

MULTI-SITE QUALITY ASSURANCE PROJECT PLAN

For

Wisconsin Public Service Corporation, Peoples Gas Light and Coke Company, and North Shore Gas
Managed By Integrys Business Support
Former Manufactured Gas Plant Sites

**Administrative Settlement Agreement and Order on Consent Nos.
CERCLA V-W-'06-C-847, V-W-'07-C-869, and V-W-'07-C-877**

Prepared for Use by:
The Contractor/Consultant

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TABLE OF CONTENTS

ACRONYMS	ACR-1
DISTRIBUTION LIST	DIS-1
1 PROJECT MANAGEMENT	1
1.1 Introduction.....	1
1.2 Project/Task Organization (A4).....	2
1.2.1 Management Responsibilities.....	3
1.2.2 QA Responsibilities.....	5
1.2.3 Field Responsibilities.....	5
1.2.4 Laboratory Responsibilities.....	6
1.2.5 Special Training Requirements/Certification.....	9
1.2.6 Project Organization Chart.....	10
1.3 Problem Definition/Background Information (A5).....	10
1.4 Project/Task Description and Schedule (A6).....	12
1.5 Quality Objectives and Criteria for Measurement Data (A7).....	15
1.5.1 Step 1 Problem Statement.....	15
1.5.2 Step 2 Decision Identification.....	16
1.5.3 Step 3 Decision Inputs.....	18
1.5.4 Step 4 Investigation Boundaries.....	20
1.5.5 Step 5 Decision Rules.....	21
1.5.6 Step 6 Decision Error Limits.....	22
1.5.7 Step 7 Optimizing Design.....	22
1.5.8 Measurement Performance Criteria.....	25
1.6 Special Training Requirements/Certification (A8).....	29
1.7 Documentation and Records (A9).....	29
1.7.1 Anticipated Documents and Records.....	30
1.7.2 Data Reporting Package Format and Documentation Control.....	34
1.7.3 Data Reporting Package Archiving and Retrieval.....	35
2 DATA GENERATION AND ACQUISITION	36
2.1 Sampling Process Design (B1).....	36
2.1.1 Schedule.....	36
2.1.2 Sampling Design Rationale.....	36
2.2 Sampling Methods Requirements (B2).....	37
2.2.1 Sampling SOPs.....	37
2.2.2 Cleaning and Decontamination of Equipment/Sample Containers.....	39
2.2.3 Field Equipment Maintenance, Testing and Inspection Requirements.....	40
2.2.4 Inspection and Acceptance Requirements for Supplies/Sample Containers..	41
2.3 Sample Handling and Custody Requirements (B3).....	42

2.3.1	Sample Handling	43
2.3.2	Sample Custody	44
2.4	Analytical Methods Requirements (B4)	47
2.5	Quality Control Requirements (B5).....	48
2.5.1	Field Sampling Quality Control	48
2.5.2	Analytical Quality Control Checks.....	49
2.6	Instrument/Equipment Calibration, Testing, Inspection and Maintenance Requirements (B6 & B7)	49
2.6.1	Field Instruments	49
2.6.2	Laboratory Instruments.....	50
2.7	Inspection/Acceptance Requirements for Supplies and Consumables (B8)	50
2.8	Data Acquisition Requirements (Non-Direct Measurements) (B9)	50
2.9	Data Management (B10)	51
2.9.1	Field Data Recording	51
2.9.2	Laboratory Data Transformation/Reduction.....	52
2.9.3	Data Validation	53
2.9.4	Data Transmittal/Transfer	53
2.9.5	Data Tracking, Storage, and Retrieval.....	53
2.9.6	Data Security	54
2.9.7	Data Analysis and Assessment	54
3	ASSESSMENT/OVERSIGHT	56
3.1	Assessment and Response Actions (C1)	56
3.1.1	Planned Assessments	56
3.1.2	Assessment Findings and Corrective Action Responses	58
3.2	Reports to Management (C2)	60
3.2.1	Progress Reports.....	60
3.2.2	Final Project Reports	61
3.2.3	Operation, Maintenance and Monitoring (OM&M) Reports	62
4	DATA VERIFICATION/VALIDATION AND USABILITY.....	63
4.1	Data Review, Validation and Verification Requirements (D1)	63
4.2	Validation and Verification Methods (D2)	63
4.3	Usability/Reconciliation with Data Quality Objectives (D3).....	64
4.3.1	Data Usability.....	64
4.3.2	Precision	65
4.3.3	Accuracy/Bias	65
4.3.4	Sample Representativeness.....	66
4.3.5	Sensitivity and Quantitation Limits.....	66
4.3.6	Completeness.....	67
4.3.7	Comparability.....	68
4.3.8	Data Limitations and Actions	68
5	REFERENCES	69

FIGURES

Figure 1 Organizational Chart

TABLES

Table 1 Ecological Risk-Based Water Matrix
 Table 2 Human Health Risk-Based Water Matrix
 Table 3 Ecological Risk-Based Soil/Sediment Matrix
 Table 4 Human Health Risk-Based Soil/Sediment Matrix
 Table 5 Sampling and Analysis Summary
 Table 6 Project Goals for Precision, Accuracy and Completeness for Laboratory Measurements
 Table 7 Project Goals for Precision, Accuracy, and Completion of Field Measurements
 Table 8 Data Measurement Units for Field and Laboratory Measurements

APPENDICES

Appendix A: Laboratory Quality Assurance Manuals and Standard Operating Procedures
 Appendix A1: Pace Analytical Services, Inc.
 Appendix A2: Alpha Woods Hole Labs
 Appendix A3: Columbia Analytical Services, Inc.
 Appendix A4: New Age/Landmark, Inc.
 Appendix A5: Test America
 Appendix A6: Gestra Engineering, Inc.
 Appendix A7: Miller Engineers & Scientists
 Appendix A8: Aquatec Biological Sciences
 Appendix A9: Microbac Laboratories, Inc., Chicagoland Division
 Appendix A10: STAT Analysis Corporation
 Appendix A11: TriMatrix Laboratories, Inc.
 Appendix B: Data Validator and Risk Assessor Qualifications
 Appendix B1: Makuehl Co.
 Appendix B2: Exponent, Inc.
 Appendix C: Record Lists
 Appendix D: Field Standard Operating Procedures

ACRONYMS

Acronyms used in this Multi-Site Quality Assurance Project Plan include the following:

AAS	Atomic Absorption Spectrometer
ASTM	ASTM International (fka American Society for Testing and Materials)
BERA	Baseline Ecological Risk Assessment
BTEX	Benzene, toluene, ethylbenzene, and xylenes
CA	Cost Analysis
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLP	Contract Laboratory Program
COPCs	Chemicals of Potential Concern
CSM	Conceptual Site Model
DQOs	Data Quality Objectives
EE	Engineering Evaluation
Eh	Oxidation/Reduction Potential
ERAGS	Ecological Risk Assessment Guidance for Superfund
ESBs	Equilibrium Partitioning Sediment Benchmarks
FSP	Field Sampling Plan
GPS	Global Positioning System
HAZWOPER	Hazardous Waste Operations and Emergency Response
HASP	Health and Safety Plan
HHRA	Human Health Risk Assessment
ICP	Inductively Coupled Plasma Argon Spectrometry
LCS	Laboratory Control Samples
LIMS	Laboratory Information Management System
MDL	Method Detection Level
MGP	Manufactured Gas Plant
MNA	Monitored Natural Attenuation
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NCP	National Contingency Plan
OM&M	Operation, Maintenance and Monitoring
OSHA	Occupational Safety and Health Administration
PAHs	Polynuclear aromatic hydrocarbons
PALs	Preventive Action Level
PARCC	Precision, Accuracy, Representativeness, Completeness and Comparability
PQLs	Practical Quantitation Limits
PRGs	Preliminary Remediation Goals
PVOCs	Petroleum Volatile Organic Compounds
QAC	Quality Assurance Coordinator
QA Director	Quality Assurance Director

ACRONYMS (Continued)

QA/QC	Quality Assurance/Quality Control
QAMs	Quality Assurance Manuals
QAPP	Quality Assurance Project Plan
RAF	Risk Assessment Framework
RAGS	Risk Assessment Guidance for Superfund
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigations and Feasibility Studies
RLs	Reporting Limits
RME	Reasonable Maximum Exposure
ROD	Record of Decision
RPD	Relative Percent Difference
RSD	Relative Standard Deviation
SAP	Sampling and Analysis Plan
SARA	Superfund Amendment and Reauthorization Act
Settlement Agreement	Settlement Agreement and Administrative Order on Consent
SI	Site Investigation
SLERA	Screening Level Ecological Risk Assessment
SOPs	Standard Operating Procedures
SOW	Statement of Work
SRM	Standard Reference Materials
TOC	Total Organic Carbon
TS	Technical Staff
TSA	Technical System Audits
USEPA	United States Environmental Protection Agency

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1 PROJECT MANAGEMENT

1.1 Introduction

This Multi-Site Quality Assurance Project Plan (QAPP) was prepared in accordance with the respective Statement of Work (SOW) attached to the Settlement Agreement and Administrative Order on Consent (Settlement Agreement) between the United States Environmental Protection Agency (USEPA) and Wisconsin Public Service Corporation (WPSC) effective May 5, 2006; The Peoples Gas Light and Coke Company (PGL) effective June 5, 2007; and North Shore Gas Company (NSG) effective July 23, 2007. The Multi-Site QAPP addresses former manufactured gas plants (MGPs) operated by WPSC, PGL, and NSG, collectively the Company. IntegrYS Business Support, LLC (IBS) is managing the work in the Settlement Agreement on behalf of the Company.

As part of the requirements of the SOWs, multi-site documents have been also been prepared for the Health and Safety Plan (HASP), Generalized Conceptual Site Model (CSM), Risk Assessment Framework (RAF) and Field Sampling Plan (FSP). Modifications to any of these multi-site documents will be included in site-specific documents (Completion Reports, Site-Specific Work Plans (SSWPs) and Progress Reports). SSWP appendices will provide information specific to the individual site as identified in the multi-site documents. For instance, the project schedule for Remedial Investigations and Feasibility Studies and/or Engineering Evaluation and Cost Analysis (Study) activities will be provided in the SSWPs.

This Multi-Site QAPP presents the organization, data quality objectives (DQOs), a set of anticipated activities, sample analysis, data handling and specific Quality Assurance/Quality Control (QA/QC) procedures associated with Studies for the above mentioned sites. Specific protocols for sampling, sample handling and storage, chain-of-custody, and laboratory and field analyses that are common activities of the program and may be performed as part of a site-specific remedial investigation (RI) are described in this QAPP. Site-specific RI activities and modifications to this plan (if any) will be presented in a SSWP, to be submitted to USEPA, as agreed to in Exhibit A of the SOW. The SSWP will

reference this QAPP, as appropriate. If additional activities, not included herein are required, such activities will be detailed within the SSWP.

To the extent practical, analytical, toxicity and geotechnical laboratories have been identified and their respective Quality Assurance Manuals (QAMs) and/or standard operating procedures (SOPs) are included in Appendix A. The SOPs will be reviewed prior to site-specific field activities to verify the most current SOPs are used. Similarly, data validators and the risk assessor are also identified. Qualifications of some of these entities are included in Appendix B. Qualifications, QAMs and SOPs from additional entities, if determined necessary, will be submitted to USEPA for approval prior to providing services.

This QAPP has been prepared in accordance with “EPA Requirements of Quality Assurance Project Plans (QA/R-5)” (EPA/240/B-01-003, March 2001), “EPA Guidance for Quality Assurance Project Plans (QA/G-5)” (EPA/600/R-02/009, December 2002), “EPA Guidance for the Data Quality Objectives Process” (EPA QA/G-4, August 2000), “USEPA Region 5 Instructions on the Preparation of a Superfund Division Quality Assurance Project Plan”, Based on EPA QA/R-5, Revision 0, June 2000, and guidance as included in the Settlement Agreements (USEPA Region 5 CERCLA Docket Nos. V-W-'06-C-847, V-W-'07-C-869, and V-W-'07-C-877).

The QAPP element number, as used in USEPA Region 5 Instructions is included in parentheses with each section heading for ease of review.

1.2 Project/Task Organization (A4)

At the direction of the Settlement Agreement with the USEPA, the Company has responsibility for all phases of the investigation. The Company’s contractor/consultant (Consultant) will implement the Study activities including preparing SSWPs, coordinating sub-consulted services (i.e., drilling, excavation, laboratories etc.), analyzing and reporting data and providing recommendations for additional investigation/studies. The Consultant will also assist in managing the Company’s MGP program. The various quality assurances, field, laboratory and management responsibilities of key project personnel are defined below.

1.2.1 Management Responsibilities

Mary Logan and Tim Prendiville, USEPA Region V, Project Coordinators

USEPA Region V has the overall regulatory responsibility for all phases of the investigation.

Project Managers from Wisconsin Department of Natural Resources (WDNR)

WDNR project managers will be given the opportunity to review reports and provide comments to the USEPA Project Coordinator for the Wisconsin sites.

Project Managers from Illinois Environmental Protection Agency (Illinois EPA)

Illinois EPA project managers will be given the opportunity to review reports and provide comments to the USEPA Project Coordinator for the Illinois sites.

Brian Bartoszek and Naren Prasad, IBS, Project Coordinators

The Project Coordinators have responsibility for administration of all actions by IBS. The IBS Project Coordinators will be present or available during site work. The Integrlys Project Coordinators are responsible for implementing the project, and have the authority to commit the resources necessary to meet project objectives and requirements. The IBS Project Coordinators will report directly to the USEPA Project Coordinators and will provide the major point of contact and control for matters concerning the project.

Consultant, Project Manager (PM)

The PM has the responsibility for ensuring that the project meets USEPA's objectives. The PM will report directly to the IBS Project Coordinators and is responsible for technical and project oversight. The PM will:

- Define project objectives and develop detailed work plan schedules;
- Establish project policy and procedures to address the specific needs of the project as a whole, as well as the objectives of each task for each site;

- Acquire and apply technical and corporate resources as needed to assure performance within budget and schedule constraints;
- Develop and meet ongoing project and/or task staffing requirements, including mechanisms to review and evaluate each task product;
- Review the work performed on each task to ensure its quality, responsiveness, and timeliness;
- Review and analyze overall task performance with respect to planned requirements and authorizations;
- Review and approve, or designate the review and approval, of all deliverables before their submission to IBS' Project Coordinators and USEPA Region 5; and
- Represent the project team, or designate a representative, at meetings and public hearings, as required.

Consultant Study Leader

The Study Leader has the responsibility for identifying and implementing specific project tasks at each site. The Study Leader is responsible for supervising Consultant project personnel, subconsultants, and subcontractors and implementing the Study activities upon completing the Study at the site. The Study Leader reports directly to the PM. The Study Leader will:

- Define project objectives and develop work schedules;
- Orient all field leaders and support staff concerning the project's special considerations;
- Monitor and direct the field team;
- Coordinate and communicate with subcontractors and subconsultants to meet the project objectives;
- Develop and meet ongoing project and/or task staffing requirements, including mechanisms to review and evaluate each task product;
- Review the work performed on each task to ensure its quality, responsiveness, and timeliness;
- Review and analyze overall task performance with respect to planned requirements and authorizations;
- Ultimately be responsible for the preparation and quality of interim and final reports; and

- Represent the Study project team at meetings, as required.

1.2.2 QA Responsibilities

Consultant, Quality Assurance (QA) Officer

The QA Officer will remain independent of direct job involvement and day-to-day operations, and have direct access to corporate executive staff as necessary, to resolve any QA dispute. He/she is responsible for auditing the implementation of the QA program in conformance with the demands of specific investigations, Consultant policies, and USEPA requirements. The QA Officer has sufficient authority to stop work on the investigation as deemed necessary in the event of serious QA issues. Specific function and duties include:

- Performing QA audits on various phases of the field operations;
- Reviewing and approving QA plans and procedures;
- Providing QA technical assistance to project staff;
- Reporting on the adequacy, status, and effectiveness of the QA program on a regular basis to the RI/FS Leader for technical operations; and
- Responsible for coordinating data validation of all sample results from the analytical laboratory.

USEPA Region V, QA Coordinator (QAC)

The USEPA Region 5 QAC has the responsibility to review and approve all QAPPs.

1.2.3 Field Responsibilities

IBS and Consultant Field Team Members

Field team members for this project are drawn from IBS' and the Consultant's pool of qualified resources. A field team leader will be identified to guide the field team members and ensure performance of all field activities, calibration checks, verify field calculations, and review field log books for errors.

The Study Leader will utilize the staff to gather and analyze data, and to prepare various task reports and support materials. All of the designated technical team members are experienced professionals who possess the degree of specialization and technical competence required to effectively and efficiently perform the required work. Field team members will also be properly trained according to the HASP as described in Section 1.2.5.

1.2.4 Laboratory Responsibilities

The laboratories assigned with responsibility for chemical analyses of environmental media and toxicity testing may include a combination of the following;

- Pace Analytical Services, Green Bay and Kimberly, Wisconsin
- Test America, Dayton, Ohio;
- Columbia Analytical Services, Kelso, Washington;
- Woods-Hole Group, Raynham, Massachusetts;
- New Age/Landmark, Inc., Benton Harbor, Michigan; and
- Aquatec Biological Sciences, Williston, Vermont.
- STAT Analysis Corporation, Chicago, Illinois
- Microbac Laboratories, Inc., Merrillville, Indiana
- TriMatrix Laboratories, Inc., Grand Rapids, Michigan

The laboratories are certified as provided in Appendix A. The laboratory QAMs and State/Federal certifications are also provided in Appendix A. Table 1 in Appendix A summarizes the analyses that each laboratory may be selected to perform.

Analytical laboratories will be selected on a site-specific basis based on the following criteria:

- Laboratory's ability to accommodate the site-specific schedule;

- Maintaining consistency with previously performed analysis, particularly with on-going groundwater monitoring;
- Laboratory costs for analysis; and
- Laboratory's experience analyzing select parameters and certification status.

The laboratories assigned with responsibility for geotechnical analyses of site media may include a combination of the following:

- Gestra Engineering Inc. (Gestra), Oak Creek, Wisconsin;
- Miller Engineering and Scientists (Miller), Sheboygan, Wisconsin; and
- Others, if qualifications are submitted and approved by USEPA.

Qualifications and procedures for geotechnical laboratories are provided in Appendix A6 through Appendix A8. Test procedures, described in Appendix A6 and Appendix A7, are only to be used for geotechnical analysis and will not be used for environmental samples.

In general, laboratory support will include the following or similar positions:

Laboratory Client Services Manager

The laboratory Client Services Manager is responsible for the management of the analytical requirements for sample analysis and will interface directly with the Study Leader. The Client Services Manager provides a complete interface with clients from initial project specification to final deliverables.

Laboratory Director

The Laboratory Director is a technical advisor and is responsible for summarizing and reporting overall unit performance. Responsibilities include:

- Provide technical, operational, and administrative leadership;
- Allocation and management of personnel and equipment resources;
- Quality performance of the facility;
- Certification and accreditation activities; and

- Compliance with audits and corrective actions.

Quality Assurance Director (QA Director)

The QA Director has the overall responsibility for data after it leaves the analytical section of the laboratory. The QA Director will be independent of the laboratory but will communicate data issues through the Laboratory Director. In addition, the QA Director will:

- Oversee laboratory QA;
- Oversee QA/QC documentation;
- Conduct detailed data review;
- Determine whether to implement laboratory corrective actions, if required;
- Define appropriate laboratory QA procedures; and
- Prepare laboratory SOPs.

QA review will be provided by the Laboratory Director and QA Director prior to release of all data to the Consultant.

Laboratory Sample Management Office

The Sample Management Office will report to the Laboratory Director. Responsibilities of the Sample Management Office will include:

- Receiving and inspecting the incoming sample containers;
- Recording the condition of the incoming sample containers;
- Verify sample pH (if applicable);
- Verifying chain-of-custody;
- Notifying Laboratory Client Services Manager of sample receipt and inspection;

- Assigning a unique identification number and customer number, and entering each into the sample receiving log;
- Initiate transfer of the samples to appropriate lab sections; and
- Controlling and monitoring access/storage of samples and extracts.

Laboratory Technical Staff (TS)

The TS will be responsible for sample analyses and identification of corrective actions. The staff will report directly to the Laboratory Director.

1.2.5 Special Training Requirements/Certification

The purpose of this section is to address any specialized or non-routine training requirements necessary for completion of the subject investigation. Sufficient information shall be provided to ensure that special training skills can be verified, documented and updated as necessary.

The Consultant's employees maintain 40-hour training for Hazardous Waste Operations and Emergency Response (HAZWOPER) and Occupational Safety and Health Administration (OSHA) 8-hour Annual HAZWOPER Refreshers in accordance with 29 CFR 1910.120. In addition, all employees are provided the HASP.

1.2.5.1 Training

Requirements for specialized training for non-routine field sampling techniques, field analyses, laboratory analyses, and data validation are specified below.

Non-routine field sampling techniques: Currently there are no non-routine field sampling techniques that require specialized training.

Non-routine field analyses: Currently there are no non-routine field analyses that require specialized training.

Non-routine laboratory analyses: Currently there are no non-routine laboratory analyses techniques that require specialized training.

Data validation: Data validation is discussed in Section 4.

Risk Assessment: A human health and ecological risk assessment may be performed by Exponent.

1.2.5.2 Certification

Data validation: One potential data validator, Marcia Kuehl, has attained certifications required for implementing this plan for MAKuehl Company. This data validator's resume is presented in Appendix B. If other data validators are proposed, the names and qualifications, including certifications will be submitted to USEPA.

Risk Assessors: The lead for the human health risk assessment is Lisa Yost (Exponent) and the lead for the ecological risk assessment is Susan Kane Driscoll (Exponent). A Statement of Qualifications with the risk assessors' resumes are presented in Appendix B.

1.2.6 Project Organization Chart

The lines of authority specific to this investigation are presented in Figure 1.

1.3 Problem Definition/Background Information (A5)

Background information for each site and the associated former MGP property will be provided in the SSWPs. Details of the sites are provided within documents as noted in the Record List (Appendix C). MGP facilities used coal to manufacture gas for lighting and heating, and produced coal by-products which served as feedstocks for other chemical manufacturing operations. Nationwide, over 2,000 MGPs operated from 1816 to the early 1960s, until natural gas became readily available and replaced the production of manufactured gas. The history of operation of these facilities is not always well defined, since most MGPs were retired more than 35 years ago. However, sufficient records typically exist to ascertain the nature of gas production processes used and the probable volumes of gas and other related

by-products manufactured. These records also provide information on other relevant factors in evaluating the likelihood for process residuals to remain on the respective properties.

The two most common methods of coal gas production that were used at the former MGP facilities were coal gas and carburetted water gas. The coal gas production method involved heating the coal in an airtight chamber (retort) which produced coke and gases containing a variety of volatilized organic constituents. The process also produced tar which had beneficial uses, including roofing, wood treatment, and paving roads. The gas was passed through purifiers to remove impurities such as sulfur, carbon dioxide, cyanide, and ammonia. Dry purifiers contained lime or hydrated iron oxide mixed with wood chips. The gas was then stored in large holders on property prior to distribution for lighting and heating.

The carburetted water gas process involved passing air and steam over the incandescent coal in a brick filled vessel to form a combustible gas which was then enriched by injecting a fine mist of oil over the bricks. The gas was then purified and stored in holders prior to distribution.

Site investigations have been performed at several of the sites covered in this Multi-Site QAPP, to varying degrees. During the investigations, WDNR and Illinois EPA were the lead regulatory agency for Wisconsin and Illinois sites, respectively.

In general, site investigations have focused on characterizing the nature and extent of MGP residuals in the vicinity of former MGP process and handling areas and potential preferential pathways to surface waters. Historic facility maps, Sanborn maps and/or regional geologic/hydrogeologic maps were used to develop the sampling plan at each site. Details of the sampling rationale and approach are provided in the respective reports for the sites. A record list for each site is included in Appendix C. Site investigations activities were conducted in accordance with Consultant's field SOPs and HASP. Site investigation activities have typically included some or all of the following:

- Test pit excavations to assess the presence and/or condition of subsurface former MGP structures;
- Surface soil and subsurface soil sampling (via test pit excavation and direct push methods, hollow stem augers, mud rotary, and/or sonic drilling methods) to characterize the nature and extent of MGP residuals and evaluate potential treatment parameters (i.e., shear strength, grain size, etc.);
- Groundwater sampling (shallow and deep) to characterize distribution of MGP residuals, evaluate trends in concentrations and flow directions;

- Hydraulic conductivity analysis to evaluate hydrogeologic conditions and zones of influence;
- Sediment poling in the nearby affected surface water to evaluate the distribution of soft sediment; and
- Sediment sampling to characterize the nature and extent of MGP residuals.

The need for soil vapor monitoring and air sampling activities are evaluated on a site-specific basis and have generally not been performed as part of past site investigation activities. If deemed necessary, soil vapor monitoring and air sampling may be included in the SSWPs. Samples collected for environmental analysis were submitted to State of Wisconsin or State of Illinois certified laboratories.

In accordance with the SOWs attached to the Settlement Agreements, Completion Reports will be prepared to document response actions in areas and/or media of each site which sufficiently protect public health, welfare or the environment. For areas and/or media of each site which do not sufficiently protect public health, welfare or the environment, additional work, if necessary, will be performed under the Study.

The Study activities will supplement existing data, determined by USEPA to be acceptable, as necessary to assess risk to human health and ecological receptors and to define chemical constituent migration pathways. Historic data will be used to focus additional activities. The Problem Statement for the Study is as follows:

To determine the current nature and extent of selected site specific chemicals of potential concern (COPCs) in site media (which may include on-property or off-property and/or on-facility and/or off-facility surface soil, subsurface soil, groundwater, sediment and/or surface water) and evaluate if unacceptable risks to human health and the environment are present, which would therefore warrant further evaluation or action.

1.4 Project/Task Description and Schedule (A6)

As mentioned previously, this is a Multi-Site QAPP, intended to address MGPs formerly operated by WPSC, PGL, and NSG. The data quality objectives (DQOs) outlined in Section 1.5 represent initial project planning to evaluate media that presents an unacceptable risk to human health and the

environment. The DQOs may be revised as additional data is generated. Any revisions will be written into the SSWPs.

Specific tasks to be performed at a site and the sampling rationale will be detailed in the SSWPs and may include a combination of the following activities:

- Site reconnaissance to evaluate property boundaries, the current understanding of site boundaries, topographic features, and site surveys;
- Geophysical investigations to assist in delineating waste depths, thicknesses and volume of fill and lateral extent of fill;
- Surface soil sampling to characterize nature and extent (vertically and laterally) of MGP residuals and generate data to support a human risk assessment. Surface soil results may also be used to support an ecological risk assessment on a site-specific basis, if appropriate;
- Subsurface soil sampling to characterize nature and extent (vertically and laterally) of MGP residuals, evaluate source areas potentially influencing groundwater quality, and generate data to support a human health risk assessment;
- Surface and subsurface soil sampling to evaluate treatability parameters;
- Groundwater monitoring well installation, monitoring and sampling to characterize nature and extent (vertically and laterally) of MGP residuals, evaluate groundwater flow direction and uses, evaluate hydraulic conductivity and vertical gradients and compile data for use in groundwater modeling;
- Multi-beam sonar (bathymetry), sub-bottom profiling (sediment thicknesses) and side scan sonar (identify sediment transition zones, evaluate river bottom elevation and identify potential debris or other manmade materials) that may obstruct sediment investigation activities and remediation, if necessary;
- Sediment poling survey to determine the extent of soft sediment deposits;
- Sediment sampling to characterize nature and extent (vertically and laterally) of MGP residuals within the nearby affected surface water bodies (primarily rivers), evaluate pore water concentrations, determine site-specific risk-based (human health and/or ecological) values, evaluate geotechnical properties of sediment;
- Sediment sampling to evaluate treatability parameters;

- Surface water sampling to characterize MGP residuals within the nearby affected surface water body, determine surface water elevation and evaluate flow and hydrodynamic conditions of the affected surface water body; and
- Biological investigations.

A summary of potential MGP target compounds and parameters with Practical Quantitation Limits (PQLs) are provided in Table 1 through Table 4. The PQLs presented for MGP residual parameters are based on the lowest values assumed to be needed for performing a risk assessment or comparing to regulatory standards/guidance. The PQLs will be reviewed as part of developing the SSWPs and will be determined on a site-by-site basis in the SSWPs. Additional parameters may also be identified for analysis in the SSWPs.

Table 5 presents a generalized sampling and analysis summary and identifies analyses that may be performed using a mobile or fixed based analytical laboratory and field based measurements. Details of the sampling design, (including the sample location and type, number and frequency of field samples, etc.) are generally provided in the Multi-Site FSP and the will be included in the SSWPs. Sample collection methods are discussed in Section 2.2. The Site-Specific Completion Reports will include previously collected sampling locations and analytical results which will be used to guide the SSWPs.

To ensure quality assurance, the proposed Sampling and Analysis Plan (SAP) will be performed in accordance with the SOPs provided in Appendix D. These SOPs will be reviewed on a site-by-site basis, prior to initiating field work, to ensure the methods are up to date. In addition, technical system audits (TSA) that may be performed during or following data collection activities are discussed in Section 3.1. The QA Officer or designated representative will be responsible for coordinating such activities and implementing corrective action measures, if necessary.

Select analytical samples will be validated by a data validator using the most current methods and quality control criteria. Data validation methods and reconciliation with the DQOs is further discussed in Section 4.

The schedule for implementing Study activities and QA assessments (discussed in Section 3) will be presented within the SSWPs for USEPA approval. Exhibit A of each of the SOWs is the Schedule for

Major Deliverables of the Company MGP program. In accordance with Section B, General Schedule, “the general schedule for a specific Site may be modified when: 1) a different schedule is approved by EPA in a SSWP, Treatability Testing Work Plan, or other EPA approved document; or 2) the Respondent submits in writing a request for a site-specific extension or schedule modification, and EPA approves any such request”. The IBS Project Coordinators will be responsible for requesting such schedule extensions and modifications to the USEPA Project Coordinators. The USEPA Project Coordinators will be responsible for approving schedule extensions or modifications and notifying appropriate agency entities of such extensions or modifications. The Consultant will notify the appropriate laboratories and sub-consultants of any such extensions or modifications.

1.5 Quality Objectives and Criteria for Measurement Data (A7)

The Study will supplement existing data as necessary to assess risk to human health and ecological receptors and to define chemical constituent migration pathways. The objectives of the Study are determined using the seven-step process defined in USEPA’s Guidance for the Data Quality Objectives Process (EPA QA/G 4, August 2000) and USEPA Region 5 Guidance. The DQOs will reflect the use of analytical methods for identifying and addressing contamination consistent with the levels for potential remedial action identified in the National Contingency Plan (NCP), 40 CFR Part 300 (NCP), the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendment and Reauthorization Act of 1986 (SARA), and guidance as provided in the Settlement Agreements.

1.5.1 Step 1 Problem Statement

The planning team members and their respective roles in the project are identified in Section 1.2 of this QAPP. As necessary, team members may be replaced or additional team members included. Stakeholders who may be affected by the Study process or offer input include the regulatory agencies and residents in the vicinity of the sites.

The Generalized CSM and Multi-Site RAF are subject to revision for each site and modifications will be included in the SSWPs. Several of the MGP properties have been the subject of previous SI work to varying degrees as described in Section 1.3. The Generalized CSM has been developed using synthesized

information from the sites regarding the location, and potential pathways at the sites that may adversely affect human health and the environment. The Generalized CSM may be refined to reflect the conditions of each site as part of the SSWP. As discussed in Section 1.3, the Problem Statement for the Study at each site is as follows:

To determine the current nature and extent of selected site specific chemicals of potential concern (COPCs) in site media (which may include on-property or off-property and/or on-facility and/or off-facility surface soil, subsurface soil, groundwater, sediment and/or surface water) and evaluate if unacceptable risks to human health and the environment are present, which would therefore warrant further evaluation or action.

SSWPs will provide a background summary for each site and the associated former MGP property. A summary of the results and observations from previous site investigations and the current conditions of each site will be included in the Site-Specific Completion Report and SSWP. A schedule to implement the Study activities will also be included in the SSWP.

1.5.2 Step 2 Decision Identification

The Study results will provide data in order to assess risk to human health and ecological receptors and to define potential chemical constituent migration pathways. The objectives of the Study are:

- Determine the nature and extent of chemical constituents in surface and subsurface soil at the site;
- Determine the nature and extent of chemical constituents in groundwater at the site;
- Determine the nature and extent of chemical constituents in nearby affected surface water;
- Determine the nature and extent of chemical constituents in nearby affected soft sediment;
- Identify potential preferential pathways of MGP residuals;
- Collect sufficient data to support an ecological risk and human health risk assessment;
- Identify and quantify potential ecological risks and human health risks posed by MGP residuals;
- Determine the volume of surface and subsurface soil and areas of concern which exceed chemical concentrations estimated to pose a risk to human health and may warrant remedial action;

- Determine the volume of surface and subsurface soil and areas of concern which may pose a risk to groundwater quality and may warrant remedial action;
- Identify impacted soft sediment that is available to the benthic community and may impact the water column;
- Determine the volume of soft sediment and areas of concern which exceed chemical concentrations estimated to adversely affect ecological and human health and may warrant remedial action;
- Collect sufficient data (i.e., soil geotechnical properties, disposal profiles, river bathymetry, etc.) to perform a Study to address environmental impacts to surface and subsurface soil, groundwater, soft sediment and surface water, if appropriate; and
- Prepare a Study to present remedial approaches that are protective of human health and the environment, compliant with the NCP, and acceptable to the USEPA for USEPA's use in selecting an appropriate remedial action for a Record of Decision (ROD).

If a risk to human health or the environment is identified in surface soil, subsurface soil, groundwater, sediment or surface water, remedial action approaches may include, but are not limited to, one or more of the following alternatives:

- No action;
- Institutional controls;
- Source removal and disposal;
- Containment;
- Extraction and treatment;
- Stabilization/Solidification;
- On-site or off-site treatment (soil and groundwater);
- Capping;
- Dredging;
- Reactive barrier wall; and
- Monitored Natural Recovery.

1.5.3 Step 3 Decision Inputs

The Study objectives will be met through characterizing (i.e., visual, field measurements, etc.) and collecting additional surface soil, subsurface soil, groundwater, sediment and/or water column samples for submittal for analysis of COPCs.

A subset of sediment samples may be submitted to a toxicology laboratory to correlate chemical concentrations with adverse affects on the benthic community. In addition, a subset of samples may also be evaluated for geotechnical parameters including Atterberg Limits, grain size, organic content, specific gravity, and moisture content.

The Multi-Site FSP and the SSWPs will provide sample collection devices, types, frequencies, and analytical methods presented in this Multi-Site QAPP. An example sampling and analysis summary is provided in Table 5. The specific analyses to be performed will be determined on a site-by-site basis in the SSWPs. Analytical data will have sufficiently low PQLs, (Tables 1 through 4) to correspond with risk assessment data needs and anticipated project specific action levels. The PQLs presented for MGP residual parameters are based on the lowest values assumed to be needed for performing a risk assessment or comparing to regulatory standards/guidance. The PQLs will be determined on a site-by-site basis in the SSWPs. Additional parameters may also be identified for analysis in the SSWPs. All data will be verified and select data will be validated by a data validator that is independent of the analytical laboratory developing the data.

Existing data, as described in the Records on File (Appendix C) and summarized in Site-Specific Completion Reports will be used to identify areas in which no additional investigation is required. The existing data may also be used to inform additional investigations, if necessary, and may be used to compare previous sample results with the current conditions.

1.5.3.1 Screening Level Ecological Risk Assessment

A screening level ecological risk assessment (SLERA) may initially be performed to determine whether a full baseline ecological risk assessment (BERA) is required. Appropriate SLERA guidance and criteria will be determined on a site-by-site basis in the SSWPs and may include the following:

- Ecological Risk Assessment Guidance for Superfund (ERAGS): Process for Designing and Conducting Ecological Risk Assessments, Interim Final, EPA/540/R 97/006, USEPA, Environmental Response Team, Edison, NJ, 1997;
- Guidelines for Ecological Risk Assessment, EPA/630/R-95/002F, USEPA, Risk Assessment Forum, Washington, D.C., 1998;
- Procedure for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures, EPA-600-R-02-013, Office of Research and Development, Washington, D.C., 2003;
- Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems, Archives of Environmental Contamination and Toxicology 39: 20-31, MacDonald, D.D., C.G., Ingersoll, and T.A. Berger, 2000; and
- Wildlife Exposure Factors Handbook, Volume I, EPA/600/R 93/187a, USEPA, Office of Research and Development, Washington, D.C., 1993.

The need for a full BERA will be determined based on the results of the SLERA.

1.5.3.2 Human Health Risk Assessment

The human health risk assessment (HHRA) may be performed to provide a quantitative assessment of the potential for adverse health effects that may result from exposure to chemicals of potential concern (COPCs) at the site.

Appropriate HHRA guidance and criteria will be determined on a site-by-site basis in the SSWPs and may include the following:

- Risk Assessment Guidance for Superfund (RAGS), Volume 1 - Human Health Evaluation Manual, Part A, Interim Final, EPA 540/1 89/002, USEPA, December 1989;
- Risk Assessment Guidance for Superfund (RAGS), Volume 1 - Human Health Evaluation Manual, Part D, (Standardized Planning, Reporting, and Review of Superfund Risk Assessments), Final, USEPA, December 2001;
- Risk Assessment Guidance for Superfund (RAGS), Volume 1 - Human Health Evaluation Manual, Part E, (Supplemental Guidance for Dermal Risk Assessment), EPA/540/R/99/005, USEPA Office of Emergency and Remedial Response, Washington, D.C., July 2004;
- Exposure Factors Handbook Volume I – General Factors, USEPA, Office of Research and Development, 1997;

- Exposure Factors Handbook Volume III – Activity Factors, USEPA, Office of Research and Development, 1997;
- Region 9 Preliminary Remediation Goals, USEPA Region 9, October 2004;
- Memorandum from Administrator Carol M. Browner to Assistant Administrators, Associate Administrators, Regional Administrators, General Counsel and Inspector General on March 21, 1995, EPA Risk Characterization Program, USEPA Office of the Administrator, Washington, D.C., March 21, 1995;
- Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites, OSWER 9285.6 10, USEPA, Office of Emergency and Remedial Response, Washington, D.C., December 2002;
- WDNR Environmental Protection, Investigation and Remediation of Environmental Contamination, W.A.C. Chapter NR 720, Soil Cleanup Standards, January 2001;
- WDNR W.A.C. Environmental Protection, General, Chapter NR 140, Groundwater Quality, February 2004;
- Chapter 35 of the Illinois Administrative Code (IAC), Part 620: Groundwater Quality, February 2002; and
- 35 IAC; Subtitle G: Waste Disposal; Chapter I: Pollution Control Board; Subchapter f: Risk Based Cleanup Objectives; Part 742: Tiered Approach to Corrective Action Objectives, February 2007.

1.5.4 Step 4 Investigation Boundaries

The investigation will be limited to on-site surface soil and subsurface soil (which may include on property and off-property locations), on-site (and potentially off-site) groundwater monitoring wells, and sediment and surface water samples in nearby affected water bodies, and downstream of, the former MGP properties. Figures depicting the former property boundaries, current property boundaries and proposed sample locations will be provided in the SSWPs. Site boundaries will be evaluated based on results and observations of previous investigations.

Sample volumes necessary for analyses will be dictated by the analytical and toxicity testing laboratories and will be provided in the SSWPs and are generally presented in the Multi-Site FSP. An example is provided in Table 5.

Samples may be collected using the following methods:

- Surface Soil Samples: Drilling methods (i.e., direct push or hollow-stem augers with split-spoon sampling) shovels, and/or trowels;
- Subsurface Soil Samples: Drilling methods, hand augers, and/or test pit excavations;
- Groundwater Samples: Low-flow sampling techniques (using peristaltic or bladder pumps) and/or dedicated and disposable bailers if the monitoring well is not conducive to low-flow sampling techniques;
- Sediment Samples: Piston type coring devices, a Ponar dredge and/or similar methods. The samples for laboratory analyses will be selected from discrete depth intervals. Samples for toxicity testing may be composites due to the large volumes of sediment required; and
- Surface Water Samples: Grab sampling device (e.g., Niskin brand bottle) and/or integrator (e.g., ISCO brand sampler) at established locations.

SOPs for sampling collection are included in Appendix D. The SOPs will be reviewed prior to initiating field activities to ensure the methods are up to date. Additional details on sampling rationale are generally provided in the Multi-Site FSP and will be presented in the SSWPs.

1.5.5 Step 5 Decision Rules

If surface soil, subsurface soil or groundwater concentrations of COPCs are present at concentrations that pose a risk to human health or the environment, then further evaluation or remedial action may be warranted. At sites where a remedial action has been performed, this may include continued post-remediation groundwater monitoring. If the chemical concentrations of COPCs are not present at concentrations that pose a risk to human health or the environment, then there will be no need for remedial action at the upland portion of the site.

Synoptically-collected sediment samples may be subject to toxicity testing and chemical analysis for COPCs to determine the concentrations that may cause effect to benthic organisms. In addition, sediment samples may be analyzed for COPCs to assess human health risks. If the chemical concentrations of COPCs exceed site-specific risk-based values, then further evaluation or remedial action may be

warranted. If the chemical concentrations of COPCs do not exceed the site-specific risk-based values, then there will be no need for remedial actions at the site.

1.5.6 Step 6 Decision Error Limits

The sampling design errors will be minimized to the extent possible by collecting representative samples that reflect the variability in sample population for risk assessment. Sampling collection and measurement decision errors will be minimized by following the SOPs provided in Appendix D and documenting field activities that deviated from the SOPs. Similarly, laboratory analyses will follow the standard laboratory procedures and QA/QC samples will be collected to identify errors associated with sample collection and analyses. Laboratory data must be reported by the laboratory at low enough levels that will allow comparison to the existing standards and support the risk assessments.

Analytical data used in risk assessments will generally be 100% validated by a data validator that is independent of the laboratory to ensure data usability and facilitate data reduction. It is assumed verification samples will be collected and will be 100% validated during remedial action activities, if necessary. Therefore, it is appropriate that the first sample delivery group of the samples to evaluate lateral and vertical extent of COPCs above the appropriate regulatory standards, guidance, and/or site-specific risk-based values will be validated. If no problems are encountered, twenty percent of subsequent data will be validated, unless a problem is encountered with the data (in which case the percent of data to be validated may be increased). Data to evaluate trends in groundwater concentrations are not proposed to be validated.

1.5.7 Step 7 Optimizing Design

Upland Portion of the Site

To achieve the objectives of the Study in the upland portion of the sites the following may occur:

- Evaluate future use of the site, if available and compare current environmental conditions to applicable regulatory standards and/or guidelines, if issues are present, then;
- Re-evaluate previously prepared Study reports, if available, at sites in which a remedial action has not been implemented and identify additional data needs, if issues are present, then;

- Review historic groundwater concentrations, gradients (vertical and horizontal), and flow directions to evaluate the need for additional groundwater monitoring wells, if issues are present, then; and
- Identify data gaps in surface and subsurface soil data from previous RIs or other investigations (i.e., lateral and vertical extents, treatability parameters, etc.) and supplement as necessary.

Analytical data in the upland portion of the site, if determined necessary, may be collected using a mobile laboratory to maximize sample density and provide near real-time results.

Nearby Affected Water Bodies

The sampling approach to achieve the objectives of the Study in the nearby affected water bodies is to review historic sediment data, complete bathymetric and poling surveys, and collect soft sediment samples to support the risk assessment evaluations described in the SSWPs. Two alternatives will be used in the nearby affected water bodies, based on the complexity and size of the site. The selected approach will be detailed in the SSWPs. A generalized approach for each alternative is described below.

Alternative 1

Alternative 1 may be used at more complex, larger sites, to develop a site-specific risk-based value for the COPCs (Step One) prior to initiating another sediment sampling event (Step Two) to delineate the extent of sediments with COPC concentrations exceeding the risk-based values.

In Alternative 1, sediment sampling for ecological risk assessment involves collecting sediment core samples and using a mobile and/or fixed based laboratory to screen sediment sub-samples for the list of 34 polynuclear aromatic hydrocarbons (PAHs) and identify samples for additional analysis. From the screening step, samples with a range of PAH concentrations (ideally from less than 7 milligrams per kilogram (mg/kg) up to 1,000 mg/kg or the highest PAH concentration previously recorded), may be evaluated for toxicity analysis and additional chemical constituents (which may include petroleum volatile organic compounds (PVOCs), PAHs, phenols and/or inorganics), total organic carbon, and/or soot carbon for use in developing the ecological site-specific risk-based value for COPCs.

Step One for human health risk assessment, involves collecting sediment core samples and analyzing them in a mobile or fixed base laboratory for use in developing the human health site-specific risk-based

value for COPCs (which may include PVOCs, PAHs, phenols, and/or inorganics), total organic carbon, and soot carbon. Rationale for sample locations may include:

- Areas of the river where people may be spending time in contact with river sediment as evident from pathways into the water and boat dock access;
- Shallow water depth areas where people may be wading in the river;
- Areas identified in previous investigations with elevated levels of PAHs or inorganics; and
- Areas recorded in previous investigations to have visual evidence of MGP residuals (sheen or tar).

Sample depths may vary based on site-specific conditions (i.e., depth of soft sediment in areas wading may occur). Sample results from the ecological risk assessment may also be included in the human health risk database.

Surface water samples may be collected and analyzed for COPCs (which may include PVOCs, PAHs, phenols, and/or inorganics) and total organic carbon in a fixed-base laboratory during Step One sampling for use in the ecological and human health risk assessments.

After the site-specific risk-based values are developed, Step Two may be conducted by collecting additional core samples to refusal using Vibrocore™ techniques (or other techniques as identified in the SSWP) to delineate the nature and extent (lateral and vertical) and risk zones of affected sediment within the nearby water body. To minimize costs, each one-foot interval of the cores may be analyzed in the mobile laboratory for COPCs only (which may include PVOCs, PAHs, phenols, and inorganics). The mobile laboratory will be fully certified and able to provide defensible data packages; no fixed-base laboratory verification testing will be necessary.

Alternative 2

Alternative 2 may be used at less complex, smaller sites, to identify the sediment volume at the site above ecological screening concentrations (presented in the Multi-Site RAF) or as described in the SSWPs. Sediment cores will be subdivided and a sub-sample of each interval will be screened against ecological screening numbers for the site COPCs.

Each interval of each sediment core will be analyzed for the COPCs and a portion of the sample will be archived for possible total organic carbon (TOC) and soot carbon analysis and evaluation of the equilibrium partitioning benchmark (ESB) approach for PAHs to delineate the nature and extent (lateral and vertical) of affected sediment within the nearby water body. To minimize costs, sediment samples may be analyzed in the mobile laboratory and intervals will be analyzed from the top of sediment down, to evaluate the need to continue analysis in the vertical direction.

If the sediment concentrations exceed the ecological screening concentrations over a larger area or greater volume than anticipated, samples with a range of PAH concentrations (ideally from less than 7 milligrams per kilogram (mg/kg) up to 1,000 mg/kg or the highest PAH concentration previously recorded), may be evaluated for toxicity analysis,, total organic carbon, and/or soot carbon for use in developing the ecological site-specific risk-based value for COPCs as described in Alternative 1. The decision to perform toxicity analysis will be based on the area and distribution of sediment with COPC concentrations above ecological screening concentration and will be discussed with USEPA.

The human health risk assessment for sediments in Alternative 2 follows the same approach identified for sediments in Alternative 1. Similarly, the surface water will be evaluated as described in Alternative 1.

The approach to be presented in the SSWPs based on the Multi-Site FSP will be developed to maximize the project objectives and usability of the data. Conditions in the field (e.g., inability to access a sampling location) or data validation may limit useable data. Corrective actions to identify, recommend, approve, and implement measures to counter unacceptable procedures, or out of quality control performance than can affect data quality, are addressed in Section 3.1.2 of the QAPP.

1.5.8 Measurement Performance Criteria

The overall objectives and criteria for assuring quality for this effort are discussed below. This QAPP addresses how the acquisition and handling of samples and the review and reporting of data will be documented. The section presents the measurement performance goals for precision, accuracy, representativeness, completeness and comparability (PARCC). These parameters indicate the qualitative and quantitative degree of quality associated with measurement data.

Analytical methods and detection/reporting limits for chemical parameters to be analyzed during this Study are summarized on Table 1, Ecological Risk-Based Water Matrix, Table 2, Human Health-Risk-Based Water Matrix, Table 3, Ecological Risk-Based Soil/Sediment Matrix, and Table 4, Human Health-Risk-Based Soil/Sediment Matrix. An example sampling and analysis summary for each matrix is provided in Table 5. These tables are provided for reference. The project specific PQLs and the sampling and analysis parameters will be determined in the SSWPs. Water levels and select water quality parameters (i.e., pH, turbidity, specific conductance, oxidation reduction potential (Eh), temperature and dissolved oxygen) may be measured in the field as described in the SOPs located in Appendix D.

Laboratory QA objectives are presented in each analytical laboratory's QAM, which are located in Appendix A. Analytical laboratories retained to analyze environmental samples for this Study may vary and will be identified after submittal of the SSWP. Precision and accuracy goals are determined by the individual analytical laboratories per the analytical methods. General guidelines for laboratory precision and accuracy are provided on Table 6. Section 2.5 discusses the frequency and type of quality control samples.

All data will be reported completely. No data will be omitted unless an error occurred in the analyses or the run was invalidated because of QC sample recovery or poor precision.

1.5.8.1 Precision

Precision is a measurement of the degree to which two or more measurements are in agreement, which is quantitatively assessed based on the standard deviation. Precision in the laboratory is assessed through the calculation of relative percent difference (RPD) and calculation of relative standard deviations (RSD) for three or more replicate samples. The equations to be used to verify precision in this Study are found in Section 4.3 of this QAPP. General precision goals for laboratory data are provided in Table 6.

Laboratory precision will be assessed through the analysis of matrix spike/matrix spike duplicate (MS/MSD) and field duplicate samples for organic parameters. For inorganic parameters, precision will be assessed through the analysis of MS/MSD and sample/sample duplicate pairs.

Precision for field parameters, including pH, turbidity, specific conductance, Eh, temperature, and dissolved oxygen, will be determined through duplicate analysis of 1 in every 20 samples. Precision control limits for field measured parameters are provided in Table 7.

Precision and bias goals for geotechnical parameters are generally not available due to the variability and nature of soil materials tested by these methods. The test methods used for analysis of geotechnical parameters are widely accepted and generated by the ASTM International (ASTM). For the ASTM test methods that will be used for this project, only Atterberg Limits and moisture content testing methods contain quantifiable precision statements. None of the testing methods have a bias statement that contains data because there is no accepted reference value for the materials tested by these test methods (due to the variability of the materials) and; therefore, bias cannot be determined.

1.5.8.2 Accuracy

Accuracy is the degree of agreement between an observed value and an accepted reference of true value. Accuracy in the field is assessed through the use of field blanks and trip blanks and through the adherence to all sample handling, preservation and holding times. One trip blank will accompany each batch of sample containers (VOCs in water) shipped to the laboratory. Laboratory accuracy is assessed through the analysis of a MS/MSD (1 per 20 samples), standard reference materials (SRM), laboratory control samples (LCS), and surrogate compounds, and the determination of percent recoveries. The equation to be used for accuracy for this Study is found in Section 4.3 of this QAPP. Accuracy control limits for the laboratory are given in Table 6.

Accuracy for field measured parameters including pH, turbidity, specific conductance, Eh, temperature, and dissolved oxygen will be assessed through instrument calibration standards discussed in instrument calibration and maintenance SOPs (see Section 2). Accuracy control limits for field measured parameters are provided in Table 7.

Laboratory accuracy for geotechnical parameters is assessed through the strict adherence to ASTM or other specified standard methods or guidelines for each parameter.

1.5.8.3 Completeness

Data completeness is a measure of the amount of valid data obtained from a prescribed measurement system as compared with that expected and required to meet the project goals. Analytical and field completeness will be addressed by applying data quality checks and assessments for accuracy and precision, as described in Section 4.3, to ensure that the data collected are valid and significant.

As shown on Table 6, the laboratory completeness objectives for the Study will be 90 percent or greater. The data validator will follow procedures described in Section 4 to assess the completeness and validity of laboratory data deliverables.

Analytical data used in risk assessments will be 100% validated by the data validator to ensure data usability and facilitate data reduction. It is assumed verification samples will be collected and will be 100% validated during remedial action activities, if necessary. Therefore, it is appropriate that the first sample delivery group of the samples to evaluate lateral and vertical extent of COPCs above the appropriate regulatory standards, guidance, and/or site-specific risk-based values will be validated. If no problems are encountered, twenty percent of subsequent data will be validated, unless a problem is encountered with the data (in which case the percent of data to be validated may be increased). Data to evaluate trends in groundwater concentrations are not proposed to be validated.

The completeness of an analysis will be documented by including in the report sufficient information to allow the data validator to assess the quality of the results. The information delivered may include such items as chromatograms, spectra, QC data, and summaries of results. Additional information, such as the laboratory worksheets and notes, will be stored with the sample results in the laboratory. In general, the raw data will be archived for at least five years by the laboratory.

1.5.8.4 Data Representativeness

Data 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. All proposed field testing and measurement procedures will be selected to maximize the degree to which the field data will represent the conditions at the site, and the matrix being sampled or analyzed.

As described in Section 3.1, the proper execution of field activities is the main mechanism for ensuring data representativeness. Representativeness in the laboratory is ensured through the use of the proper analytical procedures, appropriate methods, meeting sample holding times, and analyzing and assessing field duplicate samples.

1.5.8.5 Comparability

Data comparability expresses the confidence with which one data set can be compared to another data set. SOPs for field measurements, contained in Appendix D, will ensure that tests performed at various locations across the sites are conducted using accepted procedures, in a consistent manner between locations and over time, and including appropriate QA/QC procedures to ensure the validity of the data. Sampling procedures for environmental matrices are discussed in Section 2 to ensure that samples are collected using accepted field techniques.

Environmental samples will be analyzed by analytical laboratories using consistent protocols for sample preservation, holding times, sample preparation, analytical methodology, and QC as described in USEPA SW-846 test methods, or other approved USEPA methods.

Planned analytical data will be comparable when similar sampling and analytical methods are used as documented in the QAPP. Comparability is also dependent on similar QA objectives. The parameter units to be used are listed in Table 8.

1.6 Special Training Requirements/Certification (A8)

Specialized training requirements and certification are addressed in Section 1.2.5.

1.7 Documentation and Records (A9)

This section identifies the documents and reports to be generated throughout the Study and the information to be included in these documents and reports. A description of the data management system including a description of types of data that will be collected is presented in Section 2.9.

1.7.1 Anticipated Documents and Records

1.7.1.1 Field Documentation

Field activities performed during the Study activities will be documented in bound, dedicated logbooks. All entries will be made in ink and no erasures will be allowed. If an incorrect entry is made, the information will be crossed out with a single line and initialed. If pages are left intentionally blank, a diagonal line will be drawn across the page and the field team member will sign the page. The field team will provide a comprehensive description of field activities to allow reconstruction of events, review of data and interpretation. All documents, records, photographs and information relating to field activities will be maintained in the project file via electronic files and/or hard copy. The Study Leader will review all field documentation to verify the activities will meet the intent of the QAPP and SAP.

Daily recorded field information will include:

- Project name;
- Dates activities were performed;
- The names of the field team members and/or contractors conducting the activity and any oversight personnel;
- Climatic Conditions;
- Description of sample collection points;
- A map with proposed sampling locations;
- Equipment/methods used;
- Sample collection methods (in accordance with the Field SOPs);
- Deviations from the SSWP and/or the Field SOPs;
- Equipment calibration results;
- Field observations; and
- A description of photographs that may have been taken.

Additional field forms may be used as necessary including:

- Sample Control Logs (includes sample type, date, time, analysis requested, sample depth, number of containers, identification of duplicate samples, MS/MSDs, equipment rinsate blanks and trip blanks.);
- Borehole / Well Abandonment Field Form;
- Chain-of-Custody Sheets and Custody Seals;
- Drilling Log;
- Soil Vapor Sampling Form;
- Test Pit Logs;
- Well Development and Groundwater Sampling Field Form; and
- Well Installation Log.

All forms will include the project name, date and time, sample location and sample number(s), and the name of the field team members completing the forms, with signature.

1.7.1.2 Photographs

Digital photographs may be taken during Study activities, as appropriate. The digital photographs will be stored electronically on the Consultant's server under the project directory with the date and time of the photograph. Field notes will describe the activity or conditions, location and direction of the photograph and the name of the person taking the photograph.

1.7.1.3 Laboratory Documentation

Laboratory documentation may vary slightly between analytical laboratories. This section is intended to describe the general procedures of the analytical laboratories. Details for each analytical laboratory is provided in the laboratory QAM, included in Appendix A.

It is anticipated each analytical laboratory will maintain the following records as part of the permanent record:

- Chain-of-Custody records;
- Sample receipt forms/tracking forms;
- Workbooks;
- Bench sheets;
- Instrument logbooks;
- Instrument printouts;
- Analyst notes regarding the sample, analysis date, analytical procedures performed, instrument used, instrument calibration, and results on laboratory forms or notebooks that will be entered into the Laboratory Information Management System (LIMS);
- Raw data records to allow reconstruction of initial instrument calibrations (i.e., calibration date, test method, instrument, analysis date, each analyte name, concentrations and responses, calibration curves, response factors, or unique equations or coefficients used to reduce instrument responses into calibrations); and
- Corrective action reports, if required.

Analytical laboratory data will be entered in ink and no erasures will be allowed. If an incorrect entry is made, the information will be crossed out with a single line and initialed. If pages are left intentionally blank, a diagonal line will be drawn across the page. Laboratory records will be reviewed periodically by the laboratory QA Director for accuracy, completeness, and compliance with the objectives of the QAPP and SAP. The laboratory QA Director will verify all entries and calculations and sign off on all data packages.

1.7.1.4 Data Handling Records

All data generated through field activities, or by the laboratory operation shall be reduced, verified and validated prior to reporting. The laboratory shall disseminate no data until it has been subjected to reduction, verification and validation. Details of data validation and usability procedures are included in Section 4.

Data Reduction

Field measurements (i.e., pH, turbidity, temperature, location data, etc.) will be read directly in the units of final use as provided on Table 8. Field team members are responsible for monitoring the collection and reporting of field data. Field team members will review field measurements at the time of measurement and may re-measure a parameter as necessary to assure quality and accuracy are maintained. The QA Officer will review field procedures and compare field data to previous measurement to assess comparability and accuracy of the field data measurements.

Results of laboratory analyses will be reported in units of final use as provided on Table 8. Laboratory calculations will be performed as prescribed for a given analytical method or in conformance with acceptable laboratory standards at the time the calculation is performed.

Data Verification

As previously discussed, data will be manually verified, at the direction of the QA Director, prior to reporting analytical data and the laboratory QA Director will verify all entries and calculations and sign off on all data packages.

Data Validation

Field data will be validated by adherence to the SOPs in Appendix D. The performance of all field activities, calibration checks on all field instruments at the beginning and end of each day of use, manual checks of field calculations, checking for transcription errors and review of field log books is the responsibility of the field team leader.

Laboratory data will be validated using the most current methods and quality control criteria consistent with USEPA's National Functional Guidelines, as discussed in Section 4. The data validator shall consider the following:

- Holding times;
- Instrument performance check sample results;
- Initial and continuing instrument calibration;
- Results of blanks, surrogate spikes, MS/MSDs, laboratory control samples;

- Results of analyte identification and quantization; and
- Completeness of the data package (i.e., chain-of custody forms, analytical results, QC summaries, supporting raw data from instrument printouts).

1.7.2 Data Reporting Package Format and Documentation Control

Two levels of data reporting have been defined:

Field Screening Data: It consists of “results only” field data and health and safety reporting and does not generate or require extensive supporting documentation.

Definitive Data: This consists of analytical reporting with a fully data-validatable reporting package.

The analytical laboratories’ data packages will include:

- Case narrative;
- Initial and continuing calibration summaries and raw data;
- Interference Check Standards reports for IPC and IPC-MS methods;
- Mass Spectrometer tuning data (if appropriate);
- Gas Chromatogram (if appropriate);
- Mass spectra (if appropriate);
- Analytical quantification reports;
- Quality control summary forms and raw data;
- Inductively Coupled Plasma Argon Spectrometry (ICPAS), Atomic Absorption Spectrometer (AAS) and graphite furnace data outputs (if appropriate);
- Interelement correction data (if appropriate);
- Blank data results; and
- Method and instrumental detection limit results, instrument run logs and sample preparation logs.

Analytical data packages will be provided to the Consultant via electronic deliverable and hard copies. The electronic deliverables will be stored on the Consultant's server under the project directory. The Consultant maintains an information technology staff member to receive chain-of-custody/laboratory log in notification, verify the sample identification, sample dates and analysis requested. Electronic analytical data packages are used in the Consultant's database and subsequently used to develop summary tables of analytical results. These tables are also subject to manual quality control, using the hard copy analytical data packages.

1.7.3 Data Reporting Package Archiving and Retrieval

All Study documents will be accounted for when they are completed. Accountable documents include items such as field notebooks, sample logs, field data records, photographs, data packages, computer disks, and reports.

Laboratory data will be summarized in tabular format with such information as sample identification, sample matrix description, parameters analyzed and their corresponding detected concentrations, and the detection limit. Analytical results may be incorporated into reports as data tables, maps showing sampling locations and analytical results, and supporting text.

All Study data and reports will be stored on the Consultant's servers and made available to USEPA and IBS within 45 days, upon request. Files and analytical data are maintained by the Consultant for a period of 10 years from project close-out data unless otherwise requested. Additional discussion is included in Section 2.3.2.3.

2 DATA GENERATION AND ACQUISITION

2.1 Sampling Process Design (B1)

Sampling process design rationale and schedule of activities will be included the Multi-Site FSP, SSWPs, and other planning documents. These Work Plans will be issued to the USEPA for approval prior to implementation.

2.1.1 Schedule

The Master Schedule for sites associated with former MGPs is included in Exhibit A of the SOW attached to the respective Settlement Agreements. The schedules for site-specific activities will be presented in the SSWPs.

2.1.2 Sampling Design Rationale

A general rationale for sampling design is discussed in Section 1. This rationale is further explained in the Multi-Site Generalized CSM RAF (if available) and FSP. Tables 1 through 4 provide the anticipated analytical parameters and PQLs for media of concern. Site-specific PQLs will be presented in the SSWPs. Section 2.5 presents the frequency and type of field samples collected to assess quality control. All Study activities will be performed in accordance with the field SOPs (Appendix D). Table 5 provides an example Sampling and Analysis Summary that will be detailed in the SSWP.

The number and frequency of field samples, along with a map showing previous and proposed sampling locations, will be presented in the SSWPs.

2.2 Sampling Methods Requirements (B2)

2.2.1 Sampling SOPs

Media to be sampled at each site may include soils (both surface and subsurface), groundwater, surface water, and nearby affected river, creek, and/or pond sediments. The Field SOPs are included in Appendix D and are in general accordance with USEPA's Guidance for Preparation of Standard Operating Procedures (SOPs) for Quality-Related Documents (EPA QA/G-6).

2.2.1.1 Soil Sampling SOP

Soil samples at the sites can be collected by a variety of methods. These methods include the following:

- Test pit excavation for soil sampling in accordance with the SSWP and/or SOP SAS-05-06;
- Drilling, which includes solid and hollow-stem auger, mud rotary, and air rotary methods in accordance with the SSWP and/or SOPs SAS-05-01, SAS-06-01 and SAS-06-02;
- Hydraulic push (Geoprobe®) sampling techniques in accordance with the SSWP and/or SOP SAS-06-01 and SAS-06-02; and
- Hand methods, including augers and slide hammer techniques in accordance with the SSWP and/or SOPs SAS-06-01 and SAS-06-02.

Classification of soil samples will be conducted in accordance with the SSWP and/or SOPs SAS-05-02 and SAS-05-06. Boreholes will be abandoned in accordance with SOP SAS-05-05.

2.2.1.2 Water Sampling SOPs

Water sampling activities may include the collection of groundwater and surface water (rivers, creeks, and ponds) samples. The methods for collecting the groundwater, surface water, and pore water (from sediments) samples include the following:

- Groundwater monitoring well installation in accordance with the SSWP and/or SOP SAS-05-03;

- Groundwater elevation methods and sampling methods, which include low-flow pumps, and bailers in accordance with the SSWP and/or SOPs SAS-08-01, SAS-08-02, and SAS-08-03,;
- Surface water sampling methods in accordance with the SSWP and/or SOP SAS-09-01; and
- Pore water sampling methods in accordance with the SSWP and/or the SOPs.

2.2.1.3 River, Creek, and/or Pond Sediment Sampling SOPs.

Sediment samples, from rivers, creeks, and/or ponds, may be collected using a variety of methods at the sites. A general discussion of selecting appropriate sediment sampling location(s) to evaluate human health and ecological risk is provided in Section 1.5.7. SOP SAS-07-03 discusses a general approach to selecting sample locations to evaluate nature and extent of sediments. Sediment thickness determination is discussed in SOP SAS-07-01. The methods that the Consultant may use to collect the sediment samples, which are discussed in SOP SAS-07-03 and would be discussed in detail in the SSWPs, include the following:

- Sediment sampling using a Vibro-Core;
- Sediment sampling using a core barrel sampler (i.e., Ogeechee sand corer or similar device);
- Sediment grab sampling methods, using a Ponar™ sampler or similar device; and
- Sediment grab sampling using a container in a water body into which one can wade.

Classification of the sediment samples in the field are described in SOP SAS-07-02.

2.2.1.4 Waste Sampling SOPs

Waste sampling can include liquids, solids, and sludges produced from a variety of processes. SOPs SAS-06-01, SAS-07-03, and SAS-09-01 discuss the methods to be followed whenever collecting waste samples from the following:

- Municipal or industrial wastewater treatment plants;
- Pits, ponds, or lagoons;
- Waste containers (both closed and opened containers);

- Waste piles or landfills; and
- Contaminated surfaces; and

Waste sampling would also be discussed in the SSWP.

2.2.2 Cleaning and Decontamination of Equipment/Sample Containers

2.2.2.1 Equipment Decontamination

Equipment decontamination will be kept to a minimum through the use of either dedicated or disposable sampling equipment. However, some sampling equipment will require decontamination, and these include equipment made of glass, metals, Teflon™, and other plastic materials. Additionally, some devices are not made to be disposed of and are necessary for completion of the various sampling activities, and these include (but are not limited to): groundwater level probes; groundwater quality field instruments used to measure field parameters when groundwater sampling; grab samplers for surface water sampling; and other similar devices that are used repeatedly at more than one sampling location or site.

Equipment decontamination procedures are described in SOP SAS-04-04 which includes a discussion regarding the inspection and decontamination of drilling equipment and other subsurface sampling devices that are brought on site and used by subcontractors.

2.2.2.2 Sample Container Decontamination

The analytical laboratory will provide all containers for samples to be submitted for laboratory analysis, and these containers will not be used if the container integrity is compromised in any manner. The containers will be prepared in accordance with USEPA guidelines prior to delivery to the Consultant. The laboratory will include the appropriate preservative(s) for the various sampling media and analytical method. Examples of questionable container integrity include (but are not limited to) the following:

- The container or lid is broken or cracked;
- The container is filled with material other than the sample or appropriate preservative; (this would not include ambient air entering a groundwater sampling container); and

- The sample container is either submerged or coated with a material that may compromise sample integrity if introduced into the container when opened (e.g., a solvent or petroleum product is spilled onto sample containers).

The general rule of thumb regarding container integrity is that if there is a question, then the container should be discarded in favor of one without any such question.

If sample results indicate sample containers may be a source of contamination, providing biased results, a bottle blank sample may be submitted to the analytical laboratory for analysis of the COPCs to assess contamination of sample containers.

2.2.3 Field Equipment Maintenance, Testing and Inspection Requirements

Qualitative field data to be collected as part of groundwater and surface water sampling efforts include the following: temperature; conductivity; pH; Eh; turbidity, and dissolved oxygen. These parameters may be measured in the field using water quality field instruments (with available flow-through cell).

Calibration, operation, and maintenance instructions for meters are described in SOP SAS-02-01.

The meter will be calibrated periodically in accordance with the manufacturer's recommendations and SOP SAS-02-01. Calibration results will be recorded, copied to the master file for the piece of equipment and used for historical reference in accordance with SOPs SAS-01-01 and SAS-02-01 and the SSWPs.

During sampling activities, the meter will be checked against calibration standards up to three times daily during field activities: in the morning before work begins; during the middle of the day; and at the end of the day when all sampling work is complete. The results of these checks, as well as the time, will be recorded in accordance with SOPs SAS-01-01 and SAS-02-01 and the SSWPs.

Maintenance and inspection activities and results will be recorded in accordance with SOPs SAS-01-01 and SAS-02-01 and the SSWPs, and these sheets will be copied to the master file for the piece of equipment for historical reference. Frequently replaced parts or supplies (i.e., the dissolved oxygen membranes, calibration standards, etc.) will be maintained with the equipment. If necessary, rental equipment will be acquired as a substitute to the Consultant's equipment. To the extent practical, the identical model and/or manufacturer will be rented.

2.2.4 Inspection and Acceptance Requirements for Supplies/Sample Containers

As discussed in Section 2.2.2.2, sample containers will be provided by the laboratory. The general condition and integrity of the containers will be review upon receipt to ensure that the containers are intact and their integrity is unquestionable. Containers found to be of questionable integrity will be returned to the laboratory for new containers. Example integrity issues that have been experienced in the past include (but are not limited to) the following:

- The lid of sample containers containing liquid preservative(s) was not secured tightly, so that the preservative has leaked out and onto the outside of the container. This reduces the amount of preservative available for a sample and can results in poor preservation (e.g., not enough nitric acid in a metals sample to lower the pH to 2 or less);
- The containers or lids are cracked or broken; and
- The wrong container(s) or preservative(s) have been provided by the laboratory for the planned sampling.

The sample containers will only be accepted and used if there are no integrity issues following inspection.

Similarly, all other supplies and sampling devices that are used for completing the activities described in the SSWP will be inspected prior to use on the site. Examples of the equipment and supplies that will be inspected prior to use includes (but is not limited to) the following:

- Well supplies such as annular space, screen and casing materials;
- Groundwater and surface water sampling supplies, including tubing, wires, pumps, and bailers (whether dedicated or disposable); and
- Soil sampling materials including glass jars for head space testing.

Similar to the laboratory provided containers, these items and materials will be inspected and used only if there are no questions regarding the integrity.

For this Study, the Consultant will track critical supplies in the following manner:

Item	Date Received	Condition	Responsible Individual	Vendor
Tyvek Suits				
Disposable Bailers				
Latex or Nitrile Gloves				
Respirator Cartridges				
Sample Containers				
Decon Materials				
Alconox Detergent				
pH Buffer Solutions				
Calibration Gases				

Labels indicating the following information on receipt and testing are to be used for critical supplies and consumables.

- Unique identification number (if not clearly shown);
- Date received;
- Date opened;
- Date tested (if performed);
- Date to be retested (if applicable); and
- Expiration date.

The date received, date opened, and date expired for laboratory supplies and consumables will be documented via labels or logbooks.

2.3 Sample Handling and Custody Requirements (B3)

The following section and the field SOPs referenced herein describe the sampling handling and custody requirements. Laboratory custody, handling, and tracking procedures are briefly discussed in Section 2.3.2.2 and addressed in the various laboratories' QAMs, which are included in Appendix A.

2.3.1 Sample Handling

2.3.1.1 Sample Identification

Sample identifiers (labels) will be applied in accordance with the SOP SAS-03-01, which addresses the prefixes to be used for various sample types. In addition, wells, borings, and other sampling locations have been assigned specific numbers based on the site.

Although there are specific incidences at some of the sites where the well names/numbers do not follow the specified scenarios, this usually reflects sampling points that were conducted prior to the Consultant's involvement at the site.

2.3.1.2 Sample Delivery

Transportation of the samples will typically occur through the use of the laboratory courier service whenever possible. Regardless, the transportation and shipping requirements that will be followed are described in SOP SAS-03-01.

2.3.1.3 Sample Container, Volume, Preservation and Holding Times

As previously discussed, the media to be sampled at the various sites associated with former MGPs may include soil, water, sediment, and waste. The sample containers, volumes, preservatives, and holding times for soil, water, and sediment samples are listed on Table 5. The specific parameters and sample numbers will be presented in the SSWPs and may include the sampling requirements for the following sample types:

- Surface and Subsurface Soil Samples;
- Nearby affected Surface Water Samples;
- Sediment Samples (Human Health and Ecological Risk Assessment);
- Porewater (Ecological Risk Assessment); and
- Groundwater.

2.3.2 Sample Custody

Chain-of-custody procedures will be used to control and maintain sample custody, whereby the sample possession and handling will be tracked from the source (field) to final disposition at the laboratory. A sample is considered to be in a person's custody if one of the following applies:

- It is in the person's possession,
- It is in the person's view after being in his or her possession; or
- It was in that person's possession and that person has secured it in a vehicle or room.

Chain-of-custody procedures are described in SOP SAS-03-02.

2.3.2.1 Field Custody Procedures

Data sheets and logs will provide the means of recording day-to-day sampling activities during the investigation. As such, the data sheets and logs have been established to provide as much detail as possible so that persons going to the site could reconstruct a particular situation without reliance on memory. SOP SAS-01-01 how field data will be collected and recorded. The data sheets and logs will be comb-bound for ease of use in the field and to keep the documents together.

Each data sheet will include the following:

- The Consultant, subcontractors, (and, if present, IBS) staff that are present that particular day;
- The date and start time;
- The project site and location;
- Weather conditions; and
- A brief summary of planned activities.

The name, arrival time and departure time of visitors to associated with site activities will also be recorded, along with the purpose of their visit.

Data sheets will also be used to record the type of measurements made and samples collected. Entries will be made in permanent ink, signed, dated, and no erasures will be made. If an incorrect entry is made, the information will be crossed out with a single strike mark that is signed and dated by the sampler.

In addition to written sheets, a photographic record of field work may also be compiled, and SOPs SAS-01-01 and SAS-01-02 describe the methods for collecting and storing a photographic record of activities. In the event that photographs are taken to document field activities, the number and brief description of the photographs taken will also be recorded.

The location of sample points, whether by surveyed methods, compass and tape, or a hand-held global positioning system will be recorded in the filed logbook. The methods described in SOPs SAS-02-02 and SAS-03-03 will be used to collect and record the location information.

Samples will be collected following the sampling procedures documented in Section 2.2.1 of this QAPP and the SOPs (Appendix D). The equipment used to collect samples will be noted, along with the time of sampling, sample description, depth at which the sample was collected, volume and number of containers. Sample identification numbers will be assigned prior to sample collection as discussed above. Field duplicate samples, which will receive a separate sample identification number, will be noted under sample description, and these are discussed below in Section 2.5.1.

2.3.2.2 Laboratory Custody Procedures

Laboratory custody procedures for sample receiving and login; sample storage and numbering; tracking during sample preparation and analysis; and storage of data are described in the various laboratory QAMs (Appendix A).

Sample Receipt and Storage

Personnel at the laboratory are responsible for receiving samples, completing chain-of-custody records, determining and documenting the condition of the samples upon receipt, recording the samples in the LIMS and storing the samples appropriately. Chain-of-custody documentation is also maintained for intra- and inter-laboratory transfer and shipment of samples for analysis of the necessary parameters.

Upon receipt, the samples will be compared with the chain-of-custody record. All discrepancies, including broken containers, inappropriate container materials or preservatives, headspace in volatile organic compound (VOC) water samples, and incorrect or unclear sample identification, will be documented and communicated to the appropriate IBS Project Coordinator(s) and the Consultant PM. Each sample is given a unique laboratory code and an analytical request form is generated, and the pertinent information for each sample is listed in the laboratory QAM.

Samples will be stored in secured areas. Refrigerators or walk-in coolers will be maintained at 4° (\pm 2°) C or as required by the applicable analytical method/regulatory program. Temperatures of all refrigerated storage areas will be monitored and recorded at least once daily, and deviations from the appropriate range require corrective action, which may include moving samples to another location if necessary.

Sample Security, Custody, and Tracking

Sample custody was defined above and will be maintained throughout the analytical process. All areas of the laboratory are considered secure, as access is restricted to laboratory personnel and escorted visitors only. All samples will be maintained in the appropriate storage areas and coolers prior to and following analysis, and the samples will be removed and returned as needed. Within in the laboratory, COPC procedures will be maintained if required by the regulatory program and in accordance with the laboratory QAM.

Sample Disposal

Sample disposal will be completed in compliance with federal, state, and local regulations, as well as in accordance with the laboratory QAM. Final sample disposition will occur either 30 days after analysis or after a period of time, specified by any applicable project requirements; conversely, samples may be returned to the client by mutual agreement. All available data for each sample, including laboratory analysis results and any information provided by the client, will be reviewed before sample disposal.

All samples characterized as hazardous waste will be segregated accordingly, and will be disposed of according to the procedures outlined in the laboratory's QAM or SOPs. It should be noted that all waste produced at the laboratory, including the laboratory's own various hazardous waste streams, is treated in accordance with all applicable local and Federal laws.

2.3.2.3 Final Evidence Files

The central repository for all documents related to the sites discussed herein will be the Consultant's project specific file. All final data, field notes, and other pertinent documents produced or delivered to Consultant will be maintained in accordance with SOP SAS-01-02. A summary of documents to be maintained in the file include (but are not limited to) the following:

- Correspondence, reports, memorandums, etc., either issued or received by the Consultant;
- Data collected in the field during the project; and
- Data provided to Consultant from outside sources (e.g., laboratory reports, survey data, etc.).

Internal responsibilities for maintaining the project file, as well as the appropriate file locations (either internally or externally) are discussed in the referenced SOP SAS-01-02 and attachments. The project file will be maintained for up to 10 years (if required by the contract), and a copy of the final file will be offered to USEPA prior to disposal.

2.4 Analytical Methods Requirements (B4)

The mobile and fixed laboratory analytical procedures to be used for the project are included in the laboratory QAM. Anticipated methods and laboratory method detection levels (MDLs) and reporting limits (RLs) are included in Tables 1 through 4. Specific parameters for analysis will be determined in the SSWPs. Currently, there are no circumstances foreseen that will require the use of field equipment to quantify concentrations for constituents of concern. Rather, the only parameters that may be analyzed in the field include water temperature, conductivity, pH, Eh, turbidity, and dissolved oxygen (as discussed in Section 2.2.3); headspace results for soil or other waste samples may be used qualitatively, not quantitatively, so are not considered in this discussion. The equipment and methods used for analyzing groundwater quality parameters are described in SOPs SAS-08-02 and SAS-08-03.

2.5 Quality Control Requirements (B5)

2.5.1 Field Sampling Quality Control

Field quality control samples may consist of the following:

- Blind duplicate samples, to assess the reproducibility of laboratory results on a particular sample set;
- Matrix spike/matrix spike duplicate (MS/MSD) samples, to assess whether there is any discrepancy in the laboratory results that is attributable to the sample matrix;
- Equipment rinse/blank samples, to assess the thoroughness of field decontamination procedures and determine whether cross-contamination between sample locations occurred during field activities;
- Trip blanks to evaluate contamination during collection and transport of aqueous samples for analysis of volatile organic compounds; and
- Field blanks, which are collected to evaluate whether there are any extraneous sources of contamination that may influence the sample results (e.g., during low-level mercury sampling, a field blank [prepared by the laboratory] is opened to analyze and quantify any atmospheric mercury present during sample collection that may influence the laboratory results).

Duplicate samples for aqueous media will be collected at a rate of 1 per every 10 aqueous investigative samples. Duplicates samples for soil/sediment media will be collected at a rate of 1 per every 20 investigative soil/sediment samples. MS/MSD samples will be collected at a rate 1 per every 20 investigative samples. One equipment rinse/blank sample will be collected for each day that non-dedicated or non-disposable sampling equipment is used. SOP SAS-04-03 describes the various quality control samples that will be collected during sampling activities. Field blanks, will only be collected if required by a specific sampling protocol (e.g., low-level mercury sampling).

These quality control samples will measure accuracy (qualitative measurement referring the agreement between a measurement made on an object and its true value). In addition, these samples will assess bias (quantitative measurement of the difference between the average of measurements made on the same object and its true value).

2.5.2 Analytical Quality Control Checks

The analytical laboratories each have SOPs and a quality control system included in their respective QAMs (Appendix A). Procedures may differ slightly, however, in general the internal QC requirements include:

- Surrogate spikes;
- Duplicates;
- Preparation blanks;
- Calibration;
- Laboratory control samples (LCSs);
- Reagent checks; and
- MS/MSDs.

Precision and accuracy goals for analytical methods are included in Table 6. The frequency requirements and control limits of laboratory QC samples are discussed further in Section 4 and in the laboratory SOPs (Appendix A).

2.6 Instrument/Equipment Calibration, Testing, Inspection and Maintenance Requirements (B6 & B7)

2.6.1 Field Instruments

Discussion of the field instrument maintenance and calibration is included in Section 2.2.3 and SOP SAS-02-01. The calibration and maintenance instructions follow the manufacturer's recommendations and directions, which are also a part of SOP SAS-02-01.

2.6.2 Laboratory Instruments

All laboratories utilized as part of this project work will maintain their instruments in accordance with the laboratory QAM and the equipment manufacturer's recommendations and directions.

2.7 Inspection/Acceptance Requirements for Supplies and Consumables (B8)

Discussions regarding the inspection and acceptance of field supplies and equipment is included in Section 2.2.4.

The inspection and acceptance criteria for the laboratory supplies and consumables are discussed within the laboratory QAMs (Appendix A).

2.8 Data Acquisition Requirements (Non-Direct Measurements) (B9)

Data for the various sites associated with the Company's former MGP properties have been generated from a variety of historic sources detailed in the Site-Specific Completion Reports, Record Files, and SSWPs.

Historic data sources have generally included the following categories:

- Local, county, state, and federal governments sources of information;
- State and federal databases of historic environmental information;
- Historic maps and photographs (including aerial photos) from a variety of sources;
- Company archives and records; and
- Previous site investigations.

A few examples are provided to illustrate some of the considerations that may be used when evaluating data and information from outside sources.

1. A drawing showing a particular site feature includes no information regarding when it was generated or for what purpose. Therefore, site investigations may assess whether these features were actually located in the vicinity shown on the drawing or if they still remain in this area.
2. Historic investigation results conducted during the 1980s, may be used to focus future SI activities.
3. Government maps and historic state and federal lists of environmental conditions would be deemed to be fairly reliable, especially recent information.

Historic site investigation data is considered reliable for the following reasons:

- Data was generally collected by the Consultant, using the same or similar SOPs as presented in this QAPP. Current and historic SOPs have been developed to reflect industry standards of the time;
- Samples were collected in accordance with state-specific regulations and guidance;
- Data were collected in accordance with SSWPs; and
- Sampling approaches reflected the regulations and guidance of the state.

2.9 Data Management (B10)

Data generated in the field or by laboratory analysis will be reduced and validated, as appropriate, prior to reporting. The laboratory shall not disseminate any data until it has been reduced and validated as discussed below. Once the data has been provided to the Consultant and IBS by the laboratories, the various methods by which the data will be recorded, reduced, assessed, tracked, stored, retrieved, and kept secure are discussed herein and in Section 4.

2.9.1 Field Data Recording

Field personnel are responsible for recording accurate data during field activities. Data are recorded in the units listed on the field equipment (i.e., pH, temperature, water levels, etc. and Table 8), and these will be recorded on the appropriate sheets or forms (Section 2.2), which will become a part of the permanent project file. Field personnel will review the measurements at the time they are collected and will re-measure or check equipment calibration as necessary to assure that data quality and accuracy is

maintained. The Field Team Leader will be responsible to assure that all questionable data are re-checked prior to completion of the field activities.

2.9.2 Laboratory Data Transformation/Reduction

Laboratory analytical results will be reported in units of final use (Table 8). Laboratory calculations will be performed as prescribed for a given analytical method or in conformance with acceptable laboratory standards at the time the calculation is performed. The laboratory will retain quality assurance/quality control records for at least five years.

Original laboratory reports will be stored in the Consultant's project files. Copies of raw data will be available for review at the laboratory and may be requested as part of the QA/QC review. Complete validatable data package may be requested for these projects. The fully validatable data package will include (but not be limited to) the following:

- A cover letter;
- Case narrative;
- Sample analytical results;
- Method blank results;
- Surrogate recovery results for appropriate organic methods, including associated USEPA or laboratory acceptance criteria;
- Chain of Custody documents;
- Calibration summaries and results of initial and continuing calibration verification standards, with calculated recoveries;
- Method blank summaries;
- Sample quantitation report, and
- Standards preparation information.

The appropriate personnel assigned by the Project Manager will review the laboratory data and package. Procedures for evaluating the accuracy and precision of data are included in Section 4. Should anomalies to previous measurements or known conditions at the site be identified, then the laboratory will be instructed to review the resulting data while the methods used to obtain the data are reviewed by the Consultant and IBS. If anomalies remain, the laboratory may be asked to re-analyze selected samples.

2.9.3 Data Validation

Data validation procedures are discussed in Section 4.

2.9.4 Data Transmittal/Transfer

Laboratory data will be transmitted to the Consultant and IBS both electronically and in hard copy format. Hard copies of the data will be used for review and inclusion in the project file while electronic results will be used to construct the necessary figures and tables for reporting. Use of electronic data for inclusion in the figures and tables will reduce the overall possibility for the introduction of errors in the reporting documents, thus assuring high quality reporting. Copies of all field and laboratory results will also be included in the appendices of appropriate reports to document the quality of the work completed.

2.9.5 Data Tracking, Storage, and Retrieval

2.9.5.1 Field Data

Field data forms and sheets will be placed in the project file and copies provided to the Project Manager. These results will be scanned and transferred directly from the various forms and sheets into the Consultant's database and incorporated into the Final Report. The summary tables will be checked by the Consultant's staff to ensure that all data have been accurately presented before final storage of the data. These worksheets will be saved electronically as described in SOP SAS-01-02. This will allow these data to be retrieved and used for whatever reporting purposes may be required.

2.9.5.2 Laboratory Data

Laboratory data will be transferred electronically as described in Section 2.9.4. Once received, the data will be uploaded into the Consultant's database, which uses Microsoft SQL 2000 software or equivalent. The data are tracked in the database using both laboratories identifiers and the sampling point labels.

2.9.6 Data Security

The Consultant's office, computer system, and database are secured every day. Access to the office is limited to escorted visitors only. The computer system and database are secured from the internet and backed up daily, to ensure that the data is not compromised or lost. Multiple servers are also utilized to ensure that the computer system does not suffer a catastrophic failure.

2.9.7 Data Analysis and Assessment

As discussed above, field data will be reported on figures and tables as needed; additionally, field notes, photographs, and other data may be included in the text or appendices to document the quality of the work performed.

Analytical data will be summarized in tabular format, and the following information will be recorded: sample matrix, sample identification; analyzed parameters and corresponding concentrations; and the detection limit. Analytical results may be incorporated into reports as data tables, maps showing sampling locations and analytical results, and/or supporting text.

Data analysis and assessment may be completed using (but not limited to) the following software:

- Microsoft Word and Excel will be used to compile the reports and data tables, while PowerPoint may be used to compile presentations;
- Microsoft SQL 2000 or equivalent will be used as the database;
- Grapher™ or other approved software may be utilized to produce graphs and charts displaying the data;
- gINT® may be used to compile and produce the soil and boring logs;

- AutoCAD® (and the Civil 3D and Land Desk packages) will be used to generate maps and figures showing the sampling locations and corresponding results as well as to produce engineering drawings;
- Groundwater Vistas, which is a graphical interface that utilizes MODFlow and MT3D, may be used to model groundwater flow; and
- Other software discussed in the SSWPs.

3 ASSESSMENT/OVERSIGHT

3.1 Assessment and Response Actions (C1)

This section identifies the number, frequency and type of planned assessment activities that may be performed for the MGP Study activities. The assessments may be conducted periodically throughout the project by internal and external parties to ensure that usable data are generated. Internal audits will be performed by the Consultant. External audits may be performed by USEPA or personnel authorized by USEPA. USEPA or authorized personnel may also perform oversight assessments to identify and correct non-conformances so that project quality objectives can be achieved.

3.1.1 Planned Assessments

In general, the internal assessments may be conducted at least once at the beginning of major Study sample collection activities or as sampling milestones occur (i.e., transitioning from collecting upland soil samples to collecting sediment cores). The timing of assessments may occur early in the process, to the extent possible; to limit the extent and impact of identified non-conformances. Project duration may warrant subsequent audits on a monthly basis.

Internal assessments may be initiated by the Consultant's QA Officer. Records of the assessments will be included with the project file. External assessments may be performed at the sole discretion of USEPA.

Each deficiency identified as a result of a Technical System Audits (TSA) will be documented and submitted to the Project Manager. The following TSAs are considered for the sites associated with former MGP properties:

3.1.1.1 Field Sampling Technical System Audit (TSA)

This is an on-site audit to evaluate implementation of the sampling program in accordance with the SOPs and the QAPP. During the field sampling TSA, the auditor will inspect the sampling equipment, instrumentation, and supplies for acceptance. The auditor will document decontamination procedures,

sampling procedures, data reporting, chain-of-custodies, sampling handling and packaging, and data verification procedures.

3.1.1.2 *Field Analytical TSA*

This is an on-site audit to evaluate the performance of equipment, instruments, supplies, training, analytical methods/procedures of field analytical techniques (not performed in a mobile field laboratory). During the field analytical TSA, the auditor will review the sample handling and tracking, data reporting, data handling and management, data tracking and control, and data verification procedures for conformance with the QAPP.

3.1.1.3 *Field and Fixed Laboratory TSA*

This is an audit of an on-site field laboratory and fixed laboratory during which the facility, analytical instrumentation, supplies, personnel, training, analytical methods/procedures, laboratory procedures, sample handling and tracking, data reporting, data handling and management, data tracking and control, and data verification procedures for compliance with the QAPP. In general, only the mobile laboratory may be audited by the Consultant. The laboratories perform internal audits as described in the respective QAMs. In addition, external reviews of laboratory performance may also be conducted based on evaluation of the results of samples analyzed as part of the USEPA, State certification requirements such as National Environmental Laboratory Accreditation Program (NELAP).

3.1.1.4 *Data Validation TSA*

The complete data validation report will be reviewed by the Consultant PM with the associated analytical data package deliverables (tabulated and raw data) to assess that all required analytical data package deliverables were provided and contain the specified information. The Data Validation TSA will ensure the appropriate number of environmental samples have been validated, as stated in the QAPP. The Data Validation TSA will also evaluate the usability of the data to meet the DQOs.

3.1.1.5 Data Package TSA

Every sample delivery group (SDG) analytical data package, from fixed and field laboratories will be reviewed to assess the completeness of the package and the ability to reproduce all reported results. In addition, the Data Package TSA will assess the data verification procedures used by the laboratory.

3.1.2 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 quality control 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 regular progress reports to USEPA and included in the final report. Corrective action should be implemented only after approval by the Project Manager, or designee (e.g., the Study Leader). Approvals to implement corrective action will be documented.

For noncompliance problems, a formal corrective action program will be determined and implemented at the time the problem is identified. In the field, the person who identifies the problem is responsible for notifying the Study Leader, who will notify the Project Manager, who in turn will notify the IBS and USEPA Project Coordinators. If the problem is analytical in nature, information will be promptly communicated to the USEPA Project Coordinator via fax, telephone, or email during that same day or the next business day. Implementation of corrective action will be confirmed in writing through the same channels. If noncompliance is observed in the laboratory or during data validation, the analyst or data validator will notify the Study Leader, who will notify the Project Manager and communication will continue in the same manner as described above.

3.1.2.1 Field Corrective Action

If errors in field procedures are found during the observation or review of field activities, corrective action will be initiated. Nonconformance to the QA/QC requirements of the SOPs will be identified by field audits or immediately by field team members who know or suspect that a procedure is not being performed in accordance with the requirements. The Study Leader and QA Officer will be informed

immediately upon discovery of all deficiencies. Timely action will be taken if corrective action is necessary.

Corrective action in the field may be needed when the sample network is changed (i.e., more/less samples, sampling locations other than those specified in the QAPP or SSWP, etc.) or when sampling procedures and/or field analytical procedures require modification due to unexpected conditions. In general, the Study Leader, Project Manager, and QA Officer may identify the need for corrective action. The Project Manager will approve the corrective measure that will be implemented by the field team. It will be the responsibility of the Project Manager to ensure that corrective action has been implemented correctly and properly documented.

If the corrective action will supplement the existing sampling plan (i.e., additional soil borings) using existing and approved procedures in the QAPP, corrective action approved by the Project Manager will be documented. If the corrective actions result in less samples (or analytical fractions), significantly alternate locations, etc., which may result in non-achievement project QA objectives, it will be necessary that all levels of project management, including the USEPA Project Coordinator, concur with the proposed action.

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 Consultant QA Officer will identify deficiencies and recommend corrective action to the Consultant Project Manager. The Study Leader and field team will implement corrective actions. All corrective action proposed and implemented should be documented in the regular progress reports to USEPA and included in the final report.

Corrective actions will be implemented and documented in the project field logbook.. No staff member will initiate corrective action without prior communication of findings through the proper channels. If corrective actions are insufficient, work may be stopped by the USEPA Project Coordinator or Project Manager.

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

3.1.2.2 Laboratory Corrective Action

Corrective actions may be initiated if the quality assurance goals are not achieved. The initial step in a corrective action is to instruct the analytical laboratory to examine its procedures to assess whether analytical or computational errors caused the anomalous result. If no error in laboratory procedures or sample collection and handling procedures can be identified, then the Project Manager will assess whether reanalysis or resampling is required or whether any protocol should be modified for future sampling events.

3.1.2.3 Corrective Action During Data Validation and Data Assessment

The need for corrective action may be identified during the data validation or assessment processes. Potential types of corrective action may include resampling by the field team, or reinjection/reanalysis of samples by the analytical laboratory.

These actions are dependent upon the ability to mobilize the field team, whether the data to be collected is necessary to meet the QA objectives (e.g., the holding time for samples is not exceeded, etc.). If the data validator identifies a corrective action situation, the Project Manager will be responsible for approving the corrective action implementation. All required corrective actions will be documented by the Analytical Laboratory QA Coordinator.

3.2 Reports to Management (C2)

3.2.1 Progress Reports

Progress reports will be used to update the USEPA Project Coordinator on a monthly basis and will address the QA Management Report. The Progress Reports will be delivered to all recipients (as determined in the SSWPs) by the 15th of each month, in accordance with the General Schedule, included as Exhibit A, in the SOW, attached to the Settlement Agreement. These reports will be prepared under the guidance of the Site-Specific Project Manager and the Multi-Site QAPP Project Manager and may include the following elements, as appropriate:

- A summary of all work performed during the past month including, but not limited to drilling and sample locations, depths and descriptions, boring logs, sample collection logs, and field notes;
- All results of field and laboratory TSAs and other assessments;
- Corrective action reports, if implemented, and results of implementation;
- Information generated during the past month reflecting achievement of the DQOs;
- Problems encountered, solutions or resolutions to past problems, and anticipated problems in the field or laboratory for the coming month;
- Conformance or modifications (with justifications) to the Multi-Site QAPP, Multi-Site FSP and/or SSWPs;
- Results of analytical data received from the laboratory and/or validated by the data validator;
- Data quality assessments in terms of precision, accuracy, representativeness, completeness, comparability, and sensitivity;
- Limits on the use of data, if any;
- A summary of upcoming field activities;
- Status of the project with respect to the schedule to be provided in the SSWP; and
- Updates on training provided and key personnel.

3.2.2 Final Project Reports

The Final Project Report will be prepared under the guidance of the Site-Specific Project Manager and the Multi-Site QAPP Project Manager. The Final Project Report may include:

- A summary of all activities performed to meet the objectives of the DQOs and the SSWPs;
- Summary of major/critical problems encountered and resolutions;
- Data summaries, with clearly identified units, sample identifications, and locations. Data summaries may include one or more of the following formats: tables, charts, graphs, figures, appendices;
- Reconciliation of project data with project quality objectives;

- Conclusions and recommendations; and
- Appendix with all Progress Reports, as described above.

3.2.3 Operation, Maintenance and Monitoring (OM&M) Reports

On-going groundwater monitoring is performed at several sites where an upland remedial action has been implemented. In addition, sites generally include a remedial action component that requires operation (i.e., groundwater pumping for hydraulic control) and /or maintenance (i.e., asphalt cap inspection and sealing to limit direct contact). An annual OM&M Report will be submitted for sites in which upland remediation has been conducted and groundwater monitoring is being performed.

The OM&M Report may include the following:

- Trends in concentrations;
- Performance of gradient control and containment measures;
- Inspection of caps or other engineering controls;
- Groundwater extraction and treatment system performance;
- System modifications; and
- Recommendations for continued groundwater monitoring, including reductions in sample parameters or frequencies.

4 DATA VERIFICATION/VALIDATION AND USABILITY

4.1 Data Review, Validation and Verification Requirements (D1)

Data verification/validation consists of evaluating the completeness, correctness, and conformance or contractual compliance of a data set against the methods specified (including cited standard methods, SOPs, and/or contractual requirements). Data verification will be performed by the laboratories generating the data on 100% of the data generated.

Data validation will be performed by a data validator independent of the analytical laboratory providing analytical services.

Deviations from the sampling plan, sample collection procedures, or sample handling procedures will be noted and discussed in the Monthly Progress Reports and the Final Report. The Project Manager will review the rationale for the deviations and evaluate the suitability of each sample for use in the project, and accept or reject each sample. The rationale for the Project Manger's decision will be noted in the Monthly Progress Reports and Final Report.

4.2 Validation and Verification Methods (D2)

4.2.1.1 Field Data Validation

The collection of valid field data (i.e., data of known quality) will be facilitated by using and following the attached SOPs. Completion of the field activities, calibration and maintenance of the field equipment, daily calibration checks, review of the field notes and logs, and a check of field calculations by either the Field Team Leader or Project Manager will reduce or eliminate errors and ensure collection of valid field data.

4.2.1.2 Laboratory Data Validation

Data validation will be performed by using the most current methods and quality control criteria from SW-846 and the USEPA's Contract Laboratory Program (CLP) National Functional Guidelines for Organic and Inorganic Data Review (EPA540/R-99/008, October 1999 and EPA540R/R-01-008, July 2002 and October 2004 respectively). Data validation will also be performed in accordance with the appropriate USEPA Region 5 standards. The CLP data review guidance will be used only to the extent that it is applicable to the SW-846 methods; SW-846 methodologies will be followed primarily and given preference over CLP when differences occur.

Analytical data used in risk assessments will be 100% validated by a data validator independent of the laboratory to ensure data usability and facilitate data reduction. It is assumed verification samples will be collected and will be 100% validated during remedial action activities, if necessary. Therefore, it is appropriate that the first sample delivery group of the samples to evaluate lateral and vertical extent of COPCs above the appropriate regulatory standards, guidance, and/or site-specific risk-based values will be validated. If no problems are encountered, twenty percent of subsequent data will be validated, unless a problem is encountered with the data (in which case the percent of data to be validated may be increased). Data to evaluate trends in groundwater concentrations are not proposed to be validated.

4.2.1.3 Laboratory Data Verification

Data verification will be performed by the laboratories generating data to evaluate the completeness, correctness, and contractual compliance of the data compared to USEPA or other reference methods or laboratory-specific SOPs (Appendix A).

4.3 Usability/Reconciliation with Data Quality Objectives (D3)

4.3.1 Data Usability

Data usability is the process of evaluating verified/validated data to determine if they can be used for the purpose of the project. Data usability includes the following:

- Evaluating individual data sets to identify the measurement performance/usability issues/problems affecting the ultimate achievement of the DQOs;
- Evaluating all of the data generated for the project; and
- Documenting the project-specific measurement performance criteria and data verification/validation criteria documented in the QAPP to determine if they were appropriate for meeting project DQOs.

The data validator will validate data quality, as previously discussed, to assess potential effects of deviations from the QAPP and the effect on the DQOs.

4.3.2 Precision

For data generated by the laboratory, data precision is estimated by comparing analytical results from duplicate samples. The comparison is made by calculating the relative percent difference (RPD) given by:

$$RPD\% = \frac{2(S_1 - S_2)}{S_1 + S_2} \times 100$$

Where $\underline{S_1}$ = sample result
 $\underline{S_2}$ = duplicate result

This information is calculated and reviewed periodically by the Project Study Leader and/or Project QA Officer. The goals for data precision for duplicate samples are presented in Table 6. For data generated in the field, the precision goals are summarized in Table 7.

4.3.3 Accuracy/Bias

Data accuracy, which is assessed for laboratory data only, is based on recoveries, expressed as the percentage of the true (known) concentration, from laboratory-spiked samples and QA/QC samples generated by the analytical laboratory.

Percent recovery (%R) for MS/MSD results is determined according to the following equation:

$$R\% = \frac{(A - B)}{T} \times 100$$

Where: A = measured concentration after spiking
B = measured concentration before spiking
T = known true value of spike

Percent recovery (%R) for LCS and surrogate compound results is determined according to the following equation:

$$R\% = \frac{\text{Experimental concentration}}{\text{Known amount added}} \times 100$$

This information is reviewed periodically by the Project Study Leader or Project QA Officer. The goals for the recovery of any constituent in a spiked or QA/QC sample are presented in Table 6.

4.3.4 Sample Representativeness

Sample representativeness will be ensured by reviewing sampling SOPs, conducting Field Sampling TSAs to verify collection of samples per the SOPs, and by checking results of QC samples. The Study report will discuss results of the representativeness comparisons for each matrix, parameter, and concentration range. If samples or parameters are found to be non-representative, limitations of these data will be discussed along with their impact on decisions (including potential need for resampling).

4.3.5 Sensitivity and Quantitation Limits

Project contract terms for all laboratories will be written to specify method detection limits and project quantitation limits that are sensitive enough to support their end use (e.g., risk assessment, delineation). Each laboratory's procedures for calculating specific MDLs and PQLs are provided in Appendix A, in accordance with the methods. Each laboratory will also ensure that their lowest calibration standard is below the PQL to ensure the instrument is performing well at low levels.

Data verification and validation will assess whether PQLs have been achieved for each sample. If PQLs are not achieved, the laboratory may be asked to reanalyze the sample. If the laboratory is still unable to

achieve PQLs, the data usability and the affect of not achieving this level will be discussed. If necessary, additional corrective action may be implemented (including potential need for resampling).

4.3.6 Completeness

Data completeness will be evaluated by comparing the objectives of the Study efforts with the data obtained and determining whether there are any shortcomings in required information. A series of protocols, described below, may be used to evaluate data completeness. The purpose is to accomplish the following:

- Rigorously assess the quality and adequacy of data collected during the Study;
- Review data collected during the Study to evaluate if the objectives are being addressed and met; and
- Ensure that the data collected are valid by applying the quality checks described in this and other sections of the QAPP.

Data generated during groundwater assessment and monitoring programs will be evaluated for completeness; that is, the amount of data meeting project QA/QC goals. If data generated during field operations or during analytical procedures appear to deviate significantly from previous trends, the Study Leader or Project QA Officer will review field or laboratory procedures with the appropriate personnel to evaluate the cause of such deviations. Where data anomalies cannot be explained, resampling may be performed. Completeness is defined as the percentage of valid results according to the equation below:

$$\% \text{ completeness} = \frac{A}{B} \times 100$$

Where: A = number of valid results;
 B = total number of possible results

The goals for data completeness for laboratory measurements were presented previously in Table 6.

4.3.7 Comparability

Direct comparisons will be performed any time different means or methods are used to acquire samples, analyze data, or if screening methods are employed. Analytical data will be collected using a mobile laboratory and a land-base laboratory. Results for samples that are analyzed by both methods will be compared to determine whether any biases exist. If biases are detected early in the process, performance evaluation samples may be analyzed by both laboratories to determine where the bias lies. Corrective action will be taken to correct the comparability issue.

4.3.8 Data Limitations and Actions

The final results from the project, adjusted for any data validation qualifications, will be reconciled with the DQOs (Section 1.5). The data acquired during the Study activities should identify if site conditions present unacceptable risks to human health and the environment which warrant further evaluation or action. If the DQOs are not met, the final report will include an assessment of the DQOs and recommendations for additional work.

If the data are sufficient and meet the DQOs and project objectives, work may proceed. Determination that the data are sufficient to achieve project objectives will be the responsibility of IBS, the Consultant, and USEPA.

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