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

AUDIT REPORT

OF

LAWRENCE LIVERMORE NATIONAL LABORATORY

LIVERMORE, CALIFORNIA

AUDIT NUMBER YM-ARC-95-07
MARCH 6 THROUGH 10, 1995

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Approved by: _____ **Date:** 3/31/95
Donald G. Horton
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ENCLOSURE

1.0 EXECUTIVE SUMMARY

As a result of Quality Assurance (QA) Audit YM-ARC-95-07, the audit team determined that Lawrence Livermore National Laboratory (LLNL) is satisfactorily implementing an effective QA program in accordance with the U. S. Department of Energy (DOE) Office of Civilian Radioactive Waste Management (OCRWM) Quality Assurance Requirements and Description (QARD), DOE/RW-0333P, Revision 1, and LLNL implementing procedures for QA Program Elements 1.0, 2.0, 4.0, 5.0, 6.0, 7.0, 12.0, 13.0, 16.0, 17.0, 18.0, and Supplements I, II, and III. There was no implementation of QA Program Element 15.0 due to lack of activity in that area.

The audit team did not identify any deficiencies during the audit that resulted in the issuance of Corrective Action Request(s) (CAR). Eight deficiencies were corrected prior to the postaudit meeting as described in Section 5.5 of this report. There were 15 recommendations resulting from the audit, as described in Section 6.0 of this report.

2.0 SCOPE

The audit was conducted to evaluate the adequacy of, compliance to, and the effectiveness of the LLNL QA Program as described in the QARD and the LLNL implementing procedures.

The QA program elements/requirements evaluated during the audit, in accordance with the approved audit plan, are as follows:

QUALITY ASSURANCE PROGRAM ELEMENTS/REQUIREMENTS

1.0 Organization
2.0 Quality Assurance Program
4.0 Procurement Document Control
5.0 Implementing Documents
6.0 Document Control
7.0 Control of Purchased Items and Services
12.0 Control of Measuring and Test Equipment
13.0 Handling, Storage, and Shipping
15.0 Nonconformances
16.0 Corrective Action
17.0 Quality Assurance Records
18.0 Audits
Supplement I, Software
Supplement II, Sample Control
Supplement III, Scientific Investigation

The following QA program elements/requirements were not reviewed during the audit because LLNL has no activity for which these elements apply:

3.0 Design Control
8.0 Identification and Control of Items
9.0 Control of Special Processes
10.0 Inspection
11.0 Test Control
14.0 Inspection, Test, and Operating Status
Supplement IV, Field Surveying
Appendix A, High Level Radioactive Waste Form Production
Appendix B, Transportation
Appendix C, Mined Geologic Disposal System

TECHNICAL AREAS

The technical scope of the audit included the following areas, in accordance with the approved audit plan:

Work Breakdown Structure (WBS) No.

- WBS No. 1.2.2.5.1, Metallic Barriers
- WBS No. 1.2.2.4.1, Spent Fuel Dissolution/Oxidation; Cladding
- WBS No. 1.2.3.10.3.2, Thermodynamic Data Determination
- WBS No. 1.2.2.4.2, Glass Testing
- WBS No. 1.2.3.12.4, Small Block Testing

3.0 AUDIT TEAM AND OBSERVERS

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

Name/Title/Organization	QA Program Elements/Requirements, Processes, Activities or End-products
Thomas E. Rodgers, Audit Team Leader (ATL) Yucca Mountain Quality Assurance Division (YMQAD)	1.0
James E. Clark, Auditor, YMQAD	4.0, 7.0, 18.0, Surveillance
Robert E. Harpster, Lead Technical Specialist, YMQAD	2.0 Partial
Kristi A. Hodges, Auditor, YMQAD	5.0, 6.0, 12.0

Stephen D. Harris, Auditor, YMQAD	Supplement I
John R. Matras, Auditor, YMQAD	13.0, Supplements II and III
George R. Vaslos, Auditor, Management and Operating Contractor	15.0, 16.0, 17.0
Emily Reiter, Auditor, Headquarters Quality Assurance Division	2.0
Van Ekambaram, Technical Specialist, Woodward Clyde	WBS Nos. 1.2.2.5.1, 1.2.2.4.1, 1.2.3.10.3.2, 1.2.2.4.2, and 1.2.3.12.4
John G. Spraul, Observer, U.S. Nuclear Regulatory Commission (NRC)	
Robert D. Brient, Observer, NRC	
Virginia Colton-Bradley, Observer, NRC	
English C. Pearcy, Observer, NRC	

4.0 AUDIT MEETINGS AND PERSONNEL CONTACTED

The preaudit meeting was held at the LLNL offices in Livermore, California on March 6, 1995. A daily debriefing and coordination meeting was held with LLNL 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 LLNL offices in Livermore, California on March 10, 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 concluded that, in general, the LLNL QA Program is adequate and is being satisfactorily implemented for the scope of this audit. Individually, QA Program Elements 1.0, 2.0, 4.0, 5.0, 6.0, 12.0, 13.0, 16.0, 17.0, 18.0, and Supplements I, II, and III are satisfactorily being implemented. No implementation of QA Program Element 15.0 could be identified due to lack of activity.

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

Five technical activities covered during the audit are identified as follows:

1. WBS 1.2.2.4.1 - Spent Fuel Dissolution/Oxidation; Cladding
2. WBS 1.2.2.4.2 - Glass Testing
3. WBS 1.2.2.5.1 - Metallic Barriers
4. WBS 1.2.3.10.3.2 - Thermodynamic Data Determination
5. WBS 1.2.3.12.4 - Small Block Testing

The evaluation included the technical adequacy of the above tasks, and the adequacy of the following:

1. Technical qualifications of the technical personnel
2. Understanding of procedural requirements as they pertain to the related work
3. Adequacy of technical procedures
4. Development of study plans, scientific investigations, work supporting documents and other related work products

WBS 1.2.2.4.1: Spent Fuel Dissolution/Oxidation; Cladding

The purpose of the spent fuel dissolution/oxidation and cladding waste form testing is to obtain data to be used in the technical bases and predictive models for determining the rate of release of radionuclides from the spent fuel waste in the event of failed disposal containers. Actual samples of spent fuel of UO2

are to be tested for dissolution/oxidation and cladding characteristics under conditions appropriate to the potential Yucca Mountain Project tuff repository.

Of the different technical elements of this task, flow-through dissolution testing of unirradiated UO2 is being performed at LLNL. Similar experiments on spent fuel and oxidized spent fuel are being done at Pacific Northwest Laboratory (PNL). The experiments at PNL have been interrupted by a building closure, but work will resume after the building is reopened and preparatory activities are completed. Technical meetings between PNL and LLNL staff typically occur two of three times per year.

At LLNL, the UO2 dissolution experiments are being done using a solution, simulated to have chemical characteristics bracketing the range of waste chemistries expected to be found in a repository (similar to the J-13 groundwater). Experimental solutions are prepared by adjusting the pH, carbonate concentration and oxygen activity by adding chemical constituents to the laboratory-prepared deionized water. In addition, the chemical concentrations are maintained by the addition of solutes or equilibration with gases of known composition. The simulated water is pumped using the low-flow pumps used in high-performance liquid chromatography, through vials that contain samples of UO2. Samples of the leachate are collected periodically and analyzed by kinetic phosphorimetry for uranium concentrations. The phosphorimeter is calibrated with standard solutions supplied by the National Institute of Standards and Testing. The samples of UO2 are tested for surface area prior to loading into the vials. All tests are performed at temperatures below 90 C. These tests are not meant to simulate repository conditions, but rather, to provide basic dissolution rate parameters and mechanistic information for the kinetic portion of the spent fuel radionuclide release model.

The laboratory and apparatus were examined during the audit. In addition, scientific notebooks and calibration records were checked. Interviews were conducted with the technical area leader, task leader and laboratory personnel. The governing Scientific Investigation Plan (SIP), activity plan and other supporting documentation were reviewed in preparation for the interviews. Objective evidence reviewed included the laboratory logbooks, scientific notebooks including procedures therein, and inspection of laboratory instrumentation.

This work is judged to be satisfactory and should enable the Yucca Mountain Project to meet its goals. During the audit, three recommendations were discussed with the personnel: (1) the solutions used in the experiments were not labeled, and we recommended that it be done. This action was corrected during the audit, and the laboratory revisited to verify that the solution containers were labeled appropriately; (2) in process scientific notebooks had entries which when corrected, were not legible, sometimes overwritten, and not

initialed. The task leader was made aware of the situation (see Recommendation 12); and (3) for uranium analysis, matrix-specific accuracy and precision are not evaluated by running matrix spikes and duplicates. We recommend that a duplicate and matrix spike analysis be performed at a frequency of at least one per day or one per batch whichever is higher (see Recommendation 15).

WBS 1.2.2.4.2: Glass Testing

The purpose of the glass waste form testing is to develop the predictive models and the technical bases for determining the radionuclide release rates from failed disposal containers holding glasses under conditions appropriate to the Yucca Mountain Project tuff repository. LLNL provides technical management of experiments at Argonne National Laboratory on glass testing. Savannah River Laboratory prepares simulated glass samples with compositions approximating the expected glass waste forms. The glasses contain actinides, but to reduce the level of radioactivity, the fission products are replaced with stable forms of the same elements.

There has been no work on model development, but an activity plan has been written for that work. Specific procedures for development of models have not been written. Suitable controls will be developed before quality-affecting work begins.

The test conditions employ the water contact modes that are thought to be most likely to occur at Yucca Mountain: water vapor and occasional drips. The water composition is likewise, that of the groundwater from Well J-13. Colloids and recrystallized particulates are expected to be released from the glass forms as well. The samples are not intended to be representative of the miniature waste packages, and they differ in that the actual waste package may contain fractured glass and partial metal barriers.

This work is judged to be satisfactory and should enable the Yucca Mountain Project to meet its goals. This evaluation was based on interviews with the technical area leader, review of the governing SIP, activity plan, and other supporting documentation.

The audit team considers that LLNL technical staff had implemented and are employing adequate controls for the technical areas evaluated during the audit.

WBS 1.2.2.5.1: Metallic Barriers

The purpose of the metallic barrier testing task is to determine the rate at which the metal barrier will be degraded by its interaction with the repository environment and to project these determinations over the time scale of interest. The results are to be used in demonstrating the barrier's efficiency in containing the waste forms and potential releases of radionuclides in the event of its failure. Different candidate metal alloys are being considered for barrier materials - carbon steel to nickel and titanium-based materials. The intent of the tests are to evaluate the corrosion damage, corrosion products, destruction patterns, etc. under a variety of conditions, including exposure to potential waters of varying chemistry. Temperature, pH and chemical composition of the solutions are the primary variables in the tests. Well J-13 simulated water is used in the tests as a surrogate for water that is likely to be encountered in the repository environment. LLNL provides technical management of experiments at University of Nevada - Las Vegas and University of Nevada - Reno, who perform tests on microbiological effects. The rock-metal interactions are not part of the scope of this technical task.

To date, mostly scoping work has been done and quality-affecting work is yet to begin. Dummy containers are used in equipment designed to study the corrosion effects and the corrosion products. A thermogravimetric instrument is currently being set up to run long term tests. Initially, there appeared to be a thermal effect on the measurements, but a constant temperature chamber has been installed to rectify the ambient temperature variations. Electron microscopes will be used to study the structural details of failure and corrosion products.

The laboratory and apparatus were examined during the audit. In addition, scientific notebooks and calibration records were checked. Interviews were conducted with the technical area leader, task leader and laboratory personnel. The governing SIP, activity plan and other supporting documentation were reviewed in preparation for the interviews. Objective evidence reviewed included the laboratory logbooks, scientific notebooks including procedures included therein, and inspection of laboratory instrumentation.

This work is judged to be satisfactory and should enable the Yucca Mountain Project to meet its goals.

WBS NO 1.2.3.10.3.2: Thermodynamic Data Determination

The purpose of this task is to develop thermodynamic constants, as a function of temperature for the formation of solid phases and solution species of the actinides that occur under a variety of possible contact water conditions. Oxides, hydroxides, and carbonates tend to dominate the actinide solid phases

and hydrolysis and carbonate complexes dominate the solution species. Therefore, in this task, complexation constants and solubility product constants for oxide and carbonate solid phases as a function of temperature will be carried as the initial task.

To date a review of available literature values has been performed and a panel of experts have arrived at consensus values. The selected values have been input into the data base used to run the geochemical model EQ3/6. The planned temperature range for the experiments is 25 to 75 C. No specific tests are being planned for colloid formation during the experiments.

Los Alamos National Laboratory also performs similar tests for certain actinides. There exist technical work groups to share and exchange the results and to review the uncertainties with the data. The uncertainties associated with the results are not carried into the data base for further analysis.

Interviews were conducted with the technical area leader, task leader, and laboratory personnel. The governing SIP, activity plan, and other supporting documentation were reviewed for adequacy.

This work is judged to be satisfactory and should enable the Yucca Mountain Project to meet its goals.

WBS 1.2.3.12.4: Small Block Testing

The purpose of this task is to gather preliminary data to evaluate the critical concepts relating to the thermal, mechanical, hydrological and chemical processes associated with welded rhyolitic tuff from the same formation as that in the potential repository horizon. Small blocks of tuff are being tested at this time and the data will be incorporated into a model to predict the behavior of rocks during the repository lifetime.

To date, the scoping work, in terms of instrument set up, shakedown and calibration, have been done. The laboratory is beginning to initiate the quality-affecting work. X-ray tomography will be used for imaging the fractures.

The laboratory and apparatus were examined during the audit. In addition, scientific notebooks and calibration records were checked. Interviews were conducted with the technical area leader, task leader and laboratory personnel. The governing SIP, activity plan and other supporting documentation were reviewed in preparation for the interviews. Objective evidence reviewed included the laboratory logbooks, scientific notebooks including procedures included therein, and inspection of laboratory instrumentation.

This work is judged to be satisfactory and should enable the Yucca Mountain Project to meet its goals.

In summary, the audit team considers that LLNL technical staff had implemented and were applying adequate controls for all the technical areas evaluated during the audit.

5.5 Summary of Deficiencies

The audit team identified 8 deficiencies during the audit that were corrected prior to the postaudit meeting. No CARs were issued. Two previously issued CARs were reviewed to verify effectiveness of identified corrective actions. Additionally, there were 15 recommendations resulting from the audit, which are detailed in Section 6.0 of this report.

Synopses of deficiencies corrected during the audit, and follow-up of previously identified CARs are detailed below.

5.5.1 CARs

None were issued as a result of this audit

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. Contrary to the requirements of Paragraph 16.0.5.6.1 of Quality Procedure (QP) 16.0, Revision 5, "Corrective Action," the "QA Action Items List" was not being distributed to the Yucca Mountain Project Leader. The distribution list has been updated and the latest "QA Action Item List" was verified to be properly distributed prior to the postaudit meeting.

2. Contrary to the requirement of Paragraph 17.0.5.2 of QP 17.0, Revision 6, "Quality Assurance Records," the access list for the Local Records Center did not address privileged records and did not include training records in Room 104. The access list was updated prior to the postaudit meeting to address privileged records and include training records in Room 104.

3. Contrary to Paragraphs 3.2.2.4A and 3.2.2.1A of QP 3.2, Revision 3, "Software Quality Assurance," which requires that an Individual Software Plan (ISP) be prepared prior to development,

modification, or qualification, the ISP for work done prior to Verification and Validation (V&V) for "V-Tough" did not meet QP 3.2 requirements. This code was modified subsequent to acquisition of the "Tough" code from Lawrence Berkeley Laboratory. The ISP for work done prior to V&V did not contain the life cycle plan for subsequent work. The ISP was revised and verified to include the Life Cycle Plan prior to the postaudit meeting.

4. Contrary to the requirements of Paragraph 3.2.2.8A of QP 3.2, Revision 3, "Software Quality Assurance" traceability in the configuration management system between "CNGBOCHS" documents and the software development log was not established. Prior to the postaudit meeting the traceability between the two documents was established and verified.

5. The Readiness Review checklist, required by Paragraph 2.6.5 of QP 2.6, Revision 2, dated March 2, 1995 showed Item 16E, Supplier Qualification to be Not Applicable. However, Item 25 requires Supplier Qualification of Radioanalytical Science Group. Prior to the postaudit meeting the checklist was revised and verified to reflect that Supplier Qualification will be applicable and be performed.

6. Contrary to the requirements of QARD, Section 2.2.11 (4), Paragraph 2.9.9 of QP 2.9, Revision 5, "Indoctrination and Training" allows untrained personnel to perform quality affecting work when closely supervised. QP 2.9, Paragraph 3.9 was revised per Interim Change Notice (ICN) #2.9-5-3 to require only trained personnel perform quality-affecting work. The ICN was issued prior to the postaudit meeting.

7. Contrary to Paragraph 3.4.5.2.1 of QP 3.4, Revision 3, "Scientific Notebooks" which requires that the Technical Leader (TL) sign and date the initial scientific notebook entry, Notebook 206 was not signed by the TL. The TL signed and dated Notebook 206 prior to the postaudit meeting.

8. Contrary to the requirements of Section 7.2.12.D4 of the QARD and Paragraph 7.0.5.5.2 of QP 7.0, Revision 1, there was no objective evidence that the LLNL-Yucca Mountain Project staff reviewed and accepted Commercial Grade procured Items. This condition was corrected and verified prior to the postaudit meeting with LLNL-Yucca Mountain Project Staff reviewing and signing for the acceptance of commercial grade items.

5.5.2 Follow-up of Previously Identified CARs

CAR-94-102

This CAR identified incomplete documentation for Management Assessment 93-01. The latest Management Assessment was reviewed during the audit and all documentation was found to be complete. The corrective action taken by LLNL in response to CAR YM-94-102 is considered to be effective.

CAR-94-084

This CAR identified data sets that were statused as qualified on the Technical Data Information Form (TDIF) when they were not qualified. During the audit it was verified that the incorrectly statused TDIFs were corrected. The corrective action taken by LLNL in response to CAR YM-94-084 is considered to be effective and the CAR was closed.

6.0 RECOMMENDATIONS

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

1. LLNL directly implements Yucca Mountain Administrative Procedure (YAP)-SIII.2Q, Revision 0 and YAP-SIII.3Q, Revision 0. These (YAP) procedures do not provide a sufficient level of detail such as how to assign data tracking numbers, to support direct implementation. A draft procedure is available but is on hold awaiting transition to the Civilian Radioactive Waste Management System Management and Operating Contractor (CRWMS M&O). It is recommended that this procedure be approved and issued for use.

2. QARD Supplement I fails to address the threshold when software is to be placed under the requirements of Supplement I and what requirements are to apply to software developed outside the project funds. The requirements for acquiring software are not as rigorous as those applied to software being developed. This condition permits a loophole in the requirements that may not provide comparable results. Since this condition is applicable to all Affected Organizations, Yucca Mountain Site Characterization Office (YMSCO) needs to define specific requirements to the Project for acquired software.

3. Prior to August, 1994, LLNL had 13 data sets entered into the Data Management System. Data was not being entered in a timely manner. Since that time, 42 data sets have been entered which included old data. It is recommended that data sets continue to be entered into the Data Management System in a timely manner, even though there are no time requirements specified.

4. Procurements designated as "non-quality affecting" by the technical representative can, at present, be processed without the QA Manager's review. It is recommended that controls be implemented to have the QA Manager review any procurements designated as "non-quality" when they are associated with "quality-affecting" WBS numbers or long-lead times.

5. "GEMBOCHS" as referenced in the software category selection form lacks a declaration of whether or not it is "BLUE" Scientific Engineering Software. LLNL should check the remaining software category selection forms to ensure correctness.

6. QA procedure QP- 2.5, Revision 1, "Acceptance of Data Not Generated Under the Control of the QARD" should be deleted by LLNL since it contains conflicting requirements with YAP-SIII.1Q. LLNL was uncertain whether or not they were required to meet the administrative requirements contained in the YAP that went beyond the QARD requirements. LLNL was not involved in the review of the YAP.

7. It is recommended that closer attention to detail relative to correctness, neatness, crossouts, and legibility be made when completing the Readiness Review checklist as a QA record.

8. CAR-LLNL-039 should be expanded to include planning documents as well as the identification of organizations/individuals responsible for the generation/submittal of records to provide further clarification.

9. LLNL should evaluate if the calibration services provided by the Heusser Instrument Company will be needed in addition to the "user calibrations" that are now being performed. If Heusser calibration services will be required, Heusser should be evaluated for inclusion on the Qualified Suppliers List.

10. It is recommended that guidance/clarification regarding the criteria for determining when it is acceptable/preferred to perform calibrations using manufacturer's instructions contained in Scientific Notebooks versus the use of calibration instructions and requirements contained within a TIP be included in QP 5.0, "Technical Implementing Procedures."

11. Clarification should be provided for QP 3.2, "Software Quality Assurance," Sections 3.2.2.1.D and 3.2.2.6, that appear to conflict regarding information to be included within the ISP.

12. It is recommended that data logs/scientific notebooks have procedure requirements implemented to define how corrections are made to data entries. In-process data logs and scientific notebooks in the UO2 dissolution laboratory contained entries that were overwritten, illegible, and not initialed and dated. Corrections are required to be single line cross outs with initial and date.

13. During the review of Scientific Notebook 199 it was noted that when one of the computers was upgraded with the Intel Pentium chip, tests were run to compare calculations run before and after installation of the pentium chip to ensure consistent results. It is recommended that this good practice be standardized and included within a Technical Implementing Procedure.

14. QA technical activities are being conducted using "unqualified" data. Emphasis must be placed on the qualification of existing data so that it can be used in the future to support work related to site suitability and licensing application. This recommendation is considered of utmost importance in support of the overall YMSCO mission.

15. It is recommended that duplicate and matrix spike sample analysis be performed at specific frequencies when performing uranium analysis. This would provide additional assurance that matrix-specific accuracy and precision can be assessed.

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
Alegre, B.	LLNL-YMP/Records Coordinator		X	X
Benedict, K.	LLNL-YMP/Associate Administrator		X	X
Blink, J.	LLNL-YMP/Deputy Project Leader	X	X	X
Bourcier, W.	LLNL-YMP/TL/Glass Testing	X	X	X
Brumburgh, C.	LLNL/QA Administrative Specialist	X	X	X
Bryan, B.	LLNL-YMP/Project Administrator	X	X	X
Chukwueke, T.	LLNL-YMP/Task QA Manager	X	X	X
Clarke, W.	LLNL-YMP/Technical Project Officer	X	X	
Comstock, P.	LLNL-YMP/Resource Manager	X	X	X
Daveler, S.	LLNL-YMP/Scientist/Engineer		X	
Hamati, R.	LLNL-YMP/QA Engineer/Specialist	X	X	X
Johnson, J.	LLNL-YMP/TL/Chemical & Mineralogical Studies		X	
Lamont, A.	LLNL-YMP/PI Systems Analysis		X	
Lewis, L.	LLNL-YMP/Computer Scientist	X	X	
Lin, W.	LLNL-YMP/PI/Near Field Environmental characterization	X	X	X
Lundeen, S.	LLNL-YMP/Programming Associate		X	
MacIntyre, A.	LLNL-YMP/TL/Scenarios		X	
McCright, D.	LLNL-YMP/Materials Characterization	X	X	X
Monks, R.	LLNL-YMP/QA Manager	X	X	X
O'Connell, W.	LLNL-YMP/TL/Waste Package Performance Assessment	X	X	
Palmer, C.	LLNL-YMP/TL/Waste Form Characterization	X	X	
Podobnik, J.	LLNL-YMP/Project Control Manager	X	X	X
Revell, M.	LLNL-YMP/Technical Staff	X		X
Ruddle, D.	LLNL-YMP/Technician		X	
Roberts, J.	LLNL-YMP/Physicist		X	
Sippel, J.	LLNL-YMP/Training Coordinator	X	X	X
Steward, S.	LLNL-YMP/TL/Spent Fuel Dissolution	X	X	X

ATTACHMENT 2
Summary Table of Audit Results

AUDIT YM-ARC-95-07 DETAIL SUMMARY								
QA ELEMENT/ ACTIVITIES	PROCESS STEPS	DETAILS (Checklist)	CAR	CDA	RECOM-MENDATION	*ADE-QUACY*	*COM-PLIANCE*	*OVER-ALL*
1	QP 1.0, Revision 4	YMP-95-07-01, pgs. 2 & 3	N	N	N	*SAT*	*SAT*	*SAT*
2	QP 2.0, Revision 2	pg. 4	N	N	N	*SAT*	*SAT*	*SAT*
	QP 2.1, Revision 6	pgs. 5-8	N	N	8	*SAT*	*SAT*	
	QP 2.2, Revision 1	pgs. 9 & 10	N	N	N	*SAT*	*NI*	
	QP 2.3, Revision 1	pgs. 11-13	N	N	N	*SAT*	*SAT*	
	QP 2.4, Revision 1	pgs. 14&15	N	N	N	*NV*	*NI*	
	QP 2.5, Revision 1	pg. 16	N	N	6	*NV*	*NI*	
	QP 2.6, Revision 2	pgs. 17-19	N	5	7	*SAT*	*SAT*	
	QP 2.7, Revision 1	pg. 20	N	N	N	*SAT*	*NI*	
	QP 2.9, Revision 5	pgs. 21-25	N	6	N	*SAT*	*SAT*	
	QP 2.10, Revision 5	pgs. 26-29	N	N	N	*SAT*	*SAT*	

ATTACHMENT 1

Personnel Contacted During the Audit
(Continuation)

Name	Organization/Title	Preaudit Meeting	Contacted During Audit	Postaudit Meeting
Stewart, M.	LLNL-YMP/Document Control Coordinator	X	X	X
Stout, R.	LLNL-YMP/TAL/Waste Form Characterization	X	X	X
Thompson, J.	LLNL-YMP/Resource Management	X		X
Weed, H.	LLNL-YMP/Chemist	X	X	
Wilder, D.	LLNL-YMP/TAL/Near Field Environment Characterization	X	X	X
Wilgus, C.	LLNL-YMP/Computations Group Leader	X	X	X
Wolery, T.	LLNL-YMP/PI/Computations Group	X	X	X

LEGEND:

PI . . . Principal Investigator
TAL . . Technical Area Leader
YMP . Yucca Mountain Project (LLNL term)

ATTACHMENT 2
Summary Table of Audit Results

QA ELEMENT/ ACTIVITIES	PROCESS STEPS	DETAILS (Checklist)	CAR	CDA	RECOM-MENDATION	*ADE-QUACY*	*COM-PLIANCE*	*OVER-ALL*
4	QP 4.0, Revision 4	pgs. 30-32	N	N	4	*SAT*	*SAT*	*SAT*
	QP 4.1, Revision 3	pgs. 33&34	N	N	N	*SAT*	*SAT*	
5	QP 5.0, Revision 4	pgs. 35-37	N	N	N	*SAT*	*SAT*	*SAT*
6	QP 6.0, Revision 4	pgs. 38-41	N	N	N	*SAT*	*SAT*	*SAT*
7	QP 7.0, Revision 1	pgs. 42-44	N	8	N	*SAT*	*SAT*	*SAT*
12	QP 12.0, Revision 6	pgs. 45-49	N	N	9&10	*SAT*	*SAT*	*SAT*
13	QP 13.0, Revision 1	pgs. 50-52	N	N	N	*SAT*	*SAT*	*SAT*
15	QP 15.0, Revision 3	pg. 53	N	N	N	*SAT*	*NI*	*NI*
16	QP 16.0, Revision 5	pgs. 54-58	N	1	N	*SAT*	*SAT*	*SAT*
	QP 16.1, Revision 2	pgs. 59 & 60	N	N	N	*SAT*	*SAT*	
	QP 16.2, Revision 4	pgs. 61 & 62	N	N	N	*SAT*	*SAT*	
17	QP 17.0, Revision 6	pgs. 63-67	N	2	N	*SAT*	*SAT*	*SAT*
18	QP 18.0, Revision 5	pgs. 68-70	N	N	N	*SAT*	*SAT*	*SAT*
	QP 18.1, Revision 5	pgs. 71 & 72	N	N	N	*SAT*	*SAT*	

ATTACHMENT 2
Summary Table of Audit Results

QA ELEMENT/ ACTIVITIES	PROCESS STEPS	DETAILS (Checklist)	CAR	CDA	RECOM-MENDATION	*ADE-QUACY*	*COM-PLIANCE*	*OVER-ALL*
	QP 18.2, Revision 3	pgs. 73-76	N	N	N	*SAT*	*SAT*	
SI	QP 3.2, Revision 3	pgs. 77-101	N	3 & 4	2, 5,& 11	*SAT*	*SAT*	*SAT*
SII/8	QP 8.0, Revision 2	pgs. 102-107	N	N	N	*SAT*	*SAT*	*SAT*
	TIP-YM-03, Revision 3	pgs. 108-110	N	N	N	*SAT*	*SAT*	
SIII	QP 3.0, Revision 4	pgs. 111-116	N	N	N	*SAT*	*SAT*	*SAT*
	QP 3.3, Revision 3	pgs. 117-118	N	N	N	*SAT*	*SAT*	
	QP 3.4, Revision 3	pgs. 119-121	N	7	13	*SAT*	*SAT*	
	QP 3.5, Revision 1	pg. 122	N	N	N	*N/A*	*NI*	
	YAP-SIII.2Q, Revision 0	pg. 123	N	N	1	*N/A*	*SAT*	
	YAP-SIII.3Q, Revision 0	pg. 124	N	N	1, 3, & 14	*N/A*	*SAT*	
TECHNICAL	QAP 2.8, Revision 3	YM-ARC-95-07-02 pgs. 1-4	N	N	N	*SAT*	*SAT*	*SAT*

ATTACHMENT 2
Summary Table of Audit Results

QA ELEMENT/ ACTIVITIES	PROCESS STEPS	DETAILS (Checklist)	CAR	CDA	RECOM-MENDATION	*ADE-QUACY*	*COM-PLIANCE*	*OVER-ALL*
TECHNICAL	GENERAL	pgs. 5-7	N	N	N	*SAT*	*N/A*	*SAT*
WBS 1.2.2.4.2	Glass Testing	pgs. 8-15	N	N	N	*SAT*	*N/A*	*SAT*
WBS 1.2.2.4.1	Spent Fuel Dissolution/Oxidation; Cladding	pgs. 16-24	N	N	12&15	*SAT*	*N/A*	*SAT*
WBS 1.2.3.10.3.2	Thermodynamic Data Determination	pgs. 25-27	N	N	N	*SAT*	*N/A*	*SAT*
WBS 1.2.3.12.4	Small Block Testing	pgs. 28 & 29	N	N	N	*SAT*	*N/A*	*SAT*
WBS 1.2.2.5.1	Metallic Barriers	pgs. 30 & 31	N	N	N	*SAT*	*N/A*	*SAT*
TOTAL		177	0	8	15			

Legend:

CARs . . . . . Corrective Action Requests
CDA . . . . . Corrected During the Audit
NI . . . . . No Implementation
NV . . . . . Not Verified
SAT . . . . . Satisfactory
N/A . . . . . Not Applicable

ADEQUACY . . . Requirements in Procedure meet QARD
COMPLIANCE . Procedures Implemented
OVERALL . . . . Summary of Element
N . . . . . None

ATTACHMENT 2
Summary Table of Audit Results

QA ELEMENT/ ACTIVITIES	PROCESS STEPS	DETAILS (Checklist)	CAR	CDA	RECOM-MENDATION	*ADE-QUACY*	*COM-PLIANCE*	*OVER-ALL*
TECHNICAL	GENERAL	pgs. 5-7	N	N	N	*SAT*	*N/A*	*SAT*
WBS 1.2.2.4.2	Glass Testing	pgs. 8-15	N	N	N	*SAT*	*N/A*	*SAT*
WBS 1.2.2.4.1	Spent Fuel Dissolution/Oxidation; Cladding ①	pgs. 16-24	N	N	12&15	*SAT*	*N/A*	*SAT*
WBS 1.2.3.10.3.2	Thermodynamic Data Determination	pgs. 25-27	N	N	N	*SAT*	*N/A*	*SAT*
WBS 1.2.3.12.4	Small Block Testing	pgs. 28 & 29	N	N	N	*SAT*	*N/A*	*SAT*
WBS 1.2.2.5.1	Metallic Barriers	pgs. 30 & 31	N	N	N	*SAT*	*N/A*	*SAT*
TOTAL		177	0	8	15			

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CARs . . . . . Corrective Action Requests
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COMPLIANCE . Procedures Implemented
OVERALL . . . . Summary of Element
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① See page 5