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

AUDIT REPORT

OF

UNITED STATES GEOLOGICAL SURVEY

DENVER, COLORADO

AUDIT NUMBER YM-ARP-95-04
DECEMBER 6 THROUGH 10, 1994

Prepared by: _____ **Date:** 01-09-95
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Approved by: _____ **Date:** 1/12/95
Donald G. Horton
Director
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1.0 EXECUTIVE SUMMARY

As a result of Performance Based Quality Assurance (QA) Audit YM-ARP-95-04, the audit team determined that the United States Geological Survey (USGS) is not satisfactorily implementing an effective QA program and process controls for the development and control of the 3-D model of the unsaturated zone (UZ) Work Breakdown Structure (WBS) No. 1.2.3.3.1.2.9. The USGS is implementing an effective QA program and process controls for collection, traceability, and submittal of data related to the air permeability studies (WBS No. 1.2.3.3.1.2.3). In addition, the results of implementation of QA Program Elements 5.0, 12.0, 16.0, and 18.0 were found to be satisfactory.

The performance based evaluation of process effectiveness and product acceptability was based on 1) proper implementation of the procedures' critical process steps; 2) use of trained and qualified personnel working effectively; 3) documentation that substantiated the quality of the products; and 4) acceptable results and the quality of the end products.

The audit was performed based on direct observation of the activities in process, interviews with auditee personnel and review of pertinent documents for performance based information gained throughout this process, in order to make a determination whether or not the performance was satisfactory.

The audit team identified three deficiencies during the audit that resulted in the issuance of three Corrective Action Requests (CAR). CAR YM-95-021 concerned the lack of calibrating Measuring and Test Equipment (M&TE) in accordance with prescribed calibration intervals. CAR YM-95-020 identified procurement documents inadequately identifying USGS implementing documents that suppliers must work to. YM-95-022 documented the lack of technical procedures or scientific notebooks for controlling the development of the 3-D model of the UZ. Three deficiencies were corrected prior to the postaudit meeting; these conditions are described in Section 5.5.2 of this report. Additionally, there were two recommendations resulting from the audit which are detailed in Section 6.0 of this report.

2.0 SCOPE

The audit was conducted to evaluate the adequacy and effectiveness of USGS's QA Program as described in the Quality Assurance Requirements and Description (QARD) and USGS implementing procedures.

The QA program elements/requirements and the processes/activities/end-products evaluated during the audit, in accordance with the approved audit plan, are as follows:

QA PROGRAM ELEMENTS/REQUIREMENTS

2.0 QA Program (Surveillances Only)
5.0 Implementing Documents
12.0 Measuring and Test Equipment
16.0 Corrective Action
18.0 Audits and Surveillances

PROCESS/ACTIVITY/OR END-PRODUCT

1. The collection, traceability, and submittal of data related to air permeability studies (WBS No. 1.2.3.3.1.2.3).

2. Development and control of the 3-D model of the UZ including use of air permeability as input (WBS No. 1.2.3.3.1.2.9).

The products resulting from the above processes that were evaluated were the air permeability data described in USGS Scientific Notebook No. 241T and USGS Publication, "Results of Air Permeability Testing in a Vertical Borehole at Yucca Mountain, Nevada" and various documentation related to the 3-D model of the UZ (the 3-D model is not yet completed, so there were no end products to date for evaluation).

TECHNICAL AREAS

The technical adequacy of 1) the collection, traceability, and submittal of data related to air permeability studies (WBS No. 1.2.3.3.1.2.3), and 2) development and control of the 3-D model of the UZ including use of air permeability as input (WBS No. 1.2.3.3.1.2.9) were evaluated during the audit.

3.0 AUDIT TEAM AND OBSERVERS

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

Name/Title/Organization	QA Program Elements/Requirements, Processes, Activities or End-products
Richard L. Maudlin, Audit Team Leader (ATL) Yucca Mountain Quality Assurance Division (YMQAD)	16, 18
Robert L. Howard, ATL-in-Training	5
Kenneth O. Gilkerson, Auditor, YMQAD	12, WBS No 1.2.3.3.1.2.9

Donald J. Harris, Auditor,YMQAD	Procurement activities for WBS No. 1.2.3.3.1.2.3 and WBS No. 1.2.3.3.1.2.9
Charlie C. Warren, Auditor, YMQAD	Data traceability and technical report preparation for WBS No. 1.2.3.3.1.2.3
James Blaylock, Auditor, YMQAD	Process controls for WBS No. 1.2.3.3.1.2.3 and WBS No. 1.2.3.3.1.2.9
Dwayne Chesnut,Technical Specialist, Lawrence Livermore National Laboratory	Technical adequacy of WBS No. 1.2.3.3.1.2.3 and WBS No. 1.2.3.3.1.2.9

4.0 AUDIT MEETINGS AND PERSONNEL CONTACTED

The preaudit meeting was held at the USGS office in Denver, Colorado, on December 6, 1994. A daily debriefing and coordination meeting was held with USGS 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 USGS office in Denver, Colorado, on October 10, 1994. 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, in general, the USGS QA Program is adequate and, with the exception of those deficiencies identified in the CARs, is being satisfactorily implemented. Individually, QA Program Elements 5.0, 12.0, 16.0 and 18.0 are being satisfactorily implemented.

The audit team concluded that, in general, the process controls for work related to Air Permeability Studies (WBS 1.2.3.3.1.2.3) are effectively being implemented for areas identified in the scope of the audit. However, the process controls for the Site UZ 3-D Model (WBS No. 1.2.3.3.1.2.9) are not being effectively implemented.

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

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

WBS 1.2.3.3.1.2.9, Site Unsaturated Zone Modeling and Synthesis

The specific product evaluated in this audit is the Intermediate UZ Hydrologic Framework Model, Level 3 milestone 3GUM107M, comprising geometric data (such as faults and stratigraphic contacts) and material properties (such as porosity, permeability, and water saturation) to be used in subsequent three-dimensional modeling of flow and transport in the site UZ. The milestone is to be completed at the end of FY 95 by delivery of the framework model to EG&G, and is a small part of Study 8.3.1.2.2.9.

Development of the framework model requires the critical examination and integration of many types of data from all available sources, both within and outside of the USGS. Data generating investigations include geologic mapping, geophysical surveys, infiltration studies, air permeability tests, isotope geochemical measurements, and borehole monitoring. In most cases, material properties developed for the framework model are themselves the result of applying models to field and laboratory measurements. Models must then be used to construct reasonable interpolations and extrapolations of these properties to parts of the site where they have not been experimentally determined. Hence, the quality of the final product depends upon a number of factors:

1. The accuracy of the measurements.

2. The experience of the scientists using measurements to estimate the "measured" material properties.

3. The skill and imagination of the Principal Investigator (PI) in formulating and testing conceptual models, and using them in calculational models to fill in gaps in the data.

Because of changes in the project milestone structure, no prior year funding is shown for the P&S Account (1.2.3.3.1.2.9) element audited. Also, only two months have elapsed since the beginning of FY 95. Accordingly, no quality-

affecting work has been performed on the framework model, and the technical part of the audit was necessarily limited to examination of preliminary analyses and results.

These preliminary analyses were documented by the PI in recent presentations for the Nuclear Waste Technical Review Board and the U.S. Nuclear Regulatory Commission (NRC)/U.S. Department of Energy (DOE) Technical Exchange. The presentation materials provided the basis for two days of intensive interviews with the PI, and were supplemented by a copy of a draft Lawrence Berkeley Laboratory report, PACS networks, and selected technical procedures for producing some of the measured input data.

Scientific Assessment:

The PI has done a very thorough job of pulling together information and methods of analysis from the open literature as well as from project sources. He is quite familiar with a broad range of research aimed at understanding the physical processes governing flow through fractured rock.

The quality of the scientific thinking is excellent, with ample evidence of looking beyond the easy explanations and attempting to understand all the data and observations, including the anomalies.

There was one concern noted that could impact future activities. The PI has, quite properly, used all the information he can find to develop his understanding of the important processes controlling the movement of water and dissolved substances at Yucca Mountain. Unfortunately, much of this information was not collected under a qualified QA program, and data from only a few fully qualified boreholes will be available by the end of FY 1995. In addition, it appears that the modeling code selected (TOUGH2) has not been baselined under a software QA plan. These factors may preclude producing a framework model, which in part depends upon output from TOUGH2 simulations, which can be used to support licensing.

WBS 1.2.3.3.1.2.3, Air-Permeability Studies

Permeability tests require the injection of air or other gases into intervals isolated by packer assemblies within boreholes drilled in the UZ, and the measurement of pressure, temperature, and flow rate as functions of time. Tracer tests require, in addition, the measurement of tracer concentration as a function of time. No tracer tests have been performed as of the date of the audit.

Permeability can only be calculated from the pressure, temperature, and rate measurements by making some assumptions about the flow geometry, outer

boundary conditions, spatial distributions of material properties, and so on. Hence, the reported permeability "data" depend not only upon the measurements but upon the model used for their interpretation and the judgement of the interpreter.

Permeability tests and interpretations for more than 80 intervals, with typically three repetitions per interval, have been completed for UZ-16, and the data package was submitted to the Central Records Facility in June 1994. Field work is complete for two more boreholes (NRG 7a and NRG 6), with completion of interpretation and submission of the data packages expected by the end of FY 94. Other wells will be tested as they become available, with the first tracer testing possibly starting sometime in the spring of 1995.

Scientific Assessment:

The field work is very carefully done and controlled by a combination of technical procedures and scientific notebooks.

The PI has selected and trained the field staff so that they can work independently, but he maintains close contact by telephone and spends several days per month in the field. This demonstration of continuing interest of the PI is important to maintaining high quality in the field measurements because it shows that someone cares about the results.

There is a good balance between scheduling requirements and the need to produce high-quality data.

Data packages include raw data (typically voltage or current readings), reduced data (readings converted to physical units, such as temperature and pressure), and interpreted results (air permeability). This is important because the calculation of permeability from measured data is largely an art. Giving potential users access to the basic data allows them to make their own analyses and gain some measure of the degree of conceptual uncertainty. The PI should be commended for this.

The packer assembly includes guard zones for pressure measurements above and below the injection interval to provide a check for packer leaks from the injection interval. This is good practice and helps avoid spurious results. It was suggested to the PI that short injection tests in the guard zones themselves, which can be conducted with existing down-hole assemblies, could check for leaks around the uppermost and lowermost packers, and further increase the confidence in zonal isolation.

The use of steady-state analyses for permeability calculation may need additional corroboration to assess the effect of drilling damage and well-bore

storage on the final results. The PI is aware of these problems and plans to record pressure fall-off as well as build-up measurements in future tests to provide usable transient data.

The non-welded units, particularly the Calico Hills, exhibit little to no fracture permeability. Although this is consistent with observations of lower fracture frequency in these units relative to the welded units, it is inconsistent with Mr Al Yang's measurements of bomb-pulse levels of tritium in this borehole and with saturated-zone pump test data for the Calico Hills in other boreholes. Further scientific investigation is required, and will be performed, to determine whether these inconsistencies are test artifacts, or real differences.

5.5 Summary of Deficiencies

The audit team identified three deficiencies during the audit for which three CARs have been issued. Three additional deficiencies were identified and corrected prior to the postaudit meeting.. Additionally, there were two recommendations resulting from the audit, which are detailed in Section 6.0 of this report.

Synopses of deficiencies documented as CARs and those corrected during the audit are detailed below.

5.5.1 Corrective Action Requests

CAR YM-95-020

Procurement documents do not adequately address the USGS implementing documents that suppliers are required to follow.

CAR YM-95-021

M&TE is not being calibrated at prescribed intervals.

CAR YM-95-022

The development and control of the 3-D model of UZ is not controlled by technical implementing documents or scientific notebooks.

5.5.2 Deficiencies Corrected During the Audit

Deficiencies which are considered isolated in nature and only requiring remedial action can be corrected during the audit. The following deficiencies were identified and corrected during the audit:

1. Quality Management Procedure (QMP)-3.04, Revision 5, requires that data appropriate for the Technical Database (TDB) be submitted to the TBD Administrator in a data transmittal package within 20 working days of data approval by the Chief, Yucca Mountain Project Branch (YMPB). Contrary to this requirement, the Chief, YMPB approved the data for "Pressure, Mass Flow Measurements, and Temperature Measurements from UE-25 UZ #16 Borehole Air Injection Testing Between 11/03/93 and 4/01/94" on July 12, 1994. As of the start of the audit, a data transmittal package had not been submitted to the TDB Administrator. A data transmittal package was submitted prior to the audit exit.

2. QMP 16.04, Revision 0, requires that conditions adverse to quality discovered during surveillances shall be documented on a Quality Deficiency Report (QDR). Contrary to this requirement, two surveillance reports identified conditions adverse to quality; however, no QDR was generated. It should be noted that the conditions were resolved during the surveillance. This condition was resolved was resolved by an approved modification to QMP 16.04, Revision 0, Modification (M4) which allows conditions adverse to quality corrected during the audit and be noted only in the respective report. No QDR is required.

3. QMP 18.01, Revision 7, Attachment 4 required that the Audit Report Details address the documentation reviewed to determine satisfactory compliance. Contrary to this requirement, one audit report did not identify all of the documentation reviewed. It should be noted that the checklist for this particular audit was reviewed and did identify the documentation evaluated. This condition was resolved by a modification to QMP 18.01, Attachment 4 which allowed the documents reviewed to be identified in the audit report or as an attachment.

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.

6.0 RECOMMENDATIONS

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

1. As of the date of the audit, the FY 94 fourth quarter Management Information Report (USGS Trend Report) had not been issued. The evaluation period ended September 30, 1994. USGS needs to tighten the time frame for completion and distribution of this report.

2. In reviewing several surveillance reports, it was noted that there were action items (not QDRs) to be completed that are embedded in the reports. In verifying if these items had been acted upon, the USGS response was no. USGS QA management needs to develop a mechanism to track these action items to closure. If the action items are sufficiently important to be included in the respective report, then it appears that a formal mechanism for tracking such items to completion is warranted.

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
Branch, A.	USGS/QA Implementation Specialist	X	X	
Buckey, M.	USGS/QA Implementation Specialist	X	X	X
Burgess-Kohn, K.	USGS/SAIC-Training Coordinator	X	X	X
Chaney, T.	USGS/QA Manager		X	X
Coburn, C.	USGS/Training Specialist	X		X
Ducret, G.	USGS/Associate Branch Chief	X		
Gillies, D.	USGS/Team Chief, UZ Studies	X	X	X
Gockel, D.	USGS/QA Specialist	X	X	X
Hayes, L.	USGS/Technical Project Officer	X	X	
Hietland, G.	USGS/SAIC Lead Data Management Technician	X		
Kassabian, S.	USGS/FEC			X
Kwickless, E.	USGS/PI		X	
LeCain, G.	USGS/PI		X	
Luckey, R.	USGS/Saturated Zone &EM Chief			X
Lykins, A.	USGS/QA Specialist	X		X
McInroy, L.	USGS/SAIC/QA Specialist	X	X	X
McKinley, P.	USGS/Data Management Coordinator	X		
Mustard, M.	USGS/Hydrologist (QA Office)	X	X	
Parks, B.	USGS/Acting Chief ESIP	X		
Porter, D.	SAIC/Golden Contract Manager			X
Rodman, W.	USGS/ QA Specialist	X	X	
Rodriguez, P.	USGS/SAIC/QA Specialist			X
Scavuzzo, R.	USGS/SAIC/QA Specialist	X	X	
Walker, J.	USGS/Field Engineer		X	
Watson, J.	USGS/QA Implementation Specialist	X		X
Watt, M.	USGS/SAIC/Records Coordinator	X		
Whiteside, A.	USGS/SAIC/ QA Implementation Group Coordinator		X	X
Woolverton, J.	USGS/QA Specialist	X	X	
Zimmerman, S.	State of Nevada	X	X	

LEGEND:

ESIP = Earth Science Investigations Program
EM = Energy Measurements
FEC = Foothills Engineering Corporation
SAIC = Science Applications International Corporation

ATTACHMENT 2

AUDIT YM-ARP-95-04 DETAIL SUMMARY

QA ELEMENT/ ACTIVITIES	PROCESS STEPS	DETAILS (Checklist)	CAR	CDA	RECOM-MENDATION	*ADE-QUACY*	*COM-PLIANCE*	*OVER-ALL*
4.0 PROCUREMENT DOCUMENT CONTROL ASSOCIATED WITH STUDY PLAN 8.3.1.2.2.3	Scope of work, technical requirements, acceptance requirements and QA requirements identified QMP-4.01, Para. 5.1 (C)	Page 9	N	N	N	*NV*	*SAT*	*SAT/ EFF*
	Final procurement document incorporates requirements from requisition requirements (P)	Page 10	N	N	N	*SAT*	*NV*	
	Memorandum of Agreement planned and developed considering topics in QMP-4.02, Attachment 1 (C)	Page 10	YM-95-020	N	N	*NV*	*SAT*	

(P) Performance Based
(C) Procedural Compliance

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QA ELEMENT/ ACTIVITIES	PROCESS STEPS	DETAILS (Checklist)	CAR	CDA	RECOM-MENDATION	*ADE-QUACY*	*COM-PLIANCE*	*OVER-ALL*
	Organizational responsibilities for preparation of procurement documents are described (P)	Page 11	N	N	N	*SAT*	*NV*	
	Are procurement document problems identified during the review and do they appear repetitious (P)	Page 11	N	N	N	*SAT*	*NV*	
	Are requirements originally applied frequently reversed (P)	Page 12	N	N	N	*SAT*	*NV*	
	Do audits and surveillances reveal deficiencies in procurement documents and agreements (P)	Page 12	N	N	N	*SAT*	*NV*	

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QA ELEMENT/ ACTIVITIES	PROCESS STEPS	DETAILS (Checklist)	CAR	CDA	RECOM-MENDATION	*ADE-QUACY*	*COM-PLIANCE*	*OVER-ALL*
	Were controls for procurement adequate to assure the providers are capable of performing (P)	Page 13	N	N	N	*SAT*	*NV*	
5.0 IMPLEMENTING DOCUMENTS	YMP-USGS-QMP-5.01, R5 (C)	Page 14	N	N	N	*NV*	*SAT*	*SAT*
	YMP-USGS-QMP-12.01, R6, M1 (C)	Page 14	N	N	N	*NV*	*SAT*	
	NWM-USGS-HP-270, R2 (C)	Page 14	N	N	N	*NV*	*SAT*	
	NWM-USGS-HP-271, R2 (C)	Page 14	N	N	N	*NV*	*SAT*	

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QA ELEMENT/ ACTIVITIES	PROCESS STEPS	DETAILS (Checklist)	CAR	CDA	RECOM-MENDATION	*ADE-QUACY*	*COM-PLIANCE*	*OVER-ALL*
ACTIVITIES ASSOCIATED WITH STUDY PLAN 8.3.1.2.2.3 7.0 CONTROL OF PURCHASED ITEMS AND SERVICES	Were suppliers evaluated and qualified to perform work (P)	Page 16	N	N	N	*SAT*	*NV*	*SAT/ EFF*
	Was a survey performed or an audit after the supplier commenced work (P)	Page 17	N	N	N	*SAT*	*NV*	
	Supplier annual performance evaluations (P)	Page 17	N	N	N	*SAT*	*NV*	
	Receipt of purchased services (P)	Page 19	N	N	N	*SAT*	*NV*	
	Procurement personnel properly trained (P)	Page 20	N	N	N	*SAT*	*NV*	
	Supplier qualification maintenance (P)	Page 20	N	N	N	*SAT*	*NV*	
	USGS Procurement Program accomplish desired result (P)	Page 21	N	N	N	*SAT*	*NV*	

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QA ELEMENT/ ACTIVITIES	PROCESS STEPS	DETAILS (Checklist)	CAR	CDA	RECOM-MENDATION	ADE-QUACY	COM-PLIANCE	OVER-ALL
12.0 M&TE/WBS 1.2.3.3.1.2.3	M&TE used for air permeability testing (QARD 12.0) (P)	Page 22	N	N	N	SAT	NV	SAT/ EFF
	Responsible personnel and qualifications (QARD 2.2.11) (P)	Page 23	N	N	N	SAT	NV	
	Usage of calibration performance checks HP 251, HP 247, and HP 271 (C) (P)	Pages 23 and 24	YM-95-021	N	N	SAT	UNSAT	
	Calibration of M&TE in a controlled environment (P)	Page 24a	N	N	N	SAT	NV	
	M&TE ID, tagged, traceable (P)	Page 25	N	N	N	SAT	NV	
	Calibration data traceability (C) (P)	Page 25	YM-95-021	N	N	SAT	UNSAT	
	Identify deficient M&TE (P)	Page 26	N	N	N	SAT	NV	

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QA ELEMENT/ ACTIVITIES	PROCESS STEPS	DETAILS (Checklist)	CAR	CDA	RECOM-MENDATION	*ADE-QUACY*	*COM-PLIANCE*	*OVER-ALL*
16.0 CORRECTIVE ACTION	Responsibility (P)	Pages 34 and 35	N	N	N	*SAT*	*NV*	*SAT/ EFF*
	Prompt Identification (P)	Page 35	N	Y	N	*SAT*	*NV*	
	Data Traceability (P)	Page 36	N	N	N	*SAT*	*NV*	
	Responses (P)	Pages 36 and 37	N	N	N	*SAT*	*NV*	
	Verification (P)	Page 38	N	N	N	*SAT*	*NV*	
	Trend Evaluation/Reporting (P)	Pages 38 and 39	N	N	N	*SAT*	*NV*	
	Trend CARs (P)	Page 39	N	N	N	*SAT*	*NV*	
	Management application (P)	Page 40	N	N	N	*SAT*	*NV*	
	Procedure (P)	Page 34	N	N	N	*SAT*	*NV*	
	QMP-16.03, R3, Para. 5.2 (C)	Page 38a	N	N	N	*NV*	*SAT*	
	QMP-16.03, R3, Para. 5.3 (C)	Page 38a	N	N	N	*NV*	*SAT*	

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QA ELEMENT/ ACTIVITIES	PROCESS STEPS	DETAILS (Checklist)	CAR	CDA	RECOM-MENDATION	ADE-QUACY	COM-PLIANCE	OVER-ALL
	QMP-16.03, R3, Para. 5.4 (C)	Pages 38a and 38b	N	N	N	NV	SAT	
	QMP-16.04, R0, Para. 5.0 (C)	Pages 35 and 35a	N	N	N	NV	SAT	
	QMP-16.04, R0, Para. 5.8 (C)	Page 35b	N	N	N	NV	SAT	
	QMP-16.04, R0, Para. 5.10 (C)	Page 35c	N	N	N	NV	SAT	
18.0 AND 2.0, AUDITS AND SURVEILLANCES	Deficiencies Identified (P)	Page 41	N	Y	N	SAT	NV	SAT/ EFF
	Checklist Adequate (P)	Page 42	N	N	N	SAT	NV	
	Reports Generated (P)	Page 43	N	Y	N	SAT	NV	
	Management Application (P)	Page 44	N	N	N	SAT	NV	
	Lead Auditor Certification (P)	Page 44	N	N	N	SAT	NV	
	QMP-18.01, R7, M1, Para. 5.4 (C)	Page 42a	N	N	N	NV	SAT	

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QA ELEMENT/ ACTIVITIES	PROCESS STEPS	DETAILS (Checklist)	CAR	CDA	RECOM-MENDATION	*ADE-QUACY*	*COM-PLIANCE*	*OVER-ALL*
	QMP-18.01, R7, M1, Para. 5.6 (C)	Pages 43 and 43a	N	Y	N	*NV*	*SAT*	
	QMP-18.03, R3, para. 5.3 (C)	Pages 41 and 41a	N	Y	N	*NV*	*SAT*	
	QMP-18.03, R3, Para. 5.4 (C)	Page 41a	N	N	N	*NV*	*SAT*	
WBS 1.2.3.3.1.2.3, AIR PERMEABILITY STUDIES	Scientific Notebook Plan identifies methods, technical procedures use (P)	Page 29	N	N	N	*SAT*	*NV*	*SAT/ EFF*
	Objectives defined/criteria established (P)	Page 30	N	N	N	*SAT*	*NV*	
	Corrective action on past deficiencies (P)	Page 31	N	N	N	*SAT*	*NV*	
	Methodology controlling collecting, reporting and reviewing data from borehole (P)	Page 32	N	N	N	*SAT*	*NV*	

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QA ELEMENT/ ACTIVITIES	PROCESS STEPS	DETAILS (Checklist)	CAR	CDA	RECOM-MENDATION	ADE-QUACY	COM-PLIANCE	OVER-ALL
	Data evaluation for non-Q collected data (P)	Page 32	N	N	N	SAT	NV	
	Data validation/traceability (P)	Pages 7, 8, and 32	N	N	N	SAT	NV	
	Data suitability (P)	Page 8	N	Y	N	SAT	N/A	
	Publication review (P)	Pages 3, 5, 6, and 32	N	N	N	SAT	N/A	
	Selection of reviewers (P)	Page 4	N	N	N	SAT	N/A	
	Publication submittal and control (P)	Pages 1, 2, and 33	N	N	N	SAT	N/A	
WBS 1.2.3.3.1.2.9.3 SITE UZ MODELING AND SYNTHESIS	Modeling data gatherer - gatherer interface (P) (C)	Page 45	YM-95-022	N	N	UNSAT	UNSAT	UNSAT
	Software development and control (P) (C)	Pages 45 through 52	YM-95-022	N	N	UNSAT	UNSAT	

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AUDIT YM-ARP-95-04 DETAIL SUMMARY

QA ELEMENT/ ACTIVITIES	PROCESS STEPS	DETAILS (Checklist)	CAR	CDA	RECOM-MENDATION	*ADE-QUACY*	*COM-PLIANCE*	*OVER-ALL*
WBS 1.2.3.3.1.2.9.3 TECHNICAL EVALUATION OF SITE UZ MODELING AND SYNTHESIS (P)		(T) Pages 1 through 11	YM-95-022	N	N	*UNSAT*	*NV*	*UNSAT*
WBS 1.2.3.3.1.2.3 TECHNICAL EVALUATION OF AIR PERMEABILITY STUDIES (P)		(T) Pages 1 through 15	N	N	N	*SAT*	*NV*	*SAT/ EFF*

(P) Performance Based
(C) Procedural Compliance