Summary and Analysis of the 2011 Gasoline Benzene Pre-Compliance Reports

EPA United States Environmental Protection Agency

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Compliance Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

NOTICE

This technical report does not necessarily represent final EPA decisions or positions. It is intended to present technical analysis of issues using data that are currently available. The purpose in the release of such reports is to facilitate the exchange of technical information and to inform the public of technical developments.

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I. Executive Summary

Most refiners planning to produce gasoline after January 1, 2011 were required to submit annual pre-compliance reports to the U.S. Environmental Protection Agency (EPA) indicating their progress toward complying with EPA's gasoline benzene standards. Under the gasoline benzene regulations finalized on February 26, 2007, reports were due by June 1 of each year from 2008 through 2011 in order to provide updates on refiners' compliance plans. This report summarizes information received from refiners in their 2011 pre-compliance reports, and is the last such report that will be issued under the benzene regulations.

Refiners' benzene pre-compliance reports had to contain estimates of average daily gasoline production and annual average benzene concentration from June 1, 2007 through December 31, 2015. For those refiners planning on participating in the credit program, the reports had to contain a projection of how many credits will be generated or used by each refinery. The pre-compliance reports had to also contain information outlining each refinery's timeline for complying with the gasoline benzene standards and provide information regarding engineering plans (e.g., design and construction), and capital commitments for making the necessary modifications to produce gasoline which meets the new benzene standards.

EPA received benzene pre-compliance reports for 113 refineries in 2011. The 2011 benzene pre-compliance reports showed that:

- refiners are planning to comply with the benzene standards on time by installing new equipment to reduce benzene at many of their refineries and using the averaging, banking and trading provisions in the regulations to comply at the rest
- 58 refineries are planning to install equipment to reduce gasoline benzene
- 55 refineries are not planning to install equipment to reduce gasoline benzene because they already comply with the gasoline benzene standards, or are planning to use credits for compliance, or are exiting the gasoline market
- 30 refineries are planning to generate early credits from 2007 through 2010, and 37 refineries are planning to generate standard credits beginning in 2011
- overall average reported benzene levels are expected to decrease from 1.06 volume percent (vol%) in 2007 to 0.62 vol% in 2015
- sufficient benzene credits are anticipated to be available for overall industry compliance

This data represents estimates made by refiners, some of whose final actual compliance plans may change. While the reported information is subject to change, the results provide the clearest snapshot of refiners' aggregate benzene compliance plans available as of June 1, 2011. They represent the assessment of those who have first-hand knowledge of the unique situation faced by each refinery.

II. Gasoline Benzene Program Overview

The Mobile Source Air Toxics (MSAT2) final rule (72 FR 8428, February 26, 2007) contains a two-step approach to reducing the benzene content of gasoline. Beginning January 1, 2011, importers and most refineries were required to import or produce gasoline containing no more than 0.62 vol% benzene on an annual average basis. This 0.62 vol% benzene standard can be met by using credits. In addition, beginning July 1, 2012, importers and most refineries are required to import or produce gasoline with a maximum annual average gasoline benzene content of 1.3 vol%. A refinery's or importer's actual annual average gasoline benzene level may not exceed this maximum average standard. Credits may not be used to meet the 1.3 vol% standard.

The MSAT2 rule includes provisions for refiners and importers to generate gasoline benzene credits. Refiners could generate early benzene credits from June 1, 2007 through December 31, 2010 at a refinery by implementing certain technological improvements specified in the regulations which reduced the refinery's annual average gasoline benzene by at least 10%, compared to the refinery's average benzene from January 1, 2004 through December 31, 2005. Refiners and importers may generate standard benzene credits beginning in 2011 if a refinery's or importer's annual average gasoline benzene is less than 0.62 vol%. Early benzene credits may be used to comply with the 0.62 vol% standard during the 2011, 2012 and 2013 averaging periods, while standard benzene credits may be used to comply with the 0.62 vol% standard within five years from the year they were generated. For both early credits and standard credits, one credit is equivalent to one gallon of benzene removed from gasoline. Gasoline benzene credits may be transferred nationwide.

Small Refiner Flexibilities

Additional compliance flexibilities are provided for small refiners in the gasoline benzene regulations. The criteria for qualification as a gasoline benzene small refiner are similar to those under the Gasoline Sulfur and Diesel Sulfur rules. To qualify as "small", a refiner must: 1) have produced gasoline by processing crude oil through refinery processing units from January 1, 2005 through December 31, 2005; 2) have employed no more than 1,500 people company-wide, based on the average number of employees for all pay periods from January 1, 2005 through December 31, 2005; and, 3) have a corporate crude oil capacity less than or equal to 155,000 bpcd for 2005.

Small refiners are allowed an additional four years to comply with each benzene standard. They must begin complying with the 0.62 vol% standard no later than January 1, 2015, and begin complying with the 1.3 vol% standard no later than July 1, 2016.

Other Flexibilities

In addition to allowing refiners and importers to use credits to meet the 0.62 vol% annual average standard, the gasoline benzene regulations also allow refiners and

importers to carry forward a benzene deficit from one year to the next year. If a refinery or importer exceeds the 0.62 vol% annual average standard, and does not procure sufficient credits to meet the standard, they may offset the deficit during the following year by reducing their benzene concentration below 0.62 vol%, and/or procuring credits. Benzene deficits for one year must be offset during the following year, and may not be carried over for a second consecutive year.

III. Benzene Pre-Compliance Reporting Requirements

The gasoline benzene regulations required refiners to submit annual pre-compliance reports for each of their refineries to EPA. The first pre-compliance report was due by June 1, 2008 and subsequent reports were due annually through June 1, 2011.

The pre-compliance reports had to contain the following information:

1. Any changes in the refiner's basic company or facility information since registration.
2. Estimates of the average daily volume of gasoline produced at each refinery. The volume estimates must include gasoline produced during the periods of June 1, 2007 through December 31, 2007, and calendar years 2008 through 2015.
3. An estimate of the average gasoline benzene concentration for the periods listed above in 2.
4. For refineries expecting to participate in the benzene credit program, estimates of the number of credits generated and/or used during the periods listed above in 2.
5. Information on project schedule by known or projected completion date (by quarter) for each stage of the project (strategic planning, front-end engineering, detailed engineering and permitting, procurement and construction, and commissioning and startup).
6. Basic information regarding the selected technology pathway for compliance (e.g. re-routing of benzene precursors or other technologies, revamp versus grassroots, etc.).
7. Whether capital investments have been made or are projected to be made.
8. An update of the progress in each of these areas.

The pre-compliance reporting requirements did not apply to certain types of gasoline, including imported gasoline, gasoline produced for and used in California, gasoline produced by small refiners, gasoline exported for use outside the United States, and gasoline produced through distillation of transmix. These products are not included in this summary and analysis.

We recognize that the pre-compliance reports contain preliminary information and that final decisions on benzene removal plans may not have been made in all cases by

the reporting deadline. Accordingly, the information in this summary and analysis is based on the best available refinery information as of June 1, 2011.

IV. Gasoline Benzene Summary Data

A. Nationwide Analysis

1. Refinery Numbers and Production

We received benzene pre-compliance reports in 2011 for 113 refineries. Refiners indicated that, for most of their refineries, they have made decisions on producing gasoline which meets the benzene standards beginning January 1, 2011. Table 1 shows the aggregated results for all reporting refineries for the four years leading up to the beginning of the gasoline benzene standards, and Table 2 shows the aggregated results for the first five years that the 0.62 vol% standard is in effect. [1]

Table 1
Reported Data for Total U.S., 2007-2010

Year	2007	2008	2009	2010
# reporting refineries	113	113	113	110
Reported gasoline production, bbls/day	7,068,403	6,856,856	6,910,177	6,793,853
Average benzene concentration, vol%	1.06	1.09	1.01	0.94
# refineries with benzene < or = 0.62 vol%	20	20	23	25
# refineries with benzene > 0.62 vol% and < or = 1.3 vol%	45	40	47	47
# refineries with benzene > 1.3 vol%	48	53	43	38

Table 2
Reported Data for Total U.S., 2011-2015

Year	2011	2012	2013	2014	2015
# reporting refineries	107	107	107	107	107
Reported gasoline production, bbls/day	7,140,264	7,377,608	7,482,903	7,454,180	7,463,901
Average benzene concentration, vol%	0.75	0.65	0.62	0.62	0.62
# refineries with benzene < or = 0.62 vol%	55	62	68	69	70
# refineries with benzene > 0.62 vol%	52	45	39	38	37

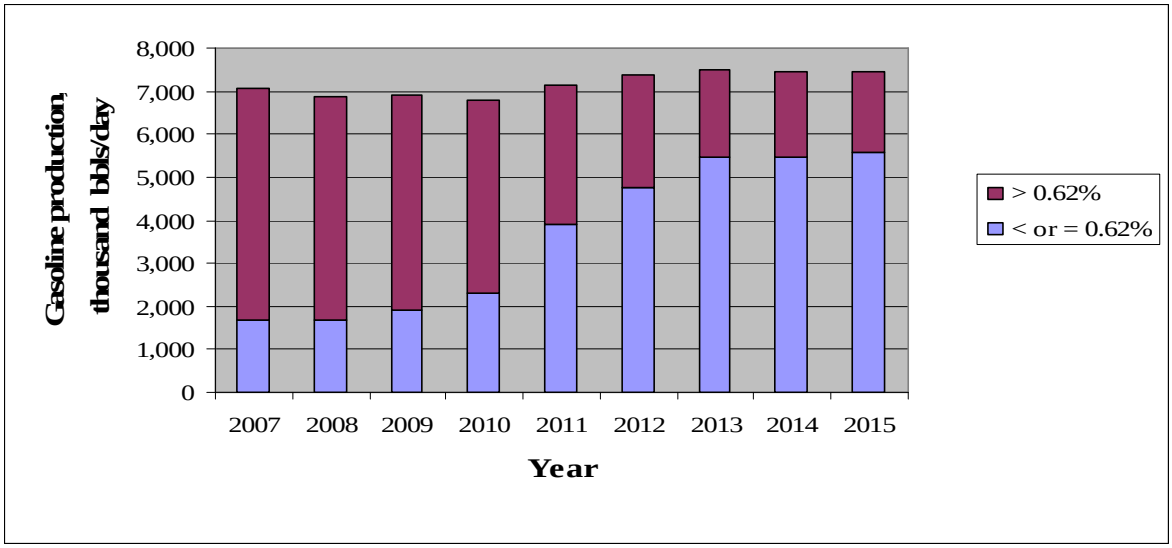
[1] The total number of reporting refineries decreases by 3 in 2010, due to the closure of 2 refineries in 2009 and 1 refinery exiting the gasoline market in 2010. The total number of refineries decreases by 3 more in 2011 due to the closure of 1 more refinery in 2010, a refiner combining 2 refineries into 1 refinery in 2010, and 1 more refinery exiting the gasoline market in 2011.

Table 1 shows that in 2007, only 20 refineries produced gasoline averaging 0.62 vol% benzene or less. Also in 2007, 93 refineries produced gasoline averaging greater than 0.62 vol% benzene, including 48 refineries that produced gasoline averaging greater than 1.3 vol% benzene. Table 2 shows that 35 of these 93 refineries planned to begin producing gasoline averaging 0.62 vol% benzene or less by 2011, as the number of refineries producing gasoline averaging 0.62 vol% benzene or less increased from 20 in 2007 to 55 in 2011. The number of refineries producing gasoline averaging 0.62 vol% benzene or less further increases to 68 by 2013, after the 1.3 vol% benzene maximum annual average standard takes effect on July 1, 2012.

Table 2 shows that the average benzene concentration for all reporting refineries is greater than 0.62 vol% in 2011 and 2012, as some refiners plan to use early credits to meet the 0.62 vol% standard in 2011 and 2012. Average benzene concentration for all reporting refineries decreases to 0.62 vol% beginning in 2013.

Tables 1 and 2 also show that refiners increased production of gasoline by approximately 72,000 bbls/day from 2007 to 2011, and plan to increase production by approximately 324,000 bbls/day from 2011 to 2015. Figure 1 illustrates reported gasoline production, by benzene concentration, for each reported year. By 2013, approximately 73 percent of all gasoline will contain 0.62 vol% benzene or less, as some refiners plan to use standard credits to meet the 0.62 vol% standard in 2013 and later.

Figure 1. Reported U.S. Gasoline Production and Benzene Content, 2007-2015



2. Projected Credit Generation and Use

Table 3 shows total reported gasoline benzene credits generated and used for each reported year. Thirty refineries indicated they generated a total of 216.0 million benzene credits (1 credit = 1 gallon benzene removed) during the early credit generation period from June 1, 2007 through December 31, 2010. Twenty five of these refineries are

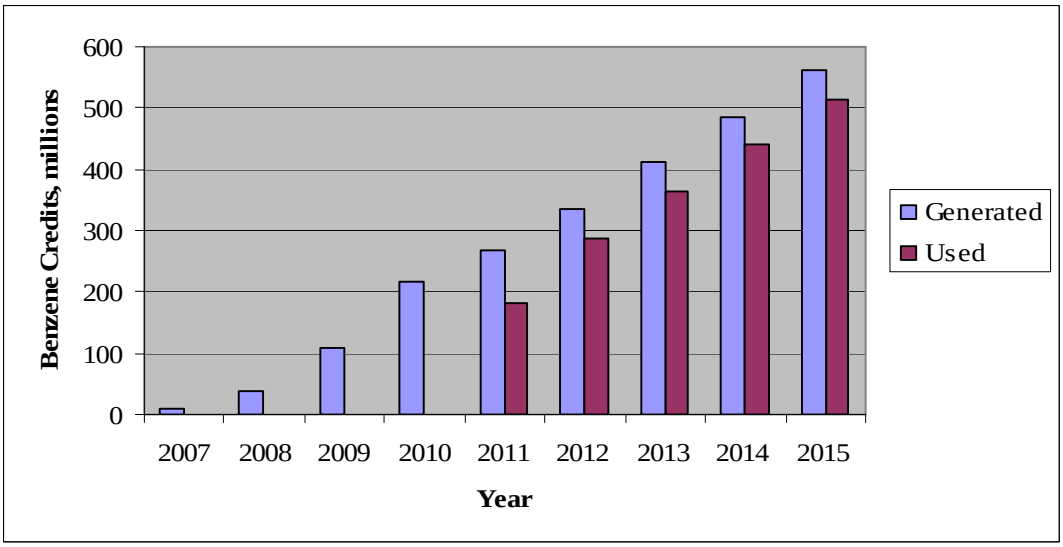
owned by refiners who own multiple refineries. To spread out the transition to the 0.62 vol% standard, refiners plan to use some of these early credits during the 2011 and 2012 compliance periods. In 2011, 37 refineries are projected to generate a total of 50.8 million credits, and 52 refineries are projected to use a total of 180.7 million credits. In 2012, 44 refineries are projected to generate a total of 68.2 million credits and 45 refineries are projected to use a total of 107.4 million credits. Annual generation of standard credits is slightly lower than annual credit usage in 2013 and 2014, and annual generation of standard credits begins to exceed annual usage in 2015, when 48 refineries are projected to generate 76.3 million credits and 37 refineries are projected to use only 74.1 million credits.

Table 3
Reported Gasoline Benzene Credits for Total U.S., 2007-2015

Year	2007	2008	2009	2010	total
# refineries generating benzene credits	6	12	18	28	30
Benzene credits generated, millions	10.5	28.8	70.5	106.3	216.0
Year	**2011**	**2012**	**2013**	**2014**	**2015**
# refineries generating benzene credits	37	44	47	48	48
# refineries using benzene credits	52	45	39	38	37
Benzene credits generated, millions	50.8	68.2	76.5	75.1	76.3
Benzene credits used, millions	180.7	107.4	77.0	75.7	74.1

Figure 2 shows cumulative projected generation and usage of gasoline benzene credits for each reported year. Refiners are planning to generate sufficient credits for overall compliance during each annual compliance period from 2011 onward.

Figure 2. Cumulative U.S. Gasoline Benzene Credits



3. Project Scope and Timing

In addition to providing projections of gasoline production, benzene concentration, and credit generation/usage, refiners had to also provide information outlining both their timeline for compliance with the gasoline benzene standards and their engineering plans (e.g., design and construction) in their pre-compliance reports. We requested that refiners report their progress according to the following five stages: 1) strategic planning, 2) planning and front-end engineering, 3) detailed engineering and permitting, 4) procurement and construction, and 5) commissioning and start-up.

In the 2011 benzene pre-compliance reports, refiners indicated they have plans to install new benzene reduction facilities at 58 refineries. Most of these refineries have completed and started up their projects to comply with the gasoline benzene standards. The remaining refineries are well into the procurement and construction phase, and generally expect to start up their benzene reduction facilities in 2011 or 2012.

Most of the 58 refineries indicated that they planned to use one or more of the gasoline benzene reduction strategies identified by EPA in the gasoline benzene rulemaking. Reported scopes for benzene compliance projects are summarized in the following list:

- 17 refineries plan to install additional naphtha pre-fractionation capacity to reduce the amount of benzene precursors in their naphtha reformer feed
- 15 refineries plan to install a new reformate splitter tower
- 11 refineries plan to install a new benzene saturation unit
- 1 refinery plans to install new benzene extraction facilities
- 8 refineries plan to revamp existing benzene extraction facilities.
- 1 refinery plans to install a new isomerization unit
- 5 refineries plan to revamp existing isomerization units
- 10 refineries plan to outhaul benzene-rich light reformate to other refineries for processing

In addition, 9 refineries indicated they planned to make operational changes to reduce gasoline benzene.

Refiners indicated they were not planning to install benzene reduction facilities at 55 refineries, either because these refineries already comply with the gasoline benzene standards, or because they are planning to use credits for compliance.

B. PADD Analysis

This section presents information specific to each Petroleum Administration for Defense District (PADD). Tables 4, 5 and 6 show aggregated reported data for 2007, 2011 and 2015, by PADD.[2] From 2007 to 2011, reported national average benzene

[2] These tables do not include imported gasoline, gasoline used in California, gasoline produced by small refiners, gasoline exported outside the U.S., and gasoline produced by transmix processors.

concentration decreased by 30 percent, with the largest decrease occurring in PADD 5 (37 percent), followed by PADD 2 (36 percent), PADD 3 (31 percent), PADD 4 (17 percent), and PADD 1 (13 percent). Also from 2007 to 2011, the number of refineries producing gasoline containing 0.62 vol% benzene or less increased from 20 to 55, with the largest increase occurring in PADD 3 (18 refineries), followed by PADD 2 (8 refineries), PADD 1 (4 refineries), PADD 5 (3 refineries), and PADD 4 (2 refineries). From 2011 to 2015, reported average benzene concentration decreases further in each PADD, with the largest decreases occurring in PADDs 2, 4 and 5. From 2011 to 2015, 15 additional refineries begin producing gasoline containing 0.62 vol% benzene or less, including 4 refineries in PADD 1, 3 refineries in PADD 2, 6 refineries in PADD 3, 1 refinery in PADD 4, and 1 refinery in PADD 5.

Table 4
Reported Data by PADD for 2007

	PADD 1	PADD 2	PADD 3	PADD 4	PADD 5	total U.S.
# reporting refineries	16	21	45	12	19	113
Reported gasoline production, bbls/day	1,197,810	1,656,183	3,578,123	240,781	395,506	7,068,403
Average benzene concentration, vol%	0.81	1.31	0.96	1.56	1.43	1.06
# refineries with benzene < or = 0.62 vol%	4	1	9	0	6	20
# refineries with benzene > 0.62 vol%	12	20	36	12	13	93

Table 5
Reported Data by PADD for 2011

	PADD 1	PADD 2	PADD 3	PADD 4	PADD 5	total U.S.
# reporting refineries	14	20	42	12	19	107
Reported gasoline production, bbls/day	1,068,071	1,749,324	3,684,696	261,600	376,573	7,140,264
Average benzene concentration, vol%	0.70	0.84	0.66	1.30	0.90	0.75
# refineries with benzene < or = 0.62 vol%	8	9	27	2	9	55
# refineries with benzene > 0.62 vol%	6	11	15	10	10	52

Table 6
Reported Data by PADD for 2015

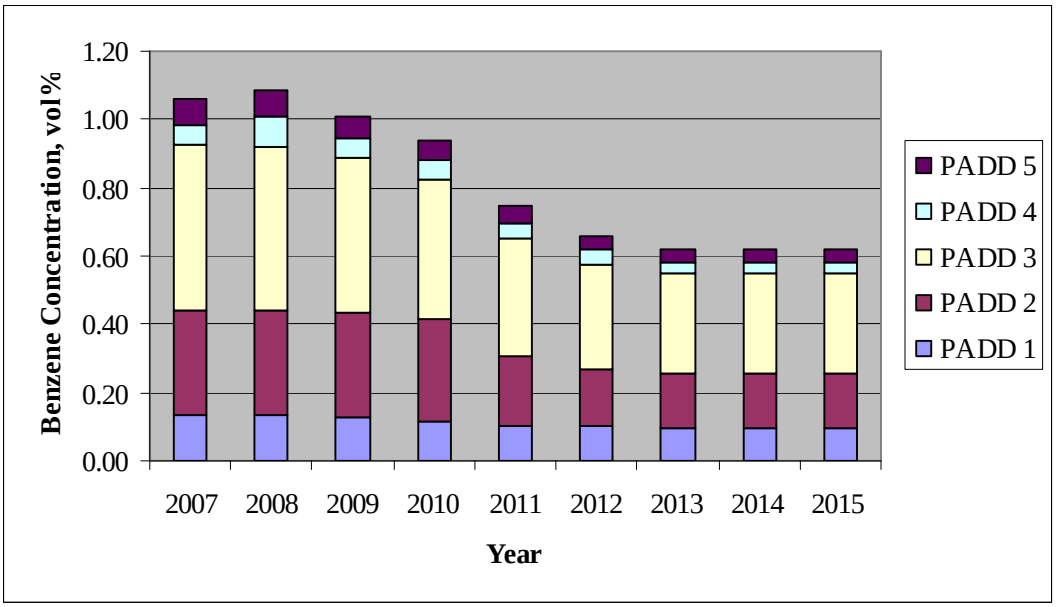
	PADD 1	PADD 2	PADD 3	PADD 4	PADD 5	total U.S.
# reporting refineries	14	20	42	12	19	107
Reported gasoline production, bbls/day	1,143,880	1,775,024	3,881,312	277,879	385,806	7,463,901
Average benzene concentration, vol%	0.61	0.67	0.56	0.94	0.71	0.62
# refineries with benzene < or = 0.62 vol%	12	12	33	3	10	70
# refineries with benzene > 0.62 vol%	2	8	9	9	9	37

Tables 4, 5 and 6 also show that most of the increase in projected total U.S. gasoline production from 2007 to 2015 occurs in PADD 3, with lesser increases in PADDs 2 and 4, and decreases in PADDs 1 and 5. From 2007 to 2015, projected total U.S. gasoline production increases by approximately 395,000 bbls/day, including

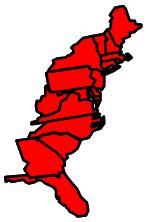
increases of approximately 303,000 bbls/day in PADD 3, 119,000 bbls/day in PADD 2, and 37,000 bbls/day in PADD 4, and decreases of approximately 10,000 bbls/day in PADD 5, and 54,000 bbls/day in PADD 1.

Figure 3 illustrates the effect of the benzene standards on national average benzene levels from 2007 through 2015. Figure 3 also shows the volume-weighted contribution of each PADD to national average benzene concentration for each reported year. PADD 3 consistently has the greatest volume-weighted contribution because PADD 3 consistently produces the most gasoline of any PADD (even though PADD 3 has the lowest gasoline benzene concentrations among all PADDs from 2011 through 2015). Conversely, PADD 4 consistently has the smallest volume-weighted contribution because PADD 4 consistently produces the least gasoline of any PADD (even though PADD 4 has the highest gasoline benzene concentrations among all PADDs in every reported year).

Figure 3. PADD Contributions to National Average Benzene, 2007-2015



More detailed information for each PADD is shown below in Tables 7 through 16.



1. PADD 1

Reported data for 16 PADD 1 refineries is summarized below in Tables 7 and 8.[3] PADD 1 average gasoline benzene concentration decreased from 0.81 vol% in 2007 to 0.70 vol% in 2011, as the number of refineries producing gasoline containing 0.62 vol% benzene or less increased from 4 to 8. PADD 1 average gasoline benzene concentration decreases further to 0.61 vol% by 2015, as 4 more refineries reduce their gasoline benzene concentration to 0.62 vol% or less. Projected gasoline production also decreases from 2007 to 2015 by approximately 54,000 bbls/day, primarily due to the closure of 2 refineries in 2009.

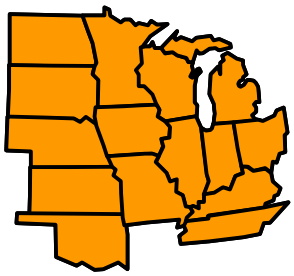
Table 7
Reported Data for PADD 1, 2007-2010

Year	2007	2008	2009	2010
# reporting refineries	16	16	16	14
Reported gasoline production, bbls/day	1,197,810	1,213,370	1,211,632	1,060,827
Average benzene concentration, vol%	0.81	0.75	0.73	0.74
# refineries with benzene < or = 0.62 vol%	4	6	7	4
# refineries with benzene > 0.62 vol%	12	10	9	10

Table 8
Reported Data for PADD 1, 2011-2015

Year	2011	2012	2013	2014	2015
# reporting refineries	14	14	14	14	14
Reported gasoline production, bbls/day	1,068,071	1,147,888	1,136,495	1,140,499	1,143,880
Average benzene concentration, vol%	0.70	0.64	0.63	0.62	0.61
# refineries with benzene < or = 0.62 vol%	8	8	10	11	12
# refineries with benzene > 0.62 vol%	6	6	4	3	2

[3] These tables do not include imported gasoline, gasoline produced by small refiners, gasoline exported outside the U.S., and gasoline produced by transmix processors.



2. PADD 2

Reported data for 21 reporting PADD 2 refineries is summarized below in Tables 9 and 10.[4] PADD 2 average gasoline benzene concentration decreased from 1.31 vol% in 2007 to 0.84 vol% in 2011, as the number of refineries producing gasoline containing 0.62 vol% benzene or less increased from 1 to 9. PADD 2 average gasoline benzene concentration decreases further to 0.67 vol% by 2015, as 4 more refineries reduce their gasoline benzene concentration to 0.62 vol% or less. The total number of reporting refineries decreases by 1 in 2011 due to a refiner combining 2 refineries into a single refinery in 2010, and projected gasoline production increases from 2007 to 2015 by approximately 119,000 bbls/day.

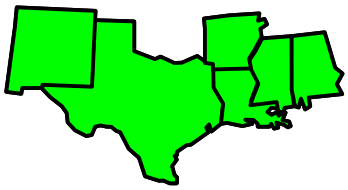
Table 9
Reported Data for PADD 2, 2007-2010

Year	2007	2008	2009	2010
# reporting refineries	21	21	21	21
Reported gasoline production, bbls/day	1,656,183	1,616,478	1,696,519	1,689,434
Average benzene concentration, vol%	1.31	1.31	1.24	1.20
# refineries with benzene < or = 0.62 vol%	1	1	1	2
# refineries with benzene > 0.62 vol%	20	20	20	19

Table 10
Reported Data for PADD 2, 2011-2015

Year	2011	2012	2013	2014	2015
# reporting refineries	20	20	20	20	20
Reported gasoline production, bbls/day	1,749,324	1,757,589	1,797,958	1,780,073	1,775,024
Average benzene concentration, vol%	0.84	0.71	0.67	0.67	0.67
# refineries with benzene < or = 0.62 vol%	9	11	12	12	12
# refineries with benzene > 0.62 vol%	11	9	8	8	8

[4] These tables do not include imported gasoline, gasoline produced by small refiners, gasoline exported outside the U.S., and gasoline produced by transmix processors.



3. PADD 3

Reported data for 45 PADD 3 refineries is summarized below in Tables 11 and 12.[5] PADD 3 average gasoline benzene concentration decreased from 0.96 vol% in 2007 to 0.66 vol% in 2011, as the number of refineries producing gasoline containing 0.62 vol% benzene or less increased from 9 to 27. PADD 3 average gasoline benzene concentration decreases further to 0.56 vol% by 2015, as 6 more refineries reduce their gasoline benzene concentration to 0.62 vol% or less. The total number of reporting refineries decreases by 3 in 2011 due to the closure of 1 refinery in 2010 and 2 other refineries exiting the gasoline market in 2011, and projected gasoline production increases from 2007 to 2015 by approximately 303,000 bbls/day.

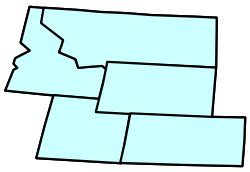
Table 11
Reported Data for PADD 3, 2007-2010

Year	2007	2008	2009	2010
# reporting refineries	45	45	45	45
Reported gasoline production, bbls/day	3,578,123	3,301,912	3,383,544	3,437,531
Average benzene concentration, vol%	0.96	1.00	0.94	0.81
# refineries with benzene < or = 0.62 vol%	9	8	9	16
# refineries with benzene > 0.62 vol%	36	37	36	29

Table 12
Reported Data for PADD 3, 2011-2015

Year	2011	2012	2013	2014	2015
# reporting refineries	42	42	42	42	42
Reported gasoline production, bbls/day	3,684,696	3,824,895	3,880,221	3,866,079	3,881,312
Average benzene concentration, vol%	0.66	0.59	0.56	0.56	0.56
# refineries with benzene < or = 0.62 vol%	27	31	33	33	33
# refineries with benzene > 0.62 vol%	15	11	9	9	9

[5] These tables do not include imported gasoline, gasoline used in California, gasoline produced by small refiners, gasoline exported outside the U.S., and gasoline produced by transmix processors.



4. PADD 4

Data for 12 reporting PADD 4 refineries is summarized below in Tables 13 and 14.[6] PADD 4 average gasoline benzene concentration decreased from 1.56 vol% in 2007 to 1.30 vol% in 2011, as the number of refineries producing gasoline containing 0.62 vol% benzene or less increased from 0 to 2. PADD 4 average gasoline benzene concentration decreases further to 0.94 vol% by 2015, as refineries further reduce their gasoline benzene concentration. Projected gasoline production also increases from 2007 to 2015 by approximately 37,000 bbls/day.

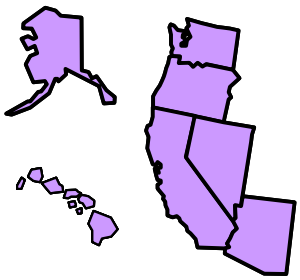
Table 13
Reported Data for PADD 4, 2007-2010

Year	2007	2008	2009	2010
# reporting refineries	12	12	12	12
Reported gasoline production, bbls/day	240,781	365,974	249,841	251,753
Average benzene concentration, vol%	1.56	1.59	1.51	1.41
# refineries with benzene < or = 0.62 vol%	0	0	0	0
# refineries with benzene > 0.62 vol%	12	12	12	12

Table 14
Reported Data for PADD 4, 2011-2015

Year	2011	2012	2013	2014	2015
# reporting refineries	12	12	12	12	12
Reported gasoline production, bbls/day	261,600	265,349	280,795	281,295	277,879
Average benzene concentration, vol%	1.30	1.12	0.95	0.95	0.94
# refineries with benzene < or = 0.62 vol%	2	2	3	3	3
# refineries with benzene > 0.62 vol%	10	10	9	9	9

[6] These tables do not include imported gasoline, gasoline used in California, gasoline produced by small refiners, gasoline exported outside the U.S., and gasoline produced by transmix processors.



5. PADD 5

Data for 19 reporting PADD 5 refineries is summarized below in Tables 15 and 16.[7] PADD 5 average gasoline benzene concentration decreased from 1.43 vol% in 2007 to 0.90 vol% in 2011, as the number of refineries producing gasoline containing 0.62 vol% benzene or less increased from 6 to 9. PADD 5 average gasoline benzene concentration decreases further to 0.71 vol% by 2015, as refineries further reduce their gasoline benzene concentration. Projected gasoline production also decreases slightly from 2007 to 2015 by approximately 10,000 bbls/day.

Table 15
Reported Data for PADD 5, 2007-2010

Year	2007	2008	2009	2010
# reporting refineries	19	19	19	18
Reported gasoline production, bbls/day	395,506	359,122	368,641	354,308
Average benzene concentration, vol%	1.43	1.54	1.25	1.18
# refineries with benzene < or = 0.62 vol%	6	5	6	3
# refineries with benzene > 0.62 vol%	13	14	13	15

Table 16
Reported Data for PADD 5, 2011-2015

Year	2011	2012	2013	2014	2015
# reporting refineries	19	19	19	19	19
Reported gasoline production, bbls/day	376,573	381,886	387,434	386,234	385,806
Average benzene concentration, vol%	0.90	0.74	0.71	0.71	0.71
# refineries with benzene < or = 0.62 vol%	9	10	10	10	10
# refineries with benzene > 0.62 vol%	10	9	9	9	9

[7] These tables do not include imported gasoline, gasoline used in California, gasoline produced by small refiners, gasoline exported outside the U.S., and gasoline produced by transmix processors.

C. Comparison of 2010 and 2011 Pre-compliance Reports

The 2011 pre-compliance reports show slightly higher overall projected reduction in benzene during the early credit generation period (June 1, 2007 through December 31, 2010), compared to the 2010 pre-compliance reports. The 2011 pre-compliance reports also show that benzene concentrations from 2011 through 2015 are projected to be approximately the same as those in the 2010 pre-compliance reports. Table 17 lists projected national gasoline production and average benzene concentration from the 2010 and 2011 pre-compliance reports.

Table 17
Projected Gasoline Production and Benzene Concentration for Total U.S., 2007-2015

	2007	2008	2009	2010	
2010 benzene reports					
Reported gasoline production, bbls/day	7,068,133	6,848,290	6,940,991	7,108,910	
Average benzene concentration, vol%	1.06	1.09	1.02	0.99	
2011 benzene reports					
Reported gasoline production, bbls/day	7,068,403	6,856,856	6,910,177	6,793,853	
Average benzene concentration, vol%	1.06	1.09	1.01	0.94	
	2011	**2012**	**2013**	**2014**	**2015**
2010 benzene reports					
Reported gasoline production, bbls/day	7,463,850	7,614,155	7,674,550	7,657,239	7,660,011
Average benzene concentration, vol%	0.73	0.65	0.62	0.62	0.62
2011 benzene reports					
Reported gasoline production, bbls/day	7,140,264	7,377,608	7,482,903	7,454,180	7,463,901
Average benzene concentration, vol%	0.75	0.65	0.62	0.62	0.62

The 2011 pre-compliance reports show more early credits being generated from 2007 through 2010, compared to the 2010 pre-compliance reports. However, the 2011 pre-compliance reports also show fewer standard credits being generated and more credits being used from 2011 through 2015, compared to the 2010 pre-compliance reports. Table 18 lists projected credit generation and usage from the 2010 and 2011 pre-compliance reports, along with the cumulative credit surplus by the end of each year from 2007 through 2015. Figure 4 illustrates that the 2011 pre-compliance reports continue to show a cumulative credit surplus at the end of each year from 2007 through 2015, but the cumulative credit surplus by the end of 2015 is smaller than the cumulative credit surplus from the 2010 pre-compliance reports.

Table 18 Projected Gasoline Production and Benzene Concentration for Total U.S., 2007-2015					
	2007	**2008**	**2009**	**2010**	
2010 benzene reports					
Benzene credits generated, millions	10.6	29.9	67.7	96.3	
Cumulative credit surplus, millions	10.6	40.5	108.1	204.4	
2011 benzene reports					
Benzene credits generated, millions	10.5	28.8	70.5	106.3	
Cumulative credit surplus, millions	10.5	39.3	109.8	216.0	
	2011	**2012**	**2013**	**2014**	**2015**
2010 benzene reports					
Benzene credits generated, millions	55.2	79.8	81.1	79.9	80.4
Benzene credits used, millions	175.1	111.8	78.7	78.4	78.0
Cumulative credit surplus, millions	84.5	52.5	54.9	56.3	58.8
2011 benzene reports					
Benzene credits generated, millions	50.8	68.2	76.5	75.1	76.3
Benzene credits used, millions	180.7	107.4	77.0	75.7	74.1
Cumulative credit surplus, millions	86.1	46.9	46.4	45.8	48.0

Figure 4. Cumulative U.S. Gasoline Benzene Credit Surplus