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

AUDIT REPORT

OF

UNITED STATES GEOLOGICAL SURVEY AND UNIVERSITY OF NEVADA, RENO SEISMOLOGICAL LABORATORY

DENVER, COLORADO AND RENO, NEVADA

AUDIT NUMBER YM-ARP-96-01
OCTOBER 23 THROUGH 27, 1995

Prepared by: Donald J. Harris Date: 12/11/95
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Approved by: R C Spence For Date: 12/12/95
Donald G. Horton
Director
Office of Quality Assurance

1.0 EXECUTIVE SUMMARY

As a result of Performance-based Quality Assurance (QA) Audit YM-ARP-96-01, the audit team determined that the University of Nevada, Reno Seismological Laboratory (UNRSL) in Reno, Nevada and the U.S. Geological Survey (USGS) in Denver, Colorado are satisfactorily implementing effective USGS QA program and the process controls for the scientific investigations and reporting of:

"Initial Summary of Geological, Geophysical, and Seismicity Data to Support Earthquake Source Characterization for Seismic Hazard Analysis at the Proposed Nuclear Waste Repository, Yucca Mountain, Nevada," review draft, dated July 1995.

"Seismicity for the Southern Great Basin of Nevada and California in 1994," preliminary draft, revised July 17, 1995.

"Precarious Rocks and Seismic Shaking at Yucca Mountain, Nevada," preliminary draft, dated 1995.

The audit team identified four deficiencies during the audit which resulted in the issuance of four Deficiency Reports (DR). Yucca Mountain Quality Assurance Division (YMQAD) DR YMQAD-96-D009 documents that the study plan for Relevant Earthquake Sources 8.3.1.17.3.1, that is currently in place, is obsolete. The topical report, Yucca Mountain Project (YMP)/TR-002 NP, dated June 1994, provides the project approach to assess fault displacement and vibratory ground motion hazards at Yucca Mountain. Consequently, there is no current planning document in effect at the time of the audit and work is not being controlled by an updated study plan describing the Project's approach to identify relevant earthquake sources. DR YMQAD-96-D010 documents that UNRSL procured Teledyne Geotech Model 18300 seismometers and calibration services from an unqualified supplier. UNRSL utilized information from the Teledyne Geotech Calibration Report as input to UNRSL calibration without verifying the actuals for the coil motor constant. DR YMQAD-96-D011 documents that UNRSL initiated a Scientific Notebook (SN) for use with the new digital seismic network, due to the new technical procedures not being in place. The SN contained information on loose pages that are not numbered, signed, or dated. The loose pages are not bound and referenced to the SN. DR YMQAD-96-D012 documents that the record "pink sheets" used for summarizing earthquake locations were found to have been partially filled out in pencil rather than ink. Some entries were erased and changed, apparently the data was

checked, but the person who checked the entries for completeness failed to initial or sign the pages. The UNRSL record "pink sheets" for the 1993 Catalog of Seismicity for the Southern Great Basin of Nevada and California, have not been turned over to the USGS Local Records Center (LRC) as required.

Additionally there were eight process improvement recommendations resulting from this audit which are detailed in Section 6.0 of this report.

2.0 SCOPE

The limited scope audit was conducted to evaluate the effectiveness of USGS's process controls for performing scientific investigations and generating reports for "Initial Summary of Geological, Geophysical, and Seismicity Data to Support Earthquake Source Characterization for Seismic Hazard Analysis at the Proposed Nuclear Waste Repository, Yucca Mountain, Nevada," "Seismicity for the Southern Great Basin of Nevada and California in 1994," and "Precarious Rocks and Seismic Shaking at Yucca Mountain, Nevada," in accordance with the Quality Assurance Requirements and Description document, DOE/RW-0333P, Revision 4, Supplement III, Study Plan 8.3.1.17.3.5, "Ground Motion at the Site from Controlling Seismic Events," (Work Breakdown Structure [WBS] 1.2.3.2.8.4.1) Study Plan 8.3.1.17.3.6, "Probablistic Analyses of Vibratory Ground Motion and Fault Displacement at Yucca Mountain," (WBS 1.2.3.2.8.4.1) and Study Plan 8.3.1.17.3.1, "Relevant Earthquake Sources." (WBS 1.2.3.2.8.3.1)

The processes/end-products evaluated during the audit, in accordance with the approved audit plan are as follows:

IN-PROCESS REPORTS EVALUATED

The three reports selected for evaluation by YMQAD in coordination with the Yucca Mountain Site Characterization Office, Assistant Manager, Scientific Programs were:

1. "Initial Summary of Geological, Geophysical, and Seismicity Data to Support Earthquake Source Characterization for Seismic Hazard Analysis at the Proposed Nuclear Waste Repository, Yucca Mountain, Nevada," review draft, dated July 1995. (WBS 1.2.3.2.8.3.1)

2. "Seismicity for the Southern Great Basin of Nevada and California in 1994," preliminary draft, revised July 17, 1995. (WBS 1.2.3.2.8.4.1)

3. "Precarious Rocks and Seismic Shaking at Yucca Mountain, Nevada," preliminary draft, dated 1995. (WBS 1.2.3.2.8.4.1)

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

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

TECHNICAL AREAS

The audit was a technical evaluation of the activities identified in the three reports listed above.

QA PROGRAM AREAS

QA Program areas were evaluated only as they directly related to the technical areas evaluated, they included:

2.0 QA Program (Qualification and Training of Personnel)
4.0 Procurement Document Control
6.0 Document Control
7.0 Control of Purchased Items and Services
12.0 Control of Measuring and Test Equipment
15.0 Nonconformances
16.0 Corrective Action

3.0 AUDIT TEAM AND OBSERVERS

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

Name/Title/Organization	QA Program Elements/Requirements, Processes, Activities or End-products
Donald J. Harris, Audit Team Leader YMQAD	QA Program Elements directly related to support of the products. QA Elements 2.0, 4.0, 6.0, 7.0, 12.0, 15.0, 16.0.
Robert E. Harpster, Lead Technical Specialist, YMQAD	Supplement II, Critical Process Steps.
James D. Agnew, Technical Specialist, Civilian Radioactive Waste Management System Management and Operating Contractor (CRWMS M&O)	Supplement III, Process Steps for: 1) "Seismicity for the Southern Great Basin of Nevada and California, in 1994," and 2) "Precarious Rocks and Seismic Shaking at Yucca Mountain," 1995.
Jefferson McCleary, Technical Specialist, CRWMS M&O	Supplement III, Process Steps for "Initial Summary of Geological, Geophysical and Seismicity Data to Support Earthquake Source Characterization for Seismic Hazard Analysis at the Proposed Nuclear Waste Repository, Yucca Mountain, Nevada."
John G. Spraul, Observer, Nuclear Regulatory Commission (NRC)	
Baler Ibrahim, Observer, NRC	
Robert Brient, Observer, NRC (Southwest Research Institute)	

4.0 AUDIT MEETINGS AND PERSONNEL CONTACTED

A preaudit meeting was held at the UNRSL offices in Reno, Nevada, on October 23, 1995. A daily debriefing and coordination meeting was held with UNRSL management and staff, and daily audit team meetings were held to discuss issues and potential deficiencies. A preaudit meeting was also held at the USGS offices in Denver, Colorado, on October 25, 1995. A daily debriefing and coordination meeting was held with USGS Yucca Mountain Project (YMP) management and staff. Daily audit team meetings were held to discuss issues and potential deficiencies. Daily Audit Team meetings were also held each evening to coordinate the pace of the audit and to discuss process recommendations and potential deficiencies. The audit was concluded with a postaudit

meeting held at the USGS offices in Denver, Colorado, on October 27, 1995. 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 determined that, in general, with the exceptions of areas identified as deficiencies, process controls are being effectively implemented by USGS and UNRSL for the scope of this audit. UNRSL was under contract to USGS as augmented staff, working to USGS's QA program implementing procedures. The audit evaluated three technical reports which were in the draft review process with different stages of completion. The audit team determined that UNRSL and USGS scientists had developed good technical data and had presented that developed data in the reports in a consistent manner, except for the "Precarious Rocks and Seismic Shaking at Yucca Mountain, Nevada," which relegated most of the technical data to appendices.

5.2 Stop Work or Immediate Corrective Actions Taken

There were no Stop Work Orders, immediate corrective actions or related additional items resulting from this audit.

5.3 QA Program Audit Activities

The QA program elements evaluated were directly related to UNRSL and USGS activities in generating the "Seismicity for the Southern Great Basin of Nevada and California in 1994,"report; "Precarious Rocks and Seismic Shaking at Yucca Mountain, Nevada;" and the "Initial Summary of Geological, Geophysical, and Seismicity Data to Support Earthquake Source Characterization for Seismic Hazard Analysis at the Proposed Nuclear Waste Repository, Yucca Mountain, Nevada," reports. The QA program areas directly related to the technical areas and activities evaluated were the QA Program (Qualification and Training of Personnel), Procurement Document Control, Control of Purchased Items and Services, Document Control, Control of Measuring and Test Equipment, Nonconformances, and Corrective Action. These areas were determined to be effective overall, except for the one instance of using an unqualified supplier, for which DR YMQAD-96-D010 was initiated.

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 checklist. The checklist is kept and maintained as a QA Record.

5.4 Technical Audit Activities

The performance-based QA audit was performed at two locations, UNRSL in Reno, Nevada and USGS in Denver, Colorado. The evaluation focused on three products and associated processes. The products consisted of:

1. "Initial Summary of Geological, Geophysical, and Seismicity Data to Support Earthquake Source Characterization for Seismic Hazard Analysis at the Proposed Nuclear Waste Repository, Yucca Mountain, Nevada," review draft, dated July 1995.

2. "Seismicity for the Southern Great Basin of Nevada and California in 1994," preliminary draft, revised July 17, 1995.

3. "Precarious Rocks and Seismic Shaking at Yucca Mountain, Nevada," preliminary draft, dated 1995.

The three reports were supplied by USGS to the audit team. The processes consisted of the critical process steps identified by USGS as being necessary for the successful development of the report products. The reports were current at the time they were provided; however, subsequently the reports were processed through various stages of review and comment resolution without being provided to the audit team, thus precluding any real time input by the audit team on their processes and products.

Technical checklist questions were developed from each report and the report authors/Principal Investigators (PI) and staff responded satisfactorily to all questions on the technical aspects of the reports, whether at UNRSL in Reno, Nevada or at the USGS offices in Denver, Colorado. Relevant documents were examined that relate to the data gathering process used in the development of the reports. The comments related to each of the three reports are as follows:

1. "Initial Summary of Geological, Geophysical, and Seismicity Data to Support Earthquake Source Characterization for Seismic Hazard Analysis at the Proposed Nuclear Waste Repository, Yucca Mountain, Nevada,"

The completeness and effectiveness of the report appears to be adequate for the stated purpose of the report introductions. The report is actually intended to guide the interpreters in the Probablistic Seismic Hazards Analyses (PSHA) project to the results of site characterization investigations and other useful data sets with emphasis on earthquakes and faulting. The report presents some data directly, but in large part is an annotated bibliography that should be very helpful to the PSHA interpreters. It was noted that the philosophy guiding the content of the report evolved during its preparation and that as a result the final product is inconsistent with the Participant Planning Sheet's (PPS) description and the overall study of relevant earthquake sources (Study Plan 8.3.1.17.3.1, Revision 0) (See YMQAD-96-D009).

Revision 0 of the study plan relied on the concept of the 10,000 year Cumulative Slip Earthquake (CSE) in order to characterize the magnitudes of relevant earthquake sources. The CSE technique estimates magnitudes from the long-term fault slip rates, rather than measuring the dimensions and displacements of Quaternary faults that are directly related to expected earthquake magnitudes. As a result, magnitude estimates are based on a time-dependent parameter, fault slip rate, which is inadequate for providing deterministic characterizations of maximum magnitudes given the current practices of seismic source characterization (see YMQAD-96-D009).

The audit team was aware of some of the complicating factors related to planning in areas such as the development of the U.S. Department of Energy methodology to assess fault displacement and vibratory ground motion hazards at Yucca Mountain and the Project's desire to obtain NRC feedback on that methodology and the evolution of the report content. However, the fact remains that ongoing work is not being controlled by up-to-date planning documents, even though the evolution of the study and the report appears to have been agreed to by all parties.

For the review of the report, a minimum of two reviewers were required in accordance with YMP-USGS-Quality Management Procedure (QMP)-3.04, Revision 6, "Technical Review and approval of YMP-USGS Data and Publications." Two reviewers were assigned. An evaluation of the qualification statements revealed that only one of the reviewers was an appropriate reviewer, the other reviewer was not a subject matter expert in seismology, paleoseismicity, Quaternary Geology, or geophysics, which were the main topics of the report. The second reviewer has a broad knowledge of the project and his review

improved the report. However, other reviewers or additional reviewers should have the technical expertise to review all aspects of the technical input into the report in order to satisfy the intent of YMP-USGS-QMP-3.04. (See Section 6.0, Item 4)

During this audit and previous audits that the technical specialist participated in, it was noticed that when examining the reviewers comments that there is a tendency for the reviewers to make all comments non mandatory. This may be due in part to the definition of "mandatory comments," in Section 3.5 of YMP-USGS-QMP-3.04. Since the goal is to produce the highest quality, most useful documents possible with available resources, any substanial technical comment that a reviewer feels would improve the report should be a mandatory comment.

The report utilizes language or terms to describe a process or concept that is inconsistent with the language and terms in previously issued project documents and regulatory guides, for the same processes or concepts. The Lead Author indicated there was no significance intended in using these different terms (see Section 6.0, Item 2).

The report states that a first order survey line containing 130 benchmarks was run in an area of interest to the project (across Yucca Mountain) and has been subsequently resurveyed approximately eight to ten times since the original survey period of 1956-1959. The report neither provides data nor references to the original survey (see Section 6.0, Item 3). The Lead Author of the report indicated this data may not be available, as he has been unable to locate it. It is felt that due to the possible geodetic changes that may have occurred as a result of the Little Skull Mountain earthquake sequence that this data is a technically important data set for the Project.

Conclusions

The work performed by the UNRSL and USGS technical staff to provide seismic data was performed in a competent manner by well qualified professional geophysics staff which have an emphasis on seismology background. This report will fulfill the needs of U.S. Department of Energy's (DOE) Site Characterization Program. The data summaries and analyses will be used by the seismic source interpreters to provide input to the Probabilistic Seismic Hazard Assessment Study.

2. "Seismicity for the Southern Great Basin of Nevada and California in 1994,"

The technical requirements, bases, inputs, and procedures appear to be adequate for the process. They were current and traceable to their source. The methods and techniques used to perform technical tasks appear to be valid, suited to the application, and recognized by the scientific and engineering communities.

The application of computer programs is appropriately documented and the codes appear to be adequately verified and validated (despite their downgrading from critical to Non-Scientific and Engineering Software).

Plans for the technical investigations and evaluation. i.e., study plans, were developed, reviewed, approved, revised, and executed in a controlled manner appropriate to the intended use of the developed information. Technical documents reflected a clear flowdown of requirements from the higher-tier programmatic to the lower-tier working documents with indications as to the origin of the requirement.

The assumptions used in the performance of the scientific work were clearly identified, highlighted for verification at a future time, and noted as qualification on the use of the end product.

The methods used to control identified errors, omissions, and deficiencies in the technical work were formal and effective in correction and prevention of recurrence, except in the case of the "pink sheets" used for summarizing earthquake locations; these were found to be filled out with pencil rather than ink. Some of the entries appeared to have been erased and changed. It appeared that the information on the "pink sheets," had been checked, but the person performing the checks for completeness of entries failed to sign and date the pages indicating the verification had in fact taken place (see YMQAD-96-012).

In addition, it was apparent that all the records generated by UNRSL for the 1993 report had not been transmitted to USGS LRC in a timely manner as required by YMP-USGS-QMP-17.01, Revision 7. The records for the 1994 report were still in process and should be transmitted soon.

The examination of the SN utilized for the new digital seismic network was performed. There were entries made on the computer network rather than the

pages of the SN. The computer entries were printed out separately, the separate sheets were not numbered, signed and dated, or identified as being part of the SN (see YMQAD-96-D011).

Conclusions

The extensive work that has and continues to be performed in this study and the report was conducted in a highly competent manner by well qualified geophysics (with emphasis on seismology), seismologist, instrumentation specialists, and data acquisition staff members cooperatively functioning together as an effective team in assemblying the seismic network activity in the Southern Great Basin. This seismic data is vital to fulfilling the DOE's Site Characterization Program. The new digital seismic newtork currently being installed will enhance both the system and data collection capability.

3. "Precarious Rocks and Seismic Shaking at Yucca Mountain, Nevada."

This report describes a methodology for using precarious rocks to study seismic hazards at Yucca Mountain, Nevada.

Technical questions were prepared from the above report and the relevant personnel at UNRSL were questioned as to the technical aspect of the report. The responses provided were satisfactory. Relevant documents were examined that related to the data gathering process and a tour of the UNRSL model shop was provided to view the precarious rock models.

The "Precariously Balanced Rock" report relegated most of the technical details to appendices to the report, which the Audit Team Technical Specialist did not have the opportunity to review prior to the audit. Incorporation of the technical detail contained in the appendices into the main body of the report text would have been preferable and would have alleviated the need for approximately 75 percent of the audit checklist questions related to this report.

Conclusion

The work that was performed to support this study and report was conducted in a highly competent manner by well qualified geophysics, with emphasis on seismology. It will fulfill the needs of the DOE's Site Characterization Program. The data required by modeling activities was developed by these field and laboratory studies and the integration between models and data is developing very

well.

5.5 Summary of Deficiencies

The audit team identified four deficiencies during the audit for which four DRs have been issued.

Synopses of deficiencies documented as DRs are detailed below. The DRs generated as a result have been transmitted by separate letters; YMQAD:RBC-430 for DR number YMQAD-96-D009 and YMQAD:RBC-433 for DR numbers YMQAD-96-D010, YMQAD-96-D011, and YMQAD-96-D012. Both letters were dated November 7, 1995.

5.5.1 Deficiency Reports

As a result of the audit, the following DRs were issued.

YMQAD-96-D009

The Study Plan for Relevant Earthquake Sources 8.3.1.17.3.1, that is currently in place, is obsolete. The study plan emphasizes the concept of a 10,000 year CSE. This concept was abandoned by the Project over two years ago. The topical report YMP/TR-002 NP, dated June 1994, provides the Project approach to assess fault displacement and vibratory ground motion hazards at Yucca Mountain. Consequently, there is no current planning document in effect at the time of the audit and work is not being controlled by an updated study plan describing the Project's approach to identifying relevant earthquake sources. The USGS PPS for Planning and Scheduling account, Project WBS 1.2.3.2.8.3.1 "Relevant Earthquake Sources," references study plans 8.3.1.17.4.1 and 8.3.1.17.3.6 (prepared December 20, 1994) but fails to provide current Project direction to USGS. USGS contract 1434-93-C-90070 to the Board of Regents, University of Nevada, Reno, dated October 1, 1992, and contract modification 2, dated October 1, 1993, still reference study plan 8.3.1.17.4.1.2, "Monitor Current Seismicity," and study plan 8.3.1.17.1.3, "Evaluate Potential for Induced Seismicity and the Site." The contract was not modified to reflect the desired content of the deliverable.

YMQAD-96-D010

UNRSL procured Teledyne Geotech Model 18300 seismometers and calibration services from an unqualified supplier. UNRSL utilized information from the Teledyne Geotech Calibration Report as input to UNRSL calibration without verifying the actuals for the coil motor constant.

YMQAD-96-D011

UNRSL initiated a SN for use with the new digital seismic network, due to the new technical procedures not being in place. The SN contains information on loose pages that are not numbered, signed, or dated. The loose pages are not bound and referenced to the SN.

YMQAD-96-D012

UNRSL record "pink sheets" generated for the 1993 Catalog of Seismicity for the Southern Great Basin of Nevada and California have not been turned over to the USGS LRC. The "pink sheets" were partially filled out in pencil, some entries were erased and changed, apparently the data was checked, but the checker failed to initial or sign and date the pages.

5.5.2 Deficiencies Corrected During the Audit

None

5.5.3 Follow-up of Previously Identified CARs

There were no previously issued CARs that were determined to be applicable to the scope of this audit. However, the audit team evaluated CAR YM-95-045, "Technical Review of Studies," and CAR YM-95-046, "Resolution of Mandatory Review Comments," for applicability to this audit's Products. It was determined by the audit team, that these deficiencies did not apply to this audit's products.

6.0 RECOMMENDATIONS

The following recommendations resulted from the audit and are presented for consideration by the USGS management.

1. Re-evaluate YMP-USGS-QMP-3.04, Revision 6, Section 3.5, Definitions of "Mandatory Comment." This definition is overly restrictive and the reviewers currently have a tendency to make all comments "non-mandatory."

2. During the technical review and comment process ensure the language and terms are consistent with previously issued Project documents and regulatory guides for the same processes and concepts.

3. Continue the efforts to retrieve the first order survey line containing the 130 benchmarks originally performed during the period between 1956 and 1959.

4. The YMP-USGS-QMP-3.04 requires a minimum of two technical reviewers. The reviewers should have the technical expertise to review all aspects of the technical input into the report, or additional reviewers should be assigned to cover all technical aspects of the report.

5. Include more of the statistical data that UNRSL program, Pickhem, displays for each earthquake location in the "Seismicity for the Southern Great Basin of Nevada and California," report, tables and appendices.

6. Resolve the conflict between Table 3, and Appendix C, where the latitude, longitude, and depth are reported differently and the original time listed for event #9 is different in the "Seismicity for the Southern Great Basin of Nevada and California," report.

7. Provide justification as to why the velocity models used by UNRSL differ from the velocity model used by USGS for the Southern Great Basin.

8. All scientific investigation files should be maintained in chronological order with copies of all relevant documents in a working file.

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

Name	Organization/Title	Preaudit Meeting	Contacted During Audit	Postaudit Meeting
Anooshehpoor, R.	UNRSL/Seismologist		X	
Bradey, T.	USGS/Reports Coordinator		X	
Brient, R.	NRC/Observer	X[1]		X
Brune, J.	UNRSL/PI Director	X[2]	X	
Chaney, T.	USGS/QA Manager	X[3]	X	X
dePolo, D.	UNRSL/Network Seismologist	X[2]	X	
Ducret, G.	USGS/Associated Branch Chief		X	
Gross, S.	UNRSL/Post Doctorate II in Seismology		X	
Ibrahim, B.	NRC/Observer	X[1]		X
Mustard, M.	USGS/Hydrologist (QA)	X[3]	X	
Nelson, M.	USGS/Training Coordinator		X	
Nicks, W.	UNRSL/Seismology Laboratory		X	
Parks, B.	USGS/Assistant Chief ESIP	X[3]		X
Pezzopane, S.	USGS/Geologist ESIP	X[3]	X	X
Rodman, W.	USGS/QA Specialist		X	X
Schneider, E.	USGS/Administrative Services		X	
Smith, K.	UNRSL/Project Coordinator	X[2]	X	
Spraul, J.	NRC/Observer	X[1]		X
Torrisi, I	UNRSL/Research & Design Engineer		X	
Von Seggern, D.	UNRSL/Seismic Network Manager	X[2]	X	
Whitney, J.	USGS/Project Chief - Seismic Hazards	X	X	X
Williams, R.	USGS/ESIP Chief			X

LEGEND:
ESIP ..... Earth Science Investigations Program
X[1] ..... Attended both UNRSL and USGS preaudit meetings
X[2] ..... Attended UNRSL preaudit meeting
X[3] ..... Attended USGS preaudit meeting

ATTACHMENT 2
Summary Table of Audit Results

AUDIT YM-ARP-96-01 DETAIL SUMMARY								
QA ELEMENT/ ACTIVITIES	**PROCESS STEPS**	**CHECKLIST DETAILS**	**PRs DRs CARs**	**CDA**	**RECOM-MENDATION**	**ADE-QUACY**	**COMP-LIANCE**	**OVER-ALL**
Initial Summary of Geological, Geophysical, and Seismicity Data to Support Earthquake Source Characterization for Seismic Hazard Analysis at the Proposed Nuclear Waste Repository, Yucca Mountain, Nevada	Identify product based on needs identified in the SCP and Study Plan.	Pages 1, 2, 3	YMQAD-96-D009	N	N	SAT	UNSAT	SAT
	Identify data needs required to produce products	Pages 5, 6	N	N	N	SAT	SAT	
	Collect Data	Pages 5, 6	N	N	#3	SAT	SAT	
	Analyze Data	Pages 7, 9	N	N	N	SAT	SAT	
	Write draft report (product)	Pages 4, 7, 8, 9	N	N	#2	SAT	SAT	
	Peer review of draft report (product)	Pages 4, 7, 8, 10, 11	N	N	#s 1 & 4	SAT	SAT	
	Respond to peer review and submit final report (product) to DOE	Pages 10, 11	N	N	N	SAT	SAT	

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QA ELEMENT/ ACTIVITIES	PROCESS STEPS	CHECKLIST DETAILS	PRs DRs CARs	CDA	RECOM-MENDATION	ADE-QUACY	COMP-LIANCE	OVER-ALL
Seismicity for the Southern Great Basin of Nevada and California in 1994.	Identify Product based on needs identified in the SCP and Study Plan	Pages 12, 13, 14	N	N	N	SAT	SAT	
	Identified data needs required to produce product	Pages 14, 15, 17, 18	N	N	N	SAT	SAT	
	Collect Data	Pages 16, 18, 32, 33, 34	YMQAD-96-D012	N	#5	SAT	UNSAT	SAT
	Analyze Data	Pages 14, 19, 20, 21, 22, 23, 24, 25, 26, 27	N	N	N	SAT	SAT	
	Write draft report (product)	Pages 28, 29	N	N	#7	SAT	SAT	
	Peer review of draft (product)	Pages 30, 31, 33	N	N	#6	SAT	SAT	
	Respond to peer review and submit final report (product) to DOE	Pages 31, 33	N	N	#8	SAT	SAT	

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QA ELEMENT/ ACTIVITIES	PROCESS STEPS	CHECKLIST DETAILS	PRs DRs CARs	CDA	RECOM-MENDATION	ADE-QUACY	COMP-LIANCE	OVER-ALL
Precarious Rocks and Seismic Shaking at Yucca Mountain, Nevada	Identify Product based on needs identified in the SCP and Study Plan	Page 35	N	N	N	SAT	SAT	SAT
	Identified data needs required to produce product	Pages 35, 36	YMQAD-96-D011	N	N	SAT	UNSAT	
	Collect Data	Page 36	N	N	N	SAT	SAT	
	Analyze Data	Pages 37, 39-41, 43 & 44	N	N	N	SAT	SAT	
	Write draft report (product)	Pages 38, 42	N	N	N	SAT	SAT	
	Peer review of draft (product)	Page 45	N	N	N	SAT	SAT	
	Respond to peer review and submit final report (product) to DOE	Page 45	N	N	N	SAT	SAT	

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Summary Table of Audit Results

QA ELEMENT/ ACTIVITIES	PROCESS STEPS	CHECKLIST DETAILS	PRs DRs CARs	CDA	RECOM-MENDATION	ADE-QUACY	COMP-LIANCE	OVER-ALL
2.0 Quality Assurance Program	YMP-USGS-QMP 2.01, Rev. 2/Mod 4	Page 46 & 47	N	N	N	SAT	SAT	SAT
	YMP-USGS-QMP 2.08, Rev. 2/Mod 3	Pages 46 & 47	N	N	N	SAT	SAT	SAT
4.0 Procurement Document Control	YMP-USGS-QMP 4.01, Rev. 7	Page 48	YMQAD-96-D010	N	N	N	UNSAT	SAT
6.0 Document Control	YMP-USGS-QMP 6.01, Rev. 6/Mod 1	Page 49	N	N	N	SAT	SAT	SAT
7.0 Control of Purchased Items and Services	YMP-USGS-QMP 7.01, Rev. 7	Page 50	N	N	N	SAT	SAT	SAT
12.0 Control of Measuring and Test Equipment	YMP-USGS-QMP 12.01, Rev. 6/Mod 2	Pages 51-53	N	N	N	SAT	SAT	SAT
15.0 Nonconformances	YAP 15.1Q, Rev. 2	Page 54	N	N	N	SAT	SAT	SAT

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Summary Table of Audit Results

QA ELEMENT/ ACTIVITIES	PROCESS STEPS	CHECKLIST DETAILS	PRs DRs CARs	CDA	RECOM-MENDATION	ADE-QUACY	COMP-LIANCE	OVER-ALL
16.0 Corrective Action	AP 16.1Q, Rev. 0	Page 55	N	N	N	SAT	SAT	SAT

Legend:
CDA ..... Correct During the Audit
N ..... None
SAT ..... Satisfactory
SCP ..... Site Characterization Plan
UNSAT .... Unsatisfactory