The San Ardo Field 3-D Seismic Survey: Design, Acquisition, and Preliminary Results

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The San Ardo field is located immediately east of Highway 101 about 30 mi north of Paso Robles, in Monterey County, California. This heavy oil field, discovered in 1948, lies on the gently dipping, eastern margin of the Salinas Basin and is associated with a mild anticlinal structure of Plio-Pleistocene age. The present production comes from steam flooding of the permeable Aurignac shelf sands of the Monterey formation, which are draped over a shallow granodiorite basement at ~2500 ft. In addition, the Lombardi sands (0-200 ft thick) conformably overlie the Aurignac at a depth of 1800 ft and provide another reservoirwith additional steamflood potential. The western edge of the field is bounded by the complex Los Lobos thrust system, which may have additional reserve potential in these Monterey-interval sands.

Evaluation of limited 1980s 2-D seismic data indicated that a 3-D survey could be acquired over the main San Ardo field. As interest in the survey increased, multiple objectives began to complicate the survey design. Imaging beneath the Los Lobos thrust fault in the highly faulted Aurignac Hills to the west for reserve potential had to be weighed against detailed mapping of the main San Ardo field to the east to identify the very shallow reservoir objectives of the Lombardi and Aurignac sands. These field reservoirs require good fold coverage with tight interval spacing necessary to identify stratigraphic changes, faulting, and the possibility of imaging the extent of steam injection in both reservoirs. The foothills need longer offsets and a strong source effort. In addition, the development team requested an evaluation, or reconnaissance, of shut-in property to the southeast to look at reserve potential.

To accommodate all the objectives, the original survey was separated into two surveys: a 1.7-mi survey to the southeast to cover the reconnaissance efforts in section 13, and a 5.4-mi^2 survey to cover the main field and foothills. Irregular grid geometries were employed by shot-point placement along oil field and mountain roads and river beds, and the design was optimized along preferred directions in the oil field. Mixed sources included vibrators, dynamite buggy drills, and heliportable drills. Acquisition had to take into account working within the bounds of the highway, river, and railroad right of ways through the field, and working within the confines of oil field operations and farming/orchard operations. Despite these complications, both surveys were successfully acquired in the first quarter of 2004. Preliminary seismic results will be reviewed to evaluate the survey objectives.