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

Alberta Energy Regulator
Calgary
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Advisory

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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 Directive 054 Section 3.1.1

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

- Background
- Geology/geoscience
- Drilling and completion
- Artificial lift
- Instrumentation
- Scheme performance
- Future plans
Scheme background

Subsurface section 1

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Background

The AIDROH project uses gravity drainage as a bitumen recovery process to recover bitumen that has been passively heated by the Cenovus EnCAID combustion project.
Geological/geoscience

Directive 54
Subsurface section 2

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## Summary of reservoir properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth</td>
<td>465m 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>~25,000 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
Wabiskaw stratigraphic cross-section

A A'

Bottom water

WBSK B VF
Depositional Edge

WBSK B Valley Fill

WBSK D Valley Fill

Regional WBSK

MCMR
Horizontal production well 104/5-10

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

Directive 54
Subsurface section 3

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Well layout

**Drilled 103/5-10-73-6W4 post burn vertical well September 2011**
- Drilled 11m northwest of 102/5-10-73-6W4
- Successfully cored 44m from top Wabiskaw to top of McMurray – no lot core
  - extensive core ad oil analysis program completed
  - core routine core analysis, SEM, XRD
  - oil API, viscosity, composition

**Drilled 104/5-10-73-6W4 horizontal producer well September 2011**
- Drilled 300m east-west horizontal section, landed 30m north of 100/5-10-73-6W4 injector well and 15m below Wabiskaw gas/bitumen interface
- Well equipped with 20 thermocouples in horizontal length
Completion

Installed tail pipe to toe

- divert hot crude to toe
- encourage warming near toe

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

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Subsurface section 4

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Artificial lift

Artificial lift technology information

• Progressive cavity pump (PCP), temperature tolerance of elastomer 150°C
• Lift capacity range: 34-50 m3/D
• Operating temperature range 44°C to 108°C
Artificial lift performance

No production activity during 2017 reporting period

• Well suspended on February 13, 2015
Instrumentation

Directive 54
Subsurface section 5

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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 temperature vs. depth
Scheme performance

Directive 54
Subsurface section 7

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Production history

No production activity during 2017 reporting period
Heated oil volume

Calculated using analytical geometry-based method

Combustion front heats bitumen by conduction in the shape of a sphere cap

• Thermally affected radius ~ 285m

Chemically affected

• 62,000m³

Thermal affected*

• 728,000m³

* Based on horizontal well depth 15m below gas/bitumen interface
Historical oil quality

Original oil ~45,000 cP at reservoir conditions (dead)

No oil quality analysis undertaken during 2017 reporting period
Basic Sediment & Water

No production activity during 2017 reporting period
Subsurface key learnings

No production activity during 2017 reporting period

EnCAID conductive heating effects observed following suspension of well operations from 2015

- TC 1-5 ~12°C temperature increase
- TC 6-11 ~19°C temperature increase
- TC 12-15 ~8°C temperature increase
Future plans

Directive 54
Subsurface section 8

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Future plans

Continue the following:

• Monitor downhole temperatures
• Continued suspension of AIDROH well operations
AER Directive 54 Section 3.1.2

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

- Facility overview/modifications
- Measurement and reporting
- Water, water disposal well and landfill waste
- Sulphur production
- Environmental issues
- Compliance statement
- Non-compliance discussion
- Future plans
Facility overview/modifications

Directive 54
Surface operations section 1

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Site layout
Process flow schematic

No changes to facility or process undertaken during 2017 reporting period
Facility performance 2017

No production activity during 2017 reporting period

- Suspended facility February, 2015
Gas usage

No gas usage activity during 2017 reporting period
Greenhouse gas emissions

No production operations or gas usage activity during 2017 reporting period
Measurement and reporting

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Surface operations section 2

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Measurement reporting

Field operations take daily tank readings, enter into daily tracking

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

Daily AIDROH 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 create PRA uploaded file.
4) PRA submission is completed.

EC

EC
Water, water disposal wells and landfill waste

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Surface operations section 5

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Water and waste disposal

No production operations during 2017 reporting period

• No processing occurred at the site
• No produced water
Sulphur production

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Surface operations section 6

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Sulphur production

No production operations during 2017 reporting period
Environmental issues

Directive 54
Surface operations section 7

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Environmental issues

No environmental issues related to the AIDROH occurred in 2017
Compliance statement

Directive 54
Surface operations section 8

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Compliance confirmation

No non-compliance events related to the AIDROH occurred in 2017
Non-compliance discussion

Directive 54
Surface operations section 9

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Non-compliance confirmation

No non-compliance events related to the AIDROH occurred in 2017
Future plans

Directive 54
Surface operations section 10

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Future plans

Continue suspension of AIDROH well and facilities
Appendix
Wellbore schematic
Thank you