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UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D. C. 20555

MAY 3 1990

LLNL90/KCC/90/5/22

MEMORANDUM FOR: Joseph O. Bunting, Chief  
Engineering Branch  
Division of High-Level Waste Management

FROM: Kien C. Chang  
Engineering Branch  
Division of High-Level Waste Management

SUBJECT: TRIP REPORT, K. CHANG'S ATTENDANCE OF QUALITY ASSURANCE  
AUDIT OF LAWRENCE LIVERMORE NATIONAL LABORATORY, MAY 14-18,  
1990

Enclosed are the Lawrence Livermore YUCCA Mountain Project Quality Assurance Audit Plan, Audit Schedule and a partial list of documentation examined during the audit. The purpose, scope and activities of the audit are stated in the audit plan. The DOE audit team was made up of members drawn from DOE/YMP and DOE contractors (SAIC and MACTEC). The NRC was represented by J. Conway (HLPD), K. Chang (HLEN) and R. Brient (CNWRA). The NRC representatives attended the audit as observers.

I attended the preaudit meeting, observed audit activities on Waste Package Performance Assessment, Metal Barrier, Waste Form, Criteria 17 and 18 and attended the Post-Audit Conference. The following are some observations I have on the audit including information of interest to DHLWM.

1. The laboratory has sustained a budget cut on YUCCA Mountain Project.
2. Many Activity Plans (APs) and Technical Implementing Procedures (TIPs) are in need of revision. The revisions include changes in Principal Investigators (loss of staff); changes in deliverable schedules and changes in Measurement & Test Equipment. These changes are expected to require unplanned for efforts (e.g. training and certification of new staff) when test activities are resumed.
3. The laboratory's YUCCA Mountain Project has made a lot of progress in its QA program especially in recording personnel qualification, training and work done.
4. A QAP (Quality Assurance Program) for software work has been approved by DOE Nevada. It is applicable for the development of PANDORA ( a DOE's waste package performance code).

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5. Some weakness is observed in the project's purchasing and the use of contractors which are not found in the lab.'s list of qualified contractors. When products are delivered by contractors not included in the list, in order for the product to be QA acceptable, validation work on the product quality or on contractor qualification must be performed. An example of this is the manufacture of metal coupon for stress corrosion cracking. The coupon was made by a contractor whose name was not found in the list of qualified contractors. To manufacture the coupon, the contractor had to redraft the coupon drawing from a sketch in a TIP. The sketch has dimensions not labelled in standard forms (e.g. not referencing from the same line and dimensioning from the center of a hole). Also, the material used was supplied by the lab. and procured by a separate procurement order. There was no indication in the record that acceptance inspection was performed.
6. Some weakness exists in calibration of equipments. The auditors identified cases where no standard procedures were used. Calibrations for some equipment were also not performed regularly. One calibration procedure called for the calculation of humidity rather than direct measurement. It was pointed out by an auditor that only direct measurement of humidity is acceptable to NIST. The use of a calibration standard must also be traceable to a NIST accepted hardware.
7. Materials tests on the six candidate container materials (austenitic alloys 304L, 316L; high nickel Alloy 825 and copper based alloys CDA 102 (oxygen free copper), CDA 613 (Cu-7Al) and CDA 715 (Cu-30Ni)) are expected to resume by the end of this year. The tests will be done on other potential candidate materials also. Weight factors for the selection of materials have been changed since 1983 when the series of testing were first started. Cost was given a maximum contribution of 25%. It may be 5 % now.
8. Some observation items from previous audits were not monitored. This could cause QA problems if corrections addressing the problem areas are not made. There seems to be inconsistencies between DOE's QA requirements and Livermore's requirements on the need to follow up observation items. It was the understanding of Livermore's QA (Kaiser Engineering) record staff that no recording of follow-up actions is required for observation items. The project was notified to have this inconsistency corrected.
9. A draft peer review report on the selection of candidate container materials was stored in a safe for classified materials and was therefore not available for the auditors. Upon request by the audit team leader, the report was retrieved for the auditors' examination. The project is expected to change the practice of storing unclassified and classified materials in the same safe.

10. In a purchase of a CDA 613 (Cu-7Al) material, CDA 614 was actually provided. In accepting the deliverable, the differences in composition and properties of the two materials were not highlighted.
11. In the exit interview, the audit team evaluated the progress of Livermore's QA program to be satisfactory, noting that not enough work has been done by the project to demonstrate implementation of QA program. A total of 5 SDRs and a few observation items will be documented in the final audit report.



Kien C. Chang  
Engineering Branch  
Division of High-Level Waste Management

Enclosures:  
As stated

cc: R. Browning  
J. Youngblood  
J. Linehan  
R. Ballard  
R. Weller  
C. Interrante  
M. Nataraja  
J. Conway

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Rec'd 4/23  
[Signature]

## YUCCA MOUNTAIN PROJECT QUALITY ASSURANCE AUDIT PLAN

AUDIT 90-02

MAY 14 - 18, 1990

### 1.0 PURPOSE AND SCOPE

The purpose of this audit is to evaluate the Lawrence Livermore National Laboratory (LLNL) implementation of its Yucca Mountain Project Quality Assurance (QA) program.

The scope of the audit will be to verify that the LLNL QA program meets the requirements of the LLNL QA Program Plan (QAPP) Rev. 0 dated December 13, 1988 and to verify the adequacy of implementation of the QA program. In addition, discrepancies identified during previous audits/surveillances that have not been closed will be added to the scope of the audit to determine whether LLNL has taken effective corrective actions.

### 2.0 ORGANIZATION TO BE AUDITED

Lawrence Livermore National Laboratory, Livermore, California.

### 3.0 AUDIT SCHEDULE

Badging of Audit Team	7:30 a.m. LLNL West Badge Office
Preaudit Team/Observer Meeting	9:00 a.m., 5/14/90, Livermore, CA
Preaudit Conference	10:30 a.m., 5/14/90, Livermore, CA
Audit Activities	12:30 p.m. - 4 p.m., 5/14/90 Livermore, CA
	8 a.m. - 4 p.m., 5/15/90 - 5/17/90 Livermore, CA
	8 a.m. - 11 a.m., 5/18/90 Livermore, CA
Postaudit Conference	2 p.m., 5/18/90, Livermore, CA

### 4.0 REQUIREMENTS TO BE AUDITED AND APPLICABLE REFERENCES

LLNL QAPP Rev. 0  
LLNL Quality Procedures  
Applicable LLNL Technical Implementing Procedures

The conduct of the audit will be guided by the documents listed below:

- o QMP-18-01, "Audit System for the Waste Management Project Office," Rev. 3

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- o QMP-16-03, "Standard Deficiency Reporting System," Rev. 1
  - o QA Audit Task Organization
  - o Audit Observer Inquiry
  - o Policy for Participation of State, Tribal, and NRC Representatives as Observers on DOE Audits, dtd. July 14, 1987
  - o HLW Division Procedure for Conducting Observation Audits of DOE HLWR Program QA Audits
  - o Headquarters Observation of Project Office QA Audits

## 5.0 ACTIVITIES TO BE AUDITED

The activities to be audited during the audit include:

### PROGRAMMATIC ELEMENTS

The following elements will be reviewed and evaluated:

<u>Criteria</u>	<u>Subject</u>
1	Organization
2	Quality Assurance Program
3	Scientific Investigation Control and Design Control
4	Procurement Document Control
5	Instructions, Procedures, Plans, and Drawings
6	Document Control
7	Control of Purchased Items and Services
8	Identification and Control of Items, Samples, and Data
12	Control of Measuring and Test Equipment
13	Handling, Storage, and Shipping
15	Control of Nonconforming Items
16	Corrective Action
17	Quality Assurance Records
18	Audits

The following criteria will not be evaluated or reviewed:

- 9 Control of Processes - Presently LLNL is not involved with process control or special processes for those activities being reviewed.
- 10 Inspection - LLNL presently does not have engineered items to inspect.
- 11 Test Control - LLNL presently does not have engineered items for testing.
- 14 Inspection, Test and Operating Status - LLNL presently does not have engineered items to inspect, test or monitor the operating status.

### TECHNICAL ACTIVITIES

Technical Specialists will review and evaluate the following technical

activities:

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<u>WBS NUMBER</u>	<u>TITLE</u>
1.2.2.3.2	Metal Barrier Selection and Testing
Sub-activity (E-20-15)	- Establishment of Selection Criteria
Sub-activity (E-20-18a)	- Use of Linear-Sweep Polarization to Determine Pitting Potentials
Sub-activity (E-20-18C)	- Parametric Studies of Metal Degradation and Microstructure: Measurement of Plane-Strain Fracture Toughness
Sub-activity (E-20-18d)	- Parametric Studies of Metal Degradation and Microstructure: Measurement of Threshold Stress Intensity for Stress Corrosion Cracking

1.2.2.3.1.1 Waste Form  
 Sub-activity (D-20-45) - Low-Temperature Oven Method for Spent Fuel Oxidation Testing

1.2.1.4.2 Waste Package Performance Assessment  
 Sub-activity (I-20-20a) - Develop Scenario Identifications

#### 6.0 AUDIT TEAM MEMBERS

Gerard Heaney, Audit Team Leader/Lead Auditor, Science Applications International Corporation (SAIC), Las Vegas, NV  
 Mario R. Diaz, Auditor, DOE/YMP  
 Robert Constable, Auditor-In-Training, DOE/YMP  
 Sydney L. Crawford, Auditor, SAIC, Las Vegas, NV  
 Amelia I. Arceo, Auditor, SAIC, Las Vegas, NV  
 Richard L. Weeks, Auditor-In-Training, SAIC, Las Vegas, NV  
~~Terry W. Noland, Auditor, SAIC, Las Vegas, NV~~  
 Thomas J. Higgins, Auditor, SAIC, Las Vegas, NV  
 Richard L. Maudlin, Auditor, MACTEC, Las Vegas, NV  
 Edward Cocoros, Auditor, MACTEC, Las Vegas, NV  
 U-Sun Park, Technical Specialist, SAIC, Las Vegas, NV  
 Paul L. Cloke, Technical Specialist, SAIC, Las Vegas, NV  
 David Stahl, Technical Specialist, SAIC, Las Vegas, NV  
 Diane Harrison-Giesler, Technical Specialist, YMP, Las Vegas, NV

#### 7.0 AUDIT CHECKLISTS, ANNEXES, AND ATTACHMENTS

Annex A - DOE Procedure on Protocol (July 1987)  
 Annex B - NRC Draft QA Procedure for Observing DOE/OGR HLWR Program Audits  
 Annex C - DOE/HQ/OGR Observation of YMP QA Audits (Draft)  
 Attachment 1 - YMP Quality Assurance Task Organization  
 Attachment 2 - YMP Audit Observer Inquiry

GREGORY P. FEHR, LEAD TECHNICAL SPECIALIST, SAIC, LV NV

## YUCCA MOUNTAIN PROJECT OFFICE AUDIT 90-02 TEAM ASSIGNMENTS

MAY 14-18, 1990

PROGRAMMATIC ELEMENTS

<u>Team Member</u>	<u>Assigned Criteria</u>
Sydney Crawford	3, 12, 13
Dick Maudlin	3, 8
Robert Constable	1, 2, 4, 7,
Mario Diaz	15, 16, 18
Thomas Higgins	15, 16, 18
Ed Cocoros	1, 2, 4, 7
Rick Weeks	5, 6, 17
Amy Arceo	5, 6, 17

TECHNICAL ACTIVITIES

<u>Team Member</u>	<u>Assigned Technical Activity</u>
Paul Cloke	Waste Package Performance Assessment
U-Sun Park	Waste Form, WASTE PACKAGE PERFORMANCE ASSESSMENT
Dave Stahl	Metal Barrier Selection and Testing
Diane Harrison-Giesler	Metal Barrier Selection and Testing

OBSERVERS (NRC)

JAMES T. CONWAY  
KIEN C. CHANG  
ROBERT BRIEN (CNWRA)

Prepared By:

Gerard Heaney, Audit Team Leader

Date: \_\_\_\_\_

Approved By:

James Blaylock, Branch Chief  
Quality Assurance Division  
Yucca Mountain Project Office

Date: \_\_\_\_\_

Approved By:

Donald G. Horton, Director  
Quality Assurance Division  
Yucca Mountain Project Office

Date: \_\_\_\_\_



~~FINAL~~  
TENTATIVE SCHEDULE FOR AUDIT 90-02

MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
9:00 A.M. PREAUDIT TEAM/OBSERVER MEETING <i>Bege 1478</i> FRANCISCAN ROOM 10:30 A.M. PREAUDIT CONFERENCE BUILDING 361	8-11:30 A.M. AUDIT  WP PERFORMANCE ASSESSMENT METAL BARRIER CRITERIA 1, 2, 3, 5, 6, 8, 13, 15, 16,	8-11:30 A.M. AUDIT  WASTE FORM METAL BARRIER CRITERIA 3, 4, 7, 12, 17, 18	8-11:30 A.M. AUDIT  METAL BARRIER CRITERIA 3, 5, 6, 17	8-11:30 A.M. AUDIT  WRAP-UP

LUNCH

12:30-4:00 P.M. AUDIT  WP PERFORMANCE ASSESSMENT METAL BARRIER CRITERIA 1, 2, 3, 5, 6, 8, 15, 16  4:00 P.M. TEAM MTG.	12:30-4:00 P.M. AUDIT  WP PERFORMANCE ASSESSMENT METAL BARRIER WASTE FORM CRITERIA 1, 2, 3, 5, 6, 8, 12, 13, 15, 16  4:00 P.M. TEAM MTG.	12:30-4:00 P.M. AUDIT  WASTE FORM METAL BARRIER CRITERIA 3, 4, 7, 17 18  4:00 P.M. TEAM MTG.	12:30-4:00 P.M. AUDIT  CRITERIA 3, 5, 6, 17  4:00 P.M. TEAM MTG.	2:00 P.M. POST-AUDIT CONFERENCE
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*(Double Tree Room)*

KIEV CHANG

YUCCA MOUNTAIN PROJECT OFFICE AUDIT 90-02 TEAM ASSIGNMENTS

MAY 14-18, 1990

PROGRAMMATIC ELEMENTS

<u>Team Member</u>	<u>Assigned Criteria</u>
Sydney Crawford	3, 12, 13
Dick Maudlin	3, 8
Jim George	3, 8
Robert Constable	1, 2, 4, 7,
Mario Diaz	15, 16, 18
Thomas Higgins	15, 16, 18
Ed Cocoros	1, 2, 4, 7
Rick Weeks	5, 6, 17
Amy Arceo	5, 6, 17

TECHNICAL ACTIVITIES

<u>Team Member</u>	<u>Assigned Technical Activity</u>
Paul Cloke	Waste Package Performance Assessment
U-Sun Park	Waste Form, Waste Package Performance Assessment
Dave Stahl	Metal Barrier Selection and Testing, Waste Form
Diane Harrison-Giesler	Metal Barrier Selection and Testing

OBSERVERS (NRC)

JAMES T. CONWAY  
KIEN C. CHANG  
ROBERT BRIEN (CNWRA)

Waste Form

1. "Plan for Spent Fuel Waste Form Testing for NNWSI" dated November 1987
2. Activity Plan titled "Low-Temperature Oven Method for Spent Fuel Oxidation Testing" Sub-activity D-20-45 Rev. 0

Applicable Implementing Procedures:

1. SFO-1-1 titled "Sample Preparation for Spent Fuel Oxidation Testing Using a Dry Bath Heating System" Rev. 0
2. SFO-1-2 titled "Measurement of Spent Fuel Oxidation Using a Dry Bath Heating System" Rev. 2
3. HTA-3-1 "Solids Analysis: Scanning Electron Microscopy" Rev. 4
4. HTA-3-2 "Solids Analysis: Transmission/Scanning Transmission Electron Microscopy" Rev. 4
5. HTA-3-3 "Solids Analysis; X-Ray Diffraction Analysis" Rev. 3

### Metal Barriers

1. SIP titled "Metal Barrier Selection and Testing" WBS 1.2.2.3.2 Rev. 0
2. Activity Plan titled "Establishment of Selection Criteria" Sub-activity E-20-15 Rev.0
3. Activity Plan titled "Parametric Studies: Use of Linear-Sweep Polarization to Determine Pitting Potentials" Sub-activity E-20-18a Rev. 0
4. Activity Plan titled "Parametric Studies of Metal Degradation and Microstructure: Measurement of Plane-Strain Fracture Toughness" Sub-activity E-20-18c Rev. 0
5. Activity Plan titled "Parametric Studies of Metal Degradation and Microstructure: Measurement of Threshold Stress Intensity for Stress Corrosion Cracking" Sub-activity E-20-18d Rev. 0

### Applicable implementing procedures:

- ✓ 1. TIP-CM-1 titled "Determination of Plane-Strain Fracture Toughness and the Threshold Stress Intensity for Stress Corrosion Cracking" Rev. 0
2. TIP-CM-2 titled "Operator Calibration of Scanning Transmission Electron Microscopes" Rev. 0 *Certified operator left the project*
- 3\* TIP-CM-3 titled "Operator Calibration of Scanning Electron Microscopes" Rev. 0 *unfunded no staff*
4. TIP-CM-4 titled "Operator Calibration of the Optical Metallograph" Rev. 0 *unfunded no staff*
- ✓ 5. TIP-CM-05 titled "Determination of Threshold Stress Intensity for Stress Corrosion Cracking Using Modified WOL Specimens" Rev. 0
6. TIP-CM-6 titled "Identification and Control of Metal Specimens" Rev. 0
7. TIP-CM-07 titled "Determination of Stress Corrosion Cracking Susceptibility Using the Constant Extension Rate Technique" Rev. 0

*No regular calibration performed for CM-2, CM-3 & CM-4*