

**Economic Assessment of the
EPA Proposed Tier 3 Rule**

Prepared for the

Emissions Control Technology Association (ECTA)

by

George R. Schink, Ph.D.¹

**Navigant Economics
1200 19th Street, N.W., Suite 850
Washington, D.C. 20036**

February 18, 2014

¹ The author is a Managing Director at Navigant Economics. The views expressed here are those of the author only, and do not represent the views of Navigant Economics.

Table of Contents

Section	Page
Executive Summary	ii
I. Introduction	1
II. Overview of the EPA Proposed Tier 3 Rule	2
III. Summary of Conclusions	3
IV. Discussion of the Four Specific Aspects of the EPA Proposed Tier 3 Rule	5
A. EPA’s Estimate of the Effects of Tier 3 on Vehicle Emissions and Ambient Air Quality	5
B. EPA’s Estimate of the Health Benefits of Tier 3	9
C. EPA’s Estimate of the Refining Industry’s Compliance Costs	10
D. EPA’s Assessment that the Tier 3 Sulfur Standard Can Be Implemented in 3 Years	14
Appendix A: Notice	

Executive Summary: Economic Assessment of the EPA Proposed Tier 3 Rule

I have performed an economic assessment of various aspects of the EPA proposed Tier 3 rule. Specifically, I have evaluated:

- (1) EPA's estimate of the effects of Tier 3 on vehicle emissions and ambient air quality;
- (2) EPA's estimate of the health benefits of Tier 3;
- (3) EPA's estimate of the refining industry's compliance costs; and
- (4) EPA's assessment that the Tier 3 sulfur study can be implemented in 3 years.

In addition to my evaluation of the EPA's analysis and results, I have evaluated the comments of the affected refining and motor vehicle industries and of independent entities involved in the assessment of the potential health benefits of Tier 3, such as the American Lung Association.

Based on my assessments, I have concluded that the EPA's estimates, as of 2030 in 2010 dollars, of \$3.4 billion in annual compliance costs² and of monetized health benefits of \$7.4 to \$23 billion are reasonable and therefore indicate that the Tier 3 program is cost effective.

Regarding EPA's estimate of the effects of Tier 3 on vehicle emission and ambient air quality, these estimates appear to be reasonable and consistent with the results obtained in studies sponsored by the American Petroleum Institute ("API").³ These ENVIRON Studies sponsored by the API estimated the effects on motor vehicle

² I have not evaluated the EPA's estimate of vehicle program compliance costs which, in 2030, amount to \$2.1 billion of the \$3.4 billion total. Given that the auto industry supports the EPA's proposed Tier 3 rule, I have assumed that the auto industry finds the EPA's estimate of vehicle program compliance costs to be reasonable.

³ There were two studies were prepared by ENVIRON International Corporation ("ENVIRON Studies").

emissions and air quality as of 2022 of a Tier 3-like program (California's LEV III program). As ENVIRON admits, the effects of this Tier 3-like program in 2022 were incomplete because the program was not to be fully implemented until 2028. However, as of 2022, the ENVIRON estimates of the effects of the Tier 3-like program on motor vehicle emissions are similar to the EPA's estimates of the Tier 3 effects as of 2022. EPA's estimate of the Tier 3 effects as of 2030 are substantially larger, and these effects continue to increase thereafter (e.g., the EPA also presents the effects as of 2050).

Regarding EPA's estimate of the health benefits of Tier 3, the EPA and the American Lung Association produce similar estimates of the monetized value of the benefits as of 2030; the EPA estimate is \$7.4 to \$23 billion while the American Lung Association estimate is \$8.5 to \$22 billion. The similarity of the EPA and American Lung Association estimates provides substantial credibility to the EPA estimate. In their comments, the API and the American Association of Fuel & Petrochemical Manufacturers ("API/AFPM") produce an estimate as of 2030 of \$0.8 to \$2.3 billion which they obtain by excluding a large percentage of the potentially affected population.

Regarding EPA's estimate of the refining industry's compliance costs, the EPA estimated the refining industry's compliance costs using a linear programming cost model which was applied on a refinery-by-refinery basis to 111 refineries. The EPA incorporated an averaging, banking, and trading ("ABT") program into its analysis which serves to reduce the marginal compliance cost toward the average compliance cost and to reduce the average compliance cost. The EPA's estimated average compliance cost without ABT is 0.97 cents per gallon which falls to 0.79 cents per gallon with ABT and nationwide averaging and trading. API/AFPM are critical of EPA's analysis claiming that the refining industry investment costs will be much higher than EPA estimates. However, in fact, the API/AFPM claim is based on highly inflated investment cost and without ABT. The EPA estimate is consistent with the estimates developed by others and is reasonable and appropriate.

Regarding EPA's assessment that the Tier 3 sulfur standard can be implemented in 3 years, the EPA performed a thorough evaluation of the time and personnel required to make the necessary refinery investments to support its position that these investments can be completed in 3 years. The 3-year estimate is also supported by the refinery experience in completing the \$6.1 billion in investments under Tier 2 within 4 years because the Tier 3 investments amount to only \$2.1 billion and involve fewer smaller projects. The smaller amount of investment under Tier 3 and the experience gained by the refiners under Tier 2 suggests that 3 years should be sufficient to complete the Tier 3 investments. API/AFPM assert that 5 years should be allowed to complete the Tier 3 investments, but they do not address EPA's analysis supporting 3 years and offer no analysis supporting their position.

Economic Assessment of the EPA Proposed Tier 3 Rule

I. Introduction

I have been asked by the Emissions Control Technology Association (“ECTA”) to comment on several aspects of Environmental Protection Agency’s (“EPA’s”) Proposed Rule on *Control of Air Pollution from Motor Vehicles: Tier 3 Motor Vehicle Emission and Fuel Standards*⁴ and also to address some of the comments on these aspects of the EPA Proposed Tier 3 Rule by the American Petroleum Institute (“API”) and the Association of Fuel & Petrochemical Manufacturers (“AFI/AFPM”).⁵ The information contained in the EPA Proposed Tier 3 Rule is supported by the EPA Draft Regulatory Impact Analysis (“DRIA”).⁶ Previously on behalf of ECTA, I co-authored a report in June 2012 based on an economic analysis of the EPA’s proposed Tier 3 regulations which I also cite below, where appropriate.⁷ In addition, I have considered other studies relevant to evaluating the EPA proposed Tier 3 rule.

The specific aspects of the EPA proposed Tier 3 rule that I discuss below are as follows:

1. EPA’s estimate of the effects of Tier 3 on vehicle emissions and ambient air quality;
2. EPA’s estimate of the health benefits of Tier 3;
3. EPA’s estimate of the refining industry’s compliance costs; and
4. EPA’s assessment that the Tier 3 sulfur standard can be implemented in 3 years.

⁴ See Federal Register, Vol. 78, No. 98, May 21, 2013, pages 29816-30191 (hereinafter “EPA Proposed Tier 3 Rule”).

⁵ Joint Comments by the American Petroleum Institute and the Association of Fuel & Petrochemical Manufacturers on the U.S. Environmental Protection Agency Proposed Rule, *Control of Air Pollution from Motor Vehicles: Tier 3 Motor Vehicle Emission and Fuel Standards*, June 28, 2013 (hereinafter “API/AFPM Comments”).

⁶ EPA Draft Regulation Impact Analysis: Tier 3 Motor Vehicle Emission and Fuel Standards, EPA 420-D-13-w2, March 2013 (hereinafter “EPA DRIA”).

⁷ George Schink & Hal Singer, *Economic Analysis of the Implications of Implementing EPA’s Tier 3 Rule*, June 14, 2012, available at http://www.naviganteconomics.com/docs/061212%20Economic%20Analysis%20of%20the%20Implications%20of%20Tier%203%20Sulfur%20Reduction%20Final_embargoed%20copy.pdf (hereinafter “ECTA Study”).

II. Overview of the EPA Proposed Tier 3 Rule

Under Tier 3, the sulfur content of gasoline will be reduced from 30 parts per million (“ppm”) to 10 ppm by January 1, 2017. This proposed gasoline sulfur standard has already been achieved in California and in Europe, Japan, South Korea and other countries. The proposed sulfur standard will enable the introduction of more efficient emission control systems for both new and existing vehicles and will enable more stringent vehicle emission standards. These new vehicle standards will be phased in over time beginning with the 2017 model year and will be phased in with the final goals being met no later than the 2025 model year. By 2030, 80 percent of the light-duty fleet will be Tier 3 vehicles, and 90 percent vehicle miles traveled will be by Tier 3 vehicles. However, substantial improvements will continue well beyond 2030 as the older vehicle fleet is retired and vehicles with the final Tier 3 technology make up the vast majority of the vehicle fleet (e.g., the EPA has estimated the benefits through 2050).

The proposed vehicle and fuel standards would result in reduced tailpipe and evaporative emissions and significant reductions in the emission of pollutants such as ozone, particulate matter, and other air toxics (e.g., benzene). As a consequence of these emissions reductions, the ambient air quality would improve. This air quality improvement, particularly the reductions in the ambient concentration of ozone, particulates, and air toxics, is expected to result in substantial health benefits.

The EPA estimates that the annual compliance costs of Tier 3 in 2030 will be \$3.4 billion consisting of \$2.1 billion in vehicle program costs and \$1.3 billion in fuel program costs.⁸ I address the fuel program costs of \$1.3 billion below. These costs are associated with refineries reducing the sulfur content of gasoline to 10 ppm. API/AFPM assert that these costs are higher,⁹ and an API sponsored study provides an annual compliance cost estimate of \$2.4 billion.¹⁰ Given that the automotive industry supports the EPA’s Tier 3 program, the auto industry appears

⁸ See EPA Proposed Tier 3 Rule, pages 29827 and 29978-979.

⁹ See API/AFPM Comments, pages 27-30.

¹⁰ Baker & O’Brien Incorporated, *Addendum to Potential Supply and Cost Impacts of Low Sulfur, Lower RVP Gasoline*, Prepared for the American Petroleum Institute, March 2012, page 9, Figure 5.

to believe that the EPA's vehicle program cost estimates are reasonable and that the fuel program will be beneficial to the auto industry and the public.¹¹ In terms of health-related benefits, the EPA estimates annual monetized health benefits by 2030 of \$7.4 to \$23 billion (2010 dollars) which is similar to the 2030 annual monetized health benefits estimated by the American Lung Association of \$8.5 to \$22 billion. API/AFPM assert a much lower annual monetized health benefit by 2030 of \$0.8 to \$2.3 billion.¹² I address the EPA and other health benefit estimates below.

III. Summary of Conclusions

Based on my assessments, I have concluded that the EPA's estimates, as of 2030 in 2010 dollars, of \$3.4 billion in annual compliance costs¹³ and of monetized health benefits of \$7.4 to \$23 billion are reasonable and therefore indicate that the Tier 3 program is cost effective.

Regarding EPA's estimate of the effects of Tier 3 on vehicle emission and ambient air quality, these estimates appear to be reasonable and consistent with the results obtained in studies sponsored by the API.¹⁴ These ENVIRON Studies sponsored by the API estimated the effects on motor vehicle emissions and air quality as of 2022 of a Tier 3-like program (California's LEV III program). As ENVIRON admits, the effects of this Tier 3-like program in 2022 were incomplete because the program was not to be fully implemented until 2028. However, as of 2022, the ENVIRON estimates of the effects of the Tier 3-like program on motor vehicle emissions are similar to the EPA's estimates of the Tier 3 effects as of 2022. EPA's estimate of the Tier 3 effects as of 2030

¹¹ See Alliance of Automobile Manufacturers and Association of Global Automakers, Comments on the Proposed Rulemaking to Control Air Pollution for Motor Vehicles: Tier 3 Motor Vehicle Emission and Fuel Standards, July 1, 2013.

¹² See API/AFPM Comments, page 39.

¹³ I have not evaluated the EPA's estimate of vehicle program compliance costs which, in 2030, amount to \$2.1 billion of the \$3.4 billion total. Given that the auto industry supports the EPA's proposed Tier 3 rule, I have assumed that the auto industry finds the EPA's estimate of vehicle program compliance costs to be reasonable.

¹⁴ There were two studies were prepared by ENVIRON International Corporation ("ENVIRON Studies").

are substantially larger, and these effects continue to increase thereafter (e.g., the EPA also presents the effects as of 2050).

Regarding EPA's estimate of the health benefits of Tier 3, the EPA and the American Lung Association produce similar estimates of the monetized value of the benefits as of 2030; the EPA estimate is \$7.4 to \$23 billion while the American Lung Association estimate is \$8.5 to \$22 billion. The similarity of the EPA and American Lung Association estimates provides substantial credibility to the EPA estimate. In their comments, the API/AFPM produce an estimate as of 2030 of \$0.8 to \$2.3 billion which they obtain by excluding a large percentage of the potentially affected population.

Regarding EPA's estimate of the refining industry's compliance costs, the EPA estimated the refining industry's compliance costs using a linear programming cost model which was applied on a refinery-by-refinery basis to 111 refineries. The EPA incorporated an averaging, banking, and trading ("ABT") program into its analysis which serves to reduce the marginal compliance cost toward the average compliance cost and to reduce the average compliance cost. The EPA's estimated average compliance cost without ABT is 0.97 cents per gallon which falls to 0.79 cents per gallon with ABT and nationwide averaging and trading. API/AFPM are critical of EPA's analysis claiming that the refining industry investment costs will be much higher than EPA estimates. However, in fact, the API/AFPM claim is based on highly inflated investment cost and without ABT. The EPA estimate is consistent with the estimates developed by others and is reasonable and appropriate.

Regarding EPA's assessment that the Tier 3 sulfur standard can be implemented in 3 years, the EPA performed a thorough evaluation of the time and personnel required to make the necessary refinery investments to support its position that these investments can be completed in 3 years. The 3-year estimate is also supported by the refinery experience in completing the \$6.1 billion in investments under Tier 2 within 4 years because the Tier 3 investments amount to only \$2.1 billion and involve fewer smaller

projects. The smaller amount of investment under Tier 3 and the experience gained by the refiners under Tier 2 suggests that 3 years should be sufficient to complete the Tier 3 investments. API/AFPM assert that 5 years should be allowed to complete the Tier 3 investments, but they do not address EPA's analysis supporting 3 years and offer no analysis supporting their position.

IV. Discussion of the Four Specific Aspects of the EPA Proposed Tier 3 Rule

A. EPA's Estimate of the Effects of Tier 3 on Vehicle Emissions and Ambient Air Quality

The EPA discusses its analyses and results related to the effects of Tier 3 on vehicle emissions and ambient air quality at length in the EPA DRIA (Chapter 7, pages 7-1 to 7-134; Appendix to Chapter 7, pages 7A-1 to 7A-14) and in the EPA Proposed Tier 3 Rule (Chapter III, pages 29840 to 29850). Regarding on-road emissions¹⁵, Table 1 below summarizes the EPA's estimated percentage reductions due to moving from the Tier 2 to the Tier 3 standards for 2017, 2022, 2030, and 2050. Given the phase-in of various Tier 3 vehicle standards and the time required to turn the vehicle fleet over, the emission reductions as of 2030, when the vehicle fleet will consist of 80% Tier 3 vehicles and 20% Tier 2 vehicles,¹⁶ provides a good indication of the overall emission impacts of Tier 3. Further, the percentage emission reductions continue to increase through 2050. The reductions in SO₂ emissions are related directly to the reductions in the sulfur content of gasoline and are fully realized in 2017.¹⁷

¹⁵ See EPA DRIA, Chapter 7, pages 7-1 to 7-46 and EPA Proposed Tier 3 Rule, Chapter III, pages 29840 to 29845.

¹⁶ See EPA DRIA, Chapter 7, page 7-3, Table 7-1.

¹⁷ See EPA DRIA, Chapter 7, pages 7-45 to 7-46.

Table 1
Percentage Reduction in Emissions in All On-road Vehicles
As a Result of Moving From Tier 2 to Tier 3 Standards

	EPA Estimates				Addenda: ENVIRON Estimates As of 2022	
	2017	2022	2030	2050	Tier 2 to Tier 3	Tier 1 to Tier 2
NO _x	8.2%	13.8%	27.8%	37.5%	5.0%	66.0%
VOC	2.8%	6.8%	23.1%	36.1%	6.0%	55.0%
CO	3.6%	9.1%	30.4%	46.3%	7.0%	48.0%
PM _{2.5}	0.1%	2.6%	10.4%	16.8%	3.0%	11.0%
SO ₂	51.0%	51.0%	51.0%	51.0%	50.0%	90.0%

Sources: EPA DRIA, pages 7-40 to 7-46, Tables 7-15, 7-17, 7-19, 7-21, 7-24; ENVIRON, *Effects of Light-duty Vehicle Emissions Standards and Gasoline Sulfur Level on Ambient Fine Particulate Matter*, Final Report, prepared for the American Petroleum Institute, June 2013, page 18, Table 8.

API/AFPM wrongfully assert that the environmental benefits of the proposed Tier 3 standards for new vehicle emissions and gasoline sulfur will provide negligible environmental benefits in terms of the (a) incremental reductions in emissions and (b) incremental improvements in air quality.¹⁸ In making this claim, the API/AFPM cite two recent studies prepared for the API by ENVIRON International Corporation.¹⁹

However, the API/AFPM mischaracterize and misrepresent the findings by ENVIRON. First, ENVIRON evaluated extending California’s LEV III program to the rest-of-the-U.S. and

¹⁸ See API/AFPM Comments, page 22-26.

¹⁹ See ENVIRON, *Effects of Light-duty Vehicle Emissions Standards and Gasoline Sulfur Level on Ambient Ozone*, Final Report, prepared for the American Petroleum Institute, September 2012 (hereinafter “ENVIRON Ozone Study”). See also ENVIRON, *Effects of Light-duty Vehicle Emissions Standards and Gasoline Sulfur Level on Ambient Fine Particulate Matter*, Final Report, prepared for the American Petroleum Institute, June 2013 (hereinafter “ENVIRON Particulate Study”).

did not specifically evaluate the EPA's Proposed Tier 3 Rule.²⁰ While California's LEV III and EPA's Tier 3 standards are very similar, they are not identical so differences in the emission reduction results obtained by ENVIRON and the EPA could reflect differences in the standards.²¹ Further, ENVIRON properly labels the changes as being from Tier 2 to LEV III while the API/AFPM improperly labels this change as being from Tier 2 to Tier 3.²² Table 1 above compares the ENVIRON results for 2022 to those obtained by the EPA for 2022. The EPA's estimate of the percentage reductions in NOx emissions is somewhat higher in 2022, but the 2022 percentage reduction estimates of EPA and ENVIRON are quite similar for the other four emission measures.

Moreover, the ENVIRON study focused on emission reductions achieved by 2022, which is just five years after the implementation of the proposed Tier 3 rules in 2017. The ENVIRON analysis is flawed since the emissions benefits of the Tier 3 program would continue to increase as the vehicle fleet turns over. A premature truncated analysis as of 2022, such as the ENVIRON analysis, cannot capture the substantial benefits that will be observed thereafter. In addition, by 2022, the phase-in of Tier 3 and LEV III standards will not be completed. The ENVIRON study recognizes this failing and states "[t]he main limitation of this study is introduced by the lack of complete phase-in of the LEV III standard by 2022, the basis year for comparing emission standards. Some additional improvements in PM2.5 beyond 2022 are expected as the LEV III standard fully matures."²³ ENVIRON further notes that some of the particulate emission technology will not be phased in until model year 2028.²⁴

The API/AFPM discuss the ENVIRON estimates of the percentage reductions of emissions as of 2022 as if these were the ultimate effects of Tier 3.²⁵ Table 1 above clearly

²⁰ See ENVIRON Ozone Study, pages 1-2 and ENVIRON Particulate Study, page 1

²¹ The EPA notes that the LEV III and Tier 3 programs are closely coordinated "to create a vehicle emissions program that would allow automakers to sell the same vehicles in all 50 states". See EPA Proposed Tier 3 Rule, page 29820.

²² See ENVIRON Ozone Study, pages 16-17, Tables 7 and 8 and ENVIRON Particulate Study, pages 17-18, Tables 7-8. See API/AFPM Comments, pages 22-25.

²³ See ENVIRON Particulate Study, page 19.

²⁴ *Id.*

²⁵ See API/AFPM Comments, pages 22-26.

documents that there are substantial further reductions in emissions after 2022. Further, the API/AFPM contrast the percentage reductions in emissions from Tier 1 to Tier 2 after all the incremental benefits of Tier 2 are realized to the incremental benefits of Tier 3, obtained after 5 years (by 2022). However, as documented in Table 1 above, the majority of the percentage emissions reductions occur after 2022.

In terms of the effects of Tier 3 on ambient air quality, the EPA evaluated the effects of implementing Tier 3 on the amounts of ambient ozone, particulate matter (PM_{2.5}), nitrogen dioxide (NO₂), and air toxics (benzene; 1,3 butadiene; acrolein; ethanol; formaldehyde; and acetaldehyde).²⁶ These ambient air quality improvements are the consequence of the reductions of on-road emissions of these materials.²⁷ As was the case of the analysis of the reduction of emissions due to Tier 3, it is appropriate to consider the effects as of 2030 when 80% of the vehicle fleet will consist of Tier 3 vehicles. The API/AFPM again cites the ENVIRON analyses which report the effects on ambient ozone and particulate matter (PM_{2.5}) as of 2022 of implementing a nationwide LEV III program.²⁸ API/AFPM again mischaracterize the ENVIRON studies as analyses of Tier 3 instead of LEV III and improperly appear to represent the results as of 2022 as capturing the full effects of Tier 3 (LEV III).²⁹ Conversely, ENVIRON explicitly recognizes that the results as of 2022 cannot reflect the full effects of LEV III.³⁰

Finally, the API/AFPM suggests that since the Tier 3 incremental benefits are smaller than the incremental reductions achieved under Tier 2, Tier 3 might not be justified which is an incorrect and meaningless claim. Given that the sulfur content of gasoline was reduced from 300 ppm to 30 ppm by Tier 2 and from 30 ppm to 10 ppm by Tier 3, the absolute size of the

²⁶ See EPA Proposed Tier 3 Rule, Chapter III, pages 29846 to 29850; see also EPA DRIA, Chapter 7, pages 7-46 to 7-126 and Appendix 7.A, pages 7A-1 to 7A-14.

²⁷ In the API/AFPM Comments, pages 25-26, API/AFPM appear to assert that there is an inconsistency between the percentage reductions in benzene as reported in Table III-1 and Table III-12 of the EPA Proposed Tier 3 Rule, pages 29842 and 29849, respectively. There is no inconsistency because Table III-1 is reporting the percentage reduction in on-road emissions of benzene while Table III-12 is reporting the reduction in the ambient benzene concentration.

²⁸ See ENVIRON Ozone Study, pages 17-20 and ENVIRON Particulate Study, pages 18-35 (pages of study improperly numbered).

²⁹ API/AFPM Comments, pages 23-25.

³⁰ See ENVIRON Ozone Study, page 18 and ENVIRON Particulate Study, page 19.

reductions in emissions due to Tier 2 will be larger than those due to Tier 3. However, this does not imply that Tier 3 is not cost effective. To survive a cost-benefit test, there is no reason why Tier 3 must deliver the same benefits as Tier 2; rather, Tier 3 need only deliver incremental benefits in excess of incremental costs. EPA's analysis shows that the proposed benefits of Tier 3 by 2030 would exceed the proposed costs by between \$4 and \$20 billion.³¹ I will address the bases for EPA estimated costs and benefits below.

B. EPA's Estimate of the Health Benefits of Tier 3

As the EPA demonstrates, the reductions in the ambient concentrations of ozone, particulate matter (PM_{2.5}), air toxics has substantial public health benefits.³² The EPA notes that these pollutants are linked to "respiratory and/or cardiovascular problems and other adverse health impacts leading to increased medication use, hospital admissions, emergency department visits, and premature mortality."³³ Specifically, the EPA estimates that, by 2030, the improvement in air quality due to Tier 3 would annually prevent between 670 and 1,700 particulate matter-related premature deaths, between 160 and 710 ozone-related premature deaths, 81,000 work days lost, and approximately 1.4 million minor restricted activity days.³⁴ The EPA estimates that annual monetized value of the health benefits by 2030, in 2010 dollars, would be between \$7.4 billion and \$23 billion.³⁵

The American Lung Association estimates that Tier 3, by 2030, would annually prevent 2,520 premature deaths, reduce asthma attacks by 15,000, reduce respiratory hospital admissions by 650, and eliminate more than 3.3 million days missed at work or school.³⁶ The American Lung Association estimates that the annual monetized value of these health benefits in 2030 will

³¹ EPA Proposed Tier 3 Rule, page 29827, Table I-7.

³² See EPA Proposed Tier 3 Rule, pages 29826 to 29840 and 29979 to 29986.

³³ See EPA Proposed Tier 3 Rule, pages 29826 to 29828. See also American Lung Association, *A Penny for Prevention: The Case for Cleaner Gasoline and Vehicle Standards*, April 2013, pages 3-4 and 15-19 (hereinafter "American Lung Association Study").

³⁴ See EPA Proposed Tier 3 Rule, pages 29827 and 29979 to 29986.

³⁵ See EPA Proposed Tier 3 Rule, page 28927, Table I-7 and pages 29979 to 29986.

³⁶ See American Lung Association Study, page 4.

be between \$8.5 billion and \$22 billion.³⁷ The American Lung Association and the EPA, despite differences in the details of their estimates, have a very similar range of estimates for the total monetized annual value by 2030 of these health benefits.

API/AFPM assert that the EPA estimates of the health benefits are implausible due to highly conservative, unrealistic assumptions.³⁸ Given that the American Lung Association analysis produced similar benefits, presumably, the API/AFPM would make similar negative assertions regarding the American Lung Association Study. The API/AFPM, not surprisingly, advocate a much lower annual monetary health benefit as of 2030 of \$0.8 to \$2.3 billion which they obtain by excluding a large percentage of the potentially affected population.³⁹ The API/AFPM monetary health benefit estimate falls short of the EPA's estimated cost of the Tier 3 Rule of \$3.4 billion. However, given the similarity of the EPA and American Lung Association monetary health benefit estimates, the EPA's estimates have much greater credibility.

C. EPA's Estimate of the Refining Industry's Compliance Costs

The EPA discusses its analysis of the refining industry's compliance costs at length in the EPA DRIA (Chapter 5, pages 5-1 to 5-89) and in the EPA Proposed Tier 3 Rule (pages 29919 to 29935 and pages 29972 to 29979). The EPA estimated the refining industry's compliance costs using a linear programming cost model which was applied on a refinery-by-refinery basis.⁴⁰ In total, 111 individual refineries were modeled.⁴¹ The EPA's refinery-by-refinery modeling indicates that "29 refiners would not need to make any capital changes, 66 would need to revamp their existing FCC posttreaters, and 16 would need to add grassroots posttreaters."⁴²

³⁷ *Id.*

³⁸ See API/AFPM Comments, pages 37-43.

³⁹ See API/AFPM Comments, pages 37-39.

⁴⁰ See EPA Proposed Tier 3 Rule, pages 29972 and EPA DRIA, Chapter 4, pages 4-1 to 4-37; and Chapter 5, pages 5-1 to 5-3.

⁴¹ See EPA Proposed Tier 3 Rule, pages 29975, Table VII-7. See also EPA DRIA, pages 5-66 to 5-68, Table 5-40.

⁴² See EPA Proposed Tier 3 Rule, page 29921.

The EPA sought and obtained multiple estimates of the capital costs associated with revamping posttreaters and with new grassroots posttreaters.⁴³ The EPA developed investment costs for producing gasoline containing 10 ppm sulfur and for gasoline containing 5 ppm sulfur. For revamping a posttreater, the volume weighted average investment cost to produce 10 ppm sulfur content gasoline is \$265 per barrel/day (inside battery limit estimate or “ISBL”) and to produce 5 ppm sulfur is \$444 per barrel/day (ISBL).⁴⁴ For a new grassroots posttreater, the volume weighted average investment cost to produce either 5 or 10 ppm sulfur⁴⁵ content gasoline is \$1,500 per barrel/day (ISBL).⁴⁶ The EPA also estimates the additional costs necessary for the posttreater to operate (the outside battery limits or “OSBL”) for the grassroots posttreater which are \$375 per barrel/day (OSBL). Therefore, the total investment associated with a grassroots posttreater are \$1,875 per barrel/day (ISBL & OSBL).

The EPA’s \$1,875 per barrel/day (ISBL & OSBL) estimate is similar to the \$1,830 per barrel/day (ISBL & OSBL) developed by MathPro.⁴⁷ In an earlier study, I confirmed that the MathPro estimate was reasonable.⁴⁸ The EPA identified four other estimates ranging from \$1,118 to \$1,833/day per barrel (ISBL & OSBL).⁴⁹ The EPA grassroots posttreater investment costs are clearly within a reasonable range.

In their comments,⁵⁰ API/AFPM claim that the EPA estimate of the investment cost for a grassroots posttreater (\$1,875 per barrel/day ISBL & OSBL)⁵¹ is too low and that the estimate

⁴³ See EPA DRIA, Chapter 5, pages 5-32 to 5-40.

⁴⁴ See EPA DRIA, Chapter 5, pages 5-34 to 5-36.

⁴⁵ See the ISBL involves the investment costs for the posttreater. There are other investments that are apt to be necessary for the posttreater to operate which are referred to as outside the battery limits (“OSBL”) investment costs.

⁴⁶ See EPA DRIA, Chapter 5, pages 5-36 to 5-38.

⁴⁷ See MathPro, Inc., *Refining Economics of a Natural Low Sulfur, Low RVP Gasoline Standard*, Prepared for the International Council for Clean Transportation, October 15, 2011 (hereinafter “MathPro Study”), page 13.

⁴⁸ See ECTA Study, page 11.

⁴⁹ See EPA DRIA, Chapter 5, pages 5-53EPA DRIA, Chapter 5, page 5-51 to 5-59. The EPA also reports two high estimates: (1) Baker & O’Brien Study prepared for API (\$6,540 per barrel/day); and (2) Jacobs (\$3,538 per barrel/day).

⁵⁰ See API/AFPM Comments, pages 27-32.

⁵¹ See EPA DRIA, Chapter 5, page 5-59, Table 5-35.

presented in studies prepared by Baker & O'Brien for the API⁵² (\$6,540 per barrel/day)⁵³ is appropriate. The Baker & O'Brien investment cost estimate is very high and inconsistent with all the other estimates identified by the EPA.⁵⁴

In assessing the cost to the refining industry of meeting the Tier 3 gasoline sulfur standard, the EPA incorporated an averaging, banking, and trading ("ABT") program which has the effect of encouraging refineries who can effectively produce very low sulfur gasoline (e.g., cost-effectively produce gasoline with 5 ppm of sulfur) to offset higher gasoline sulfur levels in gasoline produced by less efficient refineries. The ABT program has the effect of reducing the marginal cost of producing 10 ppm sulfur content of gasoline to the average cost.

As noted by the EPA, the Baker & O'Brien Study performed for the API does not incorporate an ABT program.⁵⁵ As the EPA explains, refineries with pre- and posttreaters are able to achieve further sulfur reductions below 10 ppm at a relatively low incremental cost and sell credits to refineries who would otherwise be faced with relatively high grassroots FCC posttreater investments.⁵⁶ Averaging and trading reduces EPA's estimated compliance costs from 0.97 to 0.79 cents per gallon—a reduction of nearly 19 percent;⁵⁷ with nationwide averaging and trading, 25 "high-cost" refineries out of the 111 refineries would prefer to consume credits rather than upgrade their facilities.⁵⁸ Baker & O'Brien's counterfactual assumption that these high-cost refineries would reduce the sulfur content of the gasoline they produce to 10 ppm inflates Baker & O'Brien's compliance-cost estimates. This deficiency in the Baker & O'Brien analysis, combined with Baker & O'Brien's too high investment costs, leads to a substantial overstatement of average and marginal refinery costs by Baker & O'Brien.

⁵² Baker & O'Brien prepared two studies for the API: (1) Baker & O'Brien, *Potential Supply and Cost Impacts of Lower Sulfur, Lower RVP Gasoline*, Prepared for the American Petroleum Institute, July 2011 (hereinafter "Baker & O'Brien 2011 Study"); and (2) Baker & O'Brien *Addendum to Potential Supply and Cost Impacts of Lower Sulfur, Lower RVP Gasoline*, Prepared for the American Petroleum Institute, March 2012, (hereinafter "Baker O'Brien 2012 Study").

⁵³ See, EPA DRIA, Chapter 5, page 5-59, Table 5-35.

⁵⁴ See EPA DRIA, Chapter 5, pages 5-51 to 5-59.

⁵⁵ See EPA DRIA, Chapter 5, pages 5-53.

⁵⁶ See EPA Proposed Tier 3 Rule, pages 29972 to 29973.

⁵⁷ *Id.*, page 20075. Table VII-7.

⁵⁸ *Id.*

Baker & O'Brien also assumes, without support, that the refinery with the highest cost of compliance will set the price of gasoline. If this were true, then the profit to the refinery industry, defined as the difference between marginal cost (roughly six to nine cents per gallon⁵⁹) and average cost (roughly two cents per gal⁶⁰), would be four to seven cents per gallon, at which point the refiners should endorse Tier 3. Given the refiners' opposition, it seems that Baker & O'Brien's logic must be faulty. In reality, the marginal supplier of gasoline—and thus the firm whose costs dictate prices—may not be the refinery with the highest cost of compliance. Further, the EPA's ABT program would reduce the marginal cost of compliance.

As discussed above, Baker & O'Brien's estimated capital cost for a grassroots FCC posttreater is not reasonable for the Tier 3 investments. Baker & O'Brien state that their estimates were based on actual installation for the Tier 2 program, and, as EPA explains, a grassroots FCC posttreater installed for Tier 2 would remove ten times more sulfur than one installed for Tier 3, and thus would have higher capital costs.⁶¹ Correcting this one defect brings Baker & O'Brien's average compliance-cost estimate into closer alignment with EPA's estimate.

Baker & O'Brien, on behalf of the API, have a history of overstating the cost to refiners of sulfur reduction programs. For example, Baker & O'Brien argued that the EPA's on-road ultra-low-sulfur-diesel (ULSD) regulations would cause refinery closures, reduce the supply of diesel fuel, and make the United States a net importer of diesel fuel.⁶² The opposite has occurred. During the 2010 to 2013 period, U.S. refiners' production of low-sulfur distillate exceeded U.S. consumption, and U.S. net exports of low sulfur distillate were positive.⁶³

⁵⁹ *Id.*, page 29977 to 29978.

⁶⁰ *Id.*

⁶¹ *Id.*

⁶² Baker & O'Brien, *An Assessment of the Impact of Non-Road Diesel Fuel Sulfur Regulation on Distillate Fuel Production and Availability in the U.S.*, Prepared for the American Petroleum Institute, July 2003.

⁶³ U.S. Department of Energy, Energy Information Administration, U.S. Supply and Disposition (http://www.eia.gov/dnav/pet/pet_sum_snd_d_nus_mbbldpd_a_cur-1.htm).

In addition, API/AFPM assert that EPA has underestimated the cost of replacing the gasoline octane lost due to desulfurization.⁶⁴ API/AFM's attempt to document EPA's alleged underestimate of octane costs consists of a fatally flawed approach to estimating the cost of octane. API/AFPM improperly assume that the difference in the prices of Premium and Regular gasoline is solely due to the difference in their cost of octane content.⁶⁵ Then, API/AFPM infer that since the price difference between the gasoline grades has risen that the cost of octane has increased. There is no a-priori reason to assume that the difference between the prices of Premium and Regular gasoline reflects solely the difference in their costs of octane. Moreover, API provides no information to support its faulty assumption that the price difference in the gasoline grades reflects just the cost of octane. In fact, the relative price differences between Premium and Regular gasoline vary substantially over time and change with the relative supply and demand conditions of the gasoline grades themselves and are not reflective of solely the difference in octane costs.

D. EPA's Assessment that the Tier 3 Sulfur Standard Can Be Implemented in 3 Years

The EPA has performed a thorough assessment of the time necessary for refiners to make the investments necessary to comply with the Tier 3 requirement that the sulfur content of gasoline be reduced from 30 ppm to 10 ppm. First, refiners were able to make the investments necessary to reduce the sulfur content of gasoline from 300 ppm to 30 ppm under Tier 2 in four years.⁶⁶ The sulfur reduction investments made by refiners under Tier 2 were \$6.1 billion while EPA estimates that the refiners' total sulfur reduction investments under Tier 3 will be \$2.1 billion.⁶⁷ The simple fact that refiners' investments under Tier 3 will be about one-third of those under Tier 2 suggests that the Tier 3 investments could be completed more quickly. However, the EPA performed a thorough evaluation of the time and personnel required to revamp the 66 existing FCC posttreaters and to add 16 grassroots posttreaters. On the basis of this analysis, the

⁶⁴ API Comments, page 29-30.

⁶⁵ API Comments, page 30.

⁶⁶ EPA Proposed Tier 3 Rule, page 29925.

⁶⁷ *Id.*

EPA concluded that 66 revamp projects could be completed in 2 years and the 16 grassroots projects could be completed in 3 years.⁶⁸

API/AFPM assert, with no supporting analysis, that the refiners will require 5 years to comply with the Tier 3 sulfur reduction requirements.⁶⁹ Given that the Tier 3 requires only about one-third of the investment by refiners as was required under Tier 2, asking for more than the four years that the refiners used to implement the Tier 2 investments seems inappropriate. Further, the refiners gained experience with making these sorts of investments under Tier 2 which should facilitate making the Tier 3 investments. API/AFPM have not addressed the detailed analyses that the EPA performed in developing its three-year implementation plan. There appears to be no basis for allowing more than three years for the refineries to comply with the Tier 3 requirement that the sulfur content of gasoline be reduced to 10 ppm.

⁶⁸ See EPA Proposed Tier 3 Rule, pages 29923 to 29927 and EPA DRIA, Chapter 4, pages 4-27 to 4-34.

⁶⁹ API/AFPM Comments, pages 44-48.

Appendix A

NOTICE

This paper reflects the views and opinions of the author (“Author”) and does not reflect the views and opinions of Navigant Economics (“Navigant”) or any of its other independent experts, professionals or affiliated entities. This paper was prepared for the Emissions Control Technology Association (“ECTA”) for the purposes set forth in the paper and may not be used for any other purpose. The conclusions are the results of the exercise of the Authors’ reasonable professional judgment, based in part upon publicly available materials, and these materials have not been independently verified for accuracy or validity. This paper does not constitute legal advice. The Author and Navigant make no representations or warranties, expressed or implied, and are not responsible for the reader’s use of, or reliance upon, the paper, nor any decisions made based on the paper.

Navigant’s conclusions are the results of the exercise of Navigant’s reasonable professional judgment, based in part upon materials provided by ECTA and others. Navigant makes no express or implied warranty, guaranty, or representation concerning the information contained in this publication, its merchantability, or its fitness for a particular purpose of function.

Note: Editing of this report was closed on February 18, 2014.