

U.S. DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
OFFICE OF QUALITY ASSURANCE

AUDIT REPORT

OF THE

CIVILIAN RADIOACTIVE WASTE MANAGEMENT SYSTEM
MANAGEMENT AND OPERATING CONTRACTOR

AT

LAWRENCE BERKELEY NATIONAL LABORATORY
BERKELEY, CALIFORNIA

AUDIT NUMBER YM-ARP-96-13
JULY 8 THROUGH 11, 1996

Prepared by: Dennis C. Threath Date: 8/22/96

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Enclosure

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1.0 EXECUTIVE SUMMARY

As a result of Performance-Based Quality Assurance (QA) Audit YM-ARP-96-13, the audit team determined that the Civilian Radioactive Waste Management System Management and Operating Contractor (CRWMS M&O) at the Lawrence Berkeley National Laboratory (LBNL) is satisfactorily implementing an adequate and effective QA program and process controls for work performed under Work Breakdown Structure (WBS) 1.2.3.11.2, "Surface-Based Geophysical Testing." The LBNL program examined during this audit is in accordance with the U.S. Department of Energy (DOE) Office of Civilian Radioactive Waste Management Quality Assurance Requirements and Description (QARD) document DOE/RW-0333P, Revision 5. In addition, overall adequacy of and compliance to selected LBNL implementing procedures were found to be satisfactory.

The audit team identified no deficiencies during the course of the audit (see Section 5.5 of this report).

There were seven recommendations for process improvements resulting from this audit which are provided in Section 6.0 of this report.

2.0 SCOPE

The performance-based audit was conducted to evaluate the adequacy and effectiveness of the LBNL controls for performing activities involving surface-based geophysical testing. The audit was intended to determine the progress in the collection and analysis of data and development of the Geophysics Synthesis Report to ensure that the products are being developed in accordance with program requirements and applicable sections of the QARD.

The process activities associated with the end-product evaluated during the audit, in accordance with the approved audit plan, are as follows:

PROCESS/ACTIVITY/OR END-PRODUCT

Activities involving development of the Geophysics Synthesis Report were selected for evaluation from WBS element 1.2.3.11.2, "Surface-Based Geophysical Testing."

The performance-based evaluation of process effectiveness and product acceptability was based upon:

1. Satisfactory implementation of the critical process steps;
2. Use of trained and qualified personnel working effectively;
3. Documentation that substantiates the quality of the product;
4. Acceptable results and adequate end-product; and
5. Effectiveness of corrective action.

The CRWMS M&O's critical process steps involved in the development of the audited deliverable were as follows:

- Study plan
- Test planning
- Data collection
- Data verification
- Data reduction
- Data output
- Data analysis
- Data reporting

TECHNICAL AREAS

The audit included a technical evaluation of the development process and adequacy of the Geophysics Synthesis Report. Details of the technical evaluation are included in Section 5.4.

In addition, a sample of QA program elements were evaluated only as they directly related to the technical areas. These program elements included:

- 1.0 Organization
- 2.0 QA Program (Qualification and Training of Personnel)
- 5.0 Implementing Documents
- 6.0 Document Control
- 7.0 Control of Purchased Items and Services
- 12.0 Control of Measuring and Test Equipment
- 16.0 Corrective Action
- 17.0 QA Records

Supplement I, Software
Supplement III, Scientific Investigation

3.0 AUDIT TEAM AND OBSERVERS

The following is a list of audit team members and observers and their assigned areas of responsibility:

<u>Name/Title/Organization</u>	<u>QA Program Elements/Requirements, Processes, Activities, or End-Products</u>
Dennis C. Threatt, Audit Team Leader, Yucca Mountain Quality Assurance Division (YMQAD)	QA Program Elements directly related to support of the end-product, QA Elements 1.0, 2.0, 16.0, Supp. I
Patrick V. Auer, Auditor YMQAD	QA Program Elements directly related to support of the end-product, QA Elements 5.0, 6.0, 7.0, 12.0, 17.0, Supp. III
John J. Nicholl, Jr., Technical Specialist, Woodward-Clyde	Supplement III, Process Steps for Surface-Based Geophysical Testing
Jack Spraul, Observer, U.S. Nuclear Regulatory Commission (NRC)	
Baqr Ibrahim, Observer, NRC	

4.0 AUDIT MEETINGS AND PERSONNEL CONTACTED

The preaudit meeting was held at the LBNL offices in Berkeley, California, on July 8, 1996. A daily debriefing and coordination meeting was held with the LBNL management and staff, and daily audit team meetings were held to discuss issues and potential deficiencies. The audit was concluded with a postaudit meeting held at the LBNL offices in Berkeley, California, on July 11, 1996. Personnel contacted during the audit are listed in Attachment 1. The list includes those who attended the preaudit and postaudit meetings.

5.0 SUMMARY OF AUDIT RESULTS

5.1 Program Effectiveness

The audit team concluded that the QA program and process controls are adequately and effectively being implemented by the LBNL for the areas identified in the scope of this audit. The process controls for performing activities involving development of the Geophysics Synthesis Report were found to be

effective. The report deliverable date is September 1, 1996. The audit team determined that the LBNL is progressing well in producing a geophysics report of the Yucca Mountain Site. The report is being adequately documented as to data sources and development process.

5.2 Stop Work or Immediate Corrective Actions Taken

There were no stop work order, immediate corrective actions, or related additional items resulting from this audit.

5.3 QA Program Audit Activities

A summary table of audit results is provided in Attachment 2. The details of the audit evaluation, along with the objective evidence reviewed, are contained within the audit checklists. The checklists are kept and maintained as QA Records.

5.4 Technical Audit Activities

The performance-based QA audit regarding the "Surface-Based Geophysical Testing," WBS 1.2.3.11.2, was performed at the LBNL in Berkeley, California. The audit focused on those activities and processes associated with the development of the Geophysics Synthesis Report, which will be used as a primary project document describing characterization of the site. Results described in this document, combined with other geologic, borehole, and intrusive information, will be used to further develop the three-dimensional geological model of the Yucca Mountain Site.

The development of the Geophysics Synthesis Report is a complex technical activity involving the compiling and integration of multiple geophysical data sets and interpretations from numerous sources into a cohesive document that can be utilized by various entities within the project. Potential applications of the Geophysics Synthesis Report include site characterization, seismic hazard, volcanic hazard, preclosure monitoring, natural resources assessment, and design (see Recommendation #3). Geophysical components to be integrated within this report are surface geophysical surveys including seismic reflection and vertical seismic profiling (VSP), electrical surveys involving magnetotellurics (MT), gravity, magnetics, and subsurface geophysics involving borehole logging.

Where the LBNL managed geophysical data collection efforts, parts of those efforts are included in this audit. Where the LBNL is not directly responsible for a specific geophysical data set, the integration of those results into the Geophysics Synthesis Report is part of this audit.

A checklist of technical questions was prepared to address specific data or interpretation issues that will be included or considered in the Geophysics Synthesis Report. These aspects can be categorized under several headings as follows: data compilation, seismic imaging, gravity, electrical studies, magnetics, borehole geophysics, geophysical integration and interpretation, and reporting. These are discussed below:

Data Compilation - The Geophysics Synthesis Report will include directly, or by inference, a large amount of geophysical data collected within and in the vicinity of the potential repository area. Most of the data that will be directly included are those collected in fiscal year (FY) 1994 and FY 1995; however, a large body of geophysical information exists from studies completed prior to 1993. Much of these older data and results have formed the basic groundwork for proposing and conducting subsequent site characterization geophysical activities.

Although more recent site characterization activities have had specific study goals, the geophysical studies completed in FY 1994 and FY 1995 were partially based on previous investigations conducted prior to FY 1994. The pre-FY 1994 studies were completed without the qualified QA procedures that are implemented today. Much of the existing geophysical information in the vicinity of the Site that was collected prior to FY 1994 is summarized in two "White Paper" documents compiled by the U.S. Geological Survey (USGS). The first was published in 1990, and the second in 1995. In addition to the USGS summaries, several other geophysical studies were completed prior to 1994 near the Site, and were considered in selecting geophysical methodologies to achieve specific site characterization needs and goals.

Even though much of the existing geophysical data of 1993 and earlier vintage is technically not qualified, it is important to consider the older data. Specifically, in the Geophysics Synthesis Report, broad conclusions or interpretations from the older studies will be discussed, as needed, to lay the foundation for subsequent studies and establish the appropriate regional context (see Recommendation #4). Individual data sets from previous studies will not directly be included unless they can be qualified; or if they are critically needed to establish regional trends or characteristics, such as with the gravity data or aeromagnetic data. Therefore, it is important to consider the data from early studies as corroborating data for the results from more recent studies if determined to be compatible.

Surface geophysical data sets that should be reported upon in the Geophysics Synthesis Report include: regional deep seismic reflection conducted by the USGS, high resolution (shallow) seismic reflection conducted by the LBNL, VSP conducted by the LBNL, VSP conducted by the USGS and Colorado School of

Mines (CSM), gravity conducted by the LBNL, MT conducted by the LBNL, and magnetics conducted by the USGS. Of these, several of the data sets have not been received by the LBNL as of this audit. The two major sets that are missing are the USGS ground magnetics data, and the USGS/CSM VSP data. These data sets are required by the LBNL immediately to integrate into the Geophysics Synthesis Report (see Recommendation #6).

Seismic Imaging - Substantial efforts have been expended in using seismic imaging methods to help characterize the Site. Seismic imaging surveys that will be included in the Geophysics Synthesis Report are regional seismic reflection surveys, high resolution seismic reflection surveys, and VSP surveys. Individual seismic survey goals have been quite diverse, as has the implementation of the various seismic technologies. Some of the characterization goals have included: delineation of the Paleozoic (basement) contact, identification of stratigraphic units (such as the various tuff units differentiated by the degree of welding or the presence of lithophysal zones), delineation and characterization of faulting, identification of water-bearing or saturated zones, and distinguishing the degree of fracturing and subsurface anisotropy.

The seismic reflection conducted under the supervision of the LBNL included more than 14 high resolution seismic reflection lines within the general repository area. An additional seismic line was completed in Rock Valley. The LBNL also completed two very high resolution seismic lines across the Ghost Dance Fault.

Significant time and resources have been allocated to testing of the seismic data acquisition parameters to optimize individual survey results. For example, although not the direct subject of this audit, site conditions and resolution desired required the use of a myriad of data acquisition parameters for the regional seismic reflection survey supervised by the USGS. Similarly, the LBNL has routinely completed seismic testing to optimize survey parameters for particular subsurface targets, given survey goals. In addition to field testing prior to each seismic field activity, the LBNL has adequately used lessons learned from earlier data collection efforts to better plan and execute subsequent seismic field efforts.

Testing and optimization of seismic data acquisition parameters by the LBNL have been reasonably thorough and include: ensuring good quality geophone coupling in the difficult terrain; testing the use of receiver or geophone arrays; assessing the value and utility of geophone burial; consideration and mitigation of wind noise; optimization of the geophone group intervals, shot offset, and spread geometry; evaluating the use of low-cut recording filters; maximizing the achievable dynamic range and recording capability (number of channels) by

selection of the seismograph; and making attempts to maximize the frequency bandwidth of the seismic signals, particularly on the high frequency end to increase potential resolution. The effects of the testing improved the seismic data, increasing the possibility of survey success.

In addition to the surface seismic reflection surveys, numerous VSP surveys have been conducted over several phases of the project for a variety of characterization goals. Initial VSP surveys at boreholes WT-2 and NRG-6 were conducted by the LBNL in 1993. The LBNL collected the data using p-wave and s-wave sources and a multi-component downhole geophone, with data acquisition parameters that had been reasonably successful at the nearby C-hole complex. The goal of the initial VSPs was to obtain subsurface seismic velocities, and to assess subsurface anisotropy. Later VSP surveys conducted by the LBNL were focused on obtaining p-wave velocities primarily for use in processing the surface seismic reflection data.

One other significant VSP effort was completed at borehole UZ-16 by A. Balch and CSM under the purview of Principal Investigators (PI) from the USGS. Although not the specific subject of this audit, the UZ-16 data were always expected to be part of the Geophysics Synthesis Report. Large volumes of p-wave and s-wave data sets were apparently collected, and were originally intended to be processed into detailed tomogram panels for use by hydrogeologic investigators with the USGS and others. Funding for additional and/or final work on these data has apparently been suspended. However, the LBNL has still assumed that the raw near-offset data would be available for the Geophysics Synthesis Report. The required data actually represent a very small subset of the entire UZ-16 VSP database. As of this audit, the LBNL had received the majority of requested p-wave near-offset UZ-16 VSP data. However, the s-wave near-offset UZ-16 VSP data has not been received, despite requests on numerous occasions by the LBNL. The s-wave data are important to integrate into the Geophysics Synthesis Report to compare and correlate with the p-wave data, and to provide additional information for use in assessing Site response and the potential for Site amplification as part of the seismic hazard evaluation. Appropriate steps should be taken to ensure that the requested UZ-16 s-wave data are transmitted to the LBNL immediately in order to have any chance of incorporating those data into the Geophysics Synthesis Report.

Once the surface seismic data are collected, they must be processed to enhance the subsurface reflectors in order to interpret the data. For this project, this seismic data processing must be completed in a documentable and repeatable fashion. The LBNL is using the Focus seismic data processing package, produced by CogniSeis. This software is a state-of-the-art commercial package that has been

recently approved through the qualification process. All seismic data processing are being done by the LBNL geophysicists trained in the processing of seismic data. The LBNL geophysicists have attempted to enhance the quality of the seismic sections by using various processing procedures, rather than simply relying on routine or standard commercial processing flow sequences. Sophisticated processing algorithms, such as Radon velocity filtering, have been used to maximize seismic coherency. Where possible, ties to borings and velocities determined from VSP results are used as input to the processing sequences, to provide correlation with direct observations, and to increase the accuracy of the data processing.

Gravity - The LBNL collected gravity data along most of the same profiles that were completed with seismic reflection surveys, including the two regional seismic lines. Data collection procedures, including gravity loop closure tolerances, facilitated the acquisition of high-quality gravity profile data. Density estimates necessary for Bouguer and terrain corrections were made using the available literature, standard procedures outlined by Nettleton (1954), comparing reduced gravity values with terrain, as well as limited density information obtained from borings. Terrain corrections and modeling for the gravity data are being completed using methods described by Johnson and Litehiser (1972). The computer software necessary to facilitate the above is presently in the qualification process, and will be qualified prior to final submittal of the Geophysics Synthesis Report.

Final processing of the gravity data will require the estimation of the regional gravity field to better model the Paleozoic basement structure, and to allow a residual gravity field to be calculated to facilitate modeling of near-surface features in more detail. Determinations of the regional field will require the use of older gravity data which have not been technically qualified, and cannot be qualified in a cost-effective or timely manner. The use of the unqualified data should be clearly identified in the Geophysics Synthesis Report. The real impact, if any, of using the nonqualified peripheral gravity data should also be described (see Recommendation #5). Additionally, the impact of not using the older regional gravity data should also be enumerated.

Electrical Studies - Electrical studies under the purview of LBNL include MT along one of the seismic reflection profiles. The MT survey was intended as a feasibility study to assess whether the method could be successfully implemented at Yucca Mountain. The method appears to provide valuable information, such as helping to identify faulting. To fully assess the method utility, the MT must be correlated with the other completed geophysics, particularly the ground magnetics.

Magnetics - Ground magnetics profile data were collected by the USGS along many of the completed seismic reflection lines. Assessment of the collection of those data and results are not within the scope of this audit; however, the ability of the LBNL to incorporate the USGS magnetics data into the Geophysics Synthesis Report affects the overall quality of that report, and is thus within the scope of this audit. Based on discussions with the LBNL, it appears that the ground magnetics data were collected by the USGS in 1993, 1994, and 1995, and that the processing and plotting of these data have been complete for some time. However, the digital magnetics data, which is the product the LBNL requires, has not been forthcoming from the USGS, despite numerous deadlines. Although the reasons for the USGS delays transmitting the data are unclear, it is nonetheless unfortunate that the USGS has yet to respond to repeated requests for the data. The LBNL has assumed that the magnetics data would be available to correlate with other geophysical methods. Specifically, the magnetics data would be useful in confirming fault locations where seismic and gravity data exists, for correlation with the MT data, and to help discern the effects of fracturing versus rock properties (as indicated by lithophysical development, etc.). The overall impact to the Geophysics Synthesis Report of not including the magnetics data is difficult to assess. The value of the magnetics data cannot be delineated if the LBNL is precluded from using it. Certainly it is reasonable to assume that the completeness of the Geophysics Synthesis Report is compromised somewhat by not being able to consider the USGS ground magnetics data (see Recommendation #7). Although the overall interpretation(s) will be satisfactory without the magnetics data, the confidence in the interpretation(s) would be enhanced if the magnetics data were included for consideration.

Borehole Geophysics - Downhole logging has been completed in a majority of the existing boreholes within the repository block under the purview of Science Applications International Corporation. An assessment of those data is not within the scope of this audit. However, the ability of the LBNL to incorporate the borehole geophysics results into the Geophysics Synthesis Report affects the overall quality of that report, and is thus within this audit scope. Based on discussions with the LBNL PI, interpreted logging results have been transmitted to the LBNL for selected borings or wells, as they have been qualified. However, all logging results have not been made available to the LBNL. Complete correlation between the surface geophysics and the borehole geophysics has not been possible, and will not be completed prior to submittal of the Geophysics Synthesis Report. The final Geophysics Synthesis Report will thus be divided into two primary sections: one describing the surface geophysics, and one describing the borehole geophysics. Optimally, a complete synthesis between the surface and borehole geophysics would be made, and is preferred. It should be

pointed out, however, that since it appears that the content of the Geophysics Synthesis Report is satisfactory, such a complete synthesis would serve to reduce uncertainties and increase confidence of the final interpretation(s).

Geophysical Integration and Interpretation - The LBNL is responsible for integration and interpretation of the surface geophysical work. The interpretation(s) that will be presented in the Geophysics Synthesis Report will likely encompass a suite of possible interpretations that are consistent with the available data. Ongoing discussions are being held between the LBNL and key project geological personnel to facilitate correlation of the emerging geophysical models with the geologic models. More of those discussions are encouraged.

The geophysical interpretation(s) could be made now from the existing data the LBNL currently possesses. However, a better set of interpretations would be possible if all data that were originally expected had been submitted to the LBNL in a timely fashion, or submitted immediately. Since several key data sets have not been submitted to the LBNL, there will not be time to complete any reprocessing of data, nor any substantial reinterpretation. Although it would have preferred to have sufficient time for reprocessing and reinterpretation, to maximize confidence in the final interpretation(s), the existing interpretation(s) appear to be satisfactory.

For the final Geophysics Synthesis Report, the geophysical interpretation(s) will be made using prudent engineering geophysics judgment. Although no formalized criteria exist for establishing the final interpretation(s), and considering that some aspects of the interpretation are by nature not unique, the interpretation decisions should be documented in a scientific notebook so that the steps taken to the end-product are clear and repeatable. This would also ensure appropriate adjustments to interpretation decisions based on the results of peer reviews. These interpretation decisions should consider the data collection goals for each particular geophysical survey, where the data were collected, reliability of the geophysical data based on specific objectives, and how the geophysical data and interpretations fit into the overall geophysical and geological models.

Reporting - This audit occurred during the data processing and interpretation of the surface geophysics, and thus preparation of the Geophysics Synthesis Report is just starting. The intent of the Geophysics Synthesis Report is to present the current suite of geophysical interpretations, based on all of the available surface geophysical data. The report will discuss the geophysical methodologies used, sensitivities of the various geophysical technologies, and the interpretation(s).

Profile geophysical data from the various methods will be plotted together to facilitate visual comparisons and correlation. The data may be plotted at several scales to enhance certain aspects of the interpretation(s).

Conclusions - The LBNL is progressing in preparation of the Geophysics Synthesis Report. They are responsible for integrating data from various sources and producing a deliverable with a clear deadline. Unfortunately, some of the data the LBNL has expected to consider and include in the report has not been submitted to them in a timely manner, despite numerous requests or deadlines, and apparently the LBNL has little recourse in securing those data. Data collected, processed, and interpreted under the direct purview of the LBNL appears to be high-quality, well-documented, and appropriately considered for the Geophysics Synthesis Report. The impact, however, of not including the missing data sets is difficult to quantify, particularly without being able to review them. Without those data to consider as expected, the overall completeness of the Geophysics Synthesis Report is compromised to some degree. Although the completeness of the Geophysics Synthesis Report may be somewhat compromised, the acceptability of the document nonetheless appears to be satisfactory.

5.5 Summary of Deficiencies

The audit team did not identify any deficiencies during the audit.

5.5.1 Corrective Action Requests (CAR)

None

5.5.2 Deficiency Reports (DR)

None

5.5.3 Performance Reports (PR)

None

5.5.4 Deficiencies Corrected During the Audit

None

5.5.5 Follow-up of Previously Identified CARs and DRs

There were no previously issued deficiencies that were determined to be applicable or related to the scope of this audit.

6.0 RECOMMENDATIONS

The following recommendations resulted from the audit and are presented for consideration by the CRWMS M&O's management and the LBNL's management.

1. It is recommended that the procedure YMP-LBL-QIP 6.1, Revision 0, be revised to clearly delineate the types of documents for which the review criteria are intended to be applied.
2. During the audit, it was noted that software to be used in data processing was currently being qualified. The software had not been used to perform quality-affecting work but, since the software was to be used in the near future, it was recommended that the LBNL immediately provide justification for its use prior to completion of qualification to preclude use of the software without proper documentation. The LBNL took immediate steps to provide justification for use of the software prior to completion of qualification and provided the documentation for review by the auditor before the postaudit meeting. In one case, the software qualification which was in progress (Focus 3D) was completed prior to the conclusion of the audit.

The following recommendations address the Geophysics Synthesis Report and, although the current work in developing the report was determined to be acceptable, these recommendations are presented for management consideration of improvements to the Geophysics Synthesis Report which would result in a more complete, user-friendly report.

3. The Geophysics Synthesis Report should be written fully describing the appropriate technical geophysical specifics, but with sufficient explanation that the nongeophysical scientist can understand and use the report.
4. Describe the evolution of how various data acquisition parameters have changed with successive data collection efforts throughout the Site Characterization. This description should include the thinking or decision process for early data collection efforts as contrasted with more recent efforts.

5. Appropriate delineation of qualified versus nonqualified data must be clearly identified and documented with each data set used. Therefore, a qualitative assessment of the impact to the interpretation(s) as a result of using the data should be highly considered.
6. The overall completeness and quality of the Geophysics Synthesis Report is dependent upon the availability of the data to be included. Previously expected data that has not been made available in a timely fashion, or is still unavailable, reduces the overall completeness, and subjectively could reduce the quality of the geophysical integration that is to be completed in the Geophysics Synthesis Report. All efforts should be expended to ensure that the appropriate and expected geophysical data sets are included in the synthesis.
7. Identify and describe the overall impact of any data that remains missing as the Geophysics Synthesis Report is finalized. Qualitatively identify any potential uncertainties associated with the final synthesis that may result from the data exclusions.

7.0 LIST OF ATTACHMENTS

Attachment 1: Personnel Contacted During the Audit

Attachment 2: Summary Table of Audit Results

ATTACHMENT 1

Personnel Contacted During the Audit

<u>Name</u>	<u>Organization/Title</u>	<u>Preaudit Meeting</u>	<u>Contacted During Audit</u>	<u>Postaudit Meeting</u>
Bodvarsson, G.	LBNL Project Manager	X	X	X
Daley, T.	LBNL Geophysicist/Research Assoc.	X	X	
Feighner, F.	LBNL Geological Scientist	X	X	
Fissekidou, V.	LBNL Records Manager	X	X	X
Johnson, L.	LBNL Staff Scientist		X	
Majer, E.	LBNL Principal Investigator	X	X	X
Mangold, D.	LBNL QA Manager	X	X	X
Tsang, Y.	LBNL Principal Investigator		X	X

ATTACHMENT 2
Summary Table of Audit Results

AUDIT YM-ARP-96-13 DETAIL SUMMARY										
ELEMENT	DOCUMENTS REVIEWED	DETAILS (✓/list)	CARs	DRs	PRs	CDA	REC	ADEQUACY	COMPLIANCE	OVERALL
1	YMP-LBL-QIP 1.0, Rev. 0, Mod. 1, "YMP-LBNL Organizational Structure"	pg. 1	N	N	N	N	N	SAT	SAT	SAT
2	YMP-LBL-QIP 2.1, Rev. 0, Mod. 1, "Qualifying Personnel"	pg. 3	N	N	N	N	N	SAT	SAT	SAT
5	YMP-LBL-QIP 5.0, Rev. 0, Mod. 1, "Preparing QIPs - Quality Implementing Procedures"	pgs. 2, 4	N	N	N	N	N	SAT	SAT	SAT
	YMP-LBL-QIP 5.1, Rev. 0, Mod. 1, "Preparing TIPs - Technical Implementing Procedures"	pgs. 2, 4	N	N	N	N	N	SAT	SAT	
6	YMP-LBL-QIP 6.0, Rev. 0, Mod. 1, "Document Control"	pg. 4	N	N	N	N	N	SAT	SAT	SAT
	YMP-LBL-QIP 6.1, Rev. 0, Mod. 1, "Document Review"	pgs. 4, 5	N	N	N	N	#1	SAT	SAT	

ATTACHMENT 2
Summary Table of Audit Results

ELEMENT	DOCUMENTS REVIEWED	DETAILS (✓list)	CARs	DRs	PRs	CDA	REC	ADEQUACY	COMPLIANCE	OVERALL
7	AP-7.4Q, Rev. 1, ICN 2, "Maintenance of the Office of Civilian Radioactive Waste Management Qualified Suppliers List"	pg. 6	N	N	N	N	N	SAT	SAT	SAT
12	YMP-LBL-QIP 12.1, Rev. 0, Mod. 1, "Documenting the Usage of Measuring Equipment"	pg. 6	N	N	N	N	N	SAT	SAT	SAT
16	AP-16.1Q, Rev. 0, "Performance/Deficiency Reporting"	pg. 7	N	N	N	N	N	SAT	SAT	SAT
	AP-16.2Q, Rev. 0, "Corrective Action and Stop Work"	pg. 7	N	N	N	N	N	SAT	SAT	
17	YMP-LBL-QIP 17.0, Rev. 0, Mod. 1, "Submitting Records to the YMP- LBNL Records Processing Center"	pg. 7	N	N	N	N	N	SAT	SAT	SAT
Supplement I	YMP-LBL-QIP SI.0, Rev. 0, Mod. 1, "General Software Quality Assurance"	pg. 8	N	N	N	N	#2	SAT	SAT	SAT

ATTACHMENT 2
Summary Table of Audit Results

ELEMENT	DOCUMENTS REVIEWED	DETAILS (✓/list)	CARs	DRs	PRs	CDA	REC	ADEQUACY	COMPLIANCE	OVERALL
Supplement III	YMP-LBL-QIP SIII.0, Rev. 0, Mod. 1, "Scientific Investigation"	pgs. 1, 2, 9, 10	N	N	N	N	N	SAT	SAT	SAT
	YMP-LBL-QIP SIII.3, Rev. 0, Mod. 1, "Transferring Key Data to the Yucca Mountain Project Office"	pgs. 9, 10	N	N	N	N	N	SAT	SAT	
PERFORMANCE BASED										
SURFACE-BASED GEOPHYSICAL TESTING	PROCESS STEP	DETAILS	CARs	DRs	PRs	CDA	REC	ADEQUACY	COMPLIANCE	OVERALL
	Study Plan	QA pgs. 9, 10 TS pg. 2a	N	N	N	N	N	SAT	N/A	SAT
	Test Planning	QA pgs. 9, 10 TS pgs. 6-9, 11, 12	N	N	N	N	N	SAT	N/A	
	Data Collection	QA pgs. 9, 10 TS pgs. 2, 4, 10, 20-23	N	N	N	N	#4	SAT	N/A	
	Data Verification	QA pgs. 9, 10 TS pg. 5, 24	N	N	N	N	#5	SAT	N/A	
	Data Reduction	QA pgs. 9, 10 TS pg. 5, 13, 16	N	N	N	N	N	SAT	N/A	
	Data Output	QA pgs. 9, 10 TS pg. 5, 17	N	N	N	N	N	SAT	N/A	

ATTACHMENT 2
Summary Table of Audit Results

PERFORMANCE BASED										
	PROCESS STEP	DETAILS	CARs	DRs	PRs	CDA	REC	ADEQUACY	COMPLIANCE	OVERALL
SURFACE-BASED GEOPHYSICAL TESTING (continued)	Data Analysis	QA pgs. 9, 10 TS pgs. 3, 4, 14, 15, 17, 19, 25, 29	N	N	N	N	#6, #7	SAT	N/A	SAT
	Data Reporting	QA pgs. 9, 10 TS pgs. 18, 26- 28, 30	N	N	N	N	#3, #6, #7	SAT	N/A	
TOTAL		QA - 10 pgs. TS - 30 pgs.	0	0	0	0	7			SAT

"DOCUMENTS REVIEWED" includes the referenced procedure or process step and the associated records/objective evidence

- LEGEND:**
- | | | | |
|------|----------------------------|------------|--------------------------------------|
| CARs | Corrective Action Requests | N/A | Not Applicable |
| DRs | Deficiency Reports | ADEQUACY | Requirements in Procedures meet QARD |
| PRs | Performance Reports | COMPLIANCE | Procedures Implemented |
| CDA | Corrected During Audit | OVERALL | Summary of Element |
| REC | Recommendations | UNSAT | Unsatisfactory |
| QA | QA Program Checklist | SAT | Satisfactory |
| N | None | TS | Technical Specialist Checklist |