ES.1 OVERVIEW

This Regulatory Impact Analysis (RIA) estimates the incremental costs and monetized human health benefits of attaining a revised primary lead (Pb) National Ambient Air Quality Standard (NAAQS). There are important overall data limitations and uncertainties in these estimates. They are described in section E.S.4 below. Hypothetical control strategies were developed for final NAAQS of 0.15 µg/m^3 plus several alternative lead standards. These alternatives include at least one more stringent and one less stringent alternative than the selected standard, consistent with the OMB Circular A-4 Guidelines. This summary outlines the basis for and approach used for estimating the incremental costs and monetized benefits of these standards, presents the key results of the analysis, and highlights key uncertainties and limitations.

This Regulatory Impact Analysis (RIA) provides illustrative estimates of the incremental costs and monetized human health benefits of attaining a revised primary lead (Pb) National Ambient Air Quality Standard (NAAQS) within the current monitoring network of 189 monitors representing 86 counties. Many of the highest-emitting lead sources do not have nearby Pb-TSP monitors, and it is important to note that there may be many more potential nonattainment areas than have been analyzed in this RIA.

It is important to note at the outset that overall data limitations are very significant for this analysis, compared to other NAAQS reviews. One critical area of uncertainty is the limited TSP-Pb monitoring network (discussed in chapter 2). Because monitors are present in only 86 counties nationwide, the universe of monitors exceeding the final NAAQS level of 0.15 µg/m^3 represent only 16 counties. It is important to note that data limitations prevented us from identifying a full range of controls which would bring eight of these counties all the way to attainment of the final NAAQS. It is also important to note that because many of the highest-emitting Pb sources in the 2002 NEI do not have nearby Pb-TSP monitors (see section 2.1.7), it is likely that there may be many more potential nonattainment areas than have been analyzed in this RIA.

In addition, EPA would prefer to use a detailed air quality model that simulates the dispersion and transport of lead to estimate local ambient lead concentrations with the hypothetical alternative emission control strategies expected under the NAAQS. Although models with such capabilities are available for pollutants for which EPA frequently conducts air quality analyses (e.g., particulate matter and ozone), regional scale models are currently neither available nor appropriate for lead.[1] As discussed in Chapter 3, EPA developed an air quality assessment tool to estimate the air quality impacts of each lead emissions control strategy.

In setting primary ambient air quality standards, EPA's responsibility under the law is to establish standards that protect public health, regardless of the costs of implementing a new standard. The Clean Air Act requires EPA, for each criteria pollutant, to set a standard that

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[1] U.S. Environmental Protection Agency (2007c), Review of the National Ambient Air Quality Standards for Lead: Policy Assessment of Scientific and Technical Information, OAQPS Staff Paper, section 2.4, EPA-452/R-07-013, Office of Air Quality Planning and Standards, RTP, NC.

protects public health with "an adequate margin of safety." As interpreted by the Agency and the courts, the Act requires EPA to create standards based on health considerations only.

The prohibition against the consideration of cost in the setting of the primary air quality standard, however, does not mean that costs or other economic considerations are unimportant or should be ignored. The Agency believes that consideration of costs and benefits is essential to making efficient, cost effective decisions for implementation of these standards. The impacts of cost and efficiency are considered by states during this process, as they decide what timelines, strategies, and policies are most appropriate. This RIA is intended to inform the public about the potential costs and benefits associated with a hypothetical scenario that may result when a new lead standard is implemented, but is not relevant to establishing the standards themselves.

The analysis year for this regulatory impact analysis is 2016, consistent with the attainment year for the final lead NAAQS. For the purposes of this analysis, we assess attainment by 2016 for all areas. Some areas for which we assume 2016 attainment may in fact need more time to meet one or more of the analyzed standards, while others will need less time. This analysis does not prejudge the attainment dates that will ultimately be assigned to individual areas under the Clean Air Act, which provides flexibility to postpone compliance dates, provided that the date is as expeditious as practicable.

EPA presents this RIA pursuant to Executive Order 12866 and the guidelines of OMB Circular A-4.[2] These documents present guidelines for EPA to assess the benefits and costs of the selected regulatory option, as well as one less stringent and one more stringent option. OMB Circular A-4 also requires both a benefit-cost, and a cost-effectiveness analysis for rules where health is the primary effect. Within this RIA we provide a benefit-cost analysis.

ES.2 Summary of Analytic Approach

Our assessment of the selected lead NAAQS includes several key elements, including specification of baseline lead emissions and concentrations; development of illustrative control strategies to attain the standard in 2016; development of an air quality assessment tool to assess the air quality impacts of these control strategies; and analyses of the incremental impacts of attaining the alternative standards. Figure ES-1 provides an illustration of the methodological framework of this RIA. Additional information on the methods employed by the Agency for this RIA is presented below.

Overview of Baseline Emissions Forecast and Baseline Lead Concentrations

The baseline lead emissions and lead concentrations for this RIA are based on lead emissions data from the 2002 National Emissions Inventory (NEI) and lead concentration values for 21 lead monitors included in the 2003-2005 Pb-TSP NAAQS-review database. Consistent with the $PM_{2.5}$ NAAQS RIA and ozone RIA, no growth factors were applied to the 2002 NEI emissions estimates to generate the emissions or air quality projections for 2016. Where

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[2] U.S. Office of Management and Budget. Circular A-4, September 17, 2003. Found on the Internet at <http://www.whitehouse.gov/omb/circulars/a004/a-4.pdf>.

possible, however, we adjusted these values to reflect the estimated control efficiency of MACT standards with post-2002 compliance deadlines, because the 2002 NEI and observed lead concentrations during the 2003-2005 period would not reflect the impact of MACT controls reasonably anticipated to be in place by 2016. The analysis includes similar adjustments for compliance measures simulated by the September 2006 revision to the $PM_{2.5}$ NAAQS (as included in the illustrative $PM_{2.5}$ control strategy described in the $PM_{2.5}$ NAAQS RIA) and measures listed in the 2007 Missouri Lead SIP revisions.[3]

Development of Illustrative Control Strategies

Our analysis of the emissions control measures required to meet the selected standard is limited to controls for point source emissions at active sources inventoried in the 2002 NEI. To identify point source lead emissions controls for our analysis, we collected information on PM control technologies, assuming that the control efficiency for PM would also apply to lead emissions. Most of this information was obtained from EPA's AirControlNET database, but a limited number of controls were identified from New Source Performance Standards and operating permits that apply to facilities with similar Source Classification Codes as the point sources included in our analysis.[4] 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 stationary sources. In addition, we modeled replacement of the large primary lead smelter in Jefferson County, Missouri with a more modern, lower-emitting smelter.

To identify the least-cost approach for reaching attainment in each area, EPA developed a linear programming optimization model that systematically evaluates the changes in air quality and costs associated with controlling each source 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.

It is important to remember that, compared to recent NAAQS RIAs, our current knowledge of the costs and nature of lead emissions controls is relatively poor. Lead in ambient air has not been a focus for all but a few areas of the country for the last decade or more; the selected standard of 0.15 $\mu g/m^3$ represents a substantial tightening of the existing NAAQS. As a result, although AirControlNET contains information on a large number of different point source controls, we would expect that State and local air quality managers would have access to additional information on the controls available to the most significant source.

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[3] U.S. Environmental Protection Agency. (2006). *Final Regulatory Impact Analysis: $PM_{2.5}$ NAAQS*. Office of Air and Radiation, Research Triangle Park, NC. The Missouri 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.

[4] Source Classification Codes are the identifiers that EPA uses to classify different types of emissions activity.

In addition, as discussed in the final monitoring provisions, the existing monitoring network will need to be updated. It is possible that some areas shown to be out of attainment based on the current monitoring information will be shown to be in attainment with more recent monitoring. After the revised monitoring network is in place, other areas not identified in this analysis may be found to be violating the new standard. Since many of the existing sources of ambient Pb are relatively small, states are likely to work closely with the sources to reduce emissions in a cost-effective manner.

Note also that in this RIA we have not accounted for the effect of improvements that tend to occur, such as technology improvement, process changes, efficiency improvements, materials substitution, etc. We believe these typical improvements will tend to result in more cost effective approaches than simply adding extremely expensive pollution controls in many areas by the attainment date of 2016. Many industrial sources of lead emissions emit very small quantities of lead in absolute terms. Our cost modeling shows that some could face significant costs to reduce these low levels of lead, costs which could be prohibitively expensive. Rather than applying additional controls, it may be possible for firms emitting small amounts of Pb to modify their production processes or other operational parameters, including pollution prevention techniques, which would be more cost effective than adding additional control technology. Such measures might include increasing the enclosure of buildings, increasing air flow in hoods, modifying operation and maintenance procedures, changing feed materials to lower Pb content, measures to suppress dust from tailings piles, etc.

Finally, some monitor areas are not projected to reach attainment with the proposed NAAQS or alternative standard through the application of identified controls alone. (For the selected NAAQS, identified controls account for about 94% of the emission reductions needed to reach full attainment in all areas). For the selected NAAQS and each alternative standard, we applied unspecified emission reductions to all sources until attainment was reached in each county that failed to reach attainment with identified controls alone.

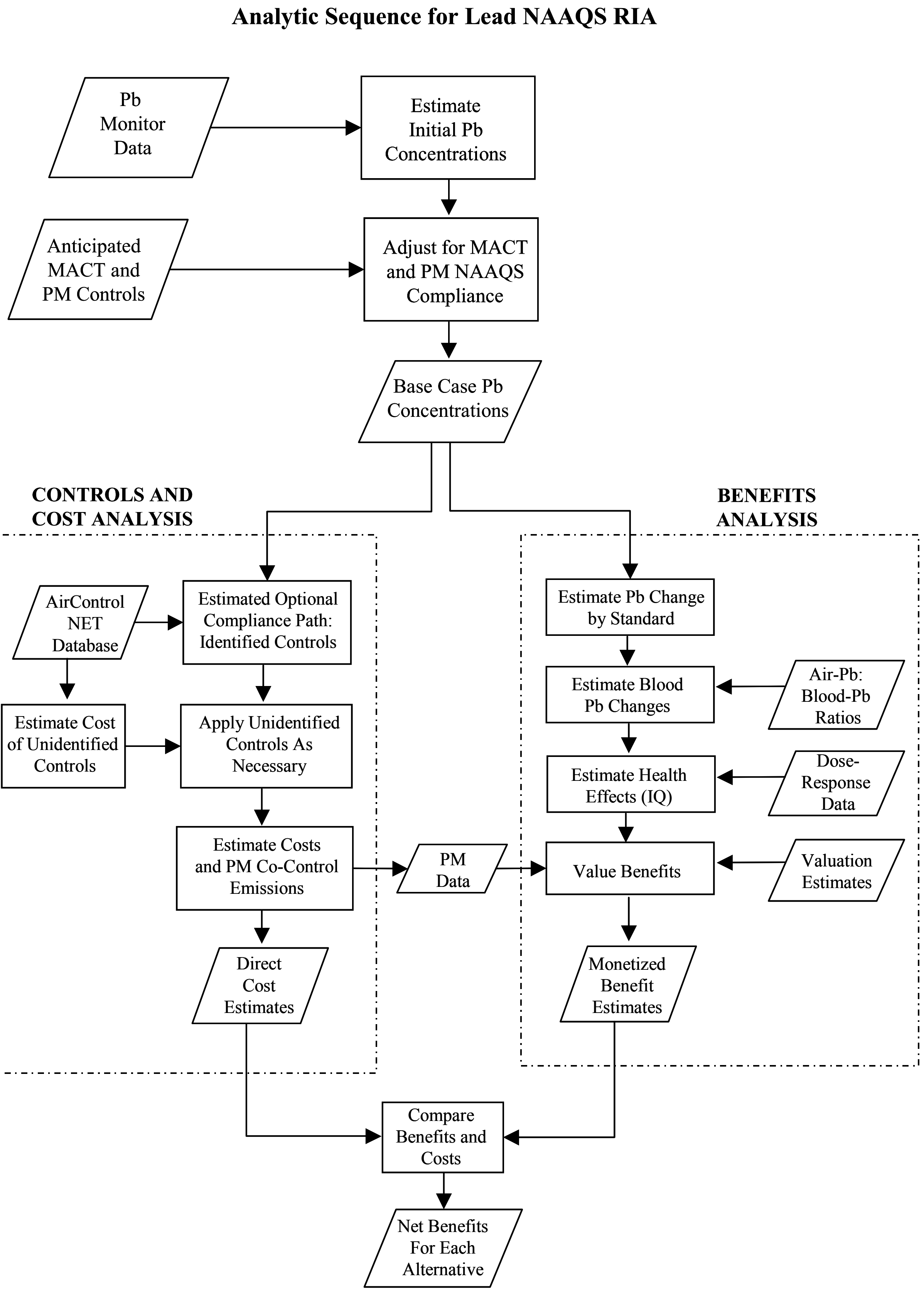

Figure ES-1. The Process Used to Create this RIA

Air Quality Assessment Tool

To assess the air quality impact of the emissions controls implemented under the selected NAAQS, EPA would ideally use a detailed air quality model that simulates the dispersion and transport of lead to estimate local ambient lead concentrations. Although models with such capabilities are available for pollutants for which EPA frequently conducts air quality analyses (e.g., particulate matter and ozone), regional scale models are currently neither available nor appropriate for Pb.[5] Dispersion, or plume-based, models are recommended for compliance with the Pb NAAQS; however, dispersion models are data –intensive and more appropriate for local scale analyses of emissions from individual sources. It was not feasible to conduct such a large-scale data-intensive analysis for this RIA.

Our air quality assessment tool, developed for the purposes of this analysis, employs a source-apportionment approach to estimate the extent to which each of the following emissions sources contribute to observed lead concentrations in each monitor area:

- Background lead
- Miscellaneous, re-entrained dust
- Emissions from area non-point sources
- Indirect fugitive emissions from active industrial sites
- Point source emissions[6]

After allocating a portion of the observed lead concentration for each monitor area to the first four categories listed above, the assessment tool apportions the remaining concentration among all inventoried point sources within ten kilometers of each monitor location by distance-weighting individual source contributions to ambient Pb concentrations.[7] Through this process, the tool establishes a point source influence factor that can be used to translate changes in the lead emissions of individual point sources to changes in the lead concentration for each monitor area.

Analysis of Benefits

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[5] See Chapter 2 of U.S. Environmental Protection Agency. (2007). Review of the National Ambient Air Quality Standards for Lead: Policy Assessment of Scientific and Technical Information – OAQPS Staff Paper. Office of Air Quality Planning and Standards, Research Triangle Park, NC. EPA-452/R-07-013.

[6] For the purposes of this analysis, airports servicing piston-engine aircraft that use leaded aviation gasoline are treated as point sources.

[7] Note that although the air quality assessment tool distinguishes between the portion of the observed lead concentration attributable to point source emissions and that attributable to indirect fugitive emissions from active point sources, this analysis assumes that the two contributions are directly related, and any reduction in the air quality impact of point source emissions would produce a corresponding reduction in the air quality impact of indirect fugitive emissions from point sources in that monitor area. The process used to relate the contributions of these two categories is described in further detail in Chapter 3 of this RIA.

Our analysis of the benefits associated with the selected NAAQS includes benefits related to reducing ambient lead concentrations and the ancillary benefits of reducing direct emissions of particulate matter. To assess benefits specific to reduced lead concentrations, we created a spreadsheet model that provides a screening-level assessment of health benefits occurring as a result of implementing the selected NAAQS level. The model uses various simplifying assumptions and is intended only to provide an approximate, preliminary estimate of the potential health benefits. For the purposes of this analysis, the model estimates the adverse health impact of blood lead levels on cognitive function (which is most often measured as changes in IQ) in young children below seven years of age. Cognitive effects are thought to strongly relate to a child's future productivity and earning potential.[8]

The model was constructed in Microsoft Excel and provides an integrated tool to complete five benefits estimation steps: 1) estimate lead in air concentrations for the "base case" and "control scenarios"; 2) estimate population exposures to air lead concentrations for each scenario; 3) estimate blood lead levels in the population for each scenario; 4) estimate avoided cases of health effects due to changes in blood lead levels; and 5) apply an economic unit value to each avoided case to calculate total monetized benefits.

Because most of the point source measures implemented to achieve the NAAQS standard are focused on controlling emissions of lead in particulate form, virtually all of these measures also have a significant impact on emissions of directly emitted particulate matter. To estimate the value of these $PM_{2.5}$ emissions reductions, EPA utilized $PM_{2.5}$ benefit-per-ton estimates. These $PM_{2.5}$ benefit-per-ton estimates provide the total monetized human health benefits (the sum of premature mortality and premature morbidity) of reducing one ton of $PM_{2.5}$ from a specified source. EPA has used a similar technique in previous RIAs, including the recent ozone NAAQS RIA.[9] The complete methodology for creating the benefit per-ton estimates used in this analysis is available in the Technical Support Document (TSD) accompanying the recent final ozone NAAQS RIA.[10]

Analysis of Costs

Consistent with our development of the illustrative control strategies described above, our analysis of the costs associated with the selected NAAQS focuses on point source PM controls. For the purposes of this analysis, these controls largely include measures from the AirControlNET control technology database, but also include additional measures associated with operating permits and/or New Source Performance Review standards applicable to sources similar to those included in our analysis. For controls identified in AirControlNET, we estimated

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[8] U.S. Environmental Protection Agency. (2006b). *Economic Analysis for the Renovation, Repair, and Painting Program Proposed Rule*. Office of Pollution Prevention and Toxics. Washington, DC.

[9] U.S. Environmental Protection Agency. (2008). *Final Ozone NAAQS Regulatory Impact Analysis*. Office of Air and Radiation. Research Triangle Park, NC, March.

[10] The Technical Support Document, entitled: *Calculating Benefit Per-Ton Estimates*, can be found in EPA Docket EPA-HQ-OAR-2007-0225-0284.

costs based on the cost equations included in AirControlNET. Our cost estimates for controls associated with operating permits and/or New Source Performance Review standards are based on cost data compiled by EPA for previous analyses.

As indicated in the above discussion on illustrative control strategies, implementation of the PM control measures identified from AirControlNET and other sources does not result in attainment with the selected NAAQS in several areas. In these areas, additional unspecified emission reductions will likely be necessary to reach attainment. In order to bring these monitor areas into attainment, we calculated control costs using two different approaches. Under one approach, we extrapolated the cost of unspecified emission reductions by constructing a cost curve using data on identified control costs. We then derived a total cost equation in quadratic form which best fit the total cost curve. Under our second approach, we calculated the cost of unspecified emission reductions by deriving an average cost per microgram of air quality improvement obtained from identified controls. For each standard, we then selected all monitor areas that failed to reach attainment and applied unspecified emission reductions to all sources until attainment was reached.

ES.3 Results of Analysis

Air Quality

Table ES-1 summarizes the number of monitor sites that reach attainment with the selected NAAQS and alternative standards in 2016 following the implementation of identified and unspecified emission reductions. According to the data presented in Table ES-2, 13 of the 21 monitor areas are expected to reach attainment with the selected NAAQS following implementation of identified controls. Table ES-2 also shows results for alternative NAAQS of 0.10 and 0.40 $\mu g/m^3$. (In the body of the RIA, we also provide analysis of three other alternative NAAQS.) For the alternative of 0.10 $\mu g/m^3$, only 9 of the 21 monitors are able to reach attainment from application of identified controls. By comparison, all but one monitor area reach attainment through the implementation of identified controls under the 0.40 $\mu g/m^3$ standard.

Table ES-1. Number of Monitor Sites Reaching Attainment with Each Alternative Standard using Identified and Unidentified Controls

Standard	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 Unspecified Emission Reductions and Identified Point Source Controls
0.40 µg/m3 Second Maximum Monthly Mean	21	12	20	21
0.15 µg/m3 Second Maximum Monthly Mean		5	13	21
0.10 µg/m3 Second Maximum Monthly Mean		0	9	20

The failure of certain areas to reach attainment with identified controls may partially reflect the lack of control information for point sources in these areas. Sources for which the AirControlNET analysis identified no controls make up a small portion of the ambient lead concentration in many of the areas not projected to reach attainment with the selected standard. For such sources in nonattainment areas, we assume that unspecified emission reductions will be obtained. When unspecified emission reductions are implemented in addition to identified controls, we project widespread attainment with the selected and alternative standards.

Benefit and Cost Estimates

Tables ES-2, ES-3 and ES-4 summarize the costs and benefits associated with the selected and alternative NAAQS standards in 2016, based on both 3 percent and 7 percent discount rates.

The results in Table ES-2 show that the assumptions used in estimating the unspecified emission reductions drive the cost estimates. Under the first approach, the majority of the costs for the selected standard (88%) come from our analysis of current known control technologies, with only 12% of the total costs coming from extrapolated costs. Under the second approach, 5% of the total costs come from our analysis of currently known control technologies, and the majority of the costs (95%) comes from our assumptions about the cost of controlling the last few ambient increments of Pb needed to reach full attainment. This reflects the limited information available to EPA on the control measures that lead sources may implement. It is important to remember that, compared to recent NAAQS RIAs, our current knowledge of the costs and nature of lead emissions controls is relatively poor. Lead in ambient air has not been a focus for all but a few areas of the country for the last decade or more; the alternative standards represent a substantial tightening of the existing NAAQS. As a result, although AirControlNET contains information on a large number of different point source controls, we would expect that State and local air quality managers would have access to additional information on the controls available to the most significant sources.

Table ES-3 presents the benefits of the proposed and alternative standards as a range to account for uncertainties associated with the benefits of the standards. The range in the benefits estimates related to IQ gains reflects two estimates of the earnings impacts associated with such gains. The low end of the range reflects an analysis by Schwartz, which estimated that a 1-point increase in IQ would increase earnings by 1.76 percent, while the high end of the range reflects the results of Salkever, which found that earnings increase by 2.38 percent for each 1-point increase in IQ.[11] The range of estimates presented for PM-related benefits is based on the upper and lower ends of the range of $PM_{2.5}$ premature mortality functions obtained by EPA through its expert elicitation study on the PM-mortality relationship, as first reported by Industrial Economics and interpreted for benefits analysis in EPA's final RIA for the PM NAAQS, published in September 2006.[12]

Table ES-4 presents a comparison of costs and benefits.

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[11] Schwartz, J. (1994). Societal Benefits of Reducing Lead Exposure. *Environmental Research* 66: 105-124 and Salkever, D.S. (1995). Updated Estimates of Earnings Benefits from Reduced Exposure of Children to Environmental Lead. *Environmental Research* 70:1-6.

[112] Industrial Economics, Inc. (2006). *Expanded Expert Judgment Assessment of the Concentration-Response Relationship between $PM_{2.5}$ Exposure and Mortality*. Prepared for: Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC; U.S. Environmental Protection Agency. (2006). *Final Regulatory Impact Analysis: $PM_{2.5}$ NAAQS*. Office of Air and Radiation, Research Triangle Park, NC.

Table ES-2. Summary of Costs for Regulatory Alternatives (Millions of 2006$)*

		Alternative NAAQS: 0.4 μg/m^3 2nd Maximum Monthly Mean		Final NAAQS: 0.15 μg/m^3 2nd Maximum Monthly Mean		Alternative NAAQS: 0.1 μg/m^3 2nd Maximum Monthly Mean	
		3% Discount rate	**7% Discount rate**	**3% Discount rate**	**7% Discount rate**	**3% Discount rate**	**7% Discount rate**
Identified Control Costs		$46	$57	$130	$150	$160	$180
Extrapolated Costs	**Cost Curve Extrapolation**	$0.32	$0.32	$20	$20	$33	$33
	Ambient Extrapolation	$390	$460	$2,600	$3,100	$3,400	$3,900
Total RIA Costs	**Cost Curve**	**$46**	**$57**	**$150**	**$170**	**$190**	**$210**
	Ambient	**$430**	**$510**	**$2,800**	**$3,200**	**$3,500**	**$4,100**
Monitoring Costs**		$4.2	$4.2	$4.2	$4.2	$4.2	$4.2

* All estimates rounded to two significant figures. As such, totals will not sum down columns.

** Consistent with the scope of this rulemaking, which includes monitoring provisions, monitoring costs are included here. See OMB 2060-0084, ICR #940.21 for a complete discussion.

Table ES-3. Summary of Benefits for Regulatory Alternatives (Millions of 2006$)

	Alternative Standard: 0.40 μg/m^3 2nd Maximum Monthly Mean		**Final NAAQS: 0.15 μg/m^3 2nd Maximum Monthly Mean**		**Alternative Standard: 0.10 μg/m^3 2nd Maximum Monthly Mean**	
	3% Discount rate	*7% Discount rate*	*3% Discount rate*	*7% Discount rate*	*3% Discount rate*	*7% Discount rate*
Annualized Benefit - IQ Gains (Range)**	$2,000 - $2,800	$250 - $490	$3,500 - $5,000	$440 - $870	$4,500 - $6,400	$560 - $1,100
Annualized Benefit - PM Co-control (Range)***	$100 - $880	$100 - $800	$230 - $1,900	$210 - $1,700	$260 - $2,200	$240 - $2,000
Total Benefits	$2,100 - $3,700	$350 -$1,300	$3,700 - $6,900	$650 - $2,600	$4,800 - $8,600	$800 - $3,100

Table ES-4. Summary of Net Benefits for Regulatory Alternatives (Millions of 2006$)[13]

	Alternative Standard: 0.40 µg/m³ 2nd Maximum Monthly Mean		Final NAAQS: 0.15 µg/m³ 2nd Maximum Monthly Mean		Alternative Standard: 0.10 µg/m³ 2nd Maximum Monthly Mean	
	3% Discount rate	**7% Discount rate**	**3% Discount rate**	**7% Discount rate**	**3% Discount rate**	**7% Discount rate**
Total RIA Costs + Monitoring Costs	$50—$430	$61—$510	$150—$2,800	$170—$3,200	$190—$3,500	$210—$4,100
Total Benefits	$2,100—$3,700	$350—$1,300	$3,700—$6,900	$650—$2,600	$4,800—$8,600	$800—$3,100
Net Benefits	**$1,700 - $3,700**	**$(160) - $1,200**	**$900 - $6,800**	**$(2,600) - $2,400**	**$1,300 - $8,400**	**$(3,300) - $2,900**

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[13] Note that bounds of the full range of net benefits is derived by subtracting the high costs from the low benefits at the lower end, and subtracting the low costs from the high benefits at the upper end. This is the only way to fully represent the uncertainty.

To provide additional context for the results presented in Table ES-3, Table ES-5 presents the total number of IQ points expected to be gained in the US in the year 2016 by achieving each of the alternate NAAQS level options, relative to the "base case" (i.e., the lead NAAQS remains at its current level). The results presented in the table demonstrate that lowering the current (1.5 µg/m^3 maximum quarterly mean) lead NAAQS to the revised or alternative NAAQS would be expected to have a significant impact on the IQ of young children. More specifically, the results indicate that the number of IQ points gained in 2016 ranges from 230,000 if a 0.4 µg/m^3 second maximum monthly mean NAAQS is achieved up to 510,000 for a 0.10 µg/m^3 second maximum monthly mean NAAQS.

Table ES-5. Number of IQ Points Gained in 2016

Standard	*IQ Points Gained*
0.40 µg/m^3 Second Maximum Monthly Mean	230,000
0.15 µg/m^3 Second Maximum Monthly Mean	400,000
0.10 µg/m^3 Second Maximum Monthly Mean	510,000

Our analysis suggests that the benefits presented in Table ES-5 will be concentrated in a small number of counties. Table ES-6 below shows the distribution of total benefits due to IQ points gained for the 0.15 µg/m^3 second maximum monthly mean NAAQS alternative. For this standard, approximately 60 percent of the total benefits are due to changes in lead air concentrations in three counties: Hillsborough, Florida; Delaware, Indiana; and Berks, PA. In these areas, sources of lead exposure and the monitors that measure ambient lead appear to be in relatively close proximity to exposed populations.

Table ES-6. Percentage of Benefits by Monitor (0.15 µg/m^3 Second Maximum Monthly Mean NAAQS)

County	State	Population of Children in Affected Area	Affected Population (%)	Percentage of Benefits (%)
Hillsborough	FL	67,359	17%	38%
Delaware	IN	7,957	2%	13%
Berks	PA	27,966	7%	13%
Collin	TX	22,192	6%	12%
Denton	TX	8,243	2%	5%
Cuyahoga	OH	60,605	16%	4%
Pike	AL	2,621	1%	4%
Jefferson	MO	6,472	2%	2%
Orange	NY	9,186	2%	2%
Dakota	MN	23,216	6%	1%
Beaver	PA	9,120	2%	1%

Fulton	OH	1,644	0%	1%
Rutherford	TN	707	0%	1%
Williamson	TN	804	0%	1%
Logan	OH	2,993	1%	1%

Note: There were several other counties that constituted less than 1 percent of benefits that are not included in this table.

The costs of the selected NAAQS are also expected to be concentrated in a limited number of areas, as summarized in chapter 6. Many of the monitor sites listed in the exhibit represent areas with the largest sources of lead emissions, such as primary or secondary lead smelters, mining operations, or battery manufacturers.

ES.4 Caveats and Limitations

Air Quality Data, Modeling and Emissions

- ***Limited TSP-Pb monitoring network.*** Because monitors are present in only 86 counties nationwide, the universe of monitors exceeding the various target NAAQS levels is very small; only 21 counties exceeding the lowest alternative NAAQS level of 0.10 µg/m^3. Because we know that many of the highest-emitting Pb sources in the 2002 NEI do not have nearby Pb-TSP monitors (see section 2.1.7), it is likely that there may be many more potential nonattainment areas than have been analyzed in this RIA.

- ***Simplified Air Quality Assessment Approach***. Dispersion, or plume-based models are recommended for compliance with the Pb NAAQS; however, dispersion models are data–intensive and more appropriate for local scale analyses of emissions from individual sources. It was not feasible to conduct such a large-scale data intensive analysis for this RIA. As a result, the simplified analysis developed for this RIA while distance-weighting individual source contributions to ambient Pb concentrations, could not account for such locally critical variables as meteorology and source stack height.

- ***Analysis Only Considers Controls on Point Source Emission Reductions.*** 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 of nonattainment in some areas. Additionally, 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 by piston-engine powered aircraft. (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. EPA, in coordination with FAA, is analyzing the petition.)

- ***Limited Point Source Controls Considered***. 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 fourth 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 standards using identified controls alone.

- ***Actual State Implementation Plans May Differ from our Simulation***. In order to reach attainment with each selected NAAQS, 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.

- ***Unspecified Emissions Reductions***. In this RIA, we report emissions reductions from both identified controls and unspecified emission reductions. 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 10 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 for industries where regulations have been imposed to reduce lead (e.g., large MWC standard, primary and secondary lead smelter MACTs, etc.).

Costs

- ***Uncertainty associated with unspecified emission reductions.*** As indicated above, some areas are expected to rely on unspecified emission reductions to reach attainment with the standards. The cost of implementing these measures, though estimated here based on the costs for identified controls, is uncertain. Many of these sources are already well-controlled for particulate matter, and additional control for the remaining increment of Pb might be difficult to achieve. Some sources have very low particulate matter (PM) emissions overall, and therefore controls are generally not applied at that emissions level.

- ***Uncertainty associated with emissions estimates for smaller sources.*** Note that there is often greater inherent uncertainty in reported emissions from smaller sources than from larger sources, and that a large portion of the lead emissions inventory consists of sources emitting less than five tons per year of lead.

- ***Uncertainty associated with estimating the extrapolated costs of unspecified emission reductions.*** The ambient extrapolation methodology emphasizes control costs that are the most expensive within an area, and assumes that knowledge of control costs from monitor areas that attain have no influence on the average control costs for areas that need unspecified emission reductions. It also assumes there will be no increased knowledge of sources or changed in technology between now and 2016. Lastly, most of the costs are based upon areas that make less than 1% progress towards attainment, indicating what little knowledge we have about controls in those areas.

  The cost curve methodology for unspecified emission reductions also presents a poor conceptual relationship between the costs of identified controls at a national level and the costs of control at a local level. The data underlying this curve contains data points which we believe to be invalid (presented as part of the distributional analysis in Section 6.1.3.3). The estimated curve estimates negative costs over a portion of emission reductions. In addition this approach relies heavily on the control strategy for the tightest standard alternative analyzed in this RIA, and does not account for variability in control strategies across alternative standards analyzed. Lastly, we do not believe this curve well represents the knowledge of how control costs behave over time.

Benefits

- ***Exposure.*** The benefits of IQ point gains in children were very sensitive to the method employed for estimating exposures to the population. When comparing the default method, which involved concentrations that were interpolated from multiple monitors, to the method assuming a uniform concentration within a 10 km radius around an individual monitor, the results increase by 40 percent. Increasing the radius to include the entire county in which the monitor resides results in roughly 3-fold increase in benefits. Decreasing the radius size also has a large impact on benefits, decreasing the value by as much as 94 percent when a radius of 1 km is used.

- ***Dose-response relationship***. The dose-response function selected for quantifying the number of IQ points gained as a result of achieving the alternative NAAQS levels affected the results. Utilizing alternate epidemiological studies decreased the primary estimate by as much as 72 percent or increased it by 140 percent.

- ***Earnings-based metric of IQ.*** The earnings-based value-per-IQ-point lost that we apply in this analysis most likely represents a lower bound on the true value of a lost IQ point, because it is essentially a cost-of-illness measure, not a measure of an individual's willingness-to-pay (WTP) to avoid the loss of an IQ point. Welfare economics emphasizes WTP measures as the more complete estimate of economic value.

- ***Co-control benefits related to PM.*** Co-control benefits estimated here reflect the application of a national dollar benefit per ton estimate of the benefits of reducing directly emitted fine particulates from point sources. Because they are based on national-level analysis, the benefit-per-ton estimates used here do not reflect local meteorology, exposure, baseline health incidence rates, or other local factors that might lead to an over-estimate or under-estimate of the actual benefits of controlling directly emitted fine particulates.

ES.5 Conclusions and Insights

Our analysis has estimated the health benefits of reductions in ambient concentrations of lead resulting from a set of illustrative control strategies to reduce emissions of lead at point sources. The results suggest there will be significant additional health benefits arising from reducing emissions from a variety of sources in and around projected nonattaining counties in

2016. While 2016 is the latest date by which states would generally need to demonstrate attainment with the revised standards, it is expected that benefits (and costs) may begin occurring earlier, as states begin implementing control measures to show progress towards attainment.