LEISMER PROJECT
Introduction and Overview

• Introduction
• Subsurface Issues Related to Resource Evaluation and Recovery – Directive 054, Section 3.1.1
• Surface Operations, Compliance, and Issues Not Related to Resource Evaluation and Recovery – Directive 054, Section 3.1.2
Subsurface Issues Related to Resource Evaluation and Recovery
1. Brief Background
2. Geoscience Overview
3. Drilling and Completions
4. Artificial Lift
5. Instrumentation in Wells
6. 4D Seismic
7. Scheme Performance
8. Future Plans
BRIEF BACKGROUND

Subsurface Section 1

Leismer 2015 Annual Performance Presentation
BACKGROUND

Leismer Regional Map
## BACKGROUND

### 2014/15 Leismer Scheme Applications

<table>
<thead>
<tr>
<th>Project</th>
<th>Date Submitted</th>
<th>Status</th>
<th>Approval Date</th>
<th>New Approval No.</th>
<th>Notes</th>
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</thead>
<tbody>
<tr>
<td>Leismer Pad L5 VIT</td>
<td>29-Jan-14</td>
<td>Approved</td>
<td>24-Feb-14</td>
<td>10935L</td>
<td>Replace approved conventional tubing in five injection wells on Pad L5 with vacuum insulated tubing (VIT) in the vertical/build section of the wellbore</td>
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<tr>
<td>Leismer Pad L4 AICD</td>
<td>01-Apr-14</td>
<td>Approved</td>
<td>18-Jun-14</td>
<td>10935M</td>
<td>Proposed test of Autonomous Inflow Control Device (AICD) on Leismer Project L4 I4 Injector well</td>
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<tr>
<td>Leismer Pad L2 Solvent Soak</td>
<td>09-Apr-14</td>
<td>Approved</td>
<td>18-Jun-14</td>
<td>10935M</td>
<td>Solvent facilitated start-up pilot at Leismer Project Pad L2</td>
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<td>Infill wells for Pad L1 and L2</td>
<td>14-Aug-14</td>
<td>Approved</td>
<td>07-Nov-14</td>
<td>10935N</td>
<td>7 infill wells drilled from Pad L1, 6 accessing Pad L1 drainage area and one accessing Pad L2 drainage area</td>
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<tr>
<td>Change in Leismer Project area</td>
<td>18-Dec-14</td>
<td>Approved</td>
<td>19-Jan-15</td>
<td>10935O</td>
<td>Reduction of Leismer Project Area to reflect the reallocation of lands post partnership dissolution</td>
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<tr>
<td>MPFM installation</td>
<td>29-Jan-15</td>
<td>Approved</td>
<td>02-Mar-15</td>
<td>10935P</td>
<td>Install MPFM instead of test separators on Pads L2 and L4, and install an MPFM in addition to the test separator on Pad L1</td>
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<td>NCG co-injection</td>
<td>04-Feb-15</td>
<td>Approved</td>
<td>02-Mar-15</td>
<td>10935P</td>
<td>Co-injection of NCG with steam on Pad L4 to enhance recovery</td>
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</table>
GEOEINCE OVERVIEW

Leismer Development Area (LDA) Well Count

<table>
<thead>
<tr>
<th>LEGEND</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>OSE - Oil Sands Evaluation Wells (211)</td>
<td>⬜</td>
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<tr>
<td>OBS - Observation Wells pre-2014 (64)</td>
<td>⬜</td>
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<tr>
<td>OBS - Observation Wells in 2014 (1)</td>
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<tr>
<td>WDW – Granite Wash Disposal (4)</td>
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<tr>
<td>WDW – McMurray Water Disposal Wells (2)</td>
<td>⬜</td>
</tr>
<tr>
<td>SAGD – 30 well pairs in Pads L1-L4 pre-2014</td>
<td>⬜</td>
</tr>
<tr>
<td>SAGD – 5 well pairs in Pad L6 in 2014</td>
<td>⬜</td>
</tr>
<tr>
<td>SAGD – 2 infill wells in Pad2 in 2014</td>
<td>⬜</td>
</tr>
<tr>
<td>Existing Pads (6)</td>
<td>⬜</td>
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<tr>
<td>Leismer Development Area (LDA)</td>
<td>⬜</td>
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<tr>
<td>Water Line</td>
<td>⬜</td>
</tr>
<tr>
<td>McMurray O and V Channels (A1 and B1 Equivalent)</td>
<td>⬜</td>
</tr>
<tr>
<td>Potential Associated Gas Zones</td>
<td>⬜</td>
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<tr>
<td>Reservoir Property</td>
<td>LDA Average</td>
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<tr>
<td>------------------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Depth (m TVD)</td>
<td>424</td>
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<tr>
<td>Depth (m subsea)</td>
<td>-216</td>
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<tr>
<td>Pay Thickness (m)</td>
<td>17</td>
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<tr>
<td>Effective Porosity (%)</td>
<td>33</td>
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<tr>
<td>Horizontal Permeability (D)</td>
<td>6</td>
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<tr>
<td>Oil Saturation (%)</td>
<td>87</td>
</tr>
<tr>
<td>Original Reservoir Pressure (kPa)</td>
<td>-</td>
</tr>
<tr>
<td>Original Reservoir Temperature (°C)</td>
<td>-</td>
</tr>
</tbody>
</table>
All well pairs on Pads L1 to L6 have 100 m interwell spacing, except:

- 2 SAGD wells in Pad L3 (L3P1-L3P2, L3P2-L3P3) are 75 m spacing
- 2 Infill Wells in Pad L2 are 50 m from existing SAGD wells
## GEOSCIENCE OVERVIEW

### Original Bitumen In Place

<table>
<thead>
<tr>
<th>Well Pad (50 m Drainage Boundary)</th>
<th>Area ((10^3 \text{ m}^2))</th>
<th>Gross Rock Volume ((10^3 \text{ m}^3))</th>
<th>McMurray Fm. Total OBIP ((10^3 \text{ m}^3))</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>523</td>
<td>12,360</td>
<td>3,636</td>
</tr>
<tr>
<td>L2</td>
<td>510</td>
<td>12,142</td>
<td>3,437</td>
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<td>L3</td>
<td>407</td>
<td>10,609</td>
<td>3,166</td>
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<tr>
<td>L4</td>
<td>378</td>
<td>8,230</td>
<td>2,334</td>
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<tr>
<td>L5</td>
<td>688</td>
<td>13,240</td>
<td>3,613</td>
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<tr>
<td>L6</td>
<td>575</td>
<td>14,625</td>
<td>4,154</td>
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<td><strong>Total</strong></td>
<td><strong>3,081</strong></td>
<td><strong>71,206</strong></td>
<td><strong>20,340</strong></td>
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<tr>
<td><strong>LDA Total</strong></td>
<td><strong>18,818</strong></td>
<td><strong>312,050</strong></td>
<td><strong>86,795</strong></td>
</tr>
</tbody>
</table>

Total OBIP = Gross Volume \(\times\) Gross Porosity \(\times\) Gross Oil Saturation

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*Classification: Open*  
*Subsurface Section 2*  
*2015-03-09*
GEOSCIENCE OVERVIEW

Top Bitumen Pay Structure Map

LEGEND

Existing Pads

Leismer Development Area (LDA)

McMurray O and V Channels (A1 and B1 Equivalent) Potential Associated Gas Zones

Contour Interval: 5m
GEOSCIENCE OVERVIEW

Base Bitumen Pay Structure Map

LEGEND

Existing Pads
Leismer Development Area (LDA)
McMurray O and V Channels (A1 and B1 Equivalent) Potential
Associated Gas Zones

Contour Interval: 5m
GEOSCIENCES OVERVIEW

LDA Pad L4 Example Well – 102/16-28-078-10W4/0

T79

T78

Top Wabiskaw Member

Top McMurray Formation

McMurray A1 Equivalent Channel

Exploited Zone (Pad L4)

Base Bitumen

O/W Contact

Devonian

Blue = Water

Green = Oil

Yellow = Sand

Grey = Mud

(Volumetrics)
GEOSCIENCE OVERVIEW

LDA Well Data Types

LEGEND

- Image Logs and Cores (137)
- Cores Only (11)
- Image Logs Only (114)
- Standard Logs Only (15)
- Existing Pads (6)
- Leismer Development Area
- Water Line

McMurray O and V Channels (A1 and B1 Equivalent) Potential Associated Gas Zones
No new cores were obtained or analyzed in 2014 within the LDA.
GEOSCIENCE OVERVIEW

LDA Petrographic Analysis

• No petrographic analyses were conducted in 2014
GEOSCIENCE OVERVIEW
Pad L6 – Pad L2 North to South Petrophysical Log Cross-Section

- Wabiskaw Member
- McMurray Formation
- McMurray A2 Mudstone Base
- Top Bitumen
- Base Bitumen
- Devonian
GEOSCIENCE OVERVIEW

Pad L6 through L2 North to South Seismic Cross-Section

- Wabiskaw Top
- A2 Mud
- O-Channel
- McMurray B1 Base
- Well Pick Top DBIP
- Well Pick Base DBIP
- WUT
- Devonian
GEOSCIENCE OVERVIEW

LDA Geomechanical Analysis

- No geomechanical analyses were conducted in 2014
GEOSCIENCE OVERVIEW

Reservoir Fracture Pressure and Caprock Integrity

• No reservoir fracture pressure and caprock integrity tests were conducted in 2014
GEOSCIENCE OVERVIEW

Pads L1-L4 InSAR Cumulative Surface Heave

- Interferometric Synthetic Aperture Radar (InSAR) – satellite-based radar technique used for mapping surface changes
- INSAR deformation monitoring commenced in April of 2011
  - 89 corner reflectors (with supplemental natural points) installed for Pads L1 to L4 and primary steam pipeline
  - 5 corner reflectors (with supplemental natural points) installed for Pad L5
- Results on Pads L1-L4 to December 27th, 2014 show minimal surface heave (Maximum = 65 mm, Mean = 28.5 mm)
- Rough correlation between high-quality reservoir (maximum steam chamber development) and maximum surface heave
New wells drilled in 2014:
- 5 SAGD well pairs (Pad L6)
- 2 Infill Wells in Pad L2
- 1 OBS well in Pad L2

New wells are in green.
Testing two liner types side-by-side. Sand control lab testing was used for slot sizing.
Leismer SAGD Project

Typical Well Pair
– Circulation Phase –

Producer

Injector

- 20" Surface Hole
- 17 1/2" Surface Hole
- Thermal Cement
- Surface Casing: 10", 65# ft, K-55, BT&C
- Surface Casing: 13 3/8", 54.5# ft, K-55, BT&C
- 185mKB
- 14 3/4" Intermediate Hole
- Intermediate Casing: 11 3/4", 54# ft, L-80, TB
- Heel String: 4 1/2", 12.7lb/ft, L-80, Hydrid 503
  x 3 1/2", 9.3lb/ft, L-80, Hydrid 511
- 650.0mKB - Liner Hanger
- 660.0mKB - Liner Hanger
- 700.0mKB/425.0mTVD
- 10 5/8" Liner Hole
- 1,410.0mKB
- 1,400.0mKB/420.0mTVD
- 1,390.0mKB
- Approx. 200m
- Injection Liner (Straight Gang Slats): 8.5/8", 32lb/ft, L-80, TB-5
- Production Liner (Seamed Keystone Slats or WWS): 7", 26lb/ft, L-80, TB-5
- 8 3/4" Liner Hole
- 700.0mKB/425.0mTVD
- 660.0mKB - Liner Hanger
- TOE Injection String: 3 1/2", 9.3lb/ft, L-80, Hydrid 503
  x 2 7/8", 6.5lb/ft, J-55, Hydrid 503
- Toe Steam Injection String: 3 1/2", 9.3lb/ft, L-80, Hydrid 503
  x 2 7/8", 6.5lb/ft, L-80, Hydrid 503
  x 3 1/2", 9.3lb/ft, L-80, Hydrid 503
- TB - Tenaris Blue
- TB** - Tenaris Blue SAGD SC/5B
- Annulus Gas Pack (CH2)
- Intermediate Casing: 9 5/8", 40lb/ft, L-80, TB*
- Thermal Cement
- 12 1/4" Intermediate Hole
- Heel String: 4", 11lb/ft, K-55, Hydrid 511
- TOE Steam Injection String: 3 1/2", 9.3lb/ft, L-80, Hydrid 503
  x 2 7/8", 6.5lb/ft, J-55, Hydrid 503
- Not to Scale
DRILLING AND COMPLETIONS

Wellbore Design (Pad L5)

**INJECTORS**
- Slotted Liner (5)
- Flow Control Devices (2)

**PRODUCERS**
- Wire Wrapped Screens (3)
- Flow Control Devices (4)

- Flow Control Devices (FCDs) are built into the liner joints
- FCDs are orifice-based and add restriction to balance injection distribution, or restrict steam entering the producer
- Well configuration is based on geology and for field testing purposes
Leismer Pad L5 SAGD Project
– Operation Phase –

Subsurface Section 3

Producer

Injector

17 1/2" Surface Hole

Thermal Cement

Surface Casing - 13 3/8", 54.5#f/t, K-55, BT&C

x 13 3/8", 54.5#f/t, K-55, BT&C

190mKB (in competent formation)

12 1/4" Production Hole

Production Casing - 9 5/8", 40lb/ft, TN-BOTH, TB*

Heel String - 7", 23lb/ft, K-55, LT & C

Single Point P&T Gauge (cable clamped to 7" tubing)

Toe Steam Injection String - 4", 111lb/ft, K-55, Hydrl 511

695.0mKB

695.0mKB - Liner Hanger

715.0mKB/455.0mTVD

8 3/4" Liner Hole

1,655.0mKB/455.0mTVD

TD 1,665.0mKB

Injection Liner (Straight Gang Slots) - 7", 26lb/ft, TN-BOTH, TBTL**

Guide String - 2 3/8", 4.6lb/ft, L-80, Hydrl 511

Production Liner - 6 5/8", 20lb/ft, L-80, Liner Base Pipe, Flow Control Device

1,645.0mKB

1,655.0mKB/460.0mTVD

TD 1,665.0mKB

TB** - Tenaris Blue
TBTL** - Tenaris Blue Thermal Liner

Production String - 3 1/2", 9.3lb/ft, L-80, Hydrl 503

ESP w/ Downhole T/P Sensors

Power Cable for ESP

Not to Scale
DRILLING & COMPLETIONS

Pressures in SAGD Start-up and Circulation

• **Maximum Operating Pressure (MOP):**
  - MOP of 5,500 kPa per AER Approval

• **Bottomhole Operating Pressure:**
  - Bottomhole operating pressure during circulation and SAGD is generally targeted between 3,000 and 3,500 kPa
    - Blanket gas is used to measure pressure on the injectors
    - Combination between BTs and PT gauges on the producers
• 5 well pairs drilled
• Drilling operations from September to December 2014
• Horizontal lengths 800 - 900 m
• First steam 2016
DRILLING AND COMPLETIONS

Wellbore Design (Pad L6)

INJECTORS
Slotted Liner (5)

PRODUCERS
Wire Wrapped Screens (2)
Flow Control Devices (3)
• Drilled 2 infill wells on Pad L2
• Drilling operations from August to September 2014
• Planned horizontal length = 800 m
• L2P3-4 started circulation December 2014
• L2P4-5 planned start-up for Q2 2015
Infill Well Placement and Timing

- Vertical placement strategy relative to neighbouring producers and provide examples
  - Infill wells are generally positioned within the bypassed bitumen region that is created when the two adjoining steam chambers spread as they rise. Avoiding direct contact with the steam chambers is critical to drilling a successful infill well; thus, understanding the steam chamber shape, extent and boundaries is very important
  - Examples include Well L2P3-4 and L2P4-5

- Infill well timing
  - The actual timing will be dependent on adjacent SAGD well pair performance, steam chamber growth, drilling rig availability, facility tie-ins, and ongoing infill well production optimization
DRILLING & COMPLETIONS

L2P2 and L2P1 - Status

**L2P2**

- Developed plan in consultation with AER to drill observation (OBS) well in close proximity to L2P2 to monitor aquifers
  - Drilled OBS well in September 2014
- Directive 051 approval granted December 2011; Statoil must execute the agreed upon mitigation plan
- Completions work completed June 2014
- Started circulation October 31, 2014

**L2P1**

- Liner breached after low subcool events
- ESP pulled in December 2012. Well suspended since January 2013
- Investigating different options to repair and re-start the well
ARTIFICIAL LIFT

Pads L1 to L5

Current LDA Artificial Lift Installs

- ESP 250 °C motors (28)
- Circulation (Started Oct 2014) → L2P2
- Suspended → L2P1

Design lift capacity: 200 - 550 m³/cd
Operating temperature: 210 - 235°C
Operating pressure: 2,800 – 3,000 kPa
INSTRUMENTATION IN WELLS

Subsurface Section 5

Leismer 2015 Annual Performance Presentation
**INSTRUMENTATION**

Leismer Downhole Producer Instrumentation (Pads L1 to L5)

- Bubble Tube and Thermocouple
- Thermocouple
- Thermocouple, Bubble Tube, and Fiber Optic P/T Gauge
- Thermocouple, Single point P/T Gauge

- FBG:
  - 40 temperature points on SAGD wells
  - 40 temperature points on L2P3/4, with 1 pressure at toe, and 1 P/T at heel

- DTS - multimode fiber (spatial resolution 0.5 - 1m) *Note: DTS on L1P3, L1P4 and L1P5 have failed*

Notes:
- L2P1 configuration modified to revised TD

Thermocouple in tangent sections to monitor ESPs, allows optimization of ESP performance.
INSTRUMENTATION

Lessons Learned

• Pressure measurement:
  − Piezometers on injector wells have been susceptible to data integrity issues
  − Fiber optic Pressure/Temperature gauge testing has been positive with reasonable matching to bubble tubes/blanket gas, and with strong reliability

• Temperature measurement:
  − Thermocouples in producers are reliable and used for subcool calculation along the horizontal wellbore
  − Thermocouples and fiber optic lines have been installed in the same wells to test fiber technology
  − DTS (Distributed Temperature Sensing) fiber has been unsuccessful but usage is limited. Continuing to test.
  − FBG (Fiber Bragg Grating) fiber has been successful with reasonable matching to thermocouples and reliable measurements
INSTRUMENTATION

Leismer Typical SAGD Wellbore Schematic (Pads L1 to L5)

Producer – Instrumentation
- 1.75” x 0.156” Coil Tubing
- 0.75” Bubble Tube @ Pump
- 3/8” Bubble Tube @ Heel
- 3/8” Bubble Tube @ Toe
- 5 x 1/8” Duplex Thermocouples
INSTRUMENTATION

Leismer Downhole Injector Instrumentation (Pads L1 to L5)

- Bubble Tube and Thermocouple
- Thermocouple
- Piezometer and Thermocouple
  *Note: significant piezometer issues*
- Bubble Tube, Piezometer and Thermocouple
  *Note: significant piezometer issues*
- Fiber Optic – Pressure and Temperature sensor

Notes:
- L211 sheared during injector re-completion
INSTRUMENTATION

Pad L5: Injection Well Schematic

• Thermocouple cable strapped to 13-3/8” surface casing on 4 wells

• 3 temperature points per cable: 40 m, 82 m and 175 m

• Only 1 point functioning at 175 m. Other 3 failed during install. All thermocouples at 40 m and 82 m are functioning

• During start-up, temperatures reached 140°C to 200°C within a few days and held relatively constant through remainder of circulation.

• Data used in an on-going cement integrity study
INSTRUMENTATION

Leismer Observation (OBS) Wells

LEGEND

OSE - Oil Sands Evaluation Wells (211)
OBS - Observation Wells pre-2014 (64)
OBS - Observation Wells in 2014 (1)
WDW – Granite Wash Disposal (4)
WDW – McMurray Water Disposal Wells (2)
SAGD – 30 well pairs in Pads L1-L4 pre-2014
SAGD – 5 well pairs in Pad L6 in 2014
SAGD – 2 infill wells in Pad 2 in 2014
Existing Pads (6)
Leismer Development Area (LDA)
Water Line
McMurray O and V Channels (A1 and B1 Equivalent)
Potential Associated Gas Zones
## INSTRUMENTATION

### Leismer OBS Well - Distances

<table>
<thead>
<tr>
<th>OBS Well</th>
<th>Distance</th>
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<tbody>
<tr>
<td>L1P2T</td>
<td>20.5 m from L1P2</td>
</tr>
<tr>
<td>L1P3T</td>
<td>6.5 m from L1P3</td>
</tr>
<tr>
<td>L1P3H</td>
<td>5.4 m from L1I3</td>
</tr>
<tr>
<td>L1P6T</td>
<td>2.3 m from L1I6</td>
</tr>
<tr>
<td>L1P6H</td>
<td>6.2 m from L1I6</td>
</tr>
<tr>
<td>L2P1H</td>
<td>7.7 m from L2P1</td>
</tr>
<tr>
<td>L2P2H</td>
<td>20.7 m from L2I2</td>
</tr>
<tr>
<td>L2P4M</td>
<td>22.9 m from L2P4</td>
</tr>
<tr>
<td>L2P4M2</td>
<td>42.4 m from L2P4</td>
</tr>
<tr>
<td>L2P6H</td>
<td>32.3 m from L2I6</td>
</tr>
<tr>
<td>L2P6H2</td>
<td>41.7 m from L2I6</td>
</tr>
<tr>
<td>L4P1M</td>
<td>17.0 m from L4I1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OBS Well</th>
<th>Distance</th>
</tr>
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<tbody>
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<td>L4P1M</td>
<td>17.0 m from L4I1</td>
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<tr>
<td>L4P1T</td>
<td>2.9 m from L4P1</td>
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<tr>
<td>L4P3T</td>
<td>24.7 m from L4I3</td>
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<tr>
<td>L4P4H</td>
<td>11.2 m from L4P4</td>
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<td>L4P5T</td>
<td>9.1 m from L4I5</td>
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<td>L4P5T2</td>
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<td>L5-05-03</td>
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<td>L5-11-03</td>
<td>43.0 m from L5P1</td>
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<td>L5-09-04</td>
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<td>L6-09-33</td>
<td>13.0 m from L6P5</td>
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<tr>
<td>L6-12-34</td>
<td>15.0 m from L6P3</td>
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</table>
**INSTRUMENTATION**

**Typical SAGD OBS Well Schematic**

*Leismer SAGD OBS Wells Contain:*

- 30 thermocouples, spaced at 1 m, above, below, and within SAGD pay
- Some wells are equipped with fiber optics (DTS) instead of thermocouples
- 3 to 4 piezometers in bitumen, bottom water, and top lean/gas zone
### INSTRUMENTATION

**OBS Well Time-Lapse RPM Saturation Logging**

<table>
<thead>
<tr>
<th>GR</th>
<th>Porosity</th>
<th>Resistivity</th>
<th>Backscattered Image</th>
<th>Lithology</th>
<th>Saturations</th>
<th>2013 SAT</th>
<th>2014 SAT</th>
<th>Permeability</th>
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</table>

**Temperature**

Wabiskaw Member
Top McMurray Formation
McM A2 Mudstone Base
McM B1 Base
Top GBIP
Top DBIP
McMurray B1-Equivalent Channel (Main SAGD Interval)
Base DBIP
Oil-Water Contact
Top Devonian

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100/05-27-078-10W4 (Pad L1 – L1P3T)
4D SEISMIC
Acquisition History

- **Q1 2009**: 4.92 km² baseline survey acquired (pre-steam) over L1-4
- **Q1 2012**: 8.6 km² 3D survey
  - 1st 4D survey (4.92 km² of active SAGD pads L1-4)
  - New baseline survey for L5 + L6 (3.68 km²)
- **Q1 2013**: 4.5 km² 3D survey
  - 2nd repeat survey (active SAGD pads L1-4)
- **Q1 2014**: 2.12 km² 4D survey (active SAGD pads L3 + L4)

Legend
- Black: Amended Leismer LDA
- Blue: Baseline 2009 Survey
- Green: 1st Monitor 2012
- Orange: 2nd Monitor 2013
- Red: 3rd Monitor 2014

[Map of subsurface section with survey areas highlighted]
- 4D seismic anomalies indicate a high degree of conformance along SAGD well pairs
- Irregularities are mainly attributable to reservoir heterogeneity and, in some cases, to heat transfer below the producer elevation into the basal McMurray Fm. (i.e., bottom water)
SCHEME PERFORMANCE

Leismer Project Historical Trends

- Fluid (m³/d)
- SOR, e³m³/d, Well Count

- Bitumen
- Water
- Steam
- ISOR
- CSOR
- Well Count

Dates:
- Sep-10
- Dec-10
- Mar-11
- Jun-11
- Sep-11
- Dec-11
- Mar-12
- Jun-12
- Sep-12
- Dec-12
- Mar-13
- Jun-13
- Sep-13
- Dec-13
- Mar-14
- Jun-14
- Sep-14
- Dec-14

Statoil
## SCHEME PERFORMANCE

### Pad Recoveries

<table>
<thead>
<tr>
<th>Well Pad (50 m Drainage Boundary)</th>
<th>McMurray Formation SAGD-able OBIP ($10^3$ m³)</th>
<th>Cumulative Production ($10^3$ m³)</th>
<th>SAGD-able Recovery To Date (%)</th>
<th>Predicted SAGD-able Recovery Factor after 15 years (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>2,772</td>
<td>966</td>
<td>34.9</td>
<td>63</td>
</tr>
<tr>
<td>L2</td>
<td>2,911</td>
<td>751a</td>
<td>25.8</td>
<td>54</td>
</tr>
<tr>
<td>L3b</td>
<td>1,005</td>
<td>371</td>
<td>37.0</td>
<td>67</td>
</tr>
<tr>
<td>L4</td>
<td>1,730c</td>
<td>609</td>
<td>35.2</td>
<td>68</td>
</tr>
<tr>
<td>L5</td>
<td>2,938</td>
<td>35</td>
<td>1.2</td>
<td>52</td>
</tr>
</tbody>
</table>

a Due to poor contribution from L2Pair1 and L2Pair2  
b Excludes wells in AER Approval No. 11834A  
c Relatively lower OBIP attributable to overall reservoir characteristics, especially thinning from a younger McMurray Fm. A1-Equivalent Channel ("O Channel")

- SAGD-able OBIP, Cumulative Production, and Recovery Factor (RF) valid as of December 31, 2013
- Predicted (SAGD-able) RF based on 2D mapping and simulations using SAGD-able OBIP (OBIP above producer well)
- Reference “Supplemental Information Request Application Nos.1693442 and 1694622, Amendment to Approval No. 10935E, Leismer Project”
SCHEME PERFORMANCE
Pad L1 Production Performance

Reservoir Imbalance (July-August 2012)
• Managed by controlling field operating parameters

Bitumen Allocation (August 2012 and November/December 2013)
• Water cut procedure/calibration modification resulted in under allocation of bitumen to Pad L1
SCHEME PERFORMANCE

Pad L1 OBS Well Temperature Profile – 102/04-27-078-10W4/0

PAD 1 L1P3 H Observation well (5.41m from L1I3)
Pad L1 operating pressure strategy for 2015: maintain an optimal pressure differential between the bottom water and SAGD chamber
SCHEME PERFORMANCE

Pad L1 Highlights

- First steam September 2010
- 6 well pairs in SAGD mode
- Average 2014 iSOR of 3.43
- Pad cSOR of 2.9 up to December 31, 2014
Nov 2013 – Q3 2014: Steam injection rate was managed relative to chamber and bottom water pressures.
• Wells included in solvent facilitated start-up program:
  - L2I2 and L2P2
• Composition of solvent
  - Diesel
• Amount of solvent injected
  - 140 m$^3$ (70 m$^3$ for L2I2 and 70 m$^3$ for L2P2)
• Key Learning: The geological condition around the wellbore is a critical parameter that needs to be identified before commencement of the solvent facilitated start-up process
Observed step change of temperature feature from March to May 2012. Shale baffle penetrated with heat.
SCHEME PERFORMANCE

Pad L2 OBS Well Pressure Profile – 103/03-27-078-10W4/0

<table>
<thead>
<tr>
<th>Gamma Ray</th>
<th>Porosity</th>
<th>Resistivity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Data communication issues**

- **Middle Bitumen Pressure**: 419.85mKB/215.65mSS
- **Top Bitumen Pressure**: 406.0mKB/229.5mSS

**Normalized pressure**: 229.5 mSS
SCHEME PERFORMANCE
Pad L2 Highlights

• First steam October 2010

• 4 well pairs in SAGD mode
  • L2Pair1 inactive
  • L2Pair2 started circulation on October 31, 2014

• Average 2014 iSOR of 2.97

• Pad cSOR of 2.97 up to December 31, 2014
SCHEME PERFORMANCE

Pad L4 Production Performance

- Turnaround
- L4P1 Metering Challenges

Fluid (m³/d)
- Bitumen
- Water
- Steam
- ISOR
- CSOR
- Gas
- Well Count

SOR, e³m³/d, Well Count

Subsurface Section 7
L4P1 Metering Challenges

- Steam injection and produced water rate curves deviated as a function of L4P1 performance. Well conditions impacted the performance of the water cut analyzer.

- However, despite this deviation the net oil and net water proration factors for those months are still within the limits defined for the AER.
Pad L4 operating pressure strategy for 2015: maintain an optimal pressure differential between the bottom water and SAGD chamber.
SCHEME PERFORMANCE

Pad L4 Highlights

- First steam November 2010
- 5 well pairs in SAGD mode
- Average 2014 iSOR of 2.86
- Pad cSOR of 3.04 up to December 31, 2014
SCHEME PERFORMANCE

Wellhead Steam Quality

• Steam quality lost during transportation to well pads due to heat losses
  – Wellhead steam quality estimated at 95%

• Steam is delivered to pads at about 7,000 – 9,000 kPa and is currently dropped to 5,000 kPa at the pad prior to injection at a specific injection wellhead
• High plant reliability helped achieve successful SAGD ramp-up
• Integrated reservoir surveillance is a key factor in optimization of well pair performance
• Gaining understanding of LDA performance over long term (i.e. effects of lean and bottom water zones)
• Temperature response and upward steam chamber development suggests shale baffles can be overcome
SCHEME PERFORMANCE
Leismer Pad Abandonments

- No pad abandonments anticipated at Leismer within next five years
SUBSURFACE – FUTURE PLANS

Leismer Future Development Plans

• Testing non condensable gas co-injection on Pad L4
• Pad L2 infill wells production in Q1/Q2 2015
• Pad L1 infill well drilling during Q2/Q3 2015; first steam Q3 2016
• Pad L6 completions Q4 2015; first steam Q2 2016
• Total steam capacity to the field of 69,000 bbl/cd
• Steam required for Pad L2 infill wells start-up
• Non-condensable gas pilot on Pad L4 (pending AER approval)
• Technology implementation under consideration for Pad L6 – vacuum insulated tubing
There's never been a better time for good ideas
Statoil Canada Ltd.
Leismer SAGD Project
Approval No. 10935P

Leismer SAGD 2015 (January 1 – December 31, 2014)
Annual D054 Performance Presentation
Alberta Energy Regulator
March 9, 2015
1. Facilities
2. Facility Performance
3. Measurement and Reporting
4. Water Production, Injection and Uses
5. Sulphur Production
6. Summary of Environmental Issues
7. Compliance Statement
8. Non-compliance Events
9. Future Plans
FACILITIES

Leismer Central Processing Facility (CPF)
FACILITIES PERFORMANCE
Surface Section 2
Leismer 2014 Annual Performance Presentation
FACILITIES PERFORMANCE

Bitumen Treatment

• Treater and Free Water Knock Out (FWKO) operations
  – Production train consists of one FWKO and two treaters
  – Achieved high unit reliability throughout year
  – Cleaned and inspected inlet emulsion and BFW exchangers
  – No major issues to report

• Chemical treatment
  – Chemical treatment optimized throughout the year

• Produced Water (PW) coolers
  – Fouling of coolers continues to be a challenge
  – Boiler blowdown cleaning system installed. Reduced acid cleanings by ~30%
  – On-going testing of chemical injection prior to coolers

• Slop volumes
  – Small volumes of slop being generated
FACILITIES PERFORMANCE
Water Treatment

• De-Oiling
  - No major issues to report; system operating as per design

• Warm Lime Softener (WLS) operations
  - Minor operational challenges throughout the year
  - Continue to optimize recycle
  - Blowdown recycle into WLS with no adverse affects; adjust recycle to meet water specifications
  - Meeting Boiler Feed Water (BFW) specifications >95% of the time
  - Process sludge pond primary liner leak – operating at lower volumes as dual liner design and additional clay layer ensures containment. Repair options still under review
FACILITIES PERFORMANCE

Water Treatment

• Weak Acid Cation (WAC) Operation
  − No major issues to report, system operating as per design
  − WAC throughputs extended to reduce chemical usage

• Ceramem pilot project commissioned – testing to begin in 2015

• Brackish Water Source
  − June 21, 2014 – system start-up
  − November 17, 2014 – system shut down due to negative reservoir retention
  − System shutdown and left in a safe condition
FACILITIES PERFORMANCE
Steam Generation

- System consists of four Once Through Steam Generators (OTSGs)
- Operating at average 80% steam quality
- Steam generators operating as per design
- Issues
  - Experienced a number of tube leaks and pigging spool flange leaks which resulted in short outages for the affected OTSG
FACILITIES PERFORMANCE

Well Pads

• Pad L1 test separator commissioned and put in-service
• Pad L2
  – Infill well L2-P3/4 began drilling August 14, 2014 – first steam to infill December 18, 2014
  – L2P2 observation well drilled and completed
  – L2P2 started steaming October 31, 2014
• Pad L3
  – Fire January 15, 2014
    • Repaired damaged electric and instrumentation cables
    • Root cause – Heat Medium Oil degradation
    • System redesigned, cleaned and complete fluid change out on all 4 pads
  – Solvent co-injection completed December 31, 2014
FACILITIES PERFORMANCE

Well Pads

• Pad L5
  - Started steaming May 13, 2014
  - ESP conversions completed October 25, 2014

• Pad L6
  - Construction started in June
  - SAGD well pair drilling completed November 30, 2014

• Issues
  - Heat medium heater modifications complete and heat medium fluid changed out
  - Multi-phase pump (MPP) operations
    • Pad L1 MPP modifications for seal flush in-service
    • MPP on all pads experienced minor maintenance issues that affected reliability
FACILITIES PERFORMANCE

Electricity Consumption

• Currently no independent power generated at Leismer CPF

Electricity Consumption

Yearly Total: 66,189 MWh
Facility Gas Usage

Yearly Total: Purchased Gas: 194,503.8 e3m3
SAGD Gas: 4,298.8 e3m3
FACILITIES PERFORMANCE

Produced Gas

Yearly Total: SAGD Gas: 4,298.8 e3m3
FACILITIES PERFORMANCE
Facility Gas Usage – Continuous Venting

Vented Gas from Raw Water Tank

Venting Rate based on the test value of the gas water ratio at raw water tank

Yearly total: 23.5 Se3m3

<table>
<thead>
<tr>
<th>Year</th>
<th>Volume (Se3m3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014-01</td>
<td>1.5</td>
</tr>
<tr>
<td>2014-02</td>
<td>1.5</td>
</tr>
<tr>
<td>2014-03</td>
<td>1.5</td>
</tr>
<tr>
<td>2014-04</td>
<td>2.0</td>
</tr>
<tr>
<td>2014-05</td>
<td>2.0</td>
</tr>
<tr>
<td>2014-06</td>
<td>2.0</td>
</tr>
<tr>
<td>2014-07</td>
<td>2.0</td>
</tr>
<tr>
<td>2014-08</td>
<td>2.5</td>
</tr>
<tr>
<td>2014-09</td>
<td>2.0</td>
</tr>
<tr>
<td>2014-10</td>
<td>2.0</td>
</tr>
<tr>
<td>2014-11</td>
<td>2.0</td>
</tr>
<tr>
<td>2014-12</td>
<td>2.0</td>
</tr>
</tbody>
</table>
• Solution gas recovery percentage was 96.2%
FACILITIES PERFORMANCE

CO₂ Emissions

CO₂ (t) Direct

Total 2014 Direct CO₂ emissions = 393,729 tonnes
LEISMER FACILITY PERFORMANCE

Plant Performance and Expectations

- Surface facilities have operated close to design
- Reliability continues to be significantly higher than anticipated
- Overall plant performance has met expectations
MEASUREMENT AND REPORTING

Proration Factors

![Proration Factors Chart]

- Proration Factors for different months from January 2014 to December 2014.
- The chart shows two categories: Net Oil Proration and Net Water Proration.
- The values range from approximately 0.70 to 1.30.

Net Oil Proration:
- Values include: 1.09622, 1.08007, 1.09883, 1.02546, 0.94172, 0.89828, 0.85548, 0.86729, 0.93593, 0.98050.

Net Water Proration:
- Values include: 0.74179, 0.95007, 0.96052, 0.97007, 0.98007, 0.99007, 1.00007, 1.01007, 1.02007, 1.03007, 1.04007, 1.05007, 1.06007, 1.07007, 1.08007, 1.09007, 1.10007, 1.11007, 1.12007, 1.13007.

Classification: Open
Date: 2015-03-09
Well tests used to calculate daily bitumen and water production

Well test frequency increased (11 hours well tests with 1 hour purge) to improve production calculation
  - Typical frequency is 6 – 7 per month per well

All pads are equipped with a water cut analyzer
  - L2/L4 rates = water cut x FQI at individual wellhead

Pads L1, L3 and L5 are equipped with a test separator
MEASUREMENT AND REPORTING
SAGD Well Testing Bottlenecks and Optimization

• Bottlenecks
  − Partial flow through 2” test header
  − Single phase flow devices for multiphase flow
  − Relying on two phase water cut analyzer for multiphase flow

• Optimization
  − Calibration of water cut analyzers on a regular basis
  − Implemented common well testing validation strategy
  − Continuous analysis of well testing data
  − Comparing and evaluating various technologies
WATER PRODUCTION, INJECTION, AND USES

Unique Well Identifiers
WATER PRODUCTION, INJECTION, AND USES

CPF Water Use

• Leismer’s source water network includes 5 wells completed in Lower Grand Rapids Formation (LGR)

• Clearwater B brackish water well was tied in and first used in 2014
CPF Water Use

• Water Diversion Licence (WDL) 00239880 for 317,915 m³/yr (871 m³/cd)
  - Total non-saline water pumped from source wells at Leismer in 2014 was 245,850 m³ (674 m³/d), 77% of allowable WDL amount
  • Of the total amount drawn from the source wells:
    - 97% went to Leismer CPF for process use
    - 2.5% was used for drilling
    - 1% for domestic use

• Temporary Diversion Licence (TDL) 00328877 for 255,500 m³/yr (700 m³/cd)
  - No water was used as part of this TDL in 2014

• A total of 5566 m³ of brackish water was used in 2014
WATER PRODUCTION, INJECTION, AND USES

Lower Grand Rapids Water Volumes

2014 Total Flow from Source Water Wells

<table>
<thead>
<tr>
<th>Month</th>
<th>Volume (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>12,000</td>
</tr>
<tr>
<td>February</td>
<td>15,000</td>
</tr>
<tr>
<td>March</td>
<td>18,000</td>
</tr>
<tr>
<td>April</td>
<td>20,000</td>
</tr>
<tr>
<td>May</td>
<td>22,000</td>
</tr>
<tr>
<td>June</td>
<td>24,000</td>
</tr>
<tr>
<td>July</td>
<td>26,000</td>
</tr>
<tr>
<td>August</td>
<td>28,000</td>
</tr>
<tr>
<td>September</td>
<td>30,000</td>
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<tr>
<td>October</td>
<td>32,000</td>
</tr>
<tr>
<td>November</td>
<td>34,000</td>
</tr>
<tr>
<td>December</td>
<td>36,000</td>
</tr>
</tbody>
</table>

Classification: Open
WATER PRODUCTION, INJECTION, AND USES

Clearwater B - Brackish Water Volumes

2014 Brackish Water Volume

Cumulative Brackish Water (m³)

Monthly Brackish Water (m³)

Cumulative Brackish Water (m³)
# Typical Water Quality

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
<th>Brackish</th>
<th>Source Water</th>
<th>Produced Water</th>
<th>Disposal Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>TDS</td>
<td>mg/L</td>
<td>5,700</td>
<td>1,450</td>
<td>1,850</td>
<td>45,000</td>
</tr>
<tr>
<td>pH</td>
<td></td>
<td>8.5</td>
<td>8.8</td>
<td>7.6</td>
<td>12.1</td>
</tr>
<tr>
<td>Hardness</td>
<td>mg/L as CaCO3</td>
<td>70</td>
<td>4.4</td>
<td>18</td>
<td>2.0</td>
</tr>
<tr>
<td>Total Alkalinity</td>
<td>mg/L as CaCO3</td>
<td>880</td>
<td>810</td>
<td>230</td>
<td>6,800</td>
</tr>
<tr>
<td>SiO2</td>
<td>mg/L</td>
<td>0</td>
<td>0</td>
<td>275</td>
<td>300</td>
</tr>
<tr>
<td>Cl</td>
<td>mg/L</td>
<td>2,800</td>
<td>250</td>
<td>850</td>
<td>18,000</td>
</tr>
</tbody>
</table>
WATER PRODUCTION, INJECTION, AND USES

Produced Water

2014 Produced Water Volume

- Cumulative PW
- Monthly PW

Month| Monthly Produced Water (m³) | Cumulative Produced Water (m³)
---|---|---
Jan| 150,000 | 150,000
Feb| 125,000 | 275,000
Mar| 175,000 | 450,000
Apr| 200,000 | 650,000
May| 225,000 | 875,000
Jun| 250,000 | 1,125,000
Jul| 275,000 | 1,400,000
Aug| 300,000 | 1,700,000
Sep| 250,000 | 2,250,000
Oct| 325,000 | 2,575,000
Nov| 375,000 | 3,350,000
Dec| 300,000 | 3,300,000
Disposal Limit (Directive 081)

2014 Disposal Limit (Directive 081)

- Allowable Disposal Limit
- Actual Disposal

<table>
<thead>
<tr>
<th>Month</th>
<th>Actual Disposal</th>
<th>Allowable Disposal Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>8%</td>
<td>9%</td>
</tr>
<tr>
<td>Feb</td>
<td>7%</td>
<td>8%</td>
</tr>
<tr>
<td>Mar</td>
<td>6%</td>
<td>7%</td>
</tr>
<tr>
<td>Apr</td>
<td>5%</td>
<td>6%</td>
</tr>
<tr>
<td>May</td>
<td>4%</td>
<td>5%</td>
</tr>
<tr>
<td>Jun</td>
<td>3%</td>
<td>4%</td>
</tr>
<tr>
<td>Jul</td>
<td>2%</td>
<td>3%</td>
</tr>
<tr>
<td>Aug</td>
<td>1%</td>
<td>2%</td>
</tr>
<tr>
<td>Sep</td>
<td>0%</td>
<td>1%</td>
</tr>
<tr>
<td>Oct</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Nov</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Dec</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Total</td>
<td>6%</td>
<td>9%</td>
</tr>
</tbody>
</table>

Disposal Percentage: 2014 Disposal Limit (Directive 081)
Blowdown Recycle Percentage

- January: 70%
- February: 80%
- March: 70%
- April: 60%
- May: 50%
- June: 60%
- July: 70%
- August: 80%
- September: 50%
- October: 70%
- November: 60%
- December: 75%

Total: 75%
WATER PRODUCTION, INJECTION, AND USES

Disposal Volumes

- Leismer has two disposal wells on site (one operating, one standby)
- Both wells are Class 1b disposal wells (Disposal Approval # 11479)

![2014 Disposal Water Volume Graph](image-url)

- Cumulative disposal and monthly disposal data for 2014.
WATER PRODUCTION, INJECTION, AND USES

Disposal Pressure and Temperature

![Graph showing Wellhead Pressure and Temperature over time with specific dates and井头压力和温度的时间图示与具体日期。]
WATER PRODUCTION, INJECTION, AND USES

Off-site Waste Disposal

• Slop Handling – 3,480 m³ of water was trucked off site with slop oil to the Lindbergh cavern facility

• Solids Disposal
  – Water treatment related solids (lime softening sludge) is allowed to settle in the sludge pond at site
SULPHUR PRODUCTION
Surface Section 5
Leismer 2015 Annual Performance Presentation
SULPHUR PRODUCTION
Sulphur and Sulphur Dioxide

• Leismer average daily sulphur dioxide (SO₂) emissions 0.31 tonnes/day (15.7% of approval limit)¹
• Total annual SO₂ emissions for 2014 – 114.9 tonnes
• Leismer peak daily SO₂ emission – 0.45 tonnes
• Leismer does not currently have sulphur recovery facilities
• Statoil shall ensure that sulphur recovery will be operational before total sulphur emissions reach one tonne/day on a calendar quarter-year average basis

¹EPEA Kai Kos Dehseh approval limit is 2.0 tonnes/calendar day of SO₂ emissions
SULPHUR PRODUCTION

Annual Trend of Sulphur Dioxide Emissions

Daily Sulphur Emission as Sulphur Dioxide (from OTSG's and Flaring)

- Q1 Avg. = 0.32
- Q2 Avg. = 0.33
- Q3 Avg. = 0.26
- Q4 Avg. = 0.38
SULPHUR PRODUCTION
Leismer Sulphur Balance

Central Processing Facility

A. Reservoir
B. Diluent

C. Emission from OTSG's
D. Flare Gas
E. Diluted Bitumen

Sulphur Balance (tonnes $)

<table>
<thead>
<tr>
<th>Month</th>
<th>Sulphur from Reservoir</th>
<th>Sulphur from Diluent Receipts</th>
<th>Emissions from OTSG's</th>
<th>Emissions from Flare Gas</th>
<th>Sulphur in Diluted Bitumen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan 2014</td>
<td>3135</td>
<td>1.7</td>
<td>3.3</td>
<td>0.292</td>
<td>3133</td>
</tr>
<tr>
<td>Feb 2014</td>
<td>3062</td>
<td>2.1</td>
<td>5.2</td>
<td>0.009</td>
<td>3059</td>
</tr>
<tr>
<td>Mar 2014</td>
<td>3918</td>
<td>2.8</td>
<td>5.8</td>
<td>0.000</td>
<td>3915</td>
</tr>
<tr>
<td>Apr 2014</td>
<td>3538</td>
<td>2.6</td>
<td>4.4</td>
<td>0.000</td>
<td>3536</td>
</tr>
<tr>
<td>May 2014</td>
<td>3702</td>
<td>2.1</td>
<td>4.7</td>
<td>0.000</td>
<td>3699</td>
</tr>
<tr>
<td>Jun 2014</td>
<td>3781</td>
<td>1.9</td>
<td>5.8</td>
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<td>3777</td>
</tr>
<tr>
<td>Jul 2014</td>
<td>3615</td>
<td>2.2</td>
<td>4.1</td>
<td>0.017</td>
<td>3613</td>
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<tr>
<td>Aug 2014</td>
<td>3919</td>
<td>2.0</td>
<td>4.1</td>
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SULPHUR PRODUCTION

Leismer Ambient Air Monitoring

Alberta Environment and and Sustainable Resource Development (ESRD) approval limits based on Alberta ambient air quality objectives:

SO₂ (1 hour average) 172 ppbv
H₂S (1 hour average) 10 ppbv

Passive Ambient Air Monitoring 2014:

<table>
<thead>
<tr>
<th>Month</th>
<th>SO₂ Peak Reading (ppb)</th>
<th>H₂S Peak Reading (ppb)</th>
<th>ESRD Approval Limit SO₂ – 1 Hour Average (ppbv)</th>
<th>ESRD Approval Limit H₂S – 1 Hour Average (ppbv)</th>
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Continuous Ambient Air Monitoring 2014:

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<tr>
<th>Month</th>
<th>SO₂ Peak Reading – 1 Hour Average (ppb)</th>
<th>H₂S Peak Reading – 1 Hour Average (ppb)</th>
<th>Operational Time SO₂ (%)</th>
<th>Operational Time H₂S (%)</th>
</tr>
</thead>
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ENVIRONMENTAL ISSUES
Surface Section 6
Leismer 2015 Annual Performance Presentation
ENVIRONMENTAL ISSUES

Environmental Approval Compliance Issues

- **EPEA Approval 241311-00-04**
  - January 2014
    - Exceeded NOx limit of 13 kg/h on January 5th, 2014. Reached 13.72 kg/h. Combustion air controller malfunctioned - dampers misaligned causing excess air condition. Reference # 280642
  - June 2014
    - Rainwater was not collected on Pad 5 and ran into the collection system. Water was running off-lease in the NW corner of the pad. Final grading was completed and topographical survey done July 5th. Reference # 284905
  - August 2014
    - Exceeded NOx limit of 13 kg/h on August 14th, 2014 during maintenance of the CEMS Unit. Reached 21.57 kg/h. Reference # 288206

- **Alberta Energy Regulator (AER)**
  - Non-compliance events reportable to AER are provided in Surface Section 8
ENVIRONMENTAL ISSUES
Leismer Approvals and Amendments

• EPEA Approval 241311-00-03
  − Received March 14th, 2014
  − Changes to the approval included:
    2. Leismer Amendment Phase 2 Project (LAP2) application (003-241311, submitted April 19th, 2013).
    3. New template from ESRD

• EPEA Approval 241311-00-04
  − Received July 28th, 2014
  − Changes to the approval included the asset swap between Statoil and PTTEP Canada Ltd. application (004-241311, submitted June 17th, 2014)
ENVIRONMENTAL ISSUES

Leismer Approvals and Amendments

- **Water Diversion Licences:**
  - Groundwater WDL 00239880 (June 2012 – June 2017): SAGD water source
  - Groundwater WDL 00297242 (Nov 2011 - Nov 2021): industrial use licence for downhole use
  - Surface Water WDL 00273542 (Nov 2011 – Nov 2021): 9 lakes for OSE/winter use (amended/reduced in October 2014 from 15 lakes)
ENVIRONMENTAL ISSUES
Leismer Approvals and Amendments

• Water Diversion Licences, continued:
  − Groundwater WDL 00322141 (Aug 2013 – Aug 2023): Waddell Camp – use includes industrial (Waddell camp supply), commercial (drilling), earthworks (construction, dust suppression and ice roads)
  − TDL 00340844 (Dec 2013 – Dec 2014): Quaternary well licence for OSE, drilling, completions, freeze down, construction
  − Groundwater TDL 00358039 (October 2014 – October 2015): Quaternary well – uses include construction related to oil and gas activity
  − Surface Water TDL 00353096 (July 2014 – July 2015): surface water runoff from seven Pads, uses include oil sands exploration (i.e. drilling, construction, dust control, misc.)
ENVIROMENTAL ISSUES

Leismer Monitoring Programs

• EPEA Approval reports and proposals submitted:
  – Monthly Air Reports
  – Soil Monitoring Program Proposal (January 2014)
  – Annual Groundwater Monitoring Report (March 2014)
  – Annual Conservation and Reclamation Report (March 2014)
  – Annual Air Report (March 2014)
  – Annual Industrial Wastewater Report (March 2014)
  – Annual Industrial Runoff Report (March 2014)
  – Annual Wetland Monitoring Report (March 2014)
  – Caribou Mitigation and Monitoring Program Proposal (August 2014)
  – Revised Groundwater Monitoring Program Proposal (December 2014)
ENVIRONMENTAL ISSUES

Leismer Monitoring Programs, Continued

• *EPEA* Program Proposals approved:
  – Caribou Mitigation and Monitoring Program Proposal – approved October 2014

• Water Act reports:
  – WDL – monthly and annual Water Use reporting
  – TDL – no formal report unless requested
ENVIRONMENTAL ISSUES

Other SCL Environment Initiatives

- Founding member of the Canada’s Oil Sands Innovation Alliance (COSIA)
- Member of the Integrated CO$_2$ Network (ICO$_2$N)
- Canadian Association of Petroleum Producers (CAPP)
  - Actively participating in various environmental working groups
  - Submitted Responsible Canadian Energy (RCE) 2013 Progress Report
- SCL participates in regional initiatives:
  - Alberta Biodiversity Monitoring Institute (ABMI) including Ecological Monitoring Committee for Lower Athabasca (EMCLA);
  - Regional Aquatics Monitoring Program (RAMP);
  - Wood Buffalo Environmental Association (WBEA);
  - Cumulative Effects Management Association (CEMA)
  - Industrial Footprint Reduction Options Group (iFROG) : Multi-stakeholder reclamation research collaboration focused on road and pad reclamation within treed poor fens.
ENVIRONMENTAL ISSUES
Other SCL Environment Initiatives, Continued

• The Woody Debris Rollback Program concept was proven in 2012, 2013, and 2014, maintaining the same number of wildlife cameras (60). A COSIA Joint Industry Project (JIP) is progressing with Devon and Connacher as partners, which will assess the effectiveness of a lower application rate on several new sites in 2015.

• Continuation of SCL’s Surface Water Monitoring Program (SWMP) in 2014, with seasonal sampling in the Leismer and Corner lease areas.

• A Planning Optimization Tool was developed in 2013 and continues to be utilized in a joint project with Devon to minimize footprint and avoid sensitive areas.

• Reclamation activities commenced for four borrow sites and one gravel stockpile site in Fall 2014.

• No SAGD pad abandonments planned within next four years.
COMPLIANCE STATEMENT

Approval and Regulatory Requirements Compliance Statement

- Statoil believes that it is in compliance with the AER Scheme Approval and regulatory requirements
NON-COMPLIANCE EVENTS
Surface Section 8
Leismer 2015 Annual Performance Presentation
NON-COMPLIANCE EVENTS

AER Non-Compliance Events

• January 2014
  • Unplanned Flaring 01/03/2014: Black smoke occurring over the 6 minute notification time period due to VRU issues. DDS # 733381
  • Reportable Spill 01/09/2014: 2-3 m³ of concentrated groundwater from the Water Treatment Plant at Leismer Lodge was released to grade when a hauling truck backed over the line carrying the water while hauling snow. A permanent underground line was installed to prevent reoccurrence. Reference # 279291
  • Unplanned Flaring 01/21/2014: Approximately 4 hours of unplanned flaring due to charge pump trip which caused the VRU to shut down. DDS # 736377

• April 2014
  • Reportable Spill 04/19/2014: Approximately 5 m³ of diluent was released from a 6” drain valve on the 30” main product line at Cheecham Terminal. Approximately 3.5 m³ was maintained in the tank farm secondary containment berm area and 1.5 m³ exposed to the outer drainage ditch on-lease. All contamination has been removed and disposed of. Reference # 20140910
NON-COMPLIANCE EVENTS

AER Non-Compliance Events

• August 2014
  • Unplanned Flaring 08/08/2014: Unplanned flaring for 7 hours starting due to a power outage caused by a raven landing on the ATCO substation. DDS # 765236

• September 2014
  • Reportable Spill 09/02/2014: A vacuum truck flipped over on Leismer Road 2, spilling approximately 30L of hydraulic fluid. All contamination has been removed and disposed of. Reference # 289075
  • Reportable Spill 09/30/2014: After cleaning drilling mud tanks and preparing them for new mud, a valve was left partially open when the vacuum truck operator removed the hose from the truck after cleaning. Once the transfer of new mud into the tank began, mud spilled out the partially closed valve. Approximately 2 cubic meters of new intermediate polymer mud was released onto the rig matting and 20L of mud spilled to grade through cracks in the rig matting. All contamination has been removed and disposed of. Reference # 20142471

• October 2014
  • Planned Flaring 10/06/2014: Planned shut down resulted in flaring on October 6 at 23:30 continuing until October 7 at 21:00. DDS # 774512
SURFACE REVIEW – FUTURE PLANS

2015 Plans

• Pad L2 – steam injection and production from pilot infill well L2P4/5
• Pad L1 infill wells – drilling in Q2 2015
• Non Condensable Gas Co-injection Pilot – Pad L4
• Pad L6 - facilities construction, first steam Q2 2016
There’s never been a better time for good ideas

Presentation: Leismer 2015 Annual Performance Presentation (D054) to Alberta Energy Regulator

Presenters name: Anne Downey et al.
Presenters title: VP Operations, Statoil Canada Ltd.
E-mail address: andow@statoil.com
Tel: 403-767-4170

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