

## 9. DATA REDUCTION, VALIDATION, AND REPORTING

### 9.1 FIELD DATA

Proper documentation of all field data will enable definitive characterization of the extent and magnitude of specific contaminants at each site. Field data will contain data from all measurements performed onsite, including well stability measurements, well logging, water-level measurements, and photoionization detector (PID) measurements. Field and analytical data, in addition to the results of the field and laboratory quality control (QC) samples, will be documented and incorporated into the final report.

#### 9.1.1 *Field Data Reduction*

All field measurements and observations will be recorded in project logbooks, field data records, or similar types of recordkeeping books. Field measurements include pH, temperature, specific conductivity, water flow, and certain air quality parameters used for personal health and safety protection. All data will be recorded directly and legibly in field logbooks, with all entries signed and dated. If entries must be changed, a single line will be drawn through the incorrect entry. The reason for the change will be stated, and the correction and explanation signed and dated at the time the correction is made. Field data records will be organized into standard formats whenever possible and retained in permanent files.

Field measurements will be made by competent field geologists, engineers, environmental scientists, and technicians. The following standard reporting units will be used during all phases of the project:

- pH will be reported to 0.1 standard units
- Specific conductivity will be reported to two significant figures below 100  $\mu\text{mhos/cm}$  and three significant figures above 100  $\mu\text{mhos/cm}$
- Temperature will be reported to the nearest 0.5 degrees Celsius ( $^{\circ}\text{C}$ )
- PID and organic vapor analyzer (OVA) readings will be reported to the nearest 0.2 parts per million (ppm)
- Mine Safety Appliances, Inc. (MSA) combustible gas indicator readings will be reported to within 10 percent

- Water levels measured in wells will be reported to the nearest 0.01 foot
- Soil sampling depths will be reported to the nearest 0.5 foot
- Altitudes above National Geodetic Vertical Datum (NGVD) of 1,929 measuring points in monitoring wells will be surveyed to  $\pm 0.01$  foot precision.

The altitude and location of existing and new wells will be determined by a survey performed by a registered land surveyor. All bench marks used must be traceable to either a U.S. Coast and Geological Survey or U.S. Geological Survey (USGS) survey marker.

All laboratory data will be cross-referenced to the appropriate field QC samples (i.e., trip blanks, equipment rinsate blanks, and field duplicates) and laboratory QC samples (e.g., method blanks, U.S. Army Environmental Center [USAEC] QC samples). Data and sample identification will be cross-referenced in spread-sheet fashion, both manually and electronically. In addition, all pertinent dates (i.e., dates samples are collected, received by the laboratory, extracted, and analyzed) for each sample applicable to the Fort McClellan remedial investigation/feasibility study (RI/FS) will be referenced against the applicable holding times.

### ***9.1.2 Field Data Validation***

Field data will be validated using the procedures summarized below:

- Routine checks for accuracy will be made during data processing
- Internal consistency of a data set will be evaluated by plotting the data on control charts and testing for outliers
- Checking for data set consistency over time will be performed by visually comparing data sets against gross upper limits obtained from historical data sets
- Parallel data sets will be checked for consistency by visually comparing data sets obtained from the same population.

The purpose of these validation checks and tests is to identify outliers (i.e., an observation that does not conform to the pattern established by other observations). Outliers may be the result of transcription errors or instrumental breakdowns. Outliers also may be manifestations of a greater degree of spatial or temporal variability than expected.

After an outlier has been identified, a decision concerning its fate must be rendered. Obvious mistakes in data will be corrected when possible, and the correct value will be inserted. If the correct value cannot be obtained, the data may be excluded. An attempt will be made to explain the existence of the outlier. If no plausible explanation can be found for the outlier, it may be excluded, but a note to that effect will be included in the report. In addition, an attempt will be made to determine the effect of the outlier when both included and excluded in the data set.

Validation of field data will be performed on two different levels. First, all data will be validated by the Supervisory Geologist at the time of collection by following standard procedures and QC checks specified in Section 8. Second, data will be validated by the Site Field Manager, who will review the data to ensure that the correct codes and units have been included. After data reduction into tables or arrays, the Site Field Manager will review data sets for anomalous values. Any inconsistencies discovered will be resolved immediately, if possible, by seeking clarification from the field personnel responsible for data collection, or by reperforming the measurement. The Site Field Manager also is responsible for ensuring that defensible and justifiable data were obtained by following the field objectives described below:

- The RI/FS Quality Assurance Project Plan (QAPP) and Field Sampling Plan (FSP) will be adhered to
- Equipment and instruments will be properly calibrated and in working order
- Samples will be collected according to standard operating procedures (SOPs)
- Sufficient sample volume will be collected to maintain sample integrity and conduct all required analyses
- Samples will be properly preserved
- All applicable blanks and field QC samples will be provided with each sample set
- Complete chain-of-custody documentation will be kept throughout the duration of the field effort at Fort McClellan, and copies will be included with each sample shipment
- Field samples will arrive at the laboratory in good condition.

Random checks of sampling and field conditions will be made by the Site Field Manager, who will check recorded data at that time to confirm observations. Whenever possible, a peer

review also will be incorporated into the data validation process to maximize data consistency between field personnel.

Once field and analytical data have been combined, the resulting technical documentation will be validated against the following criteria:

- Stated QA objectives of this QAPP and the FSP
- Analysis date versus the applicable holding times
- Percentage of QA analyses conducted
- Field and laboratory blank contamination
- Instrument calibration
- Percent recoveries of USAEC laboratory QC spike samples
- Relative percent differences (RPDs) of laboratory QC samples and field duplicates
- Checks on a random selection of calculations
- Comparison of hard-copy results to the Installation Restoration Data Management Information System (IRDMIS).

Descriptive statistics for completeness will be calculated and reported.

### ***9.1.3 Field and Technical Data Reporting***

A detailed description of the type and format of the report to be produced at the culmination of the RI/FS is presented in the RI/FS Work Plan.

## **9.2 LABORATORY DATA**

Laboratory data will be reduced according to USAEC protocols. All bench chemists will document sample preparation activities in a bound laboratory notebook, which will serve as the primary record for subsequent data reduction. The data for gas chromatography/mass spectrometry (GC/MS) and inductively coupled argon plasma (ICAP) analyses will be generated by integrators and stand-alone computers. The data for graphite furnace atomic absorption (GFAA) analyses will be collected using the instrument digital read-out or meter to measure absorbance readings and strip chart recorder to record absorbance expressed in peak height units.

Results of each analysis will be transcribed automatically or electronically onto analytical results forms specific to the particular analysis. Data entered will be sufficient to document all factors and equations used to derive the reported value for each sample. All data will be checked for accuracy and precision at the bench and instrument operator/analyst level, and at the Laboratory QA Manager and project QA Manager level. Data will be stored in installation-specific (i.e., project-specific) data packs and will be traceable to the original notebook entry. Instrument strip chart recordings and computer printouts will be labeled and attached to the applicable pages in the original notebook or cross-referenced and stored in the data pack. The concentration of the analytes found in the analysis will be expressed in the required units, depending on the sample matrix. Organic analysis results will be reported in  $\mu\text{g/L}$  for water samples and  $\mu\text{g/g}$  for soil samples. Water and soil samples analyzed for metals will be reported in  $\mu\text{g/L}$  and  $\mu\text{g/g}$ , respectively. Results for soil samples will be reported on a wet-weight basis. Correction factors (e.g., percent moisture and dilution factor) are reported separately in IRDMIS and will appear on the hard copy of the transfer files.

All work completed on a sample set will be recorded in the following laboratory notebooks:

- **Standards Logbook**—The preparation and use of all standards in the laboratory will be recorded. Standard traceability of USAEC, U.S. Environmental Protection Agency (EPA), or National Institute of Standards and Technology (NIST) standards will be indicated. Date of preparation, concentration, and name of the preparer will be noted.
- **Analytical Notebook**—The raw data and final data of every batch will be recorded. All activities associated with the analytical process will be documented. Laboratory notebooks are a functional record and will be pre-numbered.
- **Instrument Benchsheet Logbook**—Sample run sequence or injections completed during one day or one shift will be recorded, noting all instrument working parameters.

### 9.2.1 Laboratory Data Reduction

**Gas Chromatography/Mass Spectrometry Results**—Qualitative identification will be determined by obtaining extracted ion current profiles (EICPs) for the primary ion mass to

charge ratio ( $m/z$ ) and the secondary masses for each compound. Positive identification will be based on the following criteria:

- The intensity of the three characteristic masses of each compound must maximize in the same ratio ( $\pm 20$  percent), within one scan of each other
- The relative retention time must fall within 30 seconds of the retention time of the authentic compound
- The relative peak heights of the three characteristic masses in the EICPs must fall within 20 percent of the relative intensities of these masses in a reference mass spectrum (e.g., standard analysis or reference library).

Structural isomers to be listed as separate compounds must have acceptable resolution. Acceptable resolution is achieved if, in a standard mix, the baseline to valley height between the isomers is less than 25 percent of the sum of the two peak heights. Otherwise, structural isomers will be identified as isomeric pairs.

The calculation for the concentration for the suspect peak will be made using the average RF for each compound, which was obtained from the daily calibration.

**Water**

$$C_w(\mu\text{g/L}) = \frac{(A_u)(C_{is})(V_t)}{(A_{is})(RF)(V_o)(V_i)}(D)$$

where:

- $C_w$  = Compound concentration ( $\mu\text{g/L}$ )
- $A_u$  = Peak area of characteristic in  $m/z$  for the compound to be measured
- $A_{is}$  = Peak area of characteristic  $m/z$  for the internal standard
- $C_{is}$  = Concentration of the internal standard (ng)
- $V_t$  = Final volume of total extract ( $\mu\text{L}$ ) used in semivolatile organic compound (SVOC) analyses
- $V_o$  = Volume of water ( $\mu\text{L}$ ) extracted or purged
- $V_i$  = Volume of extract injected for SVOC analyses ( $\mu\text{L}$ )
- $D$  = Dilution factor

RF = Compound response factor calculated from the following equation:

$$RF = \frac{(A_s)(C_{is})}{(A_{is})(C_s)}$$

where:

$A_s$  = Area of the characteristic ion for the compound being measured

$A_{is}$  = Area of the characteristic ion for the specific internal standard

$C_{is}$  = Concentration of the specific internal standard

$C_s$  = Concentration of the compound being measured.

*Soil*

$$C_s(\mu g/Kg) = \frac{(A_u)(C_{is})(V_t)}{(A_{is})(RF)(V_i)(W_s)}(D)$$

where:

$C_s$  = Compound concentration in the soil sample ( $\mu g/kg$ )

$A_u$  = Area of the characteristic ion for the compound being measured

$C_{is}$  = Internal standard concentration (ng)

$A_{is}$  = Area of characteristic ion for the specific internal standard

$V_t$  = Volume of total extract ( $\mu L$ )

$V_i$  = Volume of extract injected ( $\mu L$ )

$W_s$  = Mass of sample extracted or purged (g)

RF = Compound response factor calculated from the calibration curve using the same equation as that used for water samples.

***Gas Chromatography and High Pressure Liquid Chromatography Results***—Calculations will be performed for each compound after it is identified. Identification will be based on the relative retention time (RRT) ratio of the suspect peak compared to the internal standard as compared to the RRT calculated from the calibration curve. The concentration of the compound

will be determined by comparing the relative response factors calculated from the calibration curve and the peak area of the compound using the following equation:

**Water**

$$C_w (\mu\text{g/L}) = \frac{(A_u) \times (C_{is})}{(A_{is}) \times (RF)(V_s)}(D)$$

where:

- $C_w$  = Concentration of the compound in the sample ( $\mu\text{g/L}$ )
- $A_u$  = Compound peak area
- $C_{is}$  = Internal standard, (ng)
- $A_{is}$  = Internal standard peak area
- $V_s$  = Volume of water extracted (mL)
- $D$  = Dilution factor
- $RF$  = Compound response factor calculated from the following equation:

$$RF = \frac{(A_s)(C_{is})}{A_{is}(C_s)}$$

where:

- $A_s$  = Compound response measured in area counts from the calibration curve
- $A_{is}$  = Internal standard response measured in area counts from the calibration curve
- $C_{is}$  = Internal standard concentration
- $C_s$  = Compound concentration from the calibration curve.

**Soil**

$$C_s(\mu\text{g/Kg}) = \frac{(A_u)(C_{is})}{A_{is}(RF)(W_s)}(D)$$

where:

- $C_s$  = Compound concentration in the soil sample ( $\mu\text{g/kg}$ )
- $A_u$  = Compound response measured in area counts
- $C_{is}$  = Internal standard concentration (ng)

$A_{is}$  = Internal standard response measured in area counts

$W_s$  = Mass of sample extracted (g)

RF = Compound response factor calculated from the calibration curve using the same equation as that used for water samples.

**Atomic Absorption Spectrophotometry Results**—Photometric absorbance is governed by the relationship:

$$\text{Absorbance} = \log \frac{100}{\%T} = 2 - \log \%T$$

where:

$$\%T = 100 - \% \text{ absorption.}$$

Percent absorption is based on the amount of light of a particular wavelength absorbed by a specific metal. Its calculation is based on the loss of light after a beam of light of a particular wavelength is passed through a flame into which a solution containing metals of interest has been aspirated.

Calibration curves establishing the absorbance relationship with concentration will be generated at various concentrations. From these curves, a comparison will be made with absorbance from sample measurement. Since absorbance is directly related to concentration, a plot of the two parameters will be linear within operable ranges and will allow for determination of unknown concentrations in solutions (direct samples or extracts) after measurement of absorbances.

**Ion Chromatography**—Calibration curves establishing the relationship of peak height to concentration will be generated at various concentrations. From these curves, the peak height of the standard will be compared with the peak heights resulting from sample injection. Each parameter will be calculated by comparing the sample peak height to that of the same parameter

in the appropriate calibration curve. The following equation will be used to calculate isopropylamine in water samples:

$$C_u(\text{mg/L})=(H)(F)(D)$$

where:

$C_u$  = Concentration of isopropylamine in mg/L

H = Peak height or area

F = Response factor (i.e., ratio of the concentration of the standard against the peak height or area generated from that standard concentration)

D = Dilution factor, if applicable.

### 9.2.2 Laboratory Data Review

Data review will be performed by the analytical technician, the section leader, and the Laboratory QA Manager. This review will be accomplished through peer review of analytical data packages, routine audits of the data collection and flow procedures, and monitoring of QC sample results. Data collection and flow audits, at a minimum, will include:

- Review of sample documents for completeness by the analyst at each step of the analysis scheme
- Review of instrument logs, performance test results, and analyst performance by the analytical task manager
- Unannounced audits of report forms, notebooks, and other data sheets by the Laboratory QA Manager
- Daily review of performance indicators, such as blanks, surrogate recoveries, and matrix spike/matrix spike duplicate analyses, by the Analytical Task Manager
- Checks on a random selection of calculations by the Laboratory QA Manager
- Review by the Laboratory QA Manager of all reports before and after computerized data entry
- Completion of the Data Package Checklists, presented in Appendix T of the *USATHAMA Quality Assurance Program, PAM 11-41 (January 1990)*, by the analyst peer reviewer and Laboratory QA Manager.

Results from the analysis of USAEC QC samples and calibration check standards will be calculated and evaluated as reported. USAEC QC sample results will be plotted on control charts and submitted to USAEC for approval. Section 8.4.2 discusses control charts. Control chart submittal to USAEC is discussed in Section 14.3. If these results indicate data quality problems, immediate corrective action will be taken, and all data collected since previous QC audits will be carefully reviewed by USAEC for validity.

***Minimum Criteria for an Out-of-Control Condition***—An analytical method for a particular analyte may be considered out of statistical control whenever, as a minimum, any one of the following conditions is demonstrated by a control chart monitoring that compound or element:

- Any one point outside the control limits
- Any two consecutive points outside the warning limits
- Any seven consecutive points on the same side of the center line
- Any five consecutive points such that each point is larger (or smaller) than its immediate predecessor
- Any obvious cyclic pattern seen in the points.

### ***9.2.3 Laboratory Data Reporting***

The laboratories are required to provide all results of analysis for both analytical samples and QC samples to the USAEC IRDMIS. IRDMIS data will be transported to Potomac Research, Inc. (PRI) via modem or hard copy diskette. DataChem Laboratories (DCL) and Environmental Science & Engineering, Inc. (ES&E) are responsible for providing to USAEC all documentation to expedite the elevation of the analytical data to IRDMIS Level III. The laboratories also are responsible for providing to USAEC:

- ***Data Package***—A complete "free standing" package containing all analytical data for an analytical lot on a particular analysis. The package is to be forwarded to USAEC at the completion of the project or upon request from USAEC.
- ***Delivery Order Package***—A package containing all of the data packages associated with a specific delivery order of a contract. This package is to be submitted to USAEC at the completion of the analysis specified in the work order.

- ***Case File (when applicable)***—A data package associated with a specific case as defined in the EPA Contract Laboratory Program (CLP). When requested, this data package is to be delivered to USAEC following those guidelines specified in the EPA CLP statement of work (SOW) at the completion of the analysis of a case lot.

USAEC also might require the contractor laboratories to provide custom documentation to augment the data submission. In conjunction with the data provided to USAEC, the laboratories are responsible for providing SAIC with the analytical results for each sample, the USAEC QC sample results, method blank results, matrix spike/matrix spike duplicate or standard reference material results, and initial and continuing calibration results. This report will be submitted in summary form format.

Laboratory QC data will be reported separately from the environmental data, but grouped by analysis method. Data necessary for calculation of percent recoveries will be presented along with the analytical results. The section containing QC data also will include upper and lower control limits for percent recovery.

Evaluation of the analytical data requires that the data be reported completely and correctly. The following information is required for complete evaluation of the analytical data:

- Laboratory sample identification number
- SAIC sample identification number and site ID
- Sample collection and laboratory receipt dates
- USAEC lot identification numbers
- Sample extraction and analysis dates
- Volume or mass of sample purged or extracted
- Percent moisture for each solid sample
- Upper and lower control limits of percent recovery and relative percent difference (RPD) calculations for all applicable QC check analyses
- Parameter analyzed, analytical result, unit, and detection level of all compounds or parameters analyzed.

The following are additional analytical reporting requirements:

- All analytical results will be reported to the significant figures as specified in the USAEC-performance demonstrated method.
- Analytical results for environmental samples will be reported in groups corresponding to samples grouped on one chain-of-custody form along with the applicable laboratory QC check results. If, for any reason, one of these check samples corresponds to more than one group of samples, it should be reported with each group. The exact reporting format will be agreed upon before the laboratory receives the first sample shipment from the RI/FS at Fort McClellan.
- All QC sample analyses (e.g., method blanks, calibration data, USAEC QC samples, and surrogate recoveries) will be cross-referenced to the applicable environmental and field QC check sample analyses, include the appropriate control limits applicable to the type of analysis, and contain identifiers for data outside the control limits.
- In addition to hard-copy reporting, the laboratories will provide data on magnetic computer diskette (5 and 1/4 inch double sided, double density) in the USAEC IRDMIS format.

### 9.3 SAIC DATA VALIDATION

The Science Applications International Corporation (SAIC) QA Manager or her designee will initiate a validation of 20 to 30 percent of DCL's and ES&E's data packages which use USAEC-performance demonstrated methods. For 20 to 30 percent of the data packages, the QA Manager will inspect and verify the lot-specific USAEC Data Package Review Checklists (Appendix T of the *USATHAMA Quality Assurance Program, PAM 11-41 (January 1990)* against the corresponding lot-specific data package for completeness and accuracy. One hundred percent of the data packages for non-USAEC performance demonstrated methods will be validated.

During the process of data validation for this project, samples will be reviewed for holding times, blank contamination, calibrations, precision (i.e., laboratory and field), accuracy (i.e., laboratory and field), error determination, detection limits, QC data, and confirmed identification data. Calculations of reported results will be verified from raw data. The data package must be reviewed for content to ensure that the necessary forms and raw data required to validate the sample results are present. Laboratory QC forms (i.e., control charts) will be reviewed to ensure that the QC results fall within appropriate QC limits. In addition, summary results for hand-transcribed values and computer-generated forms will be recalculated from the

raw data to verify that the algorithms were used and that data transcription was correct. Analytical results will be checked and recalculated from raw data.

Data validation will be conducted in three stages:

1. Examination of the data package for completeness and legibility.
2. Detailed review of all QC parameters and recalculation of the sample results from the raw data. If errors are noted during validation of the package, more extensive examination of the results will be necessary to determine if the error is an isolated case confined to one particular sample or QC parameter or extended throughout the package.
3. Preparation of a data validation report for each lot-specific analysis data package reviewed. This report includes a detailed data validation assessment, the sample Form 1's for the lot evaluated, and any data validation notes. Each data validation report includes a section summary specific to each quality assurance/quality control (QA/QC) procedure to be evaluated according to the guidelines previously specified. Each summary section should clearly state whether the required QC criteria were met for that particular QA/QC procedure. If QC criteria were not met, the section summary should explicitly state the nature and extent of the problem(s) encountered, and specify which qualifiers, if any, should be applied to associated sample results.

A secondary stage of validation will occur once the initial validation for a discrete sampling event has been completed. Individual equipment rinsates and trip blanks will be associated with the corresponding environmental samples. These field QC blanks will then be evaluated following the same criteria as method blanks, and the associated environmental samples will be appropriately qualified.

After all the data validation for the project has been completed, a final project Data Quality Assessment will be written. This will discuss in the length an overall review of all validated results. This data quality control assessment will be broken into three sections: the Data Quality Objectives (i.e., precision, accuracy, representativeness, comparability, and completeness), the Field Quality Control Assessment, and the Laboratory Quality Control Assessment.

All laboratory data are approved for presentation in the RI/FS report by USAEC and the SAIC project QA Manager. The following are the basic activities that will be conducted as part of the laboratory data evaluation:

- Reconciliation of all data received with that proposed in the RI/FS Work Plan and the analyses requested on the chain-of-custody documentation. Compilation of all missing data points and notification of the Project Manager and Laboratory QA Manager.
- Review of laboratory QC check data applicable to all samples in one analytical batch (lot) for all sample shipments received. Compilation of all check points outside method control ranges. Assessment of the impact of laboratory QC data on data quality.

#### **9.4 DATA USABILITY GUIDELINES**

All data points will be evaluated to determine whether the information can be included in the risk evaluation or as the basis for remedial action decisions. This evaluation will be conducted according to the guidelines and specifications described in the October 1990 EPA document *Guidance for Data Usability in Risk Assessment* (EPA/540/G-90/008) and the following:

- Evaluation of the data validation results and assessment
- Reconciliation of all data received with that proposed in the Fort McClellan RI/FS Sampling and Analysis Plan (SAP) and the analyses requested on the chain-of-custody documentation. Compilation of all missing data points and notification of the Project Manager and Laboratory QA Manager.
- Review of USAEC QC sample data applicable to all samples in one analytical batch (lot) for all sample shipments received. Compilation of all check points outside method control ranges. Assessment of the impact of laboratory QC data on data quality.
- Review of field QC check data applicable to all samples in one sample shipment and for all shipments from the Fort McClellan RI/FS. Calculation of RPD values from concentrations of compounds or elements in the field replicate pairs, as well as compilation of all blank contamination. Assessment of the impact of field data on data quality.
- Review of USAEC data qualifiers applied to the sample data. Assessment of the impact of the qualifiers on the usability of the data.
- Closure of all corrective action directives.

- Assessment of project DQOs.
- Calculations of project completeness.

## 10. PERFORMANCE AND SYSTEM AUDITS

To verify and document that all procedures related to quality-related activities required to ensure sample integrity and data representativeness are being followed and to evaluate the effectiveness of the quality assurance (QA) Program implementation, laboratory and field audits will be performed during the Fort McClellan remedial investigation/feasibility study (RI/FS).

### 10.1 FIELD ACTIVITIES

#### 10.1.1 *Field Performance Audits*

Field performance audits will be conducted on an ongoing basis during the project as field data are generated, reduced, and analyzed. Performance audits will include an evaluation of QA practices, procedures, and instructions. Work areas, daily activities, documentation, records, standards, and field procedures will be investigated. All numerical manipulations, including manual calculations, will be documented. All records of numerical analyses will be legible, of reproduction-quality, and sufficiently complete to permit logical reconstruction by a qualified individual other than the originator.

Other indicators of the level of field performance are the analytical results of the field quality control (QC) blank and field duplicate samples. Each blank analysis is an indirect audit of the effectiveness of measures taken in the field to ensure sample integrity (e.g., field decontamination procedures). The results of the field duplicate analyses are an indirect audit of the ability of each field team to collect representative sample portions of each matrix type.

#### 10.1.2 *Field System Audits*

System audits of site activities will be accomplished by an inspection of all field site activities by an Science Applications International Corporation (SAIC) technical audit team. During this audit, the audit team will compare current field practices with procedures outlined in the project work plans (i.e., Quality Assurance Project Plan [QAPP], Field Sampling Plan [FSP], Project Management Plan [PMP], and Health and Safety Plan [H&SP]), the *USATHAMA Quality Assurance Program, PAM 11-41 (January 1990)*, and the *1987 USATHAMA*

*Geotechnical Requirements for Drilling, Monitor Wells, Data Acquisition, and Reports.* The following elements will be evaluated during field system audits at Fort McClellan:

- Overall level of organization and professionalism
- All activities conducted in accordance with the Fort McClellan QAPP, FSP, PMP, and H&SP
- All procedures and analyses conducted according to procedures outlined in this QAPP, the *USATHAMA Quality Assurance Program, PAM 11-41 (January 1990)*, and the *1987 USATHAMA Geotechnical Requirements for Drilling, Monitor Wells, Data Acquisition, and Reports*
- Level of activity and sample documentation
- Working order of instruments and equipment
- Level of QC conducted per each field team
- Contingency plans in case of equipment failure or other event preventing the planned activity from proceeding
- Decontamination procedures
- Level of efficiency with which each team conducts planned activities at one site and proceeds to the next
- Sample packaging and shipment.

After the audit is completed, any deficiencies will be discussed with the field staff and corrections will be identified. If any of these deficiencies could affect the integrity of the samples being collected, the audit team will inform the field staff so corrections can be implemented immediately. The audit team will consist of the project QA Manager and the Project Manager. The field audit checklist that will be used is presented in Appendix F of the Sampling and Analysis Plan (SAP). Corrective action procedures are outlined in Section 13.

## **10.2 LABORATORY ACTIVITIES**

DataChem Laboratories (DCL) and Environmental Science & Engineering, Inc. (ES&E) may undergo external audits by U.S. Army Environmental Center (USAEC) and SAIC as well as internal audits by the Laboratory QA Managers. The USAEC and SAIC will fill out the USAEC audit checklist, an example of which is shown in Appendix F of the SAP.

### ***10.2.1 Laboratory Performance and System Audits***

Laboratory system audits are qualitative audits of the measurement systems, ensuring that they are properly maintained and used, and will be conducted by the DCL and ES&E QA Manager or his designee on a quarterly basis and by the SAIC project QA Manager during the field investigation. Audits will include an evaluation of QA practices, procedures, and instructions; the effectiveness of implementation; and conformance with policy directives. During this evaluation, work areas, daily activities, and analytical processes will be observed, followed by review of documents and records, standards and reagents storage procedures, and housekeeping practices. These audits include the review of:

- Analytical and support instrumentation maintenance logs
- Analytical and support instrumentation calibration logs
- Refrigerator and freezer temperature records
- Distilled/deionized water supply records
- Sample tracking system
- Reference material tracking system
- Reagent chemical log-in, tracking, and disposal.

Another type of laboratory system audit is the onsite audit by the SAIC project QA Manager. During this audit, laboratory records and procedures will be inspected for completeness, accuracy, precision, and adherence to prescribed methods. This inspection will include:

- Following the sample chain-of-custody from time of sample receipt, through all analysis steps, to data reduction, verification, and report generation
- Examination of maintenance and calibration logbooks to ensure that maintenance and calibration are performed on a scheduled basis
- Examination of procedures and records for data calculation, transfer, and verification
- Spot-check of calibration, QC, and sample data from selected instruments for selected days, to ensure acceptable precision, accuracy, and completeness

- Inspection of storage areas, glassware preparation areas, and distilled/deionized water system records and procedures
- Examination of QA procedures and records (standard and spike solution logbooks and storage areas, control charts, and QA manuals).

An additional laboratory system audit will be performed by spot-checking analytical data from the laboratory. Data packages will be examined to ensure that they contain all information specific to that particular sample lot. During the time that analytical activities are being conducted, the laboratory will be requested to send the project QA Manager data packages for a fraction of the samples under analysis. Data packages will be reviewed by the project QA Manager for completeness, accuracy, precision, technical competence, and adherence to method specifications. Any deficiencies identified during this data review will be addressed immediately by the Laboratory Director and the Project Manager and corrective action will be taken.

In the event that a major defect is discovered as a result of one of these audits, a followup inspection will be conducted after sufficient time has passed for correction of the deficiency, or evidence of correction of the deficiency may be presented by the laboratory. Corrective action will be taken for any deficiencies noted during the audit. Corrective action is discussed in Section 13.

#### ***10.2.2 USAEC External Laboratory Audits***

An onsite inspection will be conducted by USAEC audit team personnel to review the laboratory QA system developed for all samples analyzed as part of the USAEC Program. This system includes sample handling, sample analysis, document control, preventive maintenance, and proficiency testing. When USAEC personnel initiate a system audit of the analytical laboratory, any recommendations made will be considered for implementation and any deficiencies identified will be followed by immediate corrective action. These audits may or may not be announced and are at the discretion of USAEC.

### 10.3 TECHNICAL QUALITY REVIEW

All Fort McClellan RI/FS deliverables will be reviewed by a peer reviewer(s) to ensure that all project requirements have been met. Each Peer Reviewer must be adept in the area which they are reviewing (e.g., QA, field sampling, health and safety), and familiar with the procedures and policies covered in that document. This peer review will include as a minimum: comparing the document to the applicable USAEC QA document (i.e., PAM 11-41, ER 1110-1-263) and Task Order requirements, ensuring that all applicable state requirements are met, ensuring that all SAIC and/or subcontractor (i.e., analytical laboratory, soil gas survey) procedures and policies have been incorporated, and performing an editorial review to ensure consistency of context and format, presentation and clarity of information, and that the document is free of grammatical and typographical errors. Each Peer Reviewer will complete and return the *Document Review Record*, presented in Figure 10-1, along with the copy of the review document. If necessary, the peer reviewers will meet with the RI/FS project team to discuss substantive or systematic problems detected in the deliverables.

**SCIENCE APPLICATIONS INTERNATIONAL CORPORATION  
ENVIRONMENTAL COMPLIANCE GROUP**

**DOCUMENT REVIEW RECORD**

DOCUMENT PREPARER: \_\_\_\_\_ SHEET \_\_\_\_ of \_\_\_\_  
 DOCUMENT TITLE: \_\_\_\_\_  
 DOCUMENT NUMBER: \_\_\_\_\_  
 REVISION: \_\_\_\_\_  
 DATE TRANSMITTED: \_\_\_\_\_ DATE COMMENTS REQUIRED: \_\_\_\_\_  
 REVIEW TYPE:     TECHNICAL     EDITORIAL     PEER     DESIGN VERIFICATION

**COMMENTS THAT ARE ANNOTATED WITH AN (\*) ARE MANDATORY AND REQUIRE RESPONSE AND RESOLUTION.**

PAGE OR SECT./ PARA.	REVIEWER COMMENTS	PREPARER RESPONSE	REVIEWER ACCEPT/ REJECT

<b>REVIEWED BY</b>		<b>RESPONSE BY</b>	
_____ Signature	_____ Date	_____ Signature	_____ Date

**Figure 10-1. Document Review Record**

13.910124.01

## 11. PREVENTIVE MAINTENANCE

### 11.1 FIELD EQUIPMENT

Preventive maintenance will be performed on all field equipment before it is shipped to Fort McClellan. This preventive maintenance will include regular battery checks and maintenance of a sufficient stock of spare parts and supplies. Field personnel are strongly cautioned that these instructions are for general purpose only. Should equipment malfunction in the field and field crews are unable to repair the piece within a reasonable amount of time, the Equipment Manager in Science Applications International Corporation (SAIC's) Oak Ridge, Tennessee, office will be notified. A replacement will be shipped immediately by overnight courier. Whenever possible, duplicates of all equipment will initially be shipped to the field. For specific preventive maintenance procedures, the appropriate instrument manual should be consulted.

Manufacturer's procedures identify the schedule for servicing critical items to minimize the downtime of the measurement system. It will be the responsibility of the operator to adhere to this maintenance schedule and to arrange necessary and prompt service as required. Service to the equipment, instruments, tools, and gauges will be performed by qualified personnel. In the absence of any manufacturer-recommended maintenance criteria, a maintenance procedure will be developed by the operator, based upon experience and previous use of the equipment.

Logs will be established to record maintenance and service procedures and schedules. All maintenance records will be documented and traceable to the specific equipment, instruments, tools, and gauges. Records produced will be reviewed, maintained, and filed with all other project-specific documentation when and if equipment, instruments, tools, and gauges are used at the sites. The Project Manager will audit these records to verify complete adherence to these procedures.

A list of critical user-replaceable spare parts will be requested from the manufacturer and identified by the operator. These spare parts will be stored for availability and use to reduce the downtime. Table 11-1 summarizes the preventive maintenance program for field instrumentation.

**Table 11-1. Field Equipment Preventive Maintenance Requirements**

Instrument	Items Checked/Service	Frequency	Critical Spare Parts
HNU PID	<ul style="list-style-type: none"> <li>• Check and recharge batteries</li> <li>• Check UV light source</li> <li>• Check all cables</li> <li>• Clean unit</li> </ul>	<ul style="list-style-type: none"> <li>• Daily, as needed</li> <li>• Daily, as needed</li> <li>• Daily, as needed</li> <li>• Daily, as needed</li> </ul>	<ul style="list-style-type: none"> <li>• Batteries, lamps, cables</li> </ul>
Organic Vapor Analyzer	<ul style="list-style-type: none"> <li>• Check and recharge batteries</li> <li>• Check cables/cords</li> </ul>	<ul style="list-style-type: none"> <li>• Daily, as needed</li> </ul>	<ul style="list-style-type: none"> <li>• Batteries, cables</li> </ul>
MSA Combustible Gas Indicator	<ul style="list-style-type: none"> <li>• Recharge battery</li> <li>• Clean sample inlet filter</li> <li>• Check filter O-ring, inlet seal O-ring</li> </ul>	<ul style="list-style-type: none"> <li>• Every 8 hours and/or each period of operation</li> <li>• Every 8 hours and/or each period of operation</li> <li>• Before each use</li> </ul>	<ul style="list-style-type: none"> <li>• Batteries, filter O-ring, inlet seal O-ring</li> </ul>
pH Meter	<ul style="list-style-type: none"> <li>• Clean and inspect meter</li> <li>• Clean electrode</li> <li>• Check batteries</li> </ul>	<ul style="list-style-type: none"> <li>• Daily, as needed</li> <li>• Daily and/or between every analytical sample</li> <li>• Daily</li> </ul>	<ul style="list-style-type: none"> <li>• Spare electrodes, batteries</li> </ul>
Specific Conductance Meter	<ul style="list-style-type: none"> <li>• Check battery</li> <li>• Clean probe</li> </ul>	<ul style="list-style-type: none"> <li>• Checked daily, replaced as needed</li> <li>• Daily and/or between each sample</li> </ul>	<ul style="list-style-type: none"> <li>• Batteries, probes</li> </ul>
Thermometer	<ul style="list-style-type: none"> <li>• Clean thermometer</li> <li>• Visually inspect for cracks and abrasions</li> </ul>	<ul style="list-style-type: none"> <li>• Daily and/or between samples</li> <li>• Before each use and at end of day</li> </ul>	<ul style="list-style-type: none"> <li>• Thermometers</li> </ul>

### ***11.1.1 HNu Photoionization Detector***

In general, the preventive maintenance procedures to be conducted on this instrumentation include battery checks, checking the ultraviolet (UV) light source, and checking all cables. All other maintenance will be conducted by the manufacturer.

### ***11.1.2 Organic Vapor Analyzer***

The organic vapor analyzer (OVA) must be kept clean for accurate operation. Foreign materials can be rinsed off or blown out of the detector. The internal battery should be fully charged before going into the field every one to four days. The battery check indicator should be examined routinely. The cord between the analyzer and the recorder should be inspected for visible evidence of damage and replaced, if required. All other maintenance should be performed at an authorized service center. Hydrogen should be refilled at a specialist gas or welding shop.

### ***11.1.3 MSA Combustible Gas Indicator***

Each time or each 8-hour period of operation, whichever is more frequent, the MSA combustible gas indicator is used, the battery should be recharged and the sample inlet filter should be examined for cleanliness. If the filter element appears to be coated with dirt or dust, it should be washed, dried, and reinserted, or a new element should be substituted. A new filter O-ring should be installed with the new element. The inlet seal O-ring in the inlet filter cap should be checked to ensure that it is properly seated. If the O-ring is damaged or missing, it should be replaced before the instrument is used again.

### ***11.1.4 pH Meter***

The following is a description of the preventive maintenance procedures for the field pH meters:

***Charging Batteries***—After the initial charge when first placing the instrument in operation, the batteries should be recharged after each 30 hours of operation. Allow the batteries to charge 16 hours to restore them fully. Exceeding the 16-hour period will not damage the batteries. Overnight charging is recommended, and periods of operation

between charges should not exceed 30 hours. With proper charging practices, a set of batteries should last for more than 300 charge cycles.

**Battery Replacement**—When batteries no longer hold a charge for a reasonable length of time, they should be replaced. This unit requires six AA-size, nickel-cadmium batteries. Replace them as follows:

- Remove the accessories from the foam insert above the instrument panel
- Remove the four screws securing the panel in the case
- Lift the panel from the case and place it face down on a padded surface
- Pry the batteries from their clips with a screwdriver and replace all six batteries
- Replace the panel in the case, and replace the accessories in the foam insert
- Connect the charger unit to the instrument and allow the batteries to charge for 15 hours.

**pH Electrode Care and Storage**—When the electrode is not in use, the wetting cap with filling solution-soaked cotton should be reinstalled over the tip, and the fill hole cover should be placed over the hole. This will prevent loss of filling solution through evaporation. Always maintain the filling solution level just below the fill hole.

**pH Electrode Cleaning**—Normal cleaning of the electrode can be performed in the following manner:

- Immerse the electrode tip in 0.1 N hydrochloric acid followed by immersion in 0.1 N sodium hydroxide and again in 0.1 N hydrochloric acid, each for a 2-minute period. Rinse with American Society for Testing and Materials (ASTM) Type II reagent water and soak in pH 7 buffer solution for 30 minutes.
- If the electrode is slow to respond or readings are unstable and the condition cannot be remedied with normal cleaning, the reference junction may be clogged. Clean the junction for 10 minutes in dilute potassium chloride solution. First dilute a saturated potassium chloride solution about 1:10 with water. Place the electrode tip in the boiling solution for approximately 10 minutes.
- Remove the heat and allow the electrode to cool while immersed in the solution. Then, rinse with ASTM Type II reagent water and soak in pH 7 solution before testing again.
- If these steps fail to improve electrode response, replace the electrode. If the pH bulb becomes contaminated or left dry, it may be reconditioned by following the cleaning procedures above.

### ***11.1.5 Specific Conductance Meter***

Preventive maintenance procedures for the field specific conductivity meters consist of battery replacement. Low battery condition is indicated by an arrow on the liquid crystal display (LCD) display. When the arrow appears, the battery should be replaced.

### ***11.1.6 Thermometer***

After each use, the thermometer probe will be rinsed with ASTM Type II reagent water. Should the sample contain oils or other heavy hydrocarbon mixtures, the probe will be washed with laboratory-grade detergent and rinsed with ASTM Type II reagent water. The thermometer will be visually inspected for cracks and abrasions before being placed in the protective case.

## **11.2 LABORATORY INSTRUMENTATION**

As part of their quality assurance/quality control (QA/QC) program, a routine preventive maintenance program is conducted by DataChem Laboratories (DCL) and Environmental Science & Engineering, Inc. (ES&E) to minimize the occurrence of instrument failure and other system malfunctions. The instrumentation preventive maintenance program is summarized in Table 11-2 and is in accordance with the requirements of the *USATHAMA Quality Assurance Program, PAM 11-41 (January 1990)*. Most instruments are maintained by the manufacturers under contract. Each instrument is labeled with a unique number and instrument information in accordance with U.S. Army Environmental Center (USAEC) requirements. Instrument service records and maintenance calibrations are maintained by the appropriate section and in a logbook unique for each instrument. The following summarizes the preventive maintenance particular to each type of equipment.

### ***11.2.1 Gas Chromatography/Mass Spectrometry***

Thorough preventive maintenance is scheduled to be performed at quarterly intervals. The preventive maintenance includes the following services:

- Water filter change
- Mechanical pump oil change

**Table 11-2. Laboratory Preventive Maintenance Requirements**

Instrument	Items Checked/Serviced	Frequency	Critical Spare Parts
Gas Chromatograph	<ul style="list-style-type: none"> <li>• Replace column packing, clean detector, change glass wool plug, clean insert</li> <li>• Replace septa</li> <li>• Replace incoming gas drying cartridges</li> <li>• Change effluent adsorbent traps</li> <li>• Check oven performance</li> </ul>	<ul style="list-style-type: none"> <li>• Determined by analyst so that the calibration is within required specifications</li> <li>• Daily, as needed</li> <li>• When color change is observed</li> <li>• Every month</li> <li>• Daily, check retention time of standards</li> </ul>	<ul style="list-style-type: none"> <li>• Sec GC/MS</li> </ul>
Atomic Absorption Spectrophotometer	<ul style="list-style-type: none"> <li>• Perform 3-point calibration, and if readings are low, the operator checks the gas flows, burner, or cell alignment, wavelength slit width, photomultiplier voltage, and lamp intensity prior to analysis</li> <li>• Change graphite tubes and contact rings</li> <li>• Clean burner heads, nebulizers, and quartz cells according to manufacturer instructions whenever excessive noise is apparent or whenever indicated by visual inspection</li> <li>• Tygon tubing</li> <li>• Optical lenses</li> </ul>	<ul style="list-style-type: none"> <li>• Daily, as needed</li> <li>• Daily, as needed</li> <li>• Daily, as needed</li> <li>• 6 months, or if deterioration is observed</li> <li>• As needed</li> </ul>	<ul style="list-style-type: none"> <li>• Nebulizers, contact rings, graphite tubes, quartz windows, spare lamps</li> <li>• Lenses</li> </ul>
Technicon Auto Analyzer	<ul style="list-style-type: none"> <li>• Lens</li> <li>• Wavelength checked</li> <li>• Tubing checked</li> <li>• Pump maintained</li> <li>• Syringes</li> <li>• Clean System</li> </ul>	<ul style="list-style-type: none"> <li>• As needed</li> <li>• During calibration steps, as needed</li> <li>• Daily</li> <li>• Weekly</li> <li>• Daily</li> <li>• Weekly</li> </ul>	<ul style="list-style-type: none"> <li>• Lens</li> <li>• Tubing</li> <li>• Pump oil</li> <li>• Syringes</li> </ul>

**Table 11-2. Laboratory Preventive Maintenance Requirements (continued)**

Instrument	Items Checked/Service	Frequency	Critical Spare Parts
High Pressure Liquid Chromatography	<ul style="list-style-type: none"> <li>• Check plumbing</li> <li>• Check pump pressure</li> <li>• Flush column</li> <li>• Check filters, columns, fittings, and tubing</li> </ul>	<ul style="list-style-type: none"> <li>• Daily, as needed</li> <li>• Daily, as needed</li> <li>• Prior to analysis</li> <li>• Weekly, as needed</li> </ul>	<ul style="list-style-type: none"> <li>• Filters, columns, fittings, tubing</li> </ul>
Analytical Balance	<ul style="list-style-type: none"> <li>• Internal weight, train, gears, electronics</li> </ul>	<ul style="list-style-type: none"> <li>• Annual service</li> </ul>	
Inductively Coupled Plasma Spectrophotometer	<ul style="list-style-type: none"> <li>• Sample introduction system (aspirator)</li> <li>• Check pumps and tubing</li> <li>• Clean nebulizer</li> <li>• Clean sample probe</li> </ul>	<ul style="list-style-type: none"> <li>• Daily</li> <li>• Weekly</li> <li>• As needed</li> <li>• Monthly</li> </ul>	<ul style="list-style-type: none"> <li>• Torches, nebulizers, pump tubing, torch collars (bonnets)</li> </ul>
Ion Chromatograph	<ul style="list-style-type: none"> <li>• Check plumbing</li> <li>• Check filter (inlet)</li> <li>• Flush column</li> <li>• Check bed support</li> </ul>	<ul style="list-style-type: none"> <li>• Daily, or when used</li> <li>• Weekly</li> <li>• After each new sample</li> </ul>	<ul style="list-style-type: none"> <li>• Syringes, columns</li> </ul>
Infrared Spectrophotometer	<ul style="list-style-type: none"> <li>• Clean cells</li> </ul>	<ul style="list-style-type: none"> <li>• When specifications are off</li> </ul>	<ul style="list-style-type: none"> <li>• Cells</li> </ul>
pH Meters	<ul style="list-style-type: none"> <li>• Gel-filled, maintenance-free</li> </ul>	<ul style="list-style-type: none"> <li>• Daily check with 3 calibration standards</li> </ul>	<ul style="list-style-type: none"> <li>• Spare electrode</li> </ul>
Mercury Analyzer	<ul style="list-style-type: none"> <li>• Check gas lines for leaks</li> <li>• Clean cell</li> <li>• Check lamp power</li> <li>• Reagent pumps</li> </ul>	<ul style="list-style-type: none"> <li>• Daily</li> <li>• Daily</li> <li>• Daily</li> </ul>	<ul style="list-style-type: none"> <li>• New lines</li> <li>• New cells</li> <li>• New lamps</li> </ul>

**Table 11-2. Laboratory Preventive Maintenance Requirements (continued)**

Instrument	Items Checked/Service	Frequency	Critical Spare Parts
GC/MS	<p>GC/MS maintenance is the same as GC with the following additions:</p> <ul style="list-style-type: none"> <li>• Clean filters on cooling fans</li> <li>• Check cooling fan for proper operation</li> <li>• Check line voltage</li> <li>• Clean CDC disc drive prefilter</li> <li>• Check cool-flow level</li> <li>• Check power supplies in QEM box</li> <li>• Change mechanical pump oil</li> <li>• Clean source and rods</li> <li>• Clean inside and outside of printer</li> <li>• General cleaning of instrument</li> <li>• All items from monthly maintenance schedule</li> <li>• Change primary filters on CDC disc drive</li> <li>• Sensitivity analysis through use of BFB and DFTPP tune criteria</li> </ul>	<ul style="list-style-type: none"> <li>• Monthly</li> <li>• Monthly</li> <li>• Monthly</li> <li>• Monthly</li> <li>• Monthly</li> <li>• Every 4 months</li> <li>• Every 6 months</li> <li>• Every 12-hour clock</li> </ul>	<ul style="list-style-type: none"> <li>• Analyzer parts; consumable parts, filaments, filters, septa, syringes, ferrules, gaskets, O-ring, etc.</li> <li>For printer: spare head, tape, ribbon, etc.</li> </ul>
Ultraviolet (UV/VIS) Spectrophotometers	<ul style="list-style-type: none"> <li>• Lamp and wavelength checked or serviced</li> <li>• Serviced</li> <li>• Wash, rinse, and dry cells</li> </ul>	<ul style="list-style-type: none"> <li>• As needed or during calibration steps</li> <li>• As needed or yearly</li> <li>• Each use</li> </ul>	<ul style="list-style-type: none"> <li>• Lamps</li> <li>• Replacement cells</li> </ul>

- Analyzer cleaned as required
- Ionizer cleaned as required
- Filter cleaned
- System calibration
- Module function checks
- Sensitivity analysis
- Disc drive filters changed.

In addition, the gas chromatography/mass spectrometry (GC/MS) system resolution and performance will be evaluated and calibrated using decafluorotriphenylphosphine (DFTPP) or bromofluorobenzene (BFB) to satisfy U.S. Environmental Protection Agency (EPA)-specified criteria. GC/MS system sensitivity will be tested by 50-nanogram injections of DFTPP or 4-BFB for the electron impact ionization mode.

### *11.2.2 Gas Chromatography*

Preventive maintenance includes a daily performance check and calibration of standards. Parameters such as retention time and response factors are observed and back-checked with prior operational performance. Other preventive maintenance includes:

- Septa are replaced daily, as needed
- Incoming gas drying cartridges are replaced whenever a color change of the adsorbent is noticed; effluent adsorbent traps are changed every month
- Column packing is replaced, glass wool plugs are changed, GC detectors are cleaned, and injection port inserts are cleaned whenever calibration and resolution criteria are not met.

In addition, all method and/or EPA-specified criteria for resolution and performance are met before analysis may proceed.

### ***11.2.3 Atomic Absorption Spectrophotometers, Mercury Analyzers, and Inductively Coupled Argon Plasma Systems***

A number of instrumental variables will be checked for performance consistency as a part of preventive maintenance: instrument warmup, gas flow, lamp intensity, slit width, wavelength, and matrix effects. Preventive maintenance procedures include a minimum warmup period of 30 minutes. The hollow cathode lamp will be aligned to produce the maximum emitted light to the detector and the inert gas flow inside the furnace will be optimized to ensure maximum sensitivity.

The digital readout values obtained for the standard curve of each element will be checked to ensure that they fall within a specified range. If readings are excessively low or high, the operator will check gas flows, cell alignment, wavelength, photomultiplier voltage, and lamp intensity before analysis. Burner heads, nebulizers, optical lenses, quartz cells, and sampler probes will be cleaned according to manufacturer's instruction, whenever excessive electronic noise is apparent or whenever indicated by visual inspection. Tygon® tubing will be replaced when deterioration is apparent, and reagent and instrument pumps will be checked weekly to ensure they are functioning properly.

### ***11.2.4 High Pressure Liquid Chromatography***

On a daily basis or as used, the plumbing and pump pressure will be checked. Filters, columns, fittings, tubing will be checked on a weekly basis or if poor response and shifting of retention times is observed. Flush column with mobil phase prior to analysis of samples. The high pressure liquid chromatography (HPLC) will be calibrated as specified by the method, before each use to ensure that all method criteria are being met. HPLCs will be serviced at least once a year by the manufacturer. At this time, all required maintenance will be performed.

### ***11.2.5 Ion Chromatography***

On a daily basis or as used, the plumbing and pump pressure will be checked. Filters, columns, fittings, and tubings will be checked on a weekly basis or if poor response and shifting of retention times is observed. The ion chromatograph (IC) will be calibrated, as specified by the method, before each use to ensure that all method criteria are being met. ICs will be

serviced at least once a year by the manufacturer. At that time, all required maintenance will be performed.

#### *11.2.6 General Laboratory Equipment*

The most prevalent equipment type in this category is analytical balances of various capacities and operational modes. The balances will be cleaned and adjusted annually by a specialist and officially recorded as a verification of performance. All combination pH electrodes will be stored in a pH 7 buffer solution. A high-purity water system will be used to produce water that is free from particulates and total dissolved solids (TDS) and has a conductivity of 18 megohm/cm. The purity will be checked before every use with a resistivity meter. When the water resistivity drops below 12 megohm/cm (or conductivity rises above 12 megohm/cm), new deionizing and filtration cartridges will be installed.

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## 12. SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS

### 12.1 FIELD DATA

#### 12.1.1 Precision

Duplicate water and soil samples collected at Fort McClellan and analyzed by the laboratories will assess the precision of the sampling effort. Control limits for duplicate relative percent differences (RPDs) will be set at 0 to 20 percent to provide an initial guide. Once a sufficient amount of duplicate data become available, field precision control charts will be constructed similarly to the laboratory precision charts. For any given concentration, the mean and standard deviation of the replicates will be calculated. The mean is the centerline. Data from each sample set will be pooled with previous sample sets to generate control and warning limits for the next set. Warning and control limits for all samples are set at  $\pm 2s$  and  $\pm 3s$ , respectively. Data outside of any control limit are subject to quality assurance (QA) review.

#### 12.1.2 Accuracy

Field instruments will be calibrated daily or more frequently, if needed, to ensure accuracy of field parameter measurements. All blanks associated with each sample set will be analyzed and evaluated for cross-contamination. Blank contamination and the resulting corrective action will be assessed on an individual basis.

#### 12.1.3 Completeness

The Site Field Manager is responsible for ensuring that all field instrumentation and equipment are functioning properly and calibrated according to set procedures, and that all data are recorded accurately and legibly. In addition, the Site Field Manager must ensure that all sites are sampled for all of the specified analyses, sufficient sample volume has been provided to complete those analyses, and all of the quality control (QC) samples have been included with each sample set. For the purposes of this project, the goal for completeness for each sample set shipped to the laboratory will be 100 percent. The minimum acceptable completeness limit is 90 percent.

## 12.2 LABORATORY DATA

### 12.2.1 Precision

Precision will be based upon the results of the RPDs as calculated from the percent recoveries of the U.S. Army Environmental Center (USAEC) QC samples, matrix spike/matrix spike duplicates (MS/MSDs), and field duplicates associated with this project, for each parameter of interest. The control limits for precision will be based on historical laboratory data. The following equation is used to calculate RPD:

$$RPD = \frac{|V_1 - V_2|}{\left(\frac{V_1 + V_2}{2}\right)} \times 100$$

where:

$V_1$  and  $V_2$  are the sample concentrations obtained by analyzing the duplicate samples.

Analytical precision for USAEC QC samples will be monitored on the single-day and three-point moving average control charts.

### 12.2.2 Accuracy

Unless otherwise directed by the requirements of a project, accuracy control charts typically will be generated as follows:

- Analytical accuracy will be determined from percent recovery calculated from USAEC QC sample spike recoveries performed with each analytical lot.
- Matrix affected accuracy will be determined from percent recovery calculated from MS/MSDs performed at the rate of 1 set every 20 samples. Advisory control limits for present recovery of MS/MSDs are defined in Section 8.

The following equation is used to calculate percent recovery (PR):

$$PR = \frac{S_s - S_o}{S_a} \times 100$$

where:

$S_s$  = Value obtained by analyzing the sample with the spike added

$S_o$  = The background value, obtained by analyzing the sample

$S_a$  = Concentration of the spike added to the sample.

### *12.2.3 Completeness*

Completeness will be expressed as the percentage of valid data obtained compared to the amount of data expected, based on all samples received by the laboratory. For the percent recovery required to ensure data accuracy, unless specified in the method, a minimum of 90 percent completeness will be the goal for the project. The completeness of the analytical data to be delivered to the Fort McClellan remedial investigation/feasibility study (RI/FS) Project Manager will be evaluated by the Science Applications International Corporation (SAIC) project QA Manager.

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## 13. CORRECTIVE ACTION PROCEDURES

### 13.1 INITIATION OF CORRECTIVE ACTION

When a significant condition adverse to quality is noted at the project site, laboratory, or subcontractor locations, the cause of the condition will be determined and corrective action taken to preclude repetition. Condition identification, cause, reference documents, and corrective action planned to be taken will be documented and reported to the Project Manager, project Quality Assurance (QA) Manager, Site Field Manager, and involved subcontractor management, as a minimum. Implementation of corrective action will be verified by documented followup action. All project personnel have the responsibility, as part of their normal work duties, to promptly identify and solicit approved correction, and report conditions adverse to quality.

Corrective actions may be initiated as a result of the following circumstances, as a minimum:

- When predetermined acceptance standards are not met (objectives for precision, accuracy, and completeness)
- When procedures or data compiled are determined to be incorrect
- When equipment or instrumentation is found incorrectly operated or maintained
- When the custody of the remedial investigation/feasibility study (RI/FS) samples and analytical results cannot be traced with certainty
- When QA requirements have not been achieved
- When designated approvals have not been obtained
- As a result of nonconformances observed during system and performance audits
- As a result of a management assessment
- As a result of unsatisfactory laboratory or interlaboratory comparison studies or performance evaluation results.

## **13.2 PROCEDURE DESCRIPTION**

Project management and staff, including field investigation teams, QA auditors, document and sample control personnel, and laboratory groups, monitor ongoing work performance in the normal course of their daily responsibilities.

Work will be audited at the site, laboratories, and subcontractor locations by the project QA Manager or her designee. Noncompliant items, activities, or documents will be documented and corrective actions mandated by submittal of a nonconformance report (NCR) (as presented in Figure 13-1) specific to each item, activity, or document, and attached to the audit report. NCR forms are logged, maintained, and controlled by the project QA Manager. NCRs will be directed to the U.S. Army Environmental Center (USAEC) Chemistry Branch and Fort McClellan Project Manager for response and concurrence on corrective action procedures. The project QA Manager will verify that all appropriate corrective action procedures have been conducted, the nonconformance has been resolved, and the corrective measures taken will prevent a recurrence.

Following identification of an adverse condition or QA problem, notification of the deficiency will be made to the Project Manager and the senior individual in charge of the activity found to be deficient, along with recommendations for correction. A record of this notification will be attached to the audit report. Following implementation of corrective action, the senior individual in charge will report actions taken and results to the Project Manager and project QA Manager. The project QA Manager will notify the USAEC Project Manager when conditions adverse to quality have been corrected. A record of action taken and results will be attached to the audit report.

## **13.3 FIELD CORRECTIVE ACTION**

The initial responsibility for monitoring the quality of field measurements lies with the field personnel. The Supervisory Geologist is responsible for following all QA procedures and ensuring that the subcontractor personnel are also following these procedures. The Site Field Manager is responsible for verifying that these procedures are being followed and directing immediate corrections, as necessary. This verification requires that the Site Field Manager

# NONCONFORMANCE REPORT

DATE OF NCR: \_\_\_\_\_ NCR NUMBER \_\_\_\_\_

LOCATION OF NONCONFORMANCE \_\_\_\_\_

PAGE \_\_\_\_\_ OF \_\_\_\_\_

INITIATOR (Name/Organization/Phone) \_\_\_\_\_ FOUND BY \_\_\_\_\_ DATE FOUND \_\_\_\_\_

RESPONSIBLE ORGANIZATION/INDIVIDUAL \_\_\_\_\_

DESCRIPTION OF NONCONFORMANCE \_\_\_\_\_

**A** INITIATOR \_\_\_\_\_ Date \_\_\_\_\_ QA/QC OFFICER \_\_\_\_\_ Date \_\_\_\_\_ YES NO  
CAR REQ'D

DISPOSITION, PROBABLE CAUSE AND ACTIONS TAKEN TO PREVENT RECURRENCE: \_\_\_\_\_

PROPOSED BY: \_\_\_\_\_  
**B** NAME \_\_\_\_\_ Date \_\_\_\_\_ INITIATOR \_\_\_\_\_ Date \_\_\_\_\_

VERIFICATION OF DISPOSITION AND CLOSURE APPROVAL

REINSPECTION/RETEST REQUIRED  YES  NO  
IF YES: \_\_\_\_\_  
Date \_\_\_\_\_ Result \_\_\_\_\_

ACCEPTABLE  NOT ACCEPTABLE

QUALITY ASSURANCE: \_\_\_\_\_  
**C** NAME \_\_\_\_\_ Date \_\_\_\_\_

Figure 13-1. Nonconformance Report

assess the correctness of the field methods and the ability of the RI/FS team to meet QA objectives and make a subjective assessment of the impact a procedure has upon the field objectives and resulting data quality. If a problem occurs that might jeopardize project integrity, cause a QA objective not to be met, or affect data quality, the Site Field Manager will immediately notify the Project Manager and project QA Manager, as appropriate. Corrective action measures will be formulated and implemented. If the Project Manager or project QA Manager decides the situation warrants, the USAEC Chemistry Branch will be notified. The Supervisory Geologist will document the situation, the field objective affected, the corrective action taken, and the results of that action. Copies of the documentation will be provided to the Project Manager and the project QA Manager. Examples of situations requiring corrective action encountered in the field are listed in Table 13-1. An example of the proposed field corrective action form is presented in Figure 13-2.

#### **13.4 LABORATORY CORRECTIVE ACTION**

Corrective action may be required due to the following situations: equipment malfunction, failure of internal QC checks, method blank contamination, failure of performance or system audits, and noncompliance with QA requirements.

When measurement equipment or analytical methods fail to meet QC requirements, the problem will immediately be brought to the attention of the Analytical Task Manager and the Laboratory QA Manager. If failure results from equipment malfunction, the equipment will be repaired and recalibrated and the analysis will be rerun. All attempts will be made to reanalyze all affected parts of the analysis so that the results are not affected by failure to meet QC requirements. Where this is not possible, data reported will be flagged with a note as to the reason for the flag. All incidents of failure to meet QC requirements and the corrective action taken will be documented. The laboratory will notify the USAEC Chemistry Branch of any problems requiring approval or notification (i.e., coolant blank temperature, loss of QC samples) prior to corrective action. Corrective action reports (CARs) will be placed in the lot specific data package and the appropriate project file. An example of DataChem Laboratories' (DCLs') corrective action documentation is presented in Figure 13-3, and an example of Environmental Science & Engineering, Inc.'s (ES&E's) is presented in Figure 13-4. In addition, the bench

**Table 13-1. Corrective Action Procedures According to Situation\***

Situation	Field Objective Affected	Corrective Action Procedures
Equipment malfunction	Equipment is calibrated and operating properly	<ul style="list-style-type: none"> <li>• Notification of site supervisory personnel</li> <li>• Repair or replace malfunctioning parts</li> <li>• Resample or repeat task if necessary</li> <li>• Document to Project Manager and project QA Manager</li> </ul>
Incorrect sample collection procedures	Samples are taken according to SOPs	<ul style="list-style-type: none"> <li>• Notification of site supervisory personnel</li> <li>• Review of situation and correct procedures</li> <li>• Notify Laboratory Director</li> <li>• Recollect affected samples</li> <li>• Document to Project Manager and project QA Manager</li> </ul>
Insufficient sample volume collected	Sufficient sample volume is provided to maintain sample integrity and so that all required analyses can be conducted	<ul style="list-style-type: none"> <li>• Notification of site supervisory personnel by the Laboratory Director</li> <li>• Review site affected and impact of samples on site characterization and project DQOs</li> <li>• Recollect affected samples, if necessary</li> <li>• Document to Project Manager and project QA Manager</li> </ul>
Incorrect measurement data collection	Measurements are conducted according to SOPs	<ul style="list-style-type: none"> <li>• Notification of site supervisory personnel</li> <li>• Review situation and correct procedures</li> <li>• Conduct tests again</li> <li>• Document to Project Manager and project QA Manager</li> </ul>
Loss of sample shipment	Project completeness	<ul style="list-style-type: none"> <li>• Notification of site supervisory personnel by the Laboratory Director</li> <li>• Review site affected and impact of samples on site characterization and project DQOs</li> <li>• Contact shipper</li> <li>• Document to Project Manager and project QA Manager</li> </ul>

\* Situations requiring corrective action are too numerous to comprehensively list here. This table is provided to illustrate several examples.

**Table 13-1. Corrective Action Procedures According to Situation\* (continued)**

Situation	Field Objective Affected	Corrective Action Procedures
Field contamination (equipment rinsate blanks only)	Acquisition of defensible, justifiable data	<ul style="list-style-type: none"> <li>• Notification of Project Manager and project QA Manager by the Laboratory Director</li> <li>• Notify site supervisory personnel</li> <li>• Review decontamination procedures and correct deficiencies</li> <li>• Document to file for final report</li> </ul> <p>Note: no resampling necessary</p>
Field contamination (interfering compounds detected in all blanks, except the laboratory method blank, and corresponding environmental samples - VOC analysis)	Acquisition of defensible, justifiable data	<ul style="list-style-type: none"> <li>• Notification of Project Manager and project QA Manager by the Laboratory Director</li> <li>• Notify site supervisory personnel</li> <li>• Review situation, determine source of contamination, and eliminate</li> <li>• Review level of contamination found and extent of affected samples</li> <li>• Executive decision by Project Manager as to course of action</li> <li>• Resample, if necessary</li> <li>• Document to file for final report</li> </ul>
No QC sample to support data from sample batch	Acquisition of defensible, justifiable data	<ul style="list-style-type: none"> <li>• Notification of site supervisory personnel by the Laboratory Director</li> <li>• Mail appropriate samples, if available</li> <li>• If samples are not available, the Project Manager and project QA Manager will be notified</li> <li>• Review site affected and impact of samples on site characterization</li> <li>• Resample, if necessary</li> <li>• Document to file for final report</li> </ul>

\* Situations requiring corrective action are too numerous to comprehensively list here. This table is provided to illustrate several examples.

**Table 13-1. Corrective Action Procedures According to Situation\* (continued)**

Situation	Field Objective Affected	Corrective Action Procedures
Duplicate or replicate RPDs outside of control limits	Acquisition of defensible, justifiable data	<ul style="list-style-type: none"> <li>• Notification of Project Manager and project QA Manager by Laboratory Director</li> <li>• Reanalysis of in-house samples by the laboratory</li> <li>• Notification of site supervisory personnel if RPDs remain outside of control limits</li> <li>• Review site affected and impact of samples on site characterization</li> <li>• Executive decision by Project Manager concerning the importance of affected data</li> <li>• Resample, if necessary</li> <li>• Document to Project Manager and project QA Manager</li> </ul>
Expired samples (holding times exceeded)	Acquisition of defensible, justifiable data	<ul style="list-style-type: none"> <li>• Notification of Project Manager and project QA Manager by Laboratory Director</li> <li>• Notification of site supervisory personnel by the Project Manager and the USAEC Chemistry Branch by the SAIC Project Officer.</li> <li>• Review of site affected and impact of samples on site characterization</li> <li>• Executive decision by the USAEC Chemistry Branch and the Project Manager concerning the importance of the affected data</li> <li>• Resample, if necessary</li> <li>• Document to Project Manager and project QA Manager</li> </ul>
Coolant blank above 6°C	Acquisition of defensible, justifiable data	<ul style="list-style-type: none"> <li>• Notification of Project Manager and project QA Manager by Laboratory Director</li> <li>• Notification of site supervisory personnel by the Project Manager and the USAEC Chemistry Branch by the SAIC Project Officer.</li> <li>• Review of site affected and impact of samples on site characterization</li> <li>• Executive decision by the USAEC Chemistry Branch and the Project Manager concerning the importance of the affected data</li> <li>• Resample, if necessary</li> <li>• Document to Project Manager and project QA Manager</li> </ul>

\* Situations requiring corrective action are too numerous to comprehensively list here. This table is provided to illustrate several examples.



An Employee-Owned Company

# Field Corrective Action

Page \_\_\_\_\_ of \_\_\_\_\_

Audit Report No. \_\_\_\_\_

Date/Originator: \_\_\_\_\_

Person Responsible for Response: \_\_\_\_\_

**Description of Problem** and when identified: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Cause of problem if known or suspected: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Sequence of Corrective Action** (state date, person, and action planned): \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Corrective action approval: \_\_\_\_\_ Date: \_\_\_\_\_

Follow-up dates: \_\_\_\_\_

Description of follow-up: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Final corrective action approved by: \_\_\_\_\_ Date: \_\_\_\_\_

**Science Applications International Corporation** ■ 1710 Goodridge Drive, McLean, Virginia 22102

White: File Pink: Field Manager Yellow: Project QAO Goldenrod: Supervisory Geologist

**Figure 13-2 Field Corrective Action Form**

QA CAR Follow-up Dates	
1 _____	(initial)
2 _____	(2 week)
3 _____	(2 month)

Document # \_\_\_\_\_

## DATACHEM LABORATORIES NONCONFORMANCE/CORRECTIVE ACTION REPORT (NC/CAR) (SIDE ONE)

**DIRECTIONS:** Fill in blanks and check appropriate boxes. Describe nonconformance. Route to Project Manager for direction *immediately*. If corrective action is required, complete Corrective Action portion on Side 2. For distribution, follow the DCL/NC/CAR flowchart in SOP QC-DC-006.

◆ ◆ ◆ A COPY OF THIS REPORT MUST BE SUBMITTED TO QA AT INITIATION ◆ ◆ ◆

Set ID/Lot No(s): _____	Submitted by: _____ <small>(Print Name)</small>
Analysis/Analyte: _____	Signature: _____
Account #: _____	Section: _____
Client: _____	Date Initiated: _____
Sample #'s Affected: _____	Date of Occurrence: _____

NONCONFORMANCE DESCRIPTION (CHECK APPROPRIATE BOX/BOXES AND EXPLAIN BELOW):	
<input type="checkbox"/> Instrument function <input type="checkbox"/> Sample condition <input type="checkbox"/> Sample storage <input type="checkbox"/> Analysis <input type="checkbox"/> Procedure <input type="checkbox"/> Calibration <input type="checkbox"/> Duplicate results	<input type="checkbox"/> Sample documents <input type="checkbox"/> Holding time exceeded <input type="checkbox"/> Sample preparation <input type="checkbox"/> QC sample results <input type="checkbox"/> Blank value <input type="checkbox"/> Other (Explain below)

DESCRIBE NONCONFORMANCE (PROBLEM):

  
  
  

WHY DID THE PROBLEM OCCUR (CAUSE):

  
  
  

GREEN ORIGINAL TO PROJECT MANAGER; COPY TO QC		
Project Manager Notified (Date): _____	<input type="checkbox"/> Proceed with Analysis <input type="checkbox"/> Do Not Analyze	Corrective action recommended? <input type="checkbox"/> YES <input type="checkbox"/> NO

PROJECT MANAGER COMMENTS:

  
  
  

PROJECT MANAGER ROUTE TO SECTION MANAGER FOR EVALUATION    Signature: \_\_\_\_\_    Date: \_\_\_\_\_

SECTION MANAGER EVALUATION: _____ / _____ <small>INITIALS                      DATE</small>	<b>CORRECTIVE ACTION REQUIRED?</b> <input type="checkbox"/> YES - Fill out Corrective Action on back of form. <input type="checkbox"/> NO - Send original to Quality Assurance.
---	---

<b>QA REVIEW AND APPROVAL</b> <b>← WHEN NO CORRECTIVE ACTION IS REQUIRED →</b> THESE DATA ARE: <input type="checkbox"/> USABLE <input type="checkbox"/> USABLE (FLAGGED) *SEE COMMENT <input type="checkbox"/> NOT USABLE *SEE COMMENT Reviewed by QA: _____	QA COMMENTS: _____ _____ _____ DATE: _____
--	--

Revised 07/83

Figure 13-3. DataChem Laboratories Nonconformance/Corrective Action Report

## CORRECTIVE ACTION (SIDE TWO)

If corrective action is required, complete this side of form also. See other side for details of nonconformance.

<b>ACTION STEP 1</b> Section Manager/ designee Comments:  State what needs to be done to correct NC and prevent re- occurrence.	Signature: _____ Date: _____
<b>ACTION STEP 2</b> Section Manager/ designee assigns responsible person to correct nonconformance.	Nonconformance occurred in _____ Section Section Manager/designee assigns _____ to take appropriate corrective action.
<b>CORRECTIVE ACTION TAKEN</b>   When completed, route to Project Manager.	Corrective Action will be (has been) completed on: _____ Signature: _____ Date: _____
<b>ACTION STEP 3</b> Project Manager Comments: When complete, route to QA Section.	Signature: _____ Date: _____
<b>ACTION STEP 4</b> QA Review:	Date CAR Received in QA: _____
<b>QA REVIEW AND APPROVAL</b> +WHEN CORRECTIVE ACTION IS REQUIRED+	<b>QA COMMENTS:</b> _____ _____ _____ _____ _____
THESE DATA ARE: <input type="checkbox"/> USABLE <input type="checkbox"/> USABLE (FLAGGED) *SEE COMMENT <input type="checkbox"/> NOT USABLE *SEE COMMENT CORRECTIVE ACTION ACCEPTABLE <input type="checkbox"/> Yes <input type="checkbox"/> No	Reviewed by QA: _____ DATE: _____

Revised 07/93

Figure 13-3. DataChem Laboratories Nonconformance/Corrective Action Report (cont.)

**QUALITY ASSURANCE CORRECTIVE ACTION REQUEST  
AND ROUTING FORM**

1. Identification of a Problem: CA# \_\_\_\_\_

Originator: \_\_\_\_\_ Date: \_\_\_\_\_

Nature of Problem: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

2. Determination of Required Action:

Responsibility Assigned to: \_\_\_\_\_ Due Date: \_\_\_\_\_

Recommended Action: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

3. Implementation of Required Action:

Responsibility Assigned to: \_\_\_\_\_ Due Date: \_\_\_\_\_

4. Assuring Effectiveness of Action:

Responsibility Assigned to: \_\_\_\_\_ Due Date: \_\_\_\_\_

Procedure to Assure Effectiveness: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**QUALITY ASSURANCE CORRECTIVE ACTION  
REQUEST AND ROUTING FORM**

**ENVIRONMENTAL SCIENCE  
AND ENGINEERING, INC.**

**Figure 13-4. Quality Assurance Corrective Action Request And Routing Form**

chemist will be responsible for ongoing monitoring of the system(s) affected to ensure that any recurring problems are immediately identified. Corrective action will be prompt for deficiencies noted during the check of raw data. This action will vary depending upon the problems noted, and can range from correcting miscalculated data to requiring the reanalysis of samples. As soon as sufficient time has elapsed for corrective action to be implemented, evidence of correction of the deficiency will be presented. Documentation of the corrective action measure will be forwarded to the SAIC project QA Manager and the SAIC Project Manager.

When matrix interferences are encountered, the analytical report will indicate that the results for the parameter of interest could not be calculated. If typical methods are rendered ineffective by matrix interferences, or if achieving the required detection limit, precision, and specificity requires a nonroutine approach, alternate methods will be available. Once information is generated based on the source and history of the sample(s) involved, an analytical protocol will be established that will have the best chances of generating reliable analytical data. Most of the time, modification of an existing protocol for routine procedures is designed to overcome the inherent sample matrix problems, and often employs the use of more extensive sample cleanup or fractionation procedures. No existing procedures or protocols will be modified or implemented without approval from the USAEC Chemistry Branch.

Corrective action documentation will include the following information:

- Nature of the problem
- Date and time of discovery
- Analytical parameter affected
- Sample lot affected
- Date, time, and description of the resulting corrective action
- Signature of the Laboratory QA Manager.

Control limits also have been established for method blank analysis. For the purpose of this project, the volatile organic method blank will not contain any target compound greater than five times the detection limit. The semivolatile organic compound (SVOC) and explosives

method blank will not contain any target compound above the detection limit. All blank analyses will be reviewed by the bench chemist before sample analysis. When acceptance criteria for blank analyses are exceeded, no samples will be analyzed until a determination of the cause of contamination has been made and corrected.

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## **14. QUALITY ASSURANCE REPORTS**

### **14.1 FIELD QUALITY ASSURANCE REPORTS**

The mobilization stage will be audited before work begins to ensure that all field personnel have been provided with the necessary procedures, training, and materials to conduct the remedial investigation/feasibility study (RI/FS) according to the Quality Assurance Project Plan (QAPP), Field Sampling Plan (FSP), and Health and Safety Plan (H&SP). Field activities will be audited in operation to ensure compliance with the procedures described in the QAPP. Additional audits may be required, depending on the results of these audits. All audits and corrective actions will be reported in writing to the Project Manager. These reports will be summarized and included in the final RI/FS report.

The Project Manager will submit monthly status reports to U.S. Army Environmental Center (USAEC) describing the progress of the project. To support this requirement, the Field Manager will provide the Project Manager with daily field progress reports, compiled field data sets, and corrective action documentation at appropriate intervals. Based on information gathered during unannounced site audits, the project QA Manager will provide the Project Manager with periodic QA updates. Situations requiring immediate corrective action measures will be brought to the attention of the Project Manager.

### **14.2 LABORATORY QUALITY ASSURANCE REPORTS TO SAIC**

A project QA report that summarizes all QA activities and QC data for the RI/FS will be issued to the project QA Manager whenever analysis data are reported to the Project Manager. These monthly progress reports will be submitted in the format described in Section 14.2.1. In addition, the Laboratory Director will provide QA update memoranda (i.e., copies of all field custody forms received and laboratory sample status and custody forms generated) for each sampling episode to the project QA Manager and Project Manager upon evaluation of the analytical work for that episode.

The project QA Manager and Project Manager will be notified immediately of laboratory QA situations (e.g., exceeded holding times, surrogate recoveries in method blanks, and

inadequate sample volume) requiring immediate corrective action (i.e., recollecting samples). DataChem Laboratories' (DCLs') and Environmental Science & Engineering, Inc.'s (ES&E's) sample receipt officers will note all QA situations that may affect laboratory and project QA objectives on the four-part chain-of-custody form and return the pink copy to the Project Manager and the yellow copy to the project QA Manager.

#### ***14.2.1 Monthly Progress Reports to USAEC***

Monthly progress reports (MPRs) will be submitted to the Project QA Manager on the fifteenth of each month in which analysis work is conducted on samples from Science Applications International Corporation (SAIC). Information to be provided will include:

- Project name and contract number
- Laboratory sample number, SAIC sample identification number, matrix type, and location of samples received during the monthly reporting period
- Data summary of all applicable QC check sample analyses, including, as a minimum, laboratory blanks, matrix spike/matrix spike duplicates (MS/MSDs), initial and continuing calibrations, surrogate recoveries, and mass calibration and tuning forms
- Descriptions of a justification for alternative methods used or modifications of existing methods
- Summary of all out-of-control events during the monthly reporting periods, including references to documentation and corrective action reports
- Changes in laboratory QA personnel and other key technical staff, including resumes of new personnel
- Descriptions of and justifications for any significant revisions to the QAPP
- Copies of all signed chain-of-custody forms received within the applicable time period
- Notification of any changes in performance demonstration status with any regulatory or certifying agency; any unacceptable results identified on any external proficiency testing program; and all laboratory explanations, responses, and corrective action plans developed as a response to these changes in status or unacceptable results.

#### ***14.2.2 Data Quality Assessment***

As part of the final RI/FS report, SAIC will submit a Data Quality Assessment. The Data Quality Assessment will discuss results of laboratory method blanks, matrix spike/matrix spike duplicates, control charts, USAEC QC samples, holding times, calibration criteria, trip

blanks, equipment rinsates, and field duplicates. Any deviations from QC criteria will be discussed. This Data Quality Assessment also will discuss PARCC (i.e., precision, accuracy, representativeness, comparability, and completeness) parameters, QC frequency, audits, and corrective actions.

### **14.3 LABORATORY QUALITY ASSURANCE REPORTS TO USAEC**

A QC report that summarizes all QC activities at the laboratory shall be submitted to the USAEC Chemistry Branch, on a weekly basis, no later than 5 working days after analysis for a week are completed. Information to be provided will include:

- The Control Chart Checklist (*USATHAMA Quality Assurance Program, PAM 11-41 (January 1990), Appendix Q*)
- A summary table listing the method number(s), USAEC lots, dates of analysis, and analytes that are included in the QC report
- Control charts for all analyses applicable to that week
- Analysis of any trends observed, the possible start of a trend, or lack thereof
- Evaluations and explanations for all points that indicate out-of-control situations
- Summary of all corrective measures and reanalyzed samples during the weekly reporting period, including references to documentation and procedural changes to prevent reoccurrence
- Recommendation made as to the acceptance or rejection of lot analysis
- Tables of percent recoveries in all field samples, by lot and sample number.

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## 15. REFERENCES

- EPA (U.S. Environmental Protection Agency). 1987. Data Quality Objectives for Remedial Response Activities, Office of Solid Waste and Emergency Response (OSWER) Directive 933550.7B.
- EPA. 1987. Test Methods for Evaluating Solid Waste. Physical/Chemical Methods. SW 846. Third Edition.
- EPA. 1990. Guidance for Data Usability in Risk Assessment (EPA 1540/G-90/008).
- EPA. 1990. Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans, QAMS-005/80.
- USATHAMA (U.S. Army Toxic and Hazardous Materials Agency). 1987. Geotechnical Requirements for Drilling, Monitor Wells, Data Acquisition, and Reports.
- USATHAMA. 1990. Quality Assurance Program. PAM 11-41. January.

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