Nevada
Environmental
Management
Operations Activity

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National Nuclear Security Administration

Underground Test Area Activity Quality Assurance Plan Nevada National Security Site, Nevada

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Revision No.: 2

June 2015

/s/ Joseph P. Johnston, CO 06/11/2015

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U.S. Department of Energy
National Nuclear Security Administration
Nevada Field Office

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UNDERGROUND TEST AREA ACTIVITY QUALITY ASSURANCE PLAN NEVADA NATIONAL SECURITY SITE, NEVADA

U.S. Department of Energy, National Nuclear Security Administration
Nevada Site Office
Las Vegas, Nevada

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UNDERGROUND TEST AREA ACTIVITY
QUALITY ASSURANCE PLAN
NEVADA NATIONAL SECURITY SITE, NEVADA

Approved by: /s/ Bill R. Wilborn Date: 06/10/2015

Bill R. Wilborn
Underground Test Area Activity Lead

Approved by: /s/ Robert F. Boehlecke Date: 06/10/2015

Robert F. Boehlecke
Environmental Management Operations Manager

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List of Acronyms and Abbreviations

ASTM	ASTM International
CADD	Corrective action decision document
CAI	Corrective action investigation
CAIP	Corrective action investigation plan
CAP	Corrective action plan
CAU	Corrective action unit
CR	Closure report
DOE	U.S. Department of Energy
DOECAP	U.S. Department of Energy Consolidated Audit Program
DOT	U.S. Department of Transportation
DQI	Data quality indicator
DQO	Data quality objective
DRS	Document Review Sheet
EPA	U.S. Environmental Protection Agency
ET	Evapotranspiration
FAWP	Field activity work package
FFACO	*Federal Facility Agreement and Consent Order*
GPO	U.S. Government Printing Office
HFM	Hydrostratigraphic framework model
HSU	Hydrostratigraphic unit
IDW	Investigation-derived waste
K_d	Distribution coefficient
LCS	Laboratory control sample
LQC	Laboratory quality control
M&TE	Measuring and test equipment
NDEP	Nevada Division of Environmental Protection

List of Acronyms and Abbreviations (Continued)

NIST	National Institute of Standards and Technology
NNSA/NFO	U.S. Department of Energy, National Nuclear Security Administration Nevada Field Office
NNSS	Nevada National Security Site
PEP	Performance evaluation program
PER	Pre-emptive review
PEST	Parameter estimation software
QA	Quality assurance
QAP	Quality Assurance Plan
QC	Quality control
RCRA	*Resource Conservation and Recovery Act*
REOP	Real Estate/Operations Permit
ROTC	Record of Technical Change
RPD	Relative percent difference
RST	Radiologic source term
SDWA	*Safe Drinking Water Act*
SME	Subject matter expert
SOP	Standard operating procedure
SWO	Stop work order
TDR	Technical Data Repository
UGTA	Underground Test Area
XRD	X-ray diffraction
XRF	X-ray fluorescence

Definitions

Acceptance Criteria
Specific limits placed on an item, process, or service defined in requirements documents (EPA, 2005).

Assessment
A review, evaluation, inspection, test, check, surveillance, or audit to determine and document whether items, processes, systems, or services meet specified requirements and perform effectively (NNSA/NFO, 2014).

Calibration
Comparison of a measurement standard, instrument, or item with a standard or instrument of higher accuracy to detect and quantify inaccuracies and to report or eliminate those inaccuracies by adjustments (EPA, 2005).

Certification
The process of testing and evaluating against specifications designed to document, verify, and recognize the competence of a person, organization, or other entity to perform a function or service, usually for a specified time (EPA, 2005).

Contaminant Boundary
A probabilistic model-forecast perimeter and a lower hydrostratigraphic unit boundary that delineates over 1,000 years the extent of radionuclide-contaminated groundwater from underground testing. Once in the Corrective Action Decision Document/Corrective Action Plan and Closure Report stage, the revised contaminant boundaries may be based upon conceptual model refinements, using non-three-dimensional numerical model(s) and/or any other quantitative approaches acceptable to the Nevada Division of Environmental Protection and the U.S. Department of Energy, National Nuclear Security Administration Nevada Field Office (NNSA/NFO) (FFACO, 1996; as amended).

Corrective Action
Action taken in response to an identified issue and intended to resolve the existing condition, introduce compensatory or remedial actions as necessary, and minimize the probability of a recurrence of the issue (NNSA/NFO, 2014).

Data Quality Objectives
Qualitative and quantitative statements derived from the data quality objective (DQO) process. The DQOs can be used as the basis for establishing the quality and quantity of data needed to support decisions (EPA, 2005).

Definitions *(Continued)*

Data Usability
The result of verifying or determining that the quality of the data produced is adequate for its intended use (ASQ, 2004).

Deficiency
An unauthorized deviation from acceptable procedures or practices, or a defect in an item (ASQ, 2004).

Environmental Data
Any measurements or information that describe environmental processes, locations, or conditions; ecological or health effects and consequences; or the performance of environmental technology. This includes information collected directly from measurements, produced from models, and compiled from other sources such as databases or the literature (EPA, 2005).

Inspection
An examination or measurement of an item or activity to verify conformance to specific requirements (EPA, 2005).

Item
An all-inclusive term used in place of any of the following: appurtenance, facility, sample, assembly, component, equipment, material, module, part, structure, subassembly, subsystem, system, unit, documented concepts, or data (ASQ, 2004).

Management Assessment
An introspective self-analysis performed by an organization (NNSA/NFO, 2014).

Measuring and Test Equipment
Measuring instrument, software, measurement standard, referenced material or auxiliary equipment, or combination thereof, to realize a measurement process. Such equipment may include tools, gauges, instruments, sampling devices, or systems used to calibrate, measure, gauge, test, or inspect to control or acquire data to verify conformance to specified requirements (ASQ, 2004).

Method
A body of procedures and techniques for performing an activity (e.g., sampling, chemical analysis, quantification) systematically presented in the order in which they are to be executed (EPA, 2005).

Definitions (Continued)

Model
A simplification of reality that is constructed to gain insights into select attributes of a physical, biological, economic, or social system. A format representation of the behavior of system processes, often in mathematical or statistical terms. The basis can also be physical or conceptual (EPA, 2009).

Model Evaluation
The process used to determine whether a model and its results are of a quality sufficient to serve as the basis for a regulatory decision (EPA, 2009).

Nonconformance
A deficiency in characteristic, documentation, or procedure that renders the quality of an item or activity unacceptable or indeterminate; nonfulfillment of a specified requirement (EPA, 2005).

Non-direct Data
Data collected or generated under non-Underground Test Area quality assurance programs, investigations, or procedures (EPA, 2002).

Oversight Assessment
An analysis or review of contractor programs, processes, or products conducted by NNSA/NFO federal staff (NNSA/NFO, 2014).

Procedure
A specified way to carry out an activity or process (ASQ, 2004).

Quality
Degree to which a set of inherent characteristics fulfills requirements. Quality may relate to a product or service that bears on its ability to meet the stated or implied needs and expectations of the user (ASQ, 2004).

Quality Assurance
Part of quality management focused on providing confidence that quality requirements will be fulfilled. Quality assurance may include management activities involving planning, implementation assessment, reporting, and quality improvement to ensure a process, item, or service is of the type and quality needed and expected by the customer (ASQ, 2004).

Definitions (Continued)

Quality Control
Part of quality management focused on fulfilling quality requirements. Quality control includes technical activities that measure the attributes and performance of a process, item, or service against defined standards to verify they meet the stated requirements established by the customer, operational techniques, and activities that are used to fulfill requirements for quality (ASQ, 2004).

Readiness Review
A systematic, documented review of the readiness for startup or continued use of a facility, process, or activity. Readiness reviews are typically conducted before proceeding beyond project milestones and before instituting a major phase of work (ASQ, 2004).

Record
Book, paper, map, photograph, machine-readable material (i.e., electronic data, email), or other documentary material, regardless of physical form or characteristics, made or received by an agency of the United States government under federal law or in connection with the transaction of public business, and preserved or deemed appropriate for preservation by that agency or its legitimate successor as evidence of the organization, functions, policies, decisions, procedures, operations or other activities of the government or because of the informational value of the data in them (NNSA/NFO, 2014).

Remediation
The process of reducing the concentration of a contaminant (or contaminants) in air, water, or soil media to a level that poses an acceptable risk to human health (ASQ, 2004).

Sensitivity
The degree to which the model outputs are affected by changes in selected input parameters (EPA, 2009).

Specification
A document that states requirements and refers to or includes drawings or other relevant documents. Specifications should indicate the means and criteria for determining conformance (ASQ, 2004).

Suspect/Counterfeit Items
An item is suspect when inspection or testing indicates it may not conform to established specifications. A counterfeit item is one that has been copied or substituted without legal right or authority or whose material, performance, or characteristics have been misrepresented by the supplier or manufacturer (DOE, 2013a).

Definitions (Continued)

Uncertainty

Describes the lack of knowledge about models, parameters, constants, data, and beliefs. Sources of uncertainty include the science underlying a model, input data, observation error, and code uncertainty (EPA, 2009).

Validation

Confirmation through provision of objective evidence that the requirements for a specific intended use or application are fulfilled. Data validation is an analyte and sample-specific process that determines the analytical quality of a specific dataset (ASQ, 2004).

Verification

Confirmation through provision of objective evidence that specified requirements have been fulfilled. Data verification is a sampling and analysis process evaluation of the completeness, correctness, conformance, and compliance of a specific dataset against the method, procedural, or contractual requirements (ASQ, 2004).

1.0 Management

This Quality Assurance Plan (QAP) provides the overall quality assurance (QA) requirements and general quality practices to be applied to the U.S. Department of Energy (DOE), National Nuclear Security Administration Nevada Field Office (NNSA/NFO) Underground Test Area (UGTA) activities. The requirements in this QAP are consistent with DOE Order 414.1D, Change 1, *Quality Assurance* (DOE, 2013a); U.S. Environmental Protection Agency (EPA) *Guidance for Quality Assurance Project Plans for Modeling* (EPA, 2002); and EPA *Guidance on the Development, Evaluation, and Application of Environmental Models* (EPA, 2009). If a participant's requirement document differs from this QAP, the stricter requirement will take precedence. NNSA/NFO, or designee, must review this QAP every two years. Changes that do not affect the overall scope or requirements will not require an immediate QAP revision but will be incorporated into the next revision cycle after identification.

Section 1.0 describes UGTA objectives, participant responsibilities, and administrative and management quality requirements (i.e., training, records, procurement). Section 1.0 also details data management and computer software requirements. Section 2.0 establishes the requirements to ensure newly collected data are valid, existing data uses are appropriate, and environmental-modeling methods are reliable. Section 3.0 provides feedback loops through assessments and reports to management. Section 4.0 provides the framework for corrective actions. Section 5.0 provides references for this document.

1.1 Problem Definition and Background

Underground testing of nuclear weapons was conducted from 1951 to 1992 at the Nevada National Security Site (NNSS). As an unavoidable consequence of these testing activities, radionuclides were introduced into the subsurface environment and have impacted the groundwater. UGTA was initiated to address this radioactive groundwater contamination with a focus on the potential for contaminated groundwater reaching receptors (DOE, 2006). UGTA defines contaminated groundwater as groundwater with radionuclides from underground nuclear testing and identified in the Bowen et al. (2001) radiologic source term that exceeds the radiological standards of the *Safe Drinking Water Act* (SDWA) (CFR, 2014a), the State of Nevada's groundwater-quality standard to protect human health.

The nuclear testing locations assigned to UGTA are grouped into five corrective action units (CAUs): Yucca Flat/Climax Mine (CAU 97), Frenchman Flat (CAU 98), Rainier Mesa/Shoshone Mountain (CAU 99), Central Pahute Mesa (CAU 101), and Western Pahute Mesa (CAU 102). UGTA has combined the CAU 101 and 102 investigations due to proximity and hydrogeologic similarity.

1.2 Description

The UGTA objective is to define perimeter boundaries for each CAU over the next 1,000 years using (1) data collection, (2) modeling, (3) iterative model evaluations and monitoring, and (4) identification and documentation of land-use policies. The goal is to provide the data, model forecasts, and confidence in the model results to facilitate informed regulatory decisions by NNSA/NFO and Nevada Division of Environmental Protection (NDEP). This approach is consistent with the guidance by the National Research Council on the use of models in environmental regulatory decision making (NRC, 2007).

The UGTA corrective action strategy is documented in Appendix VI, Section 3.0, of the *Federal Facility Agreement and Consent Order* (FFACO) (1996, as amended). The UGTA corrective action strategy has four stages:

1. Corrective Action Investigation Plan (CAIP)
2. Corrective Action Investigation (CAI)
3. Corrective Action Decision Document (CADD)/Corrective Action Plan (CAP)
4. Closure Report (CR)

An UGTA strategy flowchart is available in Appendix VI, Section 3.0, of the FFACO (1996, as amended). The strategy leads to closure of CAUs and implementation of long-term closure monitoring programs and institutional controls.

1.2.1 Schedule

Milestones and schedules for UGTA are established by NNSA/NFO and NDEP in accordance with the FFACO. Part XII.4 of the FFACO requires annual meetings to establish priorities, milestones, and due dates for the current fiscal year. Milestones and monthly progress reports are posted to the FFACO website.

1.3 Roles and Responsibilities

NNSA/NFO personnel and UGTA participants' responsibilities are described in the following subsections.

1.3.1 Environmental Management Operations

NNSA/NFO personnel are responsible for achieving quality within the specific activities they manage. The personnel described in the following subsections may be termed "NNSA/NFO" throughout this document.

1.3.1.1 Environmental Management Operations Manager

The Environmental Management Operations Manager is responsible for the administration of the Nevada Environmental Management Operations and reports to the Assistant Manager for Environmental Management. The Operations Manager has oversight and management responsibilities for ensuring that quality requirements are established and implemented for environmental restoration activities.

1.3.1.2 Activity Lead

The UGTA Activity Lead reports directly to and is the prime point of contact for the Environmental Management Operations Manager. The Activity Lead has day-to-day management responsibilities for technical, financial, and scheduling aspects, and for monitoring participant performance. The Activity Lead is also responsible for ensuring effective communication between participants.

1.3.1.3 Task Manager

The Federal Task Manager reports directly to the Activity Lead. The Task Manager has day-to-day management responsibilities for technical aspects of assigned tasks and for monitoring participant performance.

1.3.2 Participants

The UGTA Program Management Plan (DOE/NV, 1999) provides the implementation and organizational structure for the UGTA Activity. Participants are responsible for developing procedures for their assigned scope of work and ensuring work is performed in accordance with applicable federal, state, and local regulations; and with plans and procedures consistent with individual contracts and agency agreements. To fulfill responsibilities specific to QA, participants are, at a minimum, responsible for the following:

- Report information regarding scope, schedules, costs, technical execution, and quality achievement of task order activities to NNSA/NFO.
- Ensure proper resources and QA activities are integrated into tasks.
- Implement applicable procedures and instructions.
- Verify work is technically sound, defensible, consistent with objectives, and conducted in accordance with this QAP.
- Ensure personnel are trained and qualified to achieve initial proficiency; maintain proficiency; and adapt to changes in technology, methods, and job responsibilities.
- Perform assessments (see Section 3.1.2) to verify compliance with applicable requirements.
- Identify deficient areas, implement effective corrective actions, and verify actions are effective.
- Notify the Activity Lead and other involved personnel about significant conditions adverse to quality, safety, health, the environment, or any adverse trends.

1.3.3 Subcontractors

Subcontractors are subject to the same requirements as participants. Verification of subcontractor conformance is the responsibility of the organization procuring the subcontract. Participants must ensure the flow down of applicable requirements to their subcontractors.

1.3.4 Interfaces

Contract Managers and CAU Leads maintain frequent communication and are the primary interfaces with NNSA/NFO personnel. Specific responsibilities for the primary interfaces are described within this section.

1.3.4.1 Contract Managers

Each UGTA organization assigns a Contract Manager to be responsible for developing scope, schedule, and budgets; managing resources; documenting and communicating progress; developing, authorizing, and complying with plans such as health, safety, and QA plans; planning lifecycle tasks; and coordinating with the other participants to conduct technical tasks.

1.3.4.2 CAU Leads

The CAU Lead is responsible for identifying and coordinating CAU-specific technical scope and priorities; coordinating with other CAU Leads to maintain consistency between CAUs; coordinating technical reviews; evaluating and prioritizing data needs; providing technical oversight to the CAU team; focusing Pre-Emptive Review (PER) Committee reviews; and communicating progress.

1.3.5 Committees

The following subsections describe the standing and *ad hoc* committees.

1.3.5.1 Pre-Emptive Review Committees

The CAU-specific PER Committees provide internal technical review of ongoing work throughout the CAU lifecycle. The reviews assure work is comprehensive, accurate, in keeping with the state of the art, and consistent with CAU goals. PER Committee members are participants with the appropriate expertise but are not directly responsible for CAU products they review. The committee membership will consist of a core team that is consistent throughout the CAU lifecycle and additional subject matter experts (SMEs) as needed. As part of their oversight, NDEP may have ex-officio member(s) on the committee.

The Activity Lead, or designee, appoints a Chairperson and assigns SMEs. The Chairperson, or designee, facilitates, participates in, and documents committee activities, including membership, agendas, presentations, decisions, and recommendations. The CAU Lead and Chairperson identify action items, track progress to resolution, and communicate with NNSA/NFO.

1.3.5.2 Topical Committees

Topical Committees may be formed on an as-needed basis to address issues, questions, concerns, and readiness. Any participant may identify the need for the committee to the Contract Managers. The Activity Lead must set goals and expectations; appoint a Chairperson; and assign the suitable SMEs (may include SMEs external to UGTA). The Chairperson, or designee, facilitates, participates in, and documents committee activities, including membership, agendas, presentations, decisions, and recommendations. These committees may be disbanded when the work is complete. The following are long-standing topical committees.

1.3.5.2.1 Drilling Advisory Team

Drilling Advisory Teams make real-time decisions to facilitate meeting well objectives and completing wells. The team ensures the scientific goals of each well are met. Membership is drawn from participants with an emphasis on field experience and includes the appropriate CAU Lead. The team is active only during drilling operations.

1.3.5.2.2 Guidance Team

The Guidance Team provides planning advice to NNSA/NFO on an as-needed basis. The team is composed of representatives from all UGTA participants and an ex-officio NDEP member. The team is convened by the CAU Lead to identify, prioritize, and recommend field or modeling activities. The team will ensure the following:

- Clear objectives are identified.
- The objectives are focused on the appropriate regulatory decision they are intended to support.
- The planned activities primarily address the objectives.

1.3.5.2.3 Modeling Committee

The Modeling Committee advises NNSA/NFO on modeling and software-related issues on an as-needed basis. The committee is composed of representatives from all UGTA participants and an ex-officio NDEP member with modeling expertise. The committee is convened when modeling or software issues or questions require resolution.

1.4 Qualifications and Training

NNSA/NFO and participants' management must ensure personnel are qualified and knowledgeable in the activities they perform. Training should emphasize correct performance of assigned work and provide an understanding of why quality requirements exist. Personnel qualification and training documents must be maintained as records in accordance with Section 1.7.

1.4.1 Participants

Participants must be trained and qualified to perform the tasks to which they are assigned. Objective evidence of qualifications may include academic credentials, individual resumes, registrations and/or certifications, licenses, and training records. Participants must evaluate personnel qualifications against assigned responsibilities and address identified training needs. Training should be provided to achieve and maintain proficiency; adapt to changes in technology, methods, or job description; and allow for feedback and effectiveness of job performance. Training may take the form of orientation and/or indoctrination, formal classroom training, self study, reading, or on-the-job training. Training should include regulatory requirements, scopes of work, QA/quality control (QC) requirements, and applicable work instructions.

1.4.2 Subcontractors

Subcontractor personnel must be qualified and trained to perform the duties for which they were contracted. The contracting organization must be responsible for verifying the qualifications of subcontracted personnel.

1.5 Quality Objectives and Criteria

Contract Managers must apply requirements using a graded approach. The graded approach is based on the level of managerial controls applied to an item, data, or activity according to the intended use and degree of confidence needed in the quality of the results. UGTA has incorporated an iterative process similar to EPA's Data Quality Objective (DQO) process (EPA, 2006) to establish the quality requirements. Because both data collection and modeling are performed, different quality systems are used. Data quality indicators (DQIs) are used to establish the confidence needed for data collection (see Section 2.1). Modeling quality objectives are associated not only with data uncertainty but also with demonstrating confidence in the representation of the complex environmental system. The QA requirements associated with sampling parameter distributions, multiple realizations of the models, model evaluations, PER reviews, and peer reviews establish the confidence needed in the model results.

1.5.1 Quality Objective Process

The EPA's DQO process (EPA, 2006) is a systematic planning tool to help define the environmental problem, identify the information needed to address the problem, and design an investigation program to gather the necessary data. This is an iterative process with the goal of ensuring the right type, quality, and quantity of data are produced to achieve the intended outcome. UGTA follows the overall process incorporating the FFACO (1996, as amended) and model requirements as described below. The seven steps of the process are as follows:

1. State the problem.
2. Identify the goal.
3. Identify information inputs.
4. Define the boundaries.
5. Develop the analytic approach.
6. Specify performance or acceptance criteria.
7. Develop the plan for obtaining data.

The problem (Step 1) is stated in the FFACO (1996, as amended) and in Section 1.1: Groundwater on the NNSS has been contaminated with radionuclides as a result of underground nuclear testing.

The goal (Step 2) is to provide the data, model forecasts, and confidence in the model results to facilitate informed regulatory decisions by NNSA/NFO and NDEP.

Contaminant boundaries are forecasted for each CAU enclosing areas that may potentially exceed the radiological standards of the SDWA (CFR, 2014a) over the next 1,000 years. The information needed for creating models to forecast contaminant boundaries (Step 3) is identified during the CAIP stage. The DQOs for the data needs are documented in the CAIP. NDEP must approve the CAIP before the CAI stage begins. A value of information analysis is prepared during the CAIP stage and includes the following:

- Compilation of existing data
- Identification of data needs and gaps
- Identification of sensitive parameters
- Identification of quantity and quality of additional data needs, and characterization options
- Cost of characterization options
- Effect of data characterization options on uncertainty reduction
- Comparison of characterization options through decision analysis

Model boundaries are defined (Step 4) during the CAI stage and documented in the flow and transport model document. Contaminant boundaries are also documented in the flow and transport model document.

The analytic approach, or decision rule (Step 5), is outlined in the CAIP and includes developing groundwater flow and transport models that comprise a group of model components, including a hydrostratigraphic framework model (HFM), flow model, source term model, and transport simulations (see Section 2.6.1) that are documented in the flow and transport model document. A separate modeling strategy document may be developed.

The FFACO (1996, as amended) requires the models to have the ability to forecast the location of contaminant boundaries within 1,000 years and show the 95th percentile of the model results (performance criteria, Step 6). Therefore, data collection must be adequate to develop and evaluate models with that level of performance. Criteria for data collection measurements and modeling activities are described in Section 2.0.

In addition to the overall criteria, the FFACO also requires CAU models to consider the following, at a minimum:

- Alternative HFMs, recharge models, boundary conditions, and groundwater flows
- Uncertainty in the radiologic and hydrologic source term
- Multiple permissive sets of calibrated flow models
- Probabilistic simulations of transport from calibrated flow models
- Ensembles of forecasts of contaminant boundaries for the CAU
- Sensitivity and uncertainty analyses of the model outputs

A plan for obtaining data (Step 7) is developed during the CAIP stage and refined in the CAI stage. New data are collected during the CAI stage to address deficiencies in existing data, or to improve the assimilation and use of existing data.

This process is repeated for any additional data collection activities needed to increase confidence in model results (CADD/CAP stage) or long-term monitoring strategies (CR stage). If new information requires changes in the CADD/CAP or CR, a summary report or addendum will be developed and submitted for NDEP review and approval.

The UGTA strategy also has several decision points (see Appendix VI, Section 3.0, of the FFACO) that provide opportunities for NDEP and NNSA/NFO to assess the work products and decide whether results are sufficient to proceed to the next step. If work products are not acceptable, remedial actions may include collecting additional data, refining the model or monitoring network, or revising the strategy.

1.6 Document Control

Documents are developed to ensure work is effectively managed, performed, and assessed to assure quality. Documents that prescribe technical processes, specify quality requirements, or establish management controls must be developed, reviewed, and approved in accordance with the participant's procedures. FFACO-mandated documents must be controlled by the issuing organization's system and follow the approved FFACO outlines. Documents should adhere to the organization's corporate style and usage rules; or default to the U.S. Government Printing Office (GPO) Style Manual, the *Chicago Manual of Style*, or equivalent.

Each organization must implement a system for distributing controlled documents to ensure personnel are supplied with the most current version of the document. The process must incorporate controls for identifying controlled copy holders, establishing effective dates, and assigning a unique identifier for each controlled copy. If electronic systems are employed, users must be notified that printed copies are uncontrolled. Documents no longer in use should have their status clearly indicated, and record copies must be maintained in accordance with Section 1.7.

1.6.1 Changes

Changes to approved procedures, plans, or documents may be necessary, and dependent on the extent, will require a record of technical change (ROTC), addendum, or revision. FFACO documents will be revised in accordance with the *FFACO Handbook* (NNSA/NSO, 2012). The participants must ensure changes are properly identified, documented, approved, and controlled in accordance with the appropriate procedure. Verbal authorization of changes must be documented and followed up with a written change notice in a timely manner. Document review may be limited to the scope of the revision, addendum, or ROTC; however, approval must remain at the same level of authority as the original document. The Activity Lead must be notified of changes that impact cost or schedule.

1.6.2 Protection of Documents

Documents, plans, procedures, presentations, and data must be reviewed in accordance with DOE Order 475.2B, *Identifying Classified Information* (DOE, 2014).

1.7 Records Management

Participants must maintain, or submit their records to, a storage and retrieval system that is consistent with applicable environmental regulations and DOE Orders 243.1B, *Records Management Program* (DOE, 2013b); 200.1A, *Information Technology Management* (DOE, 2008); and/or 241.1B, *Scientific and Technical Information Management* (DOE, 2010). This includes a storage system for computer-based information (e.g., software, models, data, and model output) that is retrievable and protected from loss, compromise, or catastrophic events. Sufficient detail must be included in records to allow for the reconstruction of activities as well as provide traceability. Organizations plans and procedures must identify the resultant records. Organizations must identify appropriate storage and retention time frames. Final FFACO documents must be loaded into the FFACO database.

A lifecycle approach must be maintained for hard-copy and electronic records that ensures protection and access to records until their disposition. Records must be destroyed in accordance with the provisions of authorized disposition schedules.

The UGTA Technical Data Repository (TDR) may be used as a storage and retrieval system for data and model records. Participants' business-sensitive records (i.e., training records, procurements) should not be stored on the TDR. An uncontrolled copy of procedures may be stored on the TDR, but the TDR should not be used as the controlling mechanism for procedures.

Participants should consider the following when identifying information, including electronic information, as a record:

- Is the information a specific and original source?
- Does the information support a regulatory decision?
- Is the information valuable for assessments?
- Does the information support other documents?
- Is the information a deliverable?
- Does the information describe work performed (e.g., completed forms, field logbooks)?
- Does the information support functions such as training, procurement, or accounting?
- Does the information require action?
- Does the information reflect a decision, action, or lack of action?
- Is the information necessary to understand a decision, action, or non-action?
- Does the information provide context of a decisional document?

The following controls must be applied to records, as applicable. This is not intended to be an exhaustive list, and additional controls may be applied:

- Do not use whiteout, correction tape, or black permanent markers to correct errors.
- Draw a single line through errors; note the correction; then initial and date the page.
- Take necessary actions to ensure records are not damaged or susceptible to loss, liquid/food spillage, or weather elements.
- Maintain records at job sites in a manner that facilitates ease of retrieval.
- Use indelible ink to enter information into handwritten logs, logbooks, and forms.
- Number each logbook page sequentially.

- When handwriting information, draw a diagonal line through a page or portion of a page if it is intentionally left blank, then initial and date the page.

- Back up electronic records on a regular cycle, and store backup media in a separate location or in a two-hour fire-rated safe to safeguard against the loss of information due to equipment malfunctions or human error.

Participants must ensure records are legible and complete. Incomplete information within a record reduces its overall value. For example, meeting minutes without a date or list of attendees have little value when establishing events.

1.8 Information/Data Management

Organizations must ensure processes are in place for the management, control, and transfer of information/data. The processes must include provisions for gathering, manipulating, and distributing data, and must address the following:

- Participants must verify that transcription and transfer of data are performed correctly by (1) reviewing a representative sample of sufficient data points to provide confidence that data have been transcribed or transferred properly; (2) documenting the method of verification and verification results; and (3) documenting the transfer of data to software applications, including software application name and version number.

- Data used in reports, analyses, models, or interpretive works are traceable to their source.

- Data that have been manipulated are checked to ensure the manipulation process was performed as intended.

- Data are maintained during the lifetime of the activity using backup and archival processes.

- Data used in reports, analyses, models, or interpretive works are maintained as records in accordance with Section 1.7.

- Access to databases, datasets, and files is controlled so unauthorized modifications or deletions are not allowed.

- Data source(s) and extraction criteria are documented or referenced, and maintained with the dataset extracted from a database.

- When transmitting information, professional judgment, data, code, models, or inputs to another participant, the originating participant must ensure the source(s) of the transmittal is identified and traceable. The originating participant must also identify any limitations or qualifiers for the data or information to the receiving entity.

1.9 Computer Software and Codes

Organizations must develop and implement procedures and/or forms for the development (if necessary), revision, verification, and control of computer software codes. UGTA uses three types of computer code: (1) commercially available off the shelf; (2) acquired from non-commercial sources, including open source; and (3) internally developed. Acquisition of commercially available off-the-shelf software must be controlled through the procurement process. Commercial software should be evaluated for proper installation. The code developer is responsible for "internally developed" code requirements. If a participant receives software from another participant (non-commercial entity), the "acquired" requirements must be followed. Table 1-1 presents the requirements for each code type and for code revisions.

Table 1-1
Code Requirements

Type	Selection (Section 1.9.1)	Development (Section 1.9.2)	Verification (Section 1.9.3)	Installation Testing (Section 1.9.4)	Code Review (Section 1.9.5)	Configuration Control (Section 1.9.6)
Commercial	X	--	--	X	--	X
Acquired	X	--	--	X	X	X
Developed	X	X	X	X	X	X
Revised	--	--	X	X	X	X

-- = Not applicable

1.9.1 Selection

Participants must identify the required and desirable attributes of a code in procurement, installation, or technical review documents. Participants must evaluate codes based on the identified attributes. A test problem may be created to evaluate candidate codes. The tests or documentation should compare simulation results with published analytical solutions and/or other code results. If no available code performs to the required attributes, the participant may develop the needed code after consultation with the UGTA Activity Lead.

Participants must document the code and selection criteria for groundwater flow and transport models in the CAIP. If a code change is required after publication of the CAIP, justification for the change and identification of the potential codes must be submitted to the Activity Lead for approval. The

justification must incorporate, at the minimum, a justification for the change, code attributes, testing results against the above criteria, and a comparison between available codes. Upon approval, either a CAIP addendum or ROTC must be submitted to NDEP for approval. Participants must document other code selection within a record package or with the procurement documentation.

1.9.2 Development

Participants developing code or software must ensure the code purpose, requirements, and Activity Lead consultation are documented before development. Developed software must be uniquely identified, and documentation must include the following, at a minimum:

- Input and output requirements (including the range of acceptable inputs)
- Functional requirements, including the operating system(s)
- Assumptions
- Limitations on applications
- Compiler and its version
- Instructions adequate for installation and execution of the software
- Description of equations, algorithms, and numerical solution techniques, as applicable

The developer must develop a test case for software intended for multiple users. The test case must be provided for installation testing (see Section 1.9.4) to ensure the software is functioning as intended and results are consistent with those observed by the code developer. The test case must exercise key features of the code used for UGTA models. The test case must be provided to the users and must include acceptance criteria for the results. Test case documentation must include any necessary instructions and input data to execute (clearly identifying the specific application[s] tested).

1.9.3 Verification

Once code development is complete, the code developer, or designee, must verify and document that the code performs the intended functions correctly and that the documentation identified in Section 1.9.2 is complete. The verification required will depend on the complexity, risk, and uniqueness of the code. Code modifications must be verified in accordance with the same requirements as the original code. Verification of changes may be limited to the scope of the modification if the rest of the code is not affected. Verifiers may use ASTM International (ASTM) D6025, Section 7.6: "Code Testing Evaluation Criteria" (ASTM, 1996), for determining appropriate measures for the evaluation. Verification documentation must describe the testing and results.

1.9.4 Installation Testing

Upon installation of software or code on a computer, operational checks (e.g., test cases provided by code developer) must be performed to verify the software is functioning as intended. Installation testing results must agree within the test-specified acceptance criteria before code application proceeds. Installation testing must be conducted when operation and hardware system configurations change.

1.9.5 Code Review

Code reviews must be performed and documented to ensure codes, and code applications, are technically adequate and properly documented, and satisfy established technical and quality requirements. This review documents that the code was accepted by the participant before it was placed in configuration control. The review may be conducted by an SME, Topical Committee, or PER Committee, depending upon the code use. Reviewers must possess the appropriate technical expertise and must not have participated in the development or installation testing of the code. The reviewer(s) must address the following elements, as applicable:

- Is the code appropriate for its intended application? Is it being properly applied?
- Are the assumptions reasonable and valid?
- Are the mathematical model and mathematical operations correct?
- Do the methods conform to accepted and published concepts?
- Are results consistent with known data using either visual or quantitative measures?
- Is documentation sufficient to reproduce development or testing, as applicable?
- Is verification adequate to ensure confidence in the software/code?

1.9.6 Configuration Control

Participants must maintain an inventory of computer software and codes. A system for identifying, revising, and controlling hardware/software configurations must also be developed and implemented in accordance with DOE Order 200.1A, *Information Technology Management* (DOE, 2008). The configuration of software must be controlled and documented so traceability is maintained until software retirement. The participant responsible for code development and/or configuration control must perform maintenance, verification, and instruction manual updates as necessary. Participants must obtain documentation for commercially available or acquired software. This documentation

should contain reference material, operational test records, and user-oriented information, as available, and must be maintained as records.

Configuration items include, but are not limited to, the following:

- Operating system components
- Software executables
- Source code files, if available
- Users documentation, including software requirements and designs

1.10 Procurement

Organizations must have procurement processes in place that meet the requirements of their contracts, agreements, or applicable federal requirements. Organizations must establish controls to ensure, at a minimum, procured items and services meet specifications delineated in the procurement documents. Each organization must have systems to track items and confirm delivery of procured items and services.

The procuring organization must verify the capabilities and qualifications of subcontractor personnel to determine the type and amount of training and supervision needed. Contracts must require commercial laboratories to participate in a performance evaluation program (PEP), if available, and the U.S. Department of Energy Consolidated Audit Program (DOECAP) or equivalent.

1.10.1 Procurement Documents

Procurement documents must define the scope of work for the item or service being procured; and provide specifications, acceptance criteria, shipping and handling requirements, health and safety requirements, environmental compliance requirements, and documentation, as required. Technical specifications must 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. Procurement personnel must review documents for accuracy and completeness before initial issue. Changes to a procurement document require the same level of review and approval as the original document.

1.10.2 Instrument/Equipment Testing, and Inspection

Receipt inspections and acceptance testing will be accomplished by trained personnel, in accordance with approved inspection documents and test procedures that reflect acceptance and performance criteria. Receipt inspections and testing results must be maintained as records. Quality-affecting materials must be inspected upon receipt for adequacy. Any item or work product determined to be defective must be segregated and/or controlled to avoid inadvertent use.

1.11 Identification and Control of Items

Organizations must establish and document sufficient controls to ensure quality-affecting items such as equipment, components, and material can be readily identified. These controls must be established to prevent incorrect use, retain integrity of materials, and preserve the desired operating characteristics of equipment and standards.

1.11.1 Suspect/Counterfeit Items

Organizations must establish effective controls for the prevention, detection, and disposition of suspect/counterfeit items (such as bolts and lifting straps) when such items could lead to unexpected equipment failures or to negative impacts to mission, the environment, or personnel.

1.12 Measuring and Test Equipment

Organizations must uniquely identify and control their measuring and test equipment (M&TE), and establish a system of calibration and preventive maintenance to ensure proper operation. Reference standards of the correct type, range, and acceptable uncertainty will be used.

1.12.1 Equipment Calibration

Organizations must maintain and calibrate M&TE in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications. The frequency of periodic or factory calibrations will be based on the manufacturer's recommendations, national standards of practice, equipment type and characteristics, or past experience. Participants must perform operational and/or source-response checks before work begins, and at frequent intervals to verify continued accuracy and function.

Participants must tag equipment for which the periodic calibration period has expired, equipment that fails calibration, or equipment that becomes inoperable as "out of service." When possible, this equipment must be segregated to prevent inadvertent use. Results of activities performed using equipment that is out of calibration must be evaluated for adverse affects and the appropriate personnel notified.

Physical and chemical standards must have certifications traceable to EPA, the National Institute of Standards and Technology (NIST), or other nationally recognized agencies, if available. Supporting documentation on reference standards and equipment must be maintained as records.

1.12.2 Preventive Maintenance

Participants must perform periodic preventive maintenance on field and laboratory equipment. The frequency of preventative maintenance should be based on manufacturer's recommendations and the user's professional knowledge and experience. Participants must document their preventative maintenance schedule(s) (e.g., in instrumentation procedures or laboratory maintenance plans) and maintain maintenance records.

2.0 Work Processes

Participants perform a significant number of data collection tasks. These include field activities, laboratory analyses, and laboratory studies. The activities support the development and evaluation of groundwater flow and transport models and the development and implementation of monitoring programs. This section presents the work processes used to ensure data and associated documentation are sufficient for developing defensible groundwater flow and transport models, and are of sufficient quality for testing model forecasts and monitoring compliance.

2.1 Data Quality Indicators

Participants must consider the DQIs described in the following subsections when planning, collecting, and evaluating data. DQI goals must be established during the planning process, and the information necessary to achieve established goals must be provided in planning documents or standard operating procedures (SOPs). Not all DQIs may apply to the data collection activity. After data collection, participants must perform and document an evaluation of the data to determine whether the DQI goals have been accomplished.

2.1.1 Precision

Precision measures the reproducibility of data under a given set of conditions. Specifically, precision is a quantitative measurement of the variability of a population of measurements compared to the average value. Where applicable, precision must be assessed using replicate measurements and be reported using a standard descriptive statistic (e.g., relative percent difference [RPD], standard deviation, confidence level, or coefficient of variation). If predetermined limits for a given parameter are exceeded, the data must be evaluated for usability based on the data purpose and reasons for the reduction in precision.

2.1.2 Bias

Bias describes any systematic deviation between a measured (i.e., observed) or computed value and the true or accepted reference value. Bias evaluations should address the following questions (EPA, 2002): (1) Would any characteristics of the dataset directly impact the model output?

(2) Has bias in analysis results been documented? (3) Is there sufficient information to estimate and correct bias? (4) If using data to develop probabilistic distributions, are there adequate data in the upper and lower extremes of the tails to allow for unbiased probabilistic estimates?

2.1.3 Accuracy

Accuracy is defined as the nearness of a measurement to the true or accepted reference value, and is the composite of random and systematic error in a measurement process (if the true value is known). Values exceeding acceptance criteria for accuracy must be evaluated for corrective actions.

2.1.4 Representativeness

Representativeness measures the degree to which data accurately and precisely represent a characteristic of the population, a parameter variation at a sampling point, a process condition, or an environmental condition. Representativeness should address whether the (1) data were collected from a population sufficiently similar to the population of interest and the model-specified population boundaries (see Section 2.6.1.2); (2) sampling and analytical methods used to generate the collected data were acceptable; and (3) potentially confounding effects in the data (e.g., season, time of day, location, and scale incompatibilities) were addressed so they do not unduly impact the model output (EPA, 2002).

2.1.5 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. Completeness is affected by unexpected conditions that may occur during the data collection process. The number of samples prescribed for an activity must be sufficient to meet data requirements identified in the planning process and must consider typical loss of data caused by handling, shipping, and analytical processes.

2.1.6 Comparability

Comparability describes the extent to which data from one study can be compared directly to either past data from the current activity or data from another study. It is a qualitative term that expresses the confidence that the multiple datasets can contribute to a common analysis, and it is achieved by using standard techniques and procedures to collect and analyze representative data.

2.2 Field Operations

UGTA field operations include, but are not limited to, drilling and completion of wells, well development and testing, measuring water levels, borehole logging, measuring water quality, and groundwater sampling. Surface geophysical measurements, geologic mapping and other field activities may also be performed. Wells are drilled and completed to collect geologic, hydrologic, geophysical, and geochemical data to be used as input into, or to evaluate, groundwater flow and transport models. Wells may also be drilled to provide monitoring data. Well development is conducted to increase the hydraulic efficiency of the well and restore the natural groundwater quality within the well and adjacent formation(s). UGTA testing activities include, but are not limited to, hydraulic tests (i.e., aquifer tests) and tracer tests (i.e., single-well injection/withdrawal and multiple-well forced-gradient tests).

Water levels are measured during well drilling, completion, development, and testing. Measurements are also made for long-term water-level monitoring. Water-level measurements must be made that are consistent with the wellhead diagram stored on the Field Operations SharePoint page under the well name. Wellhead diagrams show the measuring and land surface reference points to be used by all UGTA participants when measuring water levels.Water-quality measurements are made on discrete samples during drilling and well development and testing. In-line measurements of water quality may also be performed. Groundwater is monitored for tritium, pH, electrical conductivity, dissolved oxygen, temperature, turbidity, and bromide concentration to assess the progress of well development.

Borehole logs record the geologic, hydrologic, and petrophysical characteristics of rock units within individual boreholes. Depending on the logging objective, the following logs may be performed: caliper, sonic, gamma ray, spectral gamma ray, resistivity, density, neutron, image, and sidewall

coring (rotary and percussion gun). Land surveys are performed for newly drilled wells. Detailed lithologic/stratigraphic logs are produced by evaluating the core, drill cuttings, and geophysical logs. The results of petrographic (thin sections) and laboratory analyses (x-ray diffraction [XRD] and x-ray fluorescence [XRF]) may be incorporated into final lithologic and stratigraphic logs.

Participants must document the details and ensure the quality and integrity for data collection activities in the associated plans, task plans, approved field activity work packages (FAWPs), SOPs, and field instructions.

2.2.1 Planning Documentation

Participants must perform fieldwork safely and within the controls established by Real Estate/Operations Permits (REOPs) and FAWPs. Participant activity-specific plans or instructions must detail unique or experimental methods, or methods under development. Field activities are controlled, at a minimum, by the following documents, as applicable:

Drilling and Completion Criteria Document. The CAU-specific criteria document describes drilling and completion specifications for wells. The document includes a discussion of the scientific objectives of the program, well locations and settings, general well drilling and completion information, data collection procedures, and relevant operating procedures.

REOPs. The REOP process ensures work performed under NNSA/NFO's purview is well defined, properly authorized, and effectively managed. The permit identifies geographical location boundaries and hazards, and establishes and implements controls to mitigate those hazards.

SOPs. Organizations' SOPs are developed to implement specific technical and quality objectives. The SOPs must be based on established methods (e.g., ASTM, EPA, or Soil Science Society of America) when possible; must identify the DQIs and associated acceptance criteria for the measurements; and must list the resultant records.

Waste Management Plan/Fluid Management Plan. This plan (NNSA/NSO, 2009) provides the framework for the characterization, storage, accumulation, treatment, and disposal of wastes.

FAWPs. The FAWPs provide the safety basis for performing work under the *UGTA Health and Safety Plan* (NSTec, 2008). FAWPs document objectives and technical requirements for site operations, and site-specific health and safety requirements.

2.2.1.1 Sample Collection

The organization collecting samples is responsible for obtaining the samples, delivering samples, and completing paperwork for sample tracking. To prevent cross-contamination of samples, equipment coming into contact with samples must be decontaminated before use, between sampling locations, and before leaving the site. Decontamination activities must be performed and documented in accordance with the organization's SOPs. Drilling fluids, water production from the well, and sump volumes and levels must be monitored and recorded on the appropriate forms, as applicable. Geologic samples from boreholes (drill cuttings and sidewall cores) and outcrops are collected in accordance with the organization's SOPs.

The following subsections describe the documentation, handling, chain of custody, and QC requirements associated with groundwater and soil samples.

2.2.1.1.1 Sample Labels and Collection Documentation

Sample labels must be affixed to containers in a manner that does not obscure any data preprinted on the containers. The label must be protected to ensure legibility and sample integrity (e.g., clear tape of the label). The unique sample number must be written in indelible ink on the label.

Sample collection documentation must include the following information:

- Unique sample number
- Sample location
- Sampling date and time
- Sample medium
- Sample preservation or conditioning (if applicable)
- Sample collector's name
- Collection method

2.2.1.1.2 Sample Handling

Sample containers, preservation procedures, and holding times must be specified in SOPs. Where applicable, sample containers must be certified as clean and must remain sealed until ready for use. Participants must conduct operations in compliance with applicable federal, state, and local laws and regulations. U.S. Department of Transportation (DOT) regulations provide for the classification, packaging, marking, labeling, placarding, preparation of shipping papers, and transport of hazardous materials. Hazardous materials defined under Title 49 *Code of Federal Regulations*, Parts 171 to 177 (CFR, 2014b), include radioactive materials as Class 7 hazardous materials.

2.2.1.1.3 Chain of Custody

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

- Is in a person's physical 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
- Is in secure packaging and sealed with a custody seal during shipment to a laboratory

To ensure tampering is easily detectable, each sample container must be sealed with a custody seal that is initialed and dated by the sample custodian before it leaves the sample collection site. The seal must be placed such that the container cannot be opened without breaking the seal.

The sample custodian is responsible for sample custody until the sample is relinquished to another individual or a secure storage area via the chain of custody form. The chain of custody form does not document transfers to and from shipping entities; therefore, waybills must be retained and included with sample documentation. This transfer does not interrupt the chain of custody as long as the package remains sealed. Whenever samples are transferred to a new sample custodian, the new custodian must sign his or her name, the company name, and the time and date that the transfer occurred. The chain of custody form must accompany the samples.

2.2.1.1.4 Field QC Samples

Field QC samples (i.e., blanks and field duplicates) provide a mechanism for assessing and documenting that the sample-collection process meets the quality objectives. To minimize handling, analysis, and data-evaluation bias, field QC samples must be submitted to the laboratory without indicating they are QC samples. Collection and documentation of field QC samples must be in accordance with sample collection SOPs. Field QC results must be maintained with the corresponding sample data in the laboratory records file and reported in the data package.

Blanks. Blanks are used to assess potential contamination from the sample collection process:

- Equipment rinsate is collected from the final rinse solution in the equipment rinse process to determine the effectiveness of the process.
- Field blanks should be collected at specified frequencies, which will vary according to the probability of contamination or cross-contamination. Field blanks should be collected as closely in time and space to the sample as possible.

If blank analytical results indicate possible contamination of samples, sample results must be reviewed to determine whether qualifiers should be assigned to the data or whether the source should be resampled.

Field Duplicate Samples. Field duplicates are collected as closely in time and space to the original sample as possible and used to assess sampling and analytical variability. Duplicate collection should be evenly distributed throughout the sampling event. The field duplicates must be assigned a unique sample number and mirror the sampling and analysis of the original sample. Sample management and documentation procedures for duplicates must be the same as the original samples.

2.2.2 Field Documentation

Participants' field documentation must be of sufficient detail to facilitate the reconstruction of field activities; documentation must be traceable to the M&TE and procedures or work authorization documents and, if the reported results are quantitative, a valid calibration. Field personnel must document activities on a daily activity report or logbook, or on the appropriate form as required by each participating organization. Readiness review documentation must be completed before field activities begin. A staff member other than the person who performed the work, and who is

knowledgeable in the area being reviewed, must review the field-generated data for completeness and accuracy. This review should be noted on the reviewed document with an initial and date. Daily activities—such as drilling operations, well development and testing, and water-quality measurements—are communicated by posting morning reports on the Field Operations and FFACO websites (which are accessible to NDEP). Records must be preserved and maintained in accordance with Section 1.7.

Participants taking photographs of field activities must be in compliance with NNSS and U.S. Air Force requirements. The photographs must be processed and stored in accordance with NNSA/NFO security procedures.

2.2.3 Investigation-Derived Waste

Participants must manage investigation-derived waste (IDW) in accordance with DOE Orders, DOT regulations, *Resource Conservation and Recovery Act* (RCRA) regulations, Nevada laws and regulations, the FFACO, state and DOE agreements, relevant permits, and other organizational requirements. IDW must be containerized, when possible, pending the results of waste characterization. IDW must be characterized and disposed of in accordance with approved procedures and the current UGTA Waste Management Plan (NNSA/NSO, 2009).

2.3 Laboratory Analyses

Laboratories must be certified by the State of Nevada for analysis of groundwater and soil samples. Water sample results must be entered into the UGTA chemistry database.

2.3.1 Sample Storage

Samples received at the analytical laboratory must be entered into the sample tracking system and placed into a secured refrigerator or area. The methods of storage are generally intended to achieve the following:

- Retard biological action
- Retard hydrolysis of chemical compounds and complexes
- Reduce volatility of constituents
- Reduce adsorption effects
- Reduce light exposure

Preservation methods, when required, are generally limited to pH control, preservative addition, and refrigeration. The possibility of reanalysis requires proper environmental control for post-analysis samples. Sample storage must be documented and described in laboratory-specific SOPs. Samples must be properly disposed of once analyses have been completed and the sample is no longer needed.

2.3.2 Laboratory Quality Control Samples

Laboratory quality control (LQC) samples may include laboratory control samples (LCSs), method blanks, laboratory replicates, and matrix spikes. LQC samples associated with each analyte are dependent on the analytical method and are defined in individual SOPs. Statistical control limits must be established and, if the LQC sample results are outside the established limits, corrective action(s) must be performed in accordance with the laboratory's SOPs. The analytical report must include the results of LQC samples and include a discussion of any nonconformances, their causes, and the resulting corrective actions. LQC samples must be analyzed with each batch of up to 20 samples. If laboratory SOPs require a different frequency, the laboratory SOP must be followed.

- LCSs must be prepared from standards independent of the calibration standard and be carried throughout the sample preparation and analysis procedures. These samples assess laboratory accuracy.
- Method blanks must be analyzed by the laboratory to check for contamination and interference from reagents used in the analytical method.
- Laboratory replicates must be analyzed for each matrix.
- Matrix spikes, a sample aliquot spiked with the analytes of interest, must be analyzed to determine interferences of the sample matrix when required by the analytical method.

2.3.3 Performance Evaluation Programs

Analytical laboratories must participate in PEPs appropriate for the analyses performed. Performance must be summarized in the annual QA report. Some parameters do not have an available PEP; therefore, a graded approach to this requirement is described in the following subsections.

2.3.3.1 Parameters with Established PEPs

If a PEP exists for a parameter, annual participation is required for at least one laboratory. These PEPs may be parameter based or method based. Some laboratories participate in PEPs that are available on an irregular basis. These program results must be reviewed in the years performed and must satisfy the PEP requirement.

2.3.3.2 Interlaboratory Comparisons

Interlaboratory comparisons or demonstrations of capability must be performed annually for parameters not included in a formal PEP. Annual interlaboratory comparisons, whereby a sample (duplicate, split, or prepared) is analyzed by a minimum of two laboratories, may also substitute for a PEP.

The UGTA Chemistry Database administrator, or designee, must verify analytical results to ensure the values submitted by multiple independent laboratories agree within the stated acceptance criteria. Individual analyses that meet this criterion must be considered verified and retained in the database without need of further documentation. The database administrator may flag results that do not meet this criterion as "not consistent" in the database, and the responsible laboratories must identify the source of the discrepancy, if possible. If the reason for the discrepancy is not identified, additional analyses must be performed if a sample is available and holding times have not been exceeded. If the source of the discrepancy is identified, the responsible laboratory must correct or submit new data along with a brief explanation. The laboratory responsible for the error must document the causes for the discrepancy, the measures taken to ensure the problems have been rectified, and the corrective action to ensure the problem does not recur. The database administrator must flag erroneous data as "rejected" and document the explanation in the database comment field.

2.3.3.3 Blind Samples

Laboratory performance may also be evaluated using blind samples (i.e., samples with a known or previously measured detectable quantity of analyte). Blind samples must be submitted to the appropriate laboratory in a manner consistent with the field sample labeling, handling, and chain of custody requirements (Sections 2.2.1.1.1 through 2.2.1.1.3).

2.3.3.4 Data Evaluation

An SME must evaluate the data for those parameters not included in a PEP, interlaboratory comparison, or blind sample. The evaluation must include a review of the SOPs (sample collection and analytical) and results (e.g., LQC, instrument calibration results, analytical, data verification, and validation). The evaluation must be documented in accordance with Section 1.7.

2.3.4 Analytical Data Documentation

Participants are responsible for preparing data reports that summarize the results of analyses and data packages that include the following:

- Sample receipt and tracking documentation (e.g., chain of custody form and shipment way bill), including organization identification and individuals performing the analysis; and dates of sample receipt, preparation (if applicable), and analysis.
- Results of LCSs, matrix spikes, replicates, blanks, calibrations, and calibration verifications, as appropriate for the methods used.
- Identification of any nonconformance that may have affected the laboratory's measurement system during the time period in which the analysis was performed.
- Analytical results or data deliverables, including reduced data, detection limits, and identification of data qualifiers.

2.3.5 Analytical Data Verification and Validation

Analytical data must be scientifically valid, defensible, and of known precision and accuracy. The data should be of sufficient known quality to withstand scientific and legal challenge relative to the use for which the data are obtained. Data must be verified for completeness, correctness, and conformance to SOP and/or contractual requirements and validated to determine analytical quality.

Participants must verify data to evaluate how closely the procedures were followed. Verification will consist of reviewing data for completeness, required LQC results, and chain of custody form; and ensuring case narratives describe any issues related to the sample analyses. Verification must also include a review of raw data and a check of calculations. Participants may verify their own data.

Participants must validate analytical data on a portion of sample results to determine the analytical quality of a dataset. Data validation criteria will be based upon the intended use of the data and include an evaluation of method compliance, data calculations, QC, calibrations, calibration verifications, raw data, and data generation methods. Validation can include qualifying data that may restrict or limit data use. Data validation is also achieved using results of PEPs. Five percent of validated sample data must also be validated by a third party.

2.4 Laboratory Studies

The quality and integrity of laboratory studies must be ensured through organizational procedures, plans, qualified personnel, and appropriate tools and calibrated equipment. The plans or procedures must specify the DQI requirements (Section 1.6) to ensure study objectives are obtained. Participants must document the results of laboratory studies, including an evaluation stating whether the DQIs were met. XRD and XRF instrumentation operation, including QC requirements, must be described in SOPs.

2.5 Non-direct Data

Non-direct data must be reviewed and accepted in accordance with this section.

2.5.1 Approach

An SME or Topical Committee must evaluate non-direct data sources (e.g., defense projects, Yucca Mountain Project, databases) to determine the appropriateness of the methods and the correctness of the resulting dataset or data source. The SME or committee must develop a data acceptance report and address the following, as applicable:

- Description of data, its source, rationale for its selection, and its intended uses
- Extent and reliability of the documentation associated with the data
- Prior uses of the data and associated verification processes
- Dataset(s) used for corroboration, rationale for selection, and justification of inferences drawn
- Data acquisition, collection, or development records (includes procedures)
- DQIs (i.e., accuracy, precision, representativeness, completeness, and comparability)
- Impact of use or nonuse of data
- Uncertainties and restrictions, if any
- Assumptions, constraints, bounds, or limits on the data or source
- Data flags to be assigned to the data

The UGTA Non-Direct Data Acceptance Report form U-102, available on the UGTA SharePoint site, may be used to document the review.

2.5.2 Documentation Review

If a committee does not perform the acceptance evaluation, an independent reviewer must review the document for the following items:

- The content of the report is technically adequate, complete, and correct.
- Uncertainties and restrictions are discussed.
- The assumptions, constraints, bounds, or limits on the data are identified.

2.6 Groundwater Flow and Transport Modeling

Groundwater flow and transport modeling begins with compiling site characterization data and relevant information to provide a technical basis for the models. Based on this information, conceptual models are developed to describe the general geologic and hydrogeologic characteristics of the system and the various flow and transport system processes of interest. Construction of numerical flow and transport models is based on the conceptual model (Figure 2-1).

The UGTA strategy recognizes the need for understanding uncertainty in modeling studies and uses EPA guidelines (EPA, 2009) to define model development (CAI stage), model evaluation (CADD/CAP stage), and model application (CR stage). There are inherent limitations associated with models of complex hydrogeological settings that are evaluated through a combination of uncertainty quantification and multiple alternative interpretations of model components. This section presents the documentation and requirements associated with development, calibration, uncertainty analysis, and sensitivity analysis of the CAU groundwater flow and transport models (Figure 2-1).

2.6.1 Model Parameters

Groundwater flow and transport model parameters, shown in Figure 2-1, are derived from UGTA measurements (Sections 2.2 through 2.4) and/or from other sources (i.e., non-direct data). Uncertainty, including both natural variability and knowledge uncertainty, is associated with all parameters. These uncertainty components include measurement uncertainty, and natural or non-reducible parameter variability; data limitations; and conceptual model limitations. Uncertainty

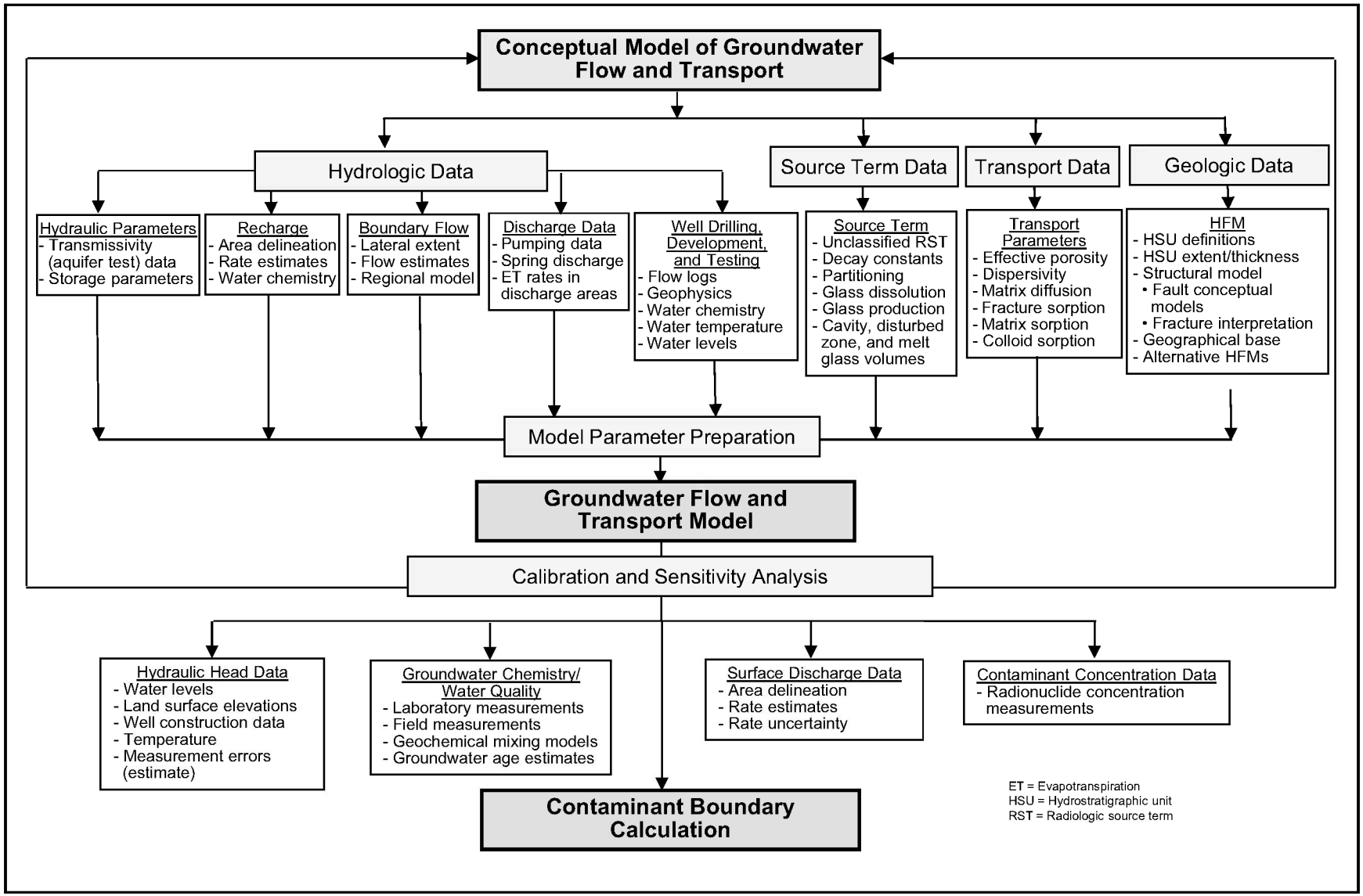

Figure 2-1
Groundwater Flow and Transport Modeling Parameters

in parameters is often quantified by developing distributions of values (probability distribution functions) for the parameters rather than using a single value. These distributions represent both the range and the likelihood of occurrence of a particular parameter value. The distribution development method varies depending on the availability of relevant data (distribution fitting) or subjective process knowledge. General guidelines for assigning probability distributions suggested by Mishra (2002) may be used in the groundwater flow and transport models.

Geologic data describing the stratigraphic and structural framework are translated into HFMs (Figure 2-2). As required by the FFACO (1996, as amended), different HFMs are evaluated as part of assessing uncertainty. This can include, but is not limited to, assessing the effects of rock alteration, conceptual models of faults and fractures, and uncertainty in stratigraphic arrangement and continuity. CAU-specific documents describe how the HFM and alternatives were developed, describe the models, and document the data sources.

Hydrologic data include hydraulic parameters, recharge, lateral boundary flow, and measurements obtained during well drilling, development, and testing (Figure 2-1). Transport parameters include effective porosity, dispersivity, matrix diffusion, matrix sorption, fracture sorption, and colloidal transport and are obtained through field tests and laboratory studies. A CAU-specific hydrologic data document and CAU-specific transport parameter document present data and the supporting information used to develop the groundwater flow and transport models; data quality assessments; data analyses to derive expected values or probability distributions; and uncertainty estimates.

A source term document is prepared for each CAU that describes development of simplified models or the conceptual models used for implementing source terms for the flow and transport models. The document also describes compilation and review of available information and data relating to the unclassified source term. The FFACO (1996, as amended) requires the use of the inventory and inventory uncertainty from the *Nevada Test Site Radionuclide Inventory, 1951–1992* (Bowen et al., 2001).

2.6.1.1 Data Quality Evaluation

Participants must evaluate and document the quality of data used in reports, analyses, interpretive works, or models.

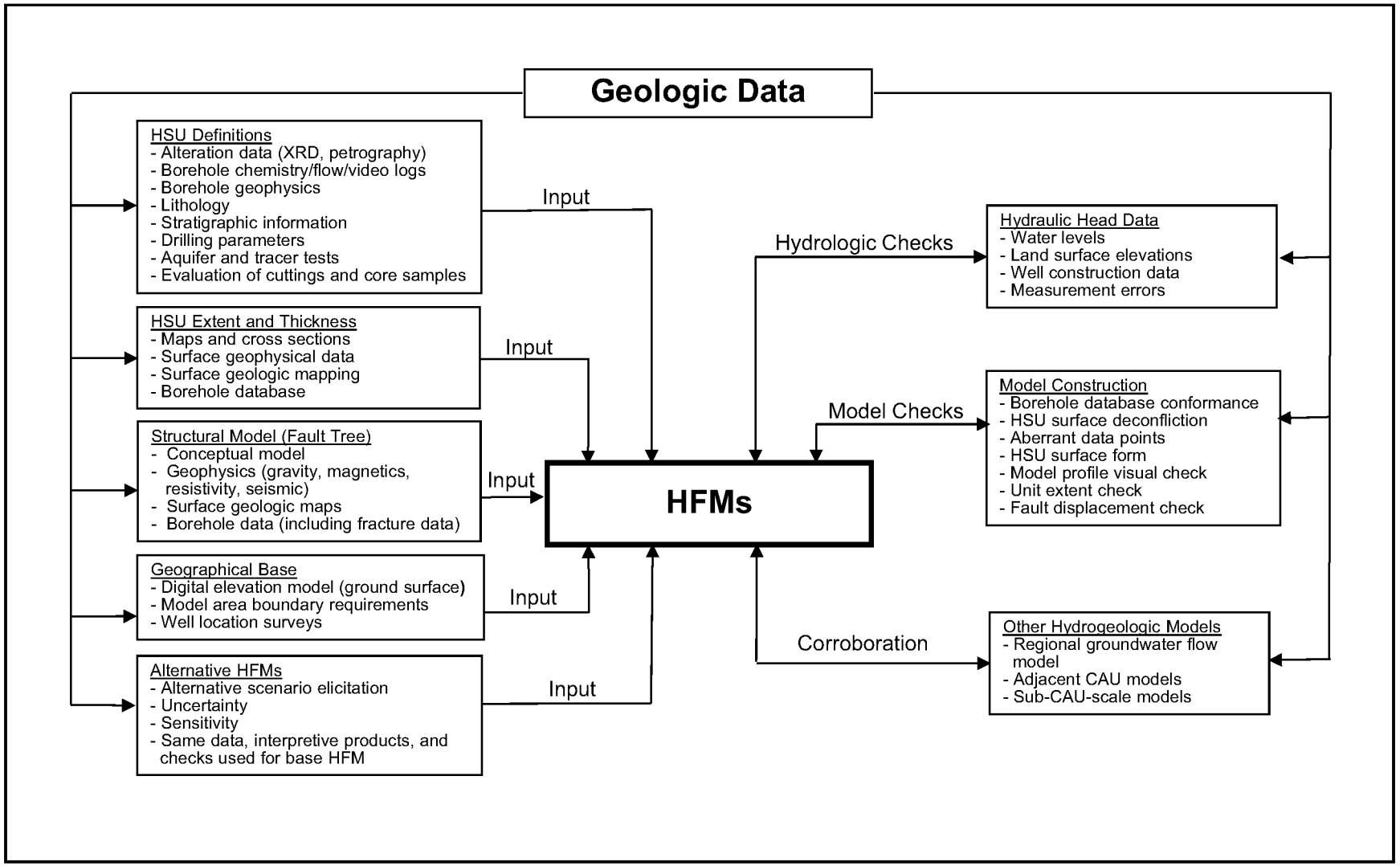

Figure 2-2
HFM Modeling Parameters and Process

2.6.1.2 Data Transferability

UGTA relies on data transferability as a process to determine whether data from other locations (e.g., geophysical, chemical) can be used to support groundwater flow, radionuclide transport, and other models within a CAU (i.e., the properties are transferred to the CAU). Participants must determine the transferability of data using the following steps (SNJV, 2004):

1. Establish acceptance criteria based on the use of the parameter and its importance. These criteria are established before the modeling simulations and the uncertainty and parameter sensitivity evaluations are performed. Changes in the criteria might be expected as the CAU investigations and modeling progress. Thus, if it is determined that more restrictive criteria are needed for a particular parameter, it will be necessary to repeat the transferability evaluation. If the previously used criteria are restrictive enough, it will not be necessary to reevaluate.

2. Evaluate whether geologic, geochemical, hydrologic, or other factors would disqualify the measurement from use.

3. Document the process and data used in sufficient detail that others can understand and repeat the process. This information should be incorporated either directly or by reference.

The approach for implementing the data transfer process must be parameter specific and must consider the following, if applicable:

- Parameter characteristics, including underlying dependencies on other parameters
- Similarity of geologic setting and other relevant characteristics
- Type of measurement and/or interpretative technique, including measurement scale
- Modeling approach, including conceptual models and model scale
- Heterogeneity
- Range in values
- Sensitivity of contaminant boundary to parameter value

Reports, models, or interpretive works must describe the transferability of the data being used.

2.6.2 Model Calibration

Model calibration refines a model until it corresponds within desired criteria of observations of a system (ASTM, 1993). This process is used to gain confidence in the model for making decisions. Components of a groundwater flow and transport model that may require calibration include, but are

not limited to, HFM, boundary conditions, recharge, hydraulic properties, and transport parameters. Calibration is generally an iterative process that involves comparing a model result to calibration targets. Models are typically calibrated using trial and error and/or automated techniques. Model scope and data availability will be used to guide the selection and application of the specific calibration procedure. The following are examples of calibration approaches:

Visual Evaluations. These involve comparisons of the various HFM units with drill-hole data; surface-grid points with HSU layers in the model; mapped versus simulated potentiometric surfaces; and scatter plots of simulated and measured water levels and flows (e.g., Oasis Valley discharge). Also residual (difference between observed and simulated values) maps examining spatial patterns of model agreement with calibration targets and histograms of weighted residuals may be visually inspected.

Quantitative Evaluations. These involve potentiometric head residuals; correlation among head residuals, flow residuals (the difference between observed and simulated volumetric flows), concentration residuals, and minimum and maximum residuals; total model objective function; and/or objective functions of particular calibration target datasets. The influence of model parameters can also be quantitatively evaluated. For instance, if a particular unit's permeability consistently requires systematic adjustment relative to its expected value, it may be indicative of a model structure problem or an incorrect expected value.

Conceptual Evaluations. These involve testing the model with the conceptual model of the system. For example:

- Geologic and hydrogeologic conventions are honored.
- Direction and/or velocity of groundwater flow are consistent with geochemical age dates.
- Direction of groundwater flow is consistent with spatial distribution of major-ion chemistry.
- Hydraulic conductivity is within reasonable range of aquifer test data.
- Permeability is consistent with the conceptual model (e.g., zeolitic units are less permeable than fractured-rock units).

The calibration process is documented in the groundwater flow and transport model document in the CAI stage, and subsequent modeling report developed during the CADD/CAP or CR stage, as needed. Documentation must include the following:

- Specific approaches used for model calibration
- Rationale for selecting particular model calibration approaches
- Calibration results
- Comparison of initial versus final unit properties (e.g., porosity, permeability)
- How the final properties relate to the conceptual model

In addition, the model developer must document why the model is a reasonable approximation of the *in situ* conditions. Independent lines of evidence such as regional studies, other CAU studies, geochemistry, or thermal observations may be used.

2.6.3 Sensitivity Analysis

Modelers use a comprehensive sensitivity analysis to build confidence in the model results and to aid in the uncertainty component identification. Sensitivity analyses can be used during model calibration and when assessing simulation results. Sensitivity analysis will consider the purpose of the analysis and focus on the hypothesis to be tested. Sensitivity analysis is an area of active research and new ideas, and analyses may be developed that may be beneficial; therefore, the following list is not prescriptive but illustrative. The applicability of sensitivity analysis techniques can vary depending on the linearity or non-linearity of the model, the goal of the analysis, and the sensitivity of model response. The following sensitivity analyses may be used to gauge the sensitivity of model response:

- Assessment of parameter correlations and covariance
- Parameter sensitivity using sensitivity coefficients defined as the change in output divided by the change in input at a reference point
- Contingency tables, including chi-square and entropy statistics for transport parameter distributions
- Classification-tree analysis
- Stepwise regression

Sensitivity analysis methods are quantitative in nature, but it is also important to consider their consistency with the conceptual model. The sensitivity analysis approach selected by the modeler must be described and justified with respect to the model purpose in the flow and transport model document (or subsequent modeling documents).

2.6.4 Uncertainty Analysis

Uncertainty analysis describes the model response with respect to the uncertainty in input parameters. Model parameter uncertainty can be examined using the null-space Monte Carlo method implemented in parameter estimation software (PEST), or similar methods. Like sensitivity analysis, uncertainty analysis is an area of developing approaches, and the examples below are not prescriptive but illustrative. Individual model components, their associated uncertainties, and approaches used may include the following:

- **HFMs.** Alternative HFMs as components of conceptual uncertainty
- **Groundwater Flow Models.** Null-space Monte Carlo evaluation of flow model parameter uncertainty
- **Groundwater Transport Models.** Latin hypercube sampling of parameter values ranges including matrix and effective porosity, distribution coefficient (K_d), fracture aperture, and matrix diffusion
- **Source Term Models.** Latin hypercube sampling of parameters including inventory, K_d, nuclear melt-glass dissolution, and exchange volume radius and properties

The uncertainty approach includes both parameter and conceptual uncertainty. For instance, the Frenchman Flat Phase I peer review (N-I, 2010) commented that the geologic model used a general concept that had uncertainty in its application. This uncertainty was later evaluated with different HFMs, which form a discrete test of uncertainty. It is not prescribed that conceptual uncertainty be in the form of discrete tests—the evaluation of this type of uncertainty is still relatively new and is highly site specific. The method applicability to the uncertainty type must be described and justified by the modeler with respect to the model purpose.

2.6.5 Contaminant Boundary Calculations

The contaminant boundary calculation procedure for the CAI stage (95th percentile contaminant boundary) involves the following steps:

1. Selecting a groundwater flow model (which may include HFM and/or parameterization alternatives) (NNES, 2010).

2. Assigning the hydrologic source term(s) using consistent groundwater flow rates observed in the selected flow model—if the test is not completely in the unsaturated zone (NNES, 2010).

3. Executing radionuclide transport calculations for flow model results, including consideration of source term and transport uncertainties (NNES, 2010).

4. Collecting contaminant concentration distributions (in space) at regular, specified output times over a 1,000-year period, for all simulations of the transport model (Daniels and Tompson, 2003; NNES, 2010).

5. Converting contaminant concentration distributions to the radiological standards of the SDWA (CFR, 2014a) for each transport model result (Daniels and Tompson, 2003; NNES, 2010).

6. Determining spatial locations and times where radiological standards are exceeded for each transport model result (Daniels and Tompson, 2003; NNES, 2010).

7. Logging the frequency that radiological standards are exceeded at each model element location, regardless of time, over the entire series of transport model simulations (Daniels and Tompson, 2003; NNES, 2010).

8. Identifying model element locations where the frequency that radiological standards are exceeded is greater than 5 percent of the total number of transport simulations. Elements meeting this criterion are then considered within the contaminant boundary at the 95th percentile; elements not meeting this criterion are considered outside the boundary (Daniels and Tompson, 2003; NNES, 2010).

9. Repeating the described procedural steps for multiple alternative models.

Unless NDEP and NNSA/NFO agree on another strategy, contaminant boundaries will be established initially from the flow and transport models in the CAI stage and may be revised at the start of the CR stage. Once in the CADD/CAP and CR stage, the revised contaminant boundaries may be based upon conceptual model refinements, using non-three-dimensional numerical model(s) and/or any other quantitative approaches acceptable to NDEP and NNSA/NFO. Contaminant boundaries are reported

in the final flow and transport model, CADD/CAP, and CR. The CADD/CAP and CR are FFACO-mandated documents.

2.7 Model Evaluation

Model evaluation continues through the UGTA corrective action strategy stages but is the focus of the CADD/CAP stage. During this stage, additional data will be gathered to increase confidence in the conceptual model and flow and transport model results reliability. Refinements to the model will be documented as a CADD/CAP addendum or model evaluation report.

During the CR stage, further model evaluation will occur as new data are gathered. These evaluations will be documented as a CR addendum or summary report.

2.8 Configuration Control

Models accepted by NDEP (before the CADD/CAP and CR stages) will be archived and placed under configuration control (Section 1.9.6). The model documentation must be sufficient to ensure traceability and reproducibility, as follows:

- Traceability is achieved to the degree that a reviewer with sufficient training and access to supporting information is able to follow the flow of information in a model from source data through conceptualization, parameterization, code input, code calculations, and code output, and ultimately to the results reported in released documents.

- Reproducibility is achieved when it is demonstrated that a model can be restored to any check point in time during the model maintenance period when it was used to produce reported results and can be rerun to obtain the reported results.

Documentation must include the following:

- Input data and source identification
- Model assumptions, assumption justifications, and limitations
- Model executable codes, including pre- and post-processors
- Computer calculations, and basis to permit traceability of inputs and outputs
- Final results and output data files
- Identification of the originator(s) and reviewer(s)

3.0 Assessment and Oversight

3.1 Assessment

Multiple decision points require assessment of work performed throughout the UGTA strategy stages. To increase confidence in the decisions, multiple assessments are performed, including management assessments, oversight assessments, technical review of project activities, and document reviews. These assessments are described within this section.

3.1.1 NDEP and NNSA/NFO Decision Points

The FFACO (1996, as amended) mandates multiple decision points within the strategy. If the work does not pass the assessment, additional work must be performed before proceeding to the next stage in the strategy.

3.1.2 Participant Assessments

Participant management must conduct at least one assessment annually. Management assessments identify and correct problems that hinder the organization from achieving its objectives. Independent assessments are conducted by qualified individuals or groups that are not directly performing the work being assessed. Independent assessments measure item and service quality, adequacy of work performance, and promote improvement. Assessments should focus on issues such as the following:

- Adequacy of implementation of the QA program, with emphasis on quality improvement
- Management biases or barriers that impede the improvement process
- Adequacy of organization's structure, staffing, and physical facilities
- Training programs

Assessment results will be documented in reports and issued to management. Participants must ensure follow-up of corrective actions, including evaluations of effectiveness of management's actions. Assessment results should be entered into a tracking system for the purposes of identifying trends and lessons learned. The responsibilities and authorities of personnel conducting assessments must be defined and documented, particularly for the authority to suspend or stop work in progress upon detection and identification of an immediate adverse condition affecting the quality of results.

3.1.3 Oversight Assessments

Oversight assessments must be performed periodically by NNSA/NFO personnel, or their designees, to verify compliance with applicable quality requirements, DOE policies, and procedures. Assessments will be conducted in accordance with NFO Order 226.X, *Line Oversight (LO) Program* (NNSA/NFO, 2014).

3.2 Technical Reviews

PER Committees (Section 1.3.5.1) and Topical Committees (Section 1.3.5.2) provide technical reviews of various products, including data, documents, software/codes, analyses, and models. These committees ensure work is technically adequate, competently performed, and properly documented; and satisfies established quality requirements through the review of assumptions, calculations, extrapolations, alternative interpretations, methods, acceptance criteria, and conclusions pertaining to the data or models. Technical review records may include, but are not limited to, meeting minutes, agendas, presentations, comments, comment responses, recommendations, white papers, decisions, action items, and technical basis documents.

3.3 Peer Review

NNSA/NFO will convene a formal external, independent peer review panel at the end of the CAI stage to review the flow and transport model results and supporting information. The peer review evaluates whether assumptions, methods, and conclusions derived from the models are based on sound scientific principles; and examines the scientific appropriateness of the model(s) for informing the regulatory decision. The peer review panel consists of nationally recognized SMEs in geology, hydrology, groundwater modeling, geochemistry, and other related fields. The Activity Lead provides the peer review panel with a scope of work and schedule. NNSA/NFO and NDEP will consider the peer review report when deciding whether there is sufficient confidence to proceed to the next strategy stage. NNSA/NFO may request a peer review at any time.

3.4 Document Review and Issuance

The following subsections outline the minimum requirements for document review and issuance. Documents must follow the FFACO approved outline, and should adhere to the organization's corporate style and usage rules; or default to the GPO Style Manual, the *Chicago Manual of Style*, or equivalent.

Participants must maintain the completed Document Review Sheets (DRSs) and NDEP comment letters as records. Each iteration of FFACO-mandated documents must be submitted to the NNSA/NFO Environmental Management Records and the NNSA/NFO FFACO database.

3.4.1 Review for Internal Organizational Use Only

Contract Managers must ensure documents issued by organizations for internal use only (i.e., plans and procedures) are developed and issued in accordance with their procedures. These documents are published as internal organization documents (e.g., data reports) but may be reviewed and distributed to other participants.

3.4.2 Draft Review

The Contract Manager must ensure the following before transmitting a draft document to participants for review:

- Includes the footer "This is a draft, predecisional document and is not releasable to the public" on the document cover and on each internal page. (If the document is FFACO mandated, the footer should read "This is a draft, predecisional U.S. Department of Energy document and is not releasable to the public.")
- Has been reviewed by a Derivative Classifier.
- Is distributed as an unsigned and uncontrolled document.
- Has been internally reviewed for quality requirements identified in internal planning documents or procedures, technical adequacy, accuracy, and completeness.
- If the document is FFACO mandated, it must also follow the approved FFACO outline (FFACO, 1996; as amended). The outline can be modified through agreement between NNSA/NFO and NDEP.

The draft document is reviewed by NNSA/NFO personnel, including the FFACO Administrator (if FFACO mandated), and any applicable committee members. Additional reviewers may be added by the originating Contract Manager provided the transmittal does not require public release of the document. Committee members may be identified for limited reviews (e.g., SMEs in modeling).

The document is transmitted with a DRS and due date. Reviewers review the document and record comments on the DRS by the due date.

If the draft was sent to a PER Committee, the comments must be sent to the Committee Chairperson. The Chairperson, and/or designee, will compile and prioritize the comments. The PER Committee may undertake comment integration and/or resolution if appropriate. The PER Committee's process must be executed within a time frame consistent with due dates or milestones.

The author(s) must resolve the comments and modify the document as necessary. Once the review comments are addressed, either a final document will be issued (if no NDEP review) or an NDEP review document (sometimes referred to as Rev. 0) will be produced.

3.4.3 NDEP Review

The originating Contract Manager must ensure the following regarding the NDEP review document:

- Has completed a draft review (Section 3.4.2).
- Includes the footer "This is a predecisional document and is not releasable to the public" on the document cover and on each internal page. (If the document is FFACO mandated, the footer should read "This is a predecisional U.S. Department of Energy document and is not releasable to the public.")
- Has been reviewed by a Derivative Classifier.

The NDEP review document is reviewed by NNSA/NFO, including the FFACO Administrator, and NDEP. The document is transmitted with its due date. NDEP comments are transmitted by letter. This section does not apply to PER reviews where NDEP is an ex-officio member.

Once the review comments are addressed, a final document (sometimes referred to as Rev. 1) for public release is produced.

3.4.4 Public Release

The public release document is submitted to the appropriate public release process (e.g., Technical Information Review Panel) for review and approval. This review may occur concurrently with the NDEP review provided any changes made in response to NDEP comments are routed through the public release process for approval. After any comment resolution, the originating Contract Manager must ensure the following regarding the document:

- Includes a document number.
- Includes the footer "Approved for public release; further dissemination unlimited."

3.5 Reports to Management

Participant management will be informed of quality-related activities through the receipt, review, and/or approval of the following:

- Task plans, schedules, and procedures
- Assessment reports
- Issues, corrective action requests, corrective actions, and schedules

In accordance with FFACO, Part VII (1996, as amended), quarterly reports and monthly schedules are prepared and submitted to NDEP.

3.5.1 Annual QA Report

The Activity Lead must submit an annual QA report to NDEP. The annual report describes the quality activities conducted by UGTA participants during the prior fiscal year. The purpose of the report is to support a determination that the UGTA Activity met the requirements set forth in the QAP. Therefore, the report must include the following:

- Committee membership
- Assessment results, corrective actions, and closure dates or completion schedules
- Laboratory performance evaluation program results
- Non-certified laboratory analyses identification and justification

4.0 Corrective Action

This section establishes the methods and responsibilities for identifying, reporting, controlling, and resolving conditions of nonconformance and conditions adverse to quality.

4.1 Stop Work Order

NNSA/NFO and participants are authorized and have the responsibility to stop work when a condition adverse to health and safety, quality, or the environment is identified. If the condition is allowed to continue, it could result in personal injury; cause damage to equipment or property; have an adverse impact on mission accomplishment, budget, or schedule; or cause damage to the public and/or environment. If imminent danger exists, a stop work order (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. The participant must notify the Activity Lead of SWOs as required by their SOPs.

Work will resume only upon completion of the necessary actions specified on the SWO and with approval of the Activity Lead, or designee.

4.2 Issues

Issues are any findings, deficiencies, nonconformance reports, incidents, or opportunities for improvement, or any other item of interest that warrants or demands management attention. Issues must be resolved and tracked to correct and track to closure. Issues can also be defined as strengths and noteworthy practices that are tracked and used for process improvement.

Personnel are encouraged to identify and document issues and focus on solutions and discourage fault-finding. Individuals identifying issues are responsible for the appropriate documentation and reporting. Responsible personnel should be notified at the time the issue is identified. Participants must document, resolve, and report issues in accordance with internal procedures.

4.3 Cause

A cause is the most basic element that, if corrected, will prevent recurrence of the same, or similar, issue. The participants should conduct a causal analysis when the understanding of the underlying cause is important to the prevention of similar or related problems. The analysis should be used to gain an understanding of the deficiency, its causes, and the necessary corrective actions to prevent recurrence. The level of effort expended should be based on the possible negative consequences of a repeat occurrence of an issue. The analysis must be maintained as a record.

4.4 Trend Analysis

Trend analysis should be performed on nonconforming conditions, deficiencies, and causes to identify possible trends. Participants must bring adverse trends to the attention of the appropriate management. Positive trends, such as improved performance or cost savings resulting from enhancements or the application of new technology, should be shared to facilitate improvement in other areas or projects. As appropriate, information obtained from trend analyses should be included in a lessons learned or records system.

4.5 Lessons Learned

NNSA/NFO has implemented a lessons learned system as a focal point for reporting and retrieving important information concerning experiences gained through previous activities. Continuous improvement can be fostered through incorporation of applicable lessons learned into work processes and planning activities, including work plan development, budget development, and strategic planning. The lessons learned program should be used interactively with other management tools such as critiques, assessments, readiness reviews, and evaluations of field activities.

5.0 References

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Appendix A

Nevada Division of Environmental Protection Comment Responses

Revision 2 - June 8, 2015

(3 Pages)

Revision 1 - October 23, 2012

(2 Pages)

UNCONTROLLED When Printed

1. Document Title/Number: Underground Test Area Activity Quality Assurance Plan Nevada National Security Site, Nevada; DOE/NV-1450-Rev. 2				2. Document Date: 2/2015	
3. Revision Number: 02				4. Originator/Organization:	
5. Responsible DOE NNSA/NFO Activity Lead: Bill Wilborn				6. Date Comments Due:	
7. Review Criteria: Complete Document					
8. Reviewer/Organization Phone No.: NDEP				9. Reviewer's Signature:	
10. Comment Number/Location		11. Type[a]	12. Comment	13. Comment Response	14. Accept/Reject
1	Page 9, Section 1.5.1, Second sentence below bullets	M	"... transport model document" should be changed to flow and transport model document to be consistent with the previous sentence. In addition, in previous sentence it should be document. The flow and transport model results are now included in one document.	Accepted; now reads: "Model boundaries are defined (Step 4) during the CAI stage and documented in the flow and transport model document. Contaminant boundaries are also documented in the flow and transport model document." And next paragraph: "…that are documented in the flow and transport model~~ing reports~~ document."	
2	Page 13, Section 1.9, First paragraph, Second sentence	M	Please clearly indicate the difference between "acquired from other participants" and "internally developed". For example are other participants the national labs and USGS, whereas internally developed are the local DOE contractor?	Accepted; deleted "…other participants or other…" sentence now reads: "UGTA uses three types of computer code: (1) commercially available off the shelf; (2) acquired from non-commercial sources, including open source; and (3) internally developed." Also see #4 below.	

1. Document Title/Number: Underground Test Area Activity Quality Assurance Plan Nevada National Security Site, Nevada; DOE/NV-1450-Rev. 2				2. Document Date: 2/2015	
3. Revision Number: 02				4. Originator/Organization:	
5. Responsible DOE NNSA/NFO Activity Lead: Bill Wilborn				6. Date Comments Due:	
7. Review Criteria: Complete Document					
8. Reviewer/Organization Phone No.: NDEP				9. Reviewer's Signature:	
10. Comment Number/Location		11. Type[a]	12. Comment	13. Comment Response	14. Accept/Reject
3	Page 13, Section 1.9, First paragraph, Fifth sentence	M	Table 1-1 has four code types listed with the last one being Revised or Modified. This fourth code type is not included in the second sentence. Please clarify for consistency.	Made paragraph consistent: "Organizations must develop and implement procedures and/or forms for the development (if necessary), ~~modification~~ revision, verification, and control of computer software codes. UGTA uses three types of computer code: (1) commercially available off the shelf; (2) acquired from ~~other participants or other~~ non-commercial sources, including open source; and (3) internally developed. Acquisition of commercially available off-the-shelf software must be controlled through the procurement process. Commercial software should be evaluated for proper installation. … Table 1-1 presents the requirements for each code type and for code revisions." Also deleted "or modified" in Table 1-1. Also see #4 below.	
4	Page 14, in Table 1-1	M	Type Acquired, Verification Column is not checked and it should be. Under Section 1.9.3 on page 15, First sentence indicates that developed codes must be verified and documented. Acquired codes have been developed at some time, thus verification applies to these types of codes.	Inserted sentence prior to Table 1-1: "The code developer is responsible for "internally developed" code requirements. If a participant receives software from another participant (non-commercial entity), the "acquired" requirements must be followed."	

1. Document Title/Number: Underground Test Area Activity Quality Assurance Plan Nevada National Security Site, Nevada; DOE/NV-1450-Rev. 2				2. Document Date: 2/2015	
3. Revision Number: 02				4. Originator/Organization:	
5. Responsible DOE NNSA/NFO Activity Lead: Bill Wilborn				6. Date Comments Due:	
7. Review Criteria: Complete Document					
8. Reviewer/Organization Phone No.: NDEP				9. Reviewer's Signature:	
10. Comment Number/Location		11. Type[a]	12. Comment	13. Comment Response	14. Accept/Reject
5	Page 29, Section 2.3.3.2	M	When there are no established PE programs for given analytes demonstrations of capability may also be used instead of interlaboratory comparisons. Add provision for DOCs.	First sentence changed to: "Interlaboratory comparisons or demonstrations of capability must be performed annually for parameters not included in a formal PEP." ~~but Regularly periodically analyzed by two or more independent laboratories.~~	
6	Page 37, Section 2.6.2, Model Calibration	M	Visual Evaluations, first sentence; incomplete sentence	First sentence changed to: ~~Visual comparison~~ "These involve comparisons of the various…"	
7	Page 37, Section 2.6.2, Model Calibration	M	Quantitative Evaluations, first sentence; incomplete sentence	First sentence changed to: ~~Quantitative evaluation of "~~These involve potentiometric…"	
8	Page 46, Under Section 3.5.1 Annual QA Report	M	please include the purpose for the annual QA report; for example see the italicized portion as follows: "The Activity Lead must submit an annual QA report to NDEP. *The purpose of the annual QA report is to determine if the UGTA Activity met the requirements set forth in the QAP. Therefore*, the report must include the following: ... "	Added "The annual report describes the quality activities conducted by UGTA participants during the prior fiscal year. The purpose of the report is to support a determination that the UGTA Activity met the requirements set forth in the QAP. Therefore, the report must include the following:" The report does not make a determination regarding QAP compliance. The assessments and issues identified in the report are the QAP compliance evaluations.	

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DOCUMENT REVIEW SHEET

1. Document Title/Number: Underground Test Area Activity Quality Assurance Plan Nevada National Security Site, Nevada	2. Document Date: 08/2012
3. Revision Number: 1	4. Originator/Organization: Navarro-Intera
5. Responsible DOE NNSA/NSO Activity Lead: Bill Wilborn	6. Date Comments Due: 10/03/2012
7. Review Criteria: Complete Document	
8. Reviewer/Organization Phone No.: NDEP	9. Reviewer's Signature: NDEP

10. Comment Number/Location	11. Type[a]	12. Comment	13. Comment Response	14. Accept/Reject
Pg. 2, Section 1.2, First Paragraph. Pg. 8, Section 1.5.1, Second Paragraph after Bullets. Page 10, Section1.5.1, Third Paragraph on Page	M	The terms "goal" and "objective/objectives" seem to be used interchangeably in these paragraphs and/or are not consistent with their use in the FFACO in regards to the UGTA strategy. Please either reference where the statements made in this QAP are taken from or make the sentences consistent with what is stated in the FFACO. NDEP	Page 2 changed to "The UGTA objective is to define perimeter boundaries for each CAU over the next 1,000 years using (1) data collection, (2) modeling, (3) iterative model evaluations and monitoring, and (4) identification and documentation of land-use policies. The goal is to provide the data, model forecasts, and confidence in the model results to facilitate informed regulatory decisions by NNSA/NSO and NDEP." Page 8 changed to "The goal (step 2) is to provide the data, model forecasts, and confidence in the model results to facilitate informed regulatory decisions by NNSA/NSO and NDEP." Page 10 changed to "The UGTA strategy also has several decision points (see Appendix VI, Section 3.0, of the FFACO) that provide opportunities for NDEP and NNSA/NSO to assess the work products and decide whether results are sufficient to advance to the next step."	Accept
Pg. 20. Section 2.1.1.1, Bias	M	Section number should be 2.1.2 because bias is not a sub heading under precision, it is an equal indicator. NDEP	Changed to 2.1.2	Accept
Pg. 21, Section 2.1.1.2, Accuracy	M	Section number should be 2.1.3 because accuracy is not a sub heading under precision, it is an equal indicator. NDEP	Changed to 2.1.3	Accept
Pg. 21, Section 2.1.1.3, Representativeness	M	Section number should be 2.1.4 because representativeness is not a sub heading under precision, it is an equal indicator. NDEP	Changed to 2.1.4	Accept
Pg. 21, Section 2.1.1.4, Completeness	M	Section number should be 2.1.5 because completeness is not a sub heading under precision, it is an equal indicator. NDEP	Changed to 2.1.5	Accept

[a]Comment Types: M = Mandatory, S = Suggested.
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10. Comment Number/Location	11. Type[a]	12. Comment	13. Comment Response	14. Accept/Reject
Pg. 22, Section 2.1.1.5, Comparability	M	Section number should be 2.1.6 because comparability is not a sub heading under precision, it is an equal indicator. NDEP	Changed to 2.1.6	Accept
Pg. 22, Section 2.2 ,Field Operations, First Paragraph, Sixth Sentence	M	"… (i.e., pumping tests and slug tests)…" should be (*i.e., aquifer tests)*. Please correct this use. NDEP	Changed as indicated	Accept
Pg. 31, Section 2.5, Non-direct Data, Second Sentence	M	"Data obtained from a peer-reviewed journal must be considered acceptable and do not require justification." Please rewrite this sentence because data obtained from a peer-reviewed journal still needs to be justified for use in UGTA applications. NDEP	Sentence was deleted.	Accept
Pg. 33, Figure 2-1	M	Under Hydraulic Parameters (pump test) should be (*aquifer test*). Please correct this use. NDEP	Changed as indicated	Accept
Pg. 35, Figure 2-2	M	Under HSU Definitions "Pumping and tracer tests" should be *Aquifer and tracer tests*. Please correct this use. NDEP	Changed as indicated	Accept
Pg. 44, Section 3.4, Document Review and Issuance, Second Paragraph, First Sentence	M	"and NDEP comment letters" should be added after "…Documented Review Sheets (DRSs)" as the NDEP submits Agency comments for Final Rev. 0 and Final Rev. 1 on Agency letterhead, not DRSs. NDEP	Changed as indicated	Accept
Pg. 45, Section 3.4.3, NDEP Review, Paragraph after Bullets, Last Sentence on Page	M	This sentence will need to be rewritten to reflect that the NDEP submits Agency comments for Final Rev. 0 and Final Rev. 1 on Agency letterhead, not DRSs. NDEP	Changed to "The document is transmitted with a due date. Non-NDEP reviewers review the document and record comments on the DRS. NDEP comments are transmitted by letter."	Accept

[a]Comment Types: M = Mandatory, S = Suggested.
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