Seismic monitoring for the Otway CO2 sequestration: acquisition and analysis of borehole seismic data

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The Australian Cooperative Research Centre for Greenhouse Gas Technologies (CO2CRC) is currently undertaking the Otway Project, which involves the injection and storage of 100,000 tones of carbon dioxide within the subsurface. CO_2 injection will be into Naylor onshore depleted gas reservoir and, therefore, the project will provide important experience for monitoring and verification under these conditions. The overall complexities of the field, its deep, small size and in particular the presence of both free and residual gas zones present a serious challenge for time-lapse seismic monitoring.

Borehole seismic has a strong advantage over surface seismic: energy crosses surface layers only once, and hence is much less sensitive to the variations in the weathered layer properties than surface seismic. Consequently a comprehensive borehole seismic observational program was designed at the Otway project. In the initial phase a Zero Offset VSP, an Offset VSP, and walkaway VSP data were acquired with a minivibroseis (6000 lb) seismic source in the Naylor-1 well in May 2006. In 2007, in the newly drilled injection well (CRC-1) a series of wireline logs, a Zero Offset, an Offset VSP and the first 3DVSP was acquired with a weight drop source simultaneously with 3D surface seismic.

The results of VSP data analysis will be shown and discussed in light of its improved repeatability and image resolution in comparison to surface seismic data. We will also discuss evolving workflows developed to overcome inherently poor land seismic repeatability which is mainly related to changes in the near surface layer conditions.

Technical Area: CO2

PRESENTER PROFILE (100 words in sentence format):

Sergei Tcherkashnev is a senior geophysicist with Schlumberger based in Perth. He received his BS degree in Exploration Geophysics from Moscow State University, USSR in 1987. After working as field and processing geophysicist for DMNG in Russia, Sergei joined Schlumberger in Melbourne as borehole geophysicist in 1995. He has worked in the UK as a senior geophysicist with Schlumberger Research & Development on integrated projects combining surface seismic and borehole data. In 2004 he took the position of geophysics domain champion developing borehole seismic and sonic business with Schlumberger Wireline, Russia. Sergei's experience includes borehole calibrated surface seismic processing; advanced borehole seismic processing (Walkaway, 3DVSP); AVO and anisotropy analysis; modeling, inversion and pore-pressure prediction.
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