RESERVOIR CLASS FIELD DEMONSTRATION PROGRAM - CLASS II REVISIT

Heterogeneous Shallow-shelf Carbonate Buildups in the Blanding Sub-basin of the Paradox Basin, Utah and Colorado: Targets for Increased Oil Production and Reserves Using Horizontal Drilling Techniques

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National Petroleum Technology Office
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Utah Geological Survey, Salt Lake City, Utah and
Colorado Geological Survey, Denver, Colorado

PUBLIC ABSTRACT

Over 400 million barrels of oil have been produced from shallow-shelf carbonate reservoirs in the Pennsylvanian Paradox Formation (primarily the Is may and Desert Creek zones) in the Paradox basin of Utah, Colorado, and Arizona. The Is may zone is dominantly limestone comprising eluant buildups of phalloid-algal with local, rapidly changing small-scale subfacies. The Desert Creek zone dominantly dolomite comprising regional shoreline trends with highly aligned, linear facies tracts. With the exception of the giant Greater Aneth field, the 100 plus oil fields in the basin typically contain 2 to 10 million barrels of original oil in place. Most of these fields are characterized by high initial production rates followed by a very short production life (primary) and hence premature abandonment. Only 15 to 25 percent of the original oil in place is recoverable during primary production from conventional vertical development wells.

An extensive and successful horizontal drilling program has been conducted by Mobil and Texaco in the Greater Aneth field. However, to date, only two horizontal wells have been drilled in small Is may and Desert Creek fields. The results from these wells were disappointing due to poor understanding of the carbonate facies and diagenetic fabrics which have created reservoir heterogeneity. These small fields and similar fields in the basin are at high risk of premature abandonment. At least 200 million barrels of oil is at risk of being left behind in these small fields because of inefficient development practices that leave undrained heterogeneous reservoirs. Through proper geological evaluation of the reservoirs, production may be increased by 20 to 50 percent through the application of horizontal, and possibly multi-lateral horizontal drilling projects that can be achieved at a lower cost. In addition, horizontal drilling allows for minimal surface disturbance in field development particularly in the environmentally sensitive areas of southeastern Utah and southwestern Colorado.

A three-phase, multidisciplinary approach will be used to increase production and reserves from the shallow-shelf carbonate reservoirs in the Is may and Desert Creek zones of the Paradox basin. Phase 1 will be the geological and reservoir characterization of selected, diversified small fields with the Cherokee field in San Juan County, Utah, or other field(s) having the greatest potential for increased well productivity and ultimate recovery to be targeted for the pilot demonstration project. This phase will include: (a) determination of regional geological setting: (b) field scale geologic analysis to focus on the reservoir heterogeneity, quality, and lateral

continuity versus compartmentalization within the fields, (c) extensive reservoir mapping including lithologic, microfacies, porosity, permeability, net pay maps, etc., (d) determination of field reserves and recovery, and (e) integration of geological data in the planning of the horizontal well(s).

Phase 2 will be a demonstration project on the field(s) selected from the geologic and reservoir characterization study using the horizontal drilling techniques identified as having the greatest potential for increased well productivity and ultimate recovery. The demonstration project will involve drilling one or more horizontal development wells (possibly with multiple horizontal legs) to maximize production. If mechanically and more economically viable, existing wells may be re-entered and multiple horizontal laterals drilled to the zones of greatest potential.

Phase 3 will include: (a) reservoir management and production monitoring, (b) economic evaluation of the results, and (c) determination of the application of the project to other similar fields in the Paradox basin and throughout the U.S.

Phases 1, 2, and 3 will have continuous but separate technical transfer activities including: (a) a industry outreach program and project newsletters, (b) a core workshop/seminars in Salt Lake City, (c) publications and technical presentations, (d) a project home page on the Utah Geological Survey and Colorado Geological Survey Internet web sites (e) digital databases, maps, and reports, (f) a summary of regulatory, economic, and financial needs, and (g) annual meetings with a Technical Advisory Board and Stake Holders Board.