

Bakken Economic Impact

North Dakota Petroleum Council
White House Office of Management and Budget



❖ North Dakota Producing 1 Million Barrels/Day of oil

- Over 10,000 wells and growing
- Only Texas, Alberta, and 19 countries produce 1 M b/d
- Number of wells expected to more than double

❖ North Dakota Impact

- After decades of outmigration, small town consolidations, lack of economic development
- 120,000 new ND citizens
- \$30 Billion in economic contribution from oil and gas industry
 - 38% to households, 24% to retail
- 11.5% in production and extraction taxes to state
 - Pays 80% of roads and schools
 - Citizens 40% property tax reduction 2013
- Lowest unemployment and fastest growing economy in U.S.
- Over \$2 billion paid to private royalty owners
- Every well generates an estimated \$4.8 million annually and 120 jobs

❖ National Impact

- 700,000 BOPD moved by Rail
- Revitalizing U.S. Refineries on East Coast & West Coast
- Jobs Creation—65,000 in ND alone
- 35-40% in DOT 111 Railcars
- 60% fleet (CPC 1232) built proactively by industry
- Replacement Railcars: \$3.6-5.2 Billion;
- Eliminate DOT 111 cars: \$10 Billion in stranded investment
- ND and TEXAS produce >50% domestic oil production
- Domestic energy production now satisfies 84% of total U.S. energy needs
- U.S. crude oil imports have dropped by 3.3 MM b/d (23%) since June, 2005
 - Imports since 2003: Saudi Arabia (-23.2%), Mexico (-45.8%), Venezuela (-36.2%)
- IEA predicts U.S. will be largest oil exporter in world by 2016
 - From 9.2 MM BOPD currently to 11.6 MM BOPD

❖ Opportunities for future

- Greater freedom in Middle Eastern foreign policy
 - Rivals price-setting capabilities of OPEC
 - Opportunity to lift export ban
 - Boost economic growth by 0.7 to 1.2%
 - 300,000 potential jobs
 - \$38.1 Billion in GDP increase

Economic Contribution of Petroleum Industry 2005 to 2011			
	2005	2011	% Change
Total Economic Contributions**	\$4.4 billion	\$30.4 billion	592%
Government Revenues	\$378 million	\$2.6 billion	600%
Industry Jobs	5,051	40,856	709%
Household Income	\$1.5 billion	\$11.6 billion	512%



BKN QUALITY & SAFETY INITIATIVE

NDPC Bakken Crude Characterization Task Force

Presentation to
Office of Management and Budget
Washington, D.C. – July 7, 2014

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Agenda

- **Overview**
 - Executive Summary
 - Description of North Dakota Petroleum Council (NDPC) Study
 - Other Recent Reports and Presentations

- **Details of NDPC Study**
 - Comprehensive Sampling and Testing
 - Round Robin Testing – SGS vs. another major lab
 - Loading vs. Destination Testing
 - Vapor Pressure Seasonality Testing

- **Conclusions**

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Executive Summary

- In early 2014, the NDPC commissioned a comprehensive sampling and testing program to establish and understand Bakken crude oil quality
- This study, in conjunction with other recent work, shows:
 - Bakken is a light, sweet crude with an average API Gravity of 40-43; similar to other light crudes, e.g. WTI, Brent
 - While rich in the naphtha and diesel range components, Bakken is not materially different in vapor pressure or light ends content from other light crudes
 - The Bakken crude is extremely consistent across the entire basin and consistent from load to delivery point.
 - Bakken crude is correctly classified as a Class 3, Flammable Liquid.
 - Packing group designation can vary depending on D86 IBP
 - NDPC recommends all producers categorize Bakken as Packing Group I (consistent with recent API working group notification)

Project Overview

- NDPC commissioned a comprehensive and tightly controlled sampling and testing program to establish a quality baseline
- Bakken (BKN) crude sampled at both well and rail sites
 - 15 well sites and 7 rail-loading terminals
 - Rail sites represent about 50% of total ND rail capacity
 - Significant geographic dispersion for both well and rail sites
- Sampling initiated on 3/25/14 and completed on 4/24/14
 - 7 samples at each site
 - Initial samples at well sites included both top and bottom
- Final report in progress
- Supplemental data provided by member companies

Project Contractors

- **Turner, Mason & Company – Overall Project Coordinator**
 - Internationally recognized refining consultants
 - 43 years in business
 - Project Lead - John Auers, P.E., Executive Vice President
 - TM&C staff supplemented by outside expertise
 - Dennis Sutton - >40 years crude quality experience
- **SGS - Sampling and Testing Contractor**
 - World leading testing and inspection company
 - Over 135 years in business
 - Utilized both local (Williston, ND) and U.S. Gulf Coast laboratories

Testing Protocol

- Testing focused on parameters relevant to DOT hazardous material compliance
- The test slate included:
 - API Gravity
 - Flash Point by ASTM D3278
 - Initial Boiling Point (IBP) by ASTM D86
 - Vapor Pressure by ASTM D6377 at 37.8°C (100°F) *
 - Light Ends Analyses by IP344
 - High Temperature Simulated Distillation (HTSD) by ASTM D7169

* Results about 1 psi higher than if D323 RVP test method is used

Operating Data

- To develop best practices, key operating conditions were recorded during sampling
 - Ambient temperatures
 - Separator and treater temps and pressures
 - Production rates/last movements out of tank
 - Tank heights
 - Vapor capture status

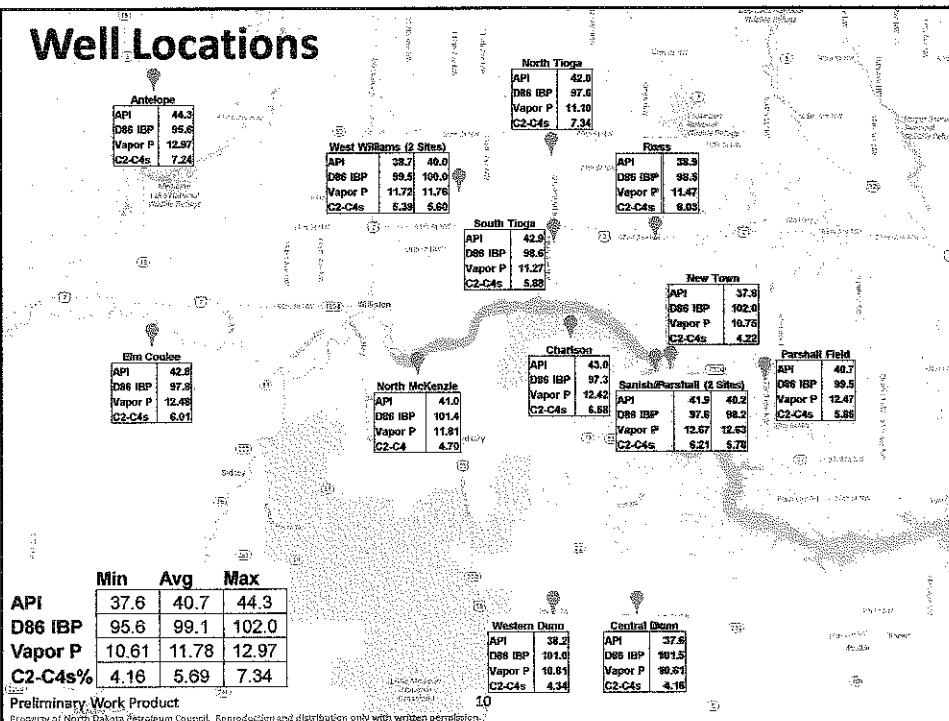
Other Recent Related Work

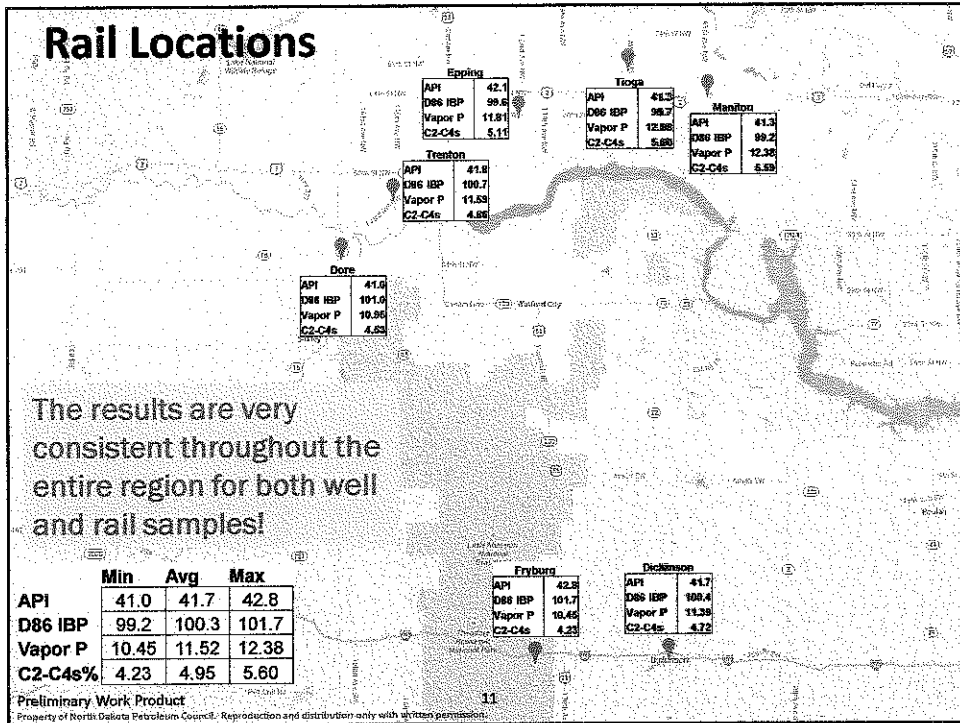
- AFPM Survey of Bakken Crude Oil Characteristics- published May 14, 2014
 - A compilation of available data from a variety of sources
- API RP3000 Classifying and Loading of Crude Oil into Rail Tank Cars - draft available June 27, 2014
- Bakken Light Ends Brief - presentation by Randy Segato, Suncor to the Crude Oil Quality Association, February 2014
- Transportation Safety Board of Canada Laboratory Report LP 148/2013
- Awaiting PHMSA data

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Well Locations





Consistent Quality – Rail vs. Well

- Quality is consistent between well and rail
- Indicates there is no spiking of crudes before shipment

	Well		Rail	
API Gravity	40.6	41.7		
D86 IBP (°F)	99.1	100		
VPCR D6377 (psi)	11.8	11.5		
Light Ends %				
Ethane	0.24	0.23		
Propane	1.63	1.39		
Isobutane	0.65	0.58		
n-Butane	3.16	2.75		
Isopentane	1.52	1.42		
n-Pentane	2.90	2.72		
C2-C4s	5.69	4.95		
C2-C5s (excluding Cyclopentane)	10.12	9.10		

SimDist (°F)	Well	Rail
IBP	<97	<97
5%	106	113
10%	153	165
20%	231	238
30%	310	316
40%	394	396
50%	481	482
60%	572	572
70%	671	670
80%	785	787
90%	935	939
95%	1053	1060
FBP	1305	1317

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Comparison of Crude Properties

Crude Grade	Origin	API Gravity	Sulfur (wt %)
Bakken	North Dakota, USA	40- 43	~0.1
WTI	Texas, USA	37- 42	~0.4
Light Louisiana Sweet (LLS)	Louisiana, USA	36-40	~0.4
Eagle Ford	Texas, USA	30-60+	~0.1
Brent	North Sea, UK	37-39	~0.4
Arabian Light	Saudi Arabia	32-33	~2.0
Arabian Heavy	Saudi Arabia	26-28	~3.0
Western Canadian Select (WCS)	Alberta, Canada	19-22	~3.5

Note: Bakken data reflects bulk of samples. Other data obtained from various sources including Capline, COQA, BP, ExxonMobil, and crudemonitor.ca.

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Supplemental Work-Round Robin Testing

- As the work progressed, questions arose regarding lab-to-lab precision
- Thus, three different labs tested four identical Bakken crude samples
- The samples were analyzed for:
 - API Gravity by ASTM D5002
 - Vapor Pressure of Crude at 37.8°C, 4:1 V/L Ratio, by ASTM D6377
 - Initial Boiling Point (IBP) by ASTM D86 distillation

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Round Robin Testing

- Excellent agreement on API gravity and Vapor Pressure
 - Supports sample integrity and lab performance
- Poor agreement on D86 IBP
 - Results for the same sample in each case fall on either side of 95°F; Level used for PG I/PG II determination
 - Underscores shortcomings of tests required by PHMSA
 - API task force has also recognized this and recommends use of a different method (ASTM D7900)

Loading vs. Destination Testing

- Tested Bakken Shipped on Train from ND; April 2014
 - 5 cars sampled
 - Loading in North Dakota - Discharge at St. James, LA
 - All analyses conducted by Intertek at labs in ND and LA
- Analyses conducted included:
 - Vapor Pressure of Crude at 37.8°C and a V/L ratio of 4, utilizing ASTM D6377
 - Flash Point by ASTM D56
 - H₂S in Vapor Phase at 77°F, using ITM 3468
 - Light Ends Analysis by Modified ASTM D6730

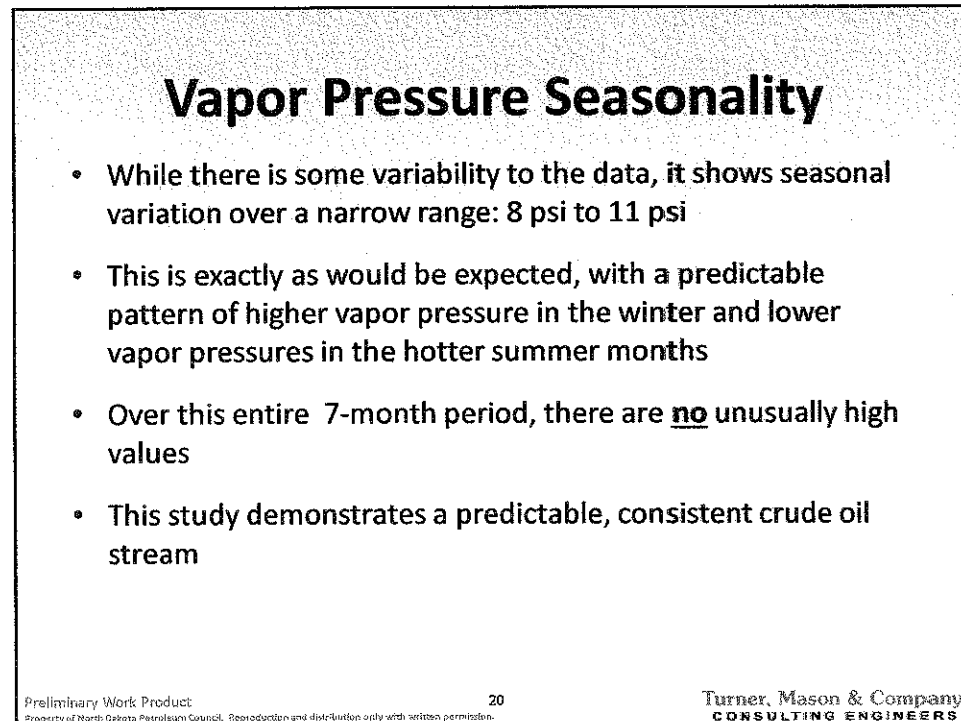
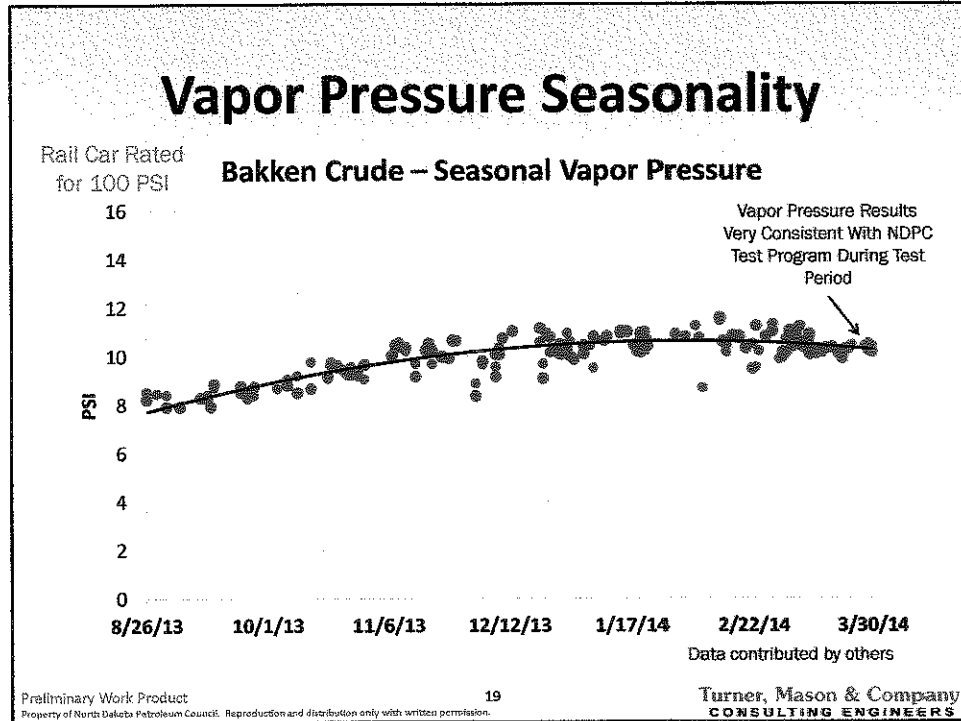
Summarized Results

Test	Units	Avg. NDPC Data for		
		Avg. ND Rail Terminal Car Samples	Avg. St. James Rail Terminal Car Samples	Same Rail Terminal
VPCR 4 (37.8° C)	psi	10.47	10.61	10.45
IBP	°F	94.7	90.4	101.7
Flash Point	°F	<50	<50	<73
H2S in Vapor Phase	ppm v/v	<1	<1	
C2-C4s	Vol %	4.00	4.08	4.23
C2-C5s (excluding cyclopentane)	Vol %	8.01	7.89	8.13

Conclusion: Excellent agreement except for IBP

Vapor Pressure Seasonality

- One NDPC member's rail terminal has been measuring Reid Vapor Pressure (RVP) at their rail-loading facility for each unit train loaded since initiating operations in 2013
- The rail terminal receives Bakken quality crude oil from both truck deliveries and pipeline receipts
- The onsite test method is ASTM D323-B (Reid, 100°F)
- This data is summarized on the following slide



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Bakken Crude - Conclusions

- BKN crude is a light sweet crude oil
 - API gravity ~40 to 43° and sulfur < 0.2 wt. %
 - Similar to other light sweet crude oils
- Quality is very consistent
 - Both well-to-well and throughout the supply chain
 - Little variation throughout entire basin
 - Shows no “spiking” with NGL’s before rail shipment
 - No practical changes in quality during transit
- Classified correctly
 - As a Class 3 Flammable Liquid
 - Recommended to be categorized as Packing Group I

Discussion and Questions?

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