

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

Project Duration: 48 Months

Budget Period #1

Activity 1. Reservoir Characterization

Task 1: Regional Geologic Facies Determination

Compile information on the major facies encountered within Ismay and Desert Creek wells in Utah and Colorado that have been conventionally cored in the Blanding sub-basin, including photographing and describing core, supplemented by available rotary sidewall core and cutting descriptions.

Map the generalized facies belts for the Ismay and Desert Creek Blanding sub-basin of the Paradox basin.

Establish the vertical sequence lithologies using selected Ismay and Desert Creek fields in Utah and Colorado, and from the non-field cores within the area based upon analysis and descriptions.

Infer the lateral changes in facies and their relationships to one another by analysis of the vertical sequences from the core descriptions.

Task 2: Reservoir Diagenetic Analysis

Catalog the important Ismay and Desert Creek sedimentary structures, bedding types, fracture types, and diagenetic textures that are prevalent for each reservoir type in selected fields.

Construct the diagenetic history that characterizes the moldic, vuggy, dolomitized, karst-brecciated, stylolitic as well as preserved primary porosity styles of the various Ismay and Desert Creek reservoirs. Emphasis in this area will include petrographic (thin section) and geochemical analysis of selected representative reservoir and non-reservoir lithologies. Typical techniques that will be employed include epi-fluorescence and cathodoluminescence petrography for the sequence of diagenesis; stable carbon and oxygen isotope analysis of diagenetic components such as cementing minerals and different generations of dolomites; strontium isotopes for tracing the origin of fluids responsible for different diagenetic events; and scanning electron microscope (SEM) analysis of various dolomites and dolomite pore casts to determine reservoir quality of the dolomites as a function of diagenetic history. Finally, pore plugging anhydrite and halite will be examined for their relative importance in the fields evaluated.

Identify the types of porosity in each reservoir for Ismay and Desert Creek fields according to petrophysical characteristics (including some capillary pressure testing) and petrography (through pore casting).

Task 3: Geophysical Well Log to Core Analysis

Analyze selected geophysical logs from wells with cores and compare to conventional core descriptions and/or petrophysical properties from core pugs.

Create "type" logs matching the distribution of diagenetic processes, carbonate pore types, and permeability trends to log character.

Task 4: Field Scale Geologic Analysis

Compile well locations, production reports, completion tests, core analysis and description, formation tops, and other data and enter in a database developed by the UGS.

Synthesize the database from wells in the study area (using core descriptions, geophysical well logs, drill cuttings and/or rotary sidewall cores) to determine the principal microfacies (lithology, biota, depositional structures, etc.) and lithofacies (for beach, shoals, mound, mound flank, and off-mound depositional environments, etc.).

Attempt to correlate the various important diagenetic events and porosity types across selected field. Compare this information with the depositional facies and vertical cycle development.

Determine the ideal vertical sequence or cycle of microfacies and lithofacies from selected Ismay and Desert Creek fields.

Construct the following Ismay and/or Desert Creek maps for selected fields: (1) top of structure, (2) Gothic Shale thickness, (3) gross carbonate thickness and net pay thickness, (4) porosity versus height, (5) permeability, (6) lithologic and microfacies, and (7) anhydrite limits and thickness.

Activity 2. Producibility Problem and Characterization

Task 1: Production Analysis

Place all depositional, diagenetic, and porosity information within the vertical and horizontal framework into the context of the production history to date of each field in order to construct a detailed overview for each candidate for horizontal drilling.

Determine whether individual beds, facies, and/or mound-building components act as flow units or barriers during production.

Task 2: Geologic Modeling

Structure, thickness, and porosity maps combined with various commercial software for three-dimensional reservoir analysis of individual Ismay and Desert Creek units or untested compartments will be used to create three-dimensional reservoir models and volume maps.

Primary recovery and original oil in place will be determined from volumetric reserve calculations of individual zones or untested compartments.

Activity 3. Recovery Technology Identification and Recovery Analysis

Task 1: Demonstration Location Determination

Identification and ranking of fields based on geologic characterization best suited for the demonstration project.

Identification and ranking of zones based on geologic characterization best suited for the demonstration project.

Task 2: Horizontal Drilling Analysis

Identify and rank of one or more of the following horizontal drilling techniques: standard horizontal well(s), multiple lateral horizontal well(s), and/or horizontal lateral from existing vertical well(s) best suited for the demonstration project.

Determine the direction and length of horizontal well(s).

Activity 4. Associated Technology Transfer Activities

Task 1: Technology Transfer

Technical Advisory Board: A Technical Advisory Board of oil company operators from the Paradox basin will be established. The Technical Advisory Board will advise the team on the direction of study, review technical progress, recommend changes and additions to the study, and provide data. The Technical Advisory Board will meet at least once a year and will receive copies of all reports throughout the year. The formation of the Technical Advisory Board ensures direct communication of the study methods and results with the Paradox basin operators.

Stake Holders Board: A Stake Holders Board will be established composed of groups that have a financial interest in the study area, such as representatives from the Utah and Colorado state governments (Utah School and Institutional Trust Lands Administration, Utah Division of Oil, Gas and Mining, and Colorado Oil and Gas Conservation Commission), Federal Government (U.S. Bureau of Land Management and U.S. Bureau of Indian Affairs), and the Ute Mountain Ute Indian Tribe, and other entities. Stake Holders will receive all quarterly and annual technical reports and copies of all publications resulting from the study. Stake Holders Board meetings and/or meetings with individual Stake Holders will be held as needed.

World-Wide-Web Site: The UGS and CGS will maintain a web site dedicated to the project. The web site will have a list containing e-mail addresses of personnel involved in the project. A description of the study and objectives will be posted as well as quarterly and annual reports, announcements of activities, and press releases.

Core Workshop/Seminars: A one day core workshop/seminar will be held at the Utah Geological Survey Sample Library to examine core evaluated during the geological characterization and results of Phase 1 of the project. Participants will be encouraged to question and discuss all aspects of the project.

Industry Outreach Program: The UGS Public Affairs Officer (PAO) will set up technical displays at two major industry conventions per year: regional and national American Association of Petroleum Geologists (AAPG). The PAO will also compile and maintain a contact list of people and companies interested in the project and provide them with the UGS news magazine Survey Notes, semi-annual newsletter Petroleum News, and press releases.

Digital Information: The UGS and CGS will coordinate and compile databases on geologic, reservoir, and engineering information gathered and generated during the project. Digital maps (with wells) will be linked to the information contained in the database. Photographs of cores and thin sections will be included on CD-ROMs.

Publications: The UGS and CGS will report all aspects of the project in a series of formal publications. These will include all the data as well as the results and interpretations. Topical papers will be submitted to appropriate journals (AAPG Bulletin and Journal of Petroleum Technology for example) and to local and regional societies for publication in their guidebooks series.

Talks and Technical Presentations: Technical talks and poster displays will be submitted to regional and national AAPG meetings when appropriate. Additionally, presentations may be given at local and regional geologic and engineering societies. Annual presentations will be made to the Technical Advisory/Stake Holders Boards.

Activity 5. Activities Required for Project Continuation

Task 1: Synthesis and Recommendations

The geologic team and the industry partner will review all aspects of the project and come to a consensus as to the recommendation for Phase 2.

Task 2: Preparation of Project Evaluation Report

Produce the Project Evaluation Report, a joint effort of the project teams, which will compile and summarize the reservoir and geological characterization. The Project Evaluation Report, if the demonstration project is economically viable, will include a complete step-by-step plan for implementation of the demonstration project.

The Project Evaluation Report also includes the following recommendations, topics, and discussions: (1) specific field(s) and zones chosen; (2) specific horizontal drilling technique(s), horizontal length(s), and horizontal direction(s); (3) demonstration project implementation plan; (4) economics; (5) expected incremental recovery, production, and reserves; and (6) location of horizontal well(s).

Activity 6. Project Administration

Task 1: Project Administration and Management

Contract Negotiation: If the proposal is selected for funding, the UGS will negotiate the final contract with DOE in consultation with other team members.

Contract Deliverables: The UGS will be responsible for ensuring that all required technical and financial reports are prepared and delivered to DOE as required in the final contract.

Contract Management: The UGS Director/State Geologist will oversee the Principal Investigator/Program Manager and a Financial/Business Manager. The Principal Investigator/Program Manager will oversee all technical aspects of the project. The Financial/Business Manager will interact with the appropriate DOE counterparts to facilitate the project activities.

Environmental Compliance and NEPA Requirements: UGS will prepare all documents and reports for the State or Federal agencies. They will be submitted by UGS as required. Assuming that the project will be granted a categorical exclusion under the NEPA regulations, UGS will prepare the report on hazardous substances handling for the project at the start of the project.

Budget Period #2

Activity 1. Implementation Recovery Techniques

Task 1: Drilling and Completion of Horizontal Development Well(s)/Laterals

Drill and complete one or more horizontal development wells/laterals in Cherokee field, San Juan County, Utah or other selected field. The direction, horizontal length, and intervals/compartments to be tested will be based on the recommendations from Phase 1. Target depth will be between 5,500 feet and 6,500 feet. Drill cuttings and geophysical logs (if run) will be evaluated to determine reservoir facies and diagenesis.

Address production problems as they occur and solve appropriately.

Terminate the project if drilling is unsuccessful.

Task 2: Monitor Response and Evaluation of Demonstration Techniques

All testing and production will be monitored from the beginning of the demonstration to the end of the project including: gauging all oil, gas, and water produced; recording flowing tubing pressures; and recording shut-in pressures.

Increasing watercuts will be monitored and their impact on oil recovery calculated by preparing water-oil ratio versus cumulative oil curves.

Activity 2. Associated Technology Transfer Activities

Task 1: Technology Transfer

Technical Advisory Board: The Technical Advisory Board will continue to advise the team on the direction of study and review technical progress. The Technical Advisory Board will meet at least once a year and will receive copies of all reports throughout the year.

Stake Holders Board: The Stake Holders Board will continue to receive all quarterly and annual technical reports and copies of all publications resulting from the study. Stake Holders Board meetings and/or meetings with individual Stake Holders will be held as needed.

World-Wide-Web Site: The UGS will continue to maintain a web site dedicated to the project. The web site will have a list containing e-mail addresses of personnel involved in the project. A description of the study and objectives will be posted as well as quarterly and annual reports, announcements of activities, and press releases.

Site Visits: Visits to the well site(s) during drilling and testing will offered to the public by the Utah Geological Survey. Notices of the dates of the site visits will be posted on the project home page.

Industry Outreach Program: The UGS Public Affairs Officer (PAO) will set up technical displays at two major industry conventions per year: regional and national American Association of Petroleum Geologists (AAPG). The PAO will also compile and maintain a contact list of people and companies interested in the project and provide them with the UGS news magazine Survey Notes, semi-annual newsletter Petroleum News, and press releases.

Publications: The UGS and CGS will report all aspects of the project in a series of formal publications. These will include all the data as well as the results and interpretations. Topical papers will be submitted to appropriate journals (AAPG Bulletin and Journal of Petroleum Technology for example) and to local and regional societies for publication in their guidebooks series.

Talks and Technical Presentations: Technical talks and poster displays will be submitted to regional and national AAPG meetings when appropriate. Additionally, presentations may be given at local and regional geologic and engineering societies. Annual presentations will be made to the Technical Advisory/Stake Holders Boards.

Activity 3. Project Administration

Task 1: Project Administration and Management

Contract Negotiation: If the project continues into the Phase 2 demonstration, the UGS will handle contract amendments as needed with DOE in consultation with other team members.

Contract Deliverables: The UGS will be responsible for ensuring that all required technical and financial reports are prepared and delivered to DOE as required in the final contract.

Contract Management: The UGS Director/State Geologist will continue to oversee the Principal Investigator/Program Manager and a Financial/Business Manager. The Principal Investigator/Program Manager will oversee all technical aspects of the project. The Financial/Business Manager will interact with the appropriate DOE counterparts to facilitate the project activities.

Environmental Compliance and NEPA Requirements: UGS will prepare all documents and reports necessary to meet environmental requirements for either the State or Federal agencies. They will be submitted by UGS as required. The detailed site and project specific information may be used as the basis for site specific NEPA documents to be prepared for DOE.

Budget Period #3

Activity 1. Extended Monitoring Activities

Task 1: Monitor Response and Evaluation of Demonstration Techniques

All production and workovers will continued to be monitored to the end of the project including: gauging all oil, gas, and water produced; recording flowing tubing pressures; and recording shut-in pressures.

Increasing watercuts will be monitored and their impact on oil recovery calculated by preparing water-oil ratio versus cumulative oil curves.

Activity 2. Associated Technology Transfer Activities

Task 1: Technology Transfer

Technical Advisory Board: The Technical Advisory Board will continue to advise the team on the direction of study and will review technical progress. The Technical Advisory Board will meet at least once a year and will receive copies of all reports throughout the year.

Stake Holders Board: The Stake Holders Board will continue to receive all quarterly and annual technical reports and copies of all publications resulting from the study. Stake Holders Board meetings and/or meetings with individual Stake Holders will be held as needed.

World-Wide-Web Site: The UGS will continue to maintain a web site dedicated to the project. The web site will have a list containing e-mail addresses of personnel involved in the project. A description of the study and objectives will be posted as well as quarterly and annual reports, announcements of activities, and press releases.

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Publications: The UGS and CGS will report all aspects of the project in a series of formal publications. These will include all the data as well as the results and interpretations. Topical papers will be submitted to appropriate journals (AAPG Bulletin and Journal of Petroleum Technology for example) and to local and regional societies for publication in their guidebooks series.

Talks and Technical Presentations: Technical talks and poster displays will be submitted to regional and national AAPG meetings when appropriate. Additionally, presentations may be given at local and regional geologic and engineering societies. Annual presentations will be made to the Technical Advisory/Stake Holders Boards.

Regulatory, Economic, and Financial Information Needs: Issues concerning appropriate well spacing, field designations, taxes and regulations, and incentives will be addressed by the UGS and the CGS to appropriate state agencies. The UGS and the CGS will also make presentations and reports to the financial institutions in Utah and Colorado, and economic analyses to the states on the impact of the project.

Activity 3. Project Administration

Task 1: Project Administration and Management

Contract Negotiation: The UGS will handle contract amendments as needed with DOE in consultation with other team members.

Contract Deliverables: The UGS will be responsible for ensuring that all required technical and financial reports are prepared and delivered to DOE as required in the final contract.

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