Will the Refining Industry Survive the Clean Air Act?(or, Will the Next Straw Break the Camel's Back?)

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ABSTRACT

Whether the refining industry will survive the Clean Air Act ("CAA") is currently important relative to the overall economic future of the United States ("U.S."). The answer requires a discussion of on-going, contemporaneous CAA requirements, which are applicable to petroleum refineries. These are primarily control requirements for criteria pollutants. However, recent developments regarding the control of greenhouse gas ("GHG") emissions under the CAA are now a major factor.

The first part of this paper discusses the refining industry's current problems with the EPA's regulation of that industry. These problems relate both to the EPA's recent control actions for both criteria pollutants and for GHGs. The latter part of the paper compares the estimated CAA cost to total U.S. refinery sales. The estimated CAA cost is just over one percent of sales.[2] From this and other factors, the conclusion is that the refining industry will survive the CAA. However, it is likely refined U.S. gasoline demand will gradually shrink over the next century. Therefore, it will make it harder for the industry to weather the CAA. Between now and 2035, the Gulf Coast will begin to supply most of East Coast's U.S. demand.[3]

INTRODUCTION

This paper estimates the cost impact of each CAA statute and EPA regulation that are potentially applicable to the petroleum refining industry. This cost is then annualized and summed. The total annualized cost is compared to refining industry sales for a recent year. The estimated CAA cost is just over one percent of sales. There is other relevant literature on CAA costs and there is other relevant literature on refining industry cost related to specific regulations. No literature could be found, however, that related total CAA costs to the refining industry. There are two basic types of environmental requirements for the petroleum refining industry. First, there are requirements mandating specific product qualities for the purpose of reducing the environmental impacts associated with the downstream use of the product. Second, there are requirements directed at reducing the environmental impacts of the refineries themselves.[4]

The writer cites cost estimates that were developed by EPA during the regulation development phase of each regulation. If an EPA source is not available, available non-EPA sources are cited. The primary purpose of this section is to develop overall current costs numbers for refiners to comply with the CAA. These numbers are summed and the totals represent the

annualized cost of the refining industry's CAA compliance expenditures. Finally, the paper compares those costs to net U.S. refining income. The writer assumes that any currently proposed regulations will eventually be adopted. Therefore, any regulations, which have reached the proposal stage, are included in the cost estimates. No GHG cap and trade type statutes have been included in the cost estimates.

SECTION 1. OVERVIEW

Clean Air Act Major Issues From the Perspective of the Petroleum Refinery Industry

The petroleum refining industry's principal concerns are centered on the following issues: EPA GHG regulation through the CAA, the Ozone National Ambient Air Quality Standards ("NAAQS"), and 15 Percent Ethanol ("E15") and the Renewable Fuels Standard ("RFS").[5]

EPA GHG Regulation through the CAA

In early 2010, EPA issued GHG standards for automobiles. EPA followed this action by ruling that the automobile GHG standards trigger CAA regulation of all new major stationary sources or major modifications to existing stationary sources that produce GHG emissions. The impact of this action is to require Prevention of Significant Deterioration ("PSD") permits for such sources. EPA has promulgated the "Tailoring Rule" so that PSD permits would only apply to modified sources with the potential to emit ("PTE") 75,000 tons per year ("tpy") or to new sources with the PTE of 100,000 tpy of GHGs. For criteria pollutants, the limit is 250 tpy or 100 tpy depending upon whether the source is within one of the 28 listed "PSD" source categories in the CAA.[6] Industry contends that the Tailoring Rule is illegal under the CAA.

On December 16, 2010, EPA entered into a court settlement with environmental activist groups and several states that will require EPA to propose regulating GHGs under New Source Performance Standards ("NSPS").[7] NSPS requires emissions performance standards for new or "modified" existing refineries; a GHG NSPS requires any regulated facility to install Best Demonstrated Technology ("BDT"). EPA is required to consider cost when developing an NSPS and BDT. However, the refining industry frequently has significant disagreements with EPA over the Agency's interpretation of what is cost-effective. Industry is concerned that a GHG NSPS may create just as much uncertainty as BACT, threatening jobs and investment.[8] Under section 111(d) of the CAA[9], subject to certain exceptions, the EPA has authority to regulate existing sources of listed source categories.[10] Rather than authorizing the EPA to directly set national standards, this provision authorizes the EPA to issue "emission guidelines" that states must meet when they regulate emissions of existing sources in a source category.[11] In late November 2011, EPA announced that it has indefinitely deferred the release of proposed GHG emission standards for new and existing petroleum refineries. Although EPA did not specify a new deadline for issuing the standards, it is expected that these standards will not be issued until after EPA completes proposed GHG performance standards for the power sector, which have also been deferred indefinitely.[12]

Ozone NAAQS

The NAAQS primarily deals with the ozone by controlling emissions of VOCs and NO_x, which are ozone precursors. In 2008, EPA finalized a new NAAQS ozone standard of 0.075 ppm in 2008. EPA is revisiting this recently enacted standard, and is proposing a 0.060 to 0.070 ppm ozone NAAQS requirement.[13] EPA estimates the costs to be between $19-$90 billion annually.[14,15]

E15 and the Renewable Fuels Standard (RFS)

Ethanol is an economic factor for the refining industry largely because every gallon of ethanol sold in the U.S. replaces a gallon of gasoline. In November 2010, the EPA approved a conditional, partial waiver that allows gasoline containing 15 percent ethanol ("E15") to be sold for use in vehicles that are model year ("MY") 2007 and later. The refining industry's concerns are first, that EPA does not have the legal authority to grant a partial waiver under Section 211(f)(4) of the CAA. Section 211(f)(4) states that EPA has to determine that any fuel or fuel additive "will not cause or contribute to a failure of *any* emission control device or system."[16] E15 would likely be marketed under the same regime as regular gasoline, which will likely lead to consumer misfueling. Industry contends that "several studies show gasoline blends containing more than 10 percent ethanol ("E10") could lead to engine damage in older vehicles and non-road engines…."[17]

There is also a CAA "One Pound Waiver" problem with E15. The CAA allows the E10 vapor pressure to increase to 8.8 psi in ozone NAAs (one pound above the "normal" limit). This waiver is not available to E15. This limitation would preclude E15 use in NAAs in summer months, because the lower 7.8 psi standard would be exceeded on hot days.[18]

Refinery Closures Since 2010

Industry experts believe that reductions of one million to two million barrels a day are needed to achieve long-term profitability.[19] This business reality seems to have been reflected in recent refinery closures. Sunoco permanently closed its Eagle Point (NJ) refinery 145,000 barrel per day ("BBL/D") in early 2010. In 2010, Western Refining shutdown a 16,800 BBL/D refinery in New Mexico and a 70,000 BBL/D Yorktown (VA) refinery.[20] The following recent closures announced in 2011 and early 2012 are:

ConocoPhillips – Trainer, PA – 185,000 BBL/D – Idled September 2011;
Sunoco – Marcus Hook, PA – 178,000 BBL/D – Idled January 2012;
Sunoco – Philadelphia, PA – 335,000 BBL/D – To be sold or idled by July 2012; and
Hovensa/Hess – U.S. Virgin Islands – 350,000 BBL/D (was 500,000 BBL/D) – Converted to fuel terminal in February 2012.

The total capacity closed since 2010 is around 1,280,000 BBL/D, most of which is located on the U.S. East Coast. The EIA predicts that the Gulf Coast will likely be a significant supplier because its refinery capacity is both more sophisticated and is increasing. In addition, U. S. gasoline consumption has decreased from about 141 billion gallons in 2007 to about 136 billion gallons in 2011. According to the EIA, U.S. total refining capacity will drop from about 18 million BBL/D in 2012 to about 16 million BBL/D in 2035.[21,22]

CAA Costs

Section 2 presents a protocol for estimating the present annualized cost of the refining industry's CAA compliance expenditures. These are based on the product of the total cost of compliance with the regulation and the estimated contribution of petroleum refining industry to that cost. For example, the EPA estimated the annualized cost of compliance for all asphalt manufacturers for the NSPS for Asphalt Processing and Asphalt Roofing Manufacture to be $1.73 million.[23] Since refinery emissions in general equal about 10% of total point source emissions nationwide, the writer used a refining cost conversion factor of 0.1 for this category to arrive at the costs for refiners to comply with this NSPS. This results in a refiners annualized cost to comply with the Asphalt NSPS of $173,000. Each cost item was then summed to arrive at a refining industry total annualized cost to comply with the CAA. This total CAA compliance cost was compared as a percentage of the total sales revenue of the industry. The resultant estimated CAA compliance cost was just over one percent of total U.S. refinery sales.[24]

SECTION 2. CAA CRITERIA POLLUTANT (NON-GHG) CURRENT COST IMPACTS

Introduction

This section describes criteria pollutant current cost impacts under the CAA. GHG emissions are discussed in the next section. This section includes EPA cost estimates developed during the regulation development phase of each regulation. If an EPA source is not available, available non-EPA sources are cited. The primary purpose of this section is to develop numbers for the overall current costs for refiners to comply with the CAA. These numbers are summed in Table 4, which totals the present annualized cost of the refining industry's CAA compliance expenditures. These are based on the product of the total cost of compliance with the regulation and the estimated contribution of petroleum refining industry to that cost.

Overview: National Ambient Air Quality Standards and State Implementation Plans ("SIPs")

In summary, EPA has implemented new lower short term standards for $PM_{2.5}$, SO_2 and NO_x and a more stringent 8 hour ozone standard (75 ppb). EPA is proposing to further reduce the ozone standard to the 60 to 70 ppb range.[25] Each lowered standard will have a cost impact on the public and to regulated industry. These costs impacts are summarized in the following sections.[26]

Nonattainment Controls

Many of the referenced NAA control costs are based on the Pechan report, which is cited at various locations in this paper. In other cases, EPA methods are referenced in the cost estimates, instead of Pechan's estimates. However, EPA typically uses very similar cost accounting methods to those used by Pechan, especially with respect to the cost annualization methods. The

EPA cost numbers are derived from the Regulatory Impact Analyses, Background Information Documents, and *Federal Register* notices for the proposed or promulgated rules.[27] Section 812 of the 1990 Clean Air Act Amendments ("CAAA") required the EPA to perform comprehensive analyses of the total costs and total benefits of the CAA and CAAA. A retrospective analysis was the first analysis conducted. This study addressed the original CAA and covered the period from 1970 to 1990. The retrospective analysis was completed in 1997. A prospective cost-benefit analysis, also required by CAAA, was completed in 1999. The prospective analyses address the incremental costs and benefits of the CAAA over the period from1990 to 2010.[28]

Controls for Ozone Nonattainment Areas

Point source control measures for VOC include Title I Reasonably Available Control Technology ("RACT") and control technique guideline ("CTG") requirements. Point source Title I RACT and CTG controls are applied in areas depending on ozone nonattainment classification. These controls are required in moderate, serious, severe, and extreme ozone NAAs, and throughout the Northeast Ozone Transport Region ("OTR").[29] For non-Electric Generating Units ("non-EGUs"), the NO_x SIP Call affects emissions from industrial, commercial and institutional boilers, gas turbines, cement kilns, and reciprocating internal combustion engines. Affected states have discretion about how to implement regulations to achieve the required emission reductions, so there are state-by-state differences in how each source category is regulated.[30] In section 183 of the CAAA, EPA was required to issue control techniques guidelines ("CTGs") for 11 categories of stationary sources of VOC emissions for which such guidelines had not been issued previously. CTGs are not federal regulations. States have flexibility to implement regulations that follow the CTGs exactly, or they may choose to adapt the CTGs using their own methodology. CTGs are typically adopted in states with 1-hour ozone moderate or worse non-attainment areas. [31]

Direct Refinery Cost Estimates for 1-Hour Ozone SIP Measures-VOC and NO_x

The following RACT categories are directly applicable to petroleum refineries for the years 2000 to 2020.

Table 1. RACT Categories Directly Applicable to Petroleum Refineries

Category	**Cost (Million $ per Year)**
Gasoline Bulk Terminals	2.7
OTC Solvent Cleaning Rule	117.8 x 0.1*= 11.8
Service Stations – Stage I-Truck Unloading	40.1
Treatment, Storage and Disposal Facilities	143.9 x 0.1*= 14.4
Marine Vessel Loading: Petroleum Liquids	66.7
Total	135.7

*** 0.1 factor based on Costs Estimate Factors derived for Table 5 (Appendix)**

The Estimated Annualized Cost for years 2010 through 2020 to the Petroleum Refining industry is therefore $135.7 million. [32]

A feature of the Houston-Galveston-Brazoria area 1-hour ozone SIP is the initiation of control programs to reduce highly reactive VOC ("HRVOC") emissions at petroleum refineries and chemical plants in the nonattainment area. This cost analysis estimates the costs of applying controls to three HRVOC source types: flares, fugitive VOC emissions, and cooling towers.[33] The total annualized cost for years 2010 through 2020 of these HRVOC emission reduction measures is $146 million.[34] EPA Toxic Release Inventory ("TRI") emission data was gathered from the EPA TRI website.[35] For the Houston area (Harris, Brazoria, and Galveston counties), the TRI air emissions were 6810 tpy for chemical and plastics plants and 2032 tpy for refineries. The fraction of the total applicable to refineries (2032/8842) is 23%. The product of 23% and $146 million yields an estimated cost applicable to refineries, which is $33.6 million.[36]

General Ozone Control Costs

In addition, the NAA SIP-based cost for non-EGU point sources for the former 1-hour ozone NAAQS is $317 million for all non-EGU industry.[37] The estimated NAAQS 8-hour ozone control cost (years 2010 through 2020) to all non-EGU industry is $735 million.[38] The VOC and NO_x emission reductions for some 8-hour ozone NAAQS NAAs in the local control measures are not sufficient to bring them into attainment with the 8-hour standard, based on the emission reduction targets. Identifiable control measures are projected to be insufficient to achieve the VOC emission reductions necessary for attainment in five areas: Chicago, the Central San Joaquin Valley, Houston-Galveston, New York, and Philadelphia. The estimated ozone control cost beyond "identifiable control measures" for all sources is $7.58 billion.[39]

The EPA has suggested it would impose a lower 0.060 or 0.070 ppm ozone NAAQS requirement.[40] EPA's numbers indicate the cost of the revised ozone NAAQS standard will range between $19 billion and $90 billion annually.[41,42] Taking the mean value, the estimated control cost for the lower standard for all sources is $55 billion.[43]

Controls for Particulate Matter (both $PM_{2.5}$ and PM_{10}) Nonattainment Areas

EPA set a new $PM_{2.5}$ NAAQS in 1997 and designated NAAs in December, 2004. In 2006, EPA issued new fine particulate standards, strengthening the 24-hour standard and retaining the current annual standard.[44] On April 27, 2007, EPA issued final requirements that state and local governments have to meet as they implement the NAAQS for $PM_{2.5}$. The implementation rule stated that NAASIPs should include Reasonably Available Control Measures ("RACM") and RACT as well as show Reasonable Further Progress ("RFP"). There are 39 $PM_{2.5}$ NAAs. The proposed rule requires states to meet the $PM_{2.5}$ standard by 2010. States may propose an attainment date extension for up to five years. Those areas for which EPA approves an extension must achieve attainment by no later than 2015.[45] EPA's implementation of the $PM_{2.5}$ NAAQS presents options that EPA might select for identifying which $PM_{2.5}$ precursors an area might use to control, proposed options for $PM_{2.5}$ classification, as well as options for RACT, RACM, and

RFP.[46] The annualized NAAQS $PM_{2.5}$ control cost to all non-EGU industry for the years 2010 to 2020 is $376 million.[47]

The estimates of costs incurred to meet the PM_{10} ambient air standards were developed by reviewing PM_{10} SIPs and control cost estimates for four serious PM_{10} NAAs in California, Nevada, and Arizona. The estimated compliance cost for these four PM_{10} areas was between $24 million and $29 million, resulting mostly from controlling dust emissions from paved roads, unpaved roads and construction activities. To estimate the compliance costs for the remaining serious and moderate PM_{10} NAAs, the costs were extrapolated to the other areas. The estimated NAAQS PM_{10} control cost to all non-EGU industry is $130 million.[48]

Controls for SO_2 and Lead Nonattainment Areas

The two SO_2 standards are described in the CAA section. Areas exceeding the SO_2 standards have to implement either RACM or Best Available Control Measures ("BACM") on point sources. Additional costs would occur when proposed new sources are "modeled" for compliance with SO_2 limits. If the modeled sources do not meet the limits, they must install controls so that the modeling indicates limits are met. Cost estimates found for the new SO_2 limits are $2.96 billion (total) or $296 million per year through 2020.[49,50,51]

Controls for NO_2 Nonattainment Areas

Like the SO_2 standard, areas exceeding the NO_2 standard have to implement either RACM or BACM on point sources. Additional costs would occur when proposed new sources are "modeled" for compliance with NO_2 limits. If the modeled sources do not meet the limits, they must install controls so that the modeling indicates the limits are met. Cost estimates found for the new NO_2 limits are $137 million (total) or $13.7 million per year through 2020.[52,53,54]

Emission Standards for Mobile Sources

Oxygenated Fuels Program

This program began in 1992. However, because of the "anti-backsliding" provisions of the CAAA, this program must be maintained even though most, if not all, areas are in attainment for CO.[55] The estimated oxygenated fuel costs are based on an incremental cost of 3.4 cents per gallon, which was converted to a cost per mile. Oxygenated fuel costs are applied in all CO NAAs during the winter months. The estimated annualized U.S. total cost is $141 million.[56]

Highway Diesel Fuel Program

Section 217 of the CAAA required that on or after October 1, 1993, motor vehicle diesel fuel would be limited to a sulfur concentration of 0.05 percent by weight.[57] The additional cost of low-sulfur diesel fuel meeting these restrictions relative to conventional diesel fuel is estimated to be 2.0 cents per gallon. The estimated annualized U.S. total cost is $1.26 billion.[58]

The 2007 Heavy-Duty Highway Rule limited the sulfur content of highway diesel fuel sold beginning in 2006 to 15 ppm.[59] The total cost of the low sulfur diesel is the sum of refinery desulfurization costs, plus a lubricity additive, and increases in distribution costs. EPA estimates the total cost of diesel fuel meeting the 15 ppm cap to be 4.5 cents per gallon during the initial years of the program. This cost increases to 5 cents per gallon after 2010. The estimated annualized U.S. total cost is $1.3 billion.[60]

California's vehicular diesel fuel regulation established a 500 ppm sulfur limit in 1993 and required a reduction of the aromatic content of the fuel from 30 to 10 percent. The sulfur limit was reduced to 15 ppm in 2004.[61] The estimated annualized U.S. total cost is $130 million. This cost is in addition to the EPA costs listed above because the California regulation was phased in six months earlier than the federal program, contains a lower aromatics content limit, and contains more stringent testing requirements.[62]

Reformulated Fuels Program

Federal RFG: Phase I and II. The CAAA required nine cities with the worst smog pollution, that is, classified as severe or extreme ozone NAAs, to use RFG. Moderate and marginal NAAs could opt-in to the RFG program. Phase I of the RFG program began in 1995 and Phase II began in 2000. EPA issued the final rule for Phase II on February 16, 1994.[63] The estimated annualized U.S. total cost is $1.441 billion.[64]

Gasoline Fuel Sulfur Limits: Tier II. The Tier II gasoline sulfur control program requires most refiners and importers to achieve a corporate average gasoline sulfur standard of 120 ppm and a cap of 300 ppm by 2004. In 2006, the cap drops to 80 ppm and the average drops to 30 ppm sulfur.[65] The estimated annualized U.S. total cost is $1.9 billion.[66]

California Phase I, II and III RFG. The California Phase I and Phase II specifications mandate limits on RVP, use of deposit control additives, and eliminate the use of leaded gasoline. California Phase III eliminated the methyl tert-butyl ether oxygenate. Each rule results in higher per-gallon costs of fuels to consumers.[67] California RFG costs refineries an added 5.5 to 16.6 cents per gallon to produce a 2.3 cent per gallon fuel economy penalty, which is also applied to estimate Phase II California RFG costs. The estimated annualized U.S. total cost is $2.251 billion.[68]

Reid Vapor Pressure Regulations of 1989 and 1992: Phase II RVP Limits

In 1989, EPA restricted the RVP of gasoline during the ozone season. This was done in two phases: Phase I started in 1989 and Phase II started in 1992. The Phase II program establishes limits for fuel RVP in all areas of the U.S.[69] The estimated annualized U.S. total cost is $650 million.[70]

Nonroad Diesel Sulfur - Phase I and II

EPA's Clean Air Nonroad Diesel Rule includes a two-step fuel sulfur control program consisting of a sulfur cap of 500 parts per million (ppm) began in 2007 to be followed by a nonroad sulfur

cap of 15 ppm beginning in 2010 and a locomotive and marine sulfur cap of 15 ppm beginning in 2012. In addition to fuel desulfurization costs, the EPA estimates other operating costs, catalyzed diesel particulate filter and closed crankcase ventilation maintenance costs, as well as savings due to decreased intervals for oil change maintenance associated with the final rule.[71] The estimated annualized U.S. total cost is $600 million.[72]

E15 and the RFS

In 2010, the EPA proposed regulations to lessen misfueling of vehicles and engines with gasoline containing up to 15 percent by volume ethanol ("E15"). These regulations were proposed in conjunction with action by EPA granting a partial waiver for ethanol blends up to E15 under Section 211(f)(4) of the CAAA.[73] The partial waiver allows the use of of E15 in 2007 MY and newer light-duty motor vehicles.[74] The estimated annualized U.S. total cost is four million.[75]

Regional Haze Rule (Clean Air Visibility Rule)

The EPA rule aimed at addressing regional haze is commonly known as the Best Available Retrofit Technology rule ("BART"), also called Clean Air Visibility Rule ("CAVR"). The Pechan study estimated the non-EGU NO_x and SO_2 emissions reductions and control costs using methods developed previously for the EPA analysis of the CAVR. EPA evaluated three possible scenarios of actions the states may take to comply with this rule. Reflected here are the medium stringency options. The CAVR requirements of the regional haze rule apply to facilities built between 1962 and 1977 that have the potential to emit more than 250 tpy of visibility impairing pollution. Those facilities fall into 26 categories, including utility and industrial boilers, large industrial plants such as pulp mills, refineries and smelters. Because many of these facilities are relatively old, they have not previously been subject to federal pollution control requirements.[76] The states must consider a number of factors when determining what facilities will be covered by CAVR, including: the cost of controls, the effect of controls on energy usage or any non-air quality environmental impacts, the remaining useful life of the equipment to be controlled, any existing controls in place, and the expected visibility improvement from controlling the emissions.[77] The estimated annualized cost is $231 million.

Table 2. CAVR Costs

Category	Cost (Million $ per Year)
Chemicals and Allied Products Petroleum Products	230 x 0.1*= 23 208
Total	231

*** 0.1 factor based on Costs Estimate Factors derived for Table 5 (Appendix)**

Refinery Settlement Agreements

Since March 2000, the agency has entered into 28 settlements with U.S. companies that refine nearly 90 percent of the nation's petroleum. Refineries have invested or will invest more than six billion dollars in control technologies and pay civil penalties of $80 million. They will also perform supplemental environmental projects valued at approximately $75 million. These emissions reductions and settlements typically apply to violations at refinery sources that occurred prior to the CAAA regulations. Settlements usually result because a facility has violated NSR requirements that were in place prior to the CAAA. These requirements can and usually do carry forward to the present day. In addition, settlements apply to emissions of criteria pollutants, which are not addressed through the CAAA MACT requirements. The estimated annualized cost over ten years is $616 million per year.[78]

SECTION 3. RECENT DEVELOPMENTS

This section discusses recent developments, including GHG controls and future costs if cost estimates are available. GHG regulation under the CAA is discussed. This section includes the history and background of GHG regulation. This is followed by a discussion of current GHG controls under PSD permitting, PSD BACT analysis, and the "Tailoring Rule." Where available, source GHG control costs estimates are examined. The GHG reporting rule and GHG NSPS for New Stationary Sources (Refinery Subparts J and Ja) are analyzed.

Greenhouse Gas Regulation under the CAA

GHG Control under PSD

On May 13, 2010, the EPA issued a final rule that addressed GHG emissions from stationary sources under the CAAA permitting programs. This final rule sets thresholds for GHG emissions that define when permits under the New Source Review PSD and Title V Operating Permit programs are required for new and existing industrial facilities. This rule "tailors" the requirements of these CAAA permitting programs to limit which facilities will be required to obtain PSD and Title V permits. Facilities responsible for nearly 70 percent of the national GHG emissions from stationary sources will be subject to permitting requirements under this rule.[79,80] The "Tailoring Rule" is actually an exemption from permitting smaller GHG sources because it exempts GHG sources from PSD and Title V permitting if GHG emissions are between 100/250 tpy and 75,000/100,000 tpy.[81]

Specific Source GHG Control Cost Estimates Applicable to the U.S. Refining Industry-EPA

The EPA PSD GHG Manual for Refineries is called *Available and Emerging Technologies for Reducing Greenhouse Gas Emissions from the Petroleum Refining Industry*.[82] Recommended GHG reduction measures for refineries are summarized in Table 1 of the manual.[83,84]

An estimate of "minimum" NSPS GHG cost were derived by the writer by applying CARB's GHG Regulations - Energy Efficiency and Co-Benefits Audits for Large Industrial Sources, Refinery Flare Recovery System Improvement, and Removal of the CH_4 Exemption from Existing Refinery Regulations to refineries nationwide. From Table 3, this results in a "minimum" NSPS GHG control cost of about $284 million.[85]

Table 3. Projection for "Minimum" NSPS

Reduction Measure	Net Annualized Cost ($ Millions) (21 CA Refineries)*	Net Annualized Cost ($ Millions) (140 U.S. Refineries)
Audits	-4.25	-28
Refinery Flare Recovery System Improvement	-39	-260
Removal of CH_4Exemption from Existing Refinery Regulations	0.6 (Payout)	4.0 (Payout)
Total "Minimum" NSPS		-284
• CARB based costs on 21 refineries.		

SECTION 4. COST ESTIMATES SUMMARY

From the cost estimates, the estimated CAA cost compared to total U.S. refinery sales is just over one percent.

Table 4. Cost Estimation Summary

Regulatory Category Name	Total Estimated Annual Cost of Regulation to Refineries (Million $/Year)[from Table 5]
Total Nonattainment Costs	3485.4
Emission Standards for Mobile Sources (Fuels) Costs	967.7
40 C.F.R. PART 61 – NESHAPs Costs	3.05
40 C.F.R. PART 63 - MACT Costs	652.02
40 C.F.R. PART 60 – NSPS Costs	194.45
Total Permits and Enforcement Costs	1000
Total GHG Costs	920
Summary	
Total Refinery CAA Costs	**7224.62**
Total Annual Refinery Sales	**521,463**[86]
Total Refinery CAA Cost Percent of Total Annual Refinery Sales	**1.39%**

SECTION 5. SUMMARY

Since the CAA costs as a percent of total annual refinery sales would be just over one percent, the refining industry would survive the CAA. However, the increasing CAA requirements such as GHG regulation through the CAA, the proposed ozone NAAQS and the E15 mandate and the RFS, together with downward U.S. gasoline consumption and refining capacity will increase the business pressures on the refining industry.

APPENDIX

Costs Estimate Factors Derived for Table 5

The "Refinery" factors ("RF") were derived as follows:[87]

1. Any rule with "Gasoline" or "Petroleum" in the title: RF= 1.
2. Any rule, which applies to point sources in general: RF = 0.1 (based on refinery emissions equaling about 10% of total point source emissions nationwide).
3. VOL Storage and Loading: RF = 0.3.
4. Marine Terminals: RF = 0.7.
5. Any rule, which applies to all sources in general ("SIP" Rules"): RF = 0.05 (based on refinery emissions equaling about 5% of total emissions nationwide).
6. Fuel Regulations: RF = 0.1 (90% pass through to consumers).
7. Combustion Regulations: RF = 0.5 of non EGU sector.[88,89]

Table 5. Cost Estimation for Individual Regulations

Regulation Name; Note: [xy] = Paper page number on which regulation cost is located.	**Total Annual Cost of Regulation (Million $/Year)**	**"Refinery" Factor**	**Total Estimated Annual Cost of Regulation to Refineries (Million $/Year)**
Nonattainment			
RACT Categories Applicable to Petroleum Refineries [06/07]	136 [90]	1	136
Old 1-Hour Ozone SIP Measures-VOC and NO_x [07]	317 [91]	0.1	31.7
Houston-Galveston-Brazoria Area Highly Reactive VOC Rules Analyses [07]	146 [92]	0.23	33.6
8-Hour Ozone Analysis [07]	735 [93]	0.1	73.5
Evaluation of Unidentified Measures [07]	7580 [94]	0.05	379
Proposed Ozone Standard (below 0.075 ppm) [07]	55,000 [95]	0.05	2750
$PM_{2.5}$ NAAQS Attainment Analysis ($PM_{2.5}$ Precursors: SO_2, NO_x, and NH_3) [07]	376 [96]	0.1	37.6
PM_{10} NAAQS Attainment Analysis [08]	130 [97]	0.1	13.0
Controls for SO_2 and Lead NAAs [08]	296 [98]	0.1	29.6
Controls for NO_2 NAAs [08]	13.7 [99]	0.1	1.4
Total Nonattainment			3485.4
Regulation Name; Note: [xy] = Paper page number on which regulation cost is located.	**Total Annual Cost of Regulation (Million**	**"Refinery" Factor**	**Total Estimated Annual Cost of Regulation to Refineries**

	$/Year)		(Million $/Year)
Emission Standards for Mobile Sources (Fuels)			
Oxygenated Fuels Program [09]	141 [100]	0.1	14.1
Low-sulfur Diesel Fuel (0.05% Sulfur in 1993) [09]	1260 [101]	0.1	126
Diesel Fuel Sulfur Limits (15 ppm) [09]	1300 [102]	0.1	130
California Reformulated Diesel [09]	130 [103]	0.1	13
Federal RFG: Phase I and II [09]	1441[104]	0.1	144.1
Gasoline Fuel Sulfur Limits: Tier II [09]	1900 [105]	0.1	190
California Phase I, II, III RFG [09/10]	2251[106]	0.1	225.1
RVP Regulations of 1989 and 1992 [10]	650 [107]	0.1	65
Off/Non-Road Diesel Sulfur - Phase I and II [10]	600 [108]	0.1	60
E15 and the Renewable Fuels Standard (RFS) [10]	4[109]	0.1	0.4
Total Fuels			967.7
Name	**Total Annual Cost of Regulation (Million $/Year)**	**"Refinery" Factor**	**Total Estimated Annual Cost of Regulation to Refineries (Million $/Year)**
40 C.F.R. PART 63 – NESHAPs Standards			
Equipment Leaks of Benzene	0.4[110]	0.1	0.04
Benzene Storage Vessels	0.1[111]	0.1	0.01
Benzene Transfer Operations	30 [112]	0.1	3.0
Total 40 C.F.R. PART 61 – NESHAPs			**3.05**
Regulation Name	**Total Annual Cost of Regulation (Million $/Year)**	**"Refinery" Factor**	**Total Estimated Annual Cost of Regulation to Refineries (Million $/Year)**
40 C.F.R. PART 63 – MACT Standards			
National Emission Standards ("MACT") for Organic Hazardous Air Pollutants from the Synthetic Organic Chemical Manufacturing Industry ("SOCMI")	230 [113]	0.1	23
MACT for Organic Hazardous Air Pollutants from the SOCMI for Process Vents, Storage Vessels, Transfer Operations, and Wastewater			
MACT for Organic Hazardous Air Pollutants for Equipment Leaks			
MACT for Organic Hazardous Air Pollutants for Certain Processes Subject to the Negotiated Regulation for Equipment Leaks			
MACT for Hazardous Air Pollutants for Industrial Process Cooling Towers	12.5 [114]	0.1	1.25
MACT for Gasoline Distribution Facilities (Bulk Gasoline Terminals and Pipeline Breakout Stations)	11.4 [115]	1	11.4
MACT for Marine Tank Vessel Loading Operations	101.7 [116]	0.7	71.2
MACT for Hazardous Air Pollutants from Petroleum Refineries	110 [117]	1	110
Hazardous Waste Combustors	63 [118]	0.1	6.3
MACT for Hazardous Air Pollutants for Petroleum Refineries: Catalytic Cracking Units, Catalytic Reforming Units, and Sulfur Recovery Units	47.3 [119]	1	47.3
MACT for Hazardous Air Pollutants: Organic Liquids Distribution (Non-Gasoline)	25 [120]	0.3	7.5
MACT for Hazardous Air Pollutants for Stationary Combustion	43 [121]	0.5	21.5

Turbines			
MACT for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines	213 [122]	0.5	106.5
MACT for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers and Process Heaters	490 [123]	0.5	245
MACT for Site Remediation	9 [124]	0.1	0.9
MACT for Hazardous Air Pollutants: Asphalt Processing and Asphalt Roofing Manufacturing	1.73 [125]	0.1	0.17
Total 40 C.F.R. PART 63 - MACT Standards			**652.02**
Regulation Name	**Total Annual Cost of Regulation (Million $/Year)**	**"Refinery" Factor**	**Total Estimated Annual Cost of Regulation to Refineries (Million $/Year)**
40 C.F.R. PART 60 – NSPS Standards; Note: The Total Annual Cost of Regulation (Million $/Year) is based on the Regulation's FR Proposal.			
NSPS for Industrial/Commercial/Institutional Steam Generating Units	165 [126]	0.5	82.5
NSPS for Small Industrial/Commercial/Institutional Steam Generating Units	38 [127]	0.5	19
NSPS for Petroleum Refineries for Which Construction, Reconstruction, or Modification Commenced After May 14, 2007	31 [128]	1	31
NSPS for Storage Vessels for Petroleum Liquids for Which Construction, Reconstruction, or Modification Commenced After May 18, 1978, and Prior to July 23, 1984	1 [129]	0.3	0.3
NSPS for Volatile Organic Liquid Storage Vessels (Including Petroleum Liquid Storage Vessels) for Which Construction, Reconstruction, or Modification Commenced After July 23, 1984	9 [130]	0.3	2.7
NSPS for Asphalt Processing and Asphalt Roofing Manufacture	2 [131]	0.1	0.2
NSPS for Equipment Leaks of VOC In the SOCMI for Which Construction, Reconstruction, or Modification Commenced After January 5, 1981, and On or Before November 7, 2006	0.4 [132]	0.1	0.04
NSPS for Equipment Leaks of VOC In the SOCMI for Which Construction, Reconstruction, or Modification Commenced After November 7, 2006	0.8 [133]	0.1	0.08
NSPS for Bulk Gasoline Terminals	3 [134]	1	3
NSPS for Equipment Leaks of VOC In Petroleum Refineries for Which Construction, Reconstruction, or Modifications Commenced After January 4, 1983 and On or Before November 7, 2006	0.4 [135]	1	0.4
NSPS for Equipment Leaks of VOC In Petroleum Refineries for Which Construction, Reconstruction, or Modifications Commenced After November 7, 2006	0.03 [136]	1	0.03
NSPS for Volatile Organic Compound (VOC) Emissions from Synthetic Organic Chemical Manufacturing Industry (SOCMI) Air Oxidation Processes	9 [137]	0.1	0.9
NSPS for Equipment Leaks of VOC from Onshore Natural Gas Processing Plants	2 [138]	0.1	0.2
NSPS for Onshore Natural Gas Processing; SO_2 Emissions	102 [139]	0.1	10.2
NSPS for VOC Emissions from SOCMI Distillation	9 [140]	0.1	0.9

Operations			
NSPS for VOC Emissions from Petroleum Refinery Wastewater Systems	1.3 [141]	1	1.3
NSPS for VOC Emissions from SOCMI Reactor Processes	5 [142]	0.1	0.5
Commercial and Industrial Solid Waste Incineration Units	12 [143]	0.1	1.2
NSPS for Stationary Compression Ignition Internal Combustion Engines	57 [144]	0.5	28.5
NSPS for Stationary Spark Ignition Internal Combustion Engines	19 [145]	0.5	9.5
NSPS for Stationary Combustion Turbines	4 [146]	0.5	2.0
Total 40 C.F.R. PART 60 – NSPS Standards			**194.45**
Regulation Name; Note: [xy] = Paper page number on which regulation cost is located.	**Total Annual Cost of Regulation (Million $/Year)**	**"Refinery" Factor**	**Total Estimated Annual Cost of Regulation to Refineries (Million $/Year)**
Permits and Enforcement			
NNSR Review {See Note 1.}	40	1	40
PSD Review {See Note 2.}	64	1	64
Regional Haze Rule (Clean Air Visibility Rule) [10/11]	231[147]	1	231
Title V Permits {See Note 3.}	40	1	40
Refinery Settlement Agreements [11]	616 [148]	1	616
Texas Flex Permits "Deflex" {See Note 4}	9	1	9
Total Permits and Enforcement			**1000**
Regulation Name; Note: [xy] = Paper page number on which regulation cost is located.	**Total Annual Cost of Regulation (Million $/Year)**	**"Refinery" Factor**	**Total Estimated Annual Cost of Regulation to Refineries (Million $/Year)**
GHG Regulation under the CAA			
GHG Reporting Rule {See Note 5.}	24	1	24
Prevention of Significant Deterioration (PSD) and GHG Title V Permits [12] {See Note 6.}	210	1	210
California Refinery GHG Cap and Trade ($10 per GHG ton)	350	1	350
Refinery GHG NSPS {see Table 3B} [14/15]	284	1	284
Marketing Costs (Estimated by writer)	52	1	52
Total GHG			**920**
Summary			
Total Refinery CAAA Costs			**7224.62**
Total Annual Refinery Sales [149]			**521,463**
Total Refinery CAAA Cost Percent of Total Annual Refinery Sales			**1.32%**

Note 1: Tech manpower and monitoring costs - $1.43 million per refinery per 5 year period; 140 refineries.
Note 2: Tech manpower and monitoring costs - $2.29 million per refinery per 5 year period; 140 refineries.
Note 3: Tech manpower and monitoring costs - $1.43 million per refinery per 5 year period; 140 refineries.
Note 4: $3 million per refinery annualized over 5 year period; estimated 15 refineries.
Note 5: Tech manpower and monitoring costs - $0.17 million per refinery per 1 year period; 140 refineries.
Note 6: Tech manpower and monitoring costs - $7.50 million per refinery per 5 year period; 140 refineries.

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[2]This paper, Table 4, at 15.

[3]This paper at 4.

[4]Sector Notebook Project. *Profile of the Petroleum Refining Industry;* EPA Office of Compliance: Washington, DC, 1995, 86-87.

[5]Drevna, C. T. (President, National Petrochemical & Refiners Association). Personal Communication, 2011, 2-8. (Letter to The Honorable Darrell Issa, Chairman, House Committee on Oversight and Government Reform).

[6]Prevention of Significant Deterioration and Title V Greenhouse Gas Tailoring Rule. *Fed Regist.* **2010,** *75,* 31514 ff.

[7]Settlement Agreement between the following groups of Petitioners: (1) the States of New York, California, Connecticut, Delaware, Maine, New Hampshire, New Mexico, Oregon, Rhode Island, Vermont, and Washington, the Commonwealth of Massachusetts, the District of

Columbia, and the City of New York (collectively "State Petitioners"); (2) Natural Resources Defense Council (NRDC), Sierra Club, and Environmental Integrity Project (EIP) (collectively "Environmental Petitioners"); and (3) Respondent, the EPA (collectively "the Parties") regarding NSPS for GHG emissions from petroleum refineries. In connection with the Final Rule, EPA declined to establish NSPS for GHGs, (2010).

[8]Drevna, C. T. (President, National Petrochemical & Refiners Association). Personal Communication, 2011. (Letter to Gina McCarthy, EPA's assistant administrator for air and radiation).

[9]Standards of Performance for New Stationary Sources. *U.S. Code,* Section 7411d , Title 42.

[10]Committee members contributing to the Committee Report: Kevin M. Gallagher, Walter R. Hall, II, Diana Jeschke, Christian D. McMurray, Zachary L. Seder, and Adam White, Initial Report of the Energy Bar Association's Environmental Regulation Committee. Energy Law Journal. **2011,** *32:637*, 648-649.

[11]Committee members contributing to the Committee Report: Kevin M. Gallagher, Walter R. Hall, II, Diana Jeschke, Christian D. McMurray, Zachary L. Seder, and Adam White, Initial Report of the Energy Bar Association's Environmental Regulation Committee. Energy Law Journal. **2011,** *32:637*, 648-649.

[12]Columbia Law School. Climate Regulation Tracking Service. http://www.law.columbia.edu/centers/climatechange/resources/epa (accessed Feb 23, 2012).

[13]Drevna, C. T. (President, National Petrochemical & Refiners Association). Personal Communication, 2011. (Letter to Gina McCarthy, EPA's assistant administrator for air and radiation).

[14] Drevna, C. T. (President, National Petrochemical & Refiners Association). Personal Communication, 2011. (Letter to Gina McCarthy, EPA's assistant administrator for air and radiation).

[15]*Final Ozone NAAQS Regulatory Impact Analysis, Summary of the Updated Regulatory Impact Analysis (RIA) for the Reconsideration of the 2008 Ozone National Ambient Air Quality Standard (NAAQS);* U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards: Washington, DC, 2008.

[16]Drevna, C. T. (President, National Petrochemical & Refiners Association). Personal Communication, 2011. (Letter to Gina McCarthy, EPA's assistant administrator for air and radiation).

[17]Drevna, C. T. (President, National Petrochemical & Refiners Association). Personal Communication, 2011. (Letter to Gina McCarthy, EPA's assistant administrator for air and radiation).

[18]Greenhouse, J. E15: Cracking the RVP Nut. Ethanol Producer Magazine. http://ethanolproducer.com/articles/8222/e15-cracking-the-rvp-nut (accessed Feb 23, 2012).

[19]Deloitte Center for Energy Solutions, Deloitte Development LLC. *Changing Times, What's Next for U.S. Refiners?,* 2010.

[20]*The U.S. Oil Refining Industry: Background in Changing Markets and Fuel Policies,* 4, November 2010.

[21]U.S. Energy Information Administration. Reductions in Northeast Refining Activity: Potential Implications for Petroleum Product Markets. http://www.eia.gov/analysis/petroleum/nerefiningactivity (accessed Feb 25, 2012).

[22]U.S. Energy Information Administration. Domestic Refinery Distillation Base Capacity, Expansion, and Utilization, Reference Case. http://205.254.135.7/oiaf/aeo/tablebrowser/#release=AEO2011&subject=9-AEO2011&table=68-AEO2011&region=0-0&cases=ref2011-d020911a (accessed Feb 25, 2012).

[23]Proposed Standards of Performance for Asphalt Processing and Asphalt Roofing Manufacture, *Fed Regist.* **1980,** *45*, 76404, ff.

[24]This paper, Table 4, at 15.

[25]National Ambient Air Quality Standards for Ozone, *Fed Regist.* **2010,** *75,* 2938.

[26]National Ambient Air Quality Standards for Ozone, *Fed Regist.* **2010,** 75, 2938.

[27]E.H. Pechan & Associates, Inc. and Industrial Economics, Inc., *Direct Cost Estimates for the Clean Air Act Second Section 812 Prospective Analysis Draft Report*; Technical Report for U.S. EPA, Office of Air and Radiation: 2009, 1-1 ff. The Pechan report was prepared in support of and was cited on Page 3-19 of *The Benefits and Costs of the Clean Air Act from 1990 to 2020, Final Report*, [U.S. EPA, Office of Air and Radiation, 2011]. Pages 1-1 and 1-2 of the latter report state the following reason for the latter report: "Section 812 of the 1990 Clean Air Act Amendments established a requirement that EPA develop periodic reports that estimate the benefits and costs of the Clean Air Act (CAA). The **main goal of these reports is to provide Congress** (emphasis added) and the public with comprehensive, up-to-date, peer-reviewed information on the Clean Air Act's social benefits and costs, including improvements in human health, welfare, and ecological resources, as well as the impact of CAA provisions on the US economy. This report is the third in the Section 812 series, and is the result of EPA's Second Prospective analysis of the 1990 Amendments. The first report EPA created under this authority, *The Benefits and Costs of the Clean Air Act: 1970 to 1990*, was published and conveyed to Congress in October 1997. This Retrospective analysis comprehensively assessed benefits and costs of requirements of the 1970 Clean Air Act and the 1977 Amendments, up to the passage of the Clean Air Act Amendments of 1990. A second Section 812 report, *The Benefits and Costs of*

the Clean Air Act: 1990 to 2010, was completed in November of 1999 and addressed the incremental costs and benefits of the Clean Air Act Amendments (CAAA) enacted by Congress and signed by the President in November of 1990. This First Prospective analysis addressed implementation of the CAAA over the period 1990 to 2010, and found that aggregate benefits of the Amendments alone, excluding provisions in place prior to 1990, exceeded the costs by a factor of four.

[28]E.H. Pechan & Associates, Inc. and Industrial Economics, Inc., *Direct Cost Estimates for the Clean Air Act Second Section 812 Prospective Analysis Draft Report*; Technical Report for U.S. EPA, Office of Air and Radiation: 2009, 1-1.

[29]E.H. Pechan & Associates, Inc. and Industrial Economics, Inc., *Direct Cost Estimates for the Clean Air Act Second Section 812 Prospective Analysis Draft Report*; Technical Report for U.S. EPA, Office of Air and Radiation: 2009, 5-1.

[30]E.H. Pechan & Associates, Inc. and Industrial Economics, Inc., *Direct Cost Estimates for the Clean Air Act Second Section 812 Prospective Analysis Draft Report*; Technical Report for U.S. EPA, Office of Air and Radiation: 2009, 5-1.

[31]E.H. Pechan & Associates, Inc. and Industrial Economics, Inc., *Direct Cost Estimates for the Clean Air Act Second Section 812 Prospective Analysis Draft Report*; Technical Report for U.S. EPA, Office of Air and Radiation: 2009, 5-1.

[32]E.H. Pechan & Associates, Inc. and Industrial Economics, Inc., *Direct Cost Estimates for the Clean Air Act Second Section 812 Prospective Analysis Draft Report*; Technical Report for U.S. EPA, Office of Air and Radiation: 2009, 5-13, 5-14.

[33]TCEQ, 30 TAC Chapter 115, Subchapter H: Highly-Reactive Volatile Organic Compounds Division 1: Vent Gas Control §§115.720-115.729; Division 2: Cooling Tower Heat Exchange Systems: §§115.760-115.769; Division 3: Fugitive Emissions: §§115.780-115.789, 2011.

[34]E.H. Pechan & Associates, Inc. and Industrial Economics, Inc., *Direct Cost Estimates for the Clean Air Act Second Section 812 Prospective Analysis Draft Report*; Technical Report for U.S. EPA, Office of Air and Radiation: 2009, 5-21.

[35]EPA TRI Explorer. Releases: Industry Report. http://www.epa.gov/cgi-bin/broker?VIEW=COSC&trilib=TRIQ1&TAB_RPT=1&_LINESPP=&sort=E2&INDUSTRY=&FLD=E1&FLD=E2&FLD=E3&FLD=E42&FLD=E52&FLD=E53A&FLD=E53B&FLD=E54&FLD=STOTHDIS&FLD=RELLBY&FLD=TSFDSP&FLD=RE_TOLBY&OTHDISPD=Y&sort_fmt=2&TopN=&STATE=48&COUNTY=48167&CHEMICAL=ALL+CHEMICALS&YEAR=2009&BGCOLOR=%23D0E0FF&FOREGCOLOR=black&FONT_FACE=arial&FONT_SIZE=10+pt&FONT_WIDTH=normal&FONT_STYLE=roman&FONT_WEIGHT=bold&_SERVICE=oiaa&_PROGRAM=xp_tri.sasmacr.tristart.macro (accessed Feb 23, 2012).

[36]Smalling, *supra note 1.*

[37]E.H. Pechan & Associates, Inc. and Industrial Economics, Inc., *Direct Cost Estimates for the Clean Air Act Second Section 812 Prospective Analysis Draft Report*; Technical Report for U.S. EPA, Office of Air and Radiation: 2009, 5-20.

[38]E.H. Pechan & Associates, Inc. and Industrial Economics, Inc., *Direct Cost Estimates for the Clean Air Act Second Section 812 Prospective Analysis Draft Report*; Technical Report for U.S. EPA, Office of Air and Radiation: 2009, 7-12.

[39]E.H. Pechan & Associates, Inc. and Industrial Economics, Inc., *Direct Cost Estimates for the Clean Air Act Second Section 812 Prospective Analysis Draft Report*; Technical Report for U.S. EPA, Office of Air and Radiation: 2009, 7-15, 7-16.

[40]National Ambient Air Quality Standards for Ozone, *Fed Regist.* **2010,** *75,* 2938, ff.

[41]*Final Ozone NAAQS Regulatory Impact Analysis, Summary of the Updated Regulatory Impact Analysis (RIA) for the Reconsideration of the 2008 Ozone National Ambient Air Quality Standard (NAAQS)*, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, 2008.

[42]Drevna, C. T. (President, National Petrochemical & Refiners Association). Personal Communication, 2011. (Letter to Gina McCarthy, EPA's assistant administrator for air and radiation).

[43]Smalling, *supra note 1.*

[44]Environmental Protection Agency. Final Clean Air Fine Particle Implementation Rule for Implementation of 1997 $PM_{2.5}$ Standards. http://www.epa.gov/pmdesignations/1997standards/documents/ Mar07/factsheethtm. (accessed Mar 31, 2011).

[45]Clean Air Fine Particle Implementation Rule; Final Rule Agency Information Collection Activities: Proposed Collection; Comment Request; $PM_{2.5}$ Ozone National Ambient Air Quality Standard Implementation Rule; EPA ICR No. 2258.01; Notice, *Fed Regist.* **2007,** *72,* 20586 ff.

[46]These areas are as follows. First, $PM_{2.5}$ precursors are SO_2 and NO_x. Second, ammonia may be added as a $PM_{2.5}$ precursor by the states if the state or EPA makes a technical demonstration that ammonia emissions from sources in the state significantly contribute to the $PM_{2.5}$ problem. EPA proposes that states are not required to address VOCs as $PM_{2.5}$ nonattainment precursors. Third, RACT controls must be in place by 2009. Fourth, for RACM, states are required to provide a demonstration that they have adopted all reasonably available measures needed to attain as expeditiously as practicable.

[47]E.H. Pechan & Associates, Inc. and Industrial Economics, Inc., *Direct Cost Estimates for the Clean Air Act Second Section 812 Prospective Analysis Draft Report*; Technical Report for U.S. EPA, Office of Air and Radiation: 2009, 7-7, 7-8, Exhibit 7-9.

[48]E.H. Pechan & Associates, Inc. and Industrial Economics, Inc., *Direct Cost Estimates for the Clean Air Act Second Section 812 Prospective Analysis Draft Report*; Technical Report for U.S. EPA, Office of Air and Radiation: 2009, 5-22.

[49]Primary National Ambient Air Quality Standard for Sulfur Dioxide, Final Rule, *Fed Regist.* **2010,** *75,* 35520 ff.

[50]*Final Regulatory Impact Analysis (RIA) for the SO2 National Ambient Air Quality Standards (NAAQS);* U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards: Washington, DC, 2010, 7-5.

[51]U.S. Environmental Protection Agency. Classifications of 8-Hour Ozone Nonattainment Areas. http://www.epa.gov/oar/oaqps/greenbk/gnc.html (accessed Feb 23, 2012).
[52]Primary National Ambient Air Quality Standards for Nitrogen Dioxide, Final Rule, *Fed Regist.* **2010,** *75,* 6464 ff.

[53]*Final Regulatory Impact Analysis (RIA) for the NO2 National Ambient Air Quality Standards (NAAQS);* U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards: Washington, DC, 2010, 5-2.

[54] Sector Notebook Project. *Profile of the Petroleum Refining Industry;* EPA Office of Compliance: Washington, DC, 1995, 89.

[55]Sector Notebook Project. *Profile of the Petroleum Refining Industry;* EPA Office of Compliance: Washington, DC, 1995, 89.

[56]E.H. Pechan & Associates, Inc. and Industrial Economics, Inc., *Direct Cost Estimates for the Clean Air Act Second Section 812 Prospective Analysis Draft Report*; Technical Report for U.S. EPA, Office of Air and Radiation: 2009, 3-17.

[57]Sector Notebook Project. *Profile of the Petroleum Refining Industry;* EPA Office of Compliance: Washington, DC, 1995, 89.

[58]E.H. Pechan & Associates, Inc. and Industrial Economics, Inc., *Direct Cost Estimates for the Clean Air Act Second Section 812 Prospective Analysis Draft Report*; Technical Report for U.S. EPA, Office of Air and Radiation: 2009, 3-17/

[59]Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements; Final Rule, *Fed Regist.* **2001,** *66,* 5002 ff.

[60]Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements; Final Rule, *Fed Regist.* **2001,** *66,* 5101 ff.

[61]Final Regulation Order, Amendments to the California Diesel Fuel Regulations as adopted May 10, 2004; California Air Resources Board ("CARB") California Code of Regulations §§2281-2282) and May 28, 2004 (§§1961, 2283, 2284, 2285, 2701 and 93114); Board Hearing: July 24, 2003 (2004).

[62]E.H. Pechan & Associates, Inc. and Industrial Economics, Inc., *Direct Cost Estimates for the Clean Air Act Second Section 812 Prospective Analysis Draft Report*; Technical Report for U.S. EPA, Office of Air and Radiation: 2009, 3-17.

[63]Sector Notebook Project. *Profile of the Petroleum Refining Industry;* EPA Office of Compliance: Washington, DC, 1995, 89.

[64]E.H. Pechan & Associates, Inc. and Industrial Economics, Inc., *Direct Cost Estimates for the Clean Air Act Second Section 812 Prospective Analysis Draft Report*; Technical Report for U.S. EPA, Office of Air and Radiation: 2009, 3-17.

[65]Control of Air Pollution From New Motor Vehicles; Revisions to Motor Vehicle Diesel Fuel Sulfur Transition Provisions; and Technical Amendments to the Highway Diesel, Nonroad Diesel, and Tier 2 Gasoline Programs, Direct Final Rule, *Fed Regist.* **2005,** *70,* 70498 ff.

[66]*Code of Federal Regulations*, Part 66, 5002, 5101. **Note:** EPA's cost derivation methodology is similar to Pechan's methodology (p. 42).

[67]CARB. Phase 2 Reformulated Gasoline Program Publications. http://www.arb.ca.gov/ fuels/ gasoline/pub/cbg_fs3.htm (accessed Mar 31, 2011).

[68]E.H. Pechan & Associates, Inc. and Industrial Economics, Inc., *Direct Cost Estimates for the Clean Air Act Second Section 812 Prospective Analysis Draft Report*; Technical Report for U.S. EPA, Office of Air and Radiation: 2009, 3-16.

[69]Regulation of Fuels and Fuel Additives: Standards for Gasoline Volatility; and Control of Air Pollution From New Motor Vehicles and New Motor Vehicle Engines: Standards for Particulate Emissions From Urban Buses, Final Rule, *Fed Regist.* **1991,** *56,* 64704 ff.

[70]Volatility Regulations for Gasoline and Alcohol Blends Sold in Calendar Years 1992 and Beyond, *Fed Regist.* **1990,** *55,* 23658.

[71]Control of Emissions of Air Pollution from Nonroad Diesel Engines and Fuel; Final Rule, *Fed Regist.* **2004,** *69,* 38958 ff.

[72]Control of Emissions of Air Pollution from Nonroad Diesel Engines and Fuel; Final Rule, *Fed Regist.* **2004,** *69*, 38958, 39132.

[73]National Petrochemical & Refiners Association v. EPA, Growth Energy and National Biodiesel Board, Intervenors, 630 F.3d 145 (D.C. Cir. 2010) (Decided Dec. 21, 2010 - Petrochemicals and refiners association and institute petitioned for review of Environmental Protection Agency (EPA) final rule, contending that it violated statutory requirements setting separate biomass-based diesel volume requirements for two years, was impermissibly retroactive, and violated statutory lead time and compliance provisions. The D.C. Circuit decided that (1) the final rule did not violate clear statutory mandate setting separate biomass-based diesel volume requirements for 2009 and 2010; (2) the final rule was not impermissibly retroactive; and (3) the final rule did not violate statutory lead time and compliance provisions. Petitions denied.)

[74]Regulation To Mitigate the Misfueling of Vehicles and Engines with Gasoline Containing Greater than Ten Volume Percent Ethanol and Modifications to the Reformulated and Conventional Gasoline Programs, Proposed Rule. *Fed Regist.* **2010,** *75*, 68046 ff.

[75]Regulation To Mitigate the Misfueling of Vehicles and Engines with Gasoline Containing Greater than Ten Volume Percent Ethanol and Modifications to the Reformulated and Conventional Gasoline Programs, Proposed Rule. *Fed Regist.* **2010,** *75*, 68058.

[76]The facilities may be located in attainment areas. Therefore, they are not subject to federal non-attainment controls. Attainment PSD permitting did not begin until August 7, 1977. Therefore, facilities constructed prior to 1977 are not subject to federal PSD permitting requirements. If the facilities were not "modified" as defined by NSPS, they are not subject to NSPS. The facilities could still be subject to state pollution control requirements.

[77]E.H. Pechan & Associates, Inc. and Industrial Economics, Inc., *Direct Cost Estimates for the Clean Air Act Second Section 812 Prospective Analysis Draft Report*; Technical Report for U.S. EPA, Office of Air and Radiation: 2009, 7-6, 7-7.

[78]U.S. Environmental Protection Agency. Petroleum Refinery National Initiative Case Results. http://www.epa.gov/compliance/resources/cases/civil/caa/oil (accessed Apr 3, 2011).

[79]EPA Administrator Lisa P. Jackson's February 22, 2010 letter to Senator Jay D. Rockefeller IV, 2, (Also Citing 549 U.S. 497, 528-529, 532-533 (**2007**)).

[80]*Prevention of Significant Deterioration and Title V Greenhouse Gas Tailoring Rule*, *Fed Regist.* **2010,** *75*, 31514 ff.

[81]*Prevention of Significant Deterioration and Title V Greenhouse Gas Tailoring Rule*, *Fed Regist.* **2010,** *75*, 31514 ff.

[82]*Available and Emerging Technologies for Reducing Greenhouse Gas Emissions from the Petroleum Refining Industry*, Environmental Protection Agency, Sector Policies and Programs Division, Office of Air Quality Planning and Standards: Washington, DC, 2010.

[83]*Available and Emerging Technologies for Reducing Greenhouse Gas Emissions from the Petroleum Refining Industry*, Environmental Protection Agency, Sector Policies and Programs Division, Office of Air Quality Planning and Standards: North Carolina, 2010, 14-19.

[84]Worrell, E.; Galitsky, C.; and Orlando, E. *Energy Efficiency Improvement and Cost Saving Opportunities For Petroleum Refineries, An ENERGY STAR Guide for Energy and Plant Managers*, Lawrence Berkeley National Laboratory, Environmental Energy Technologies Division: 2005.

[85]Smalling, *supra note 1*.

[86]*Performance Profiles of Major Energy Producers 2009*, EIA 2010.

[87]Smalling, *supra note 1*.

[88]*The American Clean Energy and Security Act An Assessment of Capacity and Employment Losses in the Domestic Refining Industry, November 2009, Executive Summary*, Energy Policy Research Foundation, Inc. (2009).

[89] H.R. 2454, EPA Data, EIA W-M Basic Case Projected Refinery Crude Throughputs, and EPRINC Calculations. *Actual emissions for the entire U.S. will be higher as ACES covers only 86% of the U.S. economy. Does not include allowances allotted to small business refiners, 0.25% of the free allowance pool).

[90]E.H. Pechan & Associates, Inc. and Industrial Economics, Inc., *Direct Cost Estimates for the Clean Air Act Second Section 812 Prospective Analysis Draft Report*; Technical Report for U.S. EPA, Office of Air and Radiation: 5-13, 5-14.

[91]E.H. Pechan & Associates, Inc. and Industrial Economics, Inc., *Direct Cost Estimates for the Clean Air Act Second Section 812 Prospective Analysis Draft Report*; Technical Report for U.S. EPA, Office of Air and Radiation: 2009, 5-21.

[92]E.H. Pechan & Associates, Inc. and Industrial Economics, Inc., *Direct Cost Estimates for the Clean Air Act Second Section 812 Prospective Analysis Draft Report*; Technical Report for U.S. EPA, Office of Air and Radiation: 2009, 5-20.

[93]E.H. Pechan & Associates, Inc. and Industrial Economics, Inc., *Direct Cost Estimates for the Clean Air Act Second Section 812 Prospective Analysis Draft Report*; Technical Report for U.S. EPA, Office of Air and Radiation: 2009, 7-12.

[94]E.H. Pechan & Associates, Inc. and Industrial Economics, Inc., *Direct Cost Estimates for the Clean Air Act Second Section 812 Prospective Analysis Draft Report*; Technical Report for U.S. EPA, Office of Air and Radiation: 2009, 7-15, 7-16..

[95]*Final Ozone NAAQS Regulatory Impact Analysis, Summary of the Updated Regulatory Impact Analysis (RIA) for the Reconsideration of the 2008 Ozone National Ambient Air Quality Standard (NAAQS)*, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards: Washington, DC, 2008.

[96]E.H. Pechan & Associates, Inc. and Industrial Economics, Inc., *Direct Cost Estimates for the Clean Air Act Second Section 812 Prospective Analysis Draft Report*; Technical Report for U.S. EPA, Office of Air and Radiation: 2009, 7-7, 7-8..

[97]E.H. Pechan & Associates, Inc. and Industrial Economics, Inc., *Direct Cost Estimates for the Clean Air Act Second Section 812 Prospective Analysis Draft Report*; Technical Report for U.S. EPA, Office of Air and Radiation: 2009, 5-22.

[98]*Final Regulatory Impact Analysis (RIA) for the SO2 National Ambient Air Quality Standards (NAAQS);* U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards: Washington, DC, 2010

[99]*Final Regulatory Impact Analysis (RIA) for the NO2 National Ambient Air Quality Standards (NAAQS);* U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards: Washington, DC, 2010

[100]E.H. Pechan & Associates, Inc. and Industrial Economics, Inc., *Direct Cost Estimates for the Clean Air Act Second Section 812 Prospective Analysis Draft Report*; Technical Report for U.S. EPA, Office of Air and Radiation: 2009, 3-17.

[101]E.H. Pechan & Associates, Inc. and Industrial Economics, Inc., *Direct Cost Estimates for the Clean Air Act Second Section 812 Prospective Analysis Draft Report*; Technical Report for U.S. EPA, Office of Air and Radiation: 2009, 3-17.

[102]Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements; Final Rule, *Fed Regist.* **2001,** *66,* 5101.

[103]E.H. Pechan & Associates, Inc. and Industrial Economics, Inc., *Direct Cost Estimates for the Clean Air Act Second Section 812 Prospective Analysis Draft Report*; Technical Report for U.S. EPA, Office of Air and Radiation: 2009, 3-17.

[104]E.H. Pechan & Associates, Inc. and Industrial Economics, Inc., *Direct Cost Estimates for the Clean Air Act Second Section 812 Prospective Analysis Draft Report*; Technical Report for U.S. EPA, Office of Air and Radiation: 2009, 3-17.

[105]E.H. Pechan & Associates, Inc. and Industrial Economics, Inc., *Direct Cost Estimates for the Clean Air Act Second Section 812 Prospective Analysis Draft Report*; Technical Report for U.S. EPA, Office of Air and Radiation: 2009, 3-17.

[106]E.H. Pechan & Associates, Inc. and Industrial Economics, Inc., *Direct Cost Estimates for the Clean Air Act Second Section 812 Prospective Analysis Draft Report*; Technical Report for U.S. EPA, Office of Air and Radiation: 2009, 3-16.

[107]Volatility Regulations for Gasoline and Alcohol Blends Sold in Calendar Years 1992 and Beyond, *Fed Regist.* **1990,** *55,* 23658.

[108]Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements; Final Rule, *Fed Regist.* **2001,** *66,* 5002 ff.

[109]Regulation To Mitigate the Misfueling of Vehicles and Engines with Gasoline Containing Greater than Ten Volume Percent Ethanol and Modifications to the Reformulated and Conventional Gasoline Programs, Proposed Rule. *Fed Regist.* **2010,** *75,* 68046 ff.

[110]National Emission Standards for Hazardous Air Pollutants for Equipment Leaks of Benzene, *Fed Regist.* **1984,** *49,* 23513 ff.

[111]National Emission Standards for Hazardous Air Pollutants for Benzene Storage Vessels, *Fed Regist.* **1989,** *54,* 38077 ff.

[112]National Emission Standards for Hazardous Air Pollutants for Benzene Transfer Operations and Benzene Waste Operations, *Fed Regist.* **1990,** *55,* 8341 ff.

[113]National Emission Standards for Hazardous Air Pollutants for Source Categories; Organic Hazardous Air Pollutants from the Synthetic Organic Chemical Manufacturing Industry and Other Processes Subject to the Negotiated Regulation for Equipment Leaks, *Fed Regist.* **1994,** *59,* 19454 ff.

[114]National Emission Standards for Hazardous Air Pollutants for Industrial Process Cooling Towers, *Fed Regist.* **1994,** *59,* 46350 ff.

[115]National Emission Standards for Hazardous Air Pollutants for Gasoline Distribution Facilities (Bulk Gasoline Terminals and Pipeline Breakout Stations), *Fed Regist.* **1994,** *59,* 64315 ff.

[116]E.H. Pechan & Associates, Inc. and Industrial Economics, Inc., *Direct Cost Estimates for the Clean Air Act Second Section 812 Prospective Analysis Draft Report*; Technical Report for U.S. EPA, Office of Air and Radiation: 2009 5-10 to 5-12.

[117]National Emission Standards for Petroleum Refineries, *Fed Regist.* **1995,** *59,* 36130.

[118]National Emission Standards for Hazardous Waste Combustors, *Fed Regist.* **1999,** *64,*. 52828 ff.

[119]National Emission Standards for Petroleum Refineries: Catalytic Cracking Units, Catalytic Reforming Units, and Sulfur Recovery Units, *Fed Regist.* **2002,** *67*, 17773 ff.

[120]National Emission Standards for Hazardous Air Pollutants: Organic Liquids Distribution (Non-Gasoline*), Fed Regist.* **2004,** *69*, 5063 ff.

[121]National Emission Standards for Hazardous Air Pollutants for Stationary Combustion Turbines, *Fed Regist.* **2004,** *69*, 10537 ff.

[122]National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines, *Fed Regist.* **2004,** *69*, 33474 ff.

[123]National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers and Process Heaters, Proposed to be published in Fed Regist. (Promulgated Feb. 21, 2011)

[124]National Emission Standards for Hazardous Air Pollutants for Site Remediation, *Fed Regist.* **2003,** *68,* 58190 ff.

[125]National Emission Standards for Hazardous Air Pollutants for Asphalt Processing and Asphalt Roofing, *Fed Regist.* **2003,** *68*, 24577 ff.

[126]Proposed Rules for Standards of Performance for New Stationary Sources for Industrial/Commercial/Institutional Steam Generating Units, *Fed Regist.* **1984,** *51*, 22384 ff.

[127]Standards of Performance for New Stationary Sources for Small Industrial-Commercial-Institutional Steam Generating Units, *Fed Regist.* **1990,** *55*,37683 ff.

[128]Standards of Performance for New Stationary Sources for Petroleum Refineries for Which Construction, Reconstruction, or Modification Commenced After May 14, 2007, *Fed Regist.* **2008,** *73*, 78552 ff.

[129]Standards of Performance for New Stationary Storage Vessels for Petroleum Liquids for Which Construction, Reconstruction, or Modification Commenced After May 18, 1978, and Prior to July 23, 1984, *Fed Regist.* **1980,** *45,* 23379 ff.

[130]Standards of Performance for New Stationary Storage Vessels for Petroleum Liquids for Which Construction, Reconstruction, or Modification Commenced After July 23, 1984, *Fed Regist.* **1987,** *52*, 11429 ff.

[131]Proposed Standards of Performance for Asphalt Processing and Asphalt Roofing Manufacture, *Fed Regist.* **1980,** *45*, 76404 ff.

[132]Standards of Performance for Equipment Leaks of VOC In the SOCMI for Which Construction, Reconstruction, or Modification Commenced After January 5, 1981, and On or Before November 7, 2006, *Fed Regist.* **1983,** *8,* 48335, ff.

[133]Standards of Performance for Equipment Leaks of VOC In the SOCMI for Which Construction, Reconstruction, or Modification Commenced After November 7, 2006, *Fed Regist.* **2007,** *72* 64883 ff.

[134]Standards of Performance for Bulk Gasoline Terminals, *Fed Regist.* **1983,** *48,* 37590 ff.

[135]Standards of Performance for Equipment Leaks of VOC In Petroleum Refineries for Which Construction, Reconstruction, or Modifications Commenced After January 4, 1983 and On or Before November 7, 2006, *Fed Regist.* **1984,** *49,* 22606 ff.

[136]Standards of Performance for Equipment Leaks of VOC in Petroleum Refineries for Which Construction, Reconstruction, or Modifications Commenced After November 7, 2006, *Fed Regist.* **2007,** *72,* 64860 ff.

[137]Standards of Performance for Volatile Organic Compound (VOC) Emissions from Synthetic Organic Chemical Manufacturing Industry (SOCMI) Air Oxidation Processes, *Fed Regist.* **1990,** *55,* 26922 ff.

[138]Standards of Performance for Equipment Leaks of VOC from Onshore Natural Gas Processing Plants, *Fed Regist.* **1985,** *50,* 26124,ff.

[139]Proposed Standards of Performance for Onshore Natural Gas Processing; SO_2 Emissions, *Fed Regist.* **1984,** *49,* 2656 ff.

[140]Standards of Performance for VOC Emissions from SOCMI Distillation Operations, *Fed Regist.* **2000,** *55,* 26942 ff.

[141]Standards of Performance for VOC Emissions from Petroleum Refinery Wastewater Systems, *Fed Regist.* **1985,** *53,* 47623 ff.

[142]Standards of Performance for VOC Emissions from SOCMI Reactor Processes, *Fed Regist.* **1993,** *58,,* 45962 ff.

[143]Standards of Performance for Commercial and Industrial Solid Waste Incineration Units, *Fed Regist.* **2000,** *65,* 75347, 75350 ff.

[144]Standards of Performance for Stationary Compression Ignition Internal Combustion Engines, *Fed Regist.* **2006,** *71,* 39172 ff.

[145]Standards of Performance for Stationary Spark Ignition Internal Combustion Engines, *Fed Regist.* **2008,** *73*, 3591 ff.

[146]Standards of Performance for New Stationary Sources for Stationary Gas Turbines, *Fed Regist.* **1979,** *44*, 52798 ff.

[147]E.H. Pechan & Associates, Inc. and Industrial Economics, Inc., *Direct Cost Estimates for the Clean Air Act Second Section 812 Prospective Analysis Draft Report*; Technical Report for U.S. EPA, Office of Air and Radiation: 2009, 7-6 to 7-7.

[148]U.S. Environmental Protection Agency. Petroleum Refinery National Initiative Case Results, http://www.epa.gov/compliance/resources/cases/civil/caa/oil (accessed Apr 3, 2011).

[149] *Performance Profiles of Major Energy Producers 2009*, EIA (2010).

KEYWORDS

Refining Industry, Clean Air Act, Greenhouse Gas Control Costs, Emission Control Costs, Criteria Pollutant Current Cost Impacts, Proposed Ozone National Ambient Air Quality Standards, EPA Disapproval of Texas "Flexible" Permits, 15 Percent Ethanol ("E15") and the Renewable Fuels Standard, Refinery Closures

