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

AER offices

Calgary

February 2015

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 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

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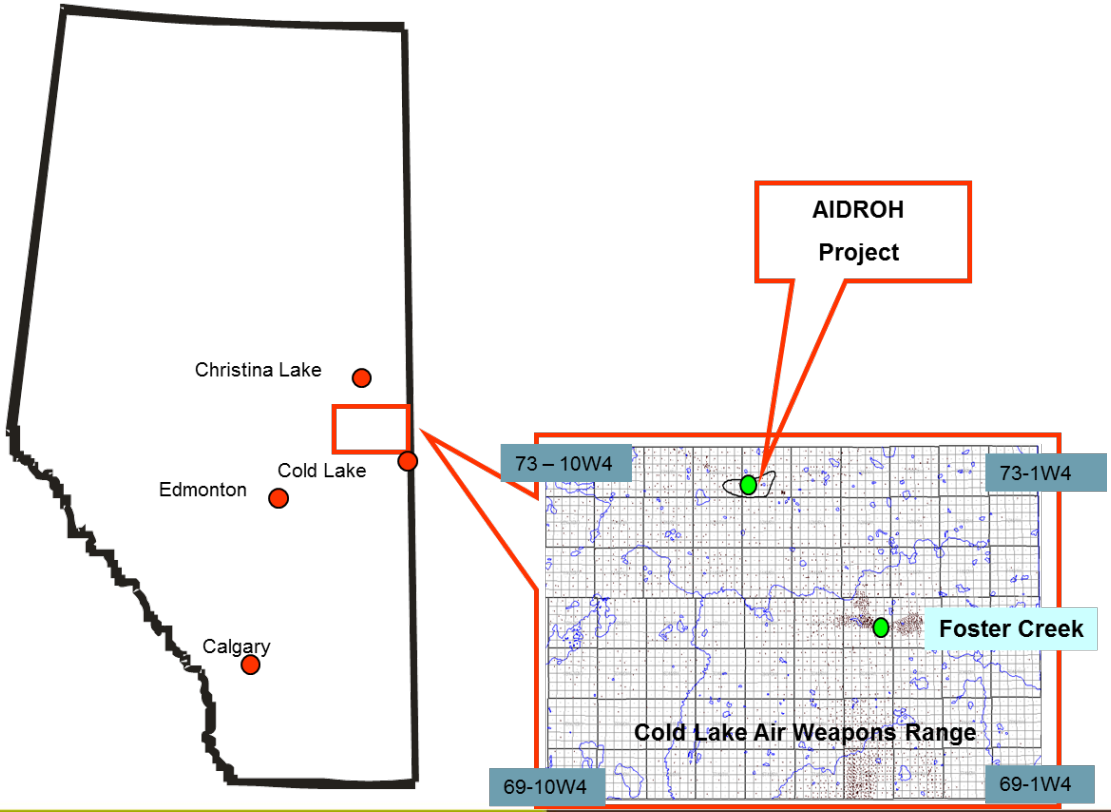
Background

The Air Injection Displacement Horizontal Oil Recovery (AIDROH) project utilities 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

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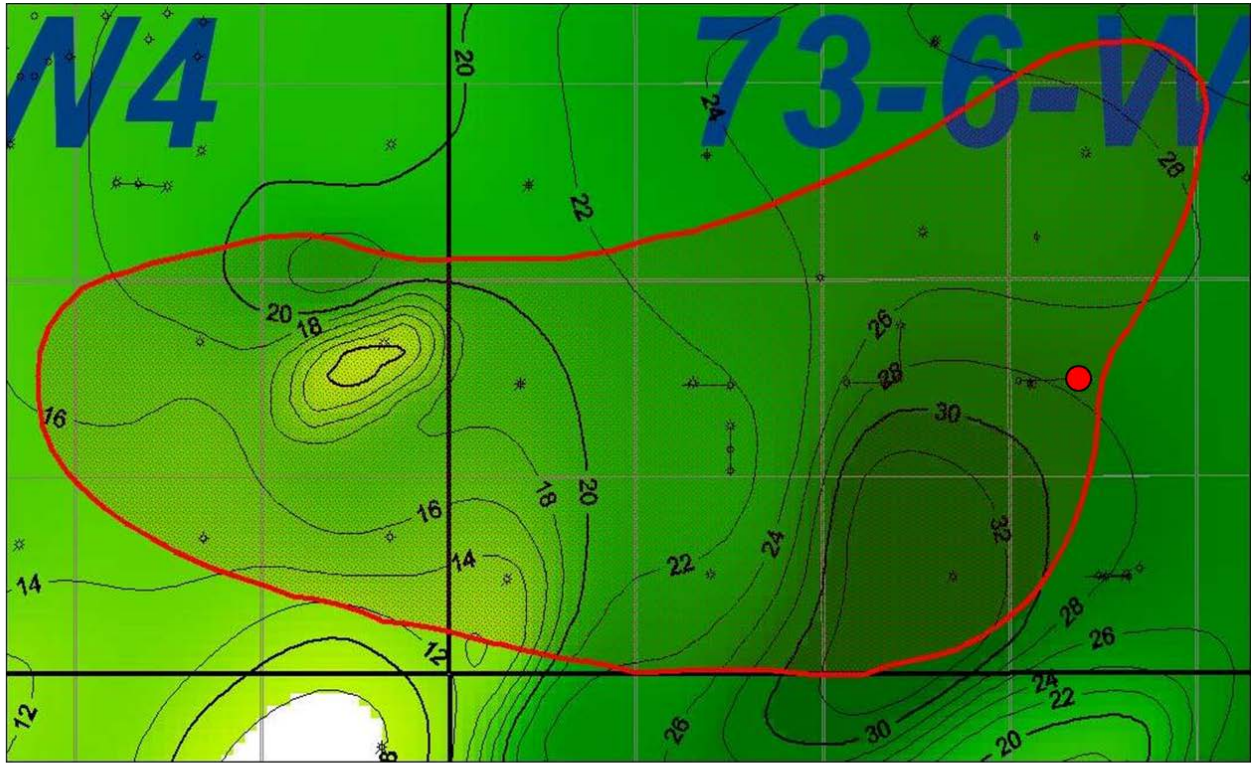
Summary of reservoir properties

Depth	465 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	~35,000 cP ~600 cP
API Oil Gravity	10.3 -10.8

Wabiskaw bitumen thickness

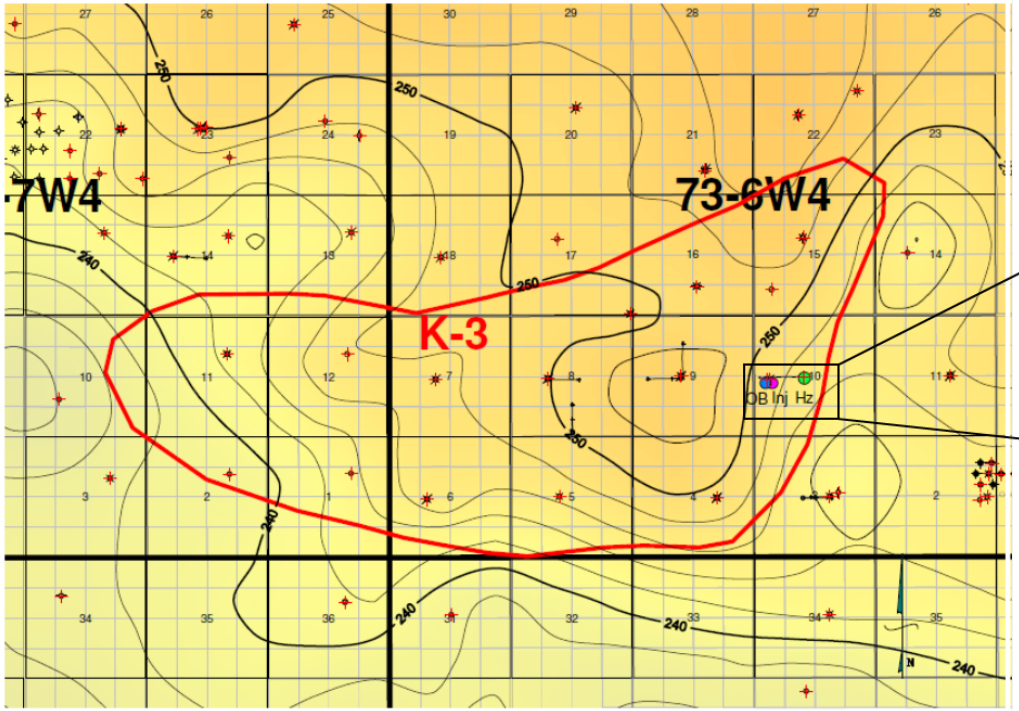


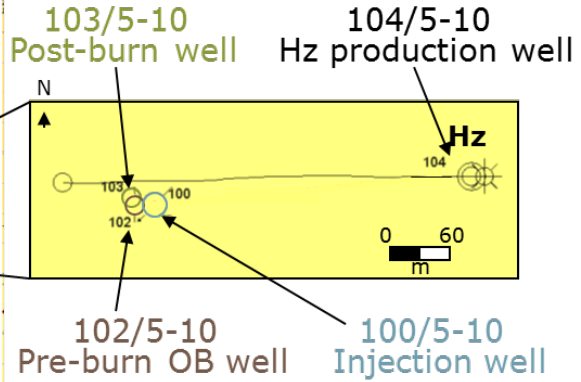
Type log cut offs:-
-<75 api gamma ray
->20 ohm resistivity
->27% porosity

OBIP under gas cap = 159,000 e³m³

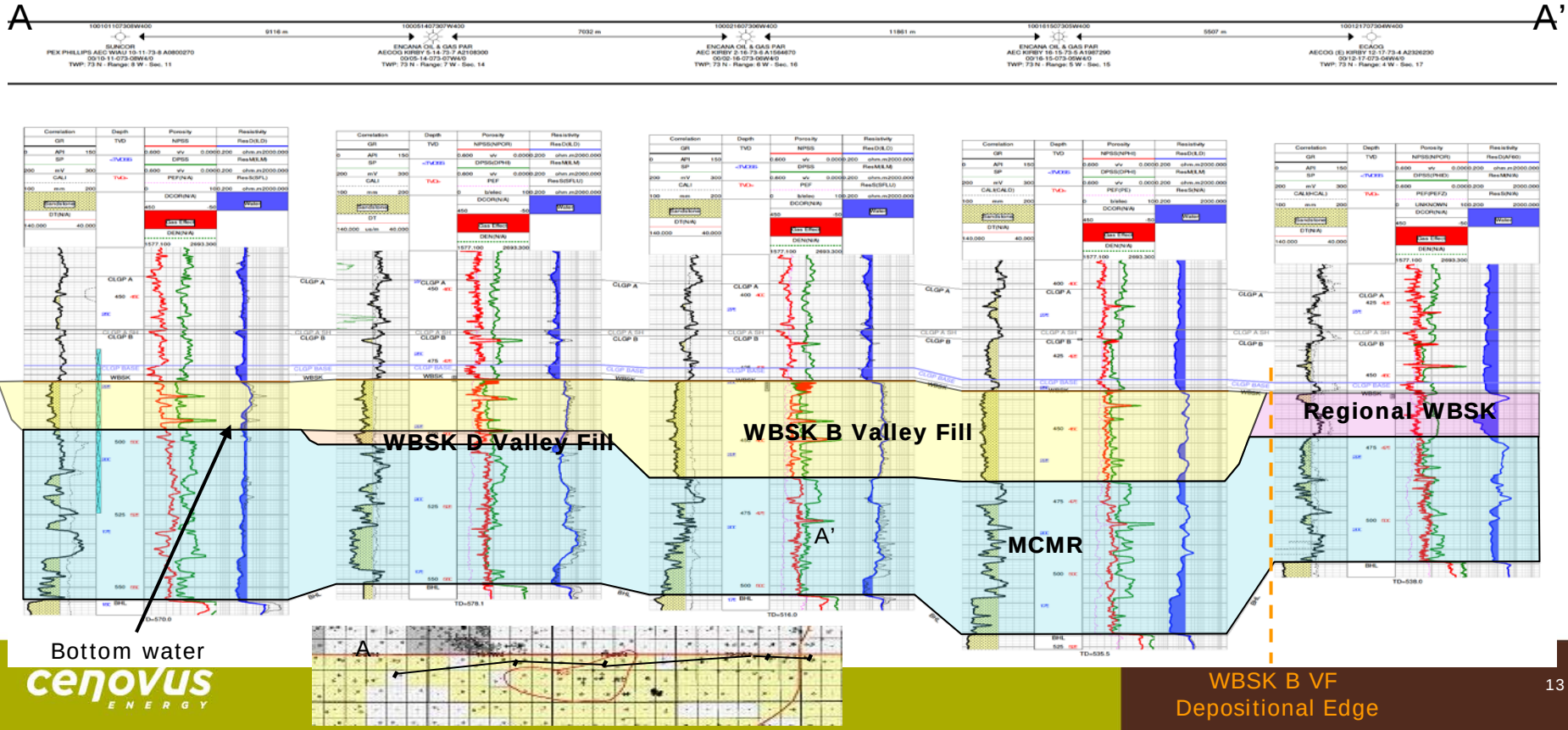
AIDROH

Wabiskaw structural map





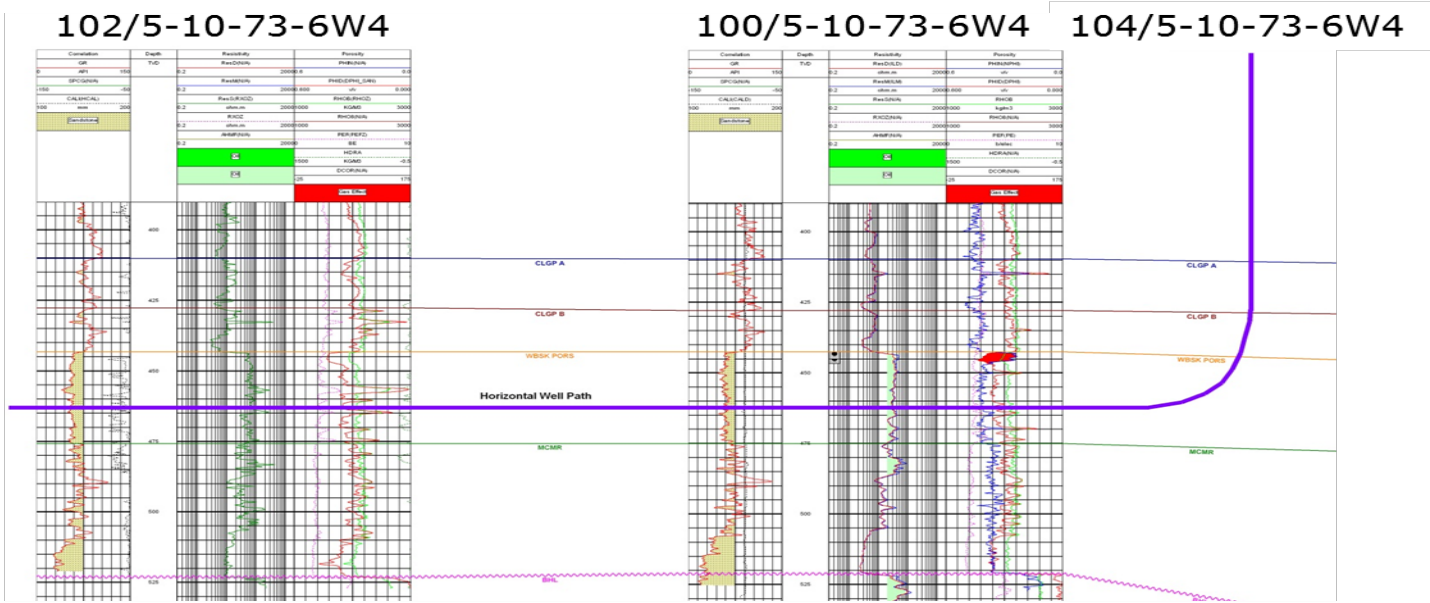
Wabiskaw stratigraphic cross-section



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

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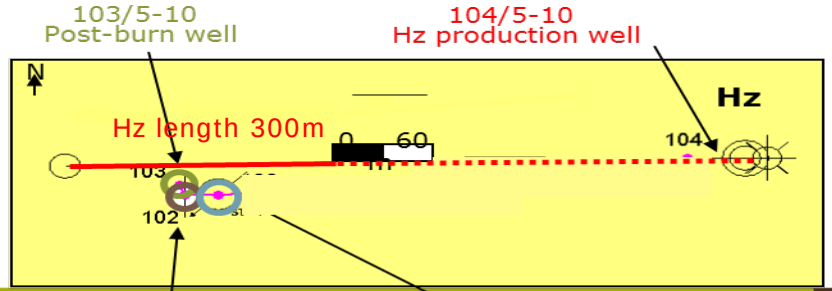
Well layout

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

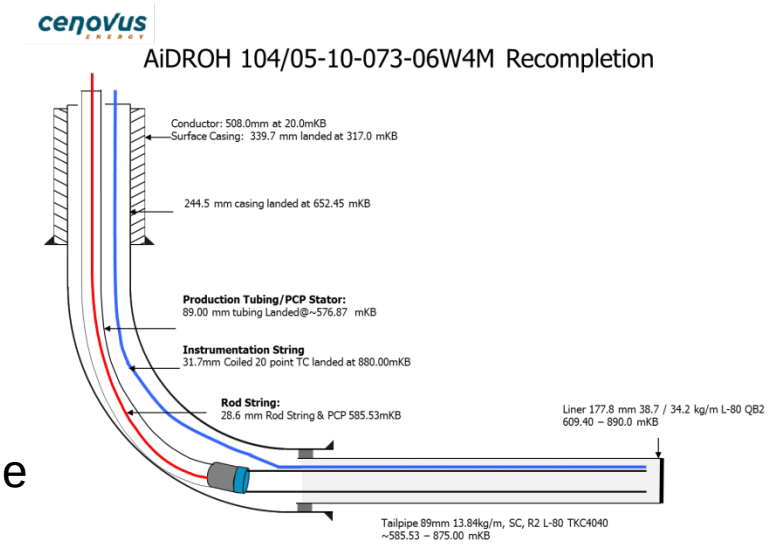
- 300m east-west horizontal section landed 30m north of 100/5-10-73-6W4 injector well and 15m below Wabiskaw gas/bitumen interface
- Equipped with 20 thermocouples along horizontal length



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

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Artificial lift

Artificial lift technology remains the same

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

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

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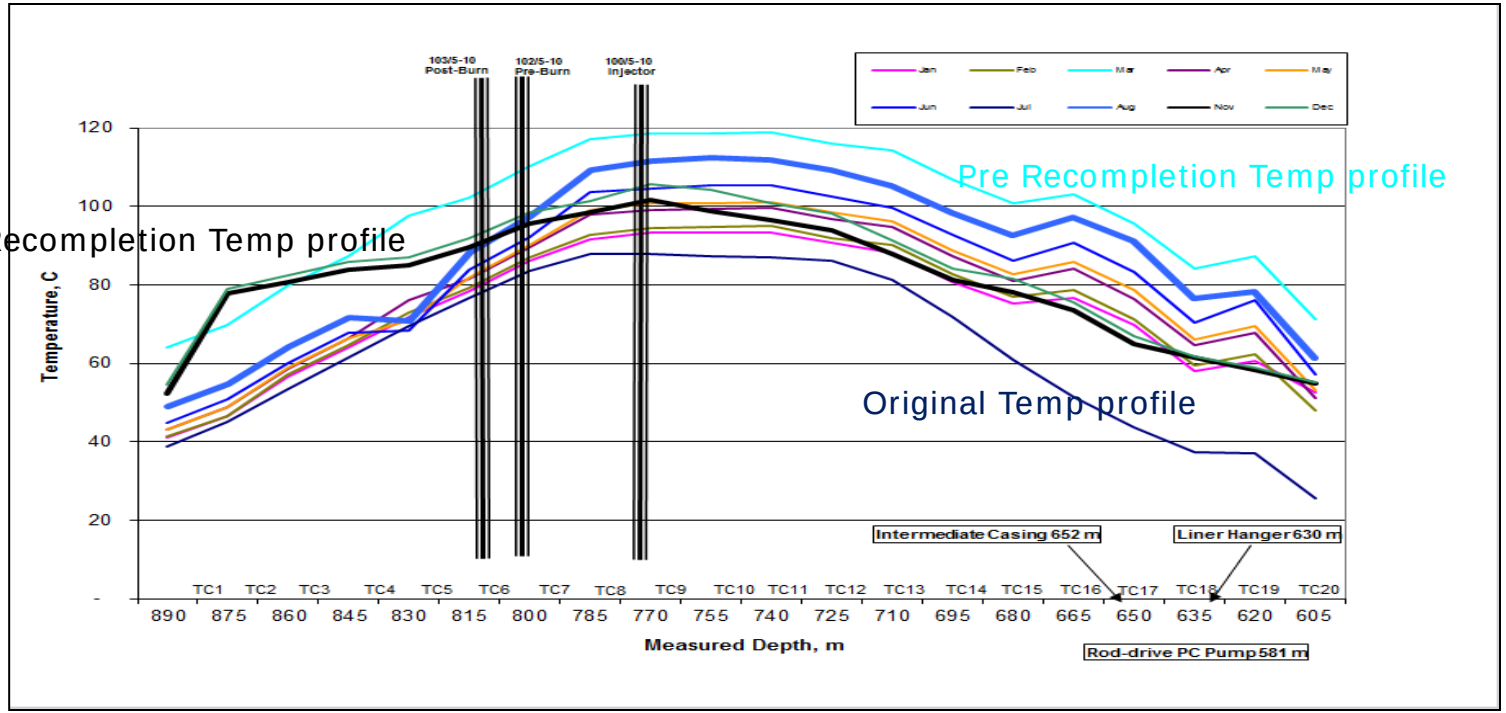
Instrumentation in wells

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 temp vs. depth



Scheme performance

Subsurface section 6

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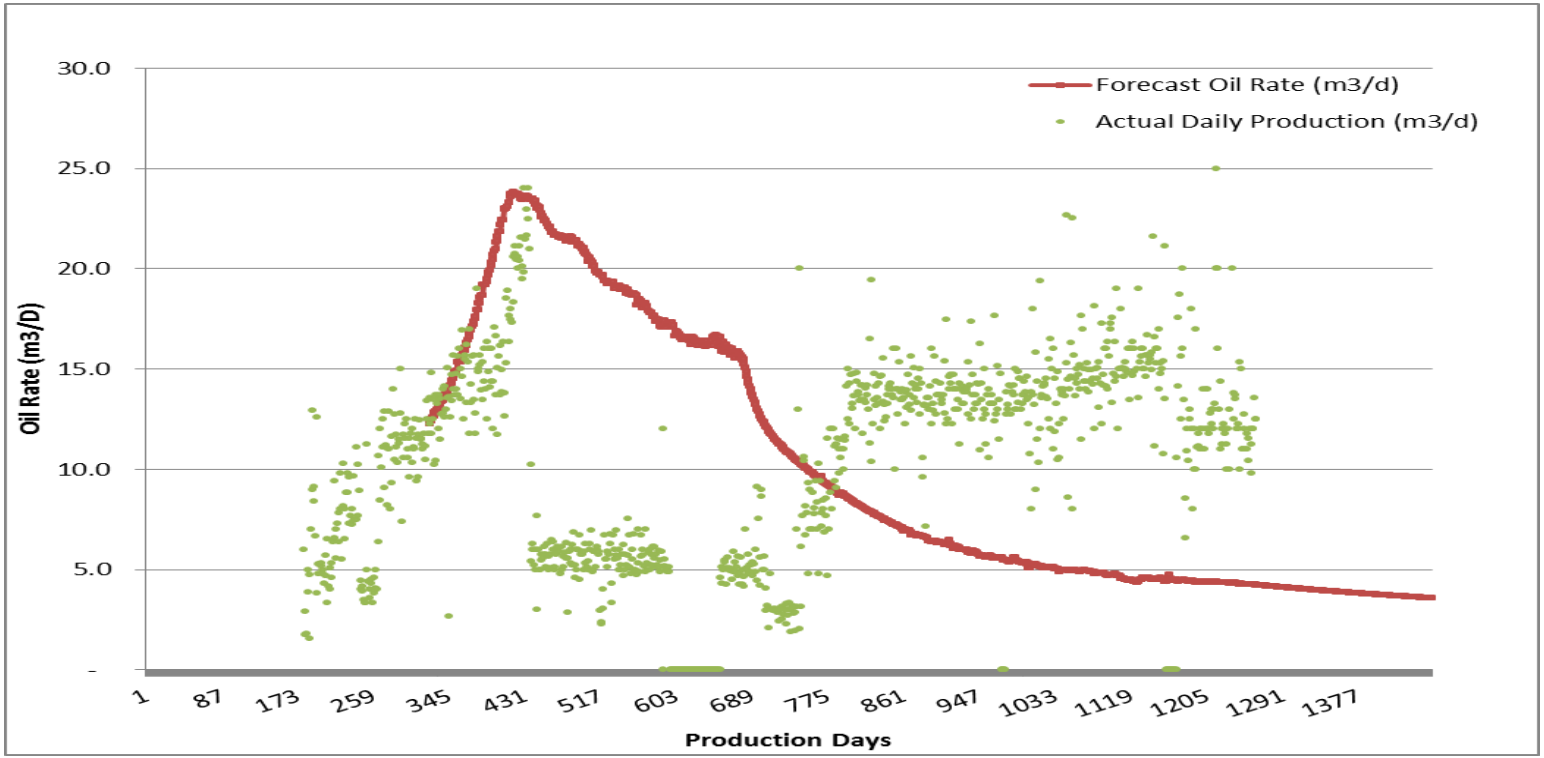
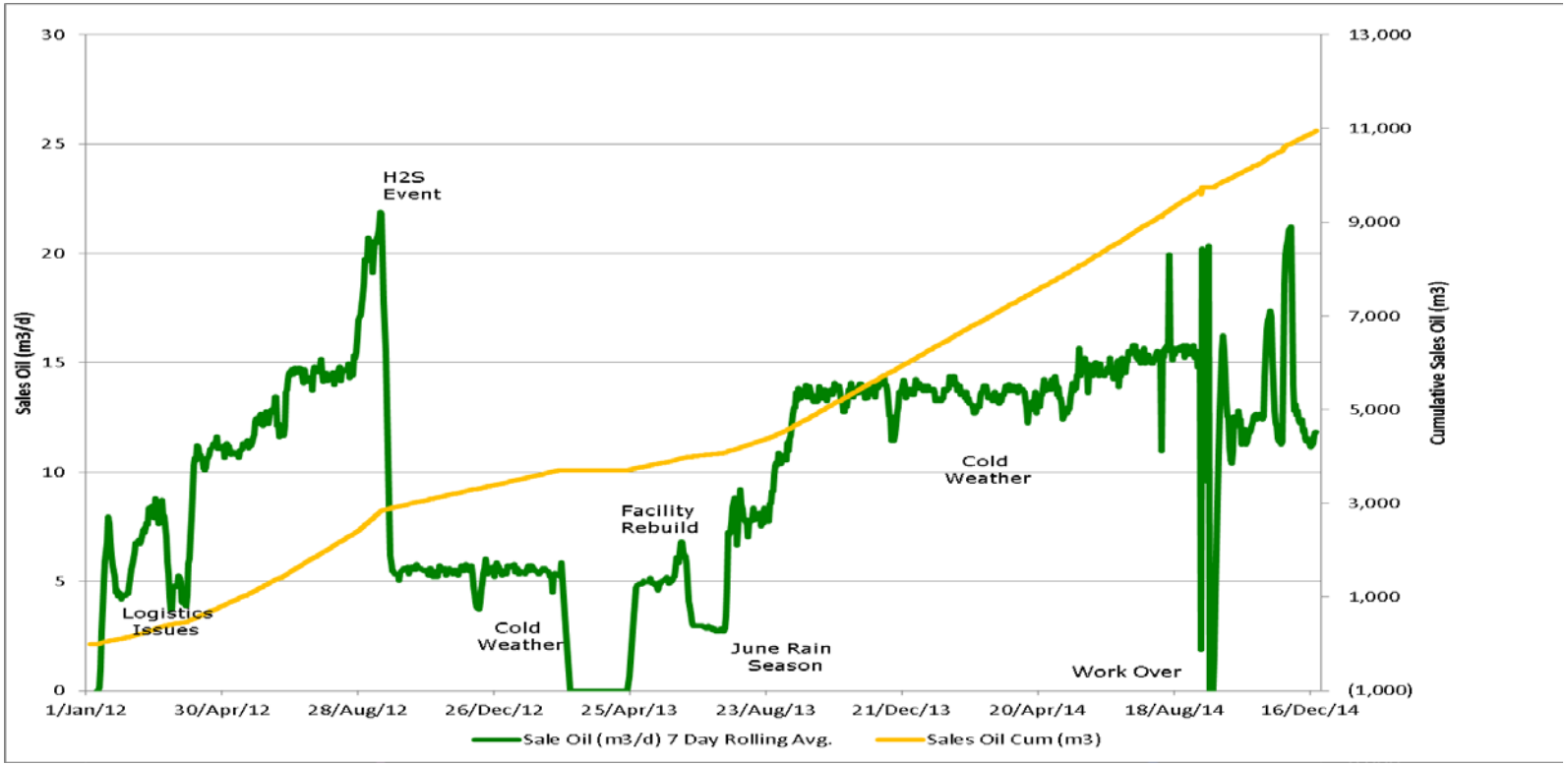
Oil rate forecast



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

	Viscosity(cSt), temp(°C)				
Sample No.	13	25	35	50	75
1	26,525	6469	2608	781	170
2		7510	2111	853	
3	15,641	5006	2103	652	216
4		9073	2483	925	
5		8013	2185	844	
6		7994	2112	1022	
7	26,454	7763	2971	860	184
8	37,131	8276	3050	884	188
9		8271	2410	923	
10		5389	1646	662	
11		8442	2338	894	
12		7180	2449	926	
13	57,523	6270	1583	737	198
14		10250	2922	1130	
15		10955	3038	1153	
16		10457	2919	1103	
17		10267	2780	1091	

	SARA, %			
Sample No.	Asphaltene (C5 insoluble)	Saturates	Resins	Aromatics
1	13	26	11	50
2	14	25	13	49
3	14	26	13	47
4	14	24	13	49
5	15	25	13	47
6	12	25	11	52
7	13	28	8	52
8	15	23	16	46
9	16	24	11	49
10	13	24	9	54
11	13	24	13	50
12	14	24	13	49
13	14	23	10	53

BS&W

	BS&W
Q1	2.0%
Q2	1.0%
Q3	1.0%
Q4	7.5%

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

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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

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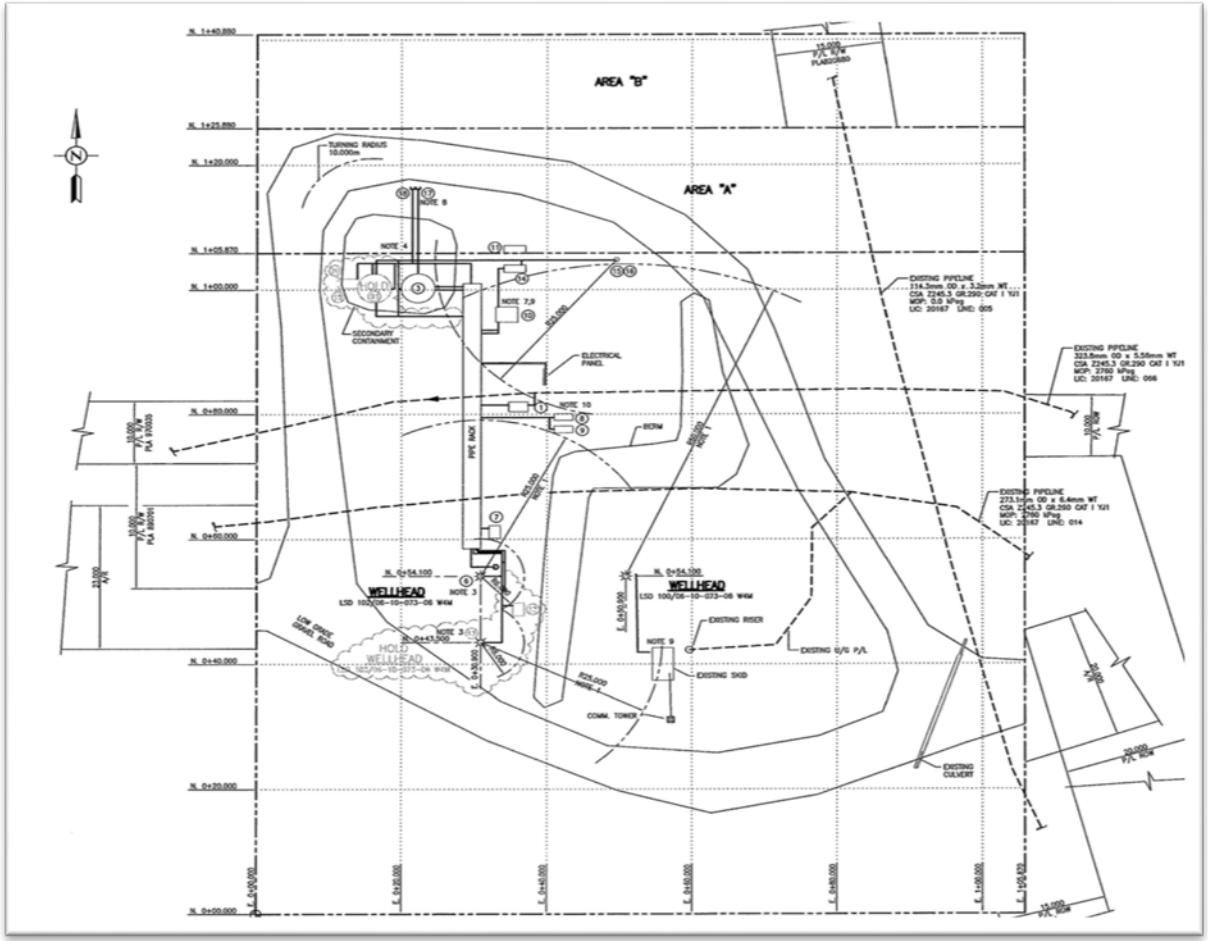
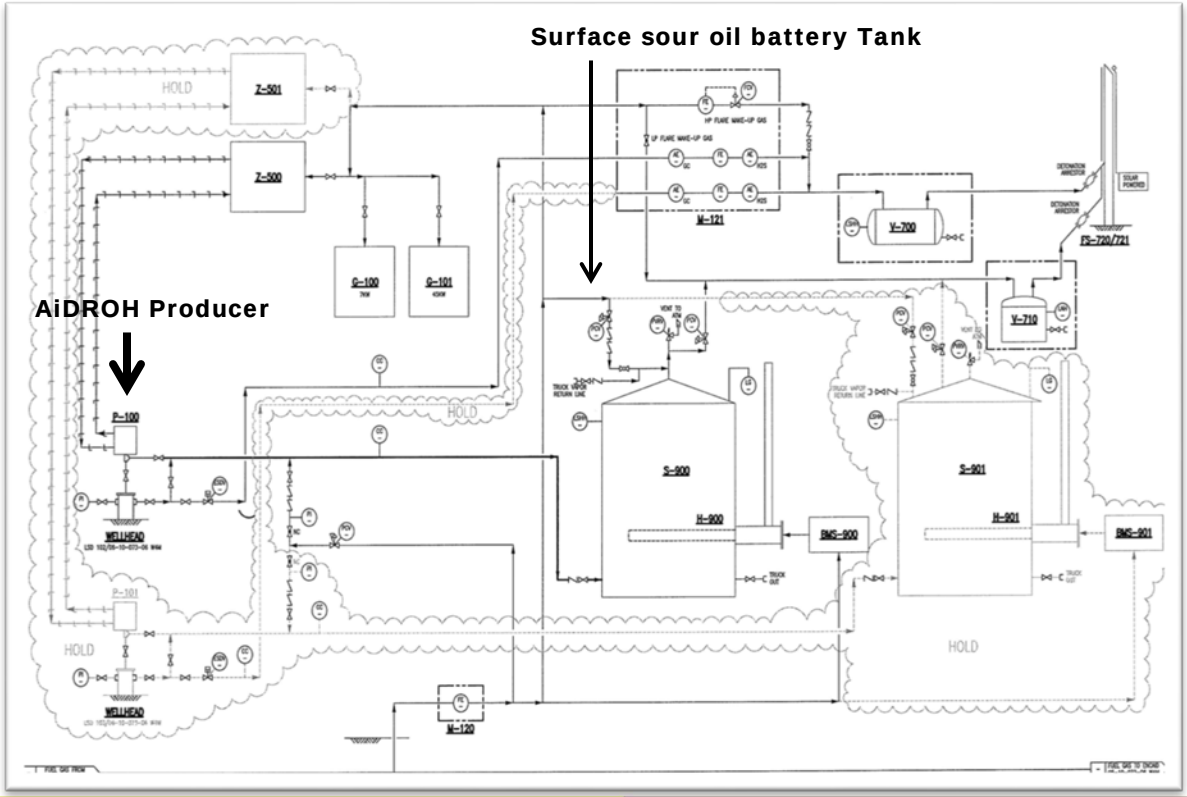
Site layout



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

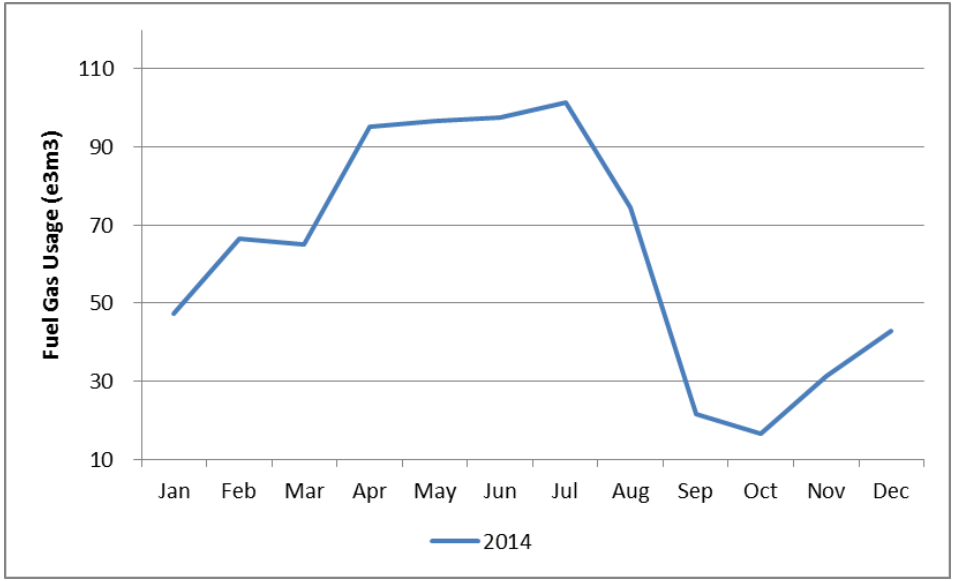
- Minimum operating pressure limits effectiveness until sufficient consistent casing pressure demonstrated
- Daily Draeger testing protocol in effect

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^3m^3



Green house gas emissions

Month	2014 GHG (Tonne)
January	46
February	64
March	91
April	101
May	109
June	112
July	115
August	78
September	23
October	11
November	22
December	30

Measurement and reporting

Surface section 2

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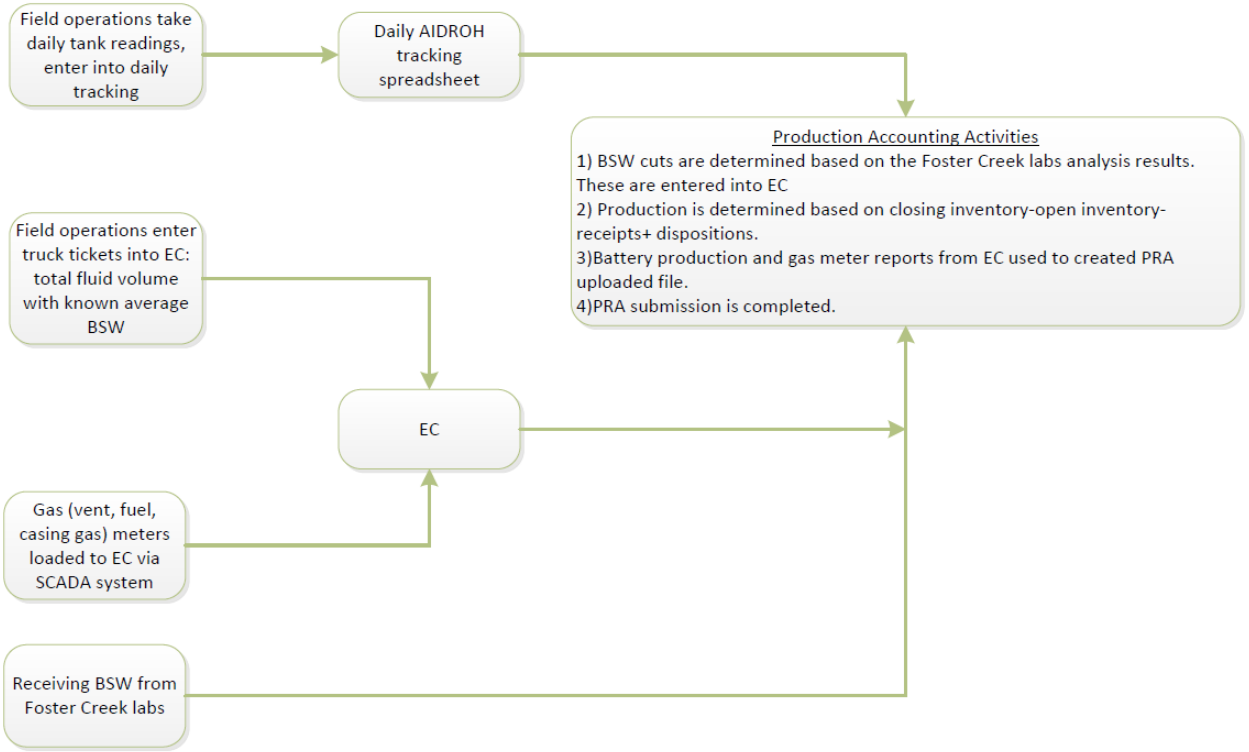
Measurement reporting



Water, water disposal wells & landfill waste

Surface section 3

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Water and waste disposal

No produced water

Produced bitumen volumes typically ~7% BS&W

No processing occurs on site

All produced volumes are trucked out for processing

Sulphur production

Surface operations section 4

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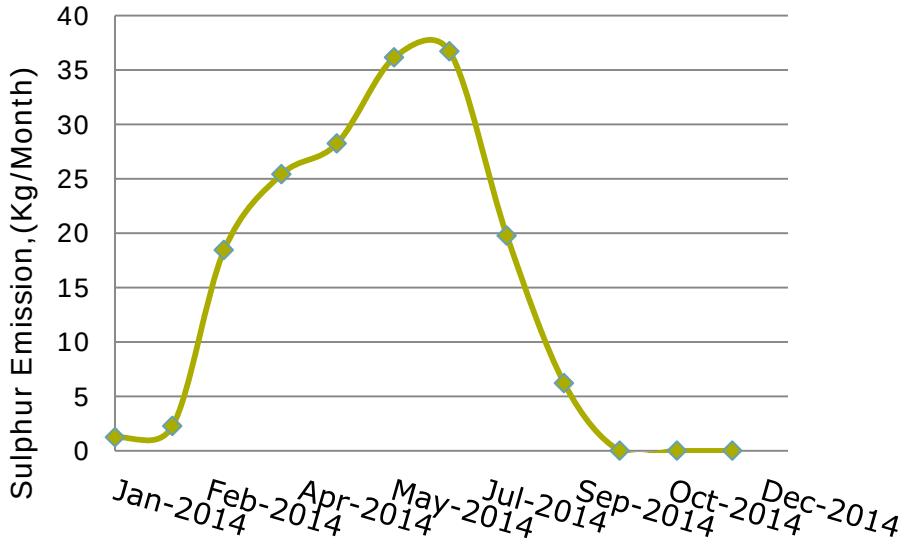
Sulphur production

No H2S detected after recompletion on Sept 2014

2014	Sulphur Emission, Kg
Q1	22
Q2	90
Q3	63
Q4	0



Environmental issues

Surface section 5

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Environmental issues

No environmental issues occurred in 2014

Compliance statement

Surface section 6

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Compliance Confirmation

No noncompliance events occurred in 2014

Non-compliance discussion

Surface section 7

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Compliance confirmation

No noncompliance events occurred since the last performance review

Future Plans

Surface section 5

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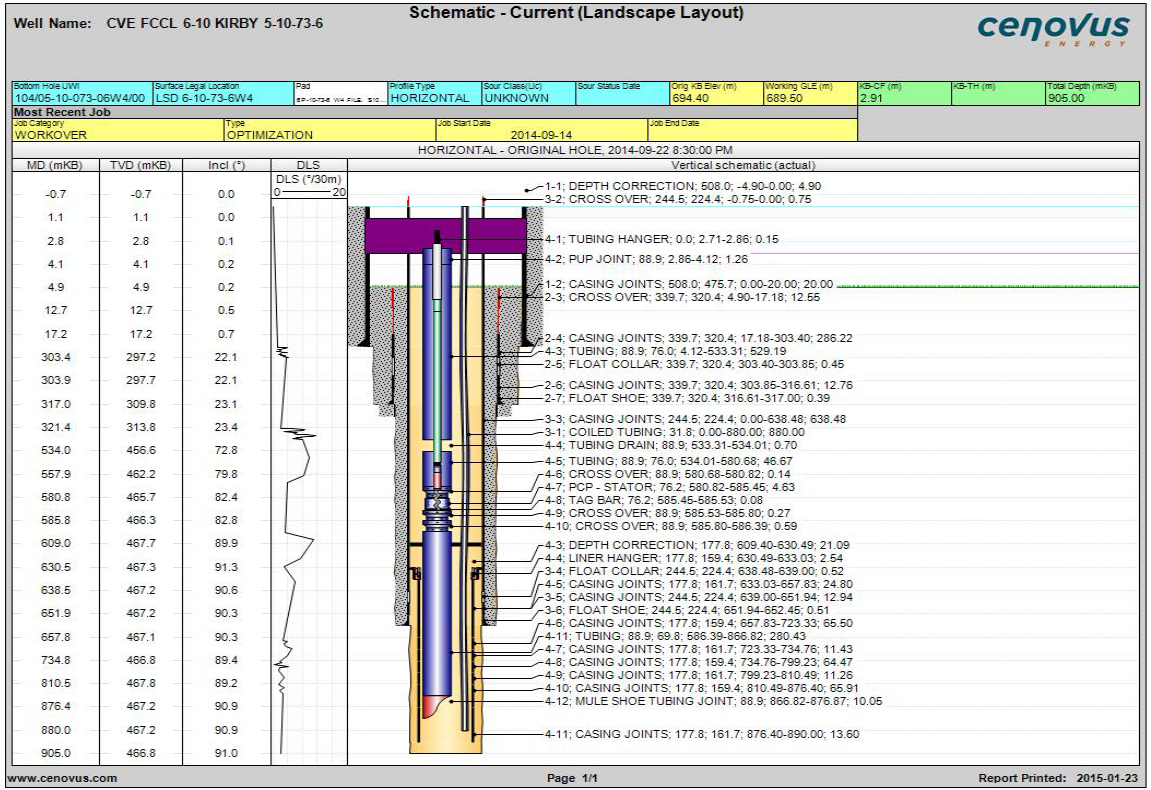
Future plans

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

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(Lic)	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	BP-10-73-6 W4 PAD 5-10	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 (°)	DLS (°/30m) 0 — 20
-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	

Vertical schematic (actual)

1-1; DEPTH CORRECTION; 508.0; -4.90-0.00; 4.90
3-2; CROSS OVER; 244.5; 224.4; -0.75-0.00; 0.75
4-1; TUBING HANGER; 0.0; 2.71-2.86; 0.15
4-2; PUP JOINT; 88.9; 2.86-4.12; 1.26
1-2; CASING JOINTS; 508.0; 475.7; 0.00-20.00; 20.00
2-3; CROSS OVER; 339.7; 320.4; 4.90-17.18; 12.55
2-4; CASING JOINTS; 339.7; 320.4; 17.18-303.40; 286.22
4-3; TUBING; 88.9; 76.0; 4.12-533.31; 529.19
2-5; FLOAT COLLAR; 339.7; 320.4; 303.40-303.85; 0.45
2-6; CASING JOINTS; 339.7; 320.4; 303.85-316.61; 12.76
2-7; FLOAT SHOE; 339.7; 320.4; 316.61-317.00; 0.39
3-3; CASING JOINTS; 244.5; 224.4; 0.00-638.48; 638.48
3-1; COILED TUBING; 31.8; 0.00-880.00; 880.00
4-4; TUBING DRAIN; 88.9; 533.31-534.01; 0.70
4-5; TUBING; 88.9; 76.0; 534.01-580.68; 46.67
4-6; CROSS OVER; 88.9; 580.68-580.82; 0.14
4-7; PCP - STATOR; 76.2; 580.82-585.45; 4.63
4-8; TAG BAR; 76.2; 585.45-585.53; 0.08
4-9; CROSS OVER; 88.9; 585.53-585.80; 0.27
4-10; CROSS OVER; 88.9; 585.80-586.39; 0.59
4-3; DEPTH CORRECTION; 177.8; 609.40-630.49; 21.09
4-4; LINER HANGER; 177.8; 159.4; 630.49-633.03; 2.54
3-4; FLOAT COLLAR; 244.5; 224.4; 638.48-639.00; 0.52
4-5; CASING JOINTS; 177.8; 161.7; 633.03-657.83; 24.80
3-5; CASING JOINTS; 244.5; 224.4; 639.00-651.94; 12.94
3-6; FLOAT SHOE; 244.5; 224.4; 651.94-652.45; 0.51
4-6; CASING JOINTS; 177.8; 159.4; 657.83-723.33; 65.50
4-11; TUBING; 88.9; 69.8; 586.39-866.82; 280.43
4-7; CASING JOINTS; 177.8; 161.7; 723.33-734.76; 11.43
4-8; CASING JOINTS; 177.8; 159.4; 734.76-799.23; 64.47
4-9; CASING JOINTS; 177.8; 161.7; 799.23-810.49; 11.26
4-10; CASING JOINTS; 177.8; 159.4; 810.49-876.40; 65.91
4-12; MULE SHOE TUBING JOINT; 88.9; 866.82-876.87; 10.05
4-11; CASING JOINTS; 177.8; 161.7; 876.40-890.00; 13.60

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Questions