DATA PROCESSING REPORT

ORIGIN ENERGY

2008 ENVIROVIBE TRIAL

SURAT BASIN
QUEENSLAND

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Integrated Seismic Technologies

Disclaimer

This report has been prepared in good faith and with all due care and diligence. It is based on the seismic and other geophysical data presented and referred to, in combination with the author's experience with the seismic technique, and as tempered by the geological and stratigraphic evidence presented in various forms and through discussions with client representatives.

As such, the report represents a collation of opinions, conclusions and recommendations, the majority of which remain untested at the time of preparation. In the light of these facts it must be clearly understood that Velseis Pty. Ltd., its proprietors and employees cannot take responsibility for any consequences arising from this report.

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Introduction

Velseis Pty Ltd acquired and processed a single line of 2D land seismic data for Origin Energy in January 2008.

Line summary for processed line

Line Name	Group Interval (m)	Shot Interval (m)	Station interval (m)	First station	Last station	Length (km)
Envirovibe Trial Line	12.5	12.5	6.25	200.0	1250.0	6.6

Note that the receivers were located on the odd numbered stations, and the sources were located on the even numbered stations. Hence, the shot and group intervals are twice the station interval.

Acquisition Parameters

Name	**2008 Envirovibe Trial Line**
Acq Company	**Velseis Pty Ltd**
Date Acquired	**January 2008**
Sample Rate (ms)	**1**
Record Length (ms)	**3000**
Group Int (m)	**12.5**
Shot Int (m)	**12.5**
Spread Description	**Symmetrical Split Spread**
Geophone	**10 Hz phone**
No. of Groups	**220**
Geophone array	**6 in line**
Filter	**0.8 Nyquist**
Near Offset (m)	**6.25**
Far Offset (m)	**1368.75**
Source Type	**Envirovibe**
Sweep frequencies (Hz)	**10-120**
Sweep duration (ms)	**6000**
Number of sweeps per source point	**1**
Number of vibes	**2**
Move-up (m)	**0**
Distance pad to pad (m)	**6**
CDP Fold	**110**

Additionally, four short trial lines (Trials 1, 2, 3, and 5) were acquired and processed, with the following acquisition parameters:

	Sweep frequency (Hz)	Number of vibes	Number of sweeps	Group interval (m)	Shot interval (m)	Station interval (m)	First station	Last station	Line Length (km)
Trial 1	10-120	1	3	6.25	12.5	6.25	100.0	420.0	2.0
Trial 2	20-120	2	1	6.25	12.5	6.25	100.0	420.0	2.0
Trial 3	10-120	1	1	6.25	12.5	6.25	100.0	420.0	2.0
Trial 5	10-180	2	1	12.5	12.5	6.25	938.0	1250.0	1.95

The remainder of this report, however, deals with the processing of the main 6.6 km production line.

Processing Sequence

As the main purpose of this trial was to compare the merits of the Envirovibe source with previous Vibroseis work, the processing sequence was kept similar to that used for the 2005 Origin Energy Condabri project.

Reformat

Input data was reformatted to ProMAX internal data format.

Minimum Phase Filter

A minimum phase filter was applied.

Trace Edit

Bad and noisy traces were removed from shot records interactively.

Geometry

Geometry information was assigned to trace headers. Information assigned to each trace includes source, receiver and CDP location along with offsets and CDP fold.

The coordinates are referenced to GDA-94, Zone 55.

Static Computation

Refraction statics were calculated from first break picks, using a datum elevation of 244m and a replacement velocity of 2500m/s.

Amplitude Recovery

A time-squared amplitude recovery was applied.

Air Blast Attenuation

An air blast attenuation filter was applied, with the following parameters:

Velocity: 345 m/s
Maximum air blast envelope width: 550 ms
Air blast enhancement filter: 70-80-120-140 Hz
Amplitude threshold ratio: 2

Gain

A removable AGC was applied, using a 300ms operator.

F-K Fan Filter

A double-sided F-K fan filter was applied, using the following parameters:

Panel width:	200 traces
Time length of filter:	500ms
Top cut speed:	2250 m/s

Gain removal

The previous 300ms AGC was removed.

Deconvolution

Surface consistent spiking deconvolution was applied.
A 160ms operator length was used. The white noise level applied was 0.1%.

Spectral Whitening

Spectral whitening was applied to all traces.

The parameters were as follows:

Operator length:	100ms
Number of panels:	8
Extent of zero padding:	25%
Spectrum:	10-120 Hz

Velocity Analysis (1st Pass)

Velocities were picked using the ProMAX interactive velocity picking package (IVA). IVA uses velocity spectra, moved out gathers and stacked panels to assist in a careful interpretation of stacking velocities. As the velocity function is altered, revised gathers and stacks are produced until optimized stacking velocities are achieved.

Velocities were picked at regular intervals of 100 CDPs.

Residual Static Calculation and Application

Surface consistent residual statics were calculated and applied using Maximum Power Autostatics.

Pilot or reference traces were formed for a 500ms time gate following structure by flattening all traces along the autostatics horizon over a smash of 11 CDPs.

These traces are summed to form a single pilot trace. Each trace from the active CDP is time shifted relative to the pilot trace and summed with it. The power of the stack is measured for each time shift. This shift-power trace is then summed with other traces having the same shot and receiver in their respective domains.

After the shift spectra has been calculated for the entire line and summed in the Receiver/Shot domains, time shifts are picked at the maximum of the power shift spectra and stored as Static Values.

The pilot stack is updated and the process repeated for a number of iterations.

In this case, calculations were conducted for at least 8 iterations or until the RMS of the change in the computed statics was less than .05ms.

Velocity Analysis (2nd Pass)

Velocities were picked again at regular intervals of 100 CDPs.

Residual Static Calculation and Application (2nd Pass)

Surface consistent residual statics were calculated and applied using Maximum Power Autostatics.

Pilot or reference traces were formed for a 500 ms time gate following structure by flattening all traces along the autostatics horizon over 11 CDPs.

In this case, calculations were conducted for at least 8 iterations or until the RMS of the change in the computed statics was less than .05.

F-K DMO

F-K DMO was applied, using absolute offset binning. The DMO stretch factor used was 0.6.

Velocities Analysis (Final Pass)

Velocities were picked again on DMO gathers at regular intervals of 50 CDPs.

Normal Moveout

An NMO correction was applied to the data using velocities picked on the first DMO volume. A hand picked offset mute was used, with a 42ms ramp.

Dynamic corrections are applied to the data using the following formula.

$$TX^2 = T0^2 + X^2/V^2$$

TX = time at offset X
T0 = time at zero offset
X = offset of the trace
V = velocity at time T

CDP Trim Statics

Trim statics application is the process of aligning traces within a gather by correlating them with a pilot trace, then applying appropriate shifts to each trace. Traces with a required shift greater than a pre-set maximum value are killed. The pilot trace came from the DMO stack created with DMO velocities, and a maximum shift was 4 ms.

Gain

An AGC with a 500ms operator length was applied after move out.

CDP Stack

Traces within a common midpoint gather were added. The post stack trace was scaled by the square root of the sum of fold for each sample in the trace.

Pre-migration F-X Deconvolution

Prior to migration, F-X deconvolution was applied to reduce the level of noise. A horizontal window of ten traces and a time window of 500ms were used.

Steep Dip Explicit Time Migration

Steep Dip Explicit Time Migration was applied using a velocity scale of 100%, and a maximum dip of 50 degrees.

Final Bandpass Filter

A final Ormsby zero phase bandpass filter was applied to the data to remove high and low frequency noise. The corner frequencies are 20-30-100-120 Hz.

F-X Deconvolution

A Wiener Levinson F-X deconvolution was applied, using a 10 trace horizontal window and a 500ms vertical window.

Gain

An AGC with a 500ms operator was applied, blended in a 1:1 ratio with non-AGC data.

Archiving

A DVD (DVD-514) has been produced, containing the following:

IN SEG-Y FORMAT:

Unfiltered Final Stack
Unfiltered Migrated Stack
Filtered Final Stack (with post-stack spectral whitening)
Filtered Final Stack (without post-stack spectral whitening)
Filtered Migrated Stack
Gathers with DMO, NMO, hand-picked mute and all statics applied
Raw gathers

IN ASCII FORMAT:

DMO stacking velocities at surface datum

IN PDF FORMAT:

This processing report

Appendix

These data were processed by Velseis Pty. Ltd., Brisbane, Australia.

Velseis Processing utilizes ProMAX 2D/3D processing software. This is a totally interactive system allowing the user to view data processing at each stage, producing a final result of the highest quality.

The software executes on a quad processor Sparc 20 Sun workstation and a 32 node, dual CPU/node Linux cluster. Data is viewed via X terminals networked to the main system, each terminal has a high definition monitor to enable accurate representation of the digital data in pixel form.

Velseis Processing is committed to offering a premium product, the software development undertaken by ProMAX resulting in processing algorithms that are state of the art.