CHAPTER 4. EMISSIONS CONTROL ANALYSIS: DESIGN AND ANALYTIC RESULTS

This chapter documents the illustrative emission control strategy we applied to simulate attainment with the selected standard and alternative standards. Section 4.1 describes the approach we followed to select cost-effective emissions controls to simulate attainment in each geographic area of analysis. Section 4.2 summarizes the emission reductions we simulated in each area based on current knowledge of emissions controls applicable to existing sources of lead emissions, while Section 4.3 presents the air quality impacts of these emissions reductions. Section 4.4 discusses the application of additional controls, beyond those already known to be available, that we estimate will be necessary to reach attainment in certain monitor areas. Section 4.5 discusses key limitations in the approach we used to estimate the optimal control strategies for each alternative standard.

4.1. Estimation of Optimal Emissions Control Strategies

Our analysis of the emissions control measures required to meet the selected standard and alternative standards is limited to controls for point source emissions at active sources inventoried in the 2002 NEI. [Note that while airports are included as point sources in the NEI, our analysis considers the impact of emissions from use of leaded aviation gasoline (avgas) at airports, but does not consider controls on those emissions as a strategy for compliance. EPA received a petition from Friends of the Earth requesting that the Agency find that aircraft lead emissions may reasonably be anticipated to endanger the public health or welfare, and to take action to control lead emissions from piston-engine aircraft. We published a Federal Register notice discussing the petition and requested comment on specific aspects of the use of leaded avgas and potential control of lead emissions from the consumption of avgas.[1]] As discussed in Chapter 3, a portion of ambient lead concentrations can be attributed not to point sources but to miscellaneous re-entrained dust and area nonpoint emissions. Nevertheless, this RIA deals only with the application of controls on emissions at active non-aviation point sources, including stack emissions and fugitive emissions from industrial processes.

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[1] The petition requested that EPA find that such emissions cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare. And, if EPA makes such a finding, the petitioner requested that EPA take steps to reduce lead emissions under the authority of the Clean Air Act Section 231 Approximately 70 different parties commented on the petition and the questions presented in the notice (72 FR 64570, November 16, 2007). These comments can be found in EPA public docket OAR-2007-0294 (at www.regulations.gov). A clear theme in many of the comments was the dependence of much of the current piston-powered aircraft fleet on leaded avgas either because of engine design, performance demands, or lack of mogas availability at airports. However, several comments identified potential near and longer term measures to reduce these lead emissions. These potential measures fall into five general categories: (1) Continued work on identifying fuel blends or additives which would provide the octane and other performance characteristics needed for a transparent fuel replacement, (2) Measures to ensure greater availability of ethanol-free unleaded avgas at airports for those aircraft which otherwise could use it, (3) Laboratory and field work to assess the potential to reduce the amount of lead now added to current leaded avgas, (4) Add-on engine technology or fuel management technology to allow for equivalent engine performance at lower avgas octane ratings and (5) Long-term measures or standards for new engines which provide the needed and desired performance characteristics using modified engine designs and calibrations on fuels or fuel blends not containing lead. For more information about the petition, see http://www.epa.gov/otaq/aviation.htm.

To simulate attainment with the selected standard and the five regulatory alternatives considered in all 21 monitor areas, we first modeled the most cost-effective application of identified emissions controls in each area, using the following four-step process:

1. Specification of baseline emissions for inventoried point sources in each geographic area of analysis.

2. Identification of potential controls for inventoried point sources.

3. Identification of an alternative lead abatement strategy for the primary lead smelter in Jefferson County, Missouri.

4. Identification of the least cost strategy for using point source controls.

In areas where identified emissions controls were not sufficient to reach attainment with one or more of the alternative standards considered, we also simulated emission reductions needed beyond identified controls at inventoried point sources. Further discussion of theseunspecified emission reductions is presented in Section 4.4.

The analysis used for the Final Rule differs from that presented in the Proposed Rule RIA in the following ways:

1. We no longer remove from consideration all identified controls with a cost/ton higher than the 98th percentile of control costs at point sources emitting more than 0.05 tons/year of lead. This was described as the "Stage 3 Filter in the Proposed Rule RIA."

2. We updated control efficiency and cost information for many of the identified emission controls used in the Proposed Rule RIA, after determining that the prior values were unlikely to reflect the performance and cost of these controls in 2016, the analysis year for this RIA.

3. Rather than applying PM emission controls to the primary lead smelter in Jefferson County, Missouri, we simulated a complete rebuild of the smelter to utilize a less-polluting smelting process.

4. We modified the analysis of emission reductions needed beyond identified controls such that these reductions are distributed across all sources in areas projected to violate any alternate standard. In the Proposed Rule analysis, these reductions were achieved by controls applied to a limited number of sources.

These changes to the analysis relative to the Proposed Rule RIA are described in greater detail throughout this chapter.

4.1.1. Specification of Baseline Lead Emissions for Inventoried Point Sources in Each Geographic Area of Analysis.

For most sources, lead emissions as specified in the 2002 National Emissions Inventory (NEI) served as the baseline for our analysis. However, for some sources (e.g., natural gas-fired utility boilers), we corrected the 2002 NEI lead emissions data with updated information. As discussed in Chapter 2, we did not apply growth factors to the 2002 NEI emissions estimates to predict emissions in 2016 (the analysis year for this RIA) because we believe that the number of Pb emitting sources will not increase with population growth. We did, however, adjust the 2002 NEI lead emissions values to reflect anticipated emissions controls necessary to comply with other regulations that have compliance deadlines after 2002, wherever possible. These adjustments included application of MACT for air toxics rules with post 2002 compliance deadlines,[2] PM controls at sources in designated nonattainment areas in the 2006 revisions to the $PM_{2.5}$ NAAQS as modeled in the illustrative control strategy in the $PM_{2.5}$ NAAQS RIA,[3] and controls planned for the primary lead smelter in Jefferson County, Missouri, as part of the 2007 Missouri lead SIP (at the one current nonattainment area for ambient lead under the Federal CAA).[4] After applying these adjustments to all affected point sources, the remaining lead emissions served as our baseline for the application of identified controls. Table 4-1 illustrates the process used to specify the baseline lead emissions for inventoried point sources in the analysis.

Table 4-1.
TOTAL BASELINE LEAD EMISSIONS FOR ALL INVENTORIED POINT SOURCES IN 23 DESIGNATED MONITOR AREAS

Original Baseline: 2002 NEI Emissions (point sources, excluding airports)	109.2 tons/year (tpy)
2002 NEI Emissions adjusted for PM NAAQS controls	109.0 tpy
2002 NEI Emissions adjusted for PM NAAQS and Missouri SIP controls	101.2 tpy
Final Baseline: 2002 NEI Emissions adjusted for PM NAAQS, Missouri SIP, and MACT controls	99.7 tpy

Following the same process as described above, we also specified baseline PM_{10} and $PM_{2.5}$ emissions for all inventoried point sources. Although the non-lead fraction of PM emissions did not play a role in simulating attainment with the selected standard and alternative standards, we did use these baseline values to estimate the ancillary benefits of co-controlling PM emissions in the process of implementing lead control strategies, as discussed in Chapter 5. Recent promulgation of mobile source rules that reduce PM is not relevant for this analysis.

4.1.2. Identification of Potential Controls for Inventoried Point Sources.

To identify point source lead emissions controls for our analysis, we collected information on PM control technologies, assuming that the control efficiency for PM emissions would also apply to lead emissions. We collected this information in the following way:

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[2] The MACT standards included covered the following industries: Integrated Iron and Steel Manufacturing; Iron and Steel Foundries; Petroleum Refineries; Secondary Aluminum Production; Industrial/Commercial/Institutional Boilers & Heaters – Coal; Pressed and Blown Glass and Glassware Manufacturing; Primary Nonferrous Metals – Zinc, Cadmium, and Beryllium; Secondary Nonferrous Metals; and Primary Copper Smelting.

[3] Available at http://www.epa.gov/ttn/ecas/ria.html

[4] This lead SIP was finalized by EPA on April 14, 2006 with a requirement that this SIP will provide attainment with the current lead standard by April 7, 2008. The SIP is available at: http://www.dnr.mo.gov/env/apcp/docs/2007revision.pdf

1. We queried EPA's AirControlNET database for information on potential PM controls available for each source, accounting for any control measures already in place, according to the 2002 NEI.[5]

2. For sources with Standard Industrial Classifications (SICs) but without identified NEI Source Classification Codes (SCCs), we used the SIC/SCC crosswalk in Appendix C of AirControlNET's Documentation Report to identify SCCs for those sources.[6] We then found controls in AirControlNET's database associated with these SCCs.

3. EPA identified additional controls from technical documents prepared in support of New Source Performance Standards, EPA memos prepared to support analyses for the $PM_{2.5}$ RIA, and operating permits that apply to facilities with similar SCCs as the point sources in our analysis. These controls include the following:

    - ***Capture hoods vented to a baghouse at iron and steel mills.*** Virtually all iron and steel mills have some type of PM control measure, but there is additional equipment that could be installed to reduce emissions further. Capture hoods that route PM emissions from a blast furnace casthouse to a fabric filter can provide 80 to 90 percent additional emission reductions from an iron or steel mill.

    - ***Diesel particulate filter (for stationary sources such as diesel generators).*** This control incorporates directly-emitted $PM_{2.5}$ reductions from stationary internal combustion engines that will be affected by the compression-ignition internal combustion engine new source performance standard (NSPS) promulgated on June 28, 2006. Diesel particulate filters (DPF) are likely to be the control technology required for these engines to meet the NSPS requirements. The control is applied here as a retrofit to existing stationary internal combustion engines in our inventory. Based on the technical support documents prepared for the final compression-ignition NSPS, the $PM_{2.5}$ control efficiency for DPF is 90 percent.[7]

    - ***Upgrade of CEMs and increased monitoring frequency of PM controls (for sources where not already identified as a control by ACN).*** This control is an upgrade to existing control measures or an improvement in control efficiency due to how existing control measures operate from increases in monitoring. Such controls can lead to small reductions in PM emissions (5 to 7 percent).[8]

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[5] Documentation available at http://www.epa.gov/ttnecas1/models/DocumentationReport.pdf. AirControlNET's database of PM controls normally excludes sources emitting fewer than 10 tons/year of PM_{10}. Because many of the point sources included in our analysis fall below this threshold and because this analysis focuses entirely on obtaining emission reductions from point sources, we effectively reduced the threshold from 10 tons/year to zero in order to identify controls for a larger number of inventoried point sources.

[6] Available at http://www.epa.gov/ttnecas1/models/DocumentationReport.pdf.

[7] U.S. Environmental Protection Agency. "Emission Reduction Associated with NSPS for Stationary CI ICE." Prepared by Alpha-Gamma, Inc. June 3, 2005, and U.S. Environmental Protection Agency. "Cost per Ton for NSPS for Stationary CI ICE." Prepared by Alpha-Gamma, Inc. June 9, 2005.

[8] U.S. Environmental Protection Agency. Regulatory Impact Analysis for the Particulate Matter NAAQS. October, 2006. Appendix E, pp. E-16 to E-24. This document is available at http://www.epa.gov/ttn/ecas/regdata/RIAs/Appendix%20E--Controls%20List.pdf.

4. In response to the degree of residual nonattainment found in a number of monitor areas in the Proposed Rule analysis, we reviewed the PM control measures in our databases in order to determine if the data for these measures were fully up to date and appropriate for an analysis year of 2016. In the course of our review, we found that the control efficiencies for a variety of PM control measures as applied in our proposal RIA were quite conservative (i.e., more likely to be underestimates than overestimates) for control strategy analyses to be conducted for 2016. A number of recent EPA references provided findings that showed that increases in PM control efficiencies from those applied in our proposal RIA were reasonable for a future year analysis. Based on these findings, we increased the control efficiencies and costs for a number of the PM control measures in our database, as summarized below:[9]

    - ***Dry and Wet ESPs:*** Control efficiency modified from 95 percent to 99 percent.

    - ***Fabric Filters (pulse jet type and mechanical shaker type):*** Control efficiency modified from 99.5 percent to 99.9 percent.

    - ***Venturi Scrubbers:*** For those source classification codes (SCCs) to which AirControlNET applies a control efficiency of 50 percent, we modified this value to 90 percent for the 2016 target year. For SCCs, where the control efficiency in AirControlNET is 25 percent, we adjusted this value to 70 percent.

    - ***Paper/Nonwoven Filters – Cartridge Collectors:*** The AirControlNET control efficiency value of 99 percent was modified to 99.5 percent.

Completion of the procedure outlined above yielded identified controls for about 43 percent of the total inventoried point sources in our analysis. However, because of the skewed distribution of lead emissions in the 2002 NEI (the top 10 percent of inventoried point sources account for more than 97 percent of total lead emissions), these sources accounted for approximately 92 percent of total lead emissions, as shown in Table 4-2.

Table 4-2.
PROFILE OF INVENTORIED POINT SOURCES, WITH AND WITHOUT IDENTIFIED CONTROLS

	Count	Percent of Total	Emissions (tons/year)	Percent of Total
Sources with Identified Controls[1]	266	42.6%	91.8	92.1%
Sources without Identified Controls	359	57.4%	7.9	7.9%
Total	**625**	**100.0%**	**99.7**	**100.0%**

[1] Identified controls, as represented in this table, include the potential rebuild of the primary lead smelter in Jefferson County, MO, as described in greater detail below. Therefore, all emissions sources at this facility are included in this table as sources with identified controls.

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[9] PM control efficiencies were increased for the following control measures: dry and wet ESPs, all types of fabric filters, venturi scrubbers, impingement-plate/tray-tower scrubbers, and paper/nonwoven filters - cartridge collectors. We also revised the capital and annualized costs for these control devices to reflect the increased control efficiencies associated with these control measures, as discussed in Chapter 6.

Controls identified through this process include major emissions controls, such as fabric filters, impingement-plate scrubbers, and electrostatic precipitators; and minor controls, such as increased monitoring frequency, upgrades to continuous emissions monitors, and diesel particulate filters. For each identified control, we identified both the expected control efficiency for the technology and the annualized cost of installing and operating the control.[10] For those point sources where the 2002 NEI indicated that control measures were already in place, we estimated the effective emissions control efficiency for each identified control by estimating the emissions reductions that would result if the pre-existing control were replaced by the identified control technology. For example, while a fabric filter might have an expected control efficiency of 90 percent when installed in the absence of pre-existing controls, if it were applied at a source that already had an electrostatic precipitator with an 80 percent control efficiency, the *effective* control efficiency of the Fabric Filter would be 50 percent.[11] We also assumed that each identified control technology would be installed in addition to any controls required under the 2006 $PM_{2.5}$ NAAQS and any MACT rules with enforcement dates after 2002, but before 2016. We therefore applied each control's effective control efficiency to the adjusted baseline lead emissions at each inventoried point source.[12]

4.1.3. Identification of an Alternative Lead Abatement Strategy for the Primary Lead Smelter in Jefferson County, Missouri.

In the Proposed Rule analysis, a significant portion of the estimated costs of the rule—ranging from 55 percent for the 0.05 $\mu g/m^3$ standard alternative to 95 percent for the 0.3 $\mu g/m^3$ standard alternative - represented reductions beyond identified controls at the primary lead smelter in Jefferson County, Missouri. To reduce the extent to which the costs and emissions reductions associated with the lead NAAQS depend on reductions beyond identified controls for a single source, we have modeled the replacement of the primary lead smelter in Jefferson County with a more modern, lower-emitting smelter, utilizing the Kivcet smelting process, as a means of reducing the facility's lead emissions. The Kivcet process is currently employed at the primary lead smelter operated by Teck Cominco in Trail, British Columbia, as well as in plants in Kazakhstan, Bolivia, and Italy.[13] While it may be more cost-effective for the facility to implement more targeted emissions controls under the selected standard, information on such controls is not available.

To estimate the emissions reductions associated with transitioning to Kivcet technology at the smelter in Jefferson County, we relied on emissions data for Teck Cominco's Trail, British Columbia, facility, which began using the Kivcet process in 1997. We derived lead emissions per ton of lead produced at this facility by obtaining lead emission values from Canada's

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[10] See Chapter 6 for a detailed discussion of how annualized control costs were estimated.

[11] With the electrostatic precipitator, 20 percent of the source's original, uncontrolled emissions would remain uncontrolled, but with the fabric filter, only 10 percent of the source's original emissions would remain uncontrolled. Thus, replacing the electrostatic precipitator with the fabric filter would represent a 50 percent (10/20 = 0.5) decrease in uncontrolled emissions.

[12] The one exception to this assumption is the installation of capture hoods vented to baghouses, a control included at some sites as part of the control strategies applied for the 2006 $PM_{2.5}$ revised NAAQS RIA. Because baghouses are major controls which would be replaced by the installation of any other major control, we applied the effective control efficiency of major controls to the *unadjusted* baseline emissions at any site with a capture hood installed.

[13] The Eastern Mining and Metallurgical Research Institute for Non-Ferrous Metals, Pyrometallurgy. http://vcm.ukg.kz/eng/v3_6.htm. Accessed September 23, 2008.

National Pollutant Release Inventory (NPRI)[14] and annual lead production values from Teck Cominco's annual reports. Taking the average value for the past five years for which NPRI data are available, we estimated that the Trail, BC, facility emits 0.07 pounds of lead for every ton of lead produced using its Kivcet smelter. Applying this emissions rate to the facility in Jefferson County, which produced 150,000 thousand tons of lead in 2002, we estimate lead emissions of 5.50 tons per year for this facility.[15] This represents an 89 percent reduction in lead emissions relative to the facility's baseline emissions of 51 tons per year. When modeling this lead emissions control strategy, we divided these reductions among the emissions sources at the Jefferson County primary lead smelter in proportion to each source's 2002 NEI emissions.

4.1.4. Identification of the Optimal Strategy for Using Point Source Controls to Reach Attainment in Each Area.

To identify the least-cost approach for reaching attainment in each area projected to violate the NAAQS, EPA developed a linear programming optimization model that systematically evaluates the air quality and cost information discussed below and in Chapter 6 to find the optimal control strategy for each area. The optimization model first identifies the measures that each source would implement if it were controlled as part of a local lead attainment strategy. Based on these controls, the optimization model then identifies sources to control such that each area would reach attainment at the least aggregate cost possible for the area. Minimizing total costs across all sources is not always equivalent to minimizing marginal costs at each source. Therefore, although the model selects major controls for each source by minimizing the marginal cost/ton of lead controlled at the source, the objective for each area is to minimize total costs associated with reaching attainment. It should be noted that unlike major controls, all minor controls identified can be implemented in conjunction with other controls, so the optimization model selects all minor controls as well.

Rather than considering all emissions controls at every inventoried point source, the optimization model utilizes a two-stage filtering process to select only the most cost-effective controls at sources making a significant impact on ambient air quality. The stages are as follows:

1. ***Stage 1 filter:*** First, the model selects all controls at sources deemed "relevant" by virtue of the fact that they account for at least 0.001 percent of all point source contributions to the ambient lead concentration in their monitor area. This stage mostly affects monitor areas with large numbers of inventoried point sources, such as Dakota County, Minnesota, where 105 out of 126 inventoried sources do not meet the 0.001 percent threshold.

2. ***Stage 2 filter:*** Because we identified multiple major emissions controls for many sources, the second stage of the model assumes that the most cost-effective major control for each relevant source would be installed, as determined by the cost/ton of lead emissions reduced. For example, consider a source that could install either an electrostatic precipitator (ESP) that would reduce lead emissions by 0.1 tons/year with an annualized cost of $1 million or a

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[14] Available at http://www.ec.gc.ca/pdb/npri/npri_home_e.cfm. Communication with David Niemi, Head Emissions Inventory Reporting and Outreach at Environment Canada, confirmed that the methods used to collect the NPRI were comparable to the methods used to collect the NEI.

[15] The estimate of 2002 lead production at this smelter comes from The Doe Run Company, Primary Mining and Smelting Division, *2002 Annual Report to our Community.*

fabric filter that would reduce lead emissions by 0.11 tons/year at a cost of $2 million/year. Because the cost/ton is lower for the ESP, the optimization model assumes that the source would (potentially) install the ESP rather than the fabric filter.[16]

In the Proposed Rule RIA, we implemented a third filter, in which we removed from consideration all point source controls with a cost/ton higher than the 98th percentile of control costs at point sources emitting more than 0.05 tons/year of lead. For this analysis, we have eliminated that filter, in order to maximize the emission reductions achieved with identified controls.

After selecting the most cost-effective emissions controls at all relevant point sources for each monitor area, the model then proceeds to evaluate every possible combination of control technologies until the monitor area reaches attainment with the selected standard or alternative standard at the lowest possible cost. If the monitor area is already in attainment with the selected standard, the model applies no controls. On the other hand, if the monitor area is unable to reach attainment with the selected standard when all cost-effective controls at relevant sources are applied, then the model assumes that all sources in the area are controlled, including those that account for less than 0.001 percent of point source contributions in the area (i.e., the model eliminates the stage 1 filter described above and thus applies controls to smaller sources).

As indicated above, this approach is not the equivalent of moving up the marginal abatement cost curve for lead. If the control strategy were selected based on the marginal cost per $\mu g/m^3$ reduced, we would not necessarily identify the least-cost strategy for attainment in each area.

4.2. Lead Emissions Reductions Achieved with each Control Strategy

Utilizing the optimization model described above, we determined the most cost-effective control strategies required to meet attainment at the largest number of monitor areas.[17] Table 4-3 presents the lead emissions reductions realized at each monitor area under the control strategies followed for each alternative standard.

4.3. Impacts Using Identified Controls

Following the steps described in Section 3.2, we estimated the overall change in ambient air quality achieved as a result of each of the control strategies identified in the AirControlNET-based emissions analysis. Table 4-4 presents a detailed breakdown of the estimated ambient lead

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[16] If there are two available control options, the least-cost approach chooses the option with a lower cost/ton. It does this even if a slightly more expensive control option can achieve greater emission reduction. Although in theory this filter could cause some emission reduction to be missed, in practice, the impact is negligible. For example, in the simulation of attainment with the 0.1 $\mu g/m^3$ standard, removal of this filter increases the emission reduction by less than 0.0001 tons per year.

[17] As will be discussed below, the application of identified controls was insufficient to bring all monitor areas into compliance with the selected standard and the alternative standards.

concentrations in 2016 at each of the 21 monitor sites under the selected standard and the five alternative standards described in Chapter 1.

According to the data presented in Table 4-4, 13 of the 21 monitor areas are expected to reach attainment with the selected standard of 0.15 $\mu g/m^3$ following implementation of the controls identified in the AirControlNET analysis (i.e., identified controls). In addition, 20 areas are expected to reach attainment with identified controls under a NAAQS of 0.5 or 0.4 $\mu g/m^3$. For the most stringent alternative considered, 0.1 $\mu g/m^3$, 9 of the 21 monitors are expected to reach attainment following the application of identified controls. For some areas, identified controls are not sufficient to reach attainment with the selected standard.

The failure of certain areas to reach attainment with identified controls partially reflects the lack of control information for point sources in these areas. As indicated in Table 4-5, emissions from sources for which the AirControlNET analysis identified no controls contribute to a significant portion of the ambient lead concentration in many of the areas not projected to reach attainment with the selected standard and four alternative standards. For such sources in areas projected to violate the NAAQS with the application of identified controls, we assume that emission reductions beyond identified controls will be applied, as discussed further below.

Table 4-6 presents the additional air quality change needed for monitor areas that did not attain at least one of the alternative standards analyzed in this RIA. In addition, Figure 1 presents the additional air quality improvement needed in each monitor area that did not attain the 0.15 ug/m3 selected standard with the application of identified controls. This figure illustrates that the progress made through the application of identified controls varies greatly by monitor area.

FIGURE 1.
AIR QUALITY CHANGE ACHIEVED THROUGH APPLICATION OF IDENTIFIED CONTROLS AND ADDITIONAL INCREMENT NEEDED TO REACH ATTAINMENT OF SELECTED STANDARD 0.15 UG/M3

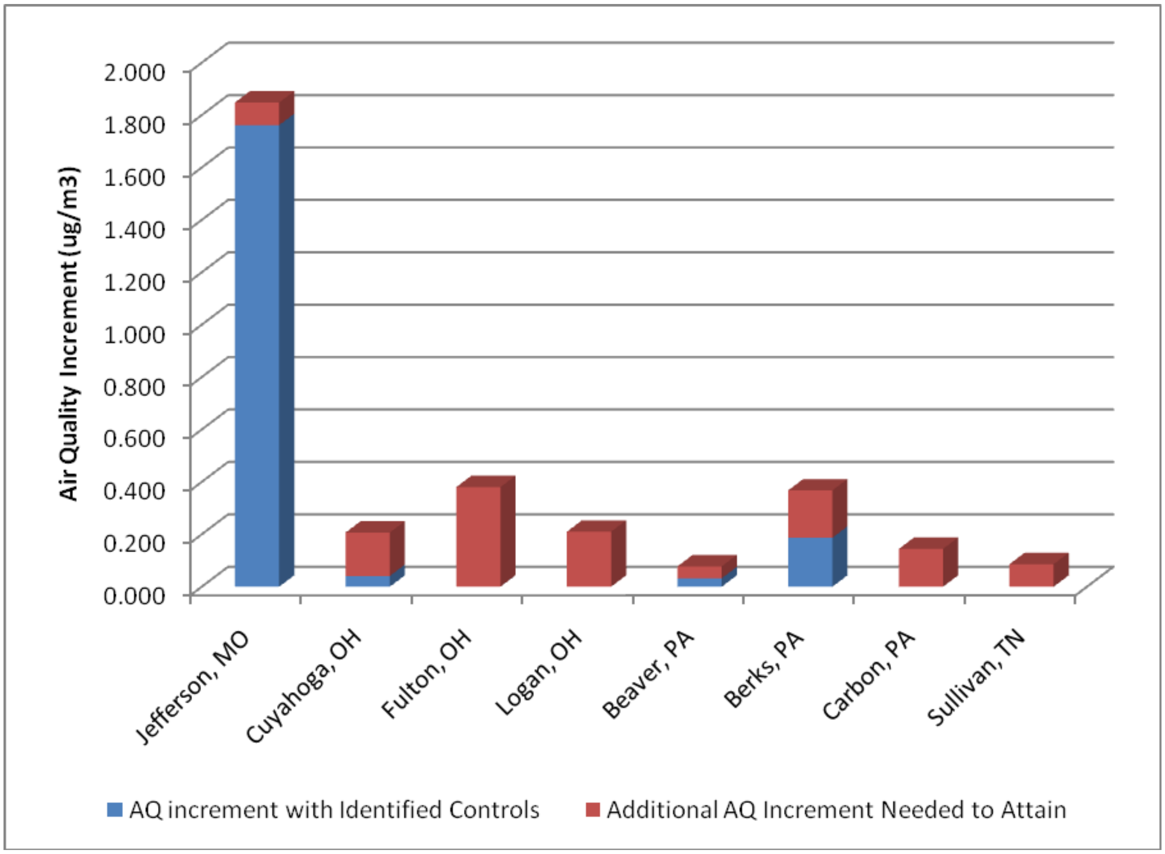


TABLE 4-3.
REDUCTION IN LEAD EMISSIONS UNDER ALTERNATIVE NAAQS AT EACH MONITOR AREA, IDENTIFIED CONTROLS ONLY

Monitor State	Monitor County	Baseline Lead Emissions in 2016	Reduction in Lead Emissions (tpy)					
			Standard Alternative: 0.5 µg/m^3 2nd Maximum Monthly Mean	Standard Alternative: 0.4 µg/m^3 2nd Maximum Monthly Mean	Standard Alternative: 0.3 µg/m^3 2nd Maximum Monthly Mean	Standard Alternative: 0.2 µg/m^3 2nd Maximum Monthly Mean	Selected Standard: 0.15 µg/m^3 2nd Maximum Monthly Mean	Standard Alternative: 0.1 µg/m^3 2nd Maximum Monthly Mean
AL	Pike	4.45	4.02	4.02	4.02	4.13	4.31	4.31
CO	El Paso	0.95	0.00	0.00	0.00	0.00	0.00	0.00*
FL	Hillsborough	1.48	1.00	1.00	1.09	1.19	1.19	1.26
IL	Madison	0.53	0.00	0.00	0.00	0.00	0.00	0.09*
IN	Delaware	1.53	1.37	1.37	1.40	1.42	1.44	1.46
MN	Dakota	3.55	0.00	0.00	0.00	0.00	1.29	3.07
MO	Iron	16.12	12.26	12.26	12.26	12.26	12.26	12.26
MO	Jefferson	51.02	45.52	45.52	45.52	45.52*	45.52*	45.52*
NY	Orange	1.80	0.00	0.00	0.00	1.39	1.39	1.39
OH	Cuyahoga	0.94	0.00	0.00	0.13*	0.13*	0.13*	0.13*
OH	Fulton	0.49	0.14*	0.14*	0.14*	0.14*	0.14*	0.14*
OH	Logan	0.12	0.00	0.00	0.00*	0.00*	0.00*	0.00*
OK	Ottawa	0.00	0.00	0.00	0.00	0.00	0.00	0.00*
PA	Beaver	4.28	0.00	0.00	0.00	0.64	0.73*	0.73*
PA	Berks	2.16	1.00	1.02	1.61*	1.61*	1.61*	1.61*
PA	Carbon	0.45	0.00	0.00	0.00	0.00*	0.00*	0.00*
TN	Sullivan	0.38	0.00	0.00	0.00	0.00*	0.00*	0.00*
TN	Williamson	2.55	1.25	1.35	1.95	2.00	2.19	2.32
TX	Collin	3.18	2.19	2.19	2.20	2.69	2.75	2.95
TX	Dallas	0.06	0.00	0.00	0.00	0.00	0.00	0.00*
UT	Salt Lake	3.66	0.00	0.00	0.00	0.00	0.00	0.62
Total		**99.7**	**68.74**	**68.86**	**70.31**	**73.11**	**74.96**	**77.87**

* Indicates monitor area does not reach attainment using identified controls.

Table 4-4.
AMBIENT LEAD CONCENTRATIONS ACHIEVED WITH IDENTIFIED CONTROLS UNDER THE ALTERNATIVE STANDARDS IN 2016

Monitor State	**Monitor County**	**Baseline Lead Concentration in 2016**	**Ambient Lead Concentration (µg/m3)**					
			Standard Alternative: 0.5 µg/m^3 2nd Maximum Monthly Mean	**Standard Alternative: 0.4 µg/m^3 2nd Maximum Monthly Mean**	**Standard Alternative: 0.3 µg/m^3 2nd Maximum Monthly Mean**	**Standard Alternative: 0.2 µg/m^3 2nd Maximum Monthly Mean**	**Selected Standard: 0.15 µg/m^3 2nd Maximum Monthly Mean**	**Standard Alternative: 0.1 µg/m^3 2nd Maximum Monthly Mean**
AL	Pike	2.420	0.256	0.256	0.256	0.197	0.098	0.098
CO	El Paso	0.131	0.131	0.131	0.131	0.131	0.131	0.131*
FL	Hillsborough	1.380	0.327	0.327	0.222	0.123	0.123	0.049
IL	Madison	0.128	0.128	0.128	0.128	0.128	0.128	0.104*
IN	Delaware	5.022	0.397	0.397	0.285	0.199	0.148	0.078
MN	Dakota	0.192	0.192	0.192	0.192	0.192	0.127	0.039
MO	Iron	1.454	0.091	0.091	0.091	0.091	0.091	0.091
MO	Jefferson	1.998	0.236	0.236	0.236	0.236*	0.236*	0.236*
NY	Orange	0.240	0.240	0.240	0.240	0.085	0.085	0.085
OH	Cuyahoga	0.357	0.357	0.357	0.316*	0.316*	0.316*	0.316*
OH	Fulton	0.530	0.530*	0.530*	0.530*	0.530*	0.530*	0.530*
OH	Logan	0.360	0.360	0.360	0.360*	0.360*	0.360*	0.360*
OK	Ottawa	0.114	0.114	0.114	0.114	0.114	0.114	0.114*
PA	Beaver	0.228	0.228	0.228	0.228	0.200	0.196*	0.196*
PA	Berks	0.518	0.404	0.400	0.331*	0.331*	0.331*	0.331*
PA	Carbon	0.294	0.294	0.294	0.294	0.294*	0.294*	0.294*
TN	Sullivan	0.236	0.236	0.236	0.236	0.236*	0.236*	0.236*
TN	Williamson	0.820	0.429	0.398	0.212	0.198	0.137	0.097
TX	Collin	0.891	0.302	0.302	0.300	0.168	0.150	0.098
TX	Dallas	0.101	0.101	0.101	0.101	0.101	0.101	0.101*
UT	Salt Lake	0.107	0.107	0.107	0.107	0.107	0.107	0.093

* Indicates that this monitor area did not reach attainment with the alternative standard.

TABLE 4-5.
BASELINE LEAD CONCENTRATIONS IN µg/m^3 IN AREAS WITH MONITORED CONCENTRATIONS GREATER THAN ANY OF THE ALTERNATIVE STANDARDS USING ONLY IDENTIFIED CONTROLS

Monitor State	Monitor County	Baseline Pb Concentration in 2016	Pb Concentration related to area non-point emissions and misc. re-entrained dust	Baseline Pb Concentration related to indirect fugitive and point source emissions		Total concentration associated with sources for which no control information available
				Point sources with no Identified Controls	Point sources with Identified Controls	
CO	El Paso	0.131	0.024	0.101	0.006	0.125
IL	Madison	0.128	0.024	0.000	0.104	0.024
MO	Jefferson	1.998	0.023	0.000	1.975	0.023
OH	Cuyahoga	0.357	0.027	0.288	0.042	0.315
OH	Fulton	0.530	0.025	0.505	0.000	0.530
OH	Logan	0.360	0.027	0.333	0.000	0.360
OK	Ottawa	0.114	0.023	0.091	0.000	0.114
PA	Beaver	0.228	0.027	0.000	0.201	0.027
PA	Berks	0.518	0.037	0.275	0.205	0.312
PA	Carbon	0.294	0.036	0.259	0.000	0.294
TN	Sullivan	0.236	0.024	0.212	0.000	0.236
TX	Dallas	0.101	0.046	0.055	0.000	0.101

TABLE 4-6.
ADDITIONAL AIR QUALITY INCREMENT (µg/m^3) POST APPLICATION OF IDENTIFIED CONTROLS IN AREAS WITH MONITORED CONCENTRATIONS GREATER THAN ANY OF THE ALTERNATIVE STANDARDS

Monitor State	Monitor County	Standard Alternative: 0.5 µg/m^3 2nd Maximum Monthly Mean	Standard Alternative: 0.4 µg/m^3 2nd Maximum Monthly Mean	Standard Alternative: 0.3 µg/m^3 2nd Maximum Monthly Mean	Standard Alternative: 0.2 µg/m^3 2nd Maximum Monthly Mean	Selected Standard: 0.15 µg/m^3 2nd Maximum Monthly Mean	Standard Alternative: 0.1 µg/m^3 2nd Maximum Monthly Mean
CO	El Paso						0.031
IL	Madison						0.004
MO	Jefferson				0.036	0.086	0.136
OH	Cuyahoga			0.016	0.116	0.166	0.216
OH	Fulton	0.030	0.130	0.230	0.330	0.380	0.430
OH	Logan			0.060	0.160	0.210	0.260
OK	Ottawa						0.014
PA	Beaver					0.046	0.096
PA	Berks			0.031	0.131	0.181	0.231
PA	Carbon				0.094	0.144	0.194
TN	Sullivan				0.036	0.086	0.136
TX	Dallas						0.001

4.4. Emission Reductions Needed Beyond Identified Controls

As discussed above, some monitor areas did not reach attainment with the selected standard or alternative standards through the application of identified controls alone in these illustrative control scenarios. In order to bring these monitor areas into attainment, we simulated the effects of unspecified emission reductions beyond identified controls. The manner in which these reductions would be achieved is yet to be determined.

4.4.1. Application of Unspecified Emission Reductions to Point Sources in Areas Projected to Violate the Standard Alternatives with the Application of Identified Controls

To model emission reductions beyond identified controls, we assumed that all point sources in an area projected to violate a standard alternative (excluding airports) would be controlled with measures employing the same control efficiency. To simulate attainment with each alternative standard, we find the minimum control efficiency required to bring each area's second maximum monthly mean lead concentration exactly to the level of the standard alternative considered. As a result, the effective control efficiency applied to point sources differs by area and by standard alternative. For example, for the 0.2 $\mu g/m^3$ standard alternative, we apply a control efficiency of 16.9 percent to all sources in Sullivan County, Tennessee, but a control efficiency of 65.3 percent to all sources in Fulton County, Ohio. We multiply the appropriate control efficiency by the remaining emissions for each point source in each county. We then sum the point source emission reductions to get a total for each county.

This process differs from the method we used in the Proposed Rule RIA for modeling emission reductions beyond identified controls. In that analysis, we applied controls to a limited number of point sources, beginning with those sources closest to the monitor and proceeding outward until each area reached attainment. In this analysis, we instead apply the same control efficiency to all point sources within each area projected to violate any alternate standard.

4.4.2. Lead Emission Reductions Needed Beyond Identified Controls

After applying unspecified emission reductions beyond identified controls using the process described above, all monitor areas reached attainment with the 0.5 $\mu g/m^3$, 0.4 $\mu g/m^3$, 0.3 $\mu g/m^3$, 0.2 $\mu g/m^3$, and 0.15 $\mu g/m^3$ alternative standards. Under the 0.1 $\mu g/m^3$ standard alternative, however, Ottawa County, Oklahoma fails to reach attainment because there are no point sources of lead to control in this county. Table 4-7 presents the lead emissions reductions required to bring the maximum number of monitor areas into attainment with each standard alternative. Table 4-8 presents the lead emissions reductions realized for each monitor area based on both identified controls alone and emission reductions beyond identified controls. Tables 4-9 and 4-10 present the air quality impacts of these emissions reductions and summarize the number of areas reaching attainment with the application of identified controls and emission reductions beyond identified controls. Lastly, Figure 2 presents the quantity of emissions reductions needed through the identified controls analysis, and the emissions reductions needed beyond identified controls.

Table 4-7.
TOTAL LEAD EMISSIONS REMAINING AND LEAD EMISSIONS REDUCTIONS REQUIRED BEYOND IDENTIFIED CONTROLS TO REACH ATTAINMENT WITH THE ALTERNATIVE STANDARDS

Standard Alternative	**Lead emissions Remaining after applying identified controls (Tons/Year)**	**Additional emission reductions needed beyond identified controls (Tons/Year)**	**Emissions remaining after applying identified controls and unspecified emission reductions beyond identified controls (Tons/Year)**
0.5 µg/m^3 2nd Maximum Monthly Mean	30.96	0.02	30.94*
0.4 µg/m^3 2nd Maximum Monthly Mean	30.84	0.08	30.76*
0.3 µg/m^3 2nd Maximum Monthly Mean	29.39	0.29	29.10*
0.2 µg/m^3 2nd Maximum Monthly Mean	26.59	2.06	24.53*
0.15 µg/m^3 2nd Maximum Monthly Mean	24.74	4.79	19.95*
0.1 µg/m^3 2nd Maximum Monthly Mean	21.83	7.91	13.92**

* 21 out of 21 monitor areas reached attainment with this standard alternative using identified point source emissions controls and unspecified emission reductions.

** 20 out of 21 monitor areas reached attainment with this standard alternative using identified point source emissions controls and unspecified emission reductions.

Table 4-8.
REDUCTION IN LEAD EMISSIONS UNDER ALTERNATIVE STANDARDS AT EACH MONITOR AREA WITH IDENTIFIED CONTROLS AND UNSPECIFIED EMISSION REDUCTIONS BEYOND IDENTIFIED CONTROLS

Monitor State	**Monitor County**	**Baseline Lead Emissions in 2016**	**Reduction in Lead Emissions (tpy)**					
			Standard Alternative: 0.5 µg/m^3 2nd Maximum Monthly Mean	**Standard Alternative: 0.4 µg/m^3 2nd Maximum Monthly Mean**	**Standard Alternative: 0.3 µg/m^3 2nd Maximum Monthly Mean**	**Standard Alternative: 0.2 µg/m^3 2nd Maximum Monthly Mean**	**Selected Standard: 0.15 µg/m^3 2nd Maximum Monthly Mean**	**Standard Alternative: 0.1 µg/m^3 2nd Maximum Monthly Mean**
AL	Pike	4.45	4.02	4.02	4.02	4.13	4.31	4.31
CO	El Paso	0.95	0.00	0.00	0.00	0.00	0.00	0.27
FL	Hillsborough	1.48	1.00	1.00	1.09	1.19	1.19	1.26
IL	Madison	0.53	0.00	0.00	0.00	0.00	0.00	0.11
IN	Delaware	1.53	1.37	1.37	1.40	1.42	1.44	1.46
MN	Dakota	3.55	0.00	0.00	0.00	0.00	1.29	3.07
MO	Iron	16.12	12.26	12.26	12.26	12.26	12.26	12.26
MO	Jefferson	51.02	45.52	45.52	45.52	46.46	47.75	49.04
NY	Orange	1.80	0.00	0.00	0.00	1.39	1.39	1.39
OH	Cuyahoga	0.94	0.00	0.00	0.18	0.49	0.65	0.81
OH	Fulton	0.49	0.16	0.23	0.30	0.37	0.40	0.44
OH	Logan	0.12	0.00	0.00	0.02	0.06	0.08	0.09
OK	Ottawa	0.00	0.00	0.00	0.00	0.00	0.00	0.00*
PA	Beaver	4.28	0.00	0.00	0.00	0.64	1.69	2.74
PA	Berks	2.16	1.00	1.02	1.66	1.86	1.95	2.05
PA	Carbon	0.45	0.00	0.00	0.00	0.16	0.25	0.34
TN	Sullivan	0.38	0.00	0.00	0.00	0.06	0.15	0.24
TN	Williamson	2.55	1.25	1.35	1.95	2.00	2.19	2.32
TX	Collin	3.18	2.19	2.19	2.20	2.69	2.75	2.95
TX	Dallas	0.06	0.00	0.00	0.00	0.00	0.00	0.01
UT	Salt Lake	3.66	0.00	0.00	0.00	0.00	0.00	0.62
Total		**99.7**	**68.76**	**68.94**	**70.6**	**75.17**	**79.75**	**85.78**

* Indicates monitor area does not reach attainment with identified controls and unspecified emission reductions beyond identified controls. Ottawa, OK contains no point sources and a large Superfund site.

Table 4-9.
AMBIENT LEAD CONCENTRATIONS ACHIEVED WITH IDENTIFIED CONTROLS AND UNSPECIFIED EMISSION REDUCTIONS BEYOND IDENTIFIED CONTROLS UNDER ALTERNATIVE STANDARDS IN 2016

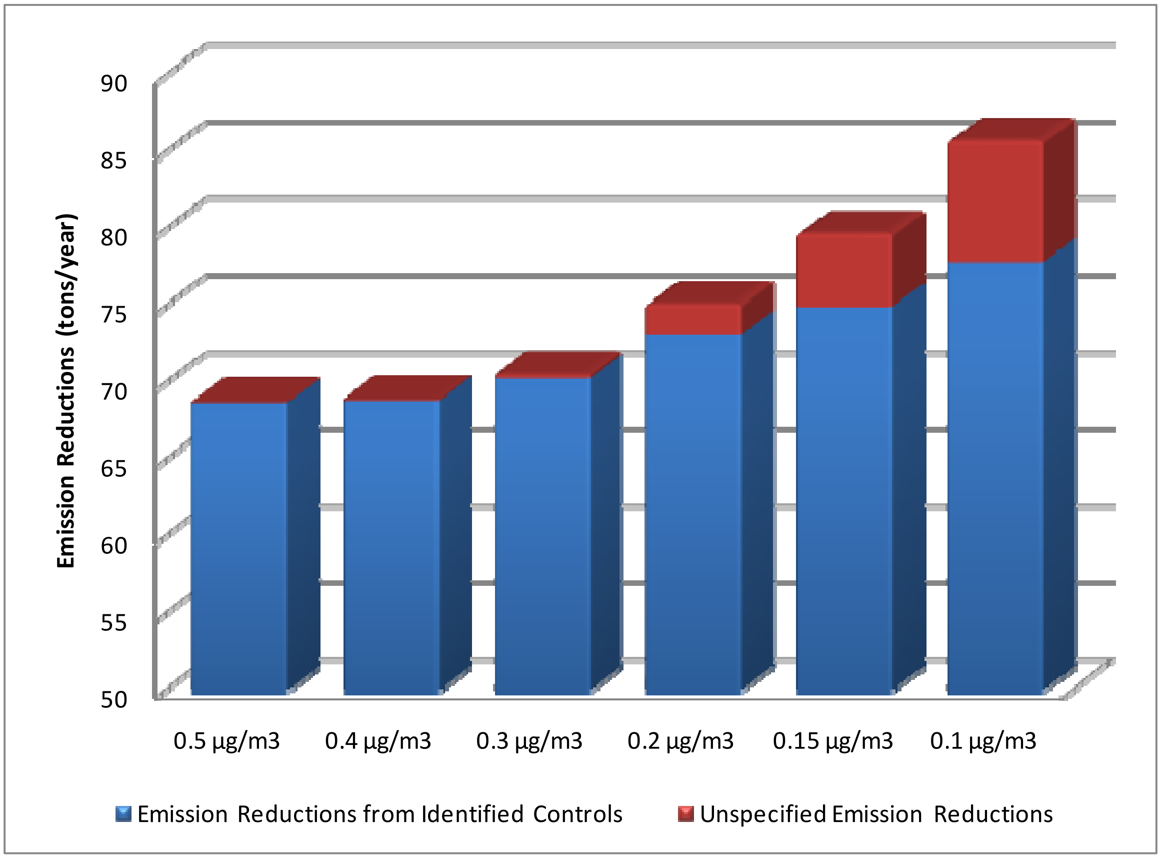
Monitor State	**Monitor County**	**Baseline Lead Concentration in 2016**	**Ambient Lead Concentration (μg/m3)**					
			Standard Alternative: 0.5 μg/m^3 2nd Maximum Monthly Mean	**Standard Alternative: 0.4 μg/m^3 2nd Maximum Monthly Mean**	**Standard Alternative: 0.3 μg/m^3 2nd Maximum Monthly Mean**	**Standard Alternative: 0.2 μg/m^3 2nd Maximum Monthly Mean**	**Selected Standard: 0.15 μg/m^3 2nd Maximum Monthly Mean**	**Standard Alternative: 0.1 μg/m^3 2nd Maximum Monthly Mean**
AL	Pike	2.420	0.256	0.256	0.256	0.197	0.098	0.098
CO	El Paso	0.131	0.131	0.131	0.131	0.131	0.131	0.100
FL	Hillsborough	1.380	0.327	0.327	0.222	0.123	0.123	0.049
IL	Madison	0.128	0.128	0.128	0.128	0.128	0.128	0.100
IN	Delaware	5.022	0.397	0.397	0.285	0.199	0.148	0.078
MN	Dakota	0.192	0.192	0.192	0.192	0.192	0.127	0.039
MO	Iron	1.454	0.091	0.091	0.091	0.091	0.091	0.091
MO	Jefferson	1.998	0.236	0.236	0.236	0.200	0.150	0.100
NY	Orange	0.240	0.240	0.240	0.240	0.085	0.085	0.085
OH	Cuyahoga	0.357	0.357	0.357	0.300	0.200	0.150	0.100
OH	Fulton	0.530	0.500	0.400	0.300	0.200	0.150	0.100
OH	Logan	0.360	0.360	0.360	0.300	0.200	0.150	0.100
OK	Ottawa	0.114	0.114	0.114	0.114	0.114	0.114	0.114*
PA	Beaver	0.228	0.228	0.228	0.228	0.200	0.150	0.100
PA	Berks	0.518	0.404	0.400	0.300	0.200	0.150	0.100
PA	Carbon	0.294	0.294	0.294	0.294	0.200	0.150	0.100
TN	Sullivan	0.236	0.236	0.236	0.236	0.200	0.150	0.100
TN	Williamson	0.820	0.429	0.398	0.212	0.198	0.137	0.097
TX	Collin	0.891	0.302	0.302	0.300	0.168	0.150	0.098
TX	Dallas	0.101	0.101	0.101	0.101	0.101	0.101	0.100
UT	Salt Lake	0.107	0.107	0.107	0.107	0.107	0.107	0.093

* Indicates monitor area does not reach attainment with identified controls and unspecified emission reductions beyond identified controls. Ottawa, OK contains no point sources and a large Superfund site.

Table 4-10.
NUMBER OF MONITOR SITES REACHING ATTAINMENT WITH EACH ALTERNATIVE STANDARD WITH IDENTIFIED CONTROLS AND EMISSION REDUCTIONS BEYOND IDENTIFIED CONTROLS

Standard Alternative	Number of Sites Analyzed	Number of Sites in Attainment with No Additional Controls	Number of Sites in Attainment with Identified Point Source Controls	Number of Sites in Attainment with Identified Point Source Controls and Unspecified Emission Reductions
0.50 µg/m^3 Second Maximum Monthly Mean	21	12	20	21
0.40 µg/m^3 Second Maximum Monthly Mean		12	20	21
0.30 µg/m^3 Second Maximum Monthly Mean		10	17	21
0.20 µg/m^3 Second Maximum Monthly Mean		6	14	21
0.15 µg/m^3 Second Maximum Monthly Mean		5	13	21
0.10 µg/m^3 Second Maximum Monthly Mean		0	9	20

FIGURE 2.
EMISSIONS REDUCTIONS FROM IDENTIFIED CONTROLS AND REDUCTIONS NEEDED BEYOND IDENTIFIED CONTROLS



4.5 Key Limitations

The estimates of emission reductions associated with the control strategies described above are subject to important limitations and uncertainties. We summarize these limitations as follows:

- ***Analysis Only Considers Controls on Point Source Emissions.*** Because the available data are not sufficiently detailed to assess the impact of indirect fugitive or area nonpoint source controls, the analysis of air quality impacts does not account for the potential implementation of such controls in areas where they might be effective. Although the analysis estimates the impact of point source controls on indirect fugitives, it does not consider the impact of controlling these emissions directly. This and the lack of control information for area nonpoint sources may have contributed to our projection that some areas would violate the NAAQS.

- ***Actual State Implementation Plans May Differ from our Simulation***: In order to reach attainment with the selected standard, each state will develop its own implementation plan implementing a combination of emissions controls that may differ from those simulated in this analysis. This analysis therefore represents an approximation of the emissions reductions that would be required to reach attainment and should not be treated as a precise estimate.

- ***Limited Sources Considered***: For this analysis we have not modeled the effect of any potential changes in emissions at airports with lead emissions associated with use of leaded aviation gasoline. Furthermore, as discussed above, we were not able to obtain emissions control information for a large number of point sources in our analysis. Although these sources collectively accounted for less than one tenth of all lead emissions considered, many of those sources were located in areas that were not able to reach attainment with one or more of the standard alternatives using identified controls alone. If more emissions control information were available, it may not be necessary to rely on estimated emissions reductions beyond identified controls in order to simulate attainment with the alternative standards.

- ***Emissions Reductions from the Rebuild of the Primary Lead Smelter in Jefferson County, Missouri:*** To estimate the emissions reductions associated with the selected standard for Jefferson County, this analysis models the replacement of the primary lead smelter in this area with a more modern, lower emitting Kivcet smelter. We estimate the emissions reductions that such a project would achieve based on the emissions performance of Teck Cominco's Kivcet smelter in Trail, British Columbia, scaling for differences in lead production volumes between the two facilities. While this is a reasonable approach for estimating the extent to which the Jefferson County smelter's emissions may decline if it rebuilds its smelter, facility-specific characteristics not included in our analysis may influence lead smelter emissions. Therefore, we may overestimate or underestimate the lead reductions that would be achieved by a rebuild of this smelter.

- ***Emissions Reduction Beyond Identified Controls***: In this chapter we report both emissions reductions from identified emissions controls and unspecified emission reductions beyond identified controls. We have taken care to report these separately, in recognition of the greater uncertainty associated with achieving emissions reductions from measures that may not be currently in use or known to EPA. Nonetheless, EPA believes it is reasonable to project that, with at least seven years of lead time before a 2016 compliance deadline, a large number of existing measures will be adapted to be applicable to additional sources, and new measures may be developed that are specifically focused on cost-effectively reducing PM emissions with high lead content. Because the current standard is attained in all but a few areas of the country, and has been for many years since the phase down of lead in gasoline, it is likely that very little effort has been devoted to development of lead emissions control technologies except in industries where regulations have been imposed to reduce lead (e.g., large MWC standard, primary and secondary lead smelter MACTs, etc.). As a result, EPA believes that the projection of emission reductions beyond identified controls is particularly appropriate for compliance with a more stringent lead standard.