

A Case Study on Acquiring 4D Seismic data Using Different Sources in Base Line and Monitor Surveys

Frank Sun
Suncor Energy, Calgary
fsun@suncor.ca

GeoConvention 2012: Vision

Introduction

Since 2006, Suncor has conducted a number of 4D seismic surveys monitoring the producing SAGD well pads at Firebag. The 4D seismic technology successfully demonstrated that the steam chamber can be accurately mapped. The 4D seismic data and interpretation is essential for optimization of reservoir development, infill trajectory planning, drilling risk assessment in producing area and evaluation of new well start-up technology. In addition, 4D is critical for history matching and understanding past production challenges and behaviors..

Problematic

The Firebag baseline surveys were acquired using a dynamite source. Subsequent surface development, pipeline, production pads and facilities, which did not exist when the baseline was acquired, makes further recording and monitoring a difficult task in producing area. According to the relevant government regulation, when using a dynamite source, shots have to be kept an established distance away from the facilities. To the pad operation team, the seismic blasting near facilities raises safety concerns. For this reason, pre 2010, only geophones were passively planted on the pads when acquiring the 4D monitor surveys. From the seismic fold map and 4D time delay, RMS map, the missing shots have a substantial impact.

Method and results

To deal with this issue, and improve the data quality, one of the solutions is to use vibroseis or EWG instead of dynamite source on the pads. To figure out the feasibility in terms of repeatability of using different sources in 4D seismic baseline and monitor data acquisition, a test 4D monitor survey was conducted at Firebag in 2010. Three datasets (vibroseis, EWG, and dynamite) were acquired, processed, calibrated, and interpreted respectively, and then compared together.

Conclusions

The baseline survey was acquired using dynamite; therefore the dynamite monitor dataset is optimal in terms of repeatability. These data are able to resolve the steam chamber in high resolution. The Vibroseis data is able to resolve the steam chamber with compromised resolution, and therefore can be used as an infill source on the pads. Furthermore, it was determined that the EWG source is not suitable for shooting monitor data for this project.