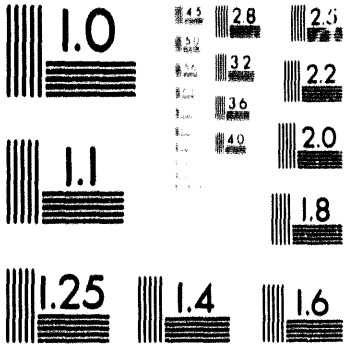
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TECHNICAL MEMORANDUM

TO U.S. DEPARTMENT OF ENERGY
ATTN MR. KARL-HEINZ FROHNE
FROM THE SCOTIA GROUP - ROBERT H. CALDWELL
DATE 16 July 1993

RE DE-AC21-91MC28130, Reserves in Western Basins, Seventh Quarterly Technical Progress Report

Technical work has been completed on the Greater Green River Basin area. As of the date of this memorandum, a final report is in preparation and exists in working draft stage. Analysis of all five plays has been completed and final figures are being quality controlled and checked. An updated production data tape for the Basin was received from Petroleum Information (PI) at the eleventh hour and has been processed to give us updated information and this data has been integrated with the previous analysis.

The final report is targeted for submission to the DOE on July 31, 1993. To give you a flavor for the results, the following represent several of the more significant findings:

1. A significant difference in original in-place resource was derived in comparison to that estimated by the USGS. The principal cause of the difference was that our methodology consisted of a detailed log analysis deriving a more detailed and comprehensive treatment of porosity and water saturation. This analysis showed that porosities were distributed with considerable skew toward the lower porosity groups and that particularly in the low porosity groups, water saturations were quite high and tended to 100 percent as porosity tended to zero. These factors alone caused

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calculation of smaller volumes for in-place resource as opposed to the USGS who assumed normal distributions for porosity with a positive correlation to hydrocarbon saturation at hydrocarbon saturations considerably higher to those derived from log interpretation.

2. The temperature and pressure model generated by this study is considerably more sophisticated than that utilized by the USGS resulting in a more rigorous derivation of formation volume factors with a net result of a more conservative calculation of gas in-place.

3. The net result revising original resource comes up with figures approximately 50 to 85 percent of those derived by the USGS.

4. Utilizing a modified McKelvely Box approach, the resource is subdivided based upon its permeability and depth, forming four subdivisions. The permeability axis separates potentially productive resources (having permeabilities generally in the range .001 to .1 md) from those which are generally regarded as too tight to produce (having permeabilities less than .001 md). The depth axis is subdivided through recognition of an economic basement into resources which are potentially economically recoverable (lie above economic basement) versus resources which are economically not recoverable (lie below economic basement). Those resources lying within the quadrant represented by permeabilities greater than .001 md and lying above economic basement represent resources available for conversion to reserves by an appropriate recovery factor model. This approach graphically characterizes plays such as the Cloverly Frontier, which mainly lie at great depth and while having significant resource, the bulk of it is not considered potentially convertible to reserves due to an imbalance between the cost of drilling and the anticipated per well recoveries at those depths. Similarly, for plays such as the Lance Fox Hills and Fort

Union where no commercial production has been established, economic viability cannot be demonstrated and hence the resources fall below the economic basement line. Of course as prices, technology and costs change, these boundaries will move and resources will shift from one category to the next.

5. The bulk of evaluated reserves lie in the Lewis and Mesaverde. Both plays have been subdivided into a number of subunits for the purpose of evaluation and several differing recovery factor models have been developed. We are still tinkering with these models.

6. It has been our finding that geological factors are extremely important in creating a commercial gas completion in the Greater Green River Basin. Of particular importance is the lateral continuity of the formation. In many cases, the preferred or most favorable reservoir development is oriented at angles to maximum horizontal stress making it extremely difficult to place a propped fracture in the target area. Thus, results appear to be most favorable in the areas where blanket geology prevails or where a fortuitous line-up between stress directions and preferred orientation of reservoirs is coincident.

7. EUR data for some of the better wells, particularly in the Mesaverde are spectacular. In fact, in certain Mesaverde fields, the wells are so strong as to make most conventional gas wells look quite ordinary. Such wells are obviously draining sands above and below the perforated interval based on rationalizing EURs with volumetrics and recovery factors. Investigating anomalies and finalizing our recovery factor models is ongoing to take these factors into account.

The project is on schedule for report submission on July 31 as a fully illustrated draft.

The fairly intense activity during the last six weeks will put the project at budget or very slightly over its scheduled level by the end of July. We are satisfied with the progress and look forward to submitting our report for your comments and criticisms.

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END