Summary and Analysis of the 2010 Gasoline Benzene Pre-Compliance Reports

United States Environmental Protection Agency

Summary and Analysis of the 2010 Gasoline Benzene Pre-Compliance Reports

Compliance and Innovative Strategies 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 are 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 are 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 2010 pre-compliance reports.

Refiners' benzene pre-compliance reports must 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 must contain a projection of how many credits will be generated or used by each refinery. The pre-compliance reports must 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 2010. The 2010 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
- 62 refineries are planning to install equipment to reduce gasoline benzene
- 47 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
- 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

This data represents estimates made by refiners whose final actual compliance plans may change prior to January 1, 2011. While the reported information is preliminary, the results provide the clearest snapshot of refiners' aggregate benzene compliance plans available as of June 1, 2010. They represent the assessment of those who have first-hand knowledge of the unique situation faced by each refinery. EPA expects that next year's benzene pre-compliance reports will contain more definite information on refiners' plans to produce gasoline which meets the benzene standards beginning January 1, 2011.

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 are 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 may 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 reduce 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 require 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 are due annually through 2011.

The pre-compliance reports must 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 do 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, 2010. The information presented here will be updated with more current analyses from subsequent annual pre-compliance reports in 2011.

IV. Gasoline Benzene Summary Data

A. Nationwide Analysis

1. Refinery Numbers and Production

We received benzene pre-compliance reports in 2010 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.

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

Year	2007	2008	2009	2010
# reporting refineries	113	113	113	109
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
# refineries with benzene < or = 0.62 vol%	20	20	22	25
# refineries with benzene > 0.62 vol% and < or = 1.3 vol%	45	40	47	42
# refineries with benzene > 1.3 vol%	48	53	44	42

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

Year	2011	2012	2013	2014	2015
# reporting refineries	109	109	109	109	109
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
# refineries with benzene < or = 0.62 vol%	55	63	68	68	68
# refineries with benzene > 0.62 vol%	54	46	41	41	41

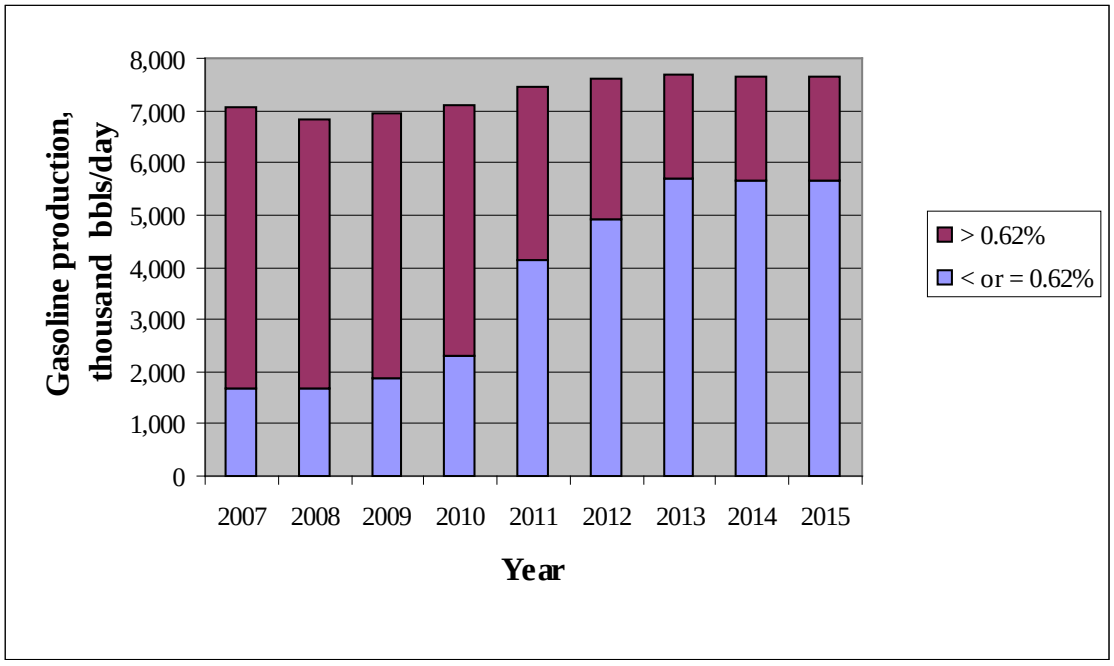
Table 1 shows that in 2007, only 20 refineries produced gasoline averaging 0.62 vol% benzene or less. Also in 2007, 93 refineries produced gasoline averaging greater than 0.62 vol% benzene, including 48 refineries that produced gasoline averaging greater than 1.3 vol% benzene. Table 2 shows that 35 of these 93 refineries plan 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 increases from 20 in 2007 to 55 in 2011.[1] 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 plan to increase production of gasoline by approximately 396,000 bbls/day from 2007 to 2011, and by approximately 196,000 bbls/day from 2011 to 2015. Figure 1 illustrates reported gasoline production, by benzene concentration, for each reported year. By 2013, approximately 76 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 plan to generate a total of 204.4 million

[1] The total number of reporting refineries decreases by 4 in 2010, due to the closure of 3 refineries in 2009 and one refiner combining 2 refineries into 1 refinery in 2009.

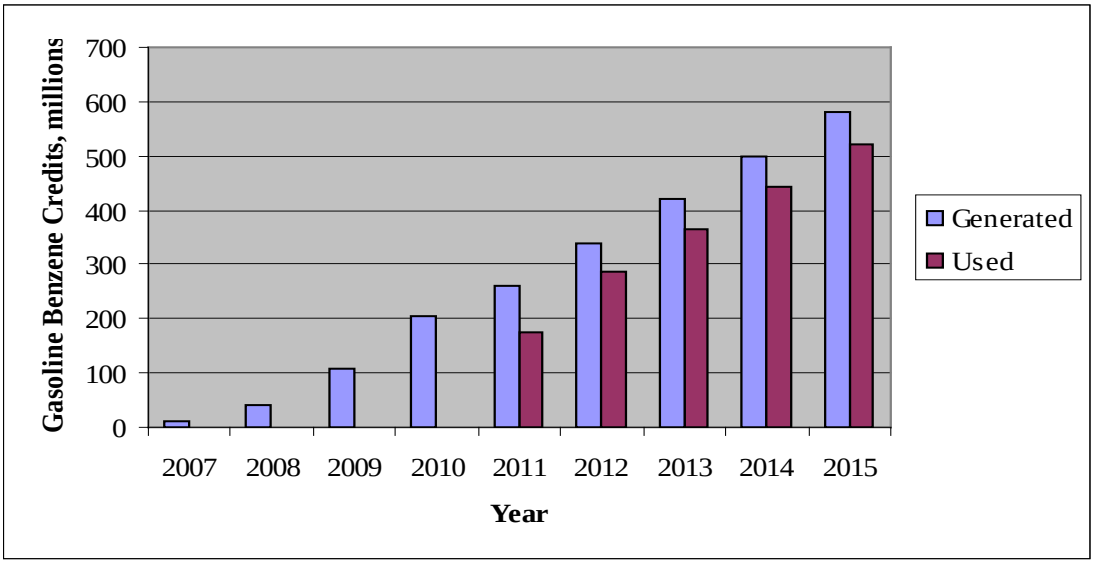
benzene credits (1 credit = 1 gallon benzene) during the early credit generation period from June 1, 2007 through December 31, 2010. Twenty five of these refineries are owned by refiners who own multiple refineries. To spread out the transition to the 0.62 vol% standard, refiners plan to use some of these early credits during the 2011 and 2012 compliance periods. In 2011, 37 refineries are projected to generate a total of 55.2 million credits, and 53 refineries are projected to use a total of 175.1 million credits. In 2012, 45 refineries are projected to generate a total of 79.8 million credits and 46 refineries are projected to use a total of 111.8 million credits. Annual generation of standard credits begins to exceed annual usage of standard credits in 2013, when 46 refineries are projected to generate 81.1 million credits and 41 refineries are projected to use only 78.7 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	17	27	30
Benzene credits generated, millions	10.6	29.9	67.7	96.3	204.4
Year	**2011**	**2012**	**2013**	**2014**	**2015**
# refineries generating benzene credits	37	45	46	46	46
# refineries using benzene credits	53	46	41	41	41
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

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 must also include 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 2010 benzene pre-compliance reports, refiners indicated they have plans to install new benzene reduction facilities at 62 refineries. These refineries are generally in the middle stages of their projects to comply with the gasoline benzene standards. Most have completed their planning and front-end engineering phase, and are well into the detailed engineering and permitting phase, while some refineries have also started the procurement and construction phase.

Most of the 62 refineries indicated that they plan 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:

- 19 refineries plan to install additional naphtha pre-fractionation capacity to reduce the amount of benzene precursors in their naphtha reformer feed
- 14 refineries plan to install a new reformate splitter tower
- 14 refineries plan to install a new benzene saturation unit
- 2 refineries plan 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
- 9 refineries plan to outhaul benzene-rich light reformate to other refineries for processing

In addition, 7 refineries indicated they planned to make operational changes to reduce gasoline benzene.

Refiners indicated they were not planning to install benzene reduction facilities at 47 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 concentration decreased by 31 percent, with the largest decrease occurring in PADD 2 (38 percent), followed by PADD 5 (37 percent), PADD 3 (32 percent), PADD 4 (20 percent), and PADD 1 (12 percent). Also from 2007 to 2011, the number of refineries producing gasoline containing 0.62 vol% benzene or less increases from 20 to 55, with the largest increase occurring in PADD 3 (20 refineries), followed by PADD 2 (7 refineries), PADD 1 (3 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, 13 additional refineries begin producing gasoline containing 0.62 vol% benzene or less, including 3 refineries in PADD 1, 4 in PADD 2, 3 in PADD 3, 1 in PADD 4, and 2 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	3,577,853	240,781	395,506	7,068,133
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	44	12	19	109
Reported gasoline production, bbls/day	1,170,216	1,765,854	3,867,412	270,107	390,260	7,463,850
Average benzene concentration, vol%	0.71	0.81	0.65	1.24	0.90	0.73
# refineries with benzene < or = 0.62 vol%	7	8	29	2	9	55
# refineries with benzene > 0.62 vol%	7	12	15	10	10	54

Table 6
Reported Data by PADD for 2015

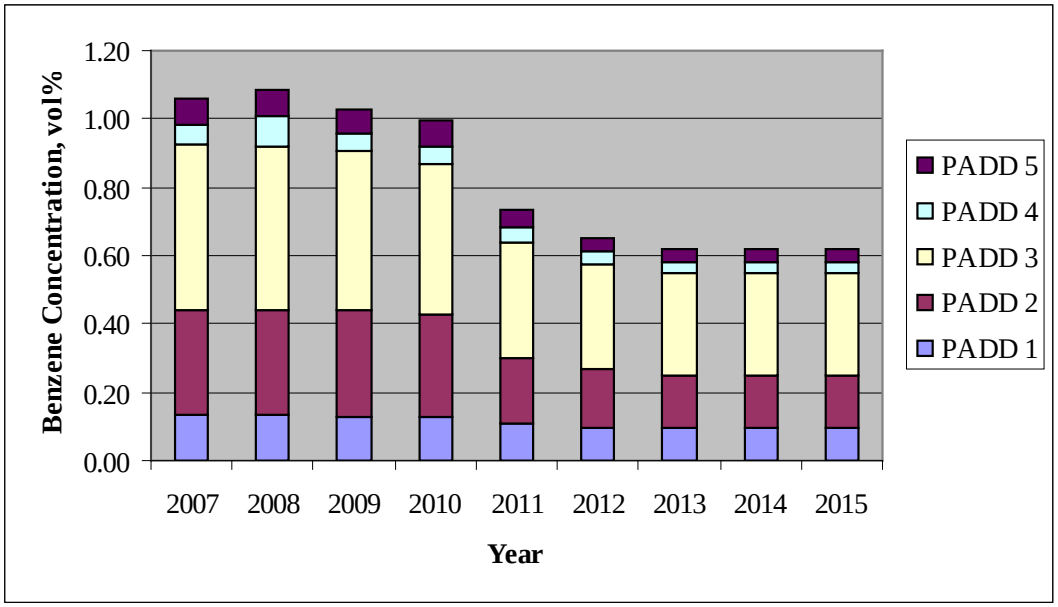
	PADD 1	PADD 2	PADD 3	PADD 4	PADD 5	total U.S.
# reporting refineries	14	20	44	12	19	109
Reported gasoline production, bbls/day	1,142,768	1,818,939	4,031,036	270,318	396,951	7,660,011
Average benzene concentration, vol%	0.62	0.65	0.57	0.97	0.69	0.62
# refineries with benzene < or = 0.62 vol%	10	12	32	3	11	68
# refineries with benzene > 0.62 vol%	4	8	12	9	8	41

[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.

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, 4 and 5, and a decrease in PADD 1. From 2007 to 2015, projected total U.S. gasoline production increases by approximately 592,000 bbls/day, including increases of approximately 454,000 bbls/day in PADD 3, 163,000 bbls/day in PADD 2, 30,000 bbls/day in PADD 4, and 1,000 bbls/day in PADD 5, and a decrease of approximately 55,000 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 decreases from 0.81 vol% in 2007 to 0.71 vol% in 2011, as the number of refineries producing gasoline containing 0.62 vol% benzene or less increases from 4 to 7. PADD 1 average gasoline benzene concentration decreases further to 0.62 vol% by 2015, as 3 more refineries reduce their gasoline benzene concentration to 0.62 vol% or less. Projected gasoline production also decreases from 2007 to 2015 by approximately 55,000 bbls/day, primarily due to the closure of 2 refineries in 2009.

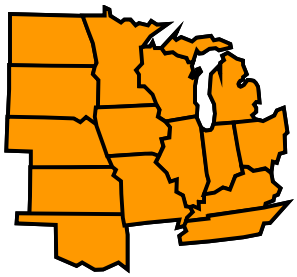
Table 7
Reported Data for PADD 1, 2007-2010

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	1,078,650
Average benzene concentration, vol%	0.81	0.75	0.73	0.83
# 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	1,170,216	1,148,412	1,148,510	1,148,510	1,142,768
Average benzene concentration, vol%	0.71	0.65	0.63	0.63	0.62
# refineries with benzene < or = 0.62 vol%	7	8	10	10	10
# refineries with benzene > 0.62 vol%	7	6	4	4	4

[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 decreases from 1.31 vol% in 2007 to 0.81 vol% in 2011, as the number of refineries producing gasoline containing 0.62 vol% benzene or less increases from 1 to 8. PADD 2 average gasoline benzene concentration decreases further to 0.65 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 2010 due to a refiner combining 2 refineries into a single refinery in 2009, and projected gasoline production increases from 2007 to 2015 by approximately 163,000 bbls/day.

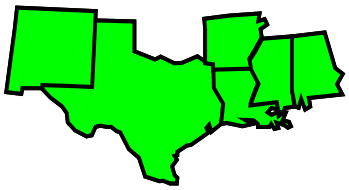
Table 9
Reported Data for PADD 2, 2007-2010

Year	2007	2008	2009	2010
# reporting refineries	21	21	21	20
Reported gasoline production, bbls/day	1,656,183	1,616,514	1,711,044	1,715,162
Average benzene concentration, vol%	1.31	1.31	1.28	1.24
# refineries with benzene < or = 0.62 vol%	1	1	0	1
# refineries with benzene > 0.62 vol%	20	20	21	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	1,765,854	1,818,511	1,823,939	1,811,939	1,818,939
Average benzene concentration, vol%	0.81	0.71	0.65	0.65	0.65
# refineries with benzene < or = 0.62 vol%	8	10	12	12	12
# refineries with benzene > 0.62 vol%	12	10	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 decreases from 0.96 vol% in 2007 to 0.65 vol% in 2011, as the number of refineries producing gasoline containing 0.62 vol% benzene or less increases from 9 to 29. PADD 3 average gasoline benzene concentration decreases further to 0.57 vol% by 2015, as 3 more refineries reduce their gasoline benzene concentration to 0.62 vol% or less. The total number of reporting refineries decreases by 1 in 2010 due to the closure of 1 refinery in 2009, and projected gasoline production increases from 2007 to 2015, by approximately 454,000 bbls/day.

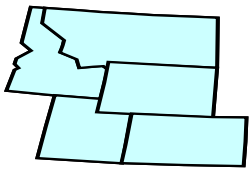
Table 11
Reported Data for PADD 3, 2007-2010

Year	2007	2008	2009	2010
# reporting refineries	45	45	45	44
Reported gasoline production, bbls/day	3,577,853	3,292,868	3,398,897	3,672,878
Average benzene concentration, vol%	0.96	1.00	0.94	0.86
# refineries with benzene < or = 0.62 vol%	9	8	9	15
# 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	44	44	44	44	44
Reported gasoline production, bbls/day	3,867,412	3,978,413	4,034,571	4,029,261	4,031,036
Average benzene concentration, vol%	0.65	0.58	0.57	0.57	0.57
# refineries with benzene < or = 0.62 vol%	29	31	32	32	32
# refineries with benzene > 0.62 vol%	15	13	12	12	12

[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 decreases from 1.56 vol% in 2007 to 1.24 vol% in 2011, as the number of refineries producing gasoline containing 0.62 vol% benzene or less increases from 0 to 2. PADD 4 average gasoline benzene concentration decreases further to 0.97 vol% by 2015, as refineries further reduce their gasoline benzene concentration. Projected gasoline production also increases from 2007 to 2015, by approximately 30,000 bbls/day.

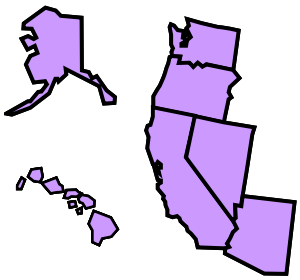
Table 13
Reported Data for PADD 4, 2007-2010

Year	2007	2008	2009	2010
# reporting refineries	12	12	12	12
Reported gasoline production, bbls/day	240,781	365,855	249,612	254,307
Average benzene concentration, vol%	1.56	1.59	1.51	1.45
# 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	270,107	270,927	270,578	270,578	270,318
Average benzene concentration, vol%	1.24	1.08	0.97	0.97	0.97
# refineries with benzene < or = 0.62 vol%	2	3	3	3	3
# refineries with benzene > 0.62 vol%	10	9	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 decreases 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 increases from 6 to 9. PADD 5 average gasoline benzene concentration decreases further to 0.69 vol% by 2015, as refineries further reduce their gasoline benzene concentration. Projected gasoline production also increases slightly from 2007 to 2015, by approximately 1,000 bbls/day.

Table 15
Reported Data for PADD 5, 2007-2010

Year	2007	2008	2009	2010
# reporting refineries	19	19	19	19
Reported gasoline production, bbls/day	395,506	359,683	369,807	387,913
Average benzene concentration, vol%	1.43	1.54	1.25	1.29
# refineries with benzene < or = 0.62 vol%	6	5	6	5
# refineries with benzene > 0.62 vol%	13	14	13	14

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	390,260	397,893	396,951	396,951	396,951
Average benzene concentration, vol%	0.90	0.76	0.69	0.69	0.69
# refineries with benzene < or = 0.62 vol%	9	11	11	11	11
# refineries with benzene > 0.62 vol%	10	8	8	8	8

[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 2009 and 2010 Pre-compliance Reports

The 2010 pre-compliance reports show approximately the same overall projected reduction in benzene during the early credit generation period (June 1, 2007 through December 31, 2010), compared to the 2009 pre-compliance reports. The 2010 pre-compliance reports also show that benzene concentrations from 2011 through 2015 are projected to be slightly higher compared to the 2009 pre-compliance reports. Table 17 lists projected national gasoline production and average benzene concentration from the 2009 and 2010 pre-compliance reports.

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

	2007	2008	2009	2010	
2009 benzene reports					
Reported gasoline production, bbls/day	7,032,887	6,788,798	7,094,997	7,460,758	
Average benzene concentration, vol%	1.05	1.08	1.02	0.99	
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	**2012**	**2013**	**2014**	**2015**
2009 benzene reports					
Reported gasoline production, bbls/day	7,687,068	7,715,576	7,747,637	7,742,999	7,751,801
Average benzene concentration, vol%	0.70	0.63	0.60	0.60	0.60
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

The 2010 pre-compliance reports show more early credits being generated from 2007 through 2010, compared to the 2009 pre-compliance reports. However, the 2010 pre-compliance reports also show fewer standard credits being generated and more credits being used from 2011 through 2015, compared to the 2009 pre-compliance reports. Table 18 lists projected credit generation and usage from the 2009 and 2010 pre-compliance reports, along with the cumulative credit surplus by the end of each year from 2007 through 2015. Figure 4 illustrates that the 2010 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 2009 pre-compliance reports.

Table 18 Projected Gasoline Production and Benzene Concentration for Total U.S., 2007-2015					
	2007	**2008**	**2009**	**2010**	
2009 benzene reports					
Benzene credits generated, millions	10.8	30.7	48.2	69.2	
Cumulative credit surplus, millions	10.8	41.5	89.7	158.9	
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	**2012**	**2013**	**2014**	**2015**
2009 benzene reports					
Benzene credits generated, millions	69.1	91.6	90.1	89.4	90.1
Benzene credits used, millions	167.3	103.5	70.7	69.4	67.9
Cumulative credit surplus, millions	60.8	48.9	68.3	88.4	110.5
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

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