Department of Energy
Washington, DC 20585

QA: L

JUL 25 1997

R. W. Craig, Technical Project Officer
for Yucca Mountain Site
Characterization Project
U.S. Geological Survey
1261 Town Center Drive
Building 12, Room 1249, M/S 423
Las Vegas, NV 89134

VERIFICATION OF CORRECTIVE ACTION AND CLOSURE OF DEFICIENCY REPORT (DR) USGS-96-D-005

The Office of Quality Assurance staff has verified the corrective action to DR USGS-96-D-005 and determined the results to be satisfactory. As a result, the DR is considered closed.

If you have any questions, please contact either James Blaylock at (702) 794-1420 or Ardell M. Whiteside at (303) 236-5050.

James Blaylock for
Donald G. Horton, Director
Office of Quality Assurance

OQA:JB-1987

Enclosure:
DR USGS-96-D-005

cc w/encl:
J. O. Thoma, NRC, Washington, DC
S. W. Zimmerman, NWPO, Carson City, NV
T. H. Chaney, USGS, Denver, CO
D. J. Sinks, OQA/USGS, Denver, CO
A. M. Whiteside, OQA/USGS, Denver, CO

cc w/o encl:
W. L. Belke, NRC, Las Vegas, NV
D. G. Sult, OQA/QATSS, Las Vegas, NV
R. W. Clark, DOE/OQA, Las Vegas, NV

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Recp: NMSS/HLWR

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

8 ☐ Performance Report
☒ Deficiency Report
NO. USGS-96-D005

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PERFORMANCE/DEFICIENCY REPORT

7/23/97

1 Controlling Document:	2 Related Report No.
JP-21, SECTION B, PARA. 2.e(9)	N/A

3 Responsible Organization:	4 Discussed With:
YMP-USGS-ESIP	G. LeCAIN/D. EDWARDS

5 Requirement/Measurement Criteria:

Job Package JP-21, Hydrologic Properties of Major Faults Encountered in the Exploratory Studies Facility North Ramp, Section B, Para. 2.e. (9) states..."Only SF6 or SUVA-Cold MP (Tetra fluoroethane) are approved for use as tracers in ESF tests and concentrations are limited to no more than 20 ppm and 30 ppm, respectively, for tracer injection purposes only"

6 Description of Condition:

SF6 concentrations measured in the pumping interval (Alcove #2) exceeded the requirements stated in Job Package 94-21, Section B, Paragraph 2.e. (9) (page 9 of 13).

7 Initiator	9 Is condition an isolated occurrence?
Robert W. Craig R. W. Craig Date 7/23/96	☒ Yes ☐ No ☐ Unknown: Must be Yes if PR

10 Recommended Actions: (Not required for PR)

Evaluate method used for mixing SF6 in order to get acceptable concentrations at this pumping interval. If appropriate work with YMSCO Permitting Contact and the State of the Nevada to make changes to Permit requirements.

USGS TPO will approve all tracer gas testing unitl a disposition is effected.

11 QA Review:	12 Response Due Date
QAR Emily S Reiter Date 7/26/96	August 23, 1996

13 Affected Organization QA Manager Issuance Approval: (QAR for PR)
Printed Name T. H. CHANEY Signature T H Chaney Date 7/26/96

22 Corrective Actions Verified	23 Closure Approved by: (N/A for PR)
QAR Anne Whitrock Date 7-16-97	AOQAM J Blaylock Date 7/24/97

Exhibit AP-16.1Q.1 Rev. 07/15/96

ENCLOSURE P1. of 2

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7/8/97

PERFORMANCE/DEFICIENCY REPORT RESPONSE

14 Remedial Actions:

SEE p. 3 ~~of 3~~ 7/8/97

15 Extent of Condition: (Not required for PR)

SEE p. 3 ~~of 3~~ 7/8/97

16 Root Cause Determination: (Not required for PR) Required: ☐ Yes ☒ No

NOT REQUESTED

17 Action to Preclude Recurrence: (Not required for PR) Required: ☐ Yes ☒ No

NOT REQUESTED

18 Corrective Action Completion Due Date:	19 Response by: ☒ Initial ☐ Amended	SEE p. 3 ~~of 3~~ 7/8/97 Date	Phone
NA			

20 Response Accepted QAR	Date	21 Response Accepted (N/A for PR) AOQAM	Date
see p. 5	see p. 5	see p. 5	see p. 5

requested amended response

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(AH.1) AH 3/4/97

- Block 14 - Remedial Actions: Complete. A memo dated August 14, 1996 has been prepared and forwarded to Debbie Edwards that specifies the following criteria regarding convergent tracer tests:

  1) A Job Package needs to be prepared or an existing Job Package needs to be revised to include the information relative to performing convergent tracer tests using SF6.

  2) An environmental permit with the state of Nevada for using SF6 as a tracer gas needs to be processed, or the existing permit needs to be modified/revised/changed to allow for injection concentrations consistent with the technical specifications required for conducting convergent tracer tests.

  3) An explanation of the methods used to conduct convergent tracer tests and specifications regarding the maximum volumes of SF6 tracer gas that will be released into rock formations will be provided..

  - Note: Copy of memo attached (AH.1) AH 3/4/97

- Impact on Data: None.

- Schedule of Completion: None. Remedial actions are complete. No additional convergent tracer tests will be conducted until the Job Package & The Environment Permit are in place. See attached memos from Bob Craig regarding the cessation of convergent tracer tests. (AH. 2 & AH. 3) AH 3/4/97

- Investigative Actions: Complete. Specifics regarding the deficient condition were established during an ESIP senior management meeting with YMP-USGS QA office staff and USGS technical staff on August 13, 1996. Resulting actions are outlined in the remedial actions.

Daniel C. Gillies
D.C. Gillies

8-15-96
Date

Gary O. LeCain
G.D. LeCain

8-15-96
Date

Attachment 1 (p. 1 of 2)

United States Department of the Interior USGS-96-D005

U. S. GEOLOGICAL SURVEY
Box 25046 M.S._____
Denver Federal Center
Denver, Colorado 80225

IN REPLY REFER TO:

Information Copy
August 14, 1996

MEMORANDUM

To: Debbie Edwards

From: Gary LeCain GL 8-15-96

Subject: QA--Work actions needed in order to resume convergent tracer tests

As a result of resolving Deficiency Report No. USGS-96-D005, the following actions are needed:

1) A job package needs to be prepared or an existing job package needs to be revised to include the information relative to performing convergent tracer tests using SF6 as the tracer gas.

2) An environmental permit with the state of Nevada is needed for using higher concentrations of SF6 as a tracer gas for conducting convergent tracer tests. Or, the existing environmental permit needs to be modified/revised/changed to allow for the higher concentrations of SF6 used for such tests.

3) Scientific Notebook No. 0088 for using the ITT leakmeter model 200 is used for documenting the convergent tracer tests. This can be verified with Jan Zigler who helped in conducting the convergent tracer test in alcove 2. For the tests, a maximum of 10 liters of SF6 will be injected into the rock formation for any given test.

Additional Information:

The following two job packages list associated test planning packages (TPP) that need to be examined to see if convergent tracer tests are discussed within their content. If so, a new or revised job package may not be needed.

The job packages are:

1) JP 94-21 entitled "Hydrologic Properties of Major Faults Encountered in the Exploratory Studies Facility North Ramp"; associated TPP is T-93-8.

Attachment 1 p. 2 of 2
USGS-96-D005

2) JP 95-1 entitled "Hydrochemistry and Radial Borehole Tests in the Exploratory Studies Facility North Ramp and Test Alcoves"; associated TPP's are a) TPP-92-12, and b) TPP-92-13.

Note: A copy of Deficiency Report No. USGS-96-D005 is attached for your information.

If you have questions or need additional assistance, give me a call at (303) 236-5050, ext. 229.

GPL/sk

w/o Atachment

cc: Dan Gillies
Bob Williams
Bob Craig
Tom Chaney
Martha Mustard
Bruce Parks
Jon Woolverton
Jan Zigler

Attachment 2
USGS-96-0005

United States Department of the Interior

U.S. GEOLOGICAL SURVEY

Rec'd from Dan
8-7-96

Yucca Mountain Project Branch
1261 Town Center Drive, Room 423
Las Vegas, NV 89134

July 23, 1996

Memorandum

To: Gary D. LeCain, Principal Investigator, Earth Science Investigations Program, Yucca Mountain Project, U.S. Geological Survey

From: Robert W. Craig, Chief, Yucca Mountain Project Branch, U.S. Geological Survey

Robert W. Craig

Subject: Convergent Tracer Testing

This is to confirm the previous verbal direction provided to you by Debra Edwards, ESF and Surface-Based Test Coordinator, to cease any additional planned tracer tests until further notice. No further convergence tracer testing or other tracer use by your project shall occur until a demonstration of a tracer release mechanism that unquestionably meets the stipulations of the Underground Injection Control Permit from the State of Nevada.

Test resumption will require, at a minimum, my written notice. I anticipate that other approvals will be required prior to resumption of any tracer testing.

cc: Wendy Dixon, DOE
Susan Jones, DOE
Rick Craun, DOE
Debra Edwards, USGS
Dan Gillies, USGS
Bob Williams, USGS
Mike Harris, M&O
Tom Pysto, M&O
Tom Chaney, USGS

Copy: A. Whiteside 8/7/96

Attachment 3 P. 1/2
USGS-96-D005
Rec'd from Dan 8-7-96

United States Department of the Interior

U.S. GEOLOGICAL SURVEY

Yucca Mountain Project Branch
1261 Town Center Drive, Room 423
Las Vegas, NV 89134

Information Only

July 24, 1996

Memorandum

To: Distribution

From: Robert W. Craig, Chief, Yucca Mountain Project Branch, U.S. Geological Survey

Subject: TRACER USAGE ON THE YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT

Effective immediately, any test activity utilizing tracers shall not be conducted by U.S. Geological Survey (USGS) personnel in support of the Yucca Mountain Site Characterization Project without my specific written notice to precede. My written notice to precede is in addition to any other applicable Yucca Mountain Site Characterization Office (YMSCO) requirements. The purpose of this directive is to ensure full compliance with the Underground Injection Control (UIC) permit issued to the YMSCO by the State of Nevada.

My notice to precede will only be issued upon a demonstration to my satisfaction that the requirements of the UIC permit will be met utilizing the proposed testing methods. You are encouraged to plan well in advance of your field testing in order to ensure timely issuance of the notice to precede. I will require a written description of testing plans and methods to be employed, as well as any applicable YMSCO approvals or documentation prior to issuing a notice to precede.

Please consult with Debra Edwards, ESF and Surface-Based Test Coordinator, for issues related to the use of tracers and the UIC permit. If it is necessary to request a modification of the UIC permit, Debra will coordinate with the appropriate YMSCO personnel. Please be aware that a modification to the UIC permit may be a time consuming process, so plan as far in advance as possible.

The only exception to this directive is the use of a gaseous tracer in conjunction with "dry" drilling, and only when conducted while utilizing USGS technical procedure HP-07, "Method to Inject and Monitor Tracer Gas in Drilling Injection/Return Air Stream."

This directive shall remain in effect until further notice. If you have any questions, please call me at (702) 295-5171.

Distribution:

D. Gillies, USGS
R. Luckey, USGS
Z. Peterman, USGS
B. Parks, USGS
M. Chornack, USGS
R. Williams, USGS
L. Ducret, USGS
B. Dudley, USGS
J. Stuckless, USGS
J. Krulik, USBR
L. Anna, USGS
S. Beason, USBR
D. Beck, USGS
J. Czarnecki, USGS
W. Day, USGS
A. Flint, USGS
L. Flint, USGS
R. Graves, USGS
E. Kwicklis, USGS
R. LaCamera, USGS
G. LeCain, USGS
S. Lundstrom, USGS
B. Marshall, USGS
C. Menges, USGS
D. O'Leary, USGS
J. Paces, USGS
G. Patterson, USGS
S. Pezzopane, USGS
J. Rousseau, USGS
R. Spengler, USGS
P. Tucci, USGS
J. Whelan, USGS
J. Whitney, USGS
A. Yang, USGS

cc: W. Dixon, DOE
S. Jones, DOE
R. Craun, DOE
M. Harris, M&O
T. Pysto, M&O
T. Chaney, USGS
D. Edwards, USGS
J. Zigler, USGS

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Evaluation of 8-15-96 response to USGS-96-D005

Blocks 14 Remedial Actions: This block should identify actions needed to correct the specific condition noted which is that the SF6 concentrations measured in the pumping interval (Alcove #2) exceeded 20 ppm. The action stated in this block is really more an action to preclude recurrence (see discussion below under that heading.) I would suspect that there is nothing that can be done to "remedy" or "correct" what already happened but the response should include a discussion of any impacts. You have concluded that there is no impact on data; please provide your justification for this statement (such that the limitation provided in the job package was not based on a scientific investigation need but solely on an environmental permit requirement if this is the case.)

Block 15 Extent of Condition: This block needs to describe the investigative actions performed to determine the extent of the deficiency and the results of the determination. A reference to a meeting does not suffice; a summary of the meeting discussion is what is needed. Block 10 Recommended Actions requested an evaluation of methods used for mixing SF6; there is no discussion of this in the response although there was a discussion during the meeting concerning using the borehole as a mixing chamber. Another topic discussed in the meeting but not mentioned in the response is why the job package and environmental permit need changing. In addition, a statement is needed regarding how extensive this problem was. (Was the violation in alcove #2 a one-time occurrence in the pump interval? Was there a violation at the tracer injection point for every convergent tracer test? How many convergent tracer tests have there been?)

Block 16 Root Cause Determination: I concur that a formal root cause determination is not required, if an amended response provides a full discussion of the investigative actions.

Block 17 Action to Preclude Recurrence: The action stated in block 14 of the initial response was to write a memo and the initial response stated that the action is complete. The 8-14-96 memo to Debbie Edwards, YMP-USGS Field Test Coordinator, was only an attempt to initiate the necessary actions. The memo to Debbie Edwards did not include all the necessary information for her to initiate the changes requested. Most notably, the needed permissible concentration is not provided. Please coordinate with Debbie to assure that you are getting all the necessary information to her and, in the amended response, provide an interim due date when you can accomplish this.

The letter from Bob Craig is a good interim control but the complete actions necessary to preclude recurrence will be changing of the job package or issuance of a new Field Work Package. (NOTE: Job Packages are being replaced by Field Work Packages per YAP-5.7Q as they are revised.) Because the environmental permit is not a QA document, I would not require

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that the response to this DR include a specific commitment to revise it or to get an exception to it; I expect that the revision/development of the Field Work Package will require this. A final completion date is also needed (i.e., when you expect the Field Work Package revision or new Field Work Package) to be complete. I realize this is not under your control and an educated guess for this date is perfectly acceptable. From discussions during the 8-13-96 meeting, I also realize that these actions may take a very long time (i.e., several months). We in QA need this due date to know when we should expect to be able to verify and close this deficiency report. As Responsible Individuals (per AP-16.1Q), you need to track the actions to know whether they are proceeding or whether you will need to amend your response or ask for an extension.

Martha H. Mustard — 8-30-96

Martha H. Mustard, Quality Assurance Representative — Date

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PERFORMANCE/DEFICIENCY REPORT RESPONSE

14 Remedial Actions:

See page 7

15 Extent of Condition: (Not required for PR)

See page 7

16 Root Cause Determination: (Not required for PR) Required: ☐ Yes ☒ No

17 Action to Preclude Recurrence: (Not required for PR) Required: ☒ Yes ☐ No

See page 7

18 Corrective Action Completion Due Date:
March 31, 1997

19 Response by:
☐ Initial
☒ Amended
See page 7
Date Phone

20 Response Accepted
QAR Martha H Mustard Date 9-17-97

21 Response Accepted (N/A for PR)
AOQAM [signature] Date 9/18/96

AP 7/18/97

Exhibit AP-16.1Q.2 Rev. 07/15/96

Block 14 Remedial Actions: Because the action has already occurred, no action can be taken to correct the completed action. Actions to preclude recurrence are described in Block 17. There is no impact on the data. The information provided in the job package which limited the concentration of gas which could be injected while performing convergent tracer tests was not based on the scientific needs of the test but rather on an environmental permit requirement. Consequently, the tests performed provided valuable and accurate data.

Block 15 Extent of Condition: The investigative actions for this deficiency initially involved inquiries by supervisors to consider the extent of the condition and actions needed to resolve the condition. Preliminary investigations indicated a meeting was needed by ESIP personnel and QA personnel to address the issues. A meeting was held on August 13, 1996. During the meeting all attendees agreed that a new Job Package needs to be prepared by Los Alamos or the appropriate existing Job Package needs to be revised. To achieve that end Debbie Edwards was requested to contact personnel responsible for preparing Job Packages to determine information they would need to prepare a new Job Package or to revise an existing Job Package. The letter of response from Debbie Edwards is attached and the response to her letter is provided at the points indicated in this Block and in Block 17. During the meeting it also was stated that no additional convergent tracer testing would be performed until all matters pertaining to this DR were resolved. (A11.4) DH 3/4/97

A discussion of the methods used for convergent tracer tests and the use of SF6 follows and is in response to Debbie Edwards item 2 - "Description of test." The tracer gas is injected directly from a factory prepared tank containing 1 to 10 percent SF6. No additional mixing of the SF6 is done. The volume of SF6 is then monitored with a mass flow controller. Convergent tracer testing starts with pumping air out of an isolated interval in a borehole. This removal of downhole air creates a pneumatic flow field where the surrounding rock gases flow into the pumped borehole and are subsequently removed from the flow system. Because the tracer release point and the pumping interval are separated by a known distance, the tracer will mix in the pneumatic flow field as it travels the known distance. In the Bow Ridge Fault Alcove the intervals were separated by 3 meters, this means the zone of mixing is a sphere with a radius of 3 meters. This sphere has a surface area of 113 square meters and tracer injection interval had a surface area of approximately 0.06 square meters. This means that with the given flow geometry the tracer gas will be mixed at a ratio of 1883:1. Based on these calculations the convergent tracer tests required SF6 tracer concentrations of 5.6% in order to measure a 30 ppm tracer response in the pumping interval. Because the drilling operations use SF6 and the SF6 measurement system is accurate only at levels in excess of 1 ppm it is necessary to have the high tracer concentrations. If we are restricted to 30 ppm at the tracer release point, the expected tracer concentration at the pumping interval would be 0.015 ppm which is masked by the drilling air and below the monitoring detection limit. Consequently, if the Job Package is not changed or if the Environmental Permit is not modified or will not allow exceptions then no meaningful convergent tracer tests can be run and required technical work cannot be completed.

The equipment and the configuration of the equipment are located at two points, the point of injection and the point of sampling. At the point of injection is the tank with a pressure regulator containing the SF6, a mass flow controller, and packers in the borehole. At the point of sampling are packers, a vacuum pump, and a final mass flow controller.

The extent of the problem occurred during the summer of 1996. In 1996, on June 26, 27, 28, and July 9, 10, 11 the USGS conducted six convergent tracer tests between boreholes 1 and 2 in the Bow Ridge Fault Alcove. These were the only convergent tracer tests preformed in the ESF. The 30 ppm limit was exceeded in the tracer release interval during all six tests. The 30 ppm limit was exceeded in the pumping interval only during test number 2.

Block 17 Action to Preclude Recurrence: The needed permissible concentrations were provided to Debbie Edwards on August 14, 1996. Future convergent tracer testing will require up to 10 liters of 10% SF6 to be released in the boreholes per test. Up to 12 tests may be conducted over a two week period in a single alcove. Tracer testing is scheduled to be conducted in the Northern Ghost Dance Fault Alcove in April of 1997. The preceding information answers Debbie Edwards' item 2 - "Maximum concentration to be injected and maximum volume of SF6."

(A11.4) DH 3/4/97

With regard to Item 1 in Debbie Edwards' memo we agree an updated Field Work Package must be prepared and we will cooperate with the responsible (Los Alamos) party as needed.

The final completion date for this DR is March 31, 1997. While completing the Field Work Package by this date is not under USGS control, completion by this date is required to allow for scheduled alcove testing to begin.

Daniel C. Gillies 9-13-96 G D LeCain 9-13-96

D. C. Gillies Date G. D. LeCain Date

USGS-96-D005

Attachment 4
page 1 of 1

United States Department of the Interior

U.S. GEOLOGICAL SURVEY

August 29, 1996

To: Bob Williams

From: Debbie Edwards

Subject: QA-Work actions needed to resume convergent tracer tests

Here are my suggestions for what is needed before fielding a convergent tracer test:

1. An updated Field Work Package (FWP) must be prepared. [The Test Planning Package (TPP) and Job Package (JP) is being replaced by a FWP. (The TPP and JP procedures no longer exist.) The FWP is currently in review and will be controlled prior to the initiation of drilling in the North Ghost Dance Access Drift on September 9th. As it stands now, it stipulates that the concentration of SF6 during injection cannot exceed 30 ppm. The State of Nevada interprets that to mean 30 ppm at the point of release of the tracer gas.]

2. The PI must submit testing requirements to initiate the process to request a case-by-case exemption from the concentration stated in the permit. (It is my understanding that actually changing the permit is a time-consuming process which requires a public hearing, etc). Testing requirements must include:

   Maximum concentration to be injected and maximum volume of SF6 (ie, 10 liters at 10%)

   Description of test: Methods, equipment, configuration, how the injection concentration will be achieved (ie, mixing of 10% SF6 with __ compressed air or by injection directly from a tank with 0.1% SF6, etc)

3. Scientific Notebook SN-0086 is referenced in the new FWP, as well as, SN-0096.

If you have any questions, please call me at (702) 794-7473.

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MARCH 31, 1997 JW 3-31-97 SUPPLEMENTAL RESPONSE (p. 1 of 1)
(STATUS OF ACTIONS)

ACCORDING TO DEBBIE EDWARDS THIS MORNING, THE JOB PACKAGE FOR LECAIN'S SF_6 INJECTION/TRACER WORK IS STILL IN PROCESS AT LOS ALAMOS. THE ENVIRONMENTAL PERMIT IS STILL IN PROCESS WITH THE STATE OF NEVADA.

Jon Woolington

cc: DEBBIE EDWARDS
GARY LECAIN
SUZY OBRIEN

NOTE: FAXED TO DONNA SINKS @ 3:20 p.m.

Exhibit AP-16.1Q3 REV.07/03/95

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SUPPLEMENTAL RESPONSE EVALUATION AND REQUEST FOR SUPPLEMENTAL RESPONSE (page 1 of 1)

The March 31, 1997 supplemental response (status of actions) has been reviewed and approved. Please submit a supplemental response regarding status of the environmental permit by June 26, 1997.

Supplemental response (status of actions) due June 26, 1997.

Submitted by: Donna Sinks
Donna Sinks, DOE/QATSS

Date: 4/2/97

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Supplemental Response:

According to Debbie Edwards, the field work package is complete, but the state environmental permit has not been submitted to the State for approval yet. Apparently the DOE-YMP environmental people have concerns that need to be addressed, and that is holding the process up. As of today, there is no expected completion date.

Michelle S. O'Brien, 6/24/97 MSO'Brien

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VERIFICATION OF REMEDIAL ACTIONS AND RECOMMENDATION FOR CLOSURE (page 1 of 2)

The Supplemental Response of 6/24/97 has been reviewed. During a review of the history of the DR, it was determined that the USGS has completed all actions necessary to address the DR, with the exception of the issuance (or revision, if appropriate) of the State of Nevada injection permit to allow exceeding the current limits of SF_6. The following is a chronology of the actions relative to this DR:

7/31/96 DR issued

8/14/96 Response (Blocks 14 and 15)
- need new or revised job package to included convergent testing informtion
- need new or revised permit to allow for higher concentration of SF6
- SF6 specifications and explanation attached to DR:

  Att. 1 (8/14/96 memo, LeCain to Edwards):
  - need new or revised job package (JP) to include convergent testing informtion
  - need new or revised permit to allow for higher concentration of SF6
  - SF6 specs. and explanation provided (refers to scientific notebook SN-0088)
  - possibly need 2 revised or new JPs based on contents of Test Planning Packages (TPPs)

  Att. 2 (7/23/96 memo, Craig to LeCain):
  - cease testing until permit stipulations met
  - written notice from Craig needed before testing to resume

  Att. 3 (7/24/96 memo, Craig to Distribution):
  - cease any testing until written notification received from Craig

8/30/96 Evaluation of response and request for amended response
- requested justification for determination that there was no impact on data
- requested summary of meeting
- requested evaluation of methods used for mixing SF6
- requested why permit and JP need changing
- requested expected date of new/revised Field Work Package (FWP), which would include permit actions

9/13/96 Amended response
- Block 14: justified why there was no impact on data
- Block 15: provided summary of 8/13/96 meeting
- Block 15: provided discussion of methods for mixing SF6
- Block 15: provided explanation why job package or permit should be modified
- Block 15: determined extent of problem (boreholes 1 and 2 in Bow Ridge Fault Alcove - Alcove #2)
- Block 17: provided estimated date (3/31/97) of new or revised FWP:

  Att. 4 8/29/96 memo, Edwards to Williams:
  - need updated FWP (will replace TPP and JP) .
  - explained why permit needed changing

9/18/96 Evaluation of Response
response accepted

3/31/97 Supplemental Response
JP (i.e., FWP) and permit still in progress

4/2/97 Acceptance of Supplemental Response and Request for Supplemental Response
- requested supplemental response by 6/26/97 indicating status of permit

6/24/97 Supplemental response
- FWP complete
- permit not approved yet

(continued on page 12)

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PR/DR CONTINUATION PAGE

VERIFICATION OF REMEDIAL ACTIONS AND RECOMMENDATION FOR CLOSURE (page 2 of 2)

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The USGS has satisfactorily completed all actions to this DR over which it has control. USGS management has taken steps to ensure that testing will not resume without the appropriate permission. The PI has been informed (see Att. 2) that testing will not resume until written permission is received from R. Craig, the USGS TPO. Additionally, all YMP USGS personnel were informed (Att. 3) that testing utilizing tracers will not be conducted without written permission from R. Craig. It was reinterated to the PI by D. Sinks, OQA On-site Representative, that any testing using tracers will not resume until written permission is granted.

As a result of the investigative actions and the remedial actions (including impact on data [none] and schedule of completion) taken by the USGS, it is recommended that this DR be closed.

Submitted by: Ardell M. Whiteside Date: 7-16-97

Ardell Whiteside, OQA On-site Representative

USGS 96-D005
Att. 5 (p. 1 of 2)

10/24/96

To: Debbie Edwards

From: Gary LeCain

Subject: FY97 tracer use in ESF testing.

The USGS Major-Faults Testing program requires permission to use SF6 as a tracer gas during air-injection testing and convergent tracer testing. Tests will be conducted under SP 8.3.1.2.2.4.4, WBS 1.2.3.3.1.2.4, Scientific Notebook 0096 (Major Features Air-k Testing in ESF). The tracer will be required during four test periods.

1. Northern Ghostdance Fault single-hole air-injection testing in the geothermal borehole.

Injected tracer concentration: 10 ppm, a 1% tracer gas will be mixed with compressed air using mass flow controllers to control the volumes, mixing will be done uphole and the tracer concentration injected downhole will not exceed 10 ppm. This testing meets the state tracer limit.

Total tracer use over the test period: 0.72 cubic meters of 1% SF6

2. Southern Ghostdance Fault single-hole air-injection testing in the geothermal borehole.

Injected tracer concentration: 10 ppm, a 1% tracer gas will be mixed with compressed air using mass flow controllers to control the volumes, mixing will be done uphole and the tracer concentration injected downhole will not exceed 10 ppm. This testing meets the state tracer limit.

Total tracer use over the test period: 0.72 cubic meters of 1% SF6

3. Northern Ghostdance Fault cross-hole air-injection testing.

Injected tracer concentration: 10 ppm, a 1% tracer gas will be mixed with compressed air using mass flow controllers to control the volumes, mixing will be done uphole and the tracer concentration injected downhole will not exceed 10 ppm. This testing meets the state tracer limit.

Total tracer use over the test period: 1.0 cubic meters of 1% SF6

4. Northern Ghostdance Fault convergent tracer testing.

Injected tracer concentration: 100,000 ppm, a 10% tracer gas will be released into selected downhole test intervals, the tracer will mix in the surrounding rock and be transported under a pneumatic gradient to a sampling interval. This testing will exceed the state tracer permit and will require an exemption.

Total tracer use over the test period: 0.5 cubic meters of 10% SF6

USGS-94-D005, Att. 6
(p. 1 of 2)

United States Department of the Interior

U.S. GEOLOGICAL SURVEY

Yucca Mountain Project Branch
101 Convention Center Drive, Suite 270
Las Vegas, NV 89109

Information Only
October 31, 1996

Ronald Oliver
Los Alamos National Laboratory
101 Convention Center Drive, Room 205
Las Vegas, NV 89109

Attention: Alan Mitchell

Subject: FY 1997 Tracer Use in Exploratory Studies Facility Testing (ESF)

The USGS Principal Investigator for Hydrologic Properties of Major Faults, Gary LeCain, requests permission to use SF6 as a tracer gas during air-injection testing and convergent tracer testing in the ESF. Tests will be conducted under SP 8.3.1.2.2.4. WBS 1.2.3.3.1.2.4, Scientific Notebook 0086 (Major Features Air-K Testing in ESF). The USGS Technical Project Officer concurs with this request. The tracer will be required during the following four test periods:

1. Northern Ghost Dance Fault single-hole air-injection testing in the geothermal borehole.

Injected tracer concentration: 10 ppm. A 1% tracer gas will be mixed with compressed air using mass flow controllers to control the volumes. Mixing will be done uphole and the tracer concentration injected downhole will not exceed 10 ppm. This testing meets the state tracer limit.

Total tracer use over the test period: 0.72 cubic meters of 1% SF6

2. Southern Ghost Dance Fault single-hole air-injection testing in the geothermal borehole.

Injected tracer concentration: 10 ppm. A 1% tracer gas will be mixed with compressed air using mass flow controllers to control the volumes. Mixing will be done uphole and the tracer concentration injected downhole will not exceed 10 ppm. This testing meets the state tracer limit.

Total tracer use over the test period: 0.72 cubic meters of 1% SF6

USGS 96-D005, Att. 6 (p. 2 of 2)

3. Northern Ghost Dance Fault cross-hole air-injection testing.

Injected tracer concentration: 10 ppm. A 1% tracer gas will be mixed with compressed air using flow controllers to control the volumes. Mixing will be done uphole and the tracer concentration injected downhole will not exceed 10 ppm. This testing meets the state tracer limit.

Total tracer use over the test period: 1.0 cubic meters of 1% SF6

4. Northern Ghost Dance Fault convergent tracer testing.

Injected tracer concentration: 100,000 ppm. A 10% tracer gas will be released into selected downhole test intervals. The tracer will mix with air in the surrounding rock and be transported under a pneumatic gradient to a sampling interval. This testing exceeds the state tracer permit and requires an exemption.

Total tracer use over the test period: 0.5 cubic meters of 10% SF6

If you have any questions, please contact me at (702) 794-7473.

Sincerely,

Debra L. Edwards

Debra Edwards
ESF & Surface-Based Testing
Coordinator

cc: R. Craig, USGS, MS 423
G. LeCain, USGS, Denver, CO
D. Luckey, USGS, Denver, CO
G. Severson, USGS, Denver, CO
N. Elkins, LANL

U.S. DEPARTMENT OF ENERGY

OCRWM

YUCCA MOUNTAIN

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT

HYDROLOGIC PROPERTIES OF MAJOR FAULTS ENCOUNTERED IN THE ESF

REVISION 1

FIELD WORK PACKAGE FWP-ESF-96-006

UNITED STATES DEPARTMENT OF ENERGY

USGS-96-0005, Att. 7, p. 2 of 2

YMP-251-R0
04/25/96

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT
ESF FIELD WORK PACKAGE APPROVAL

QA:L

SECTION I (Project Engineer completes)

WP Title:
Hydrologic Properties of Major Faults Encountered in the ESF

FWP Number:	Assigned Project Engineer:
FWP-ESF-96-006	Alan Mitchell

Affected Organizations:
CRWMS M&O (CMO/Constructor, ESF TCO, PIs, Sample Collection Support, Photography Support, Drilling Engineer Support).

HISTORY OF REVISIONS

Revision	Effective Date	Pages Affected	Reason for Change
0	09/09/96	N/A	Initial issue. Replaces TPP T-93-8 and IP 94-21.
1	11/19/96	9, 12, & 18	Correct tracer limits, references, and editorial item.

SECTION II

The following M&O signatures authorize field work to commence in accordance with this FWP and within the constraints identified in the Planning and Control System approved by the YMSCO.

M&O Scientific Program Operations Manager: L. Hayes	Signature: R.E. Smith for LRH	Date: 11-18-96
M&O Site Construction/Operations Manager: [illegible] Sandifer	Signature: R.D. Sandifer	Date: 11-13-96
M&O QA Manager - Nevada: O. Gilstrap	Signature: O.J. Gilstrap	Date: 11-15-96

Exhibit YAP-5.7Q.2

USGS-96-D005
Att. 8, p. 1 of 3

United States Department of the Interior

U.S. GEOLOGICAL SURVEY
1180 Town Center Drive
Las Vegas, NV 89134

WBS: 1.2.3.1
Information Only

May 8, 1997

Ned Z. Elkins
Scientific Programs Office/TEST
1180 Town Center Drive
Las Vegas, NV 89134

Attention: Alan Mitchell

Subject: Transmittal of Test-Related Information for Testing in the Northern Ghost Dance Fault Alcove

At your request, I am providing additional information which was not included in my letter of October 31, 1996, on planned convergent tracer tests in the Northern Ghost Dance Fault Alcove. The Principal Investigator (PI) for Hydrologic Properties of Major Faults, Gary LeCain, is planning to conduct these tests beginning in August 1997. As stated in my previous request, the PI is requesting an exemption from the 20 ppm injection limit for SF6 in order to inject up to 100,000 ppm. The PI is also requesting to inject helium (He) at the same concentrations as follows:

For SF6 and He: A 10% tracer gas will be released into selected downhole test intervals at a concentration of approximately 100,000 ppm. The tracer will mix with air in the surrounding rock and be transported under a pneumatic gradient to sampling interval. Total volume of tracer to be used during the test period is 0.5 cubic meters of 10% SF6.

The procedure that will be used for the work is scientific notebook SN-0096, Major Faults Air-K Testing. A schematic diagram of the injection system is enclosed.

The method used to conduct convergent tracer tests consists of pumping air out of an isolated zone in a borehole. This creates a pneumatic gradient where the surrounding rock gases flow into the pumped borehole and are subsequently removed from the flow system. The test goal is to measure the time it takes for a gas released in the nearby borehole to travel and be removed from the system at the pumped borehole.

As the tracer gas is released into the nearby borehole a few meters away, it mixes with the flowing rock gases and is diluted. The dilution occurs within a spherical zone of mixing

USGS-96-D005
Att. 8, p. 2 of 3

between the two boreholes. In order for the concentrations of tracer gas in the samples removed from the system to be high enough to be measurable and distinguishable from background tracer left in the system from drilling and Air-K testing activities, concentrations of up to 100,000 ppm are required.

If you have any questions or require more information, please contact me at (702) 295-5745.

Sincerely,

Debra L Edwards

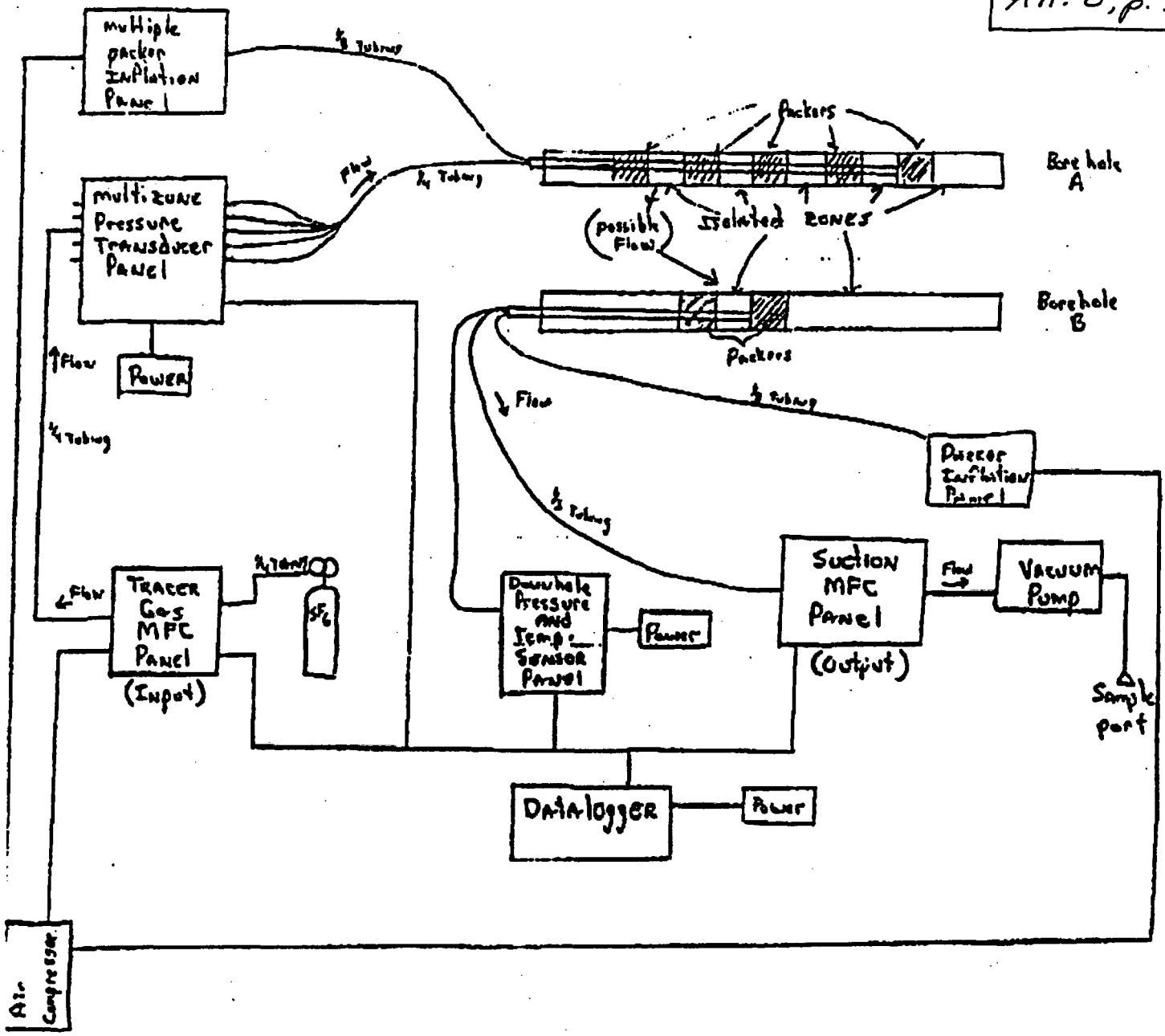
Debra L. Edwards
ESF and Surface-Based Testing Coordinator
U.S. Geological Survey

enclosure

cc: R. Craig,USGS
G. LeCain, USGS/DENVER
G. Patterson, USGS/DENVER
G. Severson, USGS/DENVER
J. Zigler, USGS/MS 721
G. Rodriquez, USGS/MS 721
R. Oliver, LANL, EES-13/LV
R. Kovach, LANL/FO

Typical Tracer Injection Testing System

USGS-96-D005
Att. 8, p. 3 of 3



The SF_6 to be injected is controlled by the Tracer Gas MFC (Mass Flow Controller) Panel. Then it is injected into ONE preselected and isolated zone, the pressure of this zone is also monitored.
All MFC information, pressure and temperature data is recorded by the data logger.

DRAFT

ORIGINAL

OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
DEFICIENCY DOCUMENT ENCODING FORM

1. Document No. USGS | 916 | D010 | 1

Issuing Org. Code
Fiscal Yr. (last 2 digits)
Document Type
Seq. Number
Extension number (for multiple deficiencies)

ORIGINAL

Doc. Type Codes:

C	Corrective Action Request	O	Other: NRC commitments, Vendor documents
D	Deficiency Report	A	Deficiency closed during audit
P	Performance Report	S	Deficiency closed during surveillance
N	Nonconformance Report	T	STIR

2. Initiation Date 07 | 26 | 96 (MM/DD/YY)

3. Deficiency Code: 21 | 9 *

Deficiency Code: | | | *

Deficiency Code: | | | *

4. Deficiency Cause Code: 02C *

Deficiency Cause Code: 04A *

Deficiency Cause Code: | | | *

5. Hardware Code: (if applicable) | | | *

6. Supplier: (if applicable) | | | | | | | | | |

7. Miscellaneous: (if applicable) | | | | | | | | | |

8. Data File Review:

Open deficiency found: ☒ No ☐ Yes - DD#

Three or more recurring deficiencies in the same organization noted in last 4 quarters? ☒ No ☐ Yes

If Yes, STIR initiated? ☐ Yes - STIR No. N/A
☐ No - If No, provide justification:

QAR Emily Miller Date 7-26-96

* See latest revision of Trending Codes List

ORIGINAL

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

☐ Performance Report
☒ Deficiency Report

NO. USGS-96-D005
PAGE 12 OF 12
QA:L

PR/DR CONTINUATION PAGE

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