



# BAKKEN CRUDE

## QUALITY ASSURANCE STUDY

### ABOUT THE RESEARCHERS

The North Dakota Petroleum Council (NDPC) commissioned Turner, Mason & Company and SGS Laboratories to study the range and variability of Bakken crude qualities. Turner, Mason & Company is an internationally recognized refining consultant with more than 43 years of experience in the petroleum and petrochemical industries. SGS Laboratories is a world leading testing and inspection company and has provided inspection, verification, testing, and certification services for more than 135 years.

### METHODOLOGY

With cooperation from North Dakota producers and rail operators, a total of 15 well sites and 7 rail loading facilities covering the entire Bakken area were sampled and tested multiple times over a one month period, ending in late April. With more than 150 samples and a broad slate of tests conducted, this quality program is perhaps the most comprehensive of its kind for a U.S. oilfield ever.

Sampling began on March 25, 2014 and was completed on April 24, 2014. Seven samples were taken from each location, with well sites representing producers with more than 50 percent of total North Dakota production and well sites representing more than 50 percent of North Dakota rail capacity. Testing is now 95 percent complete and a final report on study results will be released in June.

Testing focused on parameters that are relevant to Department of Transportation (DOT) hazardous material compliance. The test slate includes:

- **API Gravity:** the density of liquid petroleum products. The API gravity is used to classify oils as light, medium, heavy, or extra heavy.
- **Vapor Pressure:** the pressure exerted by a vapor on the solid or liquid phase with which it is in equilibrium. In this case, it would refer to the liquids ability to hold gases rather than releasing them into vapor.
- **Flash Point:** the lowest temperature at which it can vaporize to form an ignitable mixture in air. Measuring a flash point requires an ignition source.
- **Initial Boiling Point (IBP):** the temperature a liquid will start form vapor in the air.
- **Sulfur weight:** measurement of the presence of sulfur in crude. A sweet crude has a low sulfur content and corrosivity while a sour crude has high sulfur content and higher rate of corrosivity.

**STUDY RESULTS & BAKKEN CHARACTERISTICS SUMMARY**

MEASUREMENT	CHARACTERISTIC	WHAT IT MEANS
API	The average weight for Bakken crude was 41.0°.	A light crude must have an API gravity of greater than 31.1°. The gravity for Bakken is as expected for light crude.
Vapor Pressure (PSI)	Average of 11.7	This is typical for a light crude and means it can safely be transported using existing DOT-111 tank cars. DOT-111 tank cars are designed to accept vapor pressures of up to 100 PSI, meaning even Bakken’s maximum vapor pressure (14.4) is three times lower than the accepted threshold.
Flash Point	<73° F	This is consistent with a Class 3, flammable liquid of Packing Group I or II.
Initial Boiling Point	Avg.: 99.6°F Max: 107.2°F Min: 91.9°F	Bakken crude falls within the normal range for classification of a Packing Group I or II flammable liquid, and has been properly categorized, packed and transported as such. The study did identify flaws in the classification methodology, however, which are summarized below.
Sulfur Weight %	Avg.: 0.14	Bakken is a sweet crude low in sulfur and hydrogen sulfide and therefore not corrosive.

The study also showed that these qualities remained consistent throughout the Bakken field and did not change significantly during transit via rail to its destination more than 1,500 miles away. The study also found that the vapor pressure stayed within a relatively narrow range despite widely varying seasonal atmospheric temperatures.

**CONCLUSION:** The study confirmed that Bakken is a light, sweet crude with low corrosivity, and that it may be hauled safely using existing DOT-111 tank cars under current federal specifications.

**STEPS FORWARD**

The study also found that one of the tests DOT requires to determine the packing group for flammable liquids like crude oil is not optimal. The limitations of the test required for measuring initial boiling point can result in the same sample of crude being assigned to Packing Group I (<95°F IBP) or Packing Group II (>95°F IBP). The American Petroleum Institute is currently working to determine improved, more precise classification standards for assigning flammable liquid packing groups.

The data gathered by the study provides a thorough baseline of Bakken crude characteristics. NDPC recommends using study results to establish a new crude oil benchmark to complement existing benchmarks like WTI and Brent. The benefits of doing so would be threefold:

1. A benchmark will create a more accurate market price reference for buyers and sellers of crude oil
2. Producers and shippers will be compelled to follow specific field standards in order meet the BKN specifications; and,
3. It will ensure that proper Bakken oil characterization continues going forward.