WILLARD UNIT, TORRANCE COUNTY, NEW MEXICO

The prospective Willard Federal Drilling Unit is centrally located in the Estancia Basin in Torrance County, New Mexico. Specifically, the proposed unit covers approximately 7040 acres in Township 5 North, Range 8 East, and Township 4 North, Range 8 East (Please refer to attached land plat).

The geology has been defined from three principal methods of invest--igation, viz: seismic reflection profiling, near-surface geochemistry and N.U.R.E. magnetics. Essentially, the delineation of the Willard unit reflects the favorable petroleum geology based on the interpretation of these methods of interpretation.

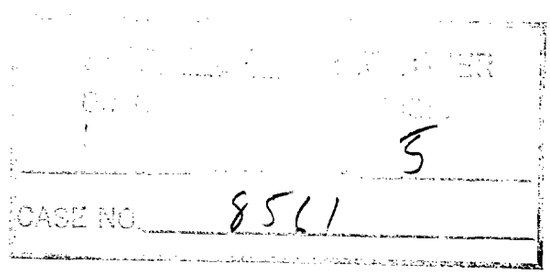
Potential traps are two east-verging, imbricate thrust faults of post-Jurassic age, and two discrete anticlinal folds with N-S axial planes, shown to have good structural closure from seismic interpretations. Other smaller traps that might exist on the Willard unit are either stratigraphic in origin, or occur as minor Cenozoic normal faults.

Source rocks would be organic-rich lower Paleozoic carbonates and subordinate shales of marine origin, primarily of lower to mid-Mississippian age. Source-rock evaluation studies, mainly kerogen studies and pyrolysis, of other wells drilled adjacent to the Willard unit confirm that these Paleozoic source-rocks of the Estancia Basin could generate commercial quantities of hydrocarbons. In support of the source-rock evaluation studies, appreciable amounts of adsorbed and interstitial hydrocarbons in the C1-C5 range have been detected in very anomalous quantities from near-surface geochemical prospecting across the Willard unit.

Potential reservoirs are Paleozoic carbonates and sands, notably Mississippian reefal limestones known to be present in the Estancia Basin from proximal outcrop examination.

Potential seals are mainly evaporitic and shaley sediments of upper Paleozoic age, that are either still in place, or are allochthonous in character. Another possible seal would be the mylonitized thrust-plane contacts of post-Jurassic age. This type of seal is ubiquitous in similar foreland basins throughout the Rocky Mountain Fold and Thrust Belt.

Maturation of hydrocarbons in the Willard unit is seen as a direct function of the age and thermal history of the associated source rocks. As mentioned prevoiusly, kerogen and pyrolysis source-rock evaluation studies in the Estancia Basin, indicate that Paleozoic sediments are within the oil generating window. Direct evidence for this hydrocarbon maturation is from the near-surface geochemical anomalies coincident with the seismic anticlinal highs. These anomalies are classified as being within the oil-prone range as shown by the ratio of [adsorbed pentane x 1000/adsorbed methane] over 80, and high adsorbed pentane (over 30 ppb) and adsorbed ethane (over 350 ppb) values.



The Willard Unit outline encompasses a NNE-trending domal feature evidenced by Arco and Cities Service proprietary seismic data which this company was permitted to view and map. The extent of the feature which is considered prospective, and thereby that portion included in the unit, was determined by the extent of the coincident geochemical anomally. That portion of the domal feature which underlies a sub-parallel, high angle reverse fault is included in the unit on the theory that hydrocarbon accumulation will be more or less symmetrical about the feature. Specifically, the north line of the unit is defined by the northern limit of the geochemical anomally. The east line of the unit is defined by a northeasterly-trending high angle reverse fault. The south line of the unit is defined by the southward plunge of the domal feature. Finally, the west line of the unit is defined by the inferred trace of the northeasterly-trending high angle reverse fault, underneath the nappe of this fault.

The location of the proposed test well will be 1980' from the north and west lines of Section 35, T5N, R8E. The location is just west of the crest of the domal feature, which acknowledges the fact that severe induration of sandstones occurs in this area over the crests of similar compressive features. Anticipated formation tops, based on scaling intervals between the Houston Oil and Minerals #1 Berkshire Ranch well in Section 29, T6N, R9E and the Eidal #1 Mitchell in Section 33, T4N, R8E, are as follows:

Base of Quaternary alluvium (Top of Yeso)-	80'
Top of Abo-	450'
Top of Madera-	1750'
Top of Sandia-	2800'
Top of pre-Cambrian-	3100'

Principal reservoir objectives are sandstone units within the upper portion of the Madera formation and massive sandstones within the Sandia formation. Shows of hydrocarbons have been tested in both sections in nearby wells.