

MEMORANDUM FOR: Ronald Ballard, Chief
Geosciences & Systems Performance Branch, HLWM

THRU: Philip S. Justus, Section Leader
Geology-Geophysics Section
Geosciences & Systems Performance Branch, HLWM

FROM: Abou-Bakr Ibrahim
Geology-Geophysics Section
Geosciences & Systems Performance Branch, HLWM

SUBJECT: TRIP REPORT; 52nd MEETING AND TECHNICAL EXHIBITION OF THE
EUROPEAN ASSOCIATION OF EXPLORATION GEOPHYSICISTS (EAEG)

From May 28 to June 1, 1990, I attended the EAEG meeting in Copenhagen, Denmark. The purpose of attending the meeting was to get acquainted with new techniques and developments in geophysical data gathering, processing and interpretation. The meeting consisted of several sessions. Each session was devoted to a particular topic in geophysics. The different sessions in the meeting covered the following topics:

1. Data interpretation
2. Data processing
3. Data inversion
4. Modelling
5. Environmental Geophysics and Groundwater
6. Borehole and Vertical Seismic profiling (VSP)
7. Engineering Geophysics
8. Environmental Geophysics and Waste Deposits

All these topics discussed at the meeting are relevant to the high level waste program at Yucca Mountain. The surface based testing program, proposed by DOE at Yucca Mountain, deals with all the topics discussed at this meeting. I consider my attendance at this meeting was very beneficial and some of the techniques discussed at the meeting will give me the opportunity to examine and review the different study plans for surface based testing with up-to-date state-of-the-art knowledge. Also, I had the chance to discuss with O. Olsson, one of the principal investigators for the Stripa Project in Sweden, the latest development in ground penetration radar used at Stripa. Also, I may be able to arrange for a presentation at NRC by Dr. Stuart Crampin of the British Geological Survey about his latest techniques for measuring crack geometry and orientation in situ around waste repositories.

9007240272 900719
NMSS SUBJ
412 CDC

Delete: CNWRA

412
NHXV

The following is a short summary of few of the papers presented at the meeting:

THE STRIPA PROJECT, A TEST OF BOREHOLE RADAR AND SEISMIC METHODS IN CONNECTION WITH STORAGE OF HIGH LEVEL NUCLEAR WASTE.

Detailed knowledge of subsurface layers is often necessary to evaluate hydrologic flow at repository sites such as Yucca Mountain and to assist in developing effective monitoring and mitigation procedures. Therefore, borehole radar and borehole seismic methods have been developed to identify and characterize fracture zones. These methods are used to find the orientation and extent of fracture zones which constitute the major pathways for groundwater movement. The author developed a new directional borehole radar antenna which can be used to determine the orientation of a fracture zone in a single borehole.

To test the directional radar, 5 boreholes were drilled at Stripa mine and measurements were made to predict the locations and extent of fracture zones. Later, additional boreholes were drilled and the prediction in the first 5 boreholes were verified.

APPLICATIONS OF GROUND RADAR

Adequate knowledge of fault displacement at a repository is essential in order to assess its safety as storage facility. The authors of the paper indicated that ground radar with a center frequency of 250 MHz can accurately map fault with displacement as small as 5 cm. Also, reflection survey results show that ground radar can be used to map fracture in the tunnel roof. It is suggested, that data obtained from the field can be substantially enhanced by computer processing techniques such as frequency filtering, gain application, velocity filtering, migration and color display. These enhancements will improve the resolution and interpretability of the data.

In another presentation, the authors showed recent surveys in different parts of the Netherlands. They used 500 MHz source, and ran 5 scans per profile. The accuracy of the measurements for subsurface object locations were $X = 50$ cm and $Z = 20$ cm; the average depth of penetration was 1.5 m.

GEOPHYSICAL SURVEYS OF HAZARDOUS WASTE DEPOSITS

Delineation of concealed canister for retrieval has to be considered in case of any type of leakage in the underground facility. Therefore, the Environmental Protection Agency (EPA) in Germany has carried out 13 geophysical surveys of 8 hazardous waste sites. They indicated that since most waste deposits contain some iron, magnetic surveys have proved to be a fast and low cost methods of delineating concealed repositories and pinpoint concentrations of iron scraps.

SHALLOW REFLECTION SEISMIC APPLIED IN THE STUDIES OF ONSHORE QUATERNARY SEDIMENTS

It has been demonstrated that the seismic reflection method is the only applicable and economical alternative to direct mapping and drilling. High resolution seismic reflection methods are becoming increasingly needed for detailed mapping of the shallow subsurface (0-1000 m). For non-saturated medium in which the upper layer acts as a high-cut filter and with variable near-surface high velocity, development of a data acquisition system and special data processing could overcome this problem.

This situation is typical to what is existing at Yucca Mountain, where so far no good reflection could be gathered. Following the above mentioned suggestion may overcome the problem. Therefore, any seismic survey should be designed with the following objectives in mind, emphasis should be placed on the relation between acquisition, processing parameters and survey goals.

DETERMINATION OF ELECTRICAL ANISOTROPY AND ITS HYDROLOGICAL SIGNIFICANCE

A detailed knowledge of the Geology is often required in hydrological modeling. For example, thin layers of clay/silty material embedded in sandy formation may be hard to detect and may have a great influence on the flow of water in the ground. The authors indicated that by using d-c resistivity and induction methods they were able to identify electrical anisotropy and the detection of the thin layer presence.

Such approach may be applied at Yucca Mountain for identification of thin embedded layer, which may contribute to any groundwater movement, in the repository horizon.

In another paper, the authors used continuous electrical sounding, combined with time and vertical geoelectrical sounding for hydrological mapping. The results from these different measurements were verified by drilling a well down to 250 m depth. The authors found that combining continuous electrical sounding and time E.M. is a powerful tool in identifying zones of high and low permeability while combining time domain and vertical geoelectrical is more reliable in determining lateral continuity of the formation.

TRAVEL TIME INVERSION OF VSP AND HSP DATA IN A LAYERED MODEL WITH ELLIPTICAL ANISOTROPY

For seismic reflections data processing, a good knowledge of static corrections is needed. These corrections play a greater role in shallow high resolution seismic reflection than in a standard survey. In high resolution surveys, high frequency sources are used, hence the weathering and elevation corrections have to be known with higher accuracy.

In this presentation, the authors used a PC-based system for the exact reductions to a datum level below the zone of rapidly varying velocities. The system consists of: 1) An interactive program for the picking of first arrivals, 2) a semi automatic program that construed continuous travel time

JUL 19 1990

- 4 -

curves, 3) a program to estimate the overburden velocity, 4) an interactive ray tracing program that optimizes the model by comparison with the raw data and reduces the reflection data to the datum level.

In another paper the authors discussed the different computational methods for determining the seismic quality factor from vertical seismic profiling measurements. The methods they used to estimate the attenuation are: a) amplitude decay, b) analytical signal, c) frequency modeling, d) matching techniques, e) phase modeling, f) rise time, g) spectral modeling, and h) spectral ratio. The authors found that no single method is superior but depending on recording, noise or geology, different methods should be tested.

RECEIVER ARRAYS TO ENHANCE WEAK SIGNALS IN WIDE ANGLE PROFILING

The authors indicated that air gun shots are effective and an economic way of obtaining closely spaced wide-angle record sections. The signal to noise ratio on the sections will be enhanced by using receiver arrays rather than single seismometers. One important note is that stacking of several channels from an irregular pattern can further increase the signal to noise ratio if static corrections are negligible or unknown. This approach may be very useful at Yucca Mountain since the static corrections are not well known.

15/

Abou-Bakr Ibrahim
Geology-Geophysics Section
Geosciences & Systems Performance Branch, HLWM

DISTRIBUTION:

Central Files
RBrowning, HLWM
JLinehan, HLPD
GPA

HLGP r/f
BJYoungblood, HLWM
GARlotto, D/DNMSS

NMSS r/f
RBallard
RMBertero, D/NMSS

OFC : *[Signature]* :HLGP *[Signature]*

NAME: AIbrahim/ga :PJustus

Date: 7/19/90 : 7/19/90
