

*September 8, 2008*

**TECHNICAL SUPPORT DOCUMENT FOR THE  
PETROLEUM REFINING SECTOR: PROPOSED  
RULE FOR MANDATORY REPORTING OF  
GREENHOUSE GASES**

Office of Air and Radiation  
U.S. Environmental Protection Agency

September 8, 2008

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## 1. Industry Description

Petroleum refineries are facilities that are engaged in producing liquefied petroleum gases (LPG), motor gasoline, jet fuels, kerosene, distillate fuel oils, residual fuel oils, lubricants, asphalt (bitumen), and other products through distillation of crude oil or through redistillation, cracking, or reforming of unfinished petroleum derivatives. There are three basic types of refineries: topping, hydroskimming, and upgrading (also referred to as “conversion” or “complex”). Topping refineries have a crude distillation column and produce naphtha and other intermediate products, but not gasoline. There are only a few topping refineries in the U.S., predominately in Alaska. Hydroskimming refineries have mild conversion units such as hydrotreating units and/or reforming units to produce finished gasoline products, but they do not upgrade heavier components of the crude oil that exit near the bottom of the crude distillation column. Some topping/hydroskimming refineries specialize in processing heavy crude oils to produce asphalt. There are 8 operating asphalt plants and approximately 20 other hydroskimming refineries operating in the U.S. as of January 2006 (EIA, 2006a). The vast majority (approximately 75 to 80 percent) of U.S. refineries are upgrading/conversion refineries. Upgrading/conversion refineries have cracking or coking operations to convert long-chain, high molecular weight hydrocarbons (“heavy distillates”) into smaller hydrocarbons that can be used to produce gasoline product (“light distillates”) and other higher value products and petrochemical feedstocks. The U.S., Western Europe, and Asia are the largest and most sophisticated producers of refined petroleum products. The U.S. produced 23 percent of the world’s refinery products in 2003 (U.S. DOE, 2007).

There are 150 petroleum refineries in 35 States and 2 U.S. territories, eight of which are considered asphalt refineries. The majority of oil distillation capacity in the U.S. is at large, integrated companies with multiple refining facilities. About 30 percent of all facilities are small operations producing fewer than 50,000 barrels per day, representing about 5 percent of the total output of petroleum products annually. As of January 2006, the combined operating crude capacity for the 150 U.S. refineries (including those in U.S. territories) was 17.9-million barrels per calendar day (bbls/cd). The combined operating crude capacity for the 148 refineries within the U.S. States is just over 17.3-million bbls/cd; the 2 refineries located in U.S. territories had a combined capacity of 572,900 bbls/cd (EIA, 2006b). The average crude capacity utilization rate for U.S. refineries was 90.6 percent in 2005. In 2005, the U.S. refineries (not including U.S. territories) produced 2,225 million barrels (MMbbl) of motor gasoline, 1,443 MMbbl of diesel fuel oil, 564 MMbbl of jet fuel, 305 MMbbl of petroleum coke, 229 MMbbl of residual fuel oil, and 209 MMbbl of LPG, as well as other products (EIA, 2006a). Table 1 includes a list of the 150 refineries within the U.S. and its territories along with crude oil distillation capacities and process charge or production capacities for various process units as of January 2006.

Petroleum refining is a very energy-intensive industry. In 2002, it accounted for about 7 percent of the total U.S. energy consumption, making it the nation’s second-highest industrial consumer (U.S. DOE, 2007).

**Table 1. Petroleum Refineries in the United States.<sup>a</sup>**

Facility Name	City	State	Crude Capacity (bbl/cd)	Charge capacity (bbl/sd)				Production capacity	
				FCCU	CRU	Fluid Coking	Delayed Coking	Hydrogen (MMcfd)	Sulfur (short tons/d)
BP	Prudhoe Bay	AK	12,500	0	0	0	0	0	0
ConocoPhillips Alaska	Kuparuk	AK	14,000	0	0	0	0	0	0
Flint Hills Resources	North Pole	AK	210,000	0	0	0	0	0	0
Petro Star Inc.	North Pole	AK	17,000	0	0	0	0	0	0
Petro Star Inc.	Valdez	AK	48,000	0	0	0	0	0	0
Tesoro Petroleum Corp.	Kenai	AK	72,000	0	13,000	0	0	13	20
Goodway Refining LLC	Atmore	AL	4,100	0	0	0	0	0	0
Gulf Atlantic Operations LLC	Mobile Bay	AL	16,700	0	0	0	0	0	0
Hunt Refining Co.	Tuscaloosa	AL	34,500	0	7,200	0	14,000	6	80
Shell Chemical LP	Saraland	AL	80,000	0	20,000	0	0	0	35
Cross Oil & Refining Co. Inc.	Smackover	AR	7,200	0	0	0	0	3	0
Lion Oil Co.	El Dorado	AR	70,000	19,900	14,800	0	0	0	157
Big West of CA	Bakersfield	CA	66,000	0	16,300	0	22,000	25	105
BP	Carson	CA	260,000	102,500	52,000	0	65,000	105	350
Chevron USA Inc.	El Segundo	CA	260,000	74,000	49,000	0	66,000	77	600
Chevron USA Inc.	Richmond	CA	242,901	90,000	71,300	0	0	181	789
ConocoPhillips	LA - Carson/ Wilmington	CA	139,000	50,280	36,750	0	52,200	105	370
ConocoPhillips	SF - Rodeo	CA	76,000	0	32,000	0	27,000	84	310
ConocoPhillips	Arroyo Grande (Santa Maria)	CA	44,200	0	0	0	23,400	0	120
Edgington Oil Co.	Long Beach	CA	26,000	0	0	0	0	0	0
ExxonMobil Corp.	Torrance	CA	149,500	100,000	20,000	0	54,600	138	400
Greka Energy	Santa Maria	CA	9,500	0	0	0	0	0	0

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				FCCU	CRU	Fluid Coking	Delayed Coking	Hydrogen (MMcfd)	Sulfur (short tons/d)
Kern Oil & Refining Co.	Bakersfield	CA	26,000	0	3,300	0	0	0	5
Lunday-Thagard Co. (aka World Oil Co.)	South Gate	CA	8,500	0	0	0	0	0	0
Paramount Petroleum Corp.	Paramount	CA	50,000	0	8,500	0	0	0	40
San Joaquin Refining Co., Inc.	Bakersfield	CA	15,000	0	0	0	0	4	3
Shell Oil Products US	Martinez	CA	155,600	73,000	31,000	22,500	27,500	107	364
Shell Oil Products US	Wilmington	CA	98,500	36,000	34,000	0	40,000	15	280
Ten By Inc.	Oxnard	CA	2,800	0	0	0	0	0	0
Tesoro	Golden Eagle	CA	166,000	71,000	42,000	48,000	0	82	200
Valero Energy (Ultramar, Inc.)	Wilmington	CA	80,887	52,000	17,000	0	29,000	0	230
Valero Energy Corp.	Benicia	CA	144,000	75,300	37,200	29,500	0	141	303
Valero Energy Corp.	Wilmington	CA	6,200	0	0	0	0	0	0
Suncor Energy	Commerce City	CO	62,000	20,000	10,500	0	0	0	106
Suncor Energy	Denver	CO	32,000	10,000	10,000	0	0	0	2
Valero Energy Corp.	Delaware City	DE	181,500	87,000	43,800	53,000	0	40	596
Citgo Petroleum	Savannah	GA	28,000	0	0	0	0	0	0
Chevron USA Inc.	Honolulu (Barber's Point)	HI	54,000	22,000	0	0	0	3	0
Tesoro Hawaii Petrol.	Kapolei	HI	93,500	0	13,000	0	0	18	34
ConocoPhillips	Wood River	IL	306,000	101,000	96,500	0	18,000	57	504
ExxonMobil Corp.	Joliet	IL	238,500	98,000	52,200	0	59,100	0	660
Marathon Petroleum Co. LLC	Robinson	IL	192,000	49,000	74,500	0	29,400	0	202
PDV Midwest Refining	Lemont	IL	167,000	70,000	31,200	0	44,000	12	400
BP	Whiting	IN	410,000	169,000	90,000	0	36,000	31	550

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				FCCU	CRU	Fluid Coking	Delayed Coking	Hydrogen (MMcfd)	Sulfur (short tons/d)
Countrymark Cooperative, Inc.	Mt. Vernon	IN	23,000	8,400	6,500	0	0	0	9
Coffeyville Refining	Coffeyville	KS	112,000	32,500	17,000	0	19,500	0	146
Frontier Oil Corp.	El Dorado	KS	106,000	39,000	30,000	0	19,000	6	230
National Cooperative Refinery Association	McPherson	KS	81,200	24,500	23,500	0	22,000	0	81
Marathon Petroleum Co. LLC	Catlettsburg	KY	222,000	99,000	50,000	0	0	0	448
Somerset Refinery Inc.	Somerset	KY	5,500	0	1,000	0	0	0	0
Calcasieu Refining Co.	Lake Charles	LA	30,000	0	0	0	0	0	0
Calumet Lubricants Co.	Shreveport	LA	42,000	10,500	8,000	0	0	6	10
Calumet Lubricants Co.	Cotton Valley	LA	13,020	0	0	0	0	2	0
Calumet Lubricants Co.	Princeton	LA	8,300	0	0	0	0	5	3
Citgo Petroleum Corp.	Lake Charles	LA	429,500	150,000	110,800	0	104,000	0	640
ConocoPhillips	Westlake	LA	239,400	50,000	44,000	0	64,000	0	860
ConocoPhillips	Belle Chasse	LA	247,000	104,000	44,600	0	27,000	0	125
ExxonMobil Corp.	Baton Rouge	LA	501,000	241,000	78,000	0	118,500	0	800
ExxonMobil Corp.- Chalmette	Chalmette	LA	188,160	71,600	49,400	0	35,000	0	935
Marathon Petroleum Co. LLC	Garyville	LA	245,000	131,000	48,500	0	37,400	0	790
Motiva Enterprises	Norco	LA	226,500	114,000	62,000	0	23,600	60	169
Motiva Enterprises	Convent	LA	235,000	92,000	40,000	0	0	63	728
Murphy Oil USA Inc.	Meraux	LA	120,000	37,000	32,000	0	0	0	31
Pelican Refining Co. LLC	Lake Charles	LA	0	0	0	0	0	0	0
Placid Refining Inc.	Port Allen	LA	56,000	20,500	11,000	0	0	0	28
Shell Chemical Co.	St. Rose	LA	55,000	0	0	0	0	0	0
Valero Energy Corp.	Krotz Springs	LA	80,000	34,000	13,000	0	0	0	0

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				FCCU	CRU	Fluid Coking	Delayed Coking	Hydrogen (MMcfd)	Sulfur (short tons/d)
Valero Energy Corp.	Norco	LA	185,003	105,380	25,000	0	70,400	0	393
Marathon Petroleum Co. LLC	Detroit	MI	100,000	30,000	20,000	0	0	0	147
Flint Hills Resources	Rosemount	MN	279,300	86,500	51,300	0	70,800	115	999
Marathon Petroleum Co. LLC	St. Paul Park	MN	70,000	26,000	20,500	0	0	9	112
Chevron USA Inc.	Pascagoula	MS	330,000	67,000	96,000	0	105,000	230	1,300
Ergon Refining Inc.	Vicksburg	MS	23,000	0	0	0	0	8	0
Hunt Southland Refining	Sandersville	MS	11,000	0	0	0	0	0	0
Cenex Harvest States	Laurel	MT	55,000	13,500	12,000	0	0	30	130
ConocoPhillips	Billings	MT	58,000	21,490	13,550	0	19,950	20	246
ExxonMobil Corp.	Billings	MT	60,000	23,500	12,500	10,400		24	0
Montana Refining Co.	Great Falls	MT	8,200	2,500	1,030	0	0	2	0
Tesoro	Mandan	ND	58,000	30,600	12,100	0	0	0	17
Chevron USA	Perth Amboy	NJ	80,000	0	0	0	0	0	0
Citgo Asphalt Refining Co.	Paulsboro	NJ	32,000	0	0	0	0	0	0
ConocoPhillips	Linden	NJ	238,000	145,000	32,000	0	0	10	180
Hess Corporation	Port Reading	NJ	0	65,000	0	0	0	0	10
Sunoco, Inc.	Westville	NJ	145,000	57,000	30,000	0	0	0	80
Valero Energy Corp.	Paulsboro	NJ	160,000	55,000	30,000	0	27,000	9	206
Giant Refining Co.	Bloomfield	NM	16,800	6,500	4,000	0	0	0	3
Giant Refining Co.	Gallup	NM	20,800	11,500	6,800	0	0	0	2
Navajo Refining Co.	Artesia + Lovington	NM	75,000	27,000	18,000	0	0	0	130
Foreland Refining Co.	Tonopah/ Eagle Springs	NV	2,000	0	0	0	0	0	0

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BP PLC	Toledo	OH	131,000	55,000	43,000	0	34,000	33	340
Marathon Petroleum Co. LLC	Canton	OH	73,000	25,000	19,000	0	0	0	110
Sunoco, Inc.	Toledo	OH	160,000	79,000	48,000	0	0	45	62
Valero Energy Corp.	Lima	OH	146,900	40,000	55,000	0	23,000	58	110
ConocoPhillips	Ponca City	OK	194,000	69,802	54,190	0	27,660	35	34
Sinclair Oil Corp.	Tulsa	OK	70,300	27,750	16,800	0	0	0	28
Sunoco, Inc.	Tulsa	OK	85,000	0	24,000	0	11,000	0	0
Valero Energy Corp.	Ardmore	OK	83,640	30,000	21,350	0	0	26	243
Wynnewood Refining Co.	Wynnewood	OK	54,000	21,000	15,000	0	0	0	36
Chevron USA	Portland	OR	0	0	0	0	0	0	0
American Refining Group	Bradford	PA	10,000	0	1800	0	0	0	0
ConocoPhillips	Trainer (Marcus Hook)	PA	185,000	53,000	50,000	0	0	0	41
Sunoco, Inc.	Marcus Hook	PA	175,000	105,000	20,000	0	0	0	33
Sunoco, Inc. (combined Sun & Chevron)	Phil. (Girard Pt & Pt Breeze)	PA	335,000	123,500	86,000	0	0	0	260
United Refining Co.	Warren	PA	65,000	26,000	14,000	0	0	0	70
Valero Energy Corp.	Memphis	TN	180,000	70,000	36,000	0	0	0	116
AGE Refining & Manufacturing	San Antonio	TX	12,200	0	0	0	0	0	0
Alon USA Energy Inc.	Big Spring	TX	67,000	25,000	21,000	0	0	0	150
BP	Texas City	TX	437,000	189,300	138,000	0	43,000	0	1,400
Citgo	Corpus Christi	TX	156,000	81,800	52,500	0	43,500	0	357
ConocoPhillips	Borger	TX	146,000	72,300	26,900	0	0	91	340
ConocoPhillips	Sweeny	TX	247,000	119,000	37,500	0	74,100	155	595

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Delek Refining Ltd	Tyler	TX	58,000	20,250	17,500	0	6,000	0	15
ExxonMobil Corp.	Beaumont	TX	348,500	117,700	155,000	0	50,700	55	636
ExxonMobil Corp.	Baytown	TX	562,500	221,000	126,000	42,000	46,500	0	1,796
Flint Hills Resources	Corpus Christi	TX	288,126	106,700	71,600	0	14,000	0	237
Lyondell-Citgo Refining Co.	Houston	TX	270,200	100,000	37,000	0	105,000	0	803
Marathon Petroleum Co. LLC	Texas City	TX	72,000	55,000	11,000	0	0	0	0
Motiva Enterprises	Port Arthur	TX	285,000	90,000	48,000	0	57,500	0	711
Pasadena Refining Systems Inc.	Pasadena	TX	100,000	56,000	23,000	0	12,500	0	28
Shell Oil Products US - Deer Park Refining Limited Partnership	Deer Park	TX	333,700	75,000	72,000	0	88,000	108	1,150
South Hampton Resources Inc.	Silsbee	TX	0	0	1,500	0	0	2	0
Total SA	Port Arthur	TX	232,000	75,000	39,600	0	0	0	300
Trigeant Ltd.	Corpus Christi	TX	0	0	0	0	0	0	0
Valero Energy Corp.	Corpus Christi	TX	142,000	114,500	69,000	0	18,500	195	1,288
Valero Energy Corp.	Houston	TX	83,000	65,000	11,500	0	0	0	110
Valero Energy Corp.	Texas City	TX	213,750	83,000	16,500	0	50,000	0	924
Valero Energy Corp.	Three Rivers	TX	90,000	24,000	33,000	0	0	12	62
Valero Energy Corp.	Sunray	TX	158,327	54,465	47,400	0	0	0	60
Valero Energy Corp.	Port Arthur	TX	260,000	78,600	53,800	0	103,000	0	1,197
Western Refining	El Paso	TX	116,000	34,000	25,000	0	0	0	40
Big West Oil Co.	Salt Lake City	UT	29,400	11,000	7,300	0	0	0	4
Chevron USA	Salt Lake City	UT	45,000	14,000	8,000	0	8,500	0	21
Holly Corp.	Woods Cross	UT	24,700	8,900	7,700	0	0	0	10

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Silver Eagle Refining Inc.	Woods Cross	UT	10,250	0	2,200	0	0	1	0
Tesoro	Salt Lake City	UT	58,000	25,200	12,600	0	0	0	18
Giant Refining	Yorktown	VA	58,600	30,200	12,100	0	19,000	0	39
BP	Ferndale	WA	225,000	0	63,000	0	64,000	128	242
ConocoPhillips	Ferndale	WA	96,000	33,500	17,400	0	0	0	55
Shell Oil Products US	Anacortes	WA	145,000	57,900	32,700	0	25,700	0	350
Tesoro	Anacortes	WA	120,000	48,000	26,000	0	0	0	0
US Oil & Refining Co.	Tacoma	WA	37,850	0	6,500	0	0	0	10
Murphy Oil USA Inc.	Superior	WI	34,300	11,000	8,000	0	0	0	34
Ergon-West Virginia Inc.	Newell (Congo)	WV	20,000	0	3,400	0	0	1	1
Frontier Oil & Refining Co.	Cheyenne	WY	47,000	12,000	9,200	0	10,000	6	101
Little America Refining Co.	Evansville (Casper)	WY	24,500	11,000	6,000	0	0	0	0
Silver Eagle Refining Inc.	Evanston	WY	3,000	0	2,150	0	0	0	0
Sinclair Oil Corp.	Sinclair	WY	66,000	21,806	12,500	0	0	26	47
Wyoming Refining Co.	Newcastle	WY	12,500	5,500	2,750	0	0	0	4
<b>Total in US States</b>			<b>17,333,014</b>	<b>6,275,123</b>	<b>3,859,070</b>	<b>205,400</b>	<b>2,305,510</b>	<b>2,823</b>	<b>32,421</b>
Shell Chemical Yabucoa Inc.	Yabucoa	P.Rico	77,900	0	20,000	0	0	0	22
Hovensa LLC	Kingshill (St. Croix)	V.Isl	495,000	150,000	115,000	0	61,000	0	550
<b>Grand Total</b>			<b>17,905,914</b>	<b>6,425,123</b>	<b>3,994,070</b>	<b>205,400</b>	<b>2,366,510</b>	<b>2,823</b>	<b>32,993</b>

<sup>a</sup> EIA, 2006. Tables 3 and 4. Abbreviation for capacity units are: bbl/cd = barrel per calendar day = maximum capacity considering scheduled maintenance over 365 calendar days; bbl/cd = barrel per stream day = maximum capacity for a single, operating day; MMcfd = million cubic feet per day.