



DEPARTMENT OF ENERGY
Office of Civilian Radioactive Waste Management
Office of Geologic Disposal
Yucca Mountain Site Characterization Project Office
P.O. Box 98608
Las Vegas, NV 89193-8608

WBS 1.2.11
QA: N/A

DEC 14 1993

Robert F. Pritchett
Technical Project Officer
for Yucca Mountain
Site Characterization Project
Reynolds Electrical & Engineering Co., Inc.
P.O. Box 98521
Las Vegas, NV 89193-8521

EVALUATION OF RESPONSE TO CORRECTIVE ACTION REQUEST (CAR) YM-93-058 RESULTING FROM YUCCA MOUNTAIN QUALITY ASSURANCE DIVISION (YMQAD) AUDIT YMP-93-12 OF REYNOLDS ELECTRICAL & ENGINEERING CO., INC. (REECo) (SCP: N/A)

Reference: Ltr, Pritchett to Spence, dtd 10/28/93

The YMQAD staff has evaluated the response to CAR YM-93-058 and REECo's "Calibration Requirements for Survey Equipment" detailed in the referenced letter. The response has been determined to be unsatisfactory for the following reasons:

The YMQAD does not agree that survey instruments are a "Commercial Device," as stated in Quality Assurance Requirements and Description DOE/RW-0333P, Section 12.2.5. Therefore, the requirements of DOE/RW-0333P, Section 12, do apply for control, calibration, and maintenance of survey instruments.

Based on a meeting held November 18, 1993, between YMQAD, REECo, Raytheon Services Nevada, and the Civilian Radioactive Waste Management System Management and Operating Contractor (CRWMS M&O), those in attendance generally agreed that specific criteria should be established to address calibration of survey instruments used for location determination of quality-affecting items. In order to ensure that the REECo survey program meets the intent of DOE/RW-0333P, Section 12 requirements, YMQAD requests that REECo address the following actions, promulgated during the November 18 meeting:

1. Using a permanent baseline of survey monuments traceable to a national standard, REECo shall provide field calibration (verification) of survey instruments. If no nationally recognized standard exists, the basis for calibration shall be documented.
2. REECo, working with CRWMS M&O, shall investigate and define survey tolerances based on 1 above and actual field construction needs.
3. REECo shall establish maintenance of survey instruments based on 1 above and preestablished intervals.

Note: Since this activity is not a calibration, the requirements stated in DOE/RW-0333P, Section 7.2.6, are not required to assess the vendors capability of providing a calibration service for survey instruments.

4. All actions associated with Items 1 through 3 above shall be described in an implementing document.

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ADD: Ken Hooks W. Encl.
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DEC 14 1993

Robert F. Pritchett

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Until the above actions are resolved, REECo shall not perform any survey activities associated with location determination of quality-affecting items. In addition, YMQAD requests REECo to determine if additional surveying was performed by REECo of quality-affecting items, subsequent to initiation of CAR YM-93-058. If additional surveying was performed, describe what actions have been taken to assure that no additional deficiencies exist.

An amended response is required to be submitted to this office within ten working days of the date of this letter. Send the original of your response to Nita J. Brogan, YMQAD/QATSS, 101 Convention Center Drive, Suite 640, Las Vegas, Nevada 89109. If an extension to the due date is necessary, it must be requested in writing, with appropriate justification, prior to that date.

If you have any questions, please contact either Robert B. Constable at 794-7945 or Stephen R. Dana at 794-7176.



Richard E. Spence, Director
Yucca Mountain Quality Assurance Division

YMQAD:RBC-1191

Enclosure:
CAR YM-93-0058

cc w/encl:

K. R. Hooks, NRC, Washington, DC
S. W. Zimmerman, NWPO, Carson City, NV
W. J. Glasser, REECo, Las Vegas, NV

cc w/o encl:

J. W. Gilray, NRC, Las Vegas, NV
N. J. Brogan, YMQAD/QATSS, Las Vegas, NV

ORIGINAL
THIS IS A RED STAMP

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

8 CAR NO.: YM-93-058
DATE: 07/02/93
SHEET: 1 OF 1
QA

CORRECTIVE ACTION REQUEST

1 Controlling Document REECO QAPP, 568-DCO-115, Revision 8		2 Related Report No. YMP-93-12	
3 Responsible Organization REECO Construction		4 Discussed With T. Leonard/D. Koss	
5 Requirement: REECO QAPP, Section II, "Quality Assurance Program," Paragraph 1.2 states, "The Quality Assurance Program of REECO consists of the QAPP plus appropriate implementing procedures required to provide and implement control over activities affecting quality."			
6 Adverse Condition: Contrary to the above, survey activities of quality-affecting items are being performed in accordance with procedures that are not part of the REECO Yucca Mountain QA Program.			
9 Does a significant condition adverse to quality exist? Yes <u>X</u> No ___ If Yes, Circle One: A B <u>C</u>		10 Does a stop work condition exist? Yes ___ No <u>X</u> ; If Yes - Attach copy of SWO If Yes, Circle One: A B C D	
		11 Response Due Date: 20 Working Days from Issuance	
12 Required Actions: <input checked="" type="checkbox"/> Remedial <input checked="" type="checkbox"/> Extent of Deficiency <input checked="" type="checkbox"/> Preclude Recurrence <input checked="" type="checkbox"/> Root Cause Determination			
13 Recommended Actions: 1) Bring present procedures for survey activities under the REECO QA Program.			
7 Initiator Gerard Heaney <i>Gerard Heaney</i> Date <u>7-1-93</u>		14 Issuance Approved by: QADD <i>Mountable</i> for Date <u>07-07-93</u>	
15 Response Accepted QAR <u>N/A</u> Date		16 Response Accepted QADD Date	
17 Amended Response Accepted QAR <i>Gerard Heaney</i> Date <u>8-31-93</u>		18 Amended Response Accepted <i>R.C. Spence</i> Date <u>9/1/93</u>	
19 Corrective Actions Verified QAR Date		20 Closure Approved by: QADD Date	

ENCLOSURE

REV. 08/91

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

CAR NO. YM-93-058
DATE: 08/04/93
PAGE: _____ OF _____
QA

CORRECTIVE ACTION REQUEST (Continuation Page)

CORRECTIVE ACTION RESPONSE for CAR # YM-93-058

A. Remedial Action:

A starter tunnel "check survey" has been performed by Raytheon Services Nevada (RSN) to ensure that line, grade, and profile at "B line" are correct. Although the "check survey" report has not been issued, no deficiencies have been reported.

Responsible Individual: T. M. Leonard
Estimated completion date: August 30, 1993

B. Investigative Action:

Extent of Deficiency: The quality affecting survey work performed by REECO Engineering applies only to the establishment of line, grade, and profile within the starter tunnel.

Responsible Individual: T. M. Leonard
Estimated completion date: Completed

C. Root Cause Determination:

The intent of the REECO Quality Assurance Program Plan was misinterpreted. Surveying of line and grade (for marking the drill face center line and grade) is shot from control points set by a QA qualified organization (RSN). Our interpretation that surveying line and grade was not a QA activity was deemed incorrect.

D. Corrective Action to Preclude Recurrence:

The REECO matrixed surveyors, supervision, and party chief will be qualified to perform quality affecting survey work in accordance with the YMP QA program.

The instruments (total station and level) will be calibrated at a QA qualified calibration facility at an interval established by the manufacturer.

Let's do it 8/4/93 - 580-01-587

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

CAR NO. YM-93-058
DATE: 08/04/93
PAGE: _____ OF _____
QA

CORRECTIVE ACTION REQUEST (Continuation Page)

D. Corrective Action to Preclude Recurrence: - Continued

A Technical Control Procedure designated as "QA" will be written per MC-05.2 that describes the QA activity of surveying line, grade, and profile in the tunnel. Personnel will be trained to this procedure prior to implementation.

Responsible Individual: T. M. Leonard
Estimated completion date: September 30, 1993.

Response Approved: *R. F. [Signature]* Date: 8/4/93

dtl 8/4/93-588-01-587

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

CAR NO. YM-93-058

DATE: 08/30/93

PAGE: _____ OF _____
QA

CORRECTIVE ACTION REQUEST (Continuation Page)

AMENDED CORRECTIVE ACTION RESPONSE for CAR # YM-93-058

A. Remedial Action:

A starter tunnel "check survey" has been performed by Raytheon Services Nevada (RSN) to ensure that line, grade, and nominal size at "B line" are correct. Although the "check survey" report has not been issued, no deficiencies have been reported.

Responsible Individual: T. M. Leonard
Estimated completion date: August 30, 1993

B. Investigative Action:

Extent of Deficiency: The quality affecting survey work performed by REECo Engineering applies only to the establishment of line, grade, and nominal size within the starter tunnel.

Responsible Individual: T. M. Leonard
Estimated completion date: Completed

C. Root Cause Determination:

The intent of the REECo Quality Assurance Program Plan was misinterpreted. Surveying of line and grade (for marking the drill face center line and grade) is shot from control points set by a QA qualified organization (RSN). Our interpretation that surveying line, grade and nominal size was not a QA activity was deemed incorrect.

D. Corrective Action to Preclude Recurrence:

The REECo matrixed surveyors, supervision, and party chief will be qualified to perform quality affecting survey work in accordance with the YMP QA program.

The instruments (total station and level) will be calibrated at a QA qualified calibration facility at an interval established by the manufacturer.

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U.S. DEPARTMENT OF ENERGY
WASHINGTON, D.C.

CAR NO. YM-93-058
DATE: 08/30/93
PAGE: OF
 QA

CORRECTIVE ACTION REQUEST (Continuation Page)

AMENDED CORRECTIVE ACTION RESPONSE for CAR # YM-93-058

D. Corrective Action to Preclude Recurrence: - Continued

A Technical Control Procedure designated as "QA" will be written per MC-05.2 that describes the QA activity of surveying line, grade, and nominal size in the tunnel. Personnel will be trained to this procedure prior to implementation.

Responsible Individual: T. M. Leonard
Estimated completion date: September 30, 1993.

Response Approved: *RJ Pritchett* Date: 8/31/93

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

CAR NO. YM-93-058

DATE: 09-30-93

PAGE: _____ OF _____
CA

CORRECTIVE ACTION REQUEST (Continuation Page)

AMENDED CORRECTIVE ACTION RESPONSE AND EXTENSION REQUEST for CAR # YM-93-058

D. Corrective Action to Preclude Recurrence:

The REECO matrixed personnel are in the process of being qualified. Additional time is necessary to complete their qualifications. Revised estimated completion date is October 22, 1993.

The calibration facility was surveyed and has been determined to be unacceptable and does not meet REECO/YMP requirements. Additional time is necessary to identify and qualify another survey instrument calibration facility. A report will be provided by October 29, 1993, documenting the status of qualifying a calibration facility.

The "QA" Technical Control Procedure has been written and has been through the "Draft" procedure review process. Comments are presently being resolved and the procedure should be approved by October 8, 1993.

Responsible Individuals: T. M. Leonard/W. J. Glasser

Response Approved: _____

RF Pittman

Date: _____

9/30/93

Ltr dtd 9/30/93 - 580-01-715



Reynolds Electrical & Engineering Co., Inc.

Post Office Box 98521 • Las Vegas, NV 89193-8521

IN REPLY REFER TO:

580-01-049

WBS 1.2.11.4
QA

OCT 28 1993

Richard E. Spence, Director
Quality Assurance Division
Yucca Mountain Site Characterization
Project Office
U.S. Department of Energy
Post Office Box 98608
Las Vegas, NV 89193-8608

CALIBRATION REQUIREMENTS FOR SURVEY EQUIPMENT (SCP: N/A)

A recent review of Calibration Criteria XII documented in U.S. Department of Energy's (DOE) Quality Assurance Requirements and Description (QARD), DOE/RX-0333P, resulted in a proposal that calibration of survey instrumentation used by Reynolds Electrical & Engineering Co., Inc. (REECO) is not required since survey instruments are "normal commercial equipment that provides adequate accuracy" (paragraph 12.2.5). The purpose of this letter is to advise DOE Quality Assurance that REECO considers this proposal to be valid and is providing a basis for considering that calibration of survey equipment is not required.

Survey instrumentation typically is designed to provide accuracies to support all levels of surveys. Surveys have accuracies defined as first, second, and third order. The accuracy of survey instrumentation capabilities are typically confirmed through setup procedures and periodic checks for repeatability. Additional information regarding the use of survey equipment is provided in the attachment which discusses Checks and Adjustments of Surveying Instruments.

Based on the usage and self check capabilities of survey equipment, REECO does not plan to calibrate survey instrumentation, but rather will maintain periodic checks on the repeatability of the equipment as well as periodic maintenance checks in accordance with REECO procedures. This letter will be referenced in any future discussion concerning the need to calibrate survey instruments.

REECO

TOTAL QUALITY IS OUR BUSINESS

EG&G

I-349175

BNA

OCT 28 1993

Richard E. Spence
580-01-049
Page 2

Should you have any questions regarding this position or consider the action not to be an appropriate application of the QARD, please contact William J. Glasser at (702) 794-7562 or advise us accordingly.


FOR

R. F. Pritchett, Manager
Yucca Mountain Project Division
YMP Technical Project Officer

RFP:WJG:as

Enclosure
Checks and Adjustments of Surveying
Instruments (3 pages)

cy w/encl.

Information Services Center, M/S 408...
K. W. Powers, DOE/NV, M/S 505

ATTACHMENT I

Checks and Adjustments of Surveying Instruments

Following is a quote from an engineering college text titled "Surveying," by Francis H. Moffit and Harry Bouchard.

"B-1. REMARKS No matter how perfectly an instrument may be adjusted when it leaves the instrument maker, repair shop, or laboratory, it seldom remains in that condition for any considerable length of time, particularly when in daily use, subjected to rough handling, and transported by car or truck over all kinds of roads. Although the field operations can be conducted so as to eliminate errors due to imperfect adjustment, more time is required when the work is done in this manner. For this reason every engineer and surveyor should be able to determine whether or not his instruments are in proper adjustment and if they are not, how to adjust them."

The inference from this statement is that surveying instruments are frequently checked in the field (usually on a daily basis or at any time the instrument has been subjected to rough treatment) and adjustments made as necessary.

Nearly all the adjustments of a transit or level depend on the principle of reversal. By reversing the position of the instrument, the effect of the error is doubled and properly adjusting for one half of the doubled error will adjust the capstan-headed screws or nuts that control the positions of the cross hairs and the bubble tubes. An example of that is the checking and adjusting of transit standards as follows:

STANDARDS: If the standards of the transit are in adjustment, the horizontal axis of the telescope is perpendicular to the vertical axis of the instrument. When the plates are leveled, the horizontal axis is truly horizontal, and the line of sight moves in a vertical plane as the telescope is raised and lowered. The test of the standards is made by sighting, with the telescope normal, to some well-defined point on a high object, such as a flagpole or church spire. In Figure 1A is such a high point. With the horizontal motion clamped, the telescope is depressed and a point B is set on the ground in the line of sight. The telescope is then plunged, the lower clamp is released, and a sight is taken on B. With the lower clamp tight, the telescope is again elevated. If the line of sight strikes the high point A, no adjustment is necessary. If, as in Figure 1, the line of sight now strikes at C, one end of the horizontal axis must be raised or lowered to bring the line of sight midway between C and A. This is done by loosening the upper screws that hold the horizontal axis in place and then turning the small capstan-headed screw that controls the position of the block on which the horizontal axis rests. In the example shown in the figure, the left-hand side should be raised or the right-hand side lowered when the telescope is in the reversed position. When the axis has been properly adjusted, the upper screws are tightened just sufficiently to prevent looseness of the bearing. If the line of sight is now lowered, it should strike point B.

This is only one example of the many checks and adjustments performed by the engineer or surveyor to assure that an instrument is always in proper adjustment when in service. None of these checks and adjustments are to any national standard but are relative to the internal hardware of the instrument to assure required precision when measuring line and elevation.

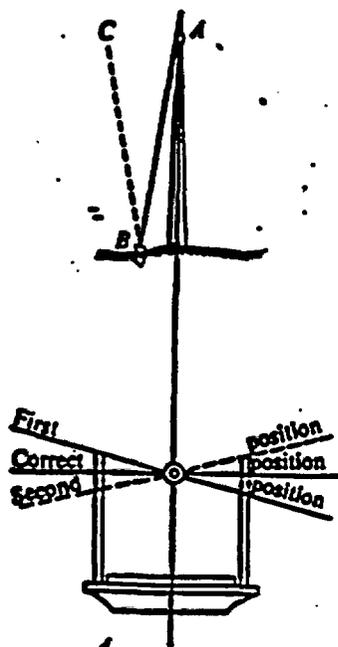


Figure 6-4: Adjustment of standards.

In the case of Electronic Distance Measuring Instruments (EDM), if the EDM is properly tuned, there will be very few sources of instrumental errors that need correcting. One possible error is the reflector constant, caused by not having the effective center of the reflector (which acts as the target for the instrument man) plumbed over the far end of the line being shot. The measurement through the reflector is a function of the distance through which light travels in the reflector cube, during retroreflection and equivalent air distance constant on account of the refractive index of the glass. An error can be introduced in the measured length of the line if the plumb line in the reflector is slightly out of location. This difference, reflector constant, can be effectively eliminated by advancing the electrical center of the EDM by a corresponding distance during manufacture.

Since reflectors are made and mounted by different manufacturers, the reflector constants for a given instrument may not all be the same. This makes it necessary to determine a combined instrument reflector constant for each combination to be used by the surveyor. Once determined, the constant is added (though a relatively small value, most commonly 30 to 40 mm) to any measurement made with that particular combination of EDM and reflector. The constant can be entered into most EDMs by the operator using a keyboard and is then automatically added to the measured slope distance.

At least two methods can be used to determine the combined constant by measuring against carefully established known taped distances.

The constant determination is made under the assumption that the instrument is properly tuned to give correct modulation frequencies. Frequencies are checked by means of a frequency counter available from various sources. Frequency checks should be performed at regular intervals, especially if high order or long distance surveys are to be performed. Alternately, if the EDM is checked regularly against known distances, applying corrections for instrument and reflector constants, meteorological conditions, and slope: frequency shifts can be detected.

Again, this example is provided to illustrate that surveying and leveling instruments are self-checking and that most needed adjustments can be performed by the engineer or surveyor.

Checks and Adjustments of Reynolds Electrical & Engineering Co., Inc. (REECO)
Specific Survey Instruments

The above discussion is typical for instruments used in the survey industry. In order to ensure REECO instrumentation is properly functioning, survey equipment is maintained in compliance with the manufacturer's recommendations for ensuring the proper maintenance and adjustment of survey instruments. Currently, REECO utilizes LEICA (formerly WILD-HEERBURG) brand survey instruments. This manufacturer recommends periodic maintenance and adjustments be performed at 18 to 24 month intervals. REECO has maintained this schedule and intends to supplement this program by performing field verification tests at a minimum of every six months.

In order to provide assurance of the continued satisfactory performance of survey instruments, tests will be performed and the results logged in an instrument log book or electronic data collector as appropriate as follows:

1. Vertical index error
2. Horizontal collimation error
3. Measurement of previously measured baseline.

All field verification tests will be performed in accordance with the manufacturer's recommended procedures as listed in the equipment operations handbook.

Before any instrument is returned to service, it will be determined that the instrument is performing within the accuracy required for the assigned tasks.

Within the REECO program, the above maintenance program and periodic accuracy checks provides more than adequate accuracy for the performance of surveying.