Industrial Commission Update

Justin J. Kringstad
Geological Engineer
Director
North Dakota Pipeline Authority

June 20, 2019
Statewide Initial Oil Production Rates – 24hr
4,000+ BOPD 24hr Initial Production Rates
Statewide Gas Performance

~12% Improvement Over 2017

IP Year
- 2018
- 2017
- 2016
- 2015
- 2014
- 2013
- 2012
- 2011
- 2010
- 2009

Cumulative Gas Production, MCF

Production Month
Statewide Initial Gas Production Rate: 24hr

Avg. 24Hr Initial Production (IP) Gas - MCFD

Bakken and Three Forks Gas Performance

**Graphs:**
- **DUNN**
- **MCKENZIE**
- **MOUNTRAIL**
- **WILLIAMS**

**Y-Axis:** Avg. MCFD

**X-Axis:** Production Month

**Colors Indicate IP Year:**
- 2018
- 2017
- 2016
- 2015
- 2014
- 2013

**Legend:**
- **IP Year**

Title:
- Bakken and Three Forks Gas Performance

Subtitle:
- JJ Kringstad - North Dakota Pipeline Authority
Top 20 IP Rates (Oil)
Top 20 IP Rates (Oil)

<table>
<thead>
<tr>
<th>Completion Zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Middle Bakken</td>
</tr>
<tr>
<td>TF B1</td>
</tr>
<tr>
<td>TF B2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Location</th>
<th>IP Test Date</th>
<th>Oil - 24Hr Rate (bbl)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DUNN</td>
<td>Mar 1, 18</td>
<td>6,500</td>
</tr>
<tr>
<td></td>
<td>Jul 1, 18</td>
<td>7,000</td>
</tr>
<tr>
<td></td>
<td>Nov 1, 18</td>
<td>7,500</td>
</tr>
<tr>
<td></td>
<td>Mar 1, 19</td>
<td>8,000</td>
</tr>
<tr>
<td>MCKENZIE</td>
<td>Mar 1, 18</td>
<td>8,500</td>
</tr>
<tr>
<td></td>
<td>Jul 1, 18</td>
<td>9,000</td>
</tr>
<tr>
<td></td>
<td>Nov 1, 18</td>
<td>9,500</td>
</tr>
<tr>
<td></td>
<td>Mar 1, 19</td>
<td>10,000</td>
</tr>
<tr>
<td>MOUNTRAIL</td>
<td>Mar 1, 18</td>
<td>10,500</td>
</tr>
<tr>
<td></td>
<td>Jul 1, 18</td>
<td>10,500</td>
</tr>
<tr>
<td></td>
<td>Nov 1, 18</td>
<td>10,500</td>
</tr>
<tr>
<td></td>
<td>Mar 1, 19</td>
<td>10,500</td>
</tr>
</tbody>
</table>
Top 20 IP Rates (Oil)
Top 20 IP Rates (Oil)

Completion Zone
- Middle Bakken
- TF B1
- TF B2

Gallons Injected Per Lateral Foot

Lbs Proppant Per Lateral Foot

IP Test - BBLs Produced Per Lateral Foot - 24Hr
Top 20 IP Rates (Oil)

*Month “0” is a partial month with daily production calculated using “Days on production”. Months 1+ use calendar days to calculate daily rate.
Top 20 IP Rates (Oil)

Electrical Submersible Pump (ESP) Timeline

Completion Zone
Middle Bakken
TF B1
TF B2

Days to ESP
Impact of ESP on Production Profiles
Well: SIBYL USA 44-19TFH (Mountrail County)

*Month "0" is a partial month with daily production calculated using "Days on production". Months 1+ use calendar days to calculate daily rate.
Impact of ESP on Production Profiles

Additional Examples

*Month “0” is a partial month with daily production calculated using “Days on production”. Months 1+ use calendar days to calculate daily rate.
High Initial Production (IP) Scenarios

“Typical” type curve used as a comparison example for how high IP wells may perform over time.

In this example, the entire production curve over time is uplifted relative to a “typical” well. Well economics and EUR are both improved.

In this example, only the early life of the well is higher relative to a “typical” well. Early well economics improve, but uncertainty exists if EUR will improve or suffer with the high IP rate.

In this example, the early life of the well is higher relative to a “typical” well. Early well economics improve along with an incremental EUR improvement.
*Month “0” is a partial month with daily production calculated using “Days on production”. Months 1+ use calendar days to calculate daily rate.
Oil IP Bin Comparison

The graph shows cumulative oil production over production months, categorized by different IP Oil 24Hr (bin) ranges:
- 9000-9999
- 8000-8999
- 7000-7999
- 6000-6999
- 5000-5999
- 4000-4999
- 3000-3999
- 2000-2999
- 1000-1999
- 0-999

Cumulative Oil is measured on the y-axis, and Production Month is on the x-axis.
Oil IP Bin Comparison – “Clean”
Oil IP Bin Comparison – “Clean”

![Graph showing Oil IP Bin Comparison for different IP Bins (2000, 4000, 6000, 8000) across production months (0 to 18)].
Economic Incentive to Higher IP Rates

Example: Payout Period Using $7 million well cost

Oil 24-Hr IP Rate Group / Well Cost

<table>
<thead>
<tr>
<th>Oil Rate Group</th>
<th>Well Cost</th>
<th>Payout (Months) @ $56 Wellhead Oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000 4000</td>
<td>6000 8000</td>
<td>7 MM</td>
</tr>
<tr>
<td>14</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>14 12</td>
<td>7 MM 4000</td>
<td>7 MM</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 6</td>
<td>7 MM 8000</td>
<td>7 MM</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Economic Incentive to Higher IP Rates
Example: Rate of Return Using $7 million well cost
Economic Incentive to Higher IP Rates
Example: Breakeven Pricing Using $7 million well cost

Well Production IP BIN / Well Cost

<table>
<thead>
<tr>
<th>Well Cost</th>
<th>Breakeven Wellhead Price (AT IRR of 20%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>$41</td>
</tr>
<tr>
<td>4000</td>
<td>$39</td>
</tr>
<tr>
<td>6000</td>
<td>$35</td>
</tr>
<tr>
<td>8000</td>
<td>$32</td>
</tr>
</tbody>
</table>
Crude Oil Prices – June 20, 2019

Pricing Data: Bloomberg & CME (LLS-Argus)

Cushing $56.74

Brent $64.23

WTI + $7.49

Houston WTI WTI + $6.81
US Crude Oil Storage Volumes and Spot Prices

- Cushing OK WTI Spot Price FOB $/bbl
- U.S. Ending Stocks of Crude Oil (Minus SPR) Mbbl
North Dakota Oil Production Forecast
Assumes Current Technology – Enhanced Oil Recovery Not Included
Major Oil Transmission Systems
Williston Basin Oil Production & Export Capacity, BOPD
Assumes Current Technology – Enhanced Oil Recovery Not Included

Production forecast is for visual demonstration purposes only and should not be considered accurate for any near or long term planning.
Major Gas Pipeline and Processing Infrastructure

Upcoming or Recent Plant Expansion

- No
- Yes
**Project Highlights**

- 67 Miles - 20” Pipeline
- 19 Miles - 12” Pipeline
- $220+ Million
- 250,000 MCFD Capacity (expandable)
- Expandable to 375,000 MCFD
- End of 2021 Proposed Completion
- Residue Gas Service From North of Lake Sakakawea to Northern Border Pipeline in McKenzie County
WBI Energy – North Bakken Expansion Project

Project Highlights

- 67 Miles - 20" Pipeline
- 19 Miles - 12" Pipeline
- $220+ Million
- 250,000 MCFD Capacity (expandable)
- Expandable to 375,000 MCFD
- End of 2021 Proposed Completion
- Residue Gas Service From North of Lake Sakakawea to Northern Border Pipeline in McKenzie County
Northern Border Pipeline

- 42” Pipeline
- Carries Canadian (Port of Morgan) and Domestic Gas
- Receives Gas From ND Plants, WBI Transmission Interconnections, and WY Pipelines (Bison & Grasslands)
- Midcontinent Deliveries

*Data Source: Northern Border IPS
Conclusion: **IF** no other gas export options open and all other deliveries on other pipelines stay static, ND gas production could increase 0.82-1.12 BCFD (from April-19) before Northern Border is 100% Bakken production. **BTU management becomes increasingly important for Bakken residue gas.**
Two Proposed Options:

Stateline/Watford City to Ventura
- 580 Mtdh Incremental (~525 MMCFD)
- Phase 1: Q3 2021
- Phase 2: Q4 2023

Stateline/Watford City to Cheyenne
- 430 Mtdh Incremental (~390 MMCFD)
- Phase 1: Q3 2021
- Phase 2: Q4 2022
Conclusion: **IF** no other gas export options open and all other deliveries on other pipelines stay static, ND gas production could increase 0.82-1.12 BCFD (from April-19) before Northern Border is 100% Bakken production. *BTU management becomes increasingly important for Bakken residue gas.*

- Gas Plants With C2+ Capture
  ~1,010+ BTU Residue Gas
- Gas Plants With C3+ Capture
  ~1,150+ BTU Residue Gas
Bakken Natural Gas Infrastructure

JJ Kringstad - North Dakota Pipeline Authority
Regional NGL Infrastructure

- Alliance Tioga Lateral
- Prairie Rose
- Alliance (Dense Phase Gas)
- Northern Border (High CO2%)
- ONEOK (Y-Grade)
- Vantage (Ethane)
- Kinder
North Dakota Captured* NGL’s

*Non-flared NGL’s & Assumes 10 GPM
NGL Pipeline Takeaway Options

[Graph showing pipeline takeaway options over time with various pipelines and dates marked]

- Northern Border (ND Prod.)
- Aux Sable Prairie Rose
- Alliance Tioga Lateral
- ONEOK Elk Creek
- WBI Transmission
- ONEOK Bakken NGL
- Vantage
- Elk Creek Expansion (Proposed)
- Case 1: All Captured NGLs
- Case 2: All Captured NGLs
ONEOK Elk Creek NGL Pipeline

Project Highlights
- 900 Miles - 20” Pipeline
- $1.4 Billion
- 240,000 BPD Capacity
- Expandable to 400,000 BPD
- End of 2019 Proposed Completion
- Y-Grade Transportation
Contact Information

Justin J. Kringstad, Director
North Dakota Pipeline Authority

600 E. Boulevard Ave. Dept. 405
Bismarck, ND 58505-0840

Phone: (701)220-6227
Fax: (701)328-2820
E-mail: jjkringstad@ndpipelines.com

Websites:
www.pipeline.nd.gov
www.northdakotapipelines.com