

PUMP II

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Title of Project: Major Oil Plays in Utah and Vicinity

Area of Interest No. 1

STATEMENT OF WORK

OIL PLAYS IN UTAH AND VICINITY

A. Objectives

The overall **objectives** of this proposed study are to: (1) increase recoverable oil from existing field reservoirs, (2) add new discoveries, (3) prevent premature abandonment of numerous small fields, (4) increase deliverability through identifying the latest drilling, completion, and secondary/tertiary techniques, and (5) reduce development costs and risk. These objectives will be achieved by providing play portfolios for Utah's major oil producing provinces (thrust belt, Uinta Basin, and Paradox Basin) and adjoining areas of Wyoming and Colorado. The objectives for each phase of the work include: describe and map the major oil plays by reservoir; provide critical production and reservoir data; provide case-study field evaluations; summarize the state-of-the-art drilling, completion, and secondary/tertiary techniques for each play; delineate the locations of major oil pipelines; describe reservoir outcrop analogs for each play in Utah; identify land use constraints; and finally make all of this information publicly available in digital (web-based and compact disc) or hard copy format through a proven technology transfer plan.

B. Scope of Work

The oil plays in Utah's three major producing provinces, the thrust belt, Uinta Basin, and Paradox Basin, will be defined as sets of known or postulated oil accumulations sharing similar geologic, geographic, and temporal properties such as source rock, migration pathway, timing, trapping mechanism, hydrocarbon type. Each of these characteristics will be described, mapped, and illustrated. The resulting play portfolios will include the oil plays (data, maps, and descriptions) where they cross state lines into Wyoming (thrust belt) and Colorado (Paradox Basin).

From the state regulatory and other government agencies of Utah, Colorado, and Wyoming, we will acquire or produce current technology, well-log, completion, and production data, and published information, and compile various databases. Conventional core will be digitally photographed and described from selected representative reservoirs and tied to geophysical logs and/or petrophysical properties. We will describe outcrop analogs (depositional or structural) for each play.

The engineering aspects for each play will be summarized based on information obtained from the Technical Advisory Board, publications, other UGS projects, interaction with the staff of operators field offices and serviced companies, visits to field facilities, etc. The locations of major oil pipelines will be delineated from available digital sources.

Finally, play maps and descriptions, data tables, core descriptions, type geophysical logs, core photographs, etc., will be assembled in an interactive, menu-driven digital format (web and compact disc [CD]).

C. Tasks to be Performed

Task 1: Data Collection, Compilation, and Generation of Computer Database

Geographical, geological, engineering, pipeline locations, oil analysis, and production data for oil reservoirs in the thrust belt (Utah and Wyoming), the Paradox Basin (Utah and Colorado), and Uinta Basin (Utah only) which have produced more than 500,000 barrels of oil prior to January 1, 2002, will be collected and compiled in a standard table of data and entered into a computer database developed by the UGS. Available reservoir data, cores and cuttings, geophysical logs, various reservoir maps, and other information from the fields in the oil provinces and regional exploratory wells will also be collected. This information will be obtained from the UGS files and previous studies, various publications, Internet web sites containing digital data, state regulatory agencies (Utah Division of Oil, Gas and Mining; Wyoming Oil and Gas Conservation Commission; Colorado Oil and Gas Commission), Geological Survey of Wyoming, Colorado Geological Survey, federal agencies (Bureau of Land Management, Bureau of Indian Affairs, U.S. Geological Survey), field operators, and commercial distributors of petroleum information with whom the UGS has contracts, etc. Well locations, production reports, completion tests, core analyses and description, formation tops, and other data will be compiled and entered in the database. This information will be digitally linked to the play maps and fields. An annotated project bibliography will be created and stored in digital format.

Task 2: Definition and Mapping of Major Oil Plays

Oil play portfolios for the Utah-Wyoming thrust belt, Uinta Basin of Utah, and Paradox Basin of Utah and Colorado, will be defined and mapped. Oil potential will also be delineated. Where appropriate, plays will be divided into sub-plays. Reservoir data in the computer database will be grouped by play and sub-play. Play maps will be produced in digital and hard copy format. Digital maps will contain layers will include oil fields, wells, play boundaries, pipelines, land ownership, and geographical information, that can be turned on or off depending on need.

Task 3: Core Description & Geophysical Well Log to Core Analysis

Slabbed conventional core will be digitally photographed and described from selected representative reservoirs (some of which may be obtained from the state agencies of Wyoming and Colorado, U.S. Geological Survey, or field operators). The geophysical logs from wells with cores will be analyzed and compared to conventional core descriptions and/or petrophysical properties from core plugs. The logs will then be used to help determine the distribution of diagenetic processes, identify pore types, and facies, to estimate these trends in wells where conventional cores were not taken in the play. Core descriptions, type geophysical logs, and core photographs will be produced in digital and hard copy format.

Task 4: Descriptions of Oil Plays

Plays and sub-plays will be described and illustrated with a variety of structure contour maps, isopach maps, cross sections, and typical logs (from selected Utah, Wyoming, or Colorado fields). These descriptions will include: (1) geologic age, (2) depositional environment, (3) lithology, (4) trapping mechanism, (5) seal, (6) source rocks, (7) discovery, (8) number of active fields and wells, (9) production (monthly and cumulative), (10) state-of-the-art drilling, completion, and secondary/tertiary techniques, (11) land ownership, (12) oil pipeline information, (13) outcrop analogs, (14) land use constraints to future development, and (15) exploration potential and trends. Play descriptions will be produced in digital and hard copy format. Tables of reservoir data (production, porosity, permeability, temperature, discovery, number of wells, and well spacing, etc.) and basic oil characteristics (color, gravity, pour point, viscosity, percent sulfur) from the UGS oil sample bank and a variety of publications of analysis from Wyoming and Colorado will accompany each play. This information will be digitally linked to the play maps and fields.

Task 5: Analysis and Description of Drilling, Completion, Secondary/Tertiary Recovery Techniques and Other Engineering Methods

The state-of-the-art drilling, completion, and secondary/tertiary techniques used in each play will be described and obtained from (1) engineers and geologists from the Technical Advisory and Stake Holders Boards, (2) well production, completion, and workover records, injection reports, etc. from the Utah Division of Oil, Gas and Mining, Wyoming Oil and Gas Conservation Commission, and Colorado Oil and Gas Commission, (3) technical publications, (4) related research projects conducted by the Utah Geological Survey, Geological Survey of Wyoming, Colorado Geological Survey and the New Mexico Bureau of Mines and Mineral Resources, and other available sources of information. Project team members will establish contacts at and meet with staff from operator field offices and oil-field service companies in Utah, Colorado, Wyoming, and New Mexico to acquire the latest best practices information from those directly involved in reservoir performance and field operations. This work will also include visits to field facilities, workover/well completion operations, etc.

These descriptions will include the techniques currently being applied, economically successful new techniques, and analytical techniques used to evaluate the effect of geologic, operational, climatic, geographic, and economic factors on the profitability of the oil plays. Guidelines and documented examples for applying analytical techniques will also be provided. Reservoir data compiled in the database will be analyzed using statistical methods (graphs of cumulative production) to assess the predominant drive mechanisms, reservoir properties, and key geologic factors controlling oil production in Utah and adjacent areas in Wyoming and Colorado. All final best practices summaries will be subject to review and approval by engineers and geologists from the Technical Advisory and Stake Holders Boards.

Task 6: Evaluation of Outcrop Analogs

Representative outcrop analogs (depositional or structural) for each play present in or near the thrust belt, Uinta Basin, and Paradox Basin will be described in terms of the trapping mechanisms, fracture patterns, or reservoir heterogeneity, flow barriers and baffles, and geometry (depending on the oil play). These descriptions will be tied to the appropriate reservoir use in the respective plays.

Task 7: Drafting, Cartography, Reviewing, Editing, Desktop Publishing

All figures, graphs, and maps will be drafted or generated using a variety of software applications. These and the written reports will be reviewed and edited according to Utah Geological Survey standards and guidelines, followed by final assembly and production in desktop publishing (digital) format.

Task 8: Preparation of Final Digital Products

Play maps and descriptions, bibliography, data tables, core descriptions, type geophysical logs, and core photographs will be assembled in an interactive, menu-driven digital format (web and compact disc [CD]); readable with Acrobat Reader in portable document format (PDF) and spatial data files (geographic Information System [GIS] shape files) using ArcExplorer. Both Acrobat Reader (freeware) and ArcExplorer (shareware) will be included on the CD. Basic geographic spatial data, for use with GIS software, will also be included. In addition to the spatial data and image files, supporting documents and the software if needed to display documents and spatial data will be included as well as several program, PDF, text, and database files. The spatial data, associated metadata, and image files will be organized into subfolders: (1) Docs, (2) well_db and oil_db, (3) Images, (4) GISfiles, and (5) Software.

Task 9: Technology Transfer

Subtask 9a: Technical Advisory Board

A voluntary Technical Advisory Board (see Appendix C, letters of commitment) of oil company operators from the petroleum-producing provinces of Utah, and which are also located in Wyoming and Colorado, will be established at the beginning of the project. The Technical Advisory Board will: (1) review technical project data which will include geologic interpretations; (2) conduct a technical review of papers and reports prior to publication; (3) advise the project management team so the project moves in the most useful direction and recommend any project changes (subject to DOE approval); and (4) provide non-proprietary geologic, well, and engineering data which will be included in project data files and become part of the public record. The Technical Advisory Board will meet each project year both in Denver, Colorado and Houston, Texas, and will receive copies of all reports throughout the year.

Subtask 9b: Stake Holders Board

A Stake Holders Board (see Appendix C, letters of commitment) will be established at the beginning the project and will be composed of groups that have a financial interest in the study area, such as representatives from the Utah, Wyoming, and Colorado state governments (Utah School and Institutional Trust Lands Administration, Utah Division of Oil, Gas and Mining, Wyoming Oil and Gas Conservation Commission, Colorado Oil and Gas Commission, and County Commissions), Federal Government (U.S. Bureau of Land Management, U.S. Bureau of Indian Affairs, U.S. Forest Service), and tribal representatives, and other entities. The Stake Holders Board 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. The Stake Holders Board will: (1) review technical project data which will include geologic interpretations and models; (2) conduct a technical review of papers and reports prior to publication; (3) advise the project management team so the project moves in the most useful direction and recommend any project changes (subject to DOE approval); (4) provide geologic and well data, if available, which will be included in project data files and become part of the public record; and (5) advise project management team on land-use issues.

Subtask 9c: Web Page

The UGS will maintain a web page, established and dedicated to the project. The web page 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, press releases, and access to digital project publications.

Subtask 9d: Industry Outreach – Displays at AAPG Conventions

The UGS Industry Outreach Geologist (IOG) will set up technical displays at the annual national American Association of Petroleum Geologists (AAPG) conventions each year as part the UGS Industry Outreach Program. The IOG 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*, annual newsletter *Petroleum News*, and press releases. The industry outreach program will prominently display the progress and goals of the project with team members available to describe them and answer questions.

Subtask 9e: Talks & Technical Presentations

Technical talks and poster displays will be submitted to the 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.

Subtask 9f: Publications

The UGS will publish play maps and descriptions, bibliography, data tables, core descriptions, type geophysical logs, and core photographs in an formal, interactive, menu-driven digital format (web and compact disc [CD]); readable with Acrobat Reader in portable

document format (PDF) and spatial data files (geographic Information System [GIS] shape files) using ArcExplorer. Hard copies will also be available. Both Acrobat Reader (freeware) and ArcExplorer (shareware) will be included on the CD. Basic geographic spatial data, for use with GIS software, will also be included so the user can display the oil-play themes or layers. The spatial data, associated metadata, and image files will be organized into subfolders: (1) Docs - PDF documents containing oil play descriptions and outcrop analogs; maps, cross sections, and other figures; data tables; a bibliography; user guides for the CD and software, (2) well_db - database of wells and production information in oil plays and oil_db - database of oil characteristics of Utah's crude oils, (3) Images - GIS generated oil-play maps, pipelines, core descriptions, type logs, and photographs as PDF files, (4) GISfiles - spatial data layers (GIS shape files) containing well and production data, as well as base and infrastructure, for Utah, and (5) software - ArcExplorer and Adobe Acrobat Reader.

Task 10: Project Administration & Management

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