Generic Quality Assurance Project Plan (QAPP) - Revision 0
United States Environmental Protection Agency (EPA)
Brownfields Assessment Cooperative Agreement
Town of Robbins, North Carolina

EPA Brownfields Cooperative Agreement BF- 00D11513-0

Prepared for:

Town of Robbins
101 North Middleton Street
Robbins, NC 27325

Prepared by:

Cardno
Shaping the Future

1233 Washington Street, Suite 1000
Columbia, SC 29201
Phone: (800) 846-6001

October 18, 2013

Approval:

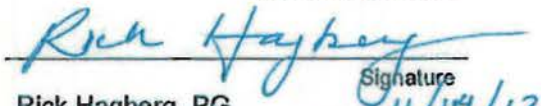
Cardno Project Manager:

Signature

M. Shane Dixon 11/14/13

Printed Name / Date

Cardno QA/QC Manager:

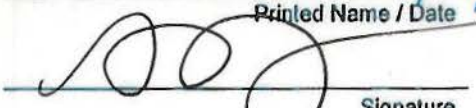


Signature

Rick Hagberg, PG 11/14/13

Printed Name / Date

EPA Project Officer:

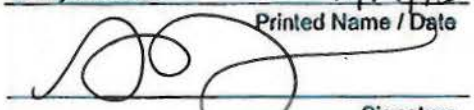


Signature

Aaryn Jones 11/14/13

Printed Name / Date

EPA Designated Approving Official (DAO):

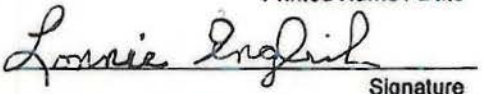


Signature

Aaryn Jones 11/14/13

Printed Name / Date

Town of Robbins Brownfield Director:



Signature

Mayor Lonnie English 11-14-13

Printed Name / Date

A2. TABLE OF CONTENTS

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A3. DISTRIBUTION LIST

The following individuals will receive copies of the approved QAPP and subsequent revisions:

- Aaryn Jones, Brownfields Project Officer, EPA Region 4, 109 T.W. Alexander Drive, Research Triangle Park, NC 27711, Phone: (919) 541-0066, Email: jones.aaryn@epa.gov
- EPA DAO, EPA – Region 4, Atlanta Federal Building, 61 Forsyth Street Southwest, Atlanta, GA 30303, Phone: (800) 241-1754
- Sharon Eckard, Brownfields Project manager, North Carolina Department of Environment and Natural Resources (NCDENR), Division of Waste Management, 1646 Mail Service Center Raleigh, NC 27699-1646, Phone: (8919) 707-8379, Email: Sharon.eckard@ncdenr.gov
- Mayor Lonnie B. English, Town of Robbins Brownfields Director, Town of Robbins (Town), 101 North Middleton Street, Robbins, NC 27325, Phone: (910) 571-1649, Email: lenglish@mountaire.com
- M. Shane Dixon, Cardno Project Manager, 1233 Washington St, Suite 1000, Columbia SC 29201, Phone: (803) 929-6058, Email: Shane.Dixon@cardno.com
- Rick Hagberg, PG, Cardno Quality Assurance/Quality Control (QA/QC) Manager, 380 Park Place Boulevard, Suite 300, Clearwater, FL, 33759, Phone: (727)431-1549, Email: rick.habgerg@cardno.com
- Field Team Leader/Technician, information will be submitted in Site-specific QAPP Addendum
- Field Team Technicians, information will be submitted in Site-specific QAPP Addendum
- Laboratory Director, information will be submitted in Site-specific QAPP Addendum

A4. PROJECT/TASK ORGANIZATION

Cardno is responsible for conducting and overseeing the Phase I and Phase II Environmental Site Assessments (ESAs) funded by the brownfields project. The information presented in this document represents the minimum standards required for the completion of ESAs under the Town's brownfields program. A project organization chart is provided as **Figure 1**. The following are the individuals participating in the project and their specific roles and responsibilities:

Aaryn Jones, EPA Region 4 Brownfields Project Officer - The EPA Project Officer is

responsible for overseeing and monitoring the grant. As part of that responsibility, she ensures the processes described in the work plan are followed and the terms and conditions of the grant are met.

EPA Region 4 Brownfields Designated Approving Official – The Brownfields Region 4 Quality Assurance Manager's DAO provides technical assistance to the Region 4 Project Officer working on Brownfields sites. The DAO's role is to provide technical reviews of the Generic QAPPs and Site-specific QAPP Addenda that are generated. This includes the approval of the Generic QAPP and Site-specific QAPP Addenda and any revisions.

Sharon Eckard, NCDENR Brownfields Project Manager – This individual is involved in the review and approval of the final site assessment plan(s), Site-specific QAPP Addenda, and report(s). This individual also ensures that plans are in compliance with the current NCDENR rules and regulations. If a potential purchaser is pursuing a Brownfields Agreement with NCDENR, this individual is involved in scoping the necessary assessment and cleanup requirements to achieve the agreement.

Mayor Lonnie B. English, Town of Robbins Brownfields Director – The Town of Robbins Brownfields Director (Director) is responsible for the overall strategic direction of the project. The Director ensures project activities are executed in accordance with the approved Work Plan and the Terms and Conditions of the Cooperative Agreement.

M. Shane Dixon, Cardno Project Manager – The Cardno Project Manager (Project Manger) will be the primary decision maker for the project and the primary user of the data to determine whether or not further action is required at the site. This individual will also coordinate the project activities and will have overall responsibility of the investigation. This individual's specific responsibilities are as follows:

1. Approving the QAPP and subsequent revisions;
2. Developing the Site-Specific Health and Safety Plan (HASP);
3. Ensuring project activities are conducted in accordance with the QAPP;
4. Coordinating corrective actions outside of standard operating procedures with the Field Team leader, and coordinating with the Laboratory Director to correct any corresponding problems encountered in the chemical analyses;
5. Coordinating the corrective actions for problems that may affect the established data quality objectives;
6. Developing and submitting a final assessment report, detailing all field and lab activities, results, and conclusions;
7. Reporting to the EPA Project Manager, NCDENR Project Manager, and Town of Robbins Brownfields Director regarding the project status; and,
8. Making final project decisions with the authority to commit the necessary resources to conduct the project.

Rick Hagberg, PG, Cardno QA/QC Manager – The Cardno QA/QC Manager (QA/QC Manger) provides documentation audits and technical review to assist in promoting, implementing, and documenting QA compliance. The QA/QC Manager is isolated from the implementation Project Manager. This allows lateral support as a peer to the Project Manager without introducing unintentional biases from conducting the work. The QA/QC

Manager must have extensive environmental and regulatory assessment experience at both the state and federal levels. The QA/QC Manager reviews the data validation for the project.

Field Team Leader – The Field Team Leader is identified in the Site-specific QAPP Addenda. The Field Team Leader reports to the Project Manager and performs the following duties:

1. Selecting and supervising the Field Team Technicians;
2. Distributing the approved QAPP and subsequent revisions to the members of the Field Team Technicians;
3. Conducting the field activities per the approved QAPP;
4. Reporting the status of field activities to the Project Manager;
5. Implementing corrective actions within standard operating procedures in the field, documenting corrective actions in the field logs, and providing documentation to the Project Manager; and
6. Coordinating corrective actions outside of standard operating procedures with the Project Manager, instituting corrective actions; documenting corrective actions in the field logs, and providing documentation to the Project Manager.

Field Team Technicians – These individuals will perform the actual fieldwork per the QAPP and at the direction of the Field Team Leader. The field team typically consists of two to four people, who are selected by the Field team Leader once the field team activities are scheduled.

Laboratory Director – The Laboratory Director will be identified in the Site-specific QAPP Addenda. The Laboratory Director is responsible for the following:

1. Coordinating the analysis of the samples and selecting the analytical team.
2. Coordinating the receipt of the samples at the laboratory.
3. Ensuring internal laboratory audits are conducted per the Laboratory's Quality Assurance Manual (QAM), and distributing the applicable sections of the QAPP and subsequent revisions to members of the analytical team.
4. Instituting corrective actions for problems encountered in the chemical analyses and reporting laboratory problems affecting the project data to the Project Manager. Corrective actions for chemical analyses will be detailed in a lab report that will be provided via electronic mail.

A5. PROBLEM DEFINITION/BACKGROUND

The problem definition/background information will be detailed in the Site-specific QAPP Addenda.

A6. PROJECT/TASK DESCRIPTION AND SCHEDULE

The project/task description and schedule will be detailed in the Site-specific QAPP Addenda.

A7. SPECIAL TRAINING REQUIREMENTS/CERTIFICATION

The following are the minimum training requirements for personnel conducting project activities. Current training records and certificates are kept in personnel files located at the respective headquarters of the project personnel. Deficiencies and the need for new training are identified during annual personnel evaluations. Personnel deficient in any of the following requirements will not conduct project activities.

Hazardous Waste Operations and Emergency Response (HAZWOPER):

The Field Team Leader will ensure that all on-site project personnel have current certificates of training for the 40-hour Occupational Safety and Health Administration (OSHA) HAZWOPER Training Class with annual 8-hour refresher courses. All personnel mobilizing to the site shall carry a Certificate of Training identification card.

Field Team Training:

Field Team Technicians are provided hands-on training in graduated phases of explaining, observing, demonstrating, and performing field sampling techniques and standard operating procedures by experienced field personnel. Additional training in field equipment technologies, quality assurance, ethics, and other skills are provided through in-house instruction, online, and external workshops and courses. Field competency is checked through personnel evaluations with direct input from the field team leaders and project managers.

Certifications:

- Assessment work must be overseen by a NC-licensed professional, and the final assessment reports will be signed and sealed by either a professional geologist (P.G.) or a professional engineer (P.E.) licensed in the State of North Carolina.

- A North Carolina-licensed driller will perform the drilling tasks for this project. Licensure of the subcontracted drilling operator will be confirmed during the solicitation for the drilling services.

- An NCDENR-accredited environmental laboratory will perform the analysis of the environmental samples in compliance will all applicable regulations and standards. As sites are selected for assessment, Cardno will issue a competitive request for qualifications and quotes to analytical laboratories to support the project. The selected laboratory's QAM will be included as an attachment in electronic format to the Site-specific QAPP Addenda.

Quality assurance training is of upmost importance for valid handling of data. As such, staff members receive QA training on an as-needed basis by taking online courses as well as attending professional training when offered.

The Town will be responsible for ensuring that their brownfields program personnel have valid and current specialized training required by the OSHA regulations as a pre-requisite for site visit(s). Additional specific certifications have not been identified as necessary during the planning of this project.

If needed, special training or certifications required for a specific site assessment will be identified in the Site-specific QAPP Addenda.

A8. DOCUMENTS AND RECORDS

All project personnel are responsible for proper documentation in accordance with their roles. **Table 1** provides a list of the project documents and records that will be generated and the purpose of each. Commonly used forms are provided in Attachment B. Document and records requirements are also maintained per US EPA Region 4, Science and Ecosystem Support Division (SESD), Field Branches Quality System and Technical Procedures, December 2008 specifications. Some of the required documentation includes:

Field crew signs or initials all records/notes with a waterproof pen;

- Use of field sampling and decontamination supplies, and equipment are tracked with an in-house system;
- Sampling containers are prepared by the laboratory and shipped with a packing list documenting contents;
- Preservatives used by the laboratory are traceable by preparation date, Vendor, and lot number;
- Sampling containers are pre-cleaned at the laboratory;
- Water level indicator and field parameter meters are cleaned according to specifications and documentation is contained in the field notes; and
- All equipment is maintained and calibrated in accordance with manufacturers' specifications.

Chain-of-custody forms accompany all samples from origin through disposal. All sample containers are labeled with sample location ID, preservative, sampler name, analyses required, and date/time of collection. The sample location ID is linked to the labels, chain-of-custody, and field notes. The chain-of-custody form includes the following information:

- Project name and address
- Date and times of sample collection
- Name of sampler
- Sample location ID
- Number of samples
- Analyses required
- Preservation method
- Timeframe (days) sample results are needed within
- Comments

Field notes are recorded during all site visits and include:

- Names of personnel, subcontractors, and others on-site
- Date and chronological summary of field activities
- Ambient conditions

- Sample location descriptions and sample ID
- Lithology
- Field measurement data
- Sample order
- Purging and sampling equipment
- Field decontamination procedures
- Field calibration records
- Types of quality control samples collected
- Sampler signatures
- Results of QC checks
- Documentation of all problems encountered in the field with corrective action resolution

Field logs and notes will be recorded in a dedicated, bound field book with sequentially numbered pages. Field logs will include all field measurements and weather observations at the site when field activities were conducted. All relevant observations or digressions from the procedures in this QAPP, deemed notable by any field team member, will also be recorded in the field logbook. Each page of the field logs will be dated and signed by the person making the entries. The project specific approved QAPP will be located onsite during field activities. The field book will be retained in the physical project file. Monitoring well installation and sampling sheets are recorded and include:

- Well casing material, diameter, screened interval, and total depth
- Drilling methods and lithology
- Water table depth
- Calculation of purge volume and sampling procedures
- Field parameter measurements and equipment used
- Sampling date
- Observations

Samples collected are immediately placed in laboratory provided coolers and chilled to four degrees Celsius using wet ice. Chain-of-custody information accompanies the samples; upon receipt of the samples and chain-of-custody information, the laboratory:

- Checks sample container integrity, temperature, and documentation
- Verifies the sample preservatives
- Logs receipt of the samples
- E-mails a .pdf file copy of the chain-of-custody and login information

Upon receipt of the e-mail confirmation, the Project Manager and QA/QC Manager will review the .pdf versions of the chain-of-custody and laboratory login information for consistency with the internal work order that documented the sampling work and analyses to be conducted during that field event.

The laboratory provides both electronic and paper copies of the analytical results generally within 10 to 14 days of sample receipt. A project timeline, including timeframe

of analytical data receipt, will be provided in the Site-specific QAPP, as it is dependent on the laboratory used on the project and is also dependent on the consultant's agreement with the laboratory. Upon receipt, Laboratory Data are reviewed by the Project Manager and QA/QC Manager. The electronic copy is placed in the project file maintained on the server, which is routinely "backed up" to ensure data integrity. The paper version of the results is maintained in the physical project file, which is eventually archived for a period of five years after the approval of the final report.

Types of information requested from the laboratory include:

- Analytical result sheets
- Method blank results
- Surrogate recoveries and acceptance limits
- Matrix spike/matrix spike duplicate results and acceptance limits
- Spike/Duplicate results and acceptance limits
- Laboratory control sample results and acceptance limits
- ICP serial dilution results
- ICP interference check samples
- Project narrative containing observations and explanation of any data qualifiers
- Signature by laboratory quality assurance officer

The laboratory analytical report will be submitted to the Project Manager. The narrative report will describe at least:

1. The dates of sample receipt, preparation, and analysis
2. The condition of the samples upon receipt
3. Sample preparation and analysis
4. Any problems encountered during sampling handling, storage, preparation, or analysis, and their solution
5. Any variance from the standard operating procedures
6. And a discussion of the quality of the reported analytical data

Project records will include all correspondence, field logs/data sheets, laboratory analytical reports, and a final report.

The Project Manager will complete a field activity report within 30 days of completion of the field activities as described in the Site-Specific QAPP. This report will include the analytical data report, a signed narrative about field activities, a summary of all collected field data, a written report of the audit of field activities (see Section CI), and copies of the original field log books and field data worksheets for this project. The narrative report will include at least discussions of all field activities, any problems encountered and their solutions, any divergences from QAPP procedures, and a discussion of field data quality.

The Project Manager will distribute copies of the Site-Specific QAPP to the people listed in the distribution list (see Section A3) once it is approved. Any revisions to this Generic QAPP or to the Site-Specific QAPP will be documented as *revised* with corresponding revision number (*revision #1*). It will be the responsibility of the Project Manager to see

to it that each person on the distribution list receives copies of any revisions.

The laboratory will manage the original raw data from this project in both hard copy and electronic format. The Laboratory Director will retain information on where the records are stored, who will be responsible for records management, and how long specific types of records or documents will be maintained.

All records and reports can be found in the physical project file located at the Project Manager's office. Electronic records shall be maintained on the company network or computers. After approval of the final report, the project file will be archived for a period of five years.

The Project Manager will maintain a copy of the final report in the project file located in the headquarters office in Columbia, South Carolina, until the completion of the cooperative agreement. The project file will then be archived for a period of five years.

The Project Manager will submit copies of all records and reports to the NCDENR Brownfields Project Manager (if a Brownfields Agreement is executed) and EPA Project Manager with the field activity report. The NCDENR Project Manager will approve deviations from these procedures before implementation, if applicable.

B1. SAMPLING DESIGN PROCESS

The sampling design process and site figures will be detailed in the Site-specific QAPP Addenda.

B2. SAMPLING AND ANALYTICAL METHODS REQUIREMENTS

The US EPA Region 4, Science and Environmental Services Division (SESD), Field Branches Quality System and Technical Procedures, provides procedures for routine field sampling and measurement (Attachment A), including field sample collection and equipment decontamination procedures. The techniques presented in this document will be followed during the field sampling events.

The purpose of performing environmental site investigations is to determine the presence, identity, and concentration of contaminants along with the extent to which they have become integrated into the surrounding environment. The objective of this effort is to collect and analyze samples which are representative of the environmental medium under investigation. The methods and equipment used for sampling environmental matrices vary with the associated physical and chemical properties of the Contaminants of Concern (COCs). Preservation, extraction, and digestion methods will be in accordance with the EPA SW-846 requirements for each method. Specific sampling procedures and the list of equipment required will be included as part of the Site-specific QAPP Addendum for the project site. If any sampling problems or abnormalities occur during sampling, the Field Team Leader will use the decision tree included in Section C1 to determine the appropriate level of responsibility to make corrective action decisions.

Table 3 provides details on sampling containers, collection volumes, holding times, and preservation requirements by matrix for methods commonly used on brownfield projects. Sample containers will be provided by the laboratory. Sample containers and preservation will be based on EPA SW-846 requirements and the specific requirements listed in the selected methods. The containers will be examined upon receipt to ensure that the appropriate number and type of containers have been provided to meet the sampling needs. The containers will also be checked to ensure that preservative has been added, if required. Additional details will be included in the Site-specific QAPP Addenda, if needed.

If any sampling problems or abnormalities occur during sampling, the Field Team Leader will use the decision tree included in Section C1 to determine the appropriate level of responsibility to make corrective action decisions. Due to the proximity of the project sites to the field technicians' facilities and the short duration of the environmental assessments, on-site support facilities will not be required unless stated otherwise in the Site-specific QAPP Addenda.

Additions to sampling personnel, sampling equipment, sampling parameters, or any other unforeseen variables will be included in the Site-specific QAPP Addenda, as needed.

B3. SAMPLE HANDLING AND CUSTODY REQUIREMENTS

Accountability for a sample begins when a sample is taken from its natural environment. The documentation procedures used to record the field sampling events are described in this section. Accurate sample documentation requires sufficient personnel, time, and space for processing forms and packaging samples. Sample containers should be organized prior to initiating the sampling activities. The following sample handling and custody procedures will be followed once the sample is collected during the implementation of this project:

Sample Numbering

Each sample will be assigned a unique identification code based on the site and its sample location. Specific sample numbering schemes will be detailed in the Site-specific QAPP Addenda.

Sample Labels

Each sample container will have a sample label affixed to it to provide sample identification, sample type, parameter(s), location, sampler's initials, date, time, and preservation. The laboratory will provide its own specific sample labels pre-affixed to the appropriate container(s). An example sample label is included in Attachment B.

Custody Seals

Custody seals will typically be used to help ensure the integrity of samples. This procedure may include seals on individual samples or on containers used to transport samples. An example of a typical custody seal is included in Attachment B.

Chain of Custody

Chain of custody procedures are intended to document sample possession in

accordance with federal guidelines from the time of collection to the time of disposal. For the purpose of this project, a sample is considered in custody if it is as follows:

- In one's actual possession;
- In view, after being in physical possession;
- Locked so that no one can tamper with it, after having been in physical custody; and/or
- In a secured area, restricted to authorized personnel.

A chain of custody record will be supplied by the analytical laboratory (an example of a blank form is included in Attachment B) and will be used to document and track possession of the samples. The chain of custody record will be sent with each sample shipment from the field to the laboratory and will serve as a record for the receipt of samples by the laboratory. The chain of custody record will include the following types of information:

- Sample numbers
- Signature of sampling team member submitting samples
- Date and time of collection
- Sample media (soil, solid, liquid, wipe, etc.)
- Identification of sampling point
- Number of containers
- Any special handling required
- Signatures of persons involved in the chain of possession
- Inclusive dates and times of possession
- Notations regarding sample integrity, such as leaking or broken containers or bags

The chain of custody will be signed each time the samples are transferred and received. The bill of lading for commercial overnight delivery services will be adequate to document possession and control of the samples during transport to the laboratory.

Sample Storage

Sample containers will be held in a refrigerator or cooler filled with ice until they are shipped. Appropriate shipping containers for samples include insulated polypropylene or aluminum-clad chests. The chests should contain ice in a sealed container or other cooling source to maintain a temperature of 4ºC in the container to help prevent degradation of the samples.

Sample Transportation/Shipment

Samples to be shipped for analysis will be handled and packaged in a manner that maintains a complete chain of custody record and prevents damage during shipment. All samples will be transported directly to the laboratory or by using a commercial carrier. When using a commercial carrier, a custody seal will be used to preserve the integrity of the sample from the time it is collected until the container is opened in the laboratory. All samples from the site will be shipped in polypropylene (or equivalent) coolers or shipping containers. As long as the custody seals are intact, commercial carriers are not required to sign the custody form. Seals will be attached so that it is necessary to break

the seal to open the container.

Sample Non-Conformance
In the event that the laboratory sample custodian judges that the sample custody is invalid, non-conformance documentation will be initiated. The Project Manager will then be notified. The decision will be made by the Project Manager as to the fate of the sample(s) in question. The sample(s) will either be processed "as is" with custody failure noted along with the analytical data or rejected with re-sampling scheduled, if necessary.

Sample Destruction
Samples will not be kept by the laboratory for an undetermined amount of time. Therefore, samples will be disposed of by the laboratory and not returned. There is no final documentation sent by the laboratory to confirm disposal.

B4. ANALYTICAL METHODS AND REQUIREMENTS

Once the samples are received and logged in at the laboratory, the samples will be analyzed by EPA Methods as specified in the Site-specific QAPP Addenda. A listing of analytical methodologies to be followed for the analytes of concern and the required instrumentation for each site will be provided in the Site-specific QAPP Addenda. If a non-standard or unpublished methodology is proposed for a given study, then the validation criteria for that methodology will be provided in the Site-specific QAPP Addenda. The laboratory will supply results of analyses within 14 calendar days (standard turnaround time).

The laboratory will follow the procedures outlined in their QAM (to be included in the Site-specific QAPP Addenda). The Laboratory Director will be responsible for overseeing the laboratory analysis and implementing corrective actions per their QAM.

B5. FIELD QUALITY CONTROL REQUIREMENTS

Field quality control requirements are detailed in **Table 4**. Specific field quality control requirements will be further defined in the Site-specific QAPP Addendum for each site. The Addendum will specify the media, type, number, and frequency of field quality control samples based on the specific conditions of the project site.

B6. LABORATORY QUALITY CONTROL REQUIREMENTS

The laboratory will be selected on a site-by-site basis. As such, the laboratory QAM will be included with the Site-specific QAPP Addenda. The Site-specific QAPP Addenda will reference the appropriate sections of the laboratory QAM which detail the laboratory QC requirements. If the information is not included in the laboratory QAM, the information will be detailed in Section B6 of the Site-specific QAPP Addenda. To monitor the achievement of the data quality objectives identified in the Site-specific QAPP Addenda, precision, accuracy, representativeness, completeness, and comparability will be assessed in accordance with the previously cited sections of each laboratory's QAM. Precision will be assessed by examining field and matrix spike duplicate (MSD) analytical results. Laboratory accuracy will be assessed by performing recovery studies,

including matrix spike (MS), laboratory control samples, and laboratory method blank analytical results. The Site-specific QAPP Addenda will provide a table with ranges of precision and accuracy considered acceptable for the CoC. If quality issues are identified, the laboratory will follow the corrective action procedures detailed in their QAM.

B7. FIELD EQUIPMENT AND CORRECTIVE ACTION

A list of common field equipment and the associated preventative maintenance for each is provided in **Table 5**. Calibration criteria (standards, frequency, acceptance limits, and adjustment procedures) and corrective actions when equipment does not meet control limits are also provided in **Table 6**. Updated tables will be provided in the Site-specific QAPP Addenda to detail the specific equipment and procedures to be used for each site assessment.

Equipment that fails in the field is immediately set aside, while field personnel contact the appropriate manufacturing company for guidance on repair. If the repair is successful, the equipment is recalibrated and put back into use. If the repair is unsuccessful, a replacement is requested and shipped overnight.

B8. LAB EQUIPMENT AND CORRECTIVE ACTION

The Site-specific QAPP Addenda will reference the appropriate sections of the laboratory QAM which address the calibration procedures and frequency for laboratory equipment, the preventative maintenance of laboratory equipment, and the corrective action procedures. If the information is not included in the laboratory QAM, the information will be detailed in Section B8 of the Site-specific QAPP Addenda.

B9. ANALYTICAL SENSITIVITY AND PROJECT CRITERIA

The Site-specific QAPP Addenda will reference the appropriate sections of the laboratory QAM which contain a discussion of analytical method sensitivity. If the information is not included in the laboratory QAM, the information will be detailed in Section B9 of the Site-specific QAPP Addenda. An analytical method sensitivity and project criteria table for the specific analytical methods to be used for each site will also be included in the Site-specific QAPP Addenda.

B10. DATA MANAGEMENT AND DOCUMENTS

Project documents and records will be generated in the field, in the laboratory, and in the office during the review and analysis of the data.

Field Documents and Records

Field personnel will maintain appropriate documents and records for the sampling events. Written field records will be the primary source for sample information. All information concerning the sampling event will be recorded in the field records and kept in a field notebook. The person responsible for the entries will sign and date each entry. Field records will contain sufficient information to reconstruct the sampling event, if necessary. Field records will be kept in a field team member's possession or in a secure

place during the period of the investigation. At the conclusion of the investigation, the field records will become part of the file for the project.

All original, recorded data will be written with waterproof ink. Accountable serialized documents will not be destroyed or thrown away, even if they are illegible or contain inaccuracies that require a replacement document. If an error is made on an accountable document, the individual will make corrections by drawing a line through the error, entering the correct information, and initialing and dating the correction. The erroneous information should not be made unreadable. Any error on an accountable document will be corrected by the person who made the entry. All corrections will be initialed and dated.

Documentation of sampling activities will include the use of the following basic items:

- Sample label
- Field data sheet
- Boring log
- Chain of custody forms
- Field sketches (optional)
- Photo log (optional)
- Analytical request form (optional)

A logical and complete sample identification system will be implemented for the project. The system will identify the sample matrix, sample station number, sample depth, quality control samples, and the sampling date, time, and location for each sample. The sample label, field sheet, sample log, chain of custody forms, and analytical request forms must all include the complete sample identification information.

Information related to each sample location will be documented in a bound field book. A field sheet will be referenced in the field book if one is used. The field book or sheets will include the following information where applicable: odors, soil descriptions, well construction details, water quality parameters, purge times, estimated purge volumes, property ownership information, exact sample locations, and analyses to be performed. In addition, the field record will include the weather and temperature conditions at the time of sampling. Any photographic documentation will also be recorded in the field record.

Special emphasis must be placed on precise identification and description of QC samples in the field sheets. Program "blind" duplicate samples should not be identified as such to the laboratory or on the chain of custody forms, but must be distinguishable in the project-level documentation. The field sheets must contain descriptions of how the QC samples were collected and notes as to how the samples were named or numbered for analysis.

All original field documents will be saved in the project file. Digital photographic documentation will also be stored in the electronic project file. Copies of the field records will be included in the final report.

Laboratory Documents and Records

At a minimum, the laboratory will provide data reports consisting of a summary package which includes the following:

- Cover letter/case narrative listing the samples submitted and analyses performed.
- Laboratory results summary listing the sample identifications, analysis methods, results of the analysis, the detection limit/practical quantitation limits, and dates of sample collection, extraction and analysis for each analyte.
- A copy of the chain of custody showing acceptance by the laboratory.
- A QA/QC summary that presents applicable surrogate recoveries, blank results, matrix spike/matrix spike duplicate (MS/MSD), or laboratory control sample (LCS) results along with the acceptable quality control limits. **Table 2** summarizes the quality control data provided by the laboratory.

Internal laboratory sample identification data must track against the chain of custody information, such that the sample may be traced back to its originating field information and sampling details. Internal laboratory tracking information must reference the laboratory identification number against the sample collection and laboratory delivery date and dates of sample extraction and analysis. The laboratory will provide both an electronic copy of the laboratory analytical summary report. The laboratory will also provide the data results in an electronic spreadsheet format to eliminate potential transcription errors. If electronic delivery cannot be completed, the laboratory data results will be entered into an electronic spreadsheet for manipulation and presentation of results in the final report. Electronic data files will be checked against the original laboratory reports for transcription/import errors. The laboratory will manage the original raw data from this project. A full data package with calibration checks, raw data, etc., may be requested, if needed. Therefore, all raw data related to sample analysis must be retained by the laboratory for a minimum of ten years. The raw data shall be available upon request. The Laboratory Director is responsible for maintaining and retaining the laboratory records.

Data Manipulation and Retention

Field and laboratory data will be reviewed for accuracy, verified, and validated per the procedures outlined in Section D. Upon receipt of laboratory data, the data is reviewed for its usability. Upon this determination, data is then formatted into tables and compared to regulatory limits to determine if contamination is present at the subject property. Most laboratories (defined in the Site-specific QAPP Addenda) provide their data in formatted tables directly from their Laboratory Information Management System (LIMS); this lessens the required manipulation of data and, therefore, provides a more accurate presentation of data. Upon completion of formatting the Analytical Data Table; data is reviewed for accuracy by the QA/QC Manager. An appropriate summary will be included in the final project report along with the data tables summarizing the collected data. Copies of the field data sheets, boring logs, chain of custody forms, and the laboratory summary package will be included as appendices to the final report.

All field records and the laboratory summary report will be stored in the project file located at the Project Manager's office. All paper files are retained at the Cardno office in Columbia, South Carolina, for a minimum of five (5) years after project closeout. In an effort to be a more environmentally-sensitive company, Cardno minimizes its use of paper copies of reports (when applicable) by generating digital reports, data files, and

other documents for use by the client, although paper report copies are always available upon request. All digital copies of Cardno reports and documents are also maintained on the company network and in the project folder. Electronic files are backed up nightly and stored on an off-site server.

C1. ASSESSMENT AND RESPONSE ACTIONS

Assessments are planned to include potential audits of field activities, the verification and validation of all reported, data and QA review of all reports by senior level technical staff. The QA/QC Manager may conduct an on-site field audit at the time(s) when samples are being collected for both field and laboratory analysis. The QA/QC Manager will have the authority to halt the on-site work if he believes the findings from the audit justify such action. In the event discrepancies are identified during an audit, the QA/QC Manager will discuss findings with the Project Manager and Field Team Leader. The Field Team Leader, in consultation with the Project Manager, will be responsible for corrective actions related to field activities. Audit findings would be included in the Final Reports along with descriptions as warranted; this information is provided to the project staff, state, and EPA project personnel.

The Laboratory Director will be responsible for ensuring that laboratory activities are performed properly. Laboratory data will be reviewed for accuracy prior to reporting. Any discrepancies will be addressed internally per the laboratory QAM (to be included in the Site-specific QAPP Addenda) by the Laboratory Director. Significant issues that affect data usability will be discussed directly with the Project Manager at the time of discovery. Other quality control deviations will be noted as part of the laboratory QA/QC summary in the laboratory report. If necessary, samples will be reanalyzed or recollected and analyzed. The laboratory will provide a narrative report with the analytical results referencing the project, associated Chain of Custody, quality control issues, and the validity and integrity of the results. Section D2 of this QAPP discuss the verification and validation process in detail.

Routine corrective measures during all sampling activities will be taken at the discretion of the Field Team Leader. All corrective measures will be thoroughly documented in field logs. When issues are encountered and decisions on corrective actions are outside of Standard Operating Procedures (SOPs), the decision tree in **Figure 2** will provide guidance for the Field Team Leader to respond to field variances. The Project Manager and the Laboratory Director will be responsible for directing assessments and corrective actions and may issue stop work orders, if necessary. If a corrective action is implemented, the Project Manager or the Laboratory Director will verify that the corrective action was adequate and was properly documented. Non-conforming items found during field sampling and/or laboratory testing will be documented and corrected. Non-conformance reports will be completed and retained in the project file.

C2. PROJECT REPORTS

The Project Manager will prepare the final report, which will be reviewed for technical accuracy and data quality by the QA/QC Manager or similar senior technical staff (as appropriate). The final report will include a summary description of project activities, a summary of all data, the field activity report, a discussion on any problems encountered

during the project and the corrective actions taken, a discussion of the conclusions drawn from the results and the rationale for those conclusions, and the results of the data quality assessment. The report will include a site map showing the sample locations, copies of boring logs, tables identifying field measurements, including the elevations of borings and laboratory analytical reports. The tables will highlight any sample results exceeding criteria. Field records will be included in an attachment to the report. The report will be provided in both hard and electronic copy. When large amounts of data are included as attachments or appendices, an electronic copy on CD may be included instead in the hard copy report. Final reports will be forwarded to the EPA Project Manager as required. Laboratory analytical reports will be generated by the Laboratory Director and submitted to the Project Manager ten to fourteen calendar days after receipt of the samples. The Project Manager will then forward the analytical information to the NCDENR and EPA Project Managers in conjunction with the field notes.

The following listing summarizes types of reports and other documents that may be generated for this project:

- Quality Assurance Project Plans (QAPPs)
- Historical Phase I ESA
- Phase II ESA / Limited Site Assessment Report
- Interim Source Removal Proposal
- Interim Source Removal Report
- Site Rehabilitation Plan
- Site Assessment Report
- Risk Assessment Report
- No Further Action Proposal
- Natural Attenuation with Monitoring (MNA) Proposal
- Analysis of Brownfields Cleanup Alternatives (ABCAs)
- Remedial Action Plan (RAP)
- Remedial Action Status Report
- Notice of Residual Petroleum
- No Further Action Proposal with Monitoring Proposal
- No Further Action Proposal with Monitoring Report

Execution of proposed field activities for this project will commence with the approval of the Generic QAPP and the Site-specific QAPP Addenda.

D1. FIELD DATA EVALUATION

The Project Manager will oversee the field data collected and discuss any problems identified during the project with the Field Team Leader. Any problems and associated corrective actions will be documented in the field activity report. After the conclusion of field activities, the Project Manager will either complete or designate a team member independent of the field activities to complete the field data verification. The data verification will evaluate the completeness, correctness, and compliance of the data against the requirements and field sampling methods specified in the Site-specific QAPP Addenda. He will identify any potential issues and initiate corrective actions, if

appropriate. He will document the results of the data verification and provide the results to the data validator. The results will be stored in the project file.

The QA/QC Manager will be responsible for performing the data validation of the field data. **Table 7** provides a list of data validation activities. The validation process will include:

- Reviewing the field records and the results of the data verification;
- Identifying unacceptable data and initiating corrective actions; and
- Assigning data qualifiers, if necessary.

Data will be categorized as fully quantified, qualified, or unusable. Unusable data will not be utilized in the project decision process. The QA/QC Manager will provide a data validation report, including all calculations and the data with the appropriate qualifiers, to the Project Manager. The Project Manager must contact the NCDENR Project Manager and EPA Project Officer in the event that there are any deviations from the QAPP, and the NCDENR Project Manager and EPA Project Officer will determine if the data is acceptable or if re-sampling is required. If data that deviates from the QAPP is accepted, the data will be used for screening purposes only and the data will be annotated as such.

D2. LABORATORY DATA EVALUATION

The Laboratory Director will review and verify the laboratory data generated under their corrective action system for accuracy according to the laboratory's Quality Assurance System. Quality control checks are performed on field data by reviewing the chain of custody forms and results from the lab for each sampling event. All sample results will be reviewed and correlated to field measurements and observations. **Table 7** provides a list of data validation activities. The validation process will include:

- Reviewing the laboratory summary package and the results of the data verification;
- Identifying unacceptable data and initiating corrective actions;
- Assigning data qualifiers, if necessary.

In addition to evaluating data qualifiers associated with laboratory analyses, the Project Manager will evaluate the reproducibility of the sample results by performing a comparison of the sample duplicate(s) and the corresponding sample result(s). For this comparison, if the duplicate or sample result is less than five (5) times the reporting limit (the higher of the two if they are not the same for each, which they almost always are), then the comparison is made by the absolute difference between the results (Sample - Duplicate). For water samples, if this difference is less than the magnitude of the (higher) reporting limit, precision is considered “acceptable.” For soil samples, if the difference is less than twice the magnitude of the (higher) reporting limit, precision is considered “acceptable.” If these differences are within two (2) times the “acceptable” limits, they are considered “slightly high” (anything beyond that would be considered “high”). If both sample and duplicate results are greater than five (5) times the reporting limit (the higher of the two RLs, if they are not the same), then precision is assessed by the %RPD (difference in results divided by the average of the two results X 100). <35%

RPD = “good/acceptable”, >35% but < 50% = variability is “slightly high”, >50% = “high”.

Precision, accuracy, and completeness calculations are as follows, respectively:

1. RPD = 200*[(BS %R - BSD Result) / (BS %R + BSD Result)]
2. BS Recovery = 100*(BS Result)/[Spike Added]
3. BSD Recovery = 100*(BSD Result)/[Spike Added]

Where:

RPD: Relative Percent Difference	BS: Blank Spike
%R: Percent Recovery	BSD: Blank Spike Duplicate

Based on the data qualifiers provided by the laboratory and on the sample/sample duplicate comparison described above, data will be categorized as fully quantified, qualified, or unusable. Unusable data will not be utilized in the project decision process. Raw data will be included in all submitted project reports.

An evaluation of laboratory analysis procedures and review of: holding times, blanks, control samples, duplicate analysis, detection limits, holding times, laboratory controls, and overall assessment of data will be conducted.

The data usability will compare proposed sample locations to actual sample locations. The review also will verify that the predefined number of samples were analyzed and will confirm that the predefined analytical methods and detection limits were used. The Project Manager will review the quality control samples, hold times, calibration, surrogate recovery, as well as the precision and accuracy data for the sampled analytes of concern to determine whether the data will be accepted or rejected. In the event results are rejected, the QA/QC Manager, Project Manager, EPA Project Officer, and NCDENR Project Manager will meet (via conference call) to discuss the reasons for the rejection of data and what steps should be initiated including additional site sampling if deemed necessary. Problems associated with the laboratory will be documented in the laboratory QA report provided with all analytical results, which will be provided to all end users in the form of summary reports.

D3. DATA USABILITY AND PROJECT VERIFICATION

The Laboratory Director will review and verify the laboratory data generated under their corrective action system for accuracy according to the laboratory's Quality Assurance System. Any problems identified during this process will be reported to the Project Manager in the analytical data report. Information on QC criteria will be included in the Site-Specific QAPP Addendum. The QA/QC Manager along with the Project Manager validates laboratory data upon receipt of the analytical results.

The Laboratory Director/QA Manager will evaluate the sample/sample duplicate data and equipment blank data to determine if data precision is of an acceptable quality. Pending these three data validation procedures, the data will be determined to be of a specified quality and reported as such. For instance, data will typically be reported with no qualifiers if the data are determined to be fully useable. However, a discussion of data limitations will be added to the data summary tables and data discussion within the reports if data validity is compromised in anyway.

When applicable, the Project Manager will also review and verify the field sheets, the final report, and the analytical data report. Any problems or deviations will be documented in the field activity report. The Project Manager will discuss any problems along with proposed corrective actions with the QA/QC Manager.

Valid data of known and documented quality is required for all media sampled. Once reliable and representative data are obtained, the data will be compared to the targeted cleanup levels to determine if no further action is required or if active remediation is needed. The Project Manager will reconcile the data with the project-specific objectives.

The process for reconciling the data includes the evaluation of the following questions:

1) Were samples collected using the appropriate collection procedures?
2) Were samples handled in accordance with the SOPs?
3) Were the samples collected from the pre-determined or specific sampling locations?
4) Were the samples properly preserved?
5) Were field sampling problems documented in field logs?
6) Were the QAPP-specified analytical methods used?
7) Were problems identified during laboratory analysis?
8) Was the laboratory able to meet the MDLs, PQLs, and QA/QC requirements specified in the QAPP or provided in the analytical methods?
9) What were the results of data validation - do any of the data points require rejection?
10) If data is problematic, is re-sampling or reanalysis required (if data is rejected - how does the result affect the ability to make site decisions)?

Because data generated with significant deviations from the requirements of the QAPP will be rejected and because of the nature of the work (biased sampling), all data will have the same expected uncertainties and there will be no limitations on data use. **Table 8** provides a list of data usability assessment activities.

Field modifications regarding sampling analysis may be necessary for circumstances such as auger refusal, limited access areas or when enough sample volume could not be collected for various reasons. Re-sampling may be necessary if results are deemed unacceptable for various reasons such as exceeding laboratory holding times, etc. These variables will be further defined in the Site-Specific QAPP Addendum when the project description is detailed based on the specific COCs.

REFERENCES

1. U.S. Environmental Protection Agency. 2006. *EPA Guidance on Systematic Planning Using the Data Quality Objectives Process*. EPA 240/B-06/001. February.

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4. U.S. Environmental Protection Agency. 2006. *Data Quality Assessment: Statistical Tools for Practitioners*. EPA QA/G-9S. EPA 240-B-06-003. February.

5. U.S. Environmental Protection Agency. 1998. *Quality Assurance Guidance for Conducting Brownfields Site Assessments*. EPA 540-R-98-038. September.

6. U.S. Environmental Protection Agency Region 4. 2010. *Brownfields Quality Assurance Project Plans (QAPPs) Interim Instructions Generic and Site-Specific QAPP Addendum for Brownfields Site Assessments and/or Cleanups.* July 2010.

7. U.S. Environmental Protection Agency Region 4. 2013. *Field Branches Quality System and Technical Procedures*, http://www.epa.gov/region4/sesd/fbqstp/.

LIST OF ABBREVIATIONS

AST	Above Ground Storage Tank
ASTM	American Society for Testing and Materials
BSA	Brownfields Site Assessment
BSRA	Brownfields Site Rehabilitation Agreement
BTEX	Benzene, Toluene, Ethylbenzene, and Total Xylenes
CD	Compact Disc
COC	Contaminants of Concern
CTL	Cleanup Target Levels
DEFT	Decision Error Feasibility Trials
DPT	Direct Push Technology
DQO	Data Quality Objective
e.g.	*exempli gratia* - for example
ESA	Environmental Site Assessment
ECD	Electron Capture Device
FID	Flame Ionization Detector
GC	Gas Chromatography
GC-MS	Gas Chromatography – Mass Spectrometry
GIS	Geographic Information Systems
GPS	Global Positioning Satellite
HAZWOPER	Hazardous Waste Operations
HPLC	High Performance Liquid Chromatography
ICP	Inductively Coupled Plasma
ID	Identification
i.e.	*id est* - that is
IUPAC	International Union of Pure and Applied Chemistry
L	Liter
MDLs	Method Detection Limits
MIP	Membrane Interface Probe
mL	Milliliter
MTBE	Methyl tert-butyl ether
MW	Monitor Well
MS	Microsoft Corporation
NA	Not Applicable
NCDENR	North Carolina Department of Environment and Natural Resources
NELAC	National Environmental Laboratory Accreditation Conference
OSHA	Occupational Safety and Health Administration
OVA	Organic Vapor Analyzer
PAHs	Polynuclear Aromatic Hydrocarbons
PE	Performance Evaluation
P.E.	Professional Engineer
P.G.	Professional Geologist
PPB	Parts per Billion
PPM	Parts per Billion
PQLs	Practical Quantification Limits
QA	Quality Assurance
QAM	Quality Assurance Manual

QAP	Quality Assurance Plan
QAPP	Quality Assurance Project Plan
QC	Quality Control
RCRA	Resource and Conservation Recovery Act
RPD	Relative Percent Difference
RQAO	Regional Quality Assurance Designated Approving Official
SPLP	Synthetic Precipitate Leaching Procedures
SS	Soil Sample
SVOC	Semi-Volatile Organic Compounds
SOP	Standard Operating Procedure
TCLP	Toxicity Characteristics Leaching Procedure
TQM	Total Quality Management
USC	United Soil Classification
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VOC	Volatile Organic Compounds

Tables

Table 1: Documents and Records

Type of Document or Record	Purpose of Document or Record
Boring log	Maintains accurate record of field soil sampling activities by providing written notes of all activities. An example boring log is included in Attachment B.
Field Data Sheet	Maintains accurate record of groundwater sampling activities by providing written notes of all activities. An example field data sheet is included in Attachment B.
Chain of custody form	Maintains proof that samples were not tampered with and that samples were under the appropriate possession at all times. An example blank chain of custody form is included in Attachment B.
Instrument calibration records	Maintains accurate record of instrument calibration.
Sample location survey	Records all sample locations so they can be accurately plotted on a map.
Photo logs	Maintains accurate record of photo documentation
Laboratory data report	Documents the results of the laboratory analyses. Refer to the "Laboratory Data Deliverables" subsection under Section A8 for more details.
Data verification checklist	Provides staff a minimum set of questions to consider during the data verification process and documents the results of data verification.
Data validation checklist	Provides staff a minimum set of questions to consider during the data validation process and documents the results of the data validation.
Final assessment report	Documents the field activities, the laboratory analyses, the results, and the conclusions of the environmental site assessment.

Table 2: Quality Control Data Provided by Laboratory

The following information by matrix (soil, ground water, surface water, sediment, etc.) and laboratory test (8260B, 8270C, 8082, etc.) will be provided by the laboratory in the project analytical report and analytical report narrative

Quality Control Results	Information Provided by Laboratory
General Sample Information	Date sample collected
	Date sample received at lab
	Sample ID versus laboratory sample number
	Condition of samples and temperature
	Date sample analyzed
	Dilution factor
	Analysts
Hold Time	The samples were analyzed within the method required hold times with any exceptions noted in the narrative
Sample Preparation	The samples were prepared in accordance with sample preparation method (EPA 5035, EPA 3010, EPA 7470, etc.) with any exceptions noted in the narrative
Initial Calibration	All criteria were within method requirements with any exceptions noted in the narrative
Continuing Calibration	All criteria were within method requirements with any exceptions noted in the narrative
Surrogates	All surrogates were within QC limits with any exceptions noted in the narrative
Method Blank	All analytes were below the report limit in the method blank with any exceptions noted in the narrative
Laboratory Control Spike	All laboratory control spike compounds were within QC limits with any exceptions noted in the narrative
Matrix Spike	All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted in the narrative
Duplicate Samples	All duplicate sample results were within method acceptance criteria with any exceptions noted in the narrative

Table 3: Sample Containers, Volumes, Preservation, and Holding Times

Matrix	Parameter Prep, digestion or extraction method(s) given first followed by analytical method(s)	Minimum Sample Volume[1]	Sample Container[2]	Preservation Method	Holding Times
Soil or Sludge	Volatile Organic Compounds (VOCs) Med/High Concentration (Methods 5035A/8260B)	5 g	5 g of soil to 5 ml methanol n 40-ml VOC vial	Methanol Cool to 4°C	14 days
	VOCs Low Concentration (Methods 5035A/8260B)	5 g	5 g soil to 40 ml VOC vial with 5ml of DI water & stirbar	Cool to 4°C	14 days
	Semivolatile Organic Compounds (SVOCs) Methods 3540C or 3550C/8270D	30 g	4-oz. clear wide-mouth glass w/Teflon lined cap	Cool to 4°C	14 days Extract, 40 days to Analyze
	Pesticides/Herbicides/PCBs Methods 3550/8081B; /8151A; 3550/8082A	30 g	4-oz. clear wide-mouth glass w/Teflon lined cap	Cool to 4°C	14 days Extract, 40 days to Analyze
	Total Metals (Priority Pollutant Metals (PPM) List = Sb, As, Be, Cd, Cr, Cu, Pb, Hg, Ni, Se, Ag, Th, Zn) Methods 3050B/6010C/7471B	10 g	4-oz. clear wide-mouth glass w/Teflon lined cap	Cool to 4°C	180 days (28 days Mercury)
	Total and Amenable Cyanide (Method 9012B)	10 g	4-oz. clear wide-mouth glass w/Teflon lined cap	Cool to 4°C	14 days
Aqueous	VOCs (Methods 5030/8260B)	80 ml	40 ml VOC Vial with Teflon Lined Septum	1:1 HCl to pH<2, Cool to 4°C	14 days
	SVOCs (Methods 3510C or 3520C/8270D)	2 L	1 L Amber Glass w/ Teflon Lined Cap	Cool to 4°C, 80 mg Sodium Thiosulfate[3]	7 days Extract, 40 days to Analyze
	Pesticides/Herbicides/PCBs (Methods 3510C or 3520C/8081;8151A; 3510C or 3520C/8082A)	2 L	1 L Amber Glass w/ Teflon Lined Cap	Cool to 4°C	7 days Extract, 40 days to Analyze
	Total Metals (PPM) (Methods 3005A or 3010A/6010C/7470A)	0.5 L	0.5 L HDPE Bottle w/ Teflon Lined Cap	1N HNO_3 to pH<2 Cool to 4°C	180 days (28 days Mercury)
	Total and Amenable Cyanide (Method 335.4 or 9010C/9014)	0.5 L	1 L HDPE Bottle w/ Teflon Lined Cap	NaOH to pH 12, Cool to 4°C + Zinc Acetate4	14 days (24 hours[5])

[1] Triple volume is required for matrix spike/matrix spike duplicate (MS/MSD) analysis

[2] Sample bottles must comply with US EPA, December 1992, Specifications and Guidance for Contaminant-Free Sample Containers: OSWER Directive 9240.0-05A, EPA 540/R-93/051, Office of Solid Waste and Emergency Response, Washington, DC. All sample containers will be provided by the laboratory.

[3] Sodium thiosulfate should only be used in the presence of residual chlorine

[4] Zinc Acetate used to remove the presence of residual chlorine

[5] Maximum holding time is 24 hours when sulfide is present

Table 4: Field Quality Control Requirements

QC Sample	Frequency	Acceptance Criteria	Corrective Action
Field Duplicate	One per 20 samples per matrix or one per day, whichever is more frequent	± 15 %	Qualify data as appropriate based on precision
Split Sample	10 % of field screening data will be confirmed with data from a fixed laboratory	± 15 %	Qualify data as appropriate based on accuracy and precision
Equipment Rinsate Blank	One per 20 samples per matrix per equipment type per decontamination event or one per day, whichever is more frequent	No target analytes in blank	Qualify data based on potential of equipment cross contamination
Field Blank	One per 20 samples per matrix or one per day, whichever is more frequent	No target analytes in blank	Qualify data based on potential cross contamination from field conditions
VOC Trip Blank	One for each cooler that which contains samples for VOC analysis	No target analytes in blank	Qualify data for field or laboratory contamination
Cooler Temperature Blank	One per cooler	± 2 °C	Qualify data as appropriate by type of analysis

Table 5: Preventive Maintenance of Common Field Equipment

Instrument	Activity	Frequency
Water Level Indicator (Solinst Model 101) and Interface (Product) Probe (Solinst Model 122)	• Check batteries and self-test • Check and clean probe tip	Prior to each field event
Photoionization (Photovac MicroFID) and Flame Ionization Detectors (Rae-Minirae 2000) (PIDs/FIDs)	• Check batteries and charge • Check with calibration gas • Check lamp and operation	Prior to each field event
	• Periodic maintenance	Per manufacturer's recommendation (typically annually)
pH Meter (YSI pH100) State Certified (#5484)	• Check for low battery indication • Calibrate with known pH standards	Daily
Specific Conductivity Meter (YSI63)	• Check batteries and self-test • Check with calibration standard	Daily
pH, Specific Conductivity, Dissolved Oxygen, Turbidity and Temperature and Other Multiple Function Meters (Horiba U-22XD)	• Check batteries and operations • Check standards and buffers • Check outputs against normal ranges for parameters	Prior to each field event

Table 6: Calibration and Corrective Action for Common Field Equipment

Instrument	Calibration Standard	Calibration Frequency	Acceptance Criteria	Corrective Action
Photoionization and Flame Ionization Detectors (PIDs/FIDs)	Calibration gas (Typically 100 ppm isobutylene)	Daily	± 5 %	1. Adjust instrument, check charge, recalibrate 2. Note calibration issues and flag field data as necessary 3. Send unit for servicing 4 Rent/retrieve replacement unit if necessary
pH Meter	pH Standards (4, 7, and 10 typical)	Prior to use in the field, at least every four hours, and any time the unit has been turned off with correction for temperature of samples as needed*	± 10 %	1. Adjust instrument, check battery, recalibrate 2. Perform occasional operational checks to see if site conditions have affected electronics. Recalibrate if necessary. 3.Note calibration issues and flag field data as necessary 4. Send unit for servicing 5 Rent/retrieve replacement unit if necessary 6. Use pH paper as back up
Specific Conductivity Meter	Calibration with manufacturer's recommended standard	Prior to use in the field with correction for temperature of samples as needed*	± 10 %	1. Adjust instrument, check charge, recalibrate 2. Calibration sensitive to temperature change. Take temperature of sample, and correct instruments temperature adjustment to temperature of sample (if required). 3. Note calibration issues and flag field data as necessary 4. Send unit for servicing 5. Rent/retrieve replacement unit if necessary
Multiple Function Meters (pH, Sp. Cond. DO, Temperature, ORP, Turbidity, etc.)	Calibration with manufacturer's recommended standard	Prior to use in the field with correction for temperature of samples as needed*	± 10 %	1. Adjust instrument, check charge, recalibrate 2. Calibration sensitive to temperature change. Take temperature of sample, and correct instruments temperature adjustment to temperature of sample (if required). 3. Note calibration issues and flag field data as necessary 4. Send unit for servicing 5. Rent/retrieve replacement unit if necessary
Water Level Indicator / Interface (Product) Probe	Surveyor's Steel or Fiberglass Tape	Quarterly	± 0.05 %	1. Measure indicator/probe cable against surveyor's tape 2. Note calibration issues and flag field data as necessary 3. Send unit for replacement cable

* A post-operation instrument verification check should be performed at the end of the day or after all measurements have been taken for a particular period of operation

Table 7: Data Validation Activities

Item	Activity
Data Deliverables and QAPP	Ensure that all required information on sampling and analysis was provided (including planning documents).
Analytes	Ensure that required lists of analytes were reported as specified.
Chain-of-Custody	Examine the traceability of the data from time of sample collection until reporting of data. Examine chain-of-custody records against contract, method, or procedural requirements.
Holding Times	Identify holding time criteria, and either confirm that they were met or document any deviations. Ensure that samples were analyzed within holding times specified in method, procedure, or contract requirements. If holding times were not met, confirm that deviations were documented, that appropriate notifications were made (consistent with procedural requirements), and that approval to proceed was received prior to analysis.
Sample Handling	Ensure that required sample handling, receipt, and storage procedures were followed, and that any deviations were documented.
Sampling Methods and Procedures	Establish that required sampling methods were used and that any deviations were noted. Ensure that the sampling procedures and field measurements met performance criteria and that any deviations were documented.
Analytical Methods and Procedures	Establish that required analytical methods were used and that any deviations were noted. Ensure that the QC samples met performance criteria and that any deviations were documented.
Data Qualifiers	Determine that the laboratory data qualifiers were defined and applied as specified in methods, procedures, or contracts.
Deviations	Determine the impacts of any deviations from sampling or analytical methods and SOPs. Consider the effectiveness and appropriateness of any corrective action.
Sampling Plan	Determine whether the sampling plan was executed as specified (i.e., the number, location, and type of field samples were collected and analyzed as specified in the QAPP).
Sampling Procedures	Evaluate whether sampling procedures were followed with respect to equipment and proper sampling support (e.g., techniques, equipment, decontamination, volume, temperature, preservatives, etc.).
Co-located Field Duplicates	Compare results of collocated field duplicates with criteria established in the QAPP.
Project Quantitation Limits	Determine that quantitation limits were achieved, as outlined in the QAPP and that the laboratory successfully analyzed a standard at the QL.
Confirmatory Analyses	Evaluate agreement of laboratory results.
Performance Criteria	Evaluate QC data against project-specific performance criteria in the QAPP (i.e., evaluate quality parameters beyond those outlined in the methods).
Data Qualifiers	Determine that the data qualifiers applied were those specified in the QAPP and that any deviations from specifications were justified.
Validation Report	Summarize deviations from methods, procedures, or contracts. Include qualified data and explanation of all data qualifiers.

Table 8: Data Usability Assessment

Item	Assessment Activity
Data Deliverables and QAPP	Ensure that all necessary information was provided, including but not limited to validation results.
Deviations	Determine the impact of deviations on the usability of data.
Sampling Locations, Deviation	Determine if alterations to sample locations continue to satisfy the project objectives.
Chain-of-Custody, Deviation	Establish that any problems with documentation or custody procedures do not prevent the data from being used for the intended purpose.
Holding Times, Deviation	Determine the acceptability of data where holding times were exceeded.
Damaged Samples, Deviation	Determine whether the data from damaged samples are usable. If the data cannot be used, determine whether resampling is necessary.
PT Sample Results, Deviation	Determine the implications of any unacceptable analytes (as identified by the PT sample results) on the usability of the analytical results. Describe any limitations on the data.
SOPs and Methods, Deviation	Evaluate the impact of deviations from SOPs and specified methods on data quality.
QC Samples	Evaluate the implications of unacceptable QC sample results on the data usability for the associated samples. For example, consider the effects of observed blank contamination.
Matrix	Evaluate matrix effects (interference or bias).
Meteorological Data and Site Conditions	Evaluate the possible effects of meteorological (e.g., wind, rain, temperature) and site conditions on sample results. Review field reports to identify whether any unusual conditions were present and how the sampling plan was executed.
Comparability	Ensure that results from different data collection activities achieve an acceptable level of agreement.
Completeness	Evaluate the impact of missing information. Ensure that enough information was obtained for the data to be usable (completeness as defined in PQOs documented in the QAPP).
Background	Determine if background levels have been adequately established (if appropriate).
Critical Samples	Establish that critical samples and critical target analytes/COCs, as defined in the QAPP, were collected and analyzed. Determine if the results meet criteria specified in the QAPP.
Data Restrictions	Describe the exact process for handling data that do not meet PQOs (i.e., when measurement performance criteria are not met). Depending on how those data will be used, specify the restrictions on use of those data for environmental decision-making.
Usability Decision	Determine if the data can be used to make a specific decision considering the implications of all deviations and corrective actions
Usability Report	Discuss and compare overall precision, accuracy/bias, representativeness, comparability, completeness, and sensitivity for each matrix, analytical group, and concentration level. Describe limitations on the use of project data if criteria for data quality indicators are not met.

Figures

Figure 1: Project Organization Chart

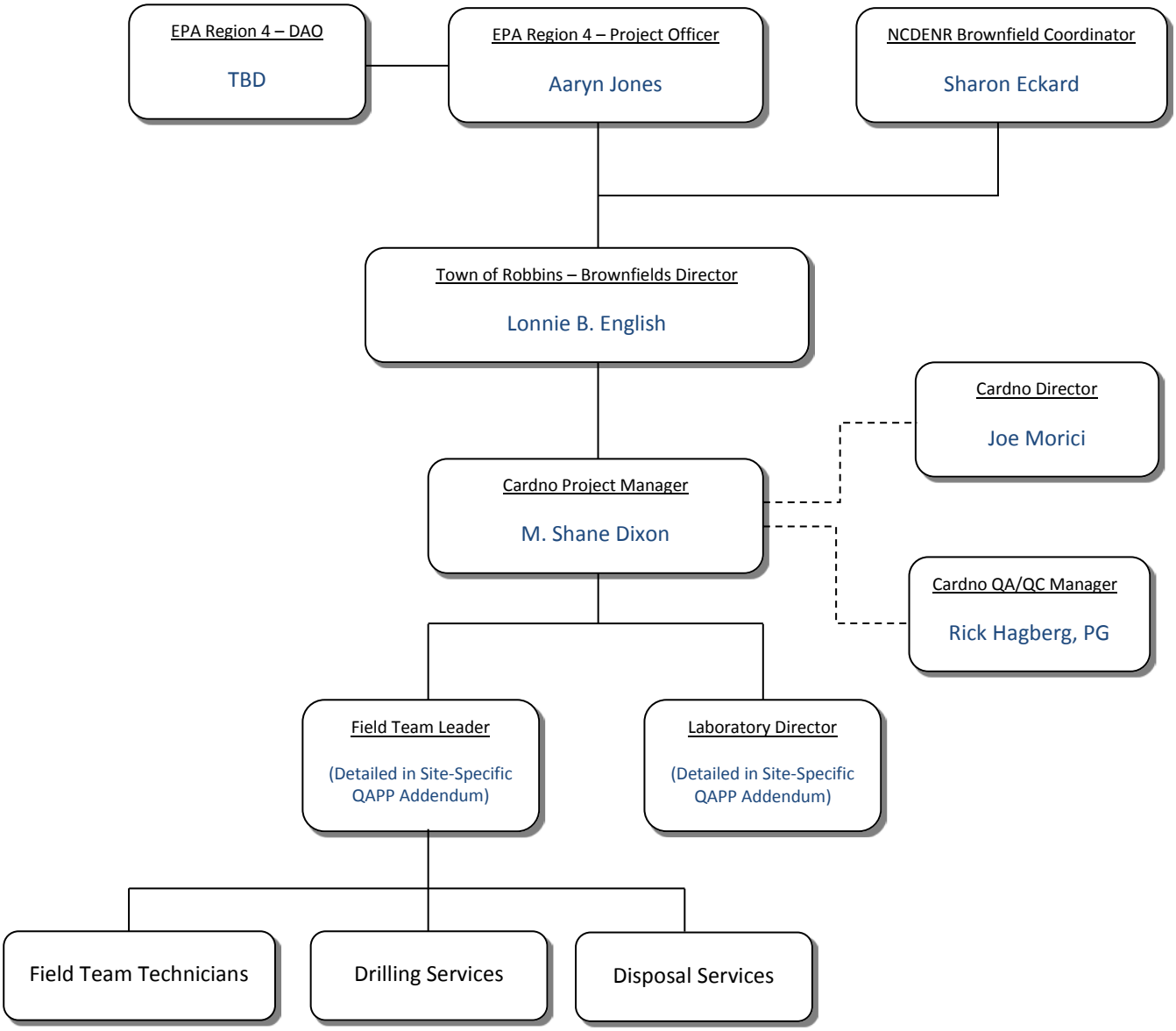
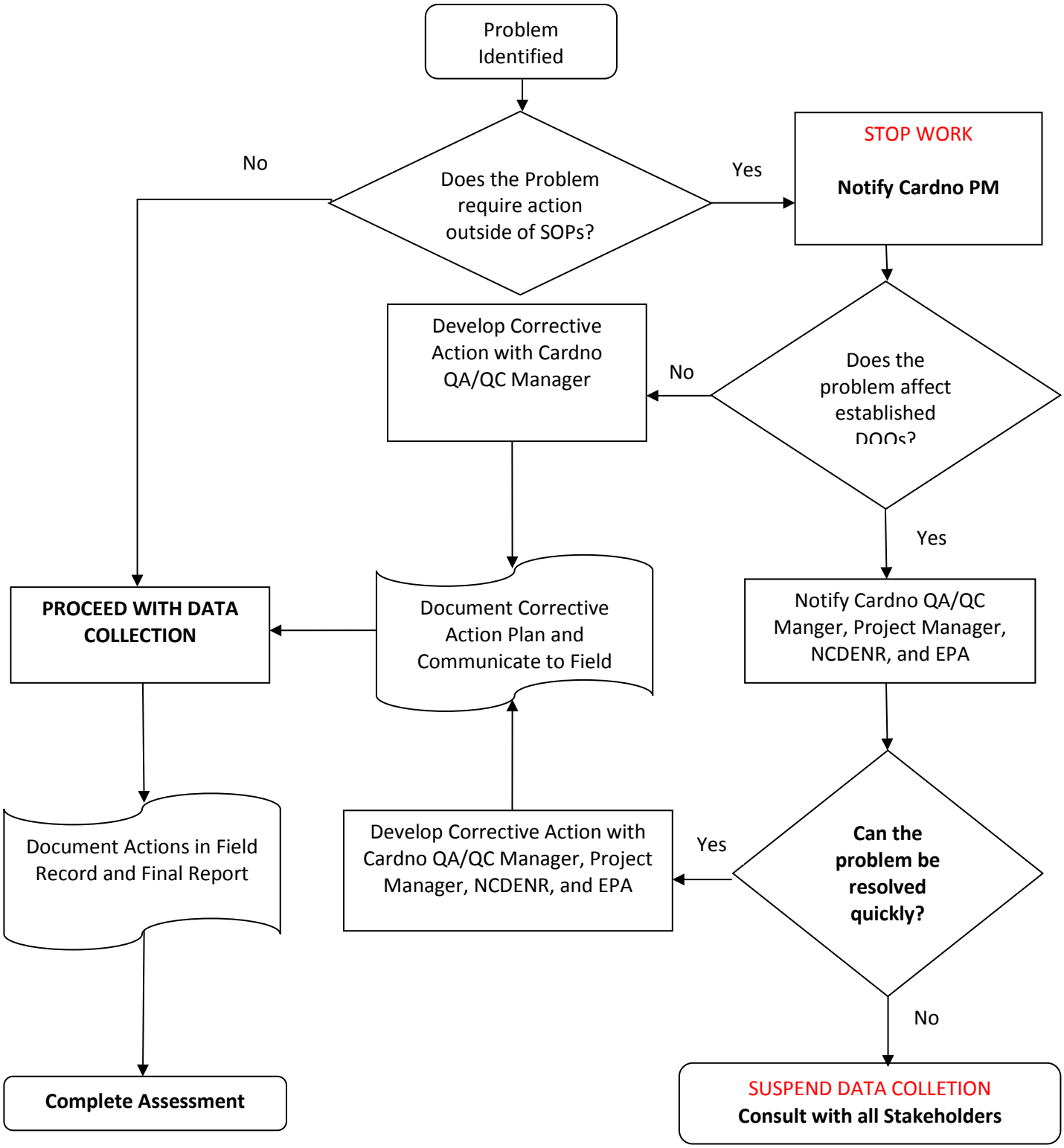


Figure 2: Field Variance Decision Tree



Attachment A
US EPA Region 4, SESD Standard Operating Procedures – CD Format

Attachment B
Commonly Used Forms