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Crude Oil Properties Relevant to Rail Transport Safety: In Brief

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Summary

The dramatic increase in U.S. crude oil production, coupled with the increase in crude oil transport by rail, has raised questions about whether properties (e.g., flammability) of these crude types—particularly Bakken crude oil from North Dakota—differ sufficiently from other crude oils to warrant any additional handling considerations. The U.S. Pipeline and Hazardous Materials Safety Administration (PHMSA) issued a Safety Alert to notify emergency responders, shippers, carriers, and the public that recent derailments and resulting fires indicate that the type of crude oil transported from the Bakken region of North Dakota may be more flammable than traditional heavy crude oil. The alert reminds emergency responders that light sweet crude oil, such as that coming from the Bakken region, pose significant fire risk if released from the package (tank car) in an accident. PHMSA has expanded the scope of lab testing to include other factors that affect proper characterization and classification of crude oil such as volatility, corrosivity, hydrogen sulfide content and composition/concentration of the entrained gases in the material.

All crude oils are flammable, to a varying degree. Further, crude oils exhibit other potentially hazardous characteristics as well. The growing perception is that light volatile crude oil, like Bakken crude, is a root cause for catastrophic incidents and thus may be too hazardous to ship by rail. However, equally hazardous and flammable liquids from other sources are routinely transported by rail, tanker truck, barge, and pipeline, though not without accident.

A key question for Congress is whether the characteristics of Bakken crude oil make it particularly hazardous to ship by rail, or are there other causes of transport incidents, such as poor maintenance practices, inadequate safety standards, or human error.

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Introduction

The dramatic increase in U.S. and Canadian crude oil production in recent years, coupled with the increase in crude oil transport by rail, has raised questions about whether properties (e.g., flammability) of these crude types—particularly Bakken crude oil from North Dakota and Canada's oil sands—differ sufficiently from other crude oils to warrant any additional handling considerations.[1] The U.S. Pipeline and Hazardous Materials Safety Administration (PHMSA) recently fined several oil companies for improperly classifying their crude oil rail shipments. Potential safety concerns have similarly been raised over pipeline shipments of crude oil from Canada's oil sands projects.[2]

Crude oil is highly variable and can exhibit a wide range of physical and chemical properties. In fact, crude oil samples drawn from the same oil field can vary significantly. Lighter oils may be prone to ignite more readily than heavier crude oils depending on the range of light hydrocarbons they contain. In addition to flammability, other factors such as specific gravity (density) and entrained gases may also play important factors in rail car loading, and corrosivity and sulfur content may affect rail car structural integrity. Bakken crude oil (traded as North Dakota Light) is a light sweet crude oil high in light-end paraffinic range hydrocarbons,[3] as well as heavy-end asphaltic range hydrocarbons.[4] Light sweet crudes, like Bakken, are easier to process directly into gasoline and middle-distillate fuels (e.g., diesel) than heavier crude oils.[5]

PHMSA has issued a Safety Alert to notify emergency responders, shippers, carriers, and the public that recent derailments and resulting fires indicate that the type of crude oil transported from the Bakken region of North Dakota may be more **flammable** than traditional heavy crude oil.[6] Under PHMSA's "Operation Classification," as it is officially known, tank car inspections will determine whether a tank car's contents are properly classified based on factors that include **volatility**, **corrosivity**, **hydrogen sulfide** content and the composition or concentration of **entrained gases** inside the contents.

PHMSA is reinforcing the requirement to properly test, characterize, classify, and, where appropriate, sufficiently degasify hazardous materials prior to and during transportation. "Operation Classification" will be an ongoing effort, and PHMSA will continue to collect samples and measure the characteristics of Bakken crude as well as oil from other locations.

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[1] See CRS Report R42032, *The Bakken Formation: Leading Unconventional Oil Development*, by Michael Ratner et al., and CRS Report RL34258, *North American Oil Sands: History of Development, Prospects for the Future*, by Marc Humphries.

[2] See CRS Report R42611, *Oil Sands and the Keystone XL Pipeline: Background and Selected Environmental Issues*, coordinated by Jonathan L. Ramseur.

[3] Paraffins are simple chain hydrocarbons.

[4] K.J. Bryden, E.T. Habib Jr., and O.A. Topete, "Processing Shale Oils in FCC: Challenges and Opportunities," *Hydrocarbon Processing*, September 1, 2013, http://www.hydrocarbonprocessing.com/Article/3250397/Processing-shale-oils-in-FCC-Challenges-and-opportunities.html.

[5] See CRS Report R41478, *The U.S. Oil Refining Industry: Background in Changing Markets and Fuel Policies*, by Anthony Andrews et al.

[6] The Pipeline and Hazardous Materials Safety Administration, "Safety Alert—January 2, 2014, Preliminary Guidance from OPERATION CLASSIFICATION." This advisory is a follow-up to the PHMSA and Federal Railroad Administration (FRA) joint safety advisory published November 20, 2013 [78 FR 69745], http://www.phmsa.dot.gov.

This report discusses the properties that PHMSA addressed in its safety alert, provides background on the composition of various U.S. crude oils, and compares Bakken crude oil to other crude oil produced or transported in the United States. For further background on crude oil transport by rail, see CRS Report R43390, *U.S. Rail Transportation of Crude Oil: Background and Issues for Congress*, by John Frittelli et al.

Flammability

There is some risk with mixing any type of crude oil with air in the proper proportion, in the presence of a source of ignition, which can cause rapid combustion or an explosion.[7] This proportion is the "flammable range" and or alternatively the "explosive range." The flammable range includes all concentrations of flammable vapor or gas in air, in which a flash will occur or a flame will travel if the mixture is ignited at or above a certain temperature (flash point). The Lower Flammable Limit (LFL) is the minimum concentration of vapor or gas in air below which propagation of flame does not occur on contact with a source of ignition. The Upper Flammable Limit (UFL) defines the maximum proportion of vapor in air above which propagation of flame does not occur. The terms Lower Explosive Limit (LEL) and Upper Explosive Limit (UEL) are used interchangeably with LFL and UFL.

Liquids having a flash point at or above 100ºF (37.8ºC) are classed as "combustible" and below 100ºF (37.8ºC) as "flammable." Crude oils may differ in terms of combustibility or flammability depending upon their volatile components. The Occupational Safety and Health Administration (OSHA) requires manufacturers and shippers of hazardous materials to provide Material Safety Data Sheets (MSDS) that must include the material's fire and explosive properties, among other properties.[8] PHMSA requires similar reporting information.[9]

According to a Material Safety Data Sheet prepared by Cenovus Energy, Bakken crude has a flash point of 95º F, making it a flammable liquid.[10] Cenovus lists benzene in concentrations of 0.1% to 1% by volume, which is relatively high compared to other crudes. Benzene is a naturally occurring hydrocarbon in the gasoline range and suspected as a cause of Bakken crude's low flash point.

The PHMSA alert reminds emergency responders that light sweet crude oil, such as that coming from the Bakken region, poses significant fire risk if released from the package (tank car) in an incident. Crude oil falls into Department of Transportation (DOT) packing group (PG) I—most serious hazard—or II—moderate hazard.[11] In the recent Lac-Megantic (Quebec) train derailment involving crude shipped from North Dakota, the shippers had reportedly mislabeled the oil as PG III (low hazard).[12]

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[7] Department of Labor, Occupational Safety and Health Administration, Flammable and Combustible Liquids—29 C.F.R. 1910.106, https://www.osha.gov/dte/library/flammable_liquids/flammable_liquids.html.

[8] Material Safety Data Sheets may be used to comply with OSHA's Hazard Communication Standard, 29 CFR 1910.1200. Standard must be consulted for specific requirements.

[9] 49 C.F.R. Parts 172 and 173.

[10] Cenovus Energy Inc., 500 Centre Street Se, PO Box 766, Calgary, AB T2P OM5.

[11] 49 C.F.R. Part 173, Subpart D—Definitions Classification, Packing Group Assignments and Other Exceptions for Hazardous Materials Other Than Class 1 and Class 7.

[12] Monique Beaudin, "Crude Oil in Lac-Megantic Derailment Was Mislabeled, Transportation Safety Board Says," *The Gazette*, October 7, 2013, http://www.montrealgazette.com/
(continued...)

DOT Package Groups

Packaging Group	Hazard	Flash Point	Boiling Point
I	Most Serious	. . .	<95° F
II	Moderate	<73° F	>95° F
III	Low	73° –140 °F	>95° F

Note: PG I is determined solely based on boiling point.

In November 2013, the Association of American Railroads (AAR) urged PHMSA to increase federal tank car safety by requiring higher standards for DOT-III tank non-pressure cars built to transport flammable liquids, and all existing cars to be retrofitted to this higher standard or phased out of flammable service.[13] (See "Rail Car Capacity and Load Limit" regarding DOT-III tank cars.) AAR specifically recommended that PHMSA increase design standards for new cars, or require a retrofit of existing cars to eliminate the option for rail shippers to classify a flammable liquid with a flash point between 100 and 140 degrees Fahrenheit as a combustible liquid.

Volatility

Volatility refers to petroleum's evaporation characteristics. ASTM D323-08 *Standard Test Method for Vapor Pressure of Petroleum Products (Reid Method*) is used to determine the vapor pressure at 37.8°C (100°F) of petroleum products and crude oils with initial boiling point above 0°C (32°F). (ASTM refers to the American Society for Testing and Materials.) Vapor pressure is an important consideration for both crude oil producers and refiners in determining general handling and initial refinery treatment. Vapor pressure also serves as an indirect measure of the evaporation rate of volatile petroleum solvents; with higher vapor pressures indicating greater losses from evaporations. The New York Mercantile Exchange (NYMEX) contract specifications for crude oil futures contracts restrict Reid Vapor Pressure (RVP) to less than 9.5 psi at 100º F.[14] Bakken crude oil has an RVP of at least 8.75.

Corrosivity

Corrosivity due to the presence of naphthenic acids in crude oil is a particular concern for refineries, and had been raised as an issue in permitting the Keystone XL pipeline to transport Canadian oil sand derived crude oil. It is measured as the number of milligrams of potassium hydroxide (mgKOH/g) needed to neutralize the acids in one gram of oil, and reported as Total

(...continued)

Crude+M%C3%A9gantic+derailment+mislabelled+Transportation+Safety+Board+says/8898364/story.html.

[13] Association of American Railroads, Railroad Tank Cars, https://www.aar.org/safety/Documents/Railroad%20Tank%20Cars.pdf.

[14] CME Group, NYMEX Rulebook, Chapter 200 – Light Sweet Crude Oil Futures. CME references RVP of less than 9.5 pounds per square inch at 100 degrees Fahrenheit by ASTM-5191-96 Standard Test Method for Vapor Pressure of Petroleum Products (Mini Method).

Acid Number (TAN). As a rule-of-thumb, crude oils with a TAN greater than 0.5 are considered potentially corrosive.[15] Bakken crude oil has a TAN of less than 0.1.

The specifications for DOT-III non-pressure tank cars that haul crude oil require a lining with acid-resistant rubber or other approved rubber compound vulcanized or bonded directly to the metal tank.[16] In general, pipelines transporting hazardous liquids must use inhibitors to mitigate internal corrosion. In the specific case of the proposed Keystone XL pipeline, the potential for corrosion is linked to the basic sediment and water entrained in the crude oil.[17]

Sulfur/Hydrogen Sulfide

A crude oil's free sulfur content is an indication of potential corrosiveness from the formation of acidic sulfur compounds. Sulfur oxides released into the air during combustion of refined petroleum products are also a major air pollutant. During the decomposition of organic matter that occurs with hydrocarbons in some geologic formations, sulfur may chemically combine with hydrogen to form hydrogen sulfide gas (H_2S), a highly corrosive, flammable, and toxic gas. Oil and gas reservoirs with high concentrations of H_2S can be particularly problematic to produce. H_2S causes sulfide-stress-corrosion cracking in the standard steel casing and valves used to construct oil wells, and thus require a switch to costly stainless steel. PHMSA has a similar concern for sulfide-stress-corrosion in tank cars. During drilling, detection of H_2S could result in abandoning the well due to concerns for worker safety.[18] (Worker exposure to no more than 0.03 ppm for up to 8 hours is generally considered safe.)

Sulfur content is measured as an overall percentage (by weight) of free sulfur and sulfur compounds in a crude oil. Total sulfur content in crude oils generally ranges from below 0.05% to 5%. Crude oils with less than 0.5% free sulfur or other sulfur-containing compounds are typically referred to as "sweet," and above 0.5% sulfur as "sour."[19] Light-sweet crude, however, may contain H_2S.

Bakken crude oil is sweet (below 0.25% free sulfur); however, H_2S may occur at problematic levels. In May 2013, Enbridge Energy Partners (a crude oil shipper) detected H_2S at concentrations of 1,200 parts-per-million in a crude oil storage tank.[20] Enbridge consequently made an emergency application to the Federal Energy Regulatory Commission (FERC) to amend

[15] R.D. Kane and M.S. Cayard, "A Comprehensive Study of Naphthenic Acid Corrosion," Paper No. 02555, Corrosion 2002, http://www.icorr.net/wp-content/uploads/2011/01/napthenic_corrosion.pdf.

[16] 49 C.F.R. 179 Subpart D—Specification for Non-Pressure Tank Cars (Classes DOT−111AW and 115AW).

[17] Per 49 C.F.R. 195.579: "Keystone must limit basic sediment and water (BS&W) to 0.5 percent by volume and report BS&W testing results to PHMSA in the annual report. Keystone must also report upset conditions causing BS&W level excursions above the limit." From Final Supplemental Environmental Impact Statement, Keystone XL Project Appendix B Potential Releases and Pipeline Safety Condition 34 Internal Corrosion, U.S. Department of State, http://keystonepipeline-xl.state.gov/finalseis/index.htm.

[18] Paradoxically, H_2S is potentially lethal but odorless at high concentrations while at low concentrations H_2S has an offensive odor similar to rotten eggs. Exposure to 10 ppm for more than 10 minutes causes eye and throat injuries, 500 ppm for 3 to 5 minutes results in unconsciousness. Alken Murray Corp, *Toxicity to Hydrogen Sulfide Gas*, http://www.alken-murray.com/H2SREM9.HTM.

[19] 10JDL Oil and Gas Exploration, Inc., "Crude Oil Basics," web page, July 28, 2011, http://www.jdloil.com/oil_basics.htm.

[20] John Kemp, "Toxic Gas in Bakken Pipeline Points to Sour Well Problem: Kemp," *Reuters*, May 29, 2013, http://www.reuters.com/article/2013/05/29/column-kemp-bakken-pipelines-idUSL5N0EA3SU20130529.

its conditions of carriage, which would give it the right to reject crude containing more than 5 parts-per-million H_2S (an exposure level that would require personal protective equipment).[21]

Composition/Concentration of Entrained Gases

The classic image of a "gusher" spraying crude oil up into the air through a drilling derrick is typically the result of dissolved methane (under pressure) that provides a conventional petroleum reservoir with a natural gas drive to move the liquid to the surface. This type of liquid/gas mixture is common—to varying degrees—for crude oil, which contains a range of hydrocarbons, ranging from very light and volatile methane (natural gas) and "condensate" (ethane, propane, butane and pentane) through natural gasoline to complex heavy asphaltenes (asphalt). When crude oil reaches the surface, the reduced pressure and temperature releases the dissolved condensates to a gaseous phase. Surface processing equipment separates the gas into various product streams. The "degassed" oil is typically stored in stock tanks before transport (by pipeline, tank truck, or rail car) to a refinery where any remaining condensate may be separated.

The Bakken formation produces both crude oil and natural gas. Due to the lack of pipelines to move the gas to a market, it has been flared (combusted) along with any associated natural gas liquids (analogous to condensate). Bakken crude oil is relatively rich in condensates, compared to similar crude oils.

Other Crude Oil Properties

Crude oils differ in density (mass per unit volume), and are typically measured in terms of degrees API Gravity (API refers to the American Petroleum Institute). [22] Higher API gravity corresponds with lighter density. Light crude oils generally exceed 38º API, intermediate crudes fall in the range of 22 to 38º API gravity, and heavy crudes fall below 22º API gravity. Bakken crude ranges from 39.7 to 42.2 º API gravity.

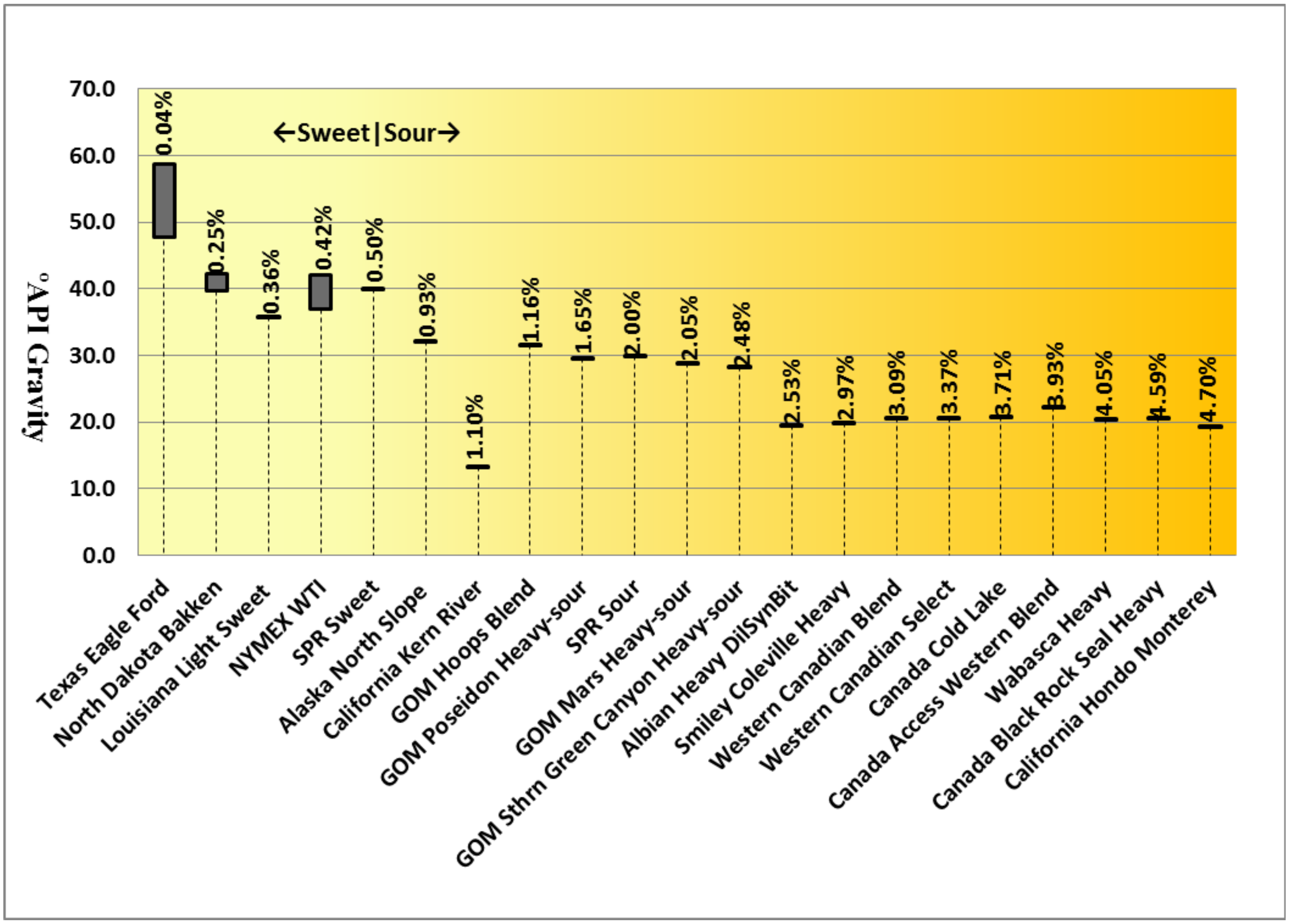
Light sweet crude has less than 0.5% sulfur. Crude oil futures contracts traded on the New York Mercantile Exchange (NYMEX) are based on West Texas Intermediate (WTI), a particular grade of light sweet crude oil. WTI ranges from 37 to 42º API gravity, has sulfur less than 0.42% by weight, and TAN of 0.28 mgKOH/G. Bakken is comparable to WTI in terms of ºAPI gravity and sulfur (see **Table 1**). Its sulfur content is less than 0.25% by weight, making it a sweet crude oil. Its TAN is less than 0.1 mgKOH/g, making it relatively non-corrosive and comparable to WTI.

Figure 1 displays various crude oils produced in the United States by API gravity, and sulfur. Bakken (North Dakota Light Sweet) represents the lighter range of crude oil currently produced in the United States, but by no means the lightest. That title belongs to Texas Eagle Ford crude oil.

[21] FERC Docket IS13-273-000).

[22] API gravity is measured with a Baume hydrometer gradated in degrees so that most values fall between 10° and 70° API gravity A Baume hydrometer is also used in auto repair shops for testing radiator fluid.

Figure 1. ºAPI Gravity vs. % Sulfur of Crude Oils Produced or Moved Through the United States



Source: Source: Various, including Capline, http://www.caplinepipeline.com/Reports1.aspx; Canadian Crude Quick Reference Guide Version 0.54, Crude Oil Quality Association, 2009, http://www.coqa-inc.org/102209CanadianCrudeReferenceGuide.pdf; http://www.genesisny.net/Commodity/Oil/OSpecs.html; BP http://www.bp.com/productfamily.do?categoryId=16002776&contentId=7020157; McQuilling Services, LLC, "Carriage of Heavy Grade Oil," Garden City, NY, 2011, http://www.meglobaloil.com/MARPOL.pdf; Hydrocarbon Publishing Co., Opportunity Crudes Report II, Southeastern, PA, 2011, p. 5, http://www.hydrocarbonpublishing.com/ReportP/Prospectus-Opportunity%20Crudes%20II_2011.pdf.

Table 1. API Gravity, Sulfur Content, and TAN for Crude Oils Produced or Moved in the United States

Crude Type	ºAPI Gravity	Sulfur Weight %	TAN mgKOH/g
Texas Eagle Ford	47.7 - 58.8	0.04 - 0.1	0.02 - 0.03
Bakken (North Dakota Light/ Sweet)	39.7 - 42.2	0.152 - 0.25	<0.1
NYMEX WTI	37.0 - 42.0	<0.42	0.28
Louisiana Light Sweet (LLS)	35.8	0.36	0.5
Alaska North Slope	32.1	0.93	0.12
Strategic Petroleum Reserve sweet/sour	30.0 - 40.0	0.5 - 2.0	0.15 - 0.16

Crude Type	°API Gravity	Sulfur Weight %	TAN mgKOH/g
GOM Hoops Blend	31.6	1.16	0.78
GOM Poseidon Heavy-sour	29.7	1.65	0.41
GOM Mars Heavy-sour	28.9	2.05	0.51
GOM Southern Green Canyon Heavy-sour	28.4	2.48	0.17
California Hondo Monterey	19.4	4.70	0.43
California Kern River	13.4	1.10	2.36
Canada Access Western Blend	22.3	3.93	1.72
Canada Cold Lake	20.8	3.71	0.92
Canada Black Rock Seal Heavy	20.7	4.59	1.84
Western Canadian Blend	20.7	3.09	0.66
Western Canadian Select	20.6	3.37	0.87
Wabasca Heavy	20.4	4.05	0.97
Smiley Coleville Heavy	20.0	2.97	0.93
Albian Heavy DilSynBit	19.5	2.53	0.50

Source: Various, including Capline, http://www.caplinepipeline.com/Reports1.aspx; Canadian Crude Quick Reference Guide Version 0.54, Crude Oil Quality Association, 2009, http://www.coqa-inc.org/102209CanadianCrudeReferenceGuide.pdf; http://www.genesisny.net/Commodity/Oil/OSpecs.html; BP http://www.bp.com/productfamily.do?categoryId=16002776&contentId=7020157; McQuilling Services, LLC, "Carriage of Heavy Grade Oil," Garden City, NY, 2011, http://www.meglobaloil.com/MARPOL.pdf; Hydrocarbon Publishing Co., *Opportunity Crudes Report II*, Southeastern, PA, 2011, p. 5, http://www.hydrocarbonpublishing.com/ReportP/Prospectus-Opportunity%20Crudes%20II_2011.pdf.

As shown in **Table 2**, Bakken's API gravity is slightly higher than WTI, 2% higher in condensates (light end hydrocarbons), but lower than WTI's upper RVP limit (leaving comparative volatilities open to interpretation). However, Bakken does fall within the upper and lower range of Eagle Ford RVP, which is the lightest crude oil produced in the United States.

Table 2. Properties of Representative Crude Oils

Distillate Fractions in percent (percentage)

Crude Oil	API°	RVP	Condensate %
Eagle Ford	47.7 - 58.8	6.5 - 9.3	1.13
Bakken	>41	8.75	3.0
NYMEX WTI	40	<9.5	1.0
LLS	36.2	2.38	2.0

Source: Grace Catalyst Technologies, *Processing shale oils in FCC: Challenges and Opportunities* (Table 1), Capline Pipeline, Most Current Approve Assay List http://www.caplinepipeline.com/Reports1.aspx, Platts, *Methodology and Specification Guide—The Eagle Ford marker: Rational and Methodology.*

Notes: Condensates are light end hydrocarbons in the range C2-C5 and include ethane, propane, butane, and pentane.

Rail Car Capacity and Load Limit

DOT-111 type tanks cars are "non-pressure" tank cars designed to carry a wide range of products including hazardous and non-hazardous materials.[23] Generally, they cannot exceed 34,500 gallons in capacity or 263,000 lbs. in gross weight on rail.[24] However, the Associate Administrator for Safety, Federal Railroad Administration (FRA) can approve a non-pressure tank car loaded up to 286,000 lbs. in gross weight on rail, if it does not contain "poisonous-by-inhalation" material, and operates under controlled interchange conditions agreed to by participating railroads.

A tank car becomes overloaded when it exceeds either the maximum gross weight on rail or maximum filling limit. An overloaded rail car can cause its axles to break, or cause the car to exceed the maximum time a car can take to achieve maximum braking.[25] A crude oil shipper has two options in meeting the weight agreement with the rail carrier: provide either a weight from a certified scale, or a weight estimate based on calculations.[26] To calculate the weight limit, the shipper must consider the "light weight" of the tank car (the unloaded or tare weight) and consider the density (API gravity) of the crude oil to be loaded. For illustrative purposes, **Figure 2** shows how increasingly heavier API gravity reduces the volume of crude oil that can be loaded into a tank car in order to not exceed the gross rail weight limit.[27]

At 50ºAPI, the tank car can hold its maximum volume of 31,800 gallons and not exceed the 286,000 lb. gross weight on rail limit. At 47.3ºAPI, the shipper must begin reducing volume of crude oil loaded into the tank car. At Bakken's highest density of 39.7ºAPI, the tank car can only hold 30,488 gallons—a volume reduction of roughly 1,300 gallons. The reduced volume also creates free space at the top of the tank car, which provides the opportunity for entrained gases to release from crude oil.

As crude oil density (and thus API gravity) is temperature dependent, volume will increase as temperature increases. Thus, shippers may have to reduce the volume of crude oil loaded in order to accommodate expansion during shipping.

[23] 949 C.F.R. Part 179, Subpart D—Specifications for Non-Pressure Tank Car Tanks (Classes DOT-111AW and 115AW).

[24] 49 C.F.R. 179.13, Tank Car Capacity and Gross Weight Limitation.

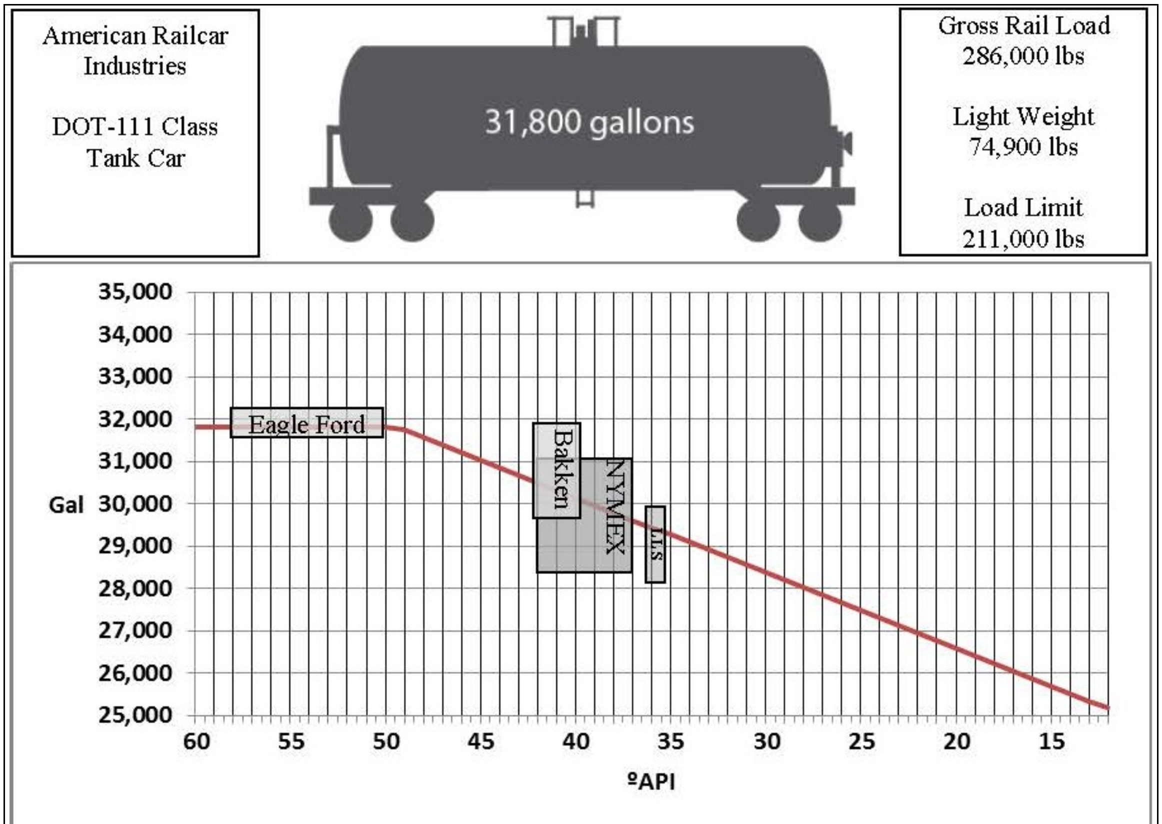
[25] The Federal Railroad Administration, under C.F.R. Part 49, specifies the maximum time each car can take to achieve maximum braking. From "An Introduction to Train Brakes," by John Bentley, http://www.tarorigin.com/art/Jbentley/.

[26] ICC Uniform Freight Classification 6000-J, Rule 35.

[27] For further information, refer to Federal Railroad Administration, *Tank Car Filling Limit & Filling Density Standards*, http://www.fra.dot.gov/eLib/details/L04699.

Figure 2. Rail Car Volume vs. °API Gravity

Volumetric Loading Limit



	Eagle Ford				Bakken	Bakken / NYMEX	Bakken / NYMEX	Bakken / NYMEX	NYMEX	LLS					
°API	58	55	50	45	42.2	42	40	39.7	37	35.8	35	30	25	20	10
gal	31,800	31,800	31,800	31,625	30,894	30,858	30,727	30,448	29,968	29,757	29.607	28,934	28,038	27,140	25,167
lbs	197,669	200,849	206,382	211,100	211,100	211,100	211,100	211,100	211,100	211,100	211,100	211,100	211,100	211,100	211,100

Policy Considerations

Crude oil shipments by rail have increased in recent years with the development of oil fields in North Dakota. With several derailments and releases of Bakken crude oil, regulators and others are concerned that it contains chemical constituents that exacerbate its volatility and thus its flammability. Absent new pipeline capacity, rail provides the primary "takeaway" capacity for Bakken producers. Unit train shipments of Bakken crude now supply refineries on both the East and West Coasts. However, the U.S. Gulf Coast (Texas and Louisiana) constitutes the most prolific region of domestic crude oil production, and the crude oils produced (WTI, Eagle Ford, and Louisiana Light Sweet, among others) rival Bakken in the characteristics the PHMSA alert has called into scrutiny. The Gulf Coast does benefit from existing pipeline infrastructure;

however, producers are relying on rail to access new markets, as evidenced by Eagle Ford crude oil moving from East Texas to St James, Louisiana by rail.[28]

All crude oils are flammable, to a varying degree. Further, crude oils exhibit other potentially hazardous characteristics as well. The growing perception is that light volatile crude oil, like Bakken crude, is a root cause for catastrophic incidents and thus may be too hazardous to ship by rail. However, equally hazardous and flammable liquids from other sources are routinely transported by rail, tanker truck, barge, and pipeline, though not without incident.

A key question for Congress is whether the characteristics of Bakken crude oil make it particularly hazardous. Conversely, does focusing so much attention on the commodity distract from other causes of transport incidents, such as maintenance practices, safety standards and human error? A further policy question is whether Bakken crude oil significantly differs from other crude oils that the standard practices do not apply, and if so, what policy steps should be taken to remedy safety concerns?

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[28] Gabe Ortt, *EOG Resources: Moving ahead with railroad demand and cost cutting,* Seeking Alpha, December 30, 2013, http://seekingalpha.com/article/1920411-eog-resources-moving-ahead-with-railroad-demand-and-cost-cutting.