101 PDR-1 LPDR-Wm-10 (2)

AUG 1 9 1987

AI/8/19/87

Mr. Scott A. Jones
Manager Geophysics
Rocky Mountain Division
Shell Western E&P Inc.
P.O. Box 831
Houston, TX 77001

Dear Mr. Jones:

I am sending you this letter of instruction (LOI) for your information. If you have any comment regarding this LOI, I will be glad to hear from you. This is a preliminary LOI which BWIP had written. Thank you for the time you and the Shell's staff spent with me discussing the seismic reflection data collected in the vicinity of the Hanford site.

Sincerely,

/S/

Abou-Bakr Ibrahim
Technical Review Branch
Division of High-Level Waste Management, NMSS

Enclosure:
As stated

8725006415
WM Project: WM-10
PDR w/encl
(Return to WM, 623-SS)

WM Record File: 101
LPDR w/encl

H

WM Record File 101
WM Project 10
Docket No.
PDR ✓
LPDR ✓ (B)
Distribution:
(Return to WM, 623-SS)

8710220434 870819
PDR WASTE
WM-10 PDR

1633

SEISMIC REFLECTION TESTING
Letter of Instruction

1.0 SUBJECT

This Letter of Instruction (LOI) is to provide potential seismic reflection contractors with the equipment requirements, current technical plan-of-attack, and background information needed to assist BWIP in evaluating seismic reflection acquisition parameters for the Basalt Waste Isolation Project (BWIP).

2.0 REFERNECES

The work identified in this LOI is a prerequisite to seismic reflection data acquisition activities as outlined in the Structure Geology Study Plans. This current work must be completed to provide proper data acquisition parameters for the seismic work to be done prior to startup of the ES shaft.

The work to be performed through the execution of this Letter of Instruction is not intended to be used for the licensing of a nuclear waste repository in basalt. Rather the work, and resulting data, will be used to develop acquisition parameters, and procedural requirements for acquiring high quality seismic reflection data in the area of the BWIP's proposed repository site.

3.0 INTRODUCTION

The Seller is to provide reflection seismic geophysical work required by the Basalt Waste Isolation Project (BWIP) in support of its assigned task for the U.S. Department of Energy. The prime objective of the BWIP is to study the feasibility of storing radioactive wastes in a repository mined in basalt.

The objectives of the developmental testing described herein are:

1. Assess the utility of three-dimensional seismic reflection techniques at the proposed repository area.

2. Develop seismic reflection acquisition parameters for use in accurately mapping the surpa-basalt sediments and top of the basalt surface.

3. Develop seismic reflection acquisition parameters to be used to image the subsurface from 0.5 to 1.5 kilometers.

4. Develop seismic reflection acquisition parameters to be used to delineate the structure of the bottom of the basalt and sedimentary rocks below the basalt sequence (approximately 5 kilometers).

5. Develop Quality Assurance procedures for the acquisition of seismic reflection data in a production mode.

3.1 BACKGROUND

Geology

The geology of the Pasco Basin area, of which the Hanford Site is a part, (Figure 1) is characterized by three general stratigraphic divisions. Oldest and lowest in the known section is the Columbia River Basalt of Miocene age which is composed of many flows, conservatively estimated at more than 100. The upper section of basalt is known to have abundant sedimentary interbeds between the individual basalt flows. Surface mapping and shallow borehole control reveals that the basalts are folded into a system of east-west trending anticlinal ridges and synclinal valleys. Magnetotelluric data and gravity inversions indicate that the bottom of the basalt sequence is from 4 to 5 kilometers below the land surface at the proposed repository location.

Above the basalt sequence lies the Pliocene Ringold Formation composed of layers of sand, silt, clays and gravels of variable thickness and lateral persistence. The gravels range in size from large sand to boulders and occur in various states of cementation. The Ringold Formation is capped by a layer of recent fluvial and glaciofluvial sediments varying in thickness from zero to more the 100 meters. These recent sediments are mainly sands and clean washed gravels.

Seismic

In fiscal years 1979 and 1980, approximately 200 kilometers of Vibroseis (trademark of Conoco) seismic reflection data were collected, processed and interpreted. The data acquisition and processing were an attempt at relatively high resolution of the upper kilometer of basalt layers. The parameters were a hybrid of deep investigation parameters and shallow, higher resolution engineering parameters.

The interpretations of these data yielded a generalized top of the basalt configuration, identifying folds and possible faults displayed in the time domain. Some deeper events are recognized, but are not laterally continuous. These features are difficult to

characterize due to poor reflection continuity. The poorest quality data occurs in the primary area of interest, and is apparently due to the thick section of Ringold Formation and recent sediments.

Several line kilometers of this data have been reprocessed indicating that suprabasalt sediment and uppermost basalt mapping is possible with seismic reflection, given good stratigraphic ties and parameter control. The reprocessed results have fundamental limitations though, due to the acquisition parameters.

Significant knowledge has been gained since the original data collection, processing and interpretation. A better understanding of the velocity layering, as well as other supporting data such as numerous boreholes, gravity, magnetics and limited shallow refraction data spurred additional tests in 1985.

The 1985 tests were performed to assess high-resolution reflection techniques. Tests were performed using dynamite, air-guns and primacord sources with various source and receiver array configurations. High resolution information below 100 milliseconds was generally not attained. These tests did reveal that a significant part of the record lies within a diverse shot-generated noise train (Figure 2).

4.0 SCOPE OF SERVICES

The Seller shall, in accordance with the Quality Assurance provisions of Section 6.0, and General/Special Conditions of Work of Section 7.0, below, provide the necessary services, material, and equipment to perform all aspects of seismic reflection and refraction surveying in accordance with the tasks specified in Section 5.0, below.

The Seller shall conduct this testing at the direction of the Buyer's technical representative. The details of the testing shall be determined at a meeting between technical representatives of the Buyer and Seller. This meeting will take place at the Buyer's office no less than one week prior to commencement of testing.

The Seller shall provide a seismic reflection field crew and equipment to conduct acquisition development testing for a period of thirty (30) working days. This testing will begin during the month of September 1987. In addition, the Buyer may extend the period of testing on a per week basis for up to four (4) weeks. The Seller will be notified of this extension at least one (1) week prior to completion of the then current testing sequence.

The Seller and Buyer's technical representatives will maintain close communication throughout the progress of the work to ensure that the Buyer's technical staff are cognizant of the Seller's data acquisition procedures and rationale, and to ensure that any data inadequacies can be identified and, if possible, corrected in a timely manner.

5.0 SPECIFIC SERVICES REQUIRED AND SPECIFIC INSTRUCTIONS

5.1 Equipment and Personnel Required

The Seller shall provide the following equipment to perform a field data acquisition testing program.

Minor deviations in the hardware specifications may be negotiated with the Buyer's Technical representative which may enhance field production, but will not effect the objectives of the tests.

5.1.1 Recording Equipment

Number of Channels	120 Minimum
Number of Acceptable Data Traces	116 Minimum Per Shot Pattern (No more than 3 percent of the data traces can be unacceptable.)
Digitization Mode	Instantaneous Floating Point Gain with No Less Than 14 Bits Mantissa
Sample Rate	2 msec
High-cut Filter	125 to 150 Hertz
Notch Filter	60 Hertz (Switchable in/out)
Field Monitors/Oscillograph	
Group Intervals	37 meters maximum
Summer/correlator	Able to record each shot individually

A second cable may be used by the Seller with shorter group interval take-outs for initial testing.

The field tapes shall be recorded in a standard Society of Exploration Geophysicists (SEG) field format at either 1,600 or 6,250 BPI. As a minimum, all header information recommended in the SEG standards shall be recorded. Positioning data shall be provided in SEG P1 format.

5.1.2 Detectors

Spike	minimum 7.6 centimeters (3-inches)
Damping	.6 to .7
Geophone Groups (P-wave)	7-20 Hertz
Number Per Group	18-24
Number of Groups	minimum of 4 times the number of channels plus 10 percent
Single Geophones (P-wave)	7-14 Hertz
Single Geophones (Shear-wave)	7-14 Hertz
Number of single Geophones	minimum - number of channels plus 10 percent

The Seller shall provide a system for calibrating of the geophone groups. A unit such as Advanced Geophysical Corp.'s Geophone Analysis Package is an example of a system which will satisfy this requirement.

5.1.3 Energy Source Requirements

Three operating LLS-3B air-guns or equivalent	60 Cubic-Inch Chambers Able to "Pop" Several Times without Motor Running
Three operating Vibroseis	Linear, non-linear, and digitally programmable sweeps Base plate and reaction mass accelerometers
One non-explosive shear-wave source	Non-experimental

Sources shall be capable of operating synchronously among the given source type. The seller shall provide the specifications for the Vibroseis they propose to use. As an option, the Seller may give a quote on the cost of providing seven additional matching vibrators for a period of one week during the later part of the testing.

5.1.4 Data Processing Unit

An "on-site" data processing unit is required to perform basic processing steps on the data. This unit may be located in Richland, Pasco or Kennewick, Washington, which are approximately 30 to 35 miles from the shooting site. As a minimum, the processing unit must be able to process the data up to and Includeing 2-dimensional Brute Stacks.

Additional features shall include routines to:

Duplicate field tapes
Perform autocorrelations
Calculate F-K and Fourier transforms
Plot records and transform output
Filter data
Trace mixing

Some basic plots, such as, walk-away displays, F-K displays of walk-aways, and Amplitude spectrums, will be required within 36 hours of shooting.

5.1.5 Digital Tapes

The seller shall deliver the original and one copy of each field tape to the Buyer's technical representative within one week of the original recording date. The Seller shall specify the cost per original tape and tape copy.

5.1.6 Personnel

The Seller shall provide a minimum of 8 trained personnel to lay-down and pick-up geophones and cables. The Seller shall specify the availability of additional lay-down/pick-up crew if needed for additional or optional testing. As a minimum, the following addition personnel shall have the indicated minimum directly applicable experience:

Party Chief	6 years
QA Representative	4 years
Observer	3 years
Jr. Observer	1 year
Surveyor	3 years
Tech. Representative	10 years
Processing Supervisor	5 years
Source Operators	1 years
Source Mechanics	1 years
Instrument Technician	3 years

Evidence of training on the specific instrumentation to be used by the Seller shall be provided for the Observer, Source mechanics, and Instrument technician.

5.2 Walk-Away Tests

The following testing sequence is the current scope of the testing to be done, and is provided for bidding purposes. Final test

sequencing and scheduling will be detailed during the pre-test kick-off meeting between the Seller's and Buyer's technical representatives, but the equipment required will remain the same.

The initial noise walk-away test will use single geophones placed one meter apart to form a 10 X 10 meter grid pattern (Figure 3). The shooting order for this spread will start with a single air-gun, followed by 3 air-guns abreast. A single vibrator will then be used, with 3 abreast following. Shear-wave geophones will then be placed in the grid at the 1-meter intervals and the spread will be shot with the shear-wave source. All sources will walk-away in all 4 directions along the center lines of the grid pattern at shot intervals of 5 meters, to a total distance of 250 meters from the grid center.

This test will be followed with a similar test with a single P-wave geophone group clustered at 2-meter intervals, to form a 20 X 20 meter grid. The center of the grid will remain the same for all the grid shooting tests. The shooting sequence will be the same except the shot intervals will be 10 meters, to a total distance of 500 meters from the grid center. The shear-wave geophones and source will also be used.

The above two grid patterns will be used in two different locations to determine the variability of the noise train with respect to shallow geology. The information from these tests should provide insight into the effectiveness of shear-wave prospecting, magnitude of scattering caused by shallow geology, and noise trains to be attenuated.

The above tests will be followed with four geophone strings per group located at 5-meter centers, forming station centers on a 50 X 50 meter grid. Sufficient information should be available to use 2-dimensional geophone arrays. The air-guns and/or vibrators will be used in walk-away tests using shot arrays. Depending upon the results, an optional 10-meter spacing (100 X 100 meter grid) of geophone arrays may be used. These tests are designed to determine acquisition parameters for imaging deeper into the basalt section and into the sub-basalt sedimentary structure.

The seller shall survey all lines/stations vertically to USGS/AEC benchmarks to a tolerance of 0.3 meter MSL. Within the arrays of geophone groups, positions shall be determined to a relative accuracy of better than 10 percent of the group spacing. Horizontal positions may be chained.

After preliminary analysis of the test results, there will be additional testing of vibrator sweeps. Sweeps will be determined

for the shallow, intermediate and deep targets.

5.3 Buyer Options

Depending upon the results of the above testing the following developmental tests may be performed as options. The order in which the options are listed in no way reflects the order in which the options may be performed. All seismic lines shot as options shall have refraction data acquired using a single air-gun source. Geophone arrays may be used to record the refraction data, depending upon the array geometry and attenuation of the refraction arrivals. These data are necessary for input to refraction statics routines, and determination of the depth of weathering zone.

Option I - Shear-wave Test

A short, 2 to 3-kilometer confirmatory test line using shear-wave source and receivers may be shot.

Option II - 2-D or Pseudo 3-D tests

Depending upon the results of the testing outlined in Section 5.2, short, confirmatory test lines may be shot. These test lines may use 2-D acquisition parameters, or a grid of geophone arrays to further test the feasibility of 3-D acquisition.

Option III - Deep Sub-basalt Test

A 5 to 10-kilometer confirmatory test line may be shot to further assess the feasibility of acquiring deep seismic reflection data from below the basalt sequence. This may include the seven optional vibroseis units.

Option IV - Additional or Alternate Tests

Additional or alternative testing may be needed to unravel the propagation pathways of the seismic energy. This will be apparent during the noise tests described in Section 5.2.

5.4 Buyer Requested Work Stoppage

The Buyer may direct the Seller to stop the work for its convenience. These are intended to be short term interruptions (one or more hours up to but not more than two days). The Seller shall keep all equipment at the site (except vehicles required for crew transportation) and be ready to resume operations by not later than the next working day after a notification to resume operations.

The stoppages are for the Buyer's convenience and do not include stoppages for weather, equipment breakdowns or failures, or for stoppages that may be the result of violations of provisions contained in Sections 6.0 or 7.0 of this Letter of Instruction.

5.5 Reporting Requirements

Daily Report

A daily record of all field work shall be maintained by each field crew. This daily record is to include, but not be limited to, the following: name, date, work location, field observations, stations shot, and CDP's shot (as applicable). Each page of the observer log must include the subcontract number, page number, date, and observer's signature.

Weekly Briefing

The Seller's project manager or technical representative for this subcontract shall submit a brief weekly report summarizing problems, accomplishments and findings for each task to the Buyer's Technical Representative. Accompanying this weekly report shall be a copy of the daily record from each field crew's notebook covering the preceding week's work.

Field Testing Report

The Seller shall prepare an oral report describing the Field Testing work (Section 5.2 above) performed by the Seller. This shall be presented to the Buyer's Technical Representative within two working days of completion of the noise walk-away testing. The oral presentation shall include the following:

Description of Procedures used
Description of conditions, techniques, assumptions and methodologies used to conduct the field testing
Recommended source arrays and geophone arrays that establish the optimum acquisition parameters for production shooting in this environment.

Final Report

The Seller shall also submit a draft final report within one month of completion of all field testing. In addition to the above, this report shall contain a detailed design layout for the acquisition of high quality seismic reflection data for all targets of interest. The draft final report shall be a detailed compilation of all the work completed, detailed description of all

procedures used, and the results of the field testing. The format and contents of the Seller's report shall, as a minimum, include:

1. Title page
2. Abstract
3. Table of Contents (including list of tables and figures)
4. Introduction, including:
   A. Authorization for the work
   B. Purpose
   C. Division of work responsibilities
5. Data Acquisition - presentation of data acquisition techniques including complete documentation of every step taken during the testing
6. Data Catalogue
7. Position Surveys
8. Quality Assurance
9. Bibliography

The Seller's draft final report will be subject to an extensive review by the Buyer. Upon completion of the review, the Seller shall incorporate mutually agreed upon Buyer's comments, additions, modifications and/or clarifications into the report. The Seller shall submit four copies of the Final Report two weeks from receipt of the Buyer's comments. The Seller's Final Report shall be accompanied with all original field data acquisition logs, data tapes and other information, if any remain in the Seller's possession. The Final Report shall also be accompanied with one copy of all maps, cross sections and plates, as applicable, on stable base transparent material at a scale determined by the Buyer.

6.0 QUALITY ASSURANCE PROGRAM

This section establishes the responsibilities and requirements for the development and implementation of a Quality Assurance Program (QA). The overall goals of a QA program is to provide documented evidence of the validity of the acquired data, and provided sufficient documentation so that all activities may be repeated by qualified personnel.

The implementation of a QA program for the developmental testing outlined in this LOI are divided into 2 parts. Part 1 specifies the required documentation which must be in place to control data quality for the developmental testing. Part 2 will include the development of procedures which may be used in the future for acquiring data appropriate for licensing a nuclear waste repository in basalt.

The primary objective of the QA development program outlined below in Section 6.2 is to determine and identify the extent to which QA controls are to be applied to specific items and activities as pertaining to seismic reflection data acquisition.

The work, and resulting data, covered by this Letter of Instruction are not intended to be used for licensing purposes of a nuclear repository in basalt. However, certain elements of a Quality Assurance program must be in place to ensure that adequate controls, and equipment standards are in place prior to actual initiation of field work. The fulfillment of these QA obligations are outlined below in Section 6.1.

6.1 Seller QA Requirements

All requirements outlined in this section of the Letter of Instruction are mandatory and shall be imposed by the Seller on all lower tier subcontractors who furnish materials, components, or services. Certain elements of these QA requirements may be supplied in the Buyer's QA Guidelines outlined in Section 6.2 below. The requirements outlined here must be submitted for approval with the Seller's bid response.

Non-performance of required QA activities by the Seller may result in a stop work order until deficiencies are corrected. This correction period shall result in no cost to the Buyer unless the deficiencies are due to the Buyer's action, or inaction.

6.1.1 Organization

The Seller shall identify their organizational structure, functional responsibilities and line of communication for performance of the Letter of Instruction activities. Resumes of key personnel involved with this project shall be submitted.

6.1.2 Equipment Calibration and Standardization

The Seller shall establish and submit documented calibration procedures to assure the gauges, instruments, and laboratory equipment are controlled, and at specified periods, calibrated and adjusted to maintain accuracy within necessary limits. Laboratory equipment shall include equipment used to ascertain the calibration status of the field equipment. If appropriate, calibrations shall be traceable to nationally recognized standards. If the measuring device cannot be related to a national standard, the method shall be documented to provide justification for the use of the device.

Procedures shall specify the method, interval, retrievability and documentation required for calibration control, in addition to specifying the measures taken when equipment is found to be out of calibration.

A full calibration and documentation of field equipment shall be preformed and approved by the Buyer prior to initiation of field activities. The Buyer reserves the right to witness these calibration activities.

6.1.3 Project Documents

Project documents shall include any written or pictorial information describing, defining, specifying, reporting or certifying activities, requirements, procedures, or results. Project documents which the Seller shall address include calibration procedures for field equipment, equipment manuals, and the documentation of control for the entire QA Program outlined in this section i.e. Section 6.1. Project documents resulting from field activities will be addressed in the Buyer's QA Guidelines outlined in Section 6.2.

All documents shall be legible and written or typed in black ink. Any errors recorded shall be stricken with a single line through the incorrect entry, and the correct entry made as close as possible to the original entry. Error corrections shall also be accompanied with the initials of the person correcting the error, and the date of the correction. Unacceptable means of correcting errors include erasure, use of white-outs, scribbling out errors, and writing over errors.

6.1.4 Document Control

The seller shall specify the distribution of controlled manuals and procedures, and state the means with which changes to these manuals and procedures will be controlled. The control of the changes must include the approval by the Buyer, and any internal reviews to be preformed.

6.1.5 QA Records

Project documents, information and data that furnish evidence of calibration, field testing of equipment, weekly and final reports, Daily Work Plans, Supplier Deviation Request Forms, and evidence of transmittal for these items to the Buyer shall be considered QA Records. The documented procedure which controls the Seller's entire QA Program and procedures which control the generation of the above QA Records shall also be considered QA Records.

Additional information or data which provides evidence of field activities or data quality will be identified as QA Records as the testing proceeds.

6.1.6 Control of QA Records

The Seller shall specify a system by which QA Records will be controlled while they reside in the Seller's possession. Control of these QA Records shall include sequential numbering systems or other identification systems for each type of QA Record to be transmitted to the Buyer. The method of these controls shall be specified. A system must be described for cataloging of all QA Records.

Provisions for magnetic media shall also be specified to prevent damage from excessive light, stacking, electromagnetic fields, temperature and humidity. The means of protecting all data, data displays, information, and QA Records from damage, loss or misuse shall be addressed.

6.1.7 Document Transmittal

The Seller shall furnish vendor data per data item list.

All data tapes, Weekly Reports and observer logs shall be transmitted to the Buyer's technical representative. All other transmittals shall be transmitted to the Buyer using a Participating Contractor Document Transmittal Form (figure 4).

Documents and QA Records that support this Letter of Instruction, should be submitted on a weekly basis. In all cases, QA Records and documents are to be handled in accordance with this Letter of Instruction, and the established QA program, while in the custody of the Seller.

If QA Records cannot be submitted to the Buyer within 20 days of creation, duplicate copies will be made and the original will be submitted. A list of all QA Records submitted to the Buyer shall be maintained. This list will be submitted to the Buyer with the final report outlined in Section 5.5.

All QA Records, as well as other documents, and data shall be identified to this Letter of Instruction in addition to being traceable to the activity to which they apply. In the event no QA Records are generated for an item or topic in which QA Records were anticipated, it shall be noted in writing and submitted to the Buyer.

The QA records are to be assembled in a logical order and secured in folders or binders, as applicable.

6.1.8 Nonconformance and Corrective Action

Measures shall be established and documented to control items when there is evidence of nonconforming conditions to established requirements. These measures shall provide a means for identifying, documenting, segregating, dispositioning, evaluating and notifying affected parties.

Nonconforming conditions and defective equipment are considered adverse to quality and upon detection, shall be documented with appropriate action taken to correct the condition. The identification and cause of the condition shall be determined with corrective action taken to preclude repetition. These actions shall be documented and reported to appropriate levels of Seller's management. Follow-up action shall be taken to verify implementation of corrective action.

The Seller shall document all nonconformances on Supplier Deviation Request (SDR) Form. This form shall be used to notify the Buyer of Seller nonconformances. Nonconformances to this LOI which consist of one or both of the following are to be submitted to the Buyer within five days of initiation, for concurrence of Seller disposition. They are:

A. A technical or material requirement is violated.
B. A requirement of Seller Quality Assurance program, plan, procedure, etc., that the Buyer has approved, is violated.

6.1.9 Right of Access

The Buyer and/or Buyer designated representative shall have right of access to conduct pre-award surveys or evaluations, preform audits, surveillances of activities of the QA program, and preform checks of actual practices against applicable procedures.

The Seller shall be responsive to deficiencies identified by the Buyer during surveillances, audits, inspections or evaluations of the Seller's QA program. The Buyer reserves the right to exercise controls over further acquisition, delivery, installation or operation of nonconforming items or services conducted in the performance of this Letter of Instruction. This control may be effected by a stop work order to the Seller.

6.1.10 Procedures, Instructions and Drawings

Since the work to be conducted will be for the development of optimum acquisition parameters, and the development of field procedures and documentation therof, detailed procedures cannot be predetermined for the extent of the program. The development of these procedures are outline below in Section 6.2. Procedures which detail the method of calibrating equipment shall be provided according to Section 6.1.2.

The planning of day-to-day investigations shall be documented prior to their execution. These Daily Work Plans shall provide for:

1. Objective of the investigation
2. Approach or method of the investigation
3. Special circumstances or details to be accounted for or attended to

The Daily Work Plans shall be signed and dated by the Seller's and Buyer's technical representatives, and other technical personnel involved with establishing the direction of the investigation for that day. The original Daily Work Plans shall be retained by the Buyer's technical representative for retention as a QA Record.

6.2 QA Procedure Development

At the present time the Buyer's representatives are developing Quality Assurance guidelines for field activities pertaining to seismic reflection surveying. These guidelines will be available for adaptation and use by the Seller on July 24,1987. The Seller shall incorporate all equipment specific details into these guidelines to complete the set of guidelines. The Seller shall evaluate these guidelines through actual field implementation.

The guidelines shall be used as the starting point from which accetable procedures shall be derived. The approach of the QA guidelines being developed are based on the following considerations:

1. Assuring a technically sound program
2. Meeting all required QA obligations for licensing a nuclear waste repository in basalt
3. Lessening the QA burden on the technical representatives
4. Minimizing the impact on normal field crew activities.

Factors which have currently been identified which affect the quality of seismic reflection data include:

Preparation and control of maps and drawings
Survey operations, (including instrument calibration, notes, calculations, and monumenting)
Source and Receiver calibration, array configurations, field checks and documentation
Recording Equipment configuration, calibration, field checks and documentation
Overall documentation ie. field deviation, observer logs, tape and monitor record identification

6.2.1 Seller's Quality Assurance Representative

The Seller shall supply a Quality Assurance (QA) Representative whose primary responsibility will be to aid in the development and implementation of the guidelines. This Responsibility will begin three (3) weeks prior to conducting the seismic reflection testing and continue until acceptance of the Final Report described in Section 5.5. The QA Representative's duties shall include:

1. Working with the Buyer's technical and QA representatives to develop specific details of the guidelines prior to initiation of the field testing.

2. Monitoring of Seller activities during the tests and surveys to assure compliance with the guidelines.

3. Working with the Buyer's technical and QA representatives to develop workable, production seismic reflection procedures applicable to licensing of a repository.

4. Assuring that the Seller's Final Report complies with QA requirements.

5. Developing recommendations to be included in the Final Report on the further development of the QA program.

6. Assisting the Buyer's technical representative in explaining the guidelines to all contractor personnel involved with the work.

6.2.2 Guideline Changes

Changes to the guidelines may be needed. All changes that are

made must be approved by the Buyer's technical representative. Prior to the implementation of the change, all affected field personnel shall be informed of the change, and have the impact of the change clearly explained to them.

6.2.3 Control of Guideline Changes

All guidelines used throughout the developmental testing shall be controlled. Complete copies of all revisions of the guidelines shall be retained by the Seller's QA Representative and the Buyer's technical representative until all work is completed. One copy of all current guidelines must be in the field while crews are working. Additional field copies may be negotiated.

6.3 Acceptance of Services

All QA records and data submitted by the Seller will be subject to review by the Buyer's technical representatives to verify satisfactory implementation of contractual requirements prior to final acceptance.

7.0 GENERAL and SPECIFIC CONDITIONS OF WORK

The following sections contain requirements for safety related items and general information concerning the work site. The seller should be aware that the Hanford Site is an U.S. Government Reservation and that access for the purposes of work is limited to U.S. Citizens.

7.1 Safety

Job safety is considered an important aspect of all work performed on the Hanford site. The Seller shall be required to uphold the Buyer's concern for safety as outlines in this Letter of Instruction as well as nation safety standards. To ensure that all work activities are conducted in a safe and efficient manner, all personnel shall at all times be cognizant of their safety practices.

Personnel Awareness

The Buyer will inform the Seller's personnel as to specific environmental hazards which exist in the area and guidelines to be followed. This information shall include the safety requirements and fire prevention measures as outlined in this Letter of Instruction, as well as what to do in case of an emergency, environmental considerations, ect.

Equipment Safety

Evidence of a certified safety professional or licensed professional safety engineer's inspection of all equipment to be used on the Hanford Site is required for this contract.

All equipment shall also be inspected by the Buyer's Environmental and Safety personnel prior to commencement of work. Equipment will be evaluated for adequate safety guards on moving parts, worn rigging such as cables and pressure hoses, adequate and working safety devices, fire safety equipment and devices as well as other safety hazards or potentially hazardous conditions.

Fire Prevention

The Pasco Basin is located in an arid to semi-arid environment which is very susceptible to range fires. As a result, fire prevention measures must be observed to ensure safety of personnel, property and the environment.

Fire prevention measures for seismic data acquisition will include:

A. Vehicle movement off roads will be kept to a minimum.

B. Vehicles will avoid brushy areas where possible.

C. Vehicles with catalytic converters will be prohibited off roads.

D. All fuel containers will be safety approved (self-closing with flash arresters) and secured during transport.

E. Any fuel spills will be promptly cleaned up and rags disposed of properly.

F. All personnel will check the under carriage and exhaust lines for brush prior to and after the movement of any vehicle.

G. Dried brush, in particular tumbleweeds, will be manually removed from vehicle paths.

H. Any vehicle required to run idle for long periods of time shall do so only in cleared areas.

I. Vehicles will not be located closely together while off road to ensure safe evacuation if needed.

J. All vehicles will carry a fire extinguisher and shovel.

K. Smoking will be prohibited outside of any vehicle or building.

In case of a fire emergency, all work will be stopped and the Hanford Fire Department will be contacted.

7.2 Housing

No Buyer camping or messing facilities will be available at the work site. The Seller shall make arrangements for their employees' housing and feeding. The distance from the shooting area to nearby Richland, Washington is approximately 30 miles and driving time is approximately 45 minutes.

7.3 General Physical Conditions

The Hanford Site is of low topographic relief and is generally covered with sagebrush and cheat grass, permitting relatively straight lines to be run. Loose wind-blown sand is locally present and can cause problems for two-wheel drive vehicles. High voltage lines are present at the Hanford Site.

LOI K-450955

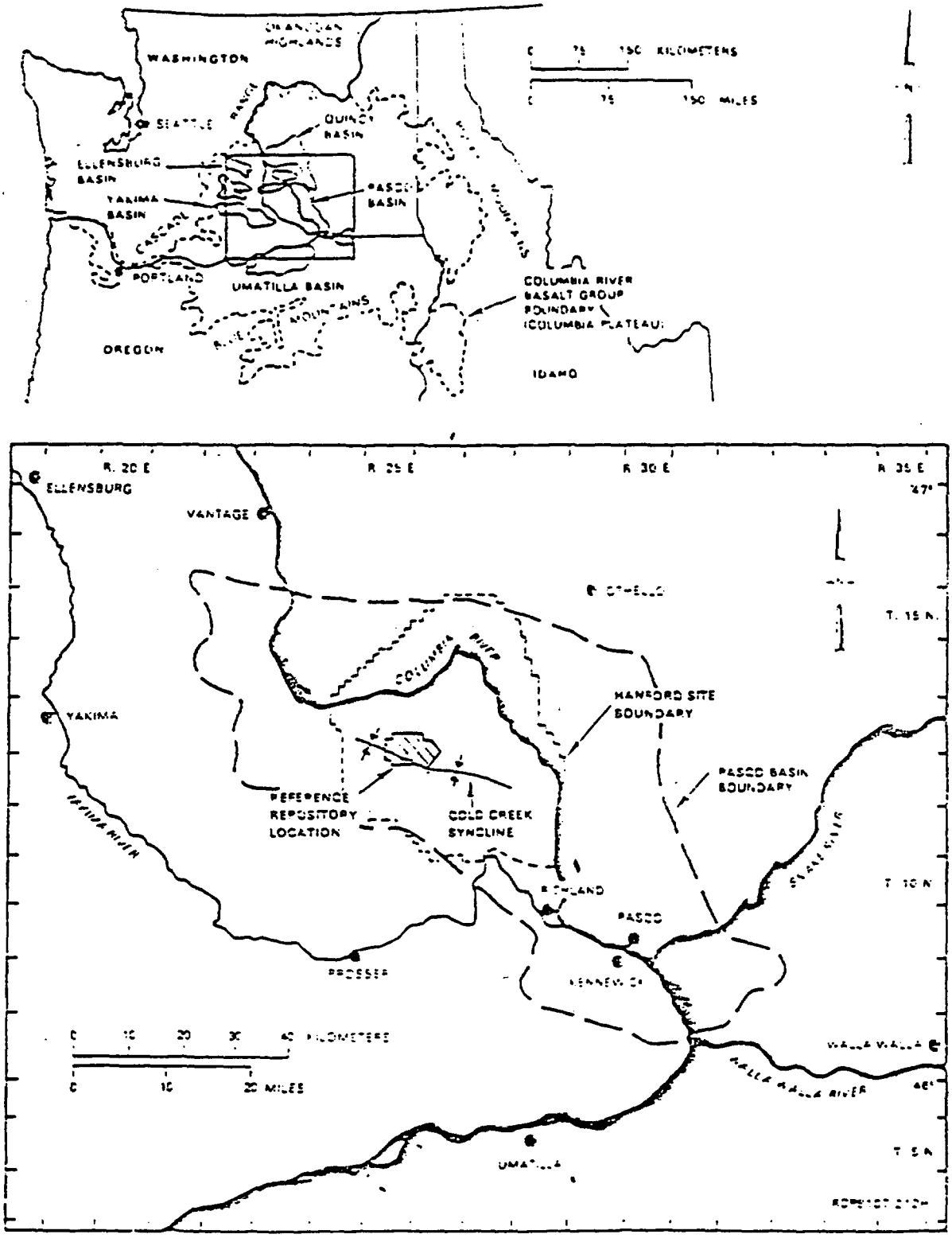
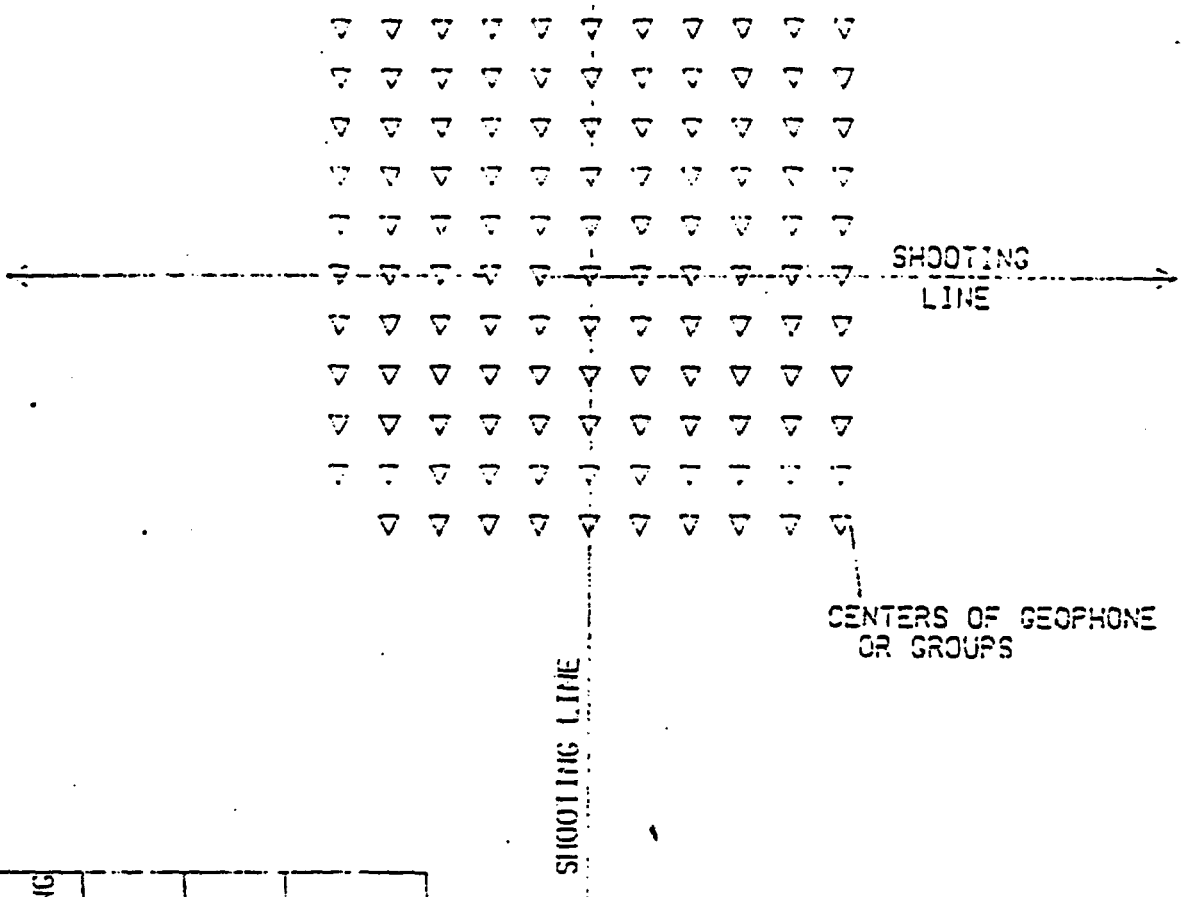


Figure 1 Location Map



GEOPHONE GROUP SPACING	SHOT SPACING	WALK-AWAY DISTANCE	TOTAL GRID SIZE
1	5.0	250	10X10
2	10.0	500	20X20
5	12.5	1250	50X50
10	50.0	2500	100X100

Figure 3. WALK-AWAY SKETCH

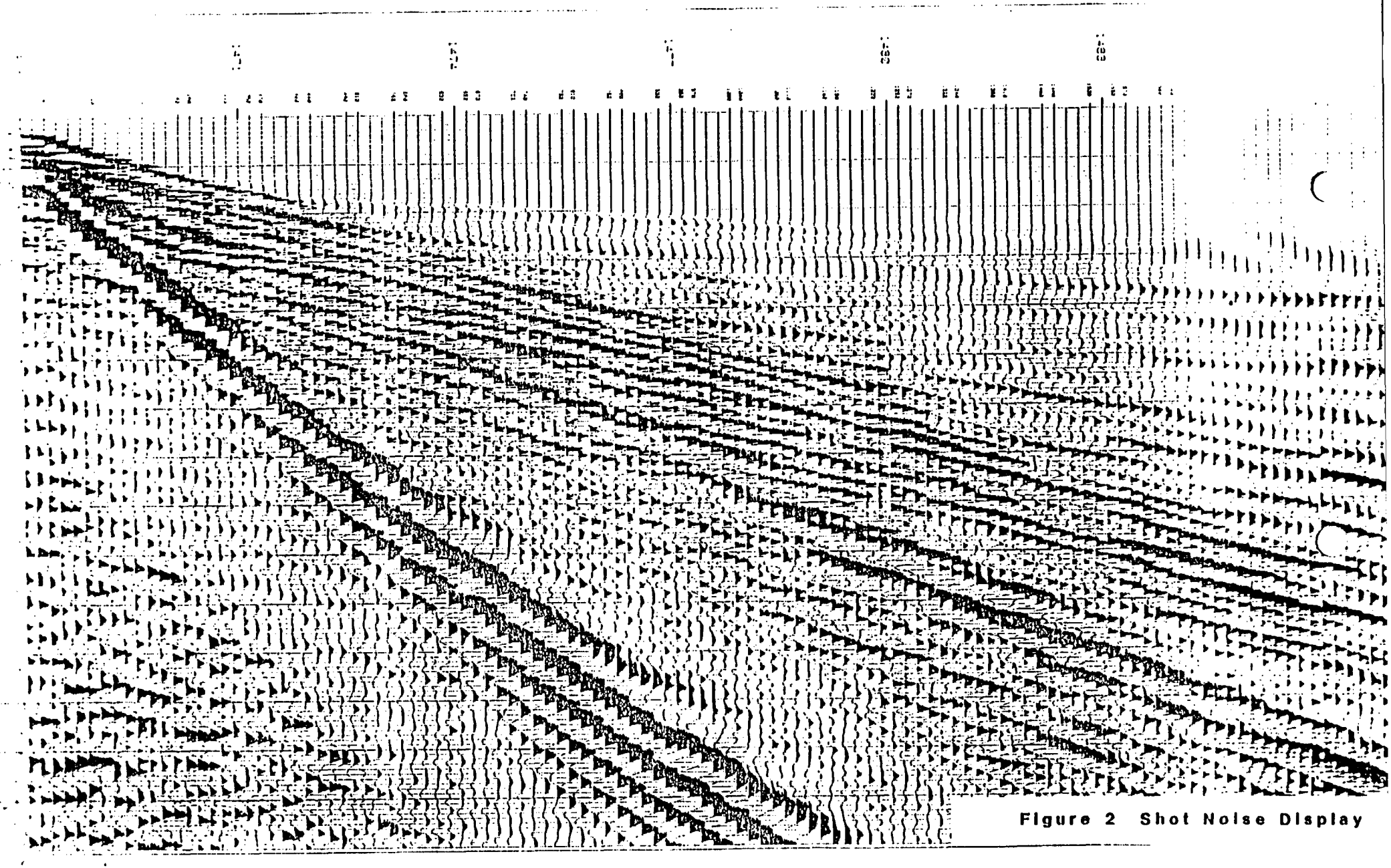
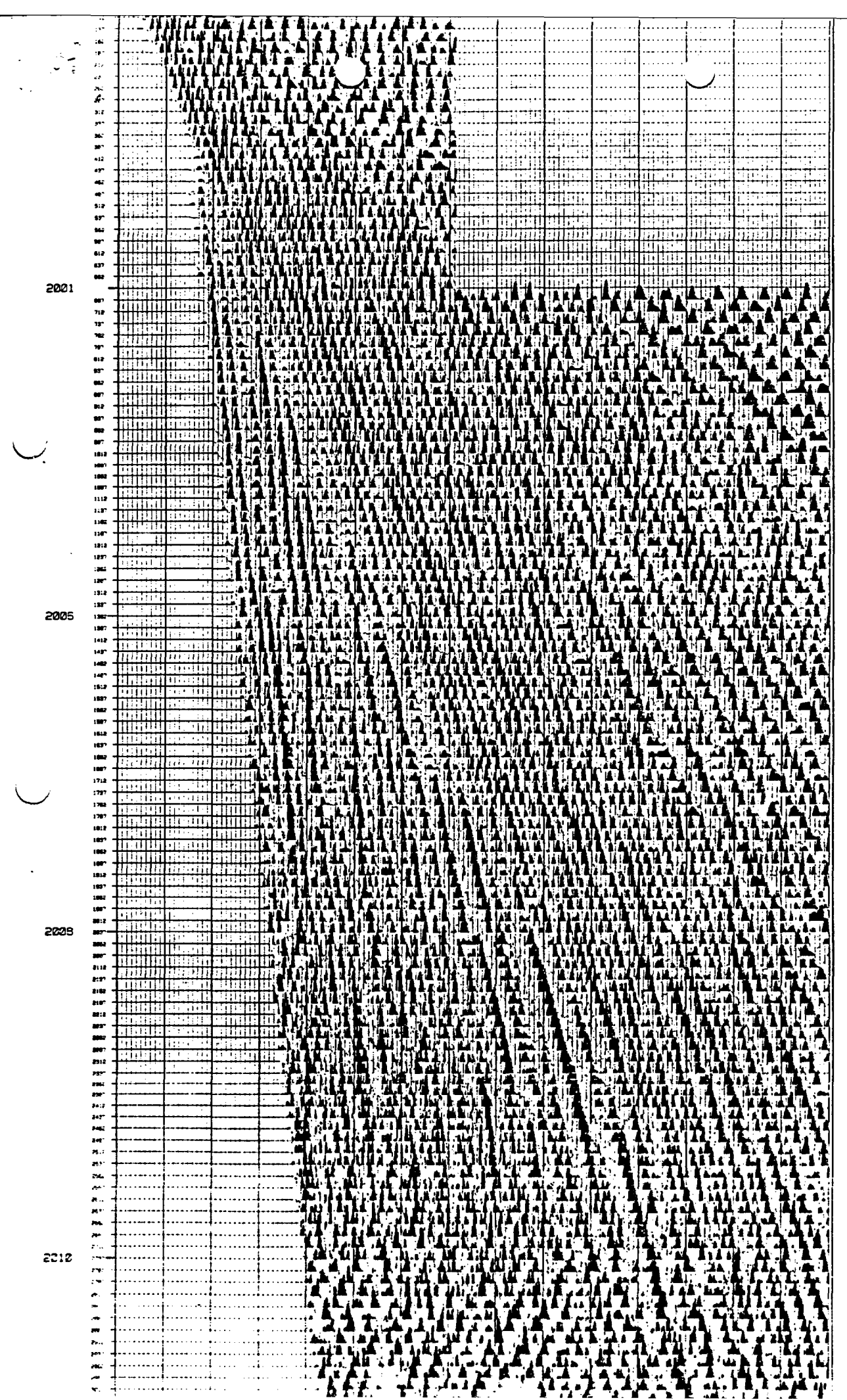


Figure 2 Shot Noise Display


2001
2005
2008
2212

AI/8/19/87

AUG 19 1987

OFFICIAL CONCURRENCE AND DISTRIBUTION RECORD

LETTER TO: Mr. Scott A. Jones
Manager Geophysics
Rocky Mountain Division
Shell Western E&P Inc.
P.O. Box 831
Houston, TX 77001

FROM: Abou-Bakr Ibrahim
Technical Review Branch
Division of High-Level Waste Management, NMSS

SUBJECT: LETTER OF INSTRUCTION (LOI) TO ADDRESSEE

DATE: AUGUST , 1987

AUG 19 1987

DISTRIBUTION

HLWM/SF	NMSS RF	RBrowning, HLWM
MBell, HLWM	JBunting, HLSE	BJYoungblood, HLOB
RBallard, HLTR	AIbrahim, HLTR	HLTR r/f
PJustus, HLTR	JTrapp, HLTR	HLefevre, HLTR

CONCURRENCES

ORGANIZATION/CONCUREE	INITIALS	DATE CONCURRED
HLTR/AIbrahim/cj	AIbrahim	87/08/19

(Mailed by the WMDOCC)
8-20-87 8:30
Date Time