Summary Slides

Our Own Debutante Party for a Special Young Lady – “ROZ”

A Recap of the 2010 Field Trip to Hess Corporation’s Seminole San Andres Unit CO$_2$ Flood and Facilities And Legado Resource’s Goldsmith Landreth CO$_2$ Flood (Ector Co, Tx)

December 8, 2010
A Very Special Thanks Goes to the Conference Sponsors

Advanced Resources International
Anadarko Petroleum
Apache Corporation
Applied Petroleum Technology Academy
Denbury Resources
Enhanced Oil Recovery Institute
Exxon Gas & Power Marketing
Hess Corporation
KinderMorgan CO₂ Company
Legado Resources
Midland College’s Petroleum Professional Development Center
NCG Consulting Group
Oxy Permian
Russell K Hall and Associates
Society of Petroleum Engineers, PB Section
Trinity CO₂, LLC
The University of Texas of the Permian Basin
Whiting Petroleum Corporation
2010 CO$_2$ Flooding Conference  
*Wednesday, Dec 8th*

**CO$_2$ Conference Field Trip to Seminole and Goldsmith**

*Clothing Requirements*: If you have fire-retardant clothing, please wear; if not, wear long sleeve cotton shirt and cotton pants. You need to also wear sturdy, closed–toe shoes. Hard hats and safety glasses will be provided for the portion of the trip where needed.

*Host Sponsors*: Hess Corporation and Legado Resources  
*Trip Coordinator*: Bob Kiker – APTA

*(8:00 am to 5:00 pm)*

- **8:00**: Check-in at Midland Center
- **8:30**: Buses Depart Midland Center Promptly
- **9:45**: Arrive at Hess Offices in Seminole, Tx
- **9:45-10:15**: Rest Stop, Briefing
- **10:30-11:45**: Tour of Field Facilities
- **12:00**: Return to Hess Offices for Buffet lunch
- **12:00-1:00**: Lunch
- **1:00**: Depart for Tour of Plant Facilities
- **2:30**: Depart for Goldsmith
- **3:30**: Goldsmith Landreth CO$_2$ Flood and Facilities
- **4:00-4:15**: Goldsmith Rest Stop
- **4:15-5:00**: Return Trip to Midland Center
CO$_2$ Floods in the Permian Basin
ACTIVE RESIDUAL OIL ZONE CO₂ EOR PROJECTS IN THE PERMIAN BASIN

MIDDLE SAN ANDRES PALEOGEOGRAPHY
with Location of Industry Documented ROZ Zones/Fields*

* Adapted from Sagnak (2006), Chevron Presentation at the 12/06 CO₂ Flooding Conference
MAP OF FIELD TRIP ROUTE
STOP NUMBER 1

THE SEMINOLE FIELD
Seminole San Andres Unit (SSAU)

Penwell and Summit Energy’s Texas Clean Energy Project
# SSAU BACKGROUND

## SSAU Background

**Seminole San Andres Unit**

### Ownership
- Hess: 34.3% (operator)
- OXY: 28.0%
- ExxonMobil: 19.2%
- Marathon: 13.5%
- Chevron: 2.5%
- Others: 2.5%

### Location
Permain Basin, TX

### Wells
- 368 prod
- 196 inj

### Facilities
SSGP Unit CO2 Recovery Plant

### Reservoir Description
Limestone and dolomite deposited in a shallow carbonate ramp environment

### Fluid Type
Saturated black oil

### Drive Mechanism
Gas in solution and gas cap during primary. External energy from water and CO2 injection during secondary and tertiary recovery.

### Develop. History
- 1936: Discovery
- 1936: First Production
- 1959: Unitized/Waterflood
- 1983: MPZ CO2 Flood Begins
- 1996: ROZ Phase 1
- 2004: ROZ Phase 2
- 2007: ROZ Stage 1

### Cumulative Production
- 674 MMBO
- 41 MMBOE NGL
- 685 BCF HC Gas

### Current Rate
- 19.7 MBOPD
- 242 MMCFD CO2+HC
- 28,113 MBOEPD (Oil+NGL+Gas)

Reference: Biagiotti, S. (2010), Houston Section of the SPE Reservoir Study Group, May 2010
SSAU Field Flow Schematic
Overall Seminole Plant Schematic

This nominal capacity of the ROZ expansion is 70 MMSCFD inlet gas, though design allowances and equipment margins should result in a throughput capacity of 75 to 80 MMSCFD (Dehydration through Membrane Separation is ~2 times to incorporate the SGPP gas). ROZ is designed to run on the common SGPP inlet system, analogous to trains 1-3. A new 30" inlet header around the NW corner of SGPP connects the new ROZ inlet to the existing inlet laterals and manifold. The three fixed-speed ROZ centrifugal compressors work in series, and are designed to run in complement with each other. Inlet Gas fluctuations will be absorbed by the existing SGPP I/T compressors and pressure control valves (PV-5031 and PV-5047).

The throughput of ROZ is controlled primarily by the flow-control valves on the inlets to the membrane skids (PV-5014/15). During normal operation, it is expected that these valves will have local set-points higher than attainable, in order to maximize throughput. Variations between the ROZ Inlet and Permeate Compressors are controlled by the pressure control valves on the SGPP inlet compression discharge header (PV-5011-1/2), allowing excess inlet gas from the Reciprocating compressors to revert to the High Pressure TEG Dehydration.
Recent Seminole Plant Expansion

HESS CORPORATION
U.S. EXPLORATION AND PRODUCTION
SEMINOLE GAS PROCESSING PLANT
SGPP GAS PROCESSING SCHEMATIC

INLET GAS
- CO2 + METHANE
- METHANE TO SALES
- CO2
- NATURAL GAS LIQUID
- SOUR GAS
PROPERTIES OF THE ROZ

SSAU Sponge Core Data

Ref: SPE 133089

Selected Interval “Average” Oil Saturation for ROZ
HISTORY OF ROZ DEVELOPMENT

Seminole San Andres Unit
ROZ Development

May 18, 2010
SSAU OIL RESPONSE* TO CO₂

SSAU TERTIARY (CO₂) PHASE OIL PRODUCTION AND ANALYSES

* Interpretations as per Melzer Consulting
STOP NUMBER 2
THE GOLDSMITH FIELD
Goldsmith Landreth
San Andres Unit (GLSAU)
Goldsmith Landreth
San Andres Unit
(GLSAU)

• 6,200 Acre San Andres Unit

• CO$_2$ ROZ Pilot in Place (as of 6/10, 4 Wells on CO$_2$ Injection 6 of 9 Producers Responding)

• Pilot Designed to Prove up ROZ Potential (More than Double CO$_2$ Reserves)

• Phase I Co-development of Main Pay and ROZ just underway (Nov ’10)
**Detailed GLSAU Background (1)**

**TIMELINE**
- Discovered in 1934 with 250 wells drilled by 1945
- Gas cap reinjection occurred from 1948 to 1969
- Unitized in 1963 with Amoco operating until 1996
- Initially a peripheral flood injecting below main pay
- Expanded to 40ac 5-spot patterns over ~20 yr span
- Water curtain ceased & oil migrated into gas cap
- Well abandonments in mid 80’s accelerates decline
- Field pressure in 2008 varied from 1000 – 2000 psi
- Legado acquired in ’08, Avg well 4 BOPD at 1% oil cut

- Reactivated, deepened through ROZ, and cut core
- Convert from rod pump to ESP when ROZ added
- Installed CO2 pilot in 2009 at 5 MMCFD injection
- Expanded pilot to 4 pats 1Q-2010 at 16 MMCFD
- Install Ph 1 CO2 by YE-2010 & ramp to 55 MMCFD
**Detailed GLSAU Background (2)**

**CO₂ FLOOD (2009-2010)**

*Well Utility ($16.9 MM)*
- 20 CO₂ injectors, 30 prods, 22 containment injectors

*Facilities ($23.6 MM, excluding NGL plant)*
- 3.5 mile 8” pipeline (200 mmcmd)
- 14 miles of injection line (3” laterals, 6”-8” trunk)
- 11 miles of flow line (3” flow line, 16” trunk)
- 3650 HP of compression (16 mmcmd, 3 units)
- Central Processing Facility (60,000 BFPD)
- 2 Test Satellites (16 prod/16 inj wells each)
- NGL Processing Facility

**Background**
- All CO₂ flood wells deepened through ROZ
- Avg CO₂ injection 4.5 MMCFD/well
- Pilot prod 300+ BOPD incremental to date
CO₂ Project
Phase I Central Processing Facility Process Flow

EMERGENCY ROUTE ONLY

INLET CO₂, OIL & SALTWATER

LOW PRESSURE SEPARATOR

T-1

10,000 BBL GUNBARREL TANK

T-3

SALTWATER

VAPORS

T-2

1,000 BBL OIL SKIM TANK

SALTWATER VAPORS

EMERGENCY GAS FLARE

ELECTRIC VRU

WATER TO BE REINJECTED

(2) 10,000 BBL SALTWATER TANKS

(2) 1000 BBL OIL STORAGE TANKS

TO BE REINJECTED

VAPORS

EMERGENCY ROUTE ONLY

ELECTRIC COMPRESSORS

SALTWATER VAPORS

ELECTRIC INJECTION PUMPS

WATER TO BE REINJECTED

TO BE REINJECTED

LEGADO RESOURCES LLC
The Woodlands, Texas

GOLDSMITH LANDRETH SAN ANDREDS UNIT
Ector County, Texas

Process Flow Diagram
Not To Scale
July 2010
CO\textsubscript{2} EOR RESPONSE AT THE GLSAU

LEGADO GOLDSMITH SAN ANDRES "BROWNFIELD" CO\textsubscript{2} EOR (+ROZ) PRODUCTION

- Legado Assumes Operations
- Estimated Nov Average
- Initiated CO\textsubscript{2} Injection 8/09 (2 wells)
- "Bump" in Production from Deepenings
Thank You