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Investigation of Improved Conductivity and Proppant Applications in the Bakken

Oil and Gas Research Council
December 9, 2010
Bismarck, North Dakota

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Energy & Environmental Research Center

DEPARTMENT OF ENERGY · UNITED STATES OF AMERICA

NETL NATIONAL ENERGY TECHNOLOGY LABORATORY

PCO2R Partnership

Grant Request Details

Description: Use laboratory methods to determine loss of conductivity relative to potential proppant or formation face collapse and suggest means to maintain conductivity.

Applicant – Energy & Environmental Research Center
Partners:

- Insight Consulting, Mike Vincent
- Carbo Ceramics, Robert Duenckel, Director of Technical Development
- U.S. Department of Energy (DOE) National Energy Technology Laboratory (NETL) Joint Research Program
- North Dakota Geologic Survey

Request – $150,000
Cost Share NETL – $113,201
Cost Share Carbo – $69,231
Total Program – $332,432

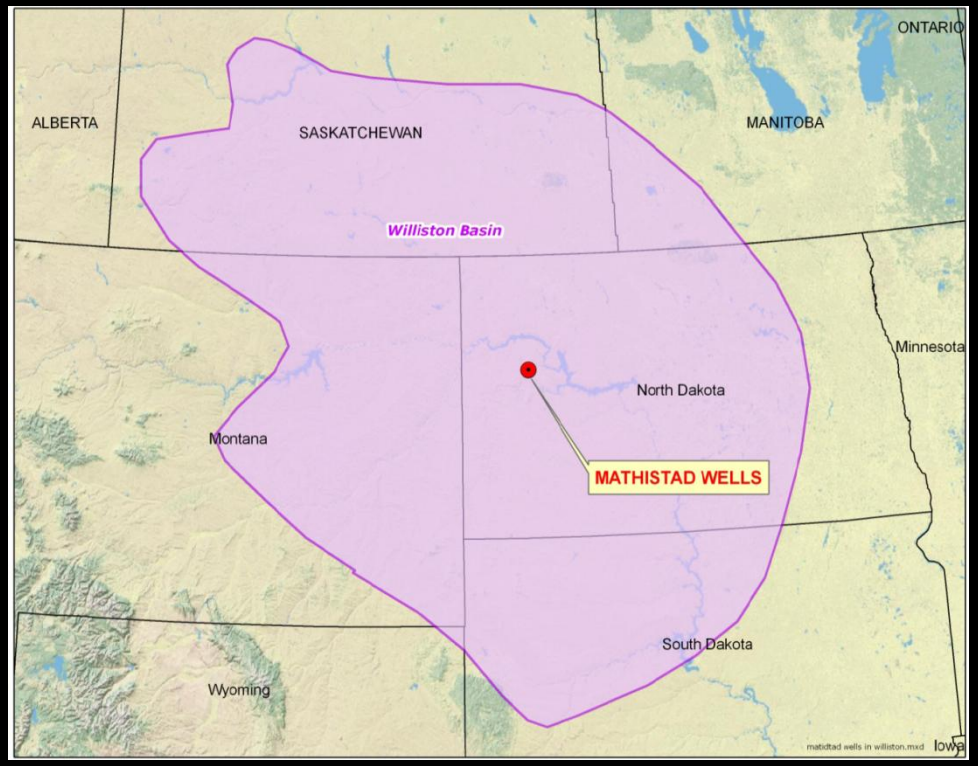
12-month contract

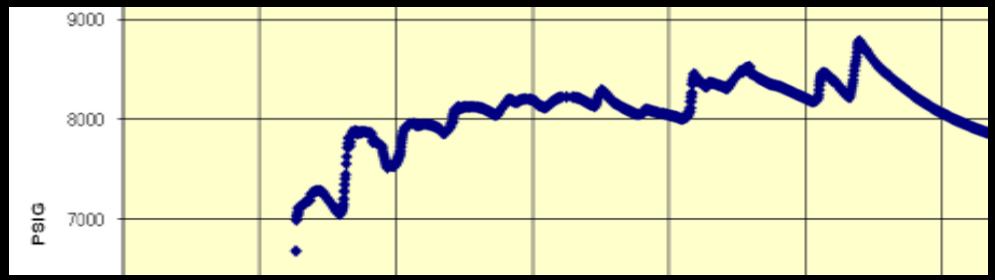
Technical Justification

OGRC Project
Continental Resources Inc.

G-018-039 "Determination of the Uniqueness of Reserves and Productivity from the Middle Bakken and the Three Forks Sanish Zones"

- Fracture communication from Middle Bakken into Three Forks wellbore.
- Production separate, healed LBS.
- Results suggesting well spacing and potential recovery.





Methodology

Goal: Improve production from the Three Forks and Bakken by identifying the factors that lead to the collapse of propped fractures.

1) Is conductivity loss due to collapse of proppant, or collapse of formation face, or some other mechanism?
2) Can loss of conductivity be remedied with more appropriate selection of fluid types, proppant types, or proppant concentrations/fracture widths?

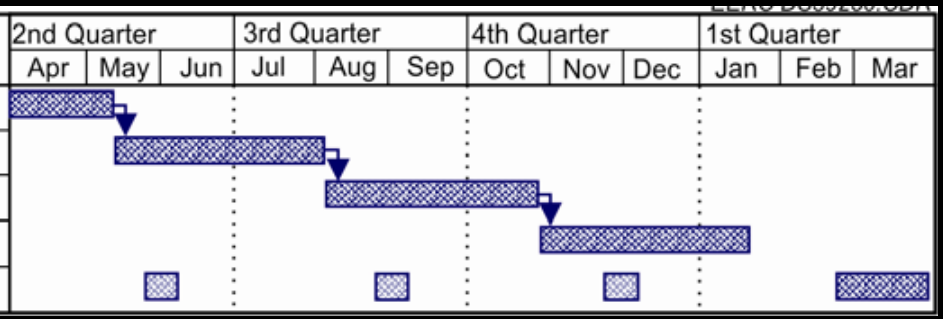
Key Elements:

- Collection of core
- Penetration and embedment testing of core relative to fluids:
  - Water
  - Alkali borate cross-linked water-based gels
  - Hydrocarbon-based fracturing fluids
  - Acidic conditions from native CO_2 with combined oil, water, and gas production
- Conductivity testing evaluating relative proppant performance
- Validation to API and ISO standards.

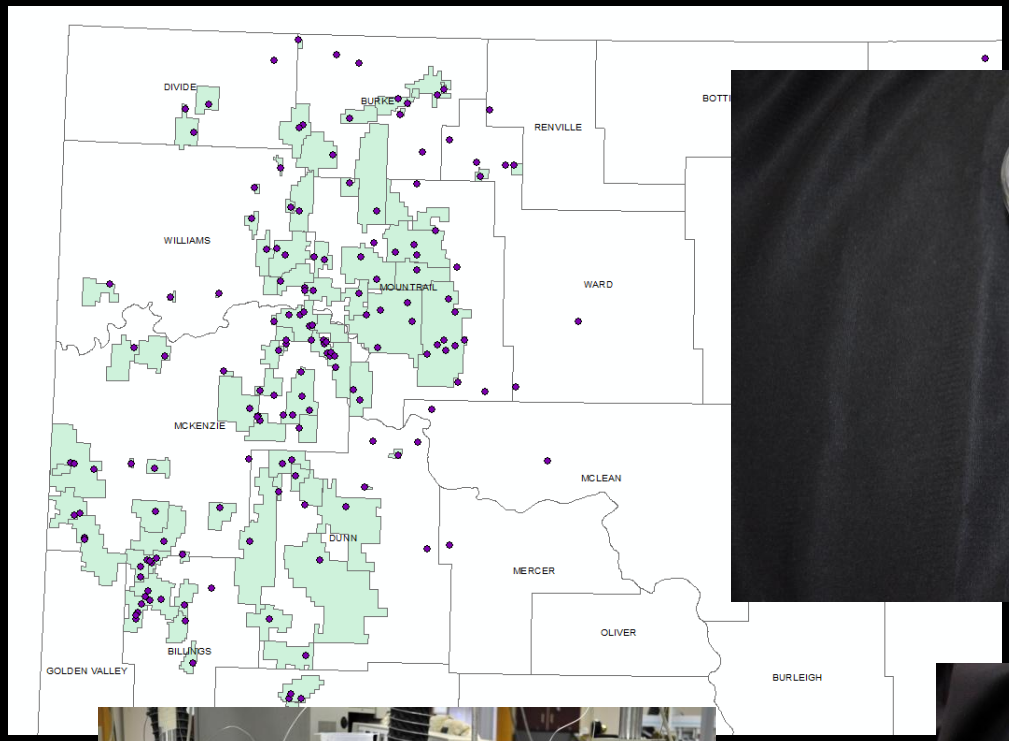
Scope of Work

- Task 1 – Obtain core samples
- Task 2 – Embedment and penetration testing
- Task 3 – Proppant degradation studies
- Task 4 – Conductivity testing
- Task 5 – Analysis and reporting

ID	Task Name	Duration
1	Task 1 – Obtain Core Sample	30 days
2	Task 2 – Embedment and Penetration Testing	60 days
3	Task 3 – Proppant Degradation Studies	60 days
4	Task 4 – Conductiivity Testing	60 days
5	**Task 5 – Analysis and Reporting**	223 days



Tools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BURLEIGH


CARBO


ROCTEST
TELEMAC

Anticipated Results

- The first published measurements of proppant conductivity against actual Bakken core.
- The first published measurements showing how various proppants perform under conditions more similar to the Bakken in situ environment, including CO_2 and other acid gases, with actual or synthetic Bakken crude and produced water.
- A comparison of currently utilized proppants to help operators recognize the range of proppant quality, performance, and durability.

- Benefit – Significant additional oil recovery; 30% improvement = 600 million bbl.