

## ENDNOTES

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<sup>41</sup> Railroad Commission of Texas.

<sup>42</sup> EIA, *Annual Energy Outlook 2006*.

<sup>43</sup> Small volumes of Canadian crude are occasionally exported from Burnaby (near Vancouver, British Columbia), but pipeline, dock, and terminal constraints preclude sizable waterborne exports from the existing facilities.

<sup>44</sup> Federal Trade Commission, *Midwest Gasoline Price Investigation*, March 29, 2001.

<sup>45</sup> Delivered to the refinery gate.

<sup>46</sup> The crude price at its point of origin is frequently referred to in the oil industry as the "netback" price, e.g., the delivered crude price less all applicable transportation costs.

<sup>47</sup> Most western Canadian crude is priced at the crude transportation hubs of Edmonton or Hardisty, both in Alberta.

<sup>48</sup> ConocoPhillips Analyst Call, *Creating an Integrated North American Heavy Oil Business*, October 5, 2006.

<sup>49</sup> Marathon Petroleum Company, *Press Release*, November 3, 2003.

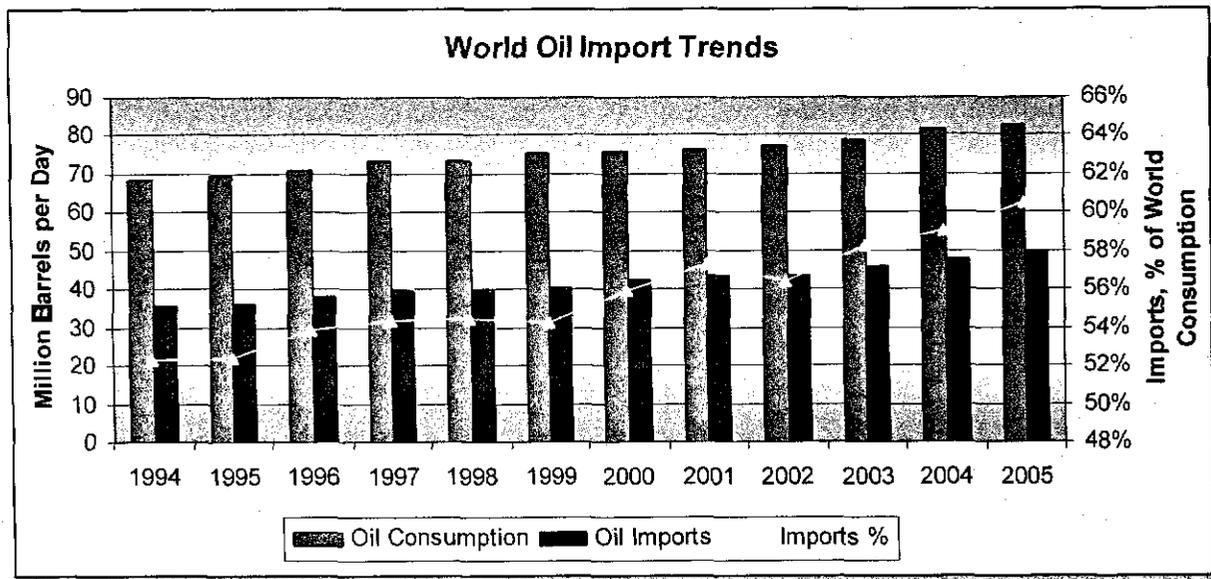
<sup>50</sup> The Mexican heavy sour crude grade is known as Maya.

<sup>51</sup> *Petroleum Intelligence Weekly*, November 7, 2005.

<sup>52</sup> Enbridge Inc., *The "Southern Access" Mainline Expansion/Extension Program*.

# PERSPECTIVE ON GLOBAL SECURITY OF SUPPLY

A clear implication of global oil demand trends is that, irrespective of what governmental policies may be implemented, all oil consuming countries, including the United States, should anticipate an increased level of competition for the world's available oil supply. Figure 1<sup>1</sup> illustrates the world's oil import trends and highlights that an increasing portion of global oil demand must be satisfied by transfers between countries. Once a country does not produce enough oil to meet its domestic demand, it must compete for imports in the global oil markets.



This heightened level of competition has become very apparent recently, as the state-owned oil companies in both China and India have emerged as being among the most aggressive bidders for oil reserves around the globe. Both China and India regard equity interests in oil reserves as being desirable from a national security perspective and, accordingly, use their state-owned oil companies as the mechanism to acquire oil reserves outside of their countries.

Today, India's state-owned Oil and Natural Gas Corporation (ONGC) has stakes in 12 foreign regions for a total oil production of 115,000 b/d. This includes a 45 percent share in Vietnam's Block 6.1 and a 20 percent interest in ExxonMobil's Sahkhalin-1 project. ONGC also has exploration acreage in Qatar, Iran, Libya, Australia, Cuba, and Ivory Coast.<sup>2</sup>

China has been even more aggressive in securing large upstream assets, frequently outbidding India. In 2004, China secured Royal Dutch Shell's 50 percent stake in Block 18 of Angola by outbidding rival ONGC. In August 2005, China National Petroleum Company (CNPC) outbid India to purchase PetroKazakhstan for \$4.2 billion. During the

past five years, China has also been very active in Africa, acquiring upstream assets in Chad, Niger, Mali, Nigeria, Ivory Coast, Mauritania, Morocco, and Algeria. China's most recent acquisition in Africa is a \$2.27 billion purchase of a 45 percent interest in a deepwater block offshore Nigeria.<sup>3</sup> Much of Nigeria's oil production historically has flowed to the United States.

The competition for oil reserves is not limited to Africa and central Asia. For example, China made an ultimately unsuccessful bid of \$18.5 billion for Unocal, one of the oldest U.S. oil companies, in 2005. In Latin America, which historically has exported most of its crude to the United States, China in September 2005 acquired five blocks in Ecuador with reserves of 143 million barrels.<sup>4</sup> In addition, Venezuela has promised to increase its oil exports to China by 10 times and offered China a stake in enormous Orinoco Belt reserves. Finally, Chinese state-owned oil companies are expressing an increased interest in western Canadian oil production which, to date, has been exported almost exclusively to the United States. In April 2005, it was announced that CNOOC Ltd, the top Chinese offshore oil producer, had acquired a 16.7 percent stake in MEG Energy Corp for CN\$150 million.<sup>5</sup> MEG Energy is a privately held Canadian corporation engaged in oil sands development in Alberta, with recoverable reserves of 2 billion barrels. In May 2005, the Chinese Sinopec Group announced that it had acquired a 40 percent interest in the Northern Lights oils sands project, which is a \$4.5 billion project designed to produce 100,000 b/d of synthetic crude.<sup>6</sup>

In addition to a heightened degree of global competition for oil, the country source of oil imports also has significant energy security implications for the United States. The foremost concern is the risk for major supply disruptions due to political instability in the Middle East. It has been the historical experience in this region that political instability can result in major supply disruptions. The impact of supply disruptions will be accentuated by the increasing share of Middle East and, perhaps to a lesser extent, African production of global oil production. Moreover, as oil production becomes increasingly concentrated into fewer countries, the probability also increases that these countries will be able to use their strengthened market position to further force up oil prices even absent supply disruptions.

Table 1 details the major crude supply disruptions since 1970.<sup>7</sup> Most of the supply outages over the last few decades have taken place in the Middle East. Since 1970, there have been 17 major disruptions to oil supply, and all but five of these were located in the Middle East (with an additional two in Africa). It is also worth noting that Venezuela, which in the past has been a reliable oil supplier to the United States, in recent years has had a major supply disruption, and that the current Venezuelan government has expressed interest in diversifying its oil sales away from the United States.





In summary, the proportion of oil that the United States will have to import will inevitably rise. And as countries such as China and India continue to develop economically and expand their oil consumption, the degree of global competition for finite oil resources will also continue to rise. Because of the size of the available crude reserves, proximity, existing transportation infrastructure, and degree of country risk, western Canada is unequivocally the most promising source for additional oil supply for the United States in the world.

The increasing proportion of the world's total oil usage that is in the transportation sector also influences the consequences of crude supply disruptions to the American consumer. As a practical matter, there are no substitutes for oil in the transportation sector in the short-term, which drives the sector's low degree of price elasticity. Accordingly, a major supply outage results in dramatic increases in price levels in the short-term, and this price response behavior will likely be further accentuated as the transportation sector's share of total oil use continues to climb.

**TABLE 1**  
Major Oil Supply Disruptions Since 1970

Date	Gross Supply Loss* (Mb/d)	Percent of World Oil Demand	Reason
May 1970 to January 1971	1.3	2.5	Libyan price controversy
April 1971 to August 1971	0.6	1.1	Algeria-France nationalization dispute
March 1973 to May 1973	0.5	0.8	Lebanon civil unrest
October 1973 to March 1974	4.3	7.1	Arab-Israeli War
May 1977	0.7	1.1	Accident at Saudi oilfield
November 1978 to April 1979	5.6	8.5	Iranian Revolution
October 1980 to January 1981	4.1	6.2	Outbreak of Iran-Iraq War
April 1989 to June 1989	0.5	0.8	UK Cormorant platform accident
August 1990 to January 1991	4.3	6.5	Iraq invasion of Kuwait
April 1999 to March 2000	3.3	4.5	OPEC production cutbacks
November - December 1999	1.1	1.5	Iraq oil export suspension - rejection of phase VI extension
December 2000	1.6	2.1	Iraq oil export suspension - price disagreement with UN
June - July 2001	2.1	2.7	Iraq oil export suspension - rejection of UN resolution 1352
April - May 2002	1.8	2.3	Iraq oil export suspension - rejection of UN resolution 1862
December 2002 to March 2003	2.6	3.4	Venezuelan strike
March 2003 to December 2003	2.3	2.9	Iraqi conflict
August 2005	1.5	1.9	Katrina Hurricane damage to US crude oil production facilities

## ENDNOTES

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- <sup>1</sup> BP Statistical Review of World Energy, June 2006.
  - <sup>2</sup> Petroleum Intelligence Weekly, October 24, 2005.
  - <sup>3</sup> Platts Oilgram News, January 10, 2006.
  - <sup>4</sup> Petroleum Intelligence Weekly, October 24, 2005.
  - <sup>5</sup> Financial Post, April 13, 2005.
  - <sup>6</sup> Synenco press release, May 31, 2005.
  - <sup>7</sup> Ibid. A major supply disruption is defined as one that equals or exceed 0.5 MMb/d.

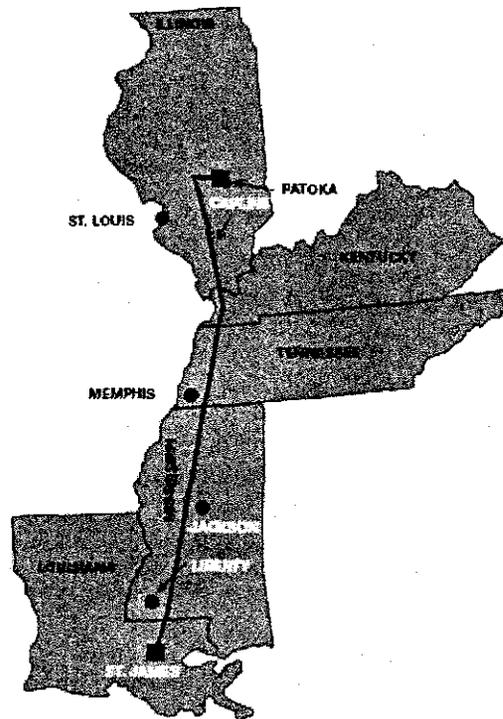


# CRUDE PIPELINE OVERVIEW

As a consequence of the lack of indigenous crude production in the Midwest, there are several high-capacity crude pipelines that supply the region's refining centers from both the Gulf Coast area and Canada. The following presents a summary of these pipelines as well as recent throughput data, if available.

## CAPLINE

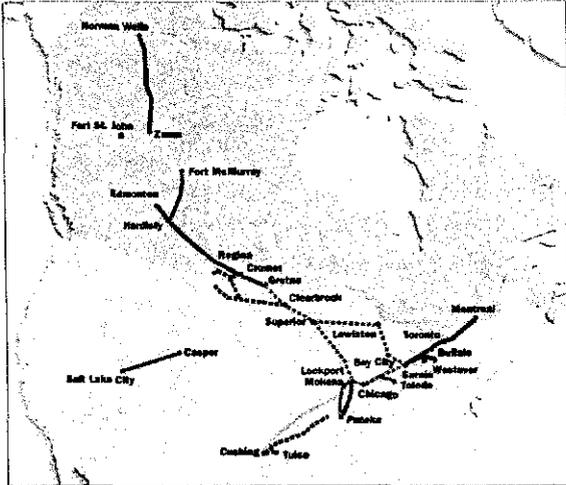
Capline is the largest single crude pipeline serving the Midwest that flows up from the south. Originating at St. James, Louisiana and with direct access to Gulf of Mexico production and the Louisiana Offshore Oil Port (LOOP), it is capable of transporting up to 1.14 million b/d of crude. The system also includes 10.4 million barrels of storage capacity and two dock facilities that are capable of handling tankers up to 600,000 barrels in size.<sup>1</sup> Capline is owned by Marathon, Plains All American Pipeline, BP, and Southcap Pipeline (a joint venture between Chevron, Marathon, and Shell). Capline is operated by Shell Pipeline.



Origin	St. James, Louisiana
Termination	Patoka, Illinois
Length	667 miles
Diameter	40 inches
2004 Throughput <sup>2</sup>	Approximately 680,000 b/d

## ENBRIDGE CANADA

The portion of Enbridge's Canadian system that supplies the Midwest with crude is comprised of four pipelines that originate in Edmonton and extend to the U.S. border at Gretna, Manitoba. At Gretna, the system connects to Enbridge's U.S.-based Lakehead system for transportation further downstream. The majority of its 1.93 million b/d of capacity is utilized for deliveries of crude to the United States, which represented approximately 72 percent of the total deliveries in 2004.<sup>3</sup>



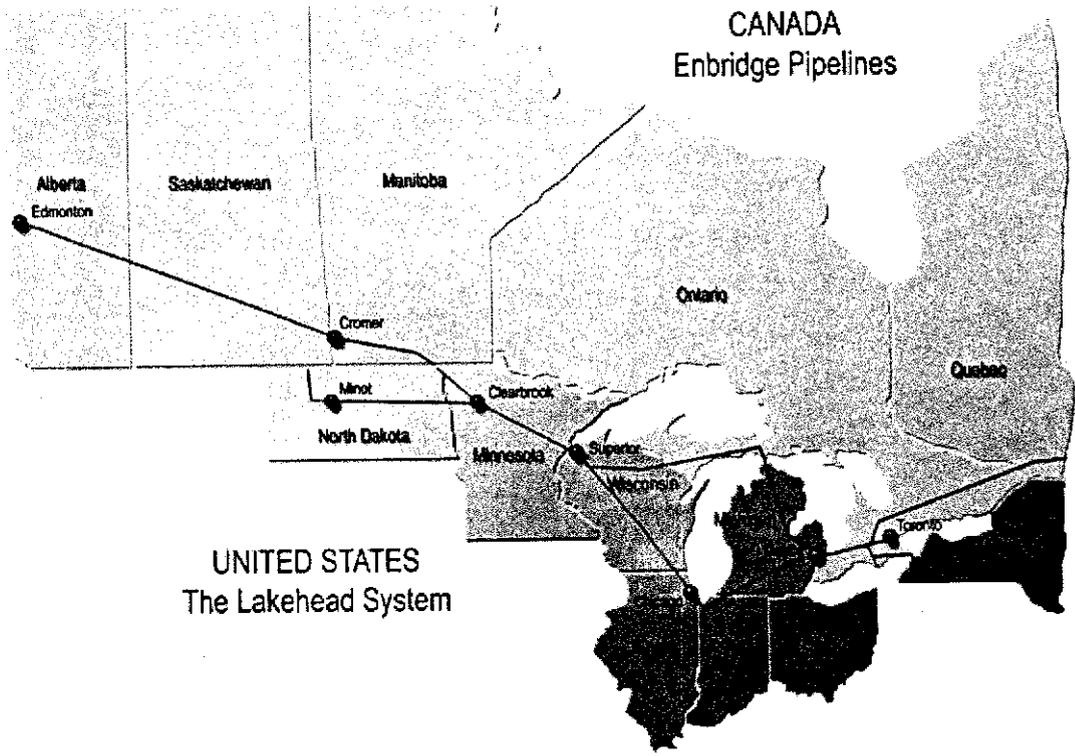
- Enbridge Pipelines Inc.
- Enbridge Pipelines (NW) Inc.
- Enbridge Pipelines (Alhambra) Inc.
- Enbridge Pipelines (Toledo) Inc.
- Mustang Pipe Line Partners
- Chicago Pipe Line Company
- Frontier Pipeline Company
- Spiritwood Pipeline
- ==== Lakehead System
- ==== North Dakota System
- ==== Enbridge Pipelines (Saskatchewan) Inc.
- ==== Ozark Pipeline
- ==== West Tube

Origin	Edmonton, Alberta
Termination	Gretna, Manitoba
Length	Approximately 1,200 miles
Diameters	16 to 48 inches
2004 U.S. Deliveries <sup>4</sup>	Approximately 1.01 million b/d

## LAKEHEAD SYSTEM

The Lakehead System is an extensive network of pipelines that receive crude from Enbridge's Canadian system and delivers to a number of points in the Upper Midwest. The system includes approximately 3,500 miles of pipelines, covering a distance of 1,900 miles, with 11.3 million barrels of storage capacity. Roughly 75 percent of the pipeline's deliveries were made in the United States in 2004, and the remainder was delivered into Enbridge's pipeline system in Ontario.<sup>5</sup> The Lakehead System is owned

and operated as a limited partnership, known as Enbridge Energy, Limited Partnership. Public unitholders directly or indirectly own approximately 89 percent of Enbridge Energy, L.P.'s parent, Enbridge Energy Partners, L.P. (EEP). Enbridge is the General Partner of EEP through an indirect subsidiary and owns directly or indirectly the balance of the units.



Origin	Gretna, Manitoba
Termination	Various points in Upper Midwest
Length	Approximately 1,900 miles
Diameters	12 to 48 inches
2004 U.S. Deliveries <sup>6</sup>	Approximately 1.06 million b/d

## ENBRIDGE – SPEARHEAD PIPELINE

Enbridge's Spearhead pipeline (formerly BP's Cushing to Chicago Pipeline System) was originally constructed to provide Chicago refineries with crude from the large crude transportation hub located in Cushing, Oklahoma. However, Enbridge recently completed the necessary modifications to reverse the pipeline's direction of flow. The reversed line, with an initial capacity of 125,000 b/d, enables crude to be transported from the Chicago area to Cushing, providing refineries in Kansas, Oklahoma, and Texas with much improved access to Canadian crude.<sup>7</sup> The Spearhead pipeline is wholly owned and operated by Enbridge.

Origin	Chicago, Illinois
Termination	Cushing, Oklahoma
Length	650 miles
Diameter	22 and 24 inches
2004 Deliveries	None (idle while system reversed)

## MUSTANG PIPELINE

The Mustang pipeline provides a southbound connection between the Chicago area and the large crude transportation hub located at Patoka, in southern Illinois. Mustang has a stated capacity of 100,000 b/d.<sup>8</sup> Enbridge and ExxonMobil own 30 and 70 percent of Mustang Pipeline, respectively. Mustang is operated by ExxonMobil.

Origin	Chicago, Illinois
Termination	Patoka, Illinois
Length	215 miles
Diameter	18 inches
2004 Deliveries <sup>9</sup>	Approximately 63,700 b/d

## CHICAP PIPELINE

Chicap originates at the Patoka crude hub and delivers crude north into the Chicago area, transporting crude in the opposing direction of the Mustang Pipeline. Its capacity is about 360,000 b/d, and it is the primary route by which crude from the Gulf Coast reaches Chicago.<sup>10</sup> Enbridge owns 23 percent of the Chicap Pipe Line Company, and the balance is held by BP (26 percent) and Chevron (48 percent). Chicap is operated by BP.

Origin	Patoka, Illinois
Termination	Chicago, Illinois
Length	205 miles
Diameter	26 inches
2004 Deliveries <sup>11</sup>	Approximately 243,000 b/d

## ENBRIDGE – OZARK PIPELINE

The Enbridge Ozark pipeline was acquired from Shell in 2004 and connects the Cushing crude hub to the Wood River area in southern Illinois. A wide range of crudes from West Texas and the Gulf Coast can be delivered into the Cushing hub, and then transported on Ozark as desired. At Wood River, crude can be delivered from Ozark to either tankage at the large ConocoPhillips refinery or into the WoodPat pipeline that runs approximately 50 miles east to the Patoka crude hub. Ozark is wholly owned and operated by EEP.

Origin	Cushing, Oklahoma
Termination	Wood River, Illinois
Length	433 miles
Diameter	22 inches
2004 Deliveries <sup>12</sup>	Approximately 170,000 b/d

## EXPRESS-PLATTE

The Express-Platte pipeline system is the only other source of Canadian crude for the Midwest. The Express segment, completed in 1997, originates in Hardisty, Alberta and extends to Casper, Wyoming, where it connects to the Platte pipeline for eventual termination at Wood River. Crude can also be delivered into Kansas from the Platte pipeline via a connection located in Nebraska. Compared to the Enbridge and Lakehead systems, the capacity of the Platte pipeline is relatively modest at about 150,000 b/d. It primarily ships medium and heavy crudes, which accounted for 92 percent of deliveries in 2004.<sup>13</sup> The Express-Platte pipeline system is wholly owned and operated by Kinder Morgan following its acquisition of Terasen in 2005. (The values in the following table refer solely to the Platte pipeline.)

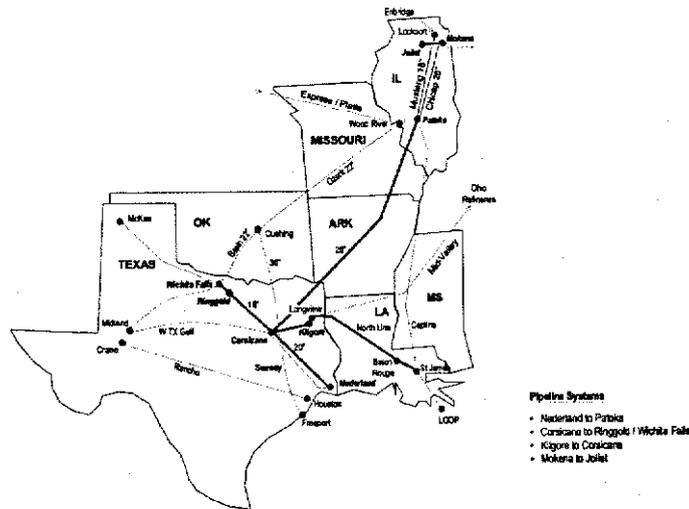


Origin	Casper, Wyoming
Termination	Wood River, Illinois
Length	932 miles
Diameter	20 inches
2004 Receipts <sup>14</sup>	Approximately 161,000 b/d

## EXXONMOBIL

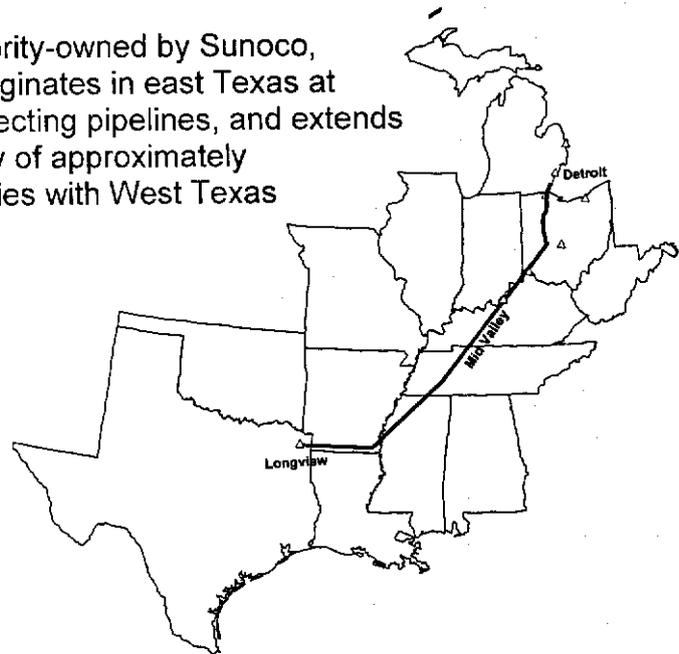
Now idled for several years, the ExxonMobil pipeline once provided Illinois with crude from the Gulf Coast and West Texas. The pipeline originated at Beaumont, Texas and terminated at the Patoka hub. The pipeline is in the process of being reactivated and reversed, so as to transport Canadian crude from Patoka to the Gulf Coast. The startup capacity is estimated to be 65,000 b/d, and it is expected to become operational during 2006.<sup>15</sup> The pipeline is wholly owned and operated by ExxonMobil.

### Central North Crude



### MID-VALLEY PIPELINE

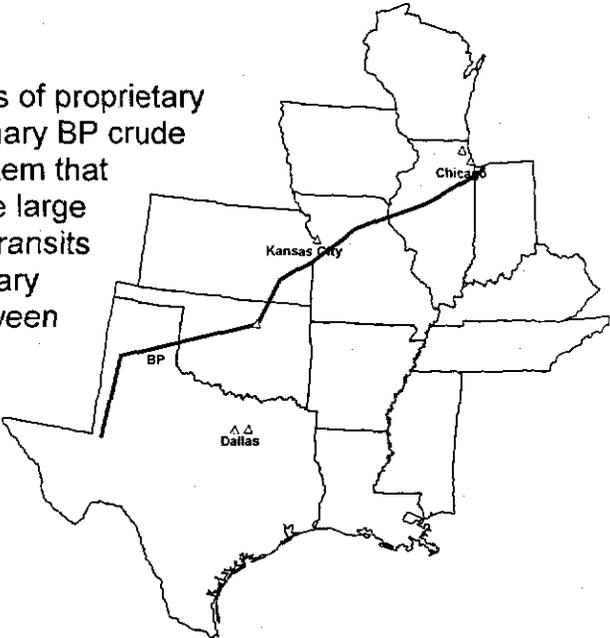
The Mid-Valley Pipeline is operated and majority-owned by Sunoco, with the balance held by BP. The pipeline originates in east Texas at Longview, where it receives crude from connecting pipelines, and extends to the Detroit, Michigan area. With a capacity of approximately 230,000 b/d, it primarily supplies Ohio refineries with West Texas crudes.<sup>16</sup>



Origin	Longview, Texas
Termination	Samaria, Michigan
Length	1,087 miles
Diameter	20-22 inches
2004 Receipts <sup>17</sup>	Approximately 195,000 b/d

**BP PIPELINES**

BP owns perhaps the most extensive networks of proprietary pipelines found in the United States. The primary BP crude pipeline serving the Midwest consists of a system that originates in West Texas and terminates at the large BP refinery in Whiting, Indiana. The pipeline transits the Cushing hub along its route. This proprietary pipeline is now the only direct connection between Cushing and the Chicago area that is still in operation.



Origin	West Texas
Termination	Whiting, Indiana
Length	Approximately 1,300 miles
Diameters	6-22 inches
2004 Deliveries <sup>18</sup>	Approximately 250,000 b/d

## ENDNOTES

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- <sup>1</sup> Plains All American Pipeline, L.P., April 2004 *Investor Presentation*.
- <sup>2</sup> Annualized data from March through December, 2004; Plains All American Pipeline, L.P., 2004 10-K.
- <sup>3</sup> Enbridge Inc., 2004 Annual Information Form.
- <sup>4</sup> Ibid.
- <sup>5</sup> Enbridge Energy Partners, L.P., 2004 10-K.
- <sup>6</sup> Ibid.
- <sup>7</sup> Enbridge Inc., 2004 Annual Information Form.
- <sup>8</sup> Ibid.
- <sup>9</sup> Ibid.
- <sup>10</sup> Ibid.
- <sup>11</sup> Ibid.
- <sup>12</sup> Enbridge Energy Partners, L.P., 2004 10-K.
- <sup>13</sup> Kinder Morgan/Terasen Pipeline website, [www.terasen.com](http://www.terasen.com).
- <sup>14</sup> Based on Wyoming and Nebraska origination barrels, Platte Pipeline Company, 2004 Form 6.
- <sup>15</sup> Richard Bird, Enbridge Investor Presentation, *Creating Value for Our Customers – “Going Beyond Transportation.”*
- <sup>16</sup> National Petroleum Council, *Petroleum Storage and Transportation: Volume V – Petroleum Liquids Transportation*, April 1989.
- <sup>17</sup> Based on Texas and Louisiana origination barrels, Mid-Valley Pipeline Company, 2004 Form 6.
- <sup>18</sup> Based on Texas and Oklahoma origination barrels and Indiana receipt barrels, BP Pipelines (North America) Inc., 2004 Form 6.

# MIDWEST CRUDE AND PRODUCT SUPPLY INTERRUPTION EVENTS

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The Explorer Pipeline is the largest pipeline that transports refined product from the Gulf Coast to the Midwest. Consequently, an interruption in the flow of refined product on Explorer can have material consequences for the Midwestern public. In March 2000, damage to the pipeline forced Explorer to halt shipments for five days, followed by a prolonged period of reduced throughput due to operational issues. The pipeline did not return to full capacity until December 2000. The Federal Trade Commission, in their 2001 investigation report, indicated that the loss of Explorer materially contributed to a sizable spike in Midwestern refined product prices.<sup>1</sup> The Explorer pipeline was again forced to shutdown in late September 2005 because of Hurricane Rita. Pipeline operations ceased for several days and then the pipeline operated at reduced capacity for several more days.<sup>2</sup>

Colonial Pipeline ships an average of 100 million gallons each day of refined product from the Gulf Coast to the southern part of the Midwest and much of the U.S. East Coast. In August 2005, Hurricane Katrina closed the Colonial Pipeline for several days. The pipeline then operated at a reduced rate for an additional week.<sup>3</sup> After Hurricane Rita, pipeline operations were again halted and then operated at reduced capacity for several weeks.

Plantation Pipeline transports more than 20 million gallons per day of refined product throughout the Southeast on its 3,100 mile pipeline network. Hurricane Katrina caused the pipeline to shut down for several days, resulting in decreased refined products shipments for the quarter.<sup>4</sup>

In the Midwest itself, regional refined product pipeline outages can have material consequences for the Midwestern public. The Wolverine Pipeline, which transports refined product from the Chicago area up into Michigan, halted operations for nine days from June 7 to 16, 2000. It then operated at reduced capacity for one month, causing shortages in Detroit and northern Ohio. The Wolverine Pipeline outage resulted in Michigan having one of the highest average gasoline prices in the nation for that period.<sup>5</sup>

Capline is the largest pipeline transporting crude oil from the Gulf Coast to the Midwest. It was shut down for four days in August 2005 as a result of Hurricane Katrina. It then operated at reduced capacity for over one week. Capline was again shut down after Rita followed by reduced throughput for several days.<sup>6</sup> The other crude pipelines available to the Midwestern refiners do not have the capability to replace Capline's capacity and, consequently, a number of Midwestern refineries were forced to reduce crude throughput.<sup>7</sup> These refinery throughput reductions directly acted to reduce the supply of local refined product for the Midwestern public.



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<sup>1</sup> Federal Trade Commission, *Midwest Gasoline Price Investigation*, March 29, 2001.

<sup>2</sup> Explorer Pipeline, Press Release, *Explorer Pipeline Plans to Resume Limited Operation Monday*, Monday, September 26, 2005.

<sup>3</sup> The State Journal (West Virginia), *Effects of Hurricane Katrina*, August 31, 2005 and Kentucky Office of Energy Policy, *Petroleum Pipelines Coming Back Online*, September 1, 2005.

<sup>4</sup> Colonial Pipeline Press Releases and Oil Daily, *Kinder Morgan Posts Strong Earnings Despite Hurricane Outages*, Friday, October 21, 2005.

<sup>5</sup> Federal Trade Commission, *Midwest Gasoline Price Investigation*, March 29, 2001.

<sup>6</sup> Shell Press Releases.

<sup>7</sup> The U.S. Department of Energy, in their Hurricane Katrina Situation Report #15, indicated that seven Midwestern refineries had reduced rates due to the Capline pipeline outage.

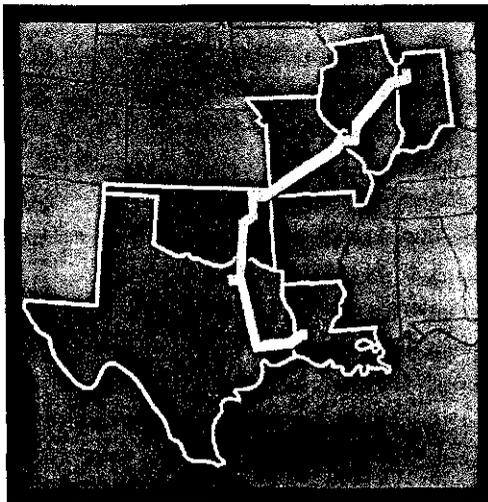


# PRODUCT PIPELINE OVERVIEW

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An extensive network of refined product pipelines serves the Midwest. Since the petroleum product consumers are far more geographically dispersed than the refineries, the Midwestern product pipeline network is also more extensive than the Midwestern crude pipeline system. This section provides an overview of the major product pipelines in the region, beginning with the primary interstate systems and progressing to the smaller regional pipelines.

## EXPLORER PIPELINE

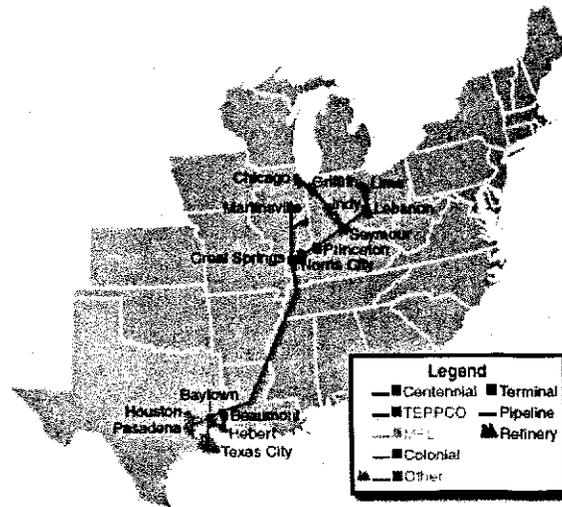


The Explorer Pipeline originates in Houston, with an inbound spur from Port Arthur, Texas. The pipeline extends north through Tulsa, Oklahoma, before terminating in Hammond, Indiana outside of Chicago. In terms of throughput, it is the largest refined product pipeline serving the Midwest. It transports a combination of gasoline, jet fuel, and distillate, with approximately 91 percent of the products originating in the Texas region.<sup>1</sup> The Explorer Pipeline is owned by Chevron, Citgo, ConocoPhillips, Marathon, Sunoco, and Shell.

Origin	Port Arthur, Texas
Termination	Hammond, Indiana
Length	1,413 miles
Diameter	24-28 inches
2004 Receipts <sup>2</sup>	Approximately 573,000 b/d

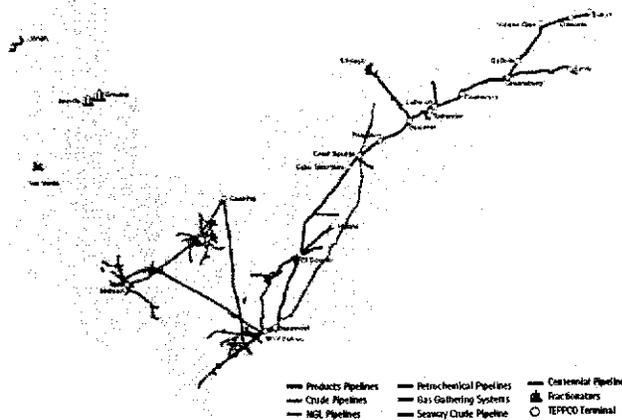
## CENTENNIAL PIPELINE

The Centennial Pipeline is a 50/50 joint venture between Marathon Petroleum Company and Texas Eastern Pipeline Company (TEPPCO). It provides southern Illinois with access to Gulf Coast refined product originated in the southeast Texas area. Total capacity is 210,000 b/d.<sup>3</sup> The 2004 utilization value, roughly 35 percent, is somewhat misleading as Centennial did not begin product shipments until 2002, and pipeline throughput typically increases gradually during the initial years of operation.



Origin	Beaumont, Texas
Termination	Bourbon, Illinois
Length	795 miles
Diameter	24-26 inches
2004 Receipts <sup>4</sup>	Approximately 74,000 b/d

## TEPPCO



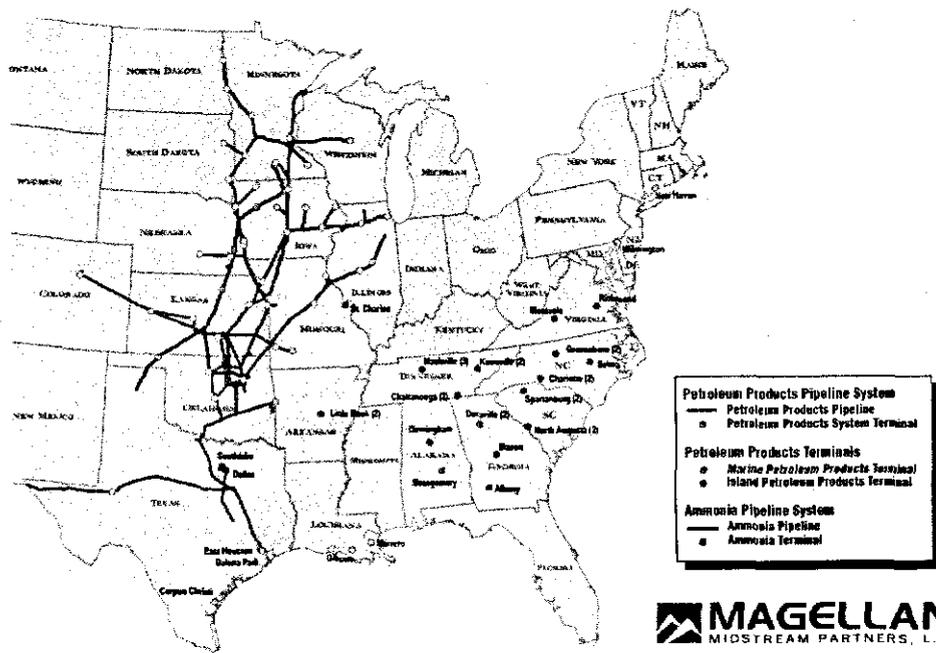
TEPPCO owns an extensive product pipeline system that stretches from southeast Texas to the Northeast, serving many major market areas along its route. The system transports a variety of refined products, including gasoline, jet fuel, and distillate into the Midwest. It can also receive refined product in Illinois from the Centennial pipeline. The portion of the system that extends east of southwest Ohio (near

Todhunter, Ohio) is dedicated solely to the transportation of LPGs, primarily propane. The primary portion of the pipeline has a capacity of roughly 330,000 b/d.<sup>5</sup> Total refined product deliveries averaged 416,390 b/d in 2004, and approximately 146,000 b/d of that total was delivered to the Illinois/Indiana area.<sup>6</sup>

Origin	Southeast Texas
Termination	Northeastern U.S.
Length	Approximately 4,600 miles
Diameters	6-20 inches
2004 IL/IN Deliveries <sup>7</sup>	Approximately 146,000 b/d

### MAGELLAN PIPELINE

The Magellan Pipeline system is an extensive network of pipelines serving the mid-continent region of the United States. In total, the system covers a 13-state area, extending from the Texas Gulf Coast to the Midwest and North Dakota. Magellan receives primarily gasoline, distillate, and jet fuel from a number of refineries and other refined product pipelines. With



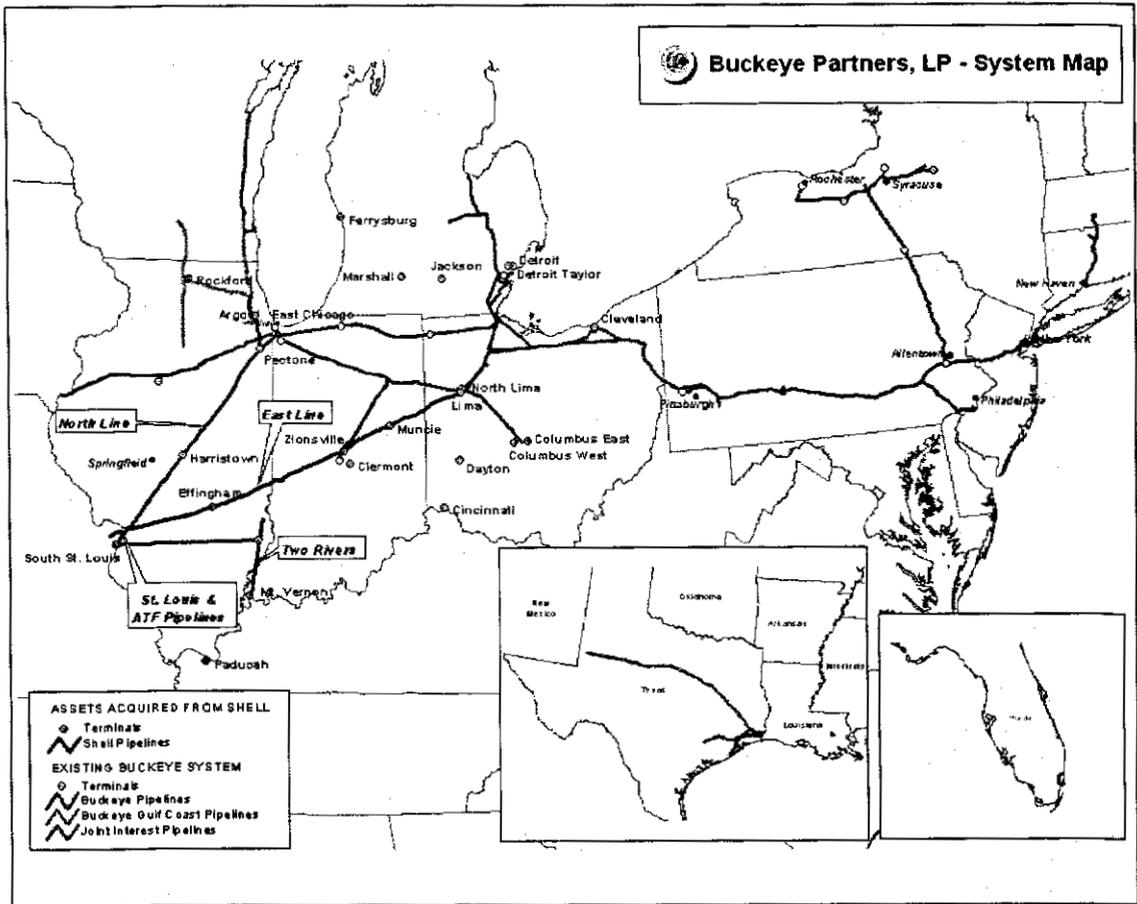
respect to the Midwest, four segments of the Magellan system are of particular significance. Two lines extending into Illinois provide refined product delivery capacity of 22,000 and 35,000 b/d to the Chicago area and the central region of the state, respectively. In Minnesota, Magellan delivers refined product from the Murphy Superior refinery into the Minneapolis/St. Paul area. Magellan also deliveries refined product into central Wisconsin from the Minneapolis/St. Paul area. These last two pipelines each

have a capacity of roughly 21,000 b/d.<sup>8</sup> Detailed public information regarding delivery volumes by state is not available. Magellan is a public company listed on the New York Stock Exchange.

Length	8,504 miles total
Diameters	6-20 inches
2004 Deliveries <sup>9</sup>	Approximately 739,000 b/d

### BUCKEYE PIPELINE

Buckeye Pipeline provides refined product transportation through its five subsidiaries that offer service in a total of thirteen states. Unlike the aforementioned refined product pipelines, Buckeye can not supply refined product into the Midwest from other regions. Its Midwest pipeline assets consist of several receiving and delivery lines that connect



to a central corridor, extending from Chicago to western Pennsylvania (Pittsburg is a balance point in Buckeye's entire system, as refined product is shipped into Pittsburg from both the west and the east). Along the Midwestern corridor, refined products are received directly from regional refineries or via other pipeline connections. Buckeye's configuration allows it to serve the Chicago area as well as other major market areas in Indiana, Ohio, and Michigan. Although the pipeline transports a variety of refined products, gasoline and jet fuel accounted for roughly 70 percent of Midwestern receipts in 2004.<sup>10</sup> Public information regarding pipeline deliveries by state is not available.

Length	2,025 miles total
Diameters	8-20 inches
2004 IN/MI/OH Receipts <sup>11</sup>	Approximately 322,000 b/d

In addition to the Buckeye pipelines, Buckeye also owns the Wood River and Norco Pipelines. The Wood River pipeline system, which Buckeye acquired from Shell Pipelines, principally consists of three segments that provide a conduit for the output of ConocoPhillips' Wood River Refinery to Chicago, St. Louis, and Lima, Ohio. At Lima, the Wood River pipeline connects to Buckeye's Midwestern system. A fourth segment receives refined product from the Explorer Pipeline in the Wood River area for delivery to a terminal on the Ohio River in Mount Vernon, Indiana. Approximately 86 percent of the products transported were gasoline and jet fuel in 2004 with the remainder being distillate.<sup>12</sup>

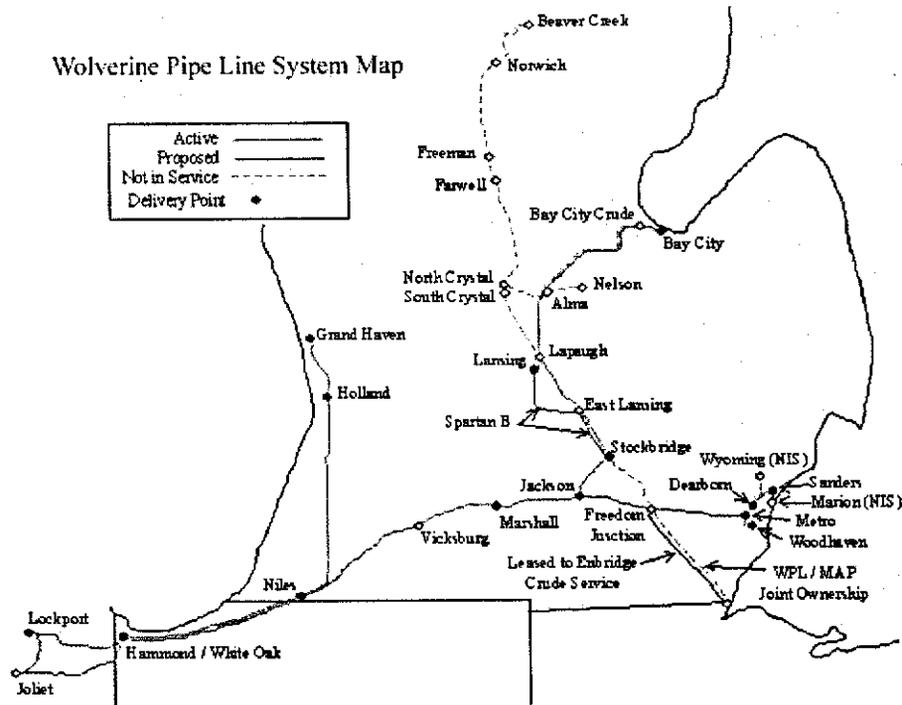
Length	889 miles total
2004 Receipts <sup>13</sup>	Approximately 50,000 b/d
<i>(these figures are exclusive of those provided for Buckeye above)</i>	

The Norco Pipeline is a 444-mile system that originates in Hartsdale, Indiana, that extends westward to Galesburg, Illinois, and eastward to Toledo, Ohio. The primary markets served by the pipeline include: Toledo; South Bend, Indiana; and Peoria, Illinois.<sup>14</sup> Buckeye is a public company listed on the New York Stock Exchange.

# WOLVERINE

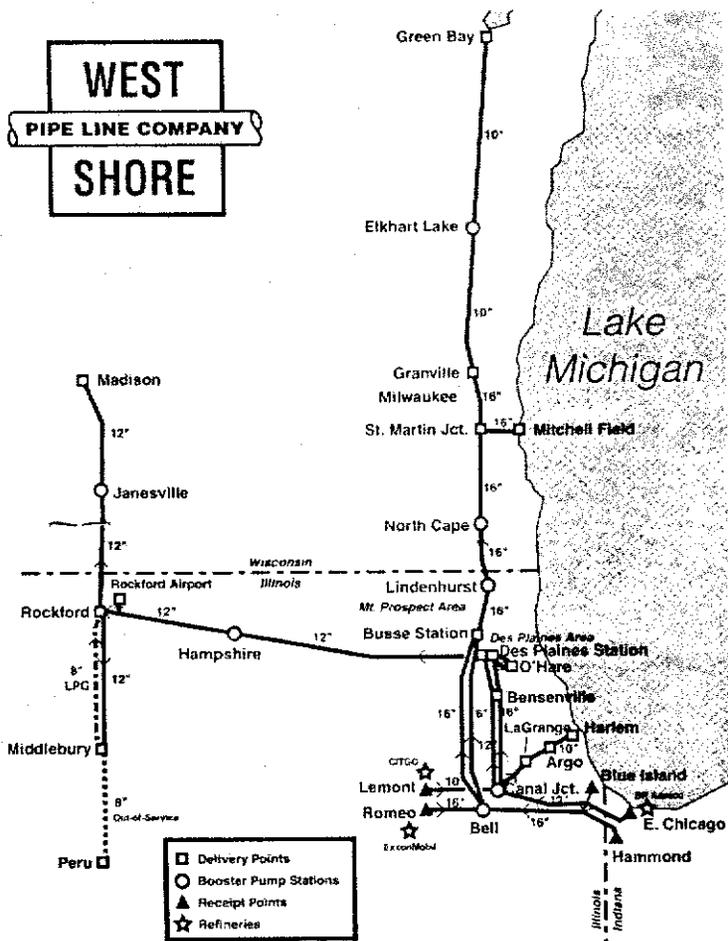
The Wolverine Pipeline is a regional pipeline. All of the pipeline's refined product shipments are originated in the Chicago area for delivery into Michigan. The pipeline has a capacity of roughly 250,000 b/d.<sup>15</sup> Wolverine transports gasoline, jet fuel, kerosene, and distillate, but

gasoline and jet fuel receipts were predominant in 2004, accounting for over 70 percent of the total.<sup>16</sup> Wolverine is owned by ExxonMobil, Sunoco, Shell, Citgo, and Marathon.



Length	Approximately 1,000 miles total
Diameters	6-18 inches
2004 Receipts <sup>17</sup>	Approximately 323,000 b/d

# WEST SHORE PIPELINE

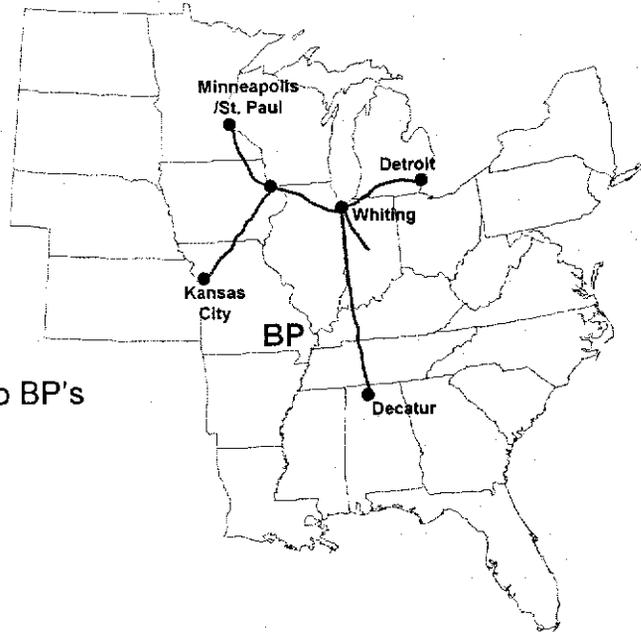


The West Shore Pipeline is a pipeline network originating in the Chicago area and extending north to both Green Bay and Madison, Wisconsin. With an origination capacity of approximately 175,000 b/d, the West Shore Pipeline is a major supplier of refined product to southern Wisconsin.<sup>18</sup> As such, the volumes of products received from the pipeline in 2004 were quite significant and, similar to the other product pipelines, were comprised primarily of gasoline and jet fuel.<sup>19</sup> West Shore Pipeline is owned by Buckeye, Citgo, BP, Sunoco, ExxonMobil, and Shell.

Length	650 miles total
Diameters	10-16 inches
2004 Receipts <sup>20</sup>	Approximately 391,000 b/d

## BP PIPELINES

Akin to its crude pipeline system, BP also owns and operates a network of proprietary product pipelines that originate at its refinery in Whiting, Indiana. Products are shipped via four different lines that terminate at Detroit, Indianapolis, Minneapolis-St. Paul, and Kansas City. In addition, a fifth pipeline transports petrochemical feedstock from the refinery to BP's petrochemical plant in Decatur, Alabama.



## KOCH PIPELINE

The Koch Pipeline originates at the Flint Hills Pine Bend refinery in the Minneapolis area and extends into Wisconsin, where it later splits to serve the major demand areas of Madison and Milwaukee. The Koch Pipeline is a proprietary system and capacity and delivery volume data are not available. The pipeline is estimated to provide for approximately 20 percent of Wisconsin's gasoline and distillate demand.<sup>21</sup> The Koch Pipeline is owned by Flint Hills Resources, a wholly-owned subsidiary of Koch Industries.



## ENDNOTES

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- <sup>1</sup> Based on product receipt data, Explorer Pipeline Company, 2004 Form 6.
- <sup>2</sup> Ibid.
- <sup>3</sup> Centennial Pipeline website, [www.centennialpipeline.com](http://www.centennialpipeline.com).
- <sup>4</sup> Ibid.
- <sup>5</sup> National Petroleum Council, *Petroleum Storage and Transportation: Volume V – Petroleum Liquids Transportation*, April 1989.
- <sup>6</sup> TEPPCO Partners, L.P., 2004 Annual Report.
- <sup>7</sup> Ibid.
- <sup>8</sup> National Petroleum Council, *Petroleum Storage and Transportation: Volume V – Petroleum Liquids Transportation*, April 1989.
- <sup>9</sup> Magellan Midstream Partners, L.P., 2004 10-K.
- <sup>10</sup> Based on Indiana, Michigan, and Ohio receipt barrels, Buckeye Partners, L.P., 2004 Form 6.
- <sup>11</sup> Ibid.
- <sup>12</sup> Based on product receipt data, Wood River Pipe Lines, LLC, 2004 Form 6.
- <sup>13</sup> Ibid.
- <sup>14</sup> Buckeye Partners, L.P., 2004 Annual Report.
- <sup>15</sup> National Petroleum Council, *Petroleum Storage and Transportation: Volume V – Petroleum Liquids Transportation*, April 1989.
- <sup>16</sup> Based on product receipt data, Wolverine Pipe Line Company, 2004 Form 6.
- <sup>17</sup> Ibid.
- <sup>18</sup> National Petroleum Council, *Petroleum Storage and Transportation: Volume V – Petroleum Liquids Transportation*, April 1989.
- <sup>19</sup> Based on product receipt data, West Shore Pipe Line Company, 2004 Form 6.
- <sup>20</sup> Ibid.
- <sup>21</sup> Flint Hills Resources Fuels website, [www.fhrfuels.com](http://www.fhrfuels.com).

# EMPLOYMENT AT REFINERY UPGRADING PROJECTS

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Refinery projects require significant expenditures not only for capital equipment but also for construction labor, and they frequently result in additional permanent positions within the refineries themselves. In order to provide an illustration of the impact that refinery upgrade projects can have on employment, a number of projects are summarized in this section to highlight this relationship. For the last several years, capital spending by refiners has been primarily directed towards improvements to meet the new, more stringent requirements for clean fuels production. Now that most of these types of projects are complete or nearing completion, it is anticipated that future capital investments will involve capacity expansions and enhancements to the upgrading abilities of refineries. These investments are in response to the growing demand for light products, the increasing availability of heavy crudes, and the favorable economics provided by the pricing differentials between light and heavy crude varieties.

Several refinery projects in the Midwest have resulted or will result in the creation of jobs. For instance, in February 2004, Flint Hills announced a \$325 to \$400 million clean fuels project at its Pine Bend refinery in Minnesota. The installation of a new hydrocracker and hydrogen plant was expected to create 500 construction jobs.<sup>1</sup> Near the end of 2005, Marathon, in conjunction with modifications for clean fuels requirements, completed a major capacity expansion of its Detroit facility. This \$300 million project necessitated the utilization of approximately 1,400 tradesmen during the peak of construction.<sup>2,3</sup>

Improvements at BP's Midwestern refineries have also resulted in job creation. In April 2005, the company announced a \$130 million project to install a distillate hydrotreater in order to produce additional ultra low sulfur diesel fuel at its refinery in Whiting, Indiana. Although the size and scope of the project is relatively modest, the project is still expected to employ 400 workers during the peak construction period.<sup>4</sup> In addition, as part of a 10-year, \$300 million upgrade of BP's Toledo, Ohio refinery, BP and Sunoco entered into a hydrogen supply agreement, whereby the BOC Group would construct a \$100 million hydrogen plant to supply both refineries. The plant's construction was expected to generate more than 800 jobs, exclusive of BP's refinery upgrade project.<sup>5</sup> This latter example illustrates the employment impact that refinery investment programs are capable of achieving both inside and outside of a refinery's gates.

The following tables provide a summary of the aforementioned projects as well as examples of other refinery projects across the U.S. that have resulted in the creation of jobs during the past ten years. In addition to the number of construction jobs that result from these capital investments, another important factor to consider is the significant amount of permanent employment that can result from some of the larger and more extensive projects.

Region	Company	Refinery	Project Summary	Investment (millions)	Job Creation Figures	
					Construction	Permanent
Midwest	BP	Whiting	Clean Fuels Modifications	\$130	400	
	BP / Sunoco	Toledo	Hydrogen Plant (serving both refineries) and Clean Fuels Modifications (at both refineries)	n/a	800	
	Flint Hills	Pine Bend	Clean Fuels Modifications	\$325-\$400	500	
	Marathon	Detroit	Capacity Expansion and Clean Fuels Modifications	\$300	1,400	
	Coffeyville <sup>6</sup>	Coffeyville	Capacity Expansion	\$92	800	
	ConocoPhillips <sup>7</sup>	Ponca City	New Vacuum Tower and Associated Modifications to Increase Heavy Crude Capacity	\$27	100	
Gulf Coast	Chevron <sup>8</sup>	Pascagoula	FCC Unit Modifications	\$150	>1,000	
	Chevron <sup>9</sup>	Pascagoula	Capacity Expansion and Clean Fuels Modifications	\$150	800	
	Citgo <sup>10</sup>	Corpus Christi	Capacity Expansion and Clean Fuels Modifications	\$600	>2,000	120
	ConocoPhillips <sup>11</sup>	Lake Charles	Hydrocracker Installation and Capacity Expansion	\$750	2,500	200
	ExxonMobil <sup>12</sup>	Baton Rouge	Clean Fuels Modifications	\$280	900	
	Motiva <sup>13</sup>	Port Arthur	Possible Capacity Expansion	\$3,500	3,000-4,000	300

35

800

\$444

Capacity Expansion

Port Arthur

Valero<sup>14</sup>

>1,000

\$337

Coker Installation and Associated Modifications to Increase Heavy Crude Capacity

Texas City

Valero<sup>15</sup>

West Coast

~100

\$38

Crude Distillation Improvements and Vacuum Tower Replacement

Cherry Point

BP<sup>16</sup>

1,000

\$220

Clean Fuels Modifications

Ferndale

ConocoPhillips<sup>17</sup>

200-300

\$140

Capacity Expansion and Environmental Control Modifications

Benicia

Valero<sup>18</sup>

## ENDNOTES

- <sup>1</sup> Flint Hills Resources Press Release, February 16, 2004.
- <sup>2</sup> Mulcahy, Marty, *No Strain for This Crane – 508,000-lb. Lift Caps Major Marathon Project*, The Building Tradesman, November 11, 2005.
- <sup>3</sup> Marathon Press Release, January 27, 2004.
- <sup>4</sup> BP Press Release, April 18, 2005.
- <sup>5</sup> McKinnon, Julie M., *\$100M Hydrogen Plant Planned in Toledo*, Toledo Blade, October 7, 2004.
- <sup>6</sup> *Coffeyville Refinery Complex Plans Expansion*, Associated Press, January 4, 2006.
- <sup>7</sup> *\$27 Million Cutpoint Project Planned at Local Refinery*, The Ponca City News, May 8, 2003.
- <sup>8</sup> Wilemon, Tom, *Chevron Announces Refinery Upgrade for Gasoline Production*, The Sun Herald, June 21, 2005.
- <sup>9</sup> Chevron Press Release, December 6, 2001.
- <sup>10</sup> Zielenbach, Alison, *Citgo to Expand Refinery*, Corpus Christi Caller Times, April 27, 2004.
- <sup>11</sup> Hydrocarbons-technology.com, *Westlake Hydrocracker Facility, LA, USA*.
- <sup>12</sup> McIlvaine Refineries Alert, March 17, 2003.
- <sup>13</sup> Wright, Tom, *County Approves Tax Break for Refinery Expansion*, KFDM-TV, January 2, 2006.
- <sup>14</sup> Port Arthur Real Estate Center, October 25, 2004 and Port Arthur News, December 6, 2004.
- <sup>15</sup> Valero Press Release, December 17, 2003.
- <sup>16</sup> Anvil Corporation Press Release, *Crude Fractionation Improvements Project: Bellingham, Washington*.
- <sup>17</sup> Daugherty, Meghann, *Good Business Makes Good Neighbors: Tosco Refinery Focuses on Big Picture to Enhance Business and Community Involvement*, Whatcom County Business Pulse, August 2001.
- <sup>18</sup> Johnson, Jason B., *Benicia Refinery Plans Appealed: Citizens Want Cleaner Air Before Valero Expansion*, San Francisco Chronicle, May 29, 2003.

# REFINERY UPGRADING PROJECTS

Due to the increasing supply of Canadian crudes and favorable light-heavy crude price differentials, a number of U.S. refiners have recently announced plans to make sizable investments in refinery upgrading projects. The following table presents a synopsis of those projects as well as the expected incremental Canadian crude demand that will result, where such data are available. Further descriptive detail regarding these projects is provided following the table.

<i>Company</i>	<i>Refinery</i>	<i>Investment (millions)</i>	<i>Potential Increased Canadian Crude Runs (approximately Mb/d)</i>
<b>ConocoPhillips</b>	Wood River	\$3,900	170
	Borger	\$1,400	115
	Billings	n/a	85
	Ferndale	n/a	15
<b>BP</b>	Whiting	\$3,000	260
	Toledo	n/a	90
	Cherry Point	n/a	100
<b>Marathon</b>	Detroit	n/a	65
	Catlettsburg	n/a	180
<b>Sunoco</b>	Toledo	n/a	50
<b>Frontier</b>	El Dorado	\$140	28
	Cheyenne	\$84	2
<b>Cenex</b>	Laurel	\$325	n/a
<b>United Refining</b>	Warren	n/a	n/a

One of the most ambitious plans is that of ConocoPhillips, which has announced improvements to increase its ability to process heavy sour crude and other low quality feedstocks, especially Canadian crudes, at four of its refineries: Wood River, Borger, Ferndale, and Billings. These refineries are located, respectively, in southern Illinois near St. Louis; the Texas Panhandle; the Seattle, Washington, area; and Montana.

The Wood River and Borger refineries can receive crude via Southern Access. Effective January 2, 2007, they will be owned by a joint venture between ConocoPhillips and Encana Corporation. ConocoPhillips will continue to operate the plants for the partnership. Expansion plans for the two refineries include increasing their combined heavy oil refining capacity from 60,000 b/d (60 Mb/d) to 550 Mb/d, with an increase in

bitumen capacity from 30 Mb/d to 275 Mb/d, by 2015. At Wood River, a \$1.9 billion project to construct a new 65 Mb/d coker will add an estimated 70 Mb/d of bitumen capacity by 2009. A second phase of the expansion is a \$2.0 billion crude unit and coker expansion that will add another 100 Mb/d of bitumen capacity by 2013.

The Borger refinery is undergoing a three-phase program. In 2005 construction began on a 25 Mb/d coker. Combined with an expansion of the Cushing to Borger pipeline, this will allow the facility to begin processing Canadian heavy sour crudes by the middle of 2007. Additional bitumen capacity will be added in 2009 with a program to debottleneck infrastructure. Finally, 2012 will see another increase in bitumen capacity with a planned expansion of the refinery's crude rate to 200 Mb/d. The total estimated cost for all three expansion phases is \$1.4 billion.<sup>1</sup>

At Ferndale, a debottlenecking program resulted in an increase of the facility's crude oil processing capacity from 93 Mb/d to 96 Mb/d effective January 1, 2006. ConocoPhillips is also installing a 25 Mb/d coker at its Ferndale refinery to allow increased processing of heavy Canadian crudes. The capital cost of the Ferndale modifications has not been detailed by ConocoPhillips, but is part of a \$1.2 billion capital improvement program for its three West Coast refineries, which includes two refineries in California in addition to Ferndale.<sup>2</sup> Finally, the Billings refinery is scheduled to receive new crude and vacuum distillation units that will allow for the processing of 85 Mb/d of Canadian heavy sour crude.

BP has announced that it will begin "repositioning" its refining portfolio to provide additional Canadian heavy crude processing capabilities at its three northern U.S. refineries. By 2015, the configurations of the Whiting, Indiana, and Toledo, Ohio, refineries are expected to be capable of accepting a 100 percent heavy sour crude slate (the heavy sour capacity of both of these refineries is currently less than 50 percent) following the upgrading projects. The \$3 billion Whiting project is in its final planning period and is tentatively scheduled for completion by 2011. It will increase Canadian heavy crude processing capability by about 260 Mb/d.<sup>3</sup> Both the Whiting and Toledo refineries will utilize Southern Access to obtain Canadian crude. During the same timeframe, the third refinery, at Cherry Point in the Seattle area, will be modified in order to allow roughly 44 percent of its crude feedstock to consist of heavy sour crudes.<sup>4</sup>

Marathon has announced that it is exploring the addition of cokers to both its Detroit, Michigan, and Catlettsburg, Kentucky, refineries with potential completion dates of 2009 or 2010. At Detroit, the installation of a 20 Mb/d coker and concurrent ancillary modifications will allow the refinery to increase its heavy crude utilization by up to 65 Mb/d and to boost its overall refining capacity from 100 to 113 Mb/d. Final approval of the project is subject to an engineering and design study, which is expected to be completed by late 2007.<sup>5</sup> The 37 Mb/d coker project at the Catlettsburg facility will permit the utilization of up to an additional 130 Mb/d of medium and heavy sour crudes, increasing their proportion of the refinery's crude slate to at least 90 percent once the



upgrades are completed.<sup>6</sup> The feasibility study phase of this project is expected to be completed by late 2007. Both the Detroit and Catlettsburg refineries can use Southern Access to receive Canadian crude.

Sunoco has indicated that it is in process of adding 50 Mb/d of capacity to its Toledo, Ohio, refinery, increasing its capacity by roughly one-third.<sup>7</sup> The modification is in response to Sunoco's desire to increase its utilization of Canadian synthetic crudes. The Toledo refinery can use Southern Access to receive Canadian crude.

The refinery upgrades to process greater amounts of Canadian heavy crude are not limited exclusive to the larger refining companies. Frontier, Cenex, and United Refining, all comparatively small refiners, have announced their intentions to upgrade their refineries as well. By the end of 2008, Frontier plans on investing \$224 million to increase both its heavy crude capacity and total crude capacity. At the El Dorado, Kansas, refinery, which can use Southern Access, a \$140 million project to expand the crude and vacuum distillation units will increase the refinery's overall capacity by 10 Mb/d (current capacity is 110 Mb/d) and will provide for greater utilization of heavy crudes, from 12 to 40 Mb/d. Frontier's refinery at Cheyenne, Wyoming, will undergo a \$76 million expansion of its coker (from 10 to 13.5 Mb/d) and an \$8 million revamp of its crude distillation units to allow greater use of Canadian heavy crudes as well.<sup>8</sup>

Both Cenex and United Refining have revealed plans to add cokers in order to better position their refineries to process heavier Canadian crudes. Cenex is investing \$325 million at its Laurel, Montana, refinery for a coker that is expected to become operational by the end of the third quarter in 2008.<sup>9</sup> United Refining, located in Warren, Pennsylvania, has entered into a 10-year heavy crude supply agreement with Nexen that will become effective once the refinery's coker project has been completed, which is expected to occur near the beginning of 2008.<sup>10</sup> United can receive Canadian crude via Southern Access. Although specifics related to the cost and size of the coker have not been disclosed, its installation in conjunction with other clean fuels modifications will increase refinery capacity by 5 Mb/d (current capacity is 65 Mb/d) and is expected to add roughly 70 unionized jobs at the facility.<sup>11</sup>

## ENDNOTES

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<sup>1</sup> ConocoPhillips Analyst Call: North American Integrated Heavy Oil Partnership, October 5, 2006.

<sup>2</sup> ConocoPhillips Analyst Meeting, Jim Nokes, Executive Vice President of Refining and Marketing, November 16, 2005.

<sup>3</sup> BP Press Release, September 20, 2006.

<sup>4</sup> BP Presentation, Enbridge Conference, *Canadian Crude: A Global Refiner's View*, June 8, 2005.

<sup>5</sup> Marathon Press Release, November 6, 2006.

<sup>6</sup> Marathon Oil Presentation, Bank of America 2005 Energy Conference, Clarence Cazalot, Jr., President and CEO, November 15, 2005.

<sup>7</sup> *Platt's Oilgram News*, Volume 83, Number 214, November 4, 2005.

<sup>8</sup> Frontier Oil, Investor Teleconference, December 1, 2005.

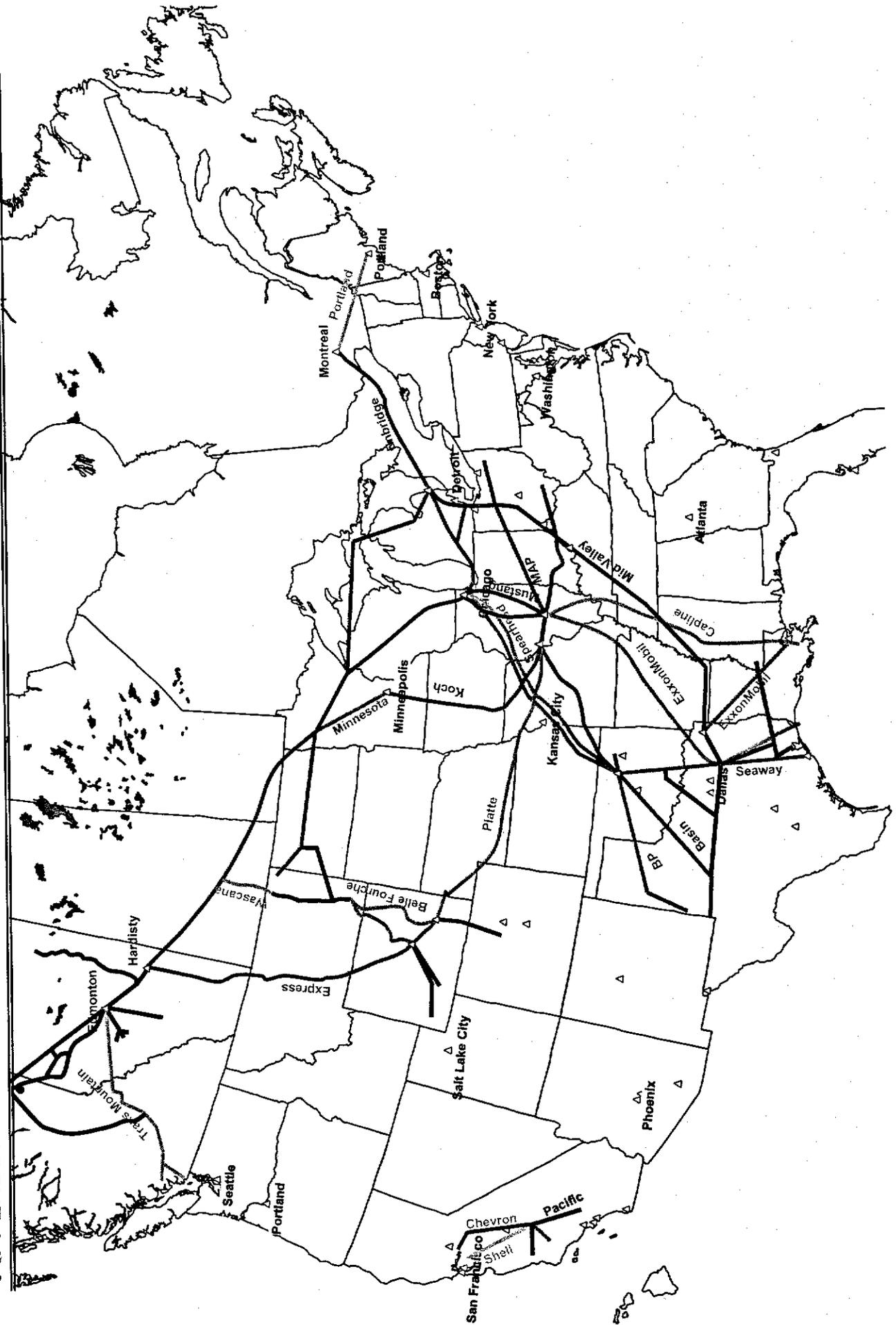
<sup>9</sup> CHS Inc. Press Release, July 13, 2005.

<sup>10</sup> United Refining Co. Press Release, May 18, 2005.

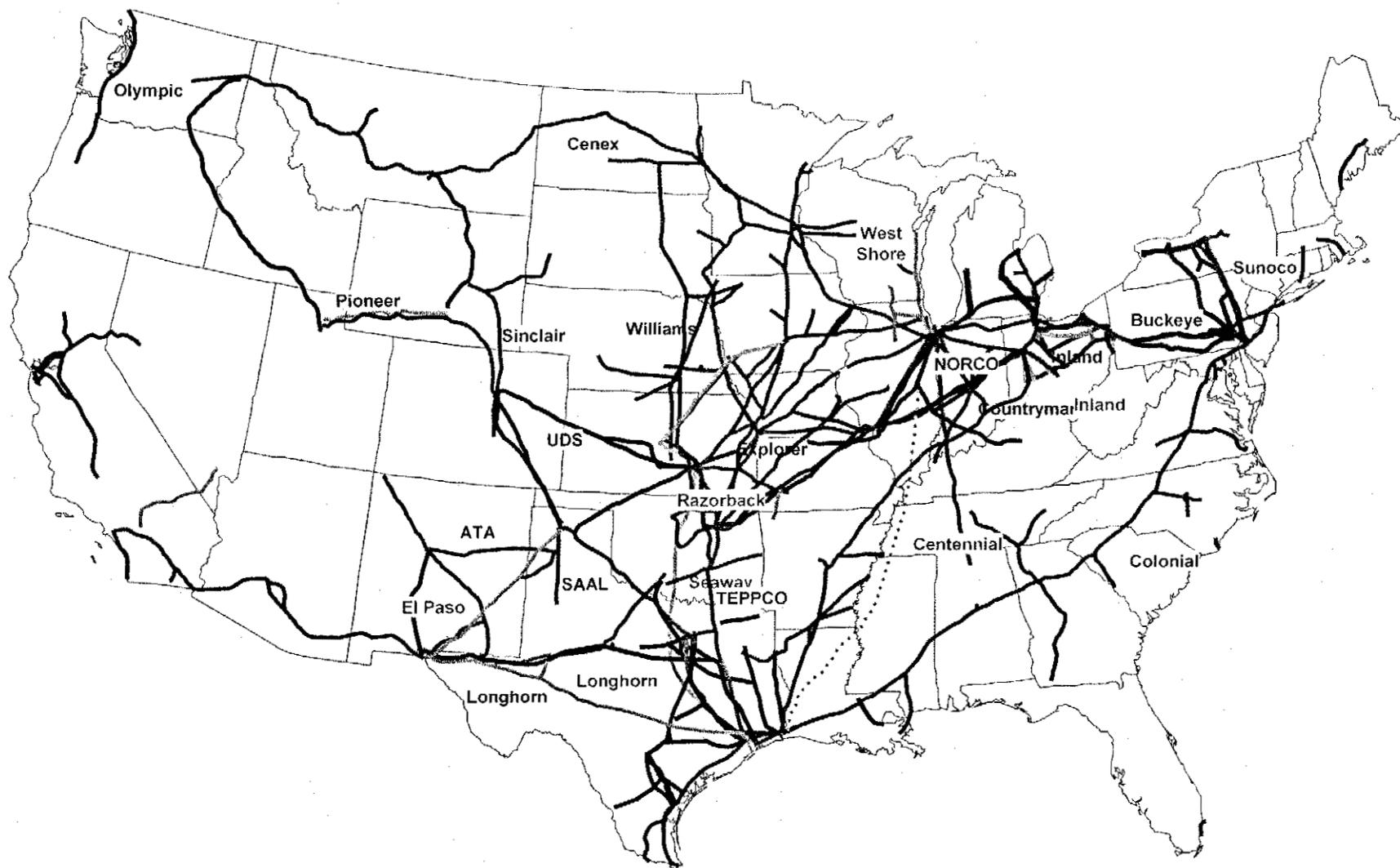
<sup>11</sup> United Refining Co. Presentation, Citigroup High Yield Conference, Myron Turfitt, President, March 2005.



# APPENDIX 1 - U.S. CRUDE OIL PIPELINES



# APPENDIX 2 – U.S. PRODUCT PIPELINES



# APPENDIX 3 – U.S. PADD MAP

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