Environmental
Management
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DOE/NV--1592

Underground Test Area Calendar Year 2017 Quality Assurance Report Nevada National Security Site, Nevada

April 2018

U.S. Department of Energy
Environmental Management Nevada Program

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UNDERGROUND TEST AREA
CALENDAR YEAR 2017
QUALITY ASSURANCE REPORT
NEVADA NATIONAL SECURITY SITE, NEVADA

U.S. Department of Energy,
Environmental Management Nevada Program
Las Vegas, Nevada

April 2018

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List of Acronyms and Abbreviations

AIMS	Assessment and Issue Management System
ALS	ALS Laboratory Group
ARS	ARS International, LLC
BMP	Best management practice
C	Carbon
CADD	Corrective action decision document
CAIP	Corrective action investigation plan
CAP	Corrective action plan
CAU	Corrective action unit
CC	Correctable deficiency
Cl	Chlorine
COC	Contaminant of concern
COPC	Contaminant of potential concern
CR	Closure report
CRAD	Criteria review approach document
CY	Calendar year
DER	Duplicate error ratio
DIC	Dissolved inorganic carbon
DOC	Dissolved organic carbon
DOE	U.S. Department of Energy
DRI	Desert Research Institute
EDC	Electronic data capture
EDD	Electronic data deliverable
E/I	Event/issue
EM	Environmental Management
ER-AS	Environmental Restoration Analytical Services

List of Acronyms and Abbreviations *(Continued)*

FAWP	Field activity work package
FFACO	*Federal Facility Agreement and Consent Order*
GEL	General Engineering Laboratory
^{3}H	Tritium
I	Iodine
IAEA	International Atomic Energy Agency
ISPID	Integrated Sampling Plan identifier
LANL	Los Alamos National Laboratory
LCS	Laboratory control sample
LLNL	Lawrence Livermore National Laboratory
MAPEP	Mixed Analyte Performance Evaluation Program
MCL	Maximum contaminant level
MDA	Minimum detectable activity
MDL	Method detection limit
M&O	Management and Operating
MSTS	Mission Support and Test Services
M&TE	Measuring and test equipment
N/A	Not applicable
NA	Not available
NDEP	Nevada Division of Environmental Protection
NELAC	National Environmental Laboratory Accreditation Conference
N-I	Navarro-Intera, LLC
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

List of Acronyms and Abbreviations (Continued)

NSSAB	Nevada Site-Specific Advisory Board
NSTec	National Security Technologies, LLC
OA	Oversight assessment
OAA	Operational awareness activity
OBS	Observation
OFI	Opportunity for improvement
OJT	On-the-job training
pCi/L	Picocuries per liter
PEP	Performance evaluation program
PER	Preemptive review
PIRDy	Public Involvement Resource Database
pmc	Percent modern carbon
PPE	Personal protective equipment
PT	Proficiency testing
Pu	Plutonium
QA	Quality assurance
QAP	Quality Assurance Plan
QC	Quality control
RM/SM	Rainier Mesa/Shoshone Mountain
S	Sulfur
SDWA	*Safe Drinking Water Act*
SME	Subject matter expert
SOP	Standard operating procedure
Sr	Strontium
SwRI	Southwest Research Institute
Tc	Technetium

List of Acronyms and Abbreviations (Continued)

TDR	Technical Data Repository
TIC	Total inorganic carbon
TOC	Total organic carbon
U	Uranium
U of A	University of Arizona
UCDB	UGTA Chemistry Database
UGTA	Underground Test Area
USGS	U.S. Geological Survey
YF/CM	Yucca Flat/Climax Mine
$d^{13}C$	delta carbon-13
$\delta^{2}H$	delta deuterium
$\delta^{18}O$	delta oxygen-18

1.0 Introduction

This report is required by the Underground Test Area (UGTA) Activity Quality Assurance Plan (QAP) (NNSA/NFO, 2015) and identifies the UGTA quality assurance (QA) activities for calendar year (CY) 2017 (January 1, 2017, through December 31, 2017).

UGTA organizations—U.S. Department of Energy (DOE) Environmental Management (EM) Nevada Program; Desert Research Institute (DRI); Lawrence Livermore National Laboratory (LLNL); Los Alamos National Laboratory (LANL); National Security Technologies, LLC (NSTec)/Mission Support and Test Services (MSTS); Navarro Research and Engineering, Inc. (Navarro); and the U.S. Geological Survey (USGS)—conduct QA activities throughout the CY. The activities include conducting oversight assessments (OAs) for UGTA Activity QAP compliance, identifying findings and completing corrective actions, evaluating laboratory performance, reviewing technical work, and publishing documents.

UGTA Activity participants conducted 20 assessments on topics including safe operations, UGTA Activity QAP compliance, and activity planning. These assessments are summarized in Section 2.0. Corrective actions tracked are presented in Appendix A.

UGTA Activity use of laboratories not certified by the State of Nevada is identified and justified in Section 3.0.

Laboratory performance was evaluated based on four approaches: (1) established performance evaluation programs (PEPs), (2) interlaboratory comparisons, (3) blind samples, or (4) data evaluation. Results of the laboratory performance evaluations are summarized in Section 4.0.

Contract managers, corrective action unit (CAU) leads, preemptive review (PER) committee members, and topical committee members are listed by name and organization in Section 5.0. Other activities that affected UGTA quality are discussed in Section 6.0.

UGTA QA program conclusions are provided in Section 7.0, and references are listed in Section 8.0.

2.0 Assessments and Corrective Action Tracking

2.1 Assessments

The UGTA Activity participants conduct management and independent assessments. Management assessments are conducted by the responsible managers or a designee to identify process improvements or efficiencies (not regulatory compliance). Independent assessments are conducted by personnel independent of the work being done and may be compliance-driven. Causal analyses are independent assessments that evaluate the underlying causes of issues or events. EM Nevada Program personnel conduct OAs and operational awareness activities (OAAs). OAs are analyses or reviews of contractor programs, processes, or products. OAAs are day-to-day documented oversight activities. The assessments are listed in Table 2-1 in the order they were conducted.

2.2 EM Nevada Program Assessments

EM Nevada Program personnel conducted three OAs in CY2017. Criteria review approach documents (CRADs) were completed in accordance with National Nuclear Security Administration, Nevada Field Office (NNSA/NFO) Order 226.X, Rev. 2, *Federal Oversight Program* (NNSA/NFO, 2016a). Each CRAD documents the objective, requirements, criteria, review approach, conclusions, records reviewed, personnel interviewed, work observed, results, and any issues identified. The assessments (Table 2-1) resulted in two findings, two opportunities for improvements (OFIs), and seven observations (OBSs).

2.3 Participant Assessments

Table 2-2 lists EM Nevada Program's mandated management assessments conducted in CY2017. The 17 assessments resulted in 8 findings, 13 OFIs, 7 OBSs, 2 best management practices (BMPs), 1 correctable deficiency (CC) and 1 event/issue (E/I).

2.4 Corrective Action Tracking

UGTA participants provide UGTA-related issues, assessment plans, assessment reports, corrective actions, and related closure documentation to Navarro for tracking and summarization on the Navarro UGTA SharePoint site. Items (findings, OFIs, OBSs, BMPs, CCs, and E/Is) may be identified during

Table 2-1
EM Nevada Program UGTA Oversight Assessments

Tracking Number	Date Conducted	Type	Scope	Result		
				Finding	OFI	OBS
A-641	01/05/2017	OA	Oversight Assessment of Navarro Sample Management Implementation (OA-16-AMEM-055)	1	0	1
A-722	07/20/2017	OA	LLNL Carbon 14 Analysis and Data Validation (OA-17-AMEM-004)	1	0	5
A-799	Started 12/19/2017	OA	USGS Implementation of UGTA Activity QAP Sections 1.7 and 1.8 (OA-18-EMNV-004)	0	2	1
			Totals	2	2	7

Table 2-2
UGTA Participant Assessments
(Page 1 of 2)

Tracking Number	Date Conducted	Assessing Org.	Type	Scope	Result			
					Finding	OFI	OBS	Other
A-650	02/25/2017	NSTec	Management	ER-4-1 Field Visit (MA-17-H000-003)	0	0	0	0
A-654	02/27/2017	Navarro	Causal Analysis	Causal Analysis for Issue I-2008, Items in Technical Data Repository (TDR) without Derivative Classifier Review	0	0	0	0
A-676	05/18/2017	Navarro	Surveillance	U-12n Vent Hole #2 Sampling and Health and Safety Measuring and Test Equipment (M&TE)	2	0	0	1 E/I
A-720	06/05/2017	LANL	Management	Rainier Mesa CAU GoldSim Model Review	0	0	0	0
A-653	06/08/2017	USGS	Management	Evaluation of Sample Processing Laboratory	4	1	0	0
A-693	06/09/2017	Navarro	Surveillance	In-Process Groundwater Sampling Activities at Well ER-20-6-3	0	0	0	1 CC
A-719	07/11/2017	Navarro	Surveillance	ER-20-12 Field Work	0	0	0	0
A-589	08/17/2017	Navarro	Management	UGTA Technical Review Process	0	0	1	0
A-576	08/30/2017	Navarro	Management	Evaluate Borehole Index for Compliance with UGTA Activity QAP and for Documentation Completeness	0	1	0	1 BMP
A-588	08/31/2017	Navarro	Management	Time Charging Practices for Staff in Remote Field Locations	2	0	2	0

Table 2-2
UGTA Participant Assessments
(Page 2 of 2)

Tracking Number	Date Conducted	Assessing Org.	Type	Scope	Result			
					Finding	OFI	OBS	Other
A-750	09/11/2017	Navarro	Causal Analysis	Causal Analysis of Issue I-2206, Release of Contaminated (Tritium) Water at Well ER-20-7	0	0	0	0
A-749	09/15/2017	Navarro	Causal Analysis	Causal Analysis for Finding I-2184, Qualified Status of Non-Navarro UGTA Participants	0	3	1	0
A-651	09/20/2017	LANL	Management	Diffusion Experiment Procedure Compliance and Method Testing Documentation	0	1	3	0
A-647	09/28/2017	DRI	Management	Review and Release of UGTA Documents	0	5	0	1 BMP
A-573	09/29/2017	Navarro	Management	Effectiveness of On-the-Job Training (OJT) and Cross-Training on UGTA Well Development and Testing Operations	0	2	0	0
A-757	10/04/2017	Navarro	Causal Analysis	Causal Analysis of Issue I-2225, Technical Consensus Needed Regarding Groundwater Chemistry	0	0	0	0
A-768	11/08/2017	DRI	Surveillance	UE-12t-6 Well Site	0	0	0	0
				Totals	8	13	7	2 BMP 1E/I 1 CC

an assessment, outside an assessment, or as a result of an event. Assessments and items are tracked in the Navarro Assessment and Issue Management System (AIMS). The open corrective actions are presented in Table A-1, and the closed corrective actions in Table A-2.

Not all issues are found during UGTA assessments or assigned to UGTA personnel (e.g., safety); therefore, some corrective actions in Tables A-1 and A-2 are not associated with UGTA assessments. UGTA corrective actions are discussed during the monthly contract managers meeting. At the end of CY2017, 7 corrective actions remained open, and 52 had been closed.

3.0 Noncertified Laboratory Use

This section identifies and justifies analyses performed during CY2017 by laboratories not certified by the Nevada Division of Environmental Protection (NDEP) Bureau of Safe Drinking Water. Required analyses associated with each UGTA CAU are described within the associated *Federal Facility Agreement and Consent Order* (FFACO) (1996, as amended) regulatory planning documents. These documents include the corrective action investigation plan (CAIP), the corrective action decision document (CADD)/corrective action plan (CAP), and the closure report (CR). The required analyses within these documents are consistent with the Nevada National Security Site (NNSS) Integrated Groundwater Sampling Plan.

The NNSS Integrated Groundwater Sampling Plan was developed by a committee of technical representatives from each UGTA organization (NNSA/NFO, 2014). This committee combined information from previous investigations, an understanding of the NNSS inventory radionuclides' relative mobility, previous sampling and analysis data, and modeling results to develop an analyte list that is CAU-dependent and location type-dependent. Wells are identified as characterization, source/plume, early detection, distal, community, or inactive. The sampling plan identifies the analyses performed by commercial laboratories certified by NDEP Bureau of Safe Drinking Water; however, analyses by noncertified laboratories are routinely added to support characterization, model evaluation activities, and/or QA.

Table 3-1 lists the analyses performed by the noncertified labs (DRI, LLNL, and USGS) for characterization and source/plume locations. Early-detection location samples are analyzed by LLNL for low-level tritium (^{3}H) for all CAUs except Frenchman Flat. The Frenchman Flat CAU is in the closure stage, so commercial laboratories are used for all analyses. LLNL data may occasionally be used for corroborative purposes or for technical investigations (e.g., noble gas studies). In some cases, the commercial laboratory and/or LLNL may analyze for low-level ^{3}H (Table 3-1). Low-level ^{3}H measurements may be performed to confirm lack of contaminant migration in these distal areas.

The purposes of the analyses performed by DRI, LLNL, and USGS along with justification for using a noncertified laboratory are presented in Table 3-2.

Table 3-1
CAU-Specific Source/Plume and Characterization Location Analyses by Noncertified Laboratories

CAU	Characterization		Source/Plume
	LLNL	Other	LLNL
Pahute Mesa [a]	• ^{14}C and ^{36}Cl • $\delta^{2}H$ and $\delta^{18}O$ • TIC and $\delta^{13}C$ • Noble gases • ^{3}H (low level) if ^{3}H is <300 pCi/L • ^{99}Tc, ^{129}I, and Pu if ^{3}H is >5,000 pCi/L	• DRI: DOC $\delta^{13}C$ and DOC ^{14}C if ^{3}H is <5,000 pCi/L • USGS: $^{34/32}S$ if ^{3}H is <200,000 pCi/L	^{14}C, ^{36}Cl, ^{99}Tc, ^{129}I
Rainier Mesa/Shoshone Mountain (RM/SM)		None	
Yucca Flat/Climax Mine (YF/CM)			

[a] New wells in Pahute Mesa sampled for the first time also require $^{234/238}U$ and $^{87/86}Sr$ by LLNL.

C = Carbon
Cl = Chlorine
DOC = Dissolved organic carbon
I = Iodine
pCi/L = Picocuries per liter
Pu = Plutonium
S = Sulfur
Sr = Strontium
Tc = Technetium
TIC = Total inorganic carbon
TOC = Total organic carbon
U = Uranium
$\delta^{13}C$ = delta carbon-13
$\delta^{2}H$ = delta deuterium
$\delta^{18}O$ = delta oxygen-18

Table 3-2
Justification for Noncertified Laboratory Analyses
(Page 1 of 3)

Analyte	Purpose	Justification for Use of Laboratory Other Than Commercial
Lawrence Livermore National Laboratory		
^{3}H (Low-Level)	^{3}H is the only contaminant of concern (COC) identified in the sampling plan. Low-level measurements provide early detection of contaminant plumes, support groundwater velocity calculations, and provide estimates of the contribution of recent recharge to the aquifer where ^{3}H presence is not test-related. Also, measurements may be used to corroborate commercial laboratory results.	LLNL uses a helium ingrowth method with a mass spectrometer by which the ^{3}H concentration is determined based on the production of its radiogenic daughter (^{3}He). Commercial labs use a sample preconcentration method followed by liquid scintillation counting. LLNL achieves a slightly lower method detection limit (MDL) (~1 vs ~4 pCi/L), but more importantly, confidence in the low-level result is gained by using the two very different methods. Low-level ^{3}H is measured only when ^{3}H is less than 300 pCi/L (i.e., the detection limit for standard ^{3}H analyses).
^{14}C	Identified as a contaminant of potential concern (COPC) for all CAUs in the sampling plan, and analyzed to evaluate extent and trends in contamination resulting from underground nuclear testing (i.e., evaluate contaminant transport). Also used for evaluating groundwater flow paths, estimating groundwater travel times/velocities, and assessing local recharge extent in areas where no test-related ^{14}C is present.	LLNL provides specialized analyses that measure this analyte at much lower levels (MDL is less than 0.05 pCi/L) than the commercial laboratory (MDL is ~500 pCi/L). Also, commercial laboratories cannot generally measure ^{14}C in NNSS groundwater samples because samples with ^{14}C above the commercial laboratory's MDL also have high ^{3}H (~10^{7} pCi/L), and the high ^{3}H results in spectral interferences. Therefore, commercial laboratories are useful for verifying nondetects below the 2,000 pCi/L maximum contaminant level (MCL), but LLNL analyses are necessary to meet other sampling objectives. Also, the low-level measurement provides confidence in results and in any exceedances reported by the commercial laboratory.
^{36}Cl	Identified as a COPC for all CAUs in the sampling plan, and analyzed to evaluate extent and trends in contamination resulting from underground nuclear testing. Also used for evaluating groundwater flow paths and estimating groundwater travel times/velocities, and used in chloride mass balance calculations.	LLNL provides specialized analyses that measure this analyte at much lower levels (<0.004 pCi/L) than commercial laboratory (4 pCi/L). LLNL can measure natural ^{36}Cl levels. Most NNSS sampling locations have ^{36}Cl activities below the commercial laboratory MDL. No samples exceed the 700 pCi/L MCL. Therefore, commercial laboratories are useful for verifying concentrations below the MCL and can be used to evaluate trends in a small number of NNSS locations. LLNL's lower detection capability is required for evaluating trends in the majority of NNSS locations and for meeting other sampling objectives. Also, the low-level measurement provides confidence in results and in any exceedances reported by the commercial laboratory.

Table 3-2
Justification for Noncertified Laboratory Analyses
(Page 2 of 3)

Analyte	Purpose	Justification for Use of Laboratory Other Than Commercial
Lawrence Livermore National Laboratory (continued)		
^{99}Tc	Identified as a COPC for all CAUs in the sampling plan, and analyzed to evaluate extent and trends in contamination resulting from underground nuclear testing (i.e., evaluate contaminant transport).	LLNL provides specialized analyses that measure this analyte at much lower levels (<0.001 pCi/L) than the commercial laboratory (10 pCi/L). Most ^{99}Tc results are reported as nondetects by the commercial laboratory. Therefore, LLNL's lower detection capability is required for a quantitative trend evaluation for the majority of the NNSS sampling locations where ^{99}Tc may exist but at concentrations well below the commercial laboratory's MDL. Also, the low-level measurement provides confidence in results and in any exceedances reported by the commercial laboratory.
^{129}I	Identified as a COPC for all CAUs in the sampling plan, and analyzed to evaluate extent and trends in contamination resulting from underground nuclear testing (i.e., evaluate contaminant transport).	LLNL provides specialized analyses that measure this analyte at much lower levels (<0.001 pCi/L) than the commercial laboratory (1 pCi/L). The reporting limit for the commercial laboratory is the same as the MDL. LLNL's lower detection capability is required for a quantitative trend evaluation for the majority of the NNSS sampling locations where ^{129}I may exist but at concentrations well below the commercial laboratory's MDL. Also, the low-level measurement provides confidence in results and in any exceedances reported by the commercial laboratory.
^{35}S	Used as evidence of the contribution of recent recharge (one year or less) to the sampled aquifer.	These are nonstandard analyses that are not performed by a commercial laboratory certified by the State of Nevada.
$^{87}Sr/^{86}Sr$	Provides information about groundwater sources, flow paths, and groundwater mixing.	These are nonstandard analyses that require specialized instrumentation and are not performed by a commercial laboratory certified by the State of Nevada.
$^{234}U/^{238}U$ Activity Ratio	Provides information about groundwater sources, flow paths, and groundwater mixing. Isotopic U analyses also performed to distinguish between natural and test-related U sources in those cases that the U (30µg/L) MCL is exceeded.	These are nonstandard analyses that require specialized instrumentation and are not performed by a commercial laboratory certified by the State of Nevada.

Table 3-2
Justification for Noncertified Laboratory Analyses
(Page 3 of 3)

Analyte	Purpose	Justification for Use of Laboratory Other Than Commercial
Pu Isotopes	Identified as a COPC for the Rainier Mesa/Shoshone Mountain (RM/SM) CAU in the sampling plan, and analyzed to evaluate extent and trends in contamination resulting from underground nuclear testing (i.e., evaluate contaminant transport). Also used to identify which test is responsible for its presence.	Samples from the test cavity or other location where contamination is from one specific nuclear test may be considered classified information, and therefore samples should not be analyzed by a commercial laboratory. This decision has not been finalized. LLNL also determines whether the Pu is in colloidal or aqueous form.
Lawrence Livermore National Laboratory (continued)		
Noble Gases	Provides information about groundwater sources, flow paths, and travel times. The composition of the dissolved noble gases (neon-xenon) is directly related to the temperature and altitude of the groundwater recharge location.	Noble gas analysis is highly specialized and cannot be performed by a commercial laboratory certified by the State of Nevada.
$\delta^{2}H$ and $\delta^{18}O$	Provides information about groundwater sources, flow paths, and groundwater mixing.	These are nonstandard analyses that require specialized instrumentation are not performed by a commercial laboratory certified by the State of Nevada.
$\delta^{13}C$ and TIC	Used for correcting ^{14}C measured values for reactions along the flow path to support groundwater age estimates. Also needed for calculating ^{14}C activities from measured values reported by the accelerator mass spectrometer.	$\delta^{13}C$ analyses cannot be performed by a commercial laboratory certified by the State of Nevada. TIC analysis is performed in support of the ^{14}C and $\delta^{13}C$ analysis and is best done using the same sample.
Desert Research Institute		
DOC and DOC ^{14}C	Used in estimating groundwater travel time/flow velocities. DOC ^{14}C is thought to be less influenced by reactive processes along the flow path and may therefore allow more straightforward interpretations than dissolved inorganic carbon (DIC)^{14}C.	The low detection limits required for DOC ^{14}C analyses cannot be achieved by a commercial laboratory certified by the State of Nevada.
U.S. Geological Survey		
$^{34}S/^{32}S$	Provides information about groundwater sources, flow paths, and groundwater mixing.	These are nonstandard analyses that are not performed by a commercial laboratory certified by the State of Nevada.

Samples analyzed by noncertified laboratories during CY2017 are presented in Table 3-2. Characterization and source/plume samples were analyzed as described in Table 3-1 unless otherwise noted in Table 3-2. One distal well (ER-12-1) was sampled for the full RM/SM characterization suite along with $^{87/86}$Sr and $^{234/238}$U (Table 3-2). Two new wells (ER-4-1 and ER-20-12) were sampled for the characterization suite. Sampling of ER-20-12 included the main completion (ER-20-12_m1) and two piezometers (ER-20-12_p1 and ER-20-12_p3). The ER-20-12_p3 sample was also analyzed for $^{87/86}$Sr and $^{234/238}$U. In addition, three Frenchman Flat wells (ER-5-3-2, ER-5-5, and RNM-2S) were sampled for noble gas analysis by LLNL. These analyses support precision evaluations of the sampling and analysis procedures.

Confidence in the QA and quality control (QC) of these laboratories is provided through data verification, data validation, and laboratory assessments. Consistency between multiple measurements from the same location and between multiple parameters are indicative of similar geochemical processes and, along with spatial trends in the data, ensure confidence in the results and data interpretations.

4.0 Performance Evaluation Programs

UGTA water chemistry data were provided by General Engineering Laboratory (GEL); ALS Laboratory Group (ALS), ARS International, LLC (ARS), DRI, Southwest Research Institute (SwRI), LLNL, and USGS. GEL, ALS, ARS and SwRI are commercial laboratories that use industry standard chemistry methods to analyze samples. They are certified by the NDEP Bureau of Safe Drinking Water. The commercial laboratories participate in established proficiency testing (PT) programs. Commercial laboratory analysts' demonstrations of capability were performed for ^{14}C, ^{36}Cl, and low-level ^{3}H as these analytes do not currently have a formal PT program. Analyses performed by DRI, LLNL, and USGS laboratories (Table 3-2) do not follow industry standard methods and do not generally have established PT programs. These analyses require interlaboratory comparisons, blind sample analyses, and/or data evaluations to assess laboratory performance.

4.1 Established PT Programs

The commercial laboratories participated in the following:

- RadCheM™ and MRaD™, conducted by Environmental Resources Associates
- Mixed Analyte Performance Evaluation Program (MAPEP), conducted by the Radiological and Environmental Sciences Laboratory
- National Environmental Laboratory Accreditation Conference (NELAC) Fields of Testing for *Clean Water Act* and *Safe Drinking Water Act* (SDWA), conducted by NSI Lab Solutions
- WatR™ Pollution Proficiency Testing, conducted by Environmental Resources Associates
- Water Pollution Proficiency Testing, conducted by phenova™ Certified Reference Materials

One of the laboratories had performance issues with mercury, alkalinity, chloride and sulfate results. Remedial PT programs were closely reviewed, monitored and trended by Navarro; when appropriate, more scrutiny was applied to data validation, additional QC samples were required, and/or passing laboratories were used for those analytes until such time that the laboratory demonstrated passing PT results. All other laboratory results for UGTA's analytes of interest were within acceptable limits for these performance programs in CY2017. PT reports are business proprietary information and can be provided as needed.

LLNL participated in the International Atomic Energy Agency (IAEA) 2017 Nuclear Material Round Robin exercise to evaluate the laboratory's ability to measure U isotopic composition and U assay and Pu isotopic composition (Treinen et al., 2017). The chemistry and mass spectrometry performed for this evaluation are consistent with the methods used on environmental samples. In general, LLNL performed well with no actions or warning limit triggers. LLNL results were consistent with assigned and consensus values with no values out of compliance.

4.2 Demonstration of Capability

The analyst's ability to meet measurement quality objectives (e.g., for precision and bias) is demonstrated by one of the following:

- Acceptable performance of a blind sample (single- or double-blind to the analyst)
- At least four consecutive laboratory control samples (LCSs) with acceptable levels of precision and accuracy

If the above cannot be performed, an authentic sample can be analyzed and the results compared to those of another analyst. The results must be statistically indistinguishable between the two analysts. ^{14}C, ^{36}C, and low-level ^{3}H are the three radionuclides measurements performed by commercial laboratories that do not have formal performance criteria. As required for state certification, the laboratory performance requirement for these radionuclides was met by demonstration of capability.

4.3 Interlaboratory Comparisons

Laboratory performance for LLNL low-level ^{3}H was assessed by comparing reported results for wells ER-4-1, ER-5-5, ER-5-3-2, and ER-EC-11 commensurate samples to the data provided by GEL or ARS. Both laboratories reported nondetected ^{3}H in wells ER-4-1 and ER-5-3-2. For well ER-5-5, LLNL detected a concentration above the minimum detected activity (MDA) of 1.0 pCi/L; GEL's MDA was 1.5 times higher than LLNL's. As a result, a calculated comparison was not made. However, LLNL's reported value is less than the average commercial lab MDA of 2.79 pCi/L, which corroborates the data (Table 4-1). For ER-EC-11 samples (ER-EC-11_m2 and ER-EC-11_p1), ^{3}H was detected by both labs (commercial and LLNL). The normalized difference is used to compare the results between the two laboratories because the ^{3}H activities are less than five times the MDA. The normalized difference, presented in Table 4-1, considers the three sigma error for the

Table 4-1
Interlaboratory Comparison for Low-Level ^{3}H (pCi/L)

Sample (ISPID)	LLNL	Commercial Lab	Normalized Difference
ER-4-1_m1	<1.0 <1.0	<2.84 <2.83	--
ER-5-5_m1	1.92 ± 0.20	<2.81 <2.77	--
ER-5-3-2_m1	<1.0 <1.0	<2.82	--
ER-EC-11_m2	11.31 ± 1.08	9.75 ± 3.40 11.83 ± 3.88	0.44 0.13
ER-EC-11_p1	11.78 ± 1.10	6.74 ± 2.64 8.22 ± 1.63 10.92 ± 3.64 8.60 ± 3.11 7.97 ± 1.50	1.76 1.81 0.23 0.96 2.05

-- = Calculation does not apply. ^{3}H was not detected, preventing quantitative comparison.
ISPID = Integrated Sampling Plan identifier

Note: Values below the MDA are reported as "<" MDA value.

comparison. The normalized differences ranged from 0.13 to 2.05 for these analyses. With the exception of one case, all normalized differences are within the laboratory duplicate acceptance criteria of two. As stated in Table 3-2, LLNL uses a much different analytical method than the commercial lab; confidence in these low-level results is increased by using the two very different methods. Because these methods are very different and because the reported concentrations are quite low, the acceptance criteria is likely smaller than statistically possible. Further evaluation of the normalized differences for these analyses is required to more effectively define the acceptance criteria.

In 2016, samples were submitted to the National Science Foundation Accelerator Mass Spectrometry Laboratory at the University of Arizona (U of A) to evaluate DRI and LLNL ^{14}C and $\delta^{13}C$ analyses. Samples from two wells (ER-EC-2a and ER-EC-12) were sent to U of A and to LLNL for analysis of DIC $\delta^{13}C$ and DIC ^{14}C. Samples were also sent to U of A and to DRI for analysis of DOC $\delta^{13}C$ and DOC ^{14}C. For DOC $\delta^{13}C$ and DOC ^{14}C, DRI converts the DOC in water samples to carbon dioxide gas, which is then sent to U of A for ^{14}C analysis by accelerator mass spectrometry. Water samples

sent directly to U or A have the DOC converted to carbon dioxide gas by U of A and then analyzed by accelerator mass spectrometry at U of A.

A comparison of the DIC $\delta^{13}C$ and DIC ^{14}C results was presented in the 2016 annual QA report (DOE/EMNV, 2017). The LLNL DIC $\delta^{13}C$ and DIC ^{14}C values were outside the ±1 per mil and ±25 percent acceptance criteria, respectively, when compared with the U of A results. These exceedances were investigated further by LLNL in 2017. LLNL determined that its $\delta^{13}C$ values were higher than U of A's (by 1.4 to 2.2 per mil) because LLNL's analytical equipment was broken and the samples were analyzed outside of their holding time. LLNL further stated that a "J" qualifier should be added to the result to identify it as "estimated." Similarly, the ^{14}C values were higher than U of A's by 36 to 71 percent because the samples were analyzed outside of their holding time. An extent of condition is currently under investigation. Although these results exceeded the acceptance criteria, the comparisons are significantly improved over those previously reported (NNSA/NFO, 2014).
The ^{14}C relative percent difference for ER-EC-13 samples analyzed by U of A and by LLNL, reported in NNSA/NFO (2014), was 157 percent. The large difference between the two labs' findings resulted from multiple sources (e.g., leak in the extraction line, use of contaminated equipment) that have now been corrected. It is important to state that the ^{14}C levels analyzed by these labs are significantly lower (approximately 0.03 pCi/L) than those from a commercial lab, which has a reporting limit of 500 pCi/L. A higher acceptance criteria is likely needed for these highly specialized analyses.

The DOC $\delta^{13}C$ and DOC ^{14}C comparison was not reported in the 2016 annual QA report because the results had not been received from DRI. These results are presented in Table 4-2. As shown in Table 4-2, the difference between the two labs is greater for these analyses than the DIC $\delta^{13}C$ and DIC ^{14}C. Criteria for acceptance of these comparisons have not been developed as a result of the uniqueness and difficulty of the analytical process. Evaluation of DOC $\delta^{13}C$ and DOC ^{14}C for characterizing groundwater flow and measuring the age of groundwater is in progress.
This evaluation will support the decision on whether the UGTA Activity will continue these analyses. The results comparison shown in Table 4-2 will be considered when presenting interpretive results.

Table 4-2
Interlaboratory Comparison for Dissolved Organic Carbon $\delta^{13}C$ and ^{14}C

Sample (ISPID)	DRI	U of A	Difference [a]	DRI	U of A	Difference [b]
	$\delta^{13}C$ (‰)			^{14}C (pmc)		
ER-EC-2A m3	-24.3	-26.2	1.9	36.34	55.76	42
ER-EC-12 m2	-27.2	-30.2	3.0	20.04	18.23	9.5
	-27.2	-30.1	2.9	18.87	34.36	58

[a] Absolute difference calculated using the average of U of A duplicate values.
[b] Relative percent difference calculated using the average of U of A duplicate values.

4.4 Blind Samples

A blind sample is defined as a sample with a known or previously measured detectable quantity of analyte that is submitted to a laboratory in a manner consistent with a field sample. No blind samples were analyzed in CY2017. An evaluation of LLNL $\delta^{2}H$ and $\delta^{18}O$ results for a blind sample was presented in the 2016 annual QA report. This comparison resulted in favorable results for all but one reported $\delta^{18}O$ result. LLNL evaluated this result in 2017 and determined that its results were accurate and that the sample concentration must not have been accurately known by the comparison laboratory. The source of this discrepancy is being evaluated. An issue with using a blind sample to determine laboratory performance has been identified and will be further evaluated.

4.5 Data Evaluation

Commercial laboratory ^{14}C, ^{36}Cl, and USGS ^{34}S analytical performance were evaluated. The data evaluations concluded that appropriate standard operating procedures (SOPs), quality control samples, sample collection, and analytical methodology were used. LLNL's ^{14}C processes were evaluated during EM Nevada Program's OA A-722. Issues associated with qualifying analytical results were identified. LLNL is currently developing and implementing the corrective actions.

5.0 Key Personnel

The following tables identify participants, committee memberships, and responsibilities, along with any personnel changes that occurred during CY2017.

5.1 EM Nevada Program

The EM Nevada Program QA point-of-contact changed from Kevin Cabble to Janis Romo. Another EM Nevada Program staff member, John Myers, was added to the Activity.

5.2 Contractor Change

The NNSS Management and Operating (M&O) contractor changed in December 2017 from NSTec to MSTS.

5.3 Contract Managers

Each organization assigns a contract manager responsible for managing the participants' tasks. There is a monthly contract managers meeting with the EM Nevada Program. Table 5-1 lists each manager by organization. There were no changes in contract manager personnel.

Table 5-1
Contract Managers by Organization

Name	Organization
Karl Pohlmann	DRI
Kay Birdsell	LANL
Andrew Tompson	LLNL
Ken Rehfeldt	Navarro
Ken Ortego	**MSTS**
Jeff Sanders	USGS

Note: Bold text denotes changes.

5.4 CAU Leads and Science Advisors

Each UGTA CAU is assigned a lead, who coordinates CAU-specific technical scope and priorities with other CAU leads, focuses PER committee reviews, and communicates progress. There are periodic CAU lead meetings with the EM Nevada Program. Table 5-2 lists the CAU leads and their respective organizations. No changes were made to CAU leads in CY2017.

Table 5-2
CAU Leads

Name	CAU	Organization
Edward Kwicklis	CAU 97, YF/CM	LANL
Brian Haight	CAU 98, Frenchman Flat	Navarro
Andrew Tompson	CAU 99, RM/SM	LLNL
Ken Rehfeldt	CAUs 101 and 102, Central and Western Pahute Mesa	Navarro

The science advisors split the CAUs:

- Irene Farnham, Navarro, monitors the YF/CM and Frenchman Flat CAUs.
- Chuck Russell, DRI, monitors the Pahute Mesa and RM/SM CAUs.

5.5 Preemptive Review Committee Members

The CAU-specific PER committees provide internal technical review of ongoing work throughout the CAU life cycle. Table 5-3 lists the members in each CAU committee.

Table 5-3
PER Committee Membership
(Page 1 of 2)

Name	Organization
CAU 97, YF/CM	
Karl Pohlmann	DRI
Nicole DeNovio	Golder and Associates
Andrew Tompson	LLNL
Joe Fenelon, Chair	USGS
Britt Jacobson, ex-officio	NDEP

Table 5-3
PER Committee Membership
(Page 2 of 2)

Name	Organization
Jamie Walker, ex-officio	Nye County
Jeff Wurtz	Navarro
Keith Halford	USGS
CAU 99, RM/SM	
Kay Birdsell	LANL
David Finnegan	LANL
Mavrik Zavarin, Chair	LLNL
Britt Jacobson, ex-officio	NDEP
Peter Martian	Navarro
John Klenke, ex-officio	Nye County
Jenny Chapman	DRI
Margaret Townsend	**MSTS**
Joe Fenelon	USGS
CAUs 101 and 102, Central and Western Pahute Mesa	
Karl Pohlmann	DRI
Jenny Chapman	DRI
Kay Birdsell	LANL
Tim Rose	LLNL
Andrew Tompson	LLNL
Mark McLane, ex-officio	NDEP
Sharad Kelkar	Navarro
Jamie Walker, ex-officio	Nye County
Wayne Belcher, Chair	USGS

Note: Bold text denotes changes.

5.6 Topical Committee Members

Topical committees may be formed on an ad hoc basis to address items such as non-CAU-specific issues, questions, concerns, and readiness. The committees may be disbanded when their scope is complete. Table 5-4 lists the current committees and membership.

Table 5-4
Topical Committee Membership

Name	Organization
Modeling	
Clay Cooper	DRI
Edward Kwicklis	LANL
Andrew Tompson, Chair	LLNL
Sharad Kelkar	Navarro
Britt Jacobson	**NDEP**
Keith Halford	USGS
Well Purging and Sampling Methods	
Chuck Russell, Chair	DRI
Mavrik Zavarin	LLNL
Irene Farnham, Science Advisor	Navarro
Jeff Wurtz	Navarro
Brian Haight	Navarro
Karl Pohlmann	DRI
Ken Ortego	**MSTS**
Terry Sonnenburg	**MSTS**
Jeff Sanchez	**USGS**
Western Pahute Mesa Guidance	
Karl Pohlmann, Chair	DRI
Chuck Russell, Science Advisor	DRI
Edward Kwicklis	LANL
Mavrik Zavarin	LLNL
Mark McLane	NDEP
Irene Farnham, Science Advisor	Navarro
Ken Rehfeldt	Navarro
Jeff Wurtz	Navarro
Ken Ortego	**MSTS**
Joe Fenelon	USGS

Note: Bold text denotes changes.

6.0 Other Activities

6.1 UGTA Activity QAP review

The UGTA Activity QAP was reviewed for adequacy in CY2017, and some minor changes were identified. A Record of Technical Change (ROTC) was developed and issued in early CY2018. The changes include the following:

- clarification on the use of non-State of Nevada certified laboratories
- clarification on publicly released documents
- change annual QA report to CY reporting period.

6.2 Nevada Site-Specific Advisory Board (NSSAB) - Stakeholder Involvement

The NSSAB is made up of appointed-volunteers from communities near the NNSS and are chartered to provide recommendations to the DOE EM Nevada Program on environmental restoration and waste management activities from the community perspective. The members bring a variety of perspectives on issues of significant concern to the region. The board considers rural interests, environmental concerns, and local government viewpoints before making recommendations to the EM Nevada Program. FY2017 work plan items associated with UGTA activities were as follows:

- Make recommendation(s) regarding the use of existing and potential sampling techniques. Board members met with UGTA subject matter experts (SMEs), received a briefing from an UGTA science advisor, and observed a pump demonstration in California. The board recommended pursuing additional information on the pump, including life cycle costs, and performance testing in several NNSS wells.

- Observe and recommend enhancements to the UGTA PER process. Board members received a briefing outlining the PER process and then observed the RM/SM GoldSim model and YF/CM CADD/CAP reviews. The board recommended a microphone system, a facilitator, at least one face-to-face meeting, and flexible meeting lengths to improve the process. The board also suggested that a list of definitions would be helpful.

- Recommend additional communication tools for groundwater-related topics. Based on a briefing detailing activities currently used by the EM Nevada Program to communicate groundwater-related topics to the general public and potential communication tools available, additional information, and board discussion, no additional improvements were recommended.

The EM Nevada Program shared the recommendations with the UGTA Activity Lead for consideration. The NSSAB will continue to be involved with the UGTA Activity.

7.0 Conclusion

During CY2017, UGTA Activity participants conducted 20 assessments on topics including safe operations, UGTA Activity QAP compliance, and activity planning. These assessments resulted in 10 findings, 13 OFIs, 13 OBSs, 2 BMPs, 1 CC and 1 E/I. The UGTA Activity continued to conduct PERs and topical committee meetings to ensure quality technical work products.

The UGTA Activity focused on sampling with a significant number of analyses (25 discrete locations) performed by specialized (noncertified) laboratories. The largest number of samples was collected from the Pahute Mesa CAUs. Confidence in the QA/QC of these laboratories was provided through data verification, data validation, and laboratory assessments. Consistency between multiple measurements from the same location and between multiple parameters is indicative of similar geochemical processes and, along with spatial trends in the data, ensures confidence in the results and data interpretations.

The second round of closure sampling for Frenchman Flat was completed in accordance with the Frenchman Flat CR (NNSA/NFO, 2016b).

The UGTA Activity QAP was reviewed for adequacy in CY2017 resulting in the following changes:

- clarification on the use of non-State of Nevada certified laboratories
- clarification on publicly released documents
- a change annual QA report to a CY reporting period.

The NSSAB also recommended (1) use of existing and potential sampling techniques, (2) enhancements to the UGTA PER process, and (3) additional communication tools for groundwater-related topics. These recommendations were shared with the UGTA Activity Lead for consideration.

8.0 References

DOE/EMNV, see U.S. Department of Energy Environmental Management Nevada Program.

FFACO, see *Federal Facility Agreement and Consent Order*.

Federal Facility Agreement and Consent Order. 1996 (as amended March 2010). Agreed to by the State of Nevada; U.S. Department of Energy, Environmental Management; U.S. Department of Defense; and U.S. Department of Energy, Legacy Management. Appendix VI, which contains the Underground Test Area Strategy, was last modified June 2014, Revision No. 5.

NNSA/NFO, see U.S. Department of Energy, National Nuclear Security Administration Nevada Field Office.

Treinen, K., A. Gaffney, and R. Williams. 2017. *Lawrence Livermore National Laboratory Participation in the IAEA 2017 Nuclear Material Round Robin Exercise*, LLNL-MI-744431. Livermore, CA: Lawrence Livermore National Laboratory.

U.S. Department of Energy Environmental Management Nevada Program. 2017. *Underground Test Area October 1, 2015, to December 31, 2016 Quality Assurance Report, Nevada National Security Site,* DOE/NV--1571. Las Vegas, NV.

U.S. Department of Energy, National Nuclear Security Administration Nevada Field Office. 2014. *Nevada National Security Site Integrated Groundwater Sampling Plan,* Rev. 0, DOE/NV--1525. Las Vegas, NV.

U.S. Department of Energy, National Nuclear Security Administration Nevada Field Office. 2015. *Underground Test Area Activity Quality Assurance Plan Nevada National Security Site, Nevada*, Rev. 2, DOE/NV--1450-Rev.2. Las Vegas, NV.

U.S. Department of Energy, National Nuclear Security Administration Nevada Field Office. 2016a. *Federal Oversight (LO) Program*, NFO Order 226.X, Rev. 2. Las Vegas, NV.

U.S. Department of Energy, National Nuclear Security Administration Nevada Field Office. 2016b. *Underground Test Area (UGTA) Closure Report for Corrective Action Unit 98: Frenchman Flat, Nevada National Security Site, Nevada,* Rev. 1, DOE/NV--1538-Rev. 1. Las Vegas, NV.

Appendix A

Tracked Corrective Actions

Table A-1
Open Corrective Actions
(Page 1 of 2)

Asst No	Track	Issue Type	Owning Organization	Due Date	Deficient Condition	Corrective Action
N/A	I-117	OFI	LLNL	02/06/2013	Underground test information was not always reported consistently between investigators or consistent with the UGTA Nuclear Test Information Database.	LLNL tasked with cavity radius paper
N/A	I-2098	Finding	Navarro	01/31/2018	Data within the Geochem database has not been qualified and accepted.	Causal analysis conducted (A-755 and associated findings/OBS/OFIs). Borehole index issues fixed and additional issue (I-2106) identified. UGTA Chemistry Database (UCDB) user manual link fixed on SharePoint site. The data flagging of historic data added to the Geochem database by 01/31/18. Data references to be uploaded into database by 01/31/18.
A-722	I-2153	Finding	LLNL	01/31/2018	Pu results for sample 112-0191414-1 (UG100374) were reported without a Validation Qualifier although the verification and validation states that a duplicate associated with this batch did not meet duplicate error ratio (DER) criteria.	Extent of condition conducted. Developed a specific list of relevant qualification flags and reason codes. Each analyst will use this list to qualify data (and supply reason codes if necessary). A second analyst will conduct validation and verification on the application of the qualifiers and reason codes, making sure the information is captured in both the data package and the database. Navarro and LLNL will discuss data flagging in January 2018.

Table A-1
Open Corrective Actions
(Page 2 of 2)

Asst No	Track	Issue Type	Owning Organization	Due Date	Deficient Condition	Corrective Action
A-722	I-2154	Observation	LLNL	01/31/2018	With the exception of issues associated with blank samples, procedures/checklists did not have instructions on qualifying results when quality control issues occur.	List of qualifiers and reason codes has been generated and will be distributed to all UGTA analysts. Analytical SMEs will make initial determination if data need to be qualified. Analysts can discuss specifics with UGTA analytical team to ensure correct qualifier and reason codes are selected. Navarro and LLNL will discuss data flagging in January 2018.
A-722	I-2155	Observation	LLNL	01/31/2018	Not all qualifiers associated with analytical issues are identified and defined.	SMEs will make initial determination if data need to be qualified. Analysts can discuss specifics with UGTA analytical team to ensure correct qualifier and reason codes are selected. Navarro and LLNL will discuss data flagging in January 2018.
A-755	I-2306	OFI	Navarro	01/12/2018	DRI and USGS can use a Navarro computer tool to format data into an electronic data deliverables (EDD) format to populate the database	Response due 01/12/18
A-755	I-2307	OFI	Navarro	01/12/2018	Database owners/administrators need a better understanding of the UGTA participants' use and needs for the UCDB.	Response due 01/12/18

Table A-2
Closed Corrective Actions
(Page 1 of 13)

Asst No.	Track	Issue Type	Owning Organization	Closure Date	Description	Corrective Action
A-301	I-880	Finding	Navarro	06/13/2017	TDR implementing documents; UGTA Sub-Project Information/Data Management Plan,Rev. 0, (January 2012) and N-I UGTA Sub-Project Information/Data Management Plan, Rev. 0 (01/21/12) are not approved.	Develop new procedure to address environmental management technical data management plan. Develop new procedure to address architecture and functionality of the TDR. Develop instructions that will broaden the scope of UGTA satellite records requirements.
A-314	I-898	OFI	M&O	02/28/2017	The delay between record generation and formal records management presents an unnecessary risk.	NSTec records input into formal record depository
A-415	I-1783	Finding	Navarro	03/6/2017	Directions on how to use single-application codes and the verification documentation for these codes is not found in the associated model documentation packages.	Extent of condition conducted for Yucca Flat Phase I and RM/SM Phase I Flow and Transport models. Verified and documented all undocumented single-use codes. Documented these efforts in a new data package and added note to each deficient data package referencing the new data package. Budget adequate time and resources for thorough technical reviews of UGTA modeling data packages to ensure compliance with UM-MDP-4.
A-534	I-1829	Finding	USGS	01/04/2017	The USGS file plan is out of date.	Created and implemented a new file plan, congruent with regulations in USGS General Records Disposition Schedule 432-1-S1 and USGS Water Resources Discipline Scientific Records Disposition Schedule 342-1-S2. Included identifications and categorization of all DOE financial and operational records.

Table A-2
Closed Corrective Actions
(Page 2 of 13)

Asst No.	Track	Issue Type	Owning Organization	Closure Date	Description	Corrective Action
A-534	I-1830	Finding	USGS	01/04/2017	Unnecessary redundancy in both physical and electronic files	Access to network files controlled. Duplicate copies systematically removed from the USGS computer network and storage cabinets. Items such as publications, open file reports, journal articles, and/or DOE records will be matched to their online/paperless form via Google searches, USGS online pubs, and the DOE online library. Templates will be made for affiliated documents. Categorization of publications, open file reports, journal articles, and DOE records will be accomplished though collaboration with SMEs.
N/A	I-1848	Finding	Navarro	06/19/2017	A 2011 Frenchman Flat self-assessment report (N-I 418) was conducted to see if Frenchman Flat Phase II model documentation was sufficient to reproduce results. N-I 418 was closed in 2012, and the closure memo for one of the findings, 418.1 (Level of Data Package Detail), indicates that the deficient conditions have been corrected and that corrective action memos to file have been included in the affected data packages. Data package LVCF082131 (Frenchman Flat Phase II transport results) has a note stating “see revised memo,” but no revised memo is present.	Extent of condition conducted. Memo added to data packages. The individual revising the documentation terminated employment before this task was completed, and no one else followed through to complete it.

Table A-2
Closed Corrective Actions
(Page 3 of 13)

Asst No.	Track	Issue Type	Owning Organization	Closure Date	Description	Corrective Action
A-558	I-1875	Finding	LLNL	02/28/2017	Three analytical balances were overdue for calibration. The calibration had expired in April.	Extent of condition conducted. Balances and weight sets recalibrated. SOP-137 revised to manufacturer recommended 2-year calibration period.
A-558	I-1877	Finding	LLNL	02/28/2017	Detection limits are not being reported and/or being reported inconsistently with dissolved organic carbon, dissolved inorganic carbon, total organic carbon, and total inorganic carbon.	Analyst oversight. Extent of condition conducted and identified data packages fixed. LLNL reconfirmed SOP workflow processes to ensure that future data packages are properly prepared.
A-558	I-1878	Finding	LLNL	02/28/2017	The National Institute of Standards and Technology (NIST) 3230 certificate of analysis for 129I is not included in the FY2015 data package.	The analyst will include the NIST certificate in future data packages.
A-558	I-1879	Observation	LLNL	02/28/2017	File 14C_03_03_2016, EDD contains qualifiers for ^{14}C results without reason codes. These qualifiers indicate estimating for positive and/or negative bias with explanation.	Reason codes for qualifiers added to the database for this data package; data resubmitted to UGTA SharePoint site.
A-558	I-1880	Observation	LLNL	02/28/2017	From FY2013 to present, all ^{36}Cl commitment dates for records and data to the Environmental Restoration Analytical Services (ER-AS) department were exceeded. The first FY2015 data were received by ER-AS 524 days after expected return date.	Analytical request sheet for ^{36}Cl revised to remove the three-month analytical turnaround that applies to other UGTA analyses.

Table A-2
Closed Corrective Actions
(Page 4 of 13)

Asst No.	Track	Issue Type	Owning Organization	Closure Date	Description	Corrective Action
A-558	I-1881	Observation	LLNL	02/28/2017	The Management Practices Manual for the Underground Test Area Project, Lawrence Livermore National Laboratory, Revision 0, 04/2016, LLNL-AM-690620, is being implemented; however, some refinements were identified and should be considered in the next revision.	Management Practices Manual revised.
A-558	I-1882	OFI	LLNL	02/28/2017	The preparation date and analysis date are confusing in the database. In the database for ^{36}Cl, the analysis date listed is actually the preparation date. The form should say “preparation date” instead of “date.”	Form revised.
A-558	I-1883	OFI	LLNL	06/30/2017	The Sr analysis SOP needs to be updated to reflect the new analytical equipment. UGTA will be sending Sr samples from Well ER-20-12 in September.	Sr SOP revised.
A-558	I-1884	Finding	LLNL	02/28/2017	Pu records packages do not include all the required elements.	A check sheet added to Pu data packages prepared under LLNL SOP UGTA-135, Revision 4, stating analyst's documentation of instrument calibration, standard reference material values and acceptance criteria, procedure blank results, ^{244}Pu spike solution verification, and acceptance criteria for duplicates, has been verified and validated. Revised SOP UGTA-135.

Table A-2
Closed Corrective Actions
(Page 5 of 13)

Asst No.	Track	Issue Type	Owning Organization	Closure Date	Description	Corrective Action
A-427	I-1947	Observation	Navarro	04/20/2017	Observed the lack of identification for SMEs or data resource owners who administer the applications used to complete project work scopes.	Establish SME/data resource owners for software applications.
A-427	I-1948	Observation	Navarro	03/20/2017	Stratigraphic lithology database has switched SME ownership. There is no schedule set to update this database with new data (recent drilling data).	Schedule established for updating the strat-lith database through FY2017.
A-427	I-1949	Observation	Navarro	07/17/2017	The UGTA staff and participants must be trained on UGTA SharePoint and use of TDR. Training should also include instructions on how to update data and an explanation of task responsibilities.	Executed formal training on TDR and introduced the latest TDR toolsets.
A-640	I-1977	OFI	Navarro	01/23/2017	Procedure DR-DM-1, Section 2.2 Step 10 requires that a Document Issuance Checklist be completed and signed. The checklist contains a requirement that the document has been checked to ensure external review comments are incorporated.	Weekly management meetings involving the project manager, integration manager, modeling manager, closure support manager, geologic interpretation manager and project controls to better define roles and responsibilities
A-640	I-1978	OFI	Navarro	01/23/2017	The supervisor and UGTA project manager will ensure that the author does not have an excessive amount of concurrent job assignments.	Weekly management meetings involving the project manager, integration manager, modeling manager, closure support manager, geologic interpretation manager; and project controls to better define roles and responsibilities

Table A-2
Closed Corrective Actions
(Page 6 of 13)

Asst No.	Track	Issue Type	Owning Organization	Closure Date	Description	Corrective Action
A-641	I-2048	Finding	Navarro	05/01/2017	GWC-121516-1 was used for samples collected from UE-2ce and ER0303 and sent to commercial laboratories. LLNL-121516-1 was used for samples collected from UE-2ce and ER-3-3 and sent to LLNL.	The analytical services manager notified the laboratories immediately upon discovery and had the lab change one of the chain of custody by adding a suffix of "a" following the COC number. This provides unique COC numbers for the two projects. The modified COC is the official record submitted to Central Files. If sampling projects are scheduled to perform sample collection on concurrent days, one project will be notified by the closure support manager or lead UGTA supervisor to add a unique suffix to their COC number (e.g., GWC-032217 versus GWC-032217-A).
A-420	I-2052	OFI	Navarro	08/07/2017	Clarify the following text in OI-SM-1, Step 3: "Custody must be documented by a member of the Sample Collection Team before shipment."	Desktop Instruction: DI-FO-11 developed.
A-420	I-2055	OFI	Navarro	03/23/2017	Communicate to all sample custodians that secure storage facility and storage number (e.g., building 6-909 refrigerator #1) are included on chain of custody when placing samples in secure storage.	UGTA personnel were briefed immediately on the need to add the specific storage unit being used and on the differences between authorized secure storage and the limited-access secure storage on the chain of custody.
A-658	I-2075	OFI	Navarro	03/28/2017	Suggest that in the future there is no need to triple-rinse brand-new bottles; they can be rinsed just once because LLNL purchases ultra-pure, highest-quality sample bottles for the samples.	OFI, for tracking only

Table A-2
Closed Corrective Actions
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Asst No.	Track	Issue Type	Owning Organization	Closure Date	Description	Corrective Action
N/A	I-2109	Finding	Navarro	05/25/2017	Five one-liter broken sample bottles found in the Bldg. 6-909 RMA-posted secure storage refrigerator. These bottles are associated with samples collected from the U-12n Vent Hole #2, which has elevated tritium.	Appropriate notifications made. Personnel immediately double-bagged the broken samples and disposed of them per waste management procedures. Work was paused for all other handling of samples. Additional 8 liters had been collected. Discontinued use of the refrigerator (had frozen samples). Checked for possible spread of contamination.
N/A	I-2127	Finding	Navarro	08/15/2017	UGTA sample shipment to laboratories was missing the custody seals on the shipping container.	Causal analysis conducted. Employees were reminded of the need to attach seals and to check one another's work.
A-693	I-2137	Correctable Deficiency	Navarro	07/07/2017	During sampling activities, the LLNL tritium sample was mistakenly mislabeled with a “total inorganic carbon” label. This was noted by one of the samplers before it was custody taped.	The sample was returned to the labeler, and the correct label was applied.

Table A-2
Closed Corrective Actions
(Page 8 of 13)

Asst No.	Track	Issue Type	Owning Organization	Closure Date	Description	Corrective Action
N/A	I-2140	Event/Issue	Navarro	11/08/2017	UGTA personnel stationed in Mercury requested a review of current schedules and associated tasks. A robust dynamic field schedule (typically back-to-back sampling events) has presented challenges to field personnel attempting to keep up with records management and data package preparation requirements, which allows very little time to achieve other important task and duties indirectly associated with field sampling.	Closure Support and UGTA integration manager implemented initiatives to improve records management through the use of the electronic data capture (EDC) sample documentation process and use of FedEx online for waybill generation. Time required for field activity work package (FAWP) development shortened due to use of new templates and stronger expectations on limiting research and information to only what is required for FAWP. Future actions: identify potential administrative resource support for records and Public Involvement Resource Database (PIRDy) uploads; evaluate alternatives in field resource management and schedule restructuring, including increased use of cross-trained office/field personnel; evaluate opportunities to reduce redundancy between SharePoint uploads and Central File submissions.
A-722	I-2156	Observation	LLNL	12/26/2017	Samples are stored in a secure room, and analysts retrieve and return (if not consumed) the samples without transferring custody or maintaining custody documentation.	Revised SOPs to include validation and verification checklists with internal COC language.
A-722	I-2157	Observation	LLNL	12/26/2017	LLNL UGTA procedures have inaccuracies and identify responsibilities for other LLNL entities.	SOPs revised.

Table A-2
Closed Corrective Actions
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Asst No.	Track	Issue Type	Owning Organization	Closure Date	Description	Corrective Action
A-722	I-2158	Observation	Navarro	10/30/2017	The following issues were discussed during the LLNL assessment for Navarro consideration: (1) Samples are packaged in a large plastic bag closed in a “horsetail,” using a lot of duct tape, making them extremely difficult to open. (2) The COC uses blue ink, which does not copy well.(3) Sample and field tritium level notifications are not timely. (4) Sample number and types are sometimes incorrect (e.g., if analyzing for ^{14}C, need total dissolved inorganic carbon sample).	Emailed samplers, reminding them that a horsetail closure is not necessary, IT department changed EDC forms from blue to black and made the COC lines thicker to ensure photocopies are legible. LLNL has permission to view the Work Planning and Control and UGTA SharePoint field activity calendars. Closure Support specifies which lab shipments are scheduled on a particular date (e.g., LLNL versus commercial or USGS). Desktop instruction for sample shipping (DI-FO-11) updated to include analytical services’ responsibilities to notify the labs of shipments and tritium levels. Desktop instruction (DI-FO-08) for fluid sample collection was updated with specifics on collecting additional bottles/analyses for LLNL ^{14}C and ^{36}Cl analyses.
A-653	I-2171	Finding	USGS	08/10/2017	No hard copy printouts of the UGTA QAP or the USGS Safety and Health Handbook manual were in the processing room.	Hard copy prints will be printed and kept in the processing room.
A-653	I-2172	Finding	USGS	08/10/2017	“No Food or Drink” signs need to be posted in the processing room.	Signs permanently posted in the processing room.
A-653	I-2173	Finding	USGS	08/10/2017	Personal Protection Equipment (PPE) storage containers need to be labeled with stored contents.	Labels applied.

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Asst No.	Track	Issue Type	Owning Organization	Closure Date	Description	Corrective Action
A-653	I-2174	Finding	USGS	08/10/2017	A first-aid kit was not readily available in the processing room.	First-aid kit added to sample processing room at all times. Contents will be checked regularly for expirations. Contents will be reordered as needed.
A-653	I-2175	OFI	USGS	08/10/2017	Anti-fatigue mats should be purchased for ergonomic considerations.	Mats supplied.
A-589	I-2194	Observation	Navarro	09/12/2017	The PER process should engage and focus the SME reviewers prior to the actual review.	(1) Initiated upfront presentations and meetings with reviewers so the review of report material is not the first time reviewers see and comment. (2) Provided the reviewers with a draft document that contains all the technical material but may have a few sections or appendices that have not been completely edited. (3) Identified specific chapters for each reviewer. This corrective action was tested with the RM/SM PER with excellent results.
A-749	I-2218	OFI	Navarro	11/09/2017	Draft an assessment procedure for DOE EM Nevada Program that instructs federal personnel to assess UGTA participants at least once every three years; assessments will cover the scope of their work that affects UGTA quality.	Draft procedure developed and transmitted to DOE EM Nevada Program.
A-749	I-2219	OFI	Navarro	12/29/2017	Assist DOE EM Nevada Program in conducting assessments of the UGTA participants.	DOE EM Nevada Program scheduled assessments of UGTA participants in FY2018.
A-749	I-2220	OFI	Navarro	09/18/2017	Draft a letter for DOE to request compliance information from UGTA participants.	DOE EM Nevada Program transmitted letter to UGTA participants.

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Asst No.	Track	Issue Type	Owning Organization	Closure Date	Description	Corrective Action
A-651	I-2226	Observation	LANL	09/28/2017	Sample identifier inconsistencies on wafer experiment spreadsheets.	Spreadsheets were modified to include a unique identifier for each sample.
A-651	I-2227	Observation	LANL	9/28/2017	Spreadsheet explanation detail insufficient. Additional information needs to be included to describe the purpose of the experiments, the procedure followed, and the samples selected.	Much more detail was added to the “spreadsheet_explanations” text to turn the document into a narrative for the data package and to assist future users of the data package. Detail included introductory material describing the purpose of the experiments, additional text describing the experiment, information on the samples selected (including rock type) and the sample selection process. Additional files were also included in the data package. Additional files were added to describe sample selection.
A-651	I-2228	Observation	LANL	09/28/2017	Sample collection for the diffusion cell experiment was not automated as described in the SOP.	A section was added to the data package narrative to document the deviation from the SOP and its impact. If additional diffusion cell experiments are used in the future, UGTA-LANL-SOP-5.25 will be reviewed and/or revised.
A-651	I-2229	OFI	LANL	09/28/2017	Diffusion wafer experiments may be more cost-effective and efficient while providing similar diffusion coefficient values. If additional diffusion experiments using this technique are proposed by the UGTA activity, a formal SOP should be generated for this new method.	OFI, for tracking only

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Asst No.	Track	Issue Type	Owning Organization	Closure Date	Description	Corrective Action
A-647	I-2230	OFI	DRI	09/28/2017	Scientific and Technical Information Tracking List and Archival Process	OFI, for tracking only
A-647	I-2231	OFI	DRI	09/28/2017	Include the information logged in the tracking spreadsheet for a particular document in the final STI archive for that document. A single-page electronic document would likely be sufficient.	OFI, for tracking only
A-647	I-2232	OFI	DRI	09/28/2017	The web page presenting the directory of scientific and technical information resources contains numerous documents with duplicative or overlapping information as well as information that applies only to DHS reports. This web page and the documents linked to it may be due for review and revision.	OFI, for tracking only
A-647	I-2233	OFI	DRI	09/28/2017	Include in the final STI archive copies of the Technical Information Review Program (TIRP) approval email, document distribution emails, and other pertinent correspondence.	OFI, for tracking only
A-647	I-2234	OFI	DRI	09/28/2017	DRI's UGTA program manager should consider maintaining a description of each UGTA STI archive produced by the STI program manager in the UGTA Project Management Inventory Database and Filing System.	OFI, for tracking only

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Asst No.	Track	Issue Type	Owning Organization	Closure Date	Description	Corrective Action
A-647	I-2235	BMP	DRI	09/28/2017	Maintenance of a complete and up-to-date tracking list of DRI's STI for the DOE Technical Research, Engineering, and Development Services (TREDS) contract by the STI program coordinator facilitates checking of the status of STI and clearly documents the completion of each step in the review and issuance process.	OFI, for tracking only
A-755	I-2304	Correctable Deficiency	Navarro	12/15/2017	The borehole index and UCDB were updated to identify wells using the ISPID naming convention.	The borehole index and UCDB were updated to identify wells using the ISPID naming convention.
A-755	I-2305	Find & Fix	Navarro	12/15/2017	The UCDB SharePoint site was linked to the incorrect user's manual.	Correct user's manual linked to UCDB SharePoint site.