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Pipelines and Water Carriers Lead the Modes of Oil Transportation in 2007--Motor Carriers and Railroads Continue Smaller But Important Role

The Association of Oil Pipe Lines today released its annual report showing shifts in petroleum transportation from 1990 through 2007. Attached is a copy of the report's data sources and statistical time series.

The report considers the four major modes of transportation--pipelines, water carriers, motor carriers, and railroads--and two major categories of petroleum--crude oil and petroleum products. Data are in short ton-miles.¹ Table 1 contains data for total crude oil and petroleum product transportation. Table 2 contains data for crude oil. Table 3 contains data for petroleum products.

The statistics show several trends over the past two decades (See Charts and Tables within the Report):

- In total, ton-miles of crude oil and petroleum products for all modes of transport have declined from 1.1 trillion ton-miles in 1990 to about 0.84 trillion ton-miles in 2007--an average annual rate of decline of 1.5 percent (Chart 1).
- Pipelines and water carriers are the two main modes of transport but their relative importance has gradually changed. In 1990 pipeline ton miles were about 30 percent higher than water carriers. However, in 2007, pipelines transported almost 160 percent more or 2.6 times the amount of oil by water carriers (Chart 1).
- Pipelines accounted for about two-thirds of all petroleum transportation in 2007--up from about 54 percent in 1990. However, pipeline transport as a percent of total ton miles has held at about two-thirds since the late 1990s (Chart 1).
- Some key influences on pipeline transport tonnage include increases in tanker crude oil imports proximate to coastal refineries, development of important offshore pipeline systems, declines in domestic oil production, greater concentration of refining, blending and liquids processing, improved integration of national oil supply and distribution, enhanced management of petroleum inventory systems (as measured in days of supply of inventory), and relative efficiencies of transport fuel costs per ton of oil delivered.
- Total crude oil production in short tons in the U.S. declined by about 28 percent between 1990 and 2007 (Chart 3). Though overall production was declining, the share of crude oil transported by pipeline increased from about 54 percent to 67 percent reflecting, in part, the diminished requirement for coastal water carriers brought about by decreases in Alaskan crude oil production (Chart 2).

¹ A ton-mile is one ton of freight shipped one mile--a combined measure of both the weight shipped (short tons or 2,000 pound tons) and the distance (miles). Ton-miles in this report provide a common measure for considering the relative contribution and efficiency of the various modes of petroleum transportation. In addition, ton-miles can be useful in considering other variables such as safety and economic service. In order to express pipeline data (reported in barrel-miles) in ton-miles, conversion factors were developed based on data reported by the Energy Information Administration for crude oil gravity of refinery receipts and the weighted average gravity of refinery net output for products. For 2007, the crude oil conversion factor was 6.13 (barrels per short ton), while for products it was 7.15 (barrels per short ton).

- Total domestic crude oil production, as well as Alaskan crude oil production, has shown annual declines almost every year during the study period starting in 1991. Decreased oil production is a primary factor for declines in crude oil ton miles since 1991 (Chart 3 and Table 2).
- Total crude oil and petroleum products in ton miles changed by less than one percent during the same period (Table 1).
- Pipelines in 2007 were the largest conveyors of both crude oil (80 percent, up from 53 percent in 1990) and petroleum products (58 percent, up from 56 percent in 1990). Water carriers provided the second highest level of ton-miles in 2007—about 20 percent of crude oil and 30 percent of petroleum products. (Tables 2 and 3).
- As noted above, declines in waterborne ton-miles are influenced by coastal shipments of oil from Alaska. Alaskan crude oil production in short tons declined by 59 percent during the 1990 to 2007 period (Chart 3).
- Motor carriers, while highly important and versatile for final disposition of petroleum, represent a smaller fraction of total ton-miles (about 4 percent). Motor carriers transport less than one-half of one percent of national crude oil movement but about 7 percent of petroleum products (Tables 1, 2, and 3).
- Railroads transport the smallest quantities of petroleum (about 3 percent in 2007). Railroads transport less than one-half of one percent of national crude oil movement but about 5 percent of petroleum products (Tables 1, 2, and 3).

Chart 1: Share of Total Petroleum Transportation by Mode (1990-2007)

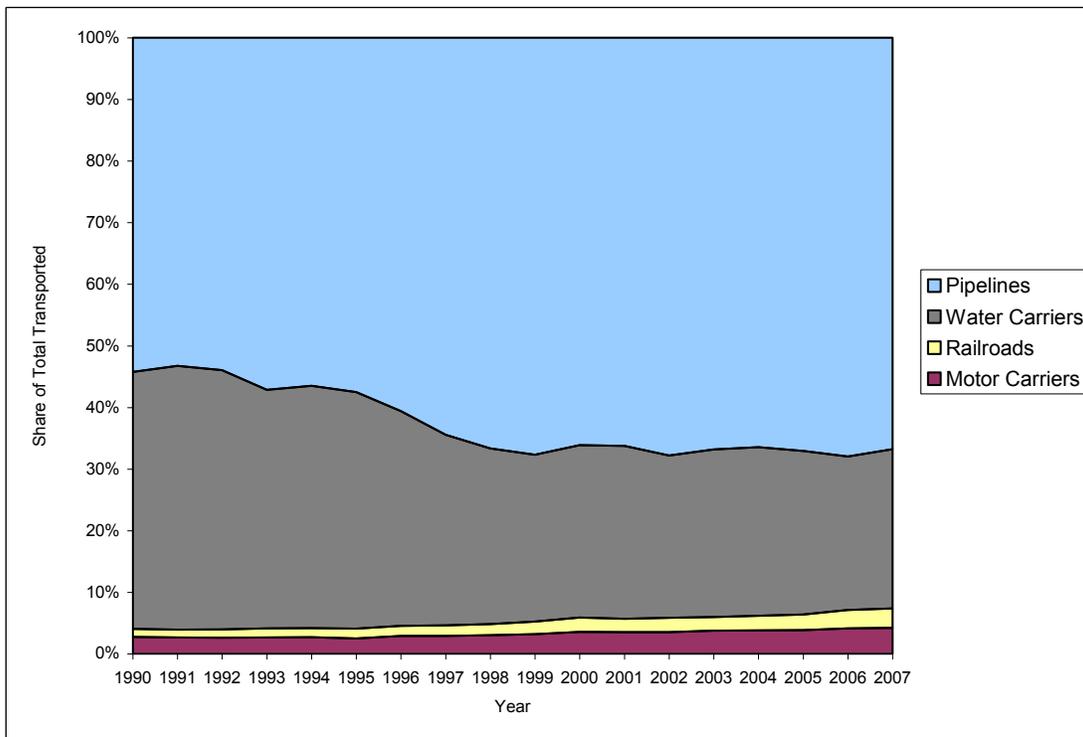


Chart 2: Share of Crude Oil Transportation by Mode (1990-2007)

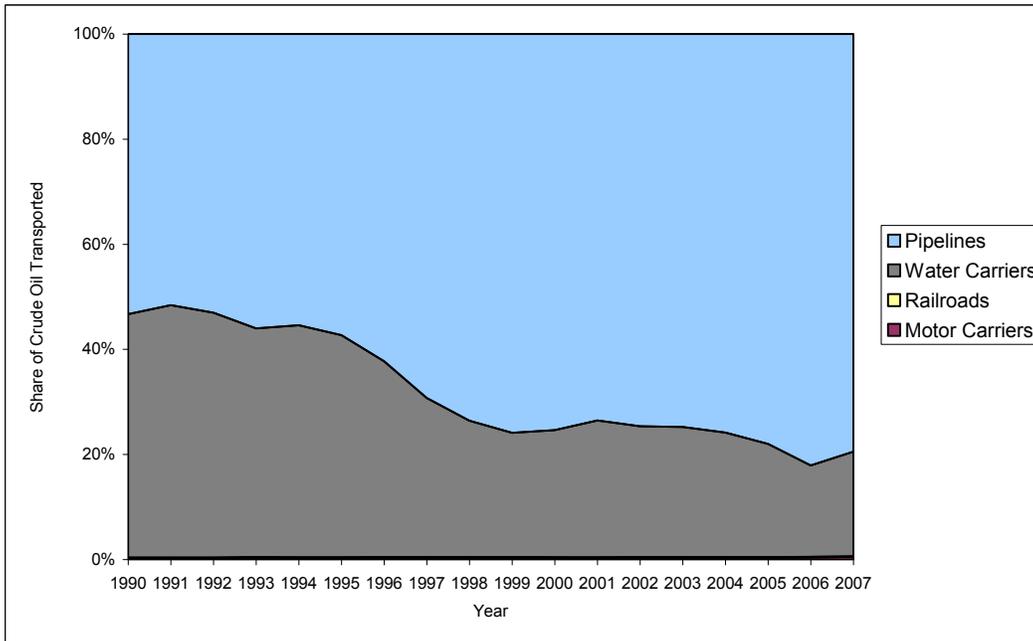
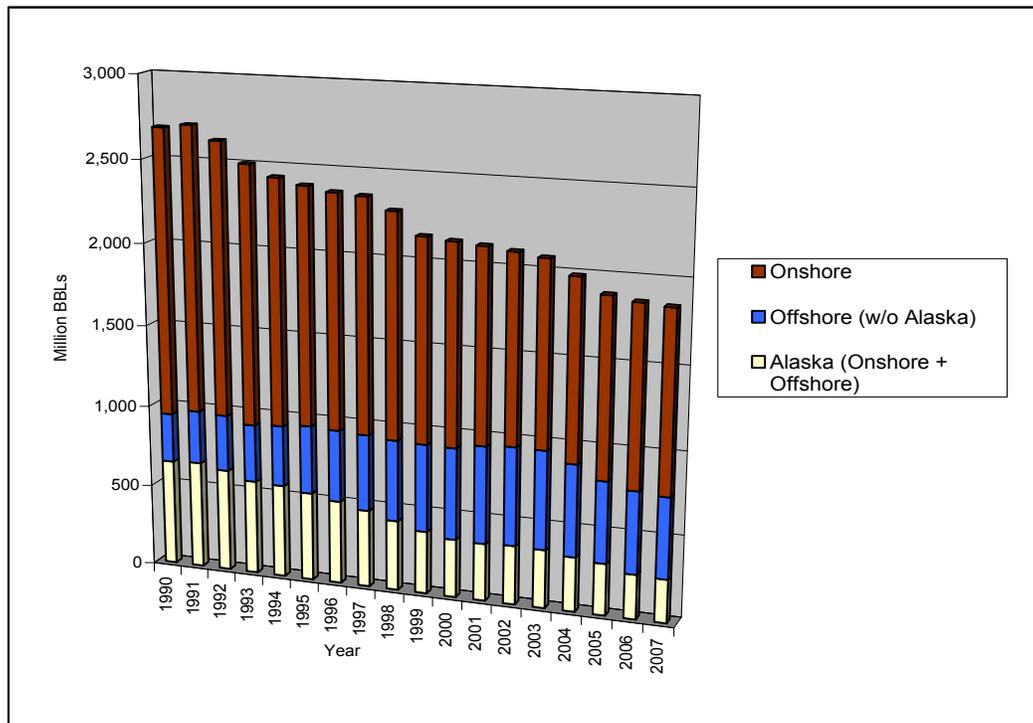


Chart 3: US Crude Oil Production (1990-2007)



Source: Energy Information Administration, Petroleum Supply Annual and Petroleum Supply Monthly reports.

Statistical Time Series

Table 1—Total Crude Oil and Products Ton-miles (Billions of Ton-miles)

Year	Total Crude & Products Ton Miles	Pipelines		Water Carriers		Motor Carriers		Railroads	
		Ton Miles	% of Total	Ton Miles	% of Total	Ton Miles	% of Total	Ton Miles	% of Total
1990	1076.8	584.1	54.2	449.0	41.7	29.7	2.8	14.0	1.3
1991	1086.1	578.5	53.3	465.0	42.8	28.8	2.7	13.8	1.3
1992	1091.7	588.8	53.9	459.3	42.1	28.8	2.6	14.8	1.4
1993	1034.6	592.9	57.3	401.7	38.8	27.8	2.7	15.2	1.5
1994	1046.7	591.4	56.5	411.4	39.3	28.1	2.7	15.8	1.5
1995	1044.9	601.1	57.5	400.9	38.4	26.3	2.5	16.7	1.6
1996	1022.2	619.2	60.6	356.5	34.9	29.7	2.9	16.8	1.6
1997	956.5	616.5	64.5	295.6	30.9	27.7	2.9	16.7	1.7
1998	929.8	619.8	66.7	265.0	28.5	28.3	3.0	16.7	1.8
1999	912.9	617.7	67.7	247.5	27.1	29.0	3.2	18.7	2.0
2000	873.3	577.3	66.1	244.4	28.0	31.3	3.6	20.3	2.3
2001	869.8	576.1	66.2	244.0	28.1	30.8	3.5	18.9	2.2
2002	864.6	586.2	67.8	227.6	26.3	30.6	3.5	20.2	2.3
2003	883.3	590.2	66.8	240.1	27.2	33.2	3.8	19.8	2.2
2004	902.5	599.6	66.4	246.9	27.4	34.4	3.8	21.6	2.4
2005	906.0	607.5	67.1	240.5	26.5	34.8	3.8	23.2	2.6
2006	855.4	581.3	68.0	213.1	24.9	35.2	4.1	25.8	3.0
2007	835.4	557.7	66.8	216.0	25.9	35.2	4.2	26.6	3.2

Rate of Growth (1990-2007)

Total All Modes: -1.5%
 Pipelines: -0.3%
 Water Carriers: -4.2%
 Motor Carriers: 1.0%
 Railroads: 3.8%

Data sources and notes: See page 7. In 2006 there was a methodology change in the calculation of pipeline data (note 1), motor carrier data (note 3) and conversion of barrels to short tons (note 5). The data sources and methodology for water carriers and railroads did not change in this release.

Table 2—Total Crude Oil Ton-miles (Billions of Ton-miles)

Year	Total Crude	Pipelines		Water Carriers		Motor Carriers		Railroads	
	Ton Miles	Ton Miles	% of Total	Ton Miles	% of Total	Ton Miles	% of Total	Ton Miles	% of Total
1990	628.2	334.8	53.3	291.2	46.4	1.5	0.2	0.7	0.1
1991	651.3	336.1	51.6	312.8	48.0	1.6	0.2	0.8	0.1
1992	647.1	343.3	53.1	301.3	46.6	1.7	0.3	0.8	0.1
1993	586.9	328.7	56.0	255.5	43.5	1.8	0.3	0.9	0.2
1994	581.8	322.6	55.4	256.7	44.1	1.7	0.3	0.8	0.1
1995	586.0	335.9	57.3	247.7	42.3	1.7	0.3	0.8	0.1
1996	543.2	338.3	62.3	202.4	37.3	1.7	0.3	0.8	0.1
1997	486.9	337.4	69.3	147.3	30.3	1.7	0.3	0.5	0.1
1998	454.1	334.1	73.6	117.9	26.0	1.6	0.4	0.5	0.1
1999	423.0	321.1	75.9	100.0	23.6	1.4	0.3	0.5	0.1
2000	376.0	283.4	75.4	91.0	24.2	1.2	0.3	0.4	0.1
2001	376.6	277.0	73.6	98.1	26.0	1.1	0.3	0.4	0.1
2002	384.0	286.6	74.6	95.7	24.9	1.2	0.3	0.5	0.1
2003	380.4	284.5	74.8	94.1	24.7	1.3	0.3	0.5	0.1
2004	374.1	283.7	75.8	88.7	23.7	1.2	0.3	0.5	0.1
2005	376.4	293.5	78.0	81.1	21.5	1.4	0.4	0.4	0.1
2006	366.0	300.5	82.1	63.8	17.4	1.4	0.4	0.4	0.1
2007	335.5	266.6	79.5	66.9	19.9	1.6	0.5	0.4	0.1

Rate of Growth (1990-2007)

Crude All Modes: -3.6%
 Pipelines: -1.3%
 Water Carriers: -8.3%
 Motor Carriers 0.5%
 Railroads -3.8%

Data sources and notes: See page 7. In 2006 there was a methodology change in the calculation of pipeline data (note 1), motor carrier data (note 3) and conversion of barrels to short tons (note 5). The data sources and methodology for water carriers and railroads did not change in this release.

Table 3—Total Petroleum Product Oil Ton-miles (Billions of Ton-miles)

Year	Total Products	Pipelines		Water Carriers		Motor Carriers		Railroads	
	Ton Miles	Ton Miles	% of Total	Ton Miles	% of Total	Ton Miles	% of Total	Ton Miles	% of Total
1990	448.6	249.3	55.6	157.8	35.2	28.2	6.3	13.3	3.0
1991	434.8	242.4	55.7	152.2	35.0	27.2	6.3	13.0	3.0
1992	444.6	245.5	55.2	158.0	35.5	27.1	6.1	14.0	3.1
1993	447.7	264.2	59.0	146.2	32.7	26.0	5.8	14.3	3.2
1994	464.9	268.8	57.8	154.7	33.3	26.4	5.7	15.0	3.2
1995	458.9	265.2	57.8	153.2	33.4	24.6	5.4	15.9	3.5
1996	479.0	280.9	58.6	154.1	32.2	28.0	5.8	16.0	3.3
1997	469.6	279.1	59.4	148.3	31.6	26.0	5.5	16.2	3.4
1998	475.7	285.7	60.1	147.1	30.9	26.7	5.6	16.2	3.4
1999	489.9	296.6	60.5	147.5	30.1	27.6	5.6	18.2	3.7
2000	497.3	293.9	59.1	153.4	30.8	30.1	6.1	19.9	4.0
2001	493.2	299.1	60.6	145.9	29.6	29.7	6.0	18.5	3.8
2002	480.6	299.6	62.3	131.9	27.4	29.4	6.1	19.7	4.1
2003	502.9	305.7	60.8	146.0	29.0	31.9	6.3	19.3	3.8
2004	528.4	315.9	59.8	158.2	29.9	33.2	6.3	21.1	4.0
2005	529.6	314.0	59.3	159.4	30.1	33.4	6.3	22.8	4.3
2006	489.4	280.9	57.4	149.3	30.5	33.8	6.9	25.4	5.2
2007	499.9	291.1	58.2	149.1	29.8	33.5	6.7	26.2	5.2

Rate of Growth (1990-2007)

Product All Modes: 0.6%
 Pipelines: 0.9%
 Water Carriers: -0.3%
 Motor Carriers 1.0%
 Railroads 4.1%

Data sources and notes: See page 7. In 2006 there was a methodology change in the calculation of pipeline data (note 1), motor carrier data (note 3) and conversion of barrels to short tons (note 5). The data sources and methodology for water carriers and railroads did not change in this release.

The 1993 data for Motor Carrier Product Ton-Miles (in italics) is a statistical revision.

Data Sources and Notes:

Data Sources for Tables 1, 2, and 3:

1. Pipelines:

- Federal Energy Regulatory Commission Form No. 6, Page 600 (1990-2005 data)
- U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration, Office of Pipeline Safety, PHMSA F 7000-1-1 (Annual Reports for Calendar Years 2006 and 2007; Hazardous Liquid or Carbon Dioxide Systems), as revised July 10, 2009.

2. Water Carriers:

- U.S. Army Corps of Engineers, annual report "Waterborne Commerce of the United States," Part 5 (national summaries), Table 2-2 from ENG forms 3925 and 3925B.

3. Motor Carriers:

- U.S. Interstate Commerce Commission Annual Reports (1990-1994) and U.S. Department of Transportation, Federal Motor Carrier Safety Administration, Form M (1995-2004). Estimates for 2005 - 2007 were developed from Energy Information Administration data. See note 3 below.

4. Railroads:

- U.S. Department of Transportation, Surface Transportation Board and the Federal Railroad Administration, carload waybill samples and estimate of total – "Carload Way Bill Statistics, Report TD-1" and "Freight Commodity Statistics" of The Association of American Railroads annual statistics, Table A3.

Notes for Tables 1, 2, and 3:

1. Beginning with 2006 data, pipeline data were taken from PHMSA F 7000-1-1. Previously, data were extracted from FERC Form No. 6, which included data for federally-regulated pipelines. For 2005, data for federally regulated pipelines were estimated to include about 90 percent of the total national ton-miles, so the pipeline statistics for that year were adjusted to include an additional 10 percent of ton-miles. From 1990 through 2004, the federally regulated estimate was 84 percent with a 16 percent addition for other pipeline ton-miles.
2. Water carrier statistics include total trip statistics as reported by water carriers to the U.S. Army Corps of Engineers.
3. Motor carrier statistics for 1990-2004 include sample data of individual motor carriers representing the motor carrier industry. The data are from U.S. Interstate Commerce Commission (1990-1994) and the U.S. Department of Transportation, Federal Motor Carrier Safety Administration, Form M. Schedule 300 of Form M includes ton mile statistics. Form M reporting for ton miles was inadequate for estimating total motor carrier ton miles in 2005, 2006, and 2007. In place of Form M data, the Shift Report uses correlations between prior time series and U.S. Energy Information Administration (EIA) data for refinery crude oil receipts by truck, EIA oil product imports, and refinery and blending outputs to establish estimates of motor carrier transport in 2005 - 2007. Average hauls are estimated at 23 miles for crude oil and 57 miles for petroleum products. The average for all motor carrier transportation is 53 miles.
4. Railroad ton mile statistics use annual samples collected by the Federal Railroad Administration and estimated to annual totals.
5. Crude oil barrel to ton conversions for 2005 - 2007 use weighted average API gravities for crude oil receipts at refineries as reported by the Energy Information Administration. Petroleum product conversions for 2005 - 2007 use product-level conversion factors reported by the Energy Information Administration as reported on Table C1 of annual releases of the "International Energy Annual."

Revisions to Methodology of the Shifts in Petroleum Transportation Report

The Association of Oil Pipelines (AOPL) has prepared the “Shifts in Petroleum Transportation Report” (“Shift Report”) for a number of years. The Shift Report provides comparative data for ton miles of petroleum transport in the United States using pipelines, water carriers, motor carriers, and railroads. The petroleum data include crude oil, petroleum products, and their total. AOPL has completed a comprehensive review of the methodology for preparation of the “Shifts in Petroleum Transportation Report” and, effective with its publication of 2006 and 2007 data, has instituted several changes in the methodology for some sections of the report. These changes seek to produce information which has high quality and transparency while maintaining capability for timeliness and low resource requirements for preparation.

The updated methodology *changes the methods for pipelines, motor carriers, and year-to-year updates of conversion factors from barrels to ton miles*, while not changing the data preparation methods for water carriers and railroads.

Pipelines

In the past, the “Shift Report” has used data from the Federal Energy Regulatory Commission (FERC) Form 6. FERC collects this information from federally-regulated interstate pipelines. Using these data requires an estimate of the transport through pipelines not regulated by FERC in order to determine total pipeline transport. The estimate has added about 10 to 16 percent to FERC pipeline ton mile data. The updated methodology takes advantage of a statistical reporting system initiated by the Pipeline and Hazardous Material Safety Administration (PHMSA) of the U.S. Department of Transportation (DOT) in 2004, which is inclusive of the universe of pipelines (interstate, intrastate, and gathering). The data come from PHMSA Form 7000-1-1. The PHMSA data systems have had time to mature in quality and timeliness and are expected to have continued availability from the DOT. Form 7000 data were used in preparing the 2007 Shift Report and will be used prospectively. Previous data, extracted from FERC Form No. 6, will remain; therefore there is a one-time change in the source for year-to-year trends in pipeline data starting in 2006.

Motor Carriers

In the past, data for motor carriers came from the U.S. Interstate Commerce Commission and, since 1995, from the U.S. DOT. However, the organizational structure and statistical systems for DOT have changed. The Federal Motor Carrier Safety Administration (FMCSA) collects these data on Form M. Efforts to obtain these data from FMCSA indicate that the statistical reporting system is not a reasonably reliable source for motor carrier ton mile data at this time. Research indicates that there is no other authoritative source for annual updates of U.S. motor carrier petroleum ton miles. As an alternative, the updated methodology uses estimators based on correlations of data between statistics of the U.S. Energy Information Administration (EIA) and the 1982-2004 motor carrier ton mile statistics in previous “Shift Report” releases. Crude oil transport estimation is excellent (always estimated within 1-2 percent) and petroleum product transport is reasonable (estimated within 4 percent of each of the years 2000 through 2004 and always within 10 percent for the years 1982 through 2004).

Barrel to Short Ton Conversion Factors

Previously, the Shift Report has used conversion factors which did not change from year-to-year. However, the changes in average gravity of oil over time were not being captured. In place of static conversion factors, the updated methodology uses data from the EIA, which provide annual data for updates. EIA statistical surveys offer high quality and up-to-date data for use in developing year-to-year factors for converting barrels to short tons. In 2007 EIA data indicate the following average conversion factors in the United States -- 7.15 barrels per short ton of petroleum products and 6.13 barrels per short ton of crude oil.

Water Carriers

Data come from the U.S. Army Corps of Engineers and its report “Waterborne Commerce of the United States” released annually. These data continue to be used in the updated “Shift Report.”

Railroads

Data from the Surface Transportation Board of the U.S. Department of Transportation and the Federal Railroad Administration will continue to be used in the report. The data are consistent with previous releases of the “Shift Report” and derive from annual releases of information from carload waybill samples.