OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT

YUCCA MOUNTAIN QUALITY ASSURANCE DIVISION

QUALITY ASSURANCE SURVEILLANCE REPORT OF

UNITED STATES GEOLOGICAL SURVEY

TRACER INJECTION AT YUCCA MOUNTAIN SITE BOREHOLES

SURVEILLANCE YMP-SR-93-002

CONDUCTED NOVEMBER 17 THROUGH DECEMBER 18, 1992

ACTIVITIES SURVEILLED:

TESTING AND INJECTION OF SULFUR HEXAFLUORIDE
INTO BOREHOLES VSP UZ-16 AND UE-25 NRG-6

Prepared by: _____ Date: 1-4-93
John S Martin
Quality Assurance Engineer
Surveillance Team Leader
Yucca Mountain Quality Assurance Division

Approved by: R. E. Spence For Date: 1/7/93
Donald G. Horton
Director
Office of Quality Assurance

9301190187 930111
PDR WASTE
WM-11 PDR

1.0 EXECUTIVE SUMMARY

This report contains the results of the Office of Civilian Radioactive Waste Management (OCRWM) Quality Assurance (QA) Surveillance YMP-SR-93-002 of the U.S. Geological Survey (USGS) testing and injection of Sulfur Hexafluoride (SF_6) into boreholes. In addition, this surveillance covered the utilization of Tracers, Fluids, and Materials (TFM) specific to site investigation activities. The surveillance was conducted from November 17 through December 18, 1993 at Yucca Mountain site boreholes VSP UZ-16 and UE-25 NRG-6, the Yucca Mountain Site Characterization Project Office (YMPO), Las Vegas, Nevada, and concluded at the U.S. Geological Survey (USGS) in Denver, Colorado. The surveillance was conducted by the Yucca Mountain Quality Assurance Division (YMQAD) of the Office of Quality Assurance in accordance with OCRWM Quality Assurance Administrative Procedure QAAP 18.3, Revision 3.

During the course of the surveillance, three deficiencies were identified that required the issuance of three OCRWM Corrective Action Requests (CARs). Of these CARs, one is considered a significant condition adverse to quality and deals with the failure to develop procedures for the implementation of the TFM Plan which was issued to the U.S. Department of Energy (DOE)/YMPO. Two CARs deal with different aspects of tracer injection and are (1) failure to monitor concentration levels of SF_6 on the vacuum side of borehole NRG-6, and (2) failure to appropriately apply calibration status stickers to instrumentation utilized at tracer injection boreholes.

In addition, three deficiencies were identified and corrected as a result of the surveillance. Details of the issued OCRWM CARs and corrected deficient conditions are found in Section 5.0 of this surveillance report.

2.0 SCOPE

The surveillance was performed to examine USGS responsibilities relative to tracer injection into site boreholes and the utilization of TFM for site investigation.

3.0 SURVEILLANCE TEAM

The surveillance team consisted of the following personnel:

John S. Martin, Quality Assurance Engineer, YMQAD

4.0 PERSONNEL CONTACTED DURING THE SURVEILLANCE

R. Bullock, RSN
W. Distel, M&O
D. Cunningham, RSN
J. Doyle, SAIC

R. Dyer, DOE/YMPO
J. Ferarese, USGS
T. Grant, SAIC
C. Hermes, SAIC
M. Mapa, SAIC
C. Peters, USGS
T. Pysto, SAIC
K. Scofield, USGS
P. Striffler, USGS
R. Wright, RSN
T. Chaney, USGS
N. Elkins, LANL
A. Girdley, DOE/YMPO
L. Hayes, USGS
H. Kalia, LANL
J. Moyer, SAIC
M. Pitterly, SAIC
W. Rodman, USGS
S. Smith, SAIC
E. Wright, RSN
J. Woolverton, USGS

Los Alamos National Laboratory = LANL
Management and Operating = M&O
Raytheon Services Nevada = RSN
Science Applications International Corporation = SAIC

5.0 SURVEILLANCE RESULTS

Tracer injection as performed by USGS, is an essential parameter in determining whether in-situ borehole conditions exist by determining the presence of any contaminants in the unsaturated rock that may have resulted from the drilling process. The purpose of injecting a tracer gas, such as SF_6, into boreholes is to qualitatively measure residual amounts of atmospheric air containing the tracer, which may remain from the injection/suction action while drilling. The tracer gas is injected at a selected rate, and sampled at the completion of the drilling phase for subsurface atmospheric contamination.

The surveillance consisted of field observation of USGS injection of tracer gas, personnel interviews and documentation reviews.

Documentation reviews consisted of a review of documentation associated with but not limited to, the approval of tracers utilized for site investigations and the flow of requirements for this activity. During this review, it was noted that a tracer analysis must be performed (reference: OCRWM Project Baseline Document, "Technical Requirements for the Yucca Mountain Site Characterization Project Surface Based Testing," YMP-CM-007, Revision 9 and the "Tracers, Fluids and Materials Plan," YMP/91-23, Revision 1) to determine the effect of the tracer on data gathering and waste isolation, and that the analysis provide such information as allowable composition, quality, and location of use. As a result of this review, it was found that the final analysis for the tracer SF_6 which is presently being utilized for borehole tracer injection, has not been completed. In addition, it was also found that procedures have not been generated to implement the TFM Plan which is required by YMP/CM-007 (reference CAR YM-93-027 issued to DOE/YMPO).

Field observation consisted of witnessing the injection of the tracer SF_6 into boreholes VSP UZ-16 and UE-25 NRG-6 by USGS. During this observation, two USGS procedures were utilized to determine compliance: USGS technical procedures NWM-USGS-HP-07, Revision 1, "Use of Trace Gas for Determining Atmospheric Contamination in Dry-Drilled Borehole" and NWM-USGS-HP-160, Revision 1, "Methods for Analysis of Samples for Gas Composition by Gas Chromatography." Based upon the results of these observations, two deficient conditions were identified which required the issuance of two OCRWM CARs, YM-93-025 and YM-93-026. Three deficiencies were identified which were considered isolated in nature and were corrected during the course of the surveillance.

Overall, the effectiveness of implementation of the TFM approval and analysis process, as managed DOE/YMPO, was found to be unsatisfactory. In addition, the effectiveness of implementation of procedural prerequisites by USGS for tracer injection at boreholes was also found to be unsatisfactory, based upon the number of deficiencies identified during the course of the surveillance.

Even though the overall implementation of tracer injection was found to be unsatisfactory, it is felt that the actual injection of tracers into boreholes has not been compromised by the identified deficiencies. However, it is believed that the overall tracer injection program should be evaluated based upon scientific needs and requirements (reference: Recommendation 1 of this report).

The following is a brief synopsis of the CARs issued as a result of this surveillance (for specific details, information copies of the CARs are included as Attachment 1 of this report).

<u>YM-93-025</u>

USGS procedure YMP-USGS-QMP-12.01, Revision 5, requires that a calibration status sticker be affixed to all equipment used for QA graded work to show the calibration status unless an alternative method is implemented. Contrary to this requirement, it was found that calibration status stickers were not affixed to the following equipment: Mass Flow Controller Serial Number (S/N) 378, Flow Meter S/N 227 and pressure gages utilized to supply pressure to the Electron Capture Detector located at borehole VSP UZ-16.

In discussions with cognizant USGS representatives, it was ascertained that the only equipment requiring calibration as part of the tracer injection process is that of the Electron Capture Device and the Gas Chromatograph. These instruments were found to be user calibrated and acceptable, and as such, data collected relative to tracer concentrations was found to be accurate. However, USGS is required to status equipment in accordance with programmatic guidelines.

YM-93-026

USGS procedure NWM-USGS-HP-07, Revision 1, requires that concentrations of tracers be monitored on the vacuum side of boreholes for which tracer injection is performed. However, for borehole UE-25 NRG-6, tracer concentrations on the vacuum side of the borehole was not monitored during initial drilling activities.

YM-93-027

The DOE Quality Assurance Program Description Document (DOE/RW-215), Revision 3, requires that OCRWM activities affecting quality be prescribed by, and controlled in accordance with, plans, procedures, and instructions. Further, it is required that the planning, preparation, and issuance of plans, procedures, and instructions be accomplished prior to the start of activities affecting quality. In addition, the TFM Plan requires the generation of procedures to implement the TFM Plan. Contrary to this, no procedures have been developed to implement the TFM Plan. This CAR is issued to DOE/YMPO.

Conditions adverse to quality that are considered isolated in nature and requiring only remedial action can be corrected during the course of the surveillance without issuance of a CAR. The following conditions adverse to quality were identified and corrected during the surveillance:

1. USGS procedure NWM-USGS-HP-07, Revision 1, requires the calibration of the Mass Flow Controller for the injection of tracers. During the course of the surveillance, it was noted that the Mass Flow Controller utilized on borehole VSP UZ-16 was not calibrated. In discussions with USGS personnel it was ascertained that the important criteria in tracer injection is the monitoring of the concentration of SF_6 being injected into the well. This is accomplished by increasing or decreasing the SF_6 flow input with the increase and decrease of air quantities being injected into the well, in order to keep the SF_6 concentrations approximately the same. Sampling the injection stream and analyzing the SF_6 concentration with the gas chromatograph supplies the needed data, and as such, calibration of the Mass Flow Controller is not required. To correct the deficiency, USGS initiated a Field Modification, as allowed per USGS procedure QMP-5.01, Revision 4, Paragraph 5.8.2, to eliminate the need to calibrate the Mass Flow Controller.

2. USGS procedure NWM-USGS-HP-07, also requires that syringes utilized to collect gas samples to be analyzed, be labeled with the date, time and location from which the sample was taken. In observation of the tracer analysis process, it was found that the syringes were only being color coded with colored tape to indicate downhole injection and vacuum side sample. In resolution, USGS initiated a Field

Modification to clarify their intent. The Field Modification states in part: "Gas samples collected in syringes as part of this procedure will be labeled to indicate location. The samples will be analyzed during the same day of collection. Date and time of analyses are printed on the gas chromatogram when analyzed. Date and time samples are collected are noted in the GC lab data book." Implementation of this new process was witnessed and this deficiency is considered resolved at this time.

3. USGS procedure NWM-USGS-HP-160, Revision 1, requires that the gas chromatograph be utilized in a draft free, relatively constant temperature laboratory environment and placed on a vibration-free bench. Contrary to this requirement, the gas chromatograph is set in the rear of an open trailer with little or no environmental controls. In resolution, USGS initiated the following Field Modification: "When used in the field, the gas chromatograph should be handled and transported carefully to prevent damage. Calibration standards run in the field demonstrate that the gas chromatograph is operating properly."

6.0 RECOMMENDATIONS

The following recommendations are provided as a result of this surveillance. These recommendations are not considered as deficiencies, but as areas in which it is felt the tracer injection program could be improved and/or enhanced.

1. During the development and start up of activities, procedures are developed to delineate and document the methodology in which activities affecting quality are to be conducted. Subsequent to this, actual implementation takes place for these activities. As these activities progress, a more convenient way of conducting business may develop. When this occurs, it must be recognized and procedures must be revised to delineate this new methodology. It is recommended that technical procedures associated with the injection of tracer gas and analysis, be reviewed by appropriate USGS personnel and revisions made where deemed necessary. This recommendation is made based upon the two CARs issued and the three deficiencies corrected during the course of the surveillance.

2. In review of the permit issued by the State of Nevada for injection of tracers into boreholes, it was found that numerous administrative requirements are stipulated, such as, submittal of procedures for well clean-outs, quarterly reporting of monitoring results and noncompliance notification. It is recommended that YMPO evaluate the need for an administrative procedure for requirements delineated within the permit issued by the State of Nevada to preclude by-passing State licensing requirements.

ATTACHMENT 1

INFORMATION COPIES OF CORRECTIVE ACTION REQUESTS

ORIGINAL
THIS IS A RED STAMP

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

8 CAR NO.: YM-93-025
DATE: 12/28/92
SHEET: 1 OF 2
QA

CORRECTIVE ACTION REQUEST

1 Controlling Document YMP-USGS-QMP-12.01, Rev. 5	2 Related Report No. YMP-SR-93-002
3 Responsible Organization USGS	4 Discussed With L. Hayes/T. Chaney

5 Requirement:

YMP-USGS-QMP-12.01, Revision 5, Paragraph 5.3.2, states in part: "A calibration Status Sticker shall be affixed to all equipment used for QA graded work to show the calibration status unless an alternative method is implemented..."

6 Adverse Condition:

The following is a listing of instrumentation for which calibration status stickers were not affixed:

Mass Flow Controller (Serial Number 378)

Flow Meter (Serial Number 227)

Pressure gages utilized to supply pressure to the Electron Capture Detector

NOTE: The above instruments were witnessed being utilized at Borehole UZ-16. The same condition was witnessed at Borehole NRG-6, although, the serial numbers and equipment names are not provided herein.

DISCUSSION: In discussion with USGS it was ascertained that the

9 Does a significant condition adverse to quality exist? Yes___ No X If Yes, Circle One: A B C	10 Does a stop work condition exist? Yes___ No X ; If Yes - Attach copy of SWO If Yes, Circle One: A B C D	11 Response Due Date: 20 days from issuance

12 Required Actions: [X] Remedial [X] Extent of Deficiency [X] Preclude Recurrence [ ] Root Cause Determination

13 Recommended Actions:

1. Determine the actions necessary to correct the deficiencies cited and report actions taken.
2. Determine like deficiencies, actions necessary to correct those deficiencies, and report results.

7 Initiator John S. Martin [signature] Date 12/28/92	14 Issuance Approved by: QADD R.C. Spence Date 12/30/92
15 Response Accepted QAR Date	16 Response Accepted QADD Date
17 Amended Response Accepted QAR Date	18 Amended Response Accepted QADD Date
19 Corrective Actions Verified QAR Date	20 Closure Approved by: QADD Date

REV. 08/91

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

8 CAR NO.: YM-93-025
DATE: 12/28/92
SHEET: 2 OF 2
QA

CORRECTIVE ACTION REQUEST (Continuation Page)

6 Adverse Condition (continued)

only equipment requiring calibration as part of the tracer injection process is that of the Electron Capture Device and the Gas Chromatograph. These instruments were found to be user calibrated and acceptable, however, USGS is required to affix Calibration Status Stickers to the above-referenced instrumentation or implement an alternative methodology.

13 Recommended Action(s) (continued)

3. Provide action necessary to preclude recurrence.

4. Determine impact to work accomplished and provide results.

ORIGINAL
THIS IS A RED STAMP

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

8 CAR NO.: YM-93-026
DATE: 12/28/92
SHEET: 1 OF 2
QA

CORRECTIVE ACTION REQUEST

1 Controlling Document NWM-USGS-HP-07, Rev. 1	2 Related Report No. YMP-SR-93-002
3 Responsible Organization USGS	4 Discussed With L. Hayes/T. Chaney

5 Requirement:

NWM-USGS-HP-07, Rev. 1, Paragraph 4.2.4, requires that the concentration of tracer gas be checked on the vacuum side of boreholes.

6 Adverse Condition:

Contrary to the above, tracer gas was not checked on borehole NRG-6 during initial drilling activities.

9 Does a significant condition adverse to quality exist? Yes___ No X If Yes, Circle One: A B C	10 Does a stop work condition exist? Yes___ No X ; If Yes - Attach copy of SWO If Yes, Circle One: A B C D	11 Response Due Date: 20 days from issuance

12 Required Actions: ☒ Remedial ☒ Extent of Deficiency ☒ Preclude Recurrence ☐ Root Cause Determination

13 Recommended Actions:

1. Determine the actions necessary to correct the deficiencies cited and report actions taken.
2. Determine like deficiencies, actions necessary to correct those deficiencies, and report results.

7 Initiator John S. Martin JL Date 12/28/92	14 Issuance Approved by: QADD R.C. Spence Date 12/30/92
15 Response Accepted QAR Date	16 Response Accepted QADD Date
17 Amended Response Accepted QAR Date	18 Amended Response Accepted QADD Date
19 Corrective Actions Verified QAR Date	20 Closure Approved by: QADD Date

REV. 08/91

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

8 CAR NO.: YM-93-026
DATE: 12/28/92
SHEET: 2 OF 2
QA

CORRECTIVE ACTION REQUEST (Continuation Page)

13 Recommended Action(s) (continued)

3. Provide action necessary to preclude recurrence.

4. Determine impact to work accomplished and provide results.

ORIGINAL
THIS IS A RED STAMP

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

8 CAR NO.: YM-93-027
DATE: 12/28/92
SHEET: 1 OF 2
QA

CORRECTIVE ACTION REQUEST

1 Controlling Document
DOE/RW-0215, Rev. 3, QAPD

2 Related Report No.
YMP-SR-93-002

3 Responsible Organization
YMPO

4 Discussed With
R. Dyer

5 Requirement:

Quality Assurance Program Description (DOW/RW-0215), Rev. 3, Section 5, Paragraph 5.0, states in part, "OCRWM activities affecting quality are prescribed by, and controlled in accordance with plans, procedures, and instructions... Planning, preparation, and issuance of plans, procedures, and instructions is accomplished prior to the start of activities affecting quality.

Yucca Mountain Site Characterization Project Tracers, Fluids, and Materials Management Plan, Rev. 1, Paragraph 2.1.4, states in part, "Users of Tracers, Fluids, and Materials (TFMs) are responsible for developing procedures for identifying potential TFM items that are not on one of the controlled lists maintained by LANL, notifying LANL of the possibility for inclusion, and ensuring that TFMs which are used in the course of Site Characterization,

6 Adverse Condition:

Contrary to the above, no procedures have been developed to implement the TFM Plan by any Participant or the Yucca Mountain Project Office. In addition, no TFM lists have been developed nor has there been final analysis of TFMs which have been utilized.

9 Does a significant condition adverse to quality exist? Yes X No___
If Yes, Circle One: (A) B C

10 Does a stop work condition exist?
Yes___ No X ; 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: [X] Remedial [X] Extent of Deficiency [X] Preclude Recurrence [X] Root Cause Determination

13 Recommended Actions:

1. Implement the TFM Plan through quality related procedures.
2. Identify all TFMs utilized to date and provide a methodology to evaluate these TFMs and provide results thereof.
3. Evaluate and provide a means to preclude the use of TFMs which

7 Initiator John S. Martin [signature] Date 12/28/92	14 Issuance Approved by QADD [signature] Date 12/30/92
15 Response Accepted QAR Date	16 Response Accepted QADD Date
17 Amended Response Accepted QAR Date	18 Amended Response Accepted QADD Date
19 Corrective Actions Verified QAR Date	20 Closure Approved by: QADD Date

REV. 08/91

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

8 CAR NO.: YM-93-027
DATE: 12/28/92
SHEET: 2 OF 2
QA

CORRECTIVE ACTION REQUEST (Continuation Page)

5 Requirements (continued)

are used in accordance with limitations and controls established in the list of approved TFMs and by the YMPC."

13 Recommended Action(s) (continued)

have not been evaluated or provide a systematic means of tracking and analysis.

4. Provide root cause determination of the deficiency.