McMullen Thermal Conduction Process Experimental Pilot Project
Review of ERCB Approval 11541 and Approval 11541A
February 12, 2014
Introductions and Overview

• Introductions
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• 3.1.2 Surface Operations, Compliance, and Issues Not Related to Resource Evaluation and Recovery – slide 61
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3.1.1 Subsurface Issues – Table of Contents

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Project Background - Approvals

- December 2010 - AER issued Approval 11541 for the McMullen TCP experimental scheme application and ESRD issued EPEA Approval 265571-00-00 in January 2011

- January 2012 - AER issued Approval 11541A for 3 additional HZ production wells as a modification to the scheme

- August 2013 – AER issued Approval 11541B for the handling of sour gas at the facility for all production wells

- October 2013 – AER issued Approval 11541C to extend the experimental scheme approval and confidentiality period to July 31, 2015
AER Approved Expanded Primary Area by an additional 41 sections for a total of 68 sections (down-spaced to 36 wells/section)

McMullen TCP Pilot Project
SW 35-78-25W4
Application area

AER Initial Approved Primary Area of 27 sections - down-spaced to 36 wells/section

Husky has drilled 300 wells since 2008
Project Location (SW/4 of 35-78-25W4)

- The Project location is the SW/4 of 35-78-25W4 based on core and log data from 100/03-35-78-25W4 well drilled in Nov 2008

- This well has a depleted gas zone of 4 meters in thickness that overlies a bitumen zone of 6 meters in thickness

- The underlying thin bitumen zone of 6 meters has excellent reservoir characteristics and is classified as a homogeneous, unconsolidated, clean sand with good porosity, excellent permeability and good oil saturation

- There is no underlying water in contact with the bitumen

- The overlying gas cap has a good seal
McMullen Thermal Conduction Process (TCP) Pilot Scope

What are we doing and why?

- Purpose is to recover a bitumen resource from a thin reservoir underlying a depleted gas cap
- 3 air injection wells equal distance along a 400 m Hz well – 6 observation wells for monitoring of the process
- Ignite and oxidize the residual oil saturation in a depleted gas cap reservoir
- Ignition process – steam/linseed oil/steam/N2/air – spontaneously combust
- Combustion zone peak temp – burn tube test 600 C, field temp 330 C
- Allow 3 to 6 months to conduct sufficient heat to underlying bitumen zone
- Husky is targeting a reservoir temperature of 56 deg C and a viscosity of 2200 cp to achieve flow rates of 25 m3 per day (see viscosity temperature chart – slide 79)
- Expected flow rates from a 400 m Hz pilot well at 25 m3 per day
- Expected recovery 50%
McMullen Thermal Conduction Process – Project Status

**Project Status and Timeline**

- 13 wells have been drilled and facility construction completed in 2011/2012
- First steam on September 28 2011
- First air injection on December 8 2011, ignition has been confirmed
- Applied for and received approval to drill 3 additional HZ producers in Q1 2012 for determining well spacing
- A third train of air compression was added in Oct 2012 to ensure that high temperature oxidation at the combustion front is maintained
- First production in Aug 2012 (H2S detection)
- Production re-start on Nov 1, 2012
- Three additional horizontal well start-up was in Sep and Oct 2013
- Confidential status expiry extended to July 31, 2015
Pilot Research Objectives (Jan 2010 Application)

• To field verify successful ignition and a continuous combustion process combined with the safe and continuous operation of the air injection facilities

• To test the effectiveness of the thermal conduction process in heating the underlying bitumen in order to mobilize the flow of oil at oil rates of 25 m³ per day

• To determine the rate at which the combustion front will move through the depleted gas zone

• To determine the optimal injector and horizontal well spacing for the anticipated future design of a commercial process

• To gain an increased understanding between the combustion front in the gas cap and the underlying horizontal well to ensure there is no breakthrough of combustion gases to the horizontal well
Improved Recovery Technique

• An innovative technology process that focuses on the successful recovery of heavy oil from a thin bitumen reservoir underlying a depleted gas cap that is currently not recoverable by other means.

• The McMullen pilot uses the concept of air injection and in-situ combustion as a “thermal recovery process” to conduct heat downward from the gas zone to the underlying bitumen leg in order to mobilize the oil for production.

• Combustion reactions will be confined to the gas zone where the low residual oil saturation (15%) combined with the air, will result in high temperature oxidation.

• This Project has a significant reduction in fresh water usage over conventional in-situ thermal recovery methods such as Steam Assisted Gravity Drainage (SAGD) and Cyclic Steam Simulation (CSS). Water requirements are for initial steaming only, using a temporary steam generator.
Geology/Geoscience
OBIP Reserve Estimate
Volumetric Methodology

Average Reservoir Parameters:

- Net Oil Pay = 6 m
- Porosity = 31%, So = 70%
- Oil FVF = 1.00 m³/m³

- 64 ha (Entire approval area = SW/4 section 35-78-25W4)
- OBIP = 833 e3m³

- Operating portion of the scheme: 13 ha (4 horizontal producers)
- OBIP = 169 e3m³
Wabiskaw “A”
Net Oil Pay Map

SW 35-78-25W4
Application area
SW 1/4 of Section 35-78-25W4
Wabiskaw “A” -Net Oil Pay Values-
Wabiskaw “A”
Net Gas Pay Map

SW 35-78-25W4
Application area
SW 1/4 of Section 35-78-25W4
Wabiskaw “A” - Net Gas Pay Values
Wabiskaw “A”
Structure map

SW 35-78-25W4
Application area
SW 1/4 of Section 35-78-25W4
Wabiskaw “A” -Structural Values-
SW 1/4 of Section 35-78-25W4
Wabiskaw “A” - Gas/Bitumen Contact Structural Values
Reservoir and Fluid Parameters

### Wabiskaw A
- **Pressure:** 1722 Kpa
- **Viscosity:** 18% 2% bulk wt
- **API:** 77,700cp 9.4 API
- **Bitumen Saturation:** 18% 2% bulk wt
- **Pressure:** 1815 Kpa
- **Viscosity:** 45% 7% bulk wt
- **API:** 95,300cp 9.1 API
- **Bitumen Saturation:** 45% 7% bulk wt
- **Pressure:** 1864 Kpa
- **Viscosity:** 75% 11% bulk wt
- **API:** 121,000cp 8.8 API
- **Bitumen Saturation:** 75% 11% bulk wt

### Wabiskaw B
- **Pressure:** 1815 Kpa
- **Viscosity:** 47% 8.8% bulk wt
- **API:** 210,800cp 7.9 API
- **Bitumen Saturation:** 47% 8.8% bulk wt
- **Pressure:** NA
- **Viscosity:** NA
- **API:** NA
- **Bitumen Saturation:** NA

### Base of Wabiskaw
- **Pressure:** 67% 10% bulk wt
- **Viscosity:** 60% 8.4% bulk wt

### McMurray
- **Pressure:** 72% 27% 3.6 - 4.5 D
- **Viscosity:** 27% 33%
- **API:** 3.6 - 4.5 D
- **Bitumen Saturation:** 32% 5.9 D
- **Porosity:** 32%
- **Permeability:** 5.3 D
- **4.0m Gas (Depleted)**
- **6.0m Bit**

**HZ Well Elevation (4m below G/B contact)**

**Main Pass: Density Porosity - Sandstone**

**Main Pass: Induction**

**8:30 Well Log**
Fluid Contacts

Bitumen
Gas Cap
Gas/Bitumen Contact
Charwater Shale (Caprock)
Wabiskaw “A”
Transgressive lag

Bottom
Top
**Mineral Composition in the Gas and Bitumen zones**

**Gas Zone**

<table>
<thead>
<tr>
<th>Mineral</th>
<th>Whole Rock Weight %</th>
<th>Whole Rock Weight %</th>
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</thead>
<tbody>
<tr>
<td>Quartz</td>
<td>93</td>
<td>96</td>
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<tr>
<td>K-Feldspar</td>
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<td>Plagioclase</td>
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<td>Anhydrite</td>
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<td>0</td>
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<td>Calcite</td>
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<td>Dolomite</td>
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<td>Halite</td>
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<td>Siderite</td>
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<tr>
<td>Pyrite</td>
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<tr>
<td>Total Clay</td>
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<tr>
<td>Total</td>
<td>100</td>
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**Bitumen Zone**

<table>
<thead>
<tr>
<th>Mineral</th>
<th>Whole Rock Weight %</th>
<th>Whole Rock Weight %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quartz</td>
<td>96</td>
<td>94</td>
</tr>
<tr>
<td>K-Feldspar</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Plagioclase</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Anhydrite</td>
<td>2</td>
<td>2</td>
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<tr>
<td>Calcite</td>
<td>0</td>
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<td>Dolomite</td>
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<tr>
<td>Halite</td>
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<td>Siderite</td>
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<td>Pyrite</td>
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<td>0</td>
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<tr>
<td>Total Clay</td>
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<tr>
<td>Total</td>
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**Clay Mineral**

<table>
<thead>
<tr>
<th>Clay Mineral</th>
<th>Relative Clay %</th>
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<tbody>
<tr>
<td>Smectite</td>
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<td>0</td>
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<tr>
<td>Illite / Smectite *</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>Illite</td>
<td>37</td>
<td>28</td>
</tr>
<tr>
<td>Kaolinite</td>
<td>21</td>
<td>41</td>
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<tr>
<td>Chlorite</td>
<td>39</td>
<td>23</td>
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<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
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</table>

* Illite / Smectite Mixed-Layer Clay

The percentage of smectite layers in illite / smectite clay is 60-70%.

Due to inherent limitations in X-ray diffraction quantification, results must be considered semi-quantitative.
Structural Cross-Section Between the 3 Injectors

00/03-35-78-25W4
RR 2008-11-19
KB: 579.6m

02/06-35-78-25W4
RR 2010-03-15
KB: 579.5m

03/06-35-78-25W4
RR 2010-03-22
KB: 579.6m
Structural Cross-Section
Between the 6 Observation Wells

B

04/05-35-78-25W4
RR 2011-03-11
KB: 578.8m

03/05-35-78-25W4
RR 2011-03-16
KB: 579.5m

07/06-35-78-25W4
RR 2011-03-20
KB: 579.3m

04/04-35-78-25W4
RR 2011-03-29
KB: 579.7m

B'

04/03-35-78-25W4
RR 2011-04-04
KB: 579.6m

04/06-35-78-25W4
RR 2011-03-26
KB: 579.6m
Husky Seismic Coverage

- Original Primary Recovery Scheme Boundary
- Expanded Primary Recovery Scheme Boundary
- TCP Recovery Scheme Boundary
- Husky 3-D Seismic Coverage
- Husky 2-D Seismic Coverage
Cap Rock Integrity Program

- **CAPROCK** (overlying Wabiskaw “A”)
  - Clearwater shale sequence (≈ 95 meters thick)

- **PILOT MINI-FRAC TEST**
  - Conducted in March 2010 on the 14-36-78-25W4 well (RR Oct 18, 2008) and submitted to the ERCB.
  - Results indicate that the cap rock shale has an interpreted in-situ minimum stress = 8,200 kPa (fracture gradient = 18.51 kpa/m)

- **ERCB Scheme Approval Maximum Operating Pressure:** 5,000 kPa

- **Injection pressures during steaming phase:** 2,200 – 2,500 kPa

- **Current Injection Scheme Operating Pressures:**
  - ≈3,200-3,300kPa with an air injection rate of 90 e3m3/d per injector
  - Current scheme operating pressures are well below the interpreted in-situ minimum stress pressure of the cap rock
Surface Monitoring Program

- Surface heave monitoring is not required due to the small volume of steam that was injected (8,311 m³ cold water equivalent) before the switchover to continuous air injection in September 2011
Drilling and Completions & Instrumentation in Wells
Metering and Monitoring

- **Air injection** will be measured on an individual well basis and the four horizontal wells are equipped with production tanks

- **Four Horizontal Oil Production Wells** – thermocouples placed every 25m along the horizontal section and pressure sensors at the heel, middle and toe of the horizontal section. All four wells are also equipped with Gas Chromatographs to monitor produced gas composition. Oil & gas samples are analyzed periodically to detect down-hole changes and confirm GC readings

- **Three Air Injection Wells** – thermocouples have been placed at the mid-point of perforations in the gas zone, two wells are equipped with additional temperature sensors to indicate the potential of flow behind pipe

- **Six Observation Wells** – 12 thermocouples have been installed per well – 2 above the gas zone, 3 in the gas zone and 7 in the bitumen zone; one well has been equipped with pressure sensors

- **Offsetting Gas Wells** – 4 area gas production wells have been equipped with gas chromatographs for continuous monitoring of produced gas composition. Wells will have periodic static gradients to monitor reservoir pressure. Wells 7-26-78-25W4 and 10-6-79-24W4 were shut-in in 2012 due to increases in N2 in the production stream
## Thermal Cement Temperature Ratings

### 4 HZ Production Wells

<table>
<thead>
<tr>
<th>Temp Rating</th>
<th>Type of Cement</th>
</tr>
</thead>
<tbody>
<tr>
<td>105/06-35-78-25W4</td>
<td>LDP-C-310+0.20% SMS + 0.15% CDF-4P+0.40% CFL-6+0.30%+0.40% CFL-4</td>
</tr>
<tr>
<td>108/06-35-78-25W4</td>
<td>LDP-C-310+1%CFR-5+0.5% CFL-3+0.3% Citric Acid+6%Gypsum+1%TAE+0.15%CDF-4P</td>
</tr>
<tr>
<td>109/06-35-78-25W4</td>
<td>LDP-C-310+1%CFR-5+0.5% CFL-3+0.3% Citric Acid+6%Gypsum+1%TAE+0.15%CDF-4P</td>
</tr>
<tr>
<td>110/06-35-78-25W4</td>
<td>LDP-C-310+1%CFR-5+0.5% CFL-3+0.3% Citric Acid+6%Gypsum+1%TAE+0.15%CDF-4P</td>
</tr>
</tbody>
</table>

### 3 Air Injection Wells

<table>
<thead>
<tr>
<th>Temp Rating</th>
<th>Type of Cement</th>
</tr>
</thead>
<tbody>
<tr>
<td>100/03-35-78-25W4</td>
<td>Thermal 40 Expandomix + 1.00% CaCl2 + 0.25% CFR-2 + 0.35% CFL-3</td>
</tr>
<tr>
<td>102/06-35-78-25W4</td>
<td>UHTC + 3.0% CFL-6 + 0.20% SMS + 0.20% CR-2 slurry @ 1900 kg/m3</td>
</tr>
<tr>
<td>103/06-35-78-25W4</td>
<td>UHTC + 3.0% CFL-6 + 0.20% SMS + 0.20% CR-2 slurry @ 1900 kg/m3</td>
</tr>
</tbody>
</table>

### 6 Observation Wells

<table>
<thead>
<tr>
<th>Temp Rating</th>
<th>Type of Cement</th>
</tr>
</thead>
<tbody>
<tr>
<td>104/05-35-78-25W4</td>
<td>LDP-C-310+0.1% CR-2 + 0.3% CFL-6 + 0.2% SMS + 0.15% CDF-4P</td>
</tr>
<tr>
<td>103/05-35-78-25W4</td>
<td>LDP-C-310+0.1% CR-2 + 0.3% CFL-6 + 0.2% SMS + 0.15% CDF-4P</td>
</tr>
<tr>
<td>104/06-35-78-25W4</td>
<td>LDP-C-310+0.1% CR-2 + 0.3% CFL-6 + 0.2% SMS + 0.15% CDF-4P</td>
</tr>
<tr>
<td>104/04-35-78-25W4</td>
<td>LDP-C-310+0.1% CR-2 + 0.3% CFL-6 + 0.2% SMS + 0.15% CDF-4P</td>
</tr>
<tr>
<td>104/03-35-78-25W4</td>
<td>LDP-C-310+0.1% CR-2 + 0.3% CFL-6 + 0.2% SMS + 0.15% CDF-4P</td>
</tr>
<tr>
<td>107/06-35-78-25W4</td>
<td>LDP-C-310+0.1% CR-2 + 0.3% CFL-6 + 0.2% SMS + 0.15% CDF-4P</td>
</tr>
</tbody>
</table>

- The 1000 deg C cement was a special cement that was ordered from Chesapeake Virginia
• The 100/03-35-78-25W4 well was drilled in Nov 2008 as a primary evaluation well and was subsequently converted to an air injection well for the Project. The well was drilled with thermal cement rated for a temperature of 360 deg C. The Pilot Project location was selected based on the core and log data from 100/03-35-78-25W4 well

• The highest temperature observed in the 100/03-35-78-25W4 air injection well was 220 deg C as seen during the initial 30 day steaming phase (Oct 2011). Once the well was turned over to continuous air injection (Dec 2011) the reservoir temperature rapidly declined and has since stabilized at approximately 20 – 25 deg C. This is due to the injected air displacing and moving the combustion front away from the well into the gas cap reservoir

• Peak combustion temperatures of 330 deg C in the 103/05-35 and 104/04-35-78-25W4 observation wells are the highest combustion temperatures observed in the gas zone – there has been no indication of wellbore integrity issues associated with these wells or of any of the remaining wells in the Pilot Project
Producing HZ Well- 105/06-35-078-25W4

<table>
<thead>
<tr>
<th>Well:</th>
<th>Husky HZ 105 Pelican 6-35-78-25</th>
<th>KB (m):</th>
<th>584.09</th>
<th>Rig:</th>
<th>Precision Drilling #102</th>
<th>TD (mKB MD):</th>
<th>992.00</th>
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</thead>
<tbody>
<tr>
<td>Unique ID:</td>
<td>105/06-35-078-25W4/00</td>
<td>GL (m):</td>
<td>579.62</td>
<td>Spud Date:</td>
<td>06/24/2011 @ 04:00 Hrs</td>
<td>TVD (mKB MD):</td>
<td>454.40</td>
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<tr>
<td>Surface Location:</td>
<td>05/04-35-078-25W4</td>
<td>CF (m):</td>
<td>579.62</td>
<td>Rig Release Date:</td>
<td>07/05/2011 @ 23:59 Hrs</td>
<td>PBTB (mKB MD):</td>
<td>981.59</td>
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<tr>
<td>License #</td>
<td>0430310</td>
<td>KB-CF (m):</td>
<td>4.47</td>
<td>Profile:</td>
<td>Horizontal</td>
<td>PB (mKB MD):</td>
<td></td>
</tr>
</tbody>
</table>

### Casing Details:

- **Surface Hole:** 444.5 mm Hole Drilled From 0.00 – 206.00 mKB
- **Surface Casing:** 16 Jts – 339.7 mm, 81.01 kg/m, J-55, ST&C. Landed @ 205.70 mKB
- **Surface Casing Cement:** 32.50 T – Proteus Core + 2.00% CacI2
- **Returns:** 12.00 m³
- **Intermediate Hole:** 270 mm Hole Drilled From 206.00 – 585.00 mKB
- **Intermediate Casing:** 46 Jts – 219.1 mm, 47.621 kg/m, K-55, ST&C. Landed @ 584.90 mKB
- **Intermediate Casing Cement:** 40.00 T – LDP-C-310 + 0.20% SMS + 0.15% CDF-4P + 0.40% CFL-6 + 0.30% CFL-3 + 0.40% CFL-4
- **Returns:** 0.80 m³
- **Liner Hole:** 200 mm Hole Drilled From 585.00 – 992.00 mKB MD
- **Liner Casing:** 35 Jts – Slotted Liner, 139.7 mm, 25.29 kg/m, L-80, GEOCONN. Landed @ 982.00 mKB MD, Liner hanger top @ 557.60 mKB MD

### Tubing String Details:

<table>
<thead>
<tr>
<th>No.</th>
<th>Size: (mm) OD:</th>
<th>Kg/m:</th>
<th>Grade:</th>
<th>Landing Depth: (mKB MD):</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>1.</td>
<td>88.9</td>
<td>13.84</td>
<td>J-55</td>
<td>550.0</td>
<td>Instrumentation String #1 - Thermocouples Landed @ 970.0, 945.0, 920.0, 895.0, 870.0, 845.0, 820.0, 795.0, 770.0, 745.0, 720.0, 695.0, 670.0, 645.0, 620.0, 595.0 mKB MD</td>
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<tr>
<td>2.</td>
<td></td>
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<td></td>
<td>Instrumentation String #2 - Thermocouples Landed @ 969.0, 770.0, 569.0 mKB MD + Pressure Sensors Landed @ 969.0, 770.0, 569.0 mKB MD</td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td></td>
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<td>1 - Tubing Hanger</td>
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<tr>
<td>4.</td>
<td></td>
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<td>1 - 60.3mm x 52.4mm Cross-Over</td>
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<tr>
<td>5.</td>
<td>57</td>
<td>25.29</td>
<td>L-80</td>
<td>501.3</td>
<td>52.4mm Tubing Jt.</td>
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<tr>
<td>6.</td>
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<td>114.3</td>
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<td>501.3</td>
<td>52.4mm Mule Shoe Jt.</td>
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<td>7.</td>
<td>38.1mm</td>
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<td>Coiled Tubing Containing Both Instrumentation Strings - Landed @ 961.00 mKB MD</td>
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<tr>
<td>8.</td>
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<td>R&amp;M Energy - Hi-Temperature Tubing Rotator</td>
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<td>9.</td>
<td>1</td>
<td>88.9</td>
<td></td>
<td>501.3</td>
<td>114.3mm x 88.9mm Cross-Over</td>
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<tr>
<td>10.</td>
<td>56</td>
<td>88.9</td>
<td></td>
<td>501.3</td>
<td>88.9mm x 88.9mm Cross-Over</td>
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<tr>
<td>11.</td>
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<td></td>
<td>PCP - pump intake landed at 501.30 mKB MD</td>
</tr>
</tbody>
</table>
## Injection Well- 100/03-35-078-25W4

### Well Details:

- **Well:** Husky Pelican 3-35-78-25
- **KB (m):** 579.80
- **Rig:** Precision Drilling #164
- **TD (mKB MD):** 496.00
- **Unique ID:** 100/03-35-078-25W4/00
- **GL (m):** 574.90
- **Spud Date:** 11/14/2008 4:00:00 PM
- **Rig Release Date:** 11/19/2008 12:00:00 PM
- **Surface Location:** 00/03-35-078-25W4
- **CF (m):** 575.60
- **License #:** 0399716
- **Profile:** Vertical
- **PB (mKB MD):** 445.50

### Surface Casing Details:

- **Surface Hole:** 349 mm Hole Drilled From 0.0 – 176.00 mKB
- **Surface Casing:** 15 Jts – 244.5 mm, 48.068 kg/m, H-40, ST&C. Landed @ 176.00 mKB
- **Surface Casing Cement:** 19.00 T – Proteus Core + 1.50% CaCl2 + 1.00% CFR-2 + 3.00% LCC-1
- **Returns:** 2.00 m3
- **Production Hole:** 222 mm Hole Drilled From 176.00 – 496.00 mKB
- **Production Casing:** 31 Jts + 1 Marker Jt - 177.8 mm, 29.763 kg/m, J-55, ST&C. Bottom @ 411.47 mKB + 6 Jts – 177.8 mm, 34.228 kg/m, L-80, Vallourec VAM. Landed @ 496.00 mKB
- **Production Casing Cement:** 13.00 T – Thermal 40 Expandomix + 1.00% CaCl2 + 0.25% CFR-2 + 0.35% CFL-3
- **Returns:** 3.00 m3

### Tubing String Details:

<table>
<thead>
<tr>
<th>No.</th>
<th>OD (mm)</th>
<th>Kgm:</th>
<th>Grade</th>
<th>Landing Depth (mKB MD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>88.9</td>
<td>13.84</td>
<td>J-55</td>
<td>439.00</td>
</tr>
</tbody>
</table>

- **Tubing:**
  - 1 - 179.4 mm x 88.9 mm Tubing Hanger
  - 2 - 88.9 mm Tubing Jt.
  - 3 - 88.9 mm x 3.10 m Pup Jt.
  - 4 - 88.9 mm x 1.80 m Pup Jt.
  - 5 - 88.9 mm x 1.20 m Pup Jt.
  - 6 - 44 - 88.9 mm Tubing Jt.
  - 7 - 88.9 mm x 3.10 m Handling Pup Jt.
  - 8 - 88.9 mm x 69.9 mm SX nipple
  - 9 - 88.9 mm Box Up x 101.6 mm Mule Shoe Down
  - 10 - 88.9 mm x 101.6 mm x 4.50 m Thermal PermaPack Locating Assembly
  - 11 - 177.8 mm Thermal PermaPack Permanent Seal Bore Packer c/w 101.6 mm x 4.50 m Integral Seal Bore
  - 12 - 114.3 mm x 69.9 mm SXN Nipple (67 mm No-Go Nipple)
  - 13 - 114.3 mm Wireline Re-Entry Guide
  - 14 - Thermocouples - Landed @ 445.50 mKB

### Isolation Equipment:

<table>
<thead>
<tr>
<th>Date Set</th>
<th>Make</th>
<th>Model</th>
<th>Depth Set (mKB MD)</th>
<th>Pressure Tested</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 16, 2011</td>
<td>Logan</td>
<td>177.8 mm Thermal PermaPack Permanent Seal Bore Packer</td>
<td>436.00</td>
<td>7 MPa @10 mins</td>
</tr>
<tr>
<td>May 1, 2010</td>
<td>Sanjel</td>
<td>1.30 m3 UHTC Cement</td>
<td>492.72-449.00</td>
<td></td>
</tr>
<tr>
<td>July 13, 2011</td>
<td>Sanjel</td>
<td>60L LDP-C-310 Cement</td>
<td>449.00-445.50</td>
<td></td>
</tr>
</tbody>
</table>
### Injection Well- 102/06-35-078-25W4

| Well: | Husky 102 Pelican 6-35-78-25 | KB (m): | 579.46 | Rig: | Precision Drilling #164 | TD (mKB MD): | 529.00 |
| Unique ID: | 102/06-35-078-25W4/00 | GL (m): | 575.32 | Spud Date: | 3/15/2010 3:30:00 PM | TVD (mKB MD): | 492.12 |
| Surface Location: | 04/06-35-078-25W4 | CF (m): | 575.41 | Rig Release Date: | 3/15/2010 11:59:00 PM | PBTD (mKB MD): | 522.20 |
| License #: | 0418707 | KB-CF (m): | 4.05 | Profile: | Directional | PB (mKB MD): | 474.30 (Cement Top) |

### Casing Details:

**Surface Hole:** 349 mm Hole Drilled From 0.00 – 199.00 mKB MD

**Surface Casing:** 15 Jts – 244.5 mm, 48.068 kg/m, H-40, ST&C. Landed @ 199.00 mKB MD

**Surface Casing Cement:** 22.00 T – Proteus CO + 2.00% CaCl2 + 1.00% CFR-2

**Returns:** 4.00 m3

**Production Hole:** 222 mm Hole Drilled From 199.00 – 529.00 mKB MD

**Production Casing:** 44 Jts + 1 Marker Jt - 177.8 mm, 34.228 kg/m, L-80, QB2. Landed @ 529.00 mKB MD

**Production Casing Cement:** Scavenger - 1.00 T - UHTC; Lead - 15.40 T – UHTC + 0.30% CFL-6 + 0.20% CR-2 + 0.20% SMS

**Returns:** 2.00 m3

### Tubing String Details:

<p>| Size: (mm) OD: | 88.9 | Kg/m: | 13.84 | Grade: | J-55 | Landing Depth: (mKB MD): |</p>
<table>
<thead>
<tr>
<th>No.</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 - 179.4 mm x 88.9 mm Tubing Hanger</td>
</tr>
<tr>
<td>2</td>
<td>1 - 88.9 mm Tubing Jt.</td>
</tr>
<tr>
<td>3</td>
<td>1 - 88.9 mm x 3.10 m Pup Jt.</td>
</tr>
<tr>
<td>4</td>
<td>1 - 88.9 mm x 1.80 m Pup Jt.</td>
</tr>
<tr>
<td>5</td>
<td>1 - 88.9 mm x 1.20 m Pup Jt.</td>
</tr>
<tr>
<td>6</td>
<td>47 - 88.9 mm Tubing Jt.</td>
</tr>
<tr>
<td>7</td>
<td>1 - 88.9 mm x 69.9 mm SX Nipple</td>
</tr>
</tbody>
</table>

### Isolation Equipment:

<table>
<thead>
<tr>
<th>Date Set</th>
<th>Make:</th>
<th>Model:</th>
<th>Depth Set (mKB MD):</th>
<th>Pressure Tested:</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 14, 2011</td>
<td>Logan</td>
<td>177.8 mm Thermal PermaPack Permanent Seal Bore Packer</td>
<td>465.00</td>
<td>7 MPa @10 mins</td>
</tr>
<tr>
<td>April 17, 2011</td>
<td>Sanjel</td>
<td>1.20 m3 LDP-C-310 (UHTC) + 0.30% CFL-6 + 0.20% SMS + 0.10% CR-2</td>
<td>522.20-482.60</td>
<td></td>
</tr>
<tr>
<td>July 13, 2011</td>
<td>Sanjel</td>
<td>1.30 T - LDP-C-310 (UHTC) + 0.30% CFL-6 + 0.20% SMS + 0.10% CR-2</td>
<td>482.60-474.30</td>
<td></td>
</tr>
</tbody>
</table>
Injection Well- 103/06-35-078-25W4

Well: Husky 103 Pelican 6-35-78-25  KB (m): 579.62  Rig: Precision Drilling #164  TD (mKB MD): 646.00
Unique ID: 10306-35-078-25W4/00  GL (m): 575.31  Spud Date: 3/16/2010 4:00:00 PM  TVD (mKB MD): 474.23
Surface Location: 02/04-35-078-25W4  CF (m): 575.61  Rig Release Date: 3/22/2010 10:00:00 AM  PBTD (mKB MD): 638.00
License #: 0418744  KB-CF (m): 4.01  Profile: Directional  PB (mKB MD): 582.00

Casing Details:
- Surface Hole: 349 mm Hole Drilled From 0.00 – 199.00 mKB MD
- Surface Casing: 16 Jts – 244.5 mm, 48.068 kg/m, H-40, ST&C. Landed @ 199.00 mKB MD
- Surface Casing Cement: 22.00 T – Proteus CO + 2.00% CaCl2 + 1.00% CFR-2
- Returns: 4.50 m3
- Production Hole: 222 mm Hole Drilled From 199.00 – 646.00 mKB MD
- Production Casing: 54 Jts + 1 Marker Jt - 177.8 mm, 34.228 kg/m, L-80, QB2. Landed @ 646.00 mKB MD
- Production Casing Cement: 16.50 T – UHTC + 0.30% CFL-6 + 0.20% CR-2 + 0.20% SMS
- Returns: 0.80 m3

Tubing String Details:
Size: (mm) OD: 88.9  Kg/m: 13.84  Grade: J-55  Landing Depth: (mKB MD):
<table>
<thead>
<tr>
<th>No.</th>
<th>Size</th>
<th>Grade</th>
<th>Landing Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>88.9 mm x 88.9 mm Tubing Hanger</td>
<td>J-55</td>
<td>579.00 - 580.50 mKB MD</td>
</tr>
<tr>
<td>2</td>
<td>88.9 mm x 114.3 mm Pup Jt</td>
<td>J-55</td>
<td>580.50 - 582.00 mKB MD</td>
</tr>
<tr>
<td>3</td>
<td>88.9 mm x 114.3 mm Thermal PermaPack Permanent Seal Bore Packer</td>
<td>J-55</td>
<td>582.00 - 584.50 mKB MD</td>
</tr>
<tr>
<td>4</td>
<td>88.9 mm x 69.9 mm SX Nipple</td>
<td>J-55</td>
<td>584.50 - 586.00 mKB MD</td>
</tr>
<tr>
<td>5</td>
<td>88.9 mm x 101.6 mm Mule Shoe Down</td>
<td>J-55</td>
<td>586.00 - 589.00 mKB MD</td>
</tr>
<tr>
<td>6</td>
<td>88.9 mm x 101.6 mm x 4.50 m Thermal PermaPack Locating Assembly</td>
<td>J-55</td>
<td>589.00 - 592.50 mKB MD</td>
</tr>
</tbody>
</table>

Isolation Equipment:
- Date Set: July 17, 2011  Make: Logan  Model: 177.8 mm Thermal PermaPack Permanent Seal Bore Packer  Depth Set (mKB MD): 572.00  Pressure Tested: 7 MPa @10 mins
- Date Set: July 9, 2011  Make: Sanjel  Model: 2.50 T - LDP-C-310 (UHTC) + 0.30% CFL-6 + 0.10% CR-2 + 0.20% SMS  Depth Set (mKB MD): 638.00 - 584.50
- Date Set: July 13, 2011  Make: Sanjel  Model: 60L - LDP-C-310 (UHTC) + 0.30% CFL-6 + 0.10% CR-2 + 0.20% SMS  Depth Set (mKB MD): 584.50 - 582.00
## Observation Well- 103/05-35-078-25W4

<table>
<thead>
<tr>
<th>Well:</th>
<th>Husky 103 Pelican 5-35-78-25</th>
<th>KB (m):</th>
<th>579.50</th>
<th>Rig:</th>
<th>Precision Drilling #163</th>
<th>TD (mKB MD):</th>
<th>465.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unique ID:</td>
<td>103/05-35-078-25W4/00</td>
<td>GL (m):</td>
<td>575.50</td>
<td>Spud Date:</td>
<td>3/12/2011 @ 13:15 Hrs</td>
<td>TVD (mKB MD):</td>
<td>462.64</td>
</tr>
<tr>
<td>Surface Location:</td>
<td>02/06-35-078-25W4</td>
<td>CF (m):</td>
<td>575.75</td>
<td>Rig Release Date:</td>
<td>3/16/2011 @ 13:00 Hrs</td>
<td>PBTD (mKB MD):</td>
<td></td>
</tr>
<tr>
<td>License #:</td>
<td>0419640</td>
<td>KB-CF (m):</td>
<td>3.75</td>
<td>Profile:</td>
<td>Directional</td>
<td>PB (mKB MD):</td>
<td>408.92 (Cement Top)</td>
</tr>
</tbody>
</table>

### Casing Details:

<table>
<thead>
<tr>
<th>Surface Hole:</th>
<th>251 mm Hole Drilled From 0.00 – 160.00 mKB MD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface Casing:</td>
<td>12 Jts – 177.8 mm, 25.30 kg/m, H-40, ST&amp;C . Landed @ 158.00 mKB MD</td>
</tr>
<tr>
<td>Surface Casing Cement:</td>
<td>12.20 T – Proteus Core + 2.00% CaCl2 + 1.00% CFR-2 + 0.15% CDF-4P</td>
</tr>
<tr>
<td>Returns:</td>
<td>3.00 m3</td>
</tr>
<tr>
<td>Production Hole:</td>
<td>159 mm Hole Drilled From 160.00 – 465.00 mKB MD</td>
</tr>
<tr>
<td>Production Casing:</td>
<td>33 Jts + 3 Marker Jt - 114.3 mm, 14.14 kg/m, J-55, ST&amp;C . Landed @ 462.87 mKB MD</td>
</tr>
<tr>
<td>Production Casing Cement:</td>
<td>11.00 T – LDP-C-310 + 0.10% CR-2 + 0.20% SMS + 0.30% CFL-6 + 0.15% CDF-4P</td>
</tr>
<tr>
<td>Returns:</td>
<td>2.00 m3</td>
</tr>
<tr>
<td>Liner Hole:</td>
<td>N/A</td>
</tr>
<tr>
<td>Liner Casing:</td>
<td>N/A</td>
</tr>
</tbody>
</table>

### Tubing String Details:

| No. | Thermocouples (Outside Casing) @ 454.23, 453.21, 452.19, 451.16, 450.14, 449.12, 448.10, 447.07, 446.05, 444.01, 434.76, 431.74 mKB MD |
Observation Well - 104/03-35-078-25W4

Well: Husky 104 Pelican 3-35-78-25  
KB (m): 579.60  
Rig: Precision Drilling #163  
TD (mKB MD): 487.00

Unique ID: 104/03-35-078-25W4/00  
GL (m): 575.40  
Spud Date: 03/30/2011 @ 12:45 Hrs  
TVD (mKB MD): 464.83

Surface Location: 04/04-35-078-25W4  
CF (m): 575.65  
Rig Release Date: 04/04/2011 @ 20:00 Hrs  
PBTD (mKB MD):

License #: 0419607  
KB-CF (m): 3.95  
Profile: Directional  
PB (mKB MD): 430.14  (Cement Top)

Casing Details:

Surface Hole: 349 mm Hole Drilled From 0.00 – 171.00 mKB MD

Surface Casing: 13 Jts – 244.5 mm, 48.068 kg/m, H-40, ST&C. Landed @ 171.00 mKB MD

Surface Casing Cement: 20.00 T – Proteus Core + 2.00% CaCl2 + 1.00% CFR-2 + 0.15% CDF-4P

Returns: 5.00 m3

Production Hole: 222 mm Hole Drilled From 171.00 – 487.00 mKB MD

Production Casing: 35 Jts + 3 Marker Jt - 114.3 mm, 14.14 kg/m, J-55, ST&C. Landed @ 484.20 mKB MD

Production Casing Cement: 29.40 T – LDP-C-310 + 0.10% CR-2 + 0.20% SMS + 0.30% CFL-6 + 0.15% CDF-4P

Returns: 5.00 m3

Liner Hole: N/A

Liner Casing: N/A

Tubing String Details:

<table>
<thead>
<tr>
<th>No.</th>
<th>Instrumentation String #1 (Outside Of Casing): Thermocouples @ 476.27, 475.14, 474.01, 472.01, 471.75, 470.62, 469.49, 468.36, 467.22, 464.96, 452.52, 451.38 mKB MD</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Instrumentation String #2 (Outside Of Casing): Thermocouples @ 476.27, 475.14, 474.01, 472.01, 471.75, 470.62, 469.49, 468.36, 467.22, 464.96, 452.52, 451.38 mKB MD</td>
</tr>
</tbody>
</table>

PB @ 430.14 mKB MD  
WBSK ‘A’
Artificial Lift

- HZ 105/06-35 and HZ 108/06-35-078-25W4 production wells are equipped with a high temperature 12-ML-17 PCP (rated for a max of 175 deg C) – HZ 105/06-35 on prod Nov 2012, HZ 108/06-35 on prod Oct 2013 (shut-in Dec 2 2013)

- HZ 109/06-35-078-25W4 production well was initially equipped with a high temperature 12-ML-44 PCP and was changed to a 16-ML-44 PCP (rated for a max of 175 deg C) – on prod Sep 30 2013

- HZ 110/06-35-078-25W4 production well is equipped with a high temperature 16-ML-44 PCP (rated for a max of 175 deg C) – on prod Oct 2013

- PCP’s were upsized to 16-ML-44 based on the HZ 105/106-35 oil rates; the HZ 105/06-35 will be upsized at the next pump change
4-D Seismic

• The lateral distribution of heat is too small to be resolved on 3D or 4D seismic surveys

• We have no plans to acquire 4D seismic data at this time
Scheme Performance

First Steam Injection on September 28, 2011
First Air Injection on December 8, 2011

HZ 105/06-35 on Production November 1, 2012
HZ 109/06-35 on Production September 30, 2013
HZ 110/06-35 on Production October 6, 2013
HZ 108/06-35 on Production October 18, 2013 (SI Dec 2/13)
Injection & Production History

• Start-up of air injection on December 8, 2011 at 15 e3m3/day
• Injection rate increase to 15 e3m3/day on Dec 12, 2011
• Injection rate increase to 20 e3m3/day on Dec 28, 2011
• Injection rate increase to 25 e3m3/day on Jan 30, 2012
• Injection rate increase to 40 e3m3/day on Feb 17, 2012
• Injection rate increase to 45 e3m3/day on Mar 16, 2012
• Injection rate increase to 55 e3m3/day on Apr 24, 2012
• Injection rate increase to 65 e3m3/day on Jul 16, 2012 (two trains)
• Injection rate increase to 90 e3m3/day on Oct 17, 2012 (third train)
• Husky placed the HZ 105/06-35-78-25W4 well on initial production for four days in August 2012 before having to shut-in due to the detection of H2S, production re-start was on November 1, 2012
• Remaining 3 HZ wells were placed on production in September and October 2013 - the HZ 08/06-35 was shut-in on Dec 2, 2013 in order to allow the bitumen zone to be further heated prior to being placed back on production
• Cum oil of 68,000 bbls after 12 months of production, 15% recovery to date, 50% estimated final
• Process performs as expected based on produced gas analysis and observed temperatures
  • GOR in graph is predominately combustion gas (79% N2 and 17% CO2 plus small amounts of reservoir gas)
• H2S concentration is approximately 400 to 2200 ppm (average 1000 ppm)
• Total production from 3 wells is currently 85 m3/day of oil (minor optimization remains)
HZ 105/06-35-78-25W4 Thermocouple Placement

TCP Injector Wells

100/03-35-078-25W4
KB: 579.8

102/06-35-078-25W4
KB: 579.5

103/06-35-078-25W4
KB: 579.6

TCP Injector Wells Placement

Vertical Section at 67.50°
McMullen TCP 05/6-35 HZ Well Temp Response

Temperature Threshold for Start-up
Base Reservoir Temperature

Pre-Start Oct 31
Producing Dec 12
Producing Dec 19
Producing Jan 16
Producing Jan 23
Producing Feb 13
Producing Feb 20
Producing Mar 13
Producing Mar 20
Producing Apr 10
Producing Apr 17
15-May-13
22-May-13
29-May-13
26-Jun-13
22-Aug-13
18-Sep-13
4-Dec-13
100/03-35
02/06-35
03/06-35

McMullen TCP Pilot Project
McMullen TCP 08/06-35 (100m) On Prod Oct 18/13, Shut-in Dec 2/13
13 Months after Start of Air Injection
1 HZ well on production Nov 2012
21 Months after Start of Air Injection
Just prior to placing remaining 3 HZ wells on production
25 Months after Start of Air Injection
3 HZ wells on production and 1 HZ well shut-in to allow further heating prior to production
103/05-35-78-25W4 OBS Well Current Temperatures
(25 m from the 100/03-35-78-25W4 Air Injector)

Temperatures 4 m below gas-bitumen contact approx 180 – 190 deg C

Gas cap zone temperatures approx 80 – 90 deg C
HZ 105/06-35-78-25W4 Current Wellbore Pressures

24 Hour SCADA Vision Trend

- Facility Construction for 3 additional HZ wells
- 105/06-35 HZ back on production Sep 27/13
- Waiting on SCADA back up & running
- Current pressure approx. 3010 kPa

F A 0 5 - 0 6 - 3 5 - 0 7 8 - 2 5 P r o m o r e 2 P r e s s 2 D a i l y A v g  [ k P a ]

Aug Sep Oct Nov Dec Jan 2014

2800 2850 2900 2950 3000 3050 3100
Facility Construction for 3 additional HZ wells

Waiting on SCADA back up & running

Current pressure approx. 3010 kPa

108/06-35 HZ on production Oct 18/13

108/06-35 HZ shut in Dec 2/13
Ultimate Recovery - Volumetric Method

Average Reservoir Parameters:

- Net Oil Pay = 6 m
- Porosity = 31%, So = 70%
- Oil FVF = 1.00 m$^3$/m$^3$
- Recovery Factor = 50%

- Entire approval area = 64 ha (SW/4 section 35-78-25W4)
- OBIP = 833 e$^3$m$^3$
- ROIP = 416.5 e$^3$m$^3$

- Operating portion of the scheme = 13 ha (4 horizontal producers)
- OBIP = 169 e$^3$m$^3$
- ROIP = 84.5 e$^3$m$^3$
Thermal EOR Recovery Factors

- **ISC Suplacu de Barcau Field, Romania** – 56%
  - Top down ISC process following reservoir dip
  - In operation since 1965

- **ISC Balol/Santhal Fields India** – 39/45%
  - In operation since 1990

- **ISC Bellevue, Louisiana** – 60%
  - In operation since 1970

- **SAGD** – 45 to 65%
- **CSS** – 25 to 45%

- **McMullen Thermal Conduction Pilot** – 50% (estimated, 2014 simulation to confirm)
Temporary Steam – Pressure, Temperature and Quality

• No steam injection in 2012 or 2013
McMullen TCP Pilot Objectives (Jan 2010)
January 2014 - 25 Months after Start of Air Injection

• To field verify successful ignition and a continuous combustion process combined with the safe and continuous operation of the air injection facilities

• To test the effectiveness of the thermal conduction process in heating the underlying bitumen in order to mobilize the flow of oil at oil rates of 25 m³ per day

  Current Rate – 85 m³/d of oil (3 wells) at a ~25-30% BS&W

• To determine the rate at which the combustion front will move through the depleted gas zone

  As forecasted

• To determine the optimal injector and horizontal well spacing for the anticipated future design of a commercial process – ongoing, early indication is less producers may be required

• To gain an increased understanding between the combustion front in the gas cap and the underlying horizontal well to ensure there is no breakthrough of combustion gases to the horizontal well – ongoing, optimistic that this can be achieved given the low well drawdown and pressure maintenance
Summary of Pilot Key Learning’s
January 2014 - 25 Months after Start of Air Injection

• There has been safe and continuous operation of the air injection facilities
• The underlying bitumen zone has been heated and the oil has been mobilized; current rates are 85 m³/day of oil (3 wells) at a 25-30% BS&W and a GOR of 140 m³/m³ at < 1% drawdown
• Process is performing as expected based on produced gas analysis and observed temperatures
• H₂S concentration is between 400 to 2200 ppm (average 1000 ppm); approval for 10,000 ppm H₂S
• Peak gas zone temperatures of 330 deg C in the 103/05-35 and 104/04-35-78-25W4 observation wells (25 m) confirms successful ignition and the presence of combustion in the gas cap zone
• An increase in the reservoir pressure from 1750 kPa to 3000 kPa has been observed along the horizontal sections of the four horizontal production wells
• Estimate that the combustion front radius has travelled a distance of 80 m after 2 years of air injection and the front radius will be 135 m after 5 years (see future development plan for a ¼ section on slide 87)
Pilot Future Plans – 2014

• Have validated 105/06-35 well productivity (12 months of production)

• Ongoing monitoring of the Pilot Project now that 3 of the 4 HZ wells are on production - temperature, pressure and reservoir performance to achieve Pilot objectives and to aid in future facility engineering design for commercial development

• HZ well 108/06-35-78-25W4 (100 m) that was placed on production and shut-in is not anticipated to be placed back on production until Q2/Q3 2014 in order to allow the bitumen zone to be further heated
3.1.2 Surface Operations, Compliance, and Issues Not Related to Resource Evaluation and Recovery
3.1.2 Surface Issues – Table of Contents

1. Facilities – slide 60
2. Facility Performance - slide 65
3. Measurement & Reporting – slide 68
4. Water Production & Injection – slide 70
5. Sulphur Production – slide 71
6. Environmental Issues – slide 73
7. Compliance Statement – slide 74
8. Future Plans – slide 75
McMullen TCP Plot Plan
McMullen TCP – Production Facilities Plot Plan
Facility Performance

• Bitumen Treatment
  • Bitumen sales started in November 2012. H2S scavenger is injected to neutralize the emulsion in order to meet sales specifications. The majority of the bitumen was trucked to Husky’s Lashburn facility in 2013.

• Water Treatment
  • Water trucking started in November 2012. Water is primarily disposed of at Husky’s 16-11-078-25W4 disposal facility after being treated with H2S Scavenger in on site tanks.

• Steam Generation
  • There was no steam generation in 2013
All power consumed in 2013 was generated onsite by a 151 kW unit at the injection pad and a 151 kW unit at the production pad which was recently upgraded from the original 20 kW unit.

Fuel Gas Usage in 2013

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan-13</td>
<td>52.7</td>
<td>774.5</td>
<td>827.2</td>
</tr>
<tr>
<td>Feb-13</td>
<td>47.6</td>
<td>694.1</td>
<td>741.7</td>
</tr>
<tr>
<td>Mar-13</td>
<td>54.1</td>
<td>758.1</td>
<td>812.2</td>
</tr>
<tr>
<td>Apr-13</td>
<td>50.4</td>
<td>769.3</td>
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</tr>
<tr>
<td>May-13</td>
<td>47.3</td>
<td>798.8</td>
<td>846.1</td>
</tr>
<tr>
<td>Jun-13</td>
<td>45.8</td>
<td>736.7</td>
<td>782.5</td>
</tr>
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<td>Jul-13</td>
<td>34.5</td>
<td>783.7</td>
<td>818.2</td>
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<td>19.6</td>
<td>784.7</td>
<td>804.3</td>
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<td>2.1</td>
<td>720.9</td>
<td>723</td>
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<td>Oct-13</td>
<td>79.3</td>
<td>797.8</td>
<td>877.1</td>
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<tr>
<td>Nov-13</td>
<td>96.1</td>
<td>691.1</td>
<td>787.2</td>
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<tr>
<td>Dec-13</td>
<td>99.7</td>
<td>753.6</td>
<td>853.3</td>
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<tr>
<td>Grand Total</td>
<td>629.2</td>
<td>9063.3</td>
<td>9692.5</td>
</tr>
</tbody>
</table>
Facility Performance

- The latest facility design for the additional production wells incorporates the incineration of all tank vapours and casing gas produced.

- Green house gas emissions:

<table>
<thead>
<tr>
<th>2013 Green House Gas Emissions</th>
<th>ERCB License</th>
<th>Exceed ERCB License</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO₂</td>
<td>CH₄</td>
<td>N₂O</td>
</tr>
<tr>
<td>tonnes/year</td>
<td>tonnes/year</td>
<td>tonnes/year</td>
</tr>
<tr>
<td>18,816.23</td>
<td>337.26</td>
<td>0.36</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2013 NOx and CO Emissions</th>
<th>ERCB License</th>
<th>Exceed ERCB License?</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOx</td>
<td>CO</td>
<td>NOx</td>
</tr>
<tr>
<td>tonnes/year</td>
<td>tonnes/year</td>
<td>tonnes/year</td>
</tr>
<tr>
<td>117.36</td>
<td>90.12</td>
<td>182.8212</td>
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</tbody>
</table>
Measurement & Reporting

- Well production

<table>
<thead>
<tr>
<th>Month</th>
<th>105 Oil (m3)</th>
<th>105 Water (m3)</th>
<th>105 Gas (e3m3)</th>
<th>109 Oil (m3)</th>
<th>109 Water (m3)</th>
<th>109 Gas (e3m3)</th>
<th>110 Oil (m3)</th>
<th>110 Water (m3)</th>
<th>110 Gas (e3m3)</th>
<th>108 Oil (m3)</th>
<th>108 Water (m3)</th>
<th>108 Gas (e3m3)</th>
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</thead>
<tbody>
<tr>
<td>Jan-13</td>
<td>763.6</td>
<td>131.6</td>
<td>8.9</td>
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<td></td>
<td></td>
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<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Feb-13</td>
<td>672</td>
<td>173</td>
<td>8.8</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mar-13</td>
<td>657.7</td>
<td>252.8</td>
<td>5.6</td>
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<td></td>
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<tr>
<td>Apr-13</td>
<td>664.2</td>
<td>242.2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>May-13</td>
<td>766.4</td>
<td>207.1</td>
<td>39.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jun-13</td>
<td>760.9</td>
<td>291.9</td>
<td>71.1</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jul-13</td>
<td>554.3</td>
<td>182.9</td>
<td>48.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aug-13</td>
<td>224.5</td>
<td>155.3</td>
<td>24.5</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Sep-13</td>
<td>184.6</td>
<td>25.1</td>
<td>0</td>
<td>0</td>
<td>28</td>
<td>7</td>
<td>0</td>
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<td></td>
<td></td>
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<tr>
<td>Oct-13</td>
<td>733.3</td>
<td>256.9</td>
<td>550.9</td>
<td>444.7</td>
<td>96.5</td>
<td>806.7</td>
<td>178.9</td>
<td>21.8</td>
<td>27.6</td>
<td>465.4</td>
<td>46.6</td>
<td></td>
</tr>
<tr>
<td>Nov-13</td>
<td>723.5</td>
<td>223.4</td>
<td>8.8</td>
<td>683.3</td>
<td>475.6</td>
<td>121</td>
<td>833.3</td>
<td>271.2</td>
<td>153.9</td>
<td>193.7</td>
<td>534.8</td>
<td>77.8</td>
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<tr>
<td>Dec-13</td>
<td>650.6</td>
<td>203.3</td>
<td>57.1</td>
<td>592.5</td>
<td>456.2</td>
<td>157.9</td>
<td>1017.6</td>
<td>350.9</td>
<td>182.7</td>
<td>16.5</td>
<td>3.2</td>
<td>14.2</td>
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<tr>
<td>Total</td>
<td>7355.6</td>
<td>2345.5</td>
<td>274</td>
<td>1854.7</td>
<td>1383.5</td>
<td>375.4</td>
<td>2657.6</td>
<td>801</td>
<td>358.4</td>
<td>237.8</td>
<td>1003.4</td>
<td>96.6</td>
</tr>
</tbody>
</table>

- Each well is treated as a single well battery:
  - Liquids: Sales = Production
  - Gas: Individual orifice meter used to measure gas production

- Proration factors – N/A

- Optimization of test durations – N/A

- New measurement technology - No
Measurement & Reporting

- Well injection volumes for 2013
  - No steam was injected in 2013
  - Air Injection Volumes
    - Air is compressed through a screw compressor and a reciprocating compressor
    - The air is then metered using an orifice plate for each individual well

Air Injection Volumes at 03-35-078-25W4 Injection Pad – Per Well

<table>
<thead>
<tr>
<th>Month</th>
<th>Volume (e3m3)</th>
<th>Daily Rate/Well (e3m3/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan-13</td>
<td>8100</td>
<td>87</td>
</tr>
<tr>
<td>Feb-13</td>
<td>6550</td>
<td>78</td>
</tr>
<tr>
<td>Mar-13</td>
<td>7000</td>
<td>75</td>
</tr>
<tr>
<td>Apr-13</td>
<td>8200</td>
<td>91</td>
</tr>
<tr>
<td>May-13</td>
<td>9020</td>
<td>97</td>
</tr>
<tr>
<td>Jun-13</td>
<td>7470</td>
<td>83</td>
</tr>
<tr>
<td>Jul-13</td>
<td>8730</td>
<td>94</td>
</tr>
<tr>
<td>Aug-13</td>
<td>8689</td>
<td>93</td>
</tr>
<tr>
<td>Sep-13</td>
<td>8623</td>
<td>96</td>
</tr>
<tr>
<td>Oct-13</td>
<td>9461</td>
<td>102</td>
</tr>
<tr>
<td>Nov-13</td>
<td>7879</td>
<td>88</td>
</tr>
<tr>
<td>Dec-13</td>
<td>7889</td>
<td>85</td>
</tr>
</tbody>
</table>
Water Production & Injection

- Produced water volumes

<table>
<thead>
<tr>
<th></th>
<th>105</th>
<th>109</th>
<th>110</th>
<th>108</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013 Total Water (m³)</td>
<td>2345.5</td>
<td>1383.5</td>
<td>801</td>
<td>1003.4</td>
</tr>
</tbody>
</table>

- No produced water recycle volumes or percent

  - Approval No. 9056B
Sulphur Production

- There is no sulphur recovery, all produced gas is incinerated at 04-35-78-25W4

### Summary of 2013 Quarterly SO₂ Emissions

<table>
<thead>
<tr>
<th>Months</th>
<th>Monthly Sulphur (tonnes)</th>
<th>Monthly SO₂ (^{a)}) (tonnes)</th>
<th>Quarter</th>
<th>Quarterly SO₂ (tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>0.01</td>
<td>0.02</td>
<td>1</td>
<td>0.05</td>
</tr>
<tr>
<td>February</td>
<td>0.01</td>
<td>0.02</td>
<td></td>
<td></td>
</tr>
<tr>
<td>March</td>
<td>0.01</td>
<td>0.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>April</td>
<td>0.00</td>
<td>0.00</td>
<td>2</td>
<td>0.32</td>
</tr>
<tr>
<td>May</td>
<td>0.04</td>
<td>0.09</td>
<td></td>
<td></td>
</tr>
<tr>
<td>June</td>
<td>0.12</td>
<td>0.23</td>
<td>3</td>
<td>0.24</td>
</tr>
<tr>
<td>July</td>
<td>0.08</td>
<td>0.16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>August</td>
<td>0.04</td>
<td>0.08</td>
<td></td>
<td></td>
</tr>
<tr>
<td>September</td>
<td>0.00</td>
<td>0.00</td>
<td>4</td>
<td>2.71</td>
</tr>
<tr>
<td>October</td>
<td>0.19</td>
<td>0.38</td>
<td></td>
<td></td>
</tr>
<tr>
<td>November</td>
<td>0.55</td>
<td>1.09</td>
<td></td>
<td></td>
</tr>
<tr>
<td>December</td>
<td>0.62</td>
<td>1.24</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Sulphur Balance
  - SO₂ emissions based on 100% conversion of H₂S to SO₂

- Sulphur emissions are expected to remain far below 1 tonne/d in the near future, therefore no sulphur recovery methods will be required
Sulphur Production

• The Facility is currently approved for 0.41 tonnes of $S_0_2$ per day

<table>
<thead>
<tr>
<th></th>
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<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily Peak Sulphur (t/d)</td>
<td>0.002</td>
<td>0.002</td>
<td>0.002</td>
<td>0.001</td>
<td>0.004</td>
<td>0.005</td>
<td>0.004</td>
<td>0.004</td>
<td>0.000</td>
<td>0.014</td>
<td>0.022</td>
<td>0.022</td>
</tr>
<tr>
<td>Daily Peak SO2 (t/d)</td>
<td>0.004</td>
<td>0.004</td>
<td>0.004</td>
<td>0.002</td>
<td>0.007</td>
<td>0.011</td>
<td>0.009</td>
<td>0.009</td>
<td>0.000</td>
<td>0.029</td>
<td>0.044</td>
<td>0.045</td>
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<tr>
<td>AESRD Approved SO2 (t/d)</td>
<td>0.12</td>
<td>0.12</td>
<td>0.12</td>
<td>0.12</td>
<td>0.12</td>
<td>0.12</td>
<td>0.12</td>
<td>0.41</td>
<td>0.41</td>
<td>0.41</td>
<td>0.41</td>
<td>0.41</td>
</tr>
<tr>
<td>Exceeds approval limit (Yes/No)</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

• Under EPEA approvals McMullen TCP has no requirement to monitor ambient air quality
Environmental Issues - Reporting

• Annual Monitoring and Reporting (March 31st)
  – Air Emission and Summary and Evaluation Report
  – Industrial Wastewater and Runoff Report
  – Groundwater Monitoring Program
    » Continue monitoring groundwater in the shallow sediments and Quaternary channel per EPEA Approval

• Other Monitoring and Reporting
  – Soil Monitoring (2014 and 2018)
  – Disturbance and Stockpile Report (submitted in early 2012)
  – Hourly Incinerator Exhaust Stack Temperature Reports January through August 2013 – this CEMS requirement was removed as part of the approval amendment dated August 28, 2013

• Participation in Alberta Biodiversity Monitoring Institute (ABMI)
To the best of Husky’s knowledge, we are currently compliant with all regulatory approval conditions and associated requirements.

A high risk noncompliance for not submitting a MARP application for approval was received in February 2013. The MARP application was submitted and AER issued approval on April 10, 2013. Annual MARP update was recently submitted on January 31, 2014.

Deviations to the minimum required incinerator stack temperature were reported to ESRD in April and July 2013.

The incinerator was replaced with a larger capacity incinerator and based on the new design, the CEMS requirement was removed as part of an Approval Amendment dated August 29, 2013.

A noncompliance related to an unauthorized release of surface water occurred in June 2013. The occurrence was reported to ESRD and surface re-contouring and site berm repairs were conducted to correct the issue.
Future Plans – Major Activities & Target Dates

- 11 strat evaluation wells are currently being drilled (Q1 2014) to further delineate areas for future TCP expansion
- Complete engineering design for air facilities and order long lead items (2014 and Q1 2015) for a commercial application
- Prepare numerical simulation for a commercial application – Q1/Q2 2014
- Environmental assessment – to be completed in the summer of 2014
- Low pressure ignition burner design – 2014 and 2015
- Submission of a commercial application for 1 ¾ sections - Q4 2014
- Drill air injection wells, procure and install facilities and drill 3 HZ wells for initial development on ¼ section – 2016
- Air injection starts Q4 2016
- Expected first production Q2 2017
- Submission of a second commercial application for 2-4 sections – Q2 2016, actual size to be determined based on the results of the 11 new evaluation wells Husky is drilling this winter
Questions?
Temperature (56 deg C), required to achieve forecasted viscosity for well start-up at 25 m3/day.
McMullen TCP Pilot Project Layout – Well Spacing

SW ¼ SECTION 35-78-25W4

3 Injectors wells
133 m apart
Along HRZ Pathway
10m south of HRZ

6 Observation wells
3 @ 25 m from 3-35 inject
3 @ various distances

1 HRZ well
400 m Long
Landing 220 m from
Surface location

3 added HRZ wells
400 m Long
Landing 220 m from
Surface location

3-35 well

106m E of W
290m N of S
Calculated Combustion Radius vs Time for a 4 meter thick gas cap

<table>
<thead>
<tr>
<th>Years</th>
<th>GIP</th>
<th>Inj Air</th>
<th>Cum Inj</th>
<th>Front velocity</th>
<th>Front velocity</th>
<th>Radius</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>m3</td>
<td>m3/day</td>
<td>E3m3</td>
<td>m/d</td>
<td>ft/d</td>
<td>m</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>25,029</td>
<td>48,000</td>
<td>17,520</td>
<td>0.133</td>
<td>0.438</td>
<td>49</td>
<td>actual</td>
</tr>
<tr>
<td>2</td>
<td>66,221</td>
<td>79,000</td>
<td>46,355</td>
<td>0.084</td>
<td>0.274</td>
<td>79</td>
<td>actual</td>
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<tr>
<td>3</td>
<td>107,936</td>
<td>80,000</td>
<td>75,555</td>
<td>0.060</td>
<td>0.197</td>
<td>101</td>
<td>estimated</td>
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<tr>
<td>4</td>
<td>149,650</td>
<td>80,000</td>
<td>104,755</td>
<td>0.035</td>
<td>0.114</td>
<td>119</td>
<td>estimated</td>
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<tr>
<td>5</td>
<td>191,364</td>
<td>80,000</td>
<td>133,955</td>
<td>0.039</td>
<td>0.129*</td>
<td>135</td>
<td>estimated</td>
</tr>
</tbody>
</table>

*Technical literature recommends a minimum burning velocity of 0.125 ft/d in order to have satisfactory combustion (Nelson and McNeil, “How to engineer an in-situ combustion project”, Oil and Gas Journal June 5, 1961).
Estimated Combustion Front Position

- 104/05-35 (87 m away)
- Radius 80 m
103/5-35-78-25W4 OBS Well Gas Cap Temperatures (25 m from 100/03-35-78-25W4 Air Injector)

Peak combustion temperature in gas cap, indicates combustion front has reached well

Front Velocity 25 m in 180 days – 0.138 m/d
Front Velocity 29 m in 240 days – 0.121 m/d
107/6-35-78-25W4 OBS Well Gas Cap Temperatures
(31 m from 100/03-35-78-25W4 Air Injector)

Peak combustion temperature in gas cap, indicates combustion front has reached well.

Front Velocity 31 m in 300 days – 0.103 m/d
Temperature in gas cap increasing as combustion front approaches (see slide 82)
¼ Section TCP Future Development Plan
(9 Air injectors and 3 HZ Producers)