APPENDIX C

YARD 520 QUALITY ASSURANCE PROJECT PLAN

Yard 520 Sampling and Analysis Plan

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

Appendix C
Quality Assurance Project Plan

ENSR Corporation
June 3, 2005
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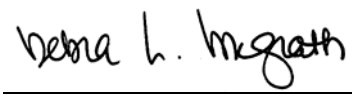
QUALITY ASSURANCE PROJECT PLAN
YARD 520 SAP
PINES AREA OF INVESTIGATION
Revision 1
Prepared by: ENSR Corporation
Prepared for: Brown Inc. and NIPSCO

September 2, 2005

ENSR Project Manager — Date
Lisa JN Bradley



September 2, 2005

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ACRONYMS

AOC I	Administrative Order on Consent, 2003 and as amended, 2004; Docket No. V-W-03-730
AOC II	Administrative Order on Consent, 2004; Docket No. V-W-'04-C-784
bgs	Below Ground Surface
CAS	Columbia Analytical Services
CCB	Coal Combustion By-product
CCBK	Continuing Calibration Blank
CCV	Continuing Calibration Verification
CLP	Contract Laboratory Program
COC	Chain of Custody
COPC	Constituents of Potential Concern
COPEC	Constituents of Potential Ecological Concern
CVAAS	Cold Vapor Atomic Absorption Spectroscopy
DOE	Department of Energy
DOT	Department of Transportation
DQL	Data Quality Level
DQO	Data Quality Objective
EDD	Electronic Data Deliverable
ENSR	ENSR Corporation
ERA	Ecological Risk Assessment
ESL	Ecological Screening Level
FS	Feasibility Study
FSP	Field Sampling Plan
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectroscopy
GEL	General Engineering Laboratory
GFAAS	Graphite Furnace Atomic Absorption Spectroscopy
GPS	Global Positioning System
HASP	Health and Safety Plan
HHRA	Human Health Risk Assessment
HRGC/HRMS	High Resolution Gas Chromatography/High Resolution Mass Spectroscopy
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
ICBK	Initial Calibration Blank
ICP	Inductively Coupled Plasma

ICV	Initial Calibration Verification
ID	Identification
IDL	Instrument Detection Limit
IDEM	Indiana Department of Environmental Management
LCS	Laboratory Control Sample
LIMS	Laboratory Information Management System
MDA	Minimum Detectable Activity
MDL	Method Detection Limit
mg/kg	Milligram per Kilogram
mg/L	Milligram per Liter
MS/MSD	Matrix Spike/Matrix Spike Duplicate
MSR	Management System Review
NIPSCO	Northern Indiana Public Service Company
ORNL	Oak Ridge National Laboratory
OSWER	Office of Solid Waste and Emergency Response
PAH	Polynuclear Aromatic Hydrocarbon
PCDD	Polychlorinated Dibenzodioxin
PCDF	Polychlorinated Dibenzofuran
pCi/g	Picocuries per Gram
PE	Performance Evaluation
PRG	Preliminary Remediation Goal
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
QC	Quality Control
%R	Percent Recovery
RAL	Removal Action Level
RI	Remedial Investigation
RI/FS	Remedial Investigation and Feasibility Study
RL	Reporting Limit
RPD	Relative Percent Difference
RPM	Remedial Project Manager
RSD	Relative Standard Deviation
SAP	Sampling and Analysis Plan
SMS	Site Management Strategy
SOP	Standard Operating Procedure
SOW	Statement of Work

TAL	Target Analyte List
TBD	To Be Determined
TSA	Technical System Audit
ug/kg	Micrograms per Kilogram
US	United States
USEPA	United States Environmental Protection Agency

STANDARD CHEMICAL ABBREVIATIONS

Ac	Actinium
Al	Aluminum
Ag	Silver
As	Arsenic
B	Boron
Ba	Barium
Be	Beryllium
Ca	Calcium
Cd	Cadmium
Co	Cobalt
Cr	Chromium
Cs	Cesium
Cu	Copper
Fe	Iron
K	Potassium
Hg	Mercury
Li	Lithium
Mg	Magnesium
Mo	Molybdenum
Mn	Manganese
Na	Sodium
Ni	Nickel
Pa	Protactinium
Pb	Lead
Po	Polonium
Ra	Radium
S	Sulphur
Sb	Antimony
Se	Selenium
Si	Silicon
Th	Thorium
Tl	Thallium
U	Uranium
V	Vanadium
Zn	Zinc

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 USEPA, and is the final version of the document.

SECTION A – PROJECT MANAGEMENT

A1 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, or Area of Investigation, as set forth in Exhibit I to AOC II, located in the environs of the Town of Pines, Indiana.

In June 2004, the Respondents submitted the first major document for the RI/FS, a Site Management Strategy (SMS) document (ENSR, 2005a), which outlined a preliminary conceptual model, data gaps, and the strategy for certain elements of the RI/FS. A revised SMS, based on comments received from the USEPA, was submitted in September 2004, and conditionally approved by USEPA in November 2004. The final SMS was submitted in January 2005. The SMS serves as the basis for development of the RI/FS Work Plan (ENSR, 2005b), including the Field Sampling Plan (FSP), Quality Assurance Project Plan (QAPP), and other supporting documents.

The SMS indicates that a baseline human health risk assessment (HHRA) and ecological risk assessment (ERA) will be conducted to evaluate the potential human health and ecological risks of potential exposures to coal combustion by-product (CCB)-derived constituents present in samples of environmental media within the Area of Investigation. As part of the HHRA and ERA, the presence of CCB-derived constituents within the Area of Investigation will be evaluated, and a subset of the constituents identified as constituents of potential concern (COPCs) or constituents of potential ecological concern (COPECs) will be quantitatively evaluated in the risk assessment. The purpose of the Yard 520 Sampling and Analysis Plan (SAP) is to determine whether additional parameter groups, specifically, polychlorinated dibenzodioxins and dibenzofurans (PCDDs and PCDFs), radionuclides, and polynuclear aromatic hydrocarbons (PAHs), may be present at concentrations of potential concern in CCBs in the Area of Investigation, and whether the analytical program for the RI should include any of these constituents.

This document provides the QAPP for the Yard 520 sampling program, and incorporates the SAP by reference. The QAPP presents the organization, objectives, planned activities, and specific quality assurance/quality control (QA/QC) procedures associated with the Yard 520 sampling program. Specific protocols for sampling, sample handling and storage, chain-of-custody, and laboratory and

field analyses are described. All QA/QC procedures are structured in accordance with applicable technical standards, USEPA's requirements, regulations, and guidance. This QAPP has been prepared in accordance with the USEPA QAPP policy as presented in the Region 5 *Instructions on the Preparation of a Superfund Division Quality Assurance Project Plan* (USEPA, 2000a).

A2 Project Schedule

The proposed schedule for implementation of the Yard 520 SAP is outlined below.

Activity	Time frame (after USEPA approval)
Sample Collection Activities	1 month
Laboratory Analysis[1]	1 to 2 months
Data Validation	2 to 3 months
Database Activities[2]	3 to 4 months
Data Submittal[3]	3 to 5 months

[1] Analytical turnaround time is 3 weeks.
[2] Includes data upload of validated data to project database.
[3] Submission of electronic data as required by AOC II, no interpretation or analysis.

A3 Distribution List

The QAPP, and any subsequent revisions, will be distributed to the personnel shown on the Distribution List that immediately follows the approval page.

A4 Project/Task Organization

The lines of authority and communication specific to the Quality Assurance (QA) program for the Yard 520 sampling program are presented in Figure A-1. The responsibilities of key personnel are described below.

A4.1 Management Responsibilities

USEPA Region 5 Remedial Project Manager (RPM)

The USEPA Region 5 RPM, Timothy Drexler, has the overall responsibility for all phases of the investigation.

Respondents' Project Managers

The Project Managers for the individual Respondents are Dan Sullivan of NiSource and Val Blumenfeld of Brown Inc. They will be responsible for project direction and decisions concerning technical issues and strategies, budget, and schedule.

ENSR Project Manager

The ENSR Project Manager, Lisa JN Bradley, will be responsible for technical, financial, scheduling matters. The ENSR Project Manager also will be responsible for project coordination between the Respondents and USEPA as required.

ENSR Task Manager

The ENSR Task Manager, Paytha Elliot, will have the overall responsibility for implementing the sampling activities described in the Yard 520 SAP. Specific responsibilities of the ENSR Task Manager will include, but not be limited to, the following:

- Providing personnel and equipment for sampling activities;
- Ensuring that ENSR's associates perform their designated duties in accordance with the SAP and the Health and Safety Plan (HASP);
- Ensuring required QA/QC procedures are properly implemented and documented;
- Ensuring that sampling activities are properly carried out and completed within the approved schedule;
- Communicating any request for modifications, if necessary, to the approved SAP to the ENSR Project Manager; and
- Promptly notifying the ENSR Project Manager if unforeseen field conditions and/or analytical issues are encountered that affect achievement of the project data quality objectives (DQOs).

ENSR Health and Safety Manager

The ENSR Regional Health and Safety Manager, Joseph Sanders, will be responsible for ensuring the objectives of ENSR's corporate health and safety program are carried out. The ENSR Regional Health

and Safety Manager will also be responsible for the coordination and communication of health and safety issues for field personnel.

A4.2 Quality Assurance Responsibilities

ENSR Project QA Officer

The ENSR Project QA Officer, Debra McGrath, has the overall responsibility for quality assurance. The ENSR Project QA Officer communicates directly to the ENSR Project Manager on matters pertaining to QA, data validation, and laboratory analyses. Specific responsibilities include:

- Reviewing and approving the QAPP;
- Reviewing and approving QA procedures, including any modifications to existing approved procedures;
- Ensuring that QA audits of the various phases of the project are conducted as required by this QAPP;
- Providing technical assistance to project staff;
- Ensuring that data validation/data assessment is conducted in accordance with the QAPP; and
- Reporting on the adequacy and efficiency of the QA Program to the ENSR Project Manager and recommending corrective actions, if necessary.

ENSR Data Validator

The ENSR Data Validator reports to the ENSR Project QA Officer. The Data Validator is responsible for validating the analytical data in accordance with the QAPP.

USEPA Region 5 Quality Assurance Plan Reviewer

The USEPA Region 5 Quality Assurance Plan Reviewer, Warren Layne, has the responsibility to review and approve all QAPPs. Additional USEPA responsibilities include:

- Conducting external performance and system audits of the selected laboratory;
- Evaluating results of performance evaluation sample data; and

- Reviewing and evaluating analytical field and laboratory procedures.

A4.3 Laboratory Responsibilities

Columbia Analytical Services (CAS), located in Rochester, NY will perform the chemical analyses of all native soil and suspected CCB materials. CAS Rochester will oversee the analyses of polychlorinated dibenzodioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) by the CAS laboratory in Houston, TX. The radionuclide analyses will be performed by General Engineering Laboratories LLC (GEL), located in Charleston, SC.

Laboratory Director

The Laboratory Directors are ultimately responsible for the data produced by their laboratories. Specific responsibilities include:

- Ensuring that resources are adequately allocated to specific projects and that sufficient staffing, equipment, and support are provided.
- Overseeing the technical operations' Section Managers and the Laboratory QA Manager.

The CAS Laboratory Director is Mike Perry. Carey Bocklet serves in this role for GEL.

Section Manager

The individual Laboratory Section Managers report to the Laboratory Director. Specific responsibilities include:

- Supervision of employees within their specific analytical area;
- Overseeing and supporting the development, implementation, and operation of analytical technical programs;
- Coordinating sample flow and for implementing QA and QC activities in their area of authority; and
- Working in conjunction with the Laboratory QA Manager to ensure that QA/QC recommendations are reviewed and that corrective actions are implemented and effective.

Laboratory QA Manager

The Laboratory QA Manager reports to the Laboratory Director. Specific responsibilities include:

- Monitoring the QA and QC activities of the laboratory to ensure conformance with authorized policies, procedures, and good laboratory practices, and recommending improvements as appropriate;
- Informing specific Section Managers of noncompliance with the approved QA/QC criteria;
- Ensuring that all records, logs, Standard Operating Procedures (SOPs), project plans, and analytical results are maintained in a retrievable fashion; and
- Ensuring that SOPs and other controlled documents are distributed to all appropriate laboratory personnel for use in the project.

The CAS QA Manager is Lisa Reyes. Robert Pullano is the GEL QA Manager.

Laboratory Project Manager

The Laboratory Project Manager is ultimately responsible for all laboratory analyses and is the primary point of contact for issues surrounding this QAPP, including resolving technical problems, modifications to SOPs, etc. The Laboratory Project Manager is responsible for the coordination of routine day-to-day project activities including project initiation, status tracking, data review and requests, inquiries and general communication related to the project. Final approval of data packages is the responsibility of the Laboratory Project Manager.

The Laboratory Project Manager is the primary point of contact between the laboratory and ENSR. Specific responsibilities of the Laboratory Project Manager include:

- Monitoring analytical and QA project requirements for a specified project;
- Acting as a liaison between ENSR and the laboratory staff;
- Reviewing project data packages for completeness and compliance to ENSR needs;
- Monitoring, reviewing, and evaluating the progress and performance of projects; and
- Providing all analytical deliverables to ENSR in a timely manner.

The Laboratory Project Managers are Janice Jaeger (CAS) and Edith Kent (GEL).

Laboratory Staff

Laboratory staff includes the Laboratory Director, the Laboratory Supervisor, Section Managers, Group Leaders, Chemists, and Technicians. These individuals are responsible for the actual preparation, analysis, reporting, and reviewing of the analytical information. The analysts are responsible for understanding and implementing SOPs and for conformance with the Quality Assurance Program. Analysts are also responsible for the initial review of data that they generate during the analytical process and the identification of nonconforming events within their scope of concern. These individuals, in conjunction with laboratory management and the laboratory QA Manager, may also be responsible for implementing corrective actions.

Sample Receipt Personnel

Sample receipt personnel, or sample custodians, are responsible for the initial assessment of samples, including documentation of sample conditions upon receipt, and accuracy and clarity of requests on the Chain-of-Custody (COC) forms that accompany the samples. Sample receipt personnel, along with laboratory management, are responsible for the resolution and documentation of any issues associated with the initial assessment of the sample integrity on arrival. Resolution may include discussions with laboratory personnel, client contacts, and/or laboratory management.

Following the initial assessment, sample receipt personnel are responsible for the accurate input of sample information into the data management system and the assignation of laboratory batch identification and individual sample identifiers. Sample receipt personnel also initiate the internal COC process and begin laboratory tracking.

Sample custodians are Greg Esmerian (CAS) and Pete Wilber (GEL).

A4.4 Field Responsibilities

ENSR Field Operations Leader

The ENSR Field Operations Leader (Paytha Elliott) has overall responsibility for completion of all field activities in accordance with the SAP and QAPP and is the communication link between the ENSR Project Manager and the field team. Specific responsibilities of the ENSR Field Operations Leader include:

- Coordinating activities in the field;
- Assigning specific duties to field team members;
- Mobilizing and demobilizing of the field team and subcontractors to and from the Yard 520 sampling area;
- Directing the activities of subcontractors during the Yard 520 sampling program;
- Resolving any logistical problems that could potentially hinder field activities, such as equipment malfunctions or availability, personnel conflicts, or weather dependent working conditions; and
- Implementing field QC including issuance and tracking of measurement and test equipment; the proper labeling, handling, storage, shipping, and COC procedures used at the time of sampling; and control and collection of all field documentation.

ENSR Field Staff

The field staff reports directly to the ENSR Field Operations Leader. The responsibilities of the field staff include:

- Collecting samples, conducting field measurements, and decontaminating equipment according to documented procedures stated in the SAP;
- Ensuring that field instruments are properly operated, calibrated, and maintained, and that adequate documentation is kept for all instruments;
- Collecting the required QC samples and thoroughly documenting QC sample collection;
- Ensuring that field documentation and data are complete and accurate; and
- Communicating and documenting any nonconformance or potential data quality issues to the ENSR Field Operations Leader as well as documenting subsequent corrective action and effectiveness of corrective action.

Subcontractors

ENSR subcontractors will provide drilling services. The subcontractors are responsible for conducting the work in accordance with the project plans and contractual agreements and for communicating any

issues concerning the budget, schedule, or achievement of the technical specifications to the ENSR Field Operations Leader.

A5 Problem Definition and Background

A5.1 Site Background and Description

Between 2000 and 2004, the Indiana Department of Environmental Management (IDEM) and USEPA responded to homeowners by conducting sampling of private water supply wells in a portion of the Town of Pines. In some of these samples, boron (B) and molybdenum (Mo) were detected at concentrations above USEPA's Removal Action Levels (RALs) (USEPA, 1998). These concentrations in groundwater are suspected by the USEPA to be derived from coal combustion by-products (CCBs). CCBs have been disposed at a permitted Restricted Waste Facility known as Yard 520, and CCBs are suspected to have been used as fill in areas within the Area of Investigation outside of Yard 520. Yard 520 is operated by Brown Inc., and most of the CCBs at Yard 520 were generated during combustion of coal at NIPSCO's Michigan City Generating Station.

To address the boron and molybdenum detections above the USEPA RALs, the Respondents agreed to extend the municipal water service from Michigan City to selected portions of the Town of Pines. This agreement was documented in an Administrative Order on Consent, referred to as AOC I. Additional sampling of other private wells indicated some concentrations near or exceeding USEPA RALs. To address this, the Respondents voluntarily approached the USEPA to discuss extending the municipal water service to a larger area under an amendment to AOC I.

The Respondents also signed AOC II to conduct an RI/FS for the Area of Investigation, as identified in the Order. Under the Statement of Work (SOW), Task 1 is the preparation of a Site Management Strategy (SMS). A draft SMS document, which outlined a preliminary conceptual model, data gaps, and the strategy for certain elements of the RI/FS, was submitted in June 2004. The SMS was conditionally approved by USEPA in November 2004. Task 1 of the SOW was completed with the submission of the Final SMS in January 2005 (ENSR, 2005a). The SMS serves as the basis for development of the RI/FS work plans prepared under Task 2 of the SOW.

A5.2 Problem Definition

The SMS indicates that a baseline human health risk assessment (HHRA) and ecological risk assessment (ERA) will be conducted to evaluate the potential human health and ecological risks of potential exposures to CCB-derived constituents present in samples of environmental media within the

Area of Investigation. As part of the HHRA and ERA, the presence of CCB-derived constituents within the Area of Investigation will be evaluated, and a subset of the constituents identified as cconstituents of potential concern (COPCs) or constituents of potential ecological concern (COPECs) will be quantitatively evaluated in the risk assessment. The purpose of this Yard 520 SAP is to determine whether additional parameter groups, specifically, PCDDs/PCDFs, radionuclides, and PAHs, may be present at concentrations of potential concern in CCBs in the Area of Investigation, and whether the analytical program for the RI should include any of these constituents.

A6 Project/Task Description

The objective for this SAP is to determine whether or not PCDDs/PCDFs, radionuclides, and PAHs are present in the CCBs within the Pines Area of Investigation at concentrations warranting further evaluation. Background samples will also be collected from areas where there are no CCBs to determine site-specific background concentrations. To accomplish this objective, the following tasks will be implemented:

- Borings will be advanced at Yard 520 to collect samples of CCBs. Sample locations will be selected to ensure that the material encountered consists of CCBs. During sampling, any other materials encountered (e.g., interim cover) will be omitted from the sample submitted for laboratory analysis. Yard 520 was selected as the location for the sample collection because it is known to have received CCBs, and the CCBs within Yard 520 are less likely to have been affected by other sources, including atmospheric deposition and roadway runoff. The Type III (South) Area of Yard 520 was selected as the location for the sample collection because this area was known to have received CCBs only. The Type II (North) Area received a small amount of other wastes, some of which may not be easily distinguishable from CCBs (such as steel slag). The sample locations in the Type III (South) Area were laid out in two triangular grids.
- Surface soil samples will be collected from within or nearby the Area of Investigation to determine site-specific background conditions. Samples will consist of native soils. Surface soil samples will be collected to document the typical background exposure point concentrations within the Area of Investigation.
- All samples will be submitted for laboratory analysis of PCDDs/PCDFs, radionuclides, and PAHs. Background samples will also be analyzed for target analyte list (TAL) metals plus boron, molybdenum, sulfur, and silicon. Additional volume will be also be collected (approximately 1 to 2 liters in volume) and retained and may be used for later visual inspection and chemical/physical analysis, if needed.

- The concentrations of constituents in the CCB samples will be compared to concentrations in background samples and to risk-based screening levels. The screening levels to be used are presented in the HHRA Work Plan and the ERA Work Plan, which are components of the overall RI/FS Work Plan (ENSR, 2005b).

A6.1 Project/Task Summary

The number of field and QC samples that will be collected for each analytical parameter is presented in Table A-1. A summary of analytical parameters by medium is presented in Table A-2. Target compounds for each analyses are presented with their respective laboratory reporting limits, method detection limits (MDLs), and data quality levels (DQLs) in Tables A-3 (PAHs), Table A-4 (PCDDs/PCDFs), A-5 (radionuclides), and A-6 (metals and sulfur).

All data generated through field activities or through the analytical program will be reviewed internally through a tiered review process and validated prior to reporting. All of the data will be validated, either as full or limited validation. The data will be validated using USEPA and Department of Energy (DOE) guidance in conjunction with ENSR data validation protocols (provided as an attachment). The USEPA and DOE guidance will be modified to reflect any differences in analytical methodology and to incorporate the project-specific acceptance criteria defined in Section A7 of this QAPP or the method criteria, whichever is more stringent. A complete description of the data verification and data validation procedures to be used is included in Section D1 of this QAPP.

ENSR's Project QA Officer and/or Field Operations Leader will be responsible for internal technical system audits (TSAs) to verify that field sampling procedures and field sampling measurements are properly followed. Additionally, laboratory TSAs are conducted periodically by ENSR's Project QA Officer or other qualified pesonnel. TSAs are conducted at project start up and then periodically while the project is under way. A detailed discussion of the QA assessments that will be performed during the course of the project is provided in Section C1 of this QAPP.

Validated project data will be compared to the project measurement criteria (Relative Percent Difference (RPD) values for precision, for example). Sensitivity, representativeness, and completeness assessments will also be performed. A complete description of how validated data will be reconciled with DQOs and how the overall assessment of the data will be performed is included in Section D3 of this QAPP.

QA reports will be generated by the ENSR Project QA Officer on an as-needed basis. A complete listing and description of all documents and reports that will be generated and maintained in the project files is included in Section A9 of this QAPP.

A7 Quality Objectives and Criteria for Measurement Data

A7.1 Data Quality Objectives

The Yard 520 investigation will consist of a sampling program and chemical analyses of suspected CCB materials and native soil. The field investigation is designed to provide information on the presence of PCDDs/PCDFs, PAHs, and radionuclides in CCBs in the Area of Investigation. Therefore, the sampling and analysis program incorporates the following QA elements:

- A sampling program designed to obtain sufficient data to determine levels of constituents in media of interest,
- The use of sample collection and handling procedures that will ensure the representativeness and integrity of the samples,
- An analytical program designed to generate definitive data of sufficient quality and sensitivity to meet the project objectives (see Section A5.2), and
- Data deliverables that will allow verification and validation of the data and reproducibility of the reported results.

At the completion of the work outlined in the SAP, it is possible that additional information may be needed to meet RI objectives. At this time, it is not possible to anticipate what additional work may be needed, as it is dependent on the results of the activities proposed. AOC II allows for additional phases of work. If needed, a memorandum documenting the need for additional data will be submitted to USEPA, per AOC II Section VIII. 32.

The design of the Yard 520 SAP was based on the DQO process (USEPA, 2000b), a multi-step, iterative process that ensures that the type, quantity, and quality of environmental data used in decision-making is appropriate for its intended application. This process is summarized below.

DQO Step	Description
State the Problem	As documented in the Site Management Strategy, CCBs from within the Area of Investigation may contain PCDDs/PCDFs, radionuclides, and/or PAHs.
Identify the Decision	The purpose of collecting samples from Yard 520 is to confirm whether or not PCDDs/PCDFs, radionuclides, and PAHs are present in the CCBs from within the Area of Investigation above levels of potential concern. If they are not present above levels of potential concern, no further evaluation of these constituents will be needed during the RI/FS. Background samples will be analyzed for PCDDs/PCDFs, radionuclides, PAHs, TAL metals plus boron, molybdenum, sulfur, and silicon. This information will be used in the RI/FS for purposes such as characterization and risk assessment.
Identify Inputs to the Decision	Samples of CCBs will be collected from the Type III (South) Area of Yard 520. The concentrations of PCDDs/PCDFs, radionuclides, and PAHs in samples will be determined. Background samples will be collected from the Area of Investigation where no CCBs are suspected to be present to determine site-specific background concentrations.
Define Study Boundaries	Samples will be collected from the Type III (South) Area of Yard 520. Background samples will be collected from the ground surface within or nearby the Area of Investigation where no CCBs are suspected to be present.
Develop a Decision Rule	The concentration of PCDDs/PCDFs, radionuclides, and PAHs in the CCB samples will be compared to concentrations in background samples and to risk-based screening levels. Additional evaluation of these constituents in the RI/FS will be performed only if concentrations in CCBs are above both site-specific background and risk-based screening levels.
Specify Decision Error Limits	A formal statistical design will not be developed for this sampling. However, the data will be considered acceptable if they are collected according to this Sampling and Analysis Plan and they meet the appropriate quality objectives for field and laboratory activities.
Optimize the Study Design	Since a formal statistical design is not being utilized, the iterative process for optimizing the sample design will not be used. However, CCB sample locations were established based on a triangular grid. Sufficient samples from each medium (10 CCBs and 25 background surface soil) will be collected to enable statistical evaluation of results.

Note that three samples will be collected from the Type II (North) Area at Yard 520 for other purposes, as described in the Field Sampling Plan of the RI/FS Work Plan (2005b).

A7.2 Data Quality Objectives for Measurement Data

The principal objectives of the QAPP pertain to the collection of data that are sufficient to evaluate the possible presence of CCB-derived constituents in the media of interest. Therefore, the quality of the data gathered in this project can be defined in terms of the following elements: precision, accuracy, completeness, sensitivity, and representativeness. These elements are discussed below.

Precision

Precision is a measure of the degree to which two or more measurements are in agreement. Field precision is assessed through the collection and measurement of field duplicates at a rate of one duplicate per ten field samples. Precision will be measured through the calculation of relative percent difference (RPD). The objectives for field precision RPDs are 25% RPD for aqueous samples and 30% RPD for solid samples.

Precision in the laboratory is 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 method. Precision control limits for laboratory analyses are provided in Table A-7.

Accuracy

Accuracy is the degree of agreement between the observed value and an accepted reference or true value. Accuracy in the field is assessed through the use of equipment blanks and through the adherence to all sample handling, preservation, and holding time requirements. Field rinsate blanks will be collected at a rate of one per ten samples (or less) collected per sampling event. The objectives for equipment blanks are shown in Table A-7.

Laboratory accuracy is assessed through the analysis of MS/MSDs, laboratory control samples (LCSs), and the subsequent determination of percent recoveries (%Rs). Accuracy control limits are given in Table A-7.

Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. "Normal conditions" are defined as the conditions expected if the sampling plan was implemented as planned.

Field completeness is a measure of the amount of valid samples obtained during all sampling for the project. The field completeness objective is greater than 90 percent.

Laboratory completeness is a measure of the amount of valid measurements obtained from all the measurements taken in the project. The laboratory completeness objective is greater than 95 percent.

Representativeness

Representativeness is the extent to which the sampling design adequately reflects the environmental conditions of the site. The data will be considered representative of the site if all sampling and analysis activities are conducted according to the Yard 520 SAP and QAPP.

Sensitivity

Sensitivity of analytical data is demonstrated by the laboratory reporting limits. The target reporting limits for the constituents to be analyzed are presented in Tables A-3 (PAHs), A-4 (PCDDs/PCDFs), A-5 (radionuclides) and A-6 (metals and sulfur). These tables also contain the DQLs, which were developed using human health and ecological risk screening levels, including USEPA Region 9 Preliminary Remediation Goals (PRGs), USEPA Region 5 Ecological Screening Levels (ESLs), and Oak Ridge National Laboratory (ORNL) Phytotoxicity Screening Values. The target reporting limits 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 several of the metals, 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 will use their most recent detection limit study results to report analytical results.

Alternative analytical methods will be evaluated if the need arises, and the QAPP will be amended, if necessary.

A8 Special Training/Certification

A8.1 Training

Field personnel will be experienced in the suspected CCB materials and native soil sampling techniques proposed in the SAP. Data validators will be familiar with the USEPA and DOE validation guidelines. Additionally, prior to starting work, personnel will be given instruction specific to the project, covering the following areas:

- Organization and lines of communication and authority;
- Overview of the SAP;
- QAPP requirements;

- QA/QC requirements;
- Documentation requirements; and
- Health and safety requirements.

Instructions will be provided and documented by the ENSR Project Manager, ENSR Task Manager, ENSR Field Operations Leader, ENSR Health and Safety Officer, and ENSR Project QA Officer.

Personnel responsible for shipping samples will also be trained in the appropriate regulations, e.g., Department of Transportation (DOT), International Civil Aviation Organization (ICAO), and International Air Transport Association (IATA).

A8.2 Certifications

Laboratories utilized for routine testing of native soils and suspected CCB materials will have appropriate certification for the test methods.

As specified in the RI/FS Work Plan (ENSR, 2005b), the RI Task Manager, Ms. Elizabeth Perry, is a Professional Geologist licensed to practice in Indiana. This certification will be maintained throughout the project.

A9 Documents and Records

A9.1 Project Files

The project files will be the central repository for all documents which constitute evidence relevant to sampling and analysis activities as described in this QAPP. ENSR is the custodian of the project files and will maintain the contents of the project files for the investigation, including all relevant records, reports, logs, field notebooks, pictures, subcontractor reports, and data reviews in a secured, limited access area and under custody of the ENSR Project Manager.

The project files will include at a minimum:

- Field logbooks;
- Field data and data deliverables;

- Photographs;
- Drawings;
- Sample collection logs;
- Laboratory data deliverables;
- Data validation reports;
- Data assessment reports;
- Progress reports, QA reports, interim project reports, etc.; and
- All custody documentation (COC forms, airbills, etc.).

Electronic versions of correspondence, reports, drawings, and statistical analyses will be stored in the project-specific network file. The original electronic data deliverables (EDDs) received from the laboratories, and the project database, will also be stored on the network, which is backed up daily and periodically archived off-site in accordance with ENSR Information Management policy.

Records associated with this sampling will be retained with all the project records for the duration of AOC II and for a minimum of 10 years after its termination. USEPA, NIPSCO and Brown Inc. will be notified in writing 90 days prior to destruction of the records (per AOC II Section XIII. 44.).

A9.2 Field Records

Field logbooks will provide the primary means of recording the data collection activities performed during the sampling activities. As such, entries will be described in as much detail as possible so that persons going to the field could reconstruct a particular situation without reliance on memory.

Field logbooks will be bound field survey books or notebooks. Logbooks will be assigned to field personnel, but will be stored in the project files when not in use. Each logbook will be identified by a project-specific document number.

Entries into the logbook will contain a variety of information. At the beginning of each entry, the date, start time, weather, names of all sampling team members present, and the signature of the person making the entry will be entered. The names of visitors to the work location, and the purpose of their visit, will also be recorded in the field logbook.

Measurements made and samples collected will be recorded. All entries will be made in permanent ink, signed, and dated and no erasures or obliterations will be made. If an incorrect entry is made, the information will be crossed out with a single strike mark and the correct entry will be made, signed and dated by the person making the correction. Whenever a sample is collected, or a measurement is made, a detailed description of the sampling location, which includes compass and distance measurements, or latitude and longitude information (e.g., obtained by using a Global Positioning System (GPS)) unit will be recorded. All equipment used to make measurements will be identified, along with the date of calibration. The coordinate system that the GPS unit displays will be recorded.

Information specific to sample collection will include:

- Sample identification number;
- Time and date of sample collection;
- Sample description (color, texture, etc.);
- Samplers' initials;
- Requested analyses;
- Depth of sample interval below ground surface (bgs) as measured with a steel measuring tape; and
- Location (GPS coordinates and description).

To streamline data recording, information will be recorded on standardized forms when this approach is logical. Examples of these forms are presented in the field SOPs included in Appendix B of the SAP.

Descriptions of geologic materials and CCBs will be logged in accordance with Indiana guidance (IDEM, 1988).

Representative photographs of sample locations will be taken with a digital camera and the camera picture frame number, date, direction facing, and subject will also be recorded in the logbook.

COC forms will be maintained as part of the field records as described in Section B3.3.1.

A9.3 Laboratory Records and Deliverables

Laboratory data reduction procedures will be performed according to the following protocol. All information related to analysis will be documented in controlled laboratory logbooks, instrument printouts, or other approved forms. All entries that are not generated by an automated data system will be made neatly and legibly in permanent, waterproof ink. Information will not be erased or obliterated. Corrections will be made by drawing a single line through the error and entering the correct information adjacent to the cross-out. All changes will be initialed, dated, and, if appropriate, accompanied by a brief explanation. Unused pages or portions of pages will be crossed out to prevent future data entry. Analytical laboratory records will be reviewed by the supervisory personnel on a regular basis, and by the Laboratory QA Manager periodically, to verify adherence to documentation requirements.

Data deliverables will be provided within standard turnaround time (21 calendar days). The laboratory will provide at least one copy of a hard copy report and one copy of an EDD. The format of the EDD is discussed in Section B11. The hard copy data package will be equivalent to a Contract Laboratory Program (CLP) deliverable, i.e., consisting of all the information presented in a CLP package, including CLP-like summary forms. This information is summarized below:

- Analytical report;
- Chain of custody information;
- Notes concerning special client requests and telephone records;
- Instrument raw data;
- Standards information;
- Preparation information;
- Sample results, including units;
- Detection limits and reporting limits, including units;
- Results for MS/MSDs, method or preparation/calibration blanks, LCSs, laboratory duplicates, inductively coupled plasma (ICP) serial dilutions, and ICP interference check samples; and
- Raw data for samples and laboratory QC samples, including labeled and dated chromatograms/spectra.

A10 References

This QAPP was prepared using the following documents:

DOE. 1982. EML Procedures Manual. HASL-300.

DOE. 1997. Evaluation of Radiochemical Data Usability.

ENSR. 2005a. Site Management Strategy. Pines Area of Investigation. AOC II. Docket No. V-W-'04-C-784. January 2005.

ENSR. 2005b. RI/FS Work Plan, Pines Area of Investigation, Volumes 1 through 7. May 23, 2005. Conditionally approved August 18, 2005, and to be finalized September 16, 2005.

IDEM. 1988. Technical Guidance Document, Volume 1 – Requirements for Describing Unconsolidated Deposits. Indiana Department of Environmental Management. Draft, Revised November 18, 1988.

USEPA. 1992. Specifications and Guidance for Contaminant-Free Sample Containers. United States Environmental Protection Agency, Office of Solid Waste and Emergency Response. December 1992.

USEPA. 1997a. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846. Third Edition. United States Environmental Protection Agency. May 1986, revised June 1997.

USEPA. 1997b. Region 5 Standard Operating Procedure for Validation of CLP Organic Data. April 1991, Revised February 1997.

USEPA. 1998. Clarification to the 1994 Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities. OSWER Directive 9200.4-27. August 1998.

U.S. EPA. 1999. Contract Laboratory Program, National Functional Guidelines for Organic Data Review. United States Environmental Protection Agency, Office of Solid Waste and Emergency Response. October 1999.

USEPA. 2000a. Instructions on the Preparation of a Superfund Division Quality Assurance Project Plan. United States Environmental Protection Agency, Region 5. Revision 0. June 2000.

USEPA. 2000b. Guidance for the Data Quality Objectives Process, EPA QA/G-4. EPA/600/R-96/055. U.S. Environmental Protection Agency. August, 2000.

USEPA. 2001. EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5. United States Environmental Protection Agency, Quality Staff. March 2001.

USEPA. 2002. National Functional Guidelines for Dioxin Data Review. United States Environmental Protection Agency.

USEPA. 2004. Contract Laboratory Program, National Functional Guidelines for Inorganic Data Review. United States Environmental Protection Agency, Office of Solid Waste and Emergency Response. October 2004.

SECTION B – MEASUREMENT/DATA ACQUISITION

B1 Sampling Process Design

The rationale for the sample design is provided in Sections 4.2 (CCBs) and 4.3 (background soil samples) of the SAP.

B2 Sampling Methods Requirements

B2.1 Field Measurements

The field measurements taken in conjunction with the native soil and suspected CCB sampling at Yard 520 will be limited to GPS measurements. These measurements will be taken as described in Section 4.4.1 of the SAP

B2.2 Sampling Procedures

The SOPs that will be utilized for sampling of CCBs and native soils are listed below and provided in Appendix B of the SAP.

- ENSR SOP No. 7116Pines – Subsurface Soil Sampling by GeoProbe™ Methods
- ENSR SOP No. 7110Pines – Surface Soil Sampling

B2.2.1 GeoProbe™ Sampling of Yard 520 Locations

CCB materials will be collected in accordance with Section 4.4.3 of the SAP.

B2.2.2 Surface Soil Sampling at Background Locations

Surface soils will be collected in accordance with Section 4.4.4 of the SAP.

B2.3 Cleaning and Decontamination of Equipment/Sample Containers

Guidance on equipment decontamination is included in ENSR SOP No. 7600Pines (Appendix B of the SAP). In general, equipment used will be decontaminated using the following procedure:

- Tap water rinse to remove gross contamination;
- Non-phosphate and non-borate detergent water rinse;
- Tap water rinse;
- 10% nitric acid rinse (metal sample locations only);
- Tap water rinse;
- Pesticide-grade methanol rinse (twice);
- Deionized water rinse;
- Air dry or wrap in aluminum foil for later use.

If sample collection tools consist entirely of disposable implements and bowls, then no equipment decontamination is necessary for these items.

Non-disposable and non-dedicated sampling equipment will be decontaminated prior to initial use and between samples. The effectiveness of the decontamination procedures is measured by collecting and analyzing equipment blank samples.

Sample containers will be purchased new. Specifications for these containers are addressed in Section B3.1.

B2.4 Inspection and Acceptance Requirements for Supplies/Sample Containers

For this project, critical supplies for field activities will be tracked through ENSR's system in the following manner.

Critical Supplies and Consumables	Inspection Requirements and Acceptance Criteria	Responsible Individual
Sample bottles	Visually inspected upon receipt for cracks, breakage, and cleanliness. Must be accompanied by certificate of analysis.	Field Operations Leader
Chemicals and reagents	Visually inspected for proper labeling, expiration dates, appropriate grade.	Field Operations Leader
Sampling equipment	Visually inspected for obvious defects, damage, and contamination.	Field Operations Leader
Field measurement equipment	Functional checks to ensure proper calibration and operating capacity.	Field Operations Leader

Supplies and consumables not meeting acceptance criteria will initiate the appropriate corrective action. Corrective measures may include repair or replacement of measurement equipment, and/or notification of vendor and subsequent replacement of defective or inappropriate materials. All actions will be documented in the project files.

The laboratory system of inspection and acceptance of supplies and consumables is discussed in Section B9.

A description of the procedures and documentation activities employed to ensure field and sampling equipment are available in working order when needed is provided in Section B6 of this QAPP.

B3 Sample Handling and Custody

B3.1 Sample Containers, Preservation, and Holding Times

Sample bottles and chemical preservatives will be provided by the laboratory. The containers will be cleaned by the manufacturer (to be determined) to meet or exceed all analyte specifications established in the latest USEPA's *Specifications and Guidance for Contaminant-Free Sample Containers* (USEPA, 1992). Certificates of analysis will be provided with each lot of containers and maintained on file to document conformance to USEPA specifications. All sample bottles and chemical preservatives provided by the laboratory will be shipped with a custody seal affixed to the outside of the cooler. The laboratory will be responsible for maintaining the certificates of analysis for the bottleware and for tracking which lot number of containers were provided with each shipment.

A summary of sample container, preservation, and holding time requirements is presented in Table B-1.

B3.2 Sample Labeling

Immediately upon collection, each sample will be labeled with an adhesive label. Samples will be assigned unique sample identifications (IDs) based on an alphanumeric code that identifies the matrix, location, date, and type of sample, as described below.

- Name of location in five digits (e.g., SS002, etc.). These location names will correspond to logs of the geologic materials, as well as sample locations posted on maps. Names of borings at Yard 520 will start with CB001; background samples will start at SS001.

- Single letter signifying depth of sample (A, B, C, etc. for samples taken at increasing depth, X if this field is not being used). The actual depth measured in the field in feet will be recorded in the field records.

- Two letters signifying the sample matrix (CB for CCBs, SS for surface soil).

- Sampling date consisting of the number corresponding to the month (2 digits), day (2 digits) and year (2 digits), for example, 061405 for samples collected on June 14, 2005.

- Letter denoting the type of sample. Codes for this field include: S – sample; D – field duplicate; B – equipment rinsate blank.

No dashes will be used to separate fields. An example sample ID for this sampling would be: SS001ASS101105D indicating a surface soil sample collected at location SS001 on October 11, 2005. This sample is a field duplicate, and the A represents the sample depth. The sample depth of 0 to 6 inches for this surface sample will be recorded in the field logbook.

Samples designated as MS/MSDs will be noted as such in the comments field of the COC form.

The sample identification code will be recorded on the label, in the field logbook, on the COC form, and will be carried through the analytical process to reporting. An example of a sample label is included as Figure B-1.

B3.3 Custody Procedures

Custody is one of several factors that are necessary for the admissibility of environmental data as evidence in a court of law. Custody procedures help to satisfy the two major requirements for

admissibility: relevance and authenticity. Sample custody is addressed in two parts: field sample collection and laboratory analysis.

A sample is considered to be under a person's custody if:

- The item is in the actual possession of a person;
- The item is in the view of the person after being in actual possession of the person;
- The item was in the actual physical possession of the person but is locked up to prevent tampering; and
- The item is in a designated and identified secure area.

B3.3.1 Field Custody Procedures

The field sampler (to be determined) is personally responsible for the care and custody of the samples until they are transferred or dispatched properly. Field procedures have been designed such that as few people as possible will handle the samples.

All sample containers will be identified by the use of adhesive sample labels (Figure B-1) which will include sample numbers, project identification (i.e., ENSR project number), date/time of collection, preservation, sampler's initials, and type of analysis. The sample numbering system is presented in Section B.3.2 of the QAPP. Sample labels will be completed for each sample using waterproof ink unless prohibited by weather conditions. For example, a logbook notation would explain that a pencil was used to fill out the sample label because the pen would not function in freezing weather.

Samples will be accompanied by a properly completed COC form. The sample numbers and locations will be listed on the COC form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents the transfer of custody of samples from the sampler to another person, to the permanent laboratory, or to/from a secure storage location. ENSR SOP No. 1007Pines – Chain-of-Custody Procedures (Appendix B of the SAP) includes additional information. An example COC form is presented as Figure B-2.

All sample shipments will be accompanied by the COC record identifying the contents. The original record will accompany the shipment, and the pink and yellow copies will be retained by the sampler and placed in the project files.

Samples will be properly packaged on ice at 4 ± 2°C for shipment and dispatched to the appropriate laboratory for analysis, with a separate signed custody record enclosed in and secured to the inside top of each sample box or cooler. Shipping containers will be locked and secured with strapping tape and custody seals for shipment to the laboratory. The custody seals will be attached to the front right and back left of the cooler and covered with clear plastic tape after being signed by field personnel. The cooler will be strapped shut with strapping tape in at least two locations. ENSR SOP No. 7510Pines – Packaging and Shipment of Environmental Samples (Appendix B of the SAP) includes a detailed description of these procedures.

If the samples are sent by common carrier, the waybill will be retained as part of the permanent documentation. Commercial carriers are not required to sign off on the custody forms since the custody forms will be sealed inside the sample cooler and the custody seals will remain intact.

Whenever possible, samples will be transported to the laboratory the same day the samples are collected in the field by overnight carrier.

B3.3.2 Laboratory Custody Procedures

Samples will be received and logged in by a designated sample custodian or his/her designee. Upon sample receipt, the sample custodian will:

- Examine the shipping containers to verify and document that the custody tape is intact;
- Examine all sample containers for damage;
- Determine if the temperature required for the requested testing program has been maintained during shipment and document the temperature on the COC form;
- Compare samples received against those listed on the COC;
- Verify that sample holding times have not been exceeded;
- Examine all shipping records for accuracy and completeness;
- Determine sample pH (if applicable) and record on COC;
- Sign and date the COC immediately (if shipment is accepted) and attach the waybill;
- Note any problems associated with the coolers and/or samples on the cooler receipt form and notify the Laboratory Project Manager, who will be responsible for contacting the client;

- Attach laboratory sample container labels with unique laboratory identification and test; and
- Place the samples in the proper laboratory storage.

Following receipt, samples will be logged in according to the following procedure:

- The samples will be entered into the laboratory information management system (LIMS). At a minimum, the following information will be entered: project name or identification, unique sample numbers (both client and internal laboratory), type of sample, required tests, date and time of laboratory receipt of samples, and field ID provided by field personnel.
- The appropriate laboratory personnel will be notified of sample arrival.
- The completed COC, waybills, and any additional documentation will be placed in the project file.

Specific details of laboratory custody procedures for sample receiving, sample identification, sample control, record retention, and data purging to the final evidence file are described in the laboratory SOPs (Attachment A).

B4 Analytical Methods

Non-radionuclide samples will be analyzed by:

Columbia Analytical Services
1 Mustard Street
Rochester, NY 14609
585-288-5380
Contact: Janice Jaeger

CAS Rochester will subcontract the PCDDs/PCDF analysis to their Houston, TX facility:

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

Radionuclide analyses will be performed by:

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

B4.1 Field Analytical Procedures

There are no field analyses associated with the Yard 520 sampling.

B4.2 Laboratory Analytical Procedures

The laboratories named above will implement the project-required SOPs. These laboratory SOPs for sample preparation and analysis are based primarily on SW-846 Third Edition, November 1986 (including all final updates through Final Update III; USEPA, 1997a) and the DOE HASL 300 method (DOE, 1982). These SOPs provide sufficient detail and are specific to the analyses to be performed for this investigation. Attachment A of the QAPP contains the laboratory SOPs. Laboratory Instrument Detection Limits (IDLs) and MDLs are listed in Tables A-3 (PAHs), A-4 (PCDDs/PCDFs), A-5 (radionuclides) and A-6 (metals and sulfur). The CAS Rochester laboratory SOP for performing MDL studies is included in Attachment A-1; no SOP for MDL studies is included for GEL or CAS Houston as MDL studies are not applicable to radionuclide or PCDD/PCDF parameters. A list of the laboratory SOPs included in Attachment A is provided in the Table B-2.

Table B-2 summarizes the analyte groups of interest, appropriate laboratory SOP number, and reference method for the organic and inorganic analytes evaluated in the investigation.

B4.3 List of Project Target Constituents and Detection Limits

A complete listing of project target constituents and reporting limits for each analyte group listed in Table B-2 can be found in Tables A-3 (PAHs), A-4 (PCDDs/PCDFs), A-5 (radionuclies) and A-6 (metals and sulfur) of this QAPP.

B4.4 List of Associated Quality Control Samples

The analytical laboratory SOPs listed in Table B-2 includes a QC section which addresses the minimum QC requirements for the analysis of specific analyte groups. Section B5 of this QAPP contains a complete list of the associated QC samples for every analyte group.

B5 Quality Control

QC is the overall system of technical activities that measure the attributes and performance of a process, item or service against defined standards to verify that they meet the stated requirements. Acceptable limits of performance are defined for each QC check and sample used in the project.

B5.1 Field

QC samples will include equipment blanks, field duplicates, and MS/MSDs. These samples will be collected as described below:

B5.1.1 Equipment Blanks

Equipment blanks will be prepared by routing laboratory grade and organic free water (provided by the laboratory) through non-disposable or non-dedicated sampling equipment after equipment decontamination and before field sample collection. Equipment blanks will be collected for all solid samples collected with non-disposable or non-dedicated equipment and will be collected at a frequency of one per 10 samples collected using a particular type of equipment. Equipment blanks will be analyzed for the same parameters as their associated samples.

B5.1.2 Field Duplicates

Field duplicates will be collected at a frequency of one field duplicate for every 10 or less investigative samples of each medium. Field duplicates will be collected by alternately filling two sets of identical sample containers from the interim container used to collect the sample. All field duplicates will be analyzed for the same parameters as their associated samples. Whenever possible, collection of field duplicate samples will occur at locations where detectable concentrations of target analytes are expected.

B5.1.3 MS/MSDs

MS/MSD or MS/duplicate samples will be collected at a frequency of one for every 20 or less investigative samples. For those samples designated as MS/MSDs or MS/duplicates, sufficient additional volume (based on the individual laboratory's requirements) will be collected.

B5.2 Analytical Quality Control Checks

Each laboratory has a QC program in place to ensure the reliability and validity of the analysis performed at the laboratories. All analytical procedures are documented in writing as SOPs and each SOP includes a QC section which addresses the minimum QC requirements for the procedure. The internal QC checks differ slightly for each individual procedure but in general the QC requirements include the following:

- Blanks (method, reagent/preparation, instrument, calibration);
- MS/MSDs;
- Surrogate spikes;
- Tracers;
- Laboratory duplicates;
- Laboratory control samples (LCSs);
- Internal standard areas;
- Inductively coupled plasma (ICP) interference checks; and
- Serial dilutions.

Table B-3 summarizes the QC for each method.

B6 Instrument/Equipment Testing, Inspection, and Maintenance

This section describes the procedures used to verify that all instruments and equipment are maintained in sound operating condition and in working order when needed.

B6.1 Field Equipment Maintenance

Specific preventative maintenance procedures to be followed for field equipment are based on those recommended by the manufacturer. The GPS will be checked and calibrated daily before use and periodically throughout the day as specified in Section 4.4.1 of the SAP. Critical spare parts will be kept on site to reduce potential downtime. Backup instruments and equipment will be available on site or within 1-day shipment to avoid delays in the field schedule.

B7 Laboratory Instrument Preventative Maintenance

As part of their QA manual, a routine preventative maintenance program is conducted by the laboratories to minimize the occurrence of instrument failure and other system malfunctions. Designated laboratory employees regularly perform routine scheduled maintenance and repair of (or coordinate with the vendor for repair of) all instruments. All maintenance that is performed is documented in the laboratories' operating record. All laboratory instruments are maintained in accordance with manufacturer's specifications. Table B-4 provides the frequency with which components of key analytical instruments will be serviced. Table B-5 provides a summary of the monitoring of laboratory equipment.

B8 Instrument/Equipment Calibration and Frequency

Calibration is required to ensure that field and laboratory analytical systems are operating correctly and functioning at the proper sensitivity to meet established detection limits.

B8.1 Field Instruments

Field instrumentation is limited to the GPS unit. Calibration of this instrument will be performed according to the manufacturer's instructions and Section 4.4.1 of the SAP. All calibration procedures will be documented in the field records. Calibration records will include the date/time of calibration, name of the person performing the calibration, reference standard used, and the results of the calibration.

B8.2 Analytical Instrumentation

Calibration procedures for laboratory instruments will consist of initial calibrations, initial calibration verifications, and continuing calibration verification. The SOP for each analysis performed in the laboratory describes the calibration procedures, their frequency, acceptance criteria, and the

conditions that will require recalibration. This information is summarized in Table B-6. The SOPs are included as Attachment A.

The laboratory maintains documentation for each instrument which includes the following information: instrument identification, serial number, date of calibration, analyst, calibration solutions, and the samples associated with these calibrations.

B9 Inspection/Acceptance of Supplies and Consumables

Inspection and acceptance procedures for field materials are discussed in Section B2.4.

The laboratory system of inspection and acceptance of supplies and consumables includes:

- Approval of purchase orders by the Laboratory Director or Section Managers to ensure that materials and supplies of the appropriate quality are ordered.
- Purchasing of supplies, reagents/chemicals, and bottles through established and approved vendors.
- Inspection of items upon receipt for damage, completeness of the order, and conformance to specifications.
- Logging in of each lot of reagents and verifying the quality through batch analysis.

B10 Non-Direct Measurements

The suitability of use of non-direct data (historical reports, maps, literature searches, previously collected analytical data) will be evaluated and limitations potentially placed on its use. Section B10 of the RI/FS QAPP (ENSR, 2005b) presents a summary of the criteria and limitations.

The data necessary to meet the Yard 520 sampling program objectives specified in Section A7 will be generated during the sampling program proposed in the Yard 520 SAP and will come from the following sources:

- Field records (sample locations, sample observations);
- Field measurements (GPS);
- Laboratory results for chemical and radionuclide analyses of soil and CCBs.

The data collected under this QAPP have been designed to be of sufficient quality to meet the program objectives.

B11 Data Management

Data management operations include data recording, validation, transformation, transmittal, reduction, analysis, tracking, storage and retrieval.

All data will be entered into an EQuIS database system. EDDs provided by the laboratories will be in an EQuIS-compatible format that will minimize manipulation of the data.

Upon receipt from the laboratory, hard copy and EDD will be assigned a unique identifier, which allows the data to be tracked from receipt, through validation, to data loading and storage. The electronic data will be imported into the EQuIS database system concurrent with the data validation process. Data qualifiers generated during data validation will be entered manually. Definitions of all qualifiers are maintained within the database structure and electronic versions of the data validation reports are stored in the project files maintained on the network drive. Data collected in the field will also be entered into the system and integrated with laboratory data.

As data are loaded into the system, a variety of quality checks are performed to ensure data integrity. These checks include:

- Audits to ensure that laboratories reported all requested analyses;
- Checks that all analytes are consistently and correctly identified;
- Reviews to ensure that units of measurement are provided and are consistent;
- Queries to determine that any codes used in the database are documented properly;
- Reports to review sample definitions (depths, dates, locations);
- Proofing manually entered data against the hard-copy original; and
- Reports to review groupings of sampling locations and coordinate systems.

Records of the checks are maintained on file.

At a minimum, the database will contain the following fields:

Sample identifier;
Sample location;
Sample media type;
Sampling date;
Analysis date;
Laboratory analysis identifier (test method);
Analyte name;
Concentration value;
Quantitation limits;
Measurement units; and
Data qualifiers.

Data will be loaded into a "temporary" database until data validation is complete, at which time the database will be finalized. Any changes made to the database after finalization will be documented, including a description of the change, date of change, person responsible, and reason for change.

Once all data quality checks are performed, the data will be exported to a variety of formats to meet project needs. Cross-tab tables showing concentrations by sample location will be prepared. Statistical analyses will be performed as required. Data can be accessed by a variety of mapping and visualization tools.

The project database will be maintained on a secure network drive which is backed up regularly. Access to the database will be limited to authorized users and will be controlled by password access. Data will be retained in accordance with the requirements stated in Section A9.1 of this QAPP.

SECTION C – PROJECT ASSESSMENT/OVERSIGHT

C1 Assessment and Response Actions

This section identifies the number, frequency, and type of planned assessment activities that will be performed for the project.

C1.1 Assessments

C1.1.1 Field Sampling Technical System Audit

The USEPA is responsible for the external TSAs of field activities, including field sampling and measurements, for compliance of requirements specified for this project.

The Project QA Officer and/or Field Operations Leader of ENSR will be responsible for periodic internal TSAs to verify that field sampling procedures and field sampling measurements are properly followed. The TSAs will include examination of

- Field sampling records;
- Field measurement results;
- Field instrument operating and calibration records;
- Sample collection, handling, and packaging procedures;
- QA procedures;
- Chain-of-custody; and
- Sample documentation, etc.

An example of the checklist used during the internal field TSAs is included as Figure C-1. Results of internal field TSAs will be documented in the QA reports to management (Section C2).

C1.1.2 Fixed Laboratory Technical System Audits

The USEPA is responsible for the external TSAs of laboratory activities for compliance of requirements specified for this project.

System audits are performed as described in the laboratory QA manual for internal auditing or as required by accreditation authorities.

Laboratory TSAs are conducted at project start up and then periodically as the project progresses, by ENSR or another qualified party, as part of their analytical subcontractor monitoring program. The laboratory TSA includes a review of the following areas:

- QA organization and procedures;
- Personnel training and qualifications;
- Sample log-in procedures;
- Sample storage facilities;
- Analyst technique;
- Adherence to laboratory SOPs and project QAPP;
- Compliance with QA/QC objectives;
- Instrument calibration and maintenance;
- Facility security;
- Bottleware preparation;
- Waste management;
- Data archival;
- Data recording, reduction, review, and reporting; and
- Cleanliness and housekeeping.

An example of the laboratory TSA checklist is included as Figure C-2.

Preliminary results of the systems audit will be discussed with the Laboratory Director, Laboratory Project Manager, and Laboratory QA Manager. A written report that summarizes audit findings and recommends corrective actions will be prepared and submitted to the Laboratory Director for response, and to the ENSR Project Manager. The results of the audit, including resolution of any deficiencies, will be included in the QA reports to management, as described in Section C2.

C1.1.3 Performance Evaluation Sample Assessment

Continuous performance auditing is accomplished through the regular use of LCS, matrix spike samples, duplicate samples, QC samples, proficiency testing, and through continuing calibration verification samples. Federal and State agencies may administer the proficiency testing.

Prior to the initiation of this project, the results of recent (within 6 months of the start of the program) Performance Evaluation (PE) samples analyzed by the laboratories will be reviewed and evaluated to ensure the acceptability of results for the parameters and matrices of interest. In the event that PE results are not current, not acceptable, or are not available for the target parameters, PE samples will be purchased from a commercial vendor and submitted to the laboratories for analysis prior to the start of the analytical program. The results of the PE samples analyzed by CAS and GEL will be reviewed by the ENSR Project QA Officer. Any deficiencies will be communicated to the ENSR Project Manager, the laboratory, and to the USEPA RPM. Corrective actions, which may include internal laboratory actions, the analysis of additional PE samples, or selection of another analytical subcontractor, will be documented in the QA reports to management (Section C2).

C1.1.4 Data Validation Technical System Audits

Data validation and verification will be performed as described in Section D2. In summary, a subset of data received will be subjected to a full data validation. The remainder of the data will receive a limited data validation. Data will be qualified and the results of the validation will be summarized in a validation memo. Each data validation technical systems audit will be reviewed by a validator other than the one performing the validation. This review will verify that the analytical deliverable package was complete and that any missing information requested from the laboratory was supplied, that validation worksheets were filled out accurately and completely, that validation actions were consistent with the validation guidelines established for this program and/or best professional judgment, and that the validation reports and data qualifiers accurately reflect the validation actions as documented on the worksheets.

C1.1.5 Data Package Technical System Audits

Audits of analytical data packages will be conducted for 100% of the packages received as part of the data validation process (Section D1). The review will include an evaluation of the package to ensure that (1) all required deliverables are provided, (2) each package contains the information necessary to reproduce the reported results, and (3) the QC acceptance criteria specified in the QAPP were met. Any deficiencies will be communicated to the laboratory and documented in the data validation reports.

C1.1.6 Management System Review (MSR)

On a quarterly basis, at a minimum, all projects within ENSR are reviewed. The review includes the following elements:

- Progress towards completion of the scope of work;
- Schedule versus approved plan;
- Costs and invoicing versus approved plan, including adherence to purchasing policy;
- Project task structure and associated budgets;
- Senior review assignments and documentation;
- Compliance with hard copy and electronic file management requirements;
- Client relationship development; and
- Future needs.

Documentation of the review will be maintained with the project files.

C1.2 Assessment Findings and Corrective Action Responses

Corrective action is the process of identifying, recommending, approving, and implementing measures to counter unacceptable procedures or out-of-limit QC performance that can affect data quality. Corrective action can occur during field activities, laboratory analyses, data validation, and data assessment. All corrective action proposed and implemented should be documented in the QA reports to management (Section C2). Corrective action should only be implemented after approval by the ENSR Project Manager, or their designee.

C1.2.1 Field Corrective Action

Corrective action in the field may be needed when the sample frequency is changed (i.e., more/fewer samples, sample locations other than those specified in the QAPP, etc.), or when sampling procedures and/or field analytical procedures require modification, etc. due to unexpected conditions. The field team may identify the need for corrective action. The Field Operations Leader will approve the corrective action and notify the Project Manager. The Project Manager will approve the corrective measure. The Field Operations Leader will ensure that the field team implements the corrective action. Refer to ENSR No. SOP 100Pines - Field Change Order Procedures (Appendix B of the SAP) for further discussion of field corrective actions.

Corrective action resulting from internal field audits will be implemented immediately if data may be adversely affected due to unapproved or improper use of approved methods. The QA auditor will identify deficiencies and recommend corrective action to the Field Operations Leader. The Field Operations Leader and field team will perform implementation of corrective actions. Corrective action will be documented in QA reports to the project management team (Section C2).

Corrective actions will be implemented and documented in the field record book. Documentation will include:

- A description of the circumstances that initiated the corrective action;
- The action taken in response;
- The final resolution;
- Any necessary approvals; and
- Effectiveness of corrective action.

No staff member will initiate corrective action without prior communication of findings through the proper channels.

If at any time a corrective action issue is identified which directly impacts the project DQOs, the USEPA RPM will be notified.

C1.2.2 Laboratory Corrective Action

Corrective action in the laboratory is specified in laboratory SOPs and may occur prior to, during, and after initial analyses. A number of conditions such as broken sample containers, multiple phases, low/high pH readings, and potentially high concentration samples may be identified during sample log-in or analysis. Following consultation with laboratory analysts and supervisory personnel, it may be necessary for the Laboratory QA Manager to approve the implementation of corrective action. If the nonconformance causes project objectives not to be achieved, the ENSR Project QA Officer will be notified, who will in turn notify the ENSR Project Manager, who will communicate with the Respondent Project Managers and other members of the project team, as necessary. The USEPA RPM will also be notified in those cases where the nonconformance affects the achievement of the project DQOs.

These corrective actions are performed prior to release of the data from the laboratory. The corrective action will be documented in both the laboratory's corrective action files, and in the narrative data report generated by the laboratory. If the corrective action does not rectify the situation, the laboratory will contact the ENSR Project QA Officer, who will determine the action to be taken and inform the appropriate personnel.

C1.2.3 Corrective Action During Data Validation and Data Assessment

The need for corrective action may be identified during either data validation or data assessment. Potential types of corrective action may include resampling by the field team or reinjection/reanalysis of samples by the laboratory. These actions are dependent upon the ability to mobilize the field team and whether the data to be collected are necessary to meet the required QA objectives. If the data validator or data assessor identifies a corrective action situation that impacts the achievement of the project objectives, the ENSR Project Manager will be responsible for informing the appropriate personnel, including the USEPA RPM.

C2 Reports to Management

QA reports will be prepared by the ENSR Project QA Officer and submitted on an as-needed basis to the ENSR Project Manager. QA reports will document any problems identified during the sampling and analysis programs and the corrective measures taken in response. The QA reports will include:

- All results of field and laboratory audits;
- Problems noted and actions taken during data validation and assessment; and

- Significant QA/QC problems, recommended corrective actions, and the outcome of corrective actions.

A summary of QA issues, audit findings, and significant nonconformances will be included in the status reports to the USEPA. A complete listing and description of all documents and reports that will be maintained in the project files is included in Section A9 of this QAPP.

SECTION D – DATA VALIDATION AND USABILITY

This element details the QA activities that will be performed to ensure that the collected data are scientifically defensible, properly documented, of known quality, and meet project objectives. Two steps are completed to ensure that project data quality needs are met:

- Data Verification/Validation
- Data Usability Assessment

D1 Data Review, Verification, and Validation

All data generated through field activities or through the analytical program, will be reduced and validated prior to reporting. No data will be disseminated until it has been subjected to the procedures summarized below.

D1.1 Field Data Review

The field data verification includes verification of sampling design, sample collection procedures and sample handling. Field data will be reviewed daily by the Field Operations Leader to ensure that the records are complete, accurate, and legible and to verify that the sampling procedures are in accordance with the protocols specified in the SAP and QAPP (refer to Section D2.1 for the specific elements reviewed).

D1.2 Internal Laboratory Review

Prior to the release of any data from the laboratory, the data will be reviewed and approved by laboratory personnel. The review will consist of a tiered approach (Section D2.2) that will include reviews by the person performing the work, by a qualified peer, and by supervisory and/or QA personnel.

D1.3 Validation of Analytical Data

Analytical data validation includes the verification and validation of analytical procedures, QC, calibration, and data reduction. Validation of the laboratory deliverables will be performed by ENSR. One hundred percent of the analytical data will receive validation, either as full or limited validation.

Ten percent of the data will be subjected to full validation and the remainder will receive limited validation. The ten percent of data selected for full validation will be representative of all matrices and analyses. It is expected that full validation will occur early in the validation process to identify any potential systematic problem and then will be performed periodically as needed.

For full validation, the data will be reviewed for the following, where applicable to the method:

- Completeness of deliverable;
- Technical holding times and sample preservation;
- Laboratory and field blank contamination;
- Surrogate recoveries;
- Tracer recoveries;
- Field and laboratory duplicates;
- MS/MSD recoveries and RPDs;
- Post-digestion spike recoveries;
- LCS recoveries;
- Initial and continuing calibrations;
- Instrument tuning,
- Internal standard performance,
- ICP serial dilution results;
- ICP interference check sample results; and
- Calculation and transcription verifications (i.e., verifying summary data against raw data).

Limited validation will be limited to information presented on summary forms and will include the following:

- Completeness of deliverable;
- Technical holding times and sample preservation;

- Laboratory and field blank contamination;
- Initial and continuing calibrations;
- Surrogate recoveries;
- Tracer recoveries;
- Field and laboratory duplicates;
- MS/MSD recoveries and RPDs; and
- LCS recoveries.

The discovery of significant anomalies or discrepancies during validation using the summary forms may result in an in-depth review of the raw data and the incorporation of additional review elements into the validation of all data.

D2 Validation and Verification Methods

D2.1 Field Data Verification

Field records will be reviewed by the Field Operations Leader to ensure that:

- Logbooks and standardized forms have been filled out completely and that the information recorded accurately reflects the activities that were performed.
- Records are legible and in accordance with good recordkeeping practices, i.e., entries are signed and dated, data are not obliterated, changes are initialed, dated, and explained.
- Sample collection, handling, preservation, storage, and shipping procedures were conducted in accordance with the protocols described in the SAP and QAPP, and that any deviations were documented and approved by the appropriate personnel.

D2.2 Laboratory Data Verification

Prior to being released as final, laboratory data will proceed through a tiered review process. Data verification starts with the analyst who performs a 100 percent review of the data to ensure the work was done correctly the first time. The data reduction and initial verification process must ensure that:

- Sample preparation and analysis information is correct and complete;
- Analytical results are correct and complete;
- Reporting limits are correct;
- The appropriate SOPs have been followed and are identified in the project records;
- Proper documentation procedures have been followed; and
- All nonconformances have been documented.

Following the completion of the initial verification by the analyst performing the data reduction, a systematic check of the data will be performed by an experienced peer or supervisor. This check will be performed to ensure that initial review has been completed correctly and thoroughly and will include a review of:

- Adherence to the requested analytical method SOP;
- Correctness of numerical input when computer programs are used (checked randomly);
- Correct identification and quantitation of constituents with appropriate qualifiers;
- Numerical correctness of calculations and formulas (checked randomly);
- Acceptability of QC data;
- Documentation that instruments were operating according to method specifications (calibrations, performance checks, etc.);
- Documentation of dilution factors, standard concentrations, etc.; and
- Sample holding time assessment.

A third-level review will be performed by the Laboratory Project Manager before results are submitted to clients. This review serves to verify the completeness of the data report and to ensure that project requirements are met for the analyses performed. A narrative to accompany the final report will be prepared by the Laboratory Project Manager.

D2.3 Validation of Analytical Deliverables

Validation will be performed as described in Section D.1.3 of the QAPP using the following documents in conjunction with ENSR data validation protocols (Attachment B):

- *Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (USEPA, 2004),
- *Region 5, Standard Operating Procedure for Validation of CLP Organic Data* (USEPA, 1997b)
- *Contract Laboratory Program National Functional Guidelines for Organic Data Review* (USEPA, 1999),
- *Evaluation of Radiochemical Data Usability* (DOE, 1997); and
- *Contract Laboratory Program, National Functional Guidelines for Chlorinated Dioxin/Furan Data Review* (USEPA, 2002).

All guidelines will be modified to reflect any differences in analytical methodologies. Acceptance/rejection criteria will be the project-specific criteria defined in Section A.7 of this QAPP or the method criteria, whichever is more stringent.

Upon completion of the validation, a report will be prepared. This report will summarize the samples reviewed, elements reviewed, any nonconformances with the established criteria, and validation actions (including application of data qualifiers). Data qualifiers will be consistent with the USEPA guidelines as shown below:

- 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 (this qualifier will be used only for metals data).
- J- – The result is an estimated quantity, but the result may be biased low (this qualifier will be used only for metals data).
- UJ - The analyte was not detected above the sample reporting limit; and the reporting limit is approximate.

- U - The analyte was analyzed for, but was not detected above the sample reporting limit.
- R – The data are unusable. The sample result is rejected due to serious deficiencies. The presence or absence of the analyte cannot be verified.

D2.4 Verification during Data Management

Data provided electronically used to facilitate data handling will be verified against the hard copy data report during data validation.

D3 Usability/Reconciliation with Data Quality Objectives

This element describes how the verified/validated project data will reconcile with the project DQOs, how data quality issues will be addressed and how limitations on the use of the data will be reported and handled. The purpose of this section is to indicate the methods by which it will be ensured that the data collected for this investigation falls in line with the DQOs as described in Sections A.7 of this QAPP. To meet these DQOs, a combination of statistical procedures and qualitative evaluations will be used to check the quality of the data. These procedures will be used by the laboratory, in generating the data, and by the Data Validator, in the evaluation of the data for ultimate use in accordance with the RI/FS Work Plan (ENSR, 2005b).

The data generated must meet the data user's needs as defined in the project DQOs in Sections A.7 of this QAPP. The primary objectives for assessing the usability of the data are to ensure (1) data are representative of conditions in the Area of Investigation; (2) data meet the project reporting limit requirements; and (3) data are of the quality needed in order to meet the overall objective of the RI/FS.

Results for QC samples, including field and laboratory blanks, spikes, and duplicates will be evaluated using the equations described below to determine the validity and usability of the data. In addition, the data will be reviewed for indications of interferences to results caused by sample matrices, contamination during sampling, contamination in the laboratory, and sample preservation and storage anomalies (i.e., sample holding time or analytical instrument problems).

Data will be qualified for precision and accuracy by the Data Validator. The Data Validator will apply the standard data validation qualifiers to data to indicate the level of uncertainty in the associated result. In general, data that are left unqualified, data qualified "U" (non-detected), data qualified "J (+/-)" (detected as an estimated result), and data qualified "UJ" (non-detected at an estimated detection reporting limit) are considered valid and usable for project objectives. Data that are qualified "R"

(rejected), due to severe exceedances of QC requirements, will be considered invalid and unusable for making project decisions.

D3.1 Comparison to Measurement Criteria

D3.1.1 Precision Assessment

The RPD, as a measure of variability between the matrix spike and matrix spike duplicate or sample and matrix duplicate (laboratory duplicates), and field duplicates, will be calculated to compare to precision and representativeness DQOs. The RPD of duplicate measurements is calculated according to the following formula:

$$RPD = \frac{|\text{Result in Sample 1 - Result in Sample 2}|}{\text{Average (Result in Sample 1 and Result in Sample 2)}} \times 100$$

where:

Sample 1 = Initial sample or spiked sample result

Sample 2 = Duplicate sample or duplicate spiked sample result

In the event of precision results that do not meet the measurement performance criteria established for this project the results will be inspected to determine if the reduced precision can be attributed to sampling techniques (field duplicates) or sample contamination (field and laboratory blanks). If precision has been determined to be affected by sampling or contamination the data users must decide how to use data near the project action limits that may be affected. Data of reduced precision might be usable with appropriate acknowledgement of the uncertainty associated with results that are near action levels.

D3.1.2 Accuracy Assessment

Accuracy, as a measure of bias, will be evaluated based on the percent recoveries (%Rs) of the matrix spike sample, matrix spike duplicate sample, LCS, surrogates, internal standards, and initial and continuing calibration check samples. These QC results will be compared to the project measurement performance criteria for accuracy.

The increase in concentration of the analyte observed in the spiked sample, due to the addition of a known quantity of the analyte, compared to the reported value of the same analyte in the unspiked sample determines the %R.

Percent recoveries for spiked samples and QC are determined using the following equation:

$$\%\ R = \frac{(\text{Result in Spiked Sample} - \text{Result in Original Unspiked Sample})}{\text{Known Amount of Spike Added}} \times 100$$

Percent recoveries for LCS are determined using the following equation:

$$\%\ R = \frac{\text{Result for constituent in LCS}}{\text{Verified amount of constituent in LCS from vendor information}} \times 100$$

Additionally, field and laboratory blanks will be used to evaluate whether field or laboratory procedures represent a possible source of contamination in the samples. Unmonitored contamination can allow false positive results to be reported and treated as true sample components when, in fact, they are not. This type of error will adversely affect the accuracy of the reported results. Several types of blanks, including field blanks, method blanks, and instrument blanks, will be used in this project as described in Section B5.B.

Specific DQOs for blanks have been defined for this program in Sections B5.B. In general, the procedure for assessing blank samples for potential contamination is as follows.

- Tabulate blank constituent results.
- Identify blank samples for which constituents are reported above the method detection limits.
- If no constituents are detected above the instrument or method detection limits in any blanks, the associated data are reported unqualified and no blank actions are taken.
- If consitituents are detected above instrument or method detection limits in the blanks, the associated sample consitituent results may be qualified during data validation. This qualification may result in the negation of results at raised reporting limits due to blank actions.

Thus potential false results will be reported with elevated reported limits. These elevated limits will be recognized in the data available for the end user. Bias that does not meet the limits of the measurement criteria objectives will be indicated by the results of LCS, MS, and calibration analyses.

Bias indicated by these measurement criteria objectives will need to be evaluated to determine the effect on the use of the data. High bias on nondetect results, results that are well below action levels, or well over action levels may have little effect on the use of the data. Low bias for results that are well below the action levels or well over the action levels may have little effect on the use of the data. For results near the action levels with a high or low bias or indeterminate bias, the data will need to be reviewed carefully to establish if the data is usable for the intended purposes. Sample reanalysis, analysis of archived material, and/or recollection of the sample may be appropriate depending on criticalness of the missing data, logistical constraints, cost, and schedule.

D3.1.3 Completeness Assessment

Completeness is the ratio of the number of valid sample results to the total number of results planned for collection. The goal of this program is to generate valid, usable data. However, in environmental sampling and analysis, some data may be lost due to sampling location logistics, field or laboratory errors, or matrix effects that may cause the rejection of results for some consitituents. The overall completeness goal of collection of valid data is 90% for the field and 95% for analytical data. The Data Validator will assess the completeness of the overall data generation against the project goals of a minimum of 90% as valid and usable results. Valid and usable results are defined as those that are not rejected during validation (e.g., due to severe holding time or spike recovery noncompliances) or during the overall assessment (e.g., improper sampling technique). Following completion of the sampling, analysis, and data validation, the percent completeness will be calculated and compared to the project objectives stated in Section A7.2 using the following equation.

$$\% \text{ Completeness} = \frac{\text{Number of valid/usable results obtained}}{\text{Number of valid/usable results planned}} \times 100$$

If this goal is not met, data gaps may exist that will require evaluation to determine the effect on the intended use of the data. Sample reanalysis, analysis of archived material, and/or recollection of the sample may be appropriate depending on criticalness of the missing data logistical constraints, cost, and schedule.

D3.1.4 Sensitivity

Sensitivity is evaluated by verifying that laboratory reporting limits meet the target reporting limits stated in Tables A-3 through A-6. The failure to calibrate with a standard at the laboratory reporting limit or the presence of excessive dilutions may result in elevated detection limits. The effect of these

elevated limits will need to be reviewed in light of the historical data and project action levels to determine if adequate information is available to satisfy the DQOs.

D3.1.5 Representativeness

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition within a defined spatial and/or temporal boundary.

Measures to Ensure Representativeness of Field Data

Representativeness is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the SAP and QAPP are followed and that proper sampling techniques are used. In designing the sampling program, media of interest have been specified.

Measures to Ensure Representativeness of Laboratory Data

Representativeness in the laboratory is ensured by using the proper analytical procedures, appropriate methods, meeting sample holding times, and analyzing and assessing field duplicate samples. The sampling network was designed to provide data representative of the Area of Investigation. During development of this network, consideration was given to past facility processes, existing analytical data, physical setting and processes, and media of interest. The rationale of the sampling network is discussed in detail in Section 2.0 of the SAP.

D3.2 Overall Assessment of Environmental Data

Data assessment will involve data evaluation and usability to determine if the data collected are of the appropriate quality, quantity, and representativeness to the project decision. This evaluation will be performed by the Project Manager in concert with other users of the data. The QC results associated with each analytical parameter for each matrix type will be compared to the objectives presented in this QAPP. Data generated in association with QC results meeting these objectives and/or the data validation criteria will be considered usable. Data that does not meet the objectives and/or the data validation criteria might still be usable. This assessment may require various statistical procedures to establish outliers, correlations between data sets, adequate sampling location coverage, etc., in order to assess the effect of qualification or rejection of data. The effect of the qualification of data or loss of data deemed unacceptable for use, for whatever reason, will be discussed and decisions made on corrective action for potential data gaps.