DEPARTMENT OF ECOLOGY
State of Washington

Crude Oil Movement by Rail and Pipeline

Quarterly Report: October 1, 2016 to December 31, 2016

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Washington State Department of Ecology
Olympia, Washington

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Introduction

To enhance crude oil spill preparedness and response in Washington State, on August 24, 2016, Ecology adopted the rule,[1] Oil Movement by Rail and Pipeline Notification. The rule establishes reporting standards for facilities that receive crude oil by rail and pipelines that transport crude oil in or through the state. Additionally, the rule identifies reporting standards for Ecology to share information with emergency responders, local governments, tribes, and the public.

This rule is the result of 2015 Legislative direction to provide a better understanding of the changing risk picture for crude oil transported in Washington State as a result of the introduction of crude oil transport by rail and the associated changes in both the volume and properties of crude moving through Washington.

Timely notice of oil movement information is necessary for emergency responders and planners to effectively prepare for and respond to oil spills and other incidents associated with transporting crude oil by rail and pipeline. Providing adequate information about the dates, routes, and properties of crude oil can help protect people living and working near railroads and pipelines, the economy, and environmental resources of Washington State.

Ecology is required to publish information collected under the rule to its website on a quarterly basis. The quarterly reports provide aggregated information on crude oil transported by rail to facilities in Washington, information on crude oil movement by pipeline, and information on crude oil spilled during transport and delivery for rail and pipeline. In order to show a full picture of crude oil moving through the state, the quarterly reports also include the volume of crude oil transported by vessel. The reports are intended to inform the public about the nature of crude oil movement through their communities.

The reporting period for this quarterly report is October 1, 2016 to December 31, 2016.

[1] Chapter 173-185 WAC

Crude Oil by Rail Summary

Movement of crude oil by rail in Washington State began in 2012 and has continued to increase since that time. Rail routes transporting crude oil enter the state from Idaho near Spokane and from British Columbia near Bellingham. Large portions of the rail routes travel along the I-5 corridor, and cross or run next to major waterways, including the Columbia River and the Puget Sound. (See Appendix A for a map of railroad routes in the state.)

Capturing information on the properties of crude oil, the volume transported, and the routes used to transport it allows for proper planning, placement of resources, and opportunities to provide detailed information to responders in the event of a spill, ensuring a more effective overall response. The rule[2] helps Ecology gather this information by requiring facilities receiving crude oil by rail to report all scheduled crude oil deliveries to be received by the facility each week for the succeeding seven-day period into Ecology's Advance Notice of Transfer (ANT) database.

Information reported by facilities on scheduled crude oil deliveries includes the region of origin of crude oil, the railroad route taken to the facility within the state (if known), scheduled time and volume in barrels (bbls) of the delivery, and gravity of the oil. Ecology uses the standard American Petroleum Institute (API) gravity ranges to define the Crude Type in the ANT database. (See Appendix B for the API Gravity definition and Crude Type ranges.)

Ecology is required to aggregate the information provided on a statewide basis by route, week, and type of crude oil. Aggregate information from the ANT database is provided below in Table 1 for the period October 1, 2016 to December 31, 2016, representing the 4th quarter of 2016. Each week is numbered by calendar week and is aggregated by route and type of crude. The information provided includes:

- Total weekly volume (in barrels) of crude oil transported by rail
- Route
- Region of origin
- Crude type
- Route volume
- Estimated number of railcars per route delivering crude oil (assumes each car holds 680 bbls)

[2] Chapter 173-185 WAC

Table 1: Crude Oil Movement by Rail

Week 40*

Calendar Week#	Route Segments	Region of Origin	Crude Type	Volume (bbls)	Est # Cars
40	1A, 2, 3	Alberta	Medium Crude	58,143	85
	1A, 2, 3, 4	North Dakota	Light Crude	67,000	98
	1A, 2, 3, 4, 5	North Dakota	Light Crude	71,500	105
			Weekly totals:	**196,643**	**288**

** Week 40 contains only one day of reported ANT volumes* due to the effective date of reporting requirement.

Week 41

Calendar Week#	Route Segments	Region of Origin	Crude Type	Volume (bbls)	Est # Cars
41	1A, 2, 3	North Dakota	Light Crude	63,611	93
	1A, 2, 3, 4	North Dakota	Light Crude	386,000	567
	1A, 2, 3, 4, 5	North Dakota	Light Crude	583,000	857
	1B, 2, 3	North Dakota	Light Crude	63,169	92
	4, 5	Alberta	Medium Crude	120,830	177
			Weekly totals:	**1,216,610**	**1786**

Week 42

Calendar Week#	Route Segments	Region of Origin	Crude Type	Volume (bbls)	Est # Cars
42	1A, 2, 3	North Dakota	Light Crude	195,286	287
	1A, 2, 3, 4	North Dakota	Light Crude	323,000	475
	1A, 2, 3, 4, 5	North Dakota	Light Crude	363,000	533
			Weekly totals:	**881,286**	**1295**

Week 43

Calendar Week#	Route Segments	Region of Origin	Crude Type	Volume (bbls)	Est # Cars
43	1A, 2, 3	North Dakota	Light Crude	68,607	100
	1A, 2, 3, 4	North Dakota	Light Crude	327,000	480
	1A, 2, 3, 4, 5	North Dakota	Light Crude	511,500	752
	1B, 2, 3	North Dakota	Light Crude	63,845	93
	4, 5	Alberta	Medium Crude	121,355	178
			Weekly totals:	**1,092,307**	**1603**

Week 44

Calendar Week#	Route Segments	Region of Origin	Crude Type	Volume (bbls)	Est # Cars
44	1A, 2, 3	North Dakota	Light Crude	132,873	195
	1A, 2, 3, 4	North Dakota	Light Crude	453,000	666
	1A, 2, 3, 4, 5	North Dakota	Light Crude	656,500	965
	1B, 2, 3	North Dakota	Light Crude	64,019	94
	4, 5	Alberta	Medium Crude	62,000	91
			Weekly totals:	**1,368,392**	**2011**

Week 45

Calendar Week#	Route Segments	Region of Origin	Crude Type	Volume (bbls)	Est # Cars
45	1A, 2, 3	North Dakota	Light Crude	202,124	297
	1A, 2, 3, 4	North Dakota	Light Crude	319,000	469
	1A, 2, 3, 4, 5	North Dakota	Light Crude	503,500	740
			Weekly totals:	**1,024,624**	**1506**

Week 46

Calendar Week#	Route Segments	Region of Origin	Crude Type	Volume (bbls)	Est # Cars
46	1A, 2, 3	North Dakota	Light Crude	137,192	201
	1A, 2, 3, 4	North Dakota	Light Crude	397,000	583
	1A, 2, 3, 4, 5	North Dakota	Light Crude	366,500	538
	1B, 2, 3	North Dakota	Light Crude	64,054	94
	4, 5	Alberta	Medium Crude	61,078	89
			Weekly totals:	**1,025,824**	**1505**

Week 47

Calendar Week#	Route Segments	Region of Origin	Crude Type	Volume (bbls)	Est # Cars
47	1A, 2, 3	North Dakota	Light Crude	65,100	95
	1A, 2, 3, 4	North Dakota	Light Crude	386,000	567
	1A, 2, 3, 4, 5	North Dakota	Light Crude	506,000	744
	4, 5	Alberta	Medium Crude	62,000	91
			Weekly totals:	**1,019,100**	**1497**

Week 48

Calendar Week#	Route Segments	Region of Origin	Crude Type	Volume (bbls)	Est # Cars
48	1A, 2, 3	North Dakota	Light Crude	267,934	394
	1A, 2, 3, 4	North Dakota	Light Crude	323,000	475
	1A, 2, 3, 4, 5	North Dakota	Light Crude	512,500	753
	1B, 2, 3	North Dakota	Light Crude	63,184	92
	4, 5	Alberta	Medium Crude	60,577	89
			Weekly totals:	**1,227,195**	**1803**

Week 49

Calendar Week#	Route Segments	Region of Origin	Crude Type	Volume (bbls)	Est # Cars
49	1A, 2, 3	North Dakota	Light Crude	65,243	95
	1A, 2, 3, 4	North Dakota	Light Crude	464,000	682
	1A, 2, 3, 4, 5	North Dakota	Light Crude	581,500	855
	1B, 2, 3	North Dakota	Light Crude	122,084	179
	4, 5	Alberta	Medium Crude	123,326	181
			Weekly totals:	**1,356,153**	**1992**

Week 50

Calendar Week#	Route Segments	Region of Origin	Crude Type	Volume (bbls)	Est # Cars
50	1A, 2, 3	North Dakota	Light Crude	130,000	191
	1A, 2, 3, 4	North Dakota	Light Crude	449,000	660
	1A, 2, 3, 4, 5	North Dakota	Light Crude	352,000	517
	4, 5	Alberta	Medium Crude	62,000	91
			Weekly totals:	**993,000**	**1459**

Week 51

Calendar Week#	Route Segments	Region of Origin	Crude Type	Volume (bbls)	Est # Cars
51	1A, 2, 3	North Dakota	Light Crude	129,463	190
	1A, 2, 3, 4	North Dakota	Light Crude	327,000	480
	1A, 2, 3, 4, 5	North Dakota	Light Crude	500,500	736
	1B, 2, 3	North Dakota	Light Crude	63,097	92
			Weekly totals:	**1,020,060**	**1498**

Week 52

Calendar Week#	Route Segments	Region of Origin	Crude Type	Volume (bbls)	Est # Cars
52	1A, 2, 3	North Dakota	Light Crude	64,498	94
	1A, 2, 3, 4	North Dakota	Light Crude	453,000	666
	1A, 2, 3, 4, 5	North Dakota	Light Crude	500,500	736
	4, 5	Alberta	Heavy Crude	122,925	180
			Weekly totals:	**1,140,923**	**1676**

Week 53*

Calendar Week#	Route Segments	Region of Origin	Crude Type	Volume (bbls)	Est # Cars
53	1A, 2, 3	North Dakota	Light Crude	130,007	191
	1A, 2, 3, 4	North Dakota	Light Crude	397,000	583
	1A, 2, 3, 4, 5	North Dakota	Light Crude	429,000**	630
	1B, 2, 3	North Dakota	Light Crude	60,934	89
	4, 5	Alberta	Heavy Crude	58,147	85
			Weekly totals:	**1,075,088**	**1578**

** The United States Gregorian calendar consists of 53 weeks in 2016.*

*** Data has been updated due to an ANT entry change since the first publication of this report.*

Quarter 4 Total

	Volume (bbls)
Total for this Period:	**14,637,205**

Note: *The data provided in Table 1 was reported to Ecology by the receiving facility into the ANT database as required by Chapter 173-185 WAC. Ecology cannot confirm the data or verify its accuracy.*

Fourteen weeks are reported in the 4th quarter of 2016 starting at calendar week 40 and ending at calendar week 53.

A summary of the data shows:

- Two regions of origin are reported: Alberta and North Dakota.
- Three types of crude oil are reported: heavy, medium, and light.
- The total volume of crude oil transported by rail during the quarter was 14,637,205 barrels (614,762,610 gallons).
- The average weekly volume of crude oil transported by rail was 1,045,515 barrels (43,911,630 gallons).
- The total number of rail cars moving crude oil by rail was 21,497 cars.
- The average number of rail cars per week moving crude oil by rail was 1,536 cars.
- 1% of crude oil transported by rail was heavy crude, 5% was medium crude, and 94% was light crude.
- Alberta was the region of origin for 6% of crude oil transported by rail, while North Dakota was the region of origin for 94% of crude oil transported by rail.

Figure 1 shows the weekly total volumes of crude transported by rail for each calendar week in the 4th quarter of 2016.

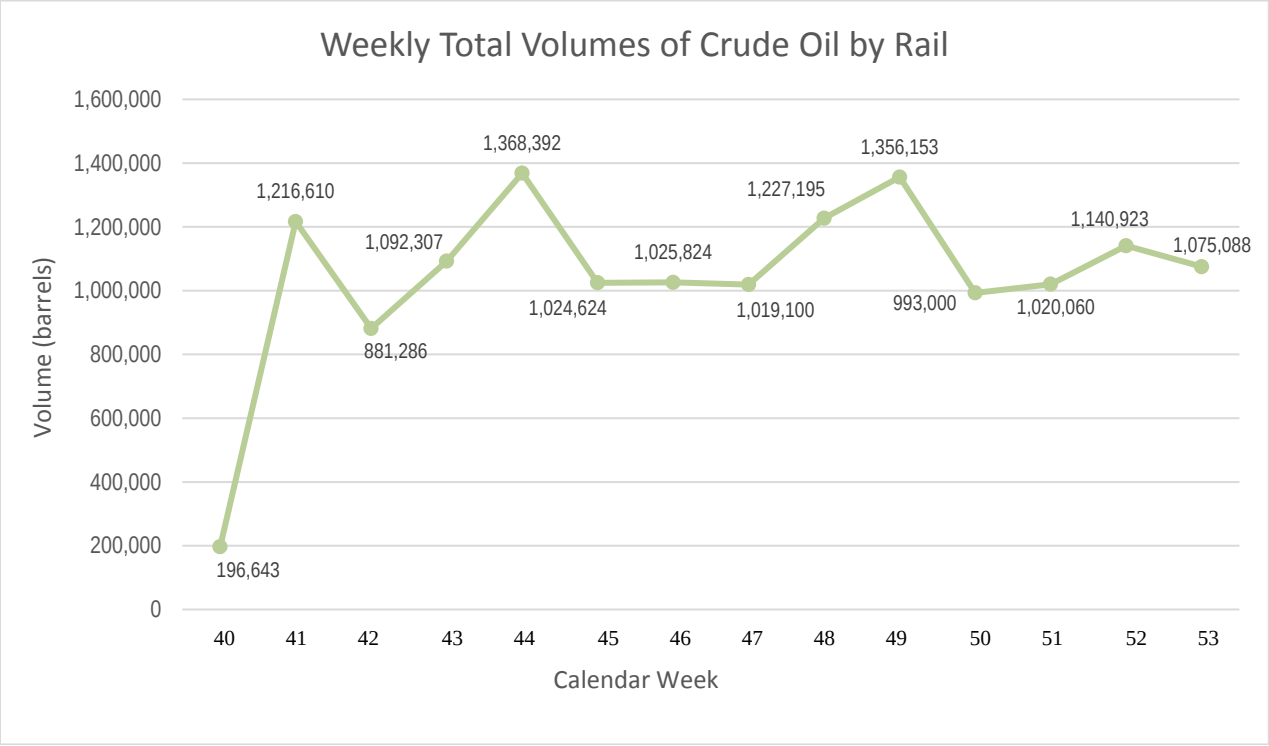

Figure 1: Weekly Total Volumes of Crude Oil by Rail for the 4th Quarter of 2016

The lowest weekly volume that included a full week of reported advance notice of transfers was 881,286 barrels (37,014,012 gallons) in week 42, while the highest weekly volume of crude transported by rail was 1,368,392 barrels (57,472,464 gallons) in week 44.

Crude Oil by Pipeline Summary

Pipelines exist inland, and may be located near waterbodies and populated areas. Knowing how much and what types of crude oil are transported through pipelines in Washington State is an important part of the overall crude oil movement picture and helps Ecology properly plan for and execute a rapid, aggressive, and well-coordinated response to a spill.

Under the rule,[3] transmission pipelines that transport crude oil in or through the state must provide Ecology biannual notice of all crude oil transported in or through the state. Biannual notice must be submitted each year by July 31 for the period from January 1 through June 30 and by January 31 for the period from July 1 through December 31. Biannual notice provided by pipelines includes contact information for the pipeline, and the total volume of crude oil transported in or through the state during the reporting period by state or province of origin.

The first biannual notices from pipelines were submitted to Ecology by January 31, 2017, and covered the period from July 1, 2016 through December 31, 2016. Table 2 below provides the total volume of crude oil transported in or through the state by pipelines during this period.

Table 2: Crude Oil Movement by Pipeline

State or Providence of Origin	Volume (Bbls)
Alberta, Canada	33,213,696

Note: *The data provided in Table 2 was reported to Ecology by the pipelines transporting crude oil in or through the state, as required by Chapter 173-185 WAC. Ecology cannot confirm the data or verify its accuracy.*

[3] Chapter 173-185 WAC

Crude Oil Spills – Rail and Pipeline

Oil spills can have significant impacts to the public, environment, and economy. Ecology strives to protect Washington's environment and public health and safety through a comprehensive spill prevention, preparedness, and response program.

The rule[4] specifies Ecology will provide the number and volume of spills to the environment during the transport and delivery of crude oil by rail and pipeline in each quarterly report. For the period of October 1, 2016 to December 31, 2016, zero spills to the environment were reported. In the event there are spills to report in the future, Ecology will provide this information and include the date of the spill, the county where the spill occurred, the source, material, and volume of the spill.

[4] Chapter 173-185 WAC

Crude Oil Movement by Vessel

In 2006, the state adopted rules for advance notice of oil transfers for vessels and facilities. Ecology has been receiving advance notice of transfer data for all transfers to or from vessels in Washington State since that time.

In order to provide a full picture of crude oil movement in Washington State, a summary of crude oil movement by vessel is provided below, which is in addition to the requirement for this quarterly report as described in the rule.[5]

Table 3 below provides the total volume of crude oil in barrels of inbound and outbound vessel transfers for the period of October 1, 2016 to December 31, 2016. Inbound vessel transfers refers to crude oil movement from vessels to facilities, while outbound vessel transfers refers to crude oil movement from facilities to vessels.

Table 3: Crude Oil Movement by Vessel

Vessel Transfers	Volume (bbls)
Inbound	27,148,953
Outbound	135,000

Note: *The data provided in Table 3 was reported to Ecology into the ANT database as required by Chapter 173-180 WAC and Chapter 173-184 WAC. Ecology cannot confirm the data or verify its accuracy.*

Table 3 shows that 27,148,953 barrels (1,140,256,026 gallons) of crude oil were transferred inbound from vessels to facilities, while 135,000 barrels (5,670,000 gallons) of crude oil were transferred outbound from facilities to vessels. The total volume from all vessel transfers of crude oil for the 4th quarter was 27,283,953 barrels (1,145,926,026 gallons).

[5] Chapter 173-185 WAC

A Broad View of Crude Oil Movement

A larger view of crude oil movement in Washington State can be seen when comparing the movement of crude oil transported into the state by vessel, rail, and pipeline side-by-side.

Figure 2 shows the percentage of crude oil transported by vessel (inbound only), rail, and pipeline for the period of October 1, 2016 to December 31, 2016.

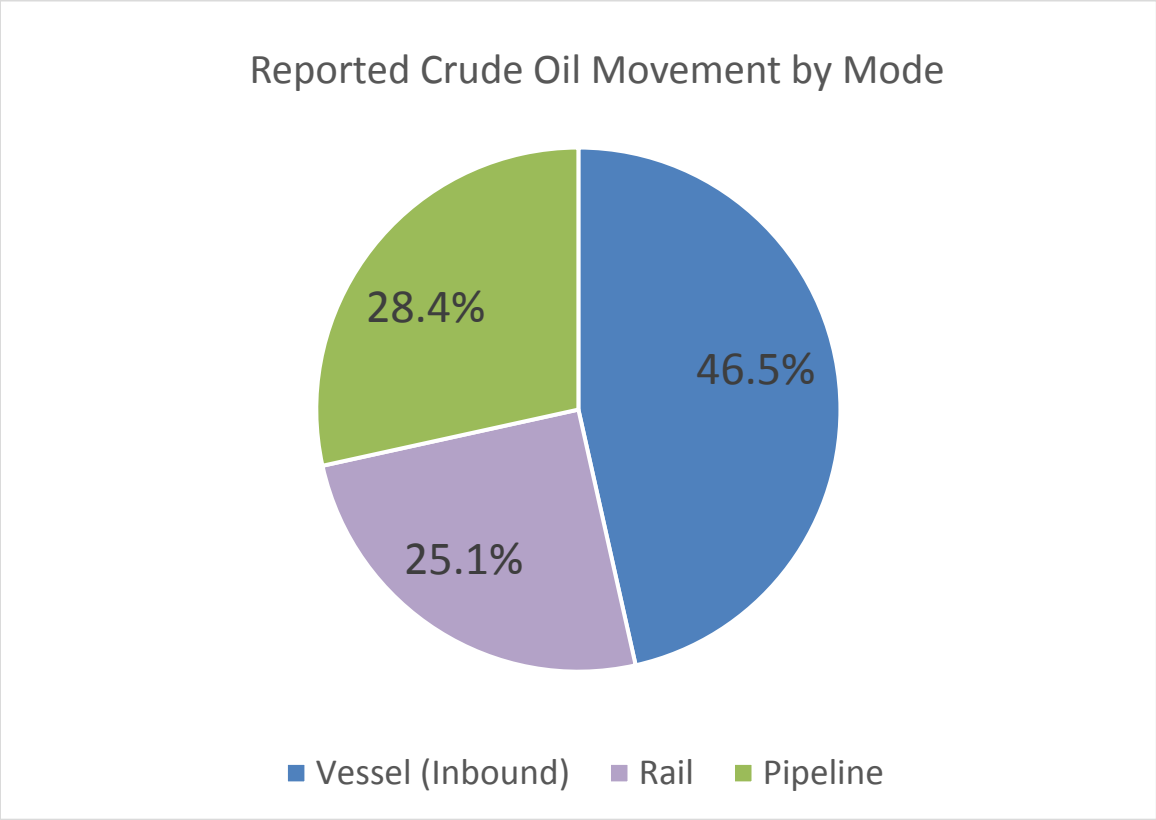

Figure 2: Reported Crude Oil Movement by Mode

Note: Because pipelines provide biannual notice containing six months of data, Ecology assumed oil moved is relatively consistent each month for the purpose of Figure 2. Based on that assumption, Ecology calculated an estimate for crude oil movement by pipeline for the quarter.

During the 4th quarter of 2016, vessels were responsible for 46.5% of reported crude oil movement into the state, while rail was responsible for 25.1% and pipeline for 28.4%.

Ecology will continue to receive information about crude oil movement and use the data to analyze trends and changes over time.

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Appendix A – Washington Railroad Routes

Appendix B – API Gravity and Crude Oil Types

Information reported by facilities on scheduled crude oil deliveries include the gravity of the oil. Ecology uses the standard American Petroleum Institute gravity (API gravity) ranges to define the Crude Type in the ANT database.

API gravity is the measure of the density of petroleum liquid in relation to the density of water and is used to classify oils as light, medium, heavy and extra heavy. The lower the API gravity, the more likely it is to sink in water. Crude Type by API gravity is shown in the table below.

Table 4: Crude Type by API Gravity

Crude Type	API Gravity Range
Light Crude	31.2-50 API
Medium Crude	22.3-31.1 API
Heavy Crude	10-22.2 API
Extra Heavy Crude	0-9.9 API