Bakken Production Optimization Program

Update for the Oil & Gas Research Council

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EERC
Energy & Environmental Research Center®
Putting Research into Practice

Energy & Environmental Research Center (EERC)…
The International Center for Applied Energy Technology®

THE UNIVERSITY OF NORTH DAKOTA

Membership to Date

Continental Resources

Petro-Hunt, L.L.C.

North Dakota oil & gas research program

ConocoPhillips

SM Energy

Marathon Oil Corporation

Hess

Oasis Petroleum

Nuverra Environmental Solutions™

Hitachi Data Systems

Whiting

Hawkinson Summary (Continental)

- Phase I – Drilling 11 New Wells
  - Complete
- Phase II – Completion Operations of 11 New Wells
  - First production Nov2013
  - VSP collected
  - 10 of 11 wells monitored with multiple VSI tool arrays
  - Microseismic conducted, now completing analysis and QC

Hawkinson Summary (Continental)

- Phase III – Reservoir Engineering
  - Fracture modeling of completion ops initiated for existing and new wells
  - Chemical tracer samples collected from fracture treatments
  - Postfracture pulse testing was performed to determine initial open-fracture connectivity after flowback
  - Completed petrophysical evaluation of pilot hole logs to determine OOIP and reservoir properties
- Phase IV – Expansion Applications via 3D Seismic
  - Completed field acquisition of 3D seismic
  - 3D seismic data processing is underway

Phase V – Optimization of Wellsite Operations Summary (EERC)

- Flaring Mitigation *(Subtask 1 – Hydrocarbon Utilization)*
  - NDPC Flaring Task Force Support
    - ♦ EERC produced a fact sheet on flaring and distributed several hundred copies
    - ♦ By task force request, EERC created a web-based database to house technical information on technologies capable of utilizing wellhead gas
    - ♦ EERC is providing support to the task force in preparation for a meeting with Gov. Dalrymple on Jan29. EERC will present a portion of this message to the governor.
  - Investigating the Potential for Utilizing Rich Gas for EOR in the Bakken Play
    - ♦ Initiated a laboratory study to evaluate the potential to utilize rich Bakken gas for EOR

Phase V – Optimization of Wellsite Operations Summary (EERC)

- NORM Disposal *(Subtask 2 – Waste Management)*
  - EERC produced a fact sheet on NORM waste and distributed several hundred copies.
  - EERC is supporting the NDPC NORM Task Force
    - NDPC is engaged in complementary efforts to the ND Dept. of Health / Argonne National Lab study – the task force has asked EERC to coordinate supplemental radionuclide analyses.
    - EERC is providing technical input to the task force as they consider the questions before them.
  - EERC produced a draft NORM educational booklet that is now being reviewed by a task force team.

Phase V – Optimization of Wellsite Operations Summary (EERC)

- Subtask 3 – Water Management
  - Produced a fact sheet on water use in Bakken drilling & completion.
  - Presented on this program at the ND Water and Pollution Control Conference, with a focus on water needs for hydraulic fracturing and the challenges related to water recycling and reuse.
- Subtask 5 – Process Optimization and Systems Failure Analysis
  - Engaged in discussions with a member company on the topic of assisting with corrosion-induced well failure analyses.
  - Initiated compilation of a document describing analytical capabilities and in-house expertise to assist members with corrosion and scale diagnostics that could facilitate mitigation strategies.

Phase V – Optimization of Wellsite Operations Summary (EERC)

- Miscellaneous Efforts Under this Program
  - The EERC was asked to provide preliminary data and format guidance on a fact sheet focused on crude oil transport by rail. The goal of this fact sheet would be to objectively compare and contrast Bakken light sweet crude to other flammable commodities commonly transported by rail in North America.
  - EERC is working to facilitate partnerships between Hitachi Data Systems and Bakken producers to explore new “big data” approaches to data analysis that could facilitate optimization of Bakken resource development.

Finances Utilized Efficiently and Effectively

Program Working Budget

Sponsors	Year 1	Year 2	Year 3	Total
NDIC Share – Cash*	$3,000,000	$3,000,000	$2,000,000	$8,000,000
Industry Share – Cash	$750,000	$750,000	$750,000	$2,250,000
Continental Share – In-Kind	$40,989,233	$40,989,233	$24,051,534	$106,030,000
TOTAL	**$44,739,233**	**$44,739,233**	**$26,801,534**	**$116,280,000**

** Includes $6.26M subcontract to Continental*

Program Expenses to Date

	NDIC	Industry	TOTAL
EERC	$225,276	$30,333	$255,609
Continental – Subcontract	$1,210,000		$1,210,000
Continental – In-Kind		$87,295,701	$87,295,701
TOTAL	**$1,435,276**	**$87,326,034**	**$88,761,310**

** Invoiced to EERC*
***Reported to EERC*

Specific Program Expansion Opportunity

Possible Additional Tasks within Bakken Production Optimization Program

- Industry and NDIC have identified possible expansions to the scope of work previously defined for the Bakken Production Optimization Program (BPOP)
  - Waste Management, Minimization & Utilization
    - ♦ Wellsite waste management
    - ♦ Cuttings disposal & reuse, especially surface to Fox Hills Fm
  - Spill Remediation Investigations (especially salt water, but oil, fuels, etc. as well)
    - ♦ New additives (brine remediation accelerators)
    - ♦ Excavate vs in-situ treatment
  - Land Reclamation Investigations
    - ♦ Reclamation after completed industrial activities
      - Abandoned/downsized pads
      - Pipeline ROWs

Possible Acceleration within BPOP

- North Dakota Resources Addressing North Dakota Challenges
  - The EERC would enlist NDSU Extension Service's soil science, rangeland productivity, and agricultural economics expertise
  - Specific efforts would be developed with member companies, NDIC, and program staff @ EERC and NDSU
- Infusion of an additional $450-600k into the BPOP program could expand and accelerate priority activities in these expansion areas
  - Industry cost share is already in place
  - Project opportunities for spring 2014 implementation and full growing season monitoring