EL DORADO

GROUND WATER SAMPLING QUALITY ASSURANCE PLAN

EL DORADO CHEMICAL COMPANY
EL DORADO, ARKANSAS

October 2003

QUALITY ASSURANCE PLAN

APPROVAL NOTIFICATION

This Quality Assurance Plan (QAP) has been prepared for ground water sampling activities at the El Dorado Chemical Company (EDC) facility in El Dorado, Arkansas. This plan has been reviewed and approved by the project management team, and shall be followed by all personnel working on the sampling activities.

Approvals are indicated as follows:

Approved by: Randall Whitmore Date: 10-16-03

Randall Whitmore

Distribution List

Randall Whitmore
Field Sampling Personnel

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1.0 INTRODUCTION

Ground water at the El Dorado Chemical Company (EDC) facility contains ammonia-N, nitrate-N, sulfate and minor amounts of lead and chromium. The sampling and analysis program governed by this QAP will provide chemical data needed to support environmental activities at this facility.

2.0 DATA QUALITY OBJECTIVES

2.1 DATA QUALITY INDICATORS

Representativeness

Representativeness "expresses the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition." QA and QC requirements ensure sample integrity. Proper procedures will prevent alteration of the samples, and ensure that samples that reach the laboratory are similar to those in the environment, thereby preventing bias.

At the micro-scale, representativeness addresses how well actual physical specimens and the measurements performed on them reflect the true conditions within the defined sampling unit. All samples collected must be representative of the conditions and will be conducted according to the appropriate procedures (see Sampling and Analysis Plan). Observable parameter variations, matrix differences, and environmental conditions will be noted. The analysis aliquot selected by the laboratory personnel will be as representative of the bulk sample as possible. This will be achieved by rejection of obvious irregularities and thorough mixing of the bulk sample.

Sampling equipment will be thoroughly cleaned between sampling points. An equipment rinsate will be collected from the sampling instruments, and analyzed at the frequencies prescribed for each sampling program.

Completeness

Completeness is "a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct normal conditions." The sampling and custody procedures described in Section 4.0 are to monitor:

- Accurate and complete labeling of sample containers;
- Correct sample preservation;
- Collection of correct sample volumes for the respective analytical method;
- Accurate and complete chain-of-custody;
- Maintenance of label integrity and protection of sample containers against breakage during transport from field to laboratory; and
- Expedition of sample delivery in response to holding time requirements.

Thorough review of transport records, with regard to the above list, will be performed as needed to assess and document the degree of completeness. Rejection of analysis results upon the basis of data completeness will be noted, and any corrective action taken will be documented in the analysis report. Included in the EMS/laboratory agreement is the assurance that the laboratory will observe the target reporting limits, required to accomplish the objectives of these sampling programs. However, several factors may affect the detection limits, and they may not always be achievable. If the analytical laboratory does not achieve the desired reporting limits, a narrative description should be attached to the laboratory results, and the Project Manager will assess this situation.

Although a completeness goal of 100% is desirable, an overall completeness goal of 90% may be realistically achieved under normal field sampling and laboratory conditions. If all the critical samples are not collected and analyzed, re-sampling will occur because each sample is needed in order to meet sampling requirements.

Comparability

Comparability "expresses the confidence with which one data set can be compared to another." Consistency in the acquisition, handling, and analysis of samples is necessary for the comparison of results to be meaningful. Strict adherence to the sampling and custody procedures will define the confidence in data comparability. As a quantitative measurement of comparability, duplicate samples will be collected at the frequency specified for each sampling program (see Section 6.0).

Precision

Precision is a measure of the reproducibility of an analytical result (i.e., the ability to obtain the same or similar results on replicate measurements of the same sample or of duplicate samples). Matrix variations, sample preparation procedures, and the analytical method affect reproducibility. Precision is measured by the variability in results between replicate analyses (e.g., the relative percent difference between duplicates). Field precision will be assessed through the analysis of duplicate field samples collected from a particular sampling point. A minimum of one duplicate per twenty samples will be collected. The DQO for the field duplicates will be a relative percent difference (RPD) no greater than ± 50% for each target element in the samples.

Laboratory precision will be evaluated by analysis of laboratory duplicates. Analysis and comparison of laboratory duplicates will evaluate laboratory precision within an analytical data group (batch). Laboratory duplicates are analyzed in accordance with the EPA method. Target laboratory precision objectives for laboratory duplicates, expressed as RPD, are generally an experimentally determined or assigned acceptability criterion. Laboratory acceptance criteria are specified in their SOPs. These objectives are consistent with levels of precision normally achievable by the standard EPA methods selected for this project. Duplicates with RPD values in excess of these control limits may be indicate a lack of precision resulting from sampling or analysis techniques, and the results should be evaluated accordingly. In these cases, the usability of the data for decisionmaking will include consideration of the difference between the concentrations in the samples and the corresponding decision criteria. Thorough review of quality control results with regard to precision and accuracy will be performed and documented as described in Section 8.0.

Accuracy

Accuracy is defined as how close a measured parameter is to its true value. The accuracy of a measurement is affected by a combination of random error (precision, as discussed above) and systematic error (bias). Potential sources of bias include imperfect sample collection methods (such as equipment cleaning), chemical instability of the samples, and interferences (matrix effects).

The potential for introducing bias will be minimized by adherence to established procedures for collection, preservation, transportation, and storage of samples. Analysis of equipment rinsate samples will be used as a check on potential bias from sample handling during collection and handling (compositing) prior to receipt by the laboratory. Equipment rinsate samples, consisting of deionized water rinsates of sampling and compositing equipment, will be analyzed to indicate potential sample contamination from contaminated sample handling equipment. Positive contamination from sampling equipment would indicate a potential high bias to associated data. The types and frequencies of equipment rinsates are discussed in Section 6.0.

Bias due to sample matrix effects will be assessed by spiking a sample with target elements of known concentration and calculating the percent recovery. Site-specific matrix spike samples will be analyzed for no less than one sample in twenty (i.e., 5%) of samples collected. Target laboratory accuracy objectives for matrix spike recoveries, expressed as percent recovery of the known spike amount, are generally an experimentally determined or assigned acceptability criterion. Laboratory acceptance criteria are specified in their SOPs.

Laboratory accuracy (as bias) will also be assessed by analysis of procedure (method) blank samples. A method blank sample is an aliquot of a known clean deionized water sample that is prepared, digested, and analyzed along with an analytical batch of samples. The method blanks are analyzed to indicate potential sample contamination from contaminated laboratory equipment. Positive contamination from laboratory equipment would indicate a potential high bias to associated data. In accordance with the analytical methods, at least one method blank sample will be prepared and analyzed along with each analytical data group (batch).

Thorough review of quality control results with regard to precision and accuracy will be performed and documented as described in Section 8.0.

2.2 DATA QUALITY OBJECTIVES

The data quality objective for this investigation is for the sample reporting limits for all samples to be below or equal to Environmental Protection Agency Region 6 screening levels. Table 1 summarizes the target reporting limits for constituents in ground water samples.

3.0 DOCUMENTATION AND RECORDS

The information contained in these records documents overall field operations and generally consists of the following:

- Sample collection records. These records show that the proper sampling protocol was performed in the field. At a minimum, this documentation should include the names of the persons conducting the activity, sample number, sample collection points, maps and diagrams as needed, equipment/method used, climatic conditions, and unusual observations. Forms are used to record raw data and make references to prescribed procedures and changes in planned activities. Example forms for ground water sampling are provided in Appendix A.

- Chain-of-custody records. Chain-of-custody records document the progression of samples as they travel from the original sampling location to the laboratory and finally to their disposal area.

- QC sample records. These records document the generation of QC samples, such as field, trip, and equipment rinsate blanks and duplicate samples. Notation of QC samples is recorded on well sampling forms. QC samples for other sampling projects may be recorded in a log generated for the project.

- General field procedures. General field procedures record the procedures used in the field to collect data and outline potential areas of difficulty in gathering specimens.

- Corrective action reports. Corrective action reports show what methods were used in cases where general field practices or other standard procedures were violated and include the methods used to resolve noncompliance.

Sampling information and data shall be entered on specific forms for well sampling or in field notebooks. All corrections shall be made with a single strike-through of the incorrect entry, followed by the entry of the corrected value. The strike-through and corrected entries are to be initialed by the person making the correction. No "white-out" type correction fluid will be permitted in correcting entries. Every form or notebook page should include signature of the sampler and a date.

4.0 SAMPLING PROCESS DESIGN

4.1 SAMPLING METHODS

All ground water sampling procedures and equipment, including decontamination are described in the Sampling and Analysis Plan in Appendix A. Sample containers, preservation and holding time requirements are summarized for each constituent and matrix in Table 2.

Laboratories selected to perform the analytical work have performed method detection limit (MDL) studies to demonstrate the laboratory is capable of meeting the reporting limits required to meet the data quality objectives for the various tasks.

If groundwater samples are found to be inadmissible (following the data verification and validation procedures described in Section 8.0), the well will be resampled.

4.2 SAMPLE HANDLING AND CUSTODY

Sample Identification

Samples shall be adequately marked for identification at the time of collection. Marking shall be on the sample container (bag, jar, bottle, etc.), on a tag or label attached to the sample container, and on the Chain-of-Custody records. Sample identification shall include, as a minimum:

- project name and number;
- unique sample number;
- sampling location (e.g., well, boring, depth or sampling interval, and field coordinates);
- sampling date;
- individual performing the sampling; and
- preservation or conditioning employed.

Sample Custody

The chain-of-custody form is intended to provide an accurate written record which can be used to trace the possession and holding of samples from the time of collection through data analysis and reporting. A chain-of-custody form will therefore accompany the samples from the initial sample collection in the field to its receipt at the analytical laboratory. At a minimum, the following information shall be included for each sample on the chain-of-custody form:

- Sample identification number;
- Sampling date;
- Sampling time;
- Sampling location and depth when appropriate;
- Analyses to be performed;
- Preservation; and
- Remarks and special instructions.

Personnel involved in handling and transfer of samples will be trained on the purpose and procedures used prior to implementation. To reduce chances for error, the number of personnel handling the sample will be restricted. The field sampler will be responsible for the custody and care of collected samples until the containers have been transferred to the custody of the laboratory and/or other custodian. A sample will be considered in custody if it is:

- in the custodian's actual possession or in view; or
- temporarily stored in a restricted, secured area

All samples are to be delivered to the laboratory as soon as possible after collection. Samples to be analyzed by local laboratories will be hand delivered; all others will be shipped by overnight courier (e.g., Federal Express). Complete chain-of-custody records for courier-shipped samples will accompany the samples in a water-tight plastic bag and taped to the underside of the lid of

the cooler containing the samples designated on the chain-of-custody form. The cooler or shipping container will be sealed using custody seals, and then shipped or hand delivered. The analytical laboratory will inspect the shipping container for violation of the container's custody seals. Violation of the container's custody seals will be noted by the receiving laboratory and shipper, and will be reported to the Quality Assurance Officer.

If any discrepancy on the records is noted, the Project Manager will be notified, and corrective action taken will be noted in the project file. The completed original will be returned to the Project Manager and included in the final analytical report. A copy shall be retained by the laboratory for its files.

5.0 ANALYTICAL METHODS REQUIREMENTS

Analytical procedures will conform to EPA methods for the parameters to be analyzed (listed in Table 1). These methods will be those referenced in the most recently promulgated:

- *Standard Methods for Chemical Analysis of Water and Wastes* (EPA-600/4-79-020, revised March 1983)

The detection/reporting limits and DQOs for these methods are those listed for each method and in the laboratory's current quality assurance manual or SOPs.

6.0 QUALITY CONTROL REQUIREMENTS

In a sampling program, a number of Quality Control samples are analyzed along with the investigative samples to determine the variability introduced in sampling, handling, shipping and analysis, as well as the inherent spatial variability of the site. This Quality Control Program is designed to protect the validity of data generated by the laboratory and field sampling so that a sound basis is provided for data analysis. The program will serve the dual purpose of verifying the recovery of given analyses from sample matrices as well as the accuracy and precision of analyses.

The laboratory quality control (QC) procedures and associated criteria are contained in laboratory standard operating procedures (available on request). The laboratory QC samples and control limits identified in the laboratory procedures were approved by the project personnel. The quality of the data generated by the selected analytical laboratories will provide analytical data of a sufficient quality for the environmental sampling projects.

The number and types of Quality Control samples are discussed in the following sections. The sampling frequencies for field Quality Control samples for the various environmental tasks are summarized in Table 3. Procedures in which this QC data is used to calculate statistics, such as precision and bias are discussed in Section 8.0.

Duplicates

Duplicates are samples that have been collected simultaneously into separate containers from the same source under identical conditions. Replication of samples generates information on the precision of the methods involved. Field replication provides information on the precision of homogeneity, handling, shipping, storage, preparation, and analysis techniques. Duplicates produced in the laboratory provide precision information on preparation and analysis. Whenever possible, field duplicates will be submitted as blind samples (i.e., samples which have a similar sample identification number as the rest of the samples, and cannot be compared to another sample to determine that it is a duplicate). The number of field duplicate samples required is 5 percent of samples of the same matrix (1 in every 20 or less). Duplicates are used to evaluate precision as described in Section 8.0. The precision goal for this investigation is 50%.

Matrix Spikes and Matrix Spike Duplicates

Many types of samples exhibit matrix effects, in which sample components interfere with the analysis of the constituent of interest. Matrix spikes provide a measurement of this effect. If a known amount of a substance (spike) is added to a sample, evaluation of the recovery of the spike during analysis can be used to help determine matrix effects on analytical results of similar parameters. Matrix spikes will be collected at a randomly selected location. They will be identified as matrix spike (MS) and matrix spike duplicate (MSD). These extra samples will be collected at a frequency of 5 percent (1 every 20), from a randomly selected location, using the same procedures, containers and preservatives as those used for the collection of the regular samples. The samples will be spiked at the laboratory and not in the field. The results will be used to evaluate precision of the data according to the procedures described in Section 8.0. Precision goals are defined by the laboratory for each analytical method, and are generally an experimentally determined or assigned acceptability criterion. Laboratory acceptance criteria are specified in their SOPs.

Equipment Rinsates

Rinsate blanks are to be collected from reusable, nondedicated sampling equipment. Rinsate blanks will consist of reagent grade water, which is poured into or over decontaminated sampling equipment in such a manner as to contact sampling surfaces as much as possible. The rinsate blanks will be analyzed for the same constituents as the media samples. Rinsate samples will be collected to monitor the following:

- the potential for contamination resulting from the sample collection equipment itself;
- the effectiveness of sample decontamination protocols; and
- the potential for cross contamination between samples.

A rinsate blank will be collected at a frequency of one per day. If a rinsate blank is contaminated, the analytical data from samples collected, shipped and/or analyzed in the same batch with the blank will be compared to the blank data. If only the blank is contaminated and the samples are not, the data quality of the associated samples will be considered uncompromised. If samples have concentrations similar to the blank, then the samples may be considered contaminated and samples re-taken.

Trip Blanks

Trip blanks are not required for groundwater sampling at this facility, as volatile organic compounds are not constituents of concern.

Field Blanks

Field blanks are not required for groundwater sampling at this facility, as volatile organic compounds are not constituents of concern.

Laboratory Control Samples

Analyses of blank samples verify that the analytical method does not introduce contaminants. The blank water will be generated as metal free. Method blanks must be below reporting limits. The spiked blank will be generated by addition of standard solutions to the blank water. The matrix spike will be generated by addition of standard solutions to a randomly selected field sample or site-specific matrix spike samples. The laboratory may produce split samples which will be collected and labeled separately as an additional internal quality control check.

Standards and Surrogates

Standards and surrogates should be purchased from suppliers that certify the quality and quantity of the compounds. These may be used directly without confirmation. Concentrations of the solutions will be checked for accuracy before release for laboratory use. Standard solutions will be replaced before their expiration date.

7.0 DATA MANAGEMENT

Data for this project will be produced in two locations: onsite and at the laboratory. Data collected onsite will be recorded on sampling forms or into field logbooks. The forms and/or logbooks will be reviewed for completeness by the Project Manager and Quality Assurance Officer. Missing data will be requested from the sampling team. If missing data cannot be provided, a notation will be made in the project file, the reason for the missing data will be investigated and corrective action will be taken. If missing data is critical, corrective action may include resampling, at the discretion of the Project Manager. Copies of forms and logbooks will be provided to EDC and become a part of the project file at both the EMS El Dorado and Baton Rouge offices.

Laboratory data will be submitted to the Project Manager and Quality Assurance Officer within 30 calendar days of the laboratory's receipt of the samples. The Project Manager or Quality Assurance Officer will be responsible for ensuring the analytical report meets the requirements in Section 8.0. Once the data has been reviewed and accepted, it is imported into an Access Database maintained by EMS. Data hand-entered from laboratory reports and sampling forms are printed and checked against the sampling forms for accuracy.

The information compiled for the chemical analysis results will include:

- Station identification and sample identification.
- QA/QC sample identification and duplicate sample cross reference identification.
- Sample matrix.
- Analytical laboratory/analytical method.
- Dates of analysis and extraction.
- Constituents, results, units, QA qualifiers, and detection limits.
- Laboratory QC data: method blank, blank spike, blank spike duplicate, laboratory matrix spike, laboratory replicate results.

The associated field information will include:

- Sample location identification, including any survey coordinates.
- Date of sample collection.
- Field indicator parameter results.
- Water level measurements.

8.0 DATA VALIDITY AND USABILITY

The Quality Assurance Officer or designee will validate the field data according to the procedures outlined in this section. Any problems identified during this process will be reported to the Project Manager.

All samples collected for the EDC groundwater monitoring program will be sent to an ADEQ-accredited laboratory. Data reduction, evaluation, and reporting for samples analyzed by the laboratory will be performed according to specifications outlined in the laboratory's QA plan. Laboratory reports will include documentation verifying analytical holding time compliance.

The laboratory will validate the laboratory data according to the criteria in their Standard Operating Procedures and in accordance with the analytical method under the direction of the Laboratory QA Manager. The Laboratory QA Officer is responsible for assessing data quality and informing the Project Manager of any data which are considered "unacceptable" or require caution on the part of the data user in terms of its reliability. The acceptance criteria have been approved by the Project Manager. Any problems identified during this process will be reported to the Project Manager in the laboratory report.

The Project Manager will review and verify the field forms and reports, and the analytical data report. Any problems or deviations identified will be discussed with the project team.

Data will be accepted if they meet the following criteria:

1. Field data sheets are complete;

2. Field data and laboratory data were validated to the prescribed level for the project;

3. Actual sample locations and collection procedures match the proposed sample locations and collection procedures identified in the Monitoring Program or Sampling and Plan, respectively;

4. Sample handling procedures documented on chain-of-custody forms, the field activity report, and case narrative match the sample handling procedures; and

5. Field QC was conducted as planned and meets the acceptance criteria (e.g., rinsate blanks are less than the reporting limit)

Any deviations from the QAP are to be reported in the Field Activity Logs or Analytical Data Report. The EMS Project Manager will verify the content of these reports. If the data fails to meet the criteria, they will be flagged by the EMS Project Manager as estimated. Any flagged data will be discussed with the laboratory management to determine if the data point will be rejected and re-sampling accomplished.

Field Data Verification

Verification of field activities will include review of the following:

- Conformity to monitoring program or analysis plan – were the samples collected from the correct locations and analyzed for the correct constituents.
- Sampling forms – were the samples collected in accordance with the procedures outlined in the QAP
- Sample identification and labeling
- Sampling handling including correct containers, preservation and storage
- Chain-of-custody records for completeness, correct information and compliance with sampling plans;
- Laboratory receipt of samples – at correct temperature, within holding times, integrity of containers
- Collection of QC samples including duplicates, field blanks, matrix spikes, matrix spike duplicates, and trip blanks
- Any corrective actions taken in response to deviation from QAP
- Impact of corrective actions on data quality

Deviation from field procedures for critical samples outlined in this QAP will be corrected by re-sampling.

Analytical Data Validation

All procedures used to assess precision and accuracy of laboratory generated data will be in accordance with the analytical methods discussed in Section 5.0. The target reporting limits are summarized in Table 1. Validation of laboratory data will include review of the following:

- Acceptance criteria for recoveries, relative percent difference met by laboratory
- Explanation and corrective action for results outside of acceptance criteria
- Detection limits specific by QAP met

- Calibrations performed
- Any corrective actions taken in response to deviation from QAP
- Impact of corrective actions on data quality

The following sections present tools that the Quality Assurance Officer can use to evaluate the data.

Holding Times

Evaluation of holding times ascertains the validity of results based on the length of time from sample collection to sample preparation or sample analysis. Verification of sample preservation must be confirmed and accounted for in the evaluation of sample holding times. The evaluation of holding times is essential to establishing sample integrity and representativeness. Concerns regarding physical, chemical, or biochemical alteration of analyte concentrations can be eliminated or qualified through this evaluation.

Completeness

Determining the level of completeness will involve a thorough review of sample handling from the time of collection through receipt of all analytical data reports. Completeness will be considered compromised whenever a field sample is not analyzed, analyzed outside of holding time protocol, or its analytical QC results are out of method QC limits. The formula for calculating completeness is:

$$PC = \frac{V}{n} \; x \; 100\%$$

where:	PC	=	Percent Completeness
	V	=	number of complete, valid measurements
	n	=	number of total expected measurements needed to achieve a specified level of confidence in decision making

Although a completeness goal of 100% is desirable, an overall completeness goal of 90% may be realistically achieved under normal field sampling and laboratory conditions. Data completeness will be calculated by reviewing the final data sheets for each sample result and a copy of the appropriate Quality Control Results. The data will be subject to a systematic review to ensure that the data meet the established criteria.

Precision

Precision is defined in terms of Relative Percent Difference (RPD). An example of the direct relationship is shown below for calculating the precision of matrix spike duplicates. The formula for determining RPD in organics is:

$$RPD = \frac{MS - MSD}{(MS + MSD)/2} \times 100\%$$

where: RPD = Relative Percent Difference
MS = spike recovery for matrix spike
MSD = spike recovery for matrix spike duplicate.

The matrix spike RPD shall be compared to an experimentally determined or assigned acceptability criterion. If the RPD for the duplicate set falls outside the criterion, the Laboratory Supervisor shall be notified and consulted to determine the need for Corrective Action. If the Laboratory Supervisor determines that Corrective Action is required, it shall consist of reanalysis of all samples in the batch associated with the duplicate set, unless specified otherwise by the method.

The precision will be calculated using:

$$RPD = \frac{(X_1 - X_2)}{(X_1 + X_2)/2} \times 100\%$$

where: RPD = Relative Percent Difference
X1 = first sample value
X2 = second sample value (duplicate)

For inorganic compounds, the RPD criteria are either developed by the laboratory or a guideline is stated in the method. For samples that fall outside the criterion, the Laboratory Supervisor shall be notified and consulted to determine the need for Corrective Action. The analytical laboratory shall submit a narrative description when the method-specific precision criteria are not met. The above method may be utilized by the data validator to calculate precision on blind duplicate samples.

Accuracy

Accuracy is defined in terms of Percent Recovery. Percent Recovery (p) is the fraction of spike analyte concentration recovered in the organic target analyte analysis. The criteria for Percent Recovery (p) as provided in 40 CFR Part 136 is determined from internal laboratory performance data. The formula for determining accuracy is:

$$p = \frac{A - B}{T} \times 100\%$$

where: p = Percent Recovery
A = concentration of analyte after spiking
B = background concentration of the analyte, before spiking
T = known true value of the spike

The method descriptions present control limits in which the Percent Recovery (p) and other Acceptance Criteria should fall. If the Percent Recovery for the spiked sample falls outside the method criterion, the Laboratory Supervisor shall be notified and reanalysis of standards/surrogates repeated until criteria are met, or follow the procedure described in the method. The analytical laboratory will submit narrative explanation when the method accuracy objectives could not be met. Accuracy goals are defined by the laboratory for each analytical method, and are generally an experimentally determined or assigned acceptability criterion. Laboratory acceptance criteria are specified in their SOPs.

Blank Samples

The various blanks specified in the sampling and analysis methods are utilized to determine if contamination occurs during sampling and analysis and where the contamination is occurring.

The various types of blanks and the contamination source predicted by the blanks are discussed in Section 6.0. Trip, field and rinsate blanks determine contamination in the field during sampling and/or transport/storage of samples. Reagent or method blanks determine contamination which occurs in the laboratory during analysis. Reagent blanks (method blanks) are to be analyzed by the laboratory at the frequency specified by the analytical method.

If trip, field or rinsate blank is contaminated, the analytical data from samples collected, shipped and/or analyzed in the same batch with the blank will be compared to the blank data. If only the blank is contaminated and the samples are not, the data quality of the associated samples will be considered uncompromised. If samples have concentrations similar to the blank, then the samples may be considered contaminated and samples re-taken.

Surrogate Recovery

System monitoring compounds are added to every sample, blank, matrix spike, MS, MSD, and standard. They are used to evaluate extraction, cleanup, and analytical efficiency by measuring recovery on a sample-specific basis. Poor system performance as indicated by low surrogate recoveries is one of the most common reasons for data qualification. Evaluation of surrogate recovery is critical to the provision of reliable sample-specific analytical results.

Internal Standards

Internal standards are utilized to evaluate and compensate for sample-specific influences on the analyte quantification. They are evaluated to determine if data require qualification due to excessive variation in acceptable internal standard quantitative or qualitative performance measures. For example, a decrease or increase in internal standard area counts for organics may reflect a change in sensitivity that can be attributed to the sample matrix. Because quantitative determination of analytes is based on the use of internal standards, evaluation is critical to the provision of reliable analytical results.

Calibration

The purpose of initial and continuing calibration verification analyses is to verify the linear dynamic range and stability of instrument response. Relative instrument response is used to quantitate the analyte results. If the relative response factor is outside acceptable limits, the data quantification is uncertain and requires appropriate qualification.

The laboratory should maintain documentation that calibrations:

- Were performed within an acceptable time prior to generation of measurement data;
- Were performed in the proper sequence;
- Included the proper number of calibration points;
- Were performed using standards that "bracketed" the range of reported measurement results (otherwise, results falling outside the calibration range are flagged as such); and
- Had acceptable linearity checks and other checks to ensure that the measurement system was stable when the calibration was performed.

If calibration problems are identified, any data produced between the suspect calibration event and any subsequent recalibration should be flagged to alert data users.

Sample Reanalysis

When instrument performance-monitoring standards indicate an analysis is out of control, the laboratory is required to reanalyze the sample. If the reanalysis does not solve the problem (i.e., surrogate compound recoveries are outside the limits for both analyses), the laboratory is required to submit data from both analyses. An independent review is required to determine which is the appropriate sample result.

Secondary Dilutions

When the concentration of any analyte in any sample exceeds the initial calibration range, a new aliquot of that sample must be diluted and reanalyzed. The laboratory is required to report data from both analyses. When this occurs, an independent review of the data is required to determine the appropriate results to be used for that sample. An evaluation of each analyte exceeding the calibration range must be made, including a review of the dilution analysis performed. Results chosen in this situation may be a combination of both the original results (i.e., analytes within initial calibration range) and the secondary dilution results.

Laboratory Case Narratives

Analytical laboratory case narratives are reviewed for specific information concerning the analytical process. This information is used to direct the data evaluator to potential problems with the data.

TABLE 1
ANALYTICAL METHODS AND REPORTING LIMITS
QUALITY ASSURANCE PLAN
EL DORADO CHEMICAL COMPANY
EL DORADO, ARKANSAS

CONSTITUENT	ANALYTICAL METHOD	REPORTING LIMIT (mg/L)
Ammonia-N	350.3	0.5
Nitrate-N	300	0.5
Sulfate	300	1
Total Dissolved Solids (TDS)	160.1	1
Lead (Total and Dissolved)	200.7	0.015
Chromium (Total and Dissolved)	200.7	0.02

TABLE 2
SAMPLE CONTAINERS, PRESERVATIVES AND HOLDING TIMES
QUALITY ASSURANCE PLAN
EL DORADO CHEMICAL COMPANY
EL DORADO, ARKANSAS

CONSTITUENT	CONTAINER	PRESERVATION	HOLDING TIME
Ammonia-N	32 oz/1000 ml glass wide-mouth bottle with Teflon-faced screw closure or high density polyethylene bottle.	H_2SO_4 (pH<2), ice	28 days of collection
Nitrate-N	32 oz/1000 ml glass wide-mouth bottle with Teflon-faced screw closure or high density polyethylene bottle.	H_2SO_4 (pH<2), ice	2 days of collection
Sulfate	32 oz/1000 ml glass wide-mouth bottle with Teflon-faced screw closure or high density polyethylene bottle.	ice	28 days of collection
Total Dissolved Solids	2 - 1 L clear wide mouth bottle	ice	7 days of collection
Chromium	32 oz/1000 ml glass wide-mouth bottle with Teflon-faced screw closure or high density polyethylene bottle.	HNO_3 (pH<2)	6 months of collection
Lead	32 oz/1000 ml glass wide-mouth bottle with Teflon-faced screw closure or high density polyethylene bottle.	HNO_3 (pH<2)	6 months of collection

TABLE 3
QUALITY CONTROL SAMPLES
QUALITY ASSURANCE PLAN
EL DORADO CHEMICAL COMPANY
EL DORADO, ARKANSAS

Matrix	Field Duplicates	Matrix Spike and Matrix Spike Duplicates	Rinsates
Groundwater	1 per 20 samples	1 per 20 samples	1 per semiannual sampling event

APPENDIX A

SAMPLING AND ANALYSIS PLAN

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A.1 DECONTAMINATION

Typically, only the meters used to measure water levels and indicator parameters will require decontamination between wells during sampling. Bailers used for purging and collecting samples will be disposable and a new bailer will be used for each well. However, decontamination procedures for all types of sampling equipment are included herein should they be necessary.

The procedures outlined in this section are for use by field personnel during the cleaning/decontamination of reusable sampling and other field equipment prior to each use. Equipment-specific decontamination procedures are presented in the following sections. Deviations from these procedures must be approved and documented in the field records.

A.1.1 DECONTAMINATION MATERIALS

The cleaning/decontamination materials referred to in the specific methods presented in the following sections are defined below. The use of any other materials than those specified below must be approved by the Project Manager and documented in the field records.

- Laboratory Detergent - The laboratory detergent will be a standard brand of phosphate-free laboratory detergent such as Alconox or Liquinox.
- Acid Solution - The acid solution will be made from either reagent-grade nitric or hydrochloric acid and deionized water and will be 10 percent acid by volume.
- Solvent - The solvent will be pesticide-grade isopropanol, acetone, methanol, or hexane. Pesticide-grade hexane is not miscible with water and should only be used when the sampling equipment is dry.
- Tap Water - Tap water may be used from any municipal water treatment system. The use of tap water from an untreated water supply is not an acceptable.
- Deionized Water - Deionized water is defined as tap water that has been treated by passing through a standard deionizing resin column.

All solvents, acid solutions, laboratory detergent, and rinse waters used to decontaminate equipment will not be reused for any reason.

A.1.2 DECONTAMINATION PROCEDURES

Decontamination procedures for equipment used during the site investigation activities are presented in the following paragraphs. Any deviation from the procedures listed below must be approved in advance by the Project Manager or designee and documented in the field record.

Decontamination of portable sampling equipment (i.e., water level indicators, etc.) may be conducted near the specific work areas, as necessary. The selected decontamination area should be downgradient and downwind of the work area. The area should be lined with polyethylene sheeting and all decontamination fluids segregated in appropriate containers (e.g. 5-gallon buckets). Every effort should be made to prevent excess splashing of decontamination fluids

onto the sheeting at the field decontamination station. Decontamination of all equipment should be completed at each work area prior to moving to another investigation area. In addition, decontamination fluids will be replaced between work areas.

Procedures to be followed when performing decontamination of portable sampling/testing equipment is provided in the following sections.

Reusable Teflon or Glass Field Sampling Equipment

The following steps will be followed for decontamination of Teflon or glass field equipment used for the collection of organic compounds and/or trace metals analyses:

1. Triple wash equipment with laboratory detergent and water using a brush to remove any solid matter or surface film.
2. Triple rinse equipment with tap water.
3. Triple rinse equipment with at least a 10 percent acid solution to remove scale, metals, and bases.
4. Triple rinse equipment with tap water.
5. Triple rinse equipment with deionized water.
6. Rinse equipment twice with solvent and allow to air dry.
7. Wrap equipment in one layer of aluminum foil. Seal the foil wrapped equipment in plastic and note the date of decontamination on the equipment.

Stainless Steel or Metal Sampling Equipment

Decontamination of steel or metal field equipment used for the collection of organic compounds and/or trace metals analyses will be cleaned prior to sample collection as follows:

1. Triple wash equipment with laboratory detergent and tap water using a brush to remove any solid matter or surface film.
2. Triple rinse equipment with tap water.
3. Triple rinse equipment with deionized water.
4. Rinse equipment twice with solvent and allow to air dry.
5. Wrap equipment in one layer of aluminum foil. Seal the foil wrapped equipment in plastic and note date of decontamination on the equipment.

Miscellaneous Sampling Equipment

Decontamination procedures for select sampling equipment are provided in the following sections.

Water Level Indicators/pH, Conductivity, Temperature Probes

1. Triple wash with laboratory detergent and tap water.
2. Triple rinse with tap water.

3. Rinse equipment once with compatible solvent.
4. Allow to air dry.

Temperature, pH, Dissolved Oxygen, and Specific Conductivity Probes

1. Triple rinse probe with deionized water.
2. Wipe dry.
3. Store probes in accordance with manufacturer specifications.

A.2 GROUNDWATER SAMPLE COLLECTION

Fluid levels will be measured at each well and recorded on a well sampling form or field notebook. Fluid level meters will be decontaminated prior to use at each well. Field indicator parameters (temperature, pH and specific conductance) will be measured prior to the collection of ground water samples. Equipment used for indicator parameter measurements will be calibrated according to the manufacturer's specifications. Calibration will be performed at least twice daily (normally once in the morning and once in the early afternoon). The probe will be rinsed with deionized or distilled water prior to placing it into the calibration solution.

A minimum of three well volumes (or until dry) shall be purged from each well prior to sampling. Each well will be purged and sampled with disposable bailers. Measurements of the three primary field parameters (pH, specific conductivity, and temperature) shall be recorded at each well after removal of each volume. Field records will also include the start and finish time for purging and the total volume removed. Odors, colors, or unusual conditions about the purge fluids will be noted. Purge and decontamination fluids shall be appropriately containerized for subsequent disposal.

Sampling personnel will wear new surgical/laboratory gloves during all sampling activities at each well. Filled sample containers are placed in a cooler and stored at a temperature of 4° C. Sample information will then be recorded on the Chain-of-Custody record. The samples will be shipped with an analysis request form (work order) by overnight courier or hand delivered to the analytical laboratory.

Groundwater samples that are collected from borings may appear to be turbid. The turbid samples may exhibit concentrations that are not representative of the groundwater zone that is sampled, particularly in the case of inorganic constituents where sample acidification may leach inorganic constituents from suspended solids. For this reason, turbid samples may be analyzed for both dissolved and total metals. When sampling for total or dissolved metals, the appropriate analytical method criteria for sample collection and preservation shall be followed.