Department of Energy
Washington, DC 20585

QA: L

SEP 12 1997

L. D. Foust, Technical Project Officer
for Yucca Mountain Site
Characterization Project
TRW Environmental Safety Systems, Inc.
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ISSUANCE OF SURVEILLANCE RECORD SNL-SR-97-045 RESULTING FROM THE OFFICE OF QUALITY ASSURANCE (OQA) SURVEILLANCE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT SYSTEM MANAGEMENT AND OPERATING CONTRACTOR (CRWMS M&O) AT SANDIA NATIONAL LABORATORIES (SNL)

Enclosed is the record of Surveillance SNL-SR-97-045, conducted by the OQA of CRWMS M&O SNL facilities at Albuquerque, New Mexico, July 22-23, 1997.

The purpose of the surveillance was to evaluate the process for rock strength determination and the procedure for submitting data to the Technical Database.

There were no Corrective Action Requests, Deficiency Reports or Performance Reports issued as a result of the surveillance. One condition adverse to quality was corrected during the surveillance relating to Technical Procedure (TP)-200, Revision 1. This TP was revised prior to the end of the surveillance.

This surveillance is considered completed and closed as of the date of this letter. A response to this surveillance record is not required.

If you have any questions, please contact either James Blaylock at (702) 794-1420 or Stephen D. Harris at (702) 794-5522.

R.W. Cel
for Donald G. Horton, Director
Office of Quality Assurance

OQA:JB-2226

Enclosure:
Surveillance Record SNL-SR-97-045

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OFFICE OF CIVILIAN
RADIOACTIVE WASTE MANAGEMENT
U.S. DEPARTMENT OF ENERGY
WASHINGTON, D.C.

Surveillance No. SNL-SR-97-045

QUALITY ASSURANCE SURVEILLANCE RECORD

SURVEILLANCE DATA

1. ORGANIZATION/LOCATION:	2. SUBJECT:	3. DATE:
Civilian Radioactive Waste Management System Management and Operating Contractor (CRWMS M&O) / Sandia National Laboratories (SNL)	Thermal Properties (Lab/Rock Properties Testing)	July 22-23, 1997

4. SURVEILLANCE OBJECTIVE:

Evaluate the process for rock strength determination and the procedure for submitting data to the Technical Database.

5. SURVEILLANCE SCOPE:

Work Breakdown Structure, WBS #1.2.3.2.7.1.1 - Laboratory Thermal Properties.
Work Agreement, WA-0329, Revision 00, Laboratory Thermal Testing for the Exploratory Studies Facility (ESF).
Quality Assurance (QA) procedures applicable to the funded work and data information submitted to the Technical Database.

6. SURVEILLANCE TEAM:
Team Leader:
Stephen D. Harris
Additional Team Members
Tom Scotese, Woodward-Clyde T.S., and James M. Graff, OQA/SNL

7. PREPARED BY:		8. CONCURRENCE:		
Stephen D. Harris	7/7/97	Donald G. Horton for		7/8/97
Surveillance Team Leader	Date	Director, OQA		Date

SURVEILLANCE RESULTS

9. BASIS OF EVALUATION/DESCRIPTION OF OBSERVATIONS:

A surveillance was conducted of the CRWMS M&O at SNL of the Thermal Properties Testing activities located in Building 823, Kirtland Air Force Base, and the University of New Mexico (UNM) X-ray Diffraction (XRD) Laboratory. Surveillance at both facilities was performed on July 22 and 23, 1997.

The objective of this surveillance was to evaluate the compliance, adequacy and effectiveness of the technical work and QA program implementation for the scope of work described in block 5. The time frame of the work evaluated was Fiscal Year (FY) to date of the surveillance.

See Pages 2-9...

10. SURVEILLANCE CONCLUSIONS:

In the opinion of the technical specialist, the technical aspects of the laboratory thermal testing program were acceptable and defensible. This finding is based on comparison of the observed testing and reporting procedures and methods with the planned work scope description and standard geomechanics testing practices.

See Page 9... Stephen D. Harris

11. COMPLETED BY:		12. APPROVED BY:	
Stephen D. Harris	8/8/97	R.W. Carl	9/12/97
Surveillance Team Leader	Date	Director, OQA for Donald G. Horton	Date

9. BASIS FOR EVALUATION/DESCRIPTION OF OBSERVATIONS: (Cont'd)

Technical Perspective

Background

The laboratory thermal testing program represents a relatively small input to resolution of thermomechanical repository design issues. The ultimate objective of thermomechanical testing and modeling is to achieve an understanding of the thermomechanical behavior of the rock mass, including thermally induced stress changes and effects of discontinuities.

The planned FY97 laboratory thermal testing program consists of three components:

- thermal conductivity testing (10 samples from Alcove 5, 10 samples from Alcove 7, 20 to 24 samples from Systematic Drilling (SD) boreholes)
- thermal expansion testing (20 samples from Alcove 5, 20 samples from Alcove 7, 20 samples from SD boreholes; 2 test cycles on each sample)
- X-ray diffraction testing

At the time of the surveillance, the progress of the planned testing was approximately 80% complete for thermal conductivity and approximately 90% complete for thermal expansion. X-ray diffraction for WBS 1.2.3.2.7.1.1 had not yet been started.

The technical aspects of the program were reviewed by reviewing file reports and by interviewing selected SNL personnel, including Nancy Brodsky and Glenn Barker of SNL, and Jim Connelly of UNM.

Technical Aspects Reviewed

The following technical aspects of the laboratory thermal testing program were reviewed and found to be acceptable and defensible:

- design and basis of tests
- comparison of test methods with American Society for Testing and Materials (ASTM) requirements
- treatment of various parameter impacts, including control and reporting of moisture content and borehole orientation effects on test results
- repeatability/consistency of results
- general documentation of results
- explanation of test results based on rock sample characteristics
- explanation of anomalous results and qualification of results with appropriate confidence limits
- equipment calibration practices

Comments on Test Methods

Thermal Conductivity

Test design and procedures for thermal conductivity included full conformance to ASTM requirements.

For WBS 1.2.3.2.7.1.1 in FY97, thermal conductivity testing was performed only on dry samples. The dry sample condition was confirmed by repeated oven drying and weighing prior to testing. The drying process typically consists of four oven drying cycles of 5 days per cycle. Past testing has used a plastic seal and O-ring to preserve water content. Weighing samples before and after testing revealed very little moisture loss. The effect of moisture content on thermal conductivity is that the conductivity values increase with moisture content for both welded and nonwelded tuffs.

Thermal Expansion

Test design and test procedures for thermal expansion use ASTM requirement as guidelines. SNL deviated from the ASTM requirements to improve the validity of the test methods because the ASTM is less applicable to testing rock in the waste environment compared to other industrial material. The technical specialist believed the deviations to be reasonable and without detrimental impacts on results. The SNL modification enhanced the reproducibility and accuracy of the test results. All deviations from the ASTM specifications will be documented in the report, similar to the explanation on pages 15 and 16 of the recent report for WBS 1.2.3.14.2 (SNL, 1997).

For WBS 1.2.3.2.7.1.1, thermal expansion testing was performed on both dry and wet samples. Fully saturated conditions were impractical to achieve in all test runs. Therefore, moisture conditions for samples which lost some moisture prior to completion of the test are reported as "wet" rather than saturated. For tests on wet samples, the environmental tube maintains 100% relative humidity. For tests on dry samples, the dry sample condition was confirmed by repeated oven drying and weighing prior to testing. The drying process typically consists of four oven drying cycles of 5 days per cycle. Results have shown that thermal expansion tests on welded tuff samples show little or no difference at various moisture contents. Moisture content effects on nonwelded zeolitized tuff samples are significant, as these rocks are susceptible to shrinkage with dehydration. Thus the moisture control for thermal expansion testing of the nonwelded tuff samples (Calico Hills, Prow Pass, and Bullfrog Units) from the surface based SD boreholes would be much more critical than that for the samples from the ESF, which were all welded tuff.

X-Ray Diffraction

Test design and procedures for X-ray diffraction are well established within the specialized field of mineralogic analysis, and have been conducted for the Yucca Mountain Project by UNM, Lawrence Livermore National Laboratories, and Los Alamos National Laboratories. For the SNL laboratory thermal testing program, these tests are performed on the outer piece of core adjacent

to the inner "subcore" samples used for thermal expansion and thermal conductivity. X-ray diffraction tests are used in interpretation of thermal expansion and thermal conductivity test results.

Quality Assurance Perspective

The WA-0329, Revision 00, "Laboratory Thermal Testing for the ESF," contained a list of quality implementing procedures and technical procedures that were authorized for use in performing the work. The following procedures were evaluated for implementation of the quality assurance program:

QAIP 1-4, Revision 0, "QA Disputes." This procedure was not implemented and is now removed from the SNL list of active procedures.

QAIP 1-5, Revision 12, "Establishing Work Agreements." The WA for this work was WA-0329, Revision 00, created under QAIP 1-5, Revision 11. A memorandum, dated May 1997, indicated a Revision 1 was in progress for "minor modifications" to this WA. This revision should have been made under QAIP 1-5, Revision 11 but had not been prepared at the time of the surveillance. Revision 12 of this procedure directs creation of a planning document instead of an implementing document as described in QAIP 1-5, Revision 11. The memorandum explained what was going to be changed in the WA as an implementing document under Revision 11; however, the change was not clear under Revision 12 of this procedure. This led to confusion as to the nature of the modification: An implementing document change or a planning document change. In further discussion with SNL, it was determined to issue Revision 1 to WA-0329 in accordance with QAIP 1-5, Revision 11, which was current at the time of the intended change. This has been completed prior to issuance of this report. Recommendation #1 is presented at the end of this report relative to future WA changes.

QAIP 2-5, Revision 4, "Training" and QAIP 2-6, Revision 4, "Qualification and Certification of Personnel." All records of personnel assigned responsibilities for performing quality affecting work under SNL WA-0329, "Laboratory Thermal Testing for the ESF," were examined with regard to required qualification and training. Although verification was possible for these records, it was noted that the system being used by SNL to document and track qualification and training was somewhat cumbersome to use and did not provide effective linkages between assignment and documented completion of required training. Recommendation #2 is included at the end of this report for evaluation of this system.

Certification of Personnel Qualification, Training Assignment forms, Training Confirmation forms and SNL NWMP Training Snapshots were examined for the following personnel:

Glenn Barker
Nancy Brodsky
Jim Connelly
Robert Hardy

QAIP 4-1, Revision 8, "Procurement." There has been only one SNL procurement in support of this WBS activity in FY-97: Purchase requisition AW-2149, 05/15/97, "Characterize YMP Rocks." This requisition was subsequently canceled and an existing SNL contract with the University of New Mexico was modified to encompass the requirements of AW-2149. It was verified, however, that the subject purchase requisition and subsequently modified contract contained appropriate quality and technical requirements and had been prepared and processed in accordance with the requirements of SNL QAIP 4-1, Revision 7, current at the time of implementation. This process was noted as being adequate and effective.

QAIP 6-1, Revision 3, "Document Control System." The process of distribution of controlled copies at the work location was determined to be satisfactory. Nancy Brodsky, Senior Member Technical Staff, had access on her office computer to an intranet site within SNL that contains the text for each current SNL procedure needed for her work. The capability included both the ability to read from the screen or print a hard copy if necessary.

QAIP 6-3, Revision 5, "Conducting and Documenting Reviews of Documents." No report had been prepared at the time of surveillance for the work performed to this WBS number for FY 1997. This procedure implementation was evaluated based on an in-process document review of Technical Procedure, TP-200, Revision 02, and found to be satisfactory.

QAIP 12-1, Revision 5, "Measuring and Test Equipment Control.". The laboratory for Thermal Testing has many pieces of measuring and test equipment that need to be calibrated either by the Primary Standards Laboratory (PSL) [a supplier on the Qualified Supplier List, approved 2-22-96] on site at SNL or the technician within the Thermal lab. The following items calibrated by PSL were found to be in compliance to QAIP 12-1: Balances with reference files SNL 2338 and 23546 and thermocouples associated with dilatometers - DT710 and TDA-HI and the thermal conductivity instrument -TCA200 LT. The thermal laboratory technician, Glenn Barker, calibrated the following: The total system for each dilatometer, Lawson A-D boards #140-004 and LL-140-001 and thermocouple boards #140-004 and 20B for each system; one Thermal Conductivity Instrument - TCA200LT system calibration, Lawson 140 A-D board and Thermocouple boards LL-20B-03, LL-20B-005, LL-140-005. Each calibration was indicated by appropriate sticker identification and documentation to comply with QAIP 12-1. Also, the University of New Mexico, X-ray diffraction laboratory, was evaluated for work performed using SNL procedures. The Siemens Diffraktometer D5000 X-Ray Diffraction instrument is calibrated with Corundum (alpha AL_2O_3 Standard Reference Material) which has documentation of its traceability to the National Institute of Standards and Technology (NIST). This standard is compared to Corundum obtained from Union Carbide as a standard material because they have a large quantity of this material and it compares satisfactorily for use as a standard for this purpose. The process for calibration is documented in a scientific notebook for previous work performed. No data had been collected for this fiscal year for X-ray analysis. Recommendation #3 is presented at the end of this report relative to implementation of QAIP 12-1.

QAIP 17-1, Revision 3, "Protecting, Preparing, and Submitting CRWM QA Records." There were no records prepared for submittal of work performed this fiscal year, only records in process.

QAIP 17-2, Revision 3, "Processing of Technical Data on the Yucca Mountain Site Characterization Project." Data was not complete and no implementation was performed.

QAIP 20-1, Revision 5, "Technical Procedures." In evaluating implementation of this procedure, four SNL Technical Procedures (TP) were considered: TP-200, Revision 1, "Inspection of Samples Used in Thermal Properties Measurements;" TP-51, Revision 2, "Preparing Cylindrical Samples, Including Inspection of Dimensional and Shape Tolerances;" TP-202, Revision 1, "Measurement of Thermal Conductivity of Geologic Specimens Using the Guarded Heat-flow Meter Method;" and TP-203, revision 2, "Measurement of Thermal Expansion of Geologic Materials Using a Push Rod Dilatometer." Two recommendations are presented at the end of this report: #4 for implementation of QAIP 20-1 and #5 for content of the TPs evaluated. One deficient condition was observed and was corrected during the surveillance. This issue is described at the end of this report.

QAIP 20-3, Revision 2, "Sample Control." The only implementation evaluated was preparation and use of chain of custody forms. These are retained in a three ring binder in the thermal laboratory.

AP-16.1Q, Revision 2, "Performance/Deficiency Reporting." No implementation of this procedure was observed.

AP-16.2Q, Revision 2, Corrective Action and Stop Work." No implementation of this procedure was observed.

YAP-SIII.3Q, Revision 1, "Processing of Technical Data on the Yucca Mountain Site Characterization Project." SNL activity in this area has been limited to date. There have only been two deliverables associated with the Thermal Testing Work Agreement processed thus far: One for the current WBS number performed last fiscal year and another for a different WBS number. Since no submittals had been prepared this year, the process used in these two cases was evaluated for adequacy. It was determined through interviews with project personnel and examination of deliverable documentation, Automated Technical Data Tracking (ATDT) forms and Technical Data Information Forms (TDIF), that SNL is implementing the YAP-SIII.3Q process in an adequate and effective manner. The two document packages examined were:

W.B.S. 1.2.3.2.7.1.1
DTN# SNL04050593001.002
TDIF# 305183
"Petrographic and Mineralogical Characterization of Samples From USW NRG-6"

W.B.S. 1.2.3.14.2
DTN# SNL22100196001.001
TDIF#.306127
"Thermal Expansion and Thermal Conductivity of Test Specimens"

Supplement I, "Software" and Supplement V, "Control of the Electronic Management of Data, of the QARD." There was discussion with the technician of the Thermal laboratory, Glenn Barker, and the Research Scientist at the XRD laboratory, Jim Connelly, about use of software in the instruments.

The Thermal laboratory uses a Dilatometer to measure thermal expansion of rock and a Guarded Heat-flow instrument to measure thermal conductivity. These instruments use software obtained from the supplier to display data read from the various parts of the instrument on a computer screen and copy the data to hard disk. The software has not been changed by the users, except for modification of output for hard copy (a different printer was obtained and output is comparable to the original printer output). No calculation is performed on the data except for Analog to Digital conversion. The software is calibrated with the instrument as a system calibration. To the degree evaluated, the process of control for software included with these instruments appeared to be satisfactory; however, due to time constraints this area was not thoroughly evaluated. The status of this software and data analysis needs to be further evaluated for compliance to QARD requirements and inclusion in SNL procedures to assure satisfactory implementation.

In addition, the Diffraktometer D5000, used at the XRD laboratory, uses software to obtain data from the instrument. Software called WINFIT is also used to analyze this data. A spreadsheet is used to further reduce the data. Since no data had been obtained this fiscal year, there was no specific software use to evaluate. Jim Connelly said the algorithms used are documented in open literature and can be easily verified. This software and analytical process needs to be further evaluated for compliance and implementation of QARD requirements.

There was also discussion of implementation of QARD, Supplement V, requirements. The only requirement that would apply is for access control to the data. This was being controlled with a combination lock to the thermal laboratory. No data had been obtained in the X-ray lab. This set of requirements may need to be more closely examined on a future audit or surveillance.

Conditions adverse to Quality Corrected During the Surveillance.

One condition adverse to quality was corrected during the surveillance. This condition was observed in TP-200, Revision 1, "Inspection of Samples Used in Thermal Properties Measurements." Contrary to the requirements of Appendix A of QAIP 20-1, Revision 5, for the content of TPs, TP-200 contained reference to procedures that no longer exist, reference to individuals responsible for work no longer performing work, and values to be obtained for data that had been changed. This procedure was revised to meet the content requirements and was completed prior to the end of the surveillance.

Recommendations.

1. QAIP 1-5, Revision 12, contains Section 3.4.2 for revising a WA. This procedure has not yet been implemented. It was discovered during the surveillance that SNL may not desire to use this section as documented or the revision process may not be desired for the purpose of

planning. It should be determined whether or not to retain a revision process in this section of the procedure. If a revision process is desired, the process needs to reflect the process as it is performed at SNL.

2. Although the system SNL is using to document and track qualification and training of personnel for the Yucca Mountain Project permits verification of these records, it is cumbersome to use and does not provide effective linkages between assignment and documented completion of required training. It is recommended SNL reassess this system to determine a more effective method of ensuring the verification and traceability of these records.

3. QAIP 12-1, Revision 5, requires written notification of out-of-calibration conditions and an evaluation of this condition documented on a Deficiency Report in accordance with AP-16.1Q. One condition was observed for the conductivity measuring instrument such that Alcove 5 data was found to be out-of-calibration during a verification check. It has not yet been determined whether or not to use the data. Rerunning the data perhaps could remove the condition if there had been an anomaly in the process. It is recommended that, if the data can be justified as acceptable for use, the out-of-calibration situation be documented as required in this procedure and resolved in accordance with AP-16.1Q prior to use. OQA personnel will continue dialogue with appropriate SNL responsible individuals regarding this matter.

4. QAIP 20-1, Revision 5, Section 4.2, is not clear when the expedited change becomes effective. It states the Principal Investigator is to be notified when the change is completed and, in a timely manner, other affected personnel are to be notified. The time needs to be specified for affectivity so those contacted will know when the process can be followed for an expedited change.

5. TP-51, TP-202 and TP-203 each generate required data but no method of documenting the data is described or provided. There needs to be a process described in each procedure to explain the form this documentation is intended to take (e.g., scientific notebook, memoranda, completed forms, etc.) and consistent use of terms for the documentation (logbooks, scientific notebook) needs to be used.

Personnel Contacted during the Surveillance.

Glenn Barker, Technician
Michelle Bouldin, Training/Records staff member
Nancy Brodsky, Senior Member Technical Staff
Jim Connelly, Research Scientist, University of New Mexico
Ron Price, Senior Member Technical Staff
Joe Schelling, Engineering Assurance Lead
Lynn Washburn, Procurement/Contracts Coordinator
Eloise James, SNL/SAIC Technical Data Records Coordinator
Kevin Harrison, SNL/SAIC Records Specialist

Surveillance Team.

Stephen D. Harris, OQA, Surveillance Team Leader
James M. Graff, OQA Representative at SNL
Tom Scotese, Woodward-Clyde, Technical Specialist

10. SURVEILLANCE CONCLUSIONS: (Cont'd)

The quality assurance compliance, adequacy and effectiveness was considered satisfactory for the scope of work evaluated during this surveillance. Of particular positive note, the Thermal laboratory was considered exemplary for calibration documentation and observed process.

Deficient Conditions: One corrected during the surveillance and discussed in Block 9.
Recommendations: Five discussed in Block 9.

References.

The following references were reviewed to gain insight on technical aspects of the laboratory thermal testing program:

Brodsky, N.S., Riggins, M. and Ricci, P., 1995, Thermal Expansion and Thermal Conductivity Measurements for Boreholes UE25 NRG-4, UE25 NRG-5, USW NRG-6, and USW NRG-7/7A, SAND 95-1955

Lappin, A.R., 1980, Thermal Conductivity of Silicic Tuffs: Predictive Formalism and Comparison with Preliminary Experimental Results, SAND 80-0679

Lappin, A.R., VanBuskirk, R.G., Enniss, D.O., Butters, S.W., Prater, F.M., Muller, C.B., and Bergosh, J.L., 1982, Thermal Conductivity Bulk Properties, and Thermal Stratigraphy of Silicic Tuffs from the Upper Portion of Hole USW-G1, Yucca Mountain, Nevada, SAND 81-1873

Nimick, F.B., 1989, Thermal Conductivity Data for Tuffs from the Unsaturated Zone atYucca Mountain, Nevada, SAND 88-0624

SNL, 1997, Thermal Expansion and Thermal Conductivity of Test Specimens from the Drift Scale Test Area of the Exploratory Studies Facility at Yucca Mountain, Nevada, TDIF No. 306127