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

Alberta Energy Regulator

Calgary

February 2018

cenovus ENERGY

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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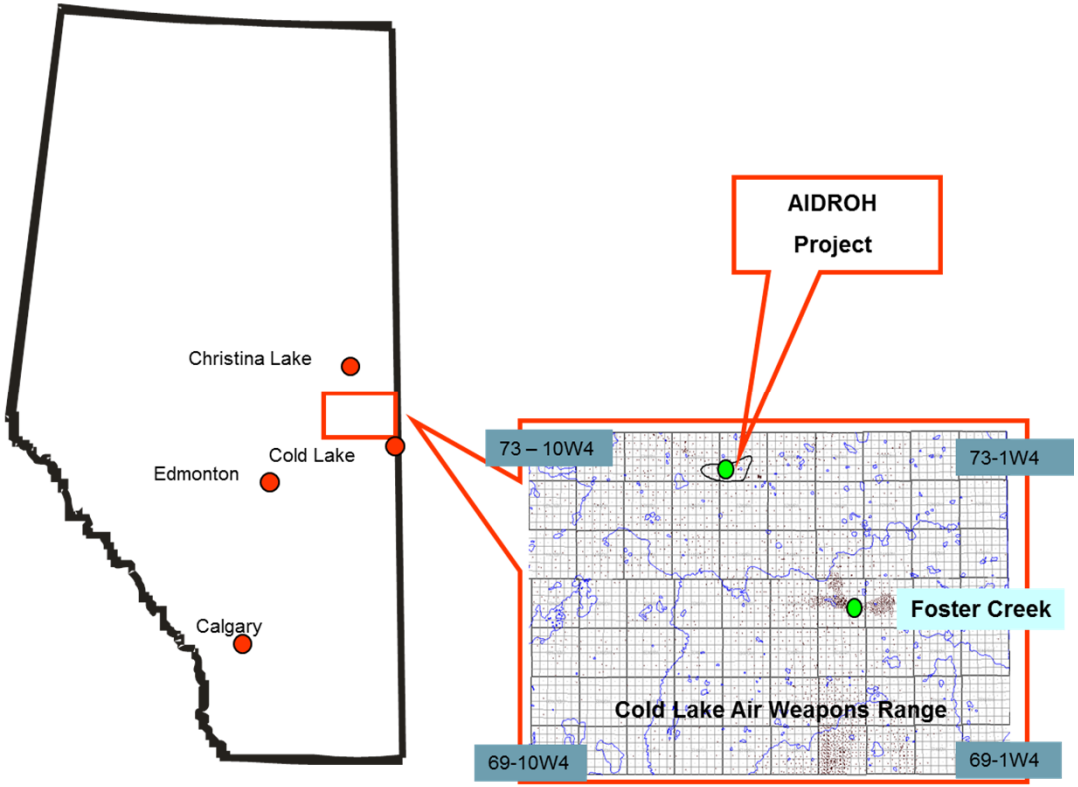
Background

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

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Subsurface section 2

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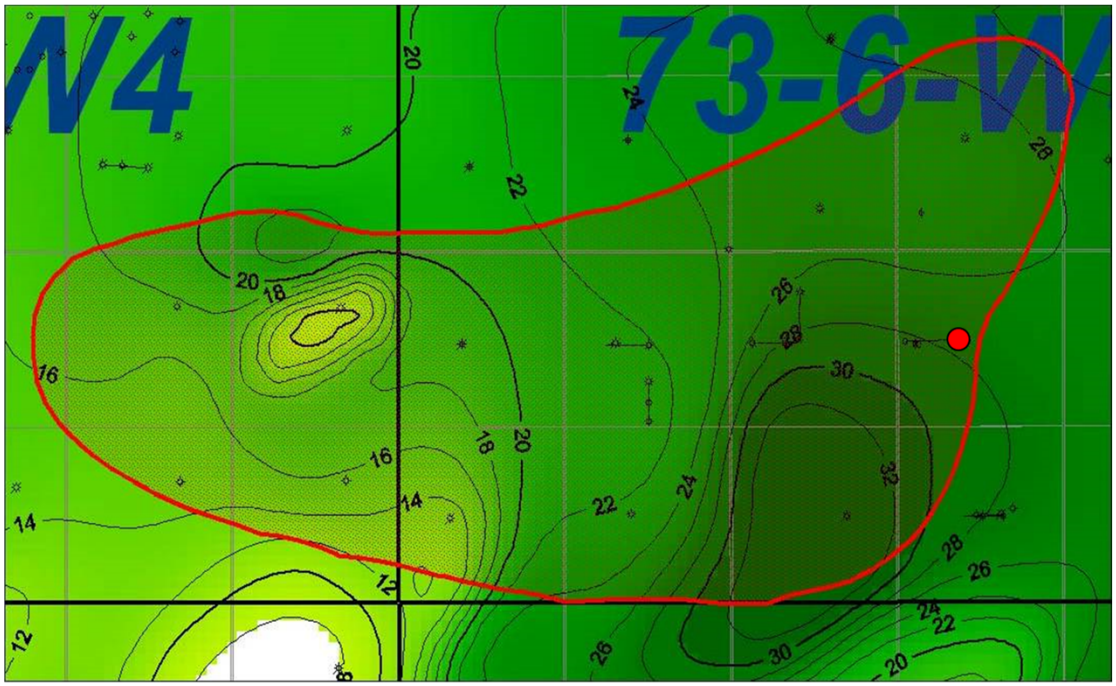
Summary of reservoir properties

Depth	465m TVD
Thickness	25-30m
Average porosity	35%
Average bitumen saturation	65%
Average permeability	1,350mD
OBIP (project area)	3,302 e^3m^3
Oil viscosity @ 13C @ 60C	~25,000 cP ~600 cP
API oil gravity	10.3 - 10.8

Wabiskaw bitumen thickness



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

OBIP under gas cap = 159,000 e³m³

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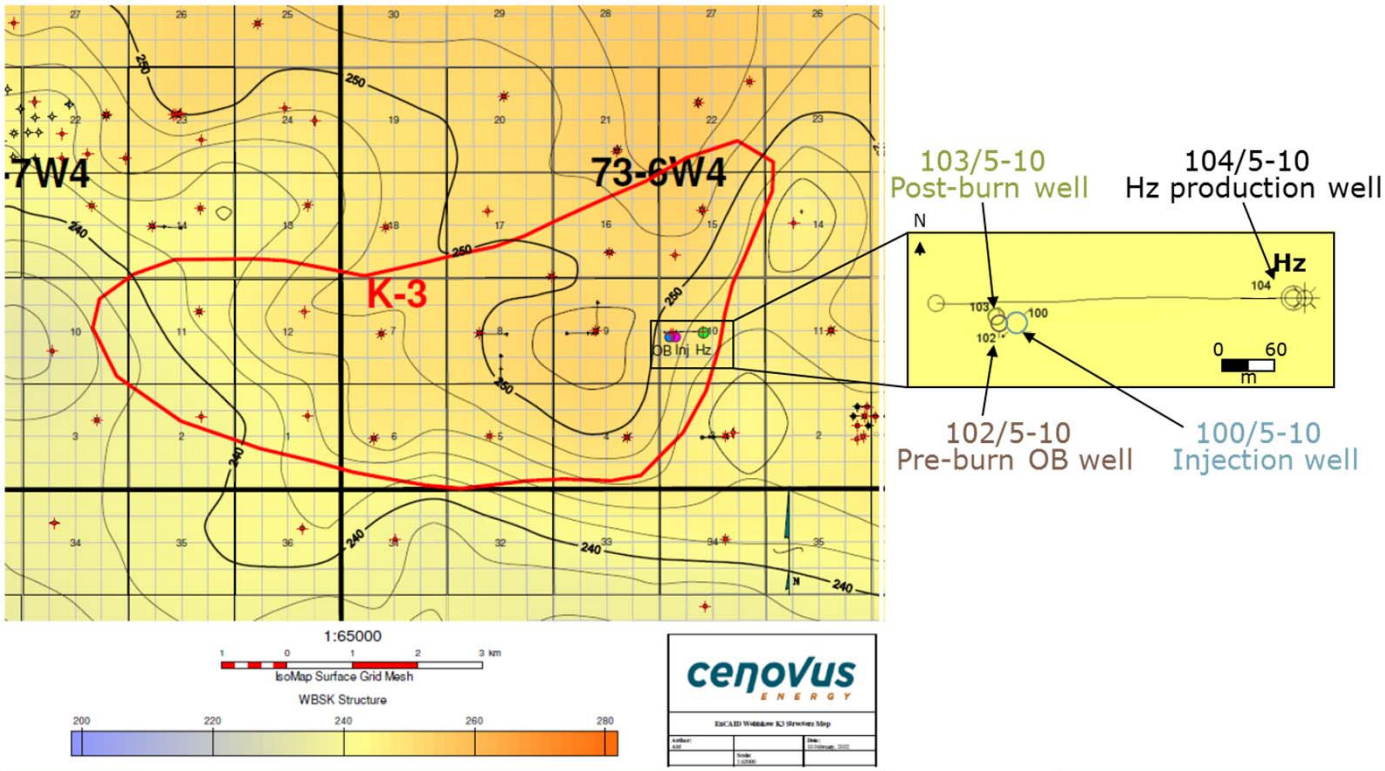
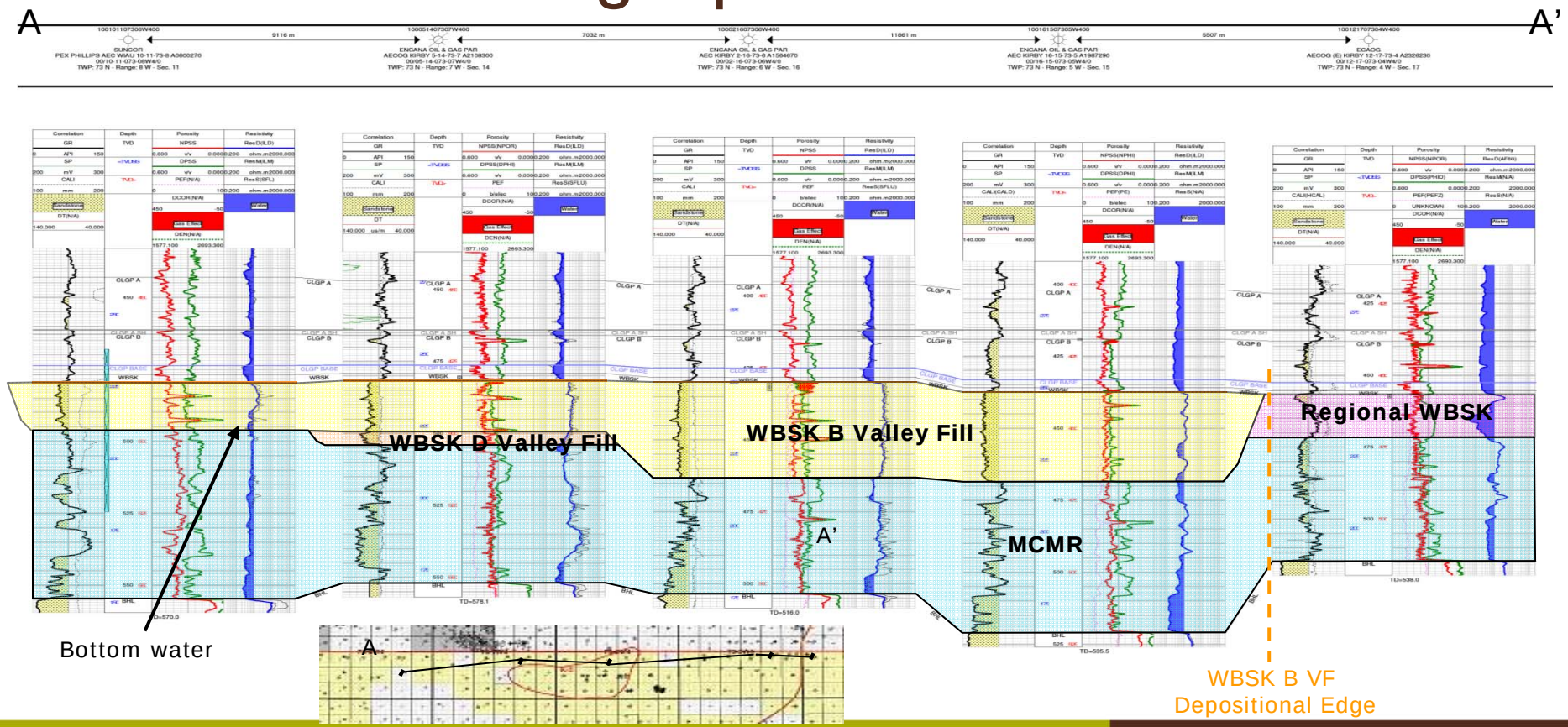
Wabiskaw structural map



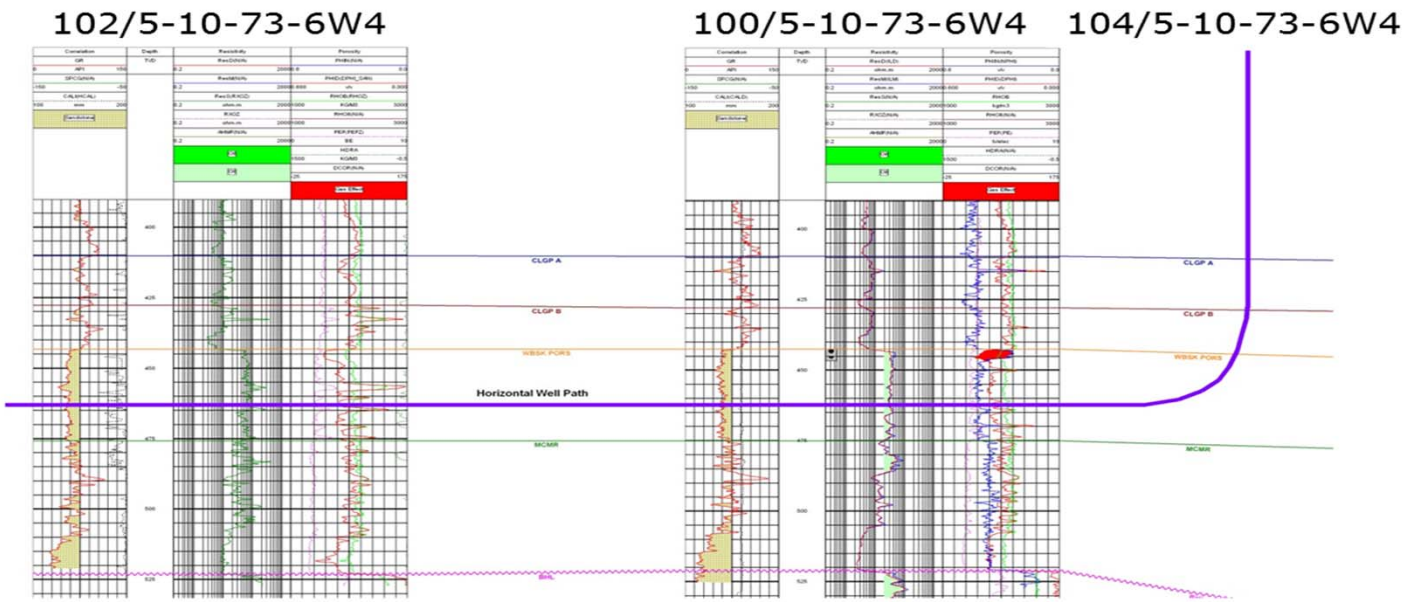
Wabiskaw stratigraphic cross-section



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

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Subsurface section 3

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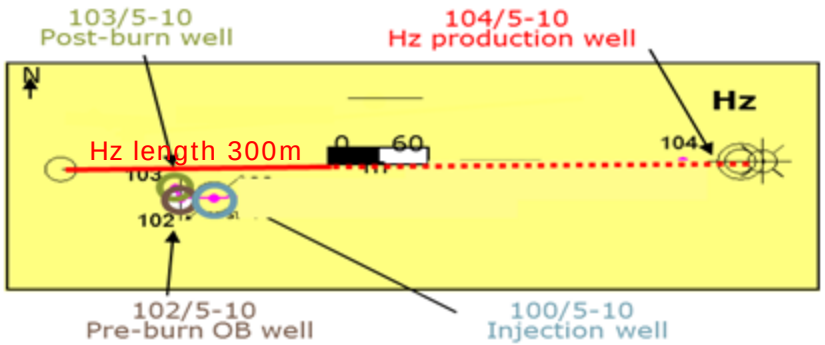
Well layout

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



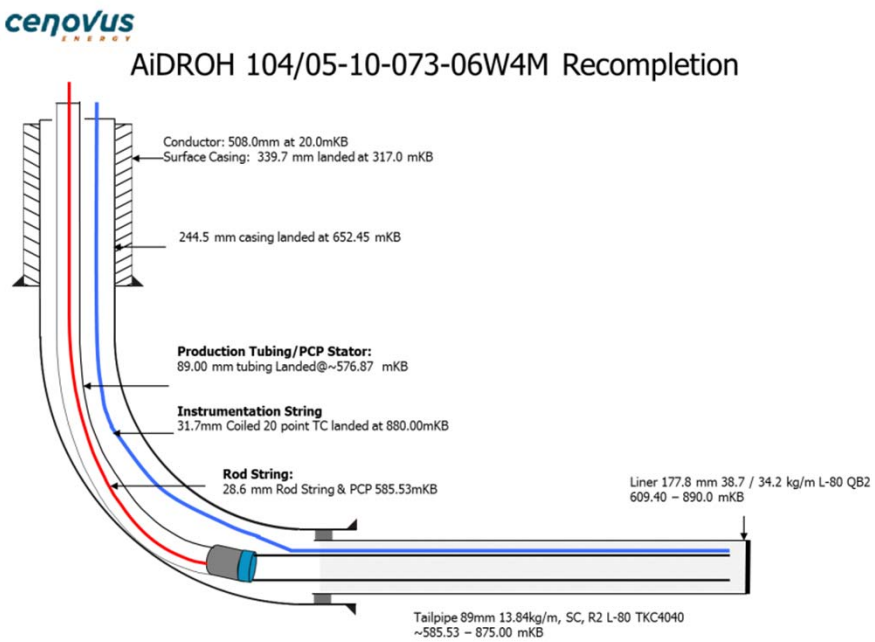
Drilled 104/5-10-73-6W4 horizontal producer well September 2011

- 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

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Subsurface section 5

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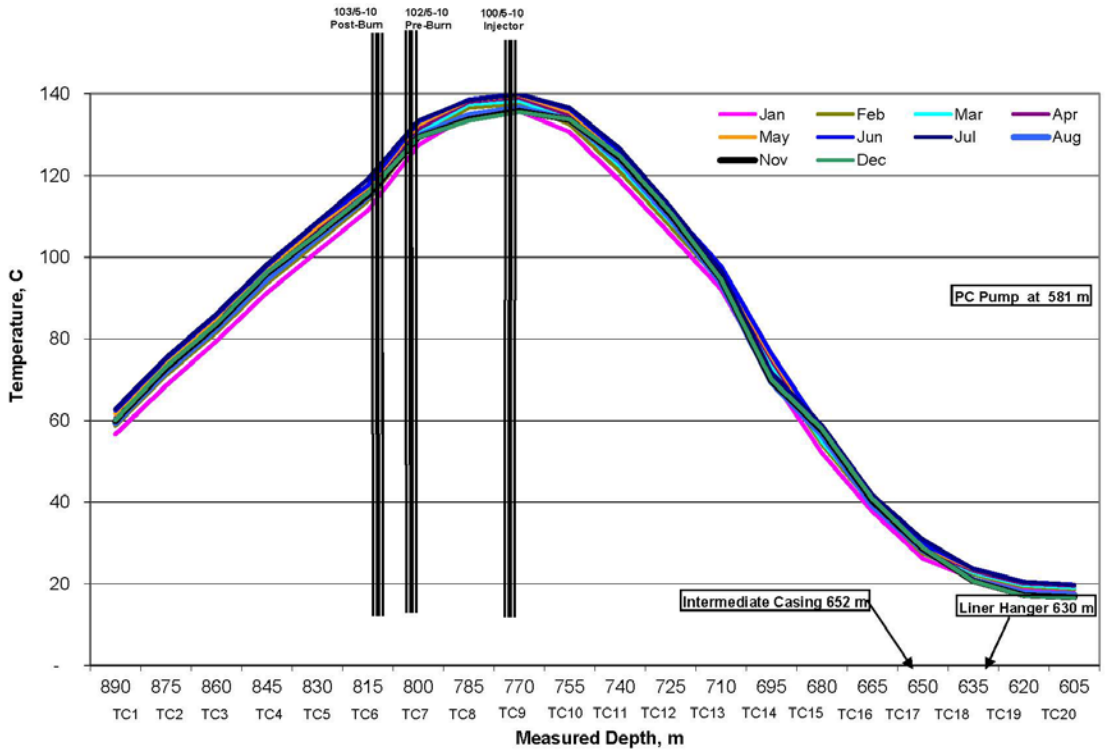
Instrumentation in wells

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

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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

- 62,000m^3

Thermal affected*

- 728,000m^3

* 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

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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

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Surface operations section 1

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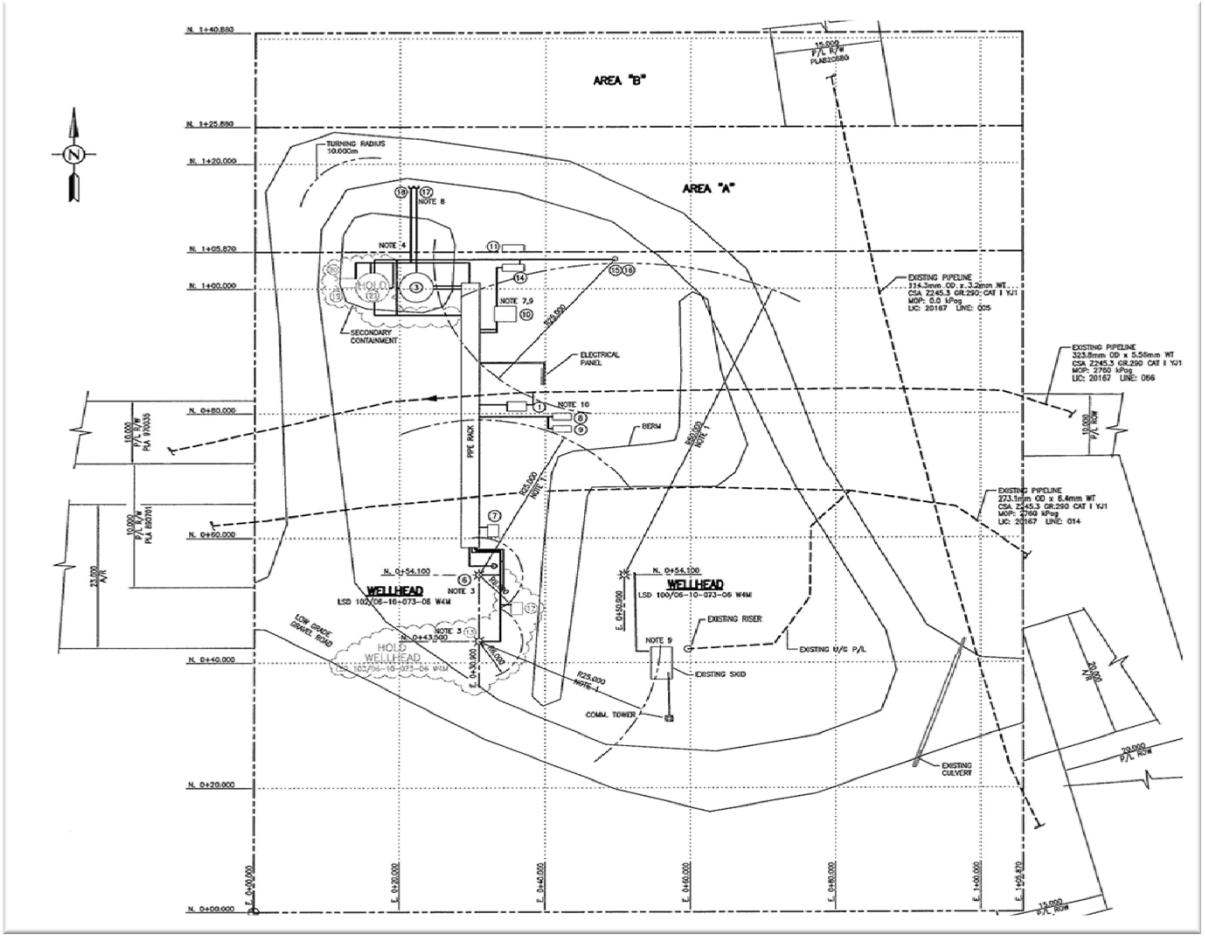
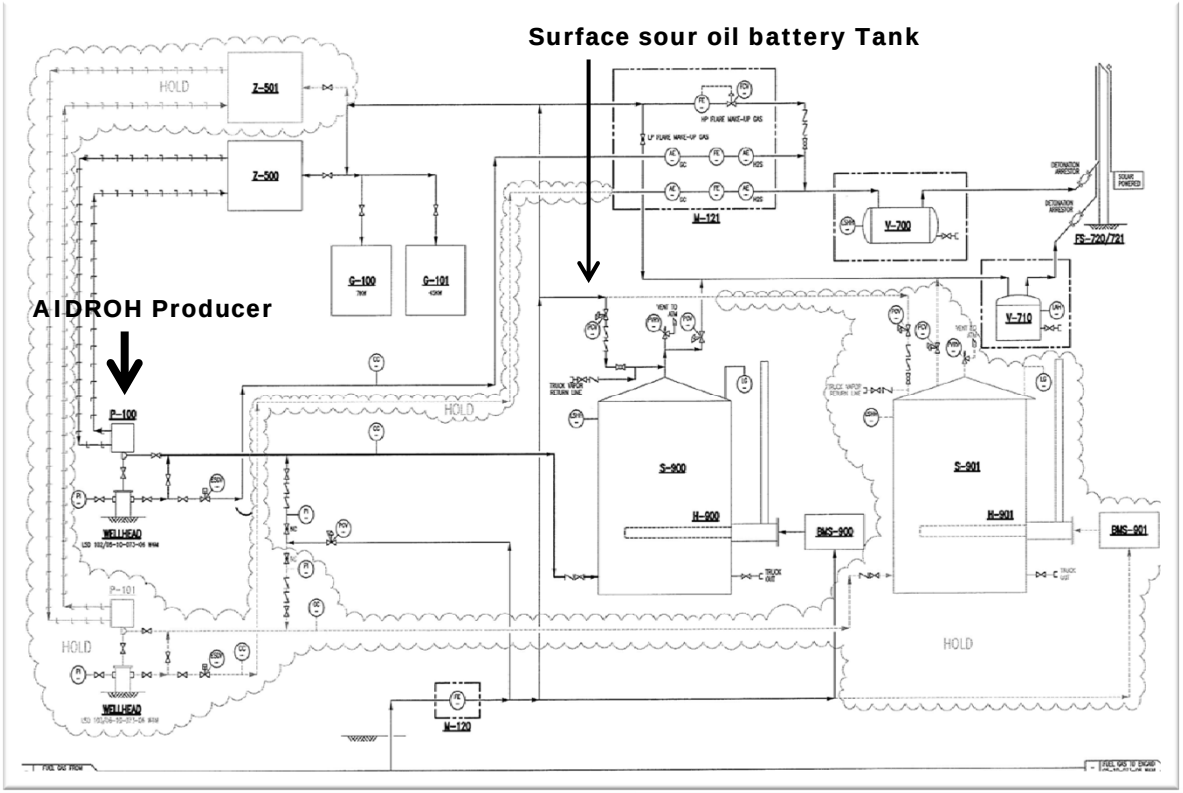
Site layout



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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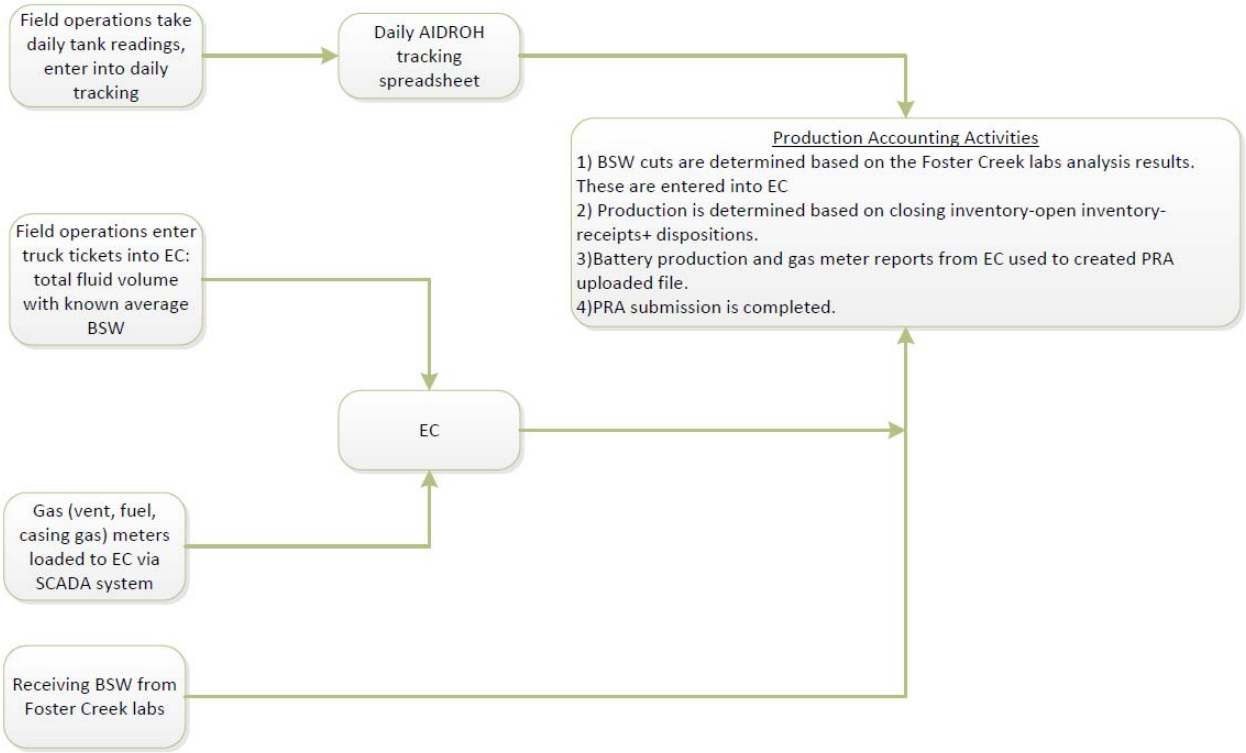
Measurement reporting



Water, water disposal wells and landfill waste

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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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Sulphur production

No production operations during 2017 reporting period

Environmental issues

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Surface operations section 7

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Environmental issues

No environmental issues related to the AIDROH occurred in 2017

Compliance statement

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Surface operations section 8

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Compliance confirmation

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

Non-compliance discussion

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Surface operations section 9

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Non-compliance confirmation

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

Future plans

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Surface operations section 10

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Future plans

Continue suspension of AIDROH well and facilities

Appendix

Wellbore schematic

Well Name: CVE FCCL 6-10 KIRBY 5-10-73-6

Schematic - Current (Landscape Layout)

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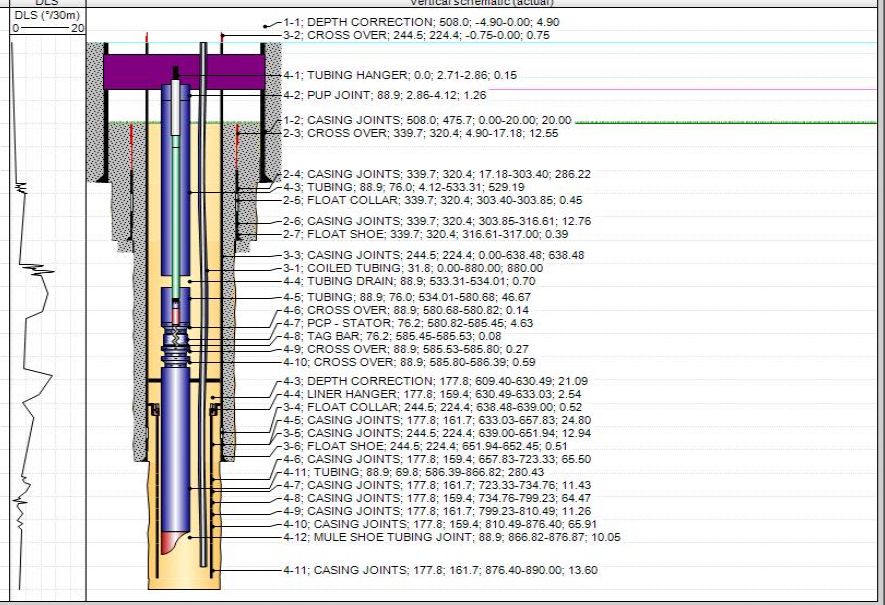
Bottom Hole UWI	Surface Legal Location	Pad	Profile Type	Sour Class(Uc)	Sour Status Date	Orig KB Elev (m)	Working GLE (m)	KB-CF (m)	KB-TH (m)	Total Depth (mKB)
104/05-10-073-06W4/00	LSD 6-10-73-6W4	6P-10-73-6 W4 FILE_S10	HORIZONTAL	UNKNOWN		694.40	689.50	2.91		905.00

Most Recent Job

Job Category	Type	Job Start Date	Job End Date
WORKOVER	OPTIMIZATION	2014-09-14	

HORIZONTAL - ORIGINAL HOLE, 2014-09-22 8:30:00 PM

MD (mKB)	TVD (mKB)	Incl (°)
-0.7	-0.7	0.0
1.1	1.1	0.0
2.8	2.8	0.1
4.1	4.1	0.2
4.9	4.9	0.2
12.7	12.7	0.5
17.2	17.2	0.7
303.4	297.2	22.1
303.9	297.7	22.1
317.0	309.8	23.1
321.4	313.8	23.4
534.0	456.6	72.8
557.9	462.2	79.8
580.8	465.7	82.4
585.8	466.3	82.8
609.0	467.7	89.9
630.5	467.3	91.3
638.5	467.2	90.6
651.9	467.2	90.3
657.8	467.1	90.3
734.8	466.8	89.4
810.5	467.8	89.2
876.4	467.2	90.9
880.0	467.2	90.9
905.0	466.8	91.0



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Thank you