S2: Supplemental Regulatory Impact Analysis of Alternative Standards 0.055 and 0.060 ppm for the Ozone NAAQS Reconsideration

Synopsis

This supplemental chapter presents the costs and benefits of two additional alternative standards[1], 0.055 ppm and 0.060 ppm.

S2.1 Uncertainties and Limitations

The estimated costs and benefits of attaining alternate ozone standards of 0.060 ppm or 0.055 ppm are highly speculative and subject to limitations and uncertainties that are unique to this analysis. We first summarize these key uncertainties before describing how best to interpret these results.

- *The estimated number of potential non-attainment areas is uncertain. Based on present-day ozone concentrations it is clear that many areas currently exceed the ozone targets of 0.055 and 0.060. It is also clear that there will be substantial improvements in ozone air quality between now and 2020 due to existing and recently promulgated emissions reduction rules.[2] We have used an air quality model to project ozone levels in 2020 based on certain estimates of how emissions will increase or decrease over that time period. These assumptions about forecasted emissions growth or reduction are highly uncertain and will depend upon economic outcomes and future policy decisions.* Additionally, the methodology for projecting future nonattainment relies upon baseline observations from the existing ozone monitoring network. This network may not include some counties that easily attain higher ozone standards, but may not attain ozone standards so far below the current NAAQS. We estimate human health benefits by adjusting monitored ozone values to just attain alternate standard levels; we can only perform this extrapolation in counties containing an ozone monitor.

- *The predicted emission reductions necessary to attain these two alternative standards are also highly uncertain. Because the hypothetical RIA control scenario left a significant portion of the country exceeding the 0.055 and 0.060 targets, we had to extrapolate the*

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[1] For benefits results of the alternative standards analyses for 0.065, 0.070, and 0.075, please see Section 3 of this supplement. For the cost results of the alternative standards analyses for 0.065, 0.070, and 0.075, please see the 2008 Ozone NAAQS RIA, which can be found at < http://www.epa.gov/ttn/ecas/regdata/RIAs>.

[2] This improvement in ozone air quality is anticipated despite other factors that may worsen ozone air quality, such as increased population, increased traffic, or other federal policies.

rate of ozone reduction seen in previous air quality modeling exercises to estimate the additional emissions reductions needed to meet the lower targets. The details of the approach are explained below, but for most areas of the analysis we used simple impact ratios to project the ozone improvements as a rate of NOx emissions reduced. Use of non-site-specific, linear impact ratios to determine the non-linear, spatially-varying, ozone response was a necessary limitation which results in considerable uncertainty in the extrapolated air quality targets.

- *The costs of identified control measures accounts for an increasingly smaller quantity of the total costs of attainment.* This is a major limitation of the cost analysis. We assume a majority of the costs of attaining the tighter alternative standards will be incurred through technologies we do not yet know about. Therefore costing future attainment based upon unspecified emission reductions is inherently difficult and speculative.

The uncertainties and limitations summarized above are generally more extensive than those for the 0.075 ppm, 0.070 ppm, and 0.065 ppm analyses. The table below contrasts our level of confidence in each of the key results.

Table S2.1: Key uncertainties and limitations in the analysis for 0.060 ppm and 0.055 ppm

Analytical question	**Standard Alternatives Analyzed**	
	0.055 ppm & 0.060 ppm	***0.065 ppm, 0.070 ppm & 0.075 ppm***
Air quality estimates		
Number of counties attaining each standard alternative	Medium	Higher
Air quality increment necessary to attain standard	Lower	Medium
Costs		
Total cost estimate	Lower	Medium
Distribution of costs by sector	Lower	Medium
Level of extrapolated costs	Lower	Medium
Benefits		
Size of ozone-related human health benefits	Lower	Higher
Size of $PM_{2.5}$-related human health co-benefits	Lower	Higher
Distribution of benefits across the population	Lower	Higher

Given the pervasive uncertainties in the 55ppb and 60ppb analysis, the types of conclusions that readers may draw is necessarily limited. Conclusions of this supplemental analysis are provided in Section S2.6.

S2.2 Estimating AQ Targets

The methodology used to develop the estimates of additional emissions reductions needed to meet the 0.055 ppm and 0.060 ppm standards is based on estimation techniques previously summarized in the 2008 Ozone NAAQS RIA Section 4.1, including application of the same control measure reductions and costs. The procedures used to extend that original analysis to the two lower ozone targets is explained below.

Of the 659 counties that are part of the analysis, there are 565 and 385 counties that are projected not to meet the 0.055 ppm and 0.060 ppm ozone targets in 2020, even after implementation of the controls in the hypothetical RIA scenario. As described in the earlier documentation, these “extrapolated control areas” were separated into three groups for the purposes of determining what additional emissions reductions would be necessary for projected attainment.

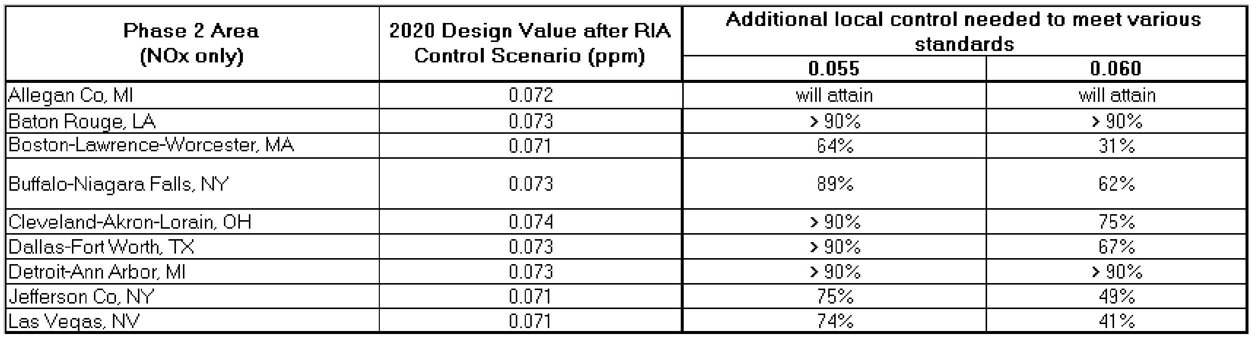
Phase 1 areas were defined as the four areas with the largest expected extrapolated costs: Southern California, western Lake Michigan, Houston, and parts of the Northeast Corridor. For these locations, we have an available set of sensitivity modeling results which allows for an assessment of the impacts of additional NOx and NOx + VOC controls of up to 90 percent beyond the RIA case. Unlike the original analysis, there were no areas for which an equal combination of NOx and VOC controls was determined to be a more cost effective control path to attain the lower ozone targets than NOx control exclusively. Therefore, for this supplemental analysis, we assumed that all additional extrapolated emissions reductions would come from NOx controls. Table S2.2 presents the additional NOx reductions estimated to be needed to meet the 0.055 and 0.060 ppm targets, above and beyond the hypothetical RIA control case. It should be noted that because the sensitivity modeling did not consider controls beyond a 90 percent reduction, it is not possible to estimate the necessary “extrapolated tons” for any area that does not meet the target in the sensitivity modeling even after 90 percent control. The emissions targets for these areas are simply listed as “greater than 90%”.

Table S2.2: Estimated Percentage Reductions of NOx beyond the RIA Control Scenario Necessary to Meet the Supplemental Analysis Targets in the Phase 1 Areas

Phase 1 Area (NOx only)	2020 Design Value after RIA Control Scenario (ppm)	Additional local control needed to meet various standards	
		0.055	0.060
Amador and Calaveras Cos., CA	0.071	65%	47%
Chico, CA	0.068	58%	37%
Imperial Co., CA	0.071	70%	51%
Inyo Co., CA	0.068	87%	56%
Los Angeles South Coast Air Basin, CA	0.122	> 90%	> 90%
Mariposa and Tuolumne Cos., CA	0.072	72%	52%
Nevada Co., CA	0.075	74%	58%
Sacramento Metro, CA	0.080	82%	69%
San Benito Co., CA	0.066	54%	29%
San Diego, CA	0.076	80%	67%
San Francisco Bay Area, CA	0.069	64%	45%
San Joaquin Valley, CA	0.096	> 90%	87%
Santa Barbara Co., CA	0.068	55%	35%
Sutter Co., CA	0.067	56%	35%
Ventura Co, CA	0.077	73%	59%
Northeast Corridor, CT-DE-MD-NJ-NY-PA	0.077	> 90%	70%
Eastern Lake Michigan, IL-IN-WI	0.080	> 90%	> 90%
Houston, TX	0.087	> 90%	> 90%

Phase 2 areas were defined as any area outside a Phase 1 area whose projected 2020 design value exceeded 0.070 ppm in the hypothetical RIA scenario. The impacts of additional hypothetical emissions reductions in upwind Phase 1 areas were accounted for in the calculation of needed extrapolated tons in Phase 2 areas. After those upwind reductions were accounted for, we utilized simple “impact ratios” (ppm improvement / % emissions reduced) to determine the remaining additional reductions needed to meet the 0.055 and 0.060 ppm targets. A site-specific impact ratio was used for each Phase 2 area based on the localized ozone changes in the RIA control scenario modeling. Table S2.3 presents the extrapolated percent reductions estimated for the Phase 2 areas.

Table S2.3: Estimated Percentage Reductions of NOx beyond the RIA Control Scenario Necessary to Meet the Supplemental Analysis Targets in the Phase 2 Areas



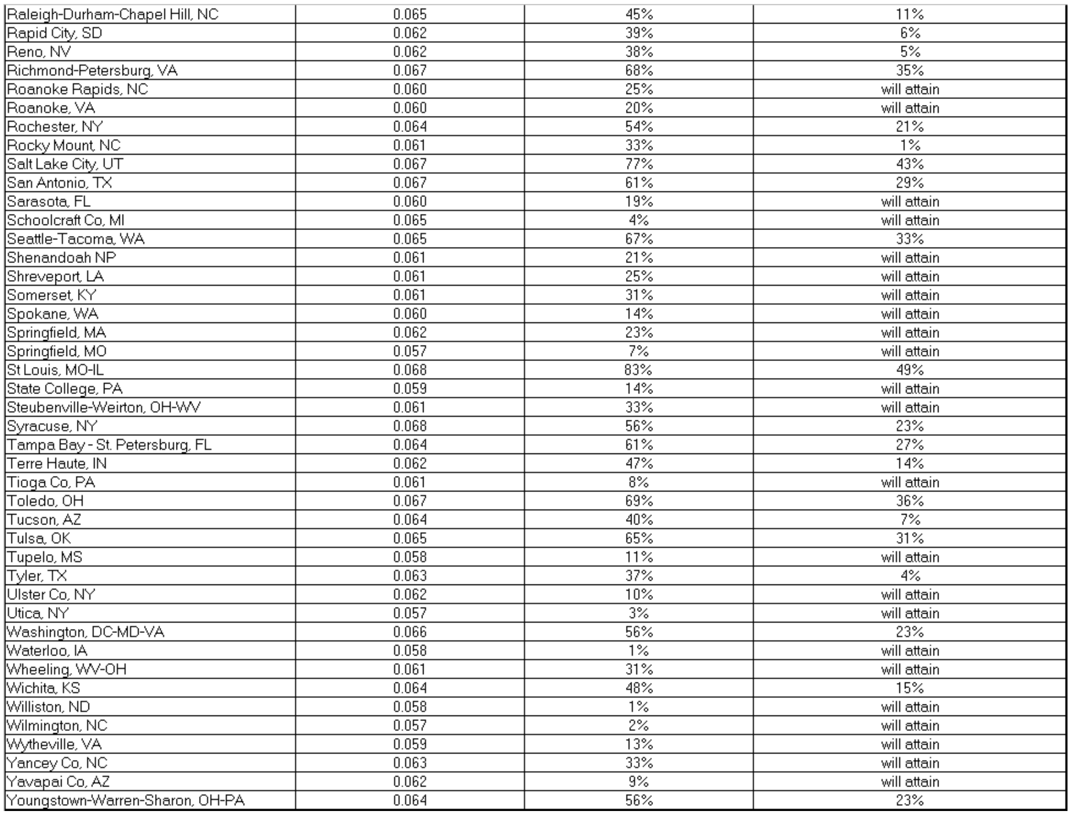
Phase 2 Area (NOx only)	2020 Design Value after RIA Control Scenario (ppm)	Additional local control needed to meet various standards	
		0.055	0.060
Allegan Co, MI	0.072	will attain	will attain
Baton Rouge, LA	0.073	> 90%	> 90%
Boston-Lawrence-Worcester, MA	0.071	64%	31%
Buffalo-Niagara Falls, NY	0.073	89%	62%
Cleveland-Akron-Lorain, OH	0.074	> 90%	75%
Dallas-Fort Worth, TX	0.073	> 90%	67%
Detroit-Ann Arbor, MI	0.073	> 90%	> 90%
Jefferson Co, NY	0.071	75%	49%
Las Vegas, NV	0.071	74%	41%

All other locations that did not meet the 0.055 or 0.060 ppm targets after the 2020 RIA control scenario were considered as a Phase 3 area. A highly simplified approach was used to determine the extrapolated tons needed in these areas. First, instead of explicitly accounting for the impacts of the Phase 1 and Phase 2 upwind emissions reductions on Phase 3 areas, we assumed that the design values from the 60% NOx reduction run were the appropriate starting point for estimating the additional emissions reductions in the Phase 3 areas. Since the targets for the Phase 1 areas are generally greater than 60% and since we have not accounted for the Phase 2 reductions, these estimates should provide a conservative estimate of the percentage emissions reductions needed for full attainment. Secondly, we did not develop site-specific impact ratios for the multiple Phase 3 areas. Instead, we used a standard relationship of 0.150 ppb / 1% NOx reduction for calculating the emissions reductions needed to attain 0.055 and 0.060 ppm in these areas. This value was the average site-specific relationship calculated for the Phase 2 areas, as described above. As a result of these assumptions, the estimated emissions reductions needed to attain the supplemental standards in the Phase 3 should be considered to be highly uncertain. The results of the Phase 3 analysis are shown in Table S2.4.

Table S2.4: Estimated Percentage Reductions of NOx beyond the RIA Control Scenario Necessary to Meet the Supplemental Analysis Targets in the Phase 3 Areas

Phase 3 Area (NOx only)	2020 Design Value after RIA Control Scenario (ppm)	Additional local control needed to meet various standards	
		0.055	**0.060**
Albuquerque, NM	0.064	55%	22%
Altoona, PA	0.058	9%	will attain
Appleton-Oshkosh, WI	0.065	25%	will attain
Atlanta, GA	0.068	79%	45%
Augusta, GA-SC	0.063	19%	will attain
Austin, TX	0.062	29%	will attain
Beaumont-Port Arthur, TX	0.066	72%	39%
Benton Harbor, MI	0.069	35%	2%
Benzie Co, MI	0.061	9%	will attain
Berkeley and Jefferson Co, WV	0.060	19%	will attain
Birmingham, AL	0.063	45%	12%
Boise, ID	0.069	87%	54%
Bowling Green, KY	0.058	14%	will attain
Burlington, VT	0.061	27%	will attain
Campbell Co., WY	0.067	75%	42%
Canton-Massillon, OH	0.061	36%	3%
Canyonlands NP	0.063	51%	18%
Carlsbad, NM	0.064	50%	17%
Carson City, NV	0.062	21%	will attain
Cass Co, MI	0.066	14%	will attain
Cedar Co, MO	0.062	43%	10%
Cedar Rapids, IA	0.057	1%	will attain
Charleston, SC	0.057	2%	will attain
Charleston, WV	0.062	33%	will attain
Charlotte-Gastonia-Rock Hill, NC-SC	0.071	90%	62%
Chattanooga, TN-GA	0.064	38%	5%
Chesterfield Co, SC	0.058	3%	will attain
Cincinnati-Hamilton, OH-KY-IN	0.067	71%	38%
Clarksville-Hopkinsville, TN-KY	0.057	6%	will attain
Clearfield and Indiana Cos, PA	0.061	37%	3%
Cleveland, MS	0.057	3%	will attain
Clinton, IA	0.061	24%	will attain
Cochise Co, AZ	0.064	59%	26%
Colorado Springs, CO	0.059	9%	will attain
Columbia, SC	0.064	53%	19%
Columbus, OH	0.066	63%	30%
Cookeville, TN	0.061	30%	will attain
Corpus Christi, TX	0.061	32%	will attain

Davenport, IA	0.060	18%	will attain
Dayton-Springfield, OH	0.062	44%	11%
Denver-Boulder-Greeley-Ft Collins-Love.,	0.067	77%	44%
Duplin Co, NC	0.058	8%	will attain
El Paso Co., TX-NM	0.068	80%	47%
Elmira, NY	0.059	6%	will attain
Erie, PA	0.067	70%	37%
Essex Co (Whiteface Mtn), NY	0.067	60%	27%
Eugene-Springfield, OR	0.059	13%	will attain
Evansville, IN	0.061	32%	will attain
Farmington, NM	0.069	87%	53%
Fayetteville, NC	0.060	21%	will attain
Flint, MI	0.062	39%	6%
Florence, SC	0.060	18%	will attain
Fond du Lac, WI	0.060	2%	will attain
Fort Wayne, IN	0.063	44%	11%
Franklin Co, PA	0.062	38%	5%
Fredricksburg, VA	0.060	9%	will attain
Grand Canyon NP	0.067	36%	3%
Grand Rapids, MI	0.064	18%	will attain
Grayson, KY	0.058	5%	will attain
Great Basin NP	0.065	25%	will attain
Great Smoky Mountains NP	0.063	49%	16%
Green Bay, WI	0.061	16%	will attain
Greene Co, IN	0.061	32%	will attain
Greene Co, PA	0.062	35%	1%
Greensboro-Winston Salem-High Point, NC	0.061	35%	2%
Greenville NC	0.059	9%	will attain
Greenville-Spartanburg-Anderson, SC	0.064	39%	6%
Gulfport-Biloxi, MS	0.065	61%	28%
Hagerstown, MD	0.062	23%	will attain
Hamilton Co, NY	0.061	33%	will attain
Hancock, Knox, Lincoln & Waldo Cos, ME	0.068	56%	22%
Hickory-Morganton-Lenoir, NC	0.062	33%	will attain
Huntington-Ashland, WV-KY	0.069	82%	49%
Huntsville-Decatur, AL	0.061	31%	will attain
Huron Co, MI	0.067	66%	32%
Indianapolis, IN	0.068	60%	26%
Ironton, OH-KY-WV	0.063	45%	12%
Jackson Co, IN	0.061	24%	will attain
Jamestown, NY	0.069	83%	49%
Johnson City-Kingsport-Bristol, TN	0.066	65%	31%
Johnstown, PA	0.062	27%	will attain
Joplin, MO-OK	0.063	38%	5%
Kansas City, MO-KS	0.065	54%	21%
Kinston, NC	0.059	11%	will attain
Knoxville, TN	0.065	57%	24%
La Crosse, WI	0.059	7%	will attain
Lafayette, IN	0.062	9%	will attain
Lafayette, LA	0.061	31%	will attain
Lake Charles, LA	0.063	45%	12%
Lansing-East Lansing, MI	0.064	26%	will attain
Lawrenceburg, TN	0.058	11%	will attain
Lima, OH	0.064	54%	21%
Little Rock, AR	0.062	36%	3%
Longview, TX	0.064	53%	20%
Louisville, KY-IN	0.066	67%	33%
Macon, GA	0.063	47%	14%
McAlester, OK	0.060	19%	will attain
McAllen, TX	0.062	30%	will attain
Medford, OR	0.061	35%	2%
Memphis, TN-AR	0.068	82%	49%
Mesa Verde NP	0.061	36%	3%
Minneapolis, MN	0.059	21%	will attain
Mobile, AL	0.064	54%	21%
Monroe, LA	0.060	25%	will attain
Mount Vernon, IL	0.057	5%	will attain
Muncie, IN	0.062	23%	will attain
Murray Co, GA	0.058	7%	will attain
Muskegon, MI	0.068	17%	will attain
Nashville, TN	0.061	37%	4%
Natchez, MS	0.059	17%	will attain
New Orleans, LA	0.065	67%	33%
Newton Co, AR	0.060	20%	will attain
Norfolk-Virginia Beach-Newport News, VA	0.070	87%	53%
Oklahoma City, OK	0.059	23%	will attain
Omaha, NE-IA	0.062	40%	7%
Orlando, FL	0.058	5%	will attain
Owensboro, KY-IN	0.063	53%	19%
Paducah, KY-IL	0.062	43%	9%
Panama City, FL	0.062	44%	11%
Parkersburg-Marietta, WV-OH	0.061	35%	1%
Pascagoula, MS	0.067	77%	43%
Pensacola, FL	0.065	58%	25%
Phoenix-Mesa, AZ	0.068	74%	40%
Pittsburgh-Beaver Valley, PA	0.069	85%	51%
Pocatello, ID	0.061	21%	will attain
Portland, ME	0.061	39%	6%
Portland, OR-WA	0.063	46%	13%
Providence, RI	0.066	3%	will attain



Raleigh-Durham-Chapel Hill, NC	0.065	45%	11%
Rapid City, SD	0.062	39%	6%
Reno, NV	0.062	38%	5%
Richmond-Petersburg, VA	0.067	68%	35%
Roanoke Rapids, NC	0.060	25%	will attain
Roanoke, VA	0.060	20%	will attain
Rochester, NY	0.064	54%	21%
Rocky Mount, NC	0.061	33%	1%
Salt Lake City, UT	0.067	77%	43%
San Antonio, TX	0.067	61%	29%
Sarasota, FL	0.060	19%	will attain
Schoolcraft Co, MI	0.065	4%	will attain
Seattle-Tacoma, WA	0.065	67%	33%
Shenandoah NP	0.061	21%	will attain
Shreveport, LA	0.061	25%	will attain
Somerset, KY	0.061	31%	will attain
Spokane, WA	0.060	14%	will attain
Springfield, MA	0.062	23%	will attain
Springfield, MO	0.057	7%	will attain
St Louis, MO-IL	0.068	83%	49%
State College, PA	0.059	14%	will attain
Steubenville-Weirton, OH-WV	0.061	33%	will attain
Syracuse, NY	0.068	56%	23%
Tampa Bay - St. Petersburg, FL	0.064	61%	27%
Terre Haute, IN	0.062	47%	14%
Tioga Co, PA	0.061	8%	will attain
Toledo, OH	0.067	69%	36%
Tucson, AZ	0.064	40%	7%
Tulsa, OK	0.065	65%	31%
Tupelo, MS	0.058	11%	will attain
Tyler, TX	0.063	37%	4%
Ulster Co, NY	0.062	10%	will attain
Utica, NY	0.057	3%	will attain
Washington, DC-MD-VA	0.066	56%	23%
Waterloo, IA	0.058	1%	will attain
Wheeling, WV-OH	0.061	31%	will attain
Wichita, KS	0.064	48%	15%
Williston, ND	0.058	1%	will attain
Wilmington, NC	0.057	2%	will attain
Wytheville, VA	0.059	13%	will attain
Yancey Co, NC	0.063	33%	will attain
Yavapai Co, AZ	0.062	9%	will attain
Youngstown-Warren-Sharon, OH-PA	0.064	56%	23%

Figures S2.1 and S2.2 show which counties are part of the extrapolated cost areas as well as the estimated percent reduction needed beyond the RIA control case to meet the alternative standards of 0.055 and 0.060 ppm within each of those areas. The conversion of these additional percentage reductions to actual extrapolated tons is described in Sections S2.3 of this supplement.

Figure S2.1: Map of Extrapolated Cost Counties for the 0.055 ppm Alternate Standard and Estimated Percentage NOx Controls Needed to Meet that Standard in 2020

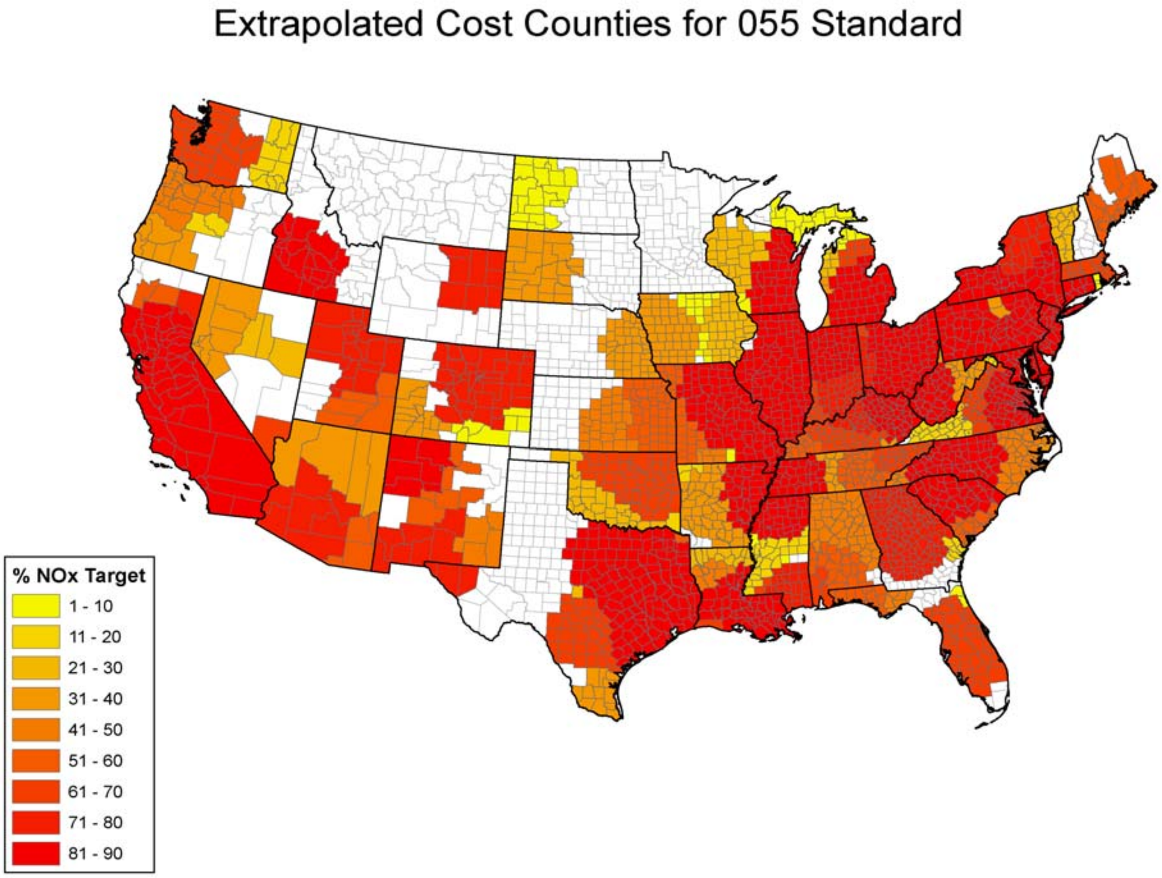
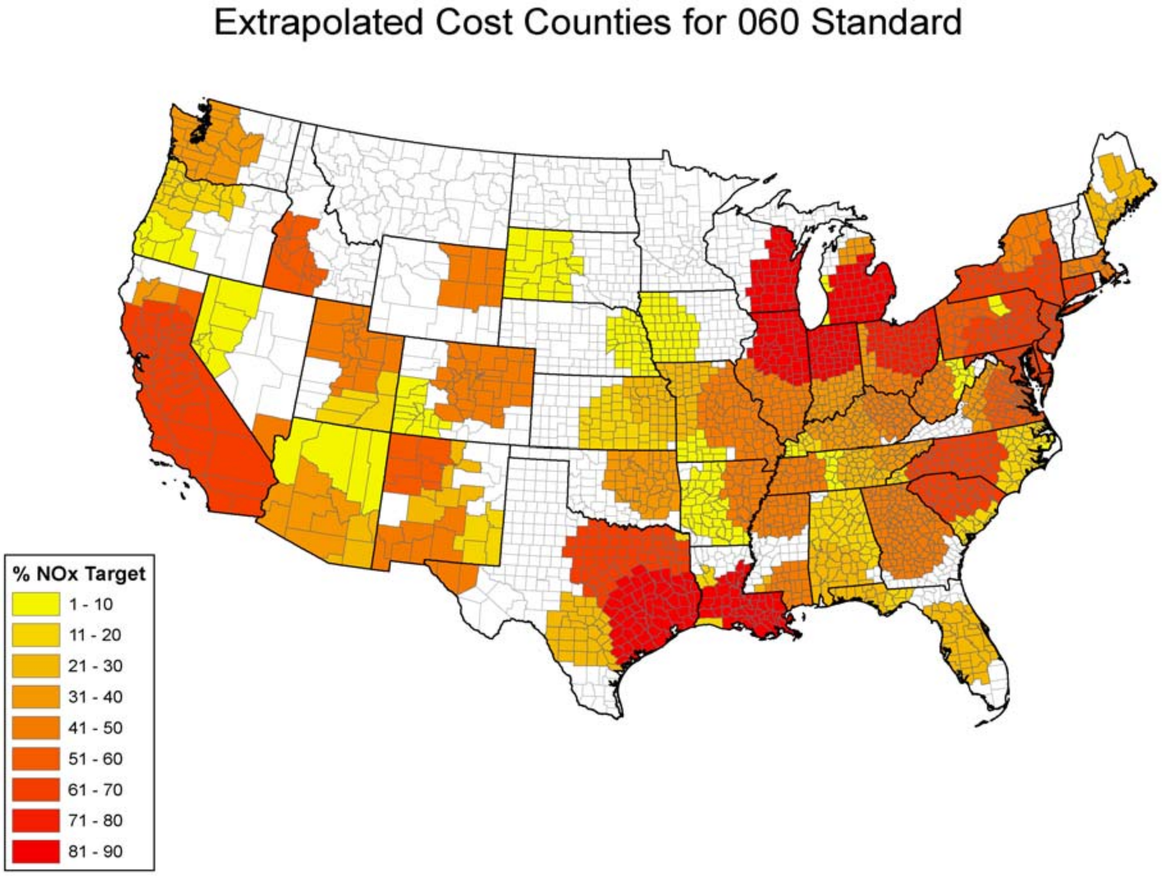


Figure S2.2: Map of Extrapolated Cost Counties for the 0.060 ppm Alternate Standard and Estimated Percentage NOx Controls Needed to Meet that Standard in 2020



S2.3 Estimating Emission Targets

The methodology to develop air quality NOx reduction targets for estimating extrapolated tons reduced for the alternative standards is presented in the 2008 Ozone NAAQS RIA[3] Section 4.1.5. No methodological changes were made to extend the analysis to targets for the 0.055 ppm and 0.060 ppm alternative standards. Discussion on the creation of the NOx targets for the 0.055 ppm and 0.060 ppm standards is in section S1.1. These NOx targets were applied to the remaining emissions from the RIA control scenario by geographic area. Table S2.5 provides the extrapolated reductions by geographic area needed to obtain the two alternative standards post-RIA control scenario emissions. The extrapolated NOx tons are obtained by multiplying the NOx targets in Tables S2.2 through S2.4 by the remaining emissions for each area after the RIA control scenario.

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[3] http://www.epa.gov/ttn/ecas/regdata/RIAs/4-ozoneriachapter4.pdf

It is important to repeat that the extrapolated cost areas are potentially standard-specific because the location of counties in an extrapolated area depends on whether the particular standard is being violated by a greater or lesser number of monitors in the area. For example, as seen in Figures 4.3a and 4.3b of the 2008 Ozone NAAQS RIA[3] the Boise Idaho area extends further east for the 0.055 ppm alternate standard where areas like New Orleans attained the 0.060 standard but not 0.055 ppm alternate standard.

Table S2.5: Extrapolated Emission Reductions (post-RIA control scenario) Needed to Meet the 0.055 ppm and 0.060 ppm Alternate Standards in 2020[a]

Extrapolated Cost Area	Additional NOx Emission Reductions Needed (annual tons/year)	
	0.055 ppm	0.060 ppm
Albuquerque, NM	7,800	3,100
Appleton-Oshkosh, WI	3,600	
Atlanta, GA	140,000	80,000
Augusta, GA-SC	4,900	
Austin, TX	41	
Baton Rouge, LA	250,000	250,000
Benton Harbor, MI	3,500	200
Benzie Co, MI	1,800	
Berkeley and Jefferson Counties, WV	1,200	
Birmingham, AL	72,000	17,000
Boise, ID	32,000	17,000
Boston-Lawrence-Worcester, MA	62,000	40,000
Buffalo-Niagara Falls, NY	50,000	35,000
Burlington, VT	3,100	
Campbell Co, WY	26,000	14,000
Canyonlands NP	1,500	530
Carlsbad, NM	20,000	6,800
Cedar Co, MO	1,400	2,200
Cedar Rapids, IA	160	
Charleston, WV	220	
Charlotte-Gastonia-Rock Hill, NC-SC	210,000	150,000
Chattanooga, TN-GA	12,000	1,600
Chico, CA	3,000	1,900
Cincinnati-Hamilton, OH-KY-IN	110,000	59,000
Clearfield and Indiana Cos, PA	410	33
Cleveland, MS	180	
Cleveland-Akron-Lorain, OH	190,000	160,000
Clinton, IA	24,000	
Cochise Co, AZ	4,800	2,100
Colorado Springs, CO	500	
Columbia, SC	24,000	8,700
Corpus Christi, TX	31,000	
Dallas-Fort Worth, TX	220,000	120,000
Davenport, IA	150	
Denver-Boulder-Greeley-Ft Collins-Love.,	80,000	43,000
Detroit-Ann Arbor, MI	180,000	180,000

Extrapolated Cost Area	Additional NOx Emission Reductions Needed (annual tons/year)	
	0.055 ppm	**0.060 ppm**
El Paso, TX-NM	20,000	12,000
Eugene-Springfield, OR	450	
Farmington, NM	86,000	52,000
Franklin Co, PA	630	100
Grand Canyon NP	22,000	1,800
Grand Rapids, MI	90	
Great Basin NP	470	
Great Smoky Mountains NP	560	180
Green Bay, WI	420	11,000
Gulfport-Biloxi, AL-MS	25,000	6,600
Hancock, Knox, Lincoln & Waldo Co, ME	17,000	
Houston-Galveston-Brazoria, TX	260,000	310,000
Huntington-Ashland, WV-KY	170,000	100,000
Huron Co, MI	15,000	7,500
Jefferson Co, NY	26,000	17,000
Johnson City-Kingsport-Bristol, TN	45,000	21,000
Kansas City, MO-KS	100,000	37,000
Knoxville, TN	22,000	9,200
La Crosse, WI	290	
Lake Charles, LA	6,900	1,100
Lansing-East Lansing, MI	1,900	
Las Vegas, NV	23,000	14,500
Little Rock, AR	18,000	1,500
Longview, TX	950	360
Los Angeles South Coast Air Basin, CA[b]	270,000	230,000
Louisville, KY-IN	59,000	29,000
Macon, GA	7,500	4,200
Madison and Page Cos (Shenandoah NP), VA	350	
McAlester, OK	800	
Medford, OR	5,200	300
Memphis, TN-AR-MS	160,000	98,000
Mesa Verde NP	4,600	390
Minneapolis-St.Paul, MN-WI	6,300	
Mobile, AL	25,000	9,900
Monroe, LA	9,300	
Muskegon, MI	160	
Nashville, TN	1,900	210
Natchez, MS	6,100	960
Nevada Co, CA	1,200	
New Orleans, LA	2,800	
Newton, AR	2,300	
Norfolk-Virginia Beach-Newport News (HR)	130,000	79,000
Northeast Corridor, CT-DE-MD-NJ-NY-PA	550,000	430,000
Oklahoma City, OK	18,600	
Omaha, NE-IA	62,000	11,000
Orlando, FL	1,300	
Owensboro, KY-IN	18,000	5,400

Extrapolated Cost Area	Additional NOx Emission Reductions Needed (annual tons/year)	
	0.055 ppm	**0.060 ppm**
Paducah, KY-IL	590	620
Panama City, FL	3,400	850
Parkersburg-Marietta, WV-OH	13,000	380
Pascagoula, MS	59,000	33,000
Pensacola, FL	24,000	10,000
Phoenix-Mesa, AZ	51,000	28,000
Pittsburgh-Beaver Valley, PA	82,000	49,000
Portland, OR-WA	37,000	11,000
Providence (All RI), RI	310	
Raleigh-Durham-Chapel Hill, NC	25,000	6,200
Rapid City, SD	4,400	700
Reno, NV	9,700	1,300
Richmond-Petersburg, VA	30,000	15,000
Roanoke, VA	7,700	
Rocky Mount, NC	710	20
Sacramento Metro, CA	11,000	8,900
Salt Lake City-Ogden-Provo, UT	43,000	24,000
San Antonio, TX	39,000	19,000
San Joaquin Valley, CA[b]	180,000	150,000
Schoolcraft Co, MI	1,000	
Seattle, WA	98,000	48,000
Somerset, KY	450	
Spokane, WA	2,700	
Springfield, MO	90	
St Louis, MO-IL	230,000	120,000
Steubenville-Weirton, OH-WV	260	
Tampa Bay-St. Petersburg, FL	140,000	52,000
Toledo, OH	2,000	1,000
Tulsa, OK	130,000	55,000
Tupelo, MS	1,600	
Washington, DC-MD-VA	2,500	1,000
Waterloo, IA	19	
Western Lake Michigan, IL-IN-WI	420,000	420,000
Wheeling, WV-OH	130	
Wichita, KS	26,000	11,000
Williston, ND	620	
Wytheville, VA	240	

[a] Estimates are rounded to two significant figures. As such, totals will not sum down columns.

[b] The Los Angeles South Coast Air Basin and San Joaquin Valley areas of CA will be reducing emissions to meet the 0.08 ppm standard in the year 2020. They are included in this analysis due to their influence on the attainment of the Sacramento geographic area.

S2.4 Engineering Costs

The methodology used to develop the extrapolated costs presented in this supplemental analysis is presented in the 2008 Ozone NAAQS RIA[4] Section 5.2.1. To extend the analysis for the 0.055 ppm and the 0.060 ppm alternative standards no methodological changes were made to the estimation techniques for the fixed cost approach or the hybrid approach.

S.2.4.1 Supplemental Controls Analysis

The analysis steps are identical to the extrapolated cost analysis steps presented for the 0.065 ppm supplemental controls analysis in the 2008 Ozone NAAQS RIA[4]. The first step in the estimation process was to identify additional supplemental known control measures that were not included in the modeled control strategy. These controls consisted of additional known measures for the geographic areas that were not included in the modeled control strategy as well as additional controls that are discussed in the 2008 Ozone NAAQS RIA[5] Appendix 3a.1.6. An exception for the 0.055 ppm and 0.060 ppm alternative standard analyses relates to the application of additional VOC controls. We did not apply additional VOC controls for these two alternative standards for the Lake Michigan geographic area. When referring to the Phase 1 air quality modeling, it was deemed that a NOx only extrapolated control strategy would be preferable to a NOx + VOC strategy. The extrapolated emission reductions needed to meet the two alternative standards post the application of supplemental controls is presented in Table S2.6. It is important to note that negative emission reductions needed indicate that there were enough supplemental known control measures for the geographic area to reach attainment without the application of unknown control measures. Detailed results of the supplemental controls analysis are provided in Appendix S2a of this supplement.

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[4] Available on the Internet at <http://www.epa.gov/ttn/ecas/regdata/RIAs/5-ozoneriachapter5.pdf>.

[5] Available on the Internet at <http://www.epa.gov/ttn/ecas/regdata/RIAs/3-ozoneriachapter3appendix.pdf>.

Table S2.6: Extrapolated Emission Reductions Needed (Post Application of Supplemental Controls) to Meet the 0.055 ppm and 0.060 ppm Alternative Standards in 2020[a]

Extrapolated Cost Area	Additional NOx Emission Reductions Needed (annual tons/year)	
	0.055 ppm	0.060 ppm
Albuquerque, NM	7,200	2,500
Appleton-Oshkosh, WI	800	
Atlanta, GA	120,000	64,000
Augusta, GA-SC	(6)[b]	
Austin, TX	41	
Baton Rouge, LA	240,000	240,000
Benton Harbor, MI	3,500	180
Benzie Co, MI	(200)[b]	
Berkeley and Jefferson Counties, WV	(200)[b]	
Birmingham, AL	55,000	500
Boise, ID	28,000	14,000
Boston-Lawrence-Worcester, MA	57,000	35,000
Buffalo-Niagara Falls, NY	49,000	34,000
Burlington, VT	2,700	
Campbell Co, WY	22,000	10,000
Canyonlands NP	550	(40)[b]
Carlsbad, NM	(10)[b]	(60)[b]
Cedar Co, MO	1,400	1,900
Cedar Rapids, IA	(500)[b]	
Charleston, WV	(4)[b]	
Charlotte-Gastonia-Rock Hill, NC-SC	200,000	130,000
Chattanooga, TN-GA	7,800	(300)[b]
Chico, CA	2,600	1,500
Cincinnati-Hamilton, OH-KY-IN	98,000	47,000
Clearfield and Indiana Cos, PA	97	(50)[b]
Cleveland, MS	(10)[b]	
Cleveland-Akron-Lorain, OH	180,000	150,000
Clinton, IA	5,600	
Cochise Co, AZ	4,600	1,900
Colorado Springs, CO	(40)[b]	
Columbia, SC	22,000	6,700
Corpus Christi, TX	15,000	
Dallas-Fort Worth, TX	210,000	110,000
Davenport, IA	39	
Denver-Boulder-Greeley-Ft Collins-Love.,	67,000	29,000
Detroit-Ann Arbor, MI	170,000	170,000
El Paso, TX-NM	16,000	8,100
Eugene-Springfield, OR	450	
Farmington, NM	67,000	34,000
Franklin Co, PA	460	(20)[b]
Grand Canyon NP	20,000	520
Grand Rapids, MI	92	
Great Basin NP	470	
Great Smoky Mountains NP	560	180

Extrapolated Cost Area	Additional NOx Emission Reductions Needed (annual tons/year)	
	0.055 ppm	0.060 ppm
Green Bay, WI	(900) [b]	
Gulfport-Biloxi, AL-MS	19,000	5,100
Hancock, Knox, Lincoln & Waldo Co, ME	15,000	5,000
Houston-Galveston-Brazoria, TX	140,000	190,000
Huntington-Ashland, WV-KY	150,000	77,000
Huron Co, MI	5,500	(5) [b]
Jefferson Co, NY	24,000	15,000
Johnson City-Kingsport-Bristol, TN	35,000	12,000
Kansas City, MO-KS	87,000	27,000
Knoxville, TN	16,000	3,500
La Crosse, WI	290	
Lake Charles, LA	810	(100) [b]
Lansing-East Lansing, MI	1,700	
Las Vegas, NV	22,000	13,000
Little Rock, AR	9,900	(2,000) [b]
Longview, TX	830	240
Los Angeles South Coast Air Basin, CA[c]	270,000	220,000
Louisville, KY-IN	57,000	27,000
Macon, GA	7,300	4,100
Madison and Page Cos (Shenandoah NP), VA	330	
McAlester, OK	(70) [b]	
Medford, OR	4,700	(20) [b]
Memphis, TN-AR-MS	140,000	72,000
Mesa Verde NP	830	(700) [b]
Minneapolis-St.Paul, MN-WI	4,900	
Mobile, AL	5,800	(6) [b]
Monroe, LA	(20) [b]	
Muskegon, MI	160	
Nashville, TN	1,900	130
Natchez, MS	(40) [b]	
Nevada Co, CA	1,100	860
New Orleans, LA	700	
Newton, AR	2,100	
Norfolk-Virginia Beach-Newport News (HR)	120,000	70,000
Northeast Corridor, CT-DE-MD-NJ-NY-PA	540,000	420,000
Oklahoma City, OK	360	
Omaha, NE-IA	50,000	(60) [b]
Orlando, FL	170	
Owensboro, KY-IN	17,000	4,900
Paducah, KY-IL	590	500
Panama City, FL	2,400	(10) [b]
Parkersburg-Marietta, WV-OH	7,800	(200) [b]
Pascagoula, MS	37,000	11,000
Pensacola, FL	15,000	1,500
Phoenix-Mesa, AZ	46,000	23,000
Pittsburgh-Beaver Valley, PA	78,000	45,000
Portland, OR-WA	33,000	5,900

Extrapolated Cost Area	Additional NOx Emission Reductions Needed (annual tons/year)	
	0.055 ppm	0.060 ppm
Providence (All RI), RI	240	
Raleigh-Durham-Chapel Hill, NC	20,000	530
Rapid City, SD	1,700	(20) [b]
Reno, NV	9,500	1,100
Richmond-Petersburg, VA	25,000	11,000
Roanoke, VA	5,600	
Rocky Mount, NC	710	20
Sacramento Metro, CA[c]	8,700	7,000
Salt Lake City-Ogden-Provo, UT	38,000	19,000
San Antonio, TX	26,000	5,900
San Joaquin Valley, CA[c]	180,000	150,000
Schoolcraft Co, MI	(4,000) [b]	
Seattle, WA	95,000	46,000
Somerset, KY	380	
Spokane, WA	1,100	
Springfield, MO	76	
St Louis, MO-IL	210,000	100,000
Steubenville-Weirton, OH-WV	190	
Tampa Bay-St. Petersburg, FL	130,000	45,000
Toledo, OH	1,800	850
Tulsa, OK	99,000	32,000
Tupelo, MS	(100) [b]	
Washington, DC-MD-VA	2,500	1,000
Waterloo, IA	(20) [b]	
Western Lake Michigan, IL-IN-WI	390,000	390,000
Wheeling, WV-OH	130	
Wichita, KS	11,000	(5) [b]
Williston, ND	(70) [b]	
Wytheville, VA	56	

[a] Estimates are rounded to two significant figures. As such, totals will not sum down columns.

[b] Negative numbers indicate the supplemental control measures applied yielded greater emission reductions than were needed for the geographic are to attain the alternative standard being analyzed.

[c] The Los Angeles South Coast Air Basin and San Joaquin Valley areas of CA will be reducing emissions to meet the 0.08 ppm standard in the year 2020. They are included in this analysis due to their influence on the attainment of the Sacramento geographic area.

S.2.4.2 Hybrid Approach Extrapolated Costs

A complete discussion of the theoretical model for the Hybrid Approach is provided in the 2008 Ozone NAAQS RIA[4] Section 5.2.1.2 as well as the Appendix[6] 5a.4.4. Consistent with

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[6] Available on the Internet at <http://www.epa.gov/ttn/ecas/regdata/RIAs/5a-ozoneriachapter5appendixa.pdf>.

the results presented in 2008 Ozone NAAQS RIA the hybrid approach results are shown for the mid range estimate[7] (Table S2.7). Sensitivities are provided in Appendix Sa1 of this supplement.

Table S2.7: Extrapolated Cost by Region to Meet the 0.055 ppm and 0.060 ppm Alternative Standards Using the Hybrid Approach (Mid)[a]

2020 Extrapolated Cost by Region	Hybrid Approach (Mid) - Extrapolated Cost (M 2006$)	
	0.055 ppm	**0.060 ppm**
East	$100,000	$72,000
West	$11,000	$3,900
California	$11,000	$9,000
Total Extrapolated Cost	**$120,000**	**$85,000**

[a] Estimates are rounded to two significant figures. As such, totals will not sum down columns.

S.2.4.3 Fixed Cost Approach Extrapolated Costs.

A complete discussion of the fixed cost approach is provided in the 2008 Ozone NAAQS RIA[4] Section 5.2.1.4. Consistent with the results presented in the 2008 Ozone NAAQS RIA the fixed cost approach results are shown for the $15,000/ton estimate (Table S2.8). Sensitivities are provided in Appendix Sa1 of this supplement.

Table S2.8: Extrapolated Cost by Region to Meet the 0.055 ppm and 0.060 ppm Alternative Standards Using the Fixed Cost Approach ($15,000/ton)[a]

2020 Extrapolated Cost by Region	Fixed Cost Approach ($15,000/ton) - Extrapolated Cost (M 2006$)	
	0.055 ppm	**0.060 ppm**
East	$59,000	$39,000
West	$7,000	$3,000
California	$6,800	$5,700
Total Extrapolated Cost	**$73,000**	**$47,000**

[a] Estimates are rounded to two significant figures. As such, totals will not sum down columns.

S.2.4.4 Summary of Total Costs

Table S2.9 presents a summary of the total national costs of attaining the 0.055 ppm and the 0.060 ppm alternative standards in 2020. This summary includes the engineering costs of the modeled control strategy (presented in the 2008 Ozone NAAQS RIA Chapter 5[4]), the additional supplemental controls, as well as the extrapolated costs. Consistent with OMB Circular A-4, costs are presented at a 7% discount rate.

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[7] The mid range estimate consists of using an M value of 0.24 for the estimation of the average cost per ton of control by geographic area. For a complete listing of average cost per ton by geographic area see Appendix S2a.

Table S2.9: Total Costs of Attainment in 2020 for the 0.055 ppm and 0.060 ppm Alternative Standards in 2020[a]

Cost Type	Region	Engineering Costs in 2020 (M 2006$)			
		0.055 ppm		0.060 ppm	
Known Control Costs	East	$4,600		$4,000	
	West	$400		$330	
	California	$160		$160	
	Known Control Costs[b]	$5,100		$4,500	
Extrapolated Costs	Approach	Fixed	Hybrid	Fixed	Hybrid
	East	$59,000	$100,000	$39,000	$72,000
	West	$7,000	$11,000	$3,000	$3,900
	California[c]	$6,800	$11,000	$5,700	$9,000
	Extrapolated Costs	$73,000	$120,000	$47,000	$85,000
	Total Costs	**$78,000**	**$130,000**	**$52,000**	**$90,000**

[a] Estimates are rounded to two significant figures. As such, totals will not sum down columns.
[b] Known control costs consist of the modeled control strategy costs presented in the RIA Table 5.1, as well as supplemental controls presented in Appendix Sa1.
[C] The extrapolated costs for the South Coast and San Joaquin areas of California only include the costs required to bring Sacramento into attainment.

S2.5 Benefits

This section presents the benefits analysis for ozone standard levels at 0.060 ppm and 0.055 ppm updated to reflect key methodological changes that EPA has implemented since having published the 2008 Ozone NAAQS RIA. In this updated analysis, we re-estimate the human health benefits of reduced exposure to ambient ozone and $PM_{2.5}$ co-benefits from simulated attainment with an alternate daily 8hr maximum standard. These benefits were calculated using exactly the same method as used to calculate the updated benefits at 0.065 ppm, and are incremental to an air quality baseline that reflects attainment with the 1997 ozone and 2006 $PM_{2.5}$ National Ambient Air Quality Standards (NAAQS).[8]

For an alternative standard at 0.060 ppm, EPA estimates the total monetized benefits to be $35 to $100 billion (2006$, 3% discount rate) in 2020.[9] For an alternative standard at 0.055 ppm, EPA estimates the total monetized benefits to be $53 to $160 billion (2006$, 3% discount rate) in 2020.[10] These monetized benefits include reduced health effects from reduced exposure to ozone, reduced health effects from reduced exposure to $PM_{2.5}$, and improvements in visibility. Higher or lower estimates of benefits are possible using other assumptions. These

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[8] For more information, please consult Chapter 6 of the 2008 Ozone RIA (U.S. EPA, 2008) and the updated benefits section S3 of this supplemental.

[9] Results are shown as a range from Bell et al. (2004) with Pope et al. (2002) to Levy (2005) with Laden et al. (2006). $PM_{2.5}$ co-benefits using a 7% discount rate would be approximately 9% lower.

[10] Results are shown as a range from Bell et al. (2004) with Pope et al. (2002) to Levy (2005) with Laden et al. (2006). $PM_{2.5}$ co-benefits using a 7% discount rate would be approximately 9% lower.

updated estimates reflect three key methodological changes we have implemented since the publication of the 2008 RIA that reflect EPA's most current interpretation of the scientific literature and include: (1) a no-threshold model for PM$_{2.5}$ that calculates incremental benefits down to the lowest modeled air quality levels; (2) removal of the assumption of no causality for the relationship between ozone exposure and premature mortality; (3) a different Value of Statistical Life (VSL). Methodological limitations prevented EPA from monetizing the benefits from several important benefit categories, including ecosystem effects.

These updated estimates reflect three key methodological changes we have implemented since the publication of the 2008 RIA that reflect EPA's most current interpretation of the scientific literature and include: (1) a no-threshold model for PM2.5 that calculates incremental benefits down to the lowest modeled air quality levels; (2) removal of the assumption of no causality for the relationship between ozone exposure and premature mortality; (3) a different Value of Statistical Life (VSL).[11] For more information on these changes, please see Section 3 of this supplemental.

In Table S2.10 and S2.11, we show the ozone benefits with confidence intervals and the ozone benefits compared to PM$_{2.5}$ co-benefits at 0.060 ppm. Tables S2.12 and S2.13, we show the ozone benefits with confidence intervals and the ozone benefits compared to PM$_{2.5}$ co-benefits at 0.055 ppm. In tables S2.14, we show the increase in life years gained as a result of increased life expectancy for 0.060 ppm and 0.055 ppm. In Table S2.15, we show the percentage of total mortality attributable to ozone based on the Bell et al. (2004) and Levy et al. (2005) risk coefficients. In the interest of clarity, we elected to report life years and percentage of total mortality attributable to ozone based on the studies with the smallest and largest effect estimate.

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[11] The current VSL is $6.3 million (2000$). After adjustments for a different currency year (2006$) and income growth to 2020, the VSL is $8.9m.

Table S2.10: Summary of National Ozone Benefits for 0.060 ppm with confidence intervals (in millions of 2006$)[A, B, C]

Endpoint Group	Author	Year	0.060 ppm Valuation	0.060 ppm Incidence
Hospital Admissions, Respiratory			$56 ($30 -- $82)	5,600 (2,700 -- 8,500)
Emergency Room Visits, Respiratory			$1.3 (-$2.6 -- $4.4)	3,600 (-8,200 -- 12,000)
School Loss Days			$190 ($82 -- $260)	2,100,000 (830,000 -- 3,000,000)
Acute Respiratory Symptoms			$330 ($130 -- $610)	5,600,000 (2,600,000 -- 8,600,000)
Hospital Admissions, Respiratory			$160 ($22 -- $270)	6,900 (330 -- 12,000)
Mortality	Bell et al.	2004	$7,900 ($660 -- $24,000)	890 (340 -- 1,400)
Mortality	Schwartz		$12,000 ($990 -- $36,000)	1,400 (500 -- 2,200)
Mortality	Huang		$13,000 ($1,100 -- $39,000)	1,500 (640 -- 2,400)
Mortality	Bell et al.	2005	$30,000 ($2,200 -- $73,000)	2,900 (1,500 -- 4,200)
Mortality	Ito et al.		$35,000 ($3,300 -- $99,000)	4,000 (2,500 -- 5,500)
Mortality	Levy et al.		$36,000 ($3,300 -- $98,000)	4,000 (2,900 -- 5,200)

[A] Does not reflect estimates for the San Joaquin and South Coast Air Basins

[B] Confidence intervals are not available for PM co-benefits because of methodological limitations when using benefit-per-ton.

[C] All estimates rounded to two significant digits

Table S2.11: Summary of National Ozone Benefits and $PM_{2.5}$ Co-Benefits for 0.060 ppm (in millions of 2006$)[A, B, C]

	Endpoint Group	Author	0.060 ppm Valuation (3% discount rate)	0.060 ppm Valuation (7% discount rate)	0.060 ppm Incidence
Ozone	Infant Hospital Admissions, Respiratory		$56	$56	5,600
	Emergency Room Visits, Respiratory		$1.3	$1.3	3,600
	School Loss Days		$190	$190	2,100,000
	Acute Respiratory Symptoms		$330	$330	5,600,000
	Hospital Admissions, Respiratory		$160	$160	6,900
	Mortality	Bell et al. (2004)	$7,900	$7,900	890
	Mortality	Schwartz	$12,000	$12,000	1,400
	Mortality	Huang	$13,000	$13,000	1,500
	Mortality	Bell et al. (2005)	$25,000	$25,000	2,900
	Mortality	Ito et al.	$35,000	$35,000	4,000
	Mortality	Levy et al.	$36,000	$36,000	4,000
$PM_{2.5}$	Chronic Bronchitis		$980	$980	2,200
	Acute Myocardial Infarction		$520	$510	5,300
	Hospital Admissions, Respiratory		$9	$9	740
	Hospital Admissions, Cardiovascular		$39	$39	1,600
	Emergency Room Visits, Respiratory		$0.87	$0.87	2,600
	Acute Bronchitis		$0.36	$0.36	5,300
	Work Loss Days		$47	$47	420,000
	Asthma Exacerbation		$2.8	$2.8	58,000
	Acute Respiratory Symptoms		$130	$130	2,500,000
	Lower Respiratory Symptoms		$1.0	$1.0	63,000
	Upper Respiratory Symptoms		$1.3	$1.3	48,000
	Infant Mortality		$100	$100	13
	Mortality	Pope et al	$25,000	$22,000	3,100
	Mortality	Laden et al	$63,000	$57,000	7,800
	Mortality	Expert K	$8,700	$7,800	1,100
	Mortality	Expert E	$83,000	$75,000	10,000

[A] Does not reflect estimates for the San Joaquin and South Coast Air Basins

[B] Does not include confidence intervals

[C] All estimates rounded to two significant digits

Table S2.12: Summary of National Ozone Benefits for 0.055 ppm with confidence intervals (in millions of 2006$)[A, B, C]

Endpoint Group	Author	Year	0.055 ppm Valuation	0.055 ppm Incidence
Hospital Admissions, Respiratory			$97 ($52 -- $140)	9,800 (4,800 -- 15,000)
Emergency Room Visits, Respiratory			$2.4 (-$4.6 -- $7.8)	6,500 (-15,000 -- 21,000)
School Loss Days			$330 ($150 -- $460)	3,700,000 (1,500,000 -- 5,300,000)
Acute Respiratory Symptoms			$580 ($230 -- $1,100)	9,800,000 (4,500,000 -- 15,000,000)
Hospital Admissions, Respiratory			$290 ($41 -- $490)	12,000 (620 -- 22,000)
Mortality	Bell et al.	2004	$14,000 ($1,200 -- $42,000)	1,600 (620 -- 2,500)
Mortality	Schwartz		$22,000 ($1,700 -- $65,000)	2,400 (890 -- 4,000)
Mortality	Huang		$24,000 ($2,000 -- $70,000)	2,600 (1,100 -- 4,200)
Mortality	Bell et al.	2005	$50,000 ($4,000 -- $130,000)	5,100 (2,600 -- 7,500)
Mortality	Ito et al.		$63,000 ($5,900 -- $180,000)	7,100 (4,500 -- 9,600)
Mortality	Levy et al.		$64,000 ($5,900 -- $170,000)	7,200 (5,100 -- 9,200)

[A] Does not reflect estimates for the San Joaquin and South Coast Air Basins

[B] Confidence intervals are not available for PM co-benefits because of methodological limitations when using benefit-per-ton.

[C] All estimates rounded to two significant digits

Table S2.13: Summary of National Ozone Benefits and PM2.5 Co-Benefits for 0.055 ppm (in millions of 2006$)[A, B, C]

	Endpoint Group	Author	0.055 ppm Valuation (3% discount rate)	0.055 ppm Valuation (7% discount rate)	0.055 ppm Incidence
Ozone	Infant Hospital Admissions, Respiratory		$97	$97	9,800
	Emergency Room Visits, Respiratory		$2.4	$2.4	6,500
	School Loss Days		$330	$330	3,700,000
	Acute Respiratory Symptoms		$580	$580	9,800,000
	Hospital Admissions, Respiratory		$290	$290	12,000
	Mortality	Bell et al. (2004)	$14,000	$14,000	1,600
	Mortality	Schwartz	$22,000	$22,000	2,400
	Mortality	Huang	$24,000	$24,000	2,600
	Mortality	Bell et al. (2005)	$45,000	$45,000	5,100
	Mortality	Ito et al.	$63,000	$63,000	7,100
	Mortality	Levy et al.	$64,000	$64,000	7,200
$PM_{2.5}$	Chronic Bronchitis		$1,400	$1,400	3,200
	Acute Myocardial Infarction		$740	$720	7,500
	Hospital Admissions, Respiratory		$13	$13	1,000
	Hospital Admissions, Cardiovascular		$56	$56	2,200
	Emergency Room Visits, Respiratory		$1.20	$1.20	3,700
	Acute Bronchitis		$0.51	$0.51	7,600
	Work Loss Days		$67	$67	600,000
	Asthma Exacerbation		$4.0	$4.0	83,000
	Acute Respiratory Symptoms		$190	$190	3,600,000
	Lower Respiratory Symptoms		$1.5	$1.5	91,000
	Upper Respiratory Symptoms		$1.8	$1.8	69,000
	Infant Mortality		$150	$150	19
	Mortality	Pope et al	$35,000	$31,000	4,300
	Mortality	Laden et al	$90,000	$81,000	11,000
	Mortality	Expert K	$12,000	$11,000	1,500
	Mortality	Expert E	$120,000	$110,000	15,000

[A] Does not reflect estimates for the San Joaquin and South Coast Air Basins

[B] Does not include confidence intervals

[C] All estimates rounded to two significant digits

Table S2.14: Estimated Reduction in Ozone-Related Premature Mortality in Terms of Life Years Gained from Increases in Life Expectancy

Age Range	*Bell et al. (2004) mortality estimate*		*Levy et al. (2005) mortality estimate*	
	0.060 ppm	0.055 ppm	0.060 ppm	0.055 ppm
25-29	240 (110—380)	400 (180—630)	2,100 (1,600—2,700)	3,600 (2,600—4,500)
30-34	220 (94—340)	360 (160—560)	1,900 (1,400—2,400)	3,200 (2,300—4,000)
35-44	850 (380—1,300)	1,400 (630—2,200)	5,100 (3,800—6,500)	8,700 (6,400—11,000)
45-54	1,700 (740—2,600)	2,900 (1,300—4,500)	8,300 (6,100—10,000)	14,000 (10,000—18,000)
55-64	3,300 (1,500—5,200)	5,700 (2,500—8,900)	15,000 (11,000—19,000)	26,000 (19,000—32,000)
65-74	3,900 (1,700—6,100)	6,700 (3,000—11,000)	17,000 (13,000—22,000)	30,000 (22,000—37,000)
75-84	2,700 (1,200—4,200)	4,600 (2,000—7,200)	12,000 (8,600—15,000)	20,000 (15,000—26,000)
85-99	1,400 (590—2,100)	2,300 (1,000—3,600)	5,600 (4,300—7,400)	10,000 (7,400—13,000)

Table S2.15: Percentage of Total Mortality Attributable to Ozone

Age Range	*Bell et al. (2004) mortality estimate*		*Levy et al. (2005) mortality estimate*	
	0.060 ppm	0.055 ppm	0.060 ppm	0.055 ppm
25-29	0.098%	0.165%	0.409%	0.694%
30-34	0.095%	0.161%	0.398%	0.681%
35-44	0.094%	0.161%	0.399%	0.682%
45-54	0.096%	0.162%	0.408%	0.692%
55-64	0.091%	0.158%	0.391%	0.674%
65-74	0.088%	0.154%	0.375%	0.657%
75-84	0.087%	0.152%	0.370%	0.650%
85-99	0.090%	0.155%	0.384%	0.663%

S2.6 Conclusions

Given the pervasive uncertainties in the 0.055 ppm and 0.060 ppm analysis, the types of conclusions that readers may draw is necessarily limited. One reasonable conclusion is that the magnitude of the costs and benefits of these two alternatives is significantly larger than that of 0.065 ppm, 0.070 ppm or 0.075 ppm. The reasons for these large uncertainties are outlined in section 2.1 above. As we noted in more detail above, our ability to predict the emissions reductions necessary to achieve the two lower standards is quite limited, and as a result, our estimates of costs and benefits of those levels is highly speculative.

S2.7 References

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