Air injection & displacement for recovery with oil horizontal (AIDROH) project Approval #11618 Performance presentation

AER offices
Calgary
February 2015
Advisory

This document contains forward-looking information prepared and submitted pursuant to the Alberta Energy Regulator’s requirements and is not intended to be relied upon for the purpose of making investment decisions, including without limitation, to purchase, hold or sell any securities of Cenovus Energy Inc. Additional information regarding Cenovus Energy Inc. is available at cenovus.com.
AIDROH* introduction and overview

This presentation was prepared in accordance with AER Directive 054 - Performance Presentations, Auditing, and Surveillance of In Situ Oil Sands Schemes

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

* Canadian patent CA2594413
AER Dir 054 Section 3.1.1

Subsurface issues related to resource evaluation and recovery
Subsurface issues: Table of contents

1. Scheme background
2. Geology / geoscience
3. Drilling & completion
4. Artificial Lift
5. Instrumentation
6. Scheme performance
7. Future plans
Scheme background

Subsurface section 1

AIDROH
Approval #11618
2014 annual performance presentation
Background

The Air Injection Displacement Horizontal Oil Recovery (AIDROH) project utilizes gravity drainage as bitumen recovery process to recover bitumen which has been passively heated by Cenovus EnCAID combustion project.
Location map
Geological / geoscience

Subsurface section 2

AIDROH
Approval #11618
2014 annual performance presentation
Summary of reservoir properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth</td>
<td>465 TVD</td>
</tr>
<tr>
<td>Thickness</td>
<td>25-30m</td>
</tr>
<tr>
<td>Average Porosity</td>
<td>35%</td>
</tr>
<tr>
<td>Average Bitumen Saturation</td>
<td>65%</td>
</tr>
<tr>
<td>Average Permeability</td>
<td>1,350mD</td>
</tr>
<tr>
<td>OBIP (Project Area)</td>
<td>3,302 e³m³</td>
</tr>
<tr>
<td>Oil Viscosity @ 13C</td>
<td>~35,000 cP</td>
</tr>
<tr>
<td>@ 60C</td>
<td>~600 cP</td>
</tr>
<tr>
<td>API Oil Gravity</td>
<td>10.3 -10.8</td>
</tr>
</tbody>
</table>
Wabiskaw bitumen thickness

Type log cut offs:
- < 75 api gamma ray
- > 20 ohm resistivity
- > 27% porosity

OBIP under gas cap = 159,000 e³m³
Wabiskaw structural map

- 103/5-10 Post-burn well
- 104/5-10 Hz production well
- 102/5-10 Pre-burn OB well
- 100/5-10 Injection well
Wabiskaw stratigraphic cross-section

WBSK B Valley Fill

WBSK D Valley Fill

Regional WBSK

Bottom water

Depositional Edge

MCMR
104/5-10 horizontal production well

Producer drilled 15m below G/B interface:
- avoid hitting concretion
- avoid missing heated zone

Learnings:
- drill lower to optimize reserves recovery

Drilled in 2011 east of injector well at surface location 6-10
300m of horizontal leg landed 30m north of injector well and
~15m into heated zone
Drilling and completion

Subsurface section 3

AIDROH
Approval #11618
2014 annual performance presentation
Well layout

Drilled 103/5-10-73-6W4 post-burn vertical well in September 2011

- Drilled 11m northwest of 102/5-10-73-6W4 pre-burn well
- Successfully cored 44m from top of Wabiskaw to top of McMurray – no lost core
- Extensive core and oil analysis program started in early 2012
  - Core - routine core analysis, thin section, SEM, XRD
  - Oil – API, viscosity, composition

Drilled 104/5-10-73-6W4 horizontal producer in September 2011

- 300m east-west horizontal section landed 30m north of 100/5-10-73-6W4 injector well and 15m below Wabiskaw gas/bitumen interface
- Equipped with 20 thermocouples along horizontal length
Completion

Recompletion on Sept 2014

- Install tail pipe to toe
  - divert hot crude to toe
  - encourage warming near toe
- Upsize artificial lift
  - anticipate more influx as toe warms
- Change the instrumentation coil
  - rid chance of instrumentation damage
  - rig wait on location

Requirements under subsection 3.1.1 3c – wellbore schematics are included in the Appendix
Artificial lift

Subsurface section 4

AIDROH
Approval #11618
2014 annual performance presentation
Artificial lift technology remains the same

- PCP, temperature tolerance of elastomer 150°C
- Lift capacity range of 34-50 m³/D
- Operating temperature range 44°C to 108°C
Artificial lift performance

Well produced throughout 2014 except from September 11th to September 22nd 2014 to perform recompletion

PCP continues to perform within its design operating parameters

• Significant volume of entrained gas ingested by the PCP
Instrumentation

Subsurface section 5

AIDROH
Approval #11618
2014 annual performance presentation
Instrumentation in wells

104/05-10-73-6W4/00

• Equipped with 10 thermocouples

Requirements under subsection 3.1.1 5a – wellbore schematics 5c and 5d are included in the Appendix
Thermocouple temp vs. depth
Scheme performance

Subsurface section 6

AIDROH
Approval #11618
2014 annual performance presentation
Oil rate forecast
Production history
Heated oil volume

Calculated using analytical geometry based method
Combustion front heats bitumen by conduction in shape of sphere cap

• Thermally affected radius ~ 240 m

Chemically affected

• 45,000 m$^3$

Thermal affected*

• 527,000 m$^3$
Produced oil quality

Original oil ~45,000 cp @ reservoir conditions (dead)
Not expecting significant upgrading

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Asphaltenes (C5 insoluble)</th>
<th>Saturates</th>
<th>Resins</th>
<th>Aromatics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>13</td>
<td>26</td>
<td>11</td>
<td>50</td>
</tr>
<tr>
<td>2</td>
<td>14</td>
<td>25</td>
<td>13</td>
<td>49</td>
</tr>
<tr>
<td>3</td>
<td>14</td>
<td>26</td>
<td>13</td>
<td>47</td>
</tr>
<tr>
<td>4</td>
<td>14</td>
<td>24</td>
<td>13</td>
<td>49</td>
</tr>
<tr>
<td>5</td>
<td>15</td>
<td>25</td>
<td>13</td>
<td>47</td>
</tr>
<tr>
<td>6</td>
<td>12</td>
<td>25</td>
<td>11</td>
<td>52</td>
</tr>
<tr>
<td>7</td>
<td>13</td>
<td>28</td>
<td>8</td>
<td>52</td>
</tr>
<tr>
<td>8</td>
<td>15</td>
<td>23</td>
<td>16</td>
<td>46</td>
</tr>
<tr>
<td>9</td>
<td>16</td>
<td>24</td>
<td>11</td>
<td>49</td>
</tr>
<tr>
<td>10</td>
<td>13</td>
<td>24</td>
<td>9</td>
<td>54</td>
</tr>
<tr>
<td>11</td>
<td>13</td>
<td>24</td>
<td>13</td>
<td>50</td>
</tr>
<tr>
<td>12</td>
<td>14</td>
<td>24</td>
<td>13</td>
<td>49</td>
</tr>
<tr>
<td>13</td>
<td>14</td>
<td>23</td>
<td>10</td>
<td>53</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Viscosity(cSt), temp(°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>26,525 6469 2608 781 170</td>
</tr>
<tr>
<td>2</td>
<td>7510 2111 853</td>
</tr>
<tr>
<td>3</td>
<td>5006 2103 652 216</td>
</tr>
<tr>
<td>4</td>
<td>9073 2483 925</td>
</tr>
<tr>
<td>5</td>
<td>8013 2185 844</td>
</tr>
<tr>
<td>6</td>
<td>7994 2112 1022</td>
</tr>
<tr>
<td>7</td>
<td>26,454 7763 2971 860 184</td>
</tr>
<tr>
<td>8</td>
<td>37,131 8276 3050 884 188</td>
</tr>
<tr>
<td>9</td>
<td>8271 2410 923</td>
</tr>
<tr>
<td>10</td>
<td>5389 1646 662</td>
</tr>
<tr>
<td>11</td>
<td>8442 2338 894</td>
</tr>
<tr>
<td>12</td>
<td>7180 2449 926</td>
</tr>
<tr>
<td>13</td>
<td>57,523 6270 1583 737 198</td>
</tr>
<tr>
<td>14</td>
<td>10250 2922 1130</td>
</tr>
<tr>
<td>15</td>
<td>10955 3038 1153</td>
</tr>
<tr>
<td>16</td>
<td>10457 2919 1103</td>
</tr>
<tr>
<td>17</td>
<td>10267 2780 1091</td>
</tr>
</tbody>
</table>
## BS&W

<table>
<thead>
<tr>
<th>Quarter</th>
<th>BS&amp;W</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1</td>
<td>2.0%</td>
</tr>
<tr>
<td>Q2</td>
<td>1.0%</td>
</tr>
<tr>
<td>Q3</td>
<td>1.0%</td>
</tr>
<tr>
<td>Q4</td>
<td>7.5%</td>
</tr>
</tbody>
</table>
Subsurface key learnings

Thermocouple data necessary for simulation modeling on history match and production prediction scenarios
Casing gas pressure not detected after recompletion
No H2S detection after recompletion
  • Maximum recorded 430 ppm
Contributions from toe section of producer improved based on observed thermocouple data
  • ~ 10-15 C temperature increase since recompletion
High BS&W Number on produced bitumen since Aug
  • Preliminary lab result suggested formation water
Future plans

Subsurface section 6

AIDROH
Approval #11618
2014 annual performance presentation
Future plans

Suspend AIDROH well in Q1 2015
AER Dir 54 Section 3.1.2

Surface operations, compliance and issues not related to resource evaluation and recovery
Surface operations: Table of contents

1. Facility overview / modifications
2. Measurement and reporting
3. Water, water disposal well and landfill waste
4. Sulphur production
5. Environmental issues
6. Compliance statement
7. Non-compliance discussion
8. Future plans
Facility overview / modifications

Surface section 1

AIDROH
Approval #11618
2014 annual performance presentation
Site layout
Process flow schematic

Modification rationale

• Compliance with sour oil battery operations and license
• Sour rated vent
Facility performance - 2014

Changed tank venting to sour rated on Sept, 2014
No casing pressure after recompletion, no H2S reading on the analyzer

- Minimum operating pressure limits effectiveness until sufficient consistent casing pressure demonstrated
- Daily Draeger testing protocol in effect

Low operating temperatures prove problematic during winter operations
Gas usage

Usages are for blanket gases in sales oil tanks and incineration of produced sour gases

- Gas source Primrose plant sales
- Total usage 674 e$^3$m$^3$
## Green house gas emissions

<table>
<thead>
<tr>
<th>Month</th>
<th>2014 GHG (Tonne)</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>46</td>
</tr>
<tr>
<td>February</td>
<td>64</td>
</tr>
<tr>
<td>March</td>
<td>91</td>
</tr>
<tr>
<td>April</td>
<td>101</td>
</tr>
<tr>
<td>May</td>
<td>109</td>
</tr>
<tr>
<td>June</td>
<td>112</td>
</tr>
<tr>
<td>July</td>
<td>115</td>
</tr>
<tr>
<td>August</td>
<td>78</td>
</tr>
<tr>
<td>September</td>
<td>23</td>
</tr>
<tr>
<td>October</td>
<td>11</td>
</tr>
<tr>
<td>November</td>
<td>22</td>
</tr>
<tr>
<td>December</td>
<td>30</td>
</tr>
</tbody>
</table>
Measurement and reporting

Surface section 2

AIDROH
Approval #11618
2014 annual performance presentation
Measurement reporting

Field operations take daily tank readings, enter into daily tracking

Daily ADRMOH tracking spreadsheet

Production Accounting Activities
1) BSW cuts are determined based on the Foster Creek labs analysis results. These are entered into EC.
2) Production is determined based on closing inventory-open inventory-receipts+dispositions.
3) Battery production and gas meter reports from EC used to created PRA uploaded file.
4) PRA submission is completed.

Field operations enter truck tickets into EC: total fluid volume with known average BSW

Gas (vent, fuel, casing gas) meters loaded to EC via SCADA system

Receiving BSW from Foster Creek labs

EC
Water, water disposal wells & landfill waste

Surface section 3

AIDROH
Approval #11618
2014 annual performance presentation
Water and waste disposal

No produced water

Produced bitumen volumes typically \( \sim 7\% \) BS&W

No processing occurs on site

All produced volumes are trucked out for processing
Sulphur production

Surface operations section 4

AIDROH
Approval #11618
2014 annual performance presentation
Sulphur production

No H2S detected after recompletion on Sept 2014

<table>
<thead>
<tr>
<th>2014</th>
<th>Sulphur Emission, Kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1</td>
<td>22</td>
</tr>
<tr>
<td>Q2</td>
<td>90</td>
</tr>
<tr>
<td>Q3</td>
<td>63</td>
</tr>
<tr>
<td>Q4</td>
<td>0</td>
</tr>
</tbody>
</table>

![Graph showing Sulphur Emission Kg/Month for different quarters of 2014](image-url)
Environmental issues

Surface section 5

AIDROH
Approval #11618
2014 annual performance presentation
Environmental issues

No environmental issues occurred in 2014
Compliance statement

Surface section 6

AIDROH
Approval #11618
2014 annual performance presentation
Compliance Confirmation

No noncompliance events occurred in 2014
Non-compliance discussion

Surface section 7

AIDROH
Approval #11618
2014 annual performance presentation
Compliance confirmation

No noncompliance events occurred since the last performance review
Future Plans

Surface section 5

AIDROH
Approval #11618
2014 annual performance presentation
Future plans

Suspend AIDROH well in Q1 2015 due to low oil price environment
Wellbore Schematic