Quality Assurance in Environmental Restoration Projects

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QA in Environmental Restoration Projects

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Introduction

- This Quality Assurance Project Plan (QAPP) Guide applies to all projects that will collect or use environmental data
- The overall purpose of this QAPP (e.g., remediation sampling and data management activities)
- Environmental data are any measurements or information that describe environmental processes or conditions or the performance of environmental technology

Introduction continued

- Environmental data include (e.g., remediation) sampling and analysis (SAP) data generated from field site preparation activities, geographic information, site survey data, information about construction activities, industrial processes, decommissioning and decontamination (D&D), data generated from site and facility inspection, and monitoring activities, and data generated from field and measurement activities
- Environmental sampling consists of samples collected from soil, sediment, groundwater, surface water and air)
- Environmental samples are collected and sent to analytical labs for analysis and then the results are verified/validated, which facilitates data management (e.g., loading data into a database and generating electronic data deliverables (EDD) and hardcopy reports)

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PROJECT DESCRIPTION

Quality Assurance Project Plans (QAPP) shall be developed to assure quality for all sampling and analysis work performed. . The QAPP shall incorporate the decisions from the planning stage. From the planning process, the project implementation and assessment shall be determined. The Quality Assurance Project Plan documents specific, detailed information for the project implementation and assessment. When applicable a QAPP shall be developed to ensure safe and reliable remedial action services and shall apply to project personnel and lower-tier subcontractors. The QAPP shall be have detailed information as follows:

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Project Organization and Responsibilities
Project Manager
Quality Assurance Manager
Environmental, Safety & Health Manager
Analytical Coordinator
Sampling Technician

PROJECT ORGANIZATION

Project Manager-PM

- The Project Manager is responsible for the implementation of the QAPP and for insuring that quality objectives are achieved during properly implemented sampling and analytical efforts associated with project operations

Quality Assurance Manager-QM

- The QA Manager, in association with the Project Manager, is responsible for insuring that quality objectives are achieved during properly implemented sampling and analytical associated with project operations

Environmental, Safety & Health Manager-ES&H

- The ES&H Manager, in association with the Project Manager, is responsible for insuring that safety objectives are achieved during sampling and analytical efforts associated with project operations

Analytical Coordinator

- Refer to the project data management implementation plan (DMIP) for detailed responsibilities

Sampling Technician

- To interface with the PM/ES&H/QA Managers on all quality-related matters; and Initiate stop-work actions when conditions or procedures adverse to safety or quality warrant immediate action.

QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT

This section should address the following: intended data use; a listing of MDL/instrument Detection limits (IDLs); a table of QC samples (duplicates, trip blanks, field blanks, and equipments rinseates) vs the number of samples by method, and matrix (include extra sample volumes for QC samples); a detailed discussion of Data Quality Objectives (DQOs), including how they will be implemented; and a table, structured by site, showing the analytical method, method number for preparation and analysis,sample media, data category, DQO level and number of samples.

Data Quality Objectives Process Steps are:

1) Define the Problem
2) Identify the Decision that Addresses the Problem
3) Identify inputs affecting the decision
4) Specify domain of the decision
5) Develop the logic statement
6) Establish constraints on uncertainty
7) Optimize the design for collecting data

QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT (Cont'd)

- The following suggests the contents of a Data Summary Package for a DQO Process:
- All potential environmental concerns have been considered and prioritized;
- The project objective has been established
- Media of interest have been identified;
- A range of decisions to address the environmental concerns has been considered
- Contaminants or characteristics of interested have been identified
- Environmental measurements and locations, sample depths, and number of samples has been identified
- Analytical methods for testing samples have been identified and actions to be taken after the data has been collected are clear
- Acceptable decision errors have been considered
- All relevant guidance and requirements documents have been reviewed and existing regulatory precedence for similar projects has been examined (to anticipate concerns which may arise); and a practice session has been conducted for any presentations to be given during the DQO meeting.

SAMPLING PROCEDURES

- This section should include the following:
- A description of sampling procedures
- A discussion of the cleaning/preparation of sample containers
- A description of sample preservation techniques and holding times
- A discussion of field logbooks/forms/notebooks
- And, a discussion of material blanks, materials certification, and readiness review.
- Use applicable Environmental monitoring procedures :
  - Audit Program
  - Conditions Adverse to Quality
  - Nonconformance Report
  - Corrective Actions
  - Correctve Action Request
  - Document Control
  - Document Review
  - Administration of Project Records
  - Storage and Maintenance of Records
  - Field Change Notice and Field Change Request
  - Documents Preparation

SAMPLE CUSTODY

This section should include the following:

- Requires documentation of sample possession from the time of collection to time of disposal. This procedure allows the possession and handling of samples from the time of collection through analysis and final disposal to be traced. The COC shall be maintained in accordance with EPA FSOPS, applicable EPA Region FSOPS and this QAPP.
- The intent of each project will be to follow EPA requirements regarding sample custody and COC protocols as described in NEIC Policies and Procedures (EPA 1985).

QUALITY CONTROL CHECKS

Field QC Checks

- QC samples will be collected at the minimum frequency identified in this QAPP to assess the quality of sampling. Field QC samples include blanks, rinseates, and duplicates.

Trip blanks

- A trip blank is a sample bottle filled with analyte-free reagent water, which shall accompany VOC samples during shipment to the laboratory. They are used to detect contamination by VOCs during the time the samples are handled and shipped

Field blanks

- Field blanks are samples of the field source waters, used in the decontamination and cleaning of sampling equipment. Primary decontamination water and final decontamination rinse waters are both considered field source waters. Field blanks shall consist of one ASTM final rinseate water per ASTM Lot # used, plus a minimum of one sample per quarter from the potable water source employed during decontamination processes

QUALITY CONTROL CHECKS (Cont'd)

Equipment Rinseates

- An equipment rinseate is a sample of the last rinse using ASTM water that has been pumped into or poured through the sampling equipment. These equipment rinseates shall be collected at a rate of approximately 5% of the samples collected. The purpose of these rinseates is to check for residual contamination as a measure of the effectiveness of decontamination.

Field Duplicates

- Field duplicates shall be collected concurrently with primary samples. Duplicates shall be sent to the laboratory responsible for analyses. Field duplicates shall be collected at a frequency of 5% of the samples collected (i.e., 1 to 20 samples collected equals 1 field duplicate; 21 to 40 samples collected equals 2 field duplicates).

Laboratory QC Procedures

- A number of laboratory QC samples will be analyzed to check and monitor laboratory performance, precision, and accuracy. Laboratory QC is necessary to assess potential impacts of interferences and contaminants during the analytical process.

Keith’s Slides

Field Method Calibration & Frequency

- Field tests will be calibrated according to the manufacturer's procedures
- Calibration frequency and criteria will be established in the QAPP and followed in the field
- Operator training and qualifications will be established in the Sampling Plan or QAPP
- Corrective actions will be established for instruments found outside calibration criteria. If necessary, back up instrumentation may be warranted.

Field Method Calibration & Frequency

Field Equipment	Calibration Verification	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
YSI® (or equivalent) Water Quality Flow Cell	Dissolved Oxygen (ambient air)	Start & End of working day	± 10% of 100% Saturation	Re-calibrate.	Field Tech	Instrument Manual & Work Plan
	pH (4.0, 7.0, 10.0) standards	Start & End of working day	± 0.1 pH unit of the standard value	Re-calibrate.	Field Tech	Instrument Manual & Work Plan
	Specific Conductance Standard	Start & End of working day	± 10% of the standard value	Re-calibrate.	Field Tech	Instrument Manual & Work Plan Attachment
	ORP Standard	Start & End of working day	± 10% of the standard value	Re-calibrate.	Field Tech	Instrument Manual & Work Plan Attachment
Field Portable Turbidity Meter	Turbidity Standards	Start & End of working day	± 10% of the standard value	Re-calibrate.	Field Tech	Instrument Manual & Work Plan Attachment

Lab Calibration Procedures & Frequency

- Calibrate instrumentation against current certified equipment or standards traceable to nationally recognized standards. Basis for calibration will be documented in the absence of such standards.
- Instrumentation shall be calibrated, adjusted, and maintained at prescribed intervals or before use.
- Instrumentation found out of calibration are (1) tagged or segregated from other equipment, and (2) disposed of or not used until they are calibrated.
- Calibration data will be recorded via instrument log or printout and include the date, operator, signature, and standard that was used. Records will be maintained for each piece of calibrated equipment to confirm that established calibration procedures have been followed.
- Instrument operators shall be qualified to perform the method.

Lab Calibration Procedures & Frequency (IC)

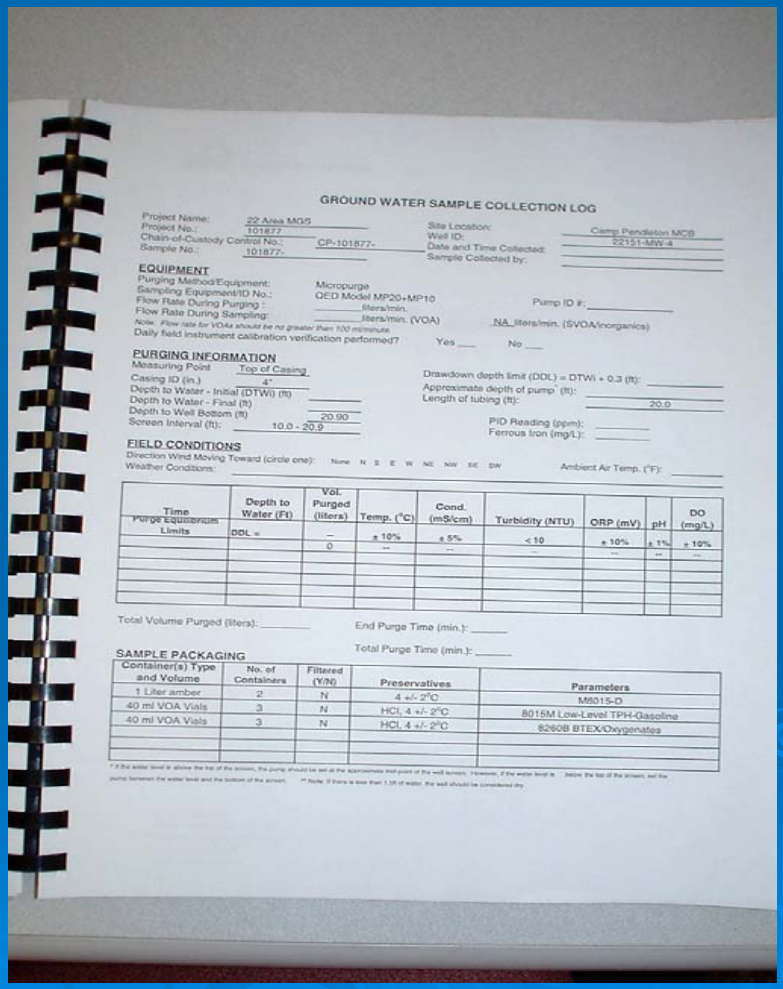
QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Initial multipoint calibration (IC), with a minimum of three standards and one calibration blank	Initial calibration prior to sample analysis	Correlation coefficient > 0.995; accepted if the initial calibration verification (ICV) passes	Correct problem, then repeat initial calibration.
Second-source ICV, prepared at the calibration midpoint	Once per initial calibration	Less than 10% difference from IC for all target analytes	Correct problem, then repeat initial calibration.
Continuing calibration verification (CCV), same source as IC	After every 10 samples and at the end of the sequence	Less than 20% difference from IC for all target analytes	Correct problem, then reanalyze previous 10 samples.
Calibration blank	After IC, before CCV calibration, after every 10 samples, and at the end of the sequence	No target analytes ≥ PQL	Re-prepare and reanalyze the blank, then recalibrate the instrument.
Demonstrate ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample	Once	QC acceptance criteria per method requirements	Recalculate results, locate and fix the problem, then rerun demonstration of those analytes that did not meet acceptance criteria.
MDL study (water only)	Once per 12-month period	MDLs will be below the PQLs	Correct problem, then repeat the MDL study.
Method blank	One per preparation batch	No target analytes ≥ PQL	Correct problem, then re-prepare and reanalyze the method blank and all samples processed with the contaminated blank.
MS/MSD for all analytes	One MS/MSD pair per preparation batch	QC acceptance criteria: 80% to 120% accuracy, 20% precision	Identify problem; if not related to matrix interference, re-prepare and reanalyze MS/MSD and all associated batch samples.
LCS or LCS/LCD pair if there is not enough sample for MS/MSD	One LCS or LCS/LCD pair per preparation batch	QC acceptance criteria: 85% to 115% accuracy, 20% precision	Correct problem, then re-digest and reanalyze LCS/LCD pair and the affected batch.
Duplicate	One per preparation batch	%D ≤ 20%	Identify problem; if not related to matrix, re-prepare and reanalyze duplicate and all associated batch samples.

Field Analytical Procedures

- Holding Times can Dictate Whether an Analysis Should be Performed in the Field or Laboratory
- Confirm that Field Methods are Suitable for Sample Matrix and Project Action Levels & Requirements
- Determine the conditions for analysis (e.g. Down Hole Well vs. Flow Cell for DO) Data
- Reporting Requirements (Logs or Electronic) will be Established

Field Documentation

- Establish Field Reporting Formats (Hardcopy vs. Electronic)
- Define the Information to be Reported
- Include Field Analytical Criteria



GROUND WATER SAMPLE COLLECTION LOG

Project Name: 22 Area MGS
Project No.: 101877
Chain-of-Custody Control No.: CP-101877-
Sample No.: 101877-

Site Location: Camp Pendleton MCB
Well ID: 22151-MW-4
Date and Time Collected:
Sample Collected by:

EQUIPMENT
Purging Method/Equipment: Micropurge
Sampling Equipment/ID No.: QED Model MP20+MP10
Flow Rate During Purging: _____liters/min.
Flow Rate During Sampling: _____liters/min. (VOA)
Pump ID #: _____
NA liters/min. (SVOA/Inorganics)
Note: Flow rate for VOAs should be no greater than 100 ml/minute.
Daily field instrument calibration verification performed? Yes ___ No ___

PURGING INFORMATION
Measuring Point: Top of Casing
Casing ID (in.): 4"
Depth to Water - Initial (DTWi) (ft): _____
Depth to Water - Final (ft): _____
Depth to Well Bottom (ft): 20.90
Screen Interval (ft): 10.0 - 20.9
Drawdown depth limit (DDL) = DTWi + 0.3 (ft): _____
Approximate depth of pump (ft): _____
Length of tubing (ft): 20.0
PID Reading (ppm): _____
Ferrous Iron (mg/L): _____

FIELD CONDITIONS
Direction Wind Moving Toward (circle one): None N S E W NE NW SE SW
Ambient Air Temp. (°F): _____
Weather Conditions: _____

Time Purge Equilibrium Limits	Depth to Water (Ft)	Vol. Purged (liters)	Temp. (°C)	Cond. (mS/cm)	Turbidity (NTU)	ORP (mV)	pH	DO (mg/L)
	DDL =	--	± 10%	± 5%	< 10	± 10%	± 1%	± 10%
		0	--	--	--	--	--	--

Total Volume Purged (liters): _____
End Purge Time (min.): _____
Total Purge Time (min.): _____

SAMPLE PACKAGING

Container(s) Type and Volume	No. of Containers	Filtered (Y/N)	Preservatives	Parameters
1 Liter amber	2	N	4 +/- 2°C	M8015-D
40 ml VOA Vials	3	N	HCl, 4 +/- 2°C	8015M Low-Level TPH-Gasoline
40 ml VOA Vials	3	N	HCl, 4 +/- 2°C	8260B BTEX/Oxygenates

* If the water level is above the top of the screen, the pump should be set at the approximate mid-point of the well screen. However, if the water level is below the top of the screen, set the pump between the water level and the bottom of the screen. ** Note: If there is less than 1.0ft of water, the well should be considered dry.

Field Methods: Include Criteria in Field Logs

Time of Reading	Duration from Start	Purge Rate (LPM)	Dynamic Depth to Water (Ft)	Cond. (mS/cm)	Temp. (°C)	pH	Turbidity (NTU)	ORP (mV)	DO (mg/ L)
Purge Equilibrium Limits	--	--	DDL =	±10%	± 10%	±1 units	<10 NTUs, If >10 NTUs, then ±10 %	±10 mV	± 10%
	0								

Laboratory Analytical Procedures

- Confirm that Analytical Methods are Suitable for Sample Matrix and Project Action Levels & Requirements
- Ensure that Analytical Methods will meet Project DQOs
- Use the Laboratory's Expertise When Establishing Requirements if a Teaming Relationship has been Established
- Confirm the Lab's Analyte List for Each Method and their Measured Detection Limits Meet the Project Analyte List & Action Limits

Laboratory Analytical Procedures

Analytical Group/ Method	Analyte	CAS Number	Units	Project Action Limit	Project Quantitation Limit	Achievable Laboratory Limits [a]	
						MDLs	QLs
TPH / 8015B	TPH -Diesel	68334-30-5	mg/L	0.1	0.1	0.1	0.5
	TPH - JP5	21274-30-0	mg/L	0.1	0.1	0.1	0.5
VOCs / 8260B	Benzene	71-43-2	µg/L	1.0	1.0	0.2	1.0
	Ethylbenzene	100-41-4	µg/L	300	5.0	0.2	1.0
	Naphthalene	91-20-3	µg/L		5.0		2.0
	Toluene	108-88-3	µg/L	150	5.0	0.2	1.0
	m,p-Xylene	108-38-3	µg/L	1750	5.0	0.5	2.0
	o-Xykene	95-47-6	µg/L	1750	5.0	0.2	1.0

Laboratory Analytical Procedures

- Ensure that Holding Times are Compatible with Conditions in the Field (e.g. Remote Locations)

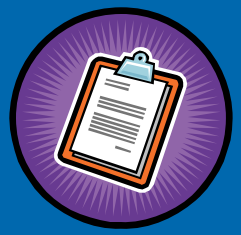
Matrix	Analytical Group	Analytical and Preparation Method/SOP Reference	Preservation Requirements	Maximum Holding Time (preparation/ analysis)
Water	Anions (Cl, SO_4, NO_3) & Carbonate/ Bicarbon-ate	EPA 300.0, 325.3, 375.4 & SM2320	Cool at 4±2ºC	28 days for sulfate & chloride 48 hours for nitrate 14 days for Carb/Bicarb
Water	Nitrate	EPA 353.2	H_2SO_4 to pH<2, Cool at 4±2°C	28 days for nitrate
Vapor	VOCs	EPA TO15	None	14 days

Laboratory Analytical Procedures

- Confirm Electronic and Hardcopy Reporting With Project Requirements
  - Standard Lab Format vs. Project Specific Format (AFCEE or CLP)
  - Level of Detail (EPA Level 2 vs. 4)
  - Electronic Formats
    - ✓Lab Standard
    - ✓Client-Specific (ERPIMS)
    - ✓Regulator-Specific (California - GeoTracker)

Analytical Laboratory Internal Data Evaluation & Processing

- In general, the analyst will process the data, either manually or by inputting the data into a computer program. For manually processed data, all the steps in the computation must be provided, including equations used and the source of input parameters such as response factors, dilution factors, and calibration constants
- When processing data acquired from instrumentation, the analyst must verify that the correct project, sample numbers, calibration constants, response factors, units, and numerical values used for detection limits are present.



Field Data Reduction

- Review the Field Documentation as it is Returned from the Field to Ensure Compliance with Project Criteria. If Warranted, Perform an Audit during First Day of Operation
- Review Calibration Data, QC, and Results Against Criteria. Check Against Historical Data, if Available
- Enter Data into Project Database from Logs or Upload from Field Computers or Instrumentation.
- Perform QC Checks on Entries or Data Uploads

Laboratory Data Reduction

- Upon Receipt, Verify that Laboratory Results have been Reported in the Prescribed Format (hardcopy & electronic). Ensure that Analyte Lists and Detection Limits Match Requirements. Verify that Analytical Results were Provided for all Requested Samples
- If Required, Perform Data Validation (3rd Party or Internal) Against Project Established Criteria Using Sampling & Lab QC Results. Add all Validation Flags per Established Procedure
- If Validation is not Required, Perform a Data Evaluation of the Sampling and Lab QC Results for the Data Quality Report
- Upload Lab Results and Perform QC Checks of Uploads to Ensure the Electronic Results Match Hardcopy

Data Verification & Validation

- When applicable, data verification/validation will be performed to ensure that the precision and accuracy of the analytical data are adequate for their intended use
- Data verification/validation will be performed to minimize the potential of using false positive or false negative concentrations in the decision-making process.
- A Review of Field & Lab Data is Performed According to the QAPP to Verify that Data Requirements have been met. Holding Times, Sample Temperatures, Field & Analytical QC Criteria, and Calibrations are all Checked for Project Compliance. In addition, a check of sample chain-of-custody is verified to ensure that the validity of the samples has not been compromised.

Data Reporting

- Database Downloads to Report Tables Ensure Consistency with Lab Reports
- Spot Check of Results against Hardcopy Helps Detect Systematic Errors
- Review Report Against DQOs to Ensure the Conclusions are Consistent with Planned DQO Decision Tree
- Review Report Against Planned Outline & Format to Ensure Client Objectives are Met

Pete’s Slides

AUDITS AND SURVEILLANCE

Audits are a very important to the QA Program.

- They provide a documented means of detecting missing quality requirements and potential problem areas.
- They form one of the basis for corrective action requirements and constitute a permanent record of the conformance of measurement systems to QA requirements.
- The QAPP should describe the audit program including planning, scheduling, performance and follow-up.

AUDITS AND SURVEILLANCE

Two types of audits are used to monitor and document the conformance with the QAPP. They are:

1. Performance Audits – that quantitatively evaluate the quality of data produced by the total measurement system.

2. System Audits – that are qualitatively on-site inspections and reviews of the total measurement system.

AUDITS AND SURVEILLANCE

Performance audits:

- provide objective assessments of the accuracy of the data collected by a given measurement system.
- provide identification of out-of-control measurements and system bias.

AUDITS AND SURVEILLANCE

System Audits:

- Provide for qualitative on-site assessments and verifications
- Reviews of the total measurement system

AUDITS AND SURVEILLANCE

- Lab Audit Areas (examples):
  - Organization & personnel qualifications
  - Sample tracking system, receipt & storage
  - Analytical instrumentation & calibration records
  - Data management, handling, review & archive
  - QA/QC program
  - Personnel training program
  - Waste handling & sample disposal
  - H&S program
  - Decontamination procedures
  - Corrective action procedures
  - Chain of custody procedures
  - Shelf-life on reagents, etc.

AUDITS AND SURVEILLANCE

Surveillance:

- Sometimes referred to as field audits, surveillance involves short-duration monitoring or the observation of an item or activity, generally by a qualified person designated as a QA surveillant.
- Surveillance, as contrasted with audits, grants wide latitude to the surveillant during the course of the surveillance.
- The qualified person must not be directly involved in the performance of the activity surveilled, and must have:
  - appropriate technical expertise
  - access to pertinent information
  - access to the areas where the surveillance is to be conducted

AUDITS AND SURVEILLANCE

Audit Records:

- Audit records include reports, responses and corrective actions taken.
- As a QA record the distribution and disposition of audit records must be identified along with their retention.

PREVENTIVE MAINTENANCE SCHEDULE

This section should include the following:

- Any equipment (an inclusive term for tools, gauges, instruments, and other items that have specific preventive maintenance) will be serviced and documented as specified by the manufacturer's recommended schedule. All service will be performed by qualified and trained individuals.

- The program should provide for item identification, control, calibration and proper use.

- Instruments which do not meet manufacturer’s standards for any reason are to be removed from service. Prior results obtained by out-of-calibration instruments must be analyzed.

DATA ASSESSMENT PROCEDURES

This section should address the following:

- The analytical data assessment objectives for laboratory analysis will produce data of known and sufficient quality to support the investigation and its resulting decisions. Appropriate procedures and QC checks will be employed to assess the level of acceptance of these parameters.
- Describe the project data management process from data gathering to final use. Referenced procedures should include the following:
  - Record keeping
  - Document control
  - Data storage & retrieval
  - Control mechanism for detecting & correcting errors; preventing loss of data during data reduction, data reporting and data entry to forms, reports and databases.

DATA ASSESSMENT PROCEDURES

Continued:

- Identify and describe all data handling equipment and procedures to process, compile and analyze the data.
- Describe the procedures for that will be followed to demonstrate acceptability of the hardware/software configuration required.
- Describe the process for assuring that applicable information resource requirements are satisfied.
- Describe how the results obtained from the project or task will be reconciled with the requirements defined by the data user or decision maker.
- Outline the proposed methods to analyze the data and determine possible anomalies or departures from assumptions established in the planning phase of data collection.

DATA ASSESSMENT PROCEDURES

Continued:

- Describe how reconciliation with user requirements will be documented, issues will be resolved, and how limitations on the use of the data will be reported to decision makers.

CORRECTIVE ACTION

This section should describe a formal process for effective corrective action :

- Corrective actions are those measures taken to rectify an occurrence that fails to meet specified criteria

- Corrective actions may be required for two major types of problems:
  - analytical/equipment problems (sample handling, instrumental analysis and data review)
  - noncompliance with specified criteria.

CORRECTIVE ACTION

- The majority of corrective actions will be of short duration.
- Corrective actions should be well documented.
- Effective corrective action should generally require a three (3) step response and approach:
  - Identify the cause
  - Fix the problem
  - Identify actions taken to preclude recurrence

QA REPORTS TO MANAGEMENT

This section should include the following:

- Results from analyses performed by the Analytical Laboratories.
- A description of deviations, deletions or additions to any phase of the project (field change requests and notifications).
- Copies of audit, surveillance and corrective action reports.
- Correspondence
- All other reporting information required to demonstrate acceptable implementation of the QAPP.

QA in Environmental Restoration Projects

Questions?