



Alberta Energy Regulator - Directive 054
2015 Annual Performance Presentation
Leismer SAGD Project, Approval No. 10935R
March 10th, 2016

1. Facilities
2. Facility Performance
3. Measurement & Reporting
4. Water Production, Injection & Uses
5. Sulphur Production
6. Environmental Issues
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8. Compliance Statement
9. Future Plans



Statoil

FACILITIES

Surface Section 1
Leismer 2015 Annual Performance Presentation

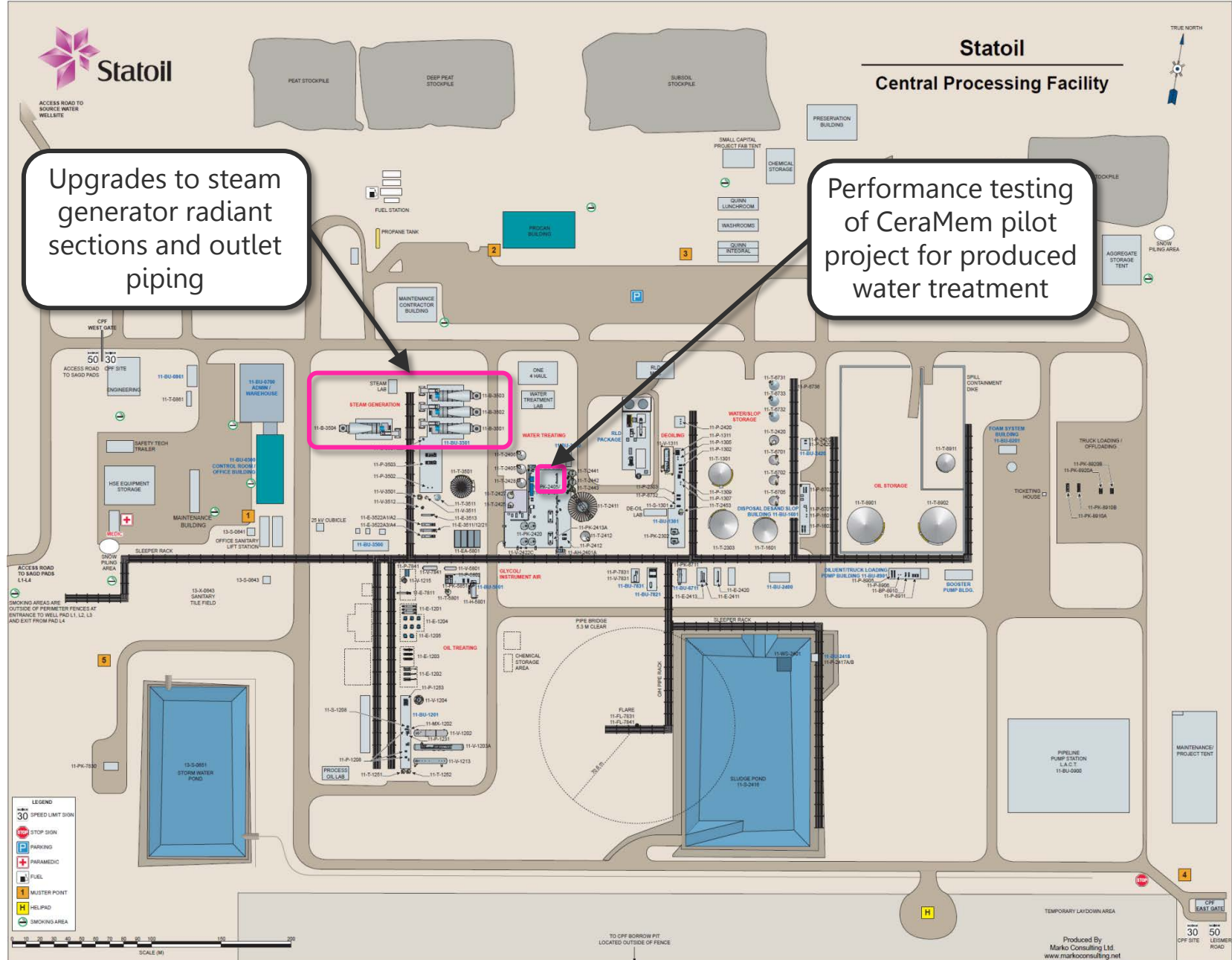
2015 Overview

- CeraMem pilot project operation
- Pad L1 infill wells drilled and facility construction underway
- Pad L5 infill wells sanctioned and approvals in place
- Pad L6 construction and commissioning complete



2015 Optimization

- Re-evaluated chemical vendors for oil, water, and steam facilities
- Reduced PW HEX chemical cleaning and neutralizing wastes by 60%
- Reduced off-site slop disposal volumes by 65%
- Optimized operating expenditures



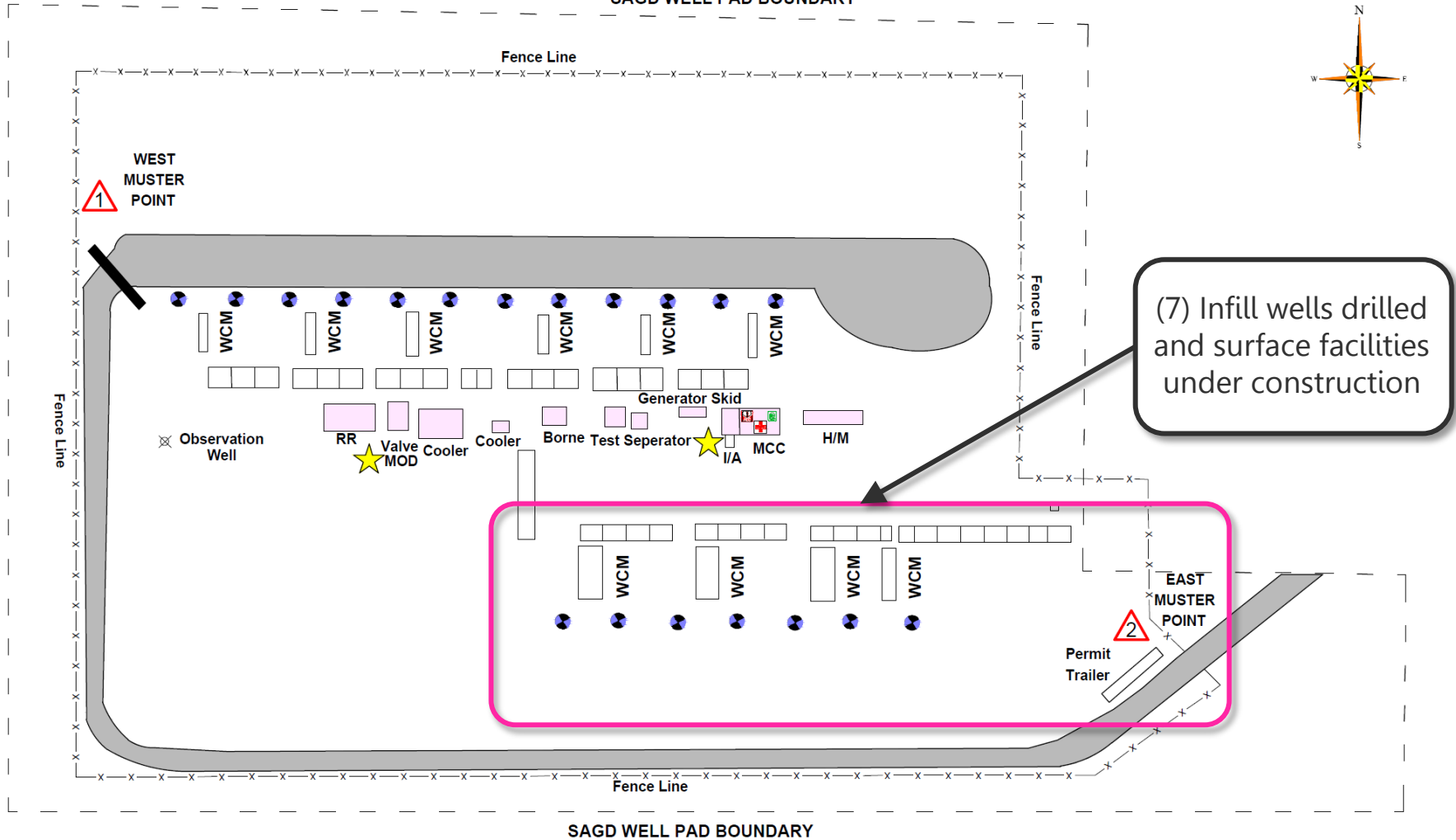
Leismer Central Processing Facility

Facilities

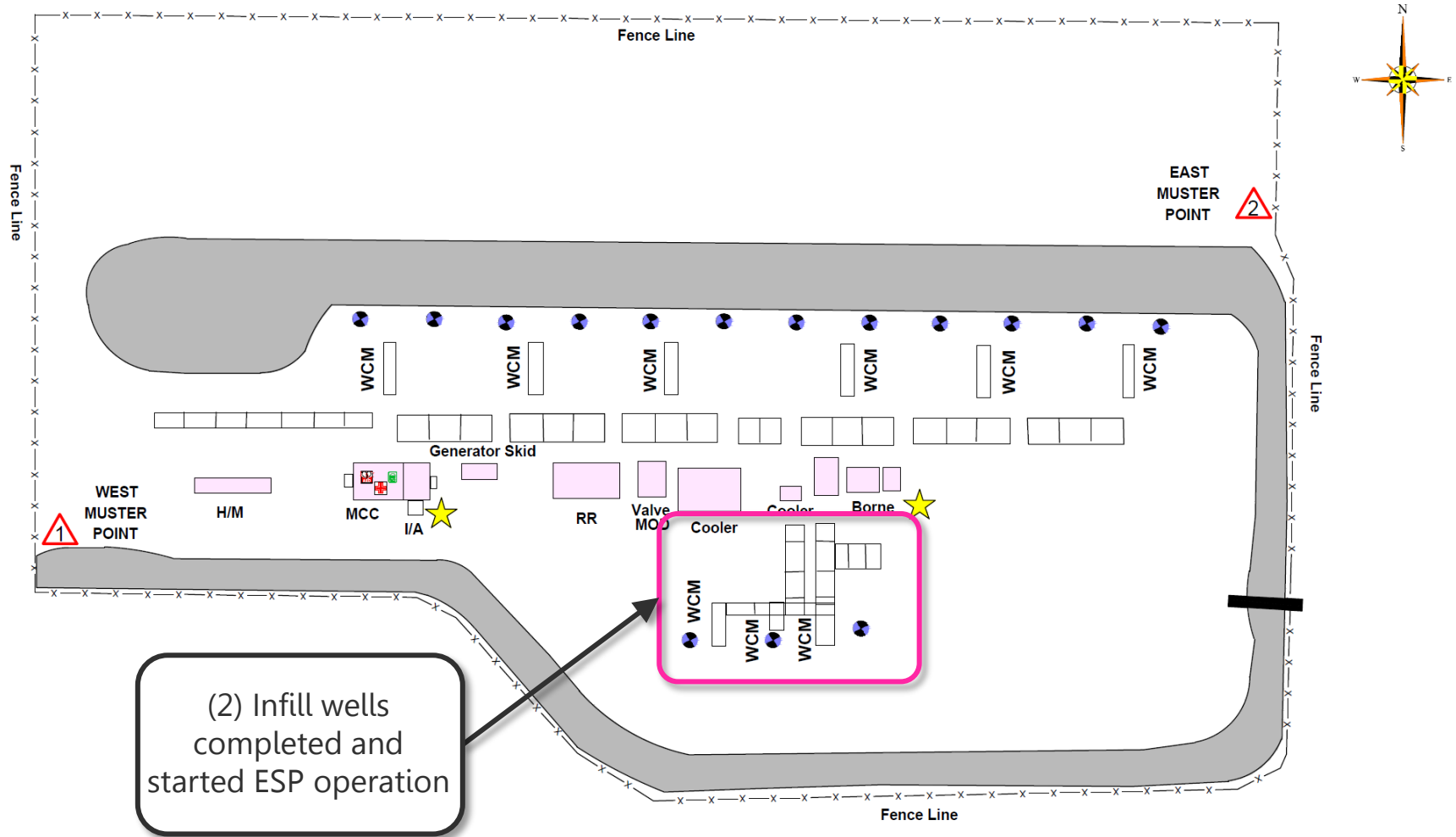
Surface Section 1

LEISMER WELL PAD L1

SAGD WELL PAD BOUNDARY



LEISMER WELL PAD L2

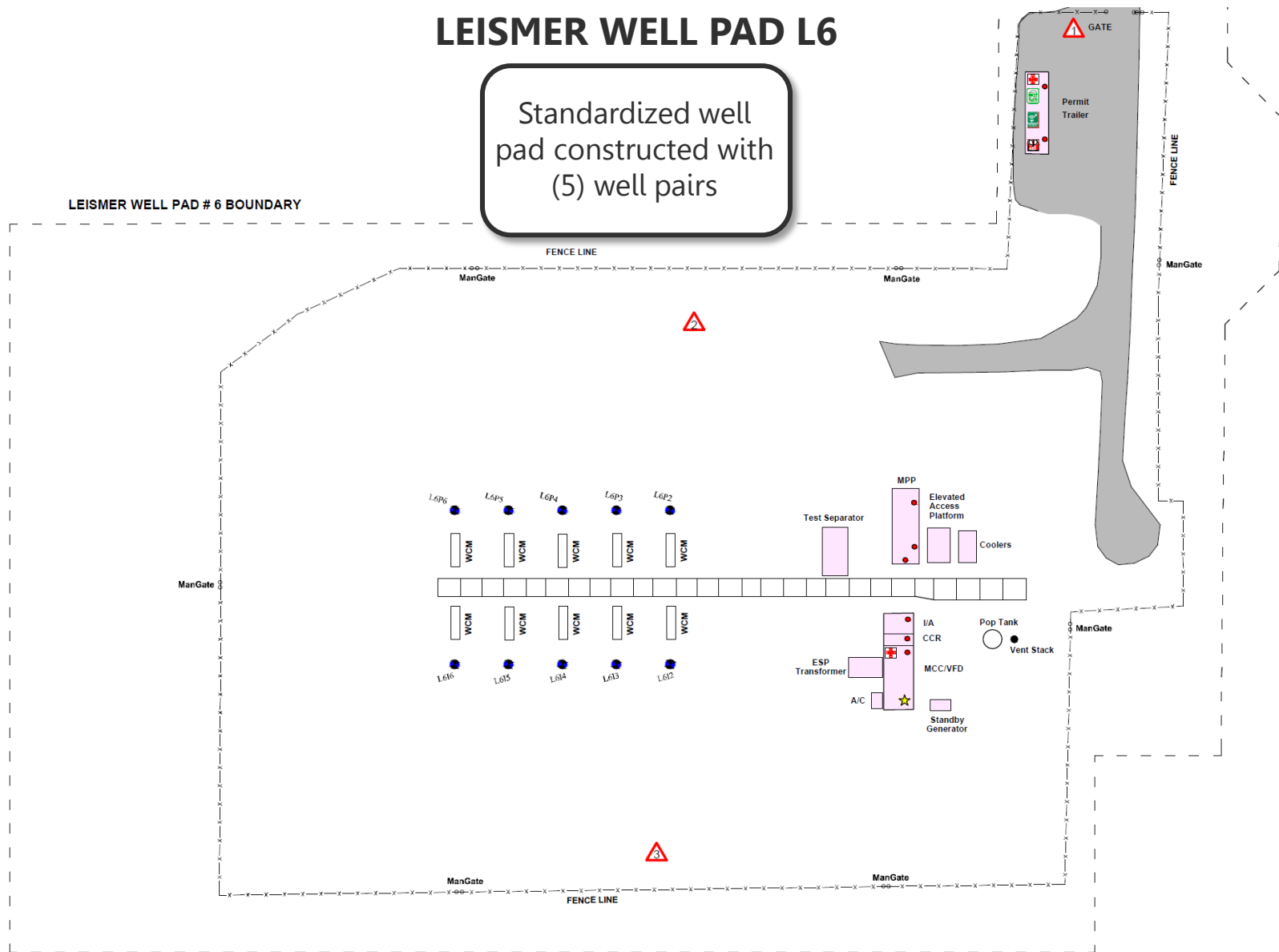


LEISMER WELL PAD L6

Standardized well
pad constructed with
(5) well pairs



LEISMER WELL PAD # 6 BOUNDARY





FACILITY PERFORMANCE

Surface Section 2
Leismer 2015 Annual Performance Presentation

Bitumen Treatment Major Facilities

- (1) FWKO, (2) treaters without electrostatic grids, and (1) vertical gas boot

Operations

- Achieved high on-spec BS&W reliability (>94%) throughout year
- Completed chemical trials and changed wet chemical supplier in June-August
- PW HEX fouling minimized with blowdown cleaning system; reduced chemical cleaning and neutralizing wastes by approx. 60%
- Reduced off-site slop disposal volumes by 65% through tank treatment, front-end recycling, and re-use
- No major issues; systems operating as per design

Challenges & Opportunities

- PW Booster pump installed downstream of FWKO/treaters; starting in Q1-2016
- Continue focus on minimizing PW HEX fouling and slop disposals
- Optimizing P&F HEX design
- Maintaining steady source of diluent supply

Water Treatment & De-oiling Major Facilities

- (1) Skim tank, (1) IGF, (2) horizontal ORFs, and (1) de-oil water tank
- (1) WLS, (2) horizontal after-filters, and (3) primary and (2) polishing WACs

Operations

- Achieved BFW specifications >95% of the time with minor process upsets
- Completed chemical trials and changed wet chemical supplier in June-August
- Continued blowdown recycle into WLS; monitoring iron transport
- Completed intermittent performance tests of CeraMem pilot project from January-July; varied success and feed conditioning system under review
- Brackish water system offline and preserved since November-2014 due to negative reservoir retention
- No major issues; systems operating as per design

Challenges & Opportunities

- Process sludge pond primary liner leak; monitoring leakage rates (<ALR) and operating at lower volumes as dual liner design ensures containment
- Blistering of rubber liner on WAC vessels being monitored; replacement/upgrade being reviewed for 2016-2017

Steam Generation Major Facilities

- (4) OTSGs, (2) HP steam separators
- (2) BFW booster and (2) BFW charge pumps

Operations

- Obtained high reliability (>93%) throughout year
- Average 80% steam quality
- Mitigated flow accelerated corrosion issues by upgrading lower radiant sections and outlet piping to 2-¼ Cr materials in February-March and August
- Currently no independent power generated at Leismer

Challenges & Opportunities

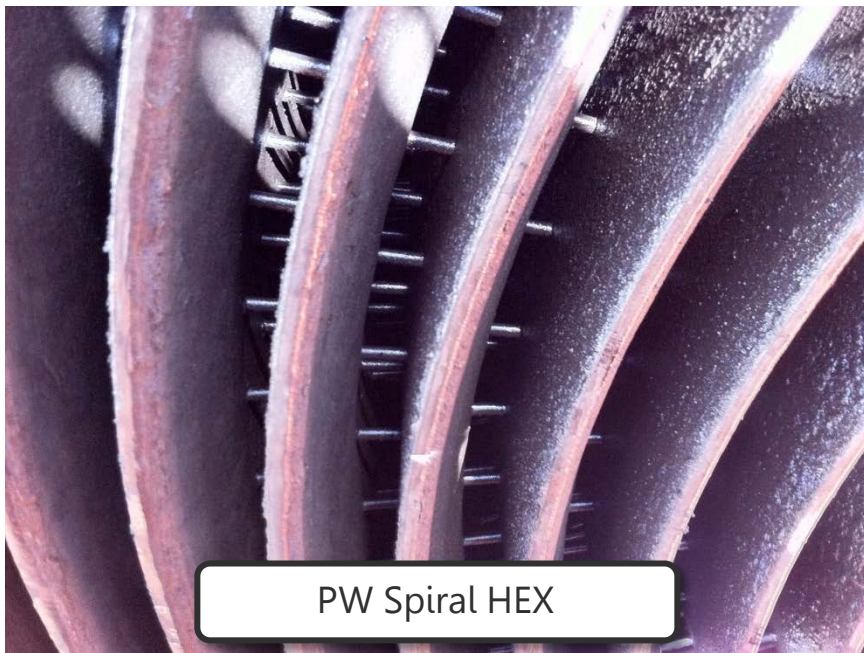
- Experienced first economizer tube failure in October; attributed to overheating caused by thin carbon-based scale from OIW excursions
- Monitoring efficiencies for early indication of generator tube fouling



Process Train



OTSG Radiant Upgrade



PW Spiral HEX



Economizer Repair

Pad L1

- (6) SAGD well pairs online
- (5) Infill wells drilled and surface facility construction underway; start up expected in Q3-2016

Pad L2

- (5) SAGD well pairs and (2) infill wells online; (1) SAGD pair suspended
- L2-P7 Infill well ESP start-up in February
- L2-P8 Infill well ESP start-up in May

Pad L3

- (6) SAGD well pairs online

Pad L4

- (5) SAGD well pairs online
- Started NCG injection on L4-I4 in April
- MPFM and second test header installation complete; start up expected in Q1-2016

Pad L5

- (7) SAGD well pairs online
- (4) Infill wells to be drilled in 2016

Pad L6

- Finished surface construction and subsurface completion of (5) SAGD well pairs in November; circulation start up underway in Q1-2016
- First well pad to incorporate standardized design

Challenges & Opportunities

- Completed proactive external inspection of surface casing and exposed intermediate casing on (4) thermal wells in April; no indication of significant corrosion but will continue to monitor
- Casing gas multi-phase pumps on all pads experiencing minor maintenance issues with seal operations that affected overall reliability



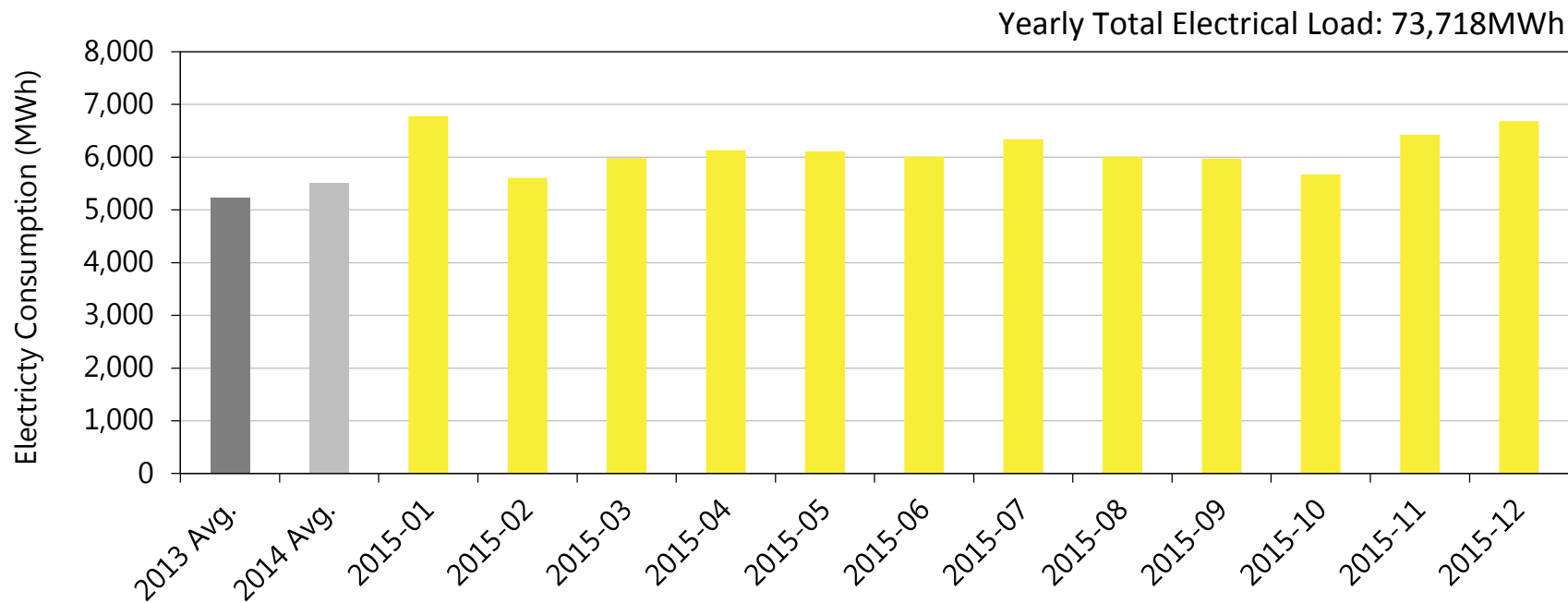
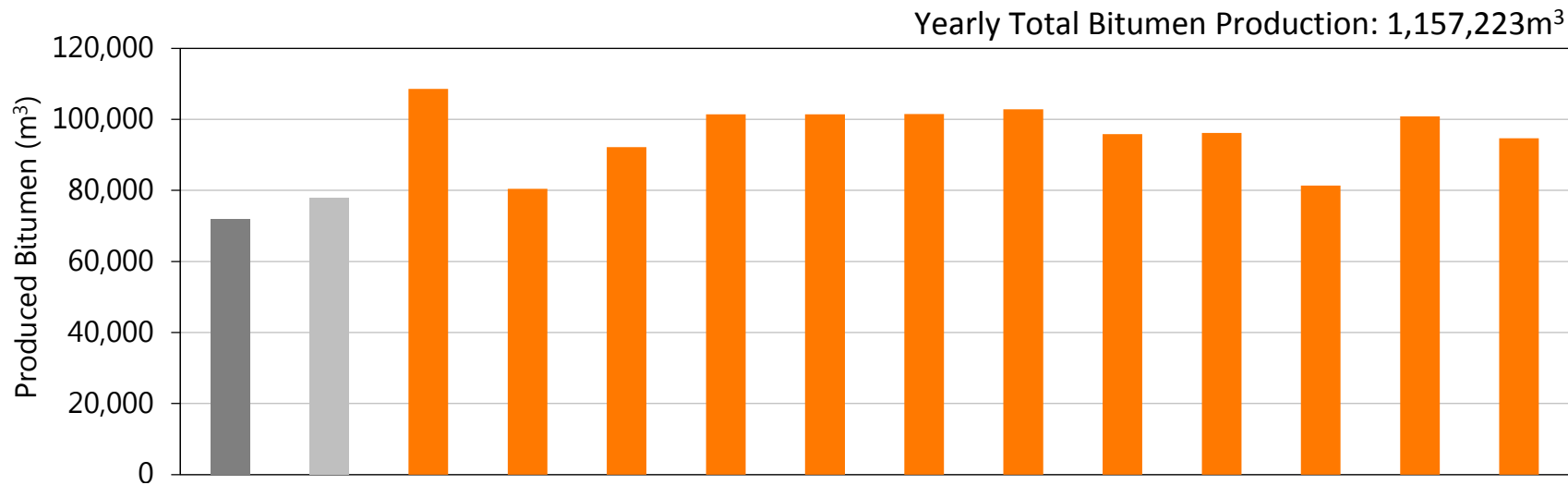
L2 Wellhead Row



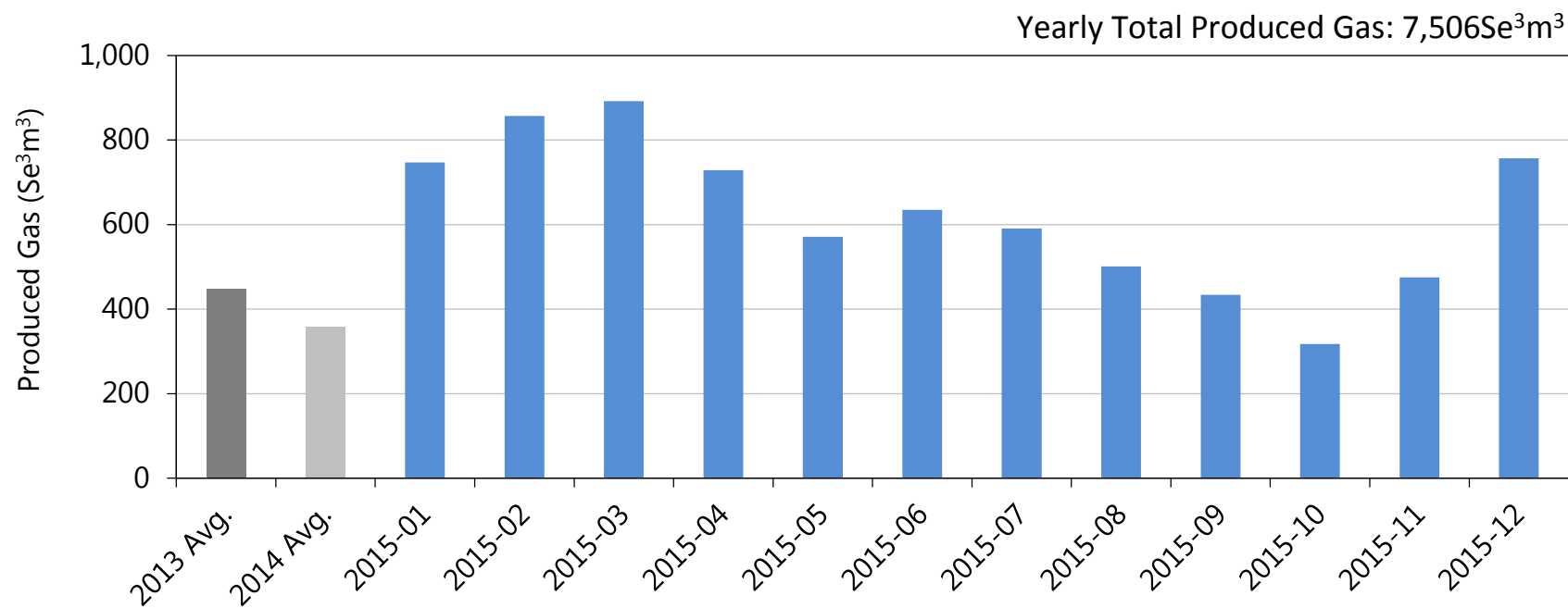
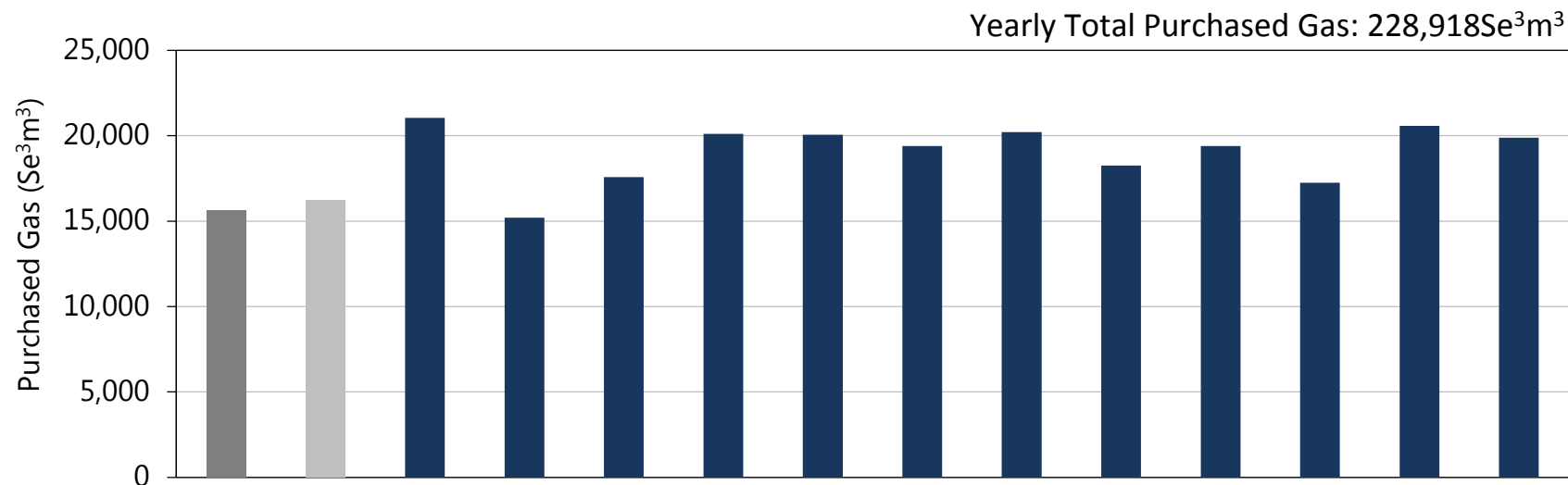
L1 Infill Well Construction



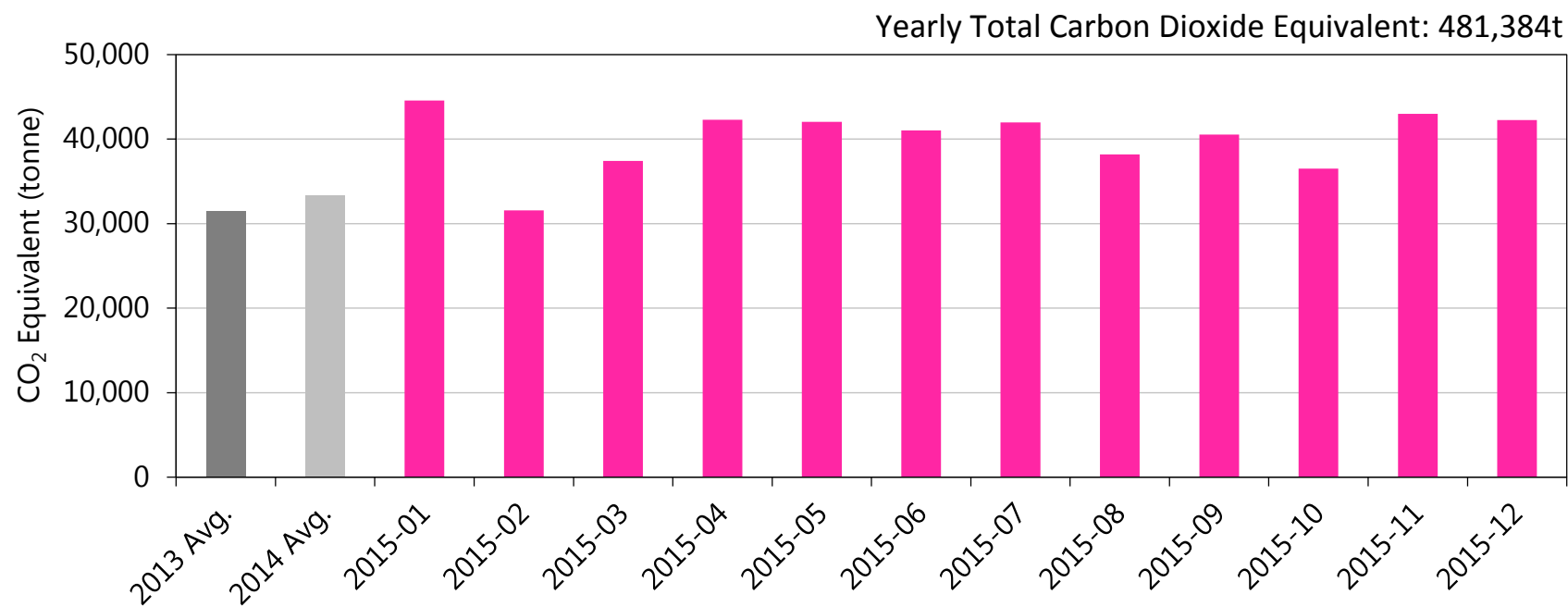
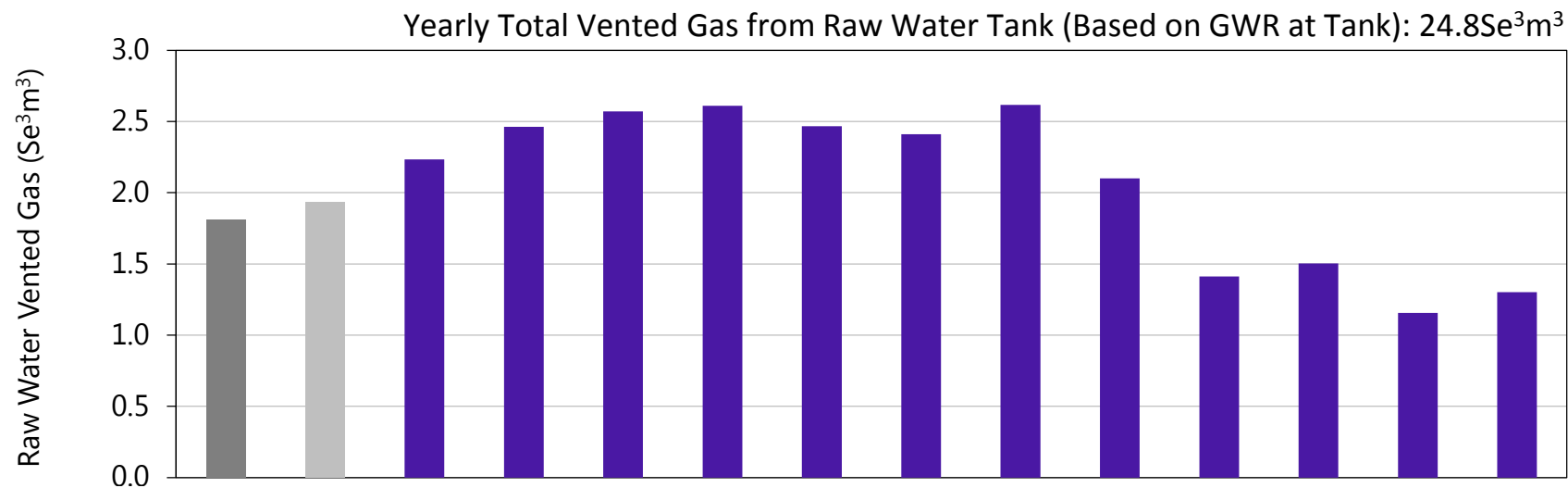
L3-P5 External Inspection



Production & Electricity Consumption



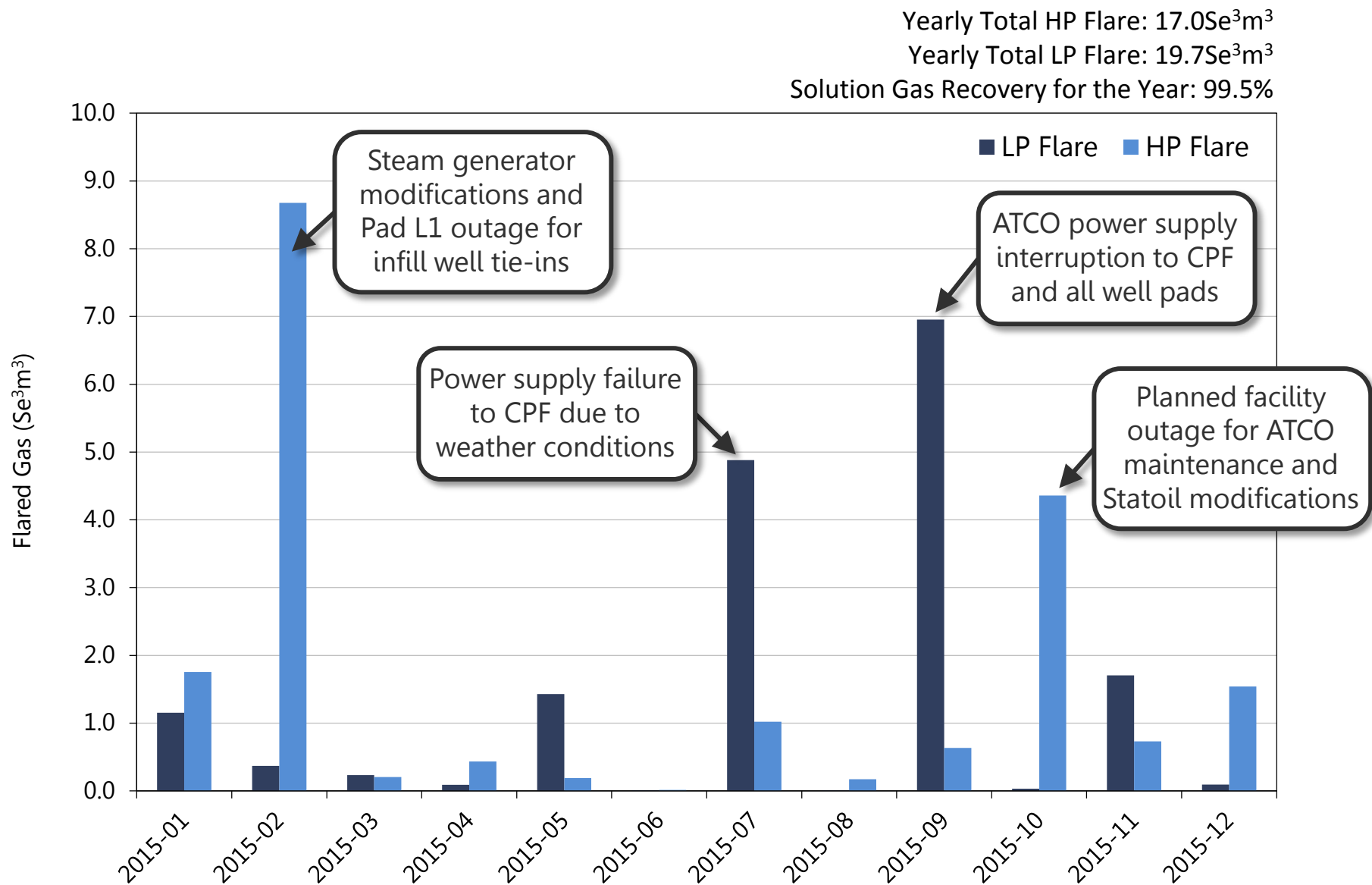
Purchased & Produced Gas Volumes



Gas Venting & CO₂ Emissions

Facility Performance

Surface Section 2



Overall Operation

- Surface facilities have operated close to design
- Overall facility performance has met expectations

Challenges

- Forest fire season required partial evacuation of facilities (2) times during the year

Opportunities

- Re-evaluated chemical vendors for oil, water, and steam facilities
- Reduced PW HEX chemical cleaning and neutralizing wastes by 60%
- Reduced off-site slop disposal volumes by 65%
- Optimized operating expenditures



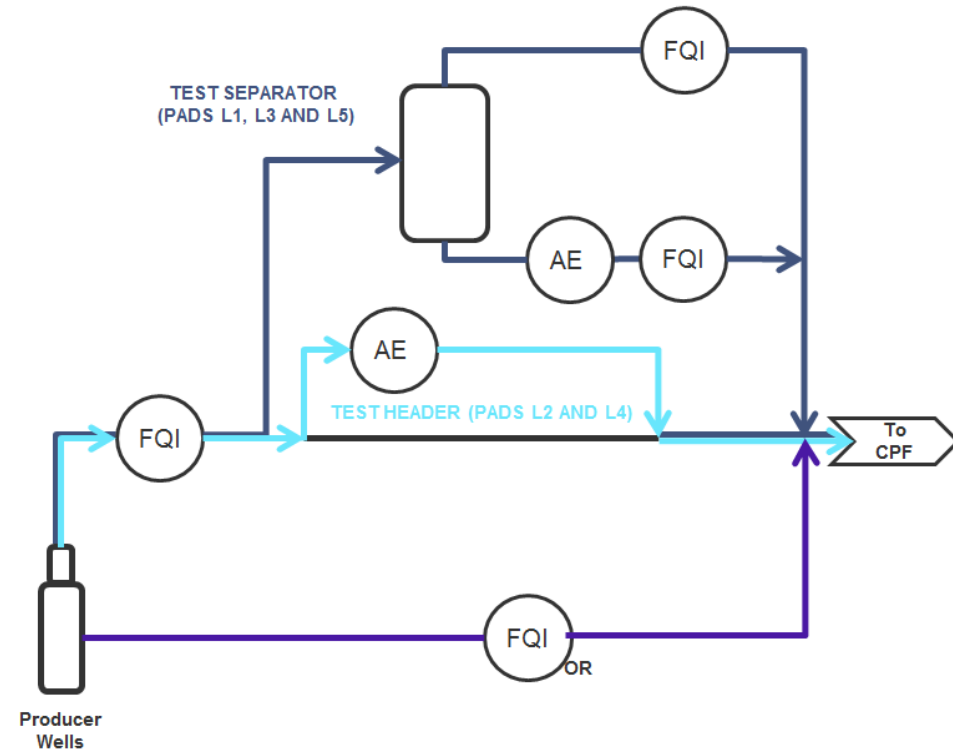
Overall Performance & Expectations

MEASUREMENT & REPORTING

Surface Section 3
Leismer 2015 Annual Performance Presentation

Well Testing

- Well tests used to calculate daily bitumen and water production
- Well test frequency increased (5-hour well tests with 1-hour purge) to improve production calculation
 - Typical frequency is 15-20 tests per well per month
- All pads are equipped with a water cut analyzer
 - Pads L2 and L4 used a slip stream test header design
 - $L2/L4 \text{ Rates} = \text{Water Cut} \times \text{FQI at individual wellhead}$
- Pads L1, L3, and L5 are equipped with full test headers and test separators

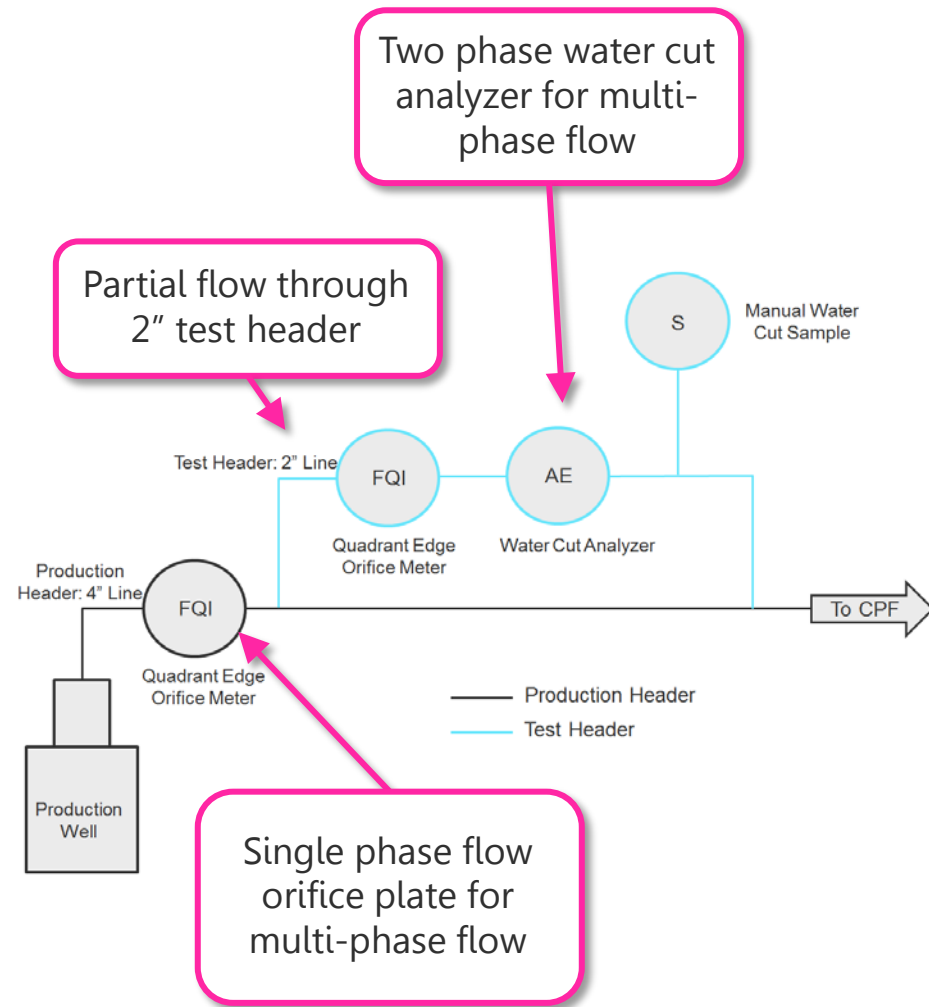


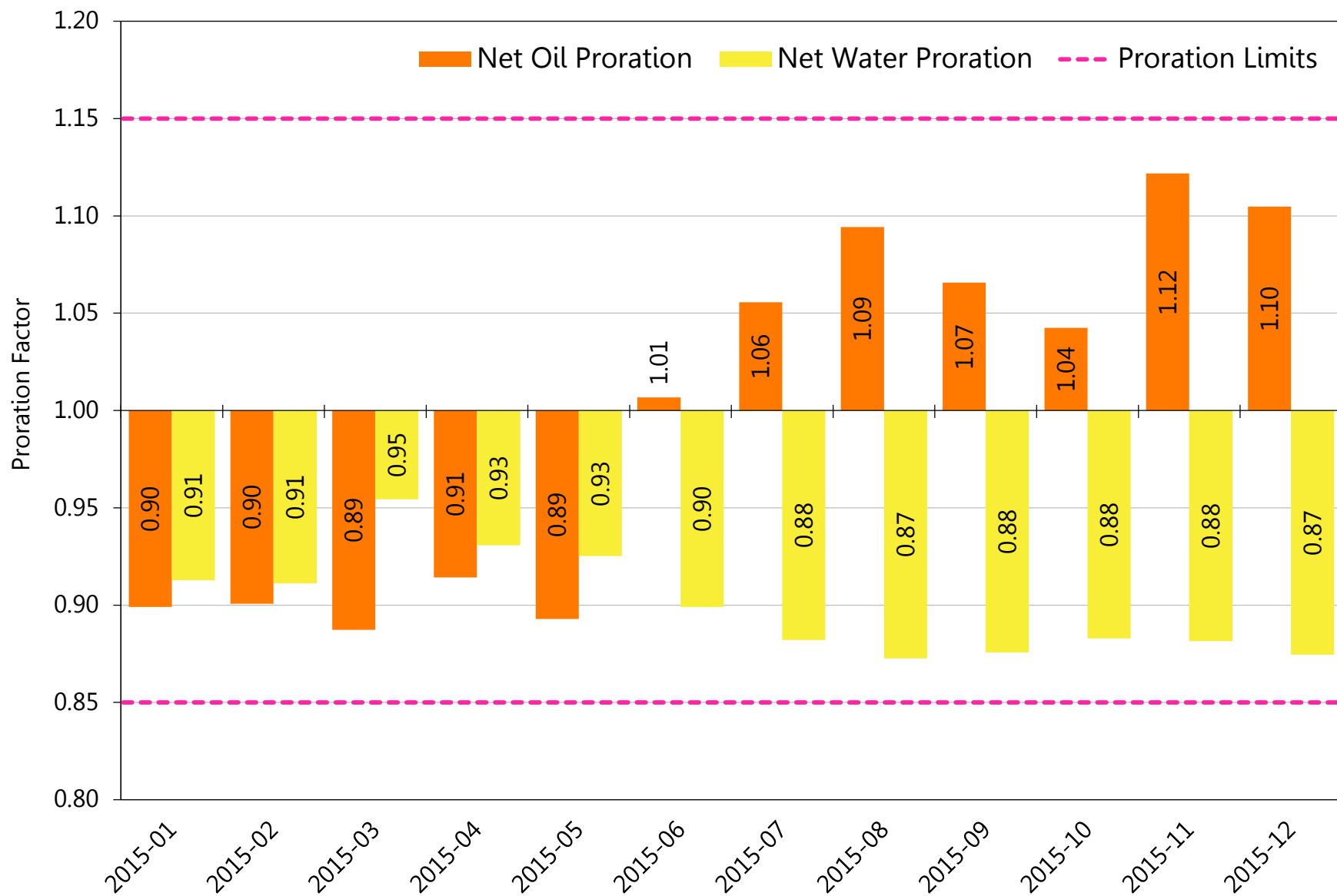
Bottlenecks

- Partial flow through 2" test header on Pads L2 and L4
- 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
 - MPFM installed on Pad L4 and will be started in Q1-2016 to replace existing test header





Proration Factors

Measurement & Reporting

Surface Section 3

Leismer:

- ABIF 0105805 – Leismer SAGD Water Disposal
- ABIF 0105806 – Leismer SAGD Steam Injection
- ABBT 0105807 – Leismer SAGD Oil Battery
- ABBT 0105808 – Leismer SAGD Water Source

SCIP:

- ABBT 0127831 – Leismer SCIP Oil Battery
- ABIF 0127832 – Leismer SCIP Steam Injection

WATER PRODUCTION, INJECTION & USES

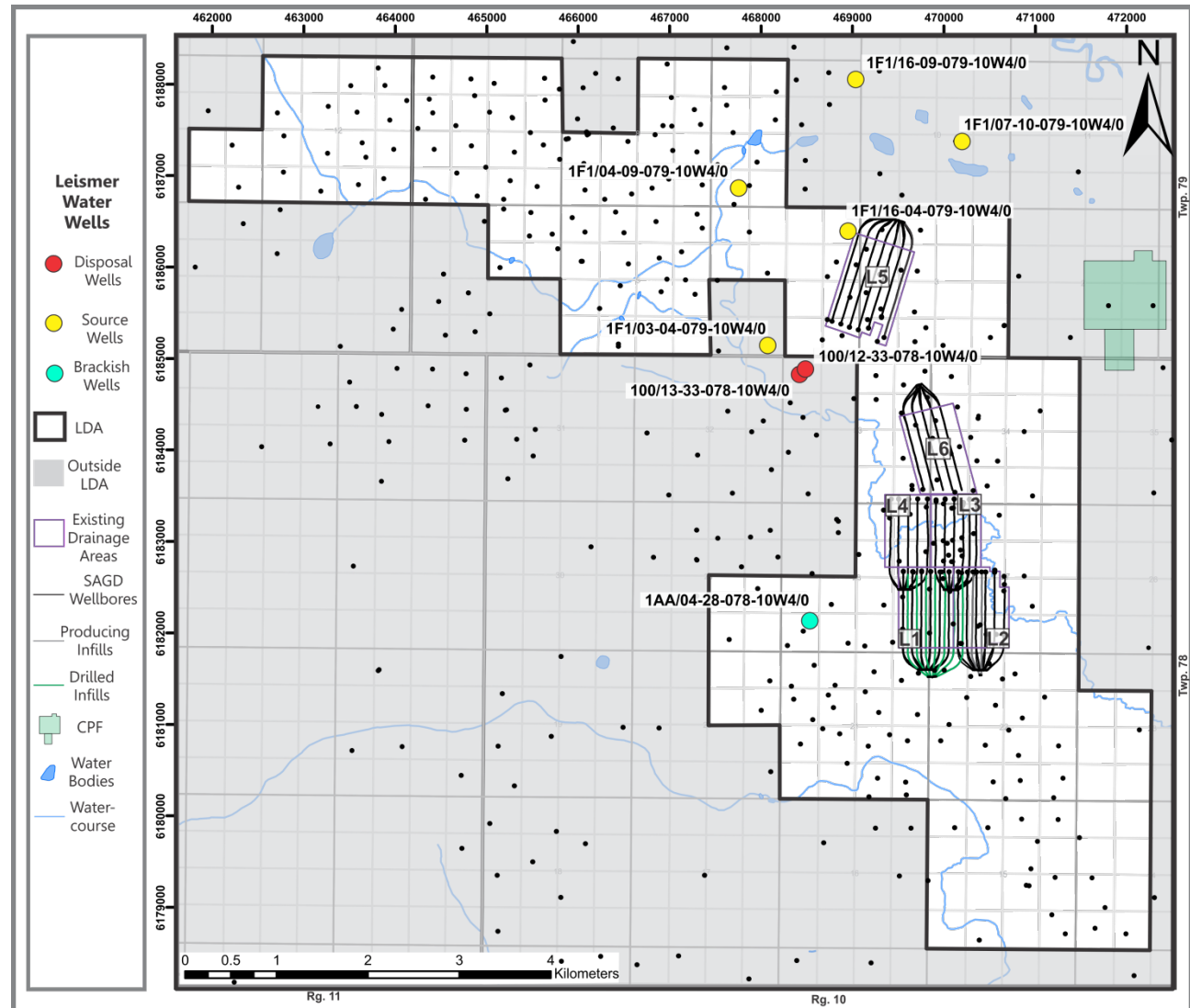
Surface Section 4
Leismer 2015 Annual Performance Presentation

Leismer's Water Network

- (5) Wells completed in Lower Grand Rapids Formation
- (1) Brackish water well in Clearwater B formation

Leismer Disposal Wells

- (2) Disposal wells in the Basal McMurray; one operating, one standby
- Both wells are Class 1b (Disposal Approval No. 11479)



Unique Well Identifiers

Water Production, Injection & Uses

Surface Section 4

Water Diversion Licence (WDL) 00239880 for 317,915m³/y (871m³/cd)

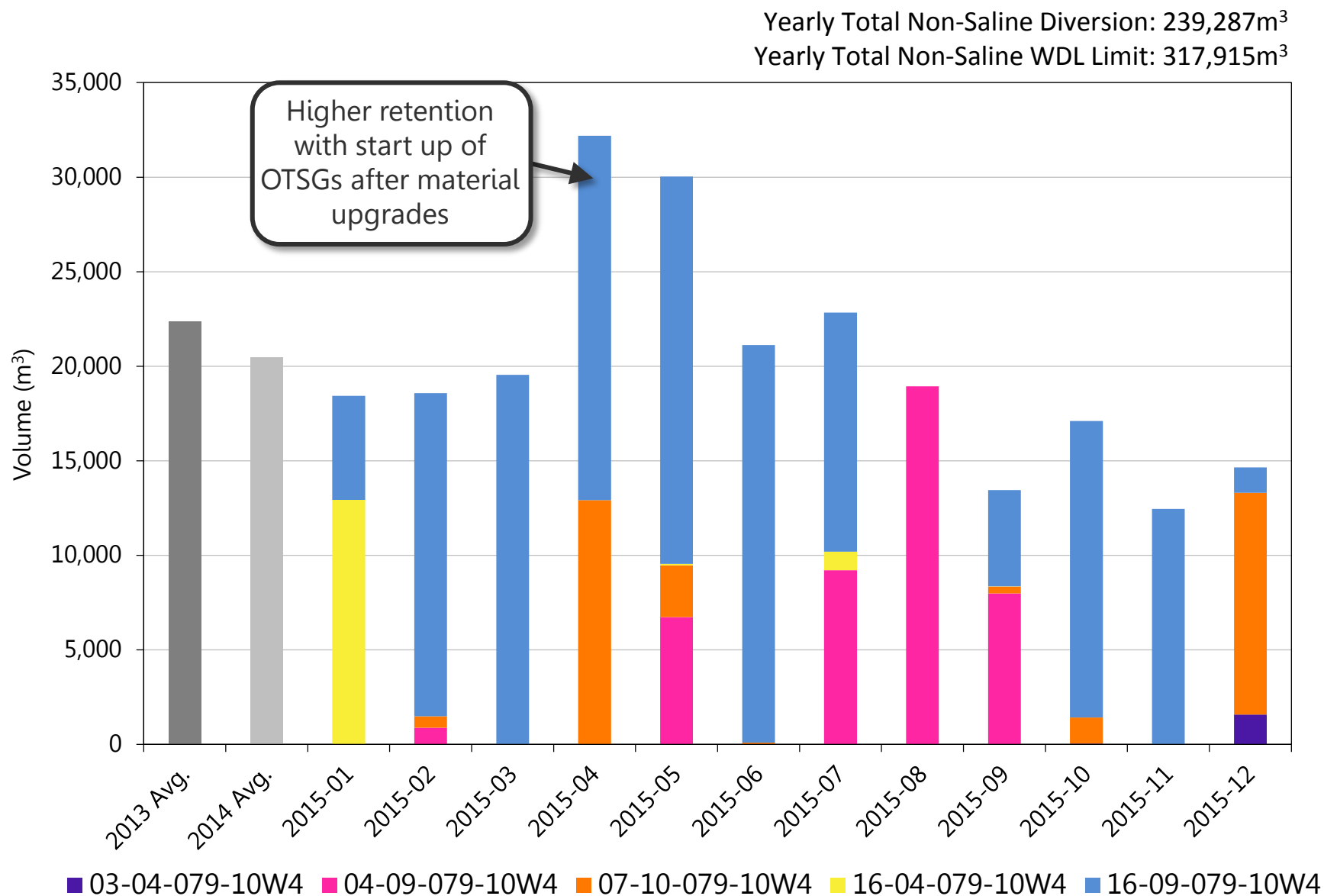
- Total non-saline water pumped from source wells at Leismer in 2015 was 239,287m³ (660m³/d), 75% of allowable WDL amount
 - 98.5% went to Leismer CPF for process use
 - <0.1% was used for drilling
 - 1.4 % for domestic use

Temporary Diversion Licence (TDL) 00366187 for 255,500m³/y (700m³/cd)

- No water was used as part of this TDL in 2015

We have minimized source water use by operating at negative reservoir retention and high blowdown recycle rates

- Source intensity was 0.21bbl-water/bbl-bitumen in 2015 representing a decrease of 20% from 2014; attributed mainly to balanced or negative retention and a reduction in utility water usage
- No brackish water was used in 2015 due to low overall source water requirements



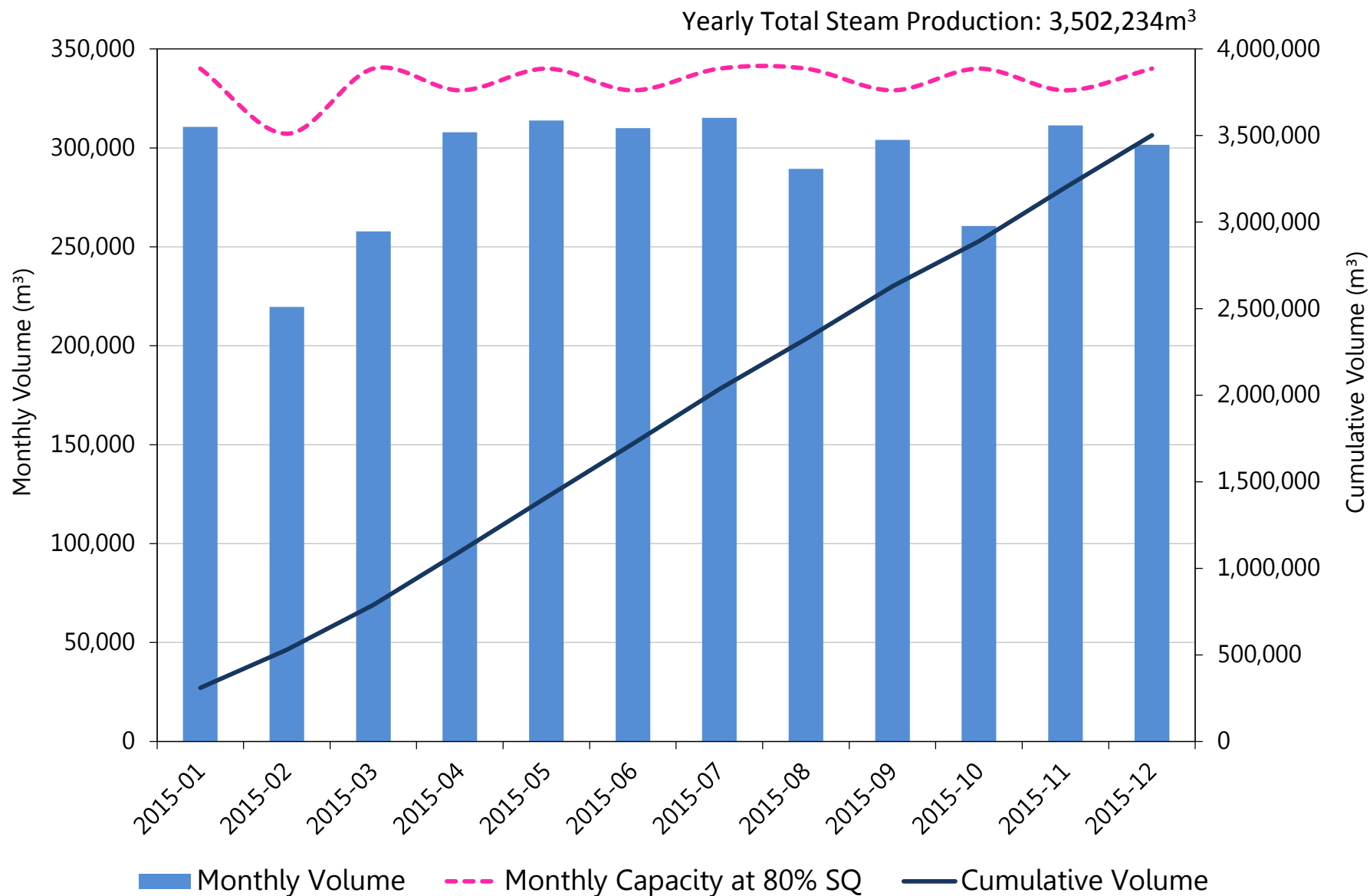
Flow from Grand Rapids

Water Production, Injection & Uses

Surface Section 4

Typical Water Quality 2015 (2014)

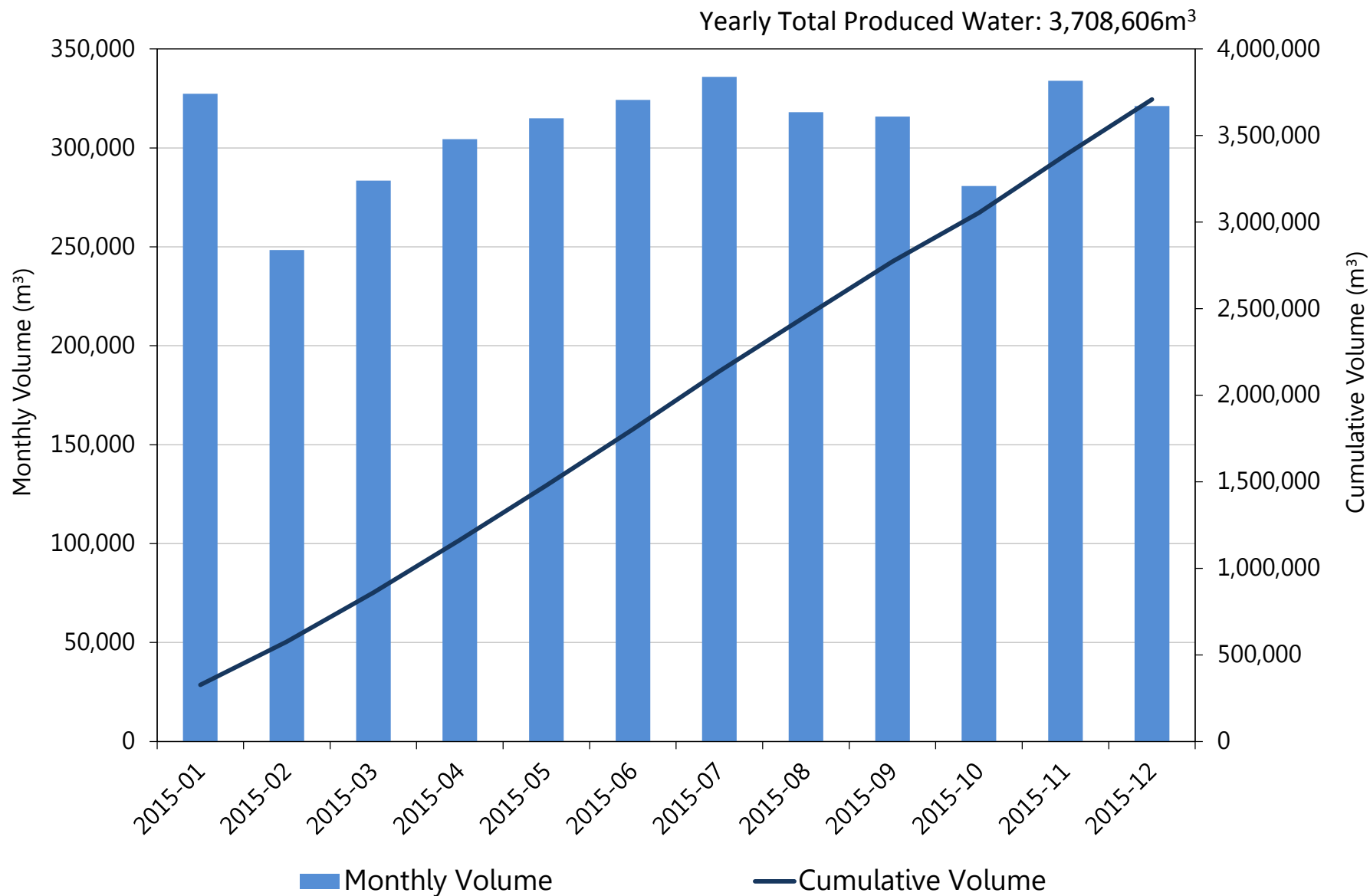
Parameter	Brackish Water	Fresh Water	Produced Water	Disposal Water
TDS [mg/L]	5,700 (5,700)	1,450 (1,400)	1,900 (1,850)	40,000 (45,000)
pH [-]	8.5 (8.5)	8.8 (8.8)	7.3 (7.6)	11.9 (12.1)
Hardness [mg/L as CaCO ₃]	70 (70)	4.4 (4.4)	18 (18)	2.0 (2.0)
Total Alkalinity [mg/L as CaCO ₃]	880 (880)	810 (810)	230 (230)	6,800 (6,800)
SiO₂ [mg/L]	0 (0)	0 (0)	275 (275)	250 (250)
Cl [mg/L]	2,800 (2,800)	250 (250)	850 (850)	15,000 (15,000)



Steam Injection

Water Production, Injection & Uses

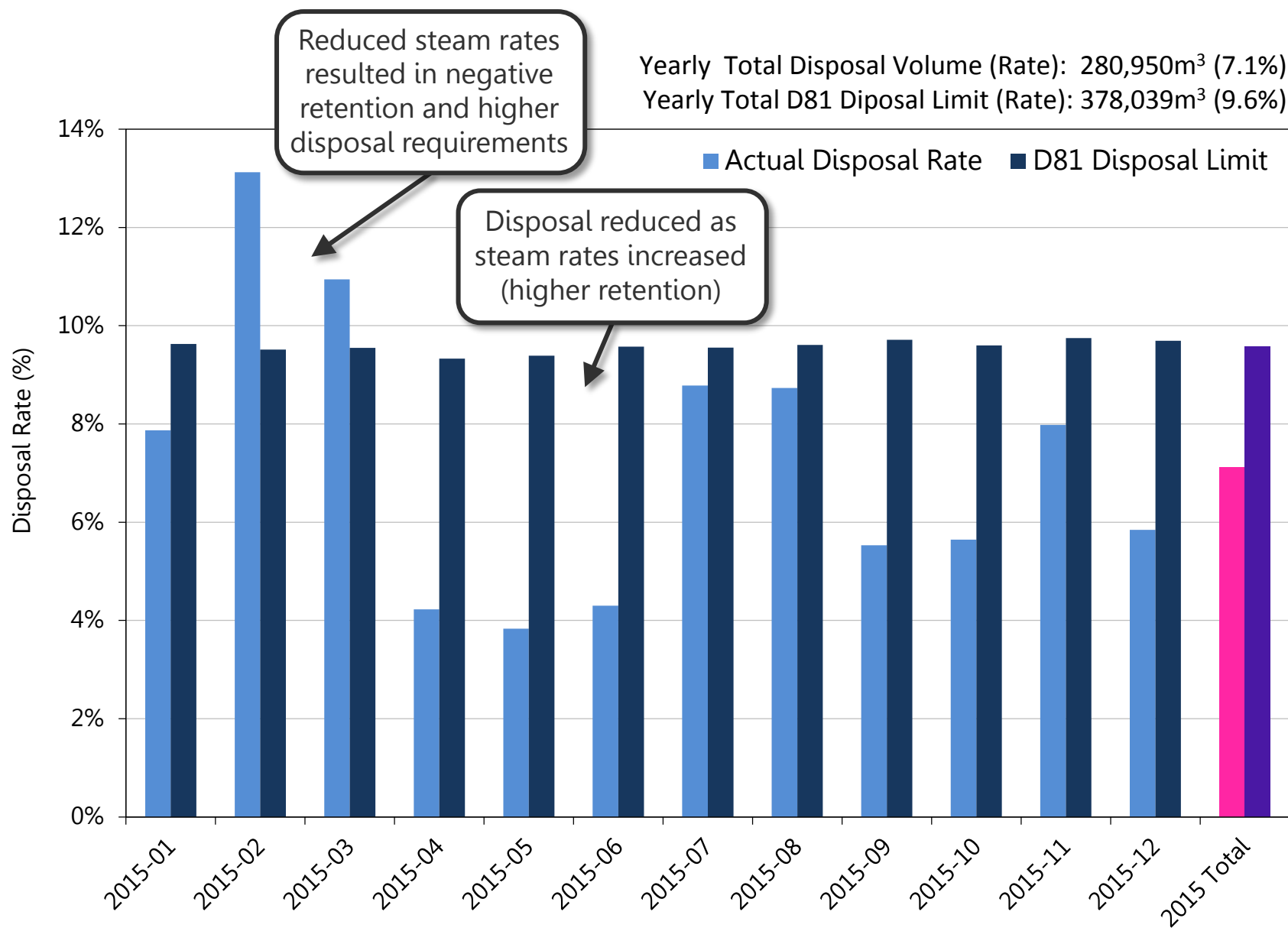
Surface Section 4



Produced Water

Water Production, Injection & Uses

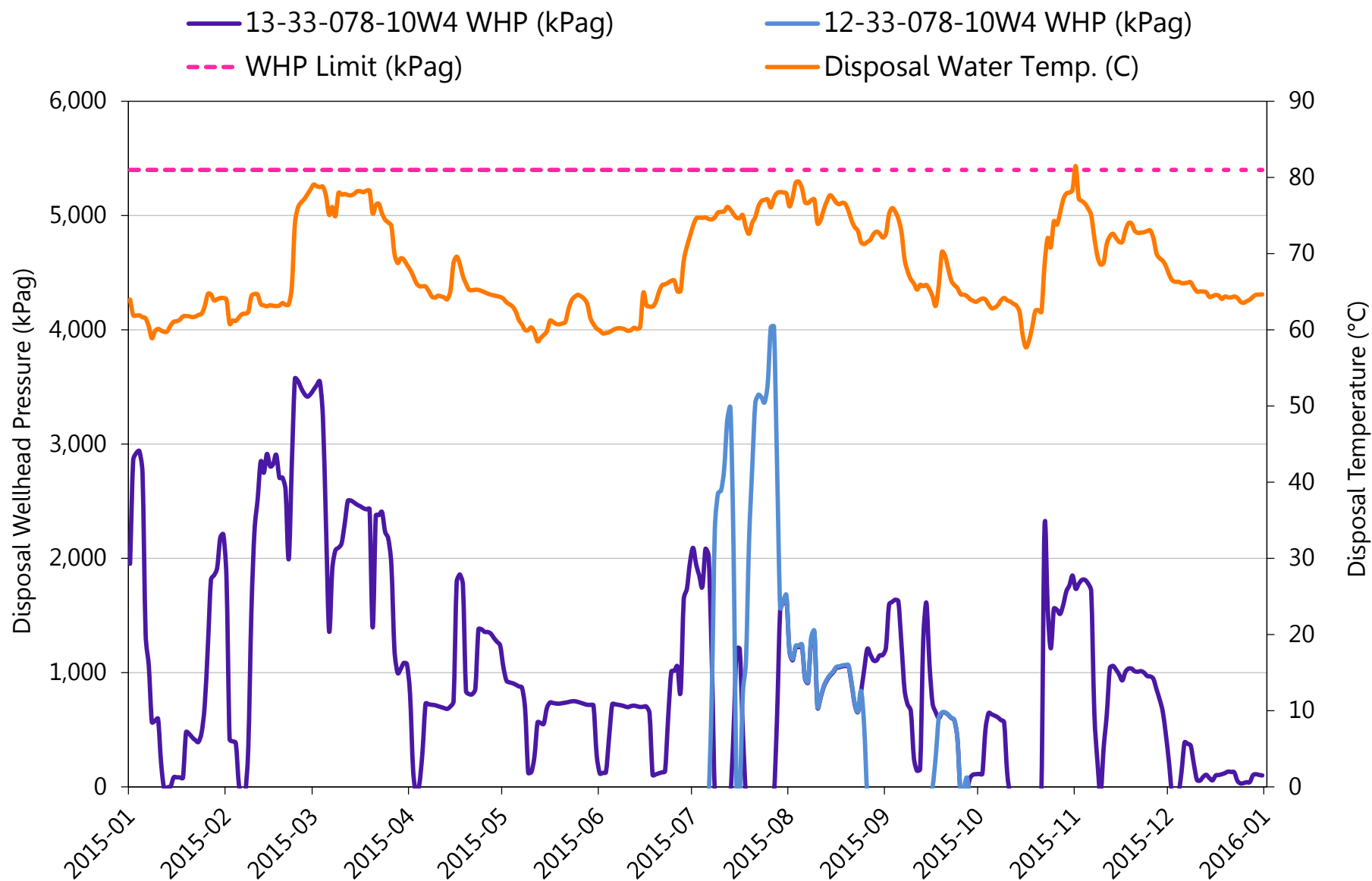
Surface Section 4



Disposal Water

Water Production, Injection & Uses

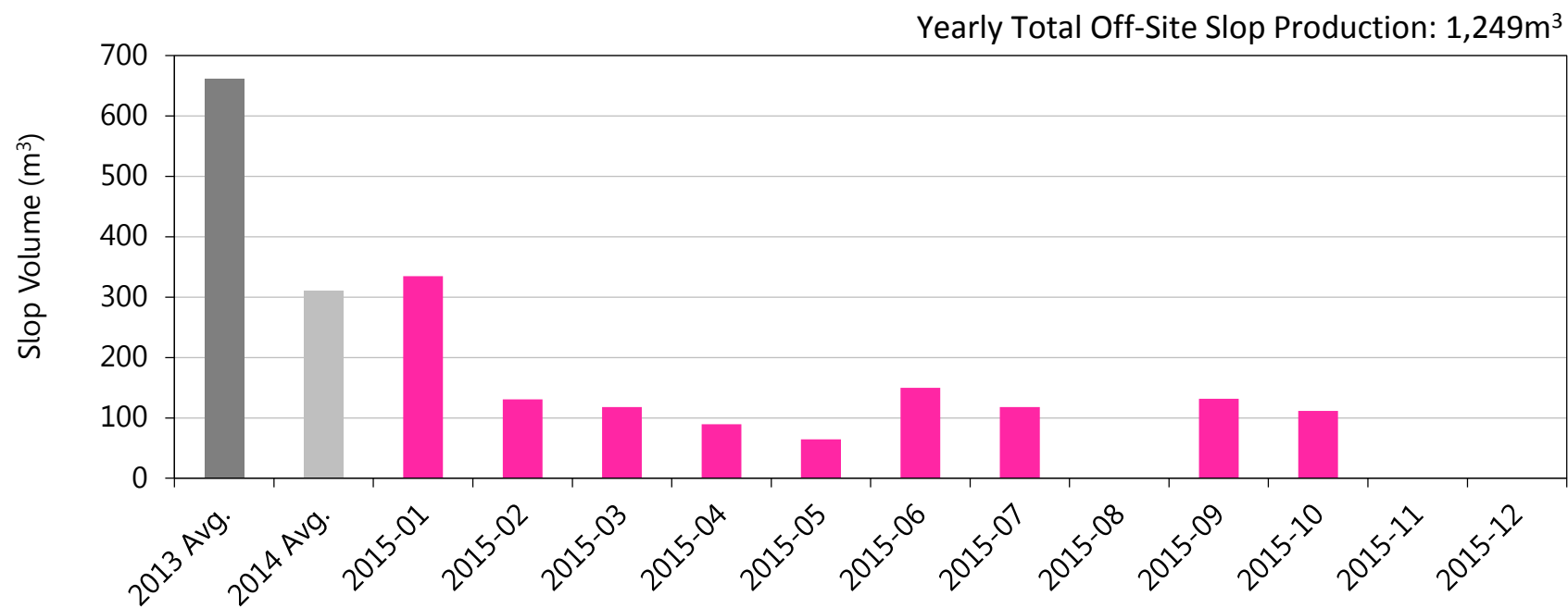
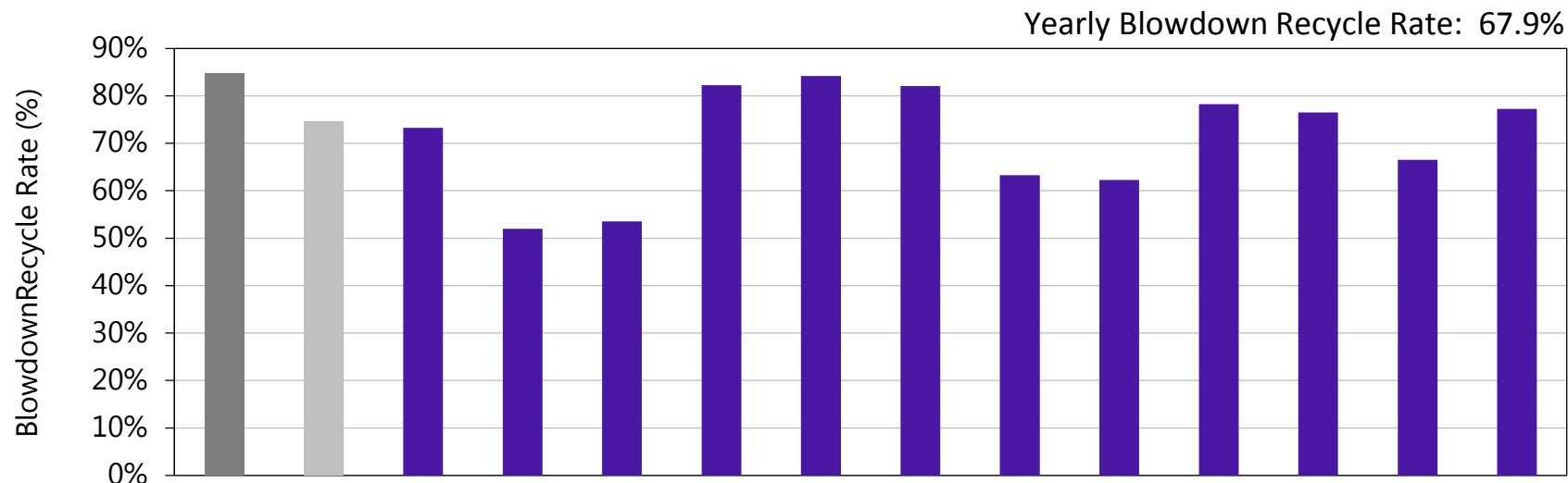
Surface Section 4



Disposal Water Pressure & Temperature

Water Production, Injection & Uses

Surface Section 4



Blowdown Recycle & Slop

Water Production, Injection & Uses

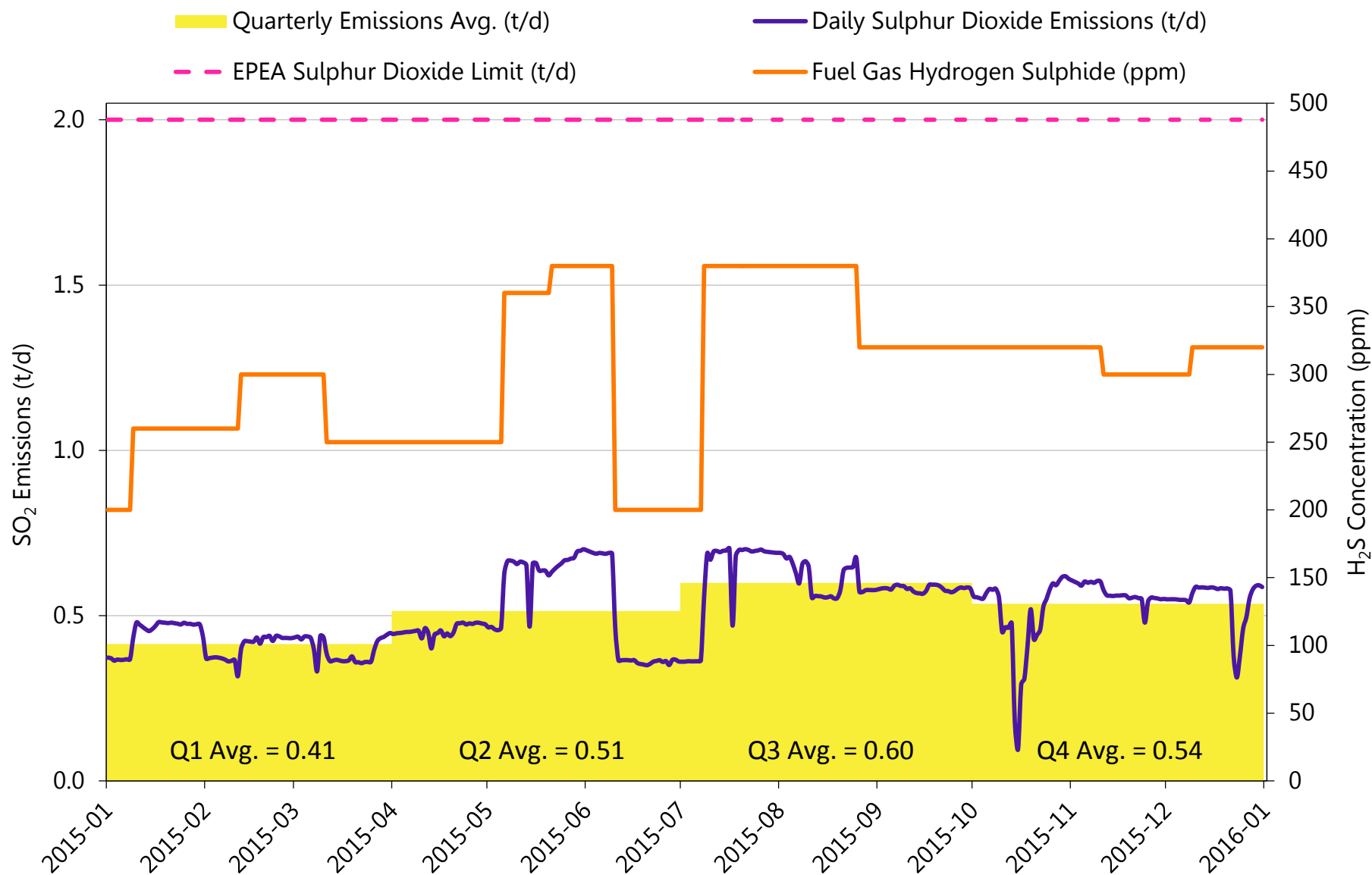
Surface Section 4

- Slop Handling: 1,180m³ of water was trucked off site within slop volume to the Lindbergh cavern facility
- Solids Disposal:
 - Water treatment related solids (lime softening sludge) is allowed to settle in the sludge pond at site
 - Sludge pond to be dredged in 2016 or 2017 depending on results of pond survey

SULPHUR PRODUCTION

Surface Section 5
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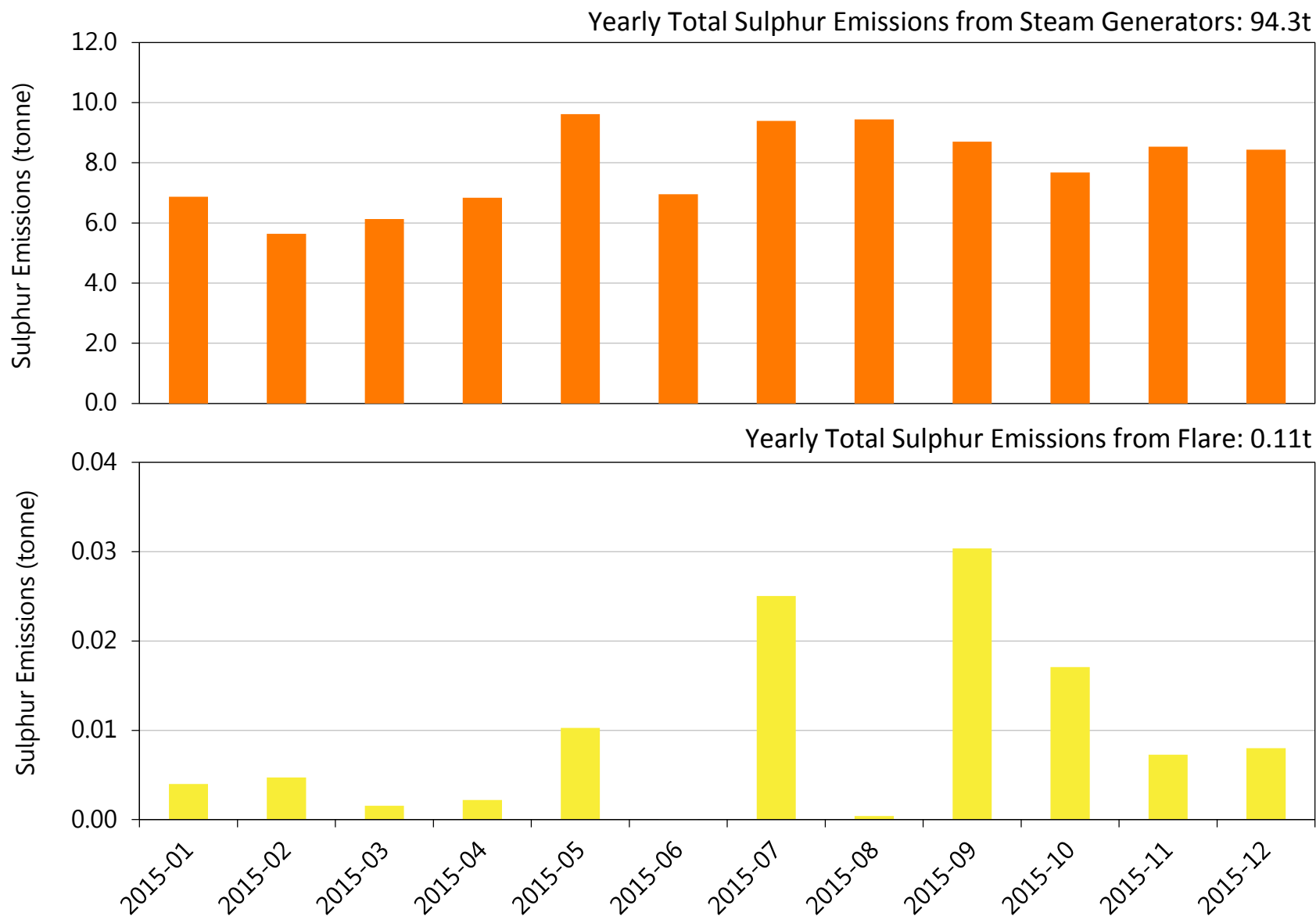
- Leismer average daily sulphur dioxide (SO₂) emissions was 0.51t/cd in 2015 (25.8% of approval limit)
 - Note: EPEA approval limit for KKD Oil Sands Partnership is 2.0t/cd of SO₂ emissions
- Total annual SO₂ emissions for 2015 was 188.5t
- Leismer peak daily SO₂ emission was 0.70t
- Leismer currently does not have sulphur recovery facilities
- Statoil shall ensure that sulphur recovery will be operational before total sulphur emissions reach 1t/d on a calendar quarter-year averaged basis



Sulphur Dioxide & Hydrogen Sulphide

Sulphur Production

Surface Section 5



Monthly Sulphur Balance

Sulphur Production

Surface Section 5

- Alberta Energy Regulator (AER) approval limits based on Alberta ambient air quality objectives:
 - SO₂ (1-hour average) 172ppbv
 - H₂S (1-hour average) 10ppbv

Passive Ambient Air Monitoring 2015

Month	Peak SO ₂ (ppb)	Peak H ₂ S (ppb)
January	1.2	0.17
February	1.3	0.15
March	1.0	0.17
April	0.6	0.05
May	0.4	0.05
June	0.9	0.33
July	0.5	0.11
August	1.2	0.25
September	0.7	0.1
October	0.7	0.15
November	0.7	0.11
December	1.1	0.21

Continuous Ambient Air Monitoring 2015

Month	October	November	December
Peak SO ₂ 1-Hour Average (ppb)	10	8	22
Peak H ₂ S 1-Hour Average (ppb)	1	1	1
Operational Time SO ₂ (%)	96.77	99.44	100
Operational Time H ₂ S (%)	94.76	98.61	99.19

COMPLIANCE STATEMENT

Surface Section 8
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- Statoil believes that it is in compliance with the AER Scheme Approval and regulatory requirements



Approval & Regulatory Requirements

Compliance Statement

Surface Section 8

FUTURE PLANS

Surface Section 9
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- Pad L1 Infill Wells
 - Sub-surface completions in June 2016
 - Start-up scheduled for Q3/Q4-2016
- Pad L2 MPFM
 - Construction and start-up by Q3-2016
- Pad L5 Infill Wells
 - Drilling to start in June 2016
 - Earthworks and facility construction throughout 2016-2017 with start-up in 2018
- Pad L6 SAGD Wells
 - Circulation underway in Q1-2016; conversion to ESP operation in Q2-2016
- Leismer CPF Maintenance
 - Sludge pond dredging; scheduled for late 2016 or early 2017
 - Hydrocarbon tank cleaning and inspections; scheduled for Q3-2016
 - Turnaround planning for 2016-2018

Major Activities & Target Dates



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