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Bakken Crude Oil and the Changing Logistics of the American Oil Industry

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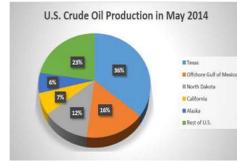
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Introduction to Bakken Crude Oil

The rapid production of Bakken oil in the Williston Basin of North Dakota is changing the logistics of the American oil industry. For the first time in history, massive volumes of oil are being shipped via railcar to refineries across the U.S. The Williston Basin has emerged as a major oil producing region in the United States, yet only produces around half of the amount as Texas – the largest oil producing region in volume. However, because of the low amount of refining needed, it became valuable and is desired by refineries across the nation which is why the production has increased dramatically in the past few years. However, due to the volatile nature of Bakken oil and lack of experience shipping oil in railcars, many accidents involving Bakken oil have occurred. The most infamous accident happened in the small town of Lac Mégantic, Quebec that killed 47 people. Bakken oil is volatile in nature because of combustible components in it. State inspectors of North Dakota are enforcing a stricter vapor pressure regulation on the oil to reduce volatility. The accidents involving Bakken oil are difficult to map because the U.S government does not collect data on domestic movements of petroleum products by rail, only on shipment via pipeline.



Railroads consider this proprietary information and argue it should only be released to those with a “need-to-know” and not to the general public. Previously available information was based on small observations reported by media sources. A US DOT mandate to release routing information took effect on May 7, 2014, however states can opt not to release information to the public. Ever since Bakken oil production expanded in 2008, accidents involving oil by rail increased.

Safety Recommendations by States

Minnesota, California, Washington, and New York have emerged as leaders in improving their emergency response framework in order to address the risks associated with moving Bakken oil via rail. Some common themes of each states’ proposed recommendations are: enhancing databases and ensuring states have adequate data, providing additional funding for local emergency responders, and changing the ID for hazardous materials on trains so it is more recognizable for first responders. On an individual state basis, Minnesota’s recommendations focus on statewide program evaluations, something also being done by New York. California has many recommendations regarding information such as real time shipment information for first responders, an interactive rail map, and more detailed information on previous accidents. Washington State is pushing for some amendments on RCW 81.53.

I interviewed Dave Christianson who works with MNDOT and asked him questions about Bakken oil in Minnesota

- Some refineries aren’t served by pipeline so rail is convenient and because of low oil prices, the Bakken production is at a plateau and the amount of shipments will probably stagnate for 2-3 years until oil prices rises
- It costs 50% more to ship by rail, but industries are moving it that way because of the demand for light sweet crude that produces quality fuels which they manufacture. .
- About 8% of the total daily production of Bakken oil is refined at one of two refineries in Minnesota: Saint Paul Park and Flint Hills.
- 70% of all Bakken oil produced passes through Minnesota

Bakken Crude Oil and the Changing Logistics of The American Oil Industry

Austin Rau

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Abstract:

The extraction of Bakken crude oil in the Williston Basin of North Dakota is transforming how petroleum is shipped. Before 2008, North American oil was carried primarily via pipeline from source regions to refineries along the Gulf Coast or to metropolitan areas close to consumers. The current pipeline system is ill-equipped to accommodate massive volumes of oil from this previously low producing region. Lack of infrastructure and high demand for “light tight oil” (LTO) led to the use of railroads as a means of moving the product to refineries across the nation. Transporting oil via rail over long distances was rare in past decades because of the associated costs. This research examines how a new rail logistics system has evolved over the past five years by mapping previously undisclosed routes used by major railroads that carry Bakken LTO. Safety issues resulting from the unusually volatile nature of the product prompted the U.S. Department of Transportation to mandate the release of routing data to states affected, however some states refused to make the information public. By supplementing this information with locational data regarding spills and accidents, the results reveal a new pattern of crude oil movement to coastal areas of the nation previously supplied by Alaskan and Middle Eastern tanker deliveries. Findings show Bakken LTO is increasingly routed to the Pacific Northwest and northeastern cities, particularly Philadelphia, passing through major population centers, putting millions at risk of major accidents.

Methodology

To achieve the goal of showing the changing logistics of Bakken oil in the United States, I used rail accident data provided by the Petroleum and Hazardous Materials Agency, PHMSA, as a surrogate for actual rail data. The data includes incidents from 7/17/2008 – 2/16/2015. Accident data was used because states are not required to publicly release what is going through their borders. The use of this data added a challenge to the analysis in that I had to use educated guesses of where the oil is being shipped based on the results from my maps. To display the accidents, I used the county as an appropriate unit of display. This was chosen because they are large enough to be seen on a continental map of the U.S. compared to the much smaller unit of zip code. Since I chose to use the county, this reduced the spatial resolution of where exactly the accident occurred, but it is still a good indicator of where oil is going. I used the table join function in ArcGIS to link the accident table to my U.S. county shapefile that I downloaded from the Census Bureau. This was challenging because there was not a common, unique field to base the join on. To accommodate for this, I added an ID field to my spreadsheet of the accidents and manually entered the county IDs from the shapefile’s attribute table to the spreadsheet. I had to join by ID because county names are not unique, i.e. there is more than one Jefferson County in the U.S. Additional data included in my maps are a railroad layer retrieved from ArcGIS online and a US oil refinery layer retrieved from the US energy information administration.

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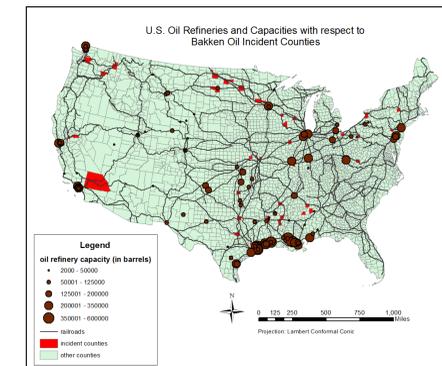
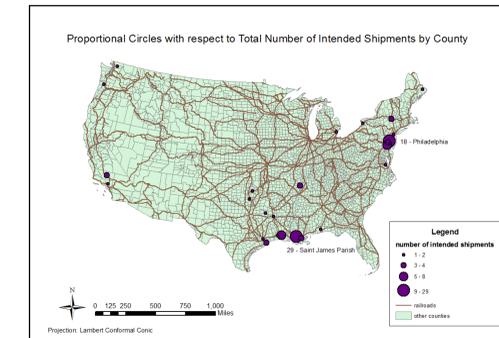
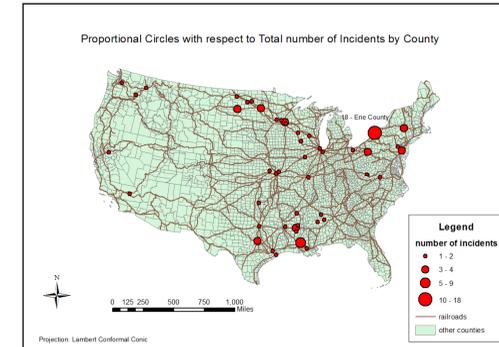
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Results



Discussion

Due to emerging improvements in technology such as hydraulic fracturing, oil previously regarded as unreachable because of its depth and the kind of rock it is in is now accessible to oil companies. The recent increase in production of oil in the Williston Basin has changed the logistics of the oil industry in America because of the lacking pipeline infrastructure in the region. Bakken oil is going to the west, east, and gulf coasts of the United States and being refined in major and minor refineries. Companies are willing to pay the additional charges associated with transport by rail because Bakken oil is high quality. Delta, for example, is specifically bringing in Bakken oil for its planes. The volatile nature of this oil combined with the many variables involved in rail transportation has caused many incidents from minor spills to large explosions. This has prompted some states to re-evaluate their current emergency response framework in order to be better prepared in case of a major spill. Experts believe that this trend will exist for 2 – 3 years and may increase when oil prices increase. This trend of oil by rail does not seem to be on the decline in the foreseeable future. So if America is to continue this trend, it must evaluate its safety framework, establish a strong dialogue with the public and emergency responders, and find a way to compensate for the goods such as grain that now have to compete with oil for car space.