Weston Geophysical CORPORATION

August 1, 1985
WGC - R531

US Nuclear Regulatory Commission
Division of Waste Management - NMSS
Washington, DC 20555

ATTN: Dr. Abou-Bakr Ibrahim, SS-623

SUBJECT: Basalt Waste Isolation Project [BWIP]
Trip Report of July 26, 1985 DOE/NRC Meeting
in Austin, Texas on Seismic Reflection Survey

Gentlemen:

In accordance with the provisions of contract NRC-02-84-001, Task Order No. 0012 dated July 19, 1985, we hereby enclose the findings and comments by Dr. Glyn M. Jones and Mr. Edward N. Levine resulting from their participation in the subject meeting. This meeting provided a status report on the DOE/Rockwell reflection profiling program.

In accordance with the contract requirements, Weston Geophysical has provided the Nuclear Regulatory Commission with technical assistance in the review and assessment of the reflection profiling program. It would be most helpful to the Nuclear Regulatory Commission and their reviewers if the progress of the test reflection survey programs and the additional processing planned for the test data could continue to be monitored before production surveying begins.

We wish to thank the Commission for the opportunity to participate in this meeting and in the review of this important project.

Very truly yours,

WESTON GEOPHYSICAL CORPORATION

Edward N. Levine
For Vincent J. Murphy
Principal/Manager

ENL:wpt-0068J1

BASALT WASTE ISOLATION PROJECT [BWIP]

COMMENTS ON DOE/NRC MEETING ON SEISMIC REFLECTION SURVEY

AUSTIN, TEXAS
JULY 26, 1985

Meeting took place to discuss the status of seismic reflection profiling program including data processing activities. Participants were:

Dr. Abou-Bakr Ibrahim, Nuclear Regulatory Commission
Dr. Glyn M. Jones, Weston Geophysical Corporation, Consultant to NRC
Edward N. Levine, Weston Geophysical Corporation, Consultant to NRC
Bruce Hurley, Geologist, Department of Energy
Ernest Berkman, Emerald Exploration, Consultant to Rockwell Hanford
Dr. James K. Applegate, Applegate Associates, Consultant to Rockwell Hanford
Ann Talman, Rockwell Hanford
Joe Kunk, Rockwell Hanford
Jan Bayshore, Rockwell Hanford Licensing

Summary

The meeting was held at the offices of Emerald Exploration Corporation [EMEX] to review preliminary data and processing from a 28-fold test line shot parallel to and approximately 1,000 feet west of Line 5 previously shot by SSC at DOE's Reference Repository Location, Hanford, Washington. The data were acquired by Walker Geophysical and processed by Digicon.

Various tests were performed using different sources, including small [1/3- 1 lb] dynamite charges in shallow [13 ft] holes [referred to as mini-holes]; primacord in 2 x 20 ft and 1 x 25 ft lengths perpendicular to and parallel to the line; and airguns. The spread consisted of 56 geophone stations, in split-spread mode, 25-ft station spacing; each station consisting of 12 x 40 Hz geophones spread over 50 ft parallel to the line. The sampling interval on recording was 1 ms. Ground roll was attenuated by applying a 60 Hz low cut filter to the recorded data.

These acquisition parameters were chosen to provide higher frequencies and greater fold than the previous SSC shoot in an attempt to image reflectors within the suprabasalt sediments and in the upper basalt flows. The results of preliminary processing [filter, elevation statics, velocity analysis, NMO, mute, residual statics, stack] of the mini-hole data indicated that only part of this goal was achieved. The processing revealed a previously-unseen reflection horizon at approximately 100 ms two-way travel time within the suprabasalt sediments which fades out upslope beneath a surficial gravel layer. However, reflection horizons below 300 ms, including the top of the basalt/basal Ringold horizon, were poorly imaged on the final section.

Rockwell and its consultant, EMEX, have concluded that part of the problem in imaging the basalt layers may be caused by the poor low-frequency response of the 40 Hz geophones. They have, therefore, decided to proceed with another limited series of tests using 20 Hz geophones. Because of contractual constraints with Walker Geophysial, this test program will commence immediately, while processing of the existing test data continues. However, the Option 1 and

Option 2 surveys [described at the May 23, 1985] meeting tentatively scheduled to be completed at this time have been cancelled from the present program due to the contractual time constraints and uncertainty in the reflection data acquisition parameters.

Comments

1. On the basis of the limited test data that have already been processed, part of the problem in imaging the basalt layers appears to lie in the processing parameters, rather than in acquisition. Reflected events at 300 ms could be clearly seen on the filtered shot records and on the moved-out CDP gathers. Based on their moveout time, these events do not appear to be multiples. However, these events do show considerable static shifts from trace to trace, even after residual statics have been applied. They would not therefore be expected to stack well. A probable cause of the static problem is near-surface velocity and/or structural complexity which has not been adequately handled by applying elevation statics alone. A discussion on the computation and application of static corrections is given below.

2. Also apparent on the final section from the mini-hole test were low-velocity events crossing and obscuring the primary reflections. These events could arise from random scattering within the near-surface weathered layer. Larner, et al. [Geophysics, Vol. 48, 7, p. 854, 1983], investigated this problem, which is particularly prevalent in certain marine data, and showed that the noise could be effectively attenuated by f-k filtering in shot or receiver space, resulting in improved velocity analysis and enhancement of the primary reflections.

Conclusions

The primary goal of this project, as described in E.N. Levine's trip report of the May 23, 1985 meeting, is to image reflectors within the basalt and in the suprabasalt sediments. At these shallow depths [less than 500 ms two-way travel time], particular problems in processing occur. Velocities are relatively low, resulting in large moveout times, and static shifts can be significant. Therefore, particular care should be taken in evaluating the results of each processing step. Routine processing may not be adequate to enhance any events present in the data.

Rockwell/EMEX indicated during the meeting that additional processing on the existing test data, including the application of refraction statics, would be performed. This is an important step which must be carefully integrated with velocity and residual statics determination to be fully successful. An appropriate processing sequence would be as follows:

a. Using refraction data, compute one-way vertical statics from the surface to a flat datum at the deepest point on the section determined by the refractions. These statics would include 1) short-wavelength time shifts due to local elevation changes and structure beneath the geophones or shots, and 2) long-wavelength statics caused by broad changes in topography and lateral variations in velocity and/or structure.

b. Within each CDP gather, add the shot and receiver statics [SUM] for each trace and take the average [AVERAGE] of the SUMs. Apply the time difference [SUM-AVERAGE] to each trace. This removes the short-wavelength statics for velocity analysis and is similar to applying elevation statics to a floating datum, with the difference that the corrections take into account other possible short-wavelength time shifts unrelated to topography,

c. Perform velocity analysis and NMO.

d. Take the mean [MEAN] of all the AVERAGEs and apply the time difference [MEAN-AVERAGE] to each moved-out trace. This corrects for long-wavelength statics relative to the average elevation along the line.

e. Perform a surface-consistent residual statics calculation, paying particular attention to residual NMO and cross-correlation coefficients.

f. Apply residual statics, stack and shift to a final datum.

It may be worthwhile to recompute velocities after step [e]. Other processing steps, such as f-k filtering to remove coherent noise, and tau-p velocity analysis, may be beneficial.