Department of Energy
Office of Civilian Radioactive Waste Management
Yucca Mountain Site Characterization Office
P.O. Box 98608
Las Vegas, NV 89193-8608

WBS: 1.2.5.2

MAY 01 1996

Overnight Mail

John H. Austin
Performance Assessment and
High-Level Waste Integration Branch
Nuclear Materials Safety and Safeguards
U.S. Nuclear Regulatory Commission
2 White Flint North
Rockville, MD 20852

REPORTABLE GEOLOGIC CONDITION: U.S. DEPARTMENT OF ENERGY (DOE) STUDY PLAN 8.3.1.2.2.2 "WATER MOVEMENT TRACER TESTS USING CHLORIDE AND CHLORINE-36 MEASUREMENTS OF PERCOLATION AT YUCCA MOUNTAIN" (SCPB: 8.3.1.2.2.2)

The Yucca Mountain Site Characterization Office (YMSCO) has invoked the procedure YAP-30.27, "Reportable Geologic Conditions," and has documented the evaluation required in the enclosed records package (enclosure 1).

As part of ongoing site characterization activities at Yucca Mountain, researchers at Los Alamos National Laboratory have detected elevated levels of Chlorine-36 in rock samples collected from several locations in the Exploratory Studies Facility (ESF). The elevated levels of Chlorine-36, found at various depths up to 600 feet (185 meters) below the surface, suggest that a small amount of water carried Chlorine-36 to some locations in the ESF in less than 50 years.

The preliminary report, "Systematic Sampling for Chlorine-36 in the Exploratory Studies Facility," was written following the collection and analysis of rock samples from 52 locations in the ESF. The purpose of this study is to assess the hydrology and evaluate water infiltration at Yucca Mountain. Researchers will continue to analyze rock samples for levels of Chlorine-36 and other indicators of age.

Chlorine-36 is created naturally by the action of cosmic radiation on the atmosphere and researchers expected to find background levels of Chlorine-36 in some of the locations where elevated levels were found. The detection in a few locations of larger quantities of Chlorine-36, perhaps generated by the atmospheric testing of nuclear weapons, suggests the radioisotope traveled from the atmosphere to its current location in less than 50 years.

YMP-5

The planned 5-mile long ESF tunnel is being excavated to allow scientists to study the geology, hydrology, and geochemistry in the rock within Yucca Mountain. The Chlorine-36 was found clustered at 5 locations along the first 3,400 meters (2.11 miles) of the ESF tunnel. Four of the five locations are associated with observable faults or fractures.

Based on the analysis of current data, the Department has not reached a conclusion on the significance of these findings. As site characterization studies continue, additional samples will be collected and analyzed as the tunnel boring machine advances within the ESF, and additional modeling studies will be performed to evaluate the significance of these data. The goal of these testing and modeling efforts is to understand the hydrologic processes at work at Yucca Mountain.

If you have any questions, please contact April V. Gil of my staff at (702) 794-5578, or Dennis R. Williams of the Assistant Manager for Scientific Programs office at (702) 794-1417.

for Stephan J. Brocoum
Assistant Manager for
Suitability and Licensing

AMSL:TWB-1630

Enclosures:
1. Records Package for YAP-30.27
2. Summary Report of Chlorine-36 Studies

cc w/encls:
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Records Processing Center

YMP-197-RO
07/24/95

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT
REPORT OF UNEXPECTED GEOLOGIC CONDITION

SECTION 1. INITIAL RESPONSE

Initiator:	Phone:	Date:	Time:
W. Arch Girdley	794-1934	04/17/96	4:00 AM/PM

Location:
Exploratory Studies Facility North Ramp Main drift; between Stations 2 and 36

Description:
See attached sheet

Study Plan Number: (if applicable)	Configuration Item Number: (if applicable)
8.3.1.2.2.2 Water Movement Tracer Tests	N/A

Evaluation:
ESF occurrences of bomb-pulse Cl-36 were anticipated by the LANL Pricipal Investigator. Modeling results show that observed Cl-36 signals are consistent with existing conceptual models and parameter estimates. While base-case parameters predict Pleistocene-age water in the ESF, parameter changes consistent with increased fracturing of the PTn unit (as might be associated with faults) lead to a prediction of a small component of bomb-pulse Cl-36 in ESF factures.

Recommendation of technical significance, non-technical significance, or non-significance:
Non-technicaly significant

Justification:
The reported occurrencees do not meet the test of being "unexpected." It would be appropriate to report the findings to the NRC and other oversight bodies as a means of apprising them that we recognize the condition and that it continues to be addressed as part of on-going site characterization activities.

Recommendation of additional data needs and/or delay or work:
N/A

Justification:
The Principal Investigator is already prepared to continue Cl-36 studies in the ESF and elsewhere at the site and has definite plans for additional investigations that will shed further light on potential fast pathways for water movement.

Actions taken:
None required.

FTC or Designee Signature:	Date:
W. A. Girdley	4-17-96

POTENTIAL UNEXPECTED GEOLOGIC CONDITION (Attachment)

Description of Condition:

A recent (March 29, 1996) summary report on Chlorine 36 (Cl-36) studies prepared by Los Alamos National Laboratory (Fabryka-Martin and others) reveals that bomb-pulse Cl-36 was detected at a few distinct fractured and/or faulted zones in the Exploratory Studies Facility (ESF), indicating that at least a small proportion of the water at these locations is less than 50 years old and the features are active paths for preferential flow. The summary is based on analyses of samples collected at 52 locations between Stations 2 and 36. Samples from 11 sites from the Tsw indicate bomb-pulse signals. All but one appear to be in the general vicinity of fault zones projected from their mapped surface locations (imbricate fault zone, Drill Hole wash structure, Sundance fault), but most of the samples showing bomb-pulse Cl-36 are associated with syngenetic features, mainly cooling joints, lithophysal cavities with intersecting cooling joints, and syngenetic breccias. Because of the potential impact on groundwater travel time scenarios it was decided to evaluate the reported bomb-pulse Cl-36 occurrences to determine whether it qualifies as a "unexpected geologic condition."

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT
REPORT OF UNEXPECTED GEOLOGIC CONDITION

SECTION 2. REVIEW OF ACTIVITIES AND RESPONSE CLOSEOUT *(to be completed by the AMSP or designee with concurrence from the AMEFO, AMSL, and FTC or their designees)*

Review of FTC evaluation:

See Attached

This geologic condition has been evaluated and determined:

☐ Technically Signficant and Reportable per YAP-30.27 See Attached

☐ Non-technically Signficant or Non-significant

If technically significant and reportable:

1. Additional data needs are indicated ☒ Yes ☐ No

   Description: *(data needs, responsible persons, study plans, etc.)*

   See Attached

2. Delay of work is indicated: ☐ Yes ☒ No

   Description: *(extent of delay, hold points, affected organizations, affected activities, etc.)*

   See Attached

Persons notified of decisions and course of action:

Notification of April 6:1 AMSL

AMSP or Designee Signature: Deputy AMSP	Date: 4-23-1996
AMEFO or Designee Signature:	Date:
AMSL or Designee Signature:	Date:
FTC or Designee Signature:	Date:

Section 2.

Review of FTC evaluation:

In the review of the FTC evaluation, the following additional information was considered and determined to be a Reportable Geologic Condition and Technically Significant.

The presence of "bomb pulse" on smaller fractures in the most recent CL-36 test results has caused DOE to revisit the conceptual models that define the hydrology of the site and refine the testing program with regard to these findings. Larger features such as the Ghost Dance Fault were obvious candidates for fast paths and the presence of "bomb pulse" and have been targeted with previously planned testing alcoves. CL-36 and "bomb pulse" CL-36 were expected to be measured at the potential repository horizon typically on larger scale features such as the Ghost Dance Fault and therefor consistent with the current conceptual model(s). The specific hypothesis being tested was, "... water within the rock mass of the Topopah Springs welded (Tsw) hydrogeologic unit is effectively stagnant and has been effectively stagnant over the past several thousand years." This hypothesis is now questioned due to the presence of "bomb pulse" on relatively small fracture surfaces significantly removed from larger faulted structures. The refined program will provide additional testing and analysis targeted at the smaller fracture features in both the Ptn, the barrier unit, ~~and~~ the Tsw, the proposed repository horizon rock.

4/25/96 and 4/25/96

Technically Significant and Reportable per YAP-30.27

As noted above, this condition precipitated a rethinking of current conceptual models and adjustments to the existing testing program. Although the range of values may have been expected, the presence of "bomb pulse" on minor fracture features would dictate that Subsection 3.4 a) 4) applies: "sufficiently relevant such that acquisition of additional data would be required to document the condition."

1. Additional data needs are indicated: Yes

Description: The principal investigator already has an appropriate study plan in place. The additional data needs will include more samples and analysis of key locations such as the boundaries of the Ptn and throughgoing fractures in the Ptn to better understand the lateral diversion and conductive properties of this unit. Below the Ptn boundary "conduit" paths v/s "dispersive" paths in the Tsw will be tested.

2. Delay of work is indicated: No

The collection of and analysis of samples for this condition is not time-dependant.

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT
REPORT OF UNEXPECTED GEOLOGIC CONDITION

SECTION 3. NOTIFICATION OF NRC ORs AND OTHER AGENCIES *(to be completed by the AMSL or designee)*

NRC ORs by telephone:

NRC Contact: ORs picked up a copy of LANL report Date: 4/17/96 Time: PM AM/(PM)

Signature: Thomas W. Bjurstedt

NRC ORs by letter:

NRC Contact: Date: Time: AM/PM

Procedural Agreement Agency by telephone:

Agency Contact: Date: Time: AM/PM

Signature:

Procedural Agreement Agency by letter: This records package is enclosed with a cover letter to NRC (Brocoum to Austin) that entered YMSCO concurrence

Agency Contact: John Austin, NRC Date: 4/25/96 Time: 12:00 AM/(PM)

Procedural Agreement Agency by telephone:

Agency Contact: Date: Time: AM/PM

Signature:

Procedural Agreement Agency by letter:

Agency Contact: Date: Time: AM/PM

Procedural Agreement Agency by telephone:

Agency Contact: Date: Time: AM/PM

Signature:

Procedural Agreement Agency by letter:

Agency Contact: Date: Time: AM/PM

Procedure completed: 4/25/96

AMSL or Designee Signature: Thomas W. Bjurstedt

Date: 4/25/96