Chapter 3: Modeled Control Strategy - Design and Analytical Results

Synopsis

In order to estimate the costs and benefits of alternate ozone standards, EPA has analyzed one possible hypothetical scenario to illustrate the control strategies that areas across the country might employ to attain an alternative more stringent primary standard of 0.070 ppm. We modeled the lower end of the range to capture a larger number of geographic areas that may be affected by a new ozone standard. Specifically, EPA has modeled the impact that additional emissions controls across numerous sectors would have on predicted ambient ozone concentrations, incremental to meeting the current $PM_{2.5}$ and ozone standards (baseline). Thus, the modeled analysis for a revised standard focuses specifically on incremental improvements beyond the current standards, and uses control options that might be available to states for application by 2020. The hypothetical modeled control strategy presented in this RIA is one illustrative option for achieving emissions reductions to move towards a national attainment of a tighter standard. It is not a recommendation for how a tighter ozone standard should be implemented, and states will make all final decisions regarding implementation strategies once a final NAAQS has been set.

In order to model a hypothetical control strategy incremental to attainment of the current standard, EPA approached the analysis in stages. First, EPA identified controls to be included in the baseline. These included current state and federal programs (see) plus controls to attain the current ozone standard (Table 3.1) and $PM_{2.5}$ standards (see http://www.epa.gov/ttnecas1/ria.html for a complete list of controls). Then, EPA applied additional known controls within geographic areas designed to bring areas predicted to exceed 0.070 ppm in 2020 into attainment. This chapter presents the hypothetical modeled control strategy, the geographic areas where controls were applied, and the results of the modeling which predicted ozone concentrations in 2020 after application of the strategy. The strategy to attain a 0.070 ppm level was the only strategy modeled for air quality changes by EPA. EPA did not expect the modeled control strategy to result in attainment at 0.070 ppm everywhere, and the modeled control strategy did yield only partial attainment. Chapter 4 will explain how EPA used additional air quality modeling to estimate total annual tons/year of emissions reductions needed to achieve ozone concentrations for 0.075 ppm as well as the less stringent option of 0.079 ppm the and the more stringent options of 0.070 ppm and 0.065 ppm). Chapters 5 and 6 present the estimated costs and benefits of the modeled costs and benefits for partial attainment.

Because EPA's baseline indicated that some areas were not likely to be in attainment with the current standard by 2020 (0.08 ppm, effectively 0.084 ppm based on current rounding conventions)—(Figure 3.4) EPA expected that known controls would not be enough to bring those areas, and likely others, into attainment with 0.070 ppm in 2020. Modeling results showed that to be the case (see Figure 3.13).

Because it was impossible to meet either the current or any tighter ozone standard nationwide using only known controls, EPA conducted a second step in the analysis, and estimated the number of further tons of emission reductions needed to attain an alternate primary ozone standard (presented in Chapter 4). It is uncertain what controls States would put in place to attain a tighter standard, since additional control measures are not currently recognized as being commercially available. However, existing emissions inventories for the areas that were predicted to be in nonattainment after application of all known controls, do indicate that substantial amounts of ozone precursor emissions (i.e., tons of NOx or VOC) are available for control, pending future technology. Chapter 4 describes the methodology EPA used to estimate the amount of extrapolated tons necessary for control to reach attainment, and Chapters 5 and 6 present the extrapolation-based costs and benefits of achieving the reductions in ozone necessary to either fully or partially attain the standards in 2020, except for a few areas in California, which will be more fully explained in Chapter 4.

3.1 Establishing the Baseline

The regulatory impact analysis (RIA) is intended to evaluate the costs and benefits of reaching attainment with potential alternative ozone standards. In order to develop and evaluate a control strategy for attaining a more stringent (0.070 ppm) primary standard, it is important to first estimate ozone levels in 2020 given the current NAAQS standards and trends (more information is provided in Chapter 1). This scenario is known as the baseline. Establishing this baseline allows us to estimate the incremental costs and benefits of attaining any alternate primary standard.

This focus on the assessment of the incremental costs and benefits of attaining any alternative standard is an important difference from the focus of the risk assessment used in developing the standard. For purposes of the Staff Paper-risk assessment, risks are estimated associated with just meeting recent air quality and upon just meeting the current and alternative standards as well as incremental reductions in risks in going from the current standard to more stringent alternative standards. When considering risk estimates remaining upon attaining a given standard, EPA is only interested in the risks in excess of policy relevant background (PRB). PRB is defined in the ozone Criteria Document and Staff Paper as including (1) O3 in the U.S. from natural sources of emissions in the U.S., Canada, and Mexico, and (2) O3 in the U.S. from the transport of O3 or the transport of emissions from both natural and man-made sources, from outside of the U.S. and its neighboring countries (Staff Paper, p.2-54). Emissions of ozone precursors from natural sources (e.g., isoprenes emitted from trees) and from sources outside of the U.S. are uncertain, as are the specific impacts those emissions will have on ozone concentrations in areas exceeding alternative standards. Our models use available information on these emissions in generating future projections of baseline ozone concentrations, and our modeled reductions in U.S. emissions of NOx and VOC are based on these baseline levels that include the contribution of natural and non-U.S. emissions. To the extent that these emissions contribute a greater (lesser) proportion of ozone on high ozone days, more (less) reductions in emissions from U.S. sources might be required to reduce ozone levels below the analyzed alternative standards.

In contrast, the RIA only examines the incremental reduction, not the remaining risk, which results from changes in U.S. anthropogenic emissions. The air quality modeling used to establish the baseline for the RIA explicitly includes contributions from natural and anthropogenic emissions in Canada, Mexico, and other countries abroad, as well as the contributions to ozone levels from natural sources in the U.S. Since the RIA does not attempt to estimate the risk remaining upon meeting a given standard, and the alternative standards are clearly above the

Staff Paper estimates of PRB, we do not consider PRB a component of the RIA costs and benefits estimates.

In developing the baseline it was important to recognize that there are several areas that are not required to meet the current standard by 2020. The Clean Air Act allows areas with more significant air quality problems to take additional time to reach the current standard. Two areas in Southern California[1] are not planning to meet the current standard by 2020.

The baseline includes controls which EPA estimates need to be included to attain the current standard (0.08 ppm, effectively 0.084 ppm based on current rounding conventions) for 2020. Two steps were used to develop the baseline. First, the reductions expected in national ozone concentrations from national rules in effect or proposed today were considered, in addition to the controls applied as part of the $PM_{2.5}$ NAAQS RIA analysis. Second, since these reductions alone were not predicted to bring all areas into attainment with the tighter standard, EPA used a hypothetical control strategy to apply additional known controls. Additional control measures were used in five sectors to establish the baseline:[2] Non-Electricity Generating Unit Point Sources (NonEGUs), Non-Point Area Sources (Area), Onroad Mobile Sources and Nonroad Mobile Sources. A fifth sector was used in the subsequent control strategy for a tighter alternative standard: Electricity Generating Unit Point Sources (EGUs). Each of these sectors is defined below for clarity.

- NonEGU point sources are stationary sources that emit at least one criteria pollutant with emissions of 100 tons per year or higher. NonEGU point sources are found across a wide variety of industries, such as chemical manufacturing, cement manufacturing, petroleum refineries, and iron and steel mills.

- NonPoint Area Sources[3] (Area) are stationary sources that are too numerous or whose emissions are too small to be individually included in a stationary source emissions inventory. Area sources are the activities where aggregated source emissions information is maintained for the entire source category instead of each point source, and are reported at the county level.

- Onroad Mobile Sources are mobile sources that travel on roadways. These sources include automobiles, buses, trucks, and motorcycles traveling on roads and highways.

- Nonroad Mobile Sources[4] are any combustion engine that travels by other means than roadways. These sources include railroad locomotives; marine vessels; aircraft; off-road

[1]At the time of this analysis the South Coast and San Joaquin Valley air basins are expected to request a redesignation to extreme status for the current ozone standard.
[2] In establishing the baseline, EPA selected a set of cost-effective controls to simulate attainment of the current ozone and $PM_{2.5}$ standards. These control sets are hypothetical as states will ultimately determine controls as part of the SIP process.
[3] Areas Sources include the nonpoint emissions sector only.
[4] For the purposes of presentation nonroad mobile sources incorporates both the nonroad emissions sector and the aircraft, locomotive, and marine vessels emissions sector.

motorcycles; snowmobiles; pleasure craft; and farm, construction, industrial and lawn/garden equipment.

- Electricity Generating Unit Point Sources (EGUs) are stationary sources of 25 megawatts (MW) capacity or greater producing and selling electricity to the grid, such as fossil-fuel-fired boilers and combustion turbines.

3.1.1 Control Measures Applied in the Baseline for Ozone Precursors

The purpose of identifying and modeling baseline controls for ozone precursors, NOx and VOC, is to reduce ambient ozone concentrations to meet the current ozone standard in this analysis. Control measures were applied in the baseline to reduce ozone concentrations in addition to the control set developed for the hypothetical national attainment strategy presented in the $PM_{2.5}$ NAAQS RIA (for more information, see http://www.epa.gov/ttn/ecas/ria.html).

The additional known controls included in the baseline to simulate attainment with current ozone NAAQS are listed in Table 3.1 and are described below. Details regarding the individual controls are provided in Appendix 3. Due to the extensive reductions from EGUs already implemented in CAIR/CAMR/CAVR, no additional EGU controls were included for the current ozone standard.

Controls included in the baseline for NonEGU point and Area sources came from a variety of geographic areas and scales. Almost all available controls in Chicago, Houston, and California were included in the baseline because these areas contain counties that were projected to be nonattainment of the current ozone NAAQS in 2020.

NOx controls from NonEGU point/Area sources were included in two ways. First, controls were included in counties with monitors that were projected to violate the current standard in 2020. Controls were then applied to all surrounding counties within the same state that were completely contained within 200 km[5] of the county containing the projected violating monitor (Figure 3.1). Second, controls were applied to large nonEGU point sources[6] outside the 200km buffer zones. The criteria for control was as follows: the plant level emissions exceeded 1,000 tons of NOx in 2020, the plant was in a county that touches the 200km buffer, and the plant was close to a nonattainment county that had difficulty attaining the baseline in the ozone NAAQS proposal RIA. VOC controls were applied to select counties where: VOC emissions were high (>5,000 tpy or >25tpy/sq. mi), the county design value was projected to be ≥ 0.08 ppm in the 2020 basecase, and the area had some historical evidence that VOC controls would appreciably lower ozone in the local region (Figure 3.2). This evidence came from internal EPA modeling or State-submitted modeling.

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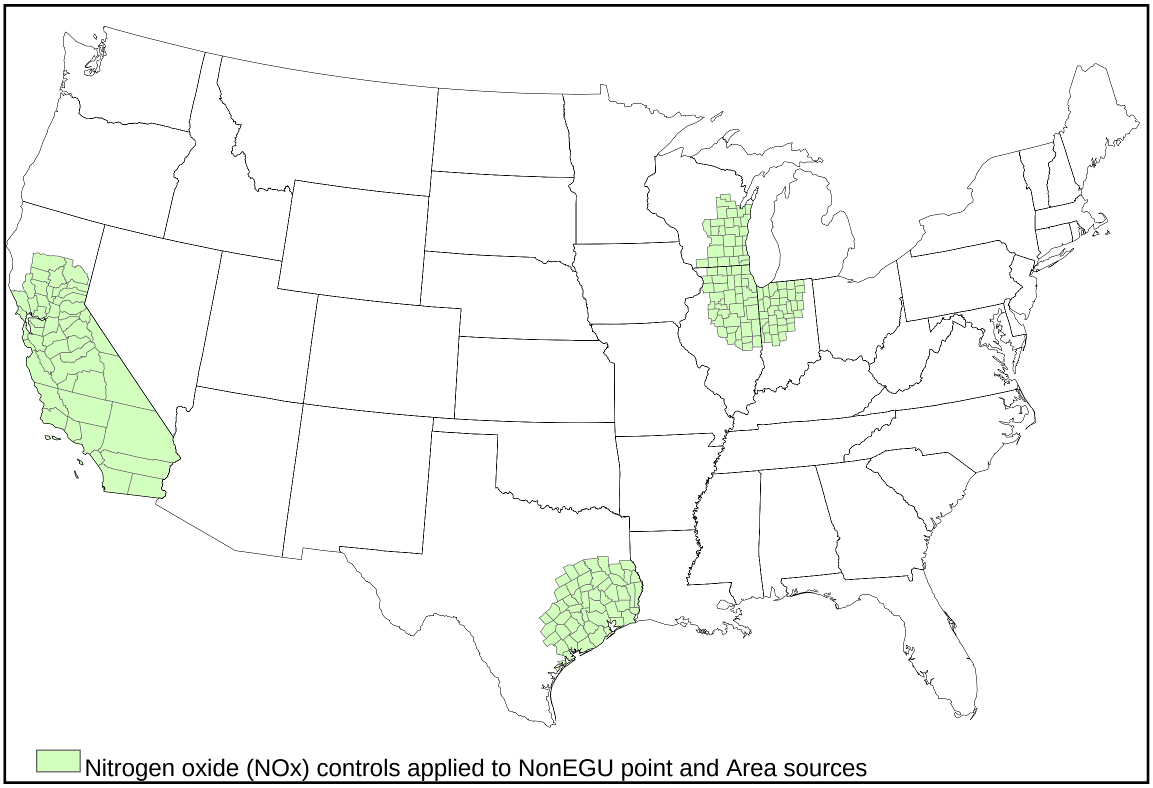
[5] It is a generic approximation used in this analysis for the sphere of possible emissions influence on air quality at the violating monitors. The actual area of emissions control is determined by states during attainment planning.

[6] Large point sources, due to the relative magnitude of emissions and high emissions stack heights, theoretically may impact air quality at a downwind violating monitor at distances beyond 200km.

Table 3.1: Controls for Current Ozone Standard by Sector Applied in the Baseline Determination for 2020

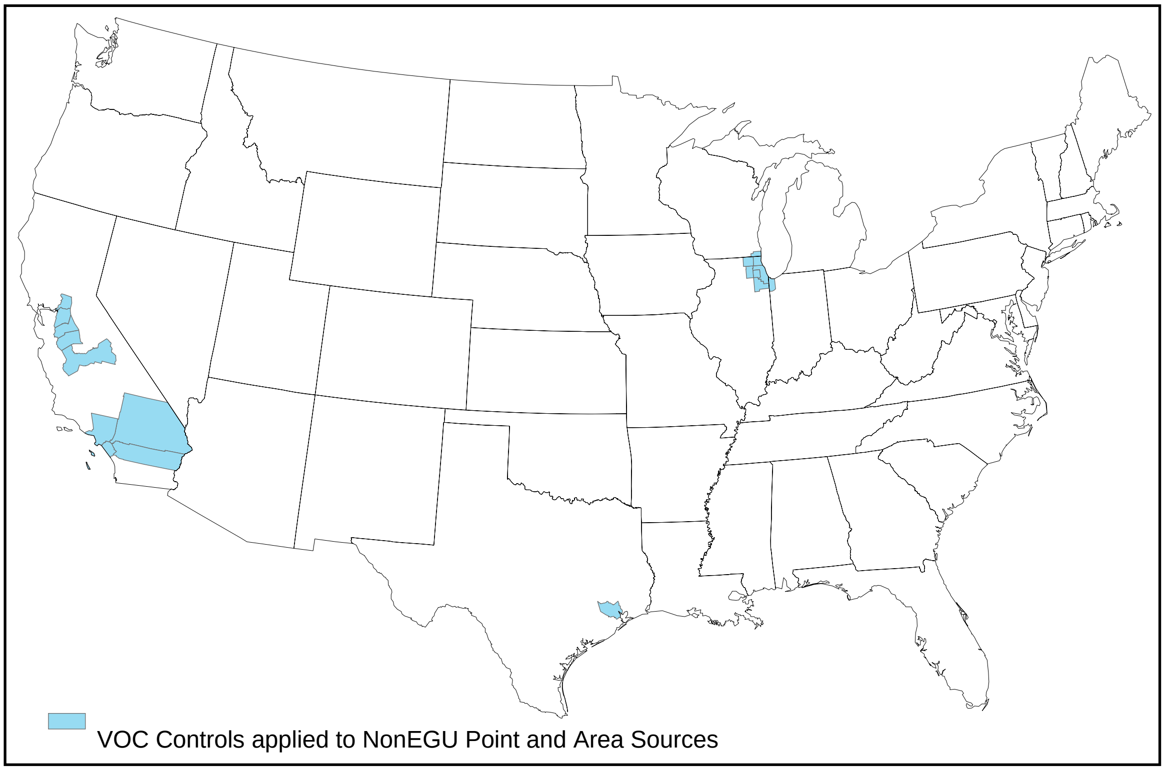
Sector	Control Measures	
	NOx	**VOC**
NonEGU Point	Biosolid Injection Technology LNB (Low NOx Burner) LNB + FGR (Flu Gas Recirculation) LNB + SCR (Selective Catalytic Reduction) NSCR (Non-selective Catalytic Reduction) OXY-Firing SCR SCR + Steam Injection SCR + Water Injection SNCR (Selective Non-catalytic Reduction) SNCR—Urea SNCR—Urea Based	Permanent Total Enclosure (PTE) Work Practices, Use of Low VOC Coatings (NonEGU Point Sources)
Area	RACT to 25 tpy (LNB) Switch to Low Sulfur Fuel Water Heater + LNB Space Heaters	CARB Long-Term Limits Catalytic Oxidizer Equipment and Maintenance Gas Collection (SCAQMD/BAAQMD) Incineration >100,000 lbs bread Low Pressure/Vacuum Relief Valve OTC Mobile Equipment Repair and Refinishing Rule OTC Solvent Cleaning Rule SCAQMD—Low VOC SCAQMD Limits SCAQMD Rule 1168 Work Practices, Use of Low VOC Coatings (Area Sources) Switch to Emulsified Asphalts
Onroad Mobile	Diesel Retrofits Reduce Gasoline Reid Vapor Pressure (RVP) to 7.0 (EPA, 2005a) Elimination of Long Duration Idling Continuous Inspection and Maintenance Commuter Programs Additional Technology Changes in the Onroad Transportation Sector	
Nonroad Mobile	Diesel Retrofits and Engine Rebuilds Reduce Gasoline Reid Vapor Pressure (RVP) to 7.0 (EPA, 2005a) Aircraft NOx International Standard	
EGU	None	None

Figure 3.1: Counties Where Controls for Nitrogen Oxides (NOx) Were Included for NonEGU Point and Area Sources, for the Current Ozone Standard in the Baseline



For the Onroad and Nonroad Mobile source sectors, some controls were applied nationwide for the current ozone standard in the baseline, while others were applied statewide in certain states or locally in a limited number of counties (see Figure 3.3). Counties were identified for locally applied Mobile source controls as follows: counties projected to have a monitor that exceeded the current standard were surrounded by a 200km buffer zone, and controls were included in the counties within this buffer that were within the same state as the exceeding monitor. Where some control measures overlapped for a given county, controls with the lowest costs were generally included first. Both onroad and nonroad diesel retrofits and idling elimination were included in California with an assumed 75% market penetration, and in baseline reduction areas outside of California with an assumed 25% market penetration. EPA determined that 25% would have a significant impact, but was feasible to achieve and was applied for reduction areas outside of California. EPA further determined that for southern California a 75% level of reduction could be achieved, which was the highest cost-effective penetration rate that EPA felt could be reasonably accomplished.

Figure 3.2: Counties Where Controls for Volatile Organic Chemicals (VOCs) Were Applied to NonEGU Point and Area Sources for the Current Ozone Standard in the Baseline



3.1.2 Ozone Levels for Baseline

Establishing the baseline required design values (predicted concentrations) of ozone across the country. Because the intention of this evaluation was to achieve attainment of the current ozone standard, controls were included to reduce ambient ozone concentrations to 0.08 ppm (effectively 0.084 ppm based on current rounding conventions). A map of the country is presented in Figure 3.4, which shows predicted concentrations for the 661 counties with ozone monitors. Projections of ozone design values were developed according to procedures outlined in EPA modeling guidance.[7,8]

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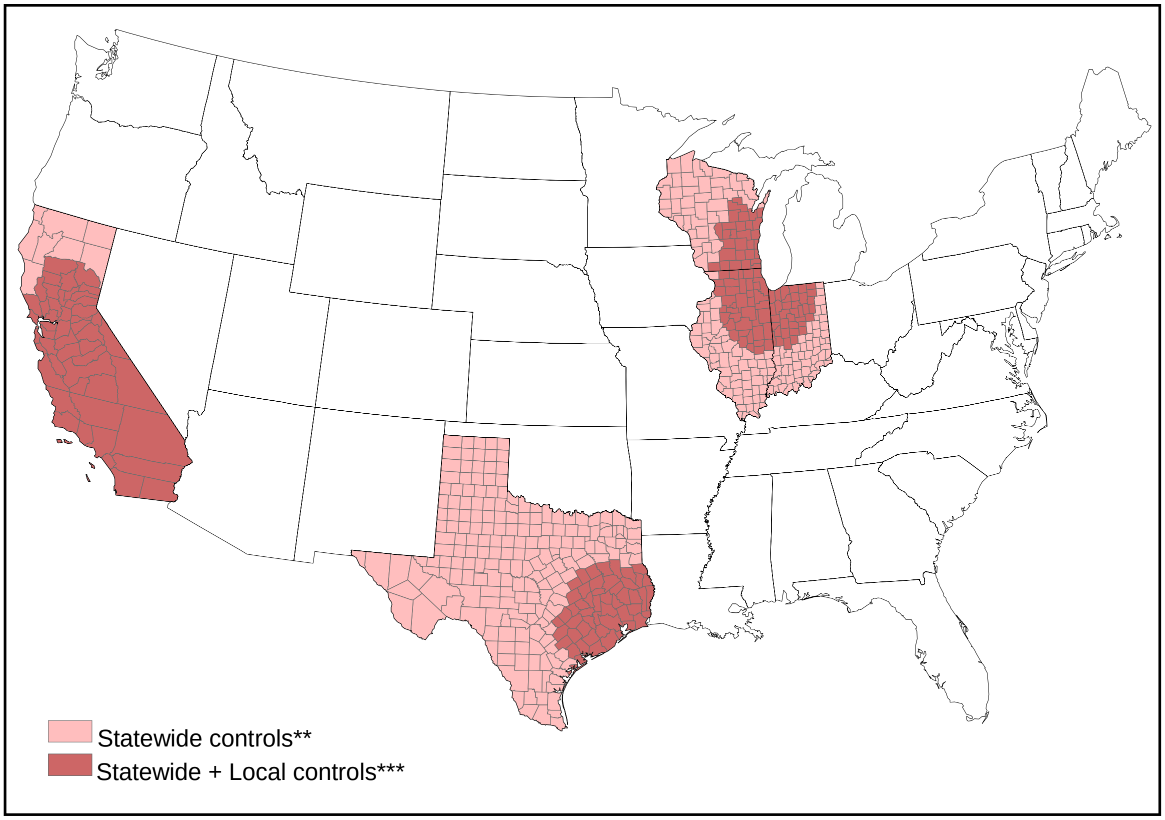
[7] Available online at: http://www.epa.gov/scram001/guidance/guide/final-03-pm-rh-guidance.pdf

[8] As part of the procedure for projecting future ozone design values, the guidance recommends using a criterion that there be a minimum of 5 modeled days with predicted base year ozone at or above 0.070 ppm. This criterion was relaxed to a minimum of 1 day at or above 0.060 ppm for the 82 counties with fewer than 5 days with predicted 2002 concentrations at or above 0.070 ppm.

Figure 3.3: Areas Where NOx and VOC Controls Were Included for Mobile Onroad and Nonroad Sources in Addition to National Mobile Controls* for the Current Ozone Standard in the Baseline



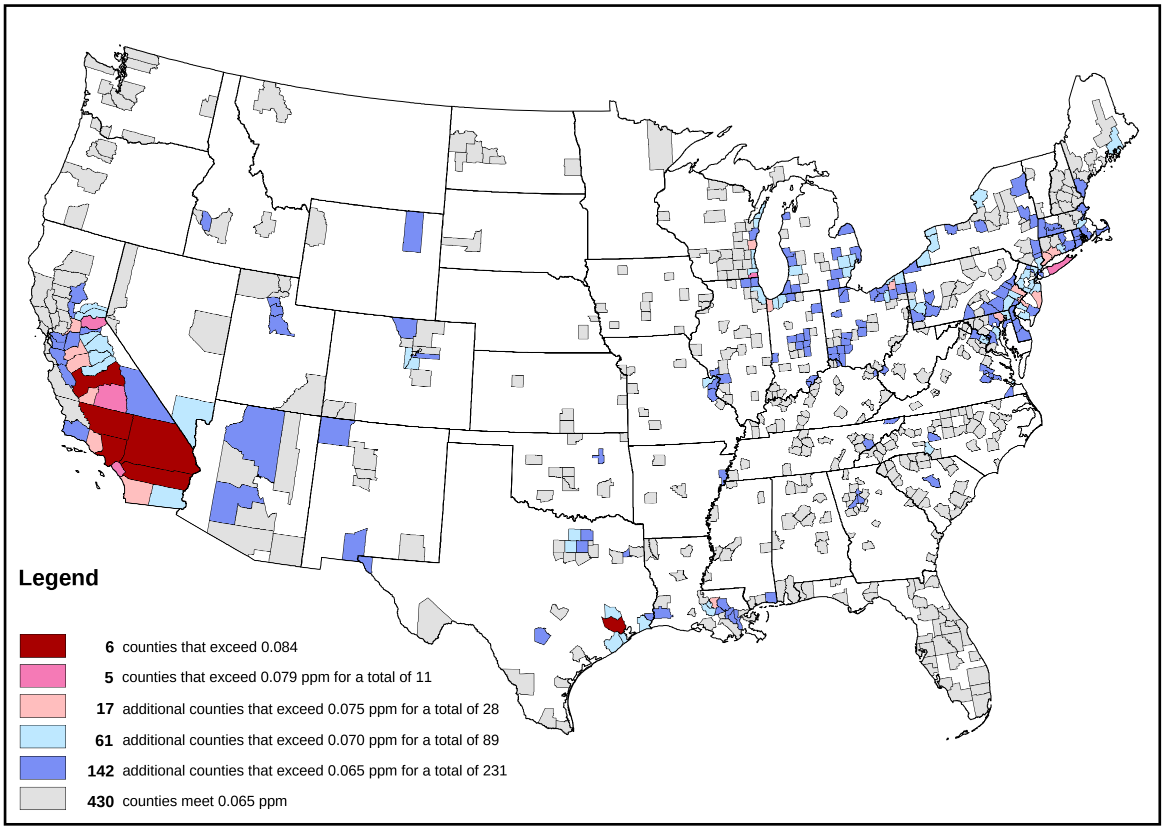
* International Aircraft NOx Standard, national control measures applied as part of the PM NAAQS RIA, and Additional Technology Changes in the Onroad Transportation Sector.

**Onroad retrofits, elimination of long duration idling, and lower Reid Vapor Pressure (RVP) gasoline.

***Nonroad retrofits, continuous inspection and maintenance, and commuter programs.

The baseline shows that 6 counties would not meet the current ozone standard in 2020, even after inclusion of all known controls. Of these 6 counties, 5 of them are in portions of California that have current state implementation plans that reflect an attainment date of 2024. After including known controls as described above, the analysis predicted that the remaining 655 counties would attain the current standard by 2020. The baseline forms the foundation for the cost-benefit analysis conducted in this RIA, where EPA compares more stringent primary ozone standard alternatives incrementally to national attainment of the current standard.

Figure 3.4: Baseline Projected 8-Hour Ozone Air Quality in 2020[a, b, c, d]



[a] Modeled emissions reflect the expected reductions from federal programs including the Clean Air Interstate Rule (EPA, 2005b), the Clean Air Mercury Rule (EPA, 2005c), the Clean Air Visibility Rule (EPA, 2005d), the Clean Air Nonroad Diesel Rule (EPA, 2004), the Light-Duty Vehicle Tier 2 Rule (EPA, 1999), the Heavy Duty Diesel Rule (EPA, 2000), proposed rules for Locomotive and Marine Vessels (EPA, 2007a) and for Small Spark-Ignition Engines (EPA, 2007b), and state and local level mobile and stationary source controls identified for additional reductions in emissions for the purpose of attaining the current PM 2.5 and Ozone standards.

[b] Controls applied are illustrative. States may choose to apply different control strategies for implementation.

[c] The current standard of 0.08 ppm is effectively expressed as 0.084 ppm when rounding conventions are applied.

[d] Modeled design values in ppm are only interpreted up to 3 decimal places.

3.1.3 National Baseline Sensitivity Analysis

Circular A-4 of the Office of Management and Budget's (OMB) guidance under Executive Order 12866 defines a no-action baseline as "what the world will be like if the proposed rule is not adopted." The illustrative analysis in this RIA assesses the costs and benefits of moving from this "no-action" baseline to a suite of possible new standards. Circular A-4 states that the choice of an appropriate baseline may require consideration of a wide range of potential factors, including:

- evolution of the market,

- changes in external factors affecting expected benefits and costs,
- changes in regulations promulgated by the agency or other government entities, and
- the degree of compliance by regulated entities with other regulations (OMB, 2003).

Circular A-4 also recommends that:

> "When more than one baseline is reasonable and the choice of baseline will significantly affect estimated benefits and costs, you should consider measuring benefits and costs against alternative baselines. In doing so you can analyze the effects on benefits and costs of making different assumptions about other agencies' regulations, or the degree of compliance with your own existing rules." (OMB 2003)

In Appendix 7a, we describe a sensitivity analysis that we conducted to provide information about how the no-action baseline would differ under different assumptions about mobile technologies. It also assesses nationally what the change would be to costs and benefits of a new standard of 0.075 ppm and alternate primary standards of 0.079, 0.070, and 0.065 ppm. See Appendix 7a for more details.

3.2 Developing the Modeled Control Strategy Analysis

After developing the baseline, EPA developed a hypothetical control strategy to illustrate one possible national control strategy that could be adopted to reach an alternative primary standard by 2020. The stricter standard alternative of 0.070 ppm was chosen as being representative of the set of alternatives being considered by EPA in its notice of proposed rulemaking on the ozone NAAQS. The 2020 baseline air quality modeling for proposal resulted in 203 counties with projected design values exceeding 0.070 ppm. In the final rule modeling of the 2020 baseline there are 89 counties projected to exceed 0.070 ppm. The reduction in the number of counties projected to exceed 0.070 between proposal and final reflects the net effect of the updates to the air quality modeling platform, as described in Chapter 2, and the additional emissions controls in the final rule baseline modeling compared to proposal.

Controls for five sectors were used in developing the control analysis, as discussed previously: nonEGU point, Area, onroad mobile and nonroad mobile, along with EGUs. Reductions in both NOx and VOC ozone precursors were needed in all sectors to meet a tighter standard.

As depicted in the flow diagram in Figure 1.1, the control strategy modeled in this RIA first applied known controls to reach attainment. For the control strategy, controls for five sectors were used in developing the control analysis, as discussed previously: nonEGU point, Area, onroad mobile and nonroad mobile, along with EGUs. Reductions in both NOx and VOC ozone precursors were needed in all sectors to meet a tighter standard. The emissions for this control strategy were input to the CMAQ model as part of the process to project ozone design values for the 2020 control strategy. The results of modeling the control strategy indicate that there were some areas projected not to attain 0.070 ppm in 2020 using all known control measures. To complete the analysis, EPA was then required to extrapolate the additional emission reductions required to reach attainment. The methodology used to develop those estimates and those calculations are presented in Chapter 4. Appendix 7a presents a sensitivity analysis of three mobile source control measures that could be included in the control strategy to illustrate attainment.

Table 3.2: Controls Applied, by Sector, for the 0.070 ppm Control Strategy (Incremental to Baseline)

Sector	Control Measures: NOx	Control Measures: VOC
NonEGU Point	Biosolid Injection Technology LNB (Low NOx Burner) LNB + FGR (Flu Gas Recirculation) LNB + SCR (Selective Catalytic Reduction) NSCR (Non-selective Catalytic Reduction) OXY-Firing SCR SCR + Steam Injection SCR + Water Injection SNCR (Selective Non-catalytic Reduction) SNCR—Urea SNCR—Urea Based	Permanent Total Enclosure (PTE) Work Practices, Use of Low VOC Coatings (NonEGU Point Sources)
Area	RACT to 25 tpy (LNB) Switch to Low Sulfur Fuel Water Heater + LNB Space Heaters	CARB Long-Term Limits Catalytic Oxidizer Equipment and Maintenance Gas Collection (SCAQMD/BAAQMD) Incineration >100,000 lbs bread Low Pressure/Vacuum Relief Valve OTC Mobile Equipment Repair and Refinishing Rule OTC Solvent Cleaning Rule SCAQMD—Low VOC SCAQMD Limits SCAQMD Rule 1168 Work Practices, Use of Low VOC Coatings (Area Sources) Switch to Emulsified Asphalts
Onroad Mobile[a]	Increased Penetration of Onroad SCR and DPF from 25% to 75% Continuous Inspection and Maintenance (OBD)	
Nonroad Mobile[a]	Increased Penetration of Nonroad SCR and DPF from 25% to 75%	
EGU	-Lower ozone season nested caps in OTC and MWRPO states while retaining the current CAIR cap and a new cap for Eastern Texas. -Application of local controls (SCR and SNCR) nationally to coal fired units in and around NA counties covering the combination of CBSA (Core based Statistical Areas) and CSA (Combined Statistical Areas)B outside of OTC and, MWRPO, and East Texas.	None

[a] Onroad and Nonroad Mobile Source control measures applied for the Baseline analysis were applied to additional geographic areas in the 0.070 ppm analysis. SCR and DPF retrofits market penetration was increased from 25% to 75% for all areas outside of California.

[b] For the definition and current lists of CBSA and CSAs, see http://www.census.gov/population/www/estimates/metrodef.html

3.2.1 Controls Applied for the Modeled Control Strategy: NonEGU Point and Area Sectors

NonEGU point and Area control measures were identified using AirControlNET 4.1.[9,10] To reduce NOx and VOC emissions, all known control measures, below a cost cap, were applied, allowing for the largest emission reduction per source over the widest geographic area. Because all available controls up to the cost cap were used in counties needing emission reductions, ordering of which controls were applied first was not relevant. In areas where residual nonattainment remained after the modeled control strategy, some known controls above the cost cap were analyzed and applied to achieve additional emissions reductions as a portion of the extrapolated cost analysis. See Chapter 5 for more information on how we selected our cost cap and the extrapolated cost analysis.

Supplemental controls, which estimated additional emissions control based on similar technology for NonEGU point and Areas sources were included in the analysis prior to the extrapolating costs of unknown controls. Supplemental controls are described in further detail in Appendix 3.

NOx nonEGU point and Area controls were applied to counties that were projected to have concentrations of greater than 0.070 ppm in the 2020 baseline. Additional controls were applied in surrounding counties within 200 km of the county projected to be out of attainment (at 0.070 ppm), but not crossing state boundaries. In addition, controls were applied to large nonEGU point sources outside the 200km buffer zones. The criteria for control of these large nonEGU point sources was as follows: the plant level emissions exceeded 1,000 tons of NOx in 2020, the plant was in a county that touches the 200km buffer, and the plant was close to a nonattainment county that had difficulty attaining 0.070 ppm in the ozone NAAQS proposal RIA.

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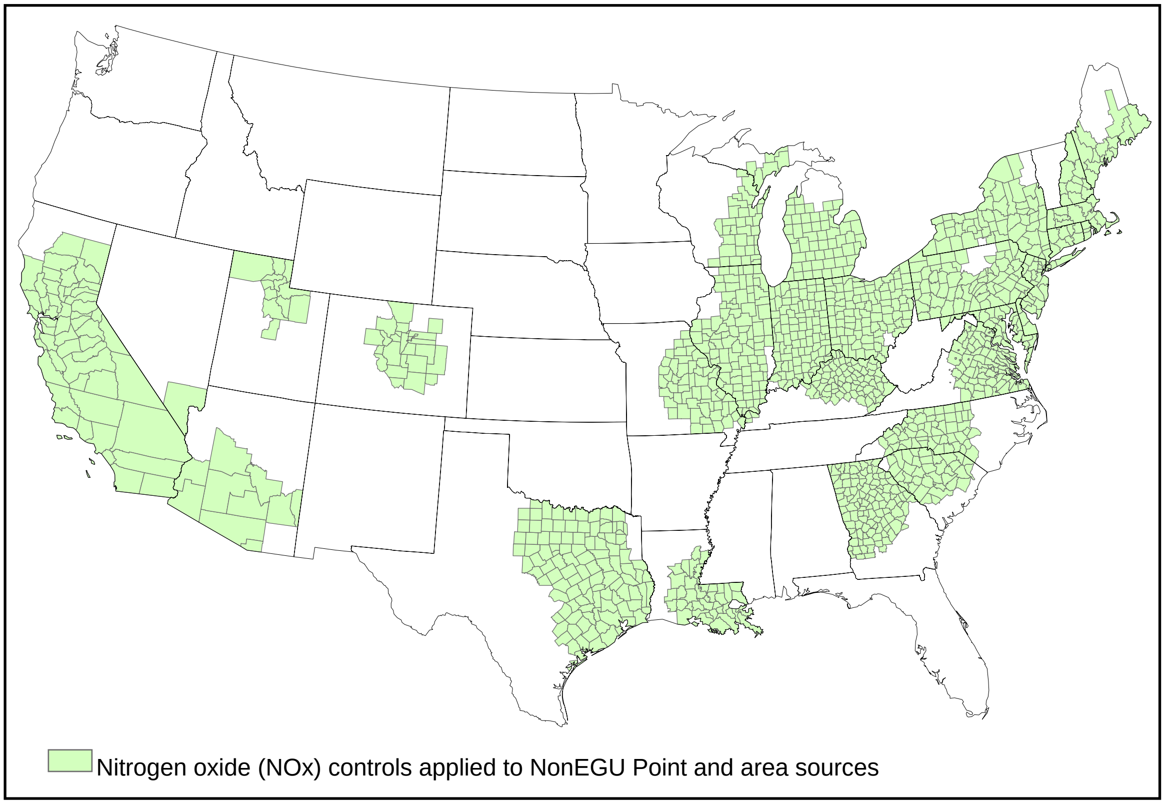
[9] See http://www.epa.gov/ttnecas1/AirControlNET.htm for a description of how AirControlNET operates and what data is included in this tool.

[10] While AirControlNET has not undergone a formal peer review, this software tool has undergone substantial review within EPA's OAR and OAQPS, and by technical staff in EPA's Regional offices. Much of the control measure data has been included in a control measure database that will be distributed to EPA Regional offices for use by States as they prepare their ozone, regional haze, and PM2.5 SIPs over the next 10 months. See http://www.epa.gov/particles/measures/pm_control_measures_tables_ver1.pdf for more details on this control measures database. In addition, the control measure data within AirControlNET has been used by Regional Planning Organizations (RPOs) such as the Lake Michigan Air District Commission (LADCO), the Ozone Transport Commission (OTC), and the Visibility Improvement State and Tribal Association of the Southeast (VISTAS) as part of their technical analyses associated with SIP development over the last 3 years. All of their technical reports are available on their web sites.

Figure 3.5: Counties Where Controls for Nitrogen Oxides (NOx) Were Applied to NonEGU Point and Areas Sources for the RIA Modeled Control Strategy (Incremental to Baseline)



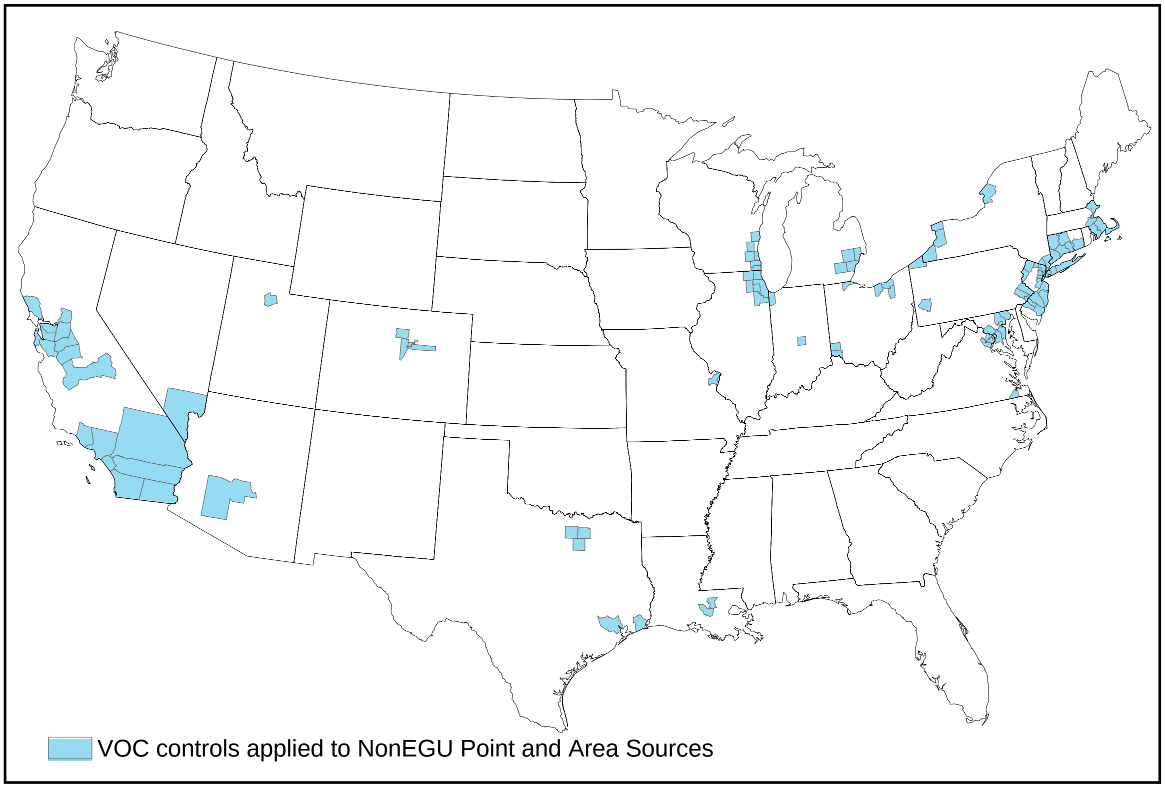
VOC controls were applied in select counties where the following criteria were met (including the counties which included VOC controls in their baselines): VOC emissions were high (>5,000 tpy or >25tpy/sq. mi), the county design value was projected to be ≥ 0.070 ppm in the 2020 (See Figure 3.6), and the area had some historical evidence that VOC controls would appreciably lower ozone in the local region. This evidence came from internal EPA modeling or State-submitted modeling.

3.2.2 Controls Applied for the Modeled Control Strategy: EGU Sector

In the Proposal RIA, a control strategy was applied for the EGU sector for the East only, (EGU controls for the West were already included in the ozone baseline since they were applied for the hypothetical national control strategy in the PM NAAQS RIA.) In the proposed RIA, emissions reductions were targeted in the OTC and MWRPO states through lower “nested caps” and “command and control” application in the non-attainment counties outside of the OTC and MWRPO within CAIR.

For the Final RIA, we have employed an enhanced strategy, both in terms of the quantity of reductions and the geographic extent of the areas covered. Figure 3.7 depicts the areas covered for the EGU sector emission reduction strategy.

Figure 3.6: Counties Where VOC Controls Were Applied to NonEGU Point and Areas Sources for the Modeled Control (Incremental to Baseline)



Annual and ozone season CAIR caps remained unchanged, but coal-fired units were targeted for this shifted strategy within those caps. This strategy was appropriate to consider because transport of NOx pollution is more of a concern in the East, and NOx from EGUs still accounts for a significant portion of emissions in this region. California, while in need of reductions as well, was not included in this strategy because all known controls (including EGU controls) had already been applied in the baseline. The development of an EGU-component to this control strategy was based exclusively on NOx emissions during the ozone season, although the hypothetical controls applied would operate year-round. The EGU sector used the Integrated Planning Model (IPM) to evaluate the reductions that are predicted from a specific control strategy. Details of this tool and subsequent analysis can be found in Appendix 3.4.

Reductions in the EGU sector are influenced significantly by the 2003 Clean Air Interstate Rule (CAIR) (see Appendix 3.4 for more details on CAIR). CAIR will bring significant emission reductions in NOx, and a result, ambient ozone concentrations in the eastern U.S. by 2020.[11] A map of the CAIR region is presented in Appendix 3.4. Emissions and air quality impacts of CAIR are documented in detail in the Regulatory Impact Analysis of the Final Clean Air Interstate Rule.[12]

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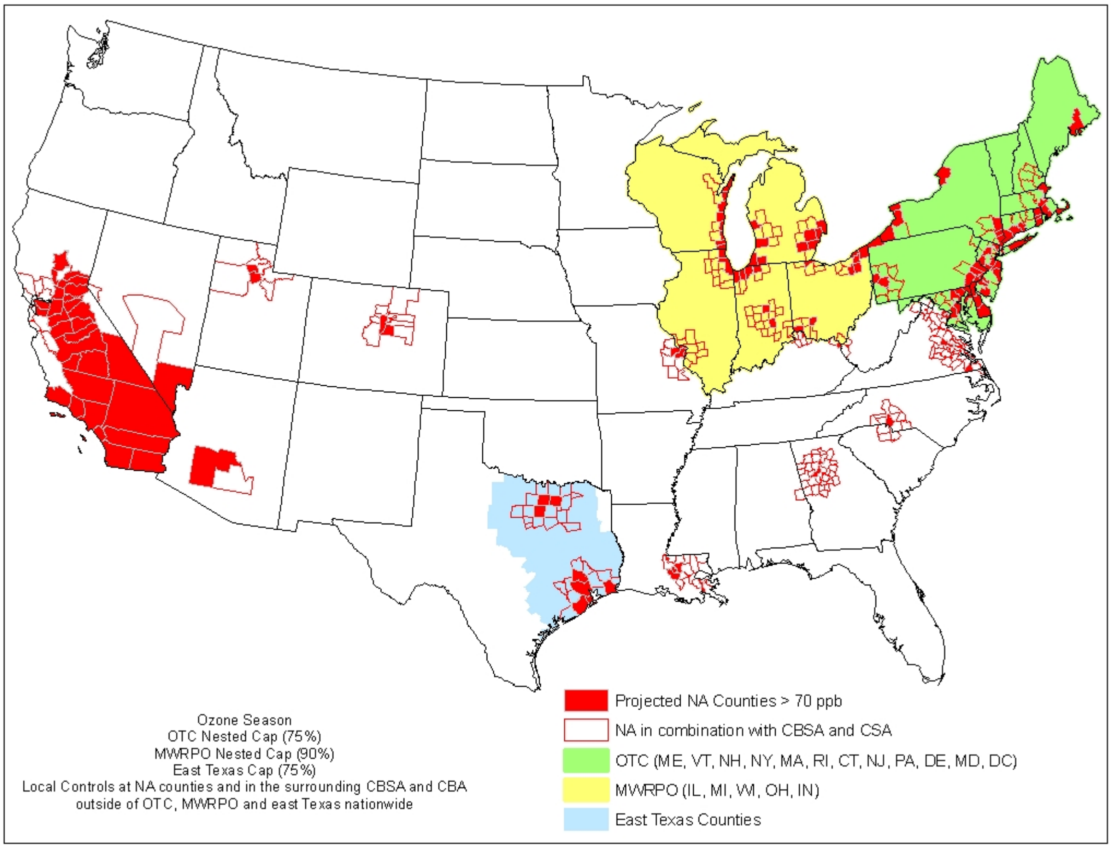
[11] See http://www.epa.gov/airmarkets/progress/progress-reports.html for more information

[12] See http://www.epa.gov/CAIR/technical.html

Figure 3.7: Geographic Areas where NOx Controls were Applied to Electrical Generating Units (EGUs) for the Modeled Control Strategy (Incremental to Baseline)



To address nonattainment in the CAIR region (especially the Midwest, Mid-Atlantic,, and Northeast), and East Texas[13] lower nested ozone season caps (a limit lower than the current CAIR cap) were applied in these areas for NOx, while holding the CAIR cap unchanged for the entire region. This provides an opportunity to reduce emissions in a cost effective manner in targeted regions. Three geographic regions were targeted for cap-and-trade type emissions reductions: the Midwest Regional Planning Organization (MWRPO) consisting WI, IL, IN, MI, and OH; and the Ozone Transport Commission (OTC), consisting of DC, MD, PA, DE, NJ, CT, NY, RI, MA, VT, NH, and ME; and East Texas consisting the counties shown in Figure 3.7. These areas were chosen because the MWRPO and OTC states are currently investigating ways of reducing EGU emissions further in their states and because most of the potential ozone nonattainment areas are found within these two regions. East Texas has also non-attainment areas, and the state is looking for strategies to reduce emissions. Considering transport, as well as the local effects, reducing emissions in these areas is expected to help bringing the Lake Michigan and Northeast corridor as well as East Texas non-attainment areas into attainment.

Lower nested caps were applied in the MWRPO and OTC states and in East Texas, for the ozone season only. The caps that were applied lead to reductions that could be obtained by installing

[13] East Texas geographic area was defined to be identical to the geographic area for other sectors.

post-combustion controls, such as Selective Catalytic Reduction (SCR) and Selective Non-Catalytic Reduction (SNCR), to all of the coal-fired units that were not projected to have previously installed post-combustion controls in the base-case. Following this, 75% of the reducti[14]on that could be obtained from these units was subtracted from the sum of State level ozone control season NOx caps for the OTC and East Texas regions, and 90% for the MWRPO states in CAIR.[15] The CAIR cap for the entire region was kept unchanged.

In order to address nonattainment elsewhere in the West and CAIR region outside of the MWRPO, and OTC, and East Texas a "command and control" type strategy for coal-fired units has been designed. Annual and ozone season CAIR caps remained unchanged in the East, and coal-fired units were targeted for this reduction. Preliminary analysis showed that most of the needed NOx reductions in the EGU sector can be achieved through application of post-combustion controls on coal units that are projected to remain without controls under the CAIR/CAMR/CAVR cap-and-trade scheme. All non-attainment areas nationwide, outside of the OTC, MWRPO, and East Texas were subject to this local command-and-control strategy, covering the CBSA and CSA counties in and around nonattainment counties.

At this time, ***we are in the process of improving our ability to achieve additional reductions available in NOx emissions from EGUs and corresponding air quality benefits, especially on high energy demand days (HEDDs) through energy efficiency measures. We were not able to apply such control strategies as part of this RIA. A Technical Support Document (TSD) is available summarizing the previous and ongoing work in this area.***

3.2.3 Controls Applied for the Modeled Control Strategy: Onroad and Nonroad Mobile Sectors

As in other sectors, there are several mobile source control strategies that have been, or are expected to be, implemented through previous national or regional rules. Although many expected reductions from these rules are included in the baseline, additional mobile source controls were required to illustrate attainment of an alternate primary standard (See Figure 3.8). Information on mobile source control measures for the modeled control strategy analysis were derived from various EPA studies and from running EPA's National Mobile Inventory Model (NMIM), which includes the MOBILE6 Onroad model and the NONROAD model. See www.epa.gov/otaq/nmim.htm for more information on NMIM and see Appendix 3.3 for more information on mobile source controls included in the modeled control strategy analysis.

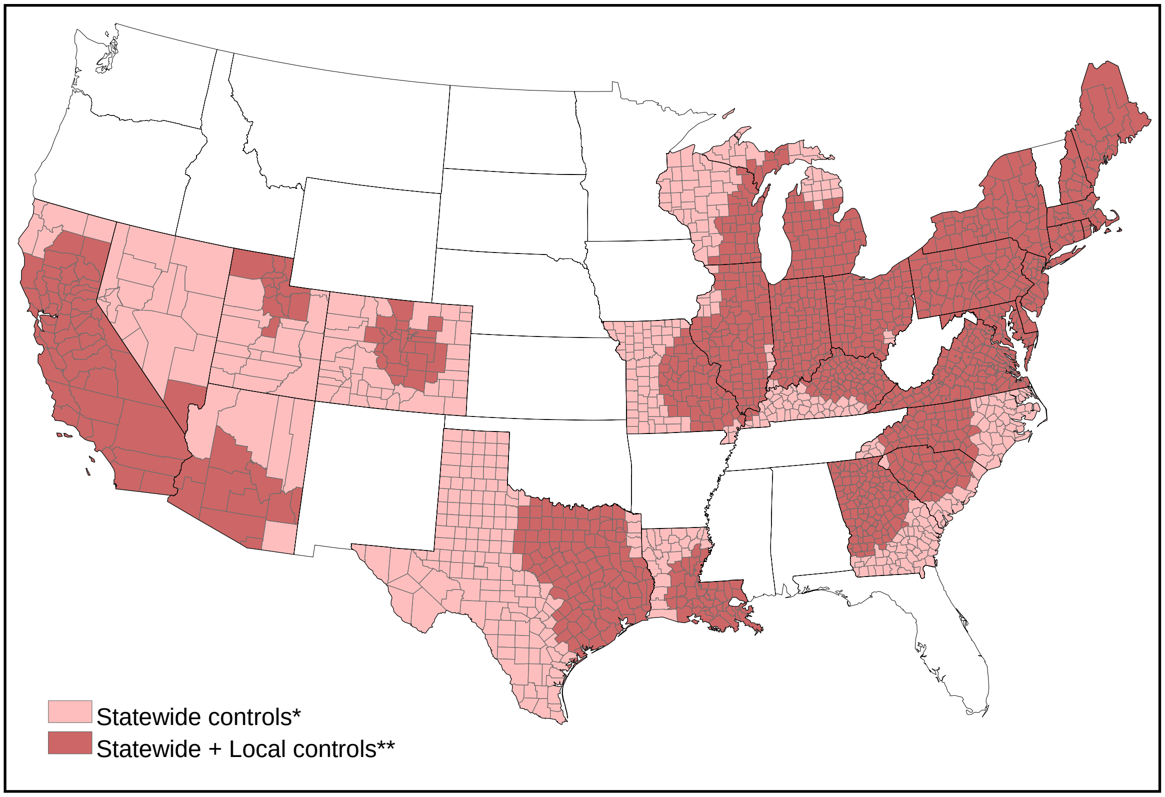
All of the local mobile source controls included in the ozone baseline were expanded for the hypothetical national control strategy to attain an alternate primary standard. In the case of onroad and nonroad Selective Catalytic Reduction (SCR) and Diesel Particulate Filters (DPF),

[14] Potential for Reducing NOx Emissions from EGU Sources on High Energy Demand Days with Energy Efficiency Measures. Technical Support Document for the Final Ozone NAAQS Regulatory Impact Analysis. U.S. Environmental Protection Agency, Office of Air and Radiation. March 2008.

[15] Detailed analysis showed that 75%–90% reduction provides the most cost-effective way of reducing emissions at the targeted non-attainment areas, considering transport, with the most air quality impacts.

the measure was applied at a greater penetration rate—to 75% of the modeled equipment population. 75% was the highest cost-effective penetration rate that EPA felt could be reasonably accomplished. All local and statewide measures were applied to sources in additional geographic areas beyond the areas controlled in the baseline. Descriptions of the mobile source rules and measures can be found in Appendix 3.3.

Figure 3.8: Areas Where NOx and VOC Controls Were Applied to Mobile Onroad and Nonroad Sources in Addition to National Mobile Controls for the Modeled Control Strategy (incremental to Baseline)



*Onroad retrofits, elimination of long duration idling, and lower Reid Vapor Pressure (RVP) gasoline.

**Nonroad retrofits, continuous inspection and maintenance, and commuter programs.

As in the baseline, some mobile source controls were applied statewide for all states with a county projected to exceed 0.070 ppm. 'Local' controls were applied to counties within a 200 km buffer from counties projected to exceed 0.070 ppm with the following exceptions:

- counties in neighboring states were omitted from the buffer zone
- controls were applied statewide to Ozone Transport Commission (OTC) states, with the exception of Vermont

As stated at the beginning of this section, additional reductions were needed to complete the analysis of the alternate standard. In addition to the emission reductions accounted for in the extrapolation approach described in Chapter 4, Appendix 7a presents a sensitivity analysis of three mobile source control measures that could be included in the control strategy to illustrate attainment of the alternate standard.

3.2.4 Data Quality for this Analysis

The estimates of emission reductions associated with our control strategies above are subject to important limitations and uncertainties. EPA's analysis is based on its best judgment for various input assumptions that are uncertain. As a general matter, the Agency selects the best available information from available engineering studies of air pollution controls and has set up what it believes is the most reasonable framework for analyzing the cost, emission changes, and other impacts of regulatory controls. EPA is working on approaches to quantify the uncertainties in these areas and will incorporate them in future RIAs as appropriate.

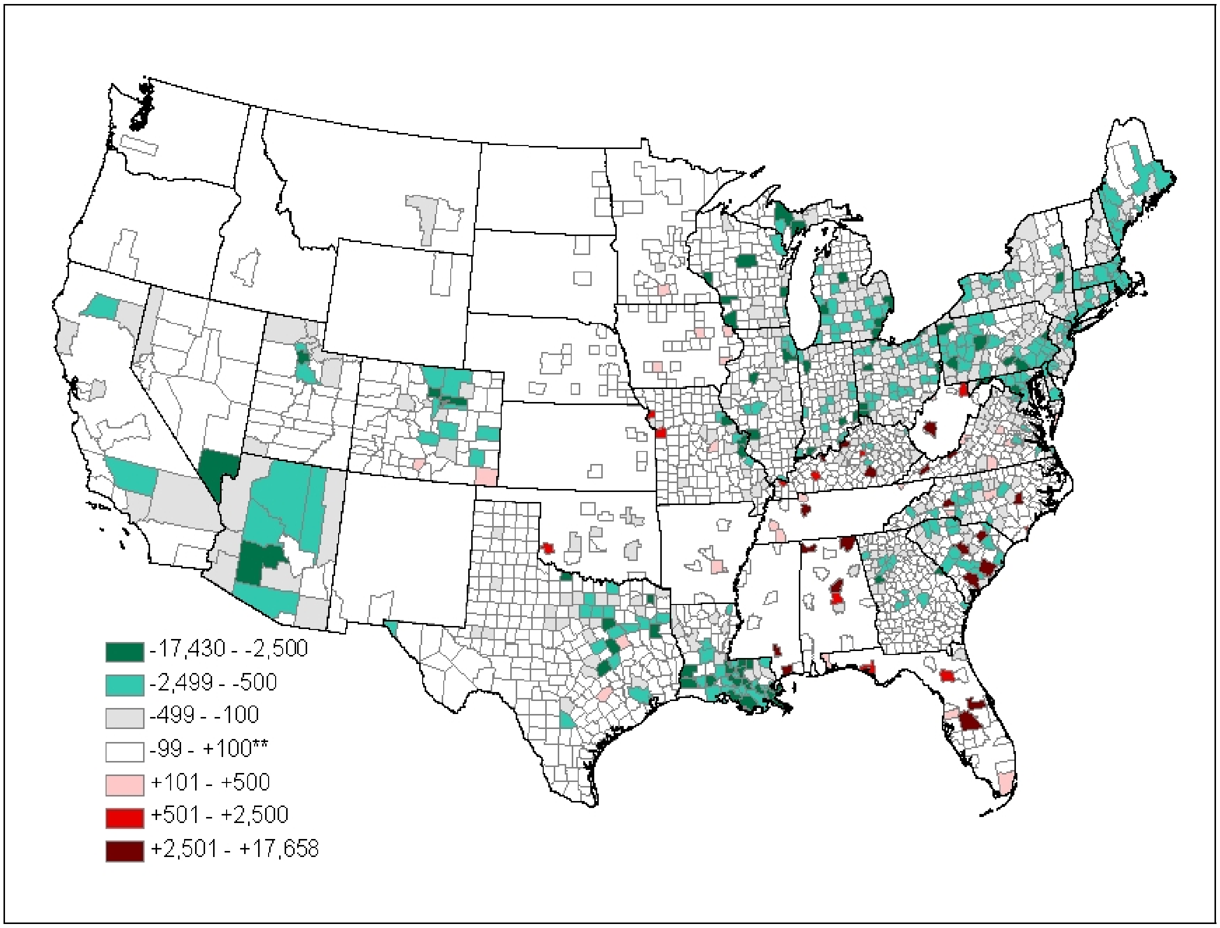
3.3 Geographic Distribution of Emissions Reductions

The following maps break out NOx and VOC reductions into the controlling sectors. The maps for NOx and VOC reductions are presented in Figures 3.9 and 3.11, respectively. Figures 3.10 and 3.12 indicate the emission reductions attributed to each sector. Appendix 3 contains maps of emissions reductions by sector, nationwide.

Prior to reading the maps, there is an important caveat to consider. The control strategy above focuses on reducing emissions of VOC and NOx, the two precursors to ozone formation. However, in some cases, the application of the control strategy actually increased the level of NOx or VOC emissions. This is due to controls that affect multiple pollutants and complex interactions between air pollutants, as well as trading aspects under the CAIR rule.

With respect to the baseline (CAIR/CAMR/CAVR), total emissions of NOx is lower. At the same time emissions shift geographically and hence do not decrease everywhere within the cap-and-trade regions. However, EGU NOx emissions do decrease substantially everywhere compared to the pre-CAIR levels. Substantial EGU NOx emission reductions are already being achieved through CAIR/CAMR/CAVR. This strategy focuses reductions under trading programs where they are needed most, with the result that some areas get less reductions than might have been otherwise expected within the. CAIR region. As explained earlier, the NOx EGU control strategy was designed to achieve emission reductions specifically in the non-attainment areas, while retaining the overall CAIR cap. Application of nested and lower (ozone season) caps (for the states in the MWRPO, and OTC, and East Texas) regions and local controls (SCR and SNCR) on the uncontrolled coal units in the non-attainment counties (and surrounding CBSA and CSA) outside of the trading regions OTC and MWRPO within CAIR region result in emission shifts increase of emissions elsewhere within or outside of CAIR region compared to the base line (CAIR/CAMR/CAVR). While there are substantial total NOx emission reductions (roughly 53,000 tons within the OTC, and MWRPO, and East Texas; and roughly 16,000 tons nationwide) expected for the 2020 ozone season (roughly 55,500 tons) compared to the base line (CAIR/CAMR/CAVR) as a result of cap-and-trade program with lower caps and local command-and-control reductions in other non-attainment counties where uncontrolled coal units exist, there are emission shifts geographically and there is the possibility of increases in emission from the remainder of sources within and outside of the CAIR region. This approach provides a cost effective opportunity for reducing emissions where the reductions are most needed to help reach attainment. It is important to recall that this is a hypothetical control strategy, and the states or other authorities may take additional steps to minimize these increases if warranted.

Figure 3.9: Annual Tons of NOx Emission Reductions for the Modeled Control Strategy (Incremental to the Baseline)*



* Reductions are negative and increases are positive.

** The −99– +100 range is shown without color because these are small county-level NOx reductions or increases that likely had little to no impact on ozone estimates. Most counties in this range had NOx differences less than 1 ton.

Figure 3.10: Percentage of 2020 Annual NOx Emissions Reduced by Sector Incremental to the Baseline

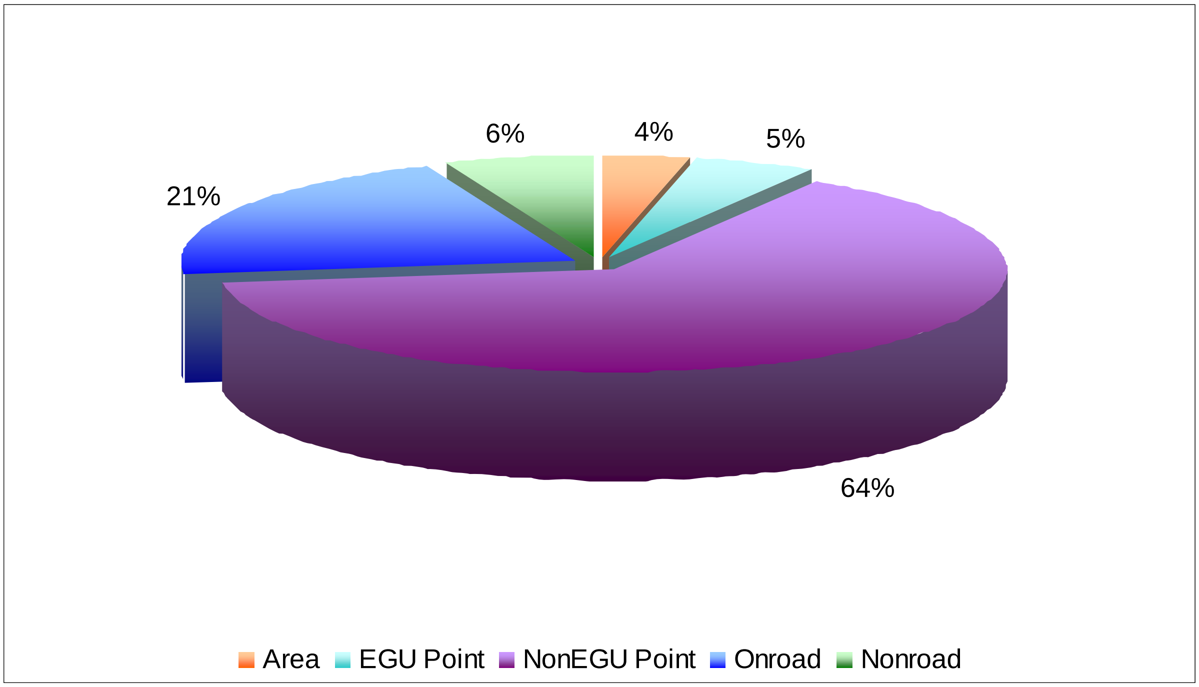
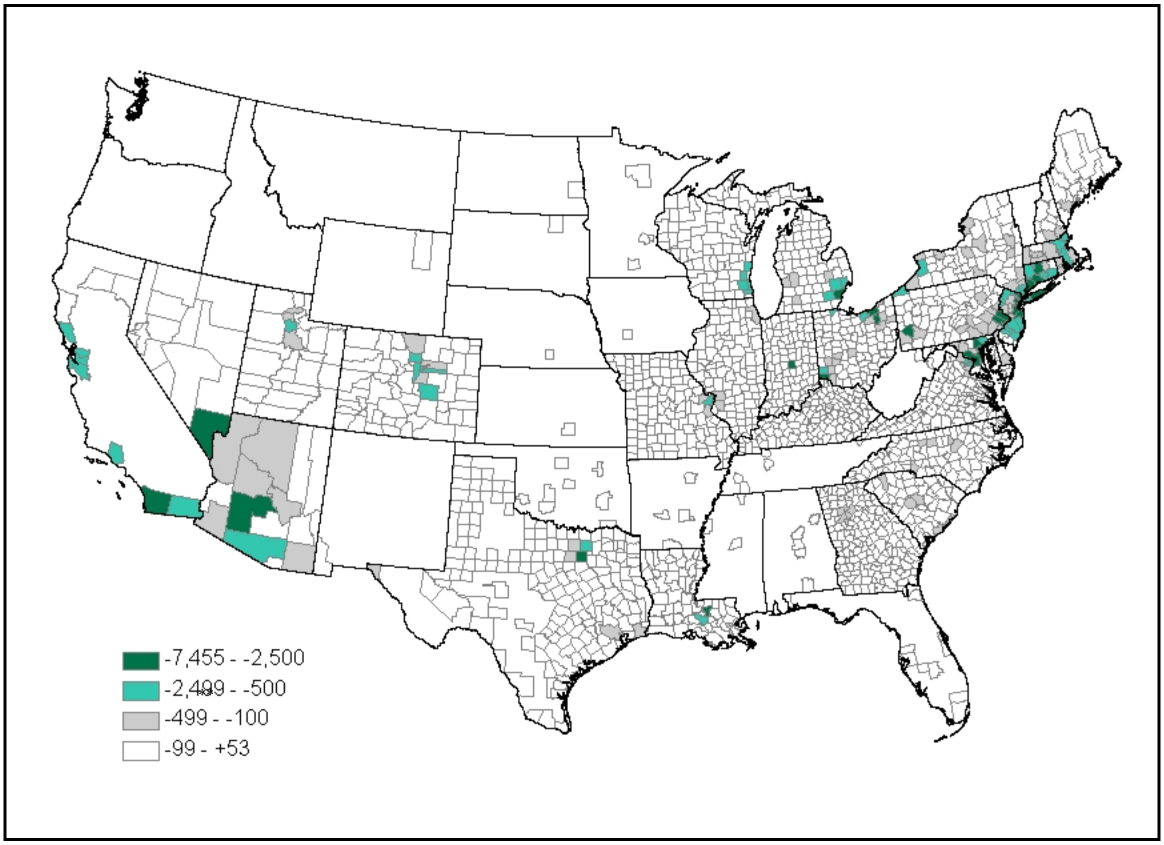


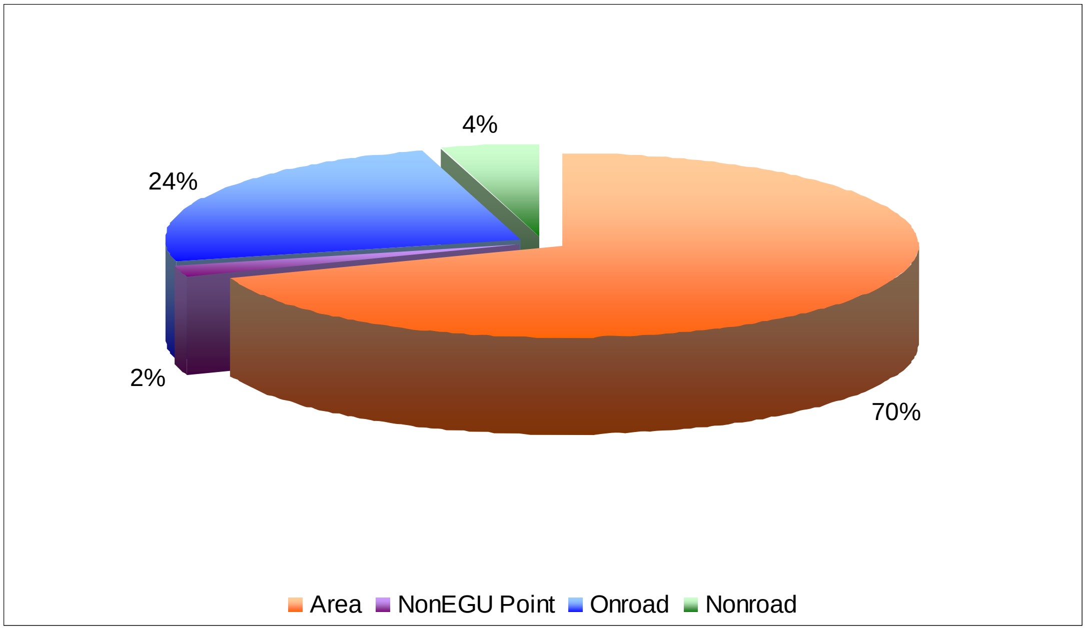
Figure 3.11: Annual Tons of VOC Emission Reductions for the Modeled Control Strategy (Incremental to the Baseline)*



[*] Reductions are negative and increases are positive

[**] The −99–+53 range is shown without color because these are small county-level VOC reductions or increases that likely had little to no impact on ozone estimates.

Figure 3.12: Percentage of 2020 Annual VOC Emissions Reduced by Sector



3.4 Ozone Design Values for Partial Attainment

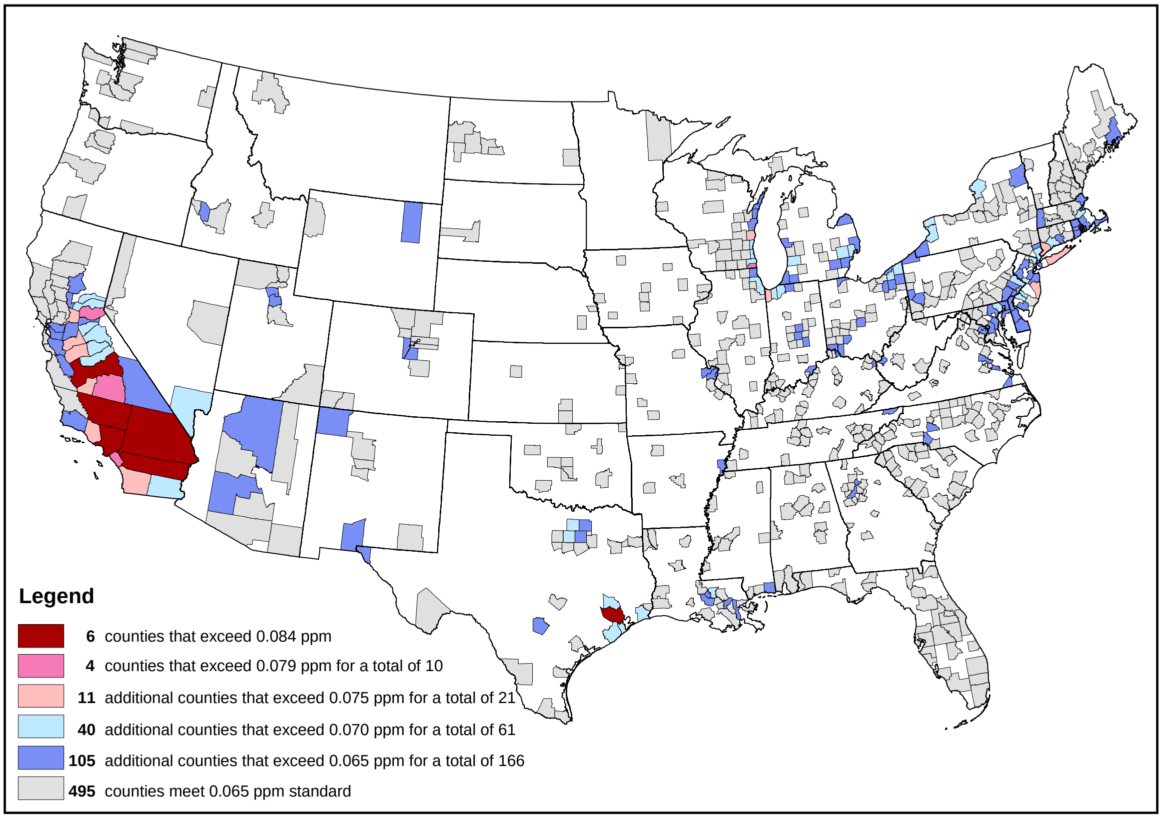
After determining the emissions reductions from NOx and VOC, we used modeling tools (see Section 2.3.2) to determine ozone design values for 2020. Figure 3.13 shows a map of the design values after the modeled control strategy. The map legend is broken out to demonstrate under this control strategy, with no adjustments, which counties would reach the targeted standard of 0.070 ppm, the more stringent alternative standard analyzed (0.065 ppm), and the other end of the proposal range (0.075 ppm, and 0.079 ppm). It is understood that this illustrative strategy would not be the exact hypothetical strategy used to try to attain either of these alternative standards, due to over- and under-attainment in many counties. (Chapter 4 describes EPA's methodology for estimating tons of reductions needed to hypothetically attain these other two possible alternative standards.) In addition, because ozone formation is dependent on a variety of factors, it is not possible to directly attribute changes in predicted ozone concentrations to emission reductions of a specific precursor from a specific sector.

A full listing of the counties and their design values is provided in Appendix 3.

Table 3.3 shows the tons of emissions reduced from the modeled control strategy, incremental to the baseline. Figure 3.14 shows the tons of emissions remaining after application of the hypothetical modeled control strategy, by sector.

Using this strategy, it is possible to reach attainment in 600 counties. However, there are still 61 counties that will remain out of attainment with an alternative standard of 0.070 ppm using this control strategy. All known controls were applied to this scenario, but attainment was not achieved everywhere. Because of this partial attainment outcome, it will be necessary to identify additional reductions in NOx and VOC. Chapter 4 will address the methodology for determining the additional tons that were needed to reach full attainment.

Figure 3.13: Projected 8-Hour Ozone Air Quality in 2020 From Applying the Modeled Control Strategy[a, b, c, d, e,]



[a] Modeled emissions reflect the expected reductions from federal programs including the Clean Air Interstate Rule (EPA, 2005b), the Clean Air Mercury Rule (EPA, 2005c), the Clean Air Visibility Rule (EPA, 2005d), the Clean Air Nonroad Diesel Rule (EPA, 2004), the Light-Duty Vehicle Tier 2 Rule (EPA, 1999), the Heavy Duty Diesel Rule (EPA, 2000), Locomotive and Marine Vessels (EPA, 2007a) and for Small Spark-Ignition Engines (EPA, 2007b), and state and local level mobile and stationary source controls identified for additional reductions in emissions for the purpose of attaining the current PM 2.5 and Ozone standards.

[b] Controls applied are illustrative. States may choose to apply different control strategies for implementation.

[c] The current standard of 0.08 ppm is effectively expressed as 0.084 ppm when rounding conventions are applied.

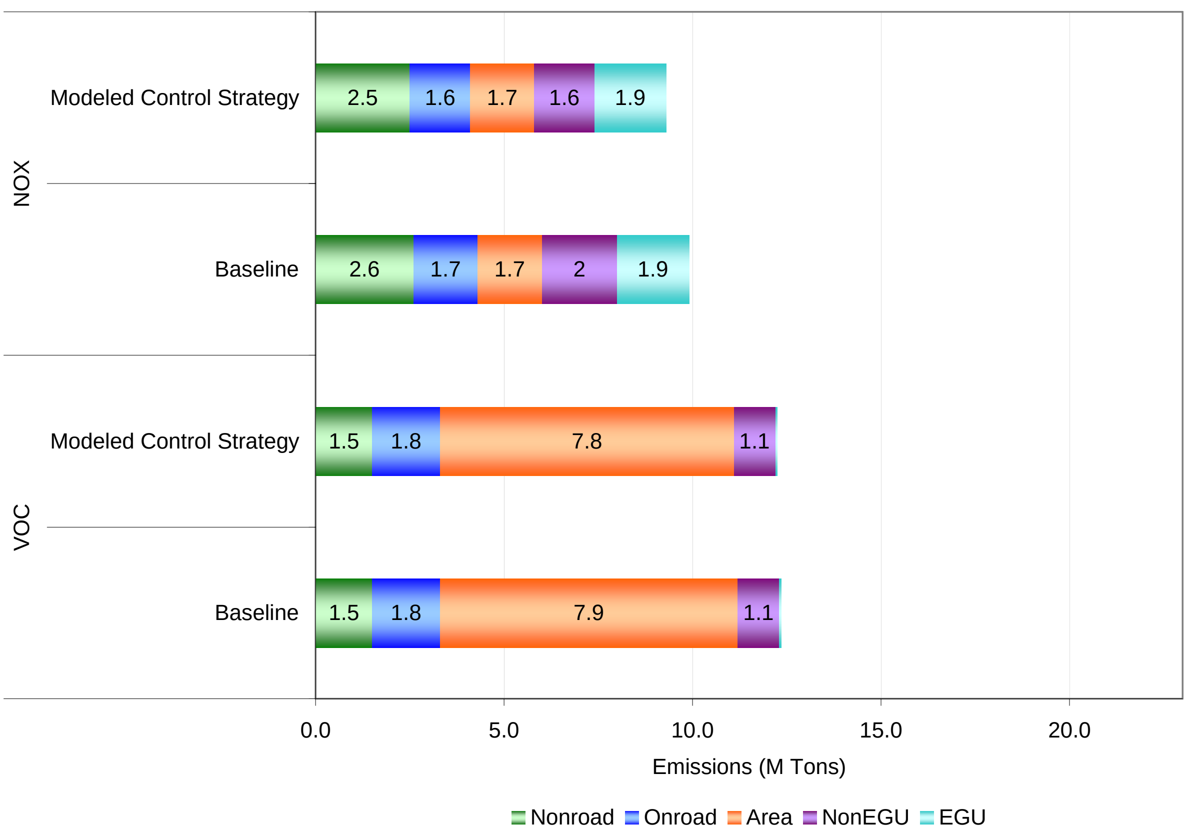
[d] Modeled design values in ppm are only interpreted up to 3 decimal places.

Table 3.3: Emissions and Reductions (2020) From Applying the Modeled Control Strategy by Region (Incremental to the Baseline)

Emissions Sector	Baseline Annual Emissions (annual tons/year)		Modeled Control Strategy Emission Reductions (annual tons/year)					
			East		West		California[a]	
	VOC	NOX	VOC	NOX	VOC	NOX	VOC	NOX
Area	7,900,000	1,700,000	140,000	20,000	15,000	1,100	10,000	35
NonEGU Point	1,100,000	2,000,000	4,000	350,000	280	19,000	260	1,600
EGU Point	49,000	1,900,000	-	7,500	-	19,000	-	1,400
Onroad	1,800,000	1,700,000	50,000	110,000	10,000	15,000	45	71
Nonroad	1,500,000	2,600,000	10,000	32,000	1,500	3,300	19	140

[a] A majority of the control measures were applied for the baseline in California.

Figure 3.14: National Annual Emissions Remaining (2020) after Application of Controls for the Baseline and Modeled Control Strategy



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