



DEPARTMENT OF
ECOLOGY
State of Washington

Crude Oil Movement by Rail and Pipeline

*Quarterly Report: October 1, 2021, through
December 31, 2021*

April 2022 (Revised)
Publication 22-08-001

Publication and Contact Information

This report is available on the Department of Ecology's website at <https://apps.ecology.wa.gov/publications/SummaryPages/2208001.html>

For more information contact:

Spill Prevention, Preparedness, and Response Program
P.O. Box 47600
Olympia, WA 98504-7600
Phone: 360-407-7455

Washington State Department of Ecology – www.ecology.wa.gov

- Headquarters, Olympia 360-407-6000
- Northwest Regional Office, Bellevue 425-649-7000
- Southwest Regional Office, Olympia 360-407-6300
- Central Regional Office, Union Gap 509-575-2490
- Eastern Regional Office, Spokane 509-329-3400

To request ADA accommodation including materials in a format for the visually impaired, call Ecology at 360-407-6831 or visit <https://ecology.wa.gov/accessibility>. People with impaired hearing may call Washington Relay Service at 711. People with speech disability may call TTY at 877-833-6341.

Crude Oil Movement by Rail and Pipeline

Quarterly Report: October 1, 2021, through December 31, 2021

Spill Prevention, Preparedness, and Response Program
Washington State Department of Ecology
Olympia, Washington

This page is purposely left blank.

Table of Contents

| | <u>Page</u> |
|------------------------------------------------------|-------------|
| List of Figures and Tables..... | ii |
| Introduction..... | 1 |
| Crude Oil by Rail Summary | 2 |
| Crude Oil by Pipeline Summary | 8 |
| Crude Oil Spills – Rail and Pipeline | 8 |
| Crude Oil Movement by Vessel..... | 9 |
| An Overview of Crude Oil Movement in Washington..... | 10 |
| Contact Information | 12 |
| Appendix A – Washington Railroad Routes..... | 13 |
| Appendix B – API Gravity and Crude Oil Types..... | 14 |

List of Figures and Tables

Page

Figures

| | |
|---------------------------------------------------------------------------------------------------|----|
| Figure 1: Weekly total volumes of crude oil by rail for the 4 th Quarter of 2021 | 6 |
| Figure 2: Crude oil movement by route for the 4 th Quarter of 2021 | 7 |
| Figure 3: 12-month crude oil movement by mode..... | 10 |
| Figure 4: Quarterly crude oil movement by mode, January 2019 – December 2021 | 11 |
| Figure 5: Railroad routes in Washington | 13 |

Tables

| | |
|-----------------------------------------------------|----|
| Table 1: Crude oil movement by rail | 3 |
| Table 2: Crude oil movement by pipeline..... | 8 |
| Table 3: Crude Oil Spills by Rail and Pipeline..... | 9 |
| Table 4: Crude oil movement by vessel..... | 9 |
| Table 5: Crude type by API gravity | 14 |

Introduction

To enhance crude oil spill preparedness and response in Washington State, on August 24, 2016, Ecology adopted the rule, [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.¹ 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 about crude oil movement by pipeline in or through the state.
- Reported spills during transport and delivery of crude by rail and pipeline.
- 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, 2021, through December 31, 2021.

¹ Chapter 173-185 WAC, Oil Movement by Rail and Pipeline Notification

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, and Ecology continues to monitor other potential routes. Large segments of the rail routes travel along the I-5 corridor, and cross or run next to major waterways, including the Columbia River and 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 directs Ecology to 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. Facilities enter this information 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 the gravity, sulfur content, and vapor pressure 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 and sulfur content definitions 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 in Table 1 for the period October 1, 2021, through December 31, 2021, representing the 4th Quarter of 2021. 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 (bbls) of crude oil transported by rail
- Route
- Region of origin
- Crude type (combining API gravity range and sulfur content)
- Route volume
- Estimated number of railcars per route delivering crude oil (assumes each car holds 680 bbls)

Fourteen calendar weeks are reported in the 4th Quarter of 2021 starting at calendar week 40 and ending at calendar week 53.

Table 1: Crude oil movement by rail**Calendar week 40**

Week 40 consists of only two days of reported ANT volumes due to the dates of the reporting period.

| Route Segments | Region of Origin | Crude Type | Volume (bbls) | Est # Cars |
|----------------------|------------------|-------------------|----------------|------------|
| 1A, 2, 3 | North Dakota | Light Sweet Crude | 68,778 | 101 |
| 1B, 2, 3 | Alberta | Heavy Sour Crude | 62,538 | 91 |
| 5 | Alberta | Light Sweet Crude | 63,222 | 92 |
| Weekly totals | | | 194,538 | 284 |

Calendar week 41

| Route Segments | Region of Origin | Crude Type | Volume (bbls) | Est # Cars |
|----------------------|------------------|-------------------|----------------|--------------|
| 1A, 2, 3 | North Dakota | Light Sweet Crude | 71,039 | 104 |
| 1A, 2, 3, 4, 5 | North Dakota | Light Sweet Crude | 430,281 | 632 |
| 1B, 2, 3 | Alberta | Heavy Sour Crude | 120,805 | 177 |
| 5 | Alberta | Light Sweet Crude | 61,684 | 90 |
| Weekly totals | | | 683,809 | 1,003 |

Calendar week 42

| Route Segments | Region of Origin | Crude Type | Volume (bbls) | Est # Cars |
|----------------------|------------------|-------------------|----------------|--------------|
| 1A, 2, 3 | North Dakota | Light Sweet Crude | 137,671 | 202 |
| 1A, 2, 3, 4, 5 | North Dakota | Light Sweet Crude | 429,292 | 631 |
| 1B, 2, 3 | Alberta | Heavy Sour Crude | 122,247 | 179 |
| 5 | Alberta | Light Sweet Crude | 66,800 | 98 |
| Weekly totals | | | 756,010 | 1,110 |

Calendar week 43

| Route Segments | Region of Origin | Crude Type | Volume (bbls) | Est # Cars |
|----------------------|------------------|-------------------|----------------|--------------|
| 1A, 2, 3 | North Dakota | Light Sweet Crude | 208,683 | 306 |
| 1A, 2, 3, 4, 5 | North Dakota | Light Sweet Crude | 357,994 | 526 |
| 1B, 2, 3 | Alberta | Heavy Sour Crude | 123,745 | 181 |
| 5 | Alberta | Light Sweet Crude | 201,359 | 296 |
| Weekly totals | | | 891,781 | 1,309 |

Calendar week 44

| Route Segments | Region of Origin | Crude Type | Volume (bbls) | Est # Cars |
|----------------------|------------------|-------------------|----------------|--------------|
| 1A, 2, 3, 4, 5 | North Dakota | Light Sweet Crude | 505,830 | 743 |
| 1B, 2, 3 | Alberta | Heavy Sour Crude | 59,693 | 87 |
| 5 | Alberta | Light Sweet Crude | 131,326 | 193 |
| Weekly totals | | | 696,849 | 1,023 |

Calendar week 45

| Route Segments | Region of Origin | Crude Type | Volume (bbls) | Est # Cars |
|----------------------|------------------|-------------------|----------------|--------------|
| 1A, 2, 3 | North Dakota | Light Sweet Crude | 137,840 | 202 |
| 1A, 2, 3, 4, 5 | North Dakota | Light Sweet Crude | 504,766 | 742 |
| 1B, 2, 3 | Alberta | Heavy Sour Crude | 124,698 | 183 |
| 5 | Alberta | Light Sweet Crude | 201,022 | 295 |
| Weekly totals | | | 968,326 | 1,422 |

Calendar week 46

| Route Segments | Region of Origin | Crude Type | Volume (bbls) | Est # Cars |
|----------------------|------------------|-------------------|----------------|--------------|
| 1A, 2, 3 | North Dakota | Light Sweet Crude | 136,888 | 201 |
| 1A, 2, 3, 4, 5 | North Dakota | Light Sweet Crude | 428,424 | 630 |
| 1B, 2, 3 | Alberta | Heavy Sour Crude | 121,211 | 178 |
| 5 | Alberta | Light Sweet Crude | 201,391 | 296 |
| Weekly totals | | | 887,914 | 1,305 |

Calendar week 47

| Route Segments | Region of Origin | Crude Type | Volume (bbls) | Est # Cars |
|----------------------|------------------|-------------------|----------------|------------|
| 1A, 2, 3 | North Dakota | Light Sweet Crude | 138,929 | 204 |
| 1A, 2, 3, 4, 5 | North Dakota | Light Sweet Crude | 429,122 | 631 |
| 1B, 2, 3 | Alberta | Heavy Sour Crude | 62,987 | 92 |
| Weekly totals | | | 631,038 | 927 |

Calendar week 48

| Route Segments | Region of Origin | Crude Type | Volume (bbls) | Est # Cars |
|----------------------|------------------|-------------------|----------------|--------------|
| 1A, 2, 3 | North Dakota | Light Sweet Crude | 137,720 | 202 |
| 1A, 2, 3, 4, 5 | North Dakota | Light Sweet Crude | 430,704 | 633 |
| 1B, 2, 3 | Alberta | Heavy Sour Crude | 124,427 | 182 |
| Weekly totals | | | 692,851 | 1,017 |

Calendar week 49

| Route Segments | Region of Origin | Crude Type | Volume (bbls) | Est # Cars |
|----------------------|------------------|-------------------|----------------|--------------|
| 1A, 2, 3 | North Dakota | Light Sweet Crude | 202,232 | 297 |
| 1A, 2, 3, 4, 5 | North Dakota | Light Sweet Crude | 572,511 | 841 |
| 1B, 2, 3 | Alberta | Heavy Sour Crude | 124,559 | 183 |
| Weekly totals | | | 899,302 | 1,321 |

Calendar week 50

| Route Segments | Region of Origin | Crude Type | Volume (bbls) | Est # Cars |
|----------------------|------------------|-------------------|----------------|--------------|
| 1A, 2, 3 | North Dakota | Light Sweet Crude | 140,756 | 206 |
| 1A, 2, 3, 4, 5 | North Dakota | Light Sweet Crude | 357,909 | 526 |
| 5 | Alberta | Light Sweet Crude | 264,136 | 388 |
| Weekly totals | | | 762,801 | 1,120 |

Calendar week 51

| Route Segments | Region of Origin | Crude Type | Volume (bbls) | Est # Cars |
|----------------------|------------------|-------------------|------------------|--------------|
| 1A, 2, 3 | North Dakota | Light Sweet Crude | 132,867 | 195 |
| 1A, 2, 3, 4, 5 | North Dakota | Light Sweet Crude | 640,106 | 941 |
| 1B, 2, 3 | Alberta | Heavy Sour Crude | 124,066 | 182 |
| 5 | Alberta | Light Sweet Crude | 129,161 | 189 |
| Weekly totals | | | 1,026,200 | 1,507 |

Calendar week 52

| Route Segments | Region of Origin | Crude Type | Volume (bbls) | Est # Cars |
|----------------------|------------------|-------------------|----------------|--------------|
| 1A, 2, 3 | North Dakota | Light Sweet Crude | 139,537 | 205 |
| 1A, 2, 3, 4, 5 | North Dakota | Light Sweet Crude | 427,088 | 628 |
| 1B, 2, 3 | Alberta | Heavy Sour Crude | 123,117 | 181 |
| 5 | Alberta | Light Sweet Crude | 62,891 | 92 |
| Weekly totals | | | 752,633 | 1,106 |

Calendar week 53

Week 53 consists of only six days of reported ANT volumes due to the dates of the reporting period.

| Route Segments | Region of Origin | Crude Type | Volume (bbls) | Est # Cars |
|----------------------|------------------|-------------------|----------------|------------|
| 1A, 2, 3 | North Dakota | Light Sweet Crude | 208,201 | 306 |
| 1A, 2, 3, 4, 5 | North Dakota | Light Sweet Crude | 71,136 | 104 |
| 5 | Alberta | Light Sweet Crude | 129,268 | 190 |
| Weekly totals | | | 408,605 | 600 |

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.

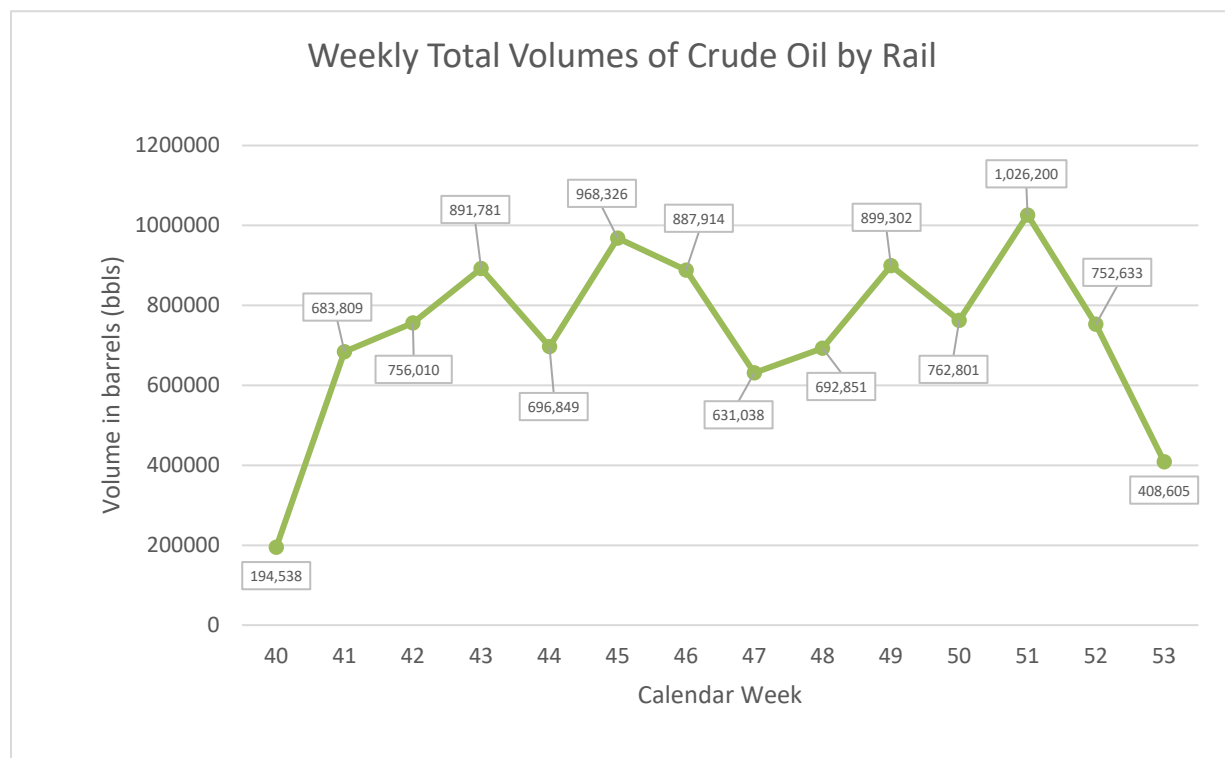
2021 Quarter 4 total volume (bbls): 10,252,657

A summary of the data shows:

- Two regions of origin were reported: North Dakota and Alberta.
- Two types of crude oil were reported: light and heavy.
- Routes 1A, 1B, and 2 through 5 were used to transport crude by rail.
- The total volume of crude oil transported by rail during the quarter was 10,252,657 barrels (430,611,594 gallons).
- The average weekly volume of crude oil transported by rail was 780,093 barrels (32,763,926 gallons).

- The total number of rail cars moving crude oil by rail was 15,054 cars.
- The average number of rail cars per week moving crude oil by rail was 1,145 cars.
- 87.38 percent of crude oil transported by rail was light crude.
12.62 percent of crude rail transported by rail was heavy crude.
- 87.38 percent of crude oil transported by rail was sweet crude.
12.62 percent of crude oil transported by rail was sour crude.
- North Dakota was the region of origin for 72.63 percent of crude oil transported by rail.
Alberta was the region of origin for 27.37 percent of crude oil transported by rail.
- Crude oil originating in North Dakota had reported vapor pressure ranging from 3.8 to 10.5 pounds per square inch.
Crude oil originating in Alberta had reported vapor pressure ranging from 6.3 to 12.4 pounds per square inch.

Figure 1 shows the weekly total volumes of crude transported by rail for each calendar week in the 4th Quarter of 2021.



Note: Week 40 consists of only 2 days of reported ANT volumes due to the dates of the reporting period. Week 53 consists of only 6 days of reported ANT volumes due to the dates of the reporting period.

Figure 1: Weekly total volumes of crude oil by rail for the 4th Quarter of 2021

The lowest weekly volume was 631,038 barrels (26,503,596 gallons) in Week 47. The highest weekly volume of crude transported by rail was 1,026,200 barrels (43,100,400 gallons) in Week 51.

Figure 2 displays crude transported by rail, by route, for the 4th Quarter of 2021.

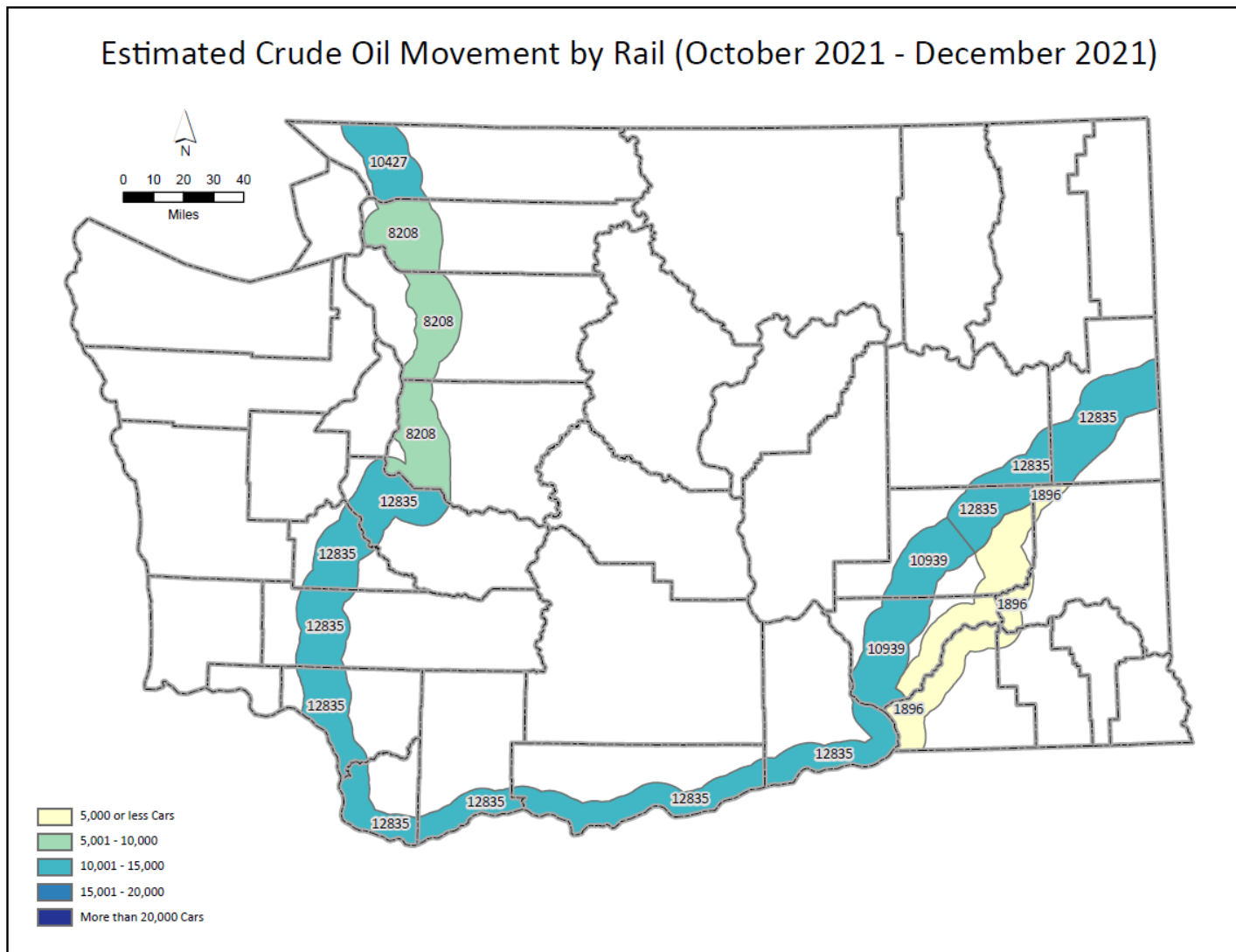


Figure 2: Crude oil movement by route for the 4th Quarter of 2021

Crude Oil by Pipeline Summary

Pipelines exist inland and may be located near waterbodies and populated areas. Knowing the types and quantities of crude oil transported through pipelines in Washington State helps Ecology properly plan for and execute a rapid, aggressive, and well-coordinated response to a spill.

Under the rule, 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.² 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 most recent biannual notices from pipelines covered the period from July 1, 2021, through December 31, 2021. 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

| Period | State/Province of Origin | Mean API Gravity & Range | Sulfur Content | Volume (bbls) |
|----------------------------------|--------------------------|--------------------------|------------------------|---------------|
| July 1, 2021 – December 31, 2021 | Alberta | 35.4 (Light) | Sweet ($\leq 0.5\%$) | 17,200,878 |
| July 1, 2021 – December 31, 2021 | Alberta | 35.8 (Light) | Sour ($> 0.5\%$) | 7,262,792 |
| July 1, 2021 – December 31, 2021 | Alberta | 21.0 (Heavy) | Sour ($> 0.5\%$) | 5,945,932 |

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.

The next biannual notices from pipelines will cover the period from January 1, 2022, through June 30, 2022 and must be submitted to Ecology by July 31, 2022.

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, economy, and public health and safety through a comprehensive spill prevention, preparedness, and response program.

The rule directs Ecology to provide the number and volume of spills to the waters of the state during the transport and delivery of crude oil by rail and pipeline in each quarterly report.³ Table 3 shows information on each reported spill that occurred during transport or delivery of crude oil by rail or pipeline.

² Chapter 173-185 WAC, Oil Movement by Rail and Pipeline Notification

³ Chapter 173-185 WAC, Oil Movement by Rail and Pipeline Notification

Table 3: Crude Oil Spills by Rail and Pipeline

| Incident Date | County | Source | Material | Volume (Bbls) |
|-------------------|--------|-------------------|-----------|---------------|
| December 30, 2021 | Pierce | Refinery/Pipeline | Crude Oil | 1 |

Note: The spill data provided in Table 3 as reported by Ecology. Ecology has taken every effort to ensure the accuracy and completeness of the information provided.

One reported spill occurred during the 4th quarter of 2021. The total volume of crude oil spilled from pipeline was 1 barrel (42 gallons).

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.⁴

Table 4 below provides the total volume of crude oil in barrels of inbound and outbound vessel transfers for the period of October 1, 2021, through December 31, 2021. 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 4: Crude oil movement by vessel

| Vessel transfers | Volume (bbls) | Volume (gallons) |
|------------------|-------------------|----------------------|
| Inbound | 27,497,764 | 1,154,906,086 |
| Outbound | 402,000 | 16,884,000 |
| Total | 27,899,764 | 1,171,790,086 |

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.

A summary of vessel transfer data for the quarter shows:

- There were 68 total vessel transfers of crude oil (inbound or outbound).
- The average volume of crude oil transferred to or from vessels per week was 2,122,808 barrels (89,157,941 gallons).

⁴ Chapter 173-185 WAC, Oil Movement by Rail and Pipeline Notification

An Overview of Crude Oil Movement in Washington

A broad 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.

Figure 3 shows the estimated percentage of crude oil transported by vessel (inbound only), rail, and pipeline for the last four quarters, covering the period of January 1, 2021, through December 31, 2021.⁵

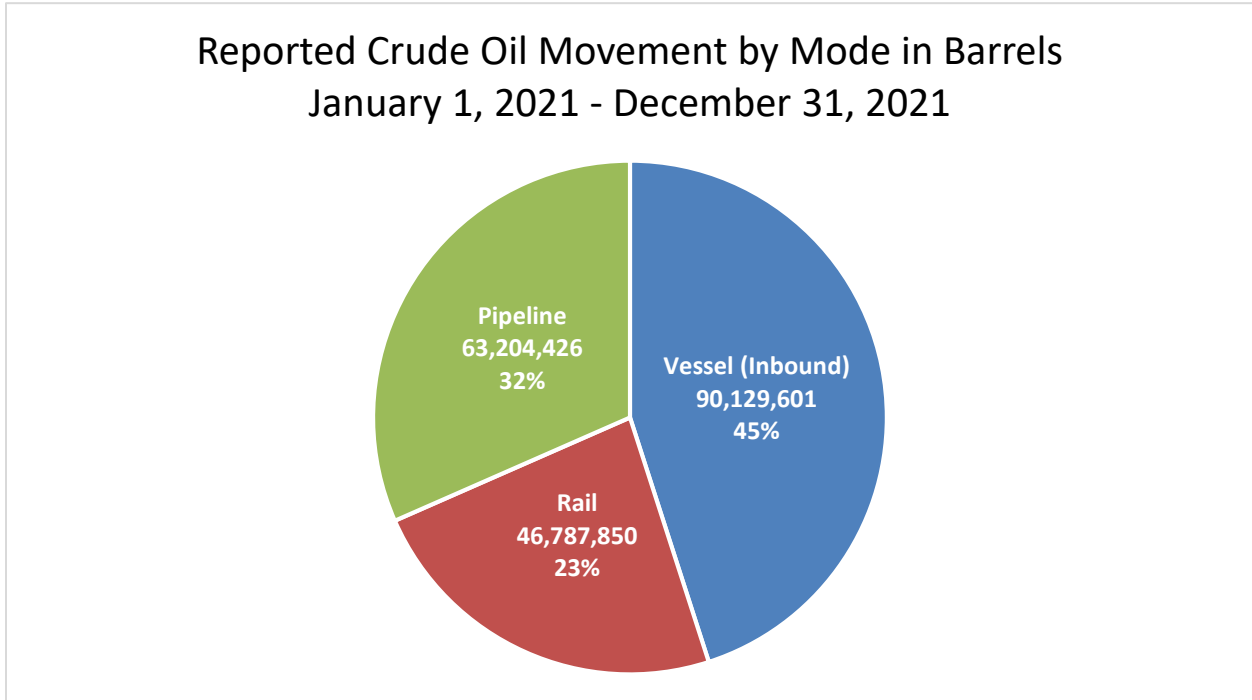
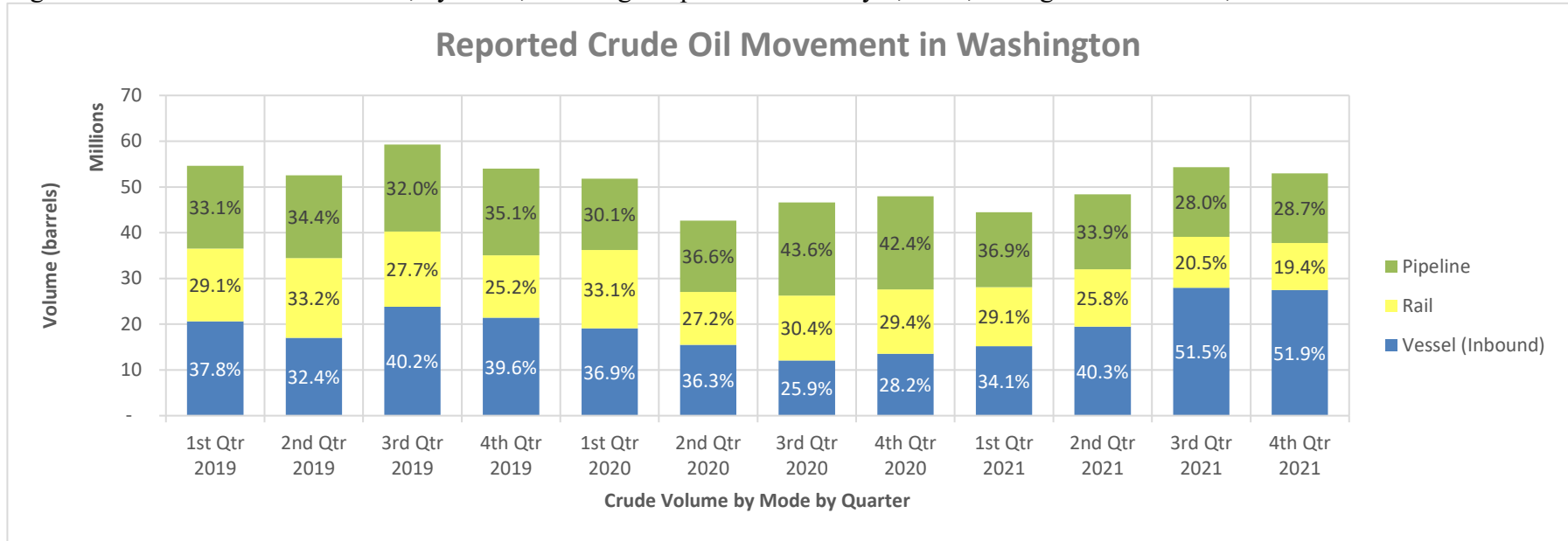


Figure 3: 12-month crude oil movement by mode

Between January 1, 2021 and December 31, 2021, vessels were responsible for 45 percent of reported crude oil movement into the state, rail was responsible for 23 percent, and pipeline for 32 percent.

⁵ The most recent biannual notices from pipelines were submitted to Ecology for the period from July 1, 2021 through December 31, 2021. The next biannual notices submitted by pipelines will cover the period from January 1, 2022, through June 30, 2022, and must be submitted to Ecology by July 31, 2022.

Figure 4 shows crude oil movement, by mode, covering the period of January 1, 2019, through December 31, 2021.



| Mode | 1 st Qtr 2019 | 2 nd Qtr 2019 | 3 rd Qtr 2019 | 4 th Qtr 2019 | 1 st Qtr 2020 | 2 nd Qtr 2020 | 3 rd Qtr 2020 | 4 th Qtr 2020 | 1 st Qtr 2021 | 2 nd Qtr 2021 | 3 rd Qtr 2021 | 4 th Qtr 2021 |
|------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Vessel (Inbound) | 37.8% | 32.4% | 40.2% | 39.6% | 36.9% | 36.3% | 25.9% | 28.2% | 34.1% | 40.3% | 51.5% | 51.9% |
| Rail | 29.1% | 33.2% | 27.7% | 25.2% | 33.1% | 27.2% | 30.4% | 29.4% | 29.1% | 25.8% | 20.5% | 19.4% |
| Pipeline | 33.1% | 34.4% | 32.0% | 35.1% | 30.1% | 36.6% | 43.6% | 42.4% | 36.9% | 33.9% | 28.0% | 28.7% |

**Note: The most recent biannual notices from pipelines were submitted to Ecology for the period from July 1, 2021, through December 31, 2021.*

Figure 4: Quarterly crude oil movement by mode, January 2019 – December 2021

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

Contact Information

Eli Seely

Department of Ecology

Spills Program

P.O. Box 47600

Olympia, WA 98504-7600

Phone: (360) 480-3095

Email: eli.seely@ecy.wa.gov

Appendix A – Washington Railroad Routes

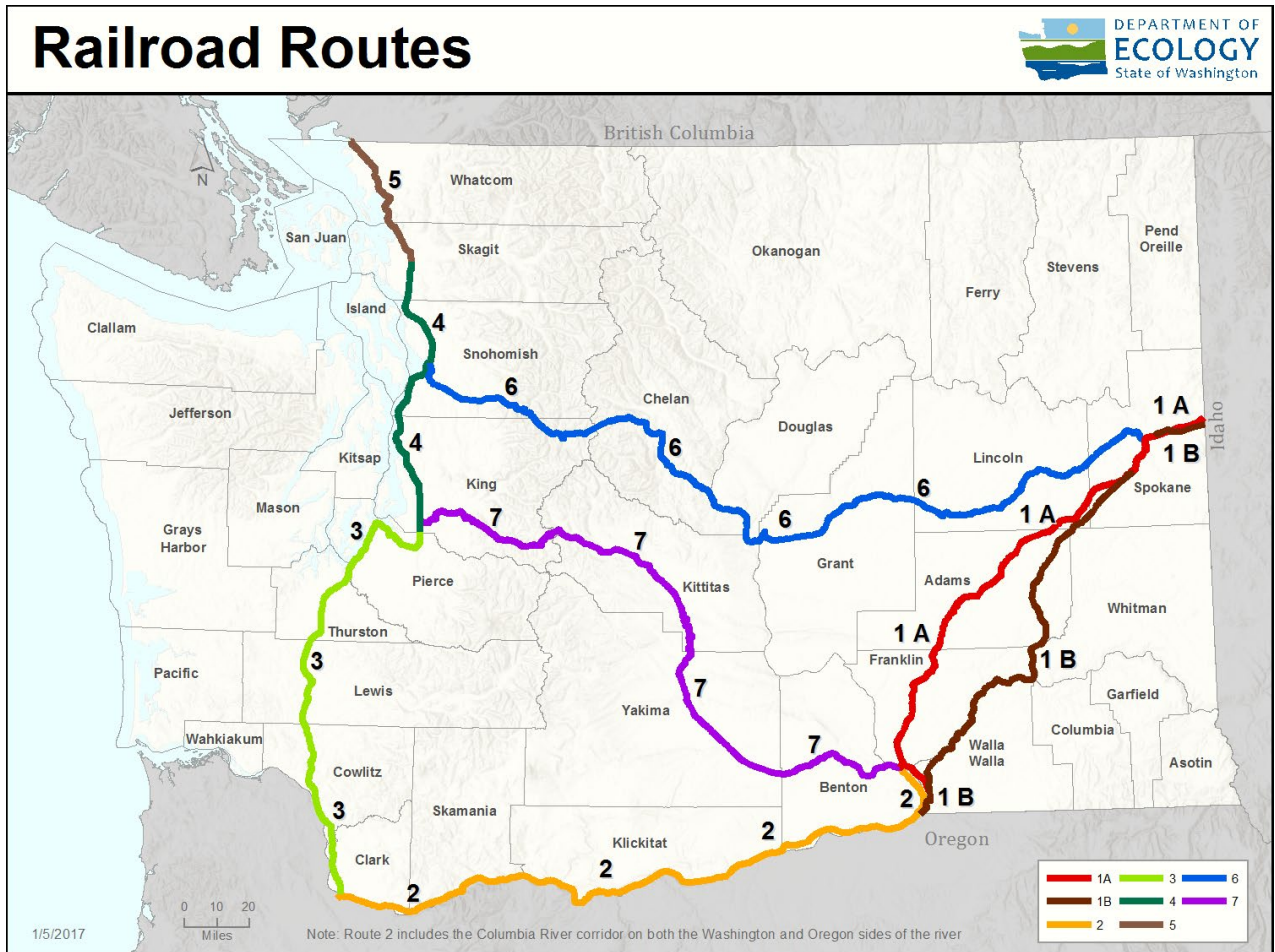


Figure 5: Railroad routes in Washington

Appendix B – API Gravity and Crude Oil Types

Information reported by facilities on scheduled crude oil deliveries includes the gravity and sulfur content of the oil. Ecology uses the standard American Petroleum Institute gravity (API gravity) ranges in combination with the sulfur content to define the crude type in the ANT database.

Sulfur content is measured as the percent of sulfur, by weight, of the crude oil. Oil is categorized by its sulfur content as either sweet or sour. Sour crudes contain greater than 0.5% sulfur. Sweet crudes have less than or equal to 0.5% sulfur.

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 5: 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 |