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U.S. DEPARTMENT OF ENERGY

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Chairmen Lummis and Broun, Ranking Members Swalwell and Maffei, and members of the Subcommittees, thank you for the opportunity to appear before you today on the subject of *Bakken Petroleum: The Substance of Energy Independence*.

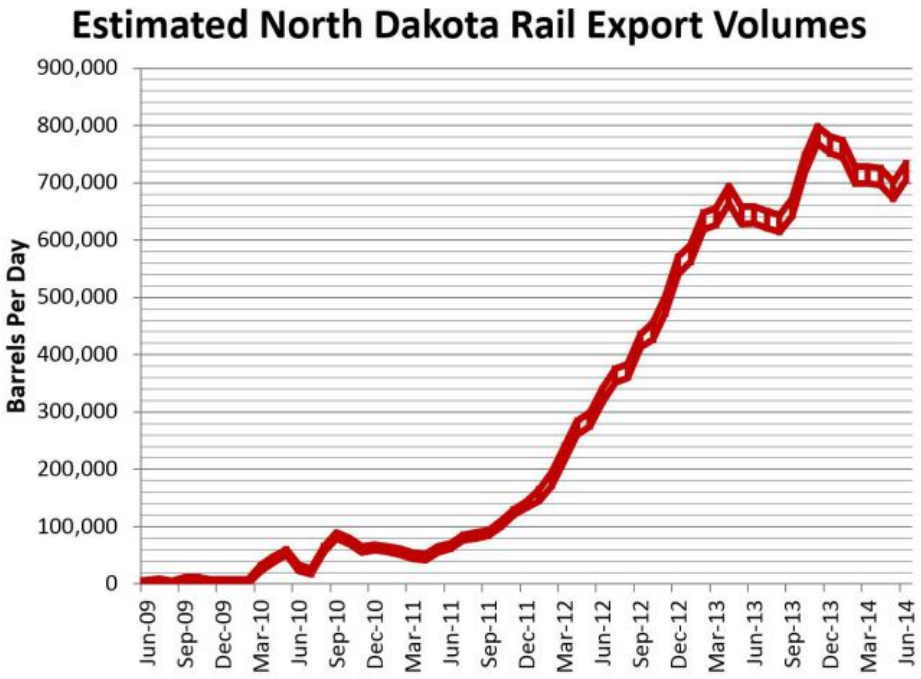
The U.S. is experiencing a renaissance in oil and gas production. According to the Energy Information Administration (EIA), U.S. oil production averaged an estimated 8.5 million barrels per day (bbl/d) in July, the highest monthly level of production since April 1987. The 2015 forecast of 9.3 million bbl/d represents the highest annual average level of oil production since 1972. This domestic oil boom is due primarily to new unconventional production of light sweet crude oil from tight-oil formations in North Dakota (Bakken) and Texas (Eagle Ford and Permian Basin). These private developments were made possible, in part by three decades of industrial research cost-shared by the Department of Energy into technologies such as hydraulic fracturing, horizontal drilling, and three dimensional mapping.

The Department of Energy (DOE) has been actively engaged with our colleagues at the Department of Transportation (DOT) in addressing the challenges associated with moving this wealth of new production to market. While DOE does not collect data on the specific volume of petroleum products transported by rail, the Energy Information Administration has examined data from the Association of American Railroads and indicated that there has been a steady increase in the volume of crude oil transported by rail in the past several years. This is due to the increases in crude oil production in not only North Dakota, but also Texas and other states. In some regions, crude oil production has exceeded the capacity of existing pipelines to move oil to refineries in other areas of the country; in other regions where significant crude oil production is a recent development (for example, in the Bakken region) the available pipelines may not serve the markets with the greatest demand for the oil and the market is still trying to determine whether there is sufficient customer demand for new pipeline capacity to support financing it. Furthermore, moving crude oil from the Bakken to east and west coast refineries via rail

often provides a higher value market opportunity for these light crude oils than moving the crude oils by pipeline to the Gulf Coast where there is an excess of light crude oil relative to refinery needs.

There is growing public concern over the safety of transporting crude oil from the Bakken and other tight oil formations. It has become clear that the continued realization of this tremendous resource may require additional measures to address safety concerns of the communities where it is extracted and through which it is transported.

Fundamentally, the responsibility for safe transportation of these materials rests with the transportation companies moving them, and the liability for accidents must remain with the private sector. Notwithstanding, the public has legitimate concerns and looks to the government for appropriate oversight and regulations to ensure their safety. These public concerns were voiced in Bismarck, North Dakota on August 8 at a public forum in which Secretary of Energy Moniz and Secretary of Transportation Foxx participated as part of the Administration's Quadrennial Energy Review (QER). At the forum, participants discussed the challenges associated with the increased transport of crude oil by rail. The graph below from the North Dakota Pipeline Authority shows the dramatic growth in rail transportation over the last five years.



With increasing volumes of crude oil being shipped by rail, ensuring public confidence in the safety of these shipments is a priority, particularly because this domestically produced oil is important for American energy security and our economic prosperity.

In light of this new and growing resource, various efforts have been launched by Federal and State governments and industry to better understand the safety aspects of moving Bakken and other crude oils from tight oil formations. I would be happy to talk about current studies that have been reviewed by DOE.

The most detailed understanding of the chemical and physical characteristics of Bakken crude oil is based on two external studies.

- One study was conducted by DOT's Pipeline and Hazardous Materials Safety Administration (PHMSA) as part of its Operation Safe Delivery, which focuses on examining the entire system

for delivery of crude oil and applying a comprehensive approach to ensure the safe transportation of crude oil moving by rail

- The other study was performed by Turner Mason and Company on behalf of the North Dakota Petroleum Council (NDPC).

The NDPC and PHSMA studies are based on tests and analyses of the physical and chemical properties of a statistically significant set of Bakken crude samples collected from aboveground storage tanks at various individual leases and rail loading facilities throughout the Bakken. DOE's review of these two studies indicates that Bakken crude oil is properly classified as a "light, sweet crude oil".

- Light crude oil refers to crude oil having a comparatively high American Petroleum Institute (API) specific gravity, which is a measurement of the density of the oil. The higher the API specific gravity, the lighter the crude oil. While there is no precise definition, light crude oil generally has an API gravity of 38 degrees or more, while medium crude falls in a range between 22 and 38 degrees. Bakken crude oil has an API gravity between 40 and 43.
- Crude oil containing generally more than 0.5 weight percent of sulfur is called sour crude oil and requires more processing. Crude oil containing less than 0.5 weight percent sulfur is considered sweet crude oil.
- Bakken crude oil as compared to other crude oils has a comparatively higher concentration of "lighter end" hydrocarbons (e.g., ethane, propane, and butanes), which contribute to its also having a somewhat higher vapor pressure than many crude oils, (on the order of 10-14 pounds per square inch absolute (psia)) which may have vapor pressures of less than 10 psia.

"Volatility" is a measure of the tendency for a material to vaporize – that is, the ease with which it changes from a liquid to a gaseous state. Crude oil contains numerous different hydrocarbon

components with different volatilities. The lower molecular weight hydrocarbon constituents such as ethane, propane and butanes are more volatile than hydrocarbons with higher molecular weights, and the volatility of any particular crude oil will increase as the concentrations of these lower molecular weight constituents rises.

Based on laboratory tests and analyses of the samples that it collected, PHMSA has preliminarily concluded that Bakken crude oil is more volatile than most other types of crude and has further indicated that this greater volatility correlates to increased ignitability and flammability. That conclusion takes into consideration such properties as gas content (i.e., the relative concentrations of ethane, propane and butanes), a low flash point, a low boiling point and high vapor pressure.

DOE has not attempted to make any detailed comparison between Bakken crude oil and other forms of crude oil. However, based on the work done by both PHMSA and the NDPC and drawing on its general knowledge of crude oils, DOE considers Bakken to be a light sweet crude oil that has a comparatively higher concentration of lighter end hydrocarbons and a higher vapor pressure than many other crude oils. On that basis, it can be considered more volatile than some, but not necessarily all, of the other crude oils produced in the U.S.

DOE believes that more scientific analysis is needed to better define the relationship between volatility and ignitability/flammability, to identify what characteristics of a complex mixture of hydrocarbons are most representative of its propensity to ignite, and to better understand the combustion characteristics of various types of crude oil in the context of the conditions typically experienced after a derailment or other type of train accident.

In support of DOT, which has the preponderance of Federal regulatory responsibilities in this area, the Administration is considering further investigation into the properties of these crudes from tight oil

formations, and how these properties may attribute to their safe handling and transport. DOE is currently working with PHMSA to finalize a statement of the scope of work for further technical assistance. This research is independent from the PHMSA rulemaking and study under discussion today. Any research undertaken will be peer reviewed prior to dissemination, and will follow government-wide information quality guidelines.

The key questions yet to be addressed are whether the chemical makeup of the crude oils from the Bakken and other tight oil formations differs from conventional crudes, and if so, how this difference influences the required conditioning and transportation. Understanding the interplay of the following characteristics will be important:

- Material properties (i.e. chemistry, phase behavior, and trace components)
- Reactivity (i.e. combustion and corrosion)
- Reservoir characteristics (i.e., mineralogy) and
- Mechanical agitation (i.e. ,tank dynamics)

Further work might also be done to discern our experience transporting similar crudes historically.

Any problem definition phase would be directed in large part toward the key questions identified by PHMSA for transportation safety. These could include collection and analysis of representative samples of Bakken and other tight crude oils as well as a review of available studies of the characteristics of these crude oils and could potentially benefit from using the information and testing methodology from the Strategic Petroleum Reserves. The analytical methods will include both chemical analyses to identify the presence of volatile constituents (e.g., methane, ethane, and propane) and an evaluation of physical properties that will determine the release of entrained hydrocarbons upon the type of pressure drop

expected in realistic tank rupture scenarios (i.e., at temperatures and pressures consistent with those seen during transportation by rail).

Finally, I would like to mention that support for additional research was acknowledged by North Dakota Governor Jack Dalrymple when he spoke with Secretary of Energy Moniz and Secretary of Transportation Foxx at the August 8 QER meeting in Bismarck, North Dakota. He shared the concern that any safety issues specific to Bakken and other tight oils need to be investigated and addressed.

Chairmen Lummis and Broun, and members of the Subcommittees, this completes my prepared statement. I would be happy to answer any questions you may have at this time.