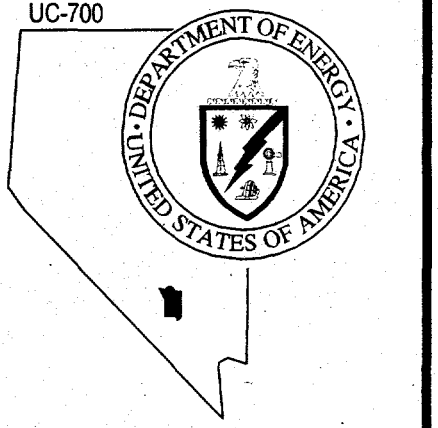
DOE/NV--341
UC-700

Nevada
Environmental
Restoration
Project



Underground Test Area Quality Assurance Project Plan Nevada Test Site, Nevada

Controlled Copy No.: UNCONTROLLED

Revision No.: 1

April 1997

Environmental Restoration
Division

U.S. Department of Energy
Nevada Operations Office

DOE/NV--341
UC-700

UNDERGROUND TEST AREA QUALITY ASSURANCE PROJECT PLAN

NEVADA TEST SITE, NEVADA

DOE Nevada Operations Office
Las Vegas, Nevada

UNCONTROLLED

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DISCLAIMER

UNDERGROUND TEST AREA
QUALITY ASSURANCE PROJECT PLAN

NEVADA TEST SITE, NEVADA

Approved by: Robert M. Bangerter Jr. Date: 4/21/97
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List of Acronyms and Abbreviations

ANSI	American National Standards Institute
APHA	American Public Health Association
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
CAU	Corrective Action Unit
CFR	*Code of Federal Regulations*
COC	Chain of Custody
DOE	U.S. Department of Energy
DOE/NV	U.S. Department of Energy, Nevada Operations Office
DRI	Desert Research Institute
EPA	U.S. Environmental Protection Agency
FFACO	*Federal Facility Agreement and Consent Order*
GC/MS	Gas chromatography/mass spectrometry
H&S	Health and Safety
ICP	Inductively coupled plasma
IDW	Investigation-derived waste
IT	IT Corporation
LANL	Los Alamos National Laboratory
LCS	Laboratory Control Sample(s)
LLNL	Lawrence Livermore National Laboratory
LQC	Laboratory Quality Control
M&TE	Measurement and test equipment
mg	Milligram(s)
mL	Milliliter(s)
MS/MSD	Matrix spike/matrix spike duplicate
NA	Not applicable
NCR	Nonconformance Report(s)
ng	Nanogram(s)
NIST	National Institute of Standards and Technology
NTS	Nevada Test Site
NV ERP	Nevada Environmental Restoration Project

List of Acronyms and Abbreviations (Continued)

PARCC	Precision, accuracy, representativeness, completeness, and comparability
pCi/L	PicoCurie(s) per liter
QA	Quality assurance
QAC	Quality Assurance Coordinator
QAPP	Quality Assurance Project Plan
QA/QC	Quality assurance and quality control
QC	Quality control
RCRA	Resource Conservation and Recovery Act
RPD	Relative percent difference
SOP	Standard Operating Procedure(s)
SWO	Stop Work Order
UGTA	Underground Test Area
VOA	Volatile organic analysis

Definitions

Acceptance Criteria - Specified characteristics of an item, process, or service defined in codes, standards, or other requirement documents.

Accuracy - A measure of the degree of agreement of a measurement (or an average of measurements of the same thing or mean of a set of results), X, with an accepted reference or true value, T. Accuracy is a measure of the bias in a system. Accuracy is assessed by means of reference samples and percent recoveries.

Blank - An artificial quality assurance sample designed to monitor the introduction of artifacts into the process.

Comparability - A measure of the confidence with which one data set can be compared to another.

Completeness - A measure of the amount of valid data obtained from a measurement system compared to the amount that was planned or that was expected to be obtained under correct normal conditions.

Condition Adverse to Quality - An all-inclusive term used in reference to any of the following: failures, malfunctions, deficiencies, defective items, and nonconformances.

Contamination (Contaminated) - Any unwanted, undesirable foreign material on the surface of an item, in the atmosphere, or in process liquids or gases; a parameter in a specific environmental medium having a maximum source concentration above an action level or regulatory threshold.

Corrective Action - As defined under the *Federal Facility Agreement and Consent Order* (FFACO): an action or series of actions taken to correct deficiencies in the disposal or containment of pollutants, hazardous wastes, and solid wastes to prevent releases and/or potential releases into the environment or discharges and/or potential discharges of such materials into waters of the state in accordance with the approved Corrective Action Plan. A corrective action may range from no action to clean closure.

Definitions *(Continued)*

Corrective Action - As defined under quality assurance practices: measures taken to rectify conditions adverse to quality and, when necessary, to preclude their repetition.

Data Quality - The totality of features and characteristics of data that bear on its ability to satisfy a given purpose. The characteristics of major importance are legibility, data accuracy, data precision, data completeness, data representativeness, and data comparability.

Data Quality Objectives - The objectives or goals predetermined for each subproject through a scientific mechanism designed to help the decision maker(s) determine the type, quantity, and quality of environmental data necessary to support decisions made for a site.

Data Reduction - Any and all processes that change either the form of expression or quantity of data values or numbers of data items.

Data Validation - A systematic effort to review data to assure acceptable data quality. A systematic process for reviewing a body of data against a set of criteria to provide assurance that the data are adequate for their intended use; a systematic review process conducted to confirm the degree of truth in an analytical measurement.

Hazardous Waste - Those wastes included in the definitions of *Resource Conservation and Recovery Act* (RCRA) 1004(5) as defined in Title 40 *Code of Federal Regulations (*CFR) 261.3 and Nevada Revised Statute 459.430 (Nevada, 1981).

Item - An all-inclusive term used in place of any of the following: appurtenance, assembly, component, equipment, material, module, part, structure, subassembly, subsystem, system, or unit.

Matrix-Spike/Matrix Spike Duplicate Analysis - In matrix-spike/matrix-spike duplicate analysis, predetermined quantities of stock solutions of certain analytes are added to a sample matrix prior to sample extraction/digestion and analysis. Samples are split into duplicates, spiked, and analyzed. Percent recoveries are calculated for each of the analytes detected. The relative percent difference between the samples is calculated and used to assess analytical precision.

Definitions *(Continued)*

Measurement Parameter - Those chemical, physical, or biological attributes from which environmentally related measurement data are obtained.

Measuring and Test Equipment - Devices or systems used to calibrate, measure, gage, test, or inspect.

Nonconformance - A deficiency in characteristic, documentation, or procedure that renders the quality of an item or activity unacceptable or indeterminate.

Precision - The measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. Precision is most desirably expressed in terms of the standard deviation. Various measures of precision exist depending upon the "prescribed similar conditions."

Qualification Tests - Tests performed to qualify the basic material source or manufacturer to ensure conformance to specification requirements.

Quality Assurance - Actions that provide confidence that quality is achieved.

Quality Assurance Program - The overall program established by an organization to implement the requirements of U.S. Department of Energy (DOE) Order 5700.6C.

Quality Assurance Project Plan - Project quality assurance plans are written to support work plans or similar documents and describe the process by which internal organizations are to implement their quality assurance responsibilities.

Quality Control - Activities that provide a means to control and measure the characteristics of an item, process, procedure, or service against established requirements.

Readiness Review - A systematic, documented review of the readiness for startup or continued extended use of a facility, process, or activity. Readiness reviews are typically conducted before proceeding beyond subproject milestones, prior to institution of a major phase of work activities.

Definitions *(Continued)*

Representativeness - The measure of the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition.

Screening - Field or laboratory analyses using same or simpler analytical methods with less rigorous quality assurance/quality control requirements whose results can be used in subproject decision-making. Screening methods are characterized by quick turnaround time (results are available in real time or within a few hours or days as opposed to weeks or months typically required for validated laboratory data) and lower costs. However, screening results may not be compound-specific, and the data may be qualitative or semiqualitative. Screening results may be directly representative of either a single laboratory contaminant parameter or a group of such parameters.

Site - An aggregate area, operable unit, or waste management unit that is appropriate to the context of the subproject as opposed to the term "Nevada Test Site," which refers to the entire DOE reservation.

Spike - The addition of a known quantity of an analyte to a blank, reference, or unknown sample used to assess accuracy and precision by evaluating percent recovery. Spikes are also used for analysis by the method of known addition.

Surrogate - Organic compounds similar to analytes of interest in chemical composition, extraction, and chromatography, but that are not normally found in environmental samples. Percent recoveries are calculated for each surrogate.

Testing - An element of verification for determining the capability of an item to meet specified requirements by subjecting the item to a set of physical, chemical, environmental, or operating conditions.

Validated Data - Data are valid when the methods, practices, techniques, and equipment used to obtain and treat them are technically sound, based on objectivity, and properly selected.

Forward

This Quality Assurance Project Plan (QAPP) is one of the planning documents used for the Underground Test Area (UGTA) Subproject at the Nevada Test Site (NTS) which falls under the oversight of the U.S. Department of Energy, Nevada Operations Office (DOE/NV) Nevada Environmental Restoration Project (NV ERP). The Nevada ERP consists of environmental restoration activities on the NTS, Tonopah Test Range, Nellis Air Force Range, and eight sites in five other states.

The UGTA Subproject constitutes a component of the Nevada Environmental Restoration Project. The purposes of the UGTA Subproject are to define boundaries around each Corrective Action Unit (CAU), as defined by the *Federal Facility Agreement and Consent Order* (FFACO) (FFACO, 1996), that establish areas containing water that may be unsafe for domestic or municipal use and to establish monitoring programs for each CAU that will verify modeling upon which the boundaries are based.

This QAPP describes policies, organization, responsibilities, and objectives of the UGTA Project and is intended to provide a consistent framework for the collection, evaluation, and use of physical and chemical data. The information provided in this QAPP has been prepared to ensure that the work is of the quality necessary to satisfy NV ERP objectives and the requirements of the FFACO. In the event that the subproject objectives or regulatory jurisdiction changes, this document must be reevaluated for adequacy.

Subproject Description

From 1951 to 1992, the NTS was used for nuclear testing. Areas used for underground nuclear testing include Yucca Flat, Frenchman Flat, Rainier Mesa, Pahute Mesa, and Shoshone Mountain (DOE/NV, 1994). As an unavoidable consequence of these testing activities, radionuclides have been introduced into the subsurface environment, impacting groundwater. The purpose of the UGTA Subproject is to evaluate existing and new data collected on the test areas to assess the contaminate migration through groundwater and determine any impacts to human health and the environment.

Subproject Objectives

The UGTA Subproject strategy is discussed in Appendix VI, Section 3.0 of the *Federal Facility Agreement and Consent Order* (FFACO, 1996). The stated objective will ensure that risks to public health posed by impacted groundwater are minimized through the implementation of administrative controls and long-term monitoring. Meeting this objective will require the following supporting subproject goals to be achieved:

- Determine the characteristics of the groundwater system as well as the nature and extent of contamination to a level necessary to support a baseline risk assessment.
- Develop credible predictions of contaminant fate and transport.
- Quantify risk to human health and the environment to an acceptable level of certainty.

QAPP Organization

The organization of this plan reflects the criteria of DOE Order 5700.6C, *Quality Assurance*, which allows for the inclusion of DOE requirements in addition to U.S. Environmental Protection Agency (EPA) guidance. The ten criteria of DOE 5700.6C cover three major areas: management, performance, and assessments. Management entails the planning and preparation required for the successful completion of the subproject mission. Additionally, this section incorporates quality improvement processes to detect and prevent quality problems. The performance section establishes the requirements and procedures to be implemented to ensure that newly collected environmental data are valid, that uses of existing data are appropriate, and that methods of environmental modeling are reliable. Assessments provide a feedback loop to subproject management whereby subproject management can use the information obtained to assess and, if necessary, modify a system or process to ensure the quality of the product.

1.0 Criterion 1 - Program

The UGTA Subproject management systems encompass the planning and preparation necessary to ensure the successful completion of objectives. Roles and responsibilities are defined; lines of communication are established; the needs and objectives of the subproject are confirmed; and reviews are conducted to ensure, to the extent possible, that all necessary planning and preparation activities have taken place.

1.1 Organizations and Responsibilities

A synopsis of roles and responsibilities specific to quality is described in the following text.

1.1.1 DOE/NV ERP Project Manager

The DOE/NV ERP Project Manager has technical oversight and management responsibilities for all activities within the Nevada Environmental Restoration (ER) Project. The ER Project Manager is the senior management official responsible for ensuring that this QAPP is established and that opportunities for improvement are identified and incorporated into the activities of the UGTA Subproject.

1.1.1.1 DOE/NV Underground Test Area Subproject Manager

The Subproject Manager for the UGTA reports directly to the DOE/NV ER Project Manager and is the prime point of contact with the ER Project Manager. The Subproject Manager has day-to-day management responsibilities for technical, financial, and scheduling of the Subproject and shall monitor the performance of UGTA Subproject participants. Other responsibilities include, but are not limited to, the following tasks:

- Review, approve, and direct the implementation of DOE/NV subproject plans.
- Participate in the organizing and planning activities to meet subproject quality objectives.
- Disseminate pertinent information from DOE/NV and others to UGTA Subproject participants.
- Review and approve variances to DOE/NV subproject documents.

- Notify the DOE/NV ERP Project Manager, the DOE/NV Quality Assurance Coordinator (QAC), and other appropriate UGTA Subproject participants of significant conditions adverse to quality or any identified trends.

- Monitor the quality-achieving activities of participating organizations and provide direction and guidance for improvement.

1.1.1.2 DOE/NV Quality Assurance Coordinator

The DOE/NV QAC reports to the DOE/NV ER Project Manager and has a direct line of communication with the DOE/NV Subproject Manager. The DOE/NV QAC will provide the overall direction for the quality assurance (QA) function. At a minimum, the DOE/NV QAC shall have the following duties:

- Identify and respond to QA and quality control (QA/QC) needs, resolve problems, and provide guidance or assistance.

- Review and evaluate quality-related changes to this QAPP and other documents that contain QA criteria.

- Verify that appropriate corrective actions are taken for nonconformances. Ensure that nonconformances and corrective actions are documented and tracked.

- Notify the DOE/NV ERP Project Manager, the DOE/NV Subproject Manager, and other involved personnel of significant conditions adverse to quality or any adverse trends.

- Participate in laboratory audits and perform surveillances of UGTA activities.

1.1.2 Underground Test Area Subproject Participants

All participants in the UGTA Subproject are responsible for developing necessary procedures and for ensuring that all work is performed in accordance with applicable federal, state, local, and DOE regulations; NV ERP QA program requirements; this QAPP; and approved subproject plans and procedures. To fulfill responsibilities specific to QA, the subproject participants shall, at a minimum, be responsible for the following:

- Report to the DOE/NV Subproject Manager about scope, schedules, costs, technical execution, and quality achievement of task order activities.

- Ensure that proper resources and budget are provided for QA personnel and that QA activities are integrated into subproject activities.

- Evaluate task order activities to ensure that planning document requirements are implemented.
- Develop and implement procedures and instructions that govern UGTA Subproject activities.
- Ensure that work is technically sound, of acceptable quality, and consistent with subproject objectives.
- Perform audits and surveillances to verify compliance with applicable requirements.
- Identify deficient areas and implement effective corrective actions for quality problems.
- Notify the DOE/NV Subproject Manager and other involved personnel of significant conditions adverse to quality or any adverse trends.
- Establish and maintain an effective records management system.

1.1.3 Analytical Laboratories

Analytical Laboratories are responsible for ensuring that samples are received, handled, stored, and analyzed according to the analytical laboratory QA program and the requirements of this QAPP. Commercial analytical laboratories performing data analysis for the UGTA Subproject shall participate in the DOE and U.S. Environmental Protection Agency (EPA) Performance Evaluation Sample Program and be subject to periodic audits.

1.2 Quality Assurance Objectives for Measurements

Quality assurance objectives are qualitative and quantitative statements that specify the data requirements for the subproject. Analytical and nonanalytical data QA objectives are based on the intended use of the data, current field procedures, instrumentation, and available resources. These objectives should be established during planning stages to properly support the overall subproject or sampling task objectives. Indicators of data quality as they relate to current sampling and laboratory analysis include precision, accuracy, representativeness, completeness, and comparability (PARCC).

1.2.1 Precision

The results of duplicate analyses are used to calculate relative percent difference (RPD), a quality control (QC) parameter for precision. If the RPD exceeds predetermined limits for a

given parameter, the data shall be evaluated for useability based on the purpose for the data and reasons for the increased RPD. This evaluation must be documented.

1.2.2 Accuracy

Analytical data accuracy for the UGTA Subproject will be assessed and controlled using matrix spikes, surrogate sample spikes, or internal sample spikes. Sample spiking will be performed at a minimum of one spike per every 20 samples. As appropriate, method accuracy will be determined and documented by Laboratory Control Samples (LCS) at a predetermined analyte-specific minimum frequency.

1.2.3 Representativeness

Representativeness depends on the proper design and execution of a sampling program. Because of the nature of the UGTA Subproject, samples do not lend themselves to statistical design. Representativeness will be achieved through careful selection of sampling intervals and locations as well as analytical parameters and the proper collection, storage, handling, and transport of each sample. During well development, water quality parameters shall be monitored to ensure wells are developed to the extent that groundwater samples are representative of *in situ* conditions.

1.2.4 Completeness

Completeness is the minimum of valid data needed to make a decision. The number of samples prescribed for an activity shall be sufficient to meet data requirements, along with anticipated losses of data, based on EPA performance data. Procedures and plans shall be developed for sample collection and handling that facilitate the final completeness of the data.

1.2.5 Comparability

Comparability is a measure of likeness (or similarity) between data or data sets. Similarity of data must be demonstrated before the data can be compared. Comparability is a parameter expressing the confidence with which one data set can be compared with another. Comparability is achieved by using standard techniques and procedures (e.g., Standard Operating Procedures [SOPs]) to collect and analyze representative samples and by reporting analytical results in appropriate units. Comparability is limited by the other PARCC parameters because only when precision and accuracy are known, can data sets be compared with confidence.

1.3 Reports to Management

Participant management and DOE/NV ERP Subproject managers shall be made aware of subproject activities and shall participate in the development, review, and operation of these activities. The management of all participants shall be informed of quality-related activities through the receipt, review, and/or approval of:

- Subproject-specific QA plans and procedures
- Assessment reports
- Corrective action requests, Corrective actions, and schedules
- Nonconformance reports (NCR)

All nonconformances and findings related to quality shall be corrected as required, documented, and properly reported. In addition, periodic assessment of QA/QC activities and data quality parameters shall be evaluated and reported to the participating subproject field and laboratory management.

1.4 Readiness Reviews

Readiness reviews, required by the DOE/NV Order 5700.6C, *Quality Assurance* (DOE, 1991), verify that all planning documents and systems are in place for the successful and efficient accomplishment of the mission. Included in readiness reviews is the verification that personnel are qualified and knowledgeable in the activities they are assigned to perform.

Readiness reviews shall be performed by participating organizations prior to the start of any major scheduled activity and prior to restarting work following stop work orders to verify and document that project planning and prerequisites have been satisfactorily completed. At a minimum, readiness reviews shall verify that the following issues have been addressed:

- The scope of work is compatible with subproject objectives.
- The planned work is appropriate to meet objectives.
- Work instructions have been reviewed for adequacy and appropriateness, formally approved, and issued to personnel who will be performing the work.
- Proper resources (e.g., personnel, equipment, and materials) have been identified and are available.

- Assigned personnel have read the applicable work instructions and have been trained and qualified.
- Internal and external interfaces have been defined.
- Proper work authorizations and permits have been obtained.
- The calibration of all material and test equipment is current.

1.5 Stop Work Order

A Stop Work Order (SWO) shall be initiated when a condition adverse to quality is identified that, if allowed to continue, would result in personal injury, damage to DOE equipment or property, or would have an adverse impact on mission accomplishment, budget, or schedule. If imminent danger exists, an SWO may be verbally imposed. An SWO may be limited to a specific activity, item, or design, or it may be broad in scope and encompass all activities relating to the deficiency or violation.

All individuals are empowered with the authority to stop work when continuing work may result in:

- Failure to adequately control the processing, delivery, installation, modification, or operation of a nonconforming item
- Serious failure or breakdown of the QA program
- Significant hazard to those items or activities that are important to health and safety, the environment, or the mission of the project

Resumption of work shall begin only upon completion of the necessary actions specified on the SWO and the approval of the DOE/NV ERP Subproject Manager. Health and Safety (H&S)-related SWOs shall require the additional signature of the DOE/NV H&S Manager or a designee in accordance with the *Nevada Environmental Project Health and Safety Plan* (DOE/NV, 1996a).

2.0 Criterion 2 - Personnel Training and Qualifications

Contractor subproject management shall ensure that personnel are qualified and knowledgeable in the activities they perform. Training should emphasize correct performance of work and provide an understanding of why quality requirements exist (DOE, 1991). All UGTA Subproject participants shall be responsible for maintaining personnel qualification and training records as quality documents.

2.1 Project Personnel

Personnel assigned to the UGTA Subproject shall be trained and qualified to perform the tasks to which they are assigned. All contractors and support agencies shall establish minimum education, experience, and training requirements for these activities.

Objective evidence of qualifications may include academic credentials, personal resumes, registrations and/or certifications, licenses, and training records. The qualifications of personnel involved in quality-related activities shall be evaluated against assigned responsibilities. Based on the results of the evaluation, any additional training needs shall be identified, provided, and documented.

Training shall be provided to achieve initial proficiency; to maintain proficiency; and to adapt to changes in technology, methods, or job description. Contractor subproject management shall be responsible for providing personnel with the instructions necessary to perform quality-related activities. Training may take the form of orientation and/or indoctrination, formal classroom training, or on-the-job training. This training shall include contractual and regulatory requirements, scopes of work, QA/QC compliance requirements, and applicable work instructions. On-the-job training shall be conducted and documented by personnel qualified to perform the task. Any work performed by a trainee shall be under the supervision of a qualified individual.

2.2 *Analytical Laboratory Personnel*

Each analytical laboratory should establish job descriptions for positions affecting data quality. These descriptions should provide the minimum qualifications in terms of education, experience, and skills necessary for an analyst to carry out duties in the laboratory. Laboratories shall provide appropriate orientation and/or training of the laboratory QA program and subproject requirements and must implement a performance-based qualification program which includes periodic requalification for analysts performing work for the UGTA Subproject.

3.0 Criterion 3 - Quality Improvement

Processes shall be established and implemented with the objective of preventing problems and improving quality (DOE, 1991). Personnel at all levels are encouraged to identify process improvement opportunities as well as problems and to offer solutions to those problems. The following sections identify processes that, at a minimum, shall be implemented.

3.1 Internal Quality Control Checks

Proprietary computer applications used for the evaluation of historical data maintained or transferred via electronic media shall have QC checks performed as appropriate to the application being used. These checks must be documented and maintained in accessible files.

Field sampling and laboratory analytical activities shall incorporate QC procedures. All field and laboratory operations and systems shall be evaluated for their potential to impact the quality of generated data. System quality controls shall be established and documented through the use of approved procedures.

QC samples shall be incorporated into the analytical stream to assess the overall data quality produced by the program. The QC samples consist of field- and laboratory-generated samples which are used to evaluate sampling and analytical precision and accuracy as well as the levels of potential contamination introduced by the sampling and analytical effort. The following paragraphs describe the QC samples that will be generated.

3.1.1 Field Quality Control

Subproject participants shall ensure that field QC samples are collected and submitted to the analytical laboratory in a manner consistent with ongoing field activities. The field QC sampling program is designed to provide confidence that samples collected during field activities adequately represent the environmental conditions of the sampling site. Field QC samples provide a mechanism for checking the precision and accuracy of the sampling and analysis systems.

Field QC samples for the UGTA Subproject include trip blanks, equipment rinsate blanks, rinsate source blanks, field blanks, and field duplicates. Field QC samples shall be submitted to the laboratory in such a manner that the laboratory is not aware that the sample is for QC purposes.

Collection and documentation of field QC samples shall be in accordance with approved plans and procedures.

3.1.1.1 Equipment Rinsate Blank Samples

An equipment rinsate blank is collected from the final rinse solution from the equipment decontamination process to determine the effectiveness of the decontamination process. The blanks shall be prepared by pouring deionized water through or over a decontaminated sampling device prior to using the device for environmental sample collection. If equipment rinsate blank analytical results indicate possible contamination of samples, environmental sample results shall be reviewed to determine whether qualifiers should be assigned to the data or whether the source should be resampled. Results of rinsate blank analyses shall be maintained with the corresponding sample analytical data in the laboratory records file and reported in the data package.

3.1.1.2 Field Blank Samples

Field blanks are collected and analyzed by the laboratory to determine if contamination in the air during sample collection and packaging may have contaminated the samples. The field blanks are prepared by pouring deionized water into clean sample containers in the field near the sampling locations. If field blank analytical results indicate possible contamination of associated samples, environmental sample results shall be reviewed to determine whether qualifiers should be assigned to the data or whether the source should be resampled.

3.1.1.3 Trip Blank Samples

A trip blank is a 40-milliliter (mL) volatile organic analysis (VOA) container of organic-free water that is shipped to the field along with the other VOA sample containers. The blank is not opened, but is otherwise maintained, handled, stored, packaged, and shipped as if it were collected in the field. The purpose of the trip blank is to determine if contaminants have entered the sample through diffusion across the Teflon™-faced, silicone rubber septum of the sample vial during the performance of laboratory, field, or shipping procedures. The trip blank is only analyzed for volatile organic constituents of interest to the UGTA Subproject. Trip blanks shall be submitted for analysis at a frequency of one sample per shipping container that carries field samples for VOA analyses.

Following the analyses, if the trip blanks indicate possible contamination of the samples, the appropriate project personnel shall be notified. Results of trip blank analyses shall be maintained with the corresponding sample analytical data in the laboratory records file and reported in the data package.

3.1.1.4 Duplicate Samples

Field duplicates are QC samples that are collected as closely in time and space to the environmental sample as possible to assess sample variability and to measure sampling and analytical precision. The field duplicates shall mirror the sampling and analytical profile of the original sample and be assigned a unique sample number. The duplicate sample number shall not indicate that it is a QC sample to minimize handling, analysis, and data-evaluation bias. Parameters to be analyzed shall be the same as those analyzed for the corresponding environmental samples.

Duplicates for water samples shall be collected simultaneously with the original sample. Duplicates for soil samples shall be collected contiguously with the original sample.

3.1.2 Laboratory Quality Control

All laboratories performing analyses shall conduct their activities in accordance with a written and approved QA plan. Laboratory quality control (LQC) samples shall be analyzed using the same analytical procedures used to analyze environmental samples. Each analytical laboratory shall generate QC samples during each analytical run to assess and document accuracy and precision associated with each analytical measurement. All data from concurrently analyzed LQC samples used to demonstrate analytical control shall be included in the analytical report. The requirements for the types and number of LQC samples will depend on the method and analytical level of each test. Laboratory quality control samples include LCS, method blanks, surrogate-spike, and matrix spike/matrix spike duplicate (MS/MSD) samples.

3.1.2.1 Laboratory Control Samples

One LCS shall be analyzed with each batch of samples. The LCS (i.e., spiked, blank, or matrix samples) shall be carried throughout the sample preparation and analysis procedures to assess laboratory accuracy and precision. The LCS shall be analyzed concurrently with each analytical batch for each analyte of interest and shall be prepared from standards independent of the calibration standard. Control limits for recovery shall be established, and recovery data shall be

plotted on internal control charts. LCS data outside these recovery limits shall be considered "out of control," and the laboratory shall initiate corrective action(s) that shall be performed in accordance with the laboratory's QA plan. Results of duplicate LCS analyses shall be reported as RPD and percent recovery and included with the associated analytical report.

3.1.2.2 Method Blank Samples

Method blanks shall be analyzed by the laboratory to check for contamination and interference from reagents used in the analytical method. A method blank shall be concurrently prepared and analyzed for each analyte of interest for each analytical batch. Method blank data outside statistical control limits shall be considered "out of control," and corrective action(s) shall be performed in accordance with the laboratory's QA plan. Method blank data shall be reported in the same units as the corresponding environmental samples, and the results shall be included with each analytical report.

3.1.2.3 Surrogate-Spike Samples

Surrogate-spike sample analysis shall be performed for all samples analyzed by gas chromatography/mass spectrometry (GC/MS) to monitor the percent recovery of the sample preparation and analytical procedures on a sample-by-sample basis. Surrogate standards are nontarget compounds added to GC/MS standards, blanks, and samples prior to extraction or purging. Surrogate compounds and concentrations added shall be those specified in the applicable analytical method. Recovery values for surrogate compounds shall be within the control limits specified by the laboratory and in accordance with assessment procedures in the laboratory's QA plan, or the analysis shall be repeated. Results of surrogate-spike sample analyses shall be reported as percent recovery.

3.1.2.4 Matrix-Spike/Matrix-Spike Duplicate Samples

Subproject site-specific MS/MSD samples shall be analyzed by the laboratory to determine interferences of the sample matrix on the analytical methods and subsample variance of the laboratory data. A separate sample aliquot shall be spiked with the analytes of interest and analyzed with every 20 samples or, if fewer than 20 samples were collected, at least one of the samples shall be spiked. Results of the MS/MSD analyses shall be reported as percent recovery and RPD and included with the analytical report. Results that are outside the established recovery or reproducibility limits for the analytical method shall be considered "out of control,"

and the laboratory shall initiate corrective action(s) that shall be performed in accordance with the laboratory's QA plan.

3.1.2.5 Laboratory Duplicate Samples

Two aliquots of the same sample shall be analyzed, and the duplicate results used to calculate the precision as defined by the RPD. If the precision value exceeds the control limit, the appropriate laboratory personnel will identify the root cause of the nonconformance and implement corrective actions. A laboratory duplicate or spiked duplicate analysis may be performed for every 20 samples.

3.2 Data Precision, Accuracy, and Completeness

Quality Control sample results are used to evaluate laboratory and field precision and accuracy. Precision shall be determined by comparing the concentrations of the various constituents between duplicate analyses. Accuracy shall be determined by comparing analytical results with the known (true) value of a reference standard (i.e., a laboratory control sample). The accuracy of the spiked samples must be within the accepted accuracy of the method of analysis for the analyte of interest. Sample results falling outside of acceptable ranges for precision and accuracy shall be brought to the attention of laboratory management for evaluation and corrective action(s) as needed. Completeness shall be determined by comparing the number of samples expected to be collected to those samples for which acceptable analytical results are received. An objective of 80 percent completeness or greater has been set for the UGTA Subproject.

Laboratory results shall be checked upon receipt. If there appears to be an error in the analysis, the laboratory shall be contacted immediately, and corrective action(s) must be taken. If investigation reveals that processes were not in control, corrective action(s) shall be taken.

3.3 Corrective Action

This section establishes the methods and responsibilities for identifying, reporting, controlling, and resolving conditions of nonconformance and conditions adverse to quality for activities performed in support of the UGTA Subproject.

3.3.1 Nonconformance

A nonconformance is a deficiency in characteristic, documentation, or procedure that renders the quality of an item or activity unacceptable or indeterminate (ANSI/ASME, NQA-1-1994).

3.3.1.1 Nonconformance Reporting

UGTA Subproject participants shall implement approved procedures for the identification, documentation, and resolution of nonconforming conditions. With the exception of the laboratories, inter-contractor nonconformances or nonconformances issued by the DOE for this subproject shall be reported using the approved DOE/NV NCR Form (Figure 3-1). For internal nonconformances, laboratories and contractors may use internal forms, providing the forms include the required components listed in the following text. All NCRs shall be processed in accordance with internal procedures. An NCR shall specify:

- Originator
- Date of the nonconformance
- NCR number (serialized)
- Responsible organization
- Requirement(s)
- Nature of the nonconformance
- Disposition
- Technical justification
- Approximate cost to implement the disposition

Copies of all NCRs and any related documents and/or correspondence shall be transmitted to the organization's internal QA department or representative.

3.3.1.2 Nonconformance Trends

Subproject participants should perform reviews and trend analyses of NCRs to identify any possible adverse trends. Adverse trends shall be brought to the attention of the appropriate contractor senior manager, the DOE/NV Subproject Manager, and the DOE/NV QAC. At a minimum, adverse trends are considered to be:

- Repetitive nonconformances for which previous corrective measures have proven ineffective

- Nonconformances that appear to be related and represent a programmatic or system breakdown or loss of confidence in the integrity or effectiveness of the item or activity

- Indication that a root cause may have generic implication to a broad group of possible deficiencies

U.S. DEPARTMENT OF ENERGY
NEVADA OPERATIONS OFFICE

NONCONFORMANCE REPORT

INITIATOR		
INITIATOR ORGANIZATION:	NCR DATE:	NCR NO.:
RESPONSIBLE ORGANIZATION:	LOCATION:	
SPECIFICATION/DRAWING/PROCEDURE REQUIREMENT(s):		
DEFICIENCY: INITIATOR: DATE:		

PROPOSED DISPOSITION	
DISPOSITION: TECHNICAL JUSTIFICATION:	
APPROXIMATE COST TO IMPLEMENT DISPOSITION:	AUTHORIZED DISPOSITIONER:

DISPOSITION CONCURRENCE/APPROVAL	
USER: (NAME/TITLE) (DATE)	NTSO: (PROGRAM/PROJECT MANAGER) (DATE)

DISPOSITION COMPLETION/NCR CLOSEOUT	
DISPOSITIONING ACTIONS COMPLETED: (DATE) _____ VERIFIED BY (NAME/TITLE) (DATE)	NCR CLOSED: (DATE)

DISTRIBUTION	
NTSO/PE NTSO/DAC OAD/NV	USER ORGANIZATION RESPONSIBLE ORG. DA DEPT. OTHER _____

A-29 (and A-30) 2-4-94

Figure 3-1
Nonconformance Report Form

3.3.2 *Corrective Action Request*

A corrective action request shall be used to identify and report significant conditions adverse to quality and to document the resolutions of such conditions. All UGTA Subproject participants are responsible for the development and implementation of approved procedures to govern the corrective action request process. These procedures shall comply with the requirements of DOE Order 5700.6C (DOE, 1991).

A corrective action request shall be initiated when a significant condition adverse to quality has been identified that is demonstrated by one or more of the following conditions:

- The existence of conditions that, if left uncorrected, may possibly compromise the quality program or degrade the quality of an item
- An identified adverse trend
- A failure to respond or resolve deficiencies identified during audits and surveillances or documented on an NCR in a timely manner
- A significant programmatic breakdown of management controls or the QA program
- The conduct of quality-affecting activities outside of the scope of approved QA program plans or procedures

Subproject participants should maintain a status log for the purpose of tracking open corrective action requests.

4.0 Criterion 4 - Documents and Records

Systems and controls shall be implemented by subproject participants for identifying, preparing, reviewing, approving, revising, collecting, indexing, filing, storing, maintaining, retrieving, distributing, and disposing of pertinent quality documentation and records. These systems and controls shall apply to all forms of documents and records.

4.1 Variances/Change Control

Variances (changes or modifications) to approved procedures or plans may be necessary in order to adjust an activity to actual field conditions or to revise programmatic methods of implementing project requirements. A system shall be employed to ensure that variances are properly identified, documented, approved, and controlled. Variances shall be approved commensurate with the original document prior to implementation. Changes that impact the technical scope of the subproject, cost, or schedule shall be in accordance with the DOE/NV procedure ERD-01-003, "Change Control" (DOE, 1992).

4.2 Document Review and Control

Documents shall be reviewed, approved, and revised in accordance with prescribed processes and DOE/NV procedure ERD-01-002, "Document Review and Coordination" (DOE, 1992). UGTA Subproject documents and changes to these documents shall be reviewed for quality requirements, technical adequacy, completeness, and accuracy prior to their approval and issuance.

A system or process for identifying and controlling documents shall be implemented to ensure that the latest revision of a document is in use. Contractor subproject management shall be responsible for ensuring that personnel who perform work are in possession of the most current version of the documents applicable to the activities being conducted.

4.3 Subproject Documentation and Maintenance

UGTA Subproject documentation and data reports shall be complete and accurate to the extent that their use in a decision-making process meets subproject objectives. The maintenance of records shall include provisions for retention, protection, preservation, traceability, accountability, and retrievability. Maintenance of records shall be in accordance with DOE Order 0200.1, *Information Management Program* (DOE, 1996).

5.0 Criterion 5 - Work Processes

All UGTA Subproject activities shall be performed in accordance with approved plans and procedures. Contractor-specific procedures shall comply with all applicable requirements of DOE Orders, procedures, and subproject planning documents. Upon request, contractors and participating organizations shall supply the DOE/NV ER Project with copies of all applicable procedures. All deviations from approved subproject plans and procedures shall be documented.

5.1 Field Activities

The performance of field activities shall be based upon the objectives of the assessment. Details of specific, environmental, data-collection activities will be discussed in the applicable planning documents. Appropriate technical methods or a scientific rationale shall be employed.

5.1.1 Environmental-Sample Numbering

Each sample shall be assigned a unique identification number that is recorded on an individual sample label, a sample collection record, and a chain-of-custody form. The UGTA Subproject participants shall ensure that assigned sample numbers are not duplicated. Information specific to each individual sample shall be recorded on the collecting organization's forms.

5.1.2 Decontamination

To prevent cross-contamination of samples, equipment coming in contact with samples shall be decontaminated prior to use and between sampling locations. Decontamination activities shall be performed in accordance with approved procedures and shall be documented in a daily activity report or field log book.

5.1.3 Sample Handling and Preservation

Proper sample handling shall be achieved by selecting appropriate sample containers, preservation procedures, and holding times for specific analyses. Where applicable, sample containers shall be certified clean per EPA protocol and shall remain sealed until ready for use. Documentation of container cleanliness shall be maintained in the subproject files.

Table 5-1 provides a list of requirements including analytical parameters, containers, and preservative specifications for groundwater samples. Radiological parameters are divided into

Table 5-1
Groundwater Characterization Parameters
(Page 1 of 4)

Analyte	Analytical Method	Number of Containers	Container Type	Preservative	Filtration	Holding Time	Detection Limit (µg/L)[a]	Laboratory	QC Requirements
Metals:									
Aluminum	SW-846[b] 6010	2*	1,000-mL[c] amber glass or polyethylene	HNO_3 to pH<2, Cool/Ice	Filtered & Nonfiltered	6 months	10	Commercial[d]	
Arsenic	SW-846 6010				Filtered & Nonfiltered	6 months	10		Standard RCRA Requirement
Barium	SW-846 6010				Filtered & Nonfiltered	6 months	200		Standard RCRA Requirement
Cadmium	SW-846 6010				Filtered & Nonfiltered	6 months	5		Standard RCRA Requirement
Calcium	SW-846 6010				Filtered	6 months	5,000		Equivalence per million balance by lab
Chromium	SW-846 6010				Filtered & Nonfiltered	6 months	10		Standard RCRA Requirement
Iron	SW-846 6010				Filtered & Nonfiltered	6 months	40		
Lead	SW-846 6010				Filtered & Nonfiltered	6 months	3		Standard RCRA Requirement
Lithium	SW-846 6010				Filtered	6 months	50		
Magnesium	SW-846 6010				Filtered	6 months	5,000		Equivalence per million balance by lab
Manganese	SW-846 6010				Filtered & Nonfiltered	6 months	15		
Mercury	SW-846 7470				Filtered & Nonfiltered	28 days	0.2		Standard RCRA Requirement
Potassium	SW-846 6010				Filtered	6 months	5,000		Equivalence per million balance by lab
Selenium	SW-846 6010				Filtered & Nonfiltered	6 months	5		Standard RCRA Requirement
Silicon	SW-846 6010				Filtered & Nonfiltered	6 months	100		
Silver	SW-846 6010				Filtered & Nonfiltered	6 months	10		Standard RCRA Requirement
Sodium	SW-846 6010				Filtered	6 months	5,000		Equivalence per million balance by lab
Strontium	SW-846 6010				Filtered	6 months	50		
Uranium	SW-846 6010				Filtered	6 months	20		
Inorganics:									
Bicarbonate	EPA 310.1	2*	1,000-mL polyethylene	Cool/Ice	Nonfiltered	14 days	1,000	Commercial	Equivalence per million balance by lab
Bromide	EPA 300.0				Filtered	28 days	250		
Carbonate	EPA 310.1				Nonfiltered	14 days	1,000		Equivalence per million balance by lab
Chloride	EPA 300.0				Filtered	28 days	250		Equivalence per million balance by lab
Fluoride	EPA 300.0				Filtered	28 days	250		Equivalence per million balance by lab
pH	EPA 150.1				Nonfiltered	ASAP	.01 pH units		
Sulfate	EPA 300.0				Filtered	28 days	1,000		Equivalence per million balance by lab
Total Dissolved Solids	EPA 160.1				Nonfiltered	7 days	10 mg/L		
Electrical Conductivity	EPA 120.1				Nonfiltered	28 days	0.1 µmhos/cm		

See Footnotes at end of table.

Table 5-1
Groundwater Characterization Parameters
(Page 2 of 4)

Analyte	Analytical Method	Number of Containers	Container Type	Preservative	Filtration	Holding Time	Precision	Sample Requirements	Laboratory	QC Requirements
Age and Migration Parameters:										
$^{12/13}$Carbon	Mass Spectrometry	1	1-liter glass	None	Nonfiltered	180 days	0.2 per mil	1 milligram (mg) C/sample	DRI[e]	
^{14}Carbon (Inorganic)	Accelerator Mass Spectrometry	1	50-mL & 125-mL glass	$HgCl_2$	Nonfiltered	180 days	1% (PMC)	1 mg C/sample	LLNL[f]	
^{36}Chlorine	Accelerator Mass Spectrometry	1	1-liter polyethylene	None	Nonfiltered	28 days	1%	3 mg Cl/sample	LLNL	
$^{3/4}$Helium	Noble Gas Mass Spectrometry	2 each	copper tubes	None	Nonfiltered	180 days	2%	10^{+12} atoms/cc	LLNL	
$^{18/16}$Oxygen	Mass Spectrometry	1	125-mL glass	None	Nonfiltered	180 days	0.2 per mil	NA	DRI	
Miscellaneous	^{3}H/ICP/SI	1	500-mL polyethylene	None	Nonfiltered	28 days	None	NA	LLNL	
Miscellaneous II	^{3}H/ICP/SI	1	1 oz. glass-polyseal	None	Nonfiltered	Indefinite	None	NA	LLNL	
$^{87/86}$Strontium	Thermal Ionization Mass Spectrometry	1	1-liter polyethylene (precleaned)	HNO_3 to pH<2	Filtered	180 days	0.1 per mil	300 nanogram (ng) Sr/sample	LLNL	
$^{234/238}$Uranium	Thermal Ionization Mass Spectrometry	1	1-liter polyethylene (precleaned)	HNO_3 to pH<2	Filtered	180 days	0.1%	100 ng U/sample	LLNL	
Deuterium/Hydrogen	Mass Spectrometry	1	10 mL glass polyseal lined cap	None	Nonfiltered	Indefinite	0.2 per mil	10 mL	DRI	

Analyte	Analytical Method	Number of Containers	Container Type	Preservative	Filtration	Holding Time	Method Detection Limit (µg/L)	Laboratory	QC Requirements
Organics:									
Total Organic Carbon	EPA 415.1	1	250-mL amber glass	HCl or H_2SO_4 pH<2, Ice	Nonfiltered	28 days	1,000	Commercial	
Dissolved Organic Carbon	EPA 415.1	1	250-mL amber glass	Iced	Silver Filtered	28 days	0.1 mg/L	Commercial	
Redox Parameters :[g]									
Ferrous Iron Ferric Iron	Field	NA	NA	NA	Filtered	NA	NA	NA	
Dissolved Oxygen	Field	NA	NA	NA	Nonfiltered	NA	NA	NA	Duplicate analysis in field
Total Sulfide	SW-846 9010	1	1,000-mL polyethylene	ZnAc+NaOH to pH>9	Nonfiltered	7 days	1,000	Commercial	

See Footnotes at end of table.

Table 5-1
Groundwater Characterization Parameters
(Page 3 of 4)

Analyte	Analytical Method	Minimum Detectable Activity (pCi/L)[h]	Number of Containers	Container Type	Preservative	Filtration	Holding Time	Laboratory	QC Requirements
Radiological Indicator Parameters/Level I:									
Gamma Scan	EPA 901.1[i]	10 (Cesium ^{137})	1	1-liter polyethylene	HNO_3 to pH<2	Nonfiltered	180 days	Commercial	
^{3}Hydrogen[j]	EPA 906.0[i]	500	1	250-mL amber glass	None	Nonfiltered	180 days	Commercial	
^{85}Krypton	Beta counting	25 pCi/L	1	500-mL stainless-steel cylinder	None	Nonfiltered	180 days	LLNL	
Radiological Indicator Parameters/Level II:									
Gross Alpha	EPA 900.0[i]	1	1	250-mL polyethylene	HNO_3 pH<2	Nonfiltered	180 days	Commercial	
Gross Beta	EPA 900.0[i]	1	1	250-mL polyethylene	HNO_3 pH<2	Nonfiltered	180 days	Commercial	
^{14}Carbon	EERF C-01[i]	2,000	1	1-liter polyethylene	None	Nonfiltered	180 days	Commercial	
^{90}Strontium	SM 7500-Sr[k]	4	1	1-liter polyethylene	HNO_3 to pH<2	Nonfiltered	180 days	Commercial	
$^{238/239}$Plutonium[l]	NAS-NS-3058[m]	0.07	4	1-liter polyethylene	HNO_3 to pH<2	Nonfiltered	180 days	Commercial	Collect duplicate
^{129}Iodine	ASTM D2334-1979[n]	2	4	1-liter amber glass	None	Nonfiltered	180 days	Commercial	
^{99}Technetium	HASL 300 E-TC-01[o]	300	1	1-liter polyethylene	HNO_3 to pH<2	Nonfiltered	180 days	Commercial	
^{237}Neptunium	ICP-MS[p]	1.5×10^{-7} dpm/L[q]	1	55-gallon polyethylene-lined drum	None	Nonfiltered	180 days	LANL[p]	

See Footnotes at end of table.

Table 5-1
Groundwater Characterization Parameters
(Page 4 of 4)

Analyte	Analytical Method	Minimum Detectable Activity (pCi/L)	Number of Containers	Container Type	Preservative	Filtration	Holding Time	Laboratory	QC Requirements
Nuclear Fuel Products[r] and Other Radionuclides:									
^{239}Plutonium	Mass Spectrometry	0.07	1**	55-gallon polyethylene-lined drum	None	Nonfiltered	180 days	LANL	
^{240}Plutonium	Mass Spectrometry	0.07							
^{233}Uranium	Mass Spectrometry	0.10							
^{234}Uranium	Mass Spectrometry	0.10							
^{235}Uranium	Mass Spectrometry	0.10							
^{236}Uranium	Mass Spectrometry	0.10							
^{238}Uranium	Mass Spectrometry	0.10							

[a] Microgram per liter
[b] U.S. EPA Test Methods for Evaluating Solid Waste, 3rd Edition, Parts 1-4 (EPA, 1986)
[c] Milliliter
[d] Commercial Environmental Services
[e] Desert Research Institute
[f] Lawrence Livermore National Laboratory
[g] Both parameters associated with a Redox Couple must be analyzed by the same laboratory.
[h] PicoCurie per liter
[i] IT Corporation (IT) 1996 and 40 CFR 136
[j] If ^{3}Hydrogen concentration is confirmed to be present at levels >2,000 pCi/L, analysis for the Radiological Indicator Parameter Level II suite must be performed. Additional sample volumes must always be collected in the event that additional analyses are required.
[k] American Public Health Association, *Standard Method for the Examination of Water and Wastewater* (APHA, 1992)
[l] If ^{239}Plutonium is confirmed to be present at levels >0.07 pCi/L, analysis for Nuclear Fuel Products must be performed. Additional sample volumes must always be collected in the event additional analyses are required.
[m] National Academy of Science, Nuclear Science Series, 1963
[n] American Society of Testing and Materials (ASTM, 1979)
[o] U.S. Department of Energy, 1992
[p] Los Alamos National Laboratory; ICP-MS = LANL requirement
[q] Disentigrations per minute per liter
[r] If ^{239}Plutonium is confirmed to be present at levels >0.07 pCi/L, analyses for nuclear fuel products must be performed. Additional sample volumes must be collected for nearfield and wells immediately downgradient of testing areas in the event additional analyses are required.

*One 1-liter filtered, one 1-liter unfiltered
**Some nearfield wells may require the collection of 3 55-gallon drums. Consult the UGTA Technical Lead prior to sampling.

μmhos/cm = micromhos per centimeter
μg/L = microgram per liter
C = carbon
Cl = chlorine
Sr = strontium
U = uranium

See Footnotes at end of table.

two levels. Initially, only Level I radiological parameters will be analyzed. Samples collected for Level II radiological parameters will be stored until Level I analytical results are received. If contamination is detected, then the Level II samples will be analyzed. If Level II samples are not analyzed, the samples shall be disposed of properly.

5.1.4 Field Documentation

Field documentation shall be of sufficient detail to facilitate the reconstruction of field activities. Field personnel shall document activities on a daily activity report or in a log book. Daily entries in the log shall be made in indelible ink and shall include the following:

- The subproject name
- The date and time of field activities
- Names and affiliations of field personnel
- The equipment used, including identification number
- A general description of the day's field activities, showing the sequence of events
- Problems encountered
- Changes or modifications to approved plans
- Nonconformances and any corrective actions taken
- Weather conditions
- Field-equipment calibration data
- Field measurements or tests performed
- References to associated forms for details of each activity conducted
- The signature and date of the individual completing the report

The contractor Subproject Manager or a designee shall review the field-generated records for completeness and accuracy. This review shall be documented by an initial and date. Reviewed records shall be maintained in the project files.

5.1.5 Photographic Documentation

With the approval of the DOE/NV and in accordance with NTS requirements, photographs may be taken of the field activities. Photographs shall be documented on a photographic log in accordance with contractor procedures.

5.1.6 Sample Labels and Identification

Identification and traceability of samples collected as part of a data-collection task are critical to the success of the UGTA Subproject. Sample labels shall be securely affixed to the container. Unique sample numbers and other sampling information shall be printed on the labels using

indelible ink. All information and data for a sample are keyed to each sample's unique number. The sample label shall contain the following required information:

- The subproject name
- A unique sample number
- The sampling date and time (military)
- Sample location and depth interval (if applicable)
- Sample medium
- Requested analyses
- The name of the individual collecting the sample
- Preservation or conditioning of the sample

Each sample number shall be indicated on both the container and field data/sample collection forms. For samples requiring multiple containers, the same sample identification numbers shall be required on each container.

5.1.7 Sample Custody

Chain of custody for each sample collected must be documented to provide the traceability of possession from the time the samples are collected until disposal. A sample is considered to be in custody if it meets any of the following criteria:

- Is in a person's actual possession
- Is in a person's unobstructed view after being in the person's physical possession
- Is in a secured area to prevent tampering after having been in the person's physical possession
- Is in a designated secured area, restricted to authorized personnel only

Subproject management shall monitor the sampling event(s) to ensure that custody procedures and records are being properly implemented. Without exception, sample custody shall be continuously maintained for all samples collected.

5.1.7.1 Chain of Custody Form

Field teams shall initiate Chain of Custody (COC) forms for samples collected during field activities in accordance with approved contractor procedures that meet the requirements

established in DOE Standard Operating Procedure ERD-05-201, "Chain of Custody" (DOE, 1992). The COC form shall accompany the samples during handling and shipment, and it shall chronicle the history of custody. The unique identification number shall identify each sample on a COC form.

Each individual who collects a sample is responsible for sample custody until the sample is relinquished to another individual via the COC form. Whenever samples are transferred to a new sample custodian, the new custodian shall sign his or her name, the company name, and note the time and date that the transfer occurred.

If field samples are split for shipment to separate laboratories, a new COC form must be generated. Sample information on the original COC form shall not be deleted, marked out, or obscured in any way. Both the original and the new COC forms must cross-reference each other using the unique COC form number. Copies of the original field COC form shall be attached to the new form. One copy of the COC form shall be retained by the field sampling personnel for tracking purposes.

5.1.7.2 Custody Seals

To ensure that tampering is easily detectable, each sample container shall be individually sealed with a custody seal. The seal shall be placed over or around the lid of the sample container so that the container cannot be opened without breaking the seal. Each custody seal shall be initialed and dated by the sample custodian.

5.1.8 Sample Packaging and Shipping

Upon completion of sampling, labeling, and custody sealing, each sample shall be placed in a separate, sealable plastic bag; transferred to an appropriate shipping container cooled with ice, if required; and protected from breakage by using shock-absorbent packing material. Approved procedures must comply with Title 49 CFR, Parts 170 to 177, for the packaging and shipping of samples.

Prior to transport to a laboratory, samples collected at the NTS must be radiologically screened and cleared for removal from the NTS in accordance with the governing requirements. Samples to be removed from the NTS must have a property removal authorization.

Samples destined for a laboratory off the NTS shall be delivered or sent by an overnight delivery service to the laboratory stipulated in the site plans. If a delivery service is used, copies of the waybill shall be retained in the contractor's subproject records. The original COC form shall be returned to contractor's subproject management after final sample disposition and shall become a permanent part of the subproject file.

5.1.9 Investigation-Derived Waste

Investigation-derived waste (IDW) shall be handled in accordance with approved procedures and the *Underground Test Area Subproject Waste Management Plan* (DOE/NV, 1996b). The waste shall be characterized in accordance with approved plans and procedures. Disposal of IDW shall be in accordance with approved procedures that ensure compliance with DOE requirements and federal and state regulations.

5.2 Laboratory Operation

Analytical support laboratories shall be provided relevant UGTA Subproject plans to obtain background information and sampling strategy information that may be useful for predicting potential impacts to analytical operations and sample loading. Each laboratory performing analyses for the UGTA Subproject shall have approved, written procedures for each required analysis. Deviations from the procedures shall be documented and filed in the contractor subproject files.

The laboratory must maintain participation in the DOE interlaboratory quality assurance programs appropriate for the samples analyzed and in the EPA programs most appropriate to sample types and analyses. The laboratory must provide the results of these performance evaluation studies along with the laboratory's response to any deficiencies which were identified.

5.2.1 Preanalysis Storage

Samples received at the analytical laboratory that have been entered into the sample tracking system shall be placed into a temporary storage refrigerator or area until analyzed. The methods of storage are generally intended to:

- Retard biological action
- Retard hydrolysis of chemical compounds and complexes
- Reduce volatility of constituents

- Reduce adsorption effects
- Reduce light exposure

Preservation methods are generally limited to pH control, preservative addition, and refrigeration. Preanalysis sample storage procedures shall be documented and described in laboratory-specific procedures.

5.2.2 Postanalysis Storage

The possibility of reanalysis requires that proper environmental control for postanalysis samples be provided. These controls shall be described in laboratory-specific procedures. In general, samples shall not be kept longer than one year. The samples shall be properly disposed of by the laboratory unless other arrangements have been made to return excess samples to the NTS.

5.2.3 Analytical Methods

A graded approach to analytical data quality requirements shall be used to meet the sampling objectives and data needs of a given site and the dynamic nature of the program. All laboratories supporting the UGTA Subproject will perform analytical work, as directed, in accordance with the specifications listed in this QAPP. Standard analytical methods shall be implemented. Modifications to standard methods shall be documented. Each laboratory performing analyses for the UGTA Subproject shall have controlled written SOPs for each analysis, which shall be available for inspection upon request by DOE/NV, and shall be made available during laboratory audits.

Certain highly specialized radiological procedures developed by the national laboratories are also approved for use under the UGTA Subproject. Pursuant to the unique requirements associated with the analysis of NTS groundwater, unpublished and/or internal procedures developed by the National Laboratories (Lawrence Livermore [LLNL] and Los Alamos [LANL]) may be used with the approval of DOE/NV.

5.3 Calibration and Preventive Maintenance

A system of calibration and preventive maintenance shall be employed by subproject participants to ensure the proper operation of measurement and test equipment (M&TE). Reference standards of the correct type, range, and acceptable uncertainty shall be used for collecting data consistent with the project objectives.

5.3.1 Calibration

M&TE that requires calibration shall be uniquely identified by the manufacturer's serial number or a suitable assigned number. Whenever possible, the M&TE identification number will be permanently marked on the equipment. The calibration status shall be identified on labels or stickers affixed to the instrument. These labels shall include the current calibration date and the next calibration due date. When it is impractical to label M&TE due to size or configuration, calibration records traceable to the M&TE must include this information and be kept in close proximity to the equipment.

M&TE shall be calibrated prior to use for UGTA Subproject activities and at prescribed intervals thereafter. During M&TE use, operational checks of the equipment shall be performed to verify the equipment's continued accuracy and operational function. Calibrations of M&TE shall be performed by trained and qualified personnel, approved external agencies, or the equipment manufacturer. Calibration shall be performed in accordance with approved procedures or the manufacturer's recommendations. All periodic and operational calibrations shall be documented and maintained in the equipment files. These record files shall include, as applicable, M&TE calibration certificates and reference standard certifications. Calibration controls are not required for rulers, tapes, levels, and similar devices if normal commercial M&TE provides adequate accuracy.

5.3.1.1 Calibration Frequency

M&TE shall be calibrated at prescribed intervals. The frequency of periodic calibrations shall be based on the manufacturer's recommendations, national standards of practice, equipment type and characteristics, and past experience. Operational calibrations and/or source-response checks shall be performed on the appropriate M&TE prior to the start of work and reestablished at prescribed intervals that have been predetermined and are instrument-specific. During use, calibration and/or response checks shall be performed and documented on the appropriate field form to verify that the M&TE functions correctly.

5.3.1.2 Reference Standards and Equipment

Calibration reference standards and equipment shall have known relationships to the National Institute of Standards and Technology (NIST) or other nationally recognized standards. If a national standard does not exist, the basis for calibration shall be fully documented and approved

by the appropriate personnel. It is the responsibility of the user to select, verify, and use the standard samples in accordance with an approved procedure or established practice.

Physical and chemical standards shall have certifications traceable to NIST, EPA, or other recognized agencies. Supporting documentation on all reference standards and equipment shall be maintained by the user and be readily available for reference and inspection. Standard samples that are repackaged or split shall also have traceable lot or batch numbers transferred onto the new container.

5.3.1.3 Calibration Failure

Each user of M&TE is responsible for checking the calibration status of equipment to be used and confirming the acceptable calibration status prior to use. Equipment for which the periodic calibration period has expired, equipment that fails calibration, or equipment that becomes inoperable shall be tagged "out-of-service" and, when possible, segregated to prevent inadvertent use. M&TE shall be repaired and/or recalibrated by the appropriate vendor, manufacturer, or qualified personnel prior to being returned to service. Results of activities performed using equipment that is out of calibration shall be evaluated for adverse affects, documented on a nonconformance report, and the appropriate personnel notified.

5.3.2 Preventive Maintenance

Periodic preventive maintenance shall be performed for all field and laboratory equipment. Preventive maintenance schedules, practices, and a list of spare parts shall be developed by UGTA Subproject participants and documented throughout the life of the subproject. Major instruments and equipment should be covered by annual service contracts with manufacturers or other qualified organizations.

Information pertaining to the histories of equipment maintenance shall be kept in individual logs or files for each instrument. Instrument manuals shall be kept on file as references for equipment needs and repair. The frequency of preventive maintenance shall be based on manufacturers' recommendations and the users' professional knowledge and experience.

5.4 Data Reduction, Validation, and Reporting

Data reduction refers to computations and calculations performed on raw data. Data validation is a systematic process for reviewing data against a set of criteria to ensure that the data are

adequate for the intended use. Data reporting is the documentation of data reduction and validation results.

5.4.1 Data Reduction and Verification

Computations performed on raw data are considered data reductions. Verification is the process of checking and reviewing the data reduction process. Data reduction output includes, but is not limited to, summary tables, statistics, and assessments relative to established output parameters with respect to levels of concern.

Written procedures shall be implemented for all data reduction steps. Numerical reduction of field and analytical data shall be formally checked in accordance with contractor approved procedures. Checking must be performed prior to the presentation of results. If unchecked results are to be presented, transmittals or subsequent calculations based on these results must be marked "preliminary" until the results are checked and determined to be correct.

Data verification is a systematic review of laboratory data by qualified individuals to ensure that data meet specified guidelines. The process consists of documentation, screening, checking, and review. All data packages shall be validated to a level required by the end user using an approved procedure. In addition, a percentage of data packages produced by laboratories performing analyses in support of the UGTA Subproject shall be independently reviewed by individuals not directly associated with the original reduction and compilation of data. Data validation data packages shall be performed in accordance with established procedures

5.4.2 Data Reporting

Analytical data shall be formatted in accordance with standardized formats for chemical and radiological data that are appropriately referenced with respect to detection limits. Electronic data transfers shall be delivered, along with the hard copy, on 3.5-in. diskettes or other methods agreed upon by the lab and the ERD data repository custodian organization.

5.4.3 Evaluation And Use of Data

Participating organizations shall have a method in place for the control and transfer of data, control of interpretive work products, and the control of data within the central database. The process should provide guidance for gathering, manipulating, and distributing data. The quality of existing data shall be determined, based on the traceability of data and the level of QA/QC

applied to the data during initial collection, prior to inclusion into the central database. Reports, models, or interpretative works shall indicate the quality of the data being used.

Interpretive Work Products should receive technical peer reviews of the interpretations. Peer Reviewers should consider the following aspects:

- Conformance of interpretive methods to accepted and published concepts (recognizing that alternative methods and interpretations other than those of the peer reviewer may be acceptable)
- Consistency of interpretive results with known data
- Reasonable and prudent use of data and analysis tools, given the context of the Technical Approach Document
- The accuracy of each Interpretive Work Product. The acceptable level of accuracy is established by the Work Product Author and the Subproject Manager.

Prior to use, newly acquired analytical data will be evaluated against predetermined objectives and criteria.

6.0 Criterion 6 - Design

Any quality-affecting items or processes designed in support of the UGTA Subproject shall be in accordance with a documented design control process and based on sound engineering and scientific principles using the appropriate standards. The acceptability and adequacy of the design product shall be verified or validated by qualified individual(s) other than those who performed the original design. Verification and validation shall be completed prior to approval and implementation of the design. Design records shall include the design steps and sources of input that support the final output. The final design output shall be approved in accordance with the participants' internal procedures. Changes or modifications to the final design shall be subject to the same control measures and approvals as applied to the original design.

7.0 Criterion 7 - Procurement

Items and services of a technical nature provided to the UGTA Subproject shall be of a quality that meets the requirements of the project. Subproject participants shall establish controls to ensure that procured equipment and services meet or exceed specifications and that systems are in place to track items and confirm the delivery of procured items and services. Subproject participants shall have a program in place, invoking the appropriate quality-related requirements of the contractor's QA program plans and procedures and this QAPP for the procurement of items and services. All procurement documents should be submitted to QA for review to ensure that the applicable quality-affecting requirements have been included. The QA representative should initial and date the procurement documents to verify that the review has taken place.

Procurement documents shall define the scope of work for the item or service being procured, the specifications, and any required documentation. Technical requirements shall either be directly included in the procurement documents or included by reference to specific drawings, specifications, procedures, regulations, or codes that describe the items or services to be furnished. Documentation required to provide evidence that items and services conform to quality standards shall be identified in the procurement documents. The procurement documents shall require that all purchased and rented M&TE be calibrated to national standards prior to acceptance and sufficient documentation provided. Calibration certification and instrument manufacturers' manuals shall be available in project files for all M&TE.

If applicable, procurement documents shall provide free access to the subcontractors' facilities, including their subtier facilities, work areas, and records for the purposes of surveillance, inspection, and audit to verify acceptability. Objective evidence of conformance to procurement requirements shall be thoroughly evaluated. The authority to stop work, based on significant quality problems, shall be clearly stated in the procurement documents.

8.0 Criterion 8 - Inspection and Acceptance Testing

Inspections and acceptance testing shall be accomplished in accordance with approved inspection documents and test procedures that reflect acceptance and performance criteria. Individuals performing inspections and acceptance testing shall be independent of those who performed the work. Quality-affecting materials used during characterization, corrective action, or sampling activities shall be inspected upon receipt for adequacy. M&TE used in the performance of inspections or acceptance tests shall be calibrated and properly maintained. Any item or work determined to be defective shall be segregated and controlled.

9.0 Criterion 9 - Management Assessment

Planned and periodic assessments shall be conducted and shall involve the direct participation of management at all levels. The primary emphasis of management assessments is to evaluate the implementation of the integrated QA program and identify problems that hinder the achievement of objectives. Contractor management should conduct periodic assessments that focus on such issues as the:

- Adequacy of implementation of the integrated QA program, with particular emphasis on quality improvement
- Existence of any management biases or organizational barriers that impede the improvement process
- Adequacy of the appraised organization's structure, staffing, and physical facilities
- Existence of effective training programs

The results of the assessment should be documented in a final report and issued to the appropriate managers. Management has the primary responsibility to ensure the timely follow-up of corrective actions, including an evaluation of the effectiveness of management's actions. Results of the management assessment should be entered into a tracking system for the purposes of identifying trends and lessons learned.

10.0 Criteria 10 - Independent Assessments

This section establishes the methods and responsibilities for planning, scheduling, and performing independent assessments in the form of audits and surveillances of quality-affecting UGTA Subproject activities. Audits and surveillances shall be performed to verify compliance with the QA program and to determine the effectiveness of its implementation. The focus of these assessments shall be on improving items and processes.

10.1 Audits

An audit is a planned and documented activity that evaluates specified components of a task against approved requirements, plans, and procedures. Audits shall examine the availability, adequacy, and implementation of work instructions and assess the effectiveness of management and work process controls.

10.1.1 Audit Schedule

Audits shall be scheduled as early as feasible in the life of an activity. Thereafter, audits may be scheduled at a frequency commensurate with the extent of activity of the element(s), previously identified deficiencies of the element(s), and the importance of the element(s). Unscheduled audits may be performed to supplement scheduled audits based on, but not limited to, results of previous audits, surveillances and management assessments, nonconformance reports, corrective actions, and identified trends.

10.1.2 Audit Teams

Commensurate with the scope, complexity, or unique nature of the activities to be audited, personnel shall be selected for auditing assignments based on their abilities, specialized technical training, experience, and education. Technical Specialists (individuals with a specialized knowledge of the area being audited) may be selected to participate under the guidance of a Lead Auditor. All selected auditors shall be independent of any direct responsibility for performing the activities to be audited. Auditors and Technical Specialists shall have, or be given, appropriate training in audit techniques and shall be indoctrinated in the specifics of the audit.

10.2 Surveillances

Audits may be supplemented with surveillances which are narrower in scope and directed at specific project activities. A surveillance is the act of monitoring or observing an item or activity to verify conformance to specified requirements.

Surveillances do not require the same level of planning and scheduling as audits and should be performed based on the potential for adverse affect. The extent and frequency of surveillances shall reflect the importance of the work activity, results of previous surveillances and/or audits, trend reports, and the inherent risks involved. Surveillance personnel shall be knowledgeable in, and not directly responsible for, the activities under surveillance.

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