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**SACRAMENTO REGIONAL  
8-HOUR OZONE MILESTONE REPORT  
2011 MILESTONE YEAR**

**October 25, 2012**

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**SACRAMENTO REGIONAL**

**8-HOUR OZONE MILESTONE REPORT**

**2011 MILESTONE YEAR**

**This report demonstrates how existing control strategies have provided the emission reductions needed to meet the federal Clean Air Act requirements for reasonable further progress toward attainment of the 1997 8-hour ozone National Ambient Air Quality Standards (NAAQS) for the Sacramento region. Actual ozone precursor emission reductions from the 2002 baseline year through the 2011 milestone year are documented in this report.**

**October 25, 2012**

## **ACKNOWLEDGEMENTS**

This report was prepared by Sacramento Metropolitan Air Quality Management District staff as a joint project with the El Dorado County Air Quality Management District, Feather River Air Quality Management District, Placer County Air Pollution Control District and the Yolo-Solano Air Quality Management District.

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## TABLE OF CONTENTS

LIST OF TABLES.....	vi
LIST OF FIGURES.....	vii
LIST OF ABBREVIATIONS AND ACRONYMS.....	viii
1. EXECUTIVE SUMMARY.....	1-1
1.1 Milestone Report Contents and Organization.....	1-1
1.2 Background Information on Ozone.....	1-1
1.3 History of Federal 8-Hour Ozone Standard.....	1-2
1.4 Clean Air Act Progress Requirements.....	1-3
1.5 Sacramento Regional Progress Plans.....	1-5
1.6 Control Measures Adopted 2002-2011.....	1-7
1.7 2002 and 2011 VOC and NOx Emission Inventories.....	1-8
1.8 8-Hour Ozone Trends in the Sacramento Region.....	1-12
1.9 2011 Milestone Demonstration Analysis.....	1-16
2. BACKGROUND INFORMATION ON OZONE.....	2-1
2.1 Ozone Health Effects.....	2-1
2.2 Ozone Formation and Precursor Pollutants.....	2-2
3. HISTORY OF FEDERAL 8-HOUR OZONE STANDARD.....	3-1
3.1 Clean Air Act and Prior Federal 1-Hour Ozone Standard (1-Hour NAAQS).....	3-1
3.2 Federal 8-Hour Ozone Standard.....	3-1
4. CLEAN AIR ACT PROGRESS REQUIREMENTS.....	4-1
4.1 Reasonable Further Progress Demonstration Requirements.....	4-1
4.2 Milestone Demonstration Requirements.....	4-3

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5.	SACRAMENTO REGIONAL PROGRESS PLANS.....	5-5
5.1	Introduction.....	5-5
5.2	Sacramento Regional 8-Hour Ozone Attainment and Reasonable Further Progress Plan 5-5	
5.2.1	Calculations of Reasonable Further Progress Demonstration.....	5-6
5.3	Conclusion .....	5-6
6.	CONTROL MEASURES ADOPTED 2002-2011 .....	6-1
6.1	Introduction.....	6-1
6.2	Federal Control Measures.....	6-1
6.3	State Control Measures.....	6-1
6.4	Regional Control Measures .....	6-2
6.5	Conclusions.....	6-6
7.	2002 AND 2011 VOC AND NOX EMISSION INVENTORIES .....	7-1
7.1	Introduction to Emissions Inventory.....	7-1
7.2	Emission Inventory Source Categories.....	7-1
7.2.1	Stationary Sources .....	7-1
7.2.2	Area-Wide Sources.....	7-2
7.2.3	On-Road Motor Vehicles.....	7-2
7.2.4	Other Mobile Sources .....	7-2
7.3	Base Year and Milestone Year Emissions Inventory .....	7-3
7.4	Milestone Year Emission Reductions .....	7-6
7.5	Top Ten Emission Sources .....	7-7
7.6	Source Category Share of Total Emissions.....	7-9
7.7	Conclusion .....	7-11

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8.	8-HOUR OZONE TRENDS IN THE SACRAMENTO REGION .....	8-1
8.1	Introduction to Air Quality Trends .....	8-1
8.2	Ozone Monitoring Sites.....	8-1
8.3	Annual Number of Exceedance Days .....	8-2
8.4	Trend in Exceedance Days.....	8-3
8.5	Ozone Design Values .....	8-4
8.6	Trend in Ozone Design Value .....	8-7
9.	2011 MILESTONE DEMONSTRATION ANALYSIS .....	9-1
9.1	Introduction.....	9-1
9.2	Milestone Compliance Analysis.....	9-1

## LIST OF TABLES

Table 1-1	2011 Reasonable Further Progress Demonstration .....	1-6
Table 1-2	2011 Milestone Demonstration Emissions Calculations .....	1-17
Table 5-1	2011 Reasonable Further Progress Demonstration .....	5-7
Table 6-1	CARB Adopted Control Measures 2002-2011 .....	6-2
Table 6-2	Regional Control Measures Adopted 2002—2011.....	6-3
Table 6-3	Regional Mobile Source Incentive Programs .....	6-5
Table 6-4	SACOG Transportation Control Measures 2002-2011 .....	6-6
Table 7-1	Adjustments to Attainment Plan 2011 Emissions Inventory.....	7-3
Table 7-2	VOC Emissions – Sacramento Nonattainment Area.....	7-4
Table 7-3	NOx Emissions – Sacramento Nonattainment Area.....	7-5
Table 8-1	8-Hour Ozone Exceedance Days.....	8-2
Table 8-2	8-Hour Ozone Design Values (ppb) – Sacramento Nonattainment Area.....	8-6
Table 9-1	2011 Milestone Demonstration Emissions Calculations .....	9-2



## LIST OF FIGURES

Figure 1-1	VOC Emissions - Sacramento Nonattainment Area .....	1-9
Figure 1-2	NOx Emissions - Sacramento Nonattainment Area .....	1-10
Figure 1-3	2002 and 2011 VOC Emissions - Share by Source .....	1-11
Figure 1-4	2002 and 2011 NOx Emissions - Share by Source.....	1-12
Figure 1-5	8-Hour Ozone Exceedance Days .....	1-13
Figure 1-6	8-Hour Ozone Design Values Trend .....	1-14
Figure 1-7	Geographic Extent of Ozone Exceedances – 2002-2011 .....	1-15
Figure 1-8	Milestone Compliance Demonstration.....	1-18
Figure 5-1	2011 Reasonable Further Progress Demonstration .....	5-8
Figure 7-1	VOC Emissions - Sacramento Nonattainment Area.....	7-6
Figure 7-2	NOx Emissions - Sacramento Nonattainment Area .....	7-7
Figure 7-3	Top Ten VOC Emission Sources.....	7-8
Figure 7-4	Top Ten NOx Emission Sources.....	7-9
Figure 7-5	2002 and 2011 VOC Emissions - Share by Source .....	7-10
Figure 7-6	2002 and 2011 NOx Emissions - Share by Source.....	7-11
Figure 8-1	Sacramento Nonattainment Area Ozone Monitoring Stations .....	8-1
Figure 8-2	8-Hour Ozone Exceedance Days .....	8-3
Figure 8-3	8-Hour Ozone Exceedance Days Trend.....	8-4
Figure 8-4	Geographic Extent of Ozone Exceedances – 2002-2011 .....	8-7
Figure 8-5	8-Hour Ozone Design Values Trend .....	8-8
Figure 9-1	Milestone Compliance Demonstration.....	9-3

## **LIST OF ABBREVIATIONS AND ACRONYMS**

**APCD - Air Pollution Control District**

**AQMD - Air Quality Management District**

**ARB - California Air Resources Board**

**BAR - Bureau of Automotive Repair**

**CAA - Clean Air Act**

**CARB - California Air Resources Board**

**CEFS - California Emissions Forecasting System**

**CFR - Code of Federal Regulations**

**EDCAQMD - El Dorado County Air Quality Management District**

**EMFAC - California's on-road motor vehicle emission factor model**

**EPA - U. S. Environmental Protection Agency**

**ERC - emission reduction credit**

**FMVCP - federal motor vehicle control program**

**FR - Federal Register**

**FRAQMD - Feather River Air Quality Management District**

**MPO - Metropolitan Planning Organization**

**NAA - nonattainment area**

**NAAQS - national ambient air quality standard**

**NO<sub>x</sub> - nitrogen oxides**

**OAQPS - EPA Office of Air Quality Planning and Standards**

**PCAPCD - Placer County Air Pollution Control District**

**ppb - parts per billion**

**ppm - parts per million**

**RACM - reasonably available control measure**

**RACT - reasonably available control technology**

**RFP - reasonable further progress**

**ROG - reactive organic gases**

**ROP - rate-of-progress**

**RVP - Reid vapor pressure**

**SACOG - Sacramento Area Council of Governments**

**SFNA - Sacramento Federal Nonattainment Area**

**SIP - State Implementation Plan**

**SJVAPCD - San Joaquin Valley Air Pollution Control District**

**SMAQMD - Sacramento Metropolitan Air Quality Management District**

**SNA - Sacramento Nonattainment Area**

**STARNET - Sacramento Transportation Area Network**

**SV - Sacramento Valley**

**TCM - transportation control measure**

**TDM - Transportation Demand Management**

**TMA - Transportation Management Association**

**tpd - tons per day**

**VOC - volatile organic compounds**

**YSAQMD - Yolo-Solano Air Quality Management District**

## **1. EXECUTIVE SUMMARY**

### **1.1 Milestone Report Contents and Organization**

This document includes information and analyses demonstrating that existing control strategies have provided the emission reductions needed to meet the federal Clean Air Act (CAA) requirements for reasonable further progress toward attainment of the 1997 8-hour ozone National Ambient Air Quality Standards (NAAQS) for the Sacramento Federal Nonattainment Area (SFNA). The SFNA includes all of Sacramento and Yolo counties and portions of Placer, El Dorado, Solano, and Sutter counties. The SFNA is administered by five air districts: El Dorado County Air Quality Management District (AQMD), Feather River AQMD, Placer County Air Pollution Control District, Sacramento Metropolitan AQMD and Yolo-Solano AQMD.

This Report is organized into the following chapters.

- Chapter 1 – Executive Summary
- Chapter 2 – Background Information on Ozone
- Chapter 3 – History of Federal 8-Hour Ozone Standard
- Chapter 4 – Clean Air Act Progress Requirements
- Chapter 5 – Sacramento Regional Progress Plans
- Chapter 6 – Control Measures Adopted 2002-2011
- Chapter 7 – 2002 and 2011 VOC and NO<sub>x</sub> Planning Emission Inventories
- Chapter 8 – 8-Hour Ozone Trends in the Sacramento Region
- Chapter 9 – 2011 Milestone Demonstration Analysis

### **1.2 Background Information on Ozone**

Air pollution, or “smog,” is composed of many different gaseous and particulate pollutants, which can create a regional haze reducing atmospheric visibility. Ground-level ozone, a colorless gas, is a major component of photochemical smog. Since ozone is primarily formed in the presence of strong sunlight, ambient ozone concentrations are most problematic from May through October in the Sacramento Region. Ground-level ozone is one of the air pollutants regulated by the federal and state government. Reducing ozone to levels below state and federal standards is one of the primary goals of the air districts.

Ozone is not directly emitted into the atmosphere. It is a pollutant formed in the atmosphere through complex chemical reactions involving volatile organic compounds (VOC) and nitrogen oxides (NOx) in the presence of sunlight. Because of this, VOC and NOx are known as ozone “precursors.” Ozone is a strong irritant that adversely affects human health. Breathing air containing ozone can reduce lung function and aggravate respiratory symptoms such as asthma, bronchitis, chest pains and emphysema. Repeated exposure can permanently scar lungs and make them more susceptible to infection. For more information visit the EPA web page at [www.epa.gov/airnow/ozone-c.pdf](http://www.epa.gov/airnow/ozone-c.pdf).

### **1.3 History of Federal 8-Hour Ozone Standard**

Prior to 1997, the U.S. Environmental Protection Agency (EPA) ozone standard was a 1-hour standard. In July, 1997, EPA promulgated the first 8-hour standard for ozone. This change lowered the health-based standard for ambient ozone concentrations from 0.12 parts per million averaged over one hour to 0.08 parts per million of ozone averaged over eight hours. In 1998 the American Trucking Association challenged this standard in the Washington D.C. Court of Appeals. In May 1999, the Court ruled that EPA’s delegation of authority and implementation approach were improper, and remanded the standard. EPA appealed this decision, and in February 2001, the U.S. Supreme Court upheld the 8-hour ozone standard.

In 2004, the Sacramento region was designated nonattainment for the 1997 8-hour standard<sup>1</sup> and classified as a “serious” area with an attainment deadline of June 15, 2013. Since the Sacramento region needs to rely on the longer term emission reduction strategies from state and federal mobile source control programs, it cannot meet the 2013 attainment date. Consequently, on February 14, 2008, the California Air Resources Board (CARB), on behalf of the air districts in the Sacramento region, submitted a letter to EPA requesting a voluntary reclassification (bump-up) of the Sacramento Federal Nonattainment Area (SFNA) from a “serious” to a “severe” 8-hour ozone nonattainment area with an extended attainment deadline of June 15, 2019, and additional mandatory requirements. On May 5, 2010 EPA approved the request, with a June 4, 2010 date.<sup>2</sup>

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<sup>1</sup> “Air Quality Designations and Classifications for the 8-Hour Ozone National Ambient Air Quality Standards; Early Action Compact Areas with Deferred Effective Dates” (Federal Register, April 30, 2004, p. 23858-23951).

<sup>2</sup> “Designation of Areas for Air Quality Planning Purposes; California; San Joaquin Valley, South Coast Air Basin, Coachella Valley, and Sacramento Metro 8-Hour Ozone Nonattainment Areas; Reclassification” (Federal Register, May 5, 2010, Vol. 75, No. 86, p. 24409).

On March 12, 2008, EPA promulgated a revised 8-hour ozone NAAQS of 0.075 parts per million, based on a review of new health studies.<sup>3</sup> The SFNA is a “severe” nonattainment area for the new standard with a 2027 attainment date. However, the 1997 standards, SIP requirements and implementation rules for the 1997 8-hour ozone standards addressed in this report are still in effect. Planning requirements for the new 2008 8-hour ozone NAAQS will be addressed in future plan development efforts.

## **1.4 Clean Air Act Progress Requirements**

### **Emission Reduction Requirements**

Sections 172(c)(2), 182(b)(1) and 182(c)(2)(B) of the Clean Air Act include RFP provisions for reducing emissions in ozone nonattainment areas. The federal 8-hour ozone regulations require that areas classified under Subpart 2 as “serious and above” submit a reasonable further progress (RFP) plan.<sup>4</sup> The RFP plan must show a VOC (and/or NOx) emission reduction of at least three percent per year averaged over the first six years from the baseline year and over each consecutive three-year period out to the attainment year.

### **Reductions from Pre-1990 Regulations Excluded**

The methodology used for demonstrating reasonable further progress includes deriving the base year and milestone year emissions inventories, calculating RFP emission reduction targets, assessing creditable reductions, and using NOx substitution for VOC reductions. Section 182(b)(1)(D) specifies that the following programs cannot be used to meet progress requirements: emissions eliminated by federal motor vehicle control program (FMVCP) regulations promulgated prior to 1990, federal Reid Vapor Pressure (RVP) fuel regulations promulgated prior to the enactment of the Clean Air Act Amendments of 1990 and vehicle inspection and maintenance program (Smog Check) corrections required by the 1990 CAA Amendments.

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<sup>3</sup> “National Ambient Air Quality Standards for Ozone” (Federal Register, March 27, 2008, p. 16436-16514).

<sup>4</sup> The final 8-hour ozone implementation rule (Phase 2) which includes the reasonable further progress requirements were published in the November 29, 2005 Federal Register, Vol. 70, No.228, p. 71615.

### **NOx Substitution for VOC Reductions**

Any remaining VOC reductions necessary to meet RFP can be met by substituting NOx emission reductions. Section 182(c)(2)(C) of the Clean Air Act allows for the substitution of NOx emission reductions in place of VOC reductions to meet the reasonable further progress requirements. According to EPA's NOx Substitution Guidance,<sup>5</sup> the substitution of NOx reductions for VOC reductions must be done on a percentage basis, rather than a straight ton-for-ton exchange. Thus, if there is a certain percent additional VOC reduction needed to demonstrate RFP or milestone compliance, an equal percentage reduction in NOx emissions can be substituted to provide the equivalent reductions necessary for meeting the reasonable further progress goals toward attainment.

### **Milestone Demonstration Requirements**

Nonattainment areas must submit a compliance demonstration (milestone report) after each milestone year. At a minimum, the milestone report must contain information and analyses required by EPA rulemaking and must demonstrate that the milestone has been met. The CAA requires ozone nonattainment areas to monitor the emission reductions that have actually occurred. Actual emission reductions must equal or exceed the percentage reductions (i.e. minimum of 3% per year). If the region does not attain by its attainment deadline, the region must continue to demonstrate required reductions for each subsequent three year interval until the standard is attained (CAA §181(b)(4)). The CAA refers to the three year emission reduction forecast intervals as the "applicable milestone" (CAA §182(g)(1)).

### **Consequences of Failure to Submit/Failure to Demonstrate**

If a "serious" or "severe" ozone nonattainment area fails to submit a timely milestone report, or EPA determines a nonattainment area has not met an applicable milestone (CAA §182(g)(3)), the state must either:

- have the area reclassified to the next higher classification,
- implement specific additional control measures adequate to meet the next milestone as provided in the applicable contingency plan, or
- adopt an economic incentive program (CAA §182(g)(4)).

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<sup>5</sup> Environmental Protection Agency (OAQPS), "NOx Substitution Guidance," December 1993.

## 1.5 Sacramento Regional Progress Plans

The Sacramento regional air districts adopted the Sacramento Regional 8-Hour Ozone Attainment and Reasonable Further Progress Plan (2011 Plan).<sup>6</sup> The 2011 Plan demonstrated that existing and new control strategies will provide the necessary future emission reductions to meet the federal Clean Air Act requirements for reasonable further progress and attainment of the 1997 8-hour ozone NAAQS for the Sacramento region.

Table 1-1 contains 2011 Plan calculations that demonstrated reasonable further progress is achieved for the required milestone target for 2011. The reasonable further progress demonstrations are achieved by forecasted emission reductions from existing control regulations and already adopted control measures. The Sacramento Region has met the CAA prerequisite of an adopted 15 percent VOC-only plan, so the SFNA may use NO<sub>x</sub> reductions to substitute for required VOC reductions. The NO<sub>x</sub> substitution is used on a percentage basis to cover any VOC percentage shortfalls.

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<sup>6</sup> Sacramento Regional 8-Hour Ozone Attainment and Reasonable Further Progress Plan (2009, revised 2011).



**Table 1-1 2011 Reasonable Further Progress Demonstration**

<b>VOC Emission Calculations – Tons/Day†</b>	<b>2011</b>
1. 2002 Baseline VOC Inventory	160.3
2. Non-Creditable FMVCP/RVP Adjustments	11.9
3. Adjusted 2002 Baseline VOC Inventory (Line 1 – Line 2)	148.4
4. VOC Emissions Forecast with existing controls + ERCs (3.5)	130.5
5. RFP Commitment for VOC Reductions from New Measures	0
<b>6. Forecasted VOC Creditable Reductions Since 2002</b> (Line 3 – Line 4 + Line 5)	17.9
7. Forecasted % VOC Reductions Since 2002 (Line 6 ÷ Line 3)	12.1%
8. RFP % Reduction Required from 2002 Adjusted Baseline VOC Inventory‡	27%
9. Forecasted % VOC Shortfall (Line 8 – Line 7)	14.9%
<b>NOx Emission Calculations – Tons/Day†</b>	
10. 2002 Baseline NOx Inventory	195.7
11. Non-Creditable FMVCP Adjustments	13.0
12. Adjusted 2002 Baseline NOx Inventory (Line 10 – Line 11)	182.7
13. NOx Emissions Forecast with existing controls + ERCs (2.4)	146.4
14. RFP Commitment for NOx Reductions from New Measures	0
<b>15. Forecasted NOx Creditable Reductions Since 2002</b> (Line 12 – Line 13 + Line 14)	<b>36.3</b>
16. Forecasted % NOx Reductions Since 2002 (Line 15 ÷ Line 12)	19.9%
17. % NOx Substitution Needed for VOC Shortfall (Same as Line 9)	14.9%
18. Forecasted % NOx Reduction Surplus (Line 16 – Line 17)	5.0%
<b>Is Reasonable Further Progress Met?</b>	<b>Yes</b>
<b>Is 3% Contingency Met for RFP?</b>	<b>Yes</b>

† Sacramento Regional 8-Hour Ozone Attainment and Reasonable Further Progress Plan (11/10/11), Page 13-5.

‡ RFP reduction requirements contained in EPA's Final Rule to Implement the 8-Hour Ozone NAAQS (Phase 2) published in the November 29, 2005 Federal Register.

## **1.6 Control Measures Adopted 2002-2011**

Control measures include rules and regulations adopted by local air districts, the California Air Resources Board (CARB) and the U.S. EPA. Control measures also include non-regulatory measures such as mobile source incentive programs that provide financial incentives to accelerate the introduction of low emission vehicles and public education programs such as “Spare the Air” that seek voluntary emission reductions by encouraging people to reduce vehicle trips. Existing control measures and their emission benefits are helping to make progress toward achieving air quality attainment goals.

### **Federal Control Measures**

Under the federal Clean Air Act, only EPA can set new engine standards for construction and farm equipment using off-road engines less than 175 horsepower and locomotives (CAA §209(e)). The Sacramento nonattainment area has benefited from these standards as well as federal mobile source measures for new locomotive Tier 1 and Tier 2 engines, nationwide heavy-duty on-highway trucks, and new emission standards for preempted farm and construction equipment.

### **State Control Measures**

CARB establishes emission standards for on-road motor vehicles and some off-road sources. CARB also establishes fuel specifications and develops consumer product standards. Sources that CARB has primary responsibility for include most new and existing on- and off-road engines and vehicles, motor vehicle fuels, and consumer products. In addition, California has unique authority under CAA section 209 to adopt and implement new emission standards for many categories of on-road vehicles and engines, and new and in-use off-road vehicles and engines, subject to EPA approval.

In recent years, CARB has adopted a number of measures that will further reduce ozone forming emissions in the Sacramento region and throughout the state. The largest state commitment in the 8-Hour Ozone Plan<sup>7</sup> is the Cleaner In-Use Heavy-Duty Trucks measure (the Truck rule). This measure, first adopted in 2008 and amended in 2011, will substantially reduce NOx emissions in the Sacramento region.

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<sup>7</sup> Sacramento Regional 8-Hour Ozone Attainment and Reasonable Further Progress Plan (2009; Rev. 2011),

## **Regional Control Measures**

The regional air districts have primary responsibility for regulating stationary sources, such as power plants and manufacturing facilities, as well as some area sources, including gas stations, automobile coating operations and agricultural operations. State and federal laws preempt a local air district's authority to directly or indirectly regulate or establish tail-pipe emission standards for mobile sources. Local air districts also cooperate with metropolitan planning organizations (MPOs) to develop measures affecting local transportation activity that are included in a SIP. In this region the MPO is the Sacramento Area Council of Governments (SACOG). MPOs coordinate the process to identify and evaluate potential transportation control measures and compile local government commitments that will be included in the regional air quality plan.

The regional air districts have adopted more than 30 control measures since 2002. SACOG was responsible for coordinating the implementation of more than 15 transportation control measures during 2002-2011. Chapter 6 includes more detail of the control measures that have been reducing emissions in the Sacramento nonattainment area during 2002-2011.

### **1.7 2002 and 2011 VOC and NOx Emission Inventories**

Planning efforts to evaluate and reduce ozone air pollution include identifying and quantifying the various processes and sources of VOC emissions (e.g. solvents, surface coatings, and motor vehicles) and NOx emissions (e.g. motor vehicles and other fuel combustion equipment). The summary of VOC and NOx emissions estimates are provided for the 2002 base year and 2011 milestone year.

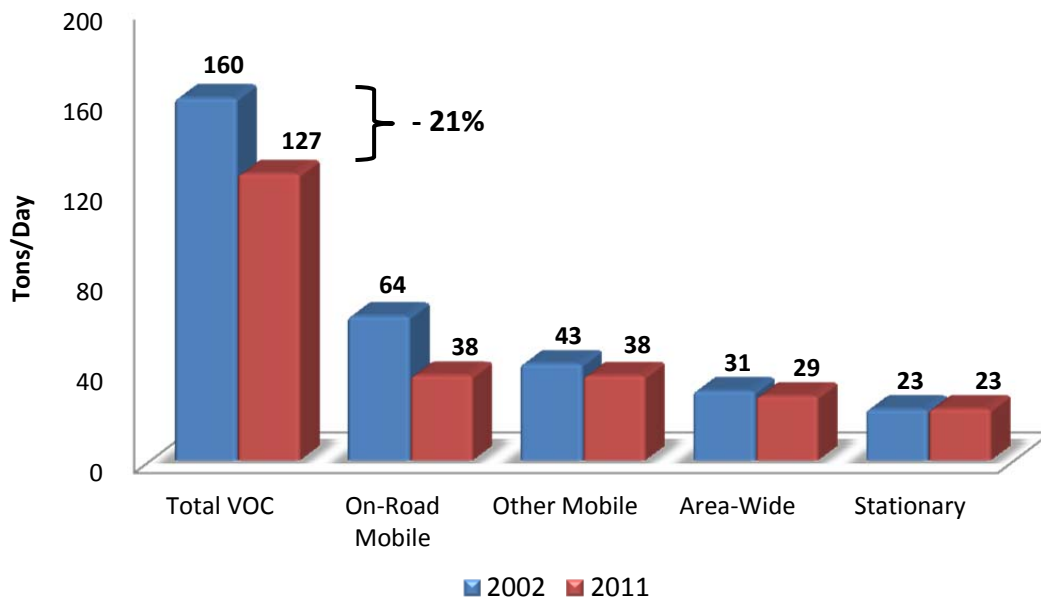
The emissions inventory system is characterized by different air pollutant source categories for the Sacramento nonattainment area. The anthropogenic emissions inventory is divided into four broad categories: stationary sources, area-wide sources, on-road motor vehicles, and other mobile sources. Stationary sources include non-mobile, fixed sources of air pollution. They are mainly comprised of individual industrial, manufacturing, and commercial facilities called "point sources." Area-wide sources are aggregated emissions from processes that are individually small and widespread or that do not have well-defined point sources. Area-wide sources include solvent evaporation from consumer products and architectural coatings; farming operations (planting, cultivation, harvesting); pesticide and fertilizer use; and miscellaneous

processes such as residential fuel combustion and controlled burning. On-road motor vehicle sources include trucks, automobiles, buses, motorhomes and motorcycles. Other mobile sources include aircraft, trains, ships, and off-road vehicles and equipment used for construction, farming, commercial, industrial, and recreational activities. This report contains the most current information available, but CARB is expected to adopt updated emission inventory data later this year or early 2013. That data will reflect new information including the impact of the recession and updated motor vehicle and off-road emission estimates.

One of the purposes of this report is to identify the emission reductions that have occurred in the region since the base year, 2002. The following graphs, Figure 1-1 and Figure 1-2, illustrate the change in VOC and NOx emissions from 2002 through 2011.

Total VOC and NOx emissions have decreased by 21 percent and 27 percent, respectively, over the nine year period. The majority of all emissions come from mobile sources (on-road and other mobile), accounting for more than half of both the 2002 and 2011 VOC emissions inventory, and about 90 percent of the 2002 and 2011 NOx emissions inventory.

**Figure 1-1 VOC Emissions - Sacramento Nonattainment Area**



**Figure 1-2 NOx Emissions - Sacramento Nonattainment Area**

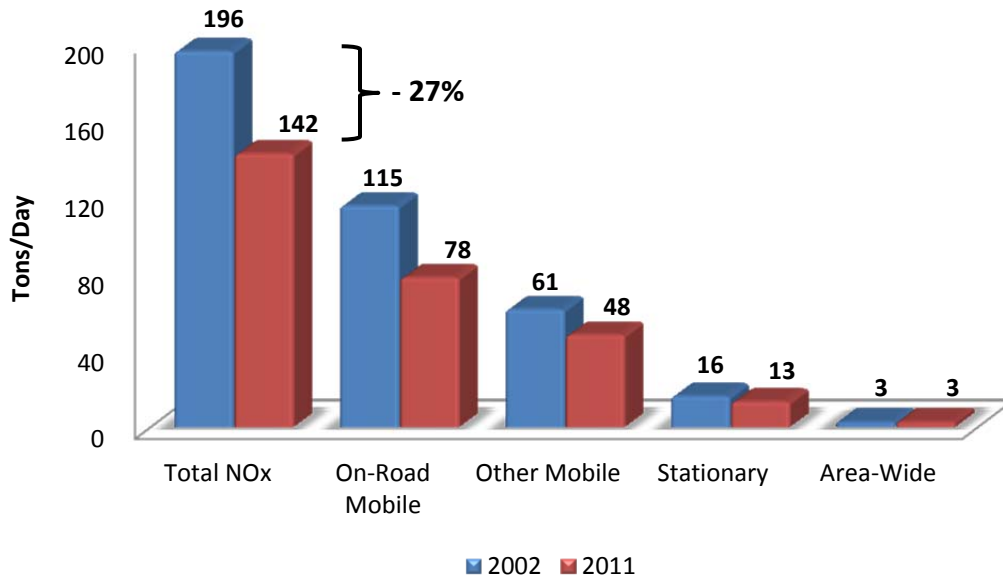
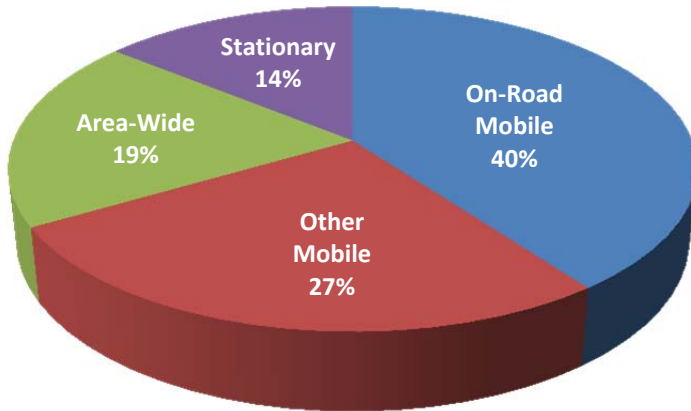


Figure 1-3 and Figure 1-4 show the 2002 and 2011 VOC and NOx emission inventory categories as a percentage of the total inventory for the Sacramento nonattainment area. In 2002, the VOC inventory comprised 40 percent on-road mobile sources, 27 percent other mobile sources, 19 percent area-wide sources, and 14 percent stationary sources. Although there was a ten percent decrease in the on-road mobile share of the inventory, the percentage share of source categories for the 2011 emissions inventory remains consistent with the 2002 inventory with 30 percent each for on-road and other mobile sources, 22 percent area-wide sources, and 18 percent stationary sources.

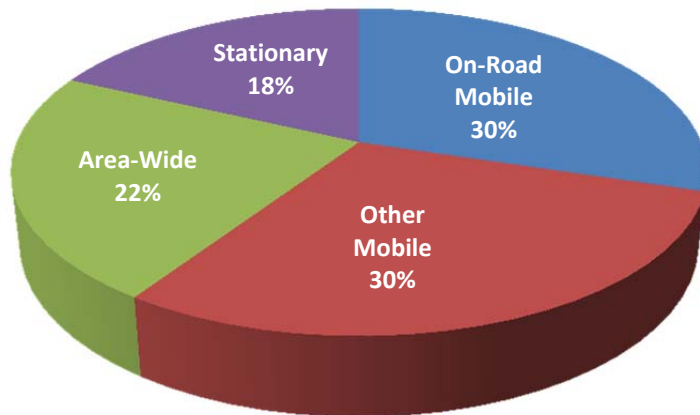
The NOx inventory consists mainly of mobile source combustion emissions. In 2002, the NOx inventory includes 59 percent on-road mobile sources, 31 percent other mobile sources, 2 percent area-wide sources, and 8 percent stationary sources. The percentage share is similar for the 2011 NOx inventory with 55 percent on-road mobile sources, 34 percent other mobile sources, 2 percent area-wide sources, and 9 percent stationary sources.

**Figure 1-3 2002 and 2011 VOC Emissions - Share by Source**

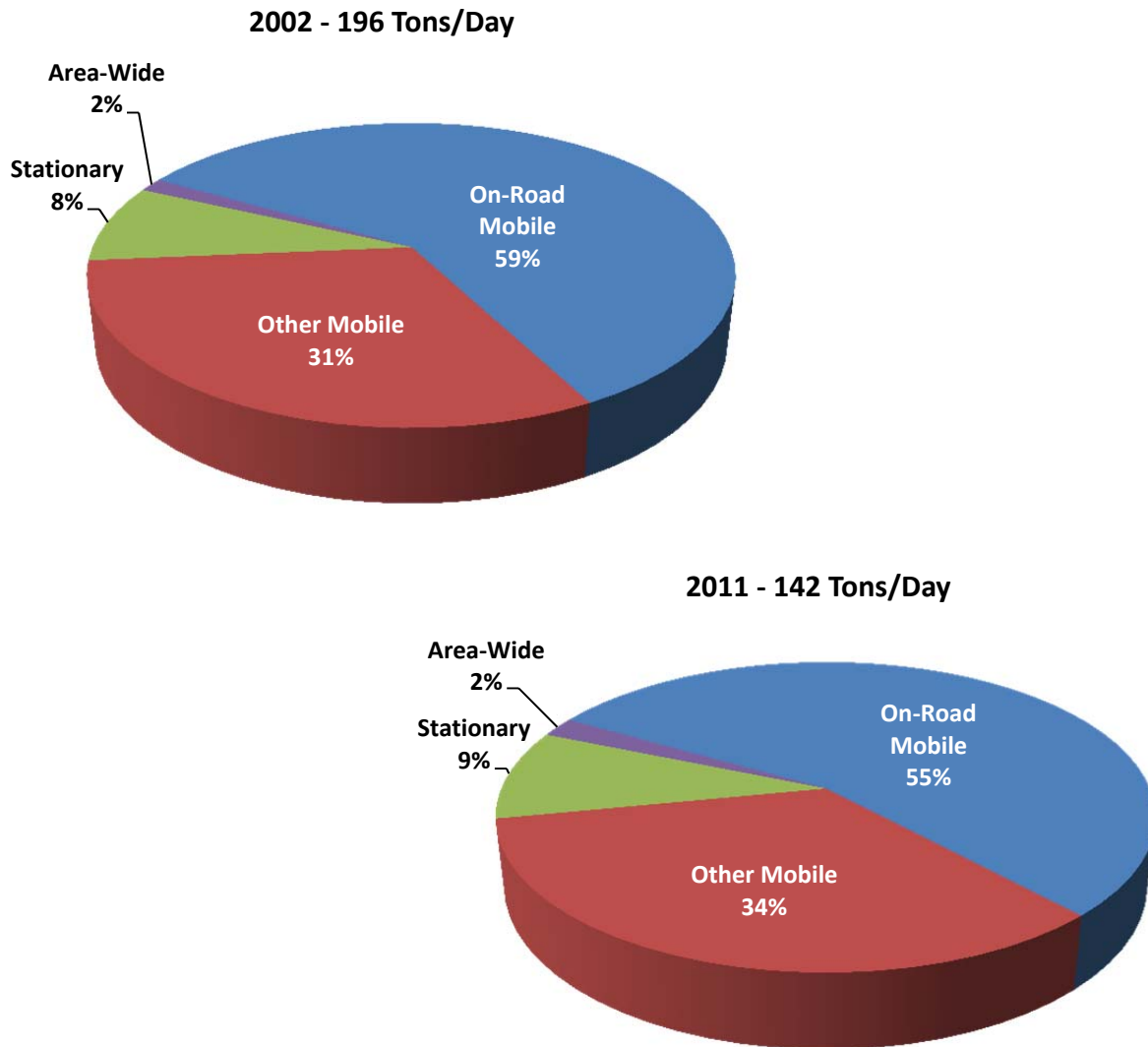
**2002 - 160 Tons/Day**



**2011 - 127 Tons/Day**



**Figure 1-4 2002 and 2011 NOx Emissions - Share by Source**



### 1.8 8-Hour Ozone Trends in the Sacramento Region

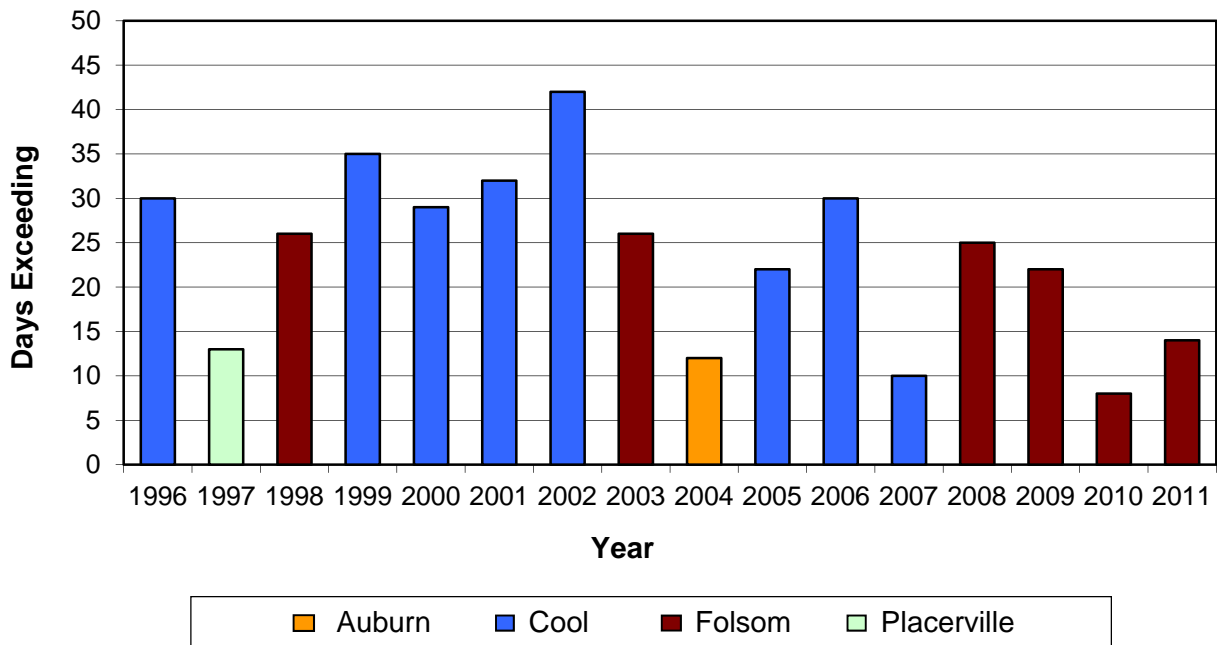
Two key indicators of air quality improvement are 1) ozone concentrations, and 2) the number of days exceeding the 8-hour ozone standard and ozone concentrations. Actual air quality improvement is assessed by comparing ozone concentrations in a region to the federal standard. An increase or decrease in the number of days an area remains below the 8-hour standard is an indicator of air quality improvement. But this factor, by itself, does not paint a complete picture. In fact, as discussed below, an area can exceed the standard on some days

and still meet federal health standards, so long as the overall ozone concentrations do not exceed the standard over three years.

**Annual Number of Exceedance Days**

The bar chart in Figure 1-5 illustrates the monitoring site locations that exceeded the federal 8-hour ozone standard the most days in each year. Year to year ozone differences are caused by meteorological variability and changes in precursor emission patterns. Therefore, we refer to these days as “exceedance days” rather than violation days. In other words, every day that the concentration is above the standard is not a violation of the standard.

**Figure 1-5 8-Hour Ozone Exceedance Days  
 Sacramento Nonattainment Area – Peak Monitoring Site**

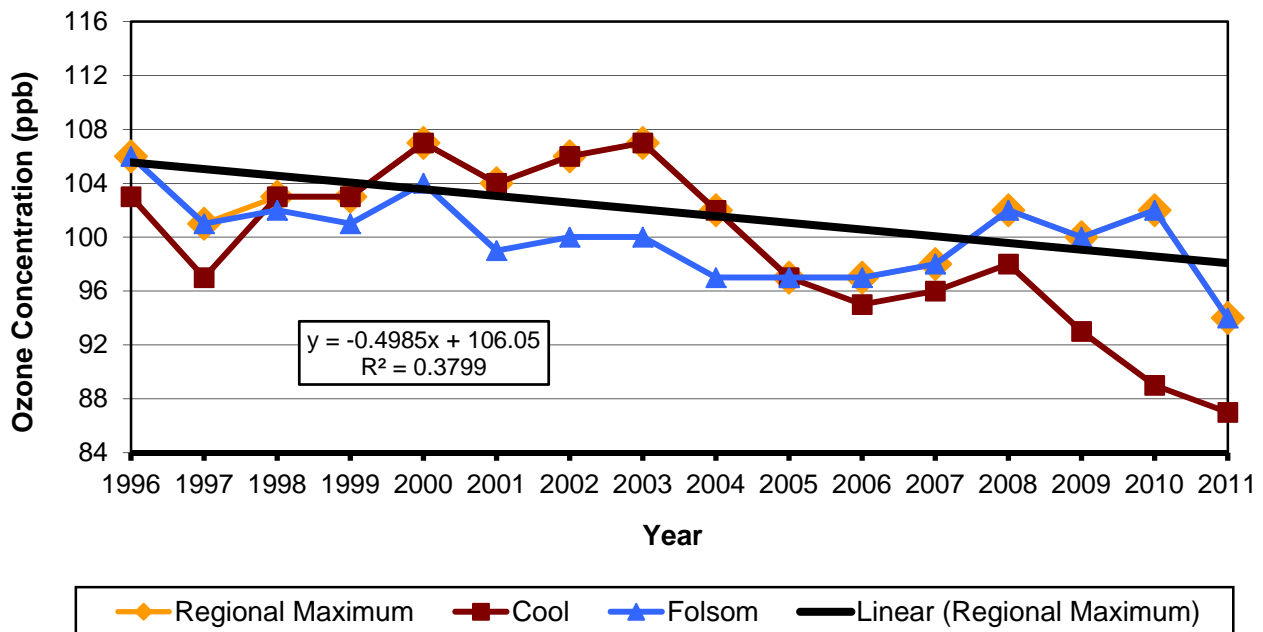




### Ozone Design Values

Ozone design value<sup>8</sup> is the indicator that determines whether the region meets the 1997 ozone standard. The line graph in Figure 1-6 shows the ozone design value for the peak monitoring site in each year and a trend line from 1996 to 2011. Figure 1-6 also includes the trend line for the two monitoring sites in the region with the highest design values, Cool and Folsom. The overall 16-year trend line indicates a decline, from 107 ppb down to 94 ppb. The ozone design value has improved from being 23 ppb (or 27%) over the standard<sup>9</sup> down to about 10 ppb (or 12%) over the standard, which equals a decline rate of about 0.8 ppb per year. Either the Cool or Folsom site has had the highest design value over the analysis years, with Folsom leading in the most recent years, which indicates a smaller area in the region exceeds the standards and consequently shifts the peak design value toward the urban core.

**Figure 1-6 8-Hour Ozone Design Values Trend  
 Sacramento Nonattainment Area – Peak, Cool and Folsom Monitoring Sites**



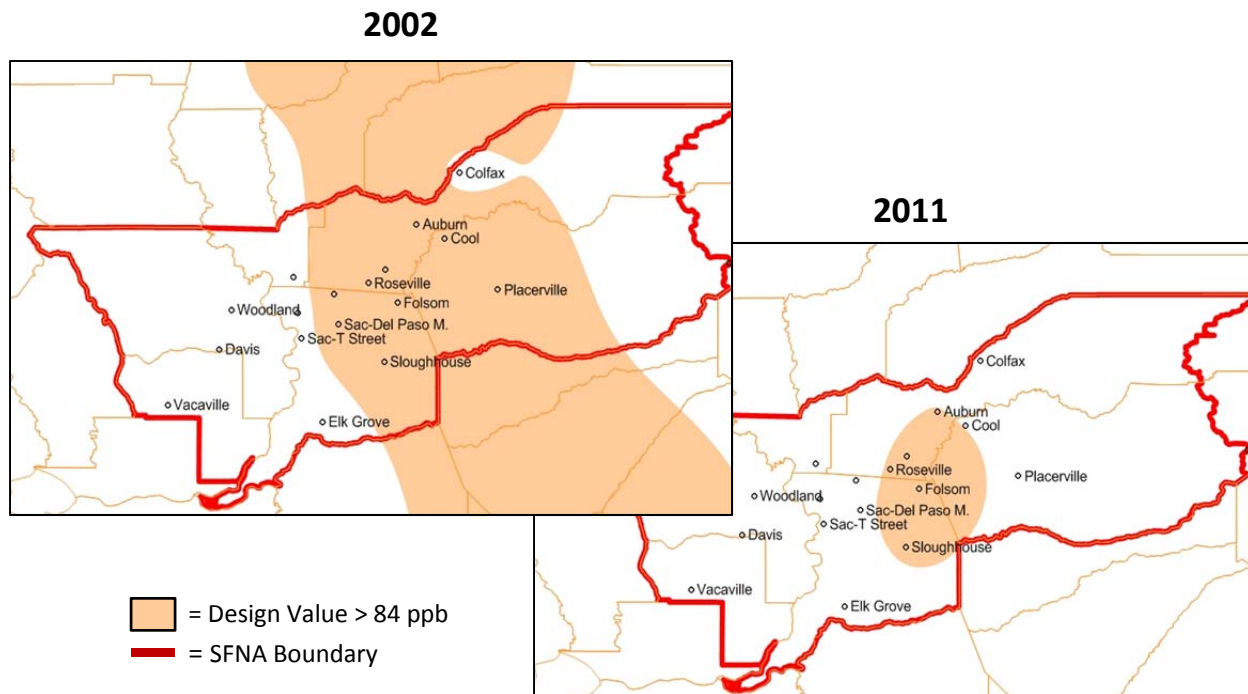
<sup>8</sup> A design value is a statistic that describes the air quality status of a given location relative to the level of the National Ambient Air Quality Standards and for ozone is the annual fourth-highest daily maximum 8-hour average ozone concentration, averaged over three consecutive years.

<sup>9</sup> Federal 1997 8-hour ozone standard = 0.08 ppm. Due to rounding convention, violation is > 0.084 ppm or 84 ppb.

The number of monitoring sites violating the standard each year has been declining. After peaking in 1999 with 14 monitoring sites exceeding the standard, the region has experienced a steady decline through 2011 when only four sites exceeded the standard. This indicates that the geographic size of the area experiencing ozone concentrations above the standard is decreasing in the Sacramento area.

The reduction of the geographic extent of violations in the Sacramento ozone nonattainment area is vividly displayed in Figure 1-7 below.<sup>10</sup> This illustration compares the widespread ozone violations in 2002 with a much-reduced area in 2011. In 2002, violations were experienced from north to south throughout the eastern portion of the SFNA, beginning slightly east of downtown Sacramento and extending farther east to near the crest of the Sierra Nevada Mountains, covering an area of more than 3,000 square miles within the SFNA. By 2011 the geographic area of ozone violations is significantly reduced, covering an area from Auburn on the north to Sloughouse on the south and Roseville on the west to about Cameron Park on the east, an area of less than 900 square miles.

**Figure 1-7 Geographic Extent of Ozone Exceedances – 2002-2011**



<sup>10</sup> The exceedance maps were developed using Surfer software (Version 9.11.947) and design value data from the CARB air quality database ([www.arb.ca.gov/adam/welcome.html](http://www.arb.ca.gov/adam/welcome.html)). Exceedance areas were interpolated from data captured at all air monitoring sites in California.

### **1.9 2011 Milestone Demonstration Analysis**

Actual emission reductions through 2011 are evaluated to determine milestone compliance. These reductions must equal or exceed the milestone target reduction to satisfy the reasonable further progress (RFP) and milestone compliance (CAA §182(g)) requirements of the Clean Air Act. The Sacramento ozone nonattainment area must reduce the 2002 VOC emissions level by a minimum of 27 percent (3% per year for 9 years from 2002-2011). NOx reductions may be used to substitute VOC reductions if there are not sufficient VOC reductions to meet RFP requirements.

Table 1-2 provides calculations demonstrating milestone compliance for the Sacramento ozone nonattainment area. From 2002 to 2011 VOC and NOx emissions were reduced by 14.6 percent and 22 percent, respectively, after deducting non-creditable reductions from pre-1990 federal vehicle control and fuel regulations.<sup>11</sup> Of the 22 percent NOx reduction, 12.4 percent is used to substitute for the remaining VOC reductions needed to achieve the 27 percent milestone target for 2011. This leaves a 9.6 percent surplus of NOx reductions.

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<sup>11</sup> Reductions from federal motor vehicle control program (FMVCP) regulations and federal Reid Vapor Pressure (RVP) fuel regulations promulgated prior to Clean Air Act Amendments of 1990 (CAA §182(b)(D)).

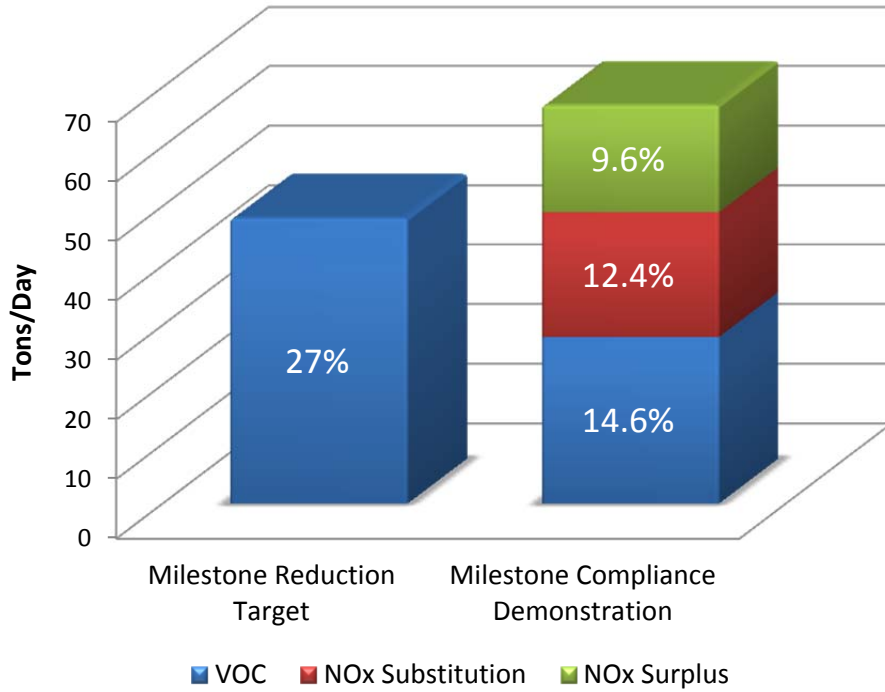
**Table 1-2 2011 Milestone Demonstration Emissions Calculations**

<b>VOC Emissions Calculation (Tons/Day)</b>	
1. 2002 VOC Baseline Emissions Inventory (Table 7-1, Page 7-4)	160.3
2. Non-Creditable Adjustments	11.9
3. 2002 Adjusted VOC Emissions Inventory (Line 1 – Line 2)	148.4
4. 2011 VOC Emissions Inventory (Table 7-1, Page 7-4)	126.8
<b>5. Creditable VOC Reductions Since 2002 (Line 3 – Line 4)</b>	<b>21.6</b>
6. Percent VOC Reduction since 2002 (Line 5 ÷ Line 3)	14.6%
7. 2011 RFP Milestone Target <sup>12</sup>	27.0%
8. 2011 Milestone VOC Deficit (Line 7 – Line 6)	12.4%
<b>NOx Emissions Calculation (Tons/Day)</b>	
9. 2002 NOx Baseline Emissions Inventory (Table 7-2, Page 7-5)	195.6
10. Non-Creditable Adjustments	13.0
11. 2002 Adjusted NOx Emissions Inventory (Line 9 – Line 10)	182.6
12. 2011 NOx Emissions Inventory (Table 7-2, Page 7-5)	142.4
<b>13. Creditable NOx Reductions Since 2002 (Line 11 – Line 12)</b>	<b>40.2</b>
14. Percent NOx Reduction since 2002 (Line 13 ÷ Line 11)	22.0%
15. Percent NOx Substitution Needed for VOC Deficit (Same as Line 8)	12.4%
16. NOx Reduction Surplus (Line 14 – Line 15)	9.6%
<b>Is Milestone Compliance Demonstrated?</b>	<b>Yes</b>

Figure 1-8 provides a graphic presentation of the milestone compliance demonstration for the Sacramento nonattainment area. This analysis demonstrates that the Sacramento nonattainment area has met the milestone compliance requirements of the Clean Air Act.

<sup>12</sup> RFP reduction requirements contained in EPA’s “Final Rule To Implement the 8-Hour Ozone National Ambient Air Quality Standard—Phase 2” (70 FR 71696-97, November 29, 2005).

**Figure 1-8 Milestone Compliance Demonstration**



## 2. BACKGROUND INFORMATION ON OZONE

### 2.1 Ozone Health Effects

Air pollution, or “smog,” is composed of many different gaseous and particulate pollutants, which can create a regional haze reducing atmospheric visibility. Ground-level ozone, a colorless gas, is a major component of photochemical smog. Since ozone is formed especially in the presence of strong sunlight, ambient ozone concentrations are more problematic during May through October in the Sacramento Region.

Ozone is a strong irritant that adversely affects human health. Breathing air containing ozone can reduce lung function and aggravate respiratory symptoms such as asthma, bronchitis, chest pains and emphysema. Repeated exposure can permanently scar lungs and make them more susceptible to infection. For more information visit the EPA web page at [www.epa.gov/airnow/ozone-c.pdf](http://www.epa.gov/airnow/ozone-c.pdf). As documented by the EPA in their 2006 Criteria Document for ozone,<sup>13</sup> both short-term and long-term exposure to ozone can irritate and damage the human respiratory system, resulting in increased:

- susceptibility to respiratory infections;
- risk of cardiovascular problems such as heart attacks and strokes;
- doctor visits, hospitalizations, and emergency room visits;
- school absenteeism; and
- mortality/premature deaths.<sup>14</sup>

The adverse effects of ozone are not just limited to humans. Ozone can also cause damage to crops and natural vegetation by acting as a chemical oxidizing agent.

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<sup>13</sup> “Air Quality Criteria for Ozone and Related Photochemical Oxidants” (EPA, February 2006) – <http://www.epa.gov/ncea>.

<sup>14</sup> Staff Report Revisions to the “Review of the California Ambient Air Quality Standard for Ozone” (California Air Resources Board, October 27, 2005, p. 1-1 and 1-2).

Ground-level ozone is one of the air pollutants regulated by the federal and state government. Reducing ozone to levels below state and federal standards is one of the primary goals of the air districts.

## **2.2 Ozone Formation and Precursor Pollutants**

Ozone is not directly emitted into the atmosphere. It is a pollutant formed in the atmosphere through complex chemical reactions involving volatile organic compounds (VOC) and nitrogen oxides (NOx) in the presence of sunlight. Because of this, VOC and NOx are known as ozone “precursors.”

VOC and NOx air pollutants are emitted by many types of sources, including on-road motor vehicles and off-road internal combustion engines and vehicles, power plants, industrial facilities, gasoline stations, organic solvents, and consumer products. VOC pollutants are also known as reactive organic gases (ROG).

### **3. HISTORY OF FEDERAL 8-HOUR OZONE STANDARD**

#### **3.1 Clean Air Act and Prior Federal 1-Hour Ozone Standard (1-Hour NAAQS)**

The first comprehensive national air pollution legislation was the federal Clean Air Act (CAA) of 1970. The CAA was amended in 1977 to require local plans for meeting national ambient air quality standards.<sup>15</sup> To protect the public from unhealthy ozone levels, the U.S. Environmental Protection Agency (EPA) revised the national ambient ozone standard in 1979 to a concentration of 0.12 parts per million averaged over one hour.<sup>16</sup>

The federal Clean Air Act Amendments of 1990 included new attainment deadlines and planning requirements. In 1991, the Sacramento region was initially designated by EPA as a “serious” nonattainment area for the 1-hour ozone standard with an attainment deadline of 1999 but later reclassified as “severe.” The attainment demonstration plan for the 1-hour ozone standard was approved by EPA January 8, 1997.<sup>17</sup>

#### **3.2 Federal 8-Hour Ozone Standard**

In July 1997, EPA promulgated the first 8-hour standard for ozone.<sup>18</sup> This change lowered the health-based standard for ambient ozone from 0.12 parts per million of ozone averaged over one hour to 0.08 parts per million of ozone averaged over eight hours. In general, the 8-hour standard is more protective of public health and more stringent than the federal 1-hour standard.<sup>19</sup> Because the 8-hour standard is more protective of health, EPA revoked the 1-hour standard.

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<sup>15</sup> History of the Clean Air Act ([http://epa.gov/oar/caa/caa\\_history.html](http://epa.gov/oar/caa/caa_history.html)).

<sup>16</sup> 44 Federal Register 8220, February 8, 1979 (Green Book, Part 50--National Primary and Secondary Ambient Air Quality Standards).

<sup>17</sup> “Approval and Promulgation of Implementation Plans; California—Ozone” (Federal Register, January 8, 1997, p. 1150-1187).

<sup>18</sup> “National Ambient Air Quality Standards for Ozone” (Federal Register, July 18, 1997, p. 38855-38896).

<sup>19</sup> Ibid.



## Court Challenges and Findings

The American Trucking Association challenged this standard in the Washington D.C. Circuit Court of Appeals. In May 1999, the Court ruled that EPA's delegation of authority and implementation approach were improper, and remanded the standard.<sup>20</sup> EPA appealed this decision, and in February 2001, the U.S. Supreme Court upheld the 8-hour ozone standard, but maintained that EPA's implementation approach was unreasonable.<sup>21</sup>

EPA established a revised implementation rule for the 8-hour ozone standard to address the Supreme Court findings in the November 29, 2005 Federal Register.<sup>22</sup> The Phase 1 rule addressed such topics as: 1) classification and attainment deadlines, 2) revocation of the 1-hour ozone standard, 3) transitioning to the 8-hour ozone standard, and 4) control measure anti-backsliding provisions.<sup>23</sup> Several parties representing various interest groups challenged different aspects of the Phase 1 rule in the D.C. Court. On December 22, 2006, the Court decided in favor of some of the petitioners but upheld parts of EPA's action.<sup>24</sup> The Court determined that EPA could revoke the 1-hour ozone standard and did not dispute EPA's classification scheme for the new 8-hour ozone standard using the approach promulgated under the 1990 CAA Amendments,<sup>25</sup> but rejected other EPA transitioning and anti-backsliding elements of the regulation that do not pertain to this milestone report.

## Nonattainment Designation

In 2004, the Sacramento region was designated nonattainment for the 1997 NAAQS,<sup>26</sup> and classified as a "serious" area with an attainment deadline of June 15, 2013. Since the Sacramento region needs to rely on the longer term emission reduction strategies from state

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<sup>20</sup> American Trucking Assoc. v. EPA, 175 F.3d 1027 (Argued Dec. 17, 1998, Decided May 14, 1999).

<sup>21</sup> Whitman v. American Trucking Assns., 99-1257 (Argued Nov. 7, 2000, Decided Feb. 27, 2001)

<sup>22</sup> "Final Rule to Implement the 8-Hour Ozone National Ambient Air Quality Standard – Phase 1" (Federal Register, April 30, 2004, p. 23951-24000) and "Final Rule to Implement the 8-Hour Ozone National Ambient Air Quality Standard – Phase 2" (Federal Register, November 29, 2005, p. 71612-71705).

<sup>23</sup> Section 172(e) of the Clean Air Act provides that in the event EPA relaxes a primary standard, controls cannot be less stringent than the controls applicable to nonattainment areas before the relaxation.

<sup>24</sup> South Coast AQMD v. EPA, 04-1200, 04-1201 (Argued October 12, 2006, Decided December 22, 2006).

<sup>25</sup> Court allowed 8-hour ozone classifications using Clean Air Act, Title 1, part D, subpart 2, but not using subpart 1.

<sup>26</sup> "Air Quality Designations and Classifications for the 8-Hour Ozone National Ambient Air Quality Standards; Early Action Compact Areas with Deferred Effective Dates" (Federal Register, April 30, 2004, p. 23858-23951).

and federal mobile source control programs, it could not meet the 2013 attainment date. Consequently, on February 14, 2008, CARB, on behalf of the air districts in the Sacramento region, submitted a letter to EPA requesting a voluntary reclassification (bump-up) of the Sacramento Federal Nonattainment Area from a “serious” to a “severe” 8-hour ozone nonattainment area with an extended attainment deadline of June 15, 2019. On May 5, 2010 EPA approved the request effective June 4, 2010.<sup>27</sup>

### **New 8-Hour Ozone NAAQS**

On March 12, 2008, EPA promulgated a revised 8-hour ozone NAAQS of 0.075 parts per million, based on a review of new health studies.<sup>28</sup> However, the 1997 standard has not been revoked. Planning requirements for the new 2008 8-hour ozone NAAQS will be identified and addressed in future plan development efforts.

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<sup>27</sup> “Designation of Areas for Air Quality Planning Purposes; California; San Joaquin Valley, South Coast Air Basin, Coachella Valley, and Sacramento Metro 8-Hour Ozone Nonattainment Areas; Reclassification” (Federal Register, May 5, 2010, p. 24409-24421).

<sup>28</sup> “National Ambient Air Quality Standards for Ozone” (Federal Register, March 27, 2008, p. 16436-16514).

#### **4. CLEAN AIR ACT PROGRESS REQUIREMENTS**

##### **4.1 Reasonable Further Progress Demonstration Requirements**

###### **Emission Reduction Requirements**

Sections 172(c)(2), 182(b)(1) and 182(c)(2)(B) of the Clean Air Act include RFP provisions for reducing emissions in ozone nonattainment areas. The federal 8-hour ozone regulations require that areas classified under subpart 2 as “serious and above” submit a reasonable further progress (RFP) plan.<sup>29</sup> The RFP plan must show a VOC (and/or NOx) emission reduction of at least three percent per year averaged over the first six years from the baseline year and over each consecutive three-year period out to the attainment year.<sup>30</sup> If the region does not attain by its attainment deadline, the region must continue to demonstrate RFP reductions for each subsequent three year interval until the standard is attained (CAA §181(b)(4)).

The required RFP percent emission reductions (e.g., average of three percent per year for first six years and every subsequent three-year period until attainment) are applied to the adjusted base year VOC emissions inventory to derive the RFP target levels for the milestone years. EPA designated the 2002 inventory as the baseline inventory primarily because of timing concerns related to attainment dates and when data required for attainment plans is collected and compiled.<sup>31</sup> For example, the RFP reduction requirement for 2011 is an additional nine percent (2009-2011 period) on top of the previous 18 percent (2002-2008 period) for a total of 27 percent reduction from the 2002 base year.

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<sup>29</sup> The final 8-hour ozone implementation rule (Phase 2) which includes the reasonable further progress requirements were published in the November 29, 2005 Federal Register, Vol. 70, No.228, p. 71615.

<sup>30</sup> The Sacramento Regional Nonattainment Area 8-Hour Ozone Rate-of-Progress Plan (February 2006) included over 18% RFP reductions of VOC and NOx emissions for the first 6 years from the 2002 baseline year.

<sup>31</sup> Final Rule To Implement the 8-Hour Ozone National Ambient Air Quality Standard—Phase 2, FR Vol. 70, No. 228, November 29, 2005, p. 71615.

### **Reductions from Pre-1990 Regulations Excluded**

The methodology for demonstrating reasonable further progress includes deriving the base year and milestone year emissions inventories, calculating RFP emission reduction targets, assessing creditable reductions, and using NO<sub>x</sub> substitution for VOC reductions. The first step is compiling the 2002 base year VOC and NO<sub>x</sub> inventories of anthropogenic emissions that are used as the basis for calculating the required percent reduction targets. Section 182(b)(1)(B) of the Clean Air Act defines these baseline emissions as the total amount of actual VOC or NO<sub>x</sub> emissions from all anthropogenic sources in the nonattainment area. Section 182(b)(1)(D) specifies that the following programs cannot be used to meet progress requirements: emissions eliminated by federal motor vehicle control program (FMVCP) regulations promulgated prior to 1990, federal Reid Vapor Pressure (RVP) fuel regulations promulgated prior to the enactment of the Clean Air Act Amendments of 1990 and vehicle inspection and maintenance program (Smog Check) corrections required by the 1990 CAA Amendments. Banked emission reductions may not be included in the baseline emissions and must be treated as growth for RFP purposes.<sup>32</sup>

### **NO<sub>x</sub> Substitution for VOC Reductions**

Any remaining VOC reductions necessary to meet RFP can be met by substituting NO<sub>x</sub> emission reductions. Section 182(c)(2)(C) of the Clean Air Act allows for the substitution of NO<sub>x</sub> emission reductions in place of VOC reductions to meet the reasonable further progress requirements. However, Phase 2 of the final rule to implement the 8-hour ozone standard requires a nonattainment area to first prepare a 15 percent VOC-only reduction plan before NO<sub>x</sub> substitution is allowed.<sup>33</sup> The rule also allows NO<sub>x</sub> substitution in areas that met the 15 percent requirement for the former 1-hour ozone NAAQS in 1990-1996.<sup>34</sup>

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<sup>32</sup> Federal Register Vol. 70, No. 228, November 29, 2005, p. 71617.

<sup>33</sup> Federal Register Vol. 70, No. 228, November 29, 2005, p. 71631.

<sup>34</sup> Federal Register Vol. 70, No. 228, November 29, 2005, p. 71616.

## **NOx Substitution Attainment Consistency Requirement**

The overall VOC and NOx reduction totals applied to the RFP demonstration must be consistent with the SIP attainment control strategy. Therefore, the cumulative amount of NOx substitution reductions used toward the RFP requirement cannot be greater than the total NOx reductions needed to attain the standard as determined by the modeled attainment demonstration. This attainment consistency requirement is meant to prevent the substitution of NOx reductions that would not lead to progress toward attaining the ozone standard.

## **4.2 Milestone Demonstration Requirements**

### **Requirement to Monitor Progress**

Each nonattainment area must submit a compliance demonstration (milestone report) after each milestone year. At a minimum, the milestone report must contain information and analyses required by EPA rulemaking and must demonstrate that the milestone has been met. EPA is required to determine whether or not a compliance demonstration is adequate within 90 days after receipt of the milestone report (CAA §182(g)(2)).

### **Reduction in Emissions**

The CAA requires ozone nonattainment areas to monitor the emission reductions that have actually occurred. Actual emission reductions must equal or exceed the percentage reductions (i.e. minimum of 3% per year). If the region does not attain by its attainment deadline, the region must continue to demonstrate required reductions for each subsequent three year interval until the standard is attained (CAA §181(b)(4)). The CAA refers to the three year emission reduction forecast intervals as the “applicable milestone” (CAA §182(g)(1)). The first milestone compliance demonstration must demonstrate three percent per year emission reductions for six years beyond the 2002 base year, or 2008. EPA designated the 2002 inventory as the baseline inventory primarily because of timing concerns related to attainment dates and when data required for attainment plans is collected and compiled. This report determines actual emission reductions since the 2002 base year through the 2011 milestone year.

### **Consequences of Failure to Submit/Failure to Demonstrate**

If a “serious” or “severe” ozone nonattainment area fails to submit a timely milestone report, or EPA determines a nonattainment area has not met an applicable milestone (CAA §182(g)(3)), the state shall elect to:

- have the area reclassified to the next higher classification,
- implement specific additional control measures adequate to meet the next milestone as provided in the applicable contingency plan, or
- adopt an economic incentive program (CAA §182(g)(4)).

An economic incentive program may be adopted to reduce emissions from permitted stationary sources, area sources, and mobile sources. The program may establish emission fees or a system of marketable permits, or fees on the sale or manufacture of products that contribute to ozone formation. The program may also include incentives and requirements to reduce vehicle emissions and vehicle miles traveled in the area, including transportation control measures.

If the State fails to make an election referred to above within six months after the milestone demonstration is due, the area shall be reclassified to the next higher classification by operation of law. Within 12 months after the date required for the state to make an election, the state shall submit a revision of the applicable implementation plan (SIP) that includes additional control measures as necessary to meet the milestone (CAA §182(g)(3)). In addition, if the ozone design value for a severe area is above 0.09 parts per million for the attainment year, or if the area has failed to achieve its most recent milestone, the new source review requirements applicable in extreme areas shall apply in the area, including the definition of “major source” and “major stationary source” (CAA §181(b)(4)(B)).

## 5. SACRAMENTO REGIONAL PROGRESS PLANS

### 5.1 Introduction

This chapter summarizes progress plans prepared for the 1997 8-hour ozone standard that demonstrated that existing or new control measures would achieve the required progress toward attainment (i.e. minimum of 3% per year). This milestone compliance report is required to demonstrate that actual reductions occurring by the milestone year (i.e. 2011) meet or exceed the percent reduction requirement.

### 5.2 Sacramento Regional 8-Hour Ozone Attainment and Reasonable Further Progress Plan

#### Plan Overview

The Sacramento regional air districts adopted the Sacramento Regional 8-Hour Ozone Attainment and Reasonable Further Progress Plan (2011 Plan).<sup>35</sup> The 2011 Plan demonstrated that existing and new control strategies will provide the necessary future emission reductions to meet the federal Clean Air Act requirements for reasonable further progress and attainment of the 1997 8-hour ozone NAAQS for the Sacramento region. The 2011 Plan RFP demonstration relied exclusively on emission reductions from the Sacramento region.

#### Creditable Control Measure Reductions

The 2011 Plan RFP demonstration identifies creditable VOC and NO<sub>x</sub> reductions from existing control regulations within the Sacramento Region that were expected to meet the RFP target levels. Both VOC and NO<sub>x</sub> emission reductions are considered in the RFP demonstration assessment.

As discussed in Chapter 4, NO<sub>x</sub> reductions can be used to meet the progress obligation because the Sacramento region satisfied the 15 percent VOC-only reduction requirement in 2006.<sup>36</sup>

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<sup>35</sup> Sacramento Regional 8-Hour Ozone Attainment and Reasonable Further Progress Plan (2009, revised 2011).

<sup>36</sup> Sacramento Regional Nonattainment Area 8-Hour Ozone Rate-of-Progress Plan (February 2006).

### 5.2.1 Calculations of Reasonable Further Progress Demonstration

Table 5-1 contains 2011 Plan calculations that demonstrated the region meets the reasonable further progress goals for the 2011 milestone target. The reasonable further progress demonstrations are achieved by forecasted emission reductions from existing control regulations and already adopted control measures. The current air quality modeling analysis from the Central California Ozone Study (CCOS) shows that attainment can be reached with different combinations of VOC and NO<sub>x</sub> control.<sup>37</sup> Photochemical modeling results indicate that both VOC and NO<sub>x</sub> reductions provide ozone benefits in the Sacramento region, but on a ton for ton basis NO<sub>x</sub> reductions provide greater ozone benefits than VOC reductions. Therefore, NO<sub>x</sub> substitution would be consistent with current analyses of ozone attainment strategies in the Sacramento nonattainment area. The Sacramento region prepared a 15 percent VOC-only reduction plan in 2006.<sup>38</sup> Since the Sacramento Region met the CAA prerequisite of an adopted 15 percent VOC-only plan, the SFNA may use NO<sub>x</sub> reductions to substitute for required VOC reductions. Both VOC and NO<sub>x</sub> emission reductions are used to meet the RFP reduction targets as shown in Figure 5-1. The NO<sub>x</sub> substitution is used on a percentage basis to cover any VOC percentage shortfalls. EPA's NO<sub>x</sub> Substitution Guidance<sup>39</sup> provides that NO<sub>x</sub> emission reductions credited toward RFP may be capped by the cumulative reductions dictated by the modeled attainment demonstration. Since the total sum of NO<sub>x</sub> emission reductions (14.9%) used to substitute VOC reductions is less than the total NO<sub>x</sub> reductions (54%) needed for attainment,<sup>40</sup> the use of NO<sub>x</sub> substitution for RFP purposes is consistent with the attainment demonstration strategy.

### 5.3 Conclusion

This chapter summarizes how the region anticipates meeting the required reasonable progress requirements. The Sacramento Regional 8-Hour Ozone Attainment and Reasonable Further Progress Plan (2011 Plan) demonstrated that reasonable further progress toward attainment of the standard would be achieved through existing control measures and require both VOC and

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<sup>37</sup> Sacramento Regional 8-Hour Ozone Attainment and Reasonable Further Progress Plan, Chapters 6 & 8 (2011).

<sup>38</sup> Sacramento Regional Nonattainment Area 8-Hour Ozone Rate-of-Progress Plan (February 2006).

<sup>39</sup> NO<sub>x</sub> Substitution Guidance, EPA, December 1993, p. 5.

<sup>40</sup> Sacramento Regional 8-Hour Ozone Attainment and Reasonable Further Progress Plan, p. 8-5, 13-4 (2009, revised 2011) ( 2018 attainment demonstration analysis in Table 8-1 indicates NO<sub>x</sub> reduction needed from 2002 base year =  $1 - (91/196) = 54\%$ ).



NOx reductions. Chapter 9 (2011 Milestone Demonstration Analysis) analyzes the actual emission reductions achieved through 2011.

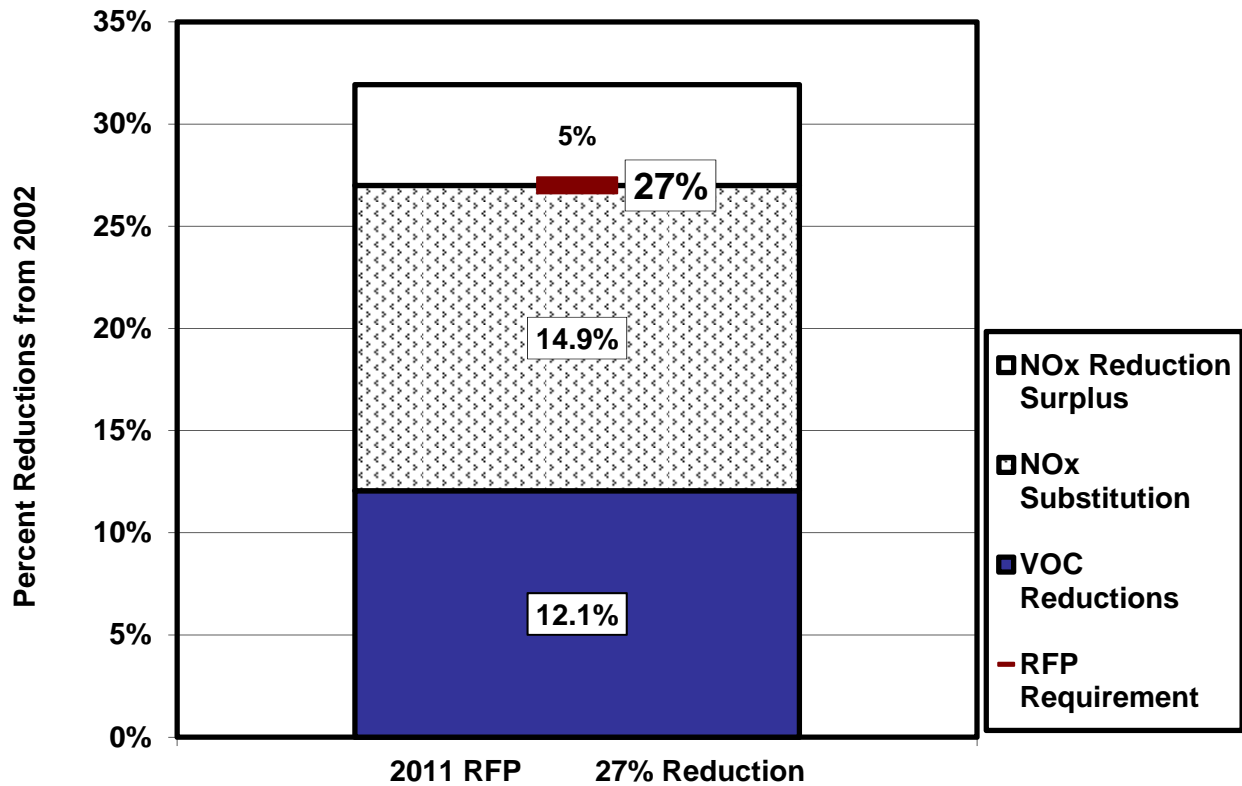
**Table 5-1 2011 Reasonable Further Progress Demonstration**

<b>VOC Emission Calculations – Tons/Day†</b>	<b>2011</b>
1. 2002 Baseline VOC Inventory	160.3
2. Non-Creditable FMVCP/RVP Adjustments	11.9
3. Adjusted 2002 Baseline VOC Inventory (Line 1 – Line 2)	148.4
4. VOC Emissions Forecast with existing controls + ERCs (3.5)	130.5
5. RFP Commitment for VOC Reductions from New Measures	0
<b>6. Forecasted VOC Creditable Reductions Since 2002</b> (Line 3 – Line 4 + Line 5)	17.9
7. Forecasted % VOC Reductions Since 2002 (Line 6 ÷ Line 3)	12.1%
8. RFP % Reduction Required from 2002 Adjusted Baseline VOC Inventory‡	27%
9. Forecasted % VOC Shortfall (Line 8 – Line 7)	14.9%
<b>NOx Emission Calculations – Tons/Day†</b>	
10. 2002 Baseline NOx Inventory	195.7
11. Non-Creditable FMVCP Adjustments	13.0
12. Adjusted 2002 Baseline NOx Inventory (Line 10 – Line 11)	182.7
13. NOx Emissions Forecast with existing controls + ERCs (2.4)	146.4
14. RFP Commitment for NOx Reductions from New Measures	0
<b>15. Forecasted NOx Creditable Reductions Since 2002</b> (Line 12 – Line 13 + Line 14)	<b>36.3</b>
16. Forecasted % NOx Reductions Since 2002 (Line 15 ÷ Line 12)	19.9%
17. % NOx Substitution Needed for VOC Shortfall (Same as Line 9)	14.9%
18. Forecasted % NOx Reduction Surplus (Line 16 – Line 17)	5.0%
<b>Is Reasonable Further Progress Met?</b>	<b>Yes</b>
<b>Is 3% Contingency Met for RFP?</b>	<b>Yes</b>

† Sacramento Regional 8-Hour Ozone Attainment and Reasonable Further Progress Plan (11/10/11), Page 13-5.

‡ RFP reduction requirements contained in EPA's Final Rule to Implement the 8-Hour Ozone NAAQS (Phase 2) published in the November 29, 2005 Federal Register.

**Figure 5-1 2011 Reasonable Further Progress Demonstration**



## **6. CONTROL MEASURES ADOPTED 2002-2011**

### **6.1 Introduction**

Air districts and state and federal agencies have been regulating stationary air pollution sources since the 1970's. Control measures include rules and regulations adopted by local air districts, the California Air Resources Board (CARB) and the U.S. EPA. Control measures also include non-regulatory measures such as mobile source incentive programs that provide financial incentives to accelerate the introduction of low emission vehicles and public education programs such as "Spare the Air" that seek voluntary emission reductions by encouraging people to reduce vehicle trips.

Existing control measures and their emission benefits are helping to make progress toward achieving air quality attainment goals. This chapter identifies the control measures adopted since 2002 and their contribution to this milestone compliance demonstration for 2011.

### **6.2 Federal Control Measures**

Under the federal Clean Air Act, only EPA can set new engine standards for construction and farm equipment using off-road engines less than 175 horsepower and locomotives (CAA §209(e)). In the case of new heavy-duty diesel trucks and other new and in-use off-road engines, CARB may establish emission standards, but must obtain a waiver/authorization from EPA before it can enforce such regulations (CAA §209(b)). In addition to the local district and state rules discussed above, the Sacramento nonattainment area has also benefited from these standards as well as federal mobile source measures for new locomotive Tier 1 and Tier 2 engines, nationwide heavy-duty on-highway trucks, and new emission standards for preempted farm and construction equipment.

### **6.3 State Control Measures**

The California Air Resources Board (CARB) and other state agencies such as the California Department of Pesticide Regulation (DPR), California Department of Transportation (CalTrans) and the Bureau of Automotive Repair also have responsibility for certain emissions sources.

CARB establishes emission standards for on-road motor vehicles and some off-road sources. CARB also establishes fuel specifications and develops consumer product standards. Sources that CARB has primary responsibility for include most new and existing on- and off-road engines and vehicles, motor vehicle fuels, and consumer products. In addition, California has unique authority under CAA section 209 to adopt and implement new emission standards for many categories of on-road vehicles and engines, and new and in-use off-road vehicles and engines, subject to EPA approval.

In recent years, CARB has adopted a number of measures that will further reduce ozone forming emissions in the Sacramento region and throughout the state. The largest state commitment in the 8-Hour Ozone Plan<sup>41</sup> is the Cleaner In-Use Heavy-Duty Trucks measure (the Truck rule). This measure will substantially reduce NOx emissions in the Sacramento region. The Truck rule and other new state measures will continue to reduce emissions even after they are fully implemented, as equipment that complies with the new requirements replaces older, more polluting equipment. CARB's commitments in the 8-Hour Ozone Plan that have been submitted as revisions to the SIP or waivers to EPA are shown in Table 6-1.

**Table 6-1 CARB Adopted Control Measures 2002-2011**

Measure/Waiver	Submitted to EPA	Implementation
Smog Check Improvements	10-28-09	2008-2013
Modifications to Reformulated Gasoline	02-03-09	2010
Cleaner In-Use Heavy-Duty Trucks	09-21-11	2011-2015
Enhanced Vapor Recovery for Above-Ground Storage Tanks	06-12-08	2006-2015
Additional Evaporative Emission Standards	05-02-11	2010-2012
Consumer Products Program (2008, 2009 Amendments)	02-16-10, 01-28-11	2010-2014
Clean Up Existing Harbor Craft waiver	04-12-10	2009-2018
Cleaner In-Use Off-Road Equipment waiver	09-21-11	2009

#### 6.4 Regional Control Measures

The regional air districts have primary responsibility for regulating stationary sources, such as power plants and manufacturing facilities, as well as some area sources, including gas stations, automobile coating operations and agricultural operations. However, state and federal laws

<sup>41</sup> Sacramento Regional 8-Hour Ozone Attainment and Reasonable Further Progress Plan (2009; Rev. 2011),

preempt a local air district’s authority to directly or indirectly regulate or establish tail-pipe emission standards for mobile sources.

A review of 8-Hour Ozone Attainment Plan<sup>42</sup> establishes that only one control measure committed to be adopted by the regional air districts through 2011 has not been adopted as scheduled. That control measure is the Miscellaneous Metal Parts and Products rule for the El Dorado AQMD (Rule 246). This rule has not been adopted because of the limited number of sources and negligible level of emissions in El Dorado County.

Table 6-2 lists control measures adopted by the local air districts between 2002 and 2011 that have contributed to emission reductions in the Sacramento region.

**Table 6-2 Regional Control Measures Adopted 2002—2011**

District	Rule No.	Rule	Adopted
SMAQMD	214	Federal New Source Review	2010
<b>VOC CONTROL MEASURES</b>			
FRAQMD	3.14	Surface Preparation and Cleanup	2011
FRAQMD	3.19	Vehicle and Mobile Equipment Coating Operations	2011
FRAQMD	3.20	Wood Products Coating Operations	2005, 2011
PCAPCD	218	Architectural Coating	2010
PCAPCD	234	Auto Refinishing Operation	2010
PCAPCD	236	Wood Products and Coating Operations	2010
PCAPCD	238	Factory Coating of Flat Wood Paneling	2010
PCAPCD	243	Polyester Resin/Plastic Product Manufacturing	2003
PCAPCD	245	Surface Coating of Metal Parts and Products	2009
PCAPCD	CM3	Miscellaneous Metal Parts and Products	2008
SMAQMD	448	Gasoline Transfer into Stationary Storage Containers	2009
SMAQMD	449	Transfer of Gasoline into Vehicle Fuel Tanks	2009
SMAQMD	451	Surface Coating of Metal Parts and Products	2008, 2010
SMAQMD	454	Degreasing Operations	2008, 2010
SMAQMD	459	Automotive, Mobile Equipment, and Associated Parts and Components Coating Operations	2011
SMAQMD	464	Organic Chemical Manufacturing Operations	2008
SMAQMD	466	Solvent Cleaning	2008
SMAQMD	496	Large Confined Animal Facilities	2006
YSAQMD	2.24/2.31	Degreasing/Solvent Cleaning	2008

<sup>42</sup> Ibid.

District	Rule No.	Rule	Adopted
YSAQMD	2.41	Expandable Polystyrene Manufacturing Operations	2008
YSAQMD	2.25	Metal Parts and Products Coating Operations	2008
YSAQMD	2.26	Motor Vehicle and Mobile Equipment Coating Operations	2008
YSAQMD	2.29	Graphic Arts Printing Operations	2008
YSAQMD	2.30	Polyester Resin Operations	2008
YSAQMD	2.31	Surface Preparation and Cleanup	2008
YSAQMD	2.33	Adhesive Operations	2008
YSAQMD	2.35	Pharmaceutical Manufacturing Operations	2008
YSAQMD	2.39	Wood Products Coating Operations	2008
<b>NO<sub>x</sub> CONTROL MEASURES</b>			
FRAQMD	3.21	Industrial, Institutional, Commercial Boilers, Steam Generators and Process Heaters	2006
FRAQMD	3.22	Internal Combustion Engines	2009
PCAPCD	231	Industrial, Institutional, Commercial Boilers, Steam Generators and Process Heaters	1997*
PCAPCD	233	Biomass Boilers	2009
PCAPCD	242	Stationary Internal Combustion Engines	2003
PCAPCD	246	Natural Gas Fired Water Heaters	1997*
SMAQMD	411	NO <sub>x</sub> from Boilers, Process Heaters, and Steam Generators	2007
SMAQMD	414	Natural Gas Fired Water Heaters	2010
YSAQMD	2.37	Large Water Heaters and Small Boilers	2009
YSAQMD	2.43	Biomass Boilers	2010
YSAQMD	2.44	Central Furnaces	2009

\* Rule approved into the California SIP in November 2011.

The regional air districts also administer statewide and local mobile source incentive programs. Incentive programs help pay for new lower emission engines, lower emission retrofits, and new equipment replacements. By helping businesses purchase newer engines the region will accelerate progress towards reducing emissions, improve air quality locally, and help the state meet federally mandated clean-air milestones. Table 6-3 lists the incentive programs that have been implemented in the SFNA between 2002 and 2011. Some of the funding has been fully expended, as indicated with “closed” in Table 6-3.

**Table 6-3 Regional Mobile Source Incentive Programs**

<b>Program</b>	<b>Purpose</b>	<b>Status</b>
Off-Road Equipment Replacement Program	Replace Tier 0, high-polluting off-road diesel equipment with the cleanest equipment.	Open
Off-Road Engine Repower Program	Funds incremental cost of cleaner-than-required engines for agriculture equipment, construction equipment, and non-pleasure craft, commercial marine vessels	Open
Off-Road Engine Retrofit Program	Retrofit off-road diesel engines with the highest level Verified Diesel Emission Strategy (VDECS)	Open
Locomotive – Carl Moyer Program	Replace, rebuild, or repower locomotives	Open
Locomotive – Goods Movement	Replace, rebuild, or repower locomotives	Closed
Lower-Emission School Bus Program	Replace pre-1987 school buses with cleaner emission school buses and retrofit 1987-2006 school buses with VDECS	Closed
Goods Movement Emission Reduction Program	Retrofit Class 8 diesel on-road trucks	Closed
Moyer Voucher Incentive Program	Replace or retrofit heavy-duty diesel vehicles earlier than expected through normal attrition or by regulation	Open
Electric Truck Replacement Program	Replace diesel medium-duty vehicles with electric technology vehicles	Open
Hybrid Truck Replacement Program	Replace diesel medium to heavy-duty vehicles, including school buses, with hybrid technology vehicles	Closed
Sacramento Emergency Clean Air Transportation	Replace on-road heavy-duty diesel vehicles that have 2002 or older engines	Closed

In addition to the regulatory and mobile source measures above, the region also adopted the “Spare The Air” program. The “Spare The Air” control measure is a year-round public education program with an episodic ozone reduction element during the summer ozone season, plus general awareness throughout the rest of the year. It is designed to protect public health by informing people when air quality is unhealthy and achieving voluntary emission reductions by encouraging them to reduce vehicle trips. This program is implemented by the SMAQMD staff on behalf of the region. In 2009 the “Spare The Air” program was adopted and submitted as a revision to the State Implementation Plan.

Local air districts also cooperate with metropolitan planning organizations (MPOs) to develop measures affecting local transportation activity that are included in a SIP. In this region the MPO is the Sacramento Area Council of Governments (SACOG). In turn, MPOs coordinate the process to identify and evaluate potential transportation control measures and compile local government commitments that will be included in the regional air quality plan. Table 6-4 lists SACOG transportation control measures implemented between 2002 and 2011.

**Table 6-4 SACOG Transportation Control Measures 2002-2011**

<b>Implementing Agency</b>	<b>Transportation Control Measure</b>	<b>Completed</b>
City of Auburn	Purchase CNG Replacement Buses	2008
City of Roseville	Purchase Replacement Buses	2008
City of Sacramento	Arden Way Smart Corridor	2008
City of Roseville	Purchase Replacement Buses	2009
City of Sacramento	Sacramento Traffic Operations Center	2009
County Sacramento	Watt Ave Phase 3 Smart Corridor	2009
SACOG	STARNET Implementation	2009
El Dorado County Transit	El Dorado Central Park and Ride Facility	2009
County Sacramento	Light Rail Grade Separation, Watt Ave & Folsom Blvd	2009
Sac Regional Transit District	13th & 16th St Light Rail Station Improvements	2009
City of Elk Grove	Purchase CNG Replacement Buses	2010
City of Folsom	Long-Term Bike Parking at Transit Stations	2010
Town of Loomis	Loomis Multimodal Center Improvements	2010
Sac Regional Transit District	Neighborhood Ride Vehicle Replacement	2010
Yolo County Transit District	Purchase CNG Replacement Buses	2010
Yuba Sutter Transit	Purchase CNG Replacement Buses	2010

## 6.5 Conclusion

The local air districts in the region have fulfilled their commitments through 2011 to adopt the control measures identified in the 8-Hour Attainment Plan.<sup>43</sup> The combined effects of local, state and federal control measures have significantly reduced emissions in the Sacramento region. As illustrated in Chapter 7, the region has experienced reductions of about 33 tons per day of VOC and 54 tons per day of NOx emissions between 2002 and 2011. The emission inventory category with the most significant decrease during the nine year period occurred in

<sup>43</sup> Ibid.



on-road mobile sources, the largest of the major categories, with a decline of 41 percent (26 tons/day) in VOC emissions and 32 percent (37 tons/day) in NOx emissions.

## **7. 2002 AND 2011 VOC AND NOX EMISSION INVENTORIES**

### **7.1 Introduction to Emissions Inventory**

Planning efforts to evaluate and reduce ozone air pollution include identifying and quantifying the various sources of VOC emissions (such as solvents, surface coatings, and motor vehicles) and NOx emissions (such as motor vehicles and other fuel combustion equipment). In this chapter, the emissions inventory system is characterized by different air pollutant source categories for the Sacramento nonattainment area. The summary of VOC and NOx emissions estimates are provided for the 2002 base year and 2011 milestone year in tabular and graphical formats.<sup>44</sup> In addition, the base year emissions are used to forecast future year inventories by using socio-economic growth indicators and the post-2002 emission reduction effects of existing control strategies. Emission reduction credits are also included in the emissions inventory forecasts.

### **7.2 Emission Inventory Source Categories**

Due to the large number and wide variety of emission processes and sources, a hierarchical system of emission inventory categories was developed for more efficient use of the data. The anthropogenic emissions inventory is divided into four broad categories: stationary sources, area-wide sources, on-road motor vehicles, and other mobile sources. Each of these major categories is subdivided into more descriptive subcategory sources, and then further defined into more specific emission processes.

#### **7.2.1 Stationary Sources**

The stationary source category of the emissions inventory includes non-mobile, fixed sources of air pollution. They are mainly comprised of individual industrial, manufacturing, and commercial facilities called “point sources.” The more descriptive subcategories include fuel

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<sup>44</sup> Emission inventories are constantly changing. The emission inventories presented in this report are the latest available at the time of this writing. CARB is currently working on an update to the emission inventory, which is due to be published later in 2012.

combustion (e.g., electric utilities), waste disposal (e.g., landfills), cleaning and surface coatings (e.g., printing), petroleum production and marketing, and industrial processes (e.g., chemical). Industrial facility operators reported the process and emissions data used to calculate emissions from point sources.

### **7.2.2 Area-Wide Sources**

The area-wide source inventory category includes aggregated emissions data from processes that are individually small and widespread or that do not have well-defined point sources. The area-wide sources include solvent evaporation from consumer products and architectural coatings; farming operations (planting, cultivation, harvesting); pesticide and fertilizer use; and miscellaneous processes such as residential fuel combustion and controlled burning. Emissions from these sources are calculated from product sales, population, employment data, and other parameters for a wide range of activities that generate air pollution across the Sacramento nonattainment area.

### **7.2.3 On-Road Motor Vehicles**

The on-road motor vehicles inventory category consists of trucks, automobiles, buses, motorhomes and motorcycles. EMFAC (EMission FACTors), is the California model for estimating on-road motor vehicle emissions. The most recent EPA-approved version, EMFAC2007, was used to develop the on-road mobile source emissions in this report.

### **7.2.4 Other Mobile Sources**

The emission inventory category for other mobile sources includes aircraft, trains, ships, and off-road vehicles and equipment used for construction, farming, commercial, industrial, and recreational activities. The OFFROAD2007 model was released November 2006 by CARB and is used to calculate the air pollutant emissions from vehicles and engines used in agriculture, construction, lawn and garden care, and off-road recreation. In general, emissions are calculated based on estimated equipment population, engine size and load, usage activity, and emission factors. Aircraft, ship, and train emissions are estimated outside the OFFROAD model.

**7.3 Base Year and Milestone Year Emissions Inventory**

Emissions inventories are derived from the California Emission Forecasting System (CEFS) maintained by CARB. The inventories used in this report were developed by updating the CEFS inventories to reflect inventory changes since 2002, such as changes in the economy, population growth and the addition of new facilities (Cosumnes Power Plant and Jepson Composting). The emission inventory categories and updated adjustment amount are listed in Table 7-1 below. These adjustments reflect the difference between the 2011 emissions inventory projection used in the Sacramento Regional 8-Hour Ozone Attainment and Reasonable Further Progress Plan (2011) and the actual 2011 emissions inventory used in this milestone report (see Table 7-2 and Table 7-3).

**Table 7-1 Adjustments to Attainment Plan 2011 Emissions Inventory**

<b>Emission Inventory Category</b>	<b>VOC (tpd)</b>	<b>NOx (tpd)</b>
Solvent/Coatings	- 0.20	—
Industrial Process	0.20	—
Architectural Coatings	- 0.10	—
Livestock Waste	- 0.10	—
Fuel Combustion	—	- 1.5

The following tables (Table 7-2 and Table 7-3) show the 2002 baseline and updated 2011 milestone emission inventories of VOC and NOx by source categories for the Sacramento nonattainment area. The emissions inventory for ozone planning purposes (i.e. planning inventory) represents emissions for a summer seasonal average day in units of tons per day (tpd). In 2002 the VOC emissions total was 160 tpd and the NOx emissions total was 196 tpd. By 2011 the region’s emissions of VOC and NOx were reduced to 127 tpd and 142 tpd, respectively.

**Table 7-2 VOC Emissions – Sacramento Nonattainment Area**

	<b>2002</b>	<b>2011</b>
<b>TOTAL EMISSIONS</b>	160	127
STATIONARY	23	23
AREA-WIDE	31	29
ON-ROAD MOTOR VEHICLES	64	38
OTHER MOBILE SOURCES	43	38
<b>STATIONARY</b>		
Solvent/Coatings	8.1	7.3
Petroleum Production/Marketing	4.9	5.3
Industrial Process	3.6	4.1
Waste Composting	4.1	4.1
Other	2.0	2.1
<b>AREA-WIDE</b>		
Consumer Products	14.8	13.8
Architectural Coatings	8.0	7.2
Pesticides	1.8	1.3
Livestock Waste	2.8	2.8
Ag Burn/Other	1.3	1.3
Other	2.1	2.3
<b>ON-ROAD</b>		
Automobiles	26.9	12.2
Lt/Med Duty Trucks	24.4	15.1
Heavy Duty Gas Trucks	6.2	3.5
Heavy Duty Diesel Trucks	3.3	3.2
Motorcycles	2.7	3.4
Buses/Motor Homes	0.5	0.3
<b>OTHER MOBILE</b>		
Recreational Boats	19.1	17.2
Equipment (Const/Ind/Farm)	9.4	6.1
Lawn & Garden Equipment	6.4	5.9
Gas Can	3.1	1.8
Trains	0.6	0.6
Aircraft	0.5	0.6
Other	3.8	5.4

Source: CARB CEFS Version 1.06 Sacramento NAA (Rf#980), February 28, 2007, for average summer day, updated to reflect recently adopted control measures, new emission and February 2008 SACOG transportation data.

**Table 7-3 NOx Emissions – Sacramento Nonattainment Area**

	<b>2002</b>	<b>2011</b>
<b>TOTAL EMISSIONS (Tons/Day)</b>	196	142
STATIONARY	16	13
AREA-WIDE	3	3
ON-ROAD MOTOR VEHICLES	115	78
OTHER MOBILE SOURCES	61	48
<b>STATIONARY</b>		
Fuel Combustion	7.5	6.6
Ag Irrigation Pumps	7.9	5.9
Industrial Process	0.8	0.9
<b>AREA-WIDE</b>		
Residential Fuel Combustion	2.4	2.5
Ag Burn/Other Managed Burn	0.4	0.4
<b>ON-ROAD</b>		
Heavy Duty Diesel Trucks	54.1	46.4
Lt/Med Duty Trucks	30.4	15.0
Automobiles	19.8	7.9
Heavy Duty Gas Trucks	7.4	5.1
Buses/Motor Homes	3.1	2.7
Motorcycles	0.5	0.9
<b>OTHER MOBILE</b>		
Construction & Mining Equip	18.2	13.0
Trains	12.2	8.8
Farm Equipment	13.0	9.0
Boats	6.2	7.3
Comm/Ind Equipment	4.9	3.2
Trans Refrig Units	1.6	2.0
Oil Drilling/Workover	2.7	1.7
Aircraft	1.6	2.2
Other	0.9	0.8

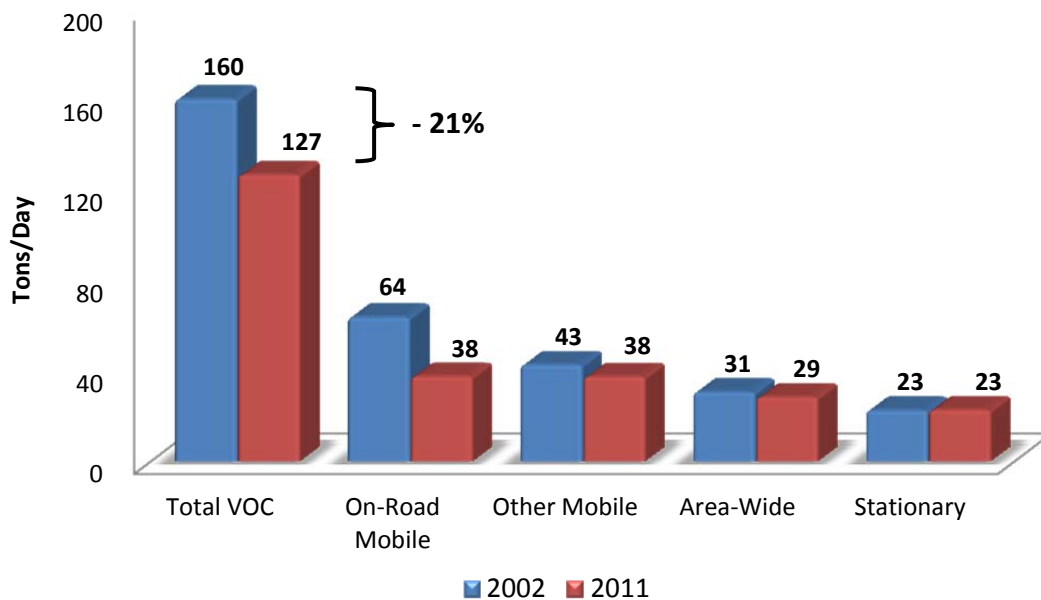
Source: CARB CEFS Version 1.06 Sacramento NAA (Rf#980), February 28, 2007, for average summer day, updated to reflect recently adopted control measures, new emission and February 2008 SACOG transportation data.

#### 7.4 Milestone Year Emission Reductions

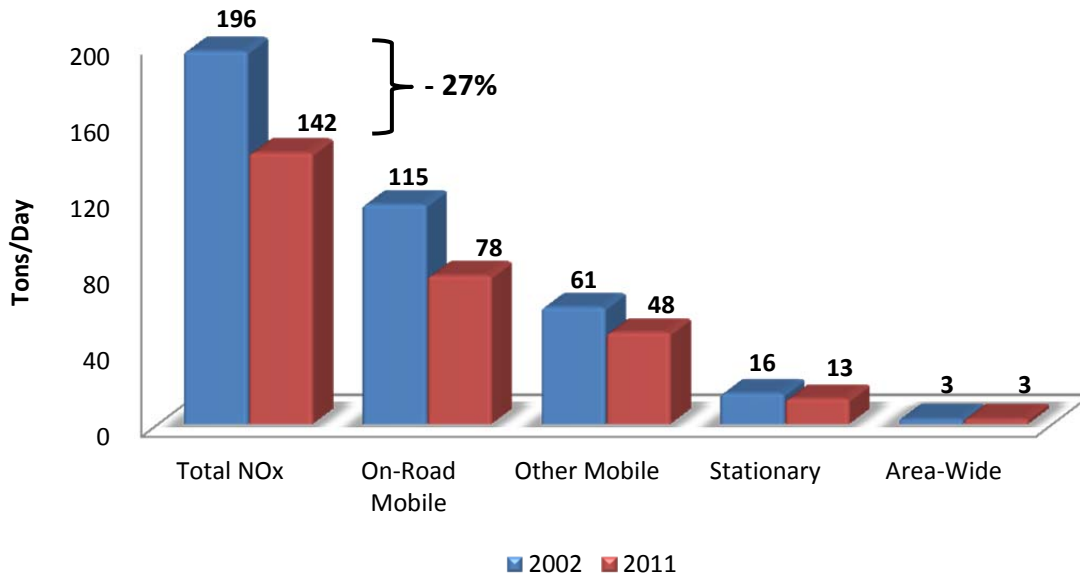
As stated previously, one of the purposes of this report is to identify the emission reductions that have occurred in the region since the base year, 2002. The following graphs, Figure 7-1 and Figure 7-2, illustrate the change in VOC and NO<sub>x</sub> emissions from 2002 through 2011.

Total VOC and NO<sub>x</sub> emissions have decreased by 21 percent and 27 percent, respectively, over the nine year period. The majority of all emissions come from mobile sources (on-road and other mobile), accounting for more than half of both the 2002 and 2011 VOC emissions inventory, and about 90 percent of the 2002 and 2011 NO<sub>x</sub> emissions inventory. Likewise, a large portion of the emission reductions also come from mobile sources.

**Figure 7-1 VOC Emissions - Sacramento Nonattainment Area**



**Figure 7-2 NOx Emissions - Sacramento Nonattainment Area**



### 7.5 Top Ten Emission Sources

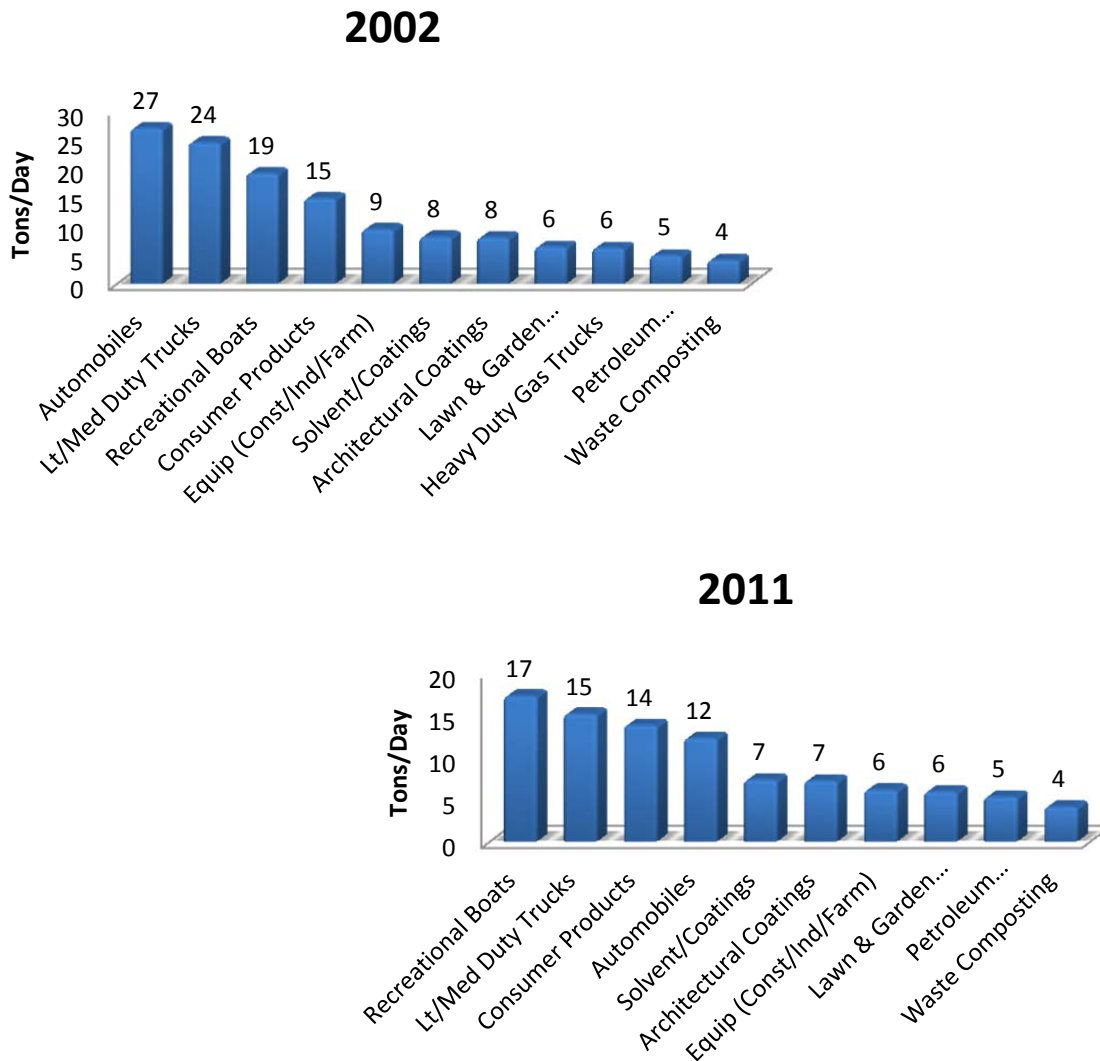
Figure 7-3 and Figure 7-4 contain bar charts that display the 2002 and 2011 top ten emission inventory categories for VOC and NOx. State and federal laws limit local air district authority to regulate certain emissions sources, notably motor vehicles, off-road engines, and consumer products. As a result, local air districts do not have direct authority to regulate seven of the top ten VOC source categories, and nine of the top ten NOx source categories. EPA retains almost exclusive regulatory authority for emissions from trains, aircraft, and ships. The significant categories that air districts have regulatory authority include solvents and coatings, architectural coatings, petroleum marketing, and stationary fuel combustion.

In 2002 the largest source categories for VOC are automobiles, light-medium duty trucks, recreational boats, consumer products, and construction, industrial and farm equipment. Although all categories experienced reductions by 2011, recreational boats took over as the top emitting source of VOCs in the region, followed by light-medium duty trucks, consumer products and automobiles.

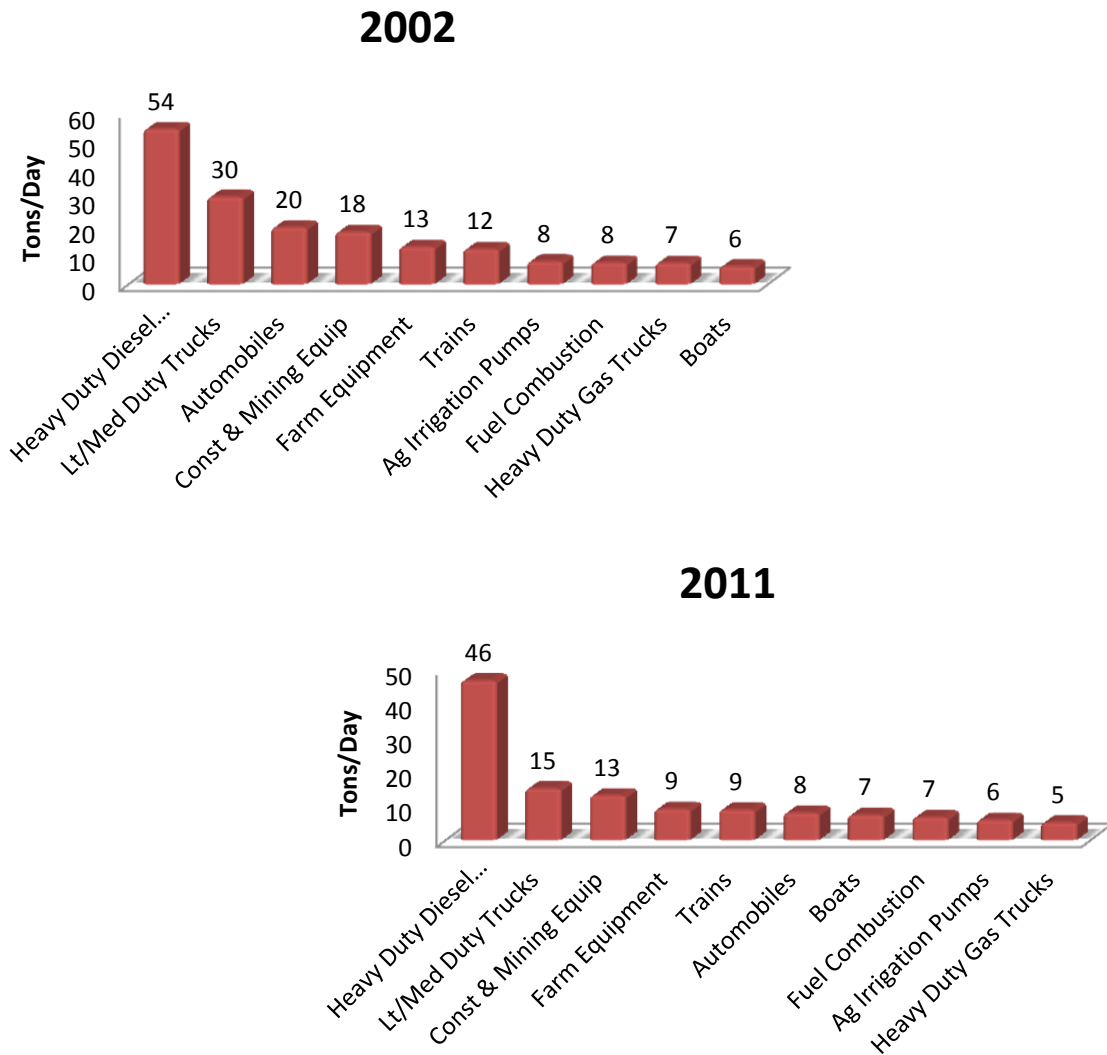


The largest source categories for NO<sub>x</sub> in 2002 are heavy duty diesel trucks, light-medium duty trucks, automobiles, construction and mining equipment, and farm equipment. In 2011 the top two sources of NO<sub>x</sub> emissions remain the same. However, automobiles dropped from third to sixth, due in large part to a 60 percent drop in emissions for that category. The significant reduction in automobile emissions can be attributed in part to improved fuel standards and the phase-in of newer vehicles into the on-road fleet.

**Figure 7-3 Top Ten VOC Emission Sources**



**Figure 7-4 Top Ten NOx Emission Sources**



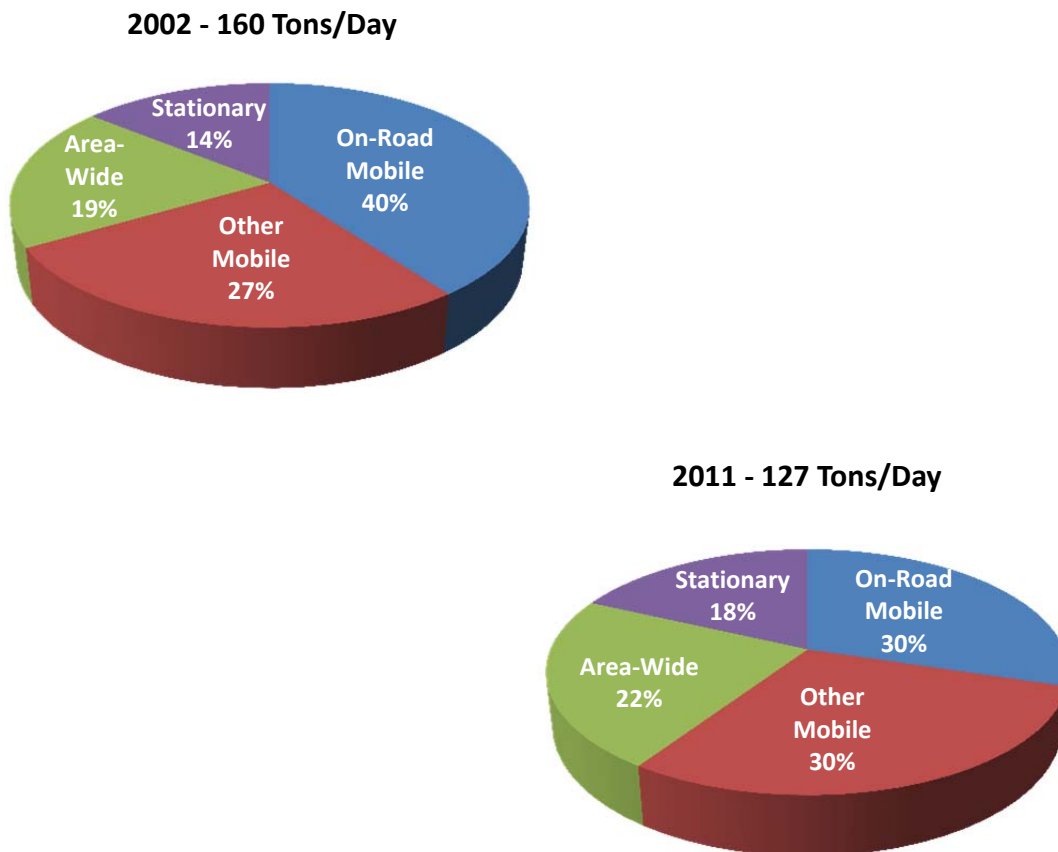
**7.6 Source Category Share of Total Emissions**

Figure 7-5 and Figure 7-6 show the 2002 and 2011 VOC and NOx emission inventory categories as a percentage of the total inventory for the Sacramento nonattainment area. In 2002, the VOC inventory comprised 40 percent on-road mobile sources, 27 percent other mobile sources, 19 percent area-wide sources, and 14 percent stationary sources. Although there was a ten percent decrease in the on-road mobile share of the inventory, the percentage share of source

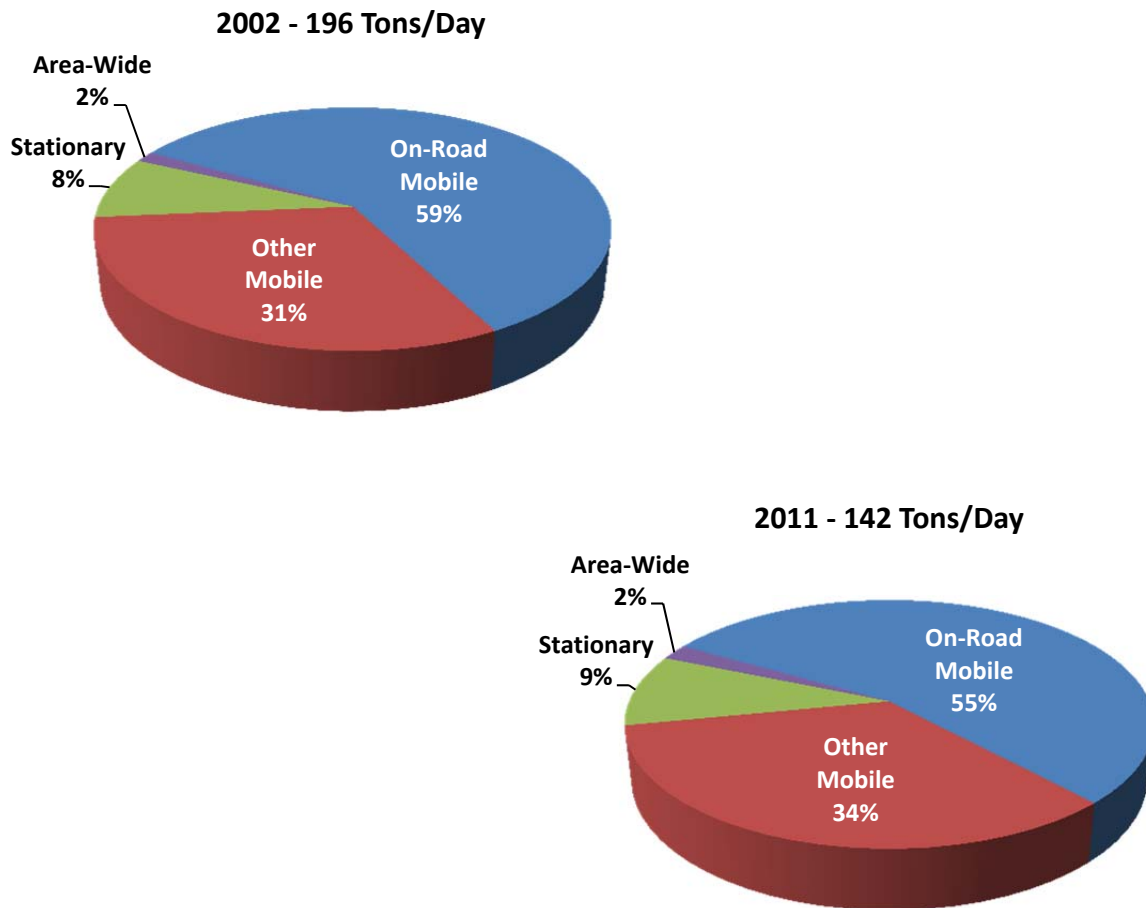
categories for the 2011 emissions inventory remains consistent with the 2002 inventory with 30 percent each for on-road and other mobile sources, 22 percent area-wide sources, and 18 percent stationary sources.

The NOx inventory consists mainly of mobile source combustion emissions. In 2002, the NOx inventory includes 59 percent on-road mobile sources, 31 percent other mobile sources, 2 percent area-wide sources, and 8 percent stationary sources. The percentage share is similar for the 2011 NOx inventory with 55 percent on-road mobile sources, 34 percent other mobile sources, 2 percent area-wide sources, and 9 percent stationary sources.

**Figure 7-5 2002 and 2011 VOC Emissions - Share by Source**



**Figure 7-6 2002 and 2011 NOx Emissions - Share by Source**



## 7.7 Conclusion

The VOC and NOx emissions inventories have been substantially reduced over the nine year period from 2002 to 2011. Various reasons account for the reductions in ozone precursors emissions including the effects of control measures implemented by local air districts, CARB and EPA. In addition, the recent downturn in the economy has caused some slowing in production, consumer spending and reduced driving.

## 8. 8-HOUR OZONE TRENDS IN THE SACRAMENTO REGION

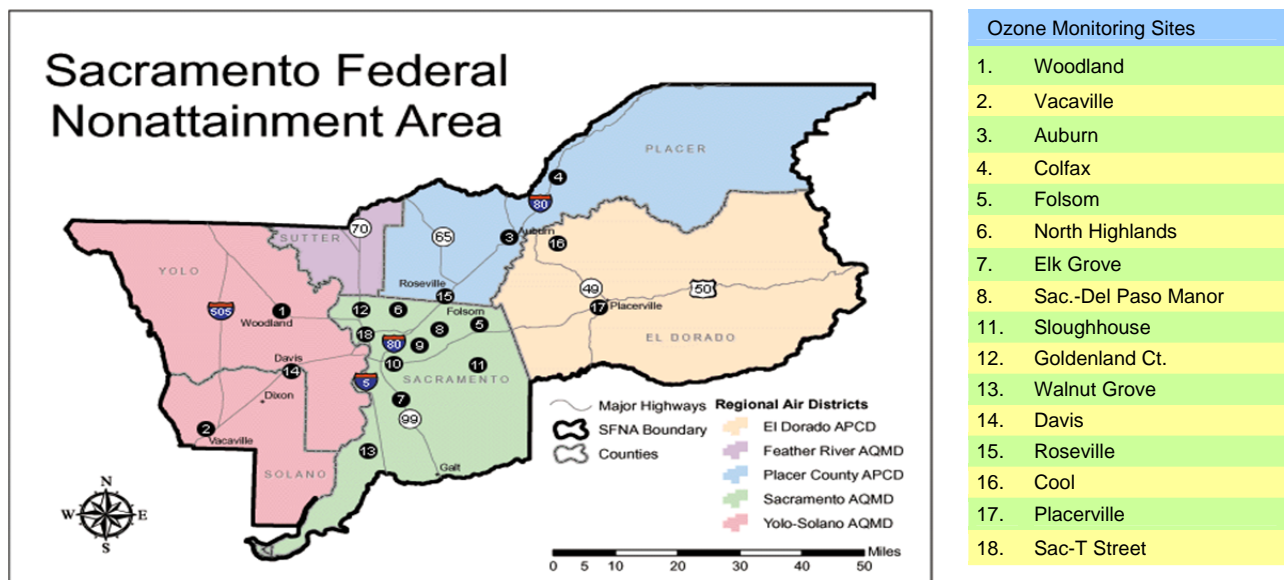
### 8.1 Introduction to Air Quality Trends

The progress toward attainment is measured by analyzing ambient air quality data collected at various monitoring sites over a period of many years. In this chapter, the focus of air quality trends is on two different 8-hour ozone parameters. These indicators are the number of days exceeding the 8-hour ozone standard and the magnitude of the 8-hour ozone design value concentrations.

### 8.2 Ozone Monitoring Sites

There are currently 16 ozone monitoring stations located throughout the Sacramento federal 8-hour ozone nonattainment area that are operated by either local air districts or the California Air Resources Board. Most ozone sites also have meteorological instruments, and some sites sample for ambient concentrations of ozone precursor pollutants. See Figure 8-1 for a map showing the location of each of the ozone monitoring stations operating in the Sacramento region during 2011.

**Figure 8-1 Sacramento Nonattainment Area Ozone Monitoring Stations**



### 8.3 Annual Number of Exceedance Days

Table 8-1 contains the annual number of days that exceeded the 8-hour ozone standard for each of the ozone monitoring sites in the Sacramento nonattainment area since 1996. The single highest ozone concentration of ozone over a given period is not used to determine whether the health standards are met. Instead, federal regulations require agencies to determine the fourth highest concentration of ozone each year for three years, and then average those concentrations. This 3-year average is referred to as the design value (or ozone concentration) for the region. The most frequent exceedances of the federal 8-hour ozone standard occur at the region’s monitoring sites near the center of the SFNA in the lower foothill areas (Cool, Folsom, Placerville, and Auburn). Also, the number of exceedance days at the peak monitoring site varies year to year, between 8 and 42.

**Table 8-1 8-Hour Ozone Exceedance Days  
Sacramento Nonattainment Area – Ozone Monitoring Sites**

Monitoring Site	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Vacaville	2	0	7	8	0	0	0	0	1	0	2	0	1	1	0	0
Woodland			4	4	0	1	4	0	0	2	4	0	1	0	0	0
Davis	4	1	4	5	2	2	2	0	0	0	1	1	1	0	0	0
Goldenland Ct.			6	1	1	2	0	1	0	1	1	1	2	na	na	na
Sac-T Street	3	1	4	4	0	3	3	1	0	1	3	1	2	1	0	1
North Highlands	15	0	9	5	7	7	11	4	1	2	10	1	0	1	2	1
Pleasant Grove*	5	0	4	3	3	3	2									
Elk Grove	9	3	4	7	1	3	0	5	1	2	7	1	2	1	1	0
Sac-Del Paso M.	13	1	10	6	9	6	23	13	3	10	10	2	7	8	1	1
Roseville	12	2	12	9	8	9	11	5	1	9	9	3	13	11	5	3
Rocklin*	20	4	12	11	12	8	15									
Sloughhouse		3	24	19	18	15	16	19	8	10	17	2	10	7	4	4
Folsom	23	8	26	18	15	19	23	26	7	19	25	7	25	22	8	14
Auburn	17	1	16	25	17	21	15	11	12	10	29	0	13	3	3	5
Colfax	5	2	8	9	na	na	18	12	9	13	14	1	3	0	0	1
Cool	30	10	25	35	29	32	42	22	8	22	30	10	15	6	1	8
Placerville	27	13	17	23	15	15	20	19	7	16	20	4	16	5	2	1
Echo Summit					0	0	0	0	0	0	0	0	0	0	0	0
Peak Site	30	13	26	35	29	32	42	26	12	22	30	10	25	22	8	14

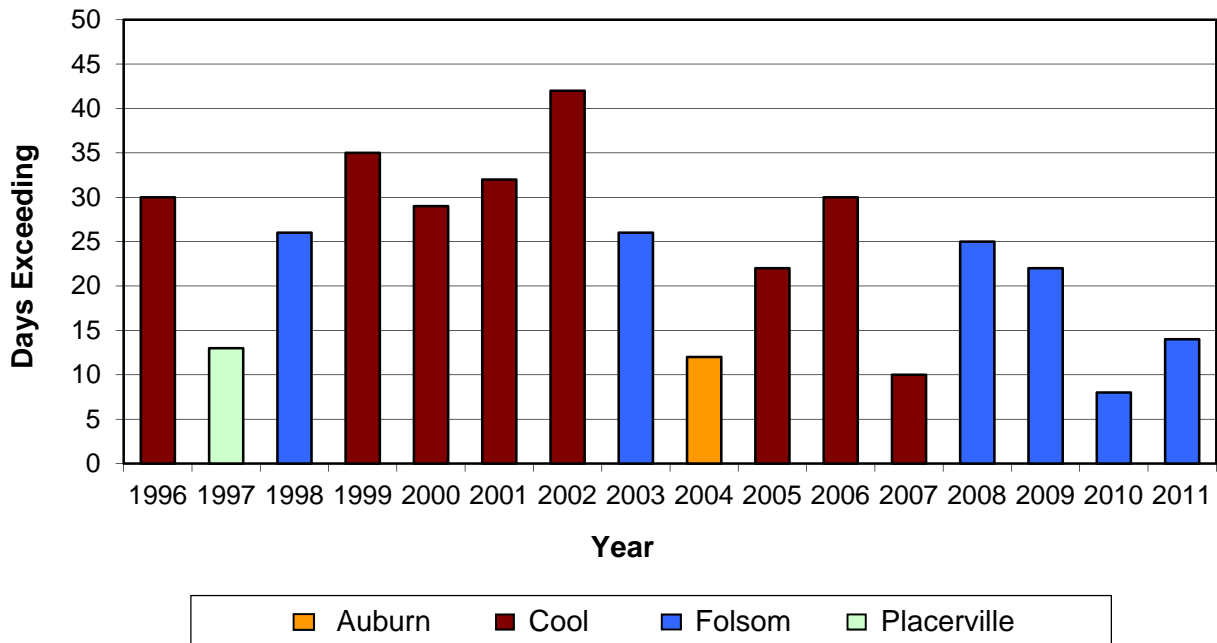
Data source: CARB air quality data base ([www.arb.ca.gov/adam/welcome.html](http://www.arb.ca.gov/adam/welcome.html)).

Bold numbers indicate peak value and site for the year.

\*Site closed. na = insufficient data available

The bar chart in Figure 8-2 illustrates the monitoring site locations that exceeded the federal 8-hour ozone standard the most days in each year. Year to year ozone differences are caused by meteorological variability and changes in precursor emission patterns. Therefore, we refer to these days as “exceedance days” rather than violation days. In other words, every day that the concentration is above the standard is not a violation of the standard.

**Figure 8-2 8-Hour Ozone Exceedance Days  
 Sacramento Nonattainment Area – Peak Monitoring Site**

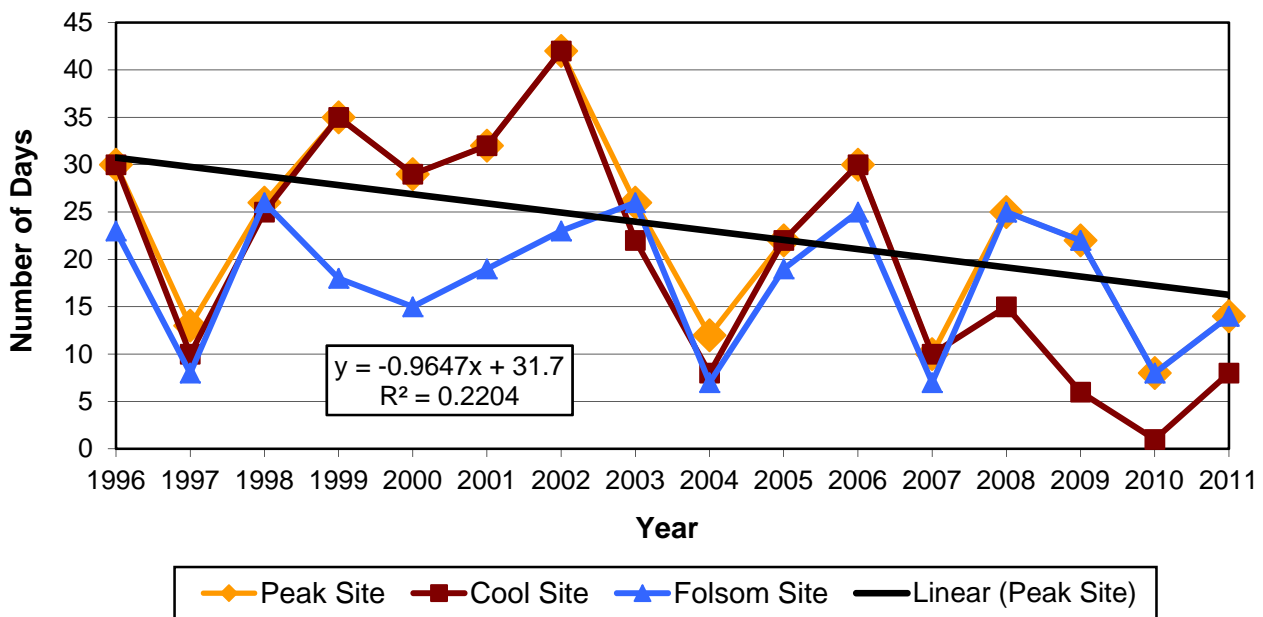


#### 8.4 Trend in Exceedance Days

The line graph in Figure 8-3 shows the number of exceedance days for the peak monitoring site in each year and a trend line from 1996 to 2011. Figure 8-3 also includes the trend line for the two monitoring sites in the region with the most exceedance days, Cool and Folsom. The 16-year trend line indicates a decline in the overall average peak number of annual exceedance days, from about 42 down to 8, a decline rate of about two exceedance days per year.

The trend line  $R^2$  statistic (coefficient of determination = 0.22) is very low, which indicates a weak correlation to the annual peak exceedance days due to the wide variability. This wide variability in peak exceedance days is possibly due to significant differences in year-to-year meteorology, including unseasonably high temperatures during the late 1990-early 2000 and the mid-2000 time periods.<sup>45</sup> Also, the Cool monitoring station skews the 16-year trend analysis toward a more rapid decline rate. Cool has been the peak exceedance site eight times and had a greater decline in the number of exceedance days than Folsom. The peak exceedance site in the last few years is Folsom.

**Figure 8-3 8-Hour Ozone Exceedance Days Trend  
 Sacramento Nonattainment Area – Peak, Cool and Folsom Monitoring Sites**



**8.5 Ozone Design Values**

Although number of exceedances is an interesting and easily understood metric, the ozone health standards are based on the ozone concentration. To show attainment, the ozone design value must meet the 8-hour ozone standard. A monitoring site’s 8-hour ozone design value is calculated using the fourth-highest daily maximum 8-hour average ozone concentrations during

<sup>45</sup> Climate of Sacramento, California, National Weather Service Office, Sacramento, California, August, 2010



a year then averaging those concentrations over the most recent three years.<sup>46</sup> Table 8-2 lists the 8-hour ozone design value concentrations for each of the ozone monitoring sites in the Sacramento nonattainment area since 1996. The region's peak ozone design value concentration varies from year to year, between 94 ppb and 107 ppb. The location of the highest 8-hour ozone design value concentrations occurs most frequently at the region's eastern monitoring sites (Cool, Folsom, Placerville, Auburn, and Colfax). With the sites listed geographically from west to east, the predominance of exceedances (shaded) at the eastern monitoring sites is illustrated.

Another interesting metric displayed in Table 8-2 is the number of monitoring sites violating the standard each year. After peaking in 1999 with 14 monitoring sites exceeding the standard, the region has experienced a steady decline through 2011 when only four sites exceeded the standard. This significant decline in monitoring site exceedances is more than 70 percent over the 16-year analysis period. This indicates that the geographic size of the area experiencing ozone concentrations above the standard is decreasing in the Sacramento area.

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<sup>46</sup> For example, the 2007 ozone design value concentration for a specific monitoring site would be calculated by taking the average of the 2005, 2006 and 2007 4<sup>th</sup> highest daily maximum 8-hour average ozone concentration.

**Table 8-2 8-Hour Ozone Design Values (ppb) – Sacramento Nonattainment Area**

Monitoring Site	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Vacaville		76	82	85	85	77	72	72	71	71	73	74	75	72	71	68
Woodland			87	86	84	82	83	83	79	77	79	80	79	74	72	69
Davis	82	79	80	81	85	81	77	76	74	73	74	75	76	74	72	70
Goldenland Ct.			88	85	82	79	78	77	74	73	73	76	78	na	na	69
Sac-T Street	80	77	79	80	82	80	79	79	75	73	76	78	79	77	75	71
North Highlands	91	88	89	87	89	89	92	91	85	80	82	80	78	74	75	77
Pleasant Grove*	83	82	81	81	84	83	82									
Elk Grove	87	87	87	88	85	84	75	80	77	82	82	83	82	79	77	74
Sac-Del Paso M.	100	97	95	91	95	92	95	97	95	92	90	90	87	86	85	81
Roseville	96	93	93	89	93	90	92	90	87	86	89	89	90	89	90	86
Rocklin*	100	95	94	92	93	91	92									
Sloughhouse			97	100	105	98	95	95	94	94	96	93	95	91	92	87
Folsom	106	101	102	101	104	99	100	100	97	97	97	98	102	100	102	95
Auburn	103	95	95	97	102	101	101	99	95	92	93	89	90	86	87	85
Colfax	91	86	86	86	79	73	77	88	92	91	97	94	89	79	78	74
Cool	103	97	103	103	107	104	106	107	102	97	95	96	98	93	89	84
Placerville	103	99	98	98	99	96	94	95	94	94	94	93	96	92	90	80
Echo Summit							76	76	75	72	72	73	76	74	71	67
Peak Site	106	101	103	103	107	104	106	107	102	97	97	98	102	100	102	95
No. Sites Violating	10	10	13	14	12	9	9	9	9	8	8	8	8	7	7	4

Data source: CARB air quality data base ([www.arb.ca.gov/adam/welcome.html](http://www.arb.ca.gov/adam/welcome.html)).

\*Site closed after 2002. na = insufficient data available.

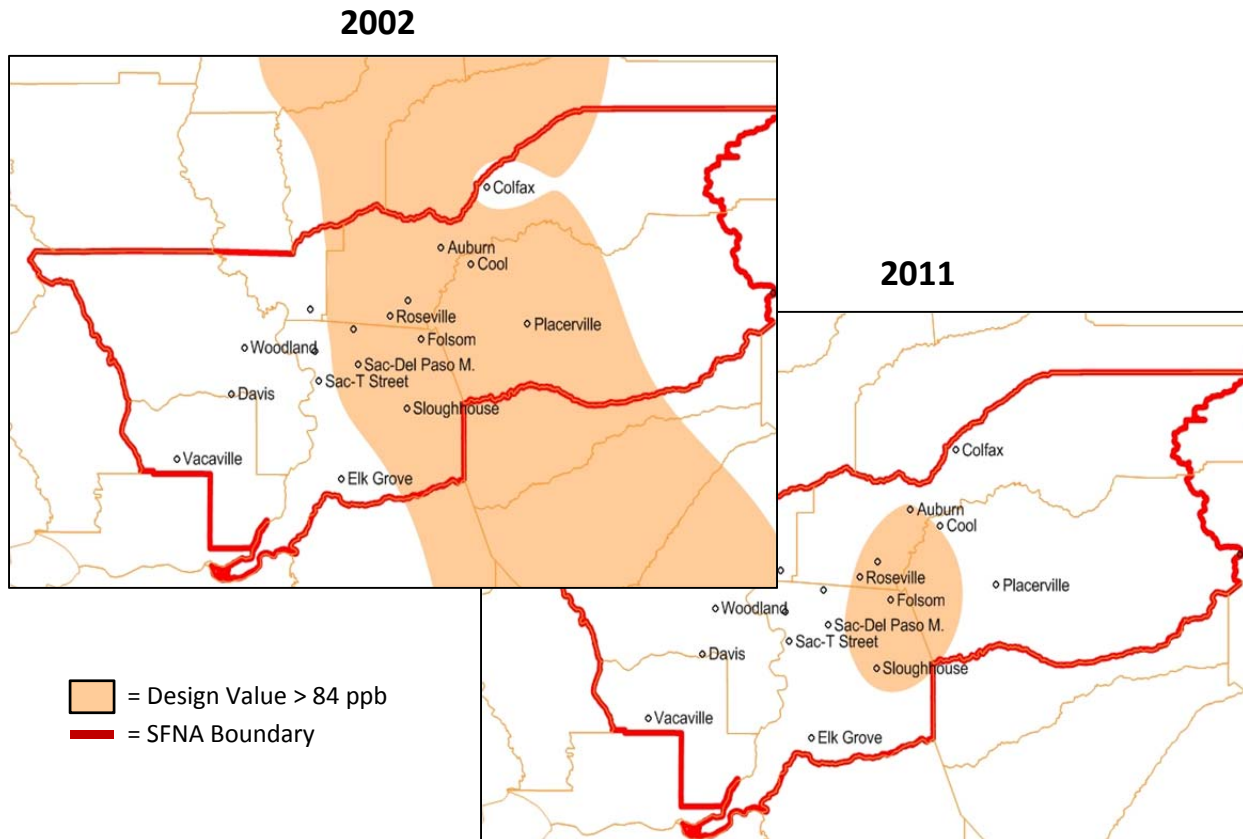
- = Design Value Exceeds Standard
- = Peak Exceedance Site

The reduction of the geographic extent of exceedances in the Sacramento ozone nonattainment area is vividly displayed in Figure 8-4 below.<sup>47</sup> This illustration compares the widespread ozone exceedances of 2002 with a much-reduced core area of exceedances in 2011. In 2002 exceedances were experienced north to south throughout the eastern portion of the SFNA, beginning slightly east of downtown Sacramento and extending farther east to near the crest of the Sierra Nevada Mountains, covering an area of more than 3,000 square miles within the SFNA. By 2011 the geographic area of ozone exceedances is significantly reduced,

<sup>47</sup> The exceedance maps were developed using Surfer software (Version 9.11.947) and design value data from the CARB air quality database ([www.arb.ca.gov/adam/welcome.html](http://www.arb.ca.gov/adam/welcome.html)). Exceedance areas were interpolated from data captured at all air monitoring sites in California.

covering an area from Auburn on the north to Sloughouse on the south and Roseville on the west to about Cameron Park on the east, an area of less than 900 square miles.

**Figure 8-4 Geographic Extent of Ozone Exceedances – 2002-2011**



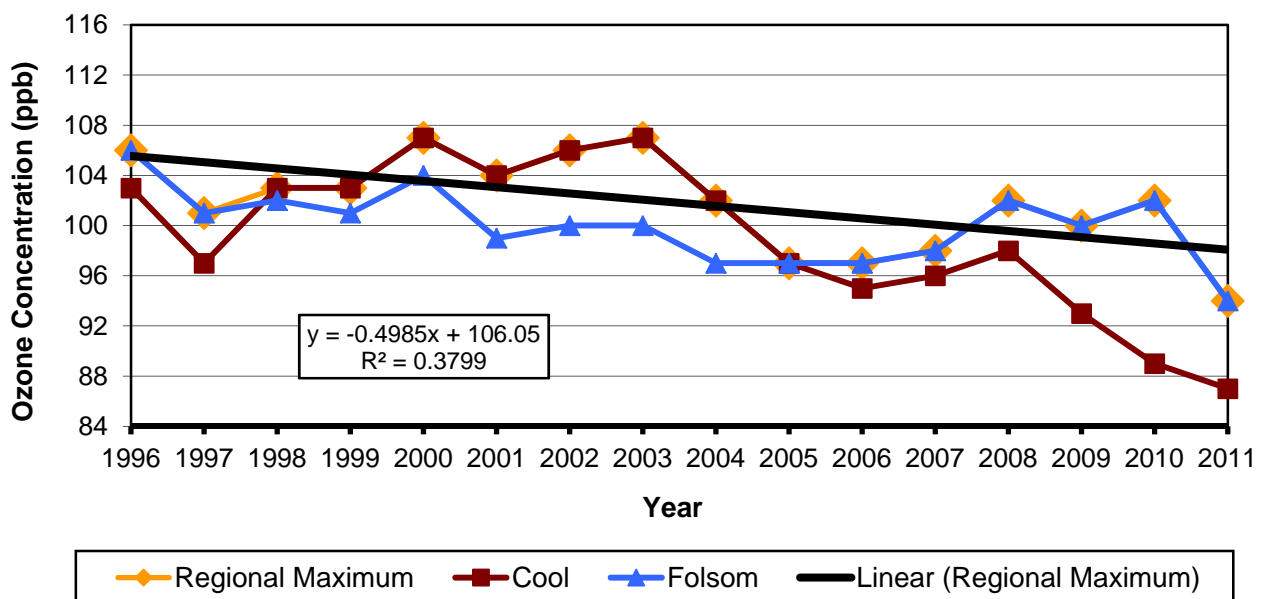
### 8.6 Trend in Ozone Design Value

The line graph in Figure 8-5 shows the ozone design value for the peak monitoring site in each year and a trend line from 1996 to 2011. Figure 8-5 also includes the trend line for the two monitoring sites in the region with the highest design values, Cool and Folsom. The overall 16-year trend line indicates a decline, from 107 ppb down to 94 ppb. The ozone design value has improved from being 23 ppb (or 27%) over the standard<sup>48</sup> down to about 10 ppb (or 12%) over the standard, which equals a decline rate of about 0.8 ppb per year. The trend line R<sup>2</sup> statistic

<sup>48</sup> Federal 1997 8-hour ozone standard = 0.08 ppm. Due to rounding convention, violation is > 0.084 ppm or 84 ppb.

(coefficient of determination = 0.38) is low, which indicates a weak correlation to the annual peak ozone design values. Also, the Cool monitoring station skews the 16-year design value trend analysis, as well as the exceedance day trend discussed above, toward a more rapid decline rate. Either the Cool or Folsom site has had the highest design value over the analysis years, with Folsom leading in the most recent years, which indicates a smaller area in the region exceeds the standards and consequently shifts the peak design value toward the urban core.

**Figure 8-5 8-Hour Ozone Design Values Trend  
 Sacramento Nonattainment Area – Peak, Cool and Folsom Monitoring Sites**



1997 8-hr ozone standard = 0.08 ppm Due to rounding convention, violation is > 0.084 ppm or 84 ppb.

**Conclusion**

Ozone air quality levels are improving by every measure analyzed. The number of days above the standard is declining at a faster rate than the design value concentrations and the geographic area experiencing levels above the standard is smaller.

## 9. 2011 MILESTONE DEMONSTRATION ANALYSIS

### 9.1 Introduction

In this chapter the actual emission reductions through 2011 are compared to the 2011 milestone target established in the adopted attainment plan.<sup>49</sup> Actual emission reductions must equal or exceed the milestone target reduction to satisfy the reasonable further progress (RFP) and milestone compliance (CAA §182(g)) requirements of the Clean Air Act. EPA guidance requires that RFP is calculated as a percentage reduction from the 2002 base year VOC emissions inventory.<sup>50</sup> The Sacramento ozone nonattainment area must reduce the 2002 VOC emissions level by a minimum of 27 percent (3% per year for 9 years from 2002-2011) and, as discussed previously in Chapters 4 and 5, NOx reductions may be used to substitute VOC reductions if there is not sufficient enough VOC reductions to meet RFP requirements.

### 9.2 Milestone Compliance Analysis

Table 9-1 provides the calculations demonstrating milestone compliance for the Sacramento ozone nonattainment area. From 2002 to 2011 VOC and NOx emissions were reduced by 14.6 percent and 22 percent, respectively, after deducting non-creditable reductions from pre-1990 federal vehicle control and fuel regulations.<sup>51</sup> Of the 22 percent NOx reduction, 12.4 percent is used to substitute for the remaining VOC reductions needed to achieve the 27 percent milestone target for 2011. This leaves a 9.6 percent surplus of NOx reductions.

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<sup>49</sup> Sacramento Regional 8-Hour Ozone Attainment and Reasonable Further Progress Plan (2009; Rev. 2011),

<sup>50</sup> Final Rule To Implement the 8-Hour Ozone National Ambient Air Quality Standard—Phase 2, FR Vol. 70, No. 228, November 29, 2005, p. 71615.

<sup>51</sup> Reductions from federal motor vehicle control program (FMVCP) regulations and federal Reid Vapor Pressure (RVP) fuel regulations promulgated prior to Clean Air Act Amendments of 1990 (CAA §182(b)(D)).

**Table 9-1 2011 Milestone Demonstration Emissions Calculations**

<b>VOC Emissions Calculation (Tons/Day)</b>	
1. 2002 VOC Baseline Emissions Inventory (Table 7-1, Page 7-4)	160.3
2. Non-Creditable Adjustments	11.9
3. 2002 Adjusted VOC Emissions Inventory (Line 1 – Line 2)	148.4
4. 2011 VOC Emissions Inventory (Table 7-1, Page 7-4)	126.8
<b>5. Creditable VOC Reductions Since 2002 (Line 3 – Line 4)</b>	<b>21.6</b>
6. Percent VOC Reduction since 2002 (Line 5 ÷ Line 3)	14.6%
7. 2011 RFP Milestone Target <sup>52</sup>	27.0%
8. 2011 Milestone VOC Deficit (Line 7 – Line 6)	12.4%
<b>NOx Emissions Calculation (Tons/Day)</b>	
9. 2002 NOx Baseline Emissions Inventory (Table 7-2, Page 7-5)	195.6
10. Non-Creditable Adjustments	13.0
11. 2002 Adjusted NOx Emissions Inventory (Line 9 – Line 10)	182.6
12. 2011 NOx Emissions Inventory (Table 7-2, Page 7-5)	142.4
<b>13. Creditable NOx Reductions Since 2002 (Line 11 – Line 12)</b>	<b>40.2</b>
14. Percent NOx Reduction since 2002 (Line 13 ÷ Line 11)	22.0%
15. Percent NOx Substitution Needed for VOC Deficit (Same as Line 8)	12.4%
16. NOx Reduction Surplus (Line 14 – Line 15)	9.6%
<b>Is Milestone Compliance Demonstrated?</b>	<b>Yes</b>

Figure 9-1 provides a graphic presentation of the milestone compliance demonstration for the Sacramento nonattainment area. This analysis demonstrates that the Sacramento nonattainment area has met the milestone compliance requirements of the Clean Air Act.

<sup>52</sup> RFP reduction requirements contained in EPA’s “Final Rule To Implement the 8-Hour Ozone National Ambient Air Quality Standard—Phase 2” (70 FR 71696-97, November 29, 2005).

**Figure 9-1 Milestone Compliance Demonstration**

