11/04/04

Sample Receipt Date: 09/27/05 Instrument ID: AutoSpec-Ultima

Ext. Date: 09/29/05 GC Column:DB-5

Ext. Vol(ul):20.0 Inj. Vol(ul):1.0 Sample Data Filename: U23474#1

Analysis Date: 5-OCT-05 Time: 14:16:16 Blank Data Filename: C14325#2

Dilution Factor: 1 Cal. Ver. Data Filename: U23470#1

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture/Lipid: 30.76

ANALYTE	CONCENTRATION FOUND	DETECTION LIMIT	Qual. (1)	ION ABUND. RATIO (2)	RRT (2)	MEAN RRF
2,3,7,8-TCDD	*	0.078	U	*	*	0.90
1,2,3,7,8-PeCDD	*	0.080	U	*	*	0.89
1,2,3,4,7,8-HxCDD	1.015	0.095	J	1.42	0.998	0.89
1,2,3,6,7,8-HxCDD	3.222	0.071		1.21	1.000	1.19
1,2,3,7,8,9-HxCDD	2.475	0.081	JK✓	1.28	1.009	1.05
1,2,3,4,6,7,8-HpCDD	87.582	0.221		1.04	1.000	0.95
OCDD	424.803	0.176	J✓	0.87	1.000	1.00
2,3,7,8-TCDF	*	0.105	U	*	*	0.86
1,2,3,7,8-PeCDF	*	0.059	U	*	*	0.92
2,3,4,7,8-PeCDF	*	0.060	U	*	*	0.91
1,2,3,4,7,8-HxCDF	0.432	0.113	J	1.30	1.000	1.12
1,2,3,6,7,8-HxCDF	0.250	0.093	JK✓	1.72	1.005	1.38
1,2,3,7,8,9-HxCDF	*	0.130	U	*	*	0.98
2,3,4,6,7,8-HxCDF	*	0.112	U	*	*	1.13
1,2,3,4,6,7,8-HpCDF	5.142	0.086		1.00	1.000	1.45
1,2,3,4,7,8,9-HpCDF	0.487	0.112	JK✓	1.28	1.033	1.12
OCDF	9.944	0.272	J✓	0.85	1.002	1.12
Total Tetra-Dioxins	*	0.078	U			
Total Penta-Dioxins	1.207	0.080	J			
Total Hexa-Dioxins	26.126	0.071				
Total Hepta-Dioxins	173.183	0.221				
Total Tetra-Furans	*	0.105	U			
Total Penta-Furans	1.306	0.060	J			
Total Hexa-Furans	7.996	0.113				
Total Hepta-Furans	20.327	0.086				

(1) Qualifiers: See flag definitions.

(2) RRTs and ion ratios are specified in Tables 11 and 8, Method 8290. 8290F1

112-A

FORM 2

PCDD/PCDF LABELED COMPOUND AND CLEANUP STANDARD RECOVERIES

CLIENT ID.
GP012ICB092305S

Lab Name: Columbia Analytical Services Episode No.:

Lab Code: CAS SDG No.: Method: 8290 Lab Sample ID: E0500690-009.01

Client Name: ENSR/PINE AREA Sample Wt/Vol: 11.570 g or mL: g

Matrix (Aqueous/Solid/Leachate): Solid Initial Calibration Date: 11/04/04

Sample Receipt Date: 09/27/05 Instrument ID: AutoSpec-Ultima

Ext. Date: 09/29/05 GC Column: DB-5

Ext. Vol(ul): 20.0 Inj. Vol(ul): 1.0 Sample Data Filename: U23474#1

Analysis Date: 5-OCT-05 Time: 14:16:16 Blank Data Filename: C14325#2

Dilution Factor: 1 Cal. Ver. Data Filename: U23470#1

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture/Lipid: 30.76

LABELED COMPOUNDS	SPIKE CONC. (pg)	CONCENT. FOUND (pg)	RECOV. %	Q	ION ABUND. RATIO (2)	RRT (2)	MEAN RRF
13C-2,3,7,8-TCDD	1000	518.62	51.86		0.79	1.013	1.07
13C-1,2,3,7,8-PeCDD	1000	598.17	59.82		1.55	1.266	0.99
13C-1,2,3,6,7,8-HxCDD	2500	1296.93	51.88		1.26	0.991	1.06
13C-1,2,3,4,6,7,8-HpCDD	2500	1081.43	43.26		1.04	1.075	0.97
13C-OCDD	5000	1620.97	32.42	Y	0.91	1.147	0.90
13C-2,3,7,8-TCDF	1000	510.24	51.02		0.78	0.971	1.48
13C-1,2,3,7,8-PeCDF	1000	620.12	62.01		1.52	1.210	1.37
13C-1,2,3,4,7,8-HxCDF	2500	1405.74	56.23		0.52	0.966	1.28
13C-1,2,3,4,6,7,8-HpCDF	2500	1078.30	43.13		0.44	1.050	0.98
CLEANUP STANDARD							
37Cl-2,3,7,8-TCDD	800	782.59	97.82			1.014	

(1) Contract-required limits for percent recovery are 40%-135% (section 8.4, Method 8290).

(2) Contract-required Reference Attributions for RRTs and ion abundance ratios are specified in Tables 11 and 8, respectively, Method 8290.

NOTE: There is no ion abundance ratio for 37C14-2378-TCDD (cleanup standard).

8290F2

Form 3

PCDD/PCDF TOXICITY EQUIVALENCE SUMMARY
Use for Sample and Blank Results

CLIENT ID.
GP012ICB092305S

Lab Name: Columbia Analytical Services Episode No.:

Lab Code: CAS Method: 8290 Lab Sample ID: E0500690-009.01

Client Name: ENSR/PINE AREA Sample Wt/Vol: 11.570 g or mL: g

Matrix (aqueous/solid/leachate): Solid Initial Calibration Date: 11/04/04

Sample Receipt Date: 09/27/05 Instrument ID: AutoSpec-Ultima

Ext. Date: 09/29/05 GC Column ID: DB-5

Ext. Vol(ul):20.0 Inj. Vol(ul):1.0 Sample Data Filename: U23474#1

Analysis Date: 5-OCT-05 Time: 14:16:16 Blank Data Filename: C14325#2

Dilution Factor: 1 Cal. Ver. Data Filename: U23470#1

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture: 30.76

	CONCENTRATION	TEF(1)	TEF-ADJUSTED CONCENTRATION
2,3,7,8-TCDD	*	X 1.0	*
1,2,3,7,8-PeCDD	*	X 0.5	*
1,2,3,4,7,8-HxCDD	1.015	X 0.1	1.02e-01
1,2,3,6,7,8-HxCDD	3.222	X 0.1	3.22e-01
1,2,3,7,8,9-HxCDD	2.475	X 0.1	2.48e-01
1,2,3,4,6,7,8-HpCDD	87.582	X 0.01	8.76e-01
OCDD	424.803	X 0.001	4.25e-01
2,3,7,8-TCDF	*	X 0.1	*
1,2,3,7,8-PeCDF	*	X 0.05	*
2,3,4,7,8-PeCDF	*	X 0.5	*
1,2,3,4,7,8-HxCDF	0.432	X 0.1	4.32e-02
1,2,3,6,7,8-HxCDF	0.250	X 0.1	2.50e-02
1,2,3,7,8,9-HxCDF	*	X 0.1	*
2,3,4,6,7,8-HxCDF	*	X 0.1	*
1,2,3,4,6,7,8-HpCDF	5.142	X 0.01	5.14e-02
1,2,3,4,7,8,9-HpCDF	0.487	X 0.01	4.87e-03
OCDF	9.944	X 0.001	9.94e-03
		Total:	2.11e+00

(1) Taken from 'Interim Procudures for Estimating Risks Associated with Exposures to Mixtures of Chlorinated Dibenzo-p-Dioxin and -Dibenzofurans (CDDs and CDFs)' and 1989 Update(EPA/625/3-89/016, March 1989.)

6/90

Form 1

PCDD/PCDF ANALYSIS DATA SHEET
Use for Sample and Blank Results

CLIENT ID.
GP008ICB092305D

Lab Name: Columbia Analytical Services Episode No.:

Lab Code: CAS SDG No.: Method: 8290 Lab Sample ID: E0500690-010.01

Client Name: ENSR/PINE AREA Sample Wt/Vol: 11.783 g or mL: g

Matrix (aqueous/solid/leachate): Solid Initial Calibration Date: 09/16/04

Sample Receipt Date: 09/27/05 Instrument ID: AutoSpec-Ultima

Ext. Date: 09/29/05 GC Column:DB-5

Ext. Vol(ul):20.0 Inj. Vol(ul):1.0 Sample Data Filename: U12885#1

Analysis Date: 6-OCT-05 Time: 20:20:38 Blank Data Filename: C14325#2

Dilution Factor: 1 Cal. Ver. Data Filename: U12881#1

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture/Lipid: 33.51

ANALYTE	CONCENTRATION FOUND	DETECTION LIMIT	Qual. (1)	ION ABUND. RATIO (2)	RRT (2)	MEAN RRF
2,3,7,8-TCDD	*	0.055	U	*	*	0.98
1,2,3,7,8-PeCDD	*	0.049	U	*	*	0.91
1,2,3,4,7,8-HxCDD	*	0.048	U	*	*	1.00
1,2,3,6,7,8-HxCDD	*	0.047	U	*	*	1.04
1,2,3,7,8,9-HxCDD	*	0.046	U	*	*	1.06
1,2,3,4,6,7,8-HpCDD	0.644	0.035	J	1.15	1.000	0.92
OCDD	4.273	0.068	UBJ	0.88	1.000	0.99
2,3,7,8-TCDF	*	0.099	U	*	*	0.82
1,2,3,7,8-PeCDF	*	0.033	U	*	*	0.84
2,3,4,7,8-PeCDF	*	0.032	U	*	*	0.87
1,2,3,4,7,8-HxCDF	0.124	0.028	J	1.24	1.000	1.13
1,2,3,6,7,8-HxCDF	*	0.030	U	*	*	1.08
1,2,3,7,8,9-HxCDF	*	0.036	U	*	*	0.88
2,3,4,6,7,8-HxCDF	*	0.032	U	*	*	1.01
1,2,3,4,6,7,8-HpCDF	0.128	0.035	JK	0.87	1.000	1.36
1,2,3,4,7,8,9-HpCDF	*	0.049	U	*	*	0.97
OCDF	0.395	0.069	JK	1.15	1.003	0.95
Total Tetra-Dioxins	*	0.055	U			
Total Penta-Dioxins	*	0.049	U			
Total Hexa-Dioxins	*	0.047	U			
Total Hepta-Dioxins	0.644	0.035	J			
Total Tetra-Furans	*	0.099	U			
Total Penta-Furans	*	0.032	U			
Total Hexa-Furans	0.124	0.028	J			
Total Hepta-Furans	*	0.035	U			

(1) Qualifiers: See flag definitions.

(2) RRTs and ion ratios are specified in Tables 11 and 8, Method 8290. 8290F1

ENSR

PRIVILEGED AND CONFIDENTIAL - ATTORNEY CLIENT WORK PRODUCT

MEMORANDUM

To: Lisa Bradley/Westford

Date: December 9, 2005

From: Linda Sulkowski/Westford

File: PI015svoc.ls.doc
01776-022-106

RE: Data Validation
PAH Analyses
Yard 520
Pines Area of Investigation, Indiana
CAS Submission Numbers R2527959

CC: D. McGrath/Westford

SUMMARY

Full validation was performed on the data for 11 soil samples and one aqueous equipment blank sample analyzed for regular level polynuclear aromatic hydrocarbons (PAHs) by SW-846 Method 8270C. The samples were collected at the Pines Area of Investigation in Indiana on September 23, 2005 and submitted to Columbia Analytical Services (CAS) in Rochester, New York for analysis. CAS processed these samples under submission number R2527959. The analytical data were evaluated with reference to the "USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review" (October 1999), the "Region 5 Standard Operating Procedure for Validation of CLP Organic Data (USEPA Region 5 Superfund Technical Support Section, February 1997), and the quality control (QC) criteria specified in the analytical method and/or Yard 520 Quality Assurance Project Plan (QAPP). Modification of the Functional Guidelines was performed to accommodate the non-CLP methodologies.

In general, the data are valid as reported and may be used for decision making purposes. All non-detected results for the low-level analysis of equipment blank GP004ICB092305B were rejected (R) since the holding time was grossly exceeded. Selected other data points were qualified as estimated (J, UJ) due to nonconformances of certain QC criteria (see discussion below).

SAMPLES

The samples included in this review are listed below.

Sample IDs	Sample IDs
GP004ICB092305S	GP005ICB092305S
GP006ICB092305S	GP007ICB092305S
GP008ICB092305S	GP008ICB092305D (field duplicate of GP008ICB092305S)
GP009ICB092305S	GP010ICB092305S
GP011ICB092305S	GP012ICB092305S
GP013ICB092305S	GP004ICB092305B (equipment blank)

REVIEW ELEMENTS

Sample data were reviewed for the following parameters:

- Agreement of analyses conducted with chain-of-custody (COC) requests
- Holding times/sample preservation
- Gas chromatography/mass spectrometry (GC/MS) tunes
- Calibrations
- Laboratory blanks/equipment blanks/field blanks
- Surrogate spike recoveries
- Internal standard performance
- Matrix spike (MS)/matrix spike duplicate (MSD) results
- Laboratory control sample (LCS)/laboratory control sample duplicate (LCSD) results
- Field duplicate results
- Sample quantitation/detection limit results

DISCUSSION

Agreement of Analyses Conducted With COC Requests

Sample reports were reviewed against the analytical requests as designated on the chain-of-custody (COC) and subsequent communications between ENSR and the laboratory. The following discrepancy was noted. According to the QAPP, the analysis requested was low-level PAH analysis. The laboratory analyzed the samples as standard-level PAHs. ENSR was notified of the error and requested that the laboratory re-extract the samples outside of hold time and re-analyze the samples using the low-level method. As noted below, the low-level data was either rejected (R) or was qualified as estimated (J, UJ) due to the holding time nonconformance.

Holding Times/Sample Preservation

The cooler temperature was 8°C upon receipt at the laboratory, which exceeded the acceptance criteria of 4 ± 2°C. No validation action was taken for this minor nonconformance other than this notation.

All samples for standard-level PAHs were extracted and analyzed within the method-specified holding times.

All soil samples were re-extracted for low-level PAHs 7 days beyond the method specified holding time of 14 days. All positive and non-detected low-level PAH results were therefore qualified as estimated (J, UJ). The equipment blank sample GP004ICB092305B was re-extracted for low-level PAHs 14 days beyond the method specified holding time of 7 days. Non-detected results were rejected (R) and positive results were estimated (J) since the holding time was grossly exceeded.

GC/MS Tunes

The frequency and abundance of the decafluorotriphenylphosphine (DFTPP) tunes were within the QC acceptance criteria. All samples were analyzed within 12 hours from the DFTPP tunes.

Initial and Continuing Calibrations

The percent relative standard deviations (%RSDs), the percent differences (%Ds), and the response factors (RFs) were all within the QC acceptance criteria in the initial and continuing calibrations.

Laboratory Blanks/Equipment Blanks/Field Blanks

Target analytes were not detected in the laboratory method blanks or in the equipment blanks except as noted below. The presence of blank contamination indicates that false positives may exist for these compounds in the associated samples. Action Levels (ALs) were established for each analyte at 5x the concentration detected. The following table summarizes the ALs.

Type of Blank	Compound	Concentration Detected (µg/L)	AL* (µg/Kg)
GP004ICB092305B (low-level analysis)	2-Methylnaphthalene	0.075	12.5
	Naphthalene	0.085	14.2
Associated samples: All low-level samples. *Adjusted for percent solids			

Sample results were qualified as follows:

- If the sample result was ≤ the sample quantitation limit (SQL) and ≤ the AL, the result was reported as undetected (U) at the SQL.
- If the sample result was > SQL but ≤ AL, the result was reported as undetected (U) at the reported concentration.
- If the sample result was > AL, the result was not qualified.

Surrogate Spike Recoveries

The surrogate recoveries were within the QC acceptance criteria in all sample analyses.

Internal Standard Performance

Internal standard performance met the QC acceptance criteria in all sample analyses.

MS/MSD Results

MS/MSD analyses were performed on sample GP011ICB092305S from this sample set. All percent recoveries (%Rs) and relative percent differences (RPDs) were within the QC acceptance criteria in the MS/MSD analyses by standard-level analysis.

In the low-level PAH analysis, the unspiked sample, the MS, and the MSD were all analyzed at 3-fold dilutions. The following table summarizes the %Rs which fell below the QC acceptance criteria. These analytes were previously qualified as estimated (J) by the laboratory since the reported results were less than the SQL. The unspiked sample GP011ICB092305S was also qualified as estimated (J, UJ) due to the holding time nonconformance noted previously. Further qualification of the data on the basis of MS/MSD recoveries were not required.

Analyte	%Rs MS/MSD	QC Limits
Benzo(a)anthracene	24/30	47-116
Benzo(a)pyrene	0/6	41-122
Benzo(b)fluoranthene	0/6	48-117
Benzo(ghi)perylene	20/20	34-126
Chrysene	12/24	45-117
Fluoranthene	0/0	36-122
Pyrene	0/0	35-128

LCS/LCSD Results

The %Rs and/or RPDs met the QC acceptance criteria for all LCS/LCSD analyses with the following exception. The %R of fluoranthene (126%) in the low-level PAH analysis exceeded the QC acceptance criteria in the LCSD associated with equipment blank sample GP004ICB092305B. Qualification of the data was not required since fluoranthene was not detected in sample GP004ICB092305B.

Field Duplicate Results

Samples GP008ICB092305S and GP008ICB092305D were submitted as the field duplicate pair. Target analytes were not detected in the samples for either the regular level or low-level analyses. The RPDs were therefore not calculable (NC). Precision was deemed acceptable.

Sample Quantitation/Detection Limit Results

Calculations were spot-checked. There were no discrepancies noted.

All samples were analyzed undiluted for the standard-level PAH analyses. SQLs were therefore not affected.

In the low-level PAH analysis, several samples were analyzed at dilutions due to elevated concentrations of PAH analytes that would have exceeded the calibration range of the instrument in the undiluted analysis. The following table lists the sample IDs and the dilution factor.

Sample ID	Dilution Factor
GP011ICB092305S	3
GP013ICB092305S	2

The SQLs for benzo(a)pyrene, naphthalene, and dibenzo(ah)anthracene exceeded the data quality objectives (DQLs) in the regular level PAH analysis. The SQLs for all analytes were at or below the DQLs in the low-level PAH analysis. Therefore, the validator selected the low-level results for reporting purposes, with the exception of the equipment blank. Owing to the majority of the results being rejected on the basis of holding times, these two sets of results were combined for reporting purposes.

COLUMBIA ANALYTICAL SERVICES

EXTRACTABLE ORGANICS
METHOD 8270C.LL PAH'S
Reported: 10/27/05

ENSR International
Project Reference: PINES AREA OF INVESTIGATION PROJECT #01776-028
Client Sample ID : GP004ICB092305B

Date Sampled : 09/23/05 09:45 **Order #:** 850985 **Sample Matrix:** WATER
Date Received: 09/26/05 **Submission #:** R2527959 **Analytical Run** 121697

ANALYTE	PQL	RESULT	UNITS
DATE EXTRACTED : 10/14/05			
DATE ANALYZED : 10/19/05			
ANALYTICAL DILUTION: 0.94			
ACENAPHTHENE	0.20	0.19 U	UG/L
ACENAPHTHYLENE	0.20	0.19 U	UG/L
ANTHRACENE	0.20	0.19 U	UG/L
BENZO(A)ANTHRACENE	0.10	0.094 U	UG/L
BENZO(A)PYRENE	0.20	0.19 U	UG/L
BENZO(B)FLUORANTHENE	0.20	0.19 U	UG/L
BENZO(G,H,I)PERYLENE	0.20	0.19 U	UG/L
BENZO(K)FLUORANTHENE	0.20	0.19 U	UG/L
INDENO(1,2,3-CD)PYRENE	0.20	0.19 U	UG/L
CHRYSENE	0.20	0.19 U	UG/L
DIBENZO(A,H)ANTHRACENE	0.20	0.19 U	UG/L
FLUORANTHENE	0.20	0.19 U	UG/L
FLUORENE	0.20	0.19 U	UG/L
2-METHYLNAPHTHALENE	0.10	0.075 J	UG/L
NAPHTHALENE	0.20	0.085 J	UG/L
PHENANTHRENE	0.20	0.19 U	UG/L
PYRENE	0.20	0.19 U	UG/L

SURROGATE RECOVERIES	QC LIMITS		
TERPHENYL-d14	(23 - 139 %)	92	%
NITROBENZENE-d5	(22 - 124 %)	86	%
2-FLUOROBIPHENYL	(27 - 114 %)	84	%

COLUMBIA ANALYTICAL SERVICES

EXTRACTABLE ORGANICS
METHOD 8270C
Reported: 11/04/05

ENSR International
Project Reference: PINES AREA OF INVESTIGATION PROJECT#01776-020
Client Sample ID : GP004ICB092305B

Date Sampled : 09/23/05 09:45 **Order #:** 844960 **Sample Matrix:** WATER
Date Received: 09/26/05 **Submission #:** R2527959 **Analytical Run:** 120842

ANALYTE	PQL	RESULT	UNITS
DATE ANALYZED: 9/28/2005			
DATE EXTRACTED: 09/27/05			
ANALYTICAL DILUTION: 0.93			
ACENAPHTHENE	10	9.3 U	UG/L
ACENAPHTHYLENE	10	9.3 U	UG/L
ANTHRACENE	10	9.3 U	UG/L
BENZO(A)ANTHRACENE	10	9.3 U	UG/L
BENZO(A)PYRENE	10	9.3 U	UG/L
BENZO(B)FLUORANTHENE	10	9.3 U	UG/L
BENZO(G,H,I)PERYLENE	10	9.3 U	UG/L
BENZO(K)FLUORANTHENE	10	9.3 U	UG/L
INDENO(1,2,3-CD)PYRENE	10	9.3 U	UG/L
CHRYSENE	10	9.3 U	UG/L
DIBENZO(A,H)ANTHRACENE	10	9.3 U	UG/L
FLUORANTHENE	10	9.3 U	UG/L
FLUORENE	10	9.3 U	UG/L
2-METHYLNAPHTHALENE	10	~~9.3 U~~	UG/L
NAPHTHALENE	10	~~9.3 U~~ Do not report	UG/L
PHENANTHRENE	10	~~9.3 U~~ DH	UG/L
PYRENE	10	9.3 U	UG/L

SURROGATE RECOVERIES	QC LIMITS		
TERPHENYL-d14	(40 - 137)	95	%
NITROBENZENE-d5	(38 - 105)	87	%
2-FLUOROBIPHENYL	(38 - 100)	86	%

COLUMBIA ANALYTICAL SERVICES

EXTRACTABLE ORGANICS
METHOD 8270C
Reported: 11/04/05

ENSR International
Project Reference: PINES AREA OF INVESTIGATION PROJECT#01776-020
Client Sample ID : GP004ICB092305S

Date Sampled : 09/23/05 09:30 **Order #:** 844950 **Sample Matrix:** SOIL/SEDIMEN
Date Received: 09/26/05 **Submission #:** R2527959 **Percent Solid:** 75.0

ANALYTE	PQL	RESULT	UNITS
DATE ANALYZED: 10/10/2005			
DATE EXTRACTED: 10/05/05			
ANALYTICAL DILUTION: 1.00			Dry Weight
ACENAPHTHENE	330	440 U	UG/KG
ACENAPHTHYLENE	330	440 U	UG/KG
ANTHRACENE	330	440 U	UG/KG
BENZO(A)ANTHRACENE	330	440 U	UG/KG
BENZO(A)PYRENE	330	440 U	UG/KG
BENZO(B)FLUORANTHENE	330	440 U	UG/KG
BENZO(G,H,I)PERYLENE	330	440 U	UG/KG
BENZO(K)FLUORANTHENE	330	440 U	UG/KG
INDENO(1,2,3-CD)PYRENE	330	440 U	UG/KG
CHRYSENE	330	440 U	UG/KG
DIBENZO(A,H)ANTHRACENE	330	440 U	UG/KG
FLUORANTHENE	330	440 U	UG/KG
FLUORENE	330	440 U	UG/KG
2-METHYLNAPHTHALENE	330	440 U	UG/KG
NAPHTHALENE	330	440 U	UG/KG
PHENANTHRENE	330	440 U	UG/KG
PYRENE	330	440 U	UG/KG

SURROGATE RECOVERIES	QC LIMITS		
TERPHENYL-d14	(48 - 131)	61	%
NITROBENZENE-d5	(27 - 130)	63	%
2-FLUOROBIPHENYL	(32 - 130)	65	%

do not report

COLUMBIA ANALYTICAL SERVICES

EXTRACTABLE ORGANICS
METHOD 8270C.LL PAH'S
Reported: 10/27/05

ENSR International
Project Reference: PINES AREA OF INVESTIGATION PROJECT #01776-028
Client Sample ID : GP004ICB092305S

Date Sampled : 09/23/05 09:30 **Order #:** 850964 **Sample Matrix:** SOIL/SEDIMENT
Date Received: 09/26/05 **Submission #:** R2527959 **Percent Solid:** 75.0

ANALYTE	PQL	RESULT	UNITS
DATE EXTRACTED : 10/14/05			
DATE ANALYZED : 10/18/05			
ANALYTICAL DILUTION: 1.00			Dry Weight
ACENAPHTHENE	6.6	8.8 UJ	UG/KG
ACENAPHTHYLENE	6.6	8.8 UJ	UG/KG
ANTHRACENE	6.6	4.5 J	UG/KG
BENZO(A)ANTHRACENE	3.3	9.1 J	UG/KG
BENZO(A)PYRENE	6.6	8.4 J	UG/KG
BENZO(B)FLUORANTHENE	6.6	13 J	UG/KG
BENZO(G,H,I)PERYLENE	6.6	7.5 J	UG/KG
BENZO(K)FLUORANTHENE	6.6	4.5 J	UG/KG
INDENO(1,2,3-CD)PYRENE	6.6	5.9 J	UG/KG
CHRYSENE	6.6	11 J	UG/KG
DIBENZO(A,H)ANTHRACENE	6.6	8.8 UJ	UG/KG
FLUORANTHENE	6.6	23 J	UG/KG
FLUORENE	6.6	8.8 UJ	UG/KG
2-METHYLNAPHTHALENE	3.3	4.9 UJ	UG/KG
NAPHTHALENE	6.6	8.8 ~~3.6~~ UJ	UG/KG
PHENANTHRENE	6.6	15 J	UG/KG
PYRENE	6.6	16 J	UG/KG

SURROGATE RECOVERIES	QC LIMITS		
TERPHENYL-d14	(19 - 145 %)	49	%
NITROBENZENE-d5	(18 - 125 %)	69	%
2-FLUOROBIPHENYL	(23 - 120 %)	58	%

COLUMBIA ANALYTICAL SERVICES

EXTRACTABLE ORGANICS
METHOD 8270C
Reported: 11/04/05

ENSR International
Project Reference: PINES AREA OF INVESTIGATION PROJECT#01776-020
Client Sample ID : GP005ICB092305S

Date Sampled : 09/23/05 10:30 **Order #:** 844951 **Sample Matrix:** SOIL/SEDIMEN
Date Received: 09/26/05 **Submission #:** R2527959 **Percent Solid:** 74.1

ANALYTE	PQL	RESULT	UNITS
DATE ANALYZED: 10/10/2005			
DATE EXTRACTED: 10/05/05			
ANALYTICAL DILUTION: 1.00			Dry Weight
ACENAPHTHENE	330	450 U	UG/KG
ACENAPHTHYLENE	330	450 U	UG/KG
ANTHRACENE	330	450 U	UG/KG
BENZO(A)ANTHRACENE	330	450 U	UG/KG
BENZO(A)PYRENE	330	450 U	UG/KG
BENZO(B)FLUORANTHENE	330	450 U	UG/KG
BENZO(G,H,I)PERYLENE	330	450 U	UG/KG
BENZO(K)FLUORANTHENE	330	450 U	UG/KG
INDENO(1,2,3-CD)PYRENE	330	450 U	UG/KG
CHRYSENE	330	450 U	UG/KG
DIBENZO(A,H)ANTHRACENE	330	450 U	UG/KG
FLUORANTHENE	330	450 U	UG/KG
FLUORENE	330	450 U	UG/KG
2-METHYLNAPHTHALENE	330	450 U	UG/KG
NAPHTHALENE	330	450 U	UG/KG
PHENANTHRENE	330	450 U	UG/KG
PYRENE	330	450 U	UG/KG

SURROGATE RECOVERIES	QC LIMITS		
TERPHENYL-d14	(48 - 131)	71	%
NITROBENZENE-d5	(27 - 130)	67	%
2-FLUOROBIPHENYL	(32 - 130)	70	%

Do not report

COLUMBIA ANALYTICAL SERVICES

EXTRACTABLE ORGANICS
METHOD 8270C.LL PAH'S
Reported: 10/27/05

ENSR International
Project Reference: PINES AREA OF INVESTIGATION PROJECT #01776-028
Client Sample ID : GP005ICB092305S

Date Sampled : 09/23/05 10:30 **Order #:** 850965 **Sample Matrix:** SOIL/SEDIMENT
Date Received: 09/26/05 **Submission #:** R2527959 **Percent Solid:** 74.1

ANALYTE	PQL	RESULT	UNITS
DATE EXTRACTED : 10/14/05			
DATE ANALYZED : 10/18/05			
ANALYTICAL DILUTION: 1.00			Dry Weight
ACENAPHTHENE	6.6	8.9 UJ	UG/KG
ACENAPHTHYLENE	6.6	3.0 J	UG/KG
ANTHRACENE	6.6	4.2 J	UG/KG
BENZO(A)ANTHRACENE	3.3	9.0 J	UG/KG
BENZO(A)PYRENE	6.6	9.9	UG/KG
BENZO(B)FLUORANTHENE	6.6	13	UG/KG
BENZO(G,H,I)PERYLENE	6.6	8.9	UG/KG
BENZO(K)FLUORANTHENE	6.6	5.4 J	UG/KG
INDENO(1,2,3-CD)PYRENE	6.6	6.9 J	UG/KG
CHRYSENE	6.6	11 J	UG/KG
DIBENZO(A,H)ANTHRACENE	6.6	8.9 UJ	UG/KG
FLUORANTHENE	6.6	22 J	UG/KG
FLUORENE	6.6	8.9 UJ	UG/KG
2-METHYLNAPHTHALENE	3.3	~~7.0~~ UJ	UG/KG
NAPHTHALENE	6.6	8.9 ~~4.3~~ UJ	UG/KG
PHENANTHRENE	6.6	13 J	UG/KG
PYRENE	6.6	18 J	UG/KG

SURROGATE RECOVERIES	QC LIMITS		
TERPHENYL-d14	(19 - 145 %)	56	%
NITROBENZENE-d5	(18 - 125 %)	77	%
2-FLUOROBIPHENYL	(23 - 120 %)	62	%

COLUMBIA ANALYTICAL SERVICES

EXTRACTABLE ORGANICS
METHOD 8270C
Reported: 11/04/05

ENSR International
Project Reference: PINES AREA OF INVESTIGATION PROJECT#01776-020
Client Sample ID : GP006ICB092305S

Date Sampled : 09/23/05 10:50 **Order #:** 844952 **Sample Matrix:** SOIL/SEDIMEN
Date Received: 09/26/05 **Submission #:** R2527959 **Percent Solid:** 69.5

ANALYTE	PQL	RESULT	UNITS
DATE ANALYZED: 10/10/2005			
DATE EXTRACTED: 10/05/05			
ANALYTICAL DILUTION: 1.00			Dry Weight
ACENAPHTHENE	330	470 U	UG/KG
ACENAPHTHYLENE	330	470 U	UG/KG
ANTHRACENE	330	470 U	UG/KG
BENZO(A)ANTHRACENE	330	470 U	UG/KG
BENZO(A)PYRENE	330	470 U	UG/KG
BENZO(B)FLUORANTHENE	330	470 U	UG/KG
BENZO(G,H,I)PERYLENE	330	470 U	UG/KG
BENZO(K)FLUORANTHENE	330	470 U	UG/KG
INDENO(1,2,3-CD)PYRENE	330	470 U	UG/KG
CHRYSENE	330	470 U	UG/KG
DIBENZO(A,H)ANTHRACENE	330	470 U	UG/KG
FLUORANTHENE	330	470 U	UG/KG
FLUORENE	330	470 U	UG/KG
2-METHYLNAPHTHALENE	330	470 U	UG/KG
NAPHTHALENE	330	470 U	UG/KG
PHENANTHRENE	330	470 U	UG/KG
PYRENE	330	470 U	UG/KG

SURROGATE RECOVERIES	QC LIMITS		
TERPHENYL-d14	(48 - 131)	70	%
NITROBENZENE-d5	(27 - 130)	70	%
2-FLUOROBIPHENYL	(32 - 130)	68	%

Do not report

COLUMBIA ANALYTICAL SERVICES

EXTRACTABLE ORGANICS
METHOD 8270C.LL PAH'S
Reported: 10/27/05

ENSR International
Project Reference: PINES AREA OF INVESTIGATION PROJECT #01776-028
Client Sample ID : GP006ICB092305S

Date Sampled : 09/23/05 10:50 **Order #:** 850966 **Sample Matrix:** SOIL/SEDIMENT
Date Received: 09/26/05 **Submission #:** R2527959 **Percent Solid:** 69.5

ANALYTE	PQL	RESULT	UNITS
DATE EXTRACTED : 10/14/05			
DATE ANALYZED : 10/18/05			
ANALYTICAL DILUTION: 1.00			Dry Weight
ACENAPHTHENE	6.6	9.5 U J	UG/KG
ACENAPHTHYLENE	6.6	9.5 U	UG/KG
ANTHRACENE	6.6	9.5 U	UG/KG
BENZO(A)ANTHRACENE	3.3	4.7 U	UG/KG
BENZO(A)PYRENE	6.6	9.5 U	UG/KG
BENZO(B)FLUORANTHENE	6.6	9.5 U	UG/KG
BENZO(G,H,I)PERYLENE	6.6	9.5 U	UG/KG
BENZO(K)FLUORANTHENE	6.6	9.5 U	UG/KG
INDENO(1,2,3-CD)PYRENE	6.6	9.5 U	UG/KG
CHRYSENE	6.6	9.5 U	UG/KG
DIBENZO(A,H)ANTHRACENE	6.6	9.5 U	UG/KG
FLUORANTHENE	6.6	9.5 U	UG/KG
FLUORENE	6.6	9.5 U	UG/KG
2-METHYLNAPHTHALENE	3.3	4.7 U	UG/KG
NAPHTHALENE	6.6	9.5 U	UG/KG
PHENANTHRENE	6.6	9.5 U	UG/KG
PYRENE	6.6	9.5 U J	UG/KG

SURROGATE RECOVERIES	QC LIMITS		
TERPHENYL-d14	(19 - 145 %)	31	%
NITROBENZENE-d5	(18 - 125 %)	84	%
2-FLUOROBIPHENYL	(23 - 120 %)	56	%

COLUMBIA ANALYTICAL SERVICES

EXTRACTABLE ORGANICS
METHOD 8270C
Reported: 11/04/05

ENSR International
Project Reference: PINES AREA OF INVESTIGATION PROJECT#01776-020
Client Sample ID : GP007ICB092305S

Date Sampled : 09/23/05 11:20 **Order #:** 844953 **Sample Matrix:** SOIL/SEDIMEN
Date Received: 09/26/05 **Submission #:** R2527959 **Percent Solid:** 63.5

ANALYTE	PQL	RESULT	UNITS
DATE ANALYZED: 10/10/2005			
DATE EXTRACTED: 10/05/05			
ANALYTICAL DILUTION: 1.00			Dry Weight
ACENAPHTHENE	330	520 U	UG/KG
ACENAPHTHYLENE	330	520 U	UG/KG
ANTHRACENE	330	520 U	UG/KG
BENZO(A)ANTHRACENE	330	520 U	UG/KG
BENZO(A)PYRENE	330	520 U	UG/KG
BENZO(B)FLUORANTHENE	330	520 U	UG/KG
BENZO(G,H,I)PERYLENE	330	520 U	UG/KG
BENZO(K)FLUORANTHENE	330	520 U	UG/KG
INDENO(1,2,3-CD)PYRENE	330	520 U	UG/KG
CHRYSENE	330	520 U	UG/KG
DIBENZO(A,H)ANTHRACENE	330	520 U	UG/KG
FLUORANTHENE	330	520 U	UG/KG
FLUORENE	330	520 U	UG/KG
2-METHYLNAPHTHALENE	330	520 U	UG/KG
NAPHTHALENE	330	520 U	UG/KG
PHENANTHRENE	330	520 U	UG/KG
PYRENE	330	520 U	UG/KG

SURROGATE RECOVERIES	QC LIMITS		
TERPHENYL-d14	(48 - 131)	65	%
NITROBENZENE-d5	(27 - 130)	66	%
2-FLUOROBIPHENYL	(32 - 130)	65	%

Do not report

COLUMBIA ANALYTICAL SERVICES

EXTRACTABLE ORGANICS
METHOD 8270C.LL PAH'S
Reported: 10/27/05

ENSR International
Project Reference: PINES AREA OF INVESTIGATION PROJECT #01776-028
Client Sample ID : GP007ICB092305S

Date Sampled : 09/23/05 11:20 **Order #:** 850968 **Sample Matrix:** SOIL/SEDIMENT
Date Received: 09/26/05 **Submission #:** R2527959 **Percent Solid:** 63.5

ANALYTE	PQL	RESULT	UNITS
DATE EXTRACTED : 10/14/05			
DATE ANALYZED : 10/18/05			
ANALYTICAL DILUTION: 1.00			Dry Weight
ACENAPHTHENE	6.6	10 UJ	UG/KG
ACENAPHTHYLENE	6.6	10 UJ	UG/KG
ANTHRACENE	6.6	10 UJ	UG/KG
BENZO(A)ANTHRACENE	3.3	5.2 UJ	UG/KG
BENZO(A)PYRENE	6.6	4.1 J	UG/KG
BENZO(B)FLUORANTHENE	6.6	5.2 J	UG/KG
BENZO(G,H,I)PERYLENE	6.6	3.9 J	UG/KG
BENZO(K)FLUORANTHENE	6.6	10 UJ	UG/KG
INDENO(1,2,3-CD)PYRENE	6.6	10 UJ	UG/KG
CHRYSENE	6.6	3.8 J	UG/KG
DIBENZO(A,H)ANTHRACENE	6.6	10 UJ	UG/KG
FLUORANTHENE	6.6	10 UJ	UG/KG
FLUORENE	6.6	10 UJ	UG/KG
2-METHYLNAPHTHALENE	3.3	5.2 UJ	UG/KG
NAPHTHALENE	6.6	10 UJ	UG/KG
PHENANTHRENE	6.6	10 UJ	UG/KG
PYRENE	6.6	10 UJ	UG/KG

SURROGATE RECOVERIES	QC LIMITS		
TERPHENYL-d14	(19 - 145 %)	30	%
NITROBENZENE-d5	(18 - 125 %)	89	%
2-FLUOROBIPHENYL	(23 - 120 %)	65	%

COLUMBIA ANALYTICAL SERVICES

EXTRACTABLE ORGANICS
METHOD 8270C
Reported: 11/04/05

ENSR International
Project Reference: PINES AREA OF INVESTIGATION PROJECT#01776-020
Client Sample ID : GP008ICB092305S

Date Sampled : 09/23/05 11:55 **Order #:** 844954 **Sample Matrix:** SOIL/SEDIMEN
Date Received: 09/26/05 **Submission #:** R2527959 **Percent Solid:** 68.7

ANALYTE	PQL	RESULT	UNITS
DATE ANALYZED: 10/10/2005			
DATE EXTRACTED: 10/05/05			
ANALYTICAL DILUTION: 1.00			Dry Weight
ACENAPHTHENE	330	480 U	UG/KG
ACENAPHTHYLENE	330	480 U	UG/KG
ANTHRACENE	330	480 U	UG/KG
BENZO(A)ANTHRACENE	330	480 U	UG/KG
BENZO(A)PYRENE	330	480 U	UG/KG
BENZO(B)FLUORANTHENE	330	480 U	UG/KG
BENZO(G,H,I)PERYLENE	330	480 U	UG/KG
BENZO(K)FLUORANTHENE	330	480 U	UG/KG
INDENO(1,2,3-CD)PYRENE	330	480 U	UG/KG
CHRYSENE	330	480 U	UG/KG
DIBENZO(A,H)ANTHRACENE	330	480 U	UG/KG
FLUORANTHENE	330	480 U	UG/KG
FLUORENE	330	480 U	UG/KG
2-METHYLNAPHTHALENE	330	480 U	UG/KG
NAPHTHALENE	330	480 U	UG/KG
PHENANTHRENE	330	480 U	UG/KG
PYRENE	330	480 U	UG/KG

SURROGATE RECOVERIES	QC LIMITS		
TERPHENYL-d14	(48 - 131)	64	%
NITROBENZENE-d5	(27 - 130)	67	%
2-FLUOROBIPHENYL	(32 - 130)	68	%

Do not report

COLUMBIA ANALYTICAL SERVICES

EXTRACTABLE ORGANICS
METHOD 8270C.LL PAH'S
Reported: 10/27/05

ENSR International
Project Reference: PINES AREA OF INVESTIGATION PROJECT #01776-028
Client Sample ID : GP008ICB092305S

Date Sampled : 09/23/05 11:55 **Order #:** 850970 **Sample Matrix:** SOIL/SEDIMENT
Date Received: 09/26/05 **Submission #:** R2527959 **Percent Solid:** 68.7

ANALYTE	PQL	RESULT	UNITS
DATE EXTRACTED : 10/14/05			
DATE ANALYZED : 10/18/05			
ANALYTICAL DILUTION: 1.00			Dry Weight
ACENAPHTHENE	6.6	9.6 U	UG/KG
ACENAPHTHYLENE	6.6	9.6 U	UG/KG
ANTHRACENE	6.6	9.6 U	UG/KG
BENZO(A)ANTHRACENE	3.3	4.8 U	UG/KG
BENZO(A)PYRENE	6.6	9.6 U	UG/KG
BENZO(B)FLUORANTHENE	6.6	9.6 U	UG/KG
BENZO(G,H,I)PERYLENE	6.6	9.6 U	UG/KG
BENZO(K)FLUORANTHENE	6.6	9.6 U	UG/KG
INDENO(1,2,3-CD)PYRENE	6.6	9.6 U	UG/KG
CHRYSENE	6.6	9.6 U	UG/KG
DIBENZO(A,H)ANTHRACENE	6.6	9.6 U	UG/KG
FLUORANTHENE	6.6	9.6 U	UG/KG
FLUORENE	6.6	9.6 U	UG/KG
2-METHYLNAPHTHALENE	3.3	4.8 U	UG/KG
NAPHTHALENE	6.6	9.6 U	UG/KG
PHENANTHRENE	6.6	9.6 U	UG/KG
PYRENE	6.6	9.6 U	UG/KG

SURROGATE RECOVERIES	QC LIMITS		
TERPHENYL-d14	(19 - 145 %)	33	%
NITROBENZENE-d5	(18 - 125 %)	84	%
2-FLUOROBIPHENYL	(23 - 120 %)	61	%

COLUMBIA ANALYTICAL SERVICES

EXTRACTABLE ORGANICS
METHOD 8270C
Reported: 11/04/05

ENSR International
Project Reference: PINES AREA OF INVESTIGATION PROJECT#01776-020
Client Sample ID : GP009ICB092305S

Date Sampled : 09/23/05 14:20 **Order #:** 844955 **Sample Matrix:** SOIL/SEDIMEN
Date Received: 09/26/05 **Submission #:** R2527959 **Percent Solid:** 61.6

ANALYTE	PQL	RESULT	UNITS
DATE ANALYZED: 10/10/2005			
DATE EXTRACTED: 10/05/05			
ANALYTICAL DILUTION: 1.00			Dry Weight
ACENAPHTHENE	330	540 U	UG/KG
ACENAPHTHYLENE	330	540 U	UG/KG
ANTHRACENE	330	540 U	UG/KG
BENZO(A)ANTHRACENE	330	540 U	UG/KG
BENZO(A)PYRENE	330	540 U	UG/KG
BENZO(B)FLUORANTHENE	330	540 U	UG/KG
BENZO(G,H,I)PERYLENE	330	540 U	UG/KG
BENZO(K)FLUORANTHENE	330	540 U	UG/KG
INDENO(1,2,3-CD)PYRENE	330	540 U	UG/KG
CHRYSENE	330	540 U	UG/KG
DIBENZO(A,H)ANTHRACENE	330	540 U	UG/KG
FLUORANTHENE	330	540 U	UG/KG
FLUORENE	330	540 U	UG/KG
2-METHYLNAPHTHALENE	330	540 U	UG/KG
NAPHTHALENE	330	540 U	UG/KG
PHENANTHRENE	330	540 U	UG/KG
PYRENE	330	540 U	UG/KG

SURROGATE RECOVERIES	QC LIMITS		
TERPHENYL-d14	(48 - 131)	74	%
NITROBENZENE-d5	(27 - 130)	75	%
2-FLUOROBIPHENYL	(32 - 130)	75	%

Do not report

COLUMBIA ANALYTICAL SERVICES

EXTRACTABLE ORGANICS
METHOD 8270C.LL PAH'S
Reported: 10/27/05

ENSR International
Project Reference: PINES AREA OF INVESTIGATION PROJECT #01776-028
Client Sample ID : GP009ICB092305S

Date Sampled : 09/23/05 14:20 **Order #:** 850972 **Sample Matrix:** SOIL/SEDIMENT
Date Received: 09/26/05 **Submission #:** R2527959 **Percent Solid:** 61.6

ANALYTE	PQL	RESULT	UNITS
DATE EXTRACTED : 10/14/05			
DATE ANALYZED : 10/18/05			
ANALYTICAL DILUTION: 1.00			Dry Weight
ACENAPHTHENE	6.6	11 U J	UG/KG
ACENAPHTHYLENE	6.6	11 U	UG/KG
ANTHRACENE	6.6	11 U	UG/KG
BENZO(A)ANTHRACENE	3.3	5.4 U	UG/KG
BENZO(A)PYRENE	6.6	4.2 J	UG/KG
BENZO(B)FLUORANTHENE	6.6	6.8 J	UG/KG
BENZO(G,H,I)PERYLENE	6.6	4.2 J	UG/KG
BENZO(K)FLUORANTHENE	6.6	11 U J	UG/KG
INDENO(1,2,3-CD)PYRENE	6.6	3.6 J	UG/KG
CHRYSENE	6.6	5.2 J	UG/KG
DIBENZO(A,H)ANTHRACENE	6.6	11 U J	UG/KG
FLUORANTHENE	6.6	11 J	UG/KG
FLUORENE	6.6	11 U J	UG/KG
2-METHYLNAPHTHALENE	3.3	5.4 U J	UG/KG
NAPHTHALENE	6.6	11 U J	UG/KG
PHENANTHRENE	6.6	11 U J	UG/KG
PYRENE	6.6	7.5 J	UG/KG

SURROGATE RECOVERIES	QC LIMITS		
TERPHENYL-d14	(19 - 145 %)	71	%
NITROBENZENE-d5	(18 - 125 %)	82	%
2-FLUOROBIPHENYL	(23 - 120 %)	67	%

COLUMBIA ANALYTICAL SERVICES

EXTRACTABLE ORGANICS
METHOD 8270C
Reported: 11/04/05

ENSR International
Project Reference: PINES AREA OF INVESTIGATION PROJECT#01776-020
Client Sample ID : GP010ICB092305S

Date Sampled : 09/23/05 14:00 **Order #:** 844956 **Sample Matrix:** SOIL/SEDIMEN
Date Received: 09/26/05 **Submission #:** R2527959 **Percent Solid:** 60.7

ANALYTE	PQL	RESULT	UNITS
DATE ANALYZED: 10/10/2005			
DATE EXTRACTED: 10/05/05			
ANALYTICAL DILUTION: 1.00			Dry Weight
ACENAPHTHENE	330	540 U	UG/KG
ACENAPHTHYLENE	330	540 U	UG/KG
ANTHRACENE	330	540 U	UG/KG
BENZO(A)ANTHRACENE	330	540 U	UG/KG
BENZO(A)PYRENE	330	540 U	UG/KG
BENZO(B)FLUORANTHENE	330	540 U	UG/KG
BENZO(G,H,I)PERYLENE	330	540 U	UG/KG
BENZO(K)FLUORANTHENE	330	540 U	UG/KG
INDENO(1,2,3-CD)PYRENE	330	540 U	UG/KG
CHRYSENE	330	540 U	UG/KG
DIBENZO(A,H)ANTHRACENE	330	540 U	UG/KG
FLUORANTHENE	330	540 U	UG/KG
FLUORENE	330	540 U	UG/KG
2-METHYLNAPHTHALENE	330	540 U	UG/KG
NAPHTHALENE	330	540 U	UG/KG
PHENANTHRENE	330	540 U	UG/KG
PYRENE	330	540 U	UG/KG

SURROGATE RECOVERIES	QC LIMITS		
TERPHENYL-d14	(48 - 131)	67	%
NITROBENZENE-d5	(27 - 130)	67	%
2-FLUOROBIPHENYL	(32 - 130)	70	%

Do not report

COLUMBIA ANALYTICAL SERVICES

EXTRACTABLE ORGANICS
METHOD 8270C.LL PAH'S
Reported: 10/27/05

ENSR International
Project Reference: PINES AREA OF INVESTIGATION PROJECT #01776-028
Client Sample ID : GP010ICB092305S

Date Sampled : 09/23/05 14:00 **Order #:** 850974 **Sample Matrix:** SOIL/SEDIMENT
Date Received: 09/26/05 **Submission #:** R2527959 **Percent Solid:** 60.7

ANALYTE	PQL	RESULT	UNITS
DATE EXTRACTED : 10/14/05			
DATE ANALYZED : 10/18/05			
ANALYTICAL DILUTION: 1.00			Dry Weight
ACENAPHTHENE	6.6	11 UJ	UG/KG
ACENAPHTHYLENE	6.6	3.8 J	UG/KG
ANTHRACENE	6.6	6.6 J	UG/KG
BENZO(A)ANTHRACENE	3.3	12 J	UG/KG
BENZO(A)PYRENE	6.6	9.1 J	UG/KG
BENZO(B)FLUORANTHENE	6.6	11 J	UG/KG
BENZO(G,H,I)PERYLENE	6.6	6.6 J	UG/KG
BENZO(K)FLUORANTHENE	6.6	11 UJ	UG/KG
INDENO(1,2,3-CD)PYRENE	6.6	5.4 J	UG/KG
CHRYSENE	6.6	11 J	UG/KG
DIBENZO(A,H)ANTHRACENE	6.6	11 UJ	UG/KG
FLUORANTHENE	6.6	28 J	UG/KG
FLUORENE	6.6	3.0 J	UG/KG
2-METHYLNAPHTHALENE	3.3	6.9 ~~J~~ UJ	UG/KG
NAPHTHALENE	6.6	11 ~~4.9 J~~ UJ	UG/KG
PHENANTHRENE	6.6	23 J	UG/KG
PYRENE	6.6	23 J	UG/KG

SURROGATE RECOVERIES	QC LIMITS		
TERPHENYL-d14	(19 - 145 %)	68	%
NITROBENZENE-d5	(18 - 125 %)	78	%
2-FLUOROBIPHENYL	(23 - 120 %)	65	%

COLUMBIA ANALYTICAL SERVICES

EXTRACTABLE ORGANICS
METHOD 8270C
Reported: 11/04/05

ENSR International
Project Reference: PINES AREA OF INVESTIGATION PROJECT#01776-020
Client Sample ID : GP011ICB092305S

Date Sampled : 09/23/05 12:45 **Order #:** 844957 **Sample Matrix:** SOIL/SEDIMEN
Date Received: 09/26/05 **Submission #:** R2527959 **Percent Solid:** 72.5

ANALYTE	PQL	RESULT	UNITS
DATE ANALYZED: 10/10/2005			
DATE EXTRACTED: 10/05/05			
ANALYTICAL DILUTION: 1.00			Dry Weight
ACENAPHTHENE	330	460 U	UG/KG
ACENAPHTHYLENE	330	460 U	UG/KG
ANTHRACENE	330	460 U	UG/KG
BENZO(A)ANTHRACENE	330	460 U	UG/KG
BENZO(A)PYRENE	330	460 U	UG/KG
BENZO(B)FLUORANTHENE	330	460 U	UG/KG
BENZO(G,H,I)PERYLENE	330	460 U	UG/KG
BENZO(K)FLUORANTHENE	330	460 U	UG/KG
INDENO(1,2,3-CD)PYRENE	330	460 U	UG/KG
CHRYSENE	330	460 U	UG/KG
DIBENZO(A,H)ANTHRACENE	330	460 U	UG/KG
FLUORANTHENE	330	460 U	UG/KG
FLUORENE	330	460 U	UG/KG
2-METHYLNAPHTHALENE	330	460 U	UG/KG
NAPHTHALENE	330	460 U	UG/KG
PHENANTHRENE	330	460 U	UG/KG
PYRENE	330	460 U	UG/KG

SURROGATE RECOVERIES	QC LIMITS		
TERPHENYL-d14	(48 - 131)	66	%
NITROBENZENE-d5	(27 - 130)	67	%
2-FLUOROBIPHENYL	(32 - 130)	69	%

Do not report

COLUMBIA ANALYTICAL SERVICES

EXTRACTABLE ORGANICS
METHOD 8270C.LL PAH'S
Reported: 10/27/05

ENSR International
Project Reference: PINES AREA OF INVESTIGATION PROJECT #01776-028
Client Sample ID : GP011ICB092305S

Date Sampled : 09/23/05 12:45 **Order #:** 850976 **Sample Matrix:** SOIL/SEDIMENT
Date Received: 09/26/05 **Submission #:** R2527959 **Percent Solid:** 72.5

ANALYTE	PQL	RESULT	UNITS
DATE EXTRACTED : 10/14/05			
DATE ANALYZED : 10/18/05			
ANALYTICAL DILUTION: 3.00			Dry Weight
ACENAPHTHENE	6.6	27 U J	UG/KG
ACENAPHTHYLENE	6.6	27 U	UG/KG
ANTHRACENE	6.6	27 U	UG/KG
BENZO(A)ANTHRACENE	3.3	17 J	UG/KG
BENZO(A)PYRENE	6.6	15 J	UG/KG
BENZO(B)FLUORANTHENE	6.6	19 J	UG/KG
BENZO(G,H,I)PERYLENE	6.6	12 J	UG/KG
BENZO(K)FLUORANTHENE	6.6	27 U J	UG/KG
INDENO(1,2,3-CD)PYRENE	6.6	27 U J	UG/KG
CHRYSENE	6.6	17 J	UG/KG
DIBENZO(A,H)ANTHRACENE	6.6	27 U J	UG/KG
FLUORANTHENE	6.6	40 J	UG/KG
FLUORENE	6.6	27 U J	UG/KG
2-METHYLNAPHTHALENE	3.3	14 U	UG/KG
NAPHTHALENE	6.6	27 U	UG/KG
PHENANTHRENE	6.6	27 U	UG/KG
PYRENE	6.6	28 J	UG/KG

SURROGATE RECOVERIES	QC LIMITS		
TERPHENYL-d14	(19 - 145 %)	59	%
NITROBENZENE-d5	(18 - 125 %)	69	%
2-FLUOROBIPHENYL	(23 - 120 %)	68	%

COLUMBIA ANALYTICAL SERVICES

EXTRACTABLE ORGANICS
METHOD 8270C
Reported: 11/04/05

ENSR International
Project Reference: PINES AREA OF INVESTIGATION PROJECT#01776-020
Client Sample ID : GP012ICB092305S

Date Sampled : 09/23/05 13:10 **Order #:** 844958 **Sample Matrix:** SOIL/SEDIMEN
Date Received: 09/26/05 **Submission #:** R2527959 **Percent Solid:** 67.7

ANALYTE	PQL	RESULT	UNITS
DATE ANALYZED: 10/12/2005			
DATE EXTRACTED: 10/05/05			
ANALYTICAL DILUTION: 1.00			Dry Weight
ACENAPHTHENE	330	490 U	UG/KG
ACENAPHTHYLENE	330	490 U	UG/KG
ANTHRACENE	330	490 U	UG/KG
BENZO(A)ANTHRACENE	330	490 U	UG/KG
BENZO(A)PYRENE	330	490 U	UG/KG
BENZO(B)FLUORANTHENE	330	490 U	UG/KG
BENZO(G,H,I)PERYLENE	330	490 U	UG/KG
BENZO(K)FLUORANTHENE	330	490 U	UG/KG
INDENO(1,2,3-CD)PYRENE	330	490 U	UG/KG
CHRYSENE	330	490 U	UG/KG
DIBENZO(A,H)ANTHRACENE	330	490 U	UG/KG
FLUORANTHENE	330	490 U	UG/KG
FLUORENE	330	490 U	UG/KG
2-METHYLNAPHTHALENE	330	490 U	UG/KG
NAPHTHALENE	330	490 U	UG/KG
PHENANTHRENE	330	490 U	UG/KG
PYRENE	330	490 U	UG/KG

SURROGATE RECOVERIES	QC LIMITS		
TERPHENYL-d14	(48 - 131)	75	%
NITROBENZENE-d5	(27 - 130)	66	%
2-FLUOROBIPHENYL	(32 - 130)	68	%

Do not report

COLUMBIA ANALYTICAL SERVICES

EXTRACTABLE ORGANICS
METHOD 8270C.LL PAH'S
Reported: 10/27/05

ENSR International
Project Reference: PINES AREA OF INVESTIGATION PROJECT #01776-028
Client Sample ID : GP012ICB092305S

Date Sampled : 09/23/05 13:10 **Order #:** 850977 **Sample Matrix:** SOIL/SEDIMENT
Date Received: 09/26/05 **Submission #:** R2527959 **Percent Solid:** 67.7

DATE EXTRACTED : 10/14/05
DATE ANALYZED : 10/18/05
ANALYTICAL DILUTION: 1.00

ANALYTE	PQL	RESULT	UNITS
			Dry Weight
ACENAPHTHENE	6.6	9.7 UJ	UG/KG
ACENAPHTHYLENE	6.6	9.7 U	UG/KG
ANTHRACENE	6.6	9.7 U	UG/KG
BENZO(A)ANTHRACENE	3.3	5.8 J	UG/KG
BENZO(A)PYRENE	6.6	4.4 J	UG/KG
BENZO(B)FLUORANTHENE	6.6	5.6 J	UG/KG
BENZO(G,H,I)PERYLENE	6.6	4.1 J	UG/KG
BENZO(K)FLUORANTHENE	6.6	9.7 UJ	UG/KG
INDENO(1,2,3-CD)PYRENE	6.6	9.7 UJ	UG/KG
CHRYSENE	6.6	6.9 J	UG/KG
DIBENZO(A,H)ANTHRACENE	6.6	9.7 UJ	UG/KG
FLUORANTHENE	6.6	9.6 J	UG/KG
FLUORENE	6.6	9.7 UJ	UG/KG
2-METHYLNAPHTHALENE	3.3	15 ~~J~~ UJ	UG/KG
NAPHTHALENE	6.6	9.7 ~~7.4~~ ~~J~~ UJ	UG/KG
PHENANTHRENE	6.6	18 J	UG/KG
PYRENE	6.6	9.3 J	UG/KG

SURROGATE RECOVERIES	QC LIMITS		
TERPHENYL-d14	(19 - 145 %)	50	%
NITROBENZENE-d5	(18 - 125 %)	77	%
2-FLUOROBIPHENYL	(23 - 120 %)	62	%

COLUMBIA ANALYTICAL SERVICES

EXTRACTABLE ORGANICS
METHOD 8270C
Reported: 11/04/05

ENSR International
Project Reference: PINES AREA OF INVESTIGATION PROJECT#01776-020
Client Sample ID : GP008ICB092305D

Date Sampled : 09/23/05 11:55 **Order #:** 844959 **Sample Matrix:** SOIL/SEDIMEN
Date Received: 09/26/05 **Submission #:** R2527959 **Percent Solid:** 69.3

ANALYTE	PQL	RESULT	UNITS
DATE ANALYZED: 10/12/2005			
DATE EXTRACTED: 10/05/05			
ANALYTICAL DILUTION: 1.00			Dry Weight
ACENAPHTHENE	330	480 U	UG/KG
ACENAPHTHYLENE	330	480 U	UG/KG
ANTHRACENE	330	480 U	UG/KG
BENZO(A)ANTHRACENE	330	480 U	UG/KG
BENZO(A)PYRENE	330	480 U	UG/KG
BENZO(B)FLUORANTHENE	330	480 U	UG/KG
BENZO(G,H,I)PERYLENE	330	480 U	UG/KG
BENZO(K)FLUORANTHENE	330	480 U	UG/KG
INDENO(1,2,3-CD)PYRENE	330	480 U	UG/KG
CHRYSENE	330	480 U	UG/KG
DIBENZO(A,H)ANTHRACENE	330	480 U	UG/KG
FLUORANTHENE	330	480 U	UG/KG
FLUORENE	330	480 U	UG/KG
2-METHYLNAPHTHALENE	330	480 U	UG/KG
NAPHTHALENE	330	480 U	UG/KG
PHENANTHRENE	330	480 U	UG/KG
PYRENE	330	480 U	UG/KG

SURROGATE RECOVERIES	QC LIMITS		
TERPHENYL-d14	(48 - 131)	74	%
NITROBENZENE-d5	(27 - 130)	70	%
2-FLUOROBIPHENYL	(32 - 130)	70	%

Do not report

COLUMBIA ANALYTICAL SERVICES

EXTRACTABLE ORGANICS
METHOD 8270C.LL PAH'S
Reported: 10/27/05

ENSR International
Project Reference: PINES AREA OF INVESTIGATION PROJECT #01776-028
Client Sample ID : GP008ICB092305D

Date Sampled : 09/23/05 11:55 **Order #:** 850978 **Sample Matrix:** SOIL/SEDIMENT
Date Received: 09/26/05 **Submission #:** R2527959 **Percent Solid:** 69.3

ANALYTE	PQL	RESULT	UNITS
DATE EXTRACTED : 10/14/05			
DATE ANALYZED : 10/18/05			
ANALYTICAL DILUTION: 1.00			Dry Weight
ACENAPHTHENE	6.6	9.5 U J	UG/KG
ACENAPHTHYLENE	6.6	9.5 U	UG/KG
ANTHRACENE	6.6	9.5 U	UG/KG
BENZO(A)ANTHRACENE	3.3	4.8 U	UG/KG
BENZO(A)PYRENE	6.6	9.5 U	UG/KG
BENZO(B)FLUORANTHENE	6.6	9.5 U	UG/KG
BENZO(G,H,I)PERYLENE	6.6	9.5 U	UG/KG
BENZO(K)FLUORANTHENE	6.6	9.5 U	UG/KG
INDENO(1,2,3-CD)PYRENE	6.6	9.5 U	UG/KG
CHRYSENE	6.6	9.5 U	UG/KG
DIBENZO(A,H)ANTHRACENE	6.6	9.5 U	UG/KG
FLUORANTHENE	6.6	9.5 U	UG/KG
FLUORENE	6.6	9.5 U	UG/KG
2-METHYLNAPHTHALENE	3.3	4.8 U	UG/KG
NAPHTHALENE	6.6	9.5 U	UG/KG
PHENANTHRENE	6.6	9.5 U	UG/KG
PYRENE	6.6	9.5 U J	UG/KG

SURROGATE RECOVERIES	QC LIMITS		
TERPHENYL-d14	(19 - 145 %)	46	%
NITROBENZENE-d5	(18 - 125 %)	85	%
2-FLUOROBIPHENYL	(23 - 120 %)	66	%

COLUMBIA ANALYTICAL SERVICES

EXTRACTABLE ORGANICS
METHOD 8270C
Reported: 11/04/05

ENSR International
Project Reference: PINES AREA OF INVESTIGATION PROJECT#01776-020
Client Sample ID : GP013ICB092305S

Date Sampled : 09/23/05 13:30 **Order #:** 844961 **Sample Matrix:** SOIL/SEDIMEN
Date Received: 09/26/05 **Submission #:** R2527959 **Percent Solid:** 68.8

ANALYTE	PQL	RESULT	UNITS
DATE ANALYZED: 10/12/2005			
DATE EXTRACTED: 10/05/05			
ANALYTICAL DILUTION: 1.00			Dry Weight
ACENAPHTHENE	330	480 U	UG/KG
ACENAPHTHYLENE	330	480 U	UG/KG
ANTHRACENE	330	480 U	UG/KG
BENZO(A)ANTHRACENE	330	480 U	UG/KG
BENZO(A)PYRENE	330	480 U	UG/KG
BENZO(B)FLUORANTHENE	330	480 U	UG/KG
BENZO(G,H,I)PERYLENE	330	480 U	UG/KG
BENZO(K)FLUORANTHENE	330	480 U	UG/KG
INDENO(1,2,3-CD)PYRENE	330	480 U	UG/KG
CHRYSENE	330	480 U	UG/KG
DIBENZO(A,H)ANTHRACENE	330	480 U	UG/KG
FLUORANTHENE	330	480 U	UG/KG
FLUORENE	330	480 U	UG/KG
2-METHYLNAPHTHALENE	330	480 U	UG/KG
NAPHTHALENE	330	480 U	UG/KG
PHENANTHRENE	330	480 U	UG/KG
PYRENE	330	480 U	UG/KG

SURROGATE RECOVERIES	QC LIMITS		
TERPHENYL-d14	(48 - 131)	74	%
NITROBENZENE-d5	(27 - 130)	63	%
2-FLUOROBIPHENYL	(32 - 130)	64	%

Do not report

COLUMBIA ANALYTICAL SERVICES

EXTRACTABLE ORGANICS
METHOD 8270C.LL PAH'S
Reported: 10/27/05

ENSR International
Project Reference: PINES AREA OF INVESTIGATION PROJECT #01776-028
Client Sample ID : GP013ICB092305S

Date Sampled : 09/23/05 13:30 **Order #:** 850979 **Sample Matrix:** SOIL/SEDIMENT
Date Received: 09/26/05 **Submission #:** R2527959 **Percent Solid:** 68.8

ANALYTE	PQL	RESULT	UNITS
DATE EXTRACTED : 10/14/05			
DATE ANALYZED : 10/18/05			
ANALYTICAL DILUTION: 2.00			Dry Weight
ACENAPHTHENE	6.6	19 U	UG/KG
ACENAPHTHYLENE	6.6	19 U	UG/KG
ANTHRACENE	6.6	19 U	UG/KG
BENZO(A)ANTHRACENE	3.3	10 J	UG/KG
BENZO(A)PYRENE	6.6	8.0 J	UG/KG
BENZO(B)FLUORANTHENE	6.6	11 J	UG/KG
BENZO(G,H,I)PERYLENE	6.6	7.0 J	UG/KG
BENZO(K)FLUORANTHENE	6.6	19 U	UG/KG
INDENO(1,2,3-CD)PYRENE	6.6	19 U	UG/KG
CHRYSENE	6.6	12 J	UG/KG
DIBENZO(A,H)ANTHRACENE	6.6	19 U	UG/KG
FLUORANTHENE	6.6	16 J	UG/KG
FLUORENE	6.6	19 U	UG/KG
2-METHYLNAPHTHALENE	3.3	9.6 U	UG/KG
NAPHTHALENE	6.6	19 U	UG/KG
PHENANTHRENE	6.6	19 U	UG/KG
PYRENE	6.6	12 J	UG/KG

SURROGATE RECOVERIES	QC LIMITS		
TERPHENYL-d14	(19 - 145 %)	60	%
NITROBENZENE-d5	(18 - 125 %)	77	%
2-FLUOROBIPHENYL	(23 - 120 %)	63	%

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Attorney-Client Work Product

Memorandum

Date: April 21, 2006
Revised November 14, 2007

To: Lisa Bradley/Westford

From: Sheena Blair/Westford

Subject: Data Validation
Total and Isotopic Uranium Analyses by ICP/MS
Yard 520
Pines Area of Investigation, Indiana
GEL SDG Number 156641

Distribution: D. McGrath/Westford

01776-022-106
PI017met.sbrev.doc

SUMMARY

Full validation was performed on the data for eleven soil samples and one equipment blank analyzed for uranium-235 and uranium-238 by SW-846 Method 6020, and for total uranium (calculated from the uranium-235 and uranium-238 results). The samples were collected at the Pines Area of Investigation in Indiana on September 237, 2005 and submitted to General Engineering Laboratories (GEL) in Charleston, South Carolina for analysis. The samples were initially submitted for radiological analyses and reported under SDG 145339. On February 13, 2006, the samples were authorized for metals analyses by ENSR, and were analyzed and reported by GEL under sample delivery group (SDG) number 156641.

The analytical data were evaluated with reference to with the "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review" (October 2004), and the quality control (QC) criteria specified in the analytical method and/or Yard 520 Quality Assurance Project Plan (QAPP).

In general, the data are valid as reported and may be used for decision making purposes. No data were rejected. Selected data points were qualified as estimated due to certain QC nonconformances (see discussion below).

SAMPLES

The samples included in this review are listed below.

Sample IDs	Sample IDs
GP004ICB092305B (equipment blank)	GP008ICB092305D (field duplicate of GP008ICB092305S)

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Sample IDs	Sample IDs
GP004ICB092305S	GP008ICB092305S
GP005ICB092305S	GP009ICB092305S
GP006ICB092305S	GP010ICB092305S
GP007ICB092305S	GP011ICB092305S

REVIEW ELEMENTS

The data were evaluated based on the following parameters:

- Data completeness
- Holding times and sample preservation
- Inductively coupled plasma-mass spectroscopy (ICP-MS) tunes
- Calibrations
- Laboratory blanks/equipment blanks
- ICP-MS interference check sample (ICS) results
- Matrix spike/matrix spike duplicate (MS/MSD) results
- Laboratory duplicate results
- Field duplicate results
- ICP-MS serial dilution results
- Laboratory control samples (LCS) results
- ICP-MS internal standards performance
- Sample quantitation/detection limit results

DISCUSSION

Data Completeness

Sample reports were reviewed against the analytical requests as designated on the chain-of-custody (COC) and subsequent communications between ENSR and the laboratory. No discrepancies were noted.

Holding Times and Sample Preservation

The cooler temperature was 22°C upon receipt at the laboratory, which grossly exceeded the validation acceptance criteria of 4 ± 2°C. All positive and nondetect metals results were qualified as estimated (J- and UJ, respectively) for all samples analyzed.

The samples were prepared and analyzed within the method-specified holding time for metals.

ICP-MS Tunes

A tuning solution containing elements representing all of the mass regions of interest was analyzed at the beginning of each analytical sequence. The percent relative standard deviations (%RSDs) met the QC acceptance criteria of <5% for metals.

Calibrations

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All criteria were met for the calibration curves and the initial and continuing calibration verification (ICV/CCV) standards for metals.

Although a Contract Required Detection Limit (CRDL) standard is not applicable to SW-846 methods, the laboratory chose to analyze a CRDL standard for metals by ICP-MS. An acceptance limit of 100 ± 30 percent recovery (%R) was used to evaluate these standards. All CRDL standards met the acceptance criteria except for the CRDL standard for uranium-235 (143%), analyzed March 01, 2006. All associated positive results for uranium-235 were >2x the CRDL standard true value; therefore no validation action was taken on this basis.

Laboratory Blanks/Equipment Blanks

No target analytes were detected in the aqueous laboratory blanks or equipment blank GP004ICB092305B

Urianium-238 and total uranium (by calculation) were detected in the soil laboratory preparation (MBs) and/or in the initial and continuing calibration blanks (ICBs and CCBs) at levels greater than the method detection limits (MDLs). The presence of blank contamination indicates that false positive results or false negatives may exist for this element in the associated samples. The following table summarizes the blank contamination. The validation actions taken are discussed below.

Blank/Date	Analyte	Concentration (mg/kg)
MB 3/1/06	Total Uranium	-0.0194
	Uranium-238	-0.0194
ICB/CCBs 3/1/06	Uranium-238	-0.011
Associated samples: All soil samples		

The levels of total uranium and uranium-238 reported in the blank were less than the reporting limits (RLs). The concentrations of these analytes in the associated samples were significantly greater than the RLs. It was considered that the low levels of blank contamination had no impact on the sample results for these analytes; therefore, no qualification of the sample data was necessary.

ICP-MS ICS

All criteria were met for the analysis of the ICS A and ICS AB solutions.

MS/MSD Results

The laboratory performed the MS/MSD analyses on samples from a different client. Although this practice is acceptable, the results could not be directly applied to the samples analyzed in this data package because of possible differences in the sample matrix and type. No validation action was taken on this basis.

Laboratory Duplicate Results

Laboratory duplicate analyses were not performed on the samples in this data set. Precision in the laboratory was demonstrated by the analyses of MS/MSDs (as discussed above).

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Field Duplicate Results

Samples GP008ICB092305S and GP008ICB092305D were submitted as the field duplicate pair with this data set. The following table summarizes the RPDs of the detected analytes in the field duplicate pair. The RPDs were within the acceptance criteria of 50% for a solid matrix.

	GP008ICB092305S (mg/kg)	GP008ICB092305 (mg/kg)	% RPD
Total Uranium	14.6	12.9	12
Uranium -235	0.105	0.0931	12
Uranium -238	14.5	12.8	12

ICP-MS Serial Dilution Results

The laboratory performed serial dilution analyses on samples from a different client. Although this practice is acceptable, the results could not be directly applied to the samples analyzed in this data package because of possible differences in the sample matrix and type. No validation action was taken on this basis.

LCS Results

All LCSs %Rs met the acceptance criteria for all parameters.

ICP-MS Internal Standard Performance

The %Rs for the internal standards met the QC acceptance limits for all analyses.

Sample Quantitation/Detection Limit Results

No dilutions were required for the samples analyzed in this sample set.

Result calculations were spot-checked and no discrepancies were noted.

The following laboratory qualifiers were removed during data validation in order to avoid confusion with the validated results.

Laboratory Qualifiers	Laboratory Definition
<	Less than the RDL

GENERAL ENGINEERING LABORATORIES, LLC
2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Company : ENSR International
Address : 2 Technology Park Drive
Westford, Massachusetts 01886--314

Report Date: March 9, 2006

Contact: Ms. Debra L. McGrath
Project: **Indiana Pines Yard 520**

Client Sample ID:	GP004ICB092305B	Project:	ENSR00205
Sample ID:	156642001	Client ID:	ENSR003
Matrix:	Water		
Collect Date:	23-SEP-05		
Receive Date:	26-SEP-05		
Collector:	Client		

Parameter	Qualifier	Result	Units	Method	Analyst	Date	Time	Batch
Metals Analysis-ICP-MS								
SW846_6020 Isotopic Uranium								
Total Uranium	J	0.200	ug/L	SW846 3005/6020	PRB	03/07/06	0121	506365
Uranium-235	J	0.070	ug/L					
Uranium-238	J	0.200	ug/L					

The above sample is reported on an "as received" basis.

This data report has been prepared and reviewed in accordance with General Engineering Laboratories, LLC standard operating procedures. Please direct any questions to your Project Manager, Edith Kent.

Kristan M. Murray
Reviewed by

GENERAL ENGINEERING LABORATORIES, LLC
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Certificate of Analysis

Company : ENSR International
Address : 2 Technology Park Drive
Westford, Massachusetts 01886--314

Report Date: March 10, 2006

Contact: Ms. Debra L. McGrath
Project: **Indiana Pines Yard 520**

Client Sample ID:	GP004ICB092305S	Project:	ENSR00205
Sample ID:	156641001	Client ID:	ENSR003
Matrix:	Soil		
Collect Date:	23-SEP-05		
Receive Date:	26-SEP-05		
Collector:	Client		
Moisture:	26.7%		

Parameter	Qualifier	Result	Units	Method	Analyst	Date	Time	Batch
Metals Analysis-ICP-MS								
SW846_6020 Isotopic Uranium								
Total Uranium	J-	6.14	mg/kg	SW846 3050B/6020	PRB	03/01/06	1347	506373
Uranium-235	J	0.0445	mg/kg					
Uranium-238		6.09	mg/kg					

The above sample is reported on a dry weight basis except where prohibited by the analytical procedure. This data report has been prepared and reviewed in accordance with General Engineering Laboratories, LLC standard operating procedures. Please direct any questions to your Project Manager, Edith Kent.

Kristan M. Murray
Reviewed by

GENERAL ENGINEERING LABORATORIES, LLC
2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Company : ENSR International
Address : 2 Technology Park Drive
Westford, Massachusetts 01886--314

Report Date: March 10, 2006

Contact: Ms. Debra L. McGrath
Project: **Indiana Pines Yard 520**

Client Sample ID:	GP005ICB092305S	Project:	ENSR00205
Sample ID:	156641002	Client ID:	ENSR003
Matrix:	Soil		
Collect Date:	23-SEP-05		
Receive Date:	26-SEP-05		
Collector:	Client		
Moisture:	38.5%		

Parameter	Qualifier	Result	Units	Method	Analyst	Date	Time	Batch
Metals Analysis-ICP-MS								
SW846_6020 Isotopic Uranium								
Total Uranium	J-	10.4	mg/kg	SW846 3050B/6020	PRB	03/01/06	1319	506373
Uranium-235	J	0.0745	mg/kg					
Uranium-238		10.4	mg/kg					

The above sample is reported on a dry weight basis except where prohibited by the analytical procedure. This data report has been prepared and reviewed in accordance with General Engineering Laboratories, LLC standard operating procedures. Please direct any questions to your Project Manager, Edith Kent.

Kristan M. Murray
Reviewed by

GENERAL ENGINEERING LABORATORIES, LLC
2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Company : ENSR International
Address : 2 Technology Park Drive
Westford, Massachusetts 01886--314

Report Date: March 10, 2006

Contact: Ms. Debra L. McGrath
Project: **Indiana Pines Yard 520**

Client Sample ID:	GP006ICB092305S	Project:	ENSR00205
Sample ID:	156641003	Client ID:	ENSR003
Matrix:	Soil		
Collect Date:	23-SEP-05		
Receive Date:	26-SEP-05		
Collector:	Client		
Moisture:	30%		

Parameter	Qualifier	Result	Units	Method	Analyst	Date	Time	Batch
Metals Analysis-ICP-MS								
SW846_6020 Isotopic Uranium								
Total Uranium	J-	11.1	mg/kg	SW846 3050B/6020	PRB	03/01/06	1321	506373
Uranium-235	U	0.0785	mg/kg					
Uranium-238		11.0	mg/kg					

The above sample is reported on a dry weight basis except where prohibited by the analytical procedure.
This data report has been prepared and reviewed in accordance with General Engineering Laboratories, LLC standard operating procedures. Please direct any questions to your Project Manager, Edith Kent.

Reviewed by Kristan M. Murray

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Certificate of Analysis

Company : ENSR International
Address : 2 Technology Park Drive
Westford, Massachusetts 01886--314

Report Date: March 10, 2006

Contact: Ms. Debra L. McGrath
Project: **Indiana Pines Yard 520**

Client Sample ID:	GP007ICB092305S	Project:	ENSR00205
Sample ID:	156641004	Client ID:	ENSR003
Matrix:	Soil		
Collect Date:	23-SEP-05		
Receive Date:	26-SEP-05		
Collector:	Client		
Moisture:	41.8%		

Parameter	Qualifier	Result	Units	Method	Analyst	Date	Time	Batch
Metals Analysis-ICP-MS								
SW846_6020 Isotopic Uranium								
Total Uranium	J-	14.0	mg/kg	SW846 3050B/6020	PRB	03/01/06	1323	506373
Uranium-235	J	0.0991	mg/kg					
Uranium-238		13.9	mg/kg					

The above sample is reported on a dry weight basis except where prohibited by the analytical procedure.
This data report has been prepared and reviewed in accordance with General Engineering Laboratories, LLC standard operating procedures. Please direct any questions to your Project Manager, Edith Kent.

Kristan M. Murray
Reviewed by

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Certificate of Analysis

Company : ENSR International
Address : 2 Technology Park Drive
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Report Date: March 10, 2006

Contact: Ms. Debra L. McGrath
Project: **Indiana Pines Yard 520**

Client Sample ID:	GP008ICB092305S	Project:	ENSR00205
Sample ID:	156641005	Client ID:	ENSR003
Matrix:	Soil		
Collect Date:	23-SEP-05		
Receive Date:	26-SEP-05		
Collector:	Client		
Moisture:	38.4%		

Parameter	Qualifier	Result	Units	Method	Analyst	Date	Time	Batch
Metals Analysis-ICP-MS								
SW846_6020 Isotopic Uranium								
Total Uranium	J-	14.6	mg/kg	SW846 3050B/6020	PRB	03/01/06	1325	506373
Uranium-235	J	0.105	mg/kg					
Uranium-238		14.5	mg/kg					

The above sample is reported on a dry weight basis except where prohibited by the analytical procedure. This data report has been prepared and reviewed in accordance with General Engineering Laboratories, LLC standard operating procedures. Please direct any questions to your Project Manager, Edith Kent.

Kristan M. Murray
Reviewed by

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Report Date: March 10, 2006

Contact: Ms. Debra L. McGrath
Project: **Indiana Pines Yard 520**

Client Sample ID:	GP009ICB092305S	Project:	ENSR00205
Sample ID:	156641006	Client ID:	ENSR003
Matrix:	Soil		
Collect Date:	23-SEP-05		
Receive Date:	26-SEP-05		
Collector:	Client		
Moisture:	35.2%		

Parameter	Qualifier	Result	Units	Method	Analyst	Date	Time	Batch
Metals Analysis-ICP-MS								
SW846_6020 Isotopic Uranium								
Total Uranium	J -	14.1	mg/kg	SW846 3050B/6020	PRB	03/01/06	1330	506373
Uranium-235		0.100	mg/kg					
Uranium-238	L	14.0	mg/kg					

The above sample is reported on a dry weight basis except where prohibited by the analytical procedure.
This data report has been prepared and reviewed in accordance with General Engineering Laboratories, LLC standard operating procedures. Please direct any questions to your Project Manager, Edith Kent.

Kristen M. Murray
Reviewed by

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Report Date: March 10, 2006
Page 1 of 1

Contact: Ms. Debra L. McGrath
Project: **Indiana Pines Yard 520**

Client Sample ID:	GP010ICB092305S	Project:	ENSR00205
Sample ID:	156641007	Client ID:	ENSR003
Matrix:	Soil		
Collect Date:	23-SEP-05		
Receive Date:	26-SEP-05		
Collector:	Client		
Moisture:	22.3%		

Parameter	Qualifier	Result	Units	Method	Analyst	Date	Time	Batch
Metals Analysis-ICP-MS								
SW846_6020 Isotopic Uranium								
Total Uranium	J-	9.80	mg/kg	SW846 3050B/6020	PRB	03/01/06	1332	506373
Uranium-235	J	0.070	mg/kg					
Uranium-238		9.73	mg/kg					

The above sample is reported on a dry weight basis except where prohibited by the analytical procedure.
This data report has been prepared and reviewed in accordance with General Engineering Laboratories, LLC standard operating procedures. Please direct any questions to your Project Manager, Edith Kent.

Kristan M. Murray
Reviewed by

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Report Date: March 10, 2006
Page 1 of 1

Contact: Ms. Debra L. McGrath
Project: **Indiana Pines Yard 520**

Client Sample ID:	GP01ICB092305S	Project:	ENSR00205
Sample ID:	156641008	Client ID:	ENSR003
Matrix:	Soil		
Collect Date:	23-SEP-05		
Receive Date:	26-SEP-05		
Collector:	Client		
Moisture:	24.1%		

Parameter	Qualifier	Result	Units	Method	Analyst	Date	Time	Batch
Metals Analysis-ICP-MS								
SW846_6020 Isotopic Uranium								
Total Uranium	J-	7.36	mg/kg	SW846 3050B/6020	PRB	03/01/06	1334	506373
Uranium-235	L	0.0513	mg/kg					
Uranium-238		7.31	mg/kg					

The above sample is reported on a dry weight basis except where prohibited by the analytical procedure.
This data report has been prepared and reviewed in accordance with General Engineering Laboratories, LLC standard operating procedures. Please direct any questions to your Project Manager, Edith Kent.

Kristen M. Murray
Reviewed by

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Report Date: March 10, 2006
Page 1 of 1

Contact: Ms. Debra L. McGrath
Project: **Indiana Pines Yard 520**

Client Sample ID:	GP012ICB092305S	Project:	ENSR00205
Sample ID:	156641009	Client ID:	ENSR003
Matrix:	Soil		
Collect Date:	23-SEP-05		
Receive Date:	26-SEP-05		
Collector:	Client		
Moisture:	31.5%		

Parameter	Qualifier	Result	Units	Method	Analyst	Date	Time	Batch
Metals Analysis-ICP-MS								
SW846_6020 Isotopic Uranium								
Total Uranium	J-	10.5	mg/kg	SW846 3050B/6020	PRB	03/01/06	1341	506373
Uranium-235	J	0.075	mg/kg					
Uranium-238		10.4	mg/kg					

The above sample is reported on a dry weight basis except where prohibited by the analytical procedure. This data report has been prepared and reviewed in accordance with General Engineering Laboratories, LLC standard operating procedures. Please direct any questions to your Project Manager, Edith Kent.

Reviewed by Kristan M. Murray

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Report Date: March 10, 2006

Contact: Ms. Debra L. McGrath
Project: **Indiana Pines Yard 520**

Client Sample ID:	GP008ICB092305D	Project:	ENSR00205
Sample ID:	156641010	Client ID:	ENSR003
Matrix:	Soil		
Collect Date:	23-SEP-05		
Receive Date:	26-SEP-05		
Collector:	Client		
Moisture:	39%		

Parameter	Qualifier	Result	Units	Method	Analyst	Date	Time	Batch
Metals Analysis-ICP-MS								
SW846_6020 Isotopic Uranium								
Total Uranium	J-	12.9	mg/kg	SW846 3050B/6020	PRB	03/01/06	1343	506373
Uranium-235	J	0.0931	mg/kg					
Uranium-238		12.8	mg/kg					

The above sample is reported on a dry weight basis except where prohibited by the analytical procedure. This data report has been prepared and reviewed in accordance with General Engineering Laboratories, LLC standard operating procedures. Please direct any questions to your Project Manager, Edith Kent.

Reviewed by Kristan M. Murray

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Report Date: March 10, 2006
Page 1 of 1

Contact: Ms. Debra L. McGrath
Project: **Indiana Pines Yard 520**

Client Sample ID:	GP013ICB092305S	Project:	ENSR00205
Sample ID:	156641011	Client ID:	ENSR003
Matrix:	Soil		
Collect Date:	23-SEP-05		
Receive Date:	26-SEP-05		
Collector:	Client		
Moisture:	27%		

Parameter	Qualifier	Result	Units	Method	Analyst	Date	Time	Batch
Metals Analysis-ICP-MS								
SW846_6020 Isotopic Uranium								
Total Uranium	J-	8.51	mg/kg	SW846 3050B/6020	PRB	03/01/06	1345	506373
Uranium-235	J	0.0601	mg/kg					
Uranium-238		8.45	mg/kg					

The above sample is reported on a dry weight basis except where prohibited by the analytical procedure.
This data report has been prepared and reviewed in accordance with General Engineering Laboratories, LLC standard operating procedures. Please direct any questions to your Project Manager, Edith Kent.

Reviewed by Kristen M. Murray

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Memorandum

Date: March 10, 2007

To: Lisa Bradley/Westford

From: Linda Sulkowski/Westford

Subject: Data Validation
Uranium Analysis
RI/FS 2nd Quarter Sampling
Pines Area of Investigation, Indiana
GEL SDG 174855

Distribution: D. Simmons/Westford

01776-036-102
PI046

SUMMARY

Full validation was performed on the data for one sediment sample analyzed for uranium using SW-846 method 6020. Total uranium results were calculated from the sum of uranium isotope 235 (U-235) and uranium isotope 238 (U-238). The sample was collected at the Pines Area of Investigation in Indiana on October 23, 2006 and submitted to General Engineering Laboratories, LLC (GEL) in Charleston, South Carolina for analysis. GEL processed this sample under sample delivery group (SDG) 174855.

The analytical data were evaluated with reference to the "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review" (February 1994 and October 2004) and the quality control (QC) criteria specified in the analytical method and/or the Quality Assurance Project Plan (QAPP) for the Remedial Investigation/Feasibility Study (RI/FS) for the Pines Area of Investigation. Modification of the Functional Guidelines was performed to accommodate the non-CLP methodology.

In general, the data are valid as reported and may be used for decision making purposes. No data were rejected. One data point was qualified due to nonconformances of certain QC criteria (see discussion below).

SAMPLES

The sample included in this review is listed below.

Sample ID
SW001ASD102306S

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REVIEW ELEMENTS

Sample data were reviewed for the following parameters:

- Agreement of analyses conducted with chain-of-custody (COC) requests
- Holding times/sample preservation
- Inductively coupled plasma/mass spectrometry (ICP/MS) tuning
- Calibrations
- Laboratory blanks/equipment blanks/field blanks
- ICP interference check sample results
- Matrix spike/matrix spike duplicate (MS/MSD) results
- Laboratory duplicate results
- Field duplicate results
- Laboratory control sample (LCS) results
- Internal standard performance
- ICP serial dilution results
- Sample quantitation/detection limit results

DISCUSSION

Agreement of Analyses Conducted With COC Requests

Sample reports were reviewed against the analytical requests as designated on the COC and subsequent communications between ENSR and the laboratory. No discrepancies were noted.

Holding Times/Sample Preservation

The sample was digested and analyzed within the method-specified holding time.

The cooler temperature was 5°C upon receipt at the laboratory, which was within the acceptance criteria of 4 ± 2°C.

ICP/MS Tuning

A tuning solution containing elements representing all of the mass regions of interest was analyzed at the beginning of each analytical sequence. The percent relative standard deviations (%RSDs) met the QC acceptance criteria of <5%.

Calibrations

All criteria were met for the calibration curves and the initial and continuing calibration verification (ICV/CCV) standards.

Although the analysis of a low level check standard is not required by SW-846 method 6020, the laboratory chose to analyze a low-level check standard containing uranium isotopes. An acceptance

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limit of 100 ± 20 percent recovery (%R) was used to evaluate these standards. The following table summarizes the standard recovery that fell below the QC acceptance criteria and the associated sample.

Date Analyzed	Standard	Analyte	%R	True Value
11/2/06	CRDL01	U-235	71.4	0.0014 µg/L
Associated Sample: SW001ASD102306S.				

Sample results were qualified as follows:

- If the %R was < 80%, and the positive sample result was < 2x the concentration of the check standard, then the positive result was qualified as estimated biased low (J-).
- If the %R was < 80%, and the positive sample result was > 2x the concentration of the check standard, then the result was accepted unqualified.
- If the %R was < 80%, then the nondetect result was estimated (UJ).

Laboratory Blanks/Equipment Blanks/Field Blanks

There were no field and equipment rinsate blank samples associated with this sample set. No validation action was necessary on this basis, as this was consistent with the requirements of the QAPP.

All sample and laboratory blank results were reported down to the method detection limit (MDL) and nondetects were reported at the MDL. Blank actions, if applicable, were applied based on the February 1994 National Functional Guidelines rather than the 2004 guidelines since all nondetect results were reported at the MDL. The qualifiers associated with the blank actions; however, are consistent with the 2004 guidelines.

Uranium isotopes were not detected in the laboratory preparation blank or in the continuing calibration blanks (CCBs). U-238 was detected in the initial calibration blank (ICB) associated with the sample. The presence of blank contamination indicates that false positive results may exist for this compound in the associated sample. An Action Level (AL) was established for U-238 at 5x the concentration in the blank detected and was used to qualify sample data. The following table summarizes the AL.

Type of Blank	Analyte	Maximum Blank Concentration (µg/L)	AL (mg/Kg)
ICB	U-238	0.052	0.025
Associated Sample: SW001ASD102306S			

Sample results were qualified as follows:

- Positive sample results ≤ the positive AL were qualified as nondetect (U) at the reported concentration.
- Positive sample results > AL and nondetects were accepted unqualified.

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ICP Interference Check Sample Results

All criteria were met for the analysis of the ICS AB solution. Uranium isotopes were not detected at a concentration greater than the method detection limit (MDL) in the ICS A solution.

MS/MSD Results

MS/MSD analyses were performed on sample SW001ASD102306S. The %Rs and relative percent differences (RPDs) met the QC acceptance criteria for uranium isotopes.

The laboratory did not perform a post-digestion spike but chose to perform a pre-digestion spike for uranium isotopes instead. No validation action was taken since it is the opinion of the validator that the pre-digestion spike is an equivalent indicator of the accuracy of the analytical procedure and a better indicator of the accuracy of the digestion procedure.

Laboratory Duplicate Results

Laboratory duplicate analyses were not performed on the sample from this sample set. The laboratory used the MS/MSD analyses performed on sample SW001ASD102306S to demonstrate precision.

Field Duplicate Results

The following field duplicate pair was associated with the sample in this data set:

Sample IDs	SDG
SW023ASD102406S/SW023ASD102406D	174990

The RPDs of uranium isotopes in the field duplicate samples reported in SDG 174990 were within the acceptance criterion of ≤ 30%.

Internal Standard Performance

The internal standard performance was within the QC acceptance criteria in the sample analyses.

ICP Serial Dilution Results

A serial dilution analysis was performed on sample SW001ASD102306S. The percent differences met the acceptance criteria for uranium isotopes.

LCS Results

The %Rs of uranium isotopes met the QC acceptance criteria for the LCS analysis.

Sample Quantitation/Detection Limit Results

The positive results for uranium isotopes were reported to the MDL. Nondetect results were flagged as "U" at the MDL.

Sample SW001ASD102306S was analyzed at a 2x dilution due to the matrix of the sample. Reporting limits, MDLs, and sample results were adjusted accordingly.

METALS
-1-
INORGANICS ANALYSIS DATA PACKAGE

SDG No: 174855 **METHOD TYPE:** SW846

SAMPLE ID: 174855001 **CLIENT ID:** SW001ASD102306S

CONTRACT: ENSRIndianaPines

MATRIX: S **DATE RECEIVED** 25-OCT-06 **LEVEL:** Low **%SOLIDS:** 64

CAS No	Analyte	Result	Units	C	Qual	M	MDL	DF	Instrument ID	Analytical Run
7440-61-1	Total Uranium	0.160	mg/kg			MS	0.0151	2	ICPMS5	061102-1
15117-96-1	Uranium-235	0.00301	mg/kg	U		MS	0.00301	2	ICPMS5	061102-1
7440-61-1	Uranium-238	0.160	mg/kg			MS	0.0151	2	ICPMS5	061102-1

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Memorandum

Date: March 10, 2007
Revised September 14, 2007

To: Lisa Bradley/Westford

From: Linda Sulkowski/Westford

Subject: Data Validation
Uranium Analyses
RI/FS 2nd Quarter Sampling
Pines Area of Investigation, Indiana
GEL SDG 174990

Distribution: D. Simmons/Westford

01776-036-102
PI048rev

SUMMARY

Limited validation was performed on the data for six soil samples analyzed for uranium using SW-846 method 6020. Total uranium results were calculated from the sum of uranium isotope 235 (U-235) and uranium isotope 238 (U-238). The samples were collected at the Pines Area of Investigation in Indiana on October 24, 2006 and submitted to General Engineering Laboratories, LLC (GEL) in Charleston, South Carolina for analysis. GEL processed these samples under sample delivery group (SDG) 174990.

The analytical data were evaluated with reference to the "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review" (February 1994 and October 2004) and the quality control (QC) criteria specified in the analytical method and/or the Quality Assurance Project Plan (QAPP) for the Remedial Investigation/Feasibility Study (RI/FS) for the Pines Area of Investigation. Modification of the Functional Guidelines was performed to accommodate the non-CLP methodology.

In general, the data are valid as reported and may be used for decision making purposes. No data were rejected. Selected data points were qualified due to nonconformances of certain QC criteria (see discussion below).

SAMPLES

The samples included in this review are listed below.

Sample IDs
SW022ASD102406S
SW022BSD102406S

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Sample IDs
SW023ASD102406S
SW023ASD102406D (Field duplicate of SW023ASD102406S)
SW023BSD102406S
SW024ASD102406S

REVIEW ELEMENTS

Sample data were reviewed for the following parameters:

- Agreement of analyses conducted with chain-of-custody (COC) requests
- Holding times/sample preservation
- Inductively coupled plasma/mass spectrometry (ICP/MS) tuning
- Calibrations
- Laboratory blanks/equipment blanks/field blanks
- Matrix spike/matrix spike duplicate (MS/MSD) results
- Laboratory duplicate results
- Field duplicate results
- Laboratory control sample (LCS) results
- Sample quantitation/detection limit results

DISCUSSION

Agreement of Analyses Conducted With COC Requests

Sample reports were reviewed against the analytical requests as designated on the COC and subsequent communications between ENSR and the laboratory. No discrepancies were noted.

Holding Times/Sample Preservation

The samples were digested and analyzed within the method-specified holding time.

The cooler temperature was 6°C upon receipt at the laboratory, which was within the acceptance criteria of 4 ± 2°C.

ICP/MS Tuning

A tuning solution containing elements representing all of the mass regions of interest was analyzed at the beginning of each analytical sequence. The percent relative standard deviations (%RSDs) met the QC acceptance criterion of <5%.

Calibrations

All criteria were met for the calibration curves and the initial and continuing calibration verification (ICV/CCV) standards.

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Although the analysis of a low level check standard is not required by SW-846 method 6020, the laboratory chose to analyze a low-level check standard containing uranium isotopes. An acceptance limit of 100 ± 20 percent recovery (%R) was used to evaluate these standards. The following table summarizes the standard recovery that fell below the QC acceptance criteria and the associated samples.

Date Analyzed	Standard	Analyte	%R	True Value
11/2/06	CRDL01	U-235	71.4	0.0014 µg/L
Associated Samples: All samples in this sample set.				

Sample results were qualified as follows:

- If the %R was < 80%, and the positive sample result was < 2x the concentration of the check standard, then the positive result was qualified as estimated biased low (J-).
- If the %R was < 80%, and the positive sample result was > 2x the concentration of the check standard, then the result was accepted unqualified.
- If the %R was < 80%, then the nondetect result was estimated (UJ).

Laboratory Blanks/Equipment Blanks/Field Blanks

There were no field and equipment rinsate blank samples associated with this sample set. No validation action was necessary on this basis, as this was consistent with the requirements of the QAPP.

All sample and laboratory blank results were reported down to the method detection limit (MDL) and nondetects were reported at the MDL. Blank actions, if applicable, were applied based on the February 1994 National Functional Guidelines rather than the 2004 guidelines since all nondetect results were reported at the MDL. The qualifiers associated with the blank actions; however, are consistent with the 2004 guidelines.

Uranium isotopes were not detected in the laboratory preparation blank. U-238 was detected in the initial and continuing calibration blanks (ICB/CCBs). The presence of blank contamination indicates that false positive results may exist for this compound in the associated samples. An Action Level (AL) was established for U-238 at 5x the maximum concentration detected in the blanks and was used to qualify sample data. The following table summarizes the AL.

Type of Blank	Analyte	Maximum Blank Concentration (µg/L)	AL (mg/Kg)
CCB	U-238	0.071	0.036
Associated samples: All samples in this sample set.			

Sample results were qualified as follows:

- Positive sample results ≤ the positive AL were qualified as nondetect (U) at the reported concentration.
- Positive sample results > AL and nondetects were accepted unqualified.

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MS/MSD Results

MS/MSD analyses were performed on sample SW022ASD102406S. The %Rs and relative percent differences (RPDs) met the QC acceptance criteria for uranium isotopes.

The laboratory did not perform a post-digestion spike but chose to perform a pre-digestion spike for uranium isotopes instead. No validation action was taken since it is the opinion of the validator that the pre-digestion spike is an equivalent indicator of the accuracy of the analytical procedure and a better indicator of the accuracy of the digestion procedure.

Laboratory Duplicate Results

Laboratory duplicate analyses were not performed on the sample from this sample set. The laboratory used the MS/MSD analyses performed on sample SW022ASD102406S to demonstrate precision.

Field Duplicate Results

The following field duplicate pair was associated with the samples in this data set:

Sample IDs	SDG
SW023ASD102406S/SW023ASD102406D	This SDG

The following table summarizes the RPDs of uranium in field duplicate samples SW023ASD102406S and SW023ASD102406D. The RPDs for total uranium and U-238 exceeded the QC acceptance criterion of ≤25%. The positive and nondetect results for total uranium and U-238 in all the soil samples were qualified as estimated (J and UJ). The remaining RPD met the acceptance criterion of ≤ 25%.

Analyte	SW023ASD102406S (mg/Kg)	SW023ASD102406D (mg/Kg)	RPD
Total Uranium	0.690	0.90	26
U-235	0.005	0.0065	17
U-238	0.690	0.890	25

LCS Results

The %Rs of uranium isotopes met the QC acceptance criteria for the LCS analysis.

Sample Quantitation/Detection Limit Results

The positive results for uranium isotopes were reported to the MDL. Nondetect results were flagged as "U" at the MDL.

Results between the IDL and the SQL were flagged with a "B" by the laboratory on the Form Is. The "B" qualifier was crossed-off during validation and replaced with a "J" qualifier to indicate that the result was estimated due to uncertainty below the SQL. It should be noted that no bias codes (+ or -) were applied to this "J" qualifier, even if a bias was indicated by other QC nonconformances. In addition, if a result

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initially reported as detected and flagged with a "B" was subsequently negated (qualified as U) due to blank contamination then the overall qualification was "UJ" to indicate an estimated nondetect.

All samples were analyzed at 2x dilutions due to the matrix of the samples. MDLs, RLs, and sample results were adjusted accordingly.

METALS
-1-
INORGANICS ANALYSIS DATA PACKAGE

SDG No: 174990 **METHOD TYPE:** SW846

SAMPLE ID: 174990001 **CLIENT ID:** SW022ASD102406S

CONTRACT: ENSRIndianaPines

MATRIX: S **DATE RECEIVED** 26-OCT-06 **LEVEL:** Low **%SOLIDS:** 29

CAS No	Analyte	Result	Units	C	Qual	M	MDL	DF	Instrument ID	Analytical Run
7440-61-1	Total Uranium	0.440	mg/kg		J	MS	0.0328	2	ICPMS5	061102-1
15117-96-1	Uranium-235	0.00657	mg/kg	U	J	MS	0.00657	2	ICPMS5	061102-1
7440-61-1	Uranium-238	0.440	mg/kg		J	MS	0.0328	2	ICPMS5	061102-1

METALS
-1-
INORGANICS ANALYSIS DATA PACKAGE

SDG No: 174990 **METHOD TYPE:** SW846

SAMPLE ID: 174990002 **CLIENT ID:** SW022BSD102406S

CONTRACT: ENSRIndianaPines

MATRIX: S **DATE RECEIVED** 26-OCT-06 **LEVEL:** Low **%SOLIDS:** 35

CAS No	Analyte	Result	Units	C	Qual	M	MDL	DF	Instrument ID	Analytical Run
7440-61-1	Total Uranium	0.750	mg/kg		J	MS	0.0281	2	ICPMS5	061102-1
15117-96-1	Uranium-235	0.00562	mg/kg	U	J	MS	0.00562	2	ICPMS5	061102-1
7440-61-1	Uranium-238	0.740	mg/kg		J	MS	0.0281	2	ICPMS5	061102-1

METALS
-1-
INORGANICS ANALYSIS DATA PACKAGE

SDG No: 174990 **METHOD TYPE:** SW846

SAMPLE ID: 174990003 **CLIENT ID:** SW023ASD102406S

CONTRACT: ENSRIndianaPines

MATRIX: S **DATE RECEIVED** 26-OCT-06 **LEVEL:** Low **%SOLIDS:** 47

CAS No	Analyte	Result	Units	C	Qual	M	MDL	DF	Instrument ID	Analytical Run
7440-61-1	Total Uranium	0.690	mg/kg		J	MS	0.0207	2	ICPMS5	061102-1
15117-96-1	Uranium-235	0.005	mg/kg	B	J	MS	0.00414	2	ICPMS5	061102-1
7440-61-1	Uranium-238	0.690	mg/kg		J	MS	0.0207	2	ICPMS5	061102-1

METALS
-1-
INORGANICS ANALYSIS DATA PACKAGE

SDG No: 174990 **METHOD TYPE:** SW846

SAMPLE ID: 174990004 **CLIENT ID:** SW023ASD102406D

CONTRACT: ENSRIndianaPines

MATRIX: S **DATE RECEIVED** 26-OCT-06 **LEVEL:** Low **%SOLIDS:** 47

CAS No	Analyte	Result	Units	C	Qual	M	MDL	DF	Instrument ID	Analytical Run
7440-61-1	Total Uranium	0.90	mg/kg		J	MS	0.0201	2	ICPMS5	061102-1
15117-96-1	Uranium-235	0.0065	mg/kg	B	J	MS	0.00403	2	ICPMS5	061102-1
7440-61-1	Uranium-238	0.890	mg/kg		J	MS	0.0201	2	ICPMS5	061102-1

METALS
-1-
INORGANICS ANALYSIS DATA PACKAGE

SDG No: 174990 **METHOD TYPE:** SW846

SAMPLE ID: 174990005 **CLIENT ID:** SW023BSD102406S

CONTRACT: ENSRIndianaPines

MATRIX: S **DATE RECEIVED** 26-OCT-06 **LEVEL:** Low **%SOLIDS:** 76

CAS No	Analyte	Result	Units	C	Qual	M	MDL	DF	Instrument ID	Analytical Run
7440-61-1	Total Uranium	0.390	mg/kg		J	MS	0.013	2	ICPMS5	061102-1
15117-96-1	Uranium-235	0.0029	mg/kg	B	J	MS	0.0026	2	ICPMS5	061102-1
7440-61-1	Uranium-238	0.390	mg/kg		J	MS	0.013	2	ICPMS5	061102-1

METALS
-1-
INORGANICS ANALYSIS DATA PACKAGE

SDG No: 174990 **METHOD TYPE:** SW846

SAMPLE ID: 174990006 **CLIENT ID:** SW024ASD102406S

CONTRACT: ENSRIndianaPines

MATRIX: S **DATE RECEIVED** 26-OCT-06 **LEVEL:** Low **%SOLIDS:** 62

CAS No	Analyte	Result	Units	C	Qual	M	MDL	DF	Instrument ID	Analytical Run
7440-61-1	Total Uranium	0.260	mg/kg		J	MS	0.0155	2	ICPMS5	061102-1
15117-96-1	Uranium-235	0.00311	mg/kg	U	J	MS	0.00311	2	ICPMS5	061102-1
7440-61-1	Uranium-238	0.260	mg/kg		J	MS	0.0155	2	ICPMS5	061102-1

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Memorandum

Date: March 10, 2007

To: Lisa Bradley/Westford

From: Linda Sulkowski/Westford

Subject: Data Validation
Uranium Analysis
RI/FS 2nd Quarter Sampling
Pines Area of Investigation, Indiana
GEL SDG 175104

Distribution: D. Simmons/Westford

01776-036-102
PI049

SUMMARY

Limited validation was performed on the data for one soil sample analyzed for uranium using SW-846 method 6020. Total uranium results were calculated from the sum of uranium isotope 235 (U-235) and uranium isotope 238 (U-238). The sample was collected at the Pines Area of Investigation in Indiana on October 25, 2006 and submitted to General Engineering Laboratories, LLC (GEL) in Charleston, South Carolina for analysis. GEL processed this sample under sample delivery group (SDG) 175104.

The analytical data were evaluated with reference to the "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review" (February 1994 and October 2004) and the quality control (QC) criteria specified in the analytical method and/or the Quality Assurance Project Plan (QAPP) for the Remedial Investigation/Feasibility Study (RI/FS) for the Pines Area of Investigation. Modification of the Functional Guidelines was performed to accommodate the non-CLP methodology.

In general, the data are valid as reported and may be used for decision making purposes. No data were rejected. One data point was qualified due to nonconformances of certain QC criteria (see discussion below).

SAMPLES

The sample included in this review is listed below.

Sample ID
SW020ASD102506S

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REVIEW ELEMENTS

Sample data were reviewed for the following parameters:

- Agreement of analyses conducted with chain-of-custody (COC) requests
- Holding times/sample preservation
- Inductively coupled plasma/mass spectrometry (ICP/MS) tuning
- Calibrations
- Laboratory blanks/equipment blanks/field blanks
- Matrix spike/matrix spike duplicate (MS/MSD) results
- Laboratory duplicate results
- Field duplicate results
- Laboratory control sample (LCS) results
- Sample quantitation/detection limit results

DISCUSSION

Agreement of Analyses Conducted With COC Requests

Sample reports were reviewed against the analytical requests as designated on the COC and subsequent communications between ENSR and the laboratory. No discrepancies were noted.

The sample reported in this SDG was a subset of the samples listed on the COC. The remaining samples listed on the COC were reported in SDGs 175110 and 175112. No validation action was taken on this basis.

Holding Times/Sample Preservation

The sample was digested and analyzed within the method-specified holding time.

The cooler temperature was 5°C upon receipt at the laboratory, which was within the acceptance criteria of 4 ± 2°C.

ICP/MS Tuning

A tuning solution containing elements representing all of the mass regions of interest was analyzed at the beginning of each analytical sequence. The percent relative standard deviations (%RSDs) met the QC acceptance criterion of <5%.

Calibrations

All criteria were met for the calibration curves and the initial and continuing calibration verification (ICV/CCV) standards.

Although the analysis of a low level check standard is not required by SW-846 method 6020, the laboratory chose to analyze a low-level check standard containing uranium isotopes. An acceptance

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limit of 100 ± 20 percent recovery (%R) was used to evaluate these standards. The following table summarizes the standard recovery that fell below the QC acceptance criteria and the associated samples.

Date Analyzed	Standard	Analyte	%R	True Value
11/2/06	CRDL01	U-235	71.4	0.0014 µg/L
Associated Sample: SW020ASD102306S				

Sample results were qualified as follows:

- If the %R was < 80%, and the positive sample result was < 2x the concentration of the check standard, then the positive result was qualified as estimated biased low (J-).
- If the %R was < 80%, and the positive sample result was > 2x the concentration of the check standard, then the result was accepted unqualified.
- If the %R was < 80%, then the nondetect result was estimated (UJ).

Laboratory Blanks/Equipment Blanks/Field Blanks

There were no field and equipment rinsate blank samples associated with this sample set. No validation action was necessary on this basis, as this was consistent with the requirements of the QAPP.

All sample and laboratory blank results were reported down to the method detection limit (MDL) and nondetects were reported at the MDL. Blank actions, if applicable, were applied based on the February 1994 National Functional Guidelines rather than the 2004 guidelines since all nondetect results were reported at the MDL. The qualifiers associated with the blank actions; however, are consistent with the 2004 guidelines.

Uranium isotopes were not detected in the laboratory preparation blank or in the continuing calibration blanks (CCBs). U-238 was detected in the initial calibration blank (ICB) associated with the sample. The presence of blank contamination indicates that false positive results may exist for this compound in the associated sample. An Action Level (AL) was established for U-238 at 5x the concentration detected in the blank and was used to qualify sample data. The following table summarizes the AL.

Type of Blank	Analyte	Maximum Blank Concentration (µg/L)	AL (mg/Kg)
ICB	U-238	0.052	0.025
Associated Sample: SW020ASD102306S			

Sample results were qualified as follows:

- Positive sample results ≤ the positive AL were qualified as nondetect (U) at the reported concentration.
- Positive sample results > AL and nondetects were accepted unqualified.

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MS/MSD Results

MS/MSD analyses were performed on sample SW020ASD102506S. The %Rs and relative percent differences (RPDs) met the QC acceptance criteria for uranium isotopes.

The laboratory did not perform a post-digestion spike but chose to perform a pre-digestion spike for uranium isotopes instead. No validation action was taken since it is the opinion of the validator that the pre-digestion spike is an equivalent indicator of the accuracy of the analytical procedure and a better indicator of the accuracy of the digestion procedure.

Laboratory Duplicate Results

Laboratory duplicate analyses were not performed on the sample from this sample set. The laboratory used the MS/MSD analyses performed on sample SW020ASD102506S to demonstrate precision.

Field Duplicate Results

The following field duplicate pair was associated with the sample in this data set:

Sample IDs	SDG
SW023ASD102406S/SW023ASD102406D	174990

The RPD of uranium in the field duplicate samples reported in SDG 174990 was within the acceptance criterion of $\leq$ 30%.

LCS Results

The %Rs of uranium isotopes met the QC acceptance criteria for the LCS analysis.

Sample Quantitation/Detection Limit Results

The positive results for uranium isotopes were reported down to the MDL. Nondetect results were flagged as "U" at the MDL.

Sample SW020ASD102506S was analyzed at a 2x dilution due to the matrix of the sample. Reporting limits, MDLs, and sample results were adjusted accordingly.

METALS
-1-
INORGANICS ANALYSIS DATA PACKAGE

SDG No: 125704 METHOD TYPE: SW846

SAMPLE ID: 125704[A01] CLIENT ID: SW026ASD 0250-S

CONTRACT: DNSRImmanuelPines

MATRIX: S DATE RECEIVED: 27-OCT-09 LEVEL: Low %SOLIDS: 84

CAS No.	Analyte	Result	Units	C	Qual	M	MDL	DF	Instrument ID	Analytical Run
7440-61-1	Total Uranium	0.270	mg/kg			MS	0.0153	2	ICPMS5	061102-1
15117-96-1	Uranium-235	0.00304	mg/kg	U	J	MS	0.00304	2	ICPMS5	061102-1
7440-61-1	Uranium-238	0.210	mg/kg			MS	0.0152	2	ICPMS5	061102-1

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Memorandum

Date: January 26, 2007

To: Lisa Bradley/Westford

From: Lisa Krowitz/Westford

Subject: Data Validation
Radiological Analyses
RI/FS 2nd Quarter Sampling
Pines Area of Investigation, Indiana
GEL SDG Number 174854

Distribution: D. Simmons/Westford

01776-036-102
PI054rad.lkk

SUMMARY

Full validation was performed on the data for one sediment sample analyzed for Actinium-227 (Ac-227), Lead-210 (Pb-210), Polonium-210 (Po-210), Protactinium-231 (Pa-231), Radium-226 (Ra-226), Radium-228 (Ra-228), Thorium-228 (Th-228), Thorium-230 (Th-230), Thorium-232 (Th-232), Uranium-234 (U-234), Uranium-235 (U-235), and Uranium-238 (U-238) by DOE EML HASL-300. The sample was collected at the Pines Area of Investigation in Pines, Indiana on October 23, 2006 and submitted to General Engineering Laboratories (GEL) in Charleston, South Carolina for analysis. GEL processed this sample under sample delivery group (SDG) number 174854.

The analytical data were evaluated with reference to the Department of Energy *Evaluation of Radiochemical Data Usability (1997)*, the *Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP)*, July 2004, and the quality control (QC) criteria specified in the analytical method and/or the Remedial Investigation/ Feasibility Study (RI/FS) Quality Assurance Project Plan (QAPP).

In general, the data were valid as reported and may be used for decision making purposes. No data were rejected or qualified as estimated.

SAMPLE

The sample included in this review was:

Sample ID
SW001ASD102306S

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REVIEW ELEMENTS

Sample data were reviewed for the following parameters:

- Agreement of analyses conducted with chain-of-custody (COC) requests
- Holding times/sample preservation
- Calibrations
- Laboratory method blank/equipment blank results
- Laboratory control sample (LCS) results
- Laboratory duplicate results
- Field duplicate results
- Sample quantitation/detection limit results

DISCUSSION

Agreement of Analyses Conducted With COC Requests

Sample reports were reviewed against the analytical requests as designated on the COC and subsequent communications between ENSR and the laboratory. No discrepancies were noted.

Holding Times/Sample Preservation

The samples were prepared and analyzed within the method-specified holding times. No issues with sample preservation were noted upon receipt in the laboratory.

Calibrations

All criteria were met for energy and efficiency calibrations and instrument backgrounds.

Laboratory Method Blank/Equipment Blank Results

Consistent with the QAPP, there were no equipment blanks associated with this data set.

There were no contaminants detected above the minimum detectable concentrations (MDCs)/detection limits (DLs) and/or reporting limits (RLs) for all nuclides analyzed in the laboratory method blank.

It should be noted that the U-235 result in the laboratory method blank was reported by the laboratory as 0.00 UI with an explanation that the result was rejected due to no valid peak. Upon further discussion with the laboratory, it was determined that this result in the laboratory blank was nondetect.

LCS Results

The LCS was spiked with Am-241, Cs-137, and Co-60. All LCSs %Rs met the acceptance criteria for these nuclides.

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Laboratory Duplicate Results

Sample SW001ASD102306S was used for laboratory duplicate analyses for all nuclides. The relative percent differences (RPDs) for Pb-210 and Po-210 were not calculable due to nondetect results in the duplicate sample. Precision was deemed acceptable for Pb-210 and Po-210 since the detected results in the sample were less than 5 times the RL. The RPD for Ra-228 exceeded the acceptance criteria, but was deemed acceptable since the sample and duplicate results were less than 5 times the RL and the absolute difference between the results was less than 2 times the RL. The remaining RPDs met the acceptance criterion of 35%.

Field Duplicate Results

The field duplicate samples associated with this data set were samples SW023ASD102406S and SW023ASD102406D, which were submitted in GEL SDG 174989. The RPDs for Pb-210 and Po-210 were not calculable due to nondetect results in the sample. Precision was deemed acceptable for Pb-210 and Po-210 since the detected results in the field duplicate sample were less than 10 times the RL and the absolute difference between the results was less than 8 times the RL. The remaining RPDs met the acceptance criterion of 50%.

Sample Quantitation/Detection Limit Results

The DL for Pa-231 in sample SW001ASD102306S was greater than the requested RL. No action was taken, except to note this noncompliance.

The laboratory reported all negative results and activities below the MDC, but flagged them with a "U" to indicate that they were considered to be not detected. This approach was consistent with the project objectives, and no change to the qualification was made during validation.

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Certificate of Analysis

Company : ENSR International
Address : 2 Technology Park Drive
Westford, Massachusetts 01886–3140

Report Date: January 19, 2007

Contact: Ms. Debra L. Simmons
Project: **Indiana Pines**

Client Sample ID: SW001ASD102306S
Sample ID: 174854009
Matrix: SE
Collect Date: 23–OCT–06 09:45
Receive Date: 25–OCT–06
Collector: Client

Project: ENSRIndianaPines
Client ID: ENSR003

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Solid (Long List)											
Actinium–227	U	–0.0376	+/–0.0765	0.134	0.160	pCi/g		MJH1 11/09/06	0529	583398	1
Lead–210		0.362	+/–0.210	0.162	3.00	pCi/g					
Polonium–210		0.362	+/–0.210	0.162	3.00	pCi/g					
Protactinium–231	U	–0.295	+/–0.305	0.520	0.500	pCi/g					
Radium–226		0.357	+/–0.0407	0.0268	0.200	pCi/g					
Radium–228		0.317	+/–0.0743	0.0519	0.300	pCi/g					
Thorium–228		0.261	+/–0.0224	0.0193	0.400	pCi/g					
Thorium–230		0.357	+/–0.0407	0.0268	0.500	pCi/g					
Thorium–232		0.257	+/–0.022	0.019	0.400	pCi/g					
Uranium–234		0.398	+/–0.0646	0.0478	3.00	pCi/g					
Uranium–235	U	0.0299	+/–0.0385	0.0716	0.100	pCi/g					
Uranium–238	U	0.164	+/–0.201	0.181	0.500	pCi/g					

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL–RAD–A–021	LXM2	10/26/06	0927	582835

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

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Certificate of Analysis Report
for

ENSR003 ENSR International

Client SDG: 174854 GEL Work Order: 174854

The Qualifiers in this report are defined as follows:

* A quality control analyte recovery is outside of specified acceptance criteria

** Analyte is a surrogate compound

U Analyte was analyzed for, but not detected above the MDL, MDA, or LOD.

UI Gamma Spectroscopy--Uncertain identification

ND The analyte concentration is not detected above the detection limit.

The above sample is reported on a dry weight basis except where prohibited by the analytical procedure.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the Certificate of Analysis.

This data report has been prepared and reviewed in accordance with GEL Laboratories LLC standard operating procedures. Please direct any questions to your Project Manager, Edith Kent.

Reviewed by

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Memorandum

Date: January 26, 2007

To: Lisa Bradley/Westford

From: Lisa Krowitz/Westford

Subject: Data Validation
Radiological Analyses
RI/FS 2nd Quarter Sampling
Pines Area of Investigation, Indiana
GEL SDG Number 175102

Distribution: D. Simmons/Westford

01776-036-102
PI055rad.lkk

SUMMARY

Limited validation was performed on the data for one sediment sample analyzed for Actinium-227 (Ac-227), Lead-210 (Pb-210), Polonium-210 (Po-210), Protactinium-231 (Pa-231), Radium-226 (Ra-226), Radium-228 (Ra-228), Thorium-228 (Th-228), Thorium-230 (Th-230), Thorium-232 (Th-232), Uranium-234 (U-234), Uranium-235 (U-235), and Uranium-238 (U-238) by DOE EML HASL-300. The sample was collected at the Pines Area of Investigation in Pines, Indiana on October 25, 2006 and submitted to General Engineering Laboratories (GEL) in Charleston, South Carolina for analysis. GEL processed this sample under sample delivery group (SDG) number 175102.

The analytical data were evaluated with reference to the Department of Energy *Evaluation of Radiochemical Data Usability (1997)*, the *Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP)*, July 2004, and the quality control (QC) criteria specified in the analytical method and/or the Remedial Investigation/ Feasibility Study (RI/FS) Quality Assurance Project Plan (QAPP).

In general, the data were valid as reported and may be used for decision making purposes. No data were rejected or qualified as estimated.

SAMPLE

The sample included in this review was:

Sample ID
SW020ASD102506S

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REVIEW ELEMENTS

Sample data were reviewed for the following parameters:

- Agreement of analyses conducted with chain-of-custody (COC) requests
- Holding times/sample preservation
- Laboratory method blank/equipment blank results
- Laboratory control sample (LCS) results
- Laboratory duplicate results
- Field duplicate results
- Sample quantitation/detection limit results

DISCUSSION

Agreement of Analyses Conducted With COC Requests

Sample reports were reviewed against the analytical requests as designated on the COC and subsequent communications between ENSR and the laboratory. No discrepancies were noted.

Holding Times/Sample Preservation

The sample was prepared and analyzed within the method-specified holding times. No issues with sample preservation were noted upon receipt in the laboratory.

Laboratory Method Blank/Equipment Blank Results

Consistent with the QAPP, there were no equipment blanks associated with this data set.

There were no contaminants detected above the minimum detectable concentrations (MDCs)/detection limits (DLs) and/or reporting limits (RLs) for all nuclides analyzed in the laboratory method blank.

It should be noted that the Pb-210, Po-210, Ra-226, Ra-228, and Th-230 results in the laboratory method blank were reported by the laboratory as 0.00 UUI with an explanation that the results were rejected due to low abundance. In addition, the U-235 result in the laboratory method blank was reported by the laboratory as 0.00 UI with an explanation that the result was rejected due to no valid peak. Upon further discussion with the laboratory, it was determined that these results in the laboratory method blank were nondetects.

LCS Results

The LCS was spiked with Am-241, Cs-137, and Co-60. All LCS percent recoveries (%Rs) met the QC acceptance criteria for these nuclides.

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Laboratory Duplicate Results

Sample SW022XASD102406S, which was reported in GEL SDG 174989, was used for laboratory duplicate analyses for all nuclides. The relative percent differences (RPDs) for Pb-210 and Po-210 were not calculable due to nondetect results in the sample. Precision was deemed acceptable for Pb-210 and Po-210 since the detected results in the duplicate sample were less than 5 times the RL and the absolute difference between the results was less than 2 times the RL. The remaining RPDs met the acceptance criterion of 35%.

Field Duplicate Results

The field duplicate samples associated with this data set were samples SW023ASD102406S and SW023ASD102406D, which were submitted in GEL SDG 174989. The RPDs for Pb-210 and Po-210 were not calculable due to nondetect results in the sample. Precision was deemed acceptable for Pb-210 and Po-210 since the detected results in the field duplicate sample were less than 10 times the RL and the absolute difference between the results was less than 8 times the RL. The remaining RPDs met the acceptance criterion of 50%.

Sample Quantitation/Detection Limit Results

The laboratory reported all negative results and activities below the MDC, but flagged them with a "U" to indicate that they were considered to be not detected. This approach was consistent with the project objectives, and no change to the qualification was made during validation.

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Certificate of Analysis

Company : ENSR International
Address : 2 Technology Park Drive
Westford, Massachusetts 01886--3140

Report Date: January 19, 2007

Contact: Ms. Debra L. Simmons
Project: **Indiana Pines**

Client Sample ID: SW020ASD102506S
Sample ID: 175102007
Matrix: SE
Collect Date: 25-OCT-06 10:00
Receive Date: 27-OCT-06
Collector: Client

Project: ENSRIndianaPines
Client ID: ENSR003

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Solid (Long List)											
Actinium-227	U	0.0189	+/-0.0694	0.125	0.160	pCi/g		MJH1 11/18/06	1157	585795	1
Lead-210	U	0.569	+/-1.06	1.26	3.00	pCi/g					
Polonium-210	U	0.569	+/-1.06	1.26	3.00	pCi/g					
Protactinium-231	U	-0.0799	+/-0.277	0.487	0.500	pCi/g					
Radium-226		0.176	+/-0.0349	0.0218	0.200	pCi/g					
Radium-228		0.212	+/-0.0675	0.0451	0.300	pCi/g					
Thorium-228		0.243	+/-0.0292	0.018	0.400	pCi/g					
Thorium-230		0.176	+/-0.0349	0.0218	0.500	pCi/g					
Thorium-232		0.237	+/-0.0285	0.0175	0.400	pCi/g					
Uranium-234		0.209	+/-0.051	0.0416	3.00	pCi/g					
Uranium-235	U	0.0162	+/-0.0638	0.0687	0.100	pCi/g					
Uranium-238	U	0.347	+/-0.308	0.395	0.500	pCi/g					

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	TMB1	10/30/06	1016	583871

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

GEL LABORATORIES LLC
2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis Report
for

ENSR003 ENSR International

Client SDG: 175102 GEL Work Order: 175102

The Qualifiers in this report are defined as follows:

* A quality control analyte recovery is outside of specified acceptance criteria

** Analyte is a surrogate compound

U Analyte was analyzed for, but not detected above the MDL, MDA, or LOD.

UI Gamma Spectroscopy--Uncertain identification

ND The analyte concentration is not detected above the detection limit.

The above sample is reported on a dry weight basis except where prohibited by the analytical procedure.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the Certificate of Analysis.

This data report has been prepared and reviewed in accordance with GEL Laboratories LLC standard operating procedures. Please direct any questions to your Project Manager, Edith Kent.

Reviewed by

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Memorandum

Date: January 26, 2007

To: Lisa Bradley/Westford

From: Lisa Krowitz/Westford

Subject: Data Validation
Radiological Analyses
RI/FS 2nd Quarter Sampling
Pines Area of Investigation, Indiana
GEL SDG Number 174989

Distribution: D. Simmons/Westford

01776-036-102
PI057rad.lkk

SUMMARY

Limited validation was performed on the data for six sediment samples analyzed for Actinium-227 (Ac-227), Lead-210 (Pb-210), Polonium-210 (Po-210), Protactinium-231 (Pa-231), Radium-226 (Ra-226), Radium-228 (Ra-228), Thorium-228 (Th-228), Thorium-230 (Th-230), Thorium-232 (Th-232), Uranium-234 (U-234), Uranium-235 (U-235), and Uranium-238 (U-238) by DOE EML HASL-300. The samples were collected at the Pines Area of Investigation in Pines, Indiana on October 24, 2006 and submitted to General Engineering Laboratories (GEL) in Charleston, South Carolina for analysis. GEL processed these samples under sample delivery group (SDG) number 174989.

The analytical data were evaluated with reference to the Department of Energy *Evaluation of Radiochemical Data Usability (1997)*, the *Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP)*, July 2004, and the quality control (QC) criteria specified in the analytical method and/or the Remedial Investigation/ Feasibility Study (RI/FS) Quality Assurance Project Plan (QAPP).

In general, the data were valid as reported and may be used for decision making purposes. No data were rejected or qualified as estimated.

SAMPLE

The samples included in this review were:

Sample ID
SW022ASD102406S
SW022BSD102406S
SW023ASD102406S

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Sample ID
SW023ASD102406D (Field Duplicate of SW023ASD102406S)
SW023BSD102406S
SW024ASD102406S

REVIEW ELEMENTS

Sample data were reviewed for the following parameters:

- Agreement of analyses conducted with chain-of-custody (COC) requests
- Holding times/sample preservation
- Laboratory method blank/equipment blank results
- Laboratory control sample (LCS) results
- Laboratory duplicate results
- Field duplicate results
- Sample quantitation/detection limit results

DISCUSSION

Agreement of Analyses Conducted With COC Requests

Sample reports were reviewed against the analytical requests as designated on the COC and subsequent communications between ENSR and the laboratory. No discrepancies were noted.

Holding Times/Sample Preservation

The samples were prepared and analyzed within the method-specified holding times. No issues with sample preservation were noted upon receipt in the laboratory.

Laboratory Method Blank/Equipment Blank Results

Consistent with the QAPP, there were no equipment blanks associated with this data set.

There were no contaminants detected above the minimum detectable concentrations (MDCs)/detection limits (DLs) and/or reporting limits (RLs) for all nuclides analyzed in the laboratory method blank.

It should be noted that the Pb-210, Po-210, Ra-226, Ra-228, and Th-230 results in the laboratory method blank were reported by the laboratory as 0.00 UUI with an explanation that the results were rejected due to low abundance. In addition, the U-235 result in the laboratory method blank was reported by the laboratory as 0.00 UI with an explanation that the result was rejected due to no valid peak. Upon further discussion with the laboratory, it was determined that these results in the method laboratory blank were nondetects.

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LCS Results

The LCS was spiked with Am-241, Cs-137, and Co-60. All LCSs percent recoveries (%Rs) met the acceptance criteria for these nuclides.

Laboratory Duplicate Results

Sample SW022XASD102406S was used for laboratory duplicate analyses for all nuclides. The relative percent differences (RPDs) for Pb-210 and Po-210 were not calculable due to nondetect results in the sample. Precision was deemed acceptable for Pb-210 and Po-210 since the detected results in the duplicate sample were less than 5 times the RL and the absolute difference between the results was less than 2 times the RL. The remaining RPDs met the acceptance criterion of 35%.

Field Duplicate Results

The field duplicate samples submitted with this data set were samples SW023ASD102406S and SW023ASD102406D. The following table summarizes the RPDs of the detected nuclides in the field duplicate pair. The RPDs for Pb-210 and Po-210 were not calculable (NC) due to nondetect results in the sample. Precision was deemed acceptable for Pb-210 and Po-210 since the detected results in the field duplicate sample were less then 10 times the RL and the absolute difference between the results was less than 8 times the RL. The remaining RPDs met the acceptance criterion of 50%.

Analyte	SW023ASD102406S (pCi/g)	SW023ASD102406D (pCi/g)	% RPD	Action
Pb-210	2.39 U	1.16 ± 0.334	NC	None, SR <10xRL and difference <8xRL
Po-210	2.39 U	1.16 ± 0.334	NC	None, SR <10xRL and difference <8xRL
Ra-226	0.844 ± 0.049	0.847 ± 0.109	1	None
Ra-228	0.857 ± 0.086	0.966 ± 0.162	12	None
Th-228	0.958 ± 0.032	0.942 ± 0.111	2	None
Th-230	0.844 ± 0.049	0.846 ± 0.109	1	None
Th-232	0.941 ± 0.031	0.919 ± 0.108	2	None
U-234	0.984 ± 0.072	0.944 ± 0.144	4	None
U-238	0.863 ± 0.735	0.703 ± 0.329	20	None

Sample Quantitation/Detection Limit Results

The nondetect U-238 result in sample SW022ASD102406S was greater than the requested RL. No action was taken, except to note this noncompliance.

The laboratory reported all negative results and activities below the MDC, but flagged them with a "U" to indicate that they were considered to be not detected. This approach was consistent with the project objectives, and no change to the qualification was made during validation.

It should be noted that the Pb-210 and Po-210 results in sample SW022BSD102406S were reported by the laboratory as 0.00 UUI with an explanation that the results were rejected due to low abundance. Upon further discussion with the laboratory, it was determined that these results in sample SW022BSD102406S were nondetects; therefore, the results were reported as 0.00 U during validation.

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Certificate of Analysis

Company : ENSR International
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Report Date: January 19, 2007

Contact: Ms. Debra L. Simmons
Project: **Indiana Pines**

Client Sample ID:	SW022ASD102406S	Project:	ENSRIndianaPines
Sample ID:	174989006	Client ID:	ENSR003
Matrix:	SE		
Collect Date:	24-OCT-06 15:10		
Receive Date:	26-OCT-06		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Solid (Long List)											
Actinium-227	U	-0.0197	+/-0.152	0.227	0.160	pCi/g		MJH1 11/10/06	0945	585795	1
Lead-210	U	0.795	+/-3.26	3.42	3.00	pCi/g					
Polonium-210	U	0.795	+/-3.26	3.42	3.00	pCi/g					
Protactinium-231	U	0.306	+/-0.559	0.944	0.500	pCi/g					
Radium-226		1.32	+/-0.0758	0.0422	0.200	pCi/g					
Radium-228		0.910	+/-0.122	0.0808	0.300	pCi/g					
Thorium-228		1.02	+/-0.0461	0.0363	0.400	pCi/g					
Thorium-230		1.32	+/-0.0758	0.0422	0.500	pCi/g					
Thorium-232		1.00	+/-0.0453	0.0357	0.400	pCi/g					
Uranium-234		1.53	+/-0.125	0.0779	3.00	pCi/g					
Uranium-235	U	0.0594	+/-0.114	0.131	0.100	pCi/g					
Uranium-238	U	0.659	+/-1.13	0.838	0.500	pCi/g					

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	BSW1	10/27/06	1030	583474

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

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Certificate of Analysis

Company : ENSR International
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Report Date: January 19, 2007

Contact: Ms. Debra L. Simmons
Project: **Indiana Pines**

Client Sample ID:	SW022BSD102406S	Project:	ENSRIndianaPines
Sample ID:	174989007	Client ID:	ENSR003
Matrix:	SE		
Collect Date:	24-OCT-06 15:10		
Receive Date:	26-OCT-06		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Solid (Long List)											
Actinium-227	U	-0.0875	+/-0.151	0.245	0.160	pCi/g		MJH1 11/10/06	0946	585795	1
Lead-210	UJ	0.00	+/-4.98	4.86	3.00	pCi/g					
Polonium-210	UJ	0.00	+/-4.98	4.86	3.00	pCi/g					
Protactinium-231	U	-0.354	+/-0.601	0.970	0.500	pCi/g					
Radium-226		1.44	+/-0.0727	0.0446	0.200	pCi/g					
Radium-228		0.917	+/-0.125	0.0871	0.300	pCi/g					
Thorium-228		1.12	+/-0.0477	0.0354	0.400	pCi/g					
Thorium-230		1.44	+/-0.0727	0.0446	0.500	pCi/g					
Thorium-232		1.10	+/-0.0469	0.0348	0.400	pCi/g					
Uranium-234		1.62	+/-0.122	0.0857	3.00	pCi/g					
Uranium-235		0.163	+/-0.128	0.138	0.100	pCi/g					
Uranium-238		1.11	+/-1.03	1.00	0.500	pCi/g					

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	BSW1	10/27/06	1030	583474

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

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Report Date: January 19, 2007

Contact: Ms. Debra L. Simmons
Project: **Indiana Pines**

Client Sample ID:	SW023ASD102406S	Project:	ENSRIndianaPines
Sample ID:	174989008	Client ID:	ENSR003
Matrix:	SE		
Collect Date:	24–OCT–06 15:15		
Receive Date:	26–OCT–06		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Solid (Long List)											
Actinium–227	U	0.0419	+/–0.117	0.174	0.160	pCi/g		MJH1 11/10/06	0946	585795	1
Lead–210	U	2.39	+/–2.22	2.71	3.00	pCi/g					
Polonium–210	U	2.39	+/–2.22	2.71	3.00	pCi/g					
Protactinium–231	U	–0.303	+/–0.402	0.651	0.500	pCi/g					
Radium–226		0.844	+/–0.049	0.0296	0.200	pCi/g					
Radium–228		0.857	+/–0.0862	0.0547	0.300	pCi/g					
Thorium–228		0.958	+/–0.0319	0.0243	0.400	pCi/g					
Thorium–230		0.844	+/–0.049	0.0296	0.500	pCi/g					
Thorium–232		0.941	+/–0.0314	0.0239	0.400	pCi/g					
Uranium–234		0.984	+/–0.0722	0.0576	3.00	pCi/g					
Uranium–235	U	0.0451	+/–0.0963	0.101	0.100	pCi/g					
Uranium–238		0.863	+/–0.735	0.734	0.500	pCi/g					

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL–RAD–A–021	BSW1	10/27/06	1031	583474

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

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Report Date: January 19, 2007

Contact: Ms. Debra L. Simmons
Project: **Indiana Pines**

Client Sample ID:	SW023ASD102406D	Project:	ENSRIndianaPines
Sample ID:	174989009	Client ID:	ENSR003
Matrix:	SE		
Collect Date:	24–OCT–06 15:15		
Receive Date:	26–OCT–06		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Solid (Long List)											
Actinium–227	U	0.115	+/–0.174	0.207	0.160	pCi/g		MJH1 11/18/06	1155	585795	1
Lead–210		1.16	+/–0.334	0.241	3.00	pCi/g					
Polonium–210		1.16	+/–0.334	0.241	3.00	pCi/g					
Protactinium–231	U	0.220	+/–0.457	0.818	0.500	pCi/g					
Radium–226		0.847	+/–0.109	0.0402	0.200	pCi/g					
Radium–228		0.966	+/–0.162	0.0694	0.300	pCi/g					
Thorium–228		0.942	+/–0.111	0.029	0.400	pCi/g					
Thorium–230		0.846	+/–0.109	0.0402	0.500	pCi/g					
Thorium–232		0.919	+/–0.108	0.0283	0.400	pCi/g					
Uranium–234		0.944	+/–0.144	0.0711	3.00	pCi/g					
Uranium–235	U	0.0625	+/–0.0765	0.108	0.100	pCi/g					
Uranium–238		0.703	+/–0.329	0.277	0.500	pCi/g					

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL–RAD–A–021	BSW1	10/27/06	1031	583474

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

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Report Date: January 19, 2007

Contact: Ms. Debra L. Simmons
Project: **Indiana Pines**

Client Sample ID:	SW023BSD102406S	Project:	ENSRIndianaPines
Sample ID:	174989010	Client ID:	ENSR003
Matrix:	SE		
Collect Date:	24–OCT–06 15:15		
Receive Date:	26–OCT–06		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Solid (Long List)											
Actinium–227	U	0.0206	+/–0.0647	0.121	0.160	pCi/g		MJH1 11/10/06	1029	585795	1
Lead–210	U	0.0524	+/–0.748	0.792	3.00	pCi/g					
Polonium–210	U	0.0524	+/–0.748	0.792	3.00	pCi/g					
Protactinium–231	U	–0.19	+/–0.258	0.467	0.500	pCi/g					
Radium–226		0.183	+/–0.030	0.0224	0.200	pCi/g					
Radium–228		0.262	+/–0.0554	0.0429	0.300	pCi/g					
Thorium–228		0.243	+/–0.0198	0.0176	0.400	pCi/g					
Thorium–230		0.183	+/–0.030	0.0224	0.500	pCi/g					
Thorium–232		0.239	+/–0.0195	0.0173	0.400	pCi/g					
Uranium–234		0.249	+/–0.0468	0.0421	3.00	pCi/g					
Uranium–235	U	0.0406	+/–0.0366	0.0684	0.100	pCi/g					
Uranium–238	U	0.135	+/–0.384	0.374	0.500	pCi/g					

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL–RAD–A–021	BSW1	10/27/06	1031	583474

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

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Certificate of Analysis

Company : ENSR International
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Report Date: January 19, 2007

Contact: Ms. Debra L. Simmons
Project: **Indiana Pines**

Client Sample ID:	SW024ASD102406S	Project:	ENSRIndianaPines
Sample ID:	174989011	Client ID:	ENSR003
Matrix:	SE		
Collect Date:	24-OCT-06 14:15		
Receive Date:	26-OCT-06		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Solid (Long List)											
Actinium-227	U	-0.0413	+/-0.0991	0.151	0.160	pCi/g		MJH1 11/10/06	1047	585795	1
Lead-210		0.752	+/-0.227	0.187	3.00	pCi/g					
Polonium-210		0.752	+/-0.227	0.187	3.00	pCi/g					
Protactinium-231	U	0.0634	+/-0.350	0.607	0.500	pCi/g					
Radium-226		0.447	+/-0.042	0.0314	0.200	pCi/g					
Radium-228		0.439	+/-0.0739	0.0556	0.300	pCi/g					
Thorium-228		0.435	+/-0.0262	0.0225	0.400	pCi/g					
Thorium-230		0.447	+/-0.042	0.0314	0.500	pCi/g					
Thorium-232		0.428	+/-0.0257	0.0221	0.400	pCi/g					
Uranium-234		0.503	+/-0.0748	0.0522	3.00	pCi/g					
Uranium-235	U	0.0548	+/-0.0618	0.0821	0.100	pCi/g					
Uranium-238	U	0.198	+/-0.234	0.207	0.500	pCi/g					

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	BSW1	10/27/06	1031	583474

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

GEL LABORATORIES LLC
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Certificate of Analysis Report
for

ENSR003 ENSR International

Client SDG: 174989 GEL Work Order: 174989

The Qualifiers in this report are defined as follows:

* A quality control analyte recovery is outside of specified acceptance criteria

** Analyte is a surrogate compound

U Analyte was analyzed for, but not detected above the MDL, MDA, or LOD.

UI Gamma Spectroscopy--Uncertain identification

ND The analyte concentration is not detected above the detection limit.

The above sample is reported on a dry weight basis except where prohibited by the analytical procedure.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the Certificate of Analysis.

This data report has been prepared and reviewed in accordance with GEL Laboratories LLC standard operating procedures. Please direct any questions to your Project Manager, Edith Kent.

Reviewed by

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Memorandum

Date: April 17, 2007

To: Lisa Bradley/Westford

From: Paula DiMattei/Westford

Subject: Data Validation
PCDD and PCDF Analyses
RI/FS 2nd Quarter Sampling
Pines Area of Investigation, Indiana
CAS Submission Number E0600785

Distribution: D. Simmons/Westford

01776-036-102
PI061dioxpld

SUMMARY

Full validation was performed on the data for eight sediment samples analyzed for polychlorinated dibenzodioxins (PCDD) and polychlorinated dibenzofurans (PCDF) by SW-846 method 8290. The samples were collected at the Pines Area of Investigation in Indiana on October 23-25, 2006 and submitted to Columbia Analytical Services (CAS) in Rochester, NY. CAS-Rochester contracted the analyses to their facility in Houston, TX. CAS-Houston processed and reported these samples under submission number E0600785.

The analytical data were evaluated with reference to the "USEPA Analytical Services Branch (ASB) National Functional Guidelines for Chlorinated Dibenzo-p-Dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs) Data Review", EPA-540-R-05-001 (September 2005) and the quality control (QC) criteria specified in the analytical method and/or the site specific Quality Assurance Project Plan (QAPP) for the Remedial Investigation/Feasibility Study (RI/FS) for the Pines Areas of Investigation. Modification of the Functional Guidelines was performed to accommodate the SW-846 methodology.

In general, the data are valid as reported and may be used for decision making purposes. No data were rejected. Selected data points were qualified due to nonconformances of certain QC criteria (see discussion below).

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SAMPLES

The samples included in this review are listed below.

Sample IDs	Sample IDs
SW022ASD102406S	SW024ASD102406S
SW022BSD102406S	SW023ASD102406D (Field duplicate of SW023ASD102406S)
SW023ASD102406S	SW020ASD102506S
SW023BSD102406S	SW001ASD102306S

REVIEW ELEMENTS

Sample data were reviewed for the following parameters:

- Agreement of analyses conducted with chain-of-custody (COC) requests
- Holding times/sample preservation
- Initial and continuing calibrations
- Laboratory blanks/equipment blanks/field blanks
- Matrix spike/matrix spike duplicate (MS/MSD) results
- Internal and clean-up standard recoveries
- Field duplicate results
- Laboratory control sample/laboratory control sample duplicate (LCS/LCSD) results
- Sample quantitation/detection limit results

DISCUSSION

Agreement of Analyses Conducted With COC Requests

Sample reports were reviewed against the analytical requests as designated on the chain-of-custody (COC). No discrepancies were noted.

Holding Times/Sample Preservation

All samples were extracted and analyzed within the method specified holding time criteria.

The cooler temperatures were within the QC acceptance criteria of $4 \pm 2^{\circ}C$ upon receipt at CAS-Rochester and when subsequently received at CAS-Houston.

Initial and Continuing Calibrations

The percent relative standard deviations of all target compounds were within the QC acceptance criteria for the initial calibrations associated with the sample analyses. The percent differences of all target compounds were within the QC acceptance criteria in the continuing calibrations associated with the sample analyses with the following exception.

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Calibration	Compound	%D	Actions
11/4/06 (ending calibration)	$^{13}C_{12}$-OCDD	-44.4	Estimate (J) the positive OCDD and OCDF results in sample SW001ASD102306S.
Associated sample: SW001ASD102306S			

All target compounds met the retention time, ion abundance ratios, and signal-to-noise QC acceptance criteria specified in the method for the initial and continuing calibrations associated with the sample analyses.

The chromatographic separation between 2,3,7,8-TCDD and the other unlabeled TCDD isomers were resolved with a valley of ≤25% in all window defining mixture analyses.

Laboratory Blanks/Equipment Blanks/Field Blanks

The presence of blank contamination indicates that false positives may exist for these compounds in the associated samples. The following table summarizes the level of blank contamination detected in the laboratory method blank associated with the sediment samples; SQLs (excluding sample specific preparation factors); action level; and actions taken. Actions taken were based on the National Functional Guidelines (September 2005). Where the National Functional Guidelines (NFG) stipulate professional judgment to qualify sample results reported at concentrations greater than the quantitation limit (lowest calibration standard), Action Levels (ALs) for the common contaminants (OCDD and OCDF) were established at 10x the concentrations detected and ALs for the remaining contaminants were established at 5x the concentrations detected.

Compound	SQL (ng/Kg)	Concentration (ng/Kg)	Action Level (ng/Kg)	Actions
1,2,3,4,6,7,8-HpCDD	2.5	1.218	6.09	Qualify the result as nondetect (U) at the reported concentration in samples SW022ASD102406S, SW022BSD102406S, SW023ASD102406S, SW023BSD102406S, SW024ASD102406S, SW023ASD102406D, and SW020ASD102506S.
OCDD	5	5.953	59.53	Qualify the result as nondetect (U) at the reported concentration in samples SW023ASD102406S, SW024ASD102406S, SW023ASD102406D, and SW020ASD102506S.

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Compound	SQL (ng/Kg)	Concentration (ng/Kg)	Action Level (ng/Kg)	Actions
1,2,3,4,7,8-HxCDF	2.5	0.209	1.045	Qualify the result as nondetect (U) at the reported concentration in samples SW022ASD102406S, SW022BSD102406S, SW023BSD102406S, SW023ASD102406D, and SW001ASD102306S.
1,2,3,4,6,7,8-HpCDF	2.5	0.385	1.925	Qualify the result as nondetect (U) at the reported concentration in samples SW022ASD102406S, SW022BSD102406S, SW023ASD102406S, SW023BSD102406S, SW023ASD102406D, and SW20ASD102506S.
Total TCDD	1.0	0.206	1.03	Qualify the result as nondetect (U) at the reported concentration in samples SW023ASD102406S and SW023ASD102406D.
Total HxCDD	2.5	0.244	1.22	Qualify the result as nondetect (U) at the reported concentration in samples SW022ASD102406S, SW022BSD102406S, SW023ASD102406S, SW023BSD102406S, SW023ASD102406D, and SW001ASD102306S.
Tiotal HpCDD	2.5	2.277	11.38	Qualify the result as nondetect (U) at the reported concentration in samples SW022BSD102406S, SW023ASD102406S, SW024ASD102406S, SW023ASD102406D, and SW020ASD102506S.
Total HxCDF	2.5	0.175	0.875	Qualify the result as nondetect (U) at the reported concentration in samples SW022ASD102406S, SW022BSD102406S, SW023ASD102406S, SW023BSD102406S, SW023ASD102406D, and SW020ASD102506S.
Total HpCDF	2.5	0.740	3.70	Qualify the result as nondetect (U) at the reported concentration in samples SW022ASD102406S, SW022BSD102406S, SW023ASD102406S, SW023BSD102406S, and SW023ASD102406D.

The method blank evaluation was based on the following actions from the NFG:

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If the method blank result was <SQL:

- and the sample result was not detected, no qualification was required.
- and the sample result was <SQL, the result was qualified as nondetect (U).
- and the sample result was ≥SQL, professional judgment was used (as stated below).

If the method blank result was >SQL (>3xSQL for OCDD/OCDF):

- and the sample result was not detected, the nondetect result was qualified (UJ).
- and the sample result was <SQL, the result was qualified as nondetect (U).
- and the sample result was ≥SQL and < blank result, the result was qualified as (U) or (J).
- and the sample result was ≥SQL and ≥ blank result, professional judgment was used (as stated below).

If the method blank result equaled the SQL:

- and the sample result was not detected, the nondetect result was qualified (UJ).
- and the sample result was <SQL, the result was qualified as nondetect (U).
- and the sample result was ≥SQL, professional judgment was used (as stated below).

The National Functional Guidelines (NFGs) stipulate that the validator should use professional judgment to qualify sample results reported at concentrations greater than the SQL. In these instances, ALs were established for the common contaminants (OCDD and OCDF) at 10x the concentration detected and ALs were established for the remaining contaminants at 5x the concentration detected. The following validation actions were applied for the established ALs:

- For all compounds except OCDD/OCDF: If the concentration in the sample was <5x the concentration in the blank, the sample result was qualified as nondetect (U).
- For OCDD/OCDF: If the concentration in the sample was <10x the concentration in the blank, the sample result was qualified as nondetect (U).
- If the concentration of OCDD/OCDF was >10x the concentration in the blank or if the concentration of all other compounds was >5x the concentration in the blank, no qualification was required.

MS/MSD Results

MS/MSD analyses were not performed on samples in this data set. No data validation actions were taken on this basis.

Internal and Clean-up Standard Recoveries

Internal standard and clean-up standard recoveries were within QC acceptance criteria for all sample analyses.

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Field Duplicate Results

Samples SW023ASD102406S and SW023ASD102406D were submitted as the field duplicate pair with this data set. The following table summarizes the field duplicate precision and actions taken. The relative percent difference (RPD) for total PeCDD was not calculable (NC) due to the nondetect result in sample SW023ASD102406S.

Compound	SW023ASD102406S (ng/Kg)	SW023ASD102406D (ng/Kg)	RPD	Actions
OCDF	0.653 J	2.207 J	109	Results were previously qualified as estimated (J) by the laboratory since these results were detected at concentrations less than the lowest calibration standard. No further validation actions were taken.
Total TCDF	0.219 J	1.258 J	140	
Total PeCDF	0.145 J	1.569 J	166	
Total PeCDD	0.049 U	0.229 J	NC	The result detected in the field duplicate sample was previously qualified as estimated (J) by the laboratory since this result was detected at a concentration less than the lowest calibration standard. No further validation actions were taken.
Criteria:	When both results are >5x the SQL, RPDs must be <50. When both results are <5x the SQL, RPDs must be <100.			

LCS/LCSD Results

The percent recoveries and RPDs of all spiked compounds were within the QC acceptance criteria for the LCS and LCSD analyses.

Sample Quantitation/Detection Limit Results

Dilutions were not performed on any samples in this data set.

The following compounds in the samples listed below met all identification criteria with the exception of their respective ion abundance ratio criteria. Consequently, these results were qualified as (K) by the laboratory to signify that these values are Estimated Maximum Possible Concentrations (EMPCs). Note that EMPCs were excluded from the total results (total concentration of all isomers within a level of chlorination).

SW022BSD102406S: 1,2,3,6,7,8-HxCDD
SW023ASD102406S: OCDF
SW023BSD102406S: 1,2,3,6,7,8-HxCDD; 1,2,3,4,7,8-HxCDF

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SW023ASD102406S: 1,2,3,4,6,7,8-HpCDF
SW020ASD102506S: 1,2,3,4,6,7,8-HpCDF

The NFGs state that "If ion abundance criteria are not satisfied, qualify the detects as unusable "R" and use professional judgment to qualify nondetects." It also states that "professional judgment should be used in determining the proper identification of analytes". Rather than deem the results as unusable "R", the validator took a conservative approach and used professional judgment to report these EMPC results qualified as estimated (J) since the method allows for compounds that do not meet ion abundance ratios to be reported as EMPCs. In addition, the laboratory "K" qualifier was retained during validation, for an overall qualification of "JK," since the identification of this compound may be uncertain.

All positive 2,3,7,8-substituted dioxins and furans detected at concentrations less than the lowest calibration standard but greater than the estimated detection limit (EDL) were qualified as estimated (J) by the laboratory. No further validation actions were taken for these compounds. The positive total results (total isomers within a level of chlorination) in several samples were qualified as estimated (J) by the validator due to quantitation of the results at concentrations less than the lowest calibration standard but greater than the EDL.

SW022ASD102406S: total PeCDD, total TCDF, total PeCDF
SW022BSD102406S: total PeCDF
SW023ASD102406S: total TCDF, total PeCDF
SW023BSD102406S: total TCDF, total PeCDF
SW023ASD102406D: total PeCDD, total TCDF, total PeCDF
SW020ASD102506S: total PeCDF

FORM 2

PCDD/PCDF LABELED COMPOUND AND CLEANUP STANDARD RECOVERIES

CLIENT ID.
SW001ASD102306S

Lab Name: Columbia Analytical Services Episode No.:

Lab Code: CAS SDG No.: Method: 8290 Lab Sample ID: E0600785-008

Client Name: ENSR Sample Wt/Vol: 11.664 g or mL: g

Matrix (Aqueous/Solid/Leachate): Solid Initial Calibration Date: 10/23/06

Sample Receipt Date: 10/28/06 Instrument ID: AutoSpec-Ultima

Ext. Date: 10/31/06 GC Column: DB-5

Ext. Vol(ul): 20.0 Inj. Vol(ul): 1.0 Sample Data Filename: U17594#1

Analysis Date: 3-NOV-06 Time: 20:03:26 Blank Data Filename: U17557#1

Dilution Factor: 1 Cal. Ver. Data Filename: U17591#1

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture/Lipid: 28.24

LABELED COMPOUNDS	SPIKE CONC.(pg)	CONCENT. FOUND(pg)	RECOV. %	Q	ION ABUND. RATIO(2)	RRT (2)	MEAN RRF
13C-2,3,7,8-TCDD	1000	736.54	73.65		0.78	1.010	0.99
13C-1,2,3,7,8-PeCDD	1000	696.70	69.67		1.55	1.197	0.88
13C-1,2,3,6,7,8-HxCDD	2500	1815.69	72.63		1.23	0.992	1.00
13C-1,2,3,4,6,7,8-HpCDD	2500	2394.09	95.76		1.04	1.069	0.65
13C-OCDD	5000	4280.29	85.61		0.91	1.142	0.60
13C-2,3,7,8-TCDF	1000	627.10	62.71		0.78	0.975	1.26
13C-1,2,3,7,8-PeCDF	1000	689.89	68.99		1.58	1.153	1.22
13C-1,2,3,4,7,8-HxCDF	2500	1915.34	76.61		0.52	0.970	1.27
13C-1,2,3,4,6,7,8-HpCDF	2500	2080.66	83.23		0.45	1.046	0.72
CLEANUP STANDARD							
37Cl-2,3,7,8-TCDD	800	716.46	89.56			1.011	

(1) Contract-required limits for percent recovery are 40%-135% (section 8.4, Method 8290).

(2) Contract-required Reference Attributions for RRTs and ion abundance ratios are specified in Tables 11 and 8, respectively, Method 8290.

NOTE: There is no ion abundance ratio for 37Cl4-2378-TCDD (cleanup standard).

8290F2

Form 1

PCDD/PCDF ANALYSIS DATA SHEET
Use for Sample and Blank Results

CLIENT ID.
SW022ASD102406S

Lab Name: Columbia Analytical Services Episode No.:

Lab Code: CAS SDG No.: Method: 8290 Lab Sample ID: E0600785-001

Client Name: ENSR Sample Wt/Vol: 12.269 g or mL: g

Matrix (Aqueous/Solid/Leachate): Solid Initial Calibration Date: 10/23/06

Sample Receipt Date: 10/28/06 Instrument ID: AutoSpec-Ultima

Ext. Date: 10/31/06 GC Column:DB-5

Ext. Vol(ul):20.0 Inj. Vol(ul):1.0 Sample Data Filename: U17584#1

Analysis Date: 3-NOV-06 Time: 11:34:33 Blank Data Filename: U17557#1

Dilution Factor: 1 Cal. Ver. Data Filename: U17580#1

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture/Lipid: 66.47

ANALYTE	CONCENTRATION FOUND	DETECTION LIMIT	Qual. (1)	ION ABUND. RATIO (2)	RRT (2)	MEAN RRF
2,3,7,8-TCDD	*	0.060	U	*	*	0.89
1,2,3,7,8-PeCDD	0.342	0.118	J	1.51	1.000	0.87
1,2,3,4,7,8-HxCDD	*	0.112	U	*	*	0.95
1,2,3,6,7,8-HxCDD	0.537	0.102	J	1.32	1.000	1.05
1,2,3,7,8,9-HxCDD	0.413	0.109	J	1.31	1.009	0.98
1,2,3,4,6,7,8-HpCDD	14.120	0.123	~~B~~ u	1.02	1.000	0.87
OCDD	400.768	0.909	~~B~~	0.89	1.000	0.98
~~2,3,7,8-TCDF~~	~~0.386~~	~~0.091~~	~~CUK~~ don't report	0.92	1.002	0.82
1,2,3,7,8-PeCDF	0.188	0.089	J	1.41	1.000	0.85
2,3,4,7,8-PeCDF	*	0.087	U	*	*	0.87
1,2,3,4,7,8-HxCDF	0.486	0.176	u ~~BJ~~	1.06	1.000	1.07
1,2,3,6,7,8-HxCDF	0.276	0.165	J	1.25	1.003	1.15
1,2,3,7,8,9-HxCDF	*	0.235	U	*	*	0.80
2,3,4,6,7,8-HxCDF	0.247	0.193	J	1.09	1.018	0.98
1,2,3,4,6,7,8-HpCDF	3.735	0.161	u ~~BJ~~	1.02	1.000	1.36
1,2,3,4,7,8,9-HpCDF	*	0.228	U	*	*	0.97
OCDF	8.173	0.253	J	0.87	1.004	1.02
Total Tetra-Dioxins	*	0.060	U			
Total Penta-Dioxins	0.342 J	0.118				
Total Hexa-Dioxins	4.946 u	0.102				
Total Hepta-Dioxins	33.094	0.123				
Total Tetra-Furans	0.877 J	0.091				
Total Penta-Furans	2.680 J	0.087				
Total Hexa-Furans	2.795 u	0.176				
Total Hepta-Furans	8.887 u	0.161				

(1) Qualifiers: See flag definitions.

(2) RRTs and ion ratios are specified in Tables 11 and 8, Method 8290. 8290F1

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2378-TCDF ANALYSIS DATA SHEET
Use for Sample and Blank Results

CLIENT ID
SW022ASD102406S

Lab Name: Columbia Analytical Services Episode No.:

Client Name: ENSR Lab Sample ID: E0600785-001

Matrix (aqueous/solid/leachate): solid Sample Wt/Vol: 12.269g or mL: g

Sample Receipt Date: 10/28/06 Initial Calibration Date: 08/06/03

Ext. Date: 10/31/06 Instrument ID: 70S

Analysis Date: 6-NOV-06 Time: 14:46:07 GC Column ID: DB-225

Ext. Vol(ul): 20.0 Sample Data Filename: A21555#7

Inj. Vol(ul): 1.0 Blank Data Filename: A21555#3

Dilution Factor: 1 Cal. Ver. Data Filename: A21555#2

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture: 66.47

ANALYTE	CONCENTRATION FOUND(1)	DETECTION LIMIT	Q	ION ABUND. RATIO	RRT	TEF
2,3,7,8-TCDF	*	1.332	U	*	*	*

INT. STANDARD	SPIKE CONCENT.(pg)	CONCENT. FOUND(pg)	RECOV. %	ION ABUND. RATIO	RRT
13C-2,3,7,8-TCDF	1000	614.08	61.41	0.79	1.05
CLEANUP STANDARD					
37Cl-2,3,7,8-TCDD	800	825.82	103.23		0.99

(1) '*' indicates non-detected.

TCDFF1

FORM 2

PCDD/PCDF LABELED COMPOUND AND CLEANUP STANDARD RECOVERIES

CLIENT ID.
SW022ASD102406S

Lab Name: Columbia Analytical Services Episode No.:

Lab Code: CAS SDG No.: Method: 8290 Lab Sample ID: E0600785-001

Client Name: ENSR Sample Wt/Vol: 12.269 g or mL: g

Matrix (Aqueous/Solid/Leachate): Solid Initial Calibration Date: 10/23/06

Sample Receipt Date: 10/28/06 Instrument ID: AutoSpec-Ultima

Ext. Date: 10/31/06 GC Column: DB-5

Ext. Vol(ul): 20.0 Inj. Vol(ul): 1.0 Sample Data Filename: U17584#1

Analysis Date: 3-NOV-06 Time: 11:34:33 Blank Data Filename: U17557#1

Dilution Factor: 1 Cal. Ver. Data Filename: U17580#1

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture/Lipid: 66.47

	SPIKE CONC.(pg)	CONCENT. FOUND(pg)	RECOV. %	Q	ION ABUND. RATIO(2)	RRT (2)	MEAN RRF
LABELED COMPOUNDS							
13C-2,3,7,8-TCDD	1000	781.44	78.14		0.79	1.010	1.02
13C-1,2,3,7,8-PeCDD	1000	730.75	73.08		1.51	1.195	0.82
13C-1,2,3,6,7,8-HxCDD	2500	2192.69	87.71		1.24	0.992	0.99
13C-1,2,3,4,6,7,8-HpCDD	2500	1978.83	79.15		1.06	1.069	0.89
13C-OCDD	5000	3144.48	62.89		0.91	1.143	0.86
13C-2,3,7,8-TCDF	1000	674.64	67.46		0.76	0.974	1.22
13C-1,2,3,7,8-PeCDF	1000	768.48	76.85		1.53	1.152	1.09
13C-1,2,3,4,7,8-HxCDF	2500	1976.98	79.08		0.53	0.970	1.17
13C-1,2,3,4,6,7,8-HpCDF	2500	1945.20	77.81		0.45	1.046	0.84
CLEANUP STANDARD							
37Cl-2,3,7,8-TCDD	800	801.91	100.24			1.010	

(1) Contract-required limits for percent recovery are 40%-135% (section 8.4, Method 8290).

(2) Contract-required Reference Attributions for RRTs and ion abundance ratios are specified in Tables 11 and 8, respectively, Method 8290.

NOTE: There is no ion abundance ratio for 37Cl4-2378-TCDD (cleanup standard).

8290F2

Form 1

PCDD/PCDF ANALYSIS DATA SHEET
Use for Sample and Blank Results

CLIENT ID.
SW022BSD102406S

Lab Name: Columbia Analytical Services Episode No.:

Lab Code: CAS SDG No.: Method: 8290 Lab Sample ID: E0600785-002

Client Name: ENSR Sample Wt/Vol: 12.690 g or mL: g

Matrix (Aqueous/Solid/Leachate): Solid Initial Calibration Date: 10/23/06

Sample Receipt Date: 10/28/06 Instrument ID: AutoSpec-Ultima

Ext. Date: 10/31/06 GC Column:DB-5

Ext. Vol(ul):20.0 Inj. Vol(ul):1.0 Sample Data Filename: U17585#1

Analysis Date: 3-NOV-06 Time: 12:22:56 Blank Data Filename: U17557#1

Dilution Factor: 1 Cal. Ver. Data Filename: U17580#1

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture/Lipid: 62.69

ANALYTE	CONCENTRATION FOUND	DETECTION LIMIT	Qual. (1)	ION ABUND. RATIO (2)	RRT (2)	MEAN RRF
2,3,7,8-TCDD	*	0.044	U	*	*	0.89
1,2,3,7,8-PeCDD	*	0.101	U	*	*	0.87
1,2,3,4,7,8-HxCDD	*	0.091	U	*	*	0.95
1,2,3,6,7,8-HxCDD	0.180	0.083	JK	0.92	1.000	1.05
1,2,3,7,8,9-HxCDD	0.231	0.089	J	1.13	1.009	0.98
1,2,3,4,6,7,8-HpCDD	6.077	0.107	~~B~~ U	1.03	1.000	0.87
OCDD	213.514	0.513	~~B~~	0.88	1.000	0.98
2,3,7,8-TCDF	*	0.127	U	*	*	0.82
1,2,3,7,8-PeCDF	*	0.080	U	*	*	0.85
2,3,4,7,8-PeCDF	*	0.078	U	*	*	0.87
1,2,3,4,7,8-HxCDF	0.260	0.123	U ~~BJ~~	1.28	1.000	1.07
1,2,3,6,7,8-HxCDF	*	0.115	U	*	*	1.15
1,2,3,7,8,9-HxCDF	*	0.165	U	*	*	0.80
2,3,4,6,7,8-HxCDF	*	0.135	U	*	*	0.98
1,2,3,4,6,7,8-HpCDF	1.514	0.120	U ~~BJ~~	1.01	1.000	1.36
1,2,3,4,7,8,9-HpCDF	*	0.169	U	*	*	0.97
OCDF	3.298	0.187	J	0.89	1.004	1.02
Total Tetra-Dioxins	*	0.044	U			
Total Penta-Dioxins	*	0.101	U			
Total Hexa-Dioxins	1.648 U	0.083				
Total Hepta-Dioxins	15.087 U	0.107				
Total Tetra-Furans	*	0.127	U			
Total Penta-Furans	1.318 J	0.078				
Total Hexa-Furans	0.953 U	0.123				
Total Hepta-Furans	3.330 U	0.120				

(1) Qualifiers: See flag definitions.

(2) RRTs and ion ratios are specified in Tables 11 and 8, Method 8290. 8290F1

FORM 2

PCDD/PCDF LABELED COMPOUND AND CLEANUP STANDARD RECOVERIES

CLIENT ID.
SW022BSD102406S

Lab Name: Columbia Analytical Services Episode No.:

Lab Code: CAS SDG No.: Method: 8290 Lab Sample ID: E0600785-002

Client Name: ENSR Sample Wt/Vol: 12.690 g or mL: g

Matrix (Aqueous/Solid/Leachate): Solid Initial Calibration Date: 10/23/06

Sample Receipt Date: 10/28/06 Instrument ID: AutoSpec-Ultima

Ext. Date: 10/31/06 GC Column: DB-5

Ext. Vol(ul): 20.0 Inj. Vol(ul): 1.0 Sample Data Filename: U17585#1

Analysis Date: 3-NOV-06 Time: 12:22:56 Blank Data Filename: U17557#1

Dilution Factor: 1 Cal. Ver. Data Filename: U17580#1

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture/Lipid: 62.69

LABELED COMPOUNDS	SPIKE CONC.(pg)	CONCENT. FOUND(pg)	RECOV. %	Q	ION ABUND. RATIO(2)	RRT (2)	MEAN RRF
13C-2,3,7,8-TCDD	1000	740.96	74.10		0.75	1.010	1.02
13C-1,2,3,7,8-PeCDD	1000	712.29	71.23		1.53	1.196	0.82
13C-1,2,3,6,7,8-HxCDD	2500	2222.20	88.89		1.26	0.991	0.99
13C-1,2,3,4,6,7,8-HpCDD	2500	1958.04	78.32		1.03	1.069	0.89
13C-OCDD	5000	3255.11	65.10		0.89	1.142	0.86
13C-2,3,7,8-TCDF	1000	653.31	65.33		0.76	0.974	1.22
13C-1,2,3,7,8-PeCDF	1000	741.28	74.13		1.58	1.153	1.09
13C-1,2,3,4,7,8-HxCDF	2500	1946.27	77.85		0.53	0.970	1.17
13C-1,2,3,4,6,7,8-HpCDF	2500	1956.46	78.26		0.45	1.045	0.84
CLEANUP STANDARD							
37Cl-2,3,7,8-TCDD	800	756.37	94.55			1.011	

(1) Contract-required limits for percent recovery are 40%-135% (section 8.4, Method 8290).

(2) Contract-required Reference Attributions for RRTs and ion abundance ratios are specified in Tables 11 and 8, respectively, Method 8290.

NOTE: There is no ion abundance ratio for 37C14-2378-TCDD (cleanup standard).

8290F2

Form 1

PCDD/PCDF ANALYSIS DATA SHEET
Use for Sample and Blank Results

CLIENT ID.
SW023ASD102406S

Lab Name: Columbia Analytical Services Episode No.:

Lab Code: CAS SDG No.: Method: 8290 Lab Sample ID: E0600785-003

Client Name: ENSR Sample Wt/Vol: 13.086 g or mL: g

Matrix (Aqueous/Solid/Leachate): Solid Initial Calibration Date: 10/23/06

Sample Receipt Date: 10/28/06 Instrument ID: AutoSpec-Ultima

Ext. Date: 10/31/06 GC Column:DB-5

Ext. Vol(ul):20.0 Inj. Vol(ul):1.0 Sample Data Filename: U17586#1

Analysis Date: 3-NOV-06 Time: 13:11:19 Blank Data Filename: U17557#1

Dilution Factor: 1 Cal. Ver. Data Filename: U17580#1

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture/Lipid: 39.54

ANALYTE	CONCENTRATION FOUND	DETECTION LIMIT	Qual. (1)	ION ABUND. RATIO (2)	RRT (2)	MEAN RRF
2,3,7,8-TCDD	*	0.032	U	*	*	0.89
1,2,3,7,8-PeCDD	*	0.049	U	*	*	0.87
1,2,3,4,7,8-HxCDD	*	0.064	U	*	*	0.95
1,2,3,6,7,8-HxCDD	*	0.058	U	*	*	1.05
1,2,3,7,8,9-HxCDD	*	0.062	U	*	*	0.98
1,2,3,4,6,7,8-HpCDD	1.185	0.061	U ~~BJ~~	1.06	1.000	0.87
OCDD	15.423	0.180	U ~~J~~	0.92	1.000	0.98
2,3,7,8-TCDF	*	0.088	U	*	*	0.82
1,2,3,7,8-PeCDF	*	0.048	U	*	*	0.85
2,3,4,7,8-PeCDF	*	0.047	U	*	*	0.87
1,2,3,4,7,8-HxCDF	*	0.035	U	*	*	1.07
1,2,3,6,7,8-HxCDF	*	0.033	U	*	*	1.15
1,2,3,7,8,9-HxCDF	*	0.047	U	*	*	0.80
2,3,4,6,7,8-HxCDF	*	0.039	U	*	*	0.98
1,2,3,4,6,7,8-HpCDF	0.244	0.073	U ~~BJ~~	1.01	1.000	1.36
1,2,3,4,7,8,9-HpCDF	*	0.103	U	*	*	0.97
OCDF	0.653	0.104	JK	1.06	1.003	1.02
Total Tetra-Dioxins	0.095 U	0.032				
Total Penta-Dioxins	*	0.049	U			
Total Hexa-Dioxins	0.167 U	0.058				
Total Hepta-Dioxins	2.788 U	0.061				
Total Tetra-Furans	0.219 J	0.088				
Total Penta-Furans	0.145 J	0.047				
Total Hexa-Furans	0.358 U	0.035				
Total Hepta-Furans	0.244 U	0.073				

(1) Qualifiers: See flag definitions.

(2) RRTs and ion ratios are specified in Tables 11 and 8, Method 8290. 8290F1

FORM 2

PCDD/PCDF LABELED COMPOUND AND CLEANUP STANDARD RECOVERIES

CLIENT ID.
SW023ASD102406S

Lab Name: Columbia Analytical Services Episode No.:

Lab Code: CAS SDG No.: Method: 8290 Lab Sample ID: E0600785-003

Client Name: ENSR Sample Wt/Vol: 13.086 g or mL: g

Matrix (Aqueous/Solid/Leachate): Solid Initial Calibration Date: 10/23/06

Sample Receipt Date: 10/28/06 Instrument ID: AutoSpec-Ultima

Ext. Date: 10/31/06 GC Column: DB-5

Ext. Vol(ul): 20.0 Inj. Vol(ul): 1.0 Sample Data Filename: U17586#1

Analysis Date: 3-NOV-06 Time: 13:11:19 Blank Data Filename: U17557#1

Dilution Factor: 1 Cal. Ver. Data Filename: U17580#1

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture/Lipid: 39.54

	SPIKE CONC.(pg)	CONCENT. FOUND(pg)	RECOV. %	Q	ION ABUND. RATIO(2)	RRT (2)	MEAN RRF
LABELED COMPOUNDS							
13C-2,3,7,8-TCDD	1000	758.01	75.80		0.79	1.010	1.02
13C-1,2,3,7,8-PeCDD	1000	740.47	74.05		1.60	1.196	0.82
13C-1,2,3,6,7,8-HxCDD	2500	2344.23	93.77		1.26	0.992	0.99
13C-1,2,3,4,6,7,8-HpCDD	2500	2037.53	81.50		1.05	1.068	0.89
13C-OCDD	5000	3408.65	68.17		0.90	1.142	0.86
13C-2,3,7,8-TCDF	1000	672.39	67.24		0.80	0.974	1.22
13C-1,2,3,7,8-PeCDF	1000	760.34	76.03		1.55	1.153	1.09
13C-1,2,3,4,7,8-HxCDF	2500	2117.01	84.68		0.53	0.970	1.17
13C-1,2,3,4,6,7,8-HpCDF	2500	2088.75	83.55		0.45	1.045	0.84
CLEANUP STANDARD							
37Cl-2,3,7,8-TCDD	800	784.30	98.04			1.011	

(1) Contract-required limits for percent recovery are 40%-135% (section 8.4, Method 8290).

(2) Contract-required Reference Attributions for RRTs and ion abundance ratios are specified in Tables 11 and 8, respectively, Method 8290.

NOTE: There is no ion abundance ratio for 37Cl4-2378-TCDD (cleanup standard).

8290F2

Form 1

PCDD/PCDF ANALYSIS DATA SHEET
Use for Sample and Blank Results

CLIENT ID.
SW023BSD102406S

Lab Name: Columbia Analytical Services Episode No.:

Lab Code: CAS SDG No.: Method: 8290 Lab Sample ID: E0600785-004

Client Name: ENSR Sample Wt/Vol: 13.616 g or mL: g

Matrix (Aqueous/Solid/Leachate): Solid Initial Calibration Date: 10/23/06

Sample Receipt Date: 10/28/06 Instrument ID: AutoSpec-Ultima

Ext. Date: 10/31/06 GC Column:DB-5

Ext. Vol(ul):20.0 Inj. Vol(ul):1.0 Sample Data Filename: U17587#1

Analysis Date: 3-NOV-06 Time: 13:59:43 Blank Data Filename: U17557#1

Dilution Factor: 1 Cal. Ver. Data Filename: U17580#1

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture/Lipid: 23.00

ANALYTE	CONCENTRATION FOUND	DETECTION LIMIT	Qual. (1)	ION ABUND. RATIO (2)	RRT (2)	MEAN RRF
2,3,7,8-TCDD	*	0.023	U	*	*	0.89
1,2,3,7,8-PeCDD	*	0.048	U	*	*	0.87
1,2,3,4,7,8-HxCDD	*	0.054	U	*	*	0.95
1,2,3,6,7,8-HxCDD	0.171	0.049	JK	1.45	1.001	1.05
1,2,3,7,8,9-HxCDD	*	0.053	U	*	*	0.98
1,2,3,4,6,7,8-HpCDD	4.521	0.050	~~B~~ u	1.05	1.000	0.87
OCDD	109.461	0.259	~~B~~	0.90	1.001	0.98
~~2,3,7,8-TCDF~~	~~0.167~~	~~0.056~~	~~CJ~~ don't report	0.73	1.002	0.82
1,2,3,7,8-PeCDF	*	0.035	U	*	*	0.85
2,3,4,7,8-PeCDF	*	0.034	U	*	*	0.87
1,2,3,4,7,8-HxCDF	0.124	0.059	uJK ~~BJK~~	0.80	1.000	1.07
1,2,3,6,7,8-HxCDF	*	0.055	U	*	*	1.15
1,2,3,7,8,9-HxCDF	*	0.079	U	*	*	0.80
2,3,4,6,7,8-HxCDF	*	0.065	U	*	*	0.98
1,2,3,4,6,7,8-HpCDF	0.922	0.051	u ~~BJ~~	1.03	1.000	1.36
1,2,3,4,7,8,9-HpCDF	*	0.072	U	*	*	0.97
OCDF	2.105	0.115	J	0.90	1.004	1.02
Total Tetra-Dioxins	*	0.023	U			
Total Penta-Dioxins	*	0.048	U			
Total Hexa-Dioxins	1.216 u	0.049				
Total Hepta-Dioxins	12.658	0.050				
Total Tetra-Furans	0.358 J	0.056				
Total Penta-Furans	0.825 J	0.034				
Total Hexa-Furans	0.860 u	0.059				
Total Hepta-Furans	2.276 u	0.051				

(1) Qualifiers: See flag definitions.

(2) RRTs and ion ratios are specified in Tables 11 and 8, Method 8290. 8290F1

CAS, INC.
2378-TCDF ANALYSIS DATA SHEET
Use for Sample and Blank Results

CLIENT ID
SW023BSD102406S

Lab Name: Columbia Analytical Services Episode No.:

Client Name: ENSR Lab Sample ID: E0600785-004

Matrix (aqueous/solid/leachate): solid Sample Wt/Vol: 13.616g or mL: g

Sample Receipt Date: 10/28/06 Initial Calibration Date: 08/06/03

Ext. Date: 10/31/06 Instrument ID: 70S

Analysis Date: 6-NOV-06 Time: 15:21:14 GC Column ID: DB-225

Ext. Vol(ul): 20.0 Sample Data Filename: A21555#8

Inj. Vol(ul): 1.0 Blank Data Filename: A21555#3

Dilution Factor: 1 Cal. Ver. Data Filename: A21555#2

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture: 23.00

ANALYTE	CONCENTRATION FOUND(1)	DETECTION LIMIT	Q	ION ABUND. RATIO	RRT	TEF
2,3,7,8-TCDF	*	0.582	U	*	*	*

INT. STANDARD	SPIKE CONCENT.(pg)	CONCENT. FOUND(pg)	RECOV. %	ION ABUND. RATIO	RRT
13C-2,3,7,8-TCDF	1000	560.54	56.05	0.81	1.05
CLEANUP STANDARD					
37Cl-2,3,7,8-TCDD	800	787.01	98.38		0.99

(1)'*' indicates non-detected.

TCDFF1

FORM 2

PCDD/PCDF LABELED COMPOUND AND CLEANUP STANDARD RECOVERIES

CLIENT ID.

SW023BSD102406S

Lab Name: Columbia Analytical Services Episode No.:

Lab Code: CAS SDG No.: Method: 8290 Lab Sample ID: E0600785-004

Client Name: ENSR Sample Wt/Vol: 13.616 g or mL: g

Matrix (Aqueous/Solid/Leachate): Solid Initial Calibration Date: 10/23/06

Sample Receipt Date: 10/28/06 Instrument ID: AutoSpec-Ultima

Ext. Date: 10/31/06 GC Column: DB-5

Ext. Vol(ul): 20.0 Inj. Vol(ul): 1.0 Sample Data Filename: U17587#1

Analysis Date: 3-NOV-06 Time: 13:59:43 Blank Data Filename: U17557#1

Dilution Factor: 1 Cal. Ver. Data Filename: U17580#1

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture/Lipid: 23.00

LABELED COMPOUNDS	SPIKE CONC.(pg)	CONCENT. FOUND(pg)	RECOV. %	Q	ION ABUND. RATIO(2)	RRT (2)	MEAN RRF
13C-2,3,7,8-TCDD	1000	751.71	75.17		0.78	1.010	1.02
13C-1,2,3,7,8-PeCDD	1000	705.66	70.57		1.55	1.196	0.82
13C-1,2,3,6,7,8-HxCDD	2500	2171.44	86.86		1.25	0.991	0.99
13C-1,2,3,4,6,7,8-HpCDD	2500	1755.85	70.23		1.02	1.068	0.89
13C-OCDD	5000	2568.40	51.37		0.90	1.142	0.86
13C-2,3,7,8-TCDF	1000	662.84	66.28		0.79	0.975	1.22
13C-1,2,3,7,8-PeCDF	1000	733.77	73.38		1.56	1.153	1.09
13C-1,2,3,4,7,8-HxCDF	2500	2011.81	80.47		0.52	0.969	1.17
13C-1,2,3,4,6,7,8-HpCDF	2500	1808.34	72.33		0.44	1.045	0.84
CLEANUP STANDARD							
37Cl-2,3,7,8-TCDD	800	762.31	95.29			1.011	

(1) Contract-required limits for percent recovery are 40%-135% (section 8.4, Method 8290).

(2) Contract-required Reference Attributions for RRTs and ion abundance ratios are specified in Tables 11 and 8, respectively, Method 8290.

NOTE: There is no ion abundance ratio for 37Cl4-2378-TCDD (cleanup standard).

8290F2

Form 1

PCDD/PCDF ANALYSIS DATA SHEET
Use for Sample and Blank Results

CLIENT ID.
SW024ASD102406S

Lab Name: Columbia Analytical Services Episode No.:

Lab Code: CAS SDG No.: Method: 8290 Lab Sample ID: E0600785-005

Client Name: ENSR Sample Wt/Vol: 10.993 g or mL: g

Matrix (Aqueous/Solid/Leachate): Solid Initial Calibration Date: 10/23/06

Sample Receipt Date: 10/28/06 Instrument ID: AutoSpec-Ultima

Ext. Date: 10/31/06 GC Column:DB-5

Ext. Vol(ul):20.0 Inj. Vol(ul):1.0 Sample Data Filename: U17588#1

Analysis Date: 3-NOV-06 Time: 14:48:08 Blank Data Filename: U17557#1

Dilution Factor: 1 Cal. Ver. Data Filename: U17580#1

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture/Lipid: 35.60

ANALYTE	CONCENTRATION FOUND	DETECTION LIMIT	Qual. (1)	ION ABUND. RATIO (2)	RRT (2)	MEAN RRF
2,3,7,8-TCDD	*	0.031	U	*	*	0.89
1,2,3,7,8-PeCDD	*	0.055	U	*	*	0.87
1,2,3,4,7,8-HxCDD	*	0.052	U	*	*	0.95
1,2,3,6,7,8-HxCDD	*	0.048	U	*	*	1.05
1,2,3,7,8,9-HxCDD	*	0.051	U	*	*	0.98
1,2,3,4,6,7,8-HpCDD	0.297	0.056	U ~~BU~~	1.08	1.000	0.87
OCDD	4.038	0.161	U ~~BU~~	0.92	1.001	0.98
2,3,7,8-TCDF	*	0.059	U	*	*	0.82
1,2,3,7,8-PeCDF	*	0.033	U	*	*	0.85
2,3,4,7,8-PeCDF	*	0.032	U	*	*	0.87
1,2,3,4,7,8-HxCDF	*	0.035	U	*	*	1.07
1,2,3,6,7,8-HxCDF	*	0.033	U	*	*	1.15
1,2,3,7,8,9-HxCDF	*	0.047	U	*	*	0.80
2,3,4,6,7,8-HxCDF	*	0.039	U	*	*	0.98
1,2,3,4,6,7,8-HpCDF	*	0.068	U	*	*	1.36
1,2,3,4,7,8,9-HpCDF	*	0.096	U	*	*	0.97
OCDF	*	0.128	U	*	*	1.02
Total Tetra-Dioxins	*	0.031	U			
Total Penta-Dioxins	*	0.055	U			
Total Hexa-Dioxins	*	0.048	U			
Total Hepta-Dioxins	0.297 U	0.056				
Total Tetra-Furans	*	0.059	U			
Total Penta-Furans	*	0.032	U			
Total Hexa-Furans	*	0.035	U			
Total Hepta-Furans	*	0.068	U			

(1) Qualifiers: See flag definitions.

(2) RRTs and ion ratios are specified in Tables 11 and 8, Method 8290. 8290F1

FORM 2

PCDD/PCDF LABELED COMPOUND AND CLEANUP STANDARD RECOVERIES

CLIENT ID.
SW024ASD102406S

Lab Name: Columbia Analytical Services Episode No.:

Lab Code: CAS SDG No.: Method: 8290 Lab Sample ID: E0600785-005

Client Name: ENSR Sample Wt/Vol: 10.993 g or mL: g

Matrix (Aqueous/Solid/Leachate): Solid Initial Calibration Date: 10/23/06

Sample Receipt Date: 10/28/06 Instrument ID: AutoSpec-Ultima

Ext. Date: 10/31/06 GC Column: DB-5

Ext. Vol(ul): 20.0 Inj. Vol(ul): 1.0 Sample Data Filename: U17588#1

Analysis Date: 3-NOV-06 Time: 14:48:08 Blank Data Filename: U17557#1

Dilution Factor: 1 Cal. Ver. Data Filename: U17580#1

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture/Lipid: 35.60

LABELED COMPOUNDS	SPIKE CONC.(pg)	CONCENT. FOUND(pg)	RECOV. %	Q	ION ABUND. RATIO(2)	RRT (2)	MEAN RRF
13C-2,3,7,8-TCDD	1000	752.84	75.28		0.78	1.010	1.02
13C-1,2,3,7,8-PeCDD	1000	757.22	75.72		1.58	1.196	0.82
13C-1,2,3,6,7,8-HxCDD	2500	2338.82	93.55		1.25	0.991	0.99
13C-1,2,3,4,6,7,8-HpCDD	2500	1971.70	78.87		1.05	1.068	0.89
13C-OCDD	5000	3155.30	63.11		0.92	1.142	0.86
13C-2,3,7,8-TCDF	1000	686.49	68.65		0.78	0.974	1.22
13C-1,2,3,7,8-PeCDF	1000	764.80	76.48		1.59	1.153	1.09
13C-1,2,3,4,7,8-HxCDF	2500	2099.32	83.97		0.53	0.969	1.17
13C-1,2,3,4,6,7,8-HpCDF	2500	1985.05	79.40		0.45	1.045	0.84
CLEANUP STANDARD							
37Cl-2,3,7,8-TCDD	800	793.89	99.24			1.010	

(1) Contract-required limits for percent recovery are 40%-135% (section 8.4, Method 8290).

(2) Contract-required Reference Attributions for RRTs and ion abundance ratios are specified in Tables 11 and 8, respectively, Method 8290.

NOTE: There is no ion abundance ratio for 37Cl4-2378-TCDD (cleanup standard).

8290F2

Form 1

PCDD/PCDF ANALYSIS DATA SHEET
Use for Sample and Blank Results

CLIENT ID.
SW023ASD102406D

Lab Name: Columbia Analytical Services Episode No.:

Lab Code: CAS SDG No.: Method: 8290 Lab Sample ID: E0600785-006

Client Name: ENSR Sample Wt/Vol: 15.177 g or mL: g

Matrix (Aqueous/Solid/Leachate): Solid Initial Calibration Date: 10/23/06

Sample Receipt Date: 10/28/06 Instrument ID: AutoSpec-Ultima

Ext. Date: 10/31/06 GC Column:DB-5

Ext. Vol(ul):20.0 Inj. Vol(ul):1.0 Sample Data Filename: U17589#1

Analysis Date: 3-NOV-06 Time: 15:36:33 Blank Data Filename: U17557#1

Dilution Factor: 1 Cal. Ver. Data Filename: U17580#1

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture/Lipid: 48.15

ANALYTE	CONCENTRATION FOUND	DETECTION LIMIT	Qual. (1)	ION ABUND. RATIO (2)	RRT (2)	MEAN RRF
2,3,7,8-TCDD	*	0.036	U	*	*	0.89
1,2,3,7,8-PeCDD	*	0.057	U	*	*	0.87
1,2,3,4,7,8-HxCDD	*	0.094	U	*	*	0.95
1,2,3,6,7,8-HxCDD	*	0.086	U	*	*	1.05
1,2,3,7,8,9-HxCDD	*	0.091	U	*	*	0.98
1,2,3,4,6,7,8-HpCDD	2.993	0.076	U BD	1.06	1.000	0.87
OCDD	46.484	0.233	U B	0.92	1.001	0.98
2,3,7,8-TCDF	*	0.088	U	*	*	0.82
1,2,3,7,8-PeCDF	*	0.049	U	*	*	0.85
2,3,4,7,8-PeCDF	*	0.048	U	*	*	0.87
1,2,3,4,7,8-HxCDF	0.130	0.076	U BD	1.11	1.000	1.07
1,2,3,6,7,8-HxCDF	*	0.071	U	*	*	1.15
1,2,3,7,8,9-HxCDF	*	0.101	U	*	*	0.80
2,3,4,6,7,8-HxCDF	0.097	0.083	J	1.12	1.018	0.98
1,2,3,4,6,7,8-HpCDF	0.831	0.068	U BJK	1.31	1.000	1.36
1,2,3,4,7,8,9-HpCDF	*	0.096	U	*	*	0.97
OCDF	2.207	0.181	J	0.90	1.004	1.02

Total Tetra-Dioxins	0.498 U	0.036
Total Penta-Dioxins	0.229 J	0.057
Total Hexa-Dioxins	1.168 U	0.086
Total Hepta-Dioxins	7.589 U	0.076
Total Tetra-Furans	1.258 J	0.088
Total Penta-Furans	1.569 J	0.048
Total Hexa-Furans	0.906 U	0.076
Total Hepta-Furans	1.182 U	0.068

(1) Qualifiers: See flag definitions.

(2) RRTs and ion ratios are specified in Tables 11 and 8, Method 8290. 8290F1

FORM 2

PCDD/PCDF LABELED COMPOUND AND CLEANUP STANDARD RECOVERIES

CLIENT ID.

SW023ASD102406D

Lab Name: Columbia Analytical Services Episode No.:

Lab Code: CAS SDG No.: Method: 8290 Lab Sample ID: E0600785-006

Client Name: ENSR Sample Wt/Vol: 15.177 g or mL: g

Matrix (Aqueous/Solid/Leachate): Solid Initial Calibration Date: 10/23/06

Sample Receipt Date: 10/28/06 Instrument ID: AutoSpec-Ultima

Ext. Date: 10/31/06 GC Column: DB-5

Ext. Vol(ul): 20.0 Inj. Vol(ul): 1.0 Sample Data Filename: U17589#1

Analysis Date: 3-NOV-06 Time: 15:36:33 Blank Data Filename: U17557#1

Dilution Factor: 1 Cal. Ver. Data Filename: U17580#1

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture/Lipid: 48.15

	SPIKE CONC.(pg)	CONCENT. FOUND(pg)	RECOV. %	Q	ION ABUND. RATIO(2)	RRT (2)	MEAN RRF
LABELED COMPOUNDS							
13C-2,3,7,8-TCDD	1000	730.13	73.01		0.78	1.010	1.02
13C-1,2,3,7,8-PeCDD	1000	704.41	70.44		1.54	1.196	0.82
13C-1,2,3,6,7,8-HxCDD	2500	2145.62	85.83		1.23	0.991	0.99
13C-1,2,3,4,6,7,8-HpCDD	2500	1682.71	67.31		1.06	1.068	0.89
13C-OCDD	5000	2359.57	47.19		0.88	1.142	0.86
13C-2,3,7,8-TCDF	1000	630.26	63.03		0.77	0.974	1.22
13C-1,2,3,7,8-PeCDF	1000	743.05	74.31		1.57	1.153	1.09
13C-1,2,3,4,7,8-HxCDF	2500	2070.77	82.83		0.53	0.969	1.17
13C-1,2,3,4,6,7,8-HpCDF	2500	1686.49	67.46		0.45	1.045	0.84
CLEANUP STANDARD							
37Cl-2,3,7,8-TCDD	800	769.54	96.19			1.011	

(1) Contract-required limits for percent recovery are 40%-135% (section 8.4, Method 8290).

(2) Contract-required Reference Attributions for RRTs and ion abundance ratios are specified in Tables 11 and 8, respectively, Method 8290.

NOTE: There is no ion abundance ratio for 37Cl4-2378-TCDD (cleanup standard).

8290F2

Form 1

PCDD/PCDF ANALYSIS DATA SHEET
Use for Sample and Blank Results

CLIENT ID.
SW020ASD102506S

Lab Name: Columbia Analytical Services Episode No.:

Lab Code: CAS SDG No.: Method: 8290 Lab Sample ID: E0600785-007

Client Name: ENSR Sample Wt/Vol: 11.095 g or mL: g

Matrix (Aqueous/Solid/Leachate): Solid Initial Calibration Date: 10/23/06

Sample Receipt Date: 10/28/06 Instrument ID: AutoSpec-Ultima

Ext. Date: 10/31/06 GC Column:DB-5

Ext. Vol(ul):20.0 Inj. Vol(ul):1.0 Sample Data Filename: U17590#1

Analysis Date: 3-NOV-06 Time: 16:24:57 Blank Data Filename: U17557#1

Dilution Factor: 1 Cal. Ver. Data Filename: U17580#1

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture/Lipid: 30.54

ANALYTE	CONCENTRATION FOUND	DETECTION LIMIT	Qual. (1)	ION ABUND. RATIO (2)	RRT (2)	MEAN RRF
2,3,7,8-TCDD	*	0.032	U	*	*	0.89
1,2,3,7,8-PeCDD	*	0.066	U	*	*	0.87
1,2,3,4,7,8-HxCDD	*	0.069	U	*	*	0.95
1,2,3,6,7,8-HxCDD	*	0.063	U	*	*	1.05
1,2,3,7,8,9-HxCDD	*	0.067	U	*	*	0.98
1,2,3,4,6,7,8-HpCDD	0.691	0.059	~~U~~ BJK	1.13	1.000	0.87
OCDD	8.342	0.200	~~U~~ J	0.83	1.000	0.98
2,3,7,8-TCDF	*	0.048	U	*	*	0.82
1,2,3,7,8-PeCDF	*	0.041	U	*	*	0.85
2,3,4,7,8-PeCDF	*	0.040	U	*	*	0.87
1,2,3,4,7,8-HxCDF	*	0.048	U	*	*	1.07
1,2,3,6,7,8-HxCDF	*	0.045	U	*	*	1.15
1,2,3,7,8,9-HxCDF	*	0.064	U	*	*	0.80
2,3,4,6,7,8-HxCDF	*	0.052	U	*	*	0.98
1,2,3,4,6,7,8-HpCDF	0.252	0.071	~~BJK~~	1.42	1.000	1.36
1,2,3,4,7,8,9-HpCDF	*	0.100	U	*	*	0.97
OCDF	0.350	0.151	J	1.00	1.004	1.02
Total Tetra-Dioxins	*	0.032	U			
Total Penta-Dioxins	*	0.066	U			
Total Hexa-Dioxins	*	0.063	U			
Total Hepta-Dioxins	1.426 U	0.059				
Total Tetra-Furans	*	0.048	U			
Total Penta-Furans	0.153 J	0.040				
Total Hexa-Furans	0.168 J	0.048				
Total Hepta-Furans	*	0.071	U			

(1) Qualifiers: See flag definitions.

(2) RRTs and ion ratios are specified in Tables 11 and 8, Method 8290. 8290F1

FORM 2

PCDD/PCDF LABELED COMPOUND AND CLEANUP STANDARD RECOVERIES

CLIENT ID.
SW020ASD102506S

Lab Name: Columbia Analytical Services Episode No.:

Lab Code: CAS SDG No.: Method: 8290 Lab Sample ID: E0600785-007

Client Name: ENSR Sample Wt/Vol: 11.095 g or mL: g

Matrix (Aqueous/Solid/Leachate): Solid Initial Calibration Date: 10/23/06

Sample Receipt Date: 10/28/06 Instrument ID: AutoSpec-Ultima

Ext. Date: 10/31/06 GC Column: DB-5

Ext. Vol(ul): 20.0 Inj. Vol(ul): 1.0 Sample Data Filename: U17590#1

Analysis Date: 3-NOV-06 Time: 16:24:57 Blank Data Filename: U17557#1

Dilution Factor: 1 Cal. Ver. Data Filename: U17580#1

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture/Lipid: 30.54

	SPIKE CONC.(pg)	CONCENT. FOUND(pg)	RECOV. %	Q	ION ABUND. RATIO(2)	RRT (2)	MEAN RRF
LABELED COMPOUNDS							
13C-2,3,7,8-TCDD	1000	665.73	66.57		0.75	1.010	1.02
13C-1,2,3,7,8-PeCDD	1000	677.76	67.78		1.53	1.197	0.82
13C-1,2,3,6,7,8-HxCDD	2500	2090.42	83.62		1.26	0.991	0.99
13C-1,2,3,4,6,7,8-HpCDD	2500	1733.74	69.35		1.05	1.069	0.89
13C-OCDD	5000	2679.53	53.59		0.92	1.143	0.86
13C-2,3,7,8-TCDF	1000	604.30	60.43		0.78	0.975	1.22
13C-1,2,3,7,8-PeCDF	1000	704.73	70.47		1.58	1.153	1.09
13C-1,2,3,4,7,8-HxCDF	2500	1981.74	79.27		0.52	0.970	1.17
13C-1,2,3,4,6,7,8-HpCDF	2500	1693.58	67.74		0.45	1.046	0.84
CLEANUP STANDARD							
37Cl-2,3,7,8-TCDD	800	715.46	89.43			1.011	

(1) Contract-required limits for percent recovery are 40%-135% (section 8.4, Method 8290).

(2) Contract-required Reference Attributions for RRTs and ion abundance ratios are specified in Tables 11 and 8, respectively, Method 8290.

NOTE: There is no ion abundance ratio for 37Cl4-2378-TCDD (cleanup standard).

8290F2

Form 1

PCDD/PCDF ANALYSIS DATA SHEET
Use for Sample and Blank Results

CLIENT ID.
SW001ASD102306S

Lab Name: Columbia Analytical Services Episode No.:

Lab Code: CAS SDG No.: Method: 8290 Lab Sample ID: E0600785-008

Client Name: ENSR Sample Wt/Vol: 11.664 g or mL: g

Matrix (Aqueous/Solid/Leachate): Solid Initial Calibration Date: 10/23/06

Sample Receipt Date: 10/28/06 Instrument ID: AutoSpec-Ultima

Ext. Date: 10/31/06 GC Column:DB-5

Ext. Vol(ul):20.0 Inj. Vol(ul):1.0 Sample Data Filename: U17594#1

Analysis Date: 3-NOV-06 Time: 20:03:26 Blank Data Filename: U17557#1

Dilution Factor: 1 Cal. Ver. Data Filename: U17591#1

Concentration Units (pg/L or ng/Kg dry weight): ng/Kg % Moisture/Lipid: 28.24

ANALYTE	CONCENTRATION FOUND	DETECTION LIMIT	Qual. (1)	ION ABUND. RATIO (2)	RRT (2)	MEAN RRF
2,3,7,8-TCDD	*	0.028	U	*	*	0.96
1,2,3,7,8-PeCDD	*	0.059	U	*	*	0.91
1,2,3,4,7,8-HxCDD	*	0.058	U	*	*	0.94
1,2,3,6,7,8-HxCDD	0.509	0.052	J	1.29	1.000	1.05
1,2,3,7,8,9-HxCDD	*	0.057	U	*	*	0.95
1,2,3,4,6,7,8-HpCDD	10.646	0.079	B	1.05	1.000	0.93
OCDD	75.499	0.071	B	0.90	1.000	1.02
2,3,7,8-TCDF	*	0.056	U	*	*	0.93
1,2,3,7,8-PeCDF	*	0.042	U	*	*	0.94
2,3,4,7,8-PeCDF	*	0.041	U	*	*	0.96
1,2,3,4,7,8-HxCDF	0.330	0.104	U BJ	1.31	1.000	1.17
1,2,3,6,7,8-HxCDF	*	0.100	U	*	*	1.22
1,2,3,7,8,9-HxCDF	*	0.157	U	*	*	0.78
2,3,4,6,7,8-HxCDF	*	0.120	U	*	*	1.02
1,2,3,4,6,7,8-HpCDF	3.718	0.100	B	1.03	1.000	1.45
1,2,3,4,7,8,9-HpCDF	*	0.154	U	*	*	0.94
OCDF	9.657 J	0.094		0.88	1.004	1.14
Total Tetra-Dioxins	*	0.028	U			
Total Penta-Dioxins	*	0.059	U			
Total Hexa-Dioxins	1.515 J	0.052				
Total Hepta-Dioxins	18.583	0.079				
Total Tetra-Furans	*	0.056	U			
Total Penta-Furans	*	0.041	U			
Total Hexa-Furans	6.161	0.100				
Total Hepta-Furans	15.850	0.100				

(1) Qualifiers: See flag definitions.

(2) RRTs and ion ratios are specified in Tables 11 and 8, Method 8290. 8290F1

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Memorandum

Date: August 22, 2007

To: Lisa Bradley/Westford

From: Linda Sulkowski/Westford

Subject: Data Validation
Boron and Uranium Analyses
Yard 520 Background Soil Sampling
Pines Area of Investigation, Indiana
GEL SDGs 185248, 185253, and 185256

Distribution: D. Simmons/Westford

01776-036-111
PI083

SUMMARY

Full validation was performed on the data for 28 soil samples and three aqueous equipment blanks analyzed for boron and uranium using SW-846 method 6020. Total uranium results were calculated from the sum of uranium isotope 235 (U-235) and uranium isotope 238 (U-238). The samples were collected at the Pines Area of Investigation in Indiana on April 30 and May 1, 2007 and submitted to General Engineering Laboratories, LLC (GEL) in Charleston, South Carolina for analysis. GEL processed these samples under sample delivery groups (SDGs) 185248, 185253, and 185256.

The analytical data were evaluated with reference to the "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review" (February 1994 and October 2004) and the quality control (QC) criteria specified in the analytical method and/or the Quality Assurance Project Plan (QAPP) for the Remedial Investigation/Feasibility Study (RI/FS) for the Pines Area of Investigation. Modification of the Functional Guidelines was performed to accommodate the non-CLP methodology.

In general, the data appear valid as reported and may be used for decision making purposes. No data were rejected. Several data points were qualified due to nonconformances of certain QC criteria (see discussion below).

SAMPLES

The samples included in this review are listed below.

Sample IDs	Sample IDs
SS002ASS043007S	SS003ASS043007S
SS004ASS043007S	SS005ASS043007S
SS006ASS043007S	SS009ASS043007S
SS009ASS043007D (Field duplicate of SS009ASS043007S)	SS012ASS043007S

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Sample IDs	Sample IDs
SS012ASS043007D (Field duplicate of SS012ASS043007S)	SS013ASS043007S
SS015ASS043007S	SS016ASS043007S
SS023ASS043007S	SS024ASS043007S
SS025ASS043007S	SS001ASS050107S
SS007ASS050107S	SS010ASS050107S
SS011ASS050107S	SS014ASS050107S
SS018ASS050107S	SS019ASS050107S
SS020ASS050107S	SS021ASS050107S
SS021ASS050107D (Field duplicate of SS021ASS050107S)	SS022ASS050107S
SS008ASS050107S	SS017ASS050107S
SS003ASS043007B (Equipment blank)	SS012ASS043007B (Equipment blank)
SS021ASS050107B (Equipment blank)	

REVIEW ELEMENTS

Sample data were reviewed for the following parameters:

- Agreement of analyses conducted with chain-of-custody (COC) requests
- Holding times/sample preservation
- Inductively coupled plasma/mass spectrometry (ICP/MS) tuning
- Calibrations
- Laboratory blanks/equipment blanks/field blanks
- ICP interference check sample results
- Matrix spike/matrix spike duplicate (MS/MSD) results
- Laboratory duplicate results
- Field duplicate results
- Internal standard performance
- ICP serial dilution results
- Laboratory control sample (LCS) results
- Sample quantitation/detection limit results

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DISCUSSION

Agreement of Analyses Conducted With COC Requests

Sample reports were reviewed against the analytical requests as designated on the COC and subsequent communications between ENSR and the laboratory. The following discrepancies were noted.

- The laboratory received two extra bottles labeled as SS016ASS043007S but the time of collection did not match the COC for sample SS016ASS043007S. The time of collection on the bottles matched the time of collection for sample SS015ASS043007S. The laboratory notified ENSR of the discrepancy and correctly logged in these extra bottles with a correct sample ID of SS015ASS043007S using the sampling collection times.

- Sample SS017ASS050107S was not listed on the COCs received by the laboratory. ENSR subsequently submitted a COC to the laboratory with this sample listed.

- The COC indicated that three containers for sample SW009ASS043007S and one container for sample SW009ASS043007D, the field duplicate of SW009ASS043007S, were submitted to the laboratory. The laboratory noted on the Cooler Receipt and Preservation Check Form that four containers were received for sample SW009ASS043007S, and that the laboratory did not receive any containers for sample SW009ASS043007D. Since these samples were a field duplicate pair, the laboratory logged in three containers as sample SW009ASS043007S and one container as sample SW009ASS043007D as instructed by ENSR.

Holding Times/Sample Preservation

All samples were digested and analyzed within the method-specified holding time.

The chemical preservation for all samples was acceptable. The cooler temperature was 4°C upon receipt at the laboratory, which was within the acceptance criteria of 4 ± 2°C.

ICP/MS Tuning

A tuning solution containing elements representing the mass regions of interest was analyzed at the beginning of each analytical sequence. The percent relative standard deviations (%RSDs) met the QC acceptance criterion of <5%.

Calibrations

All criteria were met for the calibration curves and the initial and continuing calibration verification (ICV/CCV) standards.

Although the analysis of a low level check standard is not required by SW-846 method 6020, the laboratory chose to analyze low-level check standards containing uranium isotopes and boron. An acceptance limit of 100 ± 20 percent recovery (%R) was used to evaluate these standards. The following table summarizes the standard recoveries that fell outside the QC acceptance criteria and the associated samples.

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Date Analyzed	Standard	Analyte	%R	True Value
5/14/07	CRDL01	U-235	71.4	0.0014 µg/L
Associated Samples: All soil samples.				
Date Analyzed	**Standard**	**Analyte**	**%R**	**True Value**
5/15/07	CRDL01	U-235	143	0.0014 µg/L
Associated Samples: Equipment blank samples SS003ASS043007B, SS012ASS043007B, and SS021ASS050107B.				

Sample results were qualified as follows:

- If the %R was < 80%, and the positive sample result was < 2x the concentration of the check standard, then the positive result was qualified as estimated biased low (J-).
- If the %R was < 80%, and the positive sample result was > 2x the concentration of the check standard, then the result was accepted unqualified.
- If the %R was < 80%, then the nondetect result was estimated (UJ).
- If the %R was >120%, and the positive sample result was < 2x the concentration of the check standard, then the positive result was qualified as estimated biased high (J+).
- If the %R was >120%, and the positive sample result was > 2x the concentration of the check standard, then the result was accepted unqualified.
- If the %R was >120%, then the nondetect result was accepted unqualified.

Laboratory Blanks/Equipment Blanks/Field Blanks

There were no field blank samples associated with this sample set. No validation action was necessary on this basis, as this was consistent with the requirements of the QAPP.

The equipment blanks associated with the soil samples in this sample set are listed in the table below. Target analytes were not detected in the equipment blanks.

Sample ID	SDG
SS003ASS043037B	This SDG
SS012ASS043007B	This SDG
SS021ASS050107B	This SDG

All sample and laboratory blank results were reported down to the method detection limit (MDL) and nondetects were reported at the MDL. Blank actions, if applicable, were applied based on the February 1994 National Functional Guidelines rather than the 2004 guidelines since all nondetect results were reported at the MDL. The qualifiers associated with the blank actions; however, are consistent with the 2004 guidelines.

Uranium isotopes and boron were not detected in the laboratory preparation blanks or in the initial and continuing calibration blanks (ICBs/CCBs).

ICP Interference Check Sample Results

All criteria were met for the analyses of the ICS AB solutions.

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Boron (4.53 µg/L) was detected at a concentration > the MDL in the ICS A solution associated with soil samples SS009ASS043007D, SS015ASS043007S, and SS017ASS043007S. Since interference analyte data was not provided by the laboratory, positive results for boron in these samples were qualified as estimated biased high (J+).

Boron (5.53 µg/L) and U-238 (0.074 µg/L) were detected at a concentration greater than the respective MDLs in the ICS A solutions associated with equipment blank samples SS003ASS043007B, SS012ASS043007B, and SS021ASS050107B. Boron and U-238 were not detected in the equipment blank samples SS003ASS043007B, SS012ASS043007B, and SS021ASS050107B. Qualification of the data was therefore not required.

MS/MSD Results

MS/MSD analyses were performed on soil samples SS009ASS043007S, SS015ASS043007S, and SS012ASS043007S. The %Rs and the relative percent differences (RPDs) of the spiked target analytes were within the QC acceptance criteria for sample results that were <4x the amount spiked.

The laboratory did not perform a post-digestion spike but chose to perform a pre-digestion spike instead. No validation action was taken since it is the opinion of the validator that the pre-digestion spike is an equivalent indicator of the accuracy of the analytical procedure and a better indicator of the accuracy of the digestion procedure.

Laboratory Duplicate Results

Laboratory duplicate analyses were not performed on a sample from this sample set. The laboratory used the MS/MSD analyses performed on soil samples SS009ASS043007S, SS015ASS043007S, and SS012ASS043007S to demonstrate precision.

Field Duplicate Results

The following field duplicate pairs were associated with the samples in this data set:

Sample IDs	SDG
SS009ASS043007S/SS009ASS043007D	This SDG
SS012ASS043007S/SS012ASS043007D	This SDG
SS021ASS050107S/SS021ASS050107D	This SDG

The following table summarizes the relative percent differences (RPDs) of the detected analytes in field duplicate samples SS009ASS043007S and SS009ASS043007D, which were reported in this SDG. The RPDs met the acceptance criterion of ≤30%.

Analyte	SS009ASS043007S (mg/Kg)	SS009ASS043007D (mg/Kg)	RPD
Boron	3.3	3.4	3
Total Uranium	0.440	0.450	2
U-235	0.0032	0.0029	10
U-238	0.440	0.450	2

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The following table summarizes the RPDs of the detected analytes in field duplicate samples SS012ASS043007S and SS012ASS043007D, which were reported in this SDG. The RPDs met the acceptance criterion of ≤30%.

Analyte	SS012ASS043007S (mg/Kg)	SS012ASS043007D (mg/Kg)	RPD
Total Uranium	0.20	0.21	5
U-238	0.20	0.20	0

The following table summarizes the RPDs of the detected analytes in field duplicate samples SS021ASS050107S and SS021ASS050107D, which were reported in this SDG. The RPDs met the acceptance criterion of ≤30%.

Analyte	SS021ASS050107S (mg/Kg)	SS021ASS050107D (mg/Kg)	RPD
Boron	9.2	7.4	22
Total Uranium	0.98	1	2
U-235	0.0064	0.0068	6
U-238	0.97	1	3

Internal Standard Performance

The internal standard performance was within the QC acceptance criteria in all sample analyses.

ICP Serial Dilution Results

Serial dilution analyses were performed on samples SS009ASS043007S, SS015ASS043007S, and SS012ASS043007S. The percent differences met the acceptance criteria.

LCS Results

The %Rs met the QC acceptance criteria for the LCS analyses.

Sample Quantitation/Detection Limit Results

Sample results were spot checked. No discrepancies were noted.

Results between the IDL and the SQL were flagged with a "B" by the laboratory on the Form Is. The "B" qualifier was crossed-off during validation and replaced with a "J" qualifier to indicate that the result was estimated due to uncertainty below the SQL. It should be noted that no bias codes (+ or -) were applied to this "J" qualifier, even if a bias was indicated by other QC nonconformances. In addition, if a result initially reported as detected and flagged with a "B" was subsequently negated (qualified as U) due to blank contamination then the overall qualification was "UJ" to indicate an estimated nondetect.

Since the total uranium result was based on the calculation of the individual U-235 and U-238 results, qualifications made to the individual results were applied to the total uranium result. For instance, if the U-235 result was estimated (J) then the total uranium result was estimated. In addition, if the U-235

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result was qualified as nondetect due to blank contamination then the U-235 result was not used to determine the total uranium result.

The positive results for uranium isotopes and boron were reported to the MDL. Nondetect results were flagged as "U" at the MDL.

All soil samples were analyzed at 2x dilutions due to the matrix of the samples. Reporting limits, MDLs, and/or sample results were adjusted accordingly.

METALS
-1-
INORGANICS ANALYSIS DATA PACKAGE

SDG No: 185248 **METHOD TYPE:** SW846

SAMPLE ID: 185248001 **CLIENT ID:** SS002ASS043007S

CONTRACT: ENSRIndianaPines

MATRIX: S **DATE RECEIVED** 02-MAY-07 **LEVEL:** Low **%SOLIDS:** 84

CAS No	Analyte	Result	Units	C	Qual	M	MDL	DF	Instrument ID	Analytical Run
7440-42-8	Boron	0.925	mg/kg	U		MS	0.925	2	ICPMS3	070514-2
7440-61-1	Total Uranium	0.140	mg/kg			MS	0.0116	2	ICPMS3	070514-1
15117-96-1	Uranium-235	0.00231	mg/kg	U	J	MS	0.00231	2	ICPMS3	070514-1
7440-61-1	Uranium-238	0.140	mg/kg			MS	0.0116	2	ICPMS3	070514-1

METALS
-1-
INORGANICS ANALYSIS DATA PACKAGE

SDG No: 185248 METHOD TYPE: SW846

SAMPLE ID: 185248002 CLIENT ID: SS003ASS043007S

CONTRACT: ENSRIndianaPines

MATRIX: S DATE RECEIVED 02-MAY-07 LEVEL: Low %SOLIDS: 84

CAS No	Analyte	Result	Units	C	Qual	M	MDL	DF	Instrument ID	Analytical Run
7440-42-8	Boron	3.2	mg/kg		J	MS	0.947	2	ICPMS3	070514-2
7440-61-1	Total Uranium	0.250	mg/kg			MS	0.0118	2	ICPMS3	070514-1
15117-96-1	Uranium-235	0.00237	mg/kg		UJ	MS	0.00237	2	ICPMS3	070514-1
7440-61-1	Uranium-238	0.240	mg/kg			MS	0.0118	2	ICPMS3	070514-1

METALS
-1-
INORGANICS ANALYSIS DATA PACKAGE

SDG No: 185248 METHOD TYPE: SW846

SAMPLE ID: 185248003 CLIENT ID: SS004ASS043007S

CONTRACT: ENSRIndianaPines

MATRIX: S DATE RECEIVED 02-MAY-07 LEVEL: Low %SOLIDS: 85

CAS No	Analyte	Result	Units	C	Qual	M	MDL	DF	Instrument ID	Analytical Run
7440-42-8	Boron	0.918	mg/kg	U		MS	0.918	2	ICPMS3	070514-2
7440-61-1	Total Uranium	0.170	mg/kg			MS	0.0115	2	ICPMS3	070514-1
15117-96-1	Uranium-235	0.0023	mg/kg	U	J	MS	0.0023	2	ICPMS3	070514-1
7440-61-1	Uranium-238	0.170	mg/kg			MS	0.0115	2	ICPMS3	070514-1

METALS
-1-
INORGANICS ANALYSIS DATA PACKAGE

SDG No: 185248 METHOD TYPE: SW846

SAMPLE ID: 185248004 CLIENT ID: SS005ASS043007S

CONTRACT: ENSRIndianaPines

MATRIX: S DATE RECEIVED 02-MAY-07 LEVEL: Low %SOLIDS: 62

CAS No	Analyte	Result	Units	C	Qual	M	MDL	DF	Instrument ID	Analytical Run
7440-42-8	Boron	1.5	mg/kg	B	J	MS	1.24	2	ICPMS3	070514-2
7440-61-1	Total Uranium	0.30	mg/kg			MS	0.0155	2	ICPMS3	070514-1
15117-96-1	Uranium-235	0.0031	mg/kg	U	J	MS	0.0031	2	ICPMS3	070514-1
7440-61-1	Uranium-238	0.30	mg/kg			MS	0.0155	2	ICPMS3	070514-1

METALS
-1-
INORGANICS ANALYSIS DATA PACKAGE

SDG No: 185248 METHOD TYPE: SW846

SAMPLE ID: 185248005 CLIENT ID: SS006ASS043007S

CONTRACT: ENSRIndianaPines

MATRIX: S DATE RECEIVED 02-MAY-07 LEVEL: Low %SOLIDS: 89

CAS No	Analyte	Result	Units	C	Qual	M	MDL	DF	Instrument ID	Analytical Run
7440-42-8	Boron	1.7	mg/kg		J	MS	0.883	2	ICPMS3	070514-2
7440-61-1	Total Uranium	0.170	mg/kg			MS	0.011	2	ICPMS3	070514-1
15117-96-1	Uranium-235	0.00221	mg/kg		UJ	MS	0.00221	2	ICPMS3	070514-1
7440-61-1	Uranium-238	0.170	mg/kg			MS	0.011	2	ICPMS3	070514-1

METALS
–1–
INORGANICS ANALYSIS DATA PACKAGE

SDG No: 185248 METHOD TYPE: SW846

SAMPLE ID: 185248007 CLIENT ID: SS013ASS043007S

CONTRACT: ENSRIndianaPines

MATRIX: S DATE RECEIVED 02–MAY–07 LEVEL: Low %SOLIDS: 47

CAS No	Analyte	Result	Units	C	Qual	M	MDL	DF	Instrument ID	Analytical Run
7440–42–8	Boron	1.68	mg/kg	U		MS	1.68	2	ICPMS3	070514–2
7440–61–1	Total Uranium	0.160	mg/kg			MS	0.021	2	ICPMS3	070514–1
15117–96–1	Uranium–235	0.0042	mg/kg	UJ		MS	0.0042	2	ICPMS3	070514–1
7440–61–1	Uranium–238	0.160	mg/kg			MS	0.021	2	ICPMS3	070514–1

METALS
-1-
INORGANICS ANALYSIS DATA PACKAGE

SDG No: 185248 **METHOD TYPE:** SW846

SAMPLE ID: 185248009 **CLIENT ID:** SS023ASS043007S

CONTRACT: ENSRIndianaPines

MATRIX: S **DATE RECEIVED** 02-MAY-07 **LEVEL:** Low **%SOLIDS:** 79

CAS No	Analyte	Result	Units	C	Qual	M	MDL	DF	Instrument ID	Analytical Run
7440-42-8	Boron	1.1	mg/kg	B	J	MS	1	2	ICPMS3	070514-2
7440-61-1	Total Uranium	0.210	mg/kg			MS	0.0125	2	ICPMS3	070514-1
15117-96-1	Uranium-235	0.00251	mg/kg	U	J	MS	0.00251	2	ICPMS3	070514-1
7440-61-1	Uranium-238	0.210	mg/kg			MS	0.0125	2	ICPMS3	070514-1

METALS
–I–
INORGANICS ANALYSIS DATA PACKAGE

SDG No: 185248 METHOD TYPE: SW846

SAMPLE ID: 185248010 CLIENT ID: SS024ASS043007S

CONTRACT: ENSRIndianaPines

MATRIX: S DATE RECEIVED 02–MAY–07 LEVEL: Low %SOLIDS: 83

CAS No	Analyte	Result	Units	C	Qual	M	MDL	DF	Instrument ID	Analytical Run
7440–42–8	Boron	6.8	mg/kg			MS	0.955	2	ICPMS3	070514–2
7440–61–1	Total Uranium	0.370	mg/kg			MS	0.0119	2	ICPMS3	070514–1
15117–96–1	Uranium–235	0.00239	mg/kg	U	J	MS	0.00239	2	ICPMS3	070514–1
7440–61–1	Uranium–238	0.370	mg/kg			MS	0.0119	2	ICPMS3	070514–1

METALS
–I–
INORGANICS ANALYSIS DATA PACKAGE

SDG No: 185248 METHOD TYPE: SW846

SAMPLE ID: 185248011 CLIENT ID: SS025ASS043007S

CONTRACT: ENSRIndianaPines

MATRIX: S DATE RECEIVED 02–MAY–07 LEVEL: Low %SOLIDS: 22

CAS No	Analyte	Result	Units	C	Qual	M	MDL	DF	Instrument ID	Analytical Run
7440–42–8	Boron	15.5	mg/kg			MS	3.65	2	ICPMS3	070514–2
7440–61–1	Total Uranium	0.690	mg/kg			MS	0.0457	2	ICPMS3	070514–1
15117–96–1	Uranium–235	0.00913	mg/kg	U	J	MS	0.00913	2	ICPMS3	070514–1
7440–61–1	Uranium–238	0.680	mg/kg			MS	0.0457	2	ICPMS3	070514–1

METALS
-1-
INORGANICS ANALYSIS DATA PACKAGE

SDG No: 185248-1 METHOD TYPE: SW846

SAMPLE ID: 1852530013 CLIENT ID: SS012ASS043007S

CONTRACT: ENSRIndianaPines

MATRIX: S DATE RECEIVED 02-MAY-07 LEVEL: Low %SOLIDS: 65

CAS No	Analyte	Result	Units	C	Qual	M	MDL	DF	Instrument ID	Analytical Run
7440-42-8	Boron	1.19	mg/kg	U		MS	1.19	2	ICPMS3	070514-2
7440-61-1	Total Uranium	0.20	mg/kg			MS	0.0149	2	ICPMS3	070514-1
15117-96-1	Uranium-235	0.00298	mg/kg	U	J	MS	0.00298	2	ICPMS3	070514-1
7440-61-1	Uranium-238	0.20	mg/kg			MS	0.0149	2	ICPMS3	070514-1

METALS
-1-
INORGANICS ANALYSIS DATA PACKAGE

SDG No: 185248 **METHOD TYPE:** SW846

SAMPLE ID: 185248012 **CLIENT ID:** SS012ASS043007D

CONTRACT: ENSRIndianaPines

MATRIX: S **DATE RECEIVED** 02-MAY-07 **LEVEL:** Low **%SOLIDS:** 69

CAS No	Analyte	Result	Units	C	Qual	M	MDL	DF	Instrument ID	Analytical Run
7440-42-8	Boron	1.15	mg/kg	U		MS	1.15	2	ICPMS3	070514-2
7440-61-1	Total Uranium	0.210	mg/kg			MS	0.0144	2	ICPMS3	070514-1
15117-96-1	Uranium-235	0.00288	mg/kg	U	J	MS	0.00288	2	ICPMS3	070514-1
7440-61-1	Uranium-238	0.20	mg/kg			MS	0.0144	2	ICPMS3	070514-1

METALS
-1-
INORGANICS ANALYSIS DATA PACKAGE

SDG No: 185248 **METHOD TYPE:** SW846

SAMPLE ID: 185248014 **CLIENT ID:** SS015ASS043007S

CONTRACT: ENSRIndianaPines

MATRIX: S **DATE RECEIVED** 02-MAY-07 **LEVEL:** Low **%SOLIDS:** 22

CAS No	Analyte	Result	Units	C	Qual	M	MDL	DF	Instrument ID	Analytical Run
7440-42-8	Boron	7.2	mg/kg	B	J+	MS	3.6	2	ICPMS3	070515-3
7440-61-1	Total Uranium	0.650	mg/kg			MS	0.045	2	ICPMS3	070514-1
15117-96-1	Uranium-235	0.009	mg/kg	U		MS	0.009	2	ICPMS3	070514-1
7440-61-1	Uranium-238	0.650	mg/kg			MS	0.045	2	ICPMS3	070514-1

METALS
-1-
INORGANICS ANALYSIS DATA PACKAGE

SDG No: 185248 **METHOD TYPE:** SW846

SAMPLE ID: 185248015 **CLIENT ID:** SS017ASS050107S

CONTRACT: ENSRIndianaPines

MATRIX: S **DATE RECEIVED** 02-MAY-07 **LEVEL:** Low **%SOLIDS:** 54

CAS No	Analyte	Result	Units	C	Qual	M	MDL	DF	Instrument ID	Analytical Run
7440-42-8	Boron	3.8	mg/kg		J+	MS	1.49	2	ICPMS3	070515-3
7440-61-1	Total Uranium	0.20	mg/kg			MS	0.0186	2	ICPMS3	070514-1
15117-96-1	Uranium-235	0.00372	mg/kg	U	J	MS	0.00372	2	ICPMS3	070514-1
7440-61-1	Uranium-238	0.20	mg/kg			MS	0.0186	2	ICPMS3	070514-1

METALS
-I-
INORGANICS ANALYSIS DATA PACKAGE

SDG No: 185248-1 METHOD TYPE: SW846

SAMPLE ID: 185253001 CLIENT ID: SS001ASS050107S

CONTRACT: ENSRIndianaPines

MATRIX: S DATE RECEIVED 02-MAY-07 LEVEL: Low %SOLIDS: 74

CAS No	Analyte	Result	Units	C	Qual	M	MDL	DF	Instrument ID	Analytical Run
7440-42-8	Boron	2.5	mg/kg	B	J	MS	1.04	2	ICPMS3	070514-2
7440-61-1	Total Uranium	0.190	mg/kg			MS	0.0129	2	ICPMS3	070514-1
15117-96-1	Uranium-235	0.00259	mg/kg	U	J	MS	0.00259	2	ICPMS3	070514-1
7440-61-1	Uranium-238	0.180	mg/kg			MS	0.0129	2	ICPMS3	070514-1

METALS
-1-
INORGANICS ANALYSIS DATA PACKAGE

SDG No: 185248-1 METHOD TYPE: SW846

SAMPLE ID: 185253002 CLIENT ID: SS007ASS050107S

CONTRACT: ENSRIndianaPines

MATRIX: S DATE RECEIVED 02-MAY-07 LEVEL: Low %SOLIDS: 87

CAS No	Analyte	Result	Units	C	Qual	M	MDL	DF	Instrument ID	Analytical Run
7440-42-8	Boron	0.897	mg/kg	U		MS	0.897	2	ICPMS3	070514-2
7440-61-1	Total Uranium	0.120	mg/kg			MS	0.0112	2	ICPMS3	070514-1
15117-96-1	Uranium-235	0.00224	mg/kg	U	J	MS	0.00224	2	ICPMS3	070514-1
7440-61-1	Uranium-238	0.120	mg/kg			MS	0.0112	2	ICPMS3	070514-1

METALS
-1-
INORGANICS ANALYSIS DATA PACKAGE

SDG No: 185248-1 **METHOD TYPE:** SW846

SAMPLE ID: 185253003 **CLIENT ID:** SS010ASS050107S

CONTRACT: ENSRIndianaPines

MATRIX: S **DATE RECEIVED** 02-MAY-07 **LEVEL:** Low **%SOLIDS:** 90

CAS No	Analyte	Result	Units	C	Qual	M	MDL	DF	Instrument ID	Analytical Run
7440-42-8	Boron	0.865	mg/kg	U		MS	0.865	2	ICPMS3	070514-2
7440-61-1	Total Uranium	0.180	mg/kg			MS	0.0108	2	ICPMS3	070514-1
15117-96-1	Uranium-235	0.00216	mg/kg	U		MS	0.00216	2	ICPMS3	070514-1
7440-61-1	Uranium-238	0.180	mg/kg			MS	0.0108	2	ICPMS3	070514-1

METALS
–1–
INORGANICS ANALYSIS DATA PACKAGE

SDG No: 185248–1 METHOD TYPE: SW846

SAMPLE ID: 185253004 CLIENT ID: SS01JASS050107S

CONTRACT: ENSRIndianaPines

MATRIX: S DATE RECEIVED 02–MAY–07 LEVEL: Low %SOLIDS: 79

CAS No	Analyte	Result	Units	C	Qual	M	MDL	DF	Instrument ID	Analytical Run
7440–42–8	Boron	1.01	mg/kg	U		MS	1.01	2	ICPMS3	070514–2
7440–61–1	Total Uranium	0.150	mg/kg			MS	0.0126	2	ICPMS3	070514–1
15117–96–1	Uranium–235	0.00252	mg/kg	UJ		MS	0.00252	2	ICPMS3	070514–1
7440–61–1	Uranium–238	0.140	mg/kg			MS	0.0126	2	ICPMS3	070514–1

METALS
–1–
INORGANICS ANALYSIS DATA PACKAGE

SDG No: 185248–1

METHOD TYPE: SW846

SAMPLE ID: 185253005

CLIENT ID: SS014ASS050107S

CONTRACT: ENSRIndianaPines

MATRIX: S

DATE RECEIVED 02–MAY–07

LEVEL: Low %SOLIDS: 87

CAS No	Analyte	Result	Units	C	Qual	M	MDL	DF	Instrument ID	Analytical Run
7440–42–8	Boron	3.2	mg/kg		J	MS	0.888	2	ICPMS3	070514–2
7440–61–1	Total Uranium	0.290	mg/kg			MS	0.0111	2	ICPMS3	070514–1
15117–96–1	Uranium–235	0.00222	mg/kg		UJ	MS	0.00222	2	ICPMS3	070514–1
7440–61–1	Uranium–238	0.290	mg/kg			MS	0.0111	2	ICPMS3	070514–1

METALS
--I--
INORGANICS ANALYSIS DATA PACKAGE

SDG No: 185248--1 **METHOD TYPE:** SW846

SAMPLE ID: 185253006 **CLIENT ID:** SS018ASS050107S

CONTRACT: ENSRIndianaPines

MATRIX: S **DATE RECEIVED** 02--MAY--07 **LEVEL:** Low **%SOLIDS:** 33

CAS No	Analyte	Result	Units	C	Qual	M	MDL	DF	Instrument ID	Analytical Run
7440--42--8	Boron	13.3	mg/kg			MS	2.39	2	ICPMS3	070514--2
7440--61--1	Total Uranium	6.1	mg/kg			MS	0.0299	2	ICPMS3	070514--1
15117--96--1	Uranium--235	0.044	mg/kg			MS	0.00598	2	ICPMS3	070514--1
7440--61--1	Uranium--238	6.1	mg/kg			MS	0.0299	2	ICPMS3	070514--1

METALS
-1-
INORGANICS ANALYSIS DATA PACKAGE

SDG No: 185248-1

METHOD TYPE: SW846

SAMPLE ID: 185253007

CLIENT ID: SS019ASS050107S

CONTRACT: ENSRIndianaPines

MATRIX: S

DATE RECEIVED 02-MAY-07

LEVEL: Low %SOLIDS: 90.8

CAS No	Analyte	Result	Units	C	Qual	M	MDL	DF	Instrument ID	Analytical Run
7440-42-8	Boron	0.860	mg/kg	U		MS	0.86	2	ICPMS3	070514-2
7440-61-1	Total Uranium	0.180	mg/kg			MS	0.0108	2	ICPMS3	070514-1
15117-96-1	Uranium-235	0.00215	mg/kg	U	J	MS	0.00215	2	ICPMS3	070514-1
7440-61-1	Uranium-238	0.180	mg/kg			MS	0.0108	2	ICPMS3	070514-1

METALS
-1-
INORGANICS ANALYSIS DATA PACKAGE

SDG No: 185248-1

METHOD TYPE: SW846

SAMPLE ID: 1852530O8

CLIENT ID: SS020ASS050107S

CONTRACT: ENSRIndianaPines

MATRIX: S

DATE RECEIVED 02-MAY-07

LEVEL: Low %SOLIDS: 82

CAS No	Analyte	Result	Units	C	Qual	M	MDL	DF	Instrument ID	Analytical Run
7440-42-8	Boron	1.9	mg/kg	B	J	MS	0.963	2	ICPMS3	070514-2
7440-61-1	Total Uranium	0.190	mg/kg			MS	0.012	2	ICPMS3	070514-1
15117-96-1	Uranium-235	0.00241	mg/kg	U	J	MS	0.00241	2	ICPMS3	070514-1
7440-61-1	Uranium-238	0.190	mg/kg			MS	0.012	2	ICPMS3	070514-1

METALS
-1-
INORGANICS ANALYSIS DATA PACKAGE

SDG No: 185248-1

METHOD TYPE: SW846

SAMPLE ID: 18525301I

CLIENT ID: SS02IASS050107D

CONTRACT: ENSRIndianaPines

MATRIX: S

DATE RECEIVED 02-MAY-07

LEVEL: Low %SOLIDS: 60

CAS No	Analyte	Result	Units	C	Qual	M	MDL	DF	Instrument ID	Analytical Run
7440-42-8	Boron	7.4	mg/kg			MS	1.29	2	ICPMS3	070514-2
7440-61-1	Total Uranium	1	mg/kg			MS	0.0161	2	ICPMS3	070514-1
15117-96-1	Uranium-235	0.0068	mg/kg		J	MS	0.00322	2	ICPMS3	070514-1
7440-61-1	Uranium-238	1	mg/kg			MS	0.0161	2	ICPMS3	070514-1

METALS
--1--
INORGANICS ANALYSIS DATA PACKAGE

SDG No: 185248--1

METHOD TYPE: SW846

SAMPLE ID: 185253012

CLIENT ID: SS008ASS050107S

CONTRACT: ENSRIndianaPines

MATRIX: S

DATE RECEIVED 02--MAY--07

LEVEL: Low %SOLIDS: 45

CAS No	Analyte	Result	Units	C	Qual	M	MDL	DF	Instrument ID	Analytical Run
7440--42--8	Boron	2.5	mg/kg		J	MS	1.76	2	ICPMS3	070514--2
7440--61--1	Total Uranium	1	mg/kg			MS	0.022	2	ICPMS3	070514--1
15117--96--1	Uranium--235	0.0062	mg/kg		J	MS	0.00441	2	ICPMS3	070514--1
7440--61--1	Uranium--238	1	mg/kg			MS	0.022	2	ICPMS3	070514--1

METALS
-1-
INORGANICS ANALYSIS DATA PACKAGE

SDG No: 185248-2 METHOD TYPE: SW846

SAMPLE ID: 185256001 CLIENT ID: SS003ASS043007B

CONTRACT: ENSRIndianaPines

MATRIX: W DATE RECEIVED 02-MAY-07 LEVEL: Low %SOLIDS:

CAS No	Analyte	Result	Units	C	Qual	M	MDL	DF	Instrument ID	Analytical Run
7440-42-8	Boron	4	ug/L	U		MS	4	1	ICPMS3	070517-3
7440-61-1	Total Uranium	0.050	ug/L	U		MS	0.05	1	ICPMS3	070515-1
15117-96-1	Uranium-235	0.010	ug/L	U		MS	0.01	1	ICPMS3	070515-1
7440-61-1	Uranium-238	0.050	ug/L	U		MS	0.05	1	ICPMS3	070515-1

METALS
-I-
INORGANICS ANALYSIS DATA PACKAGE

SDG No: 185248-2 **METHOD TYPE:** SW846

SAMPLE ID: 185256002 **CLIENT ID:** SS012ASS043007B

CONTRACT: ENSRIndianaPines

MATRIX: W **DATE RECEIVED** 02-MAY-07 **LEVEL:** Low **%SOLIDS:**

CAS No	Analyte	Result	Units	C	Qual	M	MDL	DF	Instrument ID	Analytical Run
7440-42-8	Boron	4	ug/L	U		MS	4	1	ICPMS3	070517-3
7440-61-1	Total Uranium	0.050	ug/L	U		MS	0.05	1	ICPMS3	070515-1
15117-96-1	Uranium-235	0.010	ug/L	U		MS	0.01	1	ICPMS3	070515-1
7440-61-1	Uranium-238	0.050	ug/L	U		MS	0.05	1	ICPMS3	070515-1

METALS
-1-
INORGANICS ANALYSIS DATA PACKAGE

SDG No: 185248-2 METHOD TYPE: SW846

SAMPLE ID: 185256003 CLIENT ID: SS021ASS050107B

CONTRACT: ENSRIndianaPines

MATRIX: W DATE RECEIVED 02-MAY-07 LEVEL: Low %SOLIDS:

CAS No	Analyte	Result	Units	C	Qual	M	MDL	DF	Instrument ID	Analytical Run
7440-42-8	Boron	4	ug/L	U		MS	4	1	ICPMS3	070517-3
7440-61-1	Total Uranium	0.050	ug/L	U		MS	0.05	1	ICPMS3	070515-1
15117-96-1	Uranium-235	0.010	ug/L	U		MS	0.01	1	ICPMS3	070515-1
7440-61-1	Uranium-238	0.050	ug/L	U		MS	0.05	1	ICPMS3	070515-1

METALS
-I-
INORGANICS ANALYSIS DATA PACKAGE

SDG No: 185248 **METHOD TYPE:** SW846

SAMPLE ID: 185248013 **CLIENT ID:** SS009ASS043007D

CONTRACT: ENSRIndianaPines

MATRIX: S **DATE RECEIVED** 02-MAY-07 **LEVEL:** Low **%SOLIDS:** 85

CAS No	Analyte	Result	Units	C	Qual	M	MDL	DF	Instrument ID	Analytical Run
7440-42-8	Boron	3.4	mg/kg		J+	MS	0.901	2	ICPMS3	070515-3
7440-61-1	Total Uranium	0.450 ~~0.459~~	mg/kg		J	MS	0.0113	2	ICPMS3	070514-1
15117-96-1	Uranium-235	0.0029	mg/kg		~~B~~ J	MS	0.00225	2	ICPMS3	070514-1
7440-61-1	Uranium-238	0.450	mg/kg			MS	0.0113	2	ICPMS3	070514-1

METALS
-1-
INORGANICS ANALYSIS DATA PACKAGE

SDG No: 185248 METHOD TYPE: SW846

SAMPLE ID: 185248006 CLIENT ID: SS009ASS043007S

CONTRACT: ENSRIndianaPines

MATRIX: S DATE RECEIVED 02-MAY-07 LEVEL: Low %SOLIDS: 85

CAS No	Analyte	Result	Units	C	Qual	M	MDL	DF	Instrument ID	Analytical Run
7440-42-8	Boron	3.3	mg/kg		J	MS	0.917	2	ICPMS3	070514-2
7440-61-1	Total Uranium	0.440 ~~0.449~~	mg/kg		J	MS	0.0115	2	ICPMS3	070514-1
15117-96-1	Uranium-235	0.0032	mg/kg		J	MS	0.00229	2	ICPMS3	070514-1
7440-61-1	Uranium-238	0.440	mg/kg			MS	0.0115	2	ICPMS3	070514-1

METALS
-1-
INORGANICS ANALYSIS DATA PACKAGE

SDG No: 185248

METHOD TYPE: SW846

SAMPLE ID: 185248008

CLIENT ID: SS016ASS043007S

CONTRACT: ENSRIndianaPines

MATRIX: S

DATE RECEIVED 02-MAY-07

LEVEL: Low %SOLIDS: 32

CAS No	Analyte	Result	Units	C	Qual	M	MDL	DF	Instrument ID	Analytical Run
7440-42-8	Boron	12.2	mg/kg			MS	2.49	2	ICPMS3	070514-2
7440-61-1	Total Uranium	0.960 0.954	mg/kg		J	MS	0.0311	2	ICPMS3	070514-1
15117-96-1	Uranium-235	0.0068	mg/kg	X	J	MS	0.00621	2	ICPMS3	070514-1
7440-61-1	Uranium-238	0.950	mg/kg			MS	0.0311	2	ICPMS3	070514-1

METALS
–1–
INORGANICS ANALYSIS DATA PACKAGE

SDG No: 185248–1

METHOD TYPE: SW846

SAMPLE ID: 185253009

CLIENT ID: SS021ASS050107S

CONTRACT: ENSRIndianaPines

MATRIX: S

DATE RECEIVED 02–MAY–07

LEVEL: Low %SOLIDS: 59

CAS No	Analyte	Result	Units	C	Qual	M	MDL	DF	Instrument ID	Analytical Run
7440–42–8	Boron	9.2	mg/kg			MS	1.35	2	ICPMS3	070514–2
7440–61–1	Total Uranium	0.980	mg/kg		J	MS	0.0168	2	ICPMS3	070514–1
15117–96–1	Uranium–235	0.0064	mg/kg		J	MS	0.00337	2	ICPMS3	070514–1
7440–61–1	Uranium–238	0.970	mg/kg			MS	0.0168	2	ICPMS3	070514–1

METALS
-1-
INORGANICS ANALYSIS DATA PACKAGE

SDG No: 185248-1 METHOD TYPE: SW846

SAMPLE ID: 185253010 CLIENT ID: SS022ASS050107S

CONTRACT: ENSRIndianaPines

MATRIX: S DATE RECEIVED 02-MAY-07 LEVEL: Low %SOLIDS: 51

CAS No	Analyte	Result	Units	C	Qual	M	MDL	DF	Instrument ID	Analytical Run
7440-42-8	Boron	5.1 1.9	mg/kg	~~J~~		MS	1.56	2	ICPMS3	070514-2
7440-61-1	Total Uranium	~~1.91~~	mg/kg	J		MS	0.0195	2	ICPMS3	070514-1
15117-96-1	Uranium-235	0.013	mg/kg	~~J~~		MS	0.0039	2	ICPMS3	070514-1
7440-61-1	Uranium-238	1.9	mg/kg			MS	0.0195	2	ICPMS3	070514-1

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Memorandum

Date: March 25, 2008

To: Lisa Bradley/Westford

From: Gregory A. Malzone/Pittsburgh

Subject: Data Validation
Radiological Analyses
Yard 520
Pines Area of Investigation, Indiana
GEL SDG Number 202261

Distribution: D. Simmons/Westford

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SUMMARY

Full validation was performed on the data for three soil samples and one equipment blank, and limited validation was performed on the 28 soil samples. The samples were analyzed for Actinium-227 (Ac-227), Lead-210 (Pb-210), Polonium-210 (Po-210), Protactinium-231 (Pa-231), Radium-226 (Ra-226), Radium-228 (Ra-228), Thorium-228 (Th-228), Thorium-230 (Th-230), Thorium-232 (Th-232), Uranium-234 (U-234), Uranium-235 (U-235), and Uranium-238 (U-238) by methods DOE EML HASL-300 (soil samples) and EPA 901.1 (aqueous samples). The samples were collected at Yard 520 Pines Area of Investigation in Pines, Indiana on April 30 - May 1, 2007 and submitted to General Engineering Laboratories (GEL) in Charleston, South Carolina for analysis. GEL processed these samples under sample delivery group (SDG) number 202261.

The analytical data were evaluated with reference to the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP), July 2004, Department of Energy (DOE) "Evaluation of Radiochemical Data Usability" (1997), and the quality control (QC) criteria specified in the analytical method and/or the Yard 520 Quality Assurance Project Plan (QAPP).

In general, the data were valid as reported and may be used for decision making purposes. No data were rejected or qualified as estimated. The data were accepted without qualification based on the quality control (QC) criteria reviewed (see discussions below).

SAMPLES

The samples included in this review are listed below.

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Based on project requirements, full data validation was performed on 10% of the data (*i.e.*, three soil samples and the associated equipment blank), and a limited data validation was performed on the remaining 90% of the data. The samples chosen for limited and full data validation are listed in the tables below.

Samples Selected for Limited Validation

Sample ID	GEL ID	Analytical Batch Number	Matrix
SS003ASS043007B	202261002	726991	Aqueous (QC) Equipment Blank
SS012ASS043007B	202261003	726991	Aqueous (QC) Equipment Blank
SS001ASS050107S	202261019	727047	Soil
SS002ASS043007S	202261013	727047	Soil
SS003ASS043007S	202261014	727047	Soil
SS004ASS043007S	202261015	727047	Soil
SS005ASS043007S	202261016	727047	Soil
SS006ASS043007S	202261017	727047	Soil
SS007ASS050107S	202261020	727047	Soil
SS009ASS043007S	202261018	727047	Soil
SS009ASS043007D	202261012	727047	Soil (QC) Field Duplicate of SS009ASS043007S
SS012ASS043007S	202261005	727047	Soil
SS012ASS050107D	202261031	727047	Soil (QC) Field Duplicate of SS012ASS043007S
SS013ASS043007S	202261006	727047	Soil
SS015ASS043007S	202261007	727047	Soil
SS016ASS043007S	202261008	727047	Soil
SS017ASS050107S	202261001	727047	Soil
SS023ASS043007S	202261009	727047	Soil
SS024ASS043007S	202261010	727047	Soil
SS025ASS043007S	202261011	727047	Soil
SS010ASS050107S	202261021	726183	Soil
SS011ASS050107S	202261022	726183	Soil
SS014ASS050107S	202261023	726183	Soil
SS018ASS050107S	202261024	726183	Soil
SS019ASS050107S	202261025	726183	Soil
SS020ASS050107S	202261026	726183	Soil
SS008ASS050107S	202261030	726183	Soil

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Samples Selected for Full Validation

Sample ID	GEL ID	Analytical Batch Number	Matrix
SS021ASS050107B	202261004	726991	Aqueous (QC) Equipment Blank
SS021ASS050107S	202261027	726183	Soil
SS021ASS050107D	202261029	726183	Soil (QC) Field Duplicate of SS022ASS050107S
SS022ASS050107S	202261028	726183	Soil

REVIEW ELEMENTS

Sample data were reviewed for the following parameters.

- Agreement of analyses conducted with chain-of-custody (COC) requests
- Holding times/sample preservation
- Calibrations
- Laboratory method blanks/equipment blanks
- Matrix spike (MS) results
- Laboratory control sample (LCS) results
- Laboratory duplicate results
- Field duplicate results
- Sample quantitation/detection limit results

DISCUSSION

Agreement of Analyses Conducted With COC Requests

Sample reports were reviewed against the analytical requests as designated on the chain-of-custody (COC) and subsequent communications between ENSR and the laboratory. No discrepancies were noted.

Holding Times/Sample Preservation

The samples were collected on April 30 – May 1, 2007 and shipped to GEL. The radiological analyses were placed on Hold pending approval from EPA. In December, at the request of ENSR, the samples were shipped from GEL to the Warrenville, IL ENSR office for storage. On February 4, 2008, the samples were shipped by ENSR to GEL for analysis since EPA approved the radiological analyses on these background samples. No issues with sample preservation were noted upon receipt in the laboratory.

All samples were received and prepared three months and 7-16 days outside the contractual six-month holding time. The sample data were not qualified in response to the lapsed holding time because of the long nuclide half-lives, and the results were decay corrected by the laboratory. The "H" and "h" flags appended by GEL were removed by the validator.

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Calibrations

All criteria were met for energy and efficiency calibrations and instrument backgrounds.

Laboratory Method Blanks/Equipment Blanks

Three equipment blank samples were associated with the samples in this data set: SS003ASS043007B, SS012ASS043007B, and SS021ASS050107B. There were no contaminants detected above the minimum detectable concentrations (MDCs)/detection limits (DLs) for all the parameters in the laboratory method and equipment blanks.

MS Results

MS analysis were not performed on an aqueous sample from this data set, but was performed on another client's sample. Although this practice is acceptable, the results of the MS analysis were not used to evaluate the aqueous data in this sample set because of possible difference in sample type. No action was taken since the aqueous samples in this data set were equipment blanks.

Note that MS analysis is not applicable to soil samples analyzed by gamma spectroscopy

LCS Results

LCSs were analyzed for both the aqueous and soil matrices. The LCS was spiked with Am-241, Cs-137, and Co-60. All LCS %Rs met the acceptance criteria for all parameters.

Laboratory Duplicate Results

Aqueous laboratory duplicate analysis was performed on sample SS003ASS043007B. The relative percent differences (RPDs) met the QC acceptance criteria of 20% RPD (if both results are greater than five times the MDC/DL). The target radionuclides were not detected in the laboratory duplicate pair; therefore, precision was deemed acceptable.

Soil laboratory duplicate analyses were performed on samples SS010ASS050107S and SS012ASS050107S.

For the laboratory duplicate analysis of sample SS010ASS050107S the RPDs met the QC acceptance criteria of 20% RPD for soil samples (if both results are greater than five times the MDC/DL).

For the laboratory duplicate analysis of sample SS012ASS050107S, the U-238 RPD of 26% was greater than the QC acceptance criterion of 20%. Therefore, the positive and nondetect U-234 results in the samples associated with batch 726183 were qualified as estimated (J/UJ). The RPDs for all the other radionuclides in this laboratory duplicate were acceptable and thus precision was deemed acceptable for all the radionuclides, except U-234.

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Field Duplicate Results

The field duplicate pairs associated with the samples in this data set were SS009ASS043007S/SS009ASS043007D, SS012ASS043007S/SS012ASS043007D, and SS021ASS050107S/SS021ASS050107D. The following tables summarize the RPDs of the detected nuclides in the field duplicate pairs.

Nuclide	SS009ASS043007S (pCi/g)	SS009ASS043007D (pCi/g)	RPD (%)
Pb-210	0.759 ± 0.0314	Nondetected	NC
Po-210	0.759 ± 0.0313	Nondetected	NC
Ra-226	0.258 ± 0.0468	0.285 ± 0.0405	10
Ra-228	0.346 ± 0.104	0.317 ± 0.0794	9
Th-228	0.46 ± 0.0572	0.478 ± 0.0439	4
Th-230	0.258 ± 0.0467	0.284 ± 0.0405	10
Th-232	0.343 ± 0.0426	0.356 ± 0.0337	4
U-234	0.294 ± 0.0778	0.332 ± 0.0502	12
U-238	0.325 ± 0.263	0.591 ± 0.345	58

Nuclide	SS012ASS043007S (pCi/g)	SS012ASS043007D (pCi/g)	RPD (%)
Ra-226	0.214 ± 0.0314	0.198 ± 0.0309	8
Ra-228	0.325 ± 0.0644	0.257 ± 0.0608	23
Th-228	0.385 ± 0.0447	0.327 ± 0.0357	16
Th-230	0.213 ± 0.0313	0.198 ± 0.0308	7
Th-232	0.287 ± 0.333	0.243 ± 0.0266	17
U-234	0.220 ± 0.0563	0.224 ± 0.0463	2

Nuclide	SS021ASS050107S (pCi/g)	SS021ASS050107D (pCi/g)	RPD (%)
Pb-210	1.61 ± 0.0358	1.77 ± 0.383	9
Po-210	1.61 ± 0.0352	1.77 ± 0.376	9
Ra-226	0.656 ± 0.0866	0.720 ± 0.0933	9
Ra-228	0.856 ± 0.150	0.960 ± 0.167	11
Th-228	1.02 ± 0.0901	1.18 ± 0.121	15
Th-230	0.656 ± 0.0866	0.720 ± 0.0444	9
Th-232	0.760 ± 0.0674	0.879 ± 0.090	15
U-234	0.613 ± 0.0891	0.808 ± 0.116	27
U-238	0.938 ± 0.388	0.935 ± 0.343	0

NC – Not calculated because one result was not detected.

The RPDs (where calculated) for all the nuclides met the QC acceptance criteria of 30% for a soil matrix, except for U-238 in samples SS009ASS043007S and SS009ASS043007D. The Pb-210, Po-210, and U-238 results for the field duplicate pair (SS009ASS043007S/SS009ASS043007D) were less than 10 times the MDC/DL and the differences were less than 8 times the MDC/DL. Therefore, no qualifications were required for the Pb-210, Po-210, and U-234 results since precision was deemed acceptable.

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Sample Quantitation/Detection Limit Results

Negative and zero results were reported for some samples, but were flagged with a "U" by GEL as being not detected. These results were reported as not detected (U) at the value reported by the laboratory.

Results reported below the MDC were flagged with a "U" by GEL as being not detected. These results were reported as not detected (U) at the value reported by the laboratory.

Positive results less than the project-required MDA, but greater than the sample MDC were reported as positive results at the value reported by the laboratory.

The following table summarizes the sample for which the laboratory MDC/DLs was greater than the RL, and the result was not detected above the MDC/DL. The result was reported as not detected (U) at the value reported by the laboratory. The laboratory indicated in the case narrative that this sample did not meet the required reporting limit due to receipt of a small sample aliquot.

Sample ID	Nuclide	Sample Result	MDC/DL (pCi/g)	RL (pCi/g)
SS015ASS043007S	U-235	0.131 U	0.139	0.100

The laboratory qualified the following sample results with "UI" to indicate "uncertain identification for gamma spectroscopy". In each case, the project reporting limits were met. This qualifier was removed and the following actions taken.

Sample ID	Analyte	Qualifier Reason	Action
SS012ASS043007B	U-238	High peak width	Report non-detect at MDC/DL
SS012ASS043007S	U-238	High counting uncertainty	Report non-detect at MDC/DL
SS016ASS043007S	U-238	High counting uncertainty	Report non-detect at MDC/DL
SS009ASS043007D	Pb-210	High counting uncertainty	Report non-detect at MDC/DL
	Po-210	High counting uncertainty	Report non-detect at MDC/DL
SS014ASS050107S	U-235	No valid peak	Report non-detect at MDC/DL
SS010ASS050107S	Pb-210	High counting uncertainty	Report non-detect at MDC/DL
	Po-210	High counting uncertainty	Report non-detect at MDC/DL

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Certificate of Analysis

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Report Date: February 25, 2008

Contact: Ms. Debra L. Simmons
Project: **Indiana Pines**

Client Sample ID:	SS001ASS050107S	Project:	ENSR00205
Sample ID:	202261019	Client ID:	ENSR003
Matrix:	SO		
Collect Date:	01-MAY-07 08:55		
Receive Date:	06-FEB-08		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Solid (Long List)											
Actinium-227	HUh	0.029	+/-0.0816	0.111	0.160	pCi/g		MJH1 02/20/08	1907	727047	1
Lead-210	HUh	0.669	+/-0.855	0.784	3.00	pCi/g					
Polonium-210	HUh	0.669	+/-0.855	0.784	3.00	pCi/g					
Protactinium-231	HUh	-0.0955	+/-0.242	0.432	0.500	pCi/g					
Radium-226	Hh	0.142	+/-0.0292	0.0197	0.200	pCi/g					
Radium-228	Hh	0.236	+/-0.0561	0.0375	0.300	pCi/g					
Thorium-228	Hh	0.251	+/-0.0283	0.021	0.400	pCi/g					
Thorium-230	Hh	0.142	+/-0.0292	0.0196	0.500	pCi/g					
Thorium-232	Hh	0.187	+/-0.0211	0.0157	0.400	pCi/g					
Uranium-234	Hh	0.132	+/-0.0634	0.0374	3.00	pCi/g					
Uranium-235	HUh	0.0304	+/-0.0474	0.0605	0.100	pCi/g					
Uranium-238	HUh	0.221	+/-0.335	0.325	0.500	pCi/g					

GAm 03/17/08

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	MXP2	02/12/08	1637	724662

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

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Company : ENSR International
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Report Date: February 25, 2008

Contact: Ms. Debra L. Simmons
Project: **Indiana Pines**

Client Sample ID:	SS002ASS043007S	Project:	ENSR00205
Sample ID:	202261013	Client ID:	ENSR003
Matrix:	SO		
Collect Date:	30-APR-07 11:30		
Receive Date:	06-FEB-08		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Solid (Long List)											
Actinium-227	UJ	0.0523	+/-0.124	0.136	0.160	pCi/g		MJH1 02/20/08	1521	727047	1
Lead-210	U	1.21	+/-1.16	1.16	3.00	pCi/g					
Polonium-210	U	1.21	+/-1.16	1.16	3.00	pCi/g					
Protactinium-231	UJ	-0.169	+/-0.330	0.552	0.500	pCi/g					
Radium-226	U	0.140	+/-0.0285	0.0257	0.200	pCi/g					
Radium-228	U	0.138	+/-0.0559	0.0501	0.300	pCi/g					
Thorium-228	U	0.187	+/-0.0308	0.0256	0.400	pCi/g					
Thorium-230	U	0.140	+/-0.0285	0.0257	0.500	pCi/g					
Thorium-232	U	0.139	+/-0.023	0.0191	0.400	pCi/g					
Uranium-234	U	0.129	+/-0.0493	0.0474	3.00	pCi/g					
Uranium-235	UJ	0.0306	+/-0.0539	0.0696	0.100	pCi/g					
Uranium-238	UJ	0.161	+/-0.359	0.400	0.500	pCi/g					

GAM 03/17/08

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	MXP2	02/12/08	1637	724662

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

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Company : ENSR International
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Report Date: February 25, 2008

Contact: Ms. Debra L. Simmons
Project: **Indiana Pines**

Client Sample ID:	SS003ASS043007S	Project:	ENSR00205
Sample ID:	202261014	Client ID:	ENSR003
Matrix:	SO		
Collect Date:	30-APR-07 12:20		
Receive Date:	06-FEB-08		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Solid (Long List)											
Actinium-227	HUh	0.0477	+/-0.0803	0.141	0.160	pCi/g		MJH1 02/20/08	1522	727047	1
Lead-210	HUh	0.480	+/-0.753	0.808	3.00	pCi/g					
Polonium-210	HUh	0.480	+/-0.752	0.808	3.00	pCi/g					
Protactinium-231	HUh	0.128	+/-0.323	0.564	0.500	pCi/g					
Radium-226	Hh	0.224	+/-0.0391	0.0249	0.200	pCi/g					
Radium-228	Hh	0.232	+/-0.0704	0.0475	0.300	pCi/g					
Thorium-228	Hh	0.298	+/-0.0382	0.0273	0.400	pCi/g					
Thorium-230	Hh	0.223	+/-0.039	0.0249	0.500	pCi/g					
Thorium-232	Hh	0.222	+/-0.0284	0.0203	0.400	pCi/g					
Uranium-234	Hh	0.262	+/-0.0595	0.0461	3.00	pCi/g					
Uranium-235	Hh	0.0949	+/-0.0738	0.0699	0.100	pCi/g					
Uranium-238	HUh	-0.316	+/-0.294	0.404	0.500	pCi/g					

GH 03/17/08

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	MXP2	02/12/08	1637	724662

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

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Report Date: February 25, 2008

Contact: Ms. Debra L. Simmons
Project: **Indiana Pines**

Client Sample ID:	SS004ASS043007S	Project:	ENSR00205
Sample ID:	202261015	Client ID:	ENSR003
Matrix:	SO		
Collect Date:	30-APR-07 12:40		
Receive Date:	06-FEB-08		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Solid (Long List)											
Actinium-227	UJ	-0.0454	+/-0.147	0.174	0.160	pCi/g		MJH1 02/20/08	1531	727047	1
Lead-210	U	0.520	+/-0.287	0.210	3.00	pCi/g					
Polonium-210	U	0.520	+/-0.286	0.210	3.00	pCi/g					
Protactinium-231	UJ	0.198	+/-0.393	0.707	0.500	pCi/g					
Radium-226	U	0.138	+/-0.0469	0.0375	0.200	pCi/g					
Radium-228	U	0.135	+/-0.0996	0.0772	0.300	pCi/g					
Thorium-228	U	0.213	+/-0.0397	0.0319	0.400	pCi/g					
Thorium-230	U	0.138	+/-0.0469	0.0375	0.500	pCi/g					
Thorium-232	U	0.159	+/-0.0295	0.0238	0.400	pCi/g					
Uranium-234	U	0.192	+/-0.0781	0.060	3.00	pCi/g					
Uranium-235	UJ	0.0128	+/-0.0852	0.0817	0.100	pCi/g					
Uranium-238	UJ	0.188	+/-0.318	0.217	0.500	pCi/g					

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The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	MXP2	02/12/08	1637	724662

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

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Report Date: February 25, 2008

Contact: Ms. Debra L. Simmons
Project: **Indiana Pines**

Client Sample ID:	SS005ASS043007S	Project:	ENSR00205
Sample ID:	202261016	Client ID:	ENSR003
Matrix:	SO		
Collect Date:	30-APR-07 17:45		
Receive Date:	06-FEB-08		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Solid (Long List)											
Actinium-227	HU	-0.0436	+/-0.0984	0.169	0.160	pCi/g		MJH1 02/20/08	1534	727047	1
Lead-210	U	1.23	+/-0.222	0.212	3.00	pCi/g					
Polonium-210	U	1.23	+/-0.216	0.212	3.00	pCi/g					
Protactinium-231	HU	-0.0517	+/-0.398	0.688	0.500	pCi/g					
Radium-226		0.264	+/-0.0506	0.0346	0.200	pCi/g					
Radium-228		0.272	+/-0.0874	0.0786	0.300	pCi/g					
Thorium-228		0.272	+/-0.0397	0.0306	0.400	pCi/g					
Thorium-230		0.264	+/-0.0505	0.0346	0.500	pCi/g					
Thorium-232		0.202	+/-0.0296	0.0228	0.400	pCi/g					
Uranium-234	U	0.240	+/-0.0525	0.0592	3.00	pCi/g					
Uranium-235	HU	0.0226	+/-0.0466	0.0793	0.100	pCi/g					
Uranium-238	U	0.342	+/-0.166	0.210	0.500	pCi/g					

GAK 03/17/08

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	MXP2	02/12/08	1637	724662

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

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Company : ENSR International
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Report Date: February 25, 2008

Contact: Ms. Debra L. Simmons
Project: **Indiana Pines**

Client Sample ID:	SS006ASS043007S	Project:	ENSR00205
Sample ID:	202261017	Client ID:	ENSR003
Matrix:	SO		
Collect Date:	30-APR-07 14:15		
Receive Date:	06-FEB-08		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Solid (Long List)											
Actinium-227	U	-0.00623	+/-0.0936	0.141	0.160	pCi/g		MJH1 02/20/08	1534	727047	1
Lead-210	U	-0.0258	+/-1.85	2.02	3.00	pCi/g					
Polonium-210	U	-0.0258	+/-1.85	2.02	3.00	pCi/g					
Protactinium-231	U	-0.121	+/-0.327	0.585	0.500	pCi/g					
Radium-226		0.195	+/-0.034	0.0299	0.200	pCi/g					
Radium-228		0.261	+/-0.0704	0.0597	0.300	pCi/g					
Thorium-228		0.241	+/-0.0343	0.0266	0.400	pCi/g					
Thorium-230		0.195	+/-0.034	0.0299	0.500	pCi/g					
Thorium-232		0.180	+/-0.0256	0.0198	0.400	pCi/g					
Uranium-234		0.184	+/-0.0669	0.0494	3.00	pCi/g					
Uranium-235	U	-0.0346	+/-0.0622	0.0711	0.100	pCi/g					
Uranium-238	U	0.158	+/-0.518	0.435	0.500	pCi/g					

GAH 03/17/08

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	MXP2	02/12/08	1637	724662

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

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Company : ENSR International
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Report Date: February 25, 2008

Contact: Ms. Debra L. Simmons
Project: **Indiana Pines**

Client Sample ID:	SS007ASS050107S	Project:	ENSR00205
Sample ID:	202261020	Client ID:	ENSR003
Matrix:	SO		
Collect Date:	01-MAY-07 11:05		
Receive Date:	06-FEB-08		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Solid (Long List)											
Actinium-227	[redacted]	0.0459	+/-0.0711	0.129	0.160	pCi/g		MJH1 02/21/08	1320	727047	1
Lead-210	[redacted]	0.607	+/-0.638	0.721	3.00	pCi/g					
Polonium-210	[redacted]	0.607	+/-0.638	0.721	3.00	pCi/g					
Protactinium-231	[redacted]	-0.0844	+/-0.291	0.515	0.500	pCi/g					
Radium-226	[redacted]	0.135	+/-0.0307	0.0227	0.200	pCi/g					
Radium-228	[redacted]	0.144	+/-0.0624	0.0482	0.300	pCi/g					
Thorium-228	[redacted]	0.205	+/-0.0294	0.0249	0.400	pCi/g					
Thorium-230	[redacted]	0.135	+/-0.0307	0.0227	0.500	pCi/g					
Thorium-232	[redacted]	0.152	+/-0.0219	0.0185	0.400	pCi/g					
Uranium-234	[redacted]	0.177	+/-0.0468	0.0427	3.00	pCi/g					
Uranium-235	[redacted]	0.00892	+/-0.0554	0.0658	0.100	pCi/g					
Uranium-238	[redacted]	0.0879	+/-0.350	0.319	0.500	pCi/g					

Gm 03/17/08

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	MXP2	02/12/08	1637	724662

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

GEL LABORATORIES LLC
2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Company : ENSR International
Address : 2 Technology Park Drive
Westford, Massachusetts 01886--3140

Report Date: February 25, 2008

Contact: Ms. Debra L. Simmons
Project: **Indiana Pines**

Client Sample ID:	SS008ASS050107S	Project:	ENSR00205
Sample ID:	202261030	Client ID:	ENSR003
Matrix:	SO		
Collect Date:	01-MAY-07 13:25		
Receive Date:	06-FEB-08		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Solid (Long List)											
Actinium-227	[redacted]U	0.0103	+/-0.108	0.183	0.160	pCi/g		MJH1 02/19/08	1917	726183	1
Lead-210	[redacted]	3.13	+/-1.81	1.67	3.00	pCi/g					
Polonium-210	[redacted]	3.13	+/-1.81	1.67	3.00	pCi/g					
Protactinium-231	[redacted]U	-0.347	+/-0.433	0.709	0.500	pCi/g					
Radium-226	[redacted]	0.233	+/-0.0523	0.0328	0.200	pCi/g					
Radium-228	[redacted]	0.484	+/-0.104	0.0607	0.300	pCi/g					
Thorium-228	[redacted]	0.503	+/-0.053	0.0344	0.400	pCi/g					
Thorium-230	[redacted]	0.233	+/-0.0523	0.0328	0.500	pCi/g					
Thorium-232	[redacted]	0.376	+/-0.0395	0.0257	0.400	pCi/g					
Uranium-234	[redacted] J	0.219	+/-0.0679	0.0618	3.00	pCi/g					
Uranium-235	[redacted]U	0.0845	+/-0.0966	0.0934	0.100	pCi/g					
Uranium-238	[redacted]	0.689	+/-0.602	0.553	0.500	pCi/g					

GAM 02/17/08

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	BXJ1	02/07/08	1427	724664

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

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Certificate of Analysis

Company : ENSR International
Address : 2 Technology Park Drive
Westford, Massachusetts 01886--3140

Report Date: February 25, 2008

Contact: Ms. Debra L. Simmons
Project: **Indiana Pines**

Client Sample ID:	SS009ASS043007S	Project:	ENSR00205
Sample ID:	202261018	Client ID:	ENSR003
Matrix:	SO		
Collect Date:	30-APR-07 14:45		
Receive Date:	06-FEB-08		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Solid (Long List)											
Actinium-227	[illegible]	0.0408	+/-0.105	0.187	0.160	pCi/g		MJH1 02/20/08	1906	727047	1
Lead-210	[illegible]	0.759	+/-0.314	0.229	3.00	pCi/g					
Polonium-210	[illegible]	0.759	+/-0.313	0.229	3.00	pCi/g					
Protactinium-231	[illegible]	0.0837	+/-0.454	0.757	0.500	pCi/g					
Radium-226	[illegible]	0.258	+/-0.0468	0.0379	0.200	pCi/g					
Radium-228	[illegible]	0.346	+/-0.104	0.0734	0.300	pCi/g					
Thorium-228	[illegible]	0.460	+/-0.0572	0.0358	0.400	pCi/g					
Thorium-230	[illegible]	0.258	+/-0.0467	0.0379	0.500	pCi/g					
Thorium-232	[illegible]	0.343	+/-0.0426	0.0266	0.400	pCi/g					
Uranium-234	[illegible]	0.294	+/-0.0778	0.0655	3.00	pCi/g					
Uranium-235	[illegible]	-0.00126	+/-0.0749	0.0975	0.100	pCi/g					
Uranium-238	[illegible]	0.325	+/-0.263	0.255	0.500	pCi/g					

GAM e 3/17/08

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	MXP2	02/12/08	1637	724662

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

GEL LABORATORIES LLC
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Certificate of Analysis

Company : ENSR International
Address : 2 Technology Park Drive
Westford, Massachusetts 01886--3140

Report Date: February 25, 2008

Contact: Ms. Debra L. Simmons
Project: **Indiana Pines**

Client Sample ID:	SS009ASS043007D	Project:	ENSR00205
Sample ID:	202261012	Client ID:	ENSR003
Matrix:	SO		
Collect Date:	30-APR-07 14:45		
Receive Date:	06-FEB-08		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Solid (Long List)											
Actinium-227	U	0.0855	+/-0.0792	0.138	0.160	pCi/g		MJH1 02/20/08	1453	727047	1
Lead-210	U	0.00	+/-0.945	0.875	3.00	pCi/g					
Polonium-210	U	0.00	+/-0.944	0.875	3.00	pCi/g					
Protactinium-231	U	-0.224	+/-0.342	0.523	0.500	pCi/g					
Radium-226		0.285	+/-0.0405	0.0236	0.200	pCi/g					
Radium-228		0.317	+/-0.0794	0.0508	0.300	pCi/g					
Thorium-228		0.478	+/-0.0439	0.0251	0.400	pCi/g					
Thorium-230		0.284	+/-0.0405	0.0236	0.500	pCi/g					
Thorium-232		0.356	+/-0.0327	0.0187	0.400	pCi/g					
Uranium-234		0.332	+/-0.0502	0.0454	3.00	pCi/g					
Uranium-235	U	0.0178	+/-0.0661	0.0704	0.100	pCi/g					
Uranium-238		0.591	+/-0.345	0.383	0.500	pCi/g					

GHC 03/17/08

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	MXP2	02/12/08	1637	724662

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

Certificate of Analysis

Company : ENSR International
Address : 2 Technology Park Drive
Westford, Massachusetts 01886--3140

Report Date: February 25, 2008

Contact: Ms. Debra L. Simmons
Project: **Indiana Pines**

Client Sample ID:	SS010ASS050107S	Project:	ENSR00205
Sample ID:	202261021	Client ID:	ENSR003
Matrix:	SO		
Collect Date:	01-MAY-07 11:30		
Receive Date:	06-FEB-08		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Solid (Long List)											
Actinium-227	U	-0.0303	+/-0.0961	0.171	0.160	pCi/g		MJH1 02/16/08	1032	726183	1
Lead-210	U	0.00	+/-0.270	0.213	3.00	pCi/g					
Polonium-210	U	0.00	+/-0.270	0.213	3.00	pCi/g					
Protactinium-231	U	-0.142	+/-0.384	0.675	0.500	pCi/g					
Radium-226		0.196	+/-0.0445	0.0337	0.200	pCi/g					
Radium-228		0.303	+/-0.096	0.074	0.300	pCi/g					
Thorium-228		0.326	+/-0.0452	0.0317	0.400	pCi/g					
Thorium-230		0.195	+/-0.0445	0.0337	0.500	pCi/g					
Thorium-232		0.244	+/-0.0338	0.0237	0.400	pCi/g					
Uranium-234		J 0.222	+/-0.0598	0.0573	3.00	pCi/g					
Uranium-235	U	0.0486	+/-0.0701	0.0856	0.100	pCi/g					
Uranium-238	U	0.125	+/-0.235	0.227	0.500	pCi/g					

GAM 03/17/08

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	BXJ1	02/07/08	1427	724664

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

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Certificate of Analysis

Company : ENSR International
Address : 2 Technology Park Drive
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Report Date: February 25, 2008

Contact: Ms. Debra L. Simmons
Project: **Indiana Pines**

Client Sample ID:	SS011ASS050107S	Project:	ENSR00205
Sample ID:	202261022	Client ID:	ENSR003
Matrix:	SO		
Collect Date:	01-MAY-07 09:40		
Receive Date:	06-FEB-08		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Solid (Long List)											
Actinium-227	[redacted]U	-0.103	+/-0.139	0.173	0.160	pCi/g		MJH1 02/16/08	1033	726183	1
Lead-210	[redacted]	0.909	+/-0.309	0.210	3.00	pCi/g					
Polonium-210	[redacted]	0.909	+/-0.307	0.210	3.00	pCi/g					
Protactinium-231	[redacted]U	-0.303	+/-0.391	0.681	0.500	pCi/g					
Radium-226	[redacted]	0.184	+/-0.0547	0.0376	0.200	pCi/g					
Radium-228	[redacted]	0.104	+/-0.094	0.0781	0.300	pCi/g					
Thorium-228	[redacted]	0.232	+/-0.0418	0.0319	0.400	pCi/g					
Thorium-230	[redacted]	0.184	+/-0.0547	0.0376	0.500	pCi/g					
Thorium-232	[redacted]	0.174	+/-0.0313	0.0238	0.400	pCi/g					
Uranium-234	[redacted] J	0.136	+/-0.068	0.0613	3.00	pCi/g					
Uranium-235	[redacted]U	0.0306	+/-0.0961	0.082	0.100	pCi/g					
Uranium-238	[redacted]U	0.208	+/-0.308	0.213	0.500	pCi/g					

GAH 03/17/08

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	BXJ1	02/07/08	1427	724664

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

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Certificate of Analysis

Company : ENSR International
Address : 2 Technology Park Drive
Westford, Massachusetts 01886--3140

Report Date: February 25, 2008

Contact: Ms. Debra L. Simmons
Project: **Indiana Pines**

Client Sample ID:	SS012ASS043007S	Project:	ENSR00205
Sample ID:	202261005	Client ID:	ENSR003
Matrix:	SO		
Collect Date:	30-APR-07 15:20		
Receive Date:	06-FEB-08		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Solid (Long List)											
Actinium-227	[redacted]U	0.012	+/-0.0812	0.146	0.160	pCi/g		MJH1 02/20/08	1413	727047	1
Lead-210	[redacted]U	1.62	+/-1.28	1.63	3.00	pCi/g					
Polonium-210	[redacted]U	1.62	+/-1.28	1.63	3.00	pCi/g					
Protactinium-231	[redacted]U	0.0663	+/-0.377	0.585	0.500	pCi/g					
Radium-226	[redacted]	0.214	+/-0.0314	0.0275	0.200	pCi/g					
Radium-228	[redacted]	0.325	+/-0.0644	0.056	0.300	pCi/g					
Thorium-228	[redacted]	0.385	+/-0.0447	0.0278	0.400	pCi/g					
Thorium-230	[redacted]	0.213	+/-0.0313	0.0275	0.500	pCi/g					
Thorium-232	[redacted]	0.287	+/-0.0333	0.0207	0.400	pCi/g					
Uranium-234	[redacted]	0.220	+/-0.0563	0.0509	3.00	pCi/g					
Uranium-235	[redacted]U	0.0299	+/-0.0521	0.0805	0.100	pCi/g					
Uranium-238	[redacted]U	0.00	+/-0.428	0.480	0.500	pCi/g					

Grm 03/17/08

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	MXP2	02/12/08	1637	724662

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

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Certificate of Analysis

Company : ENSR International
Address : 2 Technology Park Drive
Westford, Massachusetts 01886--3140

Report Date: February 25, 2008

Contact: Ms. Debra L. Simmons
Project: **Indiana Pines**

Client Sample ID:	SS012ASS043007D	Project:	ENSR00205
Sample ID:	202261031	Client ID:	ENSR003
Matrix:	SO		
Collect Date:	30-APR-07 15:20		
Receive Date:	06-FEB-08		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Solid (Long List)											
Actinium-227	U	0.0192	+/-0.0697	0.126	0.160	pCi/g		MJH1 02/21/08	1327	727047	1
Lead-210	U	0.481	+/-0.685	0.715	3.00	pCi/g					
Polonium-210	U	0.481	+/-0.685	0.715	3.00	pCi/g					
Protactinium-231	U	0.0369	+/-0.275	0.492	0.500	pCi/g					
Radium-226		0.198	+/-0.0309	0.0209	0.200	pCi/g					
Radium-228		0.257	+/-0.0608	0.0416	0.300	pCi/g					
Thorium-228		0.327	+/-0.0357	0.0229	0.400	pCi/g					
Thorium-230		0.198	+/-0.0308	0.0209	0.500	pCi/g					
Thorium-232		0.243	+/-0.0266	0.0171	0.400	pCi/g					
Uranium-234		0.224	+/-0.0463	0.0412	3.00	pCi/g					
Uranium-235	U	0.0254	+/-0.0592	0.0645	0.100	pCi/g					
Uranium-238	U	-0.124	+/-0.245	0.374	0.500	pCi/g					

GKM 03/17/08

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	BXJ1	02/13/08	1605	726507

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

GEL LABORATORIES LLC
2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Company : ENSR International
Address : 2 Technology Park Drive
Westford, Massachusetts 01886--3140

Report Date: February 25, 2008

Contact: Ms. Debra L. Simmons
Project: **Indiana Pines**

Client Sample ID:	SS013ASS043007S	Project:	ENSR00205
Sample ID:	202261006	Client ID:	ENSR003
Matrix:	SO		
Collect Date:	30-APR-07 17:00		
Receive Date:	06-FEB-08		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Solid (Long List)											
Actinium-227	[illegible]U	-0.00269	+/-0.0843	0.146	0.160	pCi/g		MJH1 02/20/08	1414	727047	1
Lead-210	[illegible]	3.10	+/-0.818	0.561	3.00	pCi/g					
Polonium-210	[illegible]	3.10	+/-0.808	0.561	3.00	pCi/g					
Protactinium-231	[illegible]U	0.0663	+/-0.330	0.572	0.500	pCi/g					
Radium-226	[illegible]	0.134	+/-0.0357	0.0281	0.200	pCi/g					
Radium-228	[illegible]	0.157	+/-0.0654	0.0599	0.300	pCi/g					
Thorium-228	[illegible]	0.277	+/-0.0384	0.0273	0.400	pCi/g					
Thorium-230	[illegible]	0.134	+/-0.0357	0.0281	0.500	pCi/g					
Thorium-232	[illegible]	0.206	+/-0.0286	0.0203	0.400	pCi/g					
Uranium-234	[illegible]	0.177	+/-0.0585	0.0492	3.00	pCi/g					
Uranium-235	[illegible]U	0.00466	+/-0.0726	0.0713	0.100	pCi/g					
Uranium-238	[illegible]U	0.149	+/-0.314	0.290	0.500	pCi/g					

Gbm 03/17/08

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	MXP2	02/12/08	1637	724662

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

Certificate of Analysis

Company : ENSR International
Address : 2 Technology Park Drive
Westford, Massachusetts 01886--3140

Report Date: February 25, 2008

Contact: Ms. Debra L. Simmons
Project: **Indiana Pines**

Client Sample ID:	SS014ASS050107S	Project:	ENSR00205
Sample ID:	202261023	Client ID:	ENSR003
Matrix:	SO		
Collect Date:	01-MAY-07 09:20		
Receive Date:	06-FEB-08		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Solid (Long List)											
Actinium-227	U	-0.0222	+/-0.0801	0.144	0.160	pCi/g		MJH1 02/16/08	1033	726183	1
Lead-210		0.622	+/-0.147	0.184	3.00	pCi/g					
Polonium-210		0.622	+/-0.144	0.184	3.00	pCi/g					
Protactinium-231	U	-0.0149	+/-0.326	0.585	0.500	pCi/g					
Radium-226		0.233	+/-0.0417	0.0302	0.200	pCi/g					
Radium-228		0.290	+/-0.0908	0.0632	0.300	pCi/g					
Thorium-228		0.330	+/-0.0373	0.026	0.400	pCi/g					
Thorium-230		0.233	+/-0.0416	0.0301	0.500	pCi/g					
Thorium-232		0.247	+/-0.0279	0.0194	0.400	pCi/g					
Uranium-234	J	0.264	+/-0.0515	0.0487	3.00	pCi/g					
Uranium-235	U	0.00	+/-0.0579	0.0676	0.100	pCi/g					
Uranium-238		0.338	+/-0.161	0.191	0.500	pCi/g					

GAM 03/17/08

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	BXJ1	02/07/08	1427	724664

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

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Certificate of Analysis

Company : ENSR International
Address : 2 Technology Park Drive
Westford, Massachusetts 01886--3140

Report Date: February 25, 2008

Contact: Ms. Debra L. Simmons
Project: **Indiana Pines**

Client Sample ID:	SS015ASS043007S	Project:	ENSR00205
Sample ID:	202261007	Client ID:	ENSR003
Matrix:	SO		
Collect Date:	30-APR-07 16:25		
Receive Date:	06-FEB-08		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Solid (Long List)											
Actinium-227	[redacted]U	0.0668	+/-0.172	0.278	0.160	pCi/g		MJH1 02/20/08	1414	727047	1
Lead-210	[redacted]	7.37	+/-2.75	2.39	3.00	pCi/g					
Polonium-210	[redacted]	7.37	+/-2.73	2.39	3.00	pCi/g					
Protactinium-231	[redacted]U	-0.316	+/-0.726	1.15	0.500	pCi/g					
Radium-226	[redacted]	0.416	+/-0.0808	0.0501	0.200	pCi/g					
Radium-228	[redacted]	0.333	+/-0.138	0.0889	0.300	pCi/g					
Thorium-228	[redacted]	0.556	+/-0.0725	0.0533	0.400	pCi/g					
Thorium-230	[redacted]	0.416	+/-0.0807	0.0501	0.500	pCi/g					
Thorium-232	[redacted]	0.414	+/-0.054	0.0397	0.400	pCi/g					
Uranium-234	[redacted]	0.399	+/-0.124	0.104	3.00	pCi/g					
Uranium-235	[redacted]U	0.131	+/-0.154	0.139	0.100	pCi/g					
Uranium-238	[redacted]U	0.457	+/-0.882	0.794	0.500	pCi/g					

GH 03/17/08

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	MXP2	02/12/08	1637	724662

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

GEL LABORATORIES LLC
2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Company : ENSR International
Address : 2 Technology Park Drive
Westford, Massachusetts 01886--3140

Report Date: February 25, 2008

Contact: Ms. Debra L. Simmons
Project: **Indiana Pines**

Client Sample ID:	SS016ASS043007S	Project:	ENSR00205
Sample ID:	202261008	Client ID:	ENSR003
Matrix:	SO		
Collect Date:	30-APR-07 15:35		
Receive Date:	06-FEB-08		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Solid (Long List)											
Actinium-227	HU	-0.0108	+/-0.216	0.329	0.160	pCi/g		MJH1 02/20/08	1415	727047	1
Lead-210	U	5.17	+/-0.829	0.413	3.00	pCi/g					
Polonium-210	U	5.17	+/-0.801	0.413	3.00	pCi/g					
Protactinium-231	HU	-0.0371	+/-0.886	1.35	0.500	pCi/g					
Radium-226	U	0.472	+/-0.126	0.0752	0.200	pCi/g					
Radium-228	U	0.632	+/-0.227	0.153	0.300	pCi/g					
Thorium-228	U	0.785	+/-0.101	0.0601	0.400	pCi/g					
Thorium-230	U	0.472	+/-0.126	0.0752	0.500	pCi/g					
Thorium-232	U	0.585	+/-0.0751	0.0448	0.400	pCi/g					
Uranium-234	U	0.383	+/-0.163	0.116	3.00	pCi/g					
Uranium-235	U	0.0369	+/-0.189	0.150	0.100	pCi/g					
Uranium-238	U	0.00	+/-0.650	0.406	0.500	pCi/g					

GAH 03/17/08

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	MXP2	02/12/08	1637	724662

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

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2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Company : ENSR International
Address : 2 Technology Park Drive
Westford, Massachusetts 01886--3140

Report Date: February 25, 2008

Contact: Ms. Debra L. Simmons
Project: **Indiana Pines**

Client Sample ID:	SS017ASS050107S	Project:	ENSR00205
Sample ID:	202261001	Client ID:	ENSR003
Matrix:	SO		
Collect Date:	01-MAY-07 12:00		
Receive Date:	06-FEB-08		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Solid (Long List)											
Actinium-227	HU	0.079	+/-0.101	0.177	0.160	pCi/g		MJH1 02/20/08	1413	727047	1
Lead-210	HU	1.94	+/-2.96	2.53	3.00	pCi/g					
Polonium-210	HU	1.94	+/-2.96	2.53	3.00	pCi/g					
Protactinium-231	HU	0.105	+/-0.388	0.670	0.500	pCi/g					
Radium-226	H	0.153	+/-0.0408	0.0313	0.200	pCi/g					
Radium-228	H	0.261	+/-0.0709	0.065	0.300	pCi/g					
Thorium-228	H	0.259	+/-0.041	0.0316	0.400	pCi/g					
Thorium-230	H	0.153	+/-0.0408	0.0313	0.500	pCi/g					
Thorium-232	H	0.193	+/-0.0306	0.0235	0.400	pCi/g					
Uranium-234	H	0.176	+/-0.0587	0.060	3.00	pCi/g					
Uranium-235	HU	-0.0103	+/-0.0787	0.098	0.100	pCi/g					
Uranium-238	HU	0.200	+/-0.872	0.601	0.500	pCi/g					

GAH 02/17/08

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	MXP2	02/12/08	1637	724662

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

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Certificate of Analysis

Company : ENSR International
Address : 2 Technology Park Drive
Westford, Massachusetts 01886--3140

Report Date: February 25, 2008

Contact: Ms. Debra L. Simmons
Project: **Indiana Pines**

Client Sample ID: SS018ASS050107S
Sample ID: 202261024
Matrix: SO
Collect Date: 01-MAY-07 14:00
Receive Date: 06-FEB-08
Collector: Client

Project: ENSR00205
Client ID: ENSR003

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Solid (Long List)											
Actinium-227	[redacted]	0.037	+/-0.124	0.178	0.160	pCi/g		MJH1 02/16/08	1249	726183	1
Lead-210	[redacted]	2.51	+/-1.09	1.18	3.00	pCi/g					
Polonium-210	[redacted]	2.51	+/-1.08	1.18	3.00	pCi/g					
Protactinium-231	[redacted]	-0.123	+/-0.410	0.702	0.500	pCi/g					
Radium-226	[redacted]	0.499	+/-0.0635	0.0325	0.200	pCi/g					
Radium-228	[redacted]	0.423	+/-0.101	0.0644	0.300	pCi/g					
Thorium-228	[redacted]	0.532	+/-0.0528	0.0339	0.400	pCi/g					
Thorium-230	[redacted]	0.499	+/-0.0635	0.0325	0.500	pCi/g					
Thorium-232	[redacted]	0.398	+/-0.0395	0.0254	0.400	pCi/g					
Uranium-234	[redacted]	0.589	+/-0.0725	0.0606	3.00	pCi/g					
Uranium-235	[redacted]	0.144	+/-0.117	0.0922	0.100	pCi/g					
Uranium-238	[redacted]	1.95	+/-0.606	0.502	0.500	pCi/g					

GAM 03/17/08

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	BXJ1	02/07/08	1427	724664

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

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Certificate of Analysis

Company : ENSR International
Address : 2 Technology Park Drive
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Report Date: February 25, 2008

Contact: Ms. Debra L. Simmons
Project: **Indiana Pines**

Client Sample ID:	SS019ASS050107S	Project:	ENSR00205
Sample ID:	202261025	Client ID:	ENSR003
Matrix:	SO		
Collect Date:	01-MAY-07 13:40		
Receive Date:	06-FEB-08		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Solid (Long List)											
Actinium-227	HU	0.0478	+/-0.0854	0.153	0.160	pCi/g		MJH1 02/16/08	1346	726183	1
Lead-210	HU	0.0379	+/-1.37	1.79	3.00	pCi/g					
Polonium-210	HU	0.0379	+/-1.37	1.79	3.00	pCi/g					
Protactinium-231	HU	-0.131	+/-0.347	0.605	0.500	pCi/g					
Radium-226	H	0.208	+/-0.0419	0.0275	0.200	pCi/g					
Radium-228	H	0.300	+/-0.0782	0.0542	0.300	pCi/g					
Thorium-228	H	0.338	+/-0.0459	0.0282	0.400	pCi/g					
Thorium-230	H	0.208	+/-0.0419	0.0275	0.500	pCi/g					
Thorium-232	H	0.253	+/-0.0343	0.0211	0.400	pCi/g					
Uranium-234	H J	0.278	+/-0.052	0.0493	3.00	pCi/g					
Uranium-235	HU	0.017	+/-0.0681	0.082	0.100	pCi/g					
Uranium-238	HU	0.467	+/-0.501	0.491	0.500	pCi/g					

Gmm 03/17/08

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	BXJ1	02/07/08	1427	724664

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

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Certificate of Analysis

Company : ENSR International
Address : 2 Technology Park Drive
Westford, Massachusetts 01886--3140

Report Date: February 25, 2008

Contact: Ms. Debra L. Simmons
Project: **Indiana Pines**

Client Sample ID:	SS020ASS050107S	Project:	ENSR00205
Sample ID:	202261026	Client ID:	ENSR003
Matrix:	SO		
Collect Date:	01-MAY-07 10:25		
Receive Date:	06-FEB-08		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Solid (Long List)											
Actinium-227	[redacted]U	-0.0645	+/-0.0804	0.138	0.160	pCi/g		MJH1 02/16/08	1347	726183	1
Lead-210	[redacted]	1.22	+/-0.649	0.528	3.00	pCi/g					
Polonium-210	[redacted]	1.22	+/-0.647	0.528	3.00	pCi/g					
Protactinium-231	[redacted]U	0.0695	+/-0.330	0.561	0.500	pCi/g					
Radium-226	[redacted]	0.185	+/-0.0351	0.0264	0.200	pCi/g					
Radium-228	[redacted]	0.269	+/-0.0772	0.0492	0.300	pCi/g					
Thorium-228	[redacted]	0.340	+/-0.0397	0.0268	0.400	pCi/g					
Thorium-230	[redacted]	0.185	+/-0.0351	0.0264	0.500	pCi/g					
Thorium-232	[redacted]	0.254	+/-0.0297	0.0201	0.400	pCi/g					
Uranium-234	[redacted]	0.207	+/-0.0617	0.0472	3.00	pCi/g					
Uranium-235	[redacted]U	0.0138	+/-0.0644	0.0687	0.100	pCi/g					
Uranium-238	[redacted]U	0.196	+/-0.304	0.291	0.500	pCi/g					

GAM 03/17/08

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	BXJ1	02/07/08	1427	724664

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

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Certificate of Analysis

Company : ENSR International
Address : 2 Technology Park Drive
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Report Date: February 25, 2008

Contact: Ms. Debra L. Simmons
Project: **Indiana Pines**

Client Sample ID:	SS021ASS050107D	Project:	ENSR00205
Sample ID:	202261029	Client ID:	ENSR003
Matrix:	SO		
Collect Date:	01-MAY-07 10:05		
Receive Date:	06-FEB-08		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Solid (Long List)											
Actinium-227	UI	-0.0215	+/-0.131	0.229	0.160	pCi/g		MJH1 02/19/08	1927	726183	1
Lead-210	U	1.77	+/-0.383	0.293	3.00	pCi/g					
Polonium-210	U	1.77	+/-0.376	0.293	3.00	pCi/g					
Protactinium-231	UI	-0.0898	+/-0.613	0.923	0.500	pCi/g					
Radium-226	U	0.720	+/-0.0933	0.0444	0.200	pCi/g					
Radium-228	U	0.960	+/-0.167	0.0905	0.300	pCi/g					
Thorium-228	U	1.18	+/-0.121	0.0427	0.400	pCi/g					
Thorium-230	U	0.720	+/-0.0933	0.0444	0.500	pCi/g					
Thorium-232	U	0.879	+/-0.090	0.0319	0.400	pCi/g					
Uranium-234	U	0.808	+/-0.116	0.0782	3.00	pCi/g					
Uranium-235	UI	0.0546	+/-0.0995	0.119	0.100	pCi/g					
Uranium-238	U	0.935	+/-0.343	0.340	0.500	pCi/g					

GAM 03/17/08

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	BXJ1	02/07/08	1427	724664

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

GEL LABORATORIES LLC
2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Company : ENSR International
Address : 2 Technology Park Drive
Westford, Massachusetts 01886--3140

Report Date: February 25, 2008

Contact: Ms. Debra L. Simmons
Project: **Indiana Pines**

Client Sample ID: SS021ASS050107S
Sample ID: 202261027
Matrix: SO
Collect Date: 01-MAY-07 10:05
Receive Date: 06-FEB-08
Collector: Client

Project: ENSR00205
Client ID: ENSR003

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Solid (Long List)											
Actinium-227	[redacted]U	0.0531	+/-0.133	0.198	0.160	pCi/g		MJH1 02/16/08	1348	726183	1
Lead-210	[redacted]	1.61	+/-0.358	0.279	3.00	pCi/g					
Polonium-210	[redacted]	1.61	+/-0.352	0.279	3.00	pCi/g					
Protactinium-231	[redacted]U	0.150	+/-0.493	0.815	0.500	pCi/g					
Radium-226	[redacted]	0.656	+/-0.0866	0.0376	0.200	pCi/g					
Radium-228	[redacted]	0.856	+/-0.150	0.0897	0.300	pCi/g					
Thorium-228	[redacted]	1.02	+/-0.0901	0.0359	0.400	pCi/g					
Thorium-230	[redacted]	0.656	+/-0.0866	0.0376	0.500	pCi/g					
Thorium-232	[redacted]	0.760	+/-0.0674	0.0269	0.400	pCi/g					
Uranium-234	[redacted] J	0.613	+/-0.0891	0.0664	3.00	pCi/g					
Uranium-235	[redacted]U	0.00607	+/-0.0918	0.0987	0.100	pCi/g					
Uranium-238	[redacted]	0.938	+/-0.388	0.290	0.500	pCi/g					

GAM 02/17/08

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	BXJ1	02/07/08	1427	724664

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

GEL LABORATORIES LLC
2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Company : ENSR International
Address : 2 Technology Park Drive
Westford, Massachusetts 01886--3140

Report Date: February 25, 2008

Contact: Ms. Debra L. Simmons
Project: **Indiana Pines**

Client Sample ID:	SS022ASS050107S	Project:	ENSR00205
Sample ID:	202261028	Client ID:	ENSR003
Matrix:	SO		
Collect Date:	01-MAY-07 07:50		
Receive Date:	06-FEB-08		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Solid (Long List)											
Actinium-227	U	0.0719	+/-0.106	0.179	0.160	pCi/g		MJH1 02/16/08	1349	726183	1
Lead-210	U	1.74	+/-1.47	1.58	3.00	pCi/g					
Polonium-210	U	1.74	+/-1.47	1.58	3.00	pCi/g					
Protactinium-231	U	-0.171	+/-0.445	0.731	0.500	pCi/g					
Radium-226	U	0.445	+/-0.0555	0.031	0.200	pCi/g					
Radium-228	U	0.511	+/-0.104	0.0655	0.300	pCi/g					
Thorium-228	U	0.603	+/-0.0601	0.0341	0.400	pCi/g					
Thorium-230	U	0.445	+/-0.0555	0.031	0.500	pCi/g					
Thorium-232	U	0.451	+/-0.0449	0.0255	0.400	pCi/g					
Uranium-234	U	0.438	+/-0.0731	0.062	3.00	pCi/g					
Uranium-235	U	0.0687	+/-0.084	0.0938	0.100	pCi/g					
Uranium-238	U	0.493	+/-0.524	0.543	0.500	pCi/g					

GAM 03/17/08

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	BXJ1	02/07/08	1427	724664

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

GEL LABORATORIES LLC
2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Company : ENSR International
Address : 2 Technology Park Drive
Westford, Massachusetts 01886--3140

Report Date: February 25, 2008

Contact: Ms. Debra L. Simmons
Project: **Indiana Pines**

Client Sample ID:	SS023ASS043007S	Project:	ENSR00205
Sample ID:	202261009	Client ID:	ENSR003
Matrix:	SO		
Collect Date:	30-APR-07 10:50		
Receive Date:	06-FEB-08		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Solid (Long List)											
Actinium-227	HUh	0.0809	+/-0.100	0.178	0.160	pCi/g		MJH1 02/20/08	1431	727047	1
Lead-210	HUh	0.231	+/-0.873	0.896	3.00	pCi/g					
Polonium-210	HUh	0.231	+/-0.873	0.896	3.00	pCi/g					
Protactinium-231	HUh	0.0964	+/-0.455	0.694	0.500	pCi/g					
Radium-226	Hh	0.173	+/-0.0412	0.0291	0.200	pCi/g					
Radium-228	Hh	0.215	+/-0.0784	0.0546	0.300	pCi/g					
Thorium-228	Hh	0.258	+/-0.0455	0.0333	0.400	pCi/g					
Thorium-230	Hh	0.173	+/-0.0412	0.0291	0.500	pCi/g					
Thorium-232	Hh	0.192	+/-0.0339	0.0248	0.400	pCi/g					
Uranium-234	Hh	0.148	+/-0.0595	0.061	3.00	pCi/g					
Uranium-235	HUh	-0.00668	+/-0.0816	0.0974	0.100	pCi/g					
Uranium-238	HUh	0.346	+/-0.428	0.429	0.500	pCi/g					

GAH 03/17/08

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	MXP2	02/12/08	1637	724662

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

GEL LABORATORIES LLC
2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Company : ENSR International
Address : 2 Technology Park Drive
Westford, Massachusetts 01886--3140

Report Date: February 25, 2008

Contact: Ms. Debra L. Simmons
Project: **Indiana Pines**

Client Sample ID:	SS024ASS043007S	Project:	ENSR00205
Sample ID:	202261010	Client ID:	ENSR003
Matrix:	SO		
Collect Date:	30-APR-07 10:35		
Receive Date:	06-FEB-08		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate Time	Batch	Method
Rad Gamma Spec Analysis										
Gammaspec, Gamma, Solid (Long List)										
Actinium-227	[redacted]U	0.0369	+/-0.0674	0.118	0.160	pCi/g		MJH1 02/20/08 1452	727047	1
Lead-210	[redacted]	0.919	+/-0.730	0.658	3.00	pCi/g				
Polonium-210	[redacted]	0.919	+/-0.729	0.658	3.00	pCi/g				
Protactinium-231	[redacted]U	0.0923	+/-0.269	0.466	0.500	pCi/g				
Radium-226	[redacted]	0.265	+/-0.0392	0.0205	0.200	pCi/g				
Radium-228	[redacted]	0.311	+/-0.0635	0.0411	0.300	pCi/g				
Thorium-228	[redacted]	0.321	+/-0.0337	0.0215	0.400	pCi/g				
Thorium-230	[redacted]	0.265	+/-0.0392	0.0205	0.500	pCi/g				
Thorium-232	[redacted]	0.239	+/-0.0251	0.016	0.400	pCi/g				
Uranium-234	[redacted]	0.274	+/-0.0485	0.0398	3.00	pCi/g				
Uranium-235	[redacted]U	0.0563	+/-0.0477	0.058	0.100	pCi/g				
Uranium-238	[redacted]U	0.222	+/-0.264	0.285	0.500	pCi/g				

GAH 03/17/08

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	MXP2	02/12/08	1637	724662

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

GEL LABORATORIES LLC
2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Company : ENSR International
Address : 2 Technology Park Drive
Westford, Massachusetts 01886--3140

Report Date: February 25, 2008

Contact: Ms. Debra L. Simmons
Project: **Indiana Pines**

Client Sample ID:	SS025ASS043007S	Project:	ENSR00205
Sample ID:	202261011	Client ID:	ENSR003
Matrix:	SO		
Collect Date:	30-APR-07 17:25		
Receive Date:	06-FEB-08		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Solid (Long List)											
Actinium-227	HU	0.0277	+/-0.169	0.275	0.160	pCi/g		MJH1 02/20/08	1452	727047	1
Lead-210	U	7.65	+/-1.93	1.48	3.00	pCi/g					
Polonium-210	U	7.65	+/-1.90	1.48	3.00	pCi/g					
Protactinium-231	HU	-0.162	+/-0.897	1.10	0.500	pCi/g					
Radium-226	U	0.481	+/-0.0896	0.0477	0.200	pCi/g					
Radium-228	U	0.397	+/-0.143	0.0972	0.300	pCi/g					
Thorium-228	U	0.492	+/-0.0691	0.0507	0.400	pCi/g					
Thorium-230	U	0.481	+/-0.0896	0.0477	0.500	pCi/g					
Thorium-232	U	0.367	+/-0.0515	0.0378	0.400	pCi/g					
Uranium-234	U	0.536	+/-0.121	0.0911	3.00	pCi/g					
Uranium-235	HU	0.0252	+/-0.130	0.135	0.100	pCi/g					
Uranium-238	HU	-0.477	+/-0.693	0.681	0.500	pCi/g					

GAw 03/17/08

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	MXP2	02/12/08	1637	724662

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EML HASL 300, 4.5.2.3	

GEL LABORATORIES LLC
2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Company : ENSR International
Address : 2 Technology Park Drive
Westford, Massachusetts 01886--3140

Report Date: February 25, 2008

Contact: Ms. Debra L. Simmons
Project: **Indiana Pines**

Client Sample ID: SS003ASS043007B
Sample ID: 202261002
Matrix: WQ
Collect Date: 30-APR-07 12:20
Receive Date: 06-FEB-08
Collector: Client

Project: ENSR00205
Client ID: ENSR003

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Liquid (Long List)											
Actinium-227	U	-7.41	+/-22.3	37.9		pCi/L		KXG3 02/15/08	1657	726991	1
Lead-210	U	169	+/-770	655	750	pCi/L					
Polonium-210	U	169	+/-770	655		pCi/L					
Protactinium-231	U	-68.5	+/-116	151		pCi/L					
Radium-226	U	-14.1	+/-85.6	117		pCi/L					
Radium-228	U	8.33	+/-9.46	16.2	20.0	pCi/L					
Thorium-228	U	-4.51	+/-6.87	8.69		pCi/L					
Thorium-230	U	-401	+/-2650	1230	20.0	pCi/L					
Thorium-232	U	-150	+/-2720	3890		pCi/L					
Uranium-234	U	1720	+/-17800	10100		pCi/L					
Uranium-235	U	1.42	+/-23.3	23.4	50.0	pCi/L					
Uranium-238	U	-75.8	+/-166	222	250	pCi/L					

Gam 03/17/09

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EPA 901.1	

GEL LABORATORIES LLC
2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Company : ENSR International
Address : 2 Technology Park Drive
Westford, Massachusetts 01886--3140

Report Date: February 25, 2008

Contact: Ms. Debra L. Simmons
Project: **Indiana Pines**

Client Sample ID:	SS012ASS043007B	Project:	ENSR00205
Sample ID:	202261003	Client ID:	ENSR003
Matrix:	WQ		
Collect Date:	30-APR-07 15:20		
Receive Date:	06-FEB-08		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec Analysis											
Gammaspec, Gamma, Liquid (Long List)											
Actinium-227	U	2.38	+/-26.9	46.2		pCi/L		KXG3 02/15/08	1658	726991	1
Lead-210	U	-570	+/-606	704	750	pCi/L					
Polonium-210	U	-570	+/-605	704		pCi/L					
Protactinium-231	U	-51.7	+/-107	179		pCi/L					
Radium-226	U	-8.9	+/-82.1	100		pCi/L					
Radium-228	U	-18.2	+/-17.4	18.1	20.0	pCi/L					
Thorium-228	U	-4.61	+/-8.22	10.6		pCi/L					
Thorium-230	U	-510	+/-3380	1430	20.0	pCi/L					
Thorium-232	U	-446	+/-5360	4180		pCi/L					
Uranium-234	U	4880	+/-48200	10700		pCi/L					
Uranium-235	U	-7.63	+/-23.2	25.2	50.0	pCi/L					
Uranium-238	U	0.00	+/-258	170	250	pCi/L					

GAm 2/21/08

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EPA 901.1	

GEL LABORATORIES LLC
2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Company : ENSR International
Address : 2 Technology Park Drive
Westford, Massachusetts 01886--3140

Report Date: February 25, 2008

Contact: Ms. Debra L. Simmons
Project: **Indiana Pines**

Client Sample ID: SS021ASS050107B
Sample ID: 202261004
Matrix: WQ
Collect Date: 01-MAY-07 10:05
Receive Date: 06-FEB-08
Collector: Client

Project: ENSR00205
Client ID: ENSR003

Parameter	Qualifier	Result	Uncertainty	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec Analysis												
Gammaspec, Gamma, Liquid (Long List)												
Actinium-227	U	-22.1	+/-23.8	38.2		pCi/L		KXG3	02/15/08	1658	726991	1
Lead-210	U	128	+/-398	504	750	pCi/L						
Polonium-210	U	128	+/-398	504		pCi/L						
Protactinium-231	U	34.7	+/-92.7	157		pCi/L						
Radium-226	U	-29.7	+/-77.7	96.5		pCi/L						
Radium-228	U	-14.3	+/-20.5	14.9	20.0	pCi/L						
Thorium-228	U	0.0879	+/-8.15	7.71		pCi/L						
Thorium-230	U	436	+/-2960	1230	20.0	pCi/L						
Thorium-232	U	-469	+/-5290	3490		pCi/L						
Uranium-234	U	-3540	+/-35200	8040		pCi/L						
Uranium-235	U	9.23	+/-20.8	23.9	50.0	pCi/L						
Uranium-238	U	-142	+/-152	170	250	pCi/L						

Gam 03/17/08

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EPA 901.1	

Attachment E

Response to USEPA Comments dated August 22, 2008

higher than in nearby Brown Ditch. In this narrow remnant strip of aquifer between Yard 520 and the ditch, it is unlikely leakage from the Type III (South) Area and the small amount of recharge could provide sufficient water to maintain these high levels. Another source of water clearly exists. Furthermore, even if the Type III (South) Area were to be replaced by a block of completely impermeable material, groundwater would still be present in this remnant aquifer area. The most likely source of that groundwater is the area north of the Type III (South) Area, that is, from the Type II (North) Area of Yard 520.

See also the response to comment 2 for additional discussion on the groundwater flow system in the area of Yard 520.

Additional discussion of the construction of the Type III (South) Area of Yard 520 is provided in responses to previous comments (e.g., response to Comment 3).

Evaluation of Data Collected Under the Yard 520 Sampling and Analysis Plan

Background Samples

Comment #204: Uranium background concentrations for sample SS018 are anomalously high. Pb-214 [sic] and Po-210 for samples SS015 and SS016 are also anomalous. Explain why these results are anomalous and potential impacts to the risk assessment, or consider these results to be outliers that should be removed.

Response: The results that are assumed to be anomalously high are most likely due to local geologic or other conditions. SS018 is located in a wetland just north of US Hwy 20 in the vicinity of two commercial facilities. The higher U could represent local geologic variability, or it could be due to the nearby anthropogenic factors. SS015 and SS016 are both located in IDNL north of Brown Ditch. The fact that they both have higher concentrations of Pb-210 and Po-210, and they are located near each other physically, suggests this is due to local conditions.

Regardless of the reasons for the higher concentrations, these samples all represent appropriate, approved background locations. There is no reason to remove them from the background datasets. See also response to comment 71. These data will be evaluated in the risk assessments.

Comment #205: The U-238 and U-235 background water concentrations were identical across three samples:

GEL Laboratories LLC
Metals
-1-
Inorganics Analysis Data Package
SDG No: 185248-2
Sample ID: 185256001
Sample ID: 185256002
Sample ID: 185256003

Getting the exact concentration in each measurement is unexpected. Determine the cause of these results and explain.

Response: The samples were aqueous equipment blank samples (SS003AS0043007B, SS012ASS043007B, and SS021ASS050107B) associated with the background soil samples. U-235 and U-238 were nondetect at 0.01 ug/L and 0.05 ug/L, respectively, in all three of these quality control (QC) samples. In addition, the total uranium result, which was calculated from the U-235 and U-238 analytical results was also nondetect in these three QC samples. In general for aqueous samples, the

reported nondetect results would be identical since the results are reported as nondetect at the Reporting Limit (RL).

The associated data package in Attachment D of the Yard 520 report is GEL data package 185256 (SDG 185248-2).

Comment #206: Uranium measurements by inductively Coupled Plasma Mass Spectrometry (ICPMS) list total uranium as the sum of uranium-238 + uranium-235. This is incorrect. Total uranium is the sum of uranium-238 + uranium-234 + uranium-235. It is important to have the uranium-234 level if a conversion from mg/kg to pCi/g is necessary. If ICP-MS is being used to determine total uranium, then the analyte should be stated as "total uranium". Please explain and correct.

Response: GEL analyzed for total uranium by ICP/MS. However, total uranium by ICP/MS as reported by GEL was based on measuring for U-235 and U-238 only (see GEL SOP GL-MA-E-014 in QAPP Rev 2_April 2008). Typically, ICP/MS concentration methods do not measure for U-234. If assuming that the uranium isotopes were present in natural abundance, then 99.99% of the total uranium concentration was contributable to U-235 and U-238. Thus, the U-234 concentration would have had only 0.0055% affect on the total concentration. However, when converting the total concentration results into activity, a slight increase in the presence of U-234 above the expected mass would have an affect on the total activity. Thus, should the conversion of concentration results to activity be necessary, the activity may be biased low.

An associated data package in Attachment D of the Yard 520 report is GEL data package 185256 (SDG 185248-2).

Comment #207: Results for ICPMS do not contain any uncertainties, nor any detection limits. It is, thus, not possible to judge the quality of the results. Please provide the necessary information used for evaluation.

Response: The data tables in the Yard 520 report include detection limits for the parameters analyzed by ICP/MS (results qualified with U qualifier). Table 9 has been revised to include the associated uncertainties for radiological parameters in the Yard 520 samples. An additional table has been added to the Yard 520 report, Table 11, which presents the results for the radiological parameters and associated uncertainties in background soil and sediment samples. I

Comment #208: U-238 backgrounds by Inductively Coupled Plasma Mass Spectrometry (ICPMS) did not exceed 1 mg/kg except for sites SS008, SS018, and SS021 which were 1, 6.1, and 1 mg/kg, respectively. It should be determined if these were local variations, problem locations, or if there was a malfunction in sample collection or in laboratory measurement. Most especially, SS018 should be investigated.

Response: See response to comment 204. Based on the data validation results, there is no reason to assume that there have been any analytical issues with these samples. The results for other analytes in these samples are within the range of the site-specific background data set. These results likely represent local geologic variability, or it could be due to the nearby anthropogenic factors.

Comment #209: U-235 backgrounds by ICPMS did not exceed 0.009 mg/kg except for sites SS018 and SS022 which were 0.044 and 0.013 mg/kg, respectively. Explain these anomalies and state whether they should be removed from sample background.

Response: See response to comments 204 and 208.

Comment #210: The GEL Laboratories water sample results (Sample IDs 202261001 to 202261031) have Detection Limits (DL) that exceed reasonable comparison standards such as

the National Primary Drinking Water Standards for radionuclides in USEPA 40 CFR 141 Total Radium (radium-226 + radium-228) standard of 5 picocuries per litre (pCi/L). This is most likely a problem of not counting the sample long enough. The DL probably could have been brought down below 5 pCi/L had it been counted longer. As a result, the Total Radium standard could not be compared to the data to determine if there might be contamination. You may consider re-running the samples to provide DLs that are useable for the risk assessment. Otherwise discuss the high uncertainty in your results.

Response: Samples 202261001 and 202261004 to 202261031 were soil samples, thus the comment with regards to comparing to drinking water standards is not applicable. The 2 aqueous samples (202261002 and 202261003) are the associated equipment blank samples and all the target nuclides were nondetect in both of these QC samples. The purpose of these QC samples was to determine if proper decontamination procedures were followed, which would then ensure that there was no "carry-over" between sample locations. Based on the purpose of these aqueous QC samples, comparing the nondetect results to the drinking water standards would not be applicable to this report. Also, note that all the samples were counted for the maximum count time of 1000 minutes.

The associated data package in Attachment D of the Yard 520 repot is GEL SDG 202261.

Comment #211: For the one radium water measurement made at GP004 by gamma spectrometry, the Total Radium including background appears to be 20.58 pCi/L or 4 times the drinking water standard. However, the uncertainties are higher than the results, and the detection limits are well above 5 pCi/L, the USEPA Total Radium drinking water standard. These radium in water data are not usable. This sample should be reanalyzed to ensure a useable detection limit.

Response: Sample GP004ICB092305B was the aqueous equipment blank sample associated with the soil samples collected in September 2005. Ra-226 and Ra-228 were nondetect in this QC sample. The purpose of this QC sample was to determine if proper decontamination procedures were followed, which would then ensure that there was no "carry-over" between sample locations. Based on the purpose of this aqueous QC sample, comparing the nondetect radium results to the radium drinking water standard would not be applicable to this report.

The associated data package in Attachment D of the Yard 520 report is GEL SDG 146464.

Comment #212: For the one uranium water measurement made at GP004 by gamma spectrometry, the measurements were made in pCi/L. When converted to ug/L, the Total Uranium level could be as high as 479 ug/L or 16 times the drinking water standard for total uranium. Also, the uncertainty is 3X the measurement result. Again, the uncertainties are higher than the results, and the detection limits are well above 30 ug/L, the USEPA Total Uranium drinking water standard. These uranium in water data are not usable. You should reanalyze to ensure a useable detection limit. Also, please explain the reference levels (RLs) provided in the water analysis results (such as 250 pCi/L for U-238).

Response: Sample GP004ICB092305B was the aqueous equipment blank sample associated with the soil samples collected in September 2005. U-234, U-235, and U-238 were nondetect in this QC sample. The purpose of this QC sample was to determine if proper decontamination procedures were followed, which would then ensure that there was no "carry-over" between sample locations. Based on the purpose of this aqueous QC sample, comparing the nondetect uranium results to the total uranium drinking water standard would not be applicable to this report.

The associated data package in Attachment D of the Yard 520 report is GEL SDG 146464.

Comment #213: The measurements for U-238 and U-235 by gamma spectrometry are not comparable to the measurements by ICPMS. The U-238 and U-235 concentrations by gamma

spectrometry, 473.5 ug/L and 5.273 ug/L, respectively, are substantially different from the concentrations by ICPMS, 0.200 ug/L and 0.070 ug/L, respectively. This appears to be an issue with measurement uncertainties.

Response: If this comment applies to sample GP004ICB092305B, then this was the aqueous equipment blank sample associated with the soil samples collected in September 2005. The results for U-235, and U-238 were nondetect in this QC sample. The purpose of this QC sample was to determine if proper decontamination procedures were followed, which would then ensure that there was no "carry-over" between sample locations. Based on the purpose of this aqueous QC sample, comparing the nondetect uranium results to the total uranium drinking water standard would not be applicable to this report.

The associated radiological data package in Attachment D of the Yard 520 report is GEL SDG 146464. The associated inorganic data package in Attachment D of the Yard 520 report is CAS SDG R2527896, which was inadvertently omitted from the report).

Comment #214: The GEL Laboratories water sample results (Sample IDs 202261001 to 202261031) have high uncertainties. State the counting times used. EPA/NAREL will typically count for 1000 minutes in order to reduce measurement uncertainty. Counting time should ensure uncertainties below +/- 10% of the measurement result. Explain the potential impact of higher uncertainty to DQOs.

Response: This comment refers to GEL data package 202261 in Attachment D of the Yard 520 report.

In this data set, there were three aqueous samples (202261002, 202261003, and 202261004), which were the associated equipment blank samples and the other 28 samples were the background soil samples (202261001 and 202261005 to 202261031).

The samples were counted for the maximum count time of 1000 minutes.

There were no target analytes detected in the three equipment blank samples. For the soil samples, 27% of the detected results had counting uncertainties greater than 30%. However, only 6% of these results were detected above the project reporting limits. Since the majority (73%) of the detected results had acceptable counting uncertainties (<30% based on MARLAP recommendations for results reported to the MDC) there should be minimal impact on the DQOs.

Yard 520 Samples

Comment #215: Five of the 11 measured samples exceed 5.618 pCi/g (GP005, GP006 , GP007, GP009, and GP010); a value equal to the 40 CFR 192 5pCi/g standard plus what appears to be Pines site-specific background. This could be an indication of possible contamination. Please discuss the potential impacts of this on the risk assessment.

Response: The site-specific background level will be developed as part of the risk assessment.

References

Shedlock, R.J., D.A. Cohen, T.E. Imbrigiotta, and T.A. Thompson. 1994. Hydrogeology and Hydrochemistry of Dunes and Wetlands Along the Southern Shore of Lake Michigan, Indiana. U.S. Geological Survey, Open File Report 92-139.

Watson, Lee R, Robert J Shedlock, Konrad J Banaszak, Leslie D Arihood, and Paul K Doss. 1989. Preliminary Analysis of the Shallow Ground-Water System in the Vicinity of the Grand Calumet River/Indiana Harbor Canal, Northwestern Indiana. USGS Open-File Report 88-492.