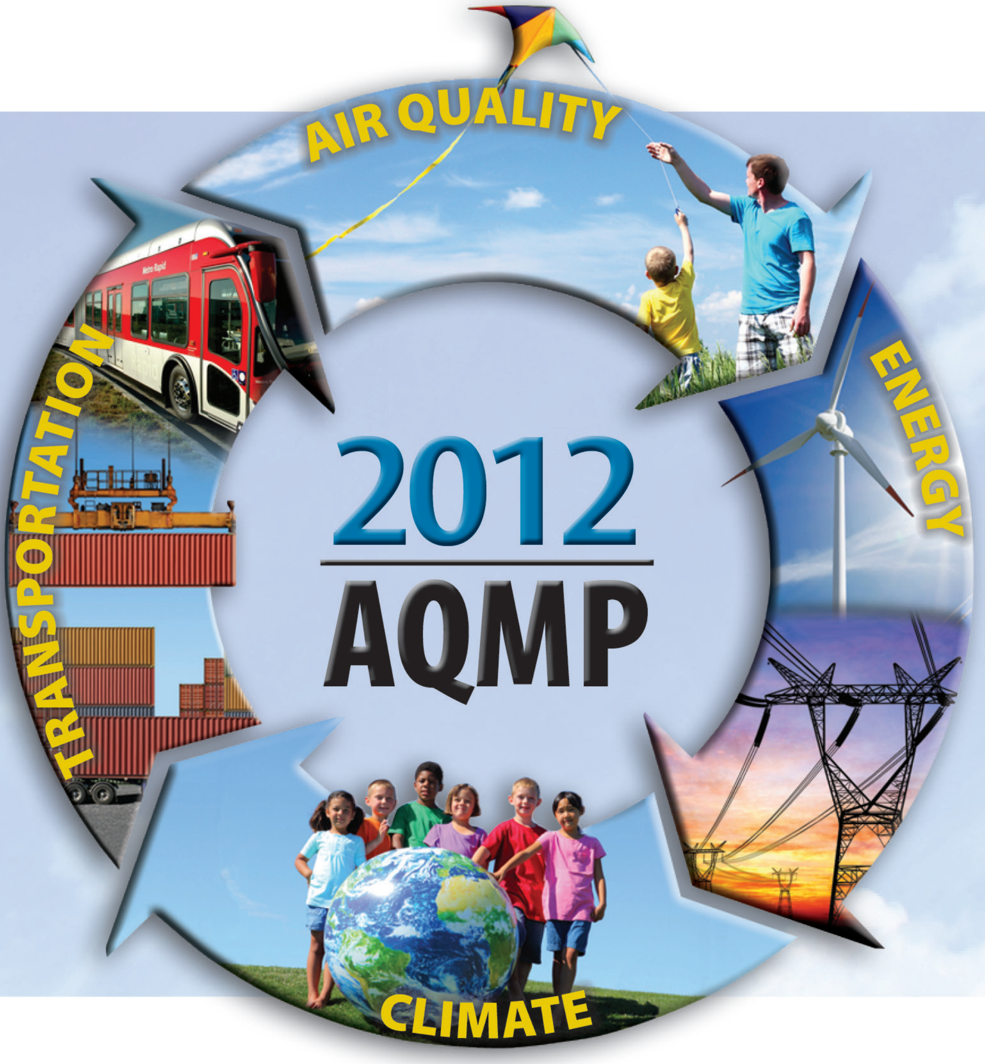
FINAL 2012
Air Quality Management Plan



February 2013

South Coast Air Quality Management District

Cleaning the air that we breathe...™

FINAL 2012 AIR QUALITY MANAGEMENT PLAN

FEBRUARY 2013

CONTRIBUTORS

South Coast Air Quality Management District

Barry R. Wallerstein, D.Env.
Executive Officer

Elaine Chang, DrPH
Deputy Executive Officer
Planning, Rule Development & Area Sources

Laki Tisopulos, Ph.D., P.E.
Assistant Deputy Executive Officer
Planning, Rule Development & Area Sources

Henry Hogo
Assistant Deputy Executive Officer
Science and Technology Advancement

Joseph Cassmassi
Planning and Rules Manager
Planning, Rule Development & Area Sources

Philip M. Fine, Ph.D.
Planning and Rules Manager
Planning, Rule Development & Area Sources

Authors

Jillian Baker, Ph.D. – Air Quality Specialist
Naveen Berry – Planning & Rules Manager
Shoreh Cohanim – Air Quality Specialist
Kevin Durkee – Senior Meteorologist
Ed Eckerle – Program Supervisor
Ali Ghasemi, P.E. – Program Supervisor
Tracy Goss, P.E. – Program Supervisor
Kathy Hsaio – Programs Supervisor
Aaron Katzenstein, Ph.D. – Program Supervisor
Michael Krause – Program Supervisor
Ian MacMillan – Program Supervisor
Victoria Moaveni – Senior Air Quality Engineer
Jean Ospital, Dr.PH – Health Effects Officer
Randall Pasek, Ph.D. – Planning & Rules Manager
Minh Pham, P.E. – Air Quality Specialist
Andrea Polidori, Ph.D. – Air Quality Specialist
Dean Saito – Fleet Implementation Manager

Contributors

Tom Chico – Program Supervisor
Bong-Mann Kim, Ph.D. – Air Quality Specialist
Jong Hoon Lee, Ph.D. – Air Quality Specialist
Sang-Mi Lee, Ph.D. – Air Quality Specialist
Arlene Martinez – Administrative Secretary
Jonathan Nadler – SCAG Department Manager
Chris Nelson – Senior Staff Specialist
Lisa Tanaka O'Malley – Community Relations Manager
Susan Yan – Air Quality Specialist
Xinqiu Zhang, Ph.D. – Air Quality Specialist

Reviewers

Barbara Baird, J.D. – District Counsel
Carol Gomez – Planning & Rules Manager
Peter Greenwald, J.D. – Senior Policy Advisor
Michael Laybourn – Air Quality Specialist
Chung Liu, D.Env. – Deputy Executive Officer
Megan Lorenz, J.D. – Deputy District Counsel II
Lauren Nevitt, J.D. – Deputy District Counsel II
Patti Whiting – Staff Specialist

Production

Ryan Banuelos – Student Intern
Faye Thomas – Senior Administrative Secretary
SCAQMD Print Shop
SCAQMD Graphics Department

ATTACHMENT A
RESOLUTION NO. 13-1

A Resolution of the South Coast Air Quality Management District (AQMD or District) Governing Board to Adopt Control Measure IND-01 (Backstop Measure for Indirect Sources of Emissions from Ports and Port-Related Facilities) as revised for submittal into the California State Implementation Plan (SIP).

A Program Environmental Impact Report (EIR) for the 2012 Air Quality Management Plan (AQMP), which includes IND-01, was previously prepared and certified by the AQMD Governing Board as being completed in compliance with the California Environmental Quality Act (CEQA) on December 7, 2012; therefore no further action on the Program EIR is required.

WHEREAS, the Final 2012 AQMP, which included IND-01, was adopted by the AQMD Governing Board on December 7, 2012, with a motion to continue the hearing on the approval of Control Measure IND-01(Backstop Measure for Indirect Sources of Emissions from Ports and Port-Related Facilities) to the Governing Board's February 1, 2013 public meeting; and

WHEREAS, staff met with affected sources to address concerns raised and met with the Marine Port Committee on January 18, 2013, per Board directive, to discuss the intent and need for IND-01; and

WHEREAS, the South Coast Air Quality Management District is committed to comply with the requirements of the federal Clean Air Act; and

WHEREAS, the South Coast Air Quality Management District Governing Board is committed to comply with the requirements of the California Clean Air Act; and

WHEREAS, the South Coast Air Quality Management District Governing Board is committed to achieving healthful air in the South Coast Air Basin and all other parts of the District at the earliest possible date; and

WHEREAS, the Draft Final Socioeconomic Report on the 2012 AQMP, which included IND-01, was adopted by the Governing Board at the December 7, 2012 Public Hearing; and

WHEREAS, significant emission reductions, including those reductions achieved by the Ports and projected in the inventory, must be achieved from sources under state and federal jurisdiction for the South Coast Air Basin to attain the federal air quality standards; and

WHEREAS, the record of the public hearing proceedings, including CEQA proceedings, is located at South Coast Air Quality Management District, 21865 Copley Drive, Diamond Bar, California 91765, and the custodian of the record is the Clerk of the Board; and

BE IT FURTHER RESOLVED, the District commits to continue working with the ports on the implementation of control measure IND-01 (Backstop Measure for Indirect Sources of Emissions from Ports and Port-Related Sources) as shown in Attachment 1.

BE IT FURTHER RESOLVED, the Governing Board finds and determines, taking into consideration the factors in §(d)(4)(D) of the Governing Board Procedures, that the modifications that have been made to IND-01, since the Final PEIR was certified by the Governing Board at the December 7, 2012 Public Hearing would not constitute significant new information within the meaning of the CEQA Guidelines; and

BE IT FURTHER RESOLVED, none of the modifications to the IND-01 alter any of the conclusions reached in the Final PEIR on the 2012 AQMP, nor provide new information of substantial importance that would require preparation of a subsequent CEQA document; and

BE IT FURTHER RESOLVED, that the South Coast Air Quality Management District Governing Board, pursuant to the requirements of Title 14 California Code of Regulations previously adopted Findings pursuant to §15091 and adopted the Statement of Overriding Considerations pursuant to §15093 at the December 7, 2012 Public Hearing; and

BE IT FURTHER RESOLVED, that the South Coast Air Quality Management District Governing Board previously adopted the Mitigation Monitoring and Reporting Plan, as required by Public Resources Code, at the December 7, 2012 Public Hearing; and

BE IT FURTHER RESOLVED, that the South Coast Air Quality Management District Governing Board, whose members reviewed, considered and approved the information contained in the document listed herein, adopts IND-01 or an alternative approach as amended by the final changes set forth by the AQMD Governing Board and the associated document listed in Attachment 1 to this Resolution.

BE IT FURTHER RESOLVED, that the South Coast Air Quality Management District Governing Board, requests that IND-01 be submitted into the SIP.

BE IT FURTHER RESOLVED, that the Executive Officer is hereby directed to forward a copy of this Resolution and IND-01 as amended by the final changes, to CARB, and to request that these documents be forwarded to the U.S. EPA for approval as part of the California State Implementation Plan. In addition, the Executive Officer is directed to forward any other information requested by the U.S. EPA for informational purposes.

AYES: Burke, Cacciotti, Gonzales, Loveridge, Lyou, Parker, Pulido, and Yates.

NOES: Antonovich, Benoit, and Nelson.

ABSTAIN: None.

ABSENT: Mitchell and Perry.

Dated: 2-1-2013

Saundra McDaniel
Clerk of the District Board

TABLE OF CONTENTS

5. FUTURE AIR QUALITY

8. LOOKING BEYOND CURRENT REQUIREMENTS

9. NEAR ROADWAY EXPOSURE AND ULTRAFINE PARTICLES

10. ENERGY AND CLIMATE

11. PUBLIC PROCESS AND PARTICIPATION

GLOSSARY

APPENDIX I	**HEALTH EFFECTS**
APPENDIX II	**CURRENT AIR QUALITY**
APPENDIX III	**BASE AND FUTURE YEAR EMISSION INVENTORY**
APPENDIX IV-A	**DISTRICT'S STATIONARY SOURCE CONTROL MEASURES**
APPENDIX IV-B	**PROPOSED 8-HOUR OZONE MEASURES**
APPENDIX IV-C	**REGIONAL TRANSPORTATION STRATEGY AND CONTROL MEASURES**
APPENDIX V	**MODELING AND ATTAINMENT DEMONSTRATIONS**
APPENDIX VI	**REASONABLY AVAILABLE CONTROL MEASURES (RACM) DEMONSTRATION**
APPENDIX VII	**2012 1-HOUR OZONE ATTAINMENT DEMONSTRATION**
APPENDIX VIII	**DEMONSTRATION OF OFFSET OF GROWTH IN EMISSIONS ASSOCIATED WITH GROWTH IN VEHICLE MILES TRAVELED UNDER SECTION 182(D)(1)(A) OF THE FEDERAL CLEAN AIR ACT**

PREFACE

The 2012 AQMP represents a regional blueprint for achieving healthful air on behalf of the 16 million residents of the South Coast Basin. The air quality challenges are great, the stakes are high…and the legal deadlines loom sooner than most people realize.

STEADY PROGRESS AND MOMENTUM

The primary task of the 2012 AQMP is to bring our Basin into attainment with federal health-based standards for unhealthful fine particulate matter (PM2.5) by 2014. Yet to have any reasonable expectation of meeting the 2023 ozone deadline, the scope and pace of continued air quality improvement must greatly intensify.

- Regulatory frameworks to reduce unhealthful emissions are mostly pollutant-specific, focusing on one pollutant at a time to meet clean air standards. However, outdoors, people inhale pollutants as a mixture, and the chemical interactions of multiple pollutants are complex. For this reason, each AQMP is also a comprehensive plan that examines multiple pollutants and the most up-to-date scientific knowledge, in order to achieve the greatest air quality and health benefits for Southland residents while also balancing factors of cost and available funding.
- The 2012 AQMP is a critical opportunity to re-sharpen our approach to achieve both breathable air and a healthier, revitalized economic future. Fuel combustion for goods movement, transportation, and energy is the major cause of our worst-in-the-nation ozone problem, while strategies for climate protection that reduce fuel use & energy consumption also have corresponding air quality benefits for everyone in the Southland region.

ECONOMIC SENSITIVITY

The District remains sensitive to our region's slow recovery from recession, while retaining the precept that healthful air is not a luxury, but a right. Therefore the 2012 AQMP seeks to maintain steady momentum along a dollar-wise path - - one that will reduce near-term public health expenses and lay a long-term foundation for more livable, energy-efficient communities and open additional economic opportunities.

- Wherever possible, the plan seeks to identify solutions that can solve multiple problems from focused investments and clean-technology incentives. Also, a number of the proposed measures are voluntary incentives and/or education programs that encourage innovation and early adoption. In addition, the District, the California Air Resources Board (CARB), and fellow non-attainment district San Joaquin Valley have engaged in a major effort to collaborate on concepts for combined clean air gains and more efficient energy production & usage, especially in transportation - - in a coordinated manner.

COLLABORATIVE, SYNERGISTIC EFFORTS

Key to timely implementation of the 2012 AQMP will be coordinated, integrated planning efforts among local, regional, state, and federal entities, together with effective public-private partnerships; and continuing active participation by stakeholders including community health groups, academic, research, & training institutions, and experts in advanced near-zero and zero-emission technologies, especially as related to advanced goods movement technologies.

- Recent years have seen co-funded projects among entities including SCAQMD, U.S. EPA, U.S. DOE, CARB, CEC, metropolitan planning organizations (such as SCAG), Clean Cities affiliates, Councils of Government, major OEMS, utility providers, goods movement authorities, and even international environmental consortiums. These efforts have been an important first step - - but the time for redoubled commitment by all parties is **now**.

Executive Summary

South Coast Air Quality Management District

Cleaning the air that we breathe...™

South Coast AQMD

EXECUTIVE SUMMARY

INTRODUCTION

The long-term trend of the quality of air we Southern Californians breathe shows continuous improvement, although the slowing rate of improvement in ozone levels causes concern. The remarkable historical improvement in air quality since the 1970's is the direct result of Southern California's comprehensive, multiyear strategy of reducing air pollution from all sources as outlined in its Air Quality Management Plans (AQMPs). Yet the air in Southern California is far from meeting all federal and state air quality standards and, in fact, is among the worst in the nation. Stemming from the preponderance of latest health evidence, new federal fine particulate (PM2.5) and 8-hour surface-level ozone standards are more stringent than the previous standards. To reach federal Clean Air Act (CAA) deadlines over the next two decades, Southern California must significantly accelerate its pollution reduction efforts.

Continuing the Basin's progress toward clean air is a challenging task, not only to recognize and understand complex interactions between emissions and resulting air quality, but also to pursue the most effective possible set of strategies to improve air quality, maintain a healthy economy, and coordinate efforts with other key public and private partners to meet a larger set of transportation, energy and climate objectives. To ensure continued progress toward clean air and comply with state and federal requirements, the South Coast Air Quality Management District (SCAQMD or District) in conjunction with the California Air Resources Board (CARB), the Southern California Association of Governments (SCAG) and the U.S. Environmental Protection Agency (U.S. EPA) have prepared the Final 2012 AQMP (Plan). The Plan employs the most up-to-date science and analytical tools and incorporates a comprehensive strategy aimed at controlling pollution from all sources, including stationary sources, on-road and off-road mobile sources and area sources.

The Final Plan demonstrates attainment of the federal 24-hour PM2.5 standard by 2014 in the South Coast Air Basin (Basin) through adoption of all feasible measures. The Final Plan also updates the U.S. EPA approved 8-hour ozone control plan with new measures designed to reduce reliance on the CAA Section 182 (e)(5) long-term measures for NOx and VOC reductions.

The Final 2012 AQMP also addresses several state and federal planning requirements, incorporating new scientific information, primarily in the form of updated emissions inventories, ambient measurements, and new meteorological air quality models. This Plan builds upon the approaches taken in the 2007 AQMP for the South Coast Air Basin for the attainment of federal PM and ozone standards, and highlights the significant amount of reductions needed and the urgent need to engage in interagency coordinated planning to identify additional strategies, especially in the area of mobile sources, to meet all federal criteria pollutant standards within the timeframes allowed under the federal Clean Air Act.

The Final 2012 AQMP also includes an update on the air quality status of the Salton Sea Air Basin (SSAB) in the Coachella Valley, a discussion of the emerging issues of ultrafine particle and near-roadway exposures, an analysis of the energy supply and demand issues that face the Basin and their relationship to air quality. The Plan also includes new demonstrations of 1-hour ozone attainment and vehicle miles travelled (VMT) emissions offsets, as per recent U.S. EPA requirements.

This Final Plan as well as other key supporting information are available electronically and can be downloaded from the District's home page on the Internet (http://www.aqmd.gov/aqmp/2012aqmp/index.htm).

WHY IS THIS FINAL PLAN BEING PREPARED?

The federal Clean Air Act requires a 24-hour PM2.5 nonattainment area to prepare a State Implementation Plan (SIP) which must be submitted to U.S. EPA by December 14, 2012. The SIP must demonstrate attainment with the 24-hour PM2.5 standard by 2014, with the possibility of up to a five-year extension to 2019, if needed. U.S. EPA approval of any extension request is based on the lack of feasible control measures to move forward the attainment date by one year. The District's attainment demonstration shows that, with implementation of all feasible controls, the earliest possible attainment date is 2014, and thus no extension of the attainment date is needed.

In addition, the U.S. EPA requires that transportation conformity budgets be established based on the most recent planning assumptions (i.e., within the last five years) and approved motor vehicle emission models. The Final Plan is based on the most recent assumptions provided by both CARB and SCAG for motor vehicle emissions and demographic updates and includes updated transportation conformity budgets.

IS AIR QUALITY IMPROVING?

Yes. Over the years, the air quality in the Basin has improved significantly, thanks to the comprehensive control strategies implemented to reduce pollution from mobile and stationary sources. For instance, the total number of days on which the Basin experiences high ozone levels has decreased dramatically over the last two decades. As shown in Figure ES-1, the majority of exceedances occur in the mountains and valleys of Southwestern San Bernardino County. The maximum 8-hour ozone levels measured in the Basin were well above 200 ppb in the early 1990s, and are now less than 140 ppb. Figure ES-2 shows the long-term trend in ambient 8-hour average and 1-hour average ozone levels since 1990. However, the Basin still exceeds the federal 8-hour standard more frequently than any other location in the U.S. Under federal law, the Basin is designated as an "extreme" nonattainment area for the 8-hour ozone standard.

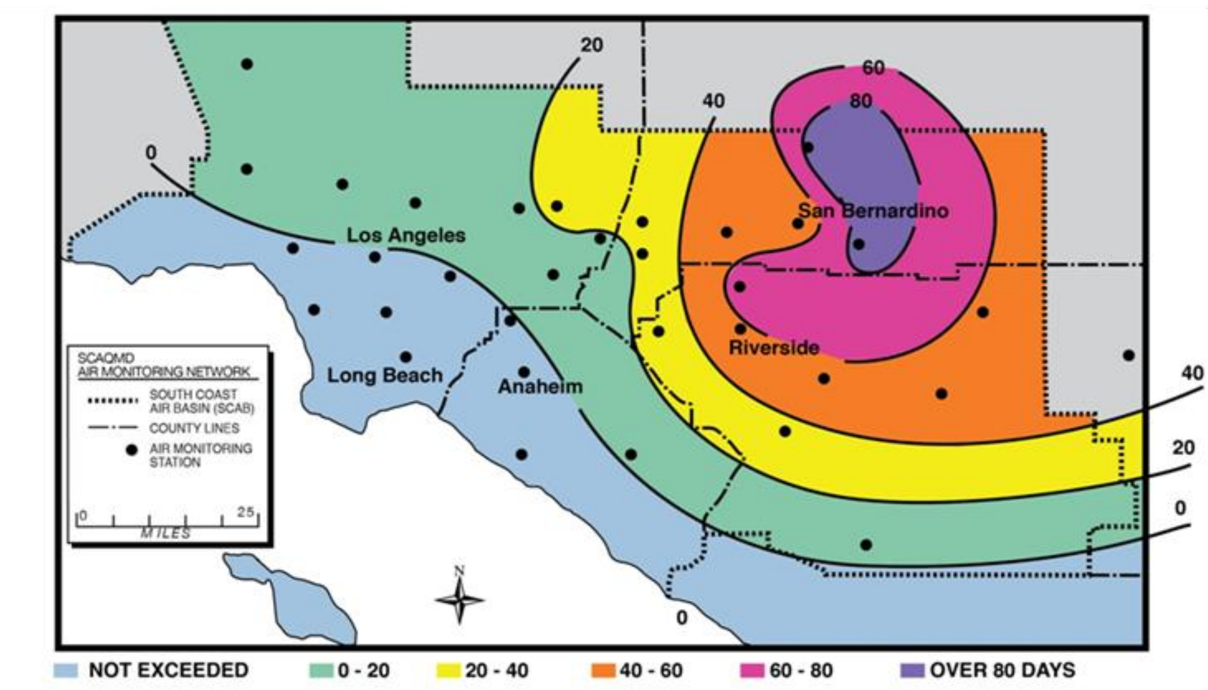


FIGURE ES-1

2011 8-Hour Ozone: Number of Days Exceeding the Current Federal Standard
(8-hour average ozone > 0.075 ppm)

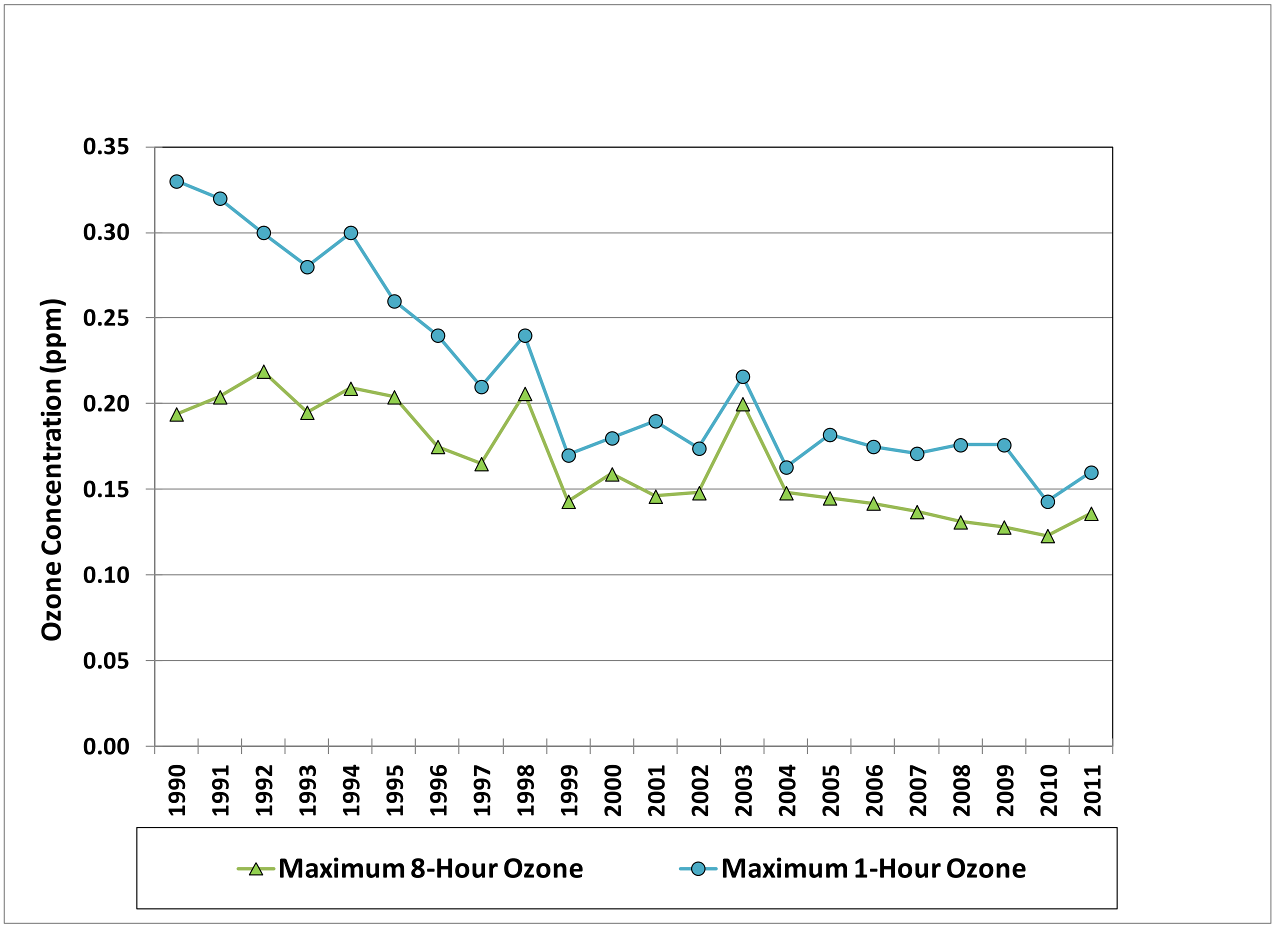


FIGURE ES-2

Maximum 1-Hour and 8-Hour Average Ozone Trends in the Basin

The rate of progress in improving ozone air quality has slowed for the last several years. The District has conducted extensive analysis, held technical forums, and reviewed all available scientific literature examining the issue of why progress has slowed, including the accuracy of emissions inventories, the effectiveness of control strategies, and the knowledge of photochemical processes. The overall result is that a strategy focusing primarily on NOx reductions has been deemed the best way to achieve long-term ozone attainment objectives. However, a recurring policy question is whether another approach, such as significant VOC reductions, would be as effective at reducing ozone levels. But given that NOx reductions are needed not only to achieve the ozone standards but also to achieve the PM2.5 standards, and given that a heavy VOC reduction strategy alone could not achieve the ozone standards, a NOx-heavy control strategy is considered best. VOC reductions are, however, still needed to provide additional ozone benefits, especially in the western areas of the Basin.

Relative to the 1-hour ozone standard, which was revoked by the U.S. EPA in favor of the new 8-hour ozone standard, the past air pollution control programs have had an overall positive impact. The number of days in which the Basin exceeds the federal 1-hour ozone standard has continually declined over the years. But as seen in Figure ES-2, the rate of progress has slowed since 2000. The Basin currently still experiences ozone levels over the revoked 1-hour federal standard on approximately 5% of the days. U.S. EPA guidance has indicated that while certain planning requirements remained in effect, a new SIP would not be required if an area failed to attain the standard by the attainment date. However, recent litigation and court decisions have suggested that there is likely a need for the District to prepare a new 1-hour ozone SIP in the near future. If a 1-hour ozone SIP is requested by U.S. EPA, the SIP would be due within 12 months of such a SIP call. The attainment demonstration in the SIP would have to show attainment within 5 years with a potential 5-year extension, which would be a similar time frame as the 1997 8-hr ozone standard deadline of 2023. Based on previous modeling estimates, the control strategies that are needed to attain the 8-hour ozone standard are nearly identical to those that would be needed to attain the 1-hour ozone standard.

Both PM10 and PM2.5 levels have improved dramatically over the past two decades. Annual average PM10 concentrations have been cut in half since 1990, and likewise, annual average PM2.5 concentrations have been cut in half since measurements began in 1999 (Figure ES-3). The Basin has met the PM10 standards at all stations and a request for re-designation to attainment is pending with U.S. EPA. In 2011, both the annual PM2.5 standard (15 $\mu g/m^3$) and the 24-hour PM2.5 standard (98th percentile greater than 35 $\mu g/m^3$) were exceeded at only one air monitoring station, Mira Loma, in Northwestern Riverside County (Figure ES-4). The primary focus of this Final 2012 AQMP is to bring the Basin into attainment with the 24-hour PM2.5 standard.

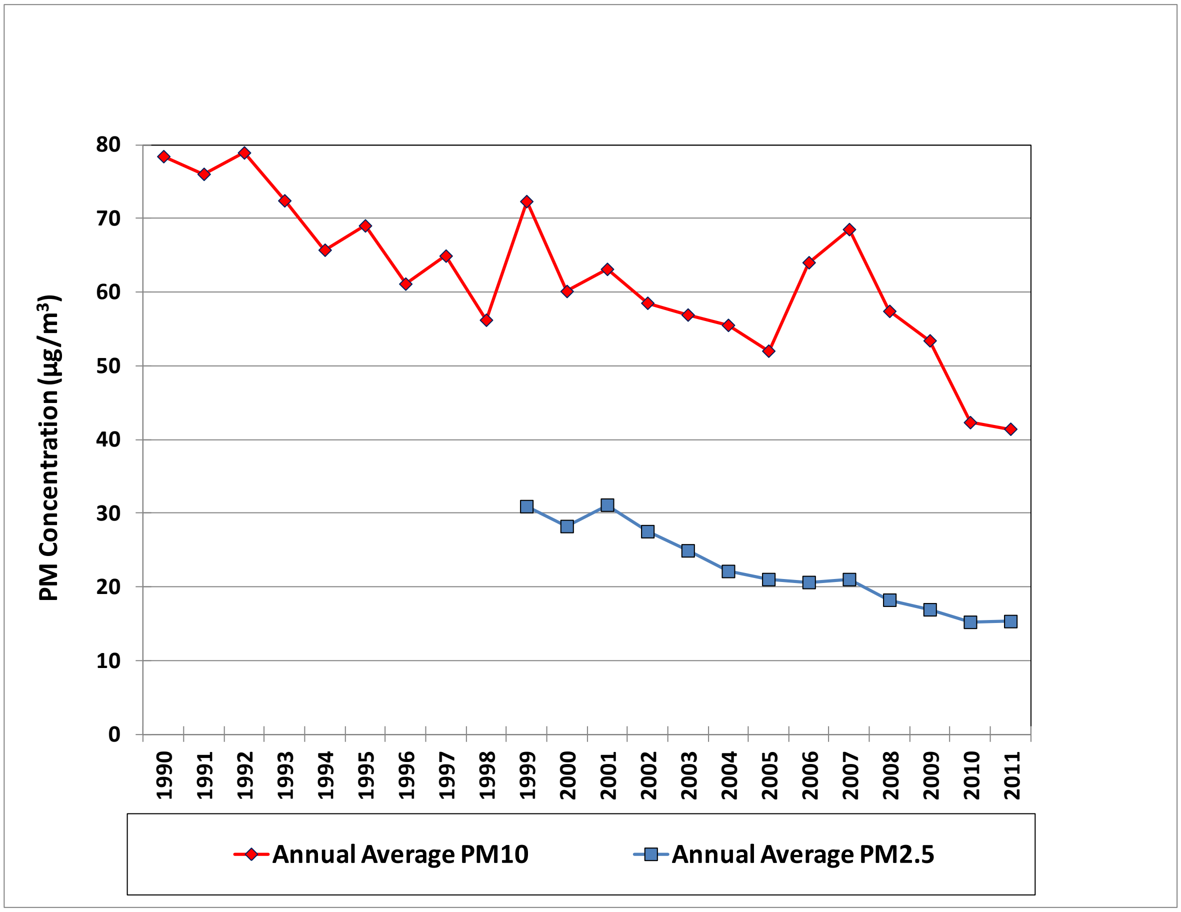


FIGURE ES-3

Maximum-Site Annual Average PM10, PM2.5 Trends in the Basin

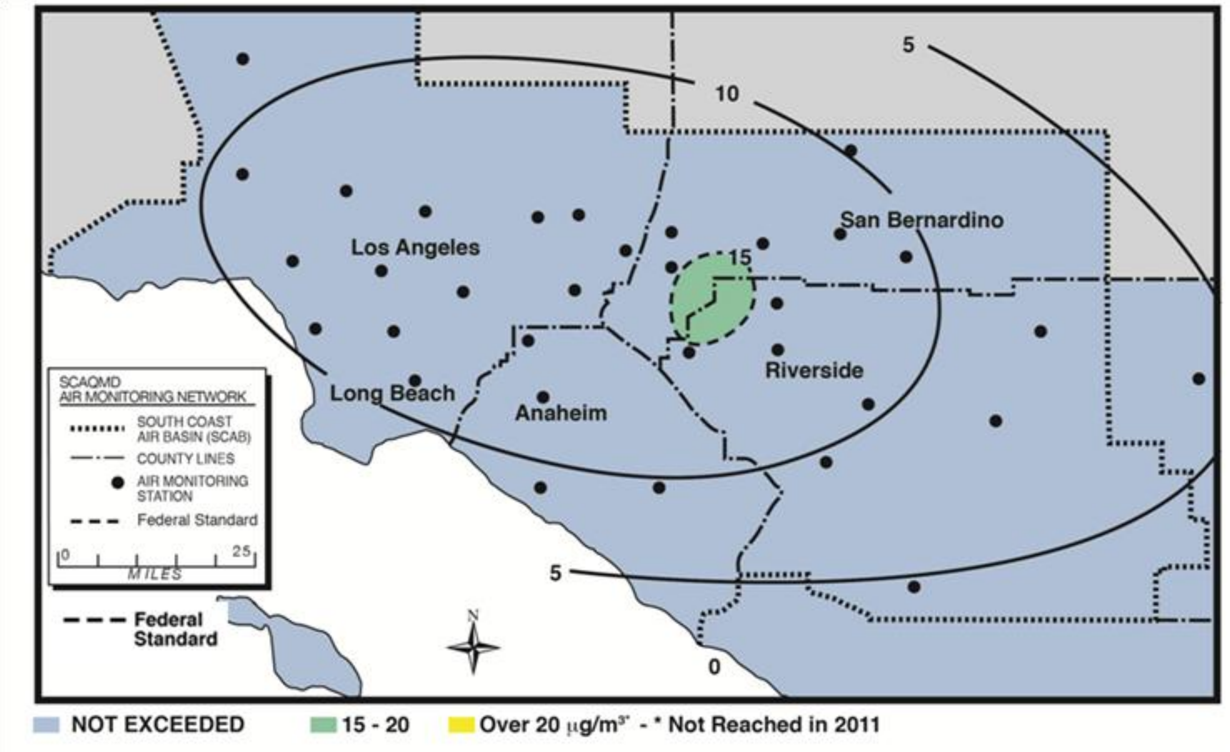


FIGURE ES-4

2011 PM2.5: Annual Average Concentration Compared to the Federal Standard
(Federal standard = 15 µg/m3, annual arithmetic mean)

In 2011, the Basin did not exceed the standards for carbon monoxide, nitrogen dioxide, or sulfur dioxide[1].

Although exposure to pollution has decreased substantially in the Basin through several decades of implementing pollution controls, increases in the population over that time have made further emissions reductions more difficult. Many sources, such as automobiles and stationary sources have been significantly controlled. However, increases in the number of sources, particularly those growing proportionately to population, can offset the potential air quality benefits of past and existing regulations. The net result is that unless additional steps are taken to further control air pollution, growth itself may begin to reverse the gains of the past decades.

[1] U.S. EPA recently revised the NO_2 and SO_2 air quality standards, but analysis to date shows continued compliance with these newly mandated levels.

HOW DID THE RECENT RECESSION AFFECT AIR QUALITY?

As shown above, air quality has improved over the last five years. Many factors affect air quality, including meteorological conditions, emissions, and control programs designed to reduce those emissions. The recession that began in late 2007, and continued reduced economic activity in the Basin, has also impacted pollutant emission levels. For example, goods movement activity declined by more than 20%, construction activity dropped by approximately 40%, and high fuel prices led to less vehicle miles travelled. It is difficult to determine exactly which portion of the air quality gains seen over the last five years are related to the economic downturn, but a rough estimate suggests that 15 - 20% of the recent improvements in air quality are attributable to economic factors. As the economy recovers, commercial activity will increase, and there is the potential for some emissions increases. The Final 2012 AQMP utilizes the most recent economic data and projections, including data from SCAG, which include some levels of economic growth. Using these assumptions, the analysis demonstrates that air quality will continue to improve in the future, but not to the degree necessary to achieve air quality standards without additional control programs.

WHAT ARE THE MAJOR SOURCES CONTRIBUTING TO AIR QUALITY PROBLEMS?

Figure ES-5 shows the sources of NOx, VOC, SOx, and direct PM2.5 emissions for 2008. PM2.5 levels benefit from reductions in all four pollutants. On a per ton basis, the greatest PM2.5 benefit results from SOx and direct PM2.5 emissions reductions. In the Basin, ozone levels benefit from both NOx and VOC reductions.

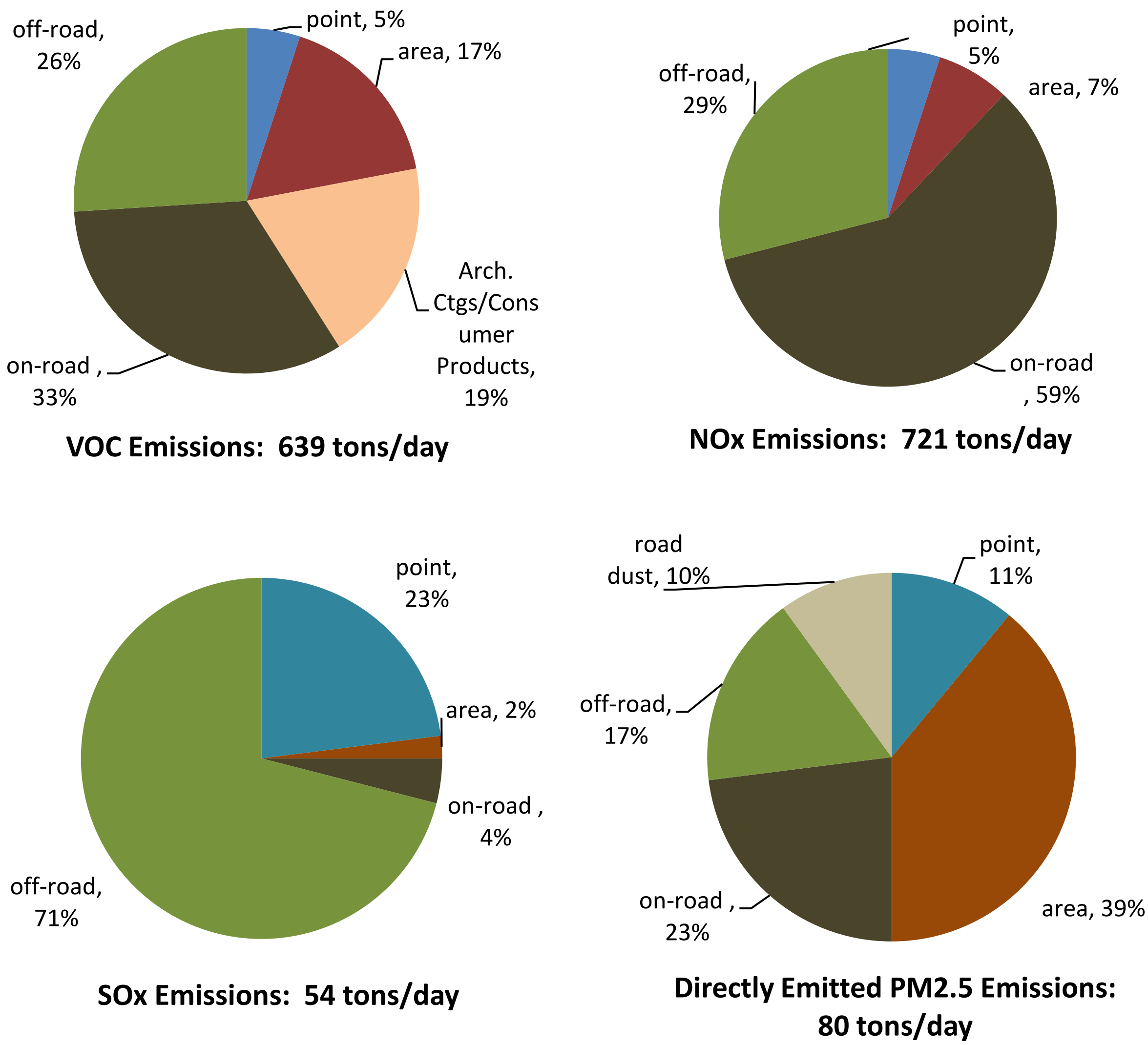


FIGURE ES-5

Relative Contribution by Source Category to 2008 Emission Inventory
(VOC & NOx – Summer Planning; SOx, & PM2.5 – Annual Average Inventory)

WHAT IS THE OVERALL CONTROL STRATEGY IN THE 2012 AQMP?

The Final 2012 AQMP outlines a comprehensive control strategy that meets the requirement for expeditious progress towards attainment with the 24-hour PM2.5 NAAQS in 2014 with all feasible control measures. The Plan also includes specific measures to further implement the ozone strategy in the 2007 AQMP to assist attaining the 8-hour ozone standard by 2023. The 2007 AQMP demonstrated attainment with the

2023 8-hour ozone standard using a provision of the federal CAA, Section 182(e)(5), that allows credit for emissions reductions from future improvements in control techniques and technologies. These "black box" emissions reductions are still needed to show attainment with the 2023 8-hour ozone NAAQS. Accordingly, these Section 182(e)(5) reductions still account for about 65% of the remaining NOx emissions reductions needed in 2023. Given the magnitude of these needed emission reductions, it is critical that the Basin maintain its continuing progress and work actively towards achieving as many specific emissions reductions as possible, and not wait until subsequent AQMPs to begin to address this looming shortfall.

As stated above, the only air monitoring station that is currently exceeding or projected to exceed the 24-hour PM2.5 standard by 2014 is Mira Loma in Western Riverside County. Consistent with U.S. EPA guidance, seasonal or episodic controls that focus on bringing the Mira Loma station into compliance can be considered as a method to bring the Basin into attainment.

The control measures contained in the Final 2012 AQMP can be categorized as follows:

Basin-wide Short-term PM2.5 Measures. Measures that apply Basin-wide, have been determined to be feasible, will be implemented by the 2014 attainment date, and are required to be implemented under state and federal law. The main short-term measures are episodic, in that they only apply during high PM2.5 days and will only be implemented as needed to achieve the necessary air quality improvements.

Contingency Measures. Measures to be automatically implemented if the Basin fails to achieve the 24-hour PM2.5 standard by 2014.

8-hour Ozone Measures. Measures that provide for necessary actions to maintain progress towards meeting the 2023 8-hour ozone NAAQS, including regulatory measures, technology assessments, key investments, and incentives.

Transportation Control Measures. Measures generally designed to reduce vehicle miles travelled (VMT) as included in SCAG's 2012 Regional Transportation Plan.

Many of the control measures proposed are not regulatory in form, but instead focus on incentives, outreach, and education to bring about emissions reductions through voluntary participation and behavioral changes needed to complement regulations.

WHY NOT REQUEST THE FULL 5-YEAR EXTENSION TO MEET THE 24-HOUR PM2.5 STANDARD?

The U.S. EPA deadline for meeting the 24-hour PM2.5 NAAQS is 2014, with a possible extension of up to five years. The extension is not automatic, and approval of an extension request will be based on a demonstration that there are no additional feasible control measures available to move up the attainment date by one year. As demonstrated in Chapter 5 of this Final 2012 AQMP, with the existing control program the Basin can attain the 24-hour PM2.5 standard by 2019, the latest possible attainment date with a full five-year extension granted by U.S. EPA. Under the federal CAA, the Basin must achieve the federal NAAQS “as expeditiously as practicable.” Therefore, if feasible measures to advance attainment are available, they must be adopted and implemented in the SIP. With all feasible measures implemented, including the episodic controls proposed, the Basin can achieve attainment by 2014 without requesting an extension.

WHY AND HOW IS THE 8-HOUR OZONE PLAN BEING UPDATED?

Given the continuing challenge of achieving the magnitude of emissions reductions needed to meet the federal 2023 8-hour ozone deadline, this Plan updates the previous 8-hour ozone plan with new emission reduction commitments from a set of new control measures, which further implement the 2007 AQMP commitments. The 2023 deadline is fast approaching and the magnitude of needed emission reductions remains about the same as it was in the 2007 AQMP. It is not a prudent or efficient strategy to wait for future plans and controls to achieve all of these reductions when they are possible today. Thus, these Final 2012 AQMP measures serve as a down payment for the much larger reductions that will be needed in future years.

Furthermore, these additional emissions reductions are needed to demonstrate attainment with the revoked 1-hour ozone standard. Due to a recent court decision, U.S. EPA has proposed to require a new 1-hour ozone attainment demonstration. The 1-hour ozone attainment strategy is essentially identical to the 8-hour ozone attainment strategy, including the updates in the Final 2012 AQMP. The 1-hour ozone attainment demonstration is included as an appendix to this Plan.

The U.S. EPA approved the 8-hour ozone SIP portion of the 2007 AQMP in 2011. The submittal of the Final 2012 AQMP will update certain portions of that SIP submittal. Namely, the new 8-hour ozone control measures will be submitted into the SIP with commitments for corresponding emissions reductions.

GIVEN THE CURRENT DIFFICULT AND UNCERTAIN ECONOMIC CONDITIONS, SHOULD THE DISTRICT WAIT BEFORE ADDING REFINED CONTROL COMMITMENTS INTO THE SIP?

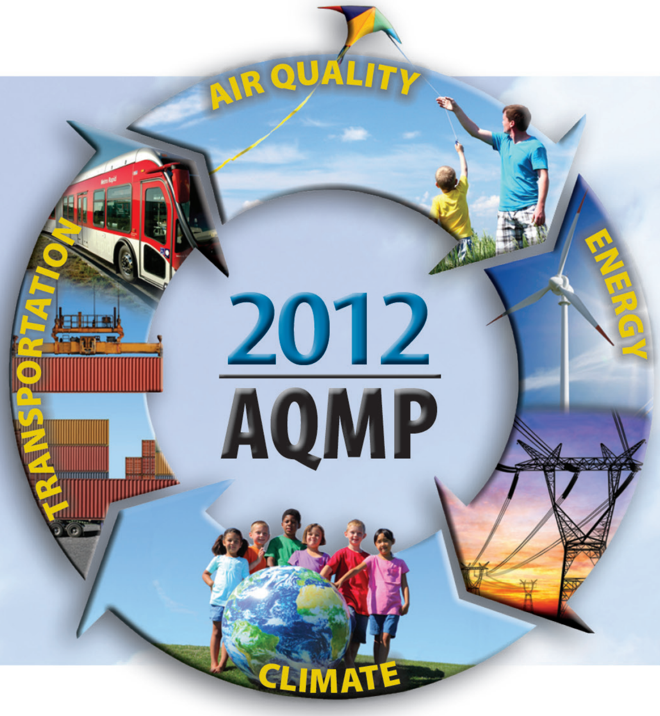
No. The PM2.5 measures are required to be submitted by December 14, 2012. As for ozone, the challenges are too great, the stakes too high, and the deadlines too soon. Waiting until the last few years to try and achieve the necessary emission reductions will make the efforts more difficult, disruptive, and probably more expensive. However, the district remains sensitive to the current economic climate and the struggles that many local businesses are experiencing. That is why this Final 2012 AQMP strives to identify the most cost-effective and efficient path to achieve federal clean air standards. A number of the measures proposed in the Plan are voluntary incentive and/or education programs that aim to achieve emission reductions without imposing new regulatory requirements. The episodic control approach seeks to minimize overall cost and economic impacts by focusing on the limited numbers of days and locations still experiencing the exceedances of the federal standards.

Furthermore, the effort to achieve multiple clean air goals will require significant public investments in the region over a long period of time. These investments need to be accomplished in an optimum fashion starting now. This also has the potential to create new Southern California jobs in clean technology sectors such as renewable power, energy efficiency, clean products, and advanced emissions controls. Fulfilling this unique opportunity to concentrate these clean air investments and jobs in the region where the air quality problems exist will require strong partnerships among all levels of government and business interests.

IS THE 2012 AQMP BEING COORDINATED WITH THE STATE'S GREENHOUSE GAS REDUCTION EFFORTS?

The Basin faces several ozone and PM attainment challenges, as strategies for significant emission reductions become harder to identify and the federal standards continue to become more stringent. California's Greenhouse Gas reductions targets under AB32 add new challenges and timelines that affect many of the same sources that emit criteria pollutants. In finding the most cost-effective and efficient path to meet multiple deadlines for multiple air quality and climate objectives, it is essential that an integrated planning approach is developed. Responsibilities for achieving these goals span all levels of government, and coordinated and consistent planning efforts among multiple government agencies are a key component of an integrated approach.

To this end, and concurrent with the development of the 2012 AQMP, the District, the Air Resources Board, and San Joaquin Valley Air Pollution Control District engaged in a joint effort to take a coordinated and integrated look at strategies needed to meet California's multiple air quality and climate goals, as well as its energy policies. California's success in reducing smog has largely relied on technology and fuel advances, and as health-based air quality standards are tightened, the introduction of cleaner technologies must keep pace. More broadly, a transition to zero- and near-zero emission technologies is necessary to meet 2023 and 2032 air quality standards and 2050 climate goals. Many of the same technologies will address air quality, climate and energy goals. As such, strategies developed for air quality and climate change planning should be coordinated to make the most efficient use of limited resources and the time needed to develop cleaner technologies. The product of this collaborative effort, the draft *Vision for Clean Air: A Framework for Air Quality and Climate Planning*, examines how those technologies can meet both air quality and climate goals over time. A public review draft of this document is now available at http://www.aqmd.gov/aqmp/2012aqmp and serves as context and a resource for the 2012 AQMP.



Chapter 1

Introduction

South Coast Air Quality Management District

Cleaning the air that we breathe...™

CHAPTER 1

INTRODUCTION

PURPOSE

The purpose of the 2012 Air Quality Management Plan (AQMP or Plan) for the South Coast Air Basin (Basin) is to set forth a comprehensive and integrated program that will lead the Basin into compliance with the federal 24-hour PM2.5 air quality standard, and to provide an update to the Basin's commitments towards meeting the federal 8-hour ozone standards. It will also serve to satisfy recent U.S. EPA requirements for a new attainment demonstration of the revoked 1-hour ozone standard, as well as a vehicle miles travelled (VMT) emissions offset demonstration. The Plan will be submitted to the U.S. Environmental Protection Agency (U.S. EPA) as the State Implementation Plan (SIP) once it is approved by the South Coast Air Quality Management District's (AQMD or District) Governing Board and the California Air Resources Board (CARB). Specifically, the Plan will serve as the official SIP submittal for the federal 2006 24-hour PM2.5 standard, for which U.S. EPA has established a due date of December 14, 2012. In addition, the Plan will update specific new control measures and commitments for emissions reductions to implement the attainment strategy for the 8-hour ozone SIP and help reduce reliance on the Section 182(e)(5) long-term measures. The key federal and state planning requirements are summarized briefly later in this chapter. Given the challenges and complexities in demonstrating attainment with air quality standards, District staff believes it is important to initiate broad public dialogue on a broad range of air quality issues, to inform the public regarding the challenges ahead, and to solicit public input in an open and transparent process. This Final 2012 AQMP sets forth programs which require integrated planning efforts and the cooperation of all levels of government: local, regional, state, and federal.

At the federal level, U.S. EPA is charged with establishing emission standards for on-road motor vehicles; train, airplane, and ship pollutant exhaust and fuel standards; and establishing emissions standards for non-road engines less than 175 horsepower. CARB, at the state level, also establishes on-road vehicle emission standards, fuel specifications, some off-road source requirements, and most consumer product standards. CARB is also primarily responsible for the implementation of California's greenhouse gas emission reduction program as mandated by AB 32. The strategies to achieve air quality and climate goals have significant overlap in terms of sources and control measures. When also considering other regional needs and constraints, such as energy supply, mobility, goods movement, and jobs, it is clear that an integrated and coordinated planning approach is needed to efficiently achieve multiple objectives.

Since air pollution is not constrained within city and county boundaries, it is largely a regional issue. As the regional air quality agency for Orange County and portions of Los Angeles, Riverside, and San Bernardino Counties, including the Coachella Valley, the District is responsible for stationary sources with some limited mobile source and consumer product authority. The District also has the primary responsibility for the development and adoption of the AQMP. Lastly, at the local level, the cities, counties and their various departments (e.g., harbors and airports) have a dual role related to transportation and land use. Their efforts are coordinated through the regional metropolitan planning organization (MPO) for the Basin, the Southern California Association of Governments (SCAG). Along with CARB, SCAG is the District's partner in the preparation of the AQMP, providing the latest economic forecasts and developing transportation control measures. Interagency commitment and cooperation are keys to the success of the AQMP. No one agency can design or implement the Plan alone and the strategies in the Plan reflect this fact.

CONSTRAINTS IN ACHIEVING STANDARDS

The District is faced with a number of constraints and that make achieving clean air standards a difficult challenge. These include the physical and meteorological setting, the large pollutant emissions burden of the Basin (including pollution from international goods movement), and the continued population growth of the area.

Setting

The District has jurisdiction over an area of approximately 10,743 square miles, consisting of the South Coast Air Basin, and the Riverside County portions of the Salton Sea Air Basin (SSAB) and Mojave Desert Air Basin (MDAB). The Basin, which is a subregion of the District's jurisdiction, is bounded by the Pacific Ocean to the west and the San Gabriel, San Bernardino, and San Jacinto mountains to the north and east. It includes all of Orange County and the non-desert portions of Los Angeles, Riverside, and San Bernardino Counties. The Riverside County portion of the SSAB is bounded by the San Jacinto Mountains in the west and spans eastward up to the Palo Verde Valley. The federal nonattainment area (known as the Coachella Valley Planning Area) is a sub-region of Riverside County and the SSAB that is bounded by the San Jacinto Mountains to the west and the eastern boundary of the Coachella Valley to the east. The Los Angeles County portion of the MDAB (known as North County or Antelope Valley) is bounded by the San Gabriel Mountains to the south and west, the Los Angeles/Kern County border to the north, and the Los Angeles/San Bernardino County border to the east. The SSAB and MDAB were previously included in a single large basin called the Southeast Desert Air Basin (SEDAB). On May 30, 1996, CARB replaced the SEDAB with the SSAB and MDAB. In July 1997, the Antelope Valley area of MDAB was separated from the District and incorporated into a new air district under the jurisdiction of the newly formed Antelope Valley Air Pollution Control District (AVAPCD). The entire region is shown in Figure 1-1.

The Coachella Valley Planning Area is impacted by pollutant transport from the South Coast Air Basin. In addition, pollutant transport also impacts the Antelope Valley, Mojave Desert, Ventura County, and San Diego County. As part of this AQMP, an update on the status of the Coachella Valley ozone non-attainment area is also provided.

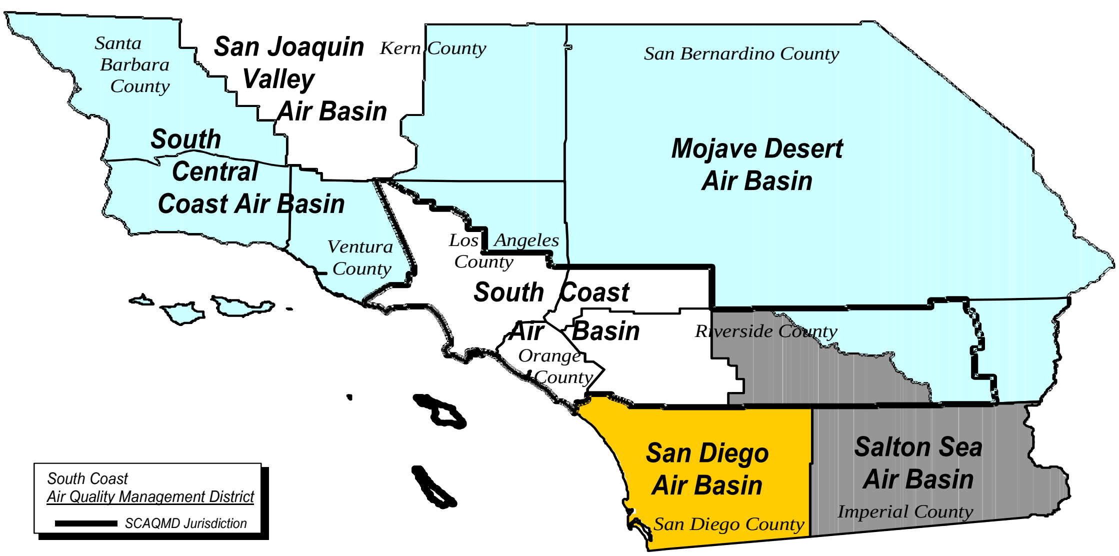


FIGURE 1-1

Boundaries of the South Coast Air Quality Management District
and Federal Planning Areas

The topography and climate of Southern California combine to make the Basin an area of high air pollution potential. During the summer months, a warm air mass frequently descends over the cool, moist marine layer produced by the interaction between the ocean's surface and the lowest layer of the atmosphere. The warm upper layer forms a cap over the cooler surface layer which inhibits the pollutants from dispersing upward. Light winds during the summer further limit ventilation. Additionally, abundant sunlight triggers the photochemical reactions which produce ozone and the majority of particulate matter. The region experiences more days of sunlight than any other major urban area in the nation except Phoenix.

The Basin's economic base is diverse. Historically, the four counties of the Basin have collectively comprised one of the fastest-growing local economies in the United States. Significant changes have occurred in the composition of the industrial base of the region in the past twenty years. As in many areas of the country, a large segment of heavy manufacturing, including steel and tire manufacturing as well as automobile assembly, has been phased down. Due to growth in shipping and trade, small service industries and businesses have replaced much of the heavy industry.

Emission Sources

The pollution burden of the Basin is substantial. In spite of substantial reductions already achieved through effective control strategies, additional significant reductions of volatile organic compounds (VOCs), oxides of nitrogen (NOx), sulfur oxides (SOx), and particulate matter (PM) in the Basin are needed to attain the federal and state air quality standards.

Air pollution forms either directly or indirectly from pollutants emitted from a variety of sources. These sources can be natural, such as oil seeps, vegetation, or windblown dust, but the majority of emissions are related to human activity. Emissions result from fuel combustion sources, such as cars and trucks; from the evaporation of organic liquids, such as those used in coating and cleaning processes; and through abrasion processes, such as tires on roadways. The air pollution control strategy in the Final 2012 AQMP is directed entirely at controlling man-made sources. The emission sources in the Basin are described in Chapter 3. Natural emissions are included in the air quality modeling analysis in Chapter 5.

Population

Since the end of World War II, the Basin has experienced faster population growth than the rest of the nation. Although growth has slowed somewhat, the region's population is expected to increase significantly through 2023 and beyond. Table 1-1 shows the projected growth based on SCAG's regional growth forecast.

TABLE 1-1

Population Growth

YEAR	POPULATION	AVERAGE PERCENT INCREASE PER YEAR OVER THE PERIOD
1990	13.0 million	--
2000	14.8 million	1.4
2008	15.6 million	0.7
2023 [a]	17.3 million	0.7
2030 [a]	18.1 million	0.7

[a] Based on SCAG forecasts in the 2012 Regional Transportation Plan

Despite this growth, air quality has improved significantly over the years, primarily due to the impacts of the region's air quality control program. Figure 1-2 shows the trends since 1990 in the annual average PM10 and PM2.5 concentrations. PM10 levels have declined almost 50% since 1990, and PM2.5 levels have also declined 50% since measurements began in 1999. As shown in Chapters 2 and 5, the only air monitoring station that is currently exceeding or projected to exceed the 24-hour PM2.5 standard from 2011 forward is the Mira Loma station in Western Riverside County. Figure 1-3 shows the improvements in the 1-hour ozone and 8-hour ozone levels over the same time period. Similar improvements are observed with ozone, although the rate of ozone decline has slowed in recent years.

Although exposure to pollution has decreased substantially in the Basin through several decades of implementing pollution controls, increases in the population over that time have made further emission reductions more difficult. Many sources, such as automobiles and stationary sources have been significantly controlled. However, increases in the number of sources, particularly those growing proportionately to population, can offset the potential air quality benefits of past and existing regulations. The net result is that unless additional steps are taken to further control air pollution, growth itself may reverse the gains of the past decades.

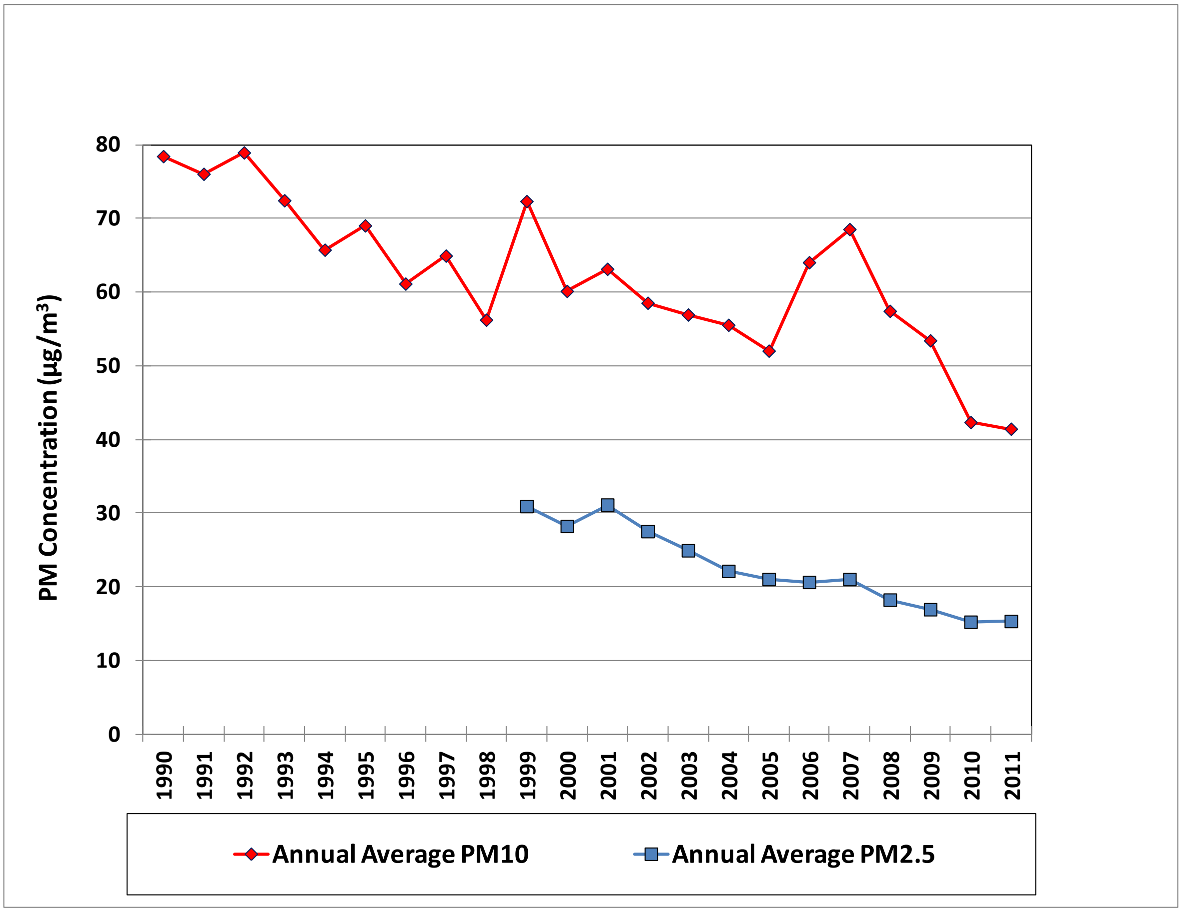


FIGURE 1-2

Maximum Annual Average PM10, PM2.5 Trends in the Basin

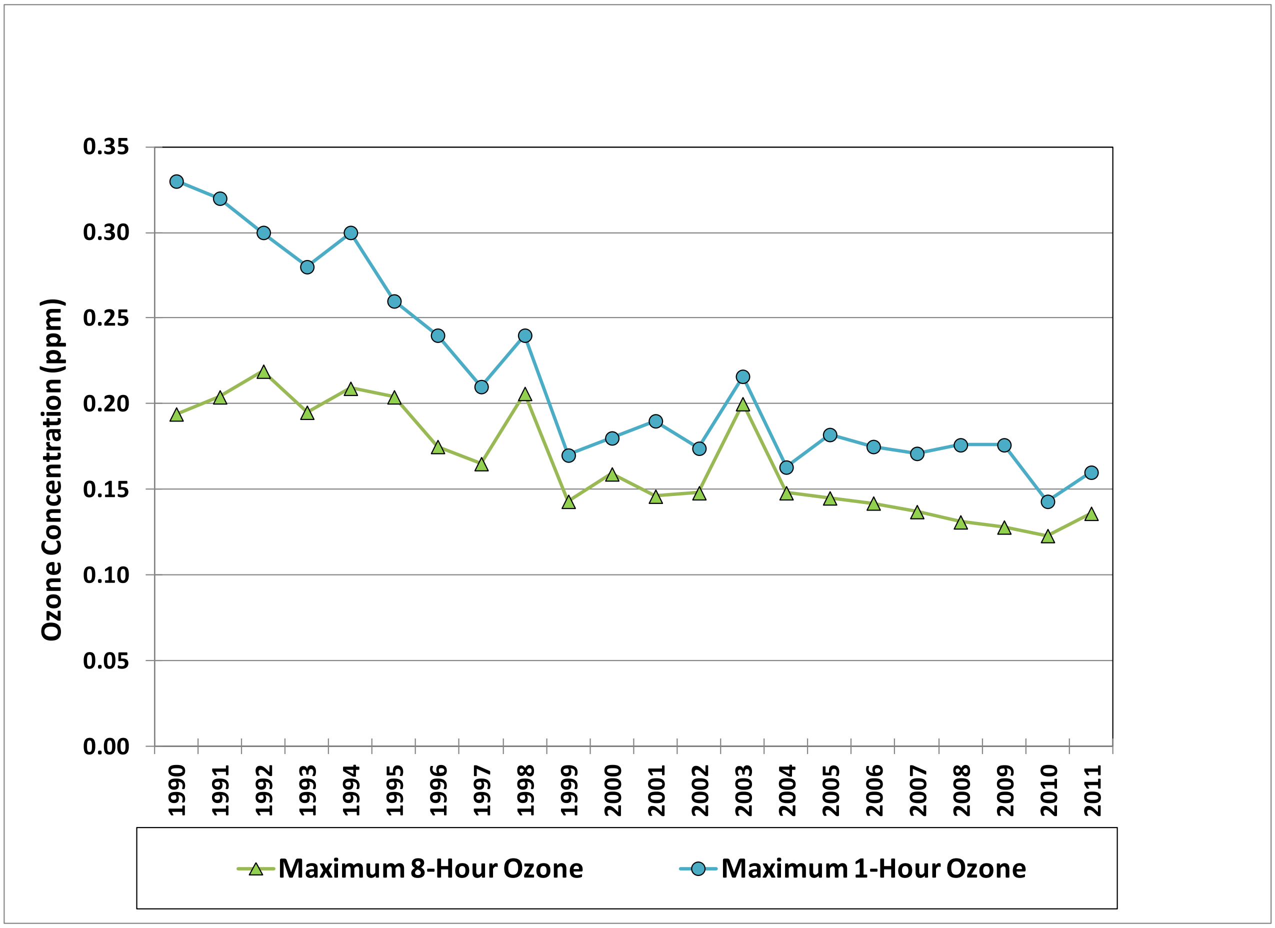


FIGURE 1-3

Maximum 1-hour and 8-hour Average Ozone Trends in the Basin

The Recent Recession

The collapse in the housing and financial markets precipitated the economic recession that began in the fourth quarter of 2007. By technical economic definitions, the recession ended in the second quarter of 2009, but the economy is still being affected and recovery has been slow. Certain industries, such as housing and construction, were disproportionately affected and continue to struggle to return to pre-recessionary growth levels. While unemployment has improved since the height of the recession, it still remains above historical levels. As many businesses continue to struggle under difficult and uncertain economic conditions, the District will continue to work closely with businesses and industry groups to identify the most cost-effective and efficient path to meeting clean air goals while being sensitive to their economic concerns.

CONTROL EFFORTS

History

The seriousness of the local air pollution problem in the Basin was recognized in the early 1940s. In 1946, the Los Angeles County Board of Supervisors established the first air pollution control district in the nation to address the problems of industrial air pollution. In the mid-1950s, California established the first state agency to control motor vehicle emissions. County or regional air pollution districts were formed in California by the 1970s. Many of the control strategies originating in California became the basis for the federal control programs which began in the 1960s.

Nearly all control programs developed to date have relied on the development and application of cleaner technologies and add-on emission control devices. Emissions from industrial and vehicular sources have been significantly cut by the use of these technologies. Only recently have preventive efforts come to the forefront of the air pollution control program, including alternative materials, waste minimization, and maintenance procedures for industrial sources.

In the 1970s, it became apparent at both the state and federal levels that local programs were not enough to solve a problem that was regional in nature and was not contained within city and county jurisdictional boundaries. Instead, air basins, defined by logical geographical boundaries, became the basis for regulatory programs.

In 1976, the California Legislature adopted the Lewis Air Quality Management Act which created the South Coast Air Quality Management District from a voluntary association of air pollution control districts in Los Angeles, Orange, Riverside, and San Bernardino Counties. The new agency was charged with developing uniform plans and programs for the region to attain federal standards by the dates specified in federal law. The agency was also mandated to meet state standards by the earliest date achievable, using reasonably available control measures.

Rule development in the 1970s through 1990s resulted in dramatic improvement in Basin air quality (see Chapter 2 and Appendix II). However, the effort to impose incremental rule changes on the thousands of stationary sources through the command-and-control regulatory process began to be challenged as less economically efficient than programs taking advantage of market incentives. The 1991 AQMP introduced the concept of a Marketable Permits Program and outlined the framework of an idea that was the forerunner to what is now known as the Regional Clean Air Incentives Market (RECLAIM). RECLAIM, a NOx and SOx cap-and-trade program, calls for declining mass emission limits on the total emissions from all facilities within the program and achieves cost-effective emission reductions. In addition to the implementation of RECLAIM, other statewide incentive programs such as the Carl Moyer Memorial Air Quality Standards Attainment Program (Carl Moyer Program) and the Highway Safety, Traffic reduction, Air Quality, and Port Security Bond Act of 2006 (Proposition 1B) were implemented and provide expedited reductions through accelerated fleet turnover that would otherwise have been difficult to obtain through regulatory mandates and their associated lead time for implementation.

In summary, while the region's effort to attain applicable ambient air quality standards continues to rely on the successful command-and-control regulatory structure, the strategy is supplemented, where appropriate, with market incentive and compliance flexibility strategies.

Air Quality Impact of Control Efforts

Air pollution controls have had a positive impact on the Basin's air quality relative to the now revoked 1979 federal 1-hour ozone standard. The number of days where the Basin exceeded the federal 1-hour ozone standard has continually declined over the years. However, while the number of days exceeding the federal 1-hour ozone standard has dropped since the 1990s, the rate of progress has slowed since 2000. The Basin experienced ozone levels over the revoked federal 1-hour ozone standard on 7 days in 2010, the original attainment year for the revoked 1-hour ozone standard, and the maximum recorded value exceeded the standard by nearly 20 percent.

Although past controls were primarily designed to address the federal 1-hour ozone and the PM10 standards, they also benefited the more recent efforts to attain the 8-hour ozone and the PM2.5 standards. The 8-hour ozone levels have been reduced by half over the past 20 years, nitrogen dioxide and sulfur dioxide standards have been met, and other criteria pollutant concentrations have significantly declined. The federal and state CO standards were also met as of the end of 2002. The Basin has met the PM10 standards at all stations and has requested a redesignation to attainment status. However, the Basin still experiences substantial exceedances of the 8-hour ozone standards and nominal exceedances of the PM2.5 standards. Air quality summaries and health effects in the Basin are discussed in Chapter 2;

Appendix II provides an in-depth analysis of air quality as measured within the District's jurisdiction.

PROGRESS IN IMPLEMENTING THE 2007 AQMP

District's Actions

The ozone portion of the 2007 AQMP has been approved by U.S. EPA into the SIP. The majority of the PM2.5 portion of the 2007 AQMP has also been approved by U.S. EPA, with the only exception being the failure to meet contingency measure requirements. These approvals include SIP revisions submitted in response to U.S. EPA's initial findings. The District has also submitted a SIP revision designed to meet the contingency measure requirement for the annual PM2.5 plan.

The District continues to implement the 2007 AQMP. Progress in implementing the 2007 AQMP can be measured by the number of control measures that have been adopted as rules and the resulting tons of pollutants targeted for reduction. Emission reduction commitments and reductions which will be achieved in 2014 and 2023 through already adopted measures are based on the emissions inventories from the 2007 AQMP. Between 2008 and 2011, twelve control measures or rules have been adopted or amended by the District. Table 1-2 lists the District's 2007 AQMP commitments and the control measures or rules that were adopted through 2011. The table is largely derived from the PM2.5 SIP revisions submitted to U.S. EPA in 2011, and thus emissions substitutions and other factors are included in the footnotes. As shown in Table 1-2, for the control measures adopted by the District over this period, 22.5 tons per day of VOC reductions, 7.6 tons per day of NOx reductions, 4.0 tons per day of SOx reductions, and 1.0 tons per day of PM2.5 reductions will be achieved by 2014. Additional reductions from these adopted rules will be achieved by 2023.

TABLE 1-2

2007 AQMP Emission Reductions (tons per day) by Measure/Adoption Date

Control Measure #	CONTROL MEASURE TITLE	Adoption Date	COMMITMENT [a]		ACHIEVED [a]	
			2014	2023	2014	2023
VOC EMISSIONS						
MOB-05	AB923 Light-Duty Vehicle High-Emitter Identification Program [NOx, VOC]	On-going	0.8	0.7	--	--
MOB-06	AB923 Medium-Duty Vehicle High-Emitter Identification Program [NOx, VOC]	On-going	0.5	0.6	--	--
FUG-04	Pipeline and Storage Tank Degassing[VOC]- R1149	2008	NA	NA	0.04	0.04
BCM-03	Emission Reductions from Wood Burning Fireplaces and Wood Stoves [All]	2008	NA	NA	0.44	0.70
MCS-01	Facility Modernization [NOx, VOC, PM] - *R1110.2*	2008+	2.0	9.2	0.3	0.3
CTS-01	Emission Reductions from Lubricants [VOC][R1144]	2009	1.9	2.0	3.9	3.2
CTS-04	Emission Reductions from the Reduction of VOC Content of Consumer Products Not Regulated by the State Board [VOC][R1143]	2009	NA	NA	9.7	10.1
MCS-04	Further Emission Reductions from Greenwaste Composting Operations [VOC][R1133.3]	2011	NA	NA	0.88	0.88
MCS-07	Application of All Feasible Measures [VOC][R1113, R1177]	2011	NA	NA	7.2	11.1
FLX-02	Petroleum Refinery Pilot Program [VOC and PM2.5]	(b)	0.7	1.6	0	0
FUG-02	Emission Reductions from Gasoline Transfer and Dispensing Facilities [VOC]	(b)	3.7	4.0	0	0
MCS-05	Emission Reductions from Livestock Waste [VOC]	(b)	0.8	0.6	0	0
EGM-01	Emission Reductions from New or Redevelopment Projects [NOx, VOC, PM2.5]	(c)	NA	0.5	NA	--
		TOTAL VOC REDUCTIONS (TPD)	**10.4**	**19.2**	**22.5**	**26.4**

TABLE 1-2 (continued)

2007 AQMP Emission Reductions (tons per day) by Measure/Adoption Date

Control Measure #	CONTROL MEASURE TITLE	Adoption Date	COMMITMENT [a]		ACHIEVED [a]	
			2014	2023	2014	2023
NOx EMISSIONS						
MOB-05	AB923 Light-Duty Vehicle High-Emitter Identification Program [NOx, VOC]	On-going	0.4	0.4	--	--
MOB-06	AB923 Medium-Duty Vehicle High-Emitter Identification Program [NOx, VOC]	On-going	0.5	0.6	--	--
CMB-01	NOx Reduction from Non-RECLAIM Ovens, Dryers and Furnaces [NOx][R1147]	2008	3.5	4.1	3.5	4.1
BCM-03	Emission Reductions from Wood Burning Fireplaces and Wood Stoves [All][R445]	2008	NA	NA	0.06	0.10
	SOON Program	2008	4-8	NA	1.8	NA
MCS-01	Facility Modernization [NOx, VOC, PM] - *R1110.2, PR1146, PR1146.1*	2008+	1.6	2.2	2.17	3.15
CMB-03	Further NOx Reductions from Space Heaters [NOx]	2009	0.8	1.1	0.1	3.0
EGM-01	Emission Reductions from New or Redevelopment Projects [NOx, VOC, PM2.5]	(c)	0	0.8	--	--
TOTAL NOx REDUCTIONS [d] (TPD)			**10.8**	**9.2**	**7.6**	**10.3**
PM2.5 EMISSIONS						
BCM-03	Emission Reductions from Wood Burning Fireplaces and Wood Stoves [PM2.5]	2008	1.0	1.6	1.0	1.6
FLX-02	Petroleum Refinery Pilot Program [VOC and PM2.5]	(d)	0.4	0.4	--	--
EGM-01	Emission Reductions from New or Redevelopment Projects [NOx, VOC, PM2.5]	(c)	NA	0.5	NA	--
MCS-01	Facility Modernization [NOx, VOC, PM]	(d)	0.4	1.7	0	0
BCM-05	PM Emission Reductions from Under-fired Charbroilers [PM2.5]	(d)	1.1	1.2	--	--
TOTAL PM2.5 REDUCTIONS (TPD)			**2.9**	**5.4**	**1.0**	**1.6**

TABLE 1-2 (concluded)

2007 AQMP Emission Reductions (tons per day) by Measure/Adoption Date

Control Measure #	CONTROL MEASURE TITLE	Adoption Date	COMMITMENT [a]		ACHIEVED [a]	
			2014	2023	2014	2023
SOx EMISSIONS						
CMB-02	Further SOx Reductions for RECLAIM (BARCT) [SOx]	2010	2.9	2.9	4.0	5.7
		TOTAL SOx REDUCTIONS (TPD)	**2.9**	**2.9**	**4.0**	**5.7**

(a) 2014 reductions estimated in average annual day, 2023 in planning inventory.
(b) SIP commitment for VOC reductions in the PM2.5 Plan was met via excess reductions achieved from CTS-04 (R1143).
(c) No SIP emission reduction commitment for the PM2.5 Plan. Rulemaking is delayed due to potential co-benefits of SB375 reduction targets.
(d) Reduction commitment for NOx and PM2.5 reductions in the PM2.5 SIP was met via excess reductions achieved from the 2010 SOx RECLAIM amendments. The PM2.5 forming potential established in the 2007 AQMP is NOx: PM2.5:SOx=1:10:15.

NA: Not applicable, no SIP Reductions quantified in the 2007 AQMP

CARB Actions

Table 1-3 lists the 2007 AQMP's control measure commitments that have been adopted (either entirely or partially) by CARB since the 2007 AQMP was adopted. The emissions are presented in terms of remaining emissions, rather than reductions, due to some significant changes to the inventory that preclude a direct comparison of committed emissions to those achieved. The table is based on SIP revisions submitted to U.S. EPA in 2011, and thus reflect adopted measures through specific dates in 2011 as described in the footnotes. To date, CARB has achieved more than the committed 2014 emissions reductions for all pollutants for these source categories. The same is true for VOC and NOx emissions in 2023.

TABLE 1-3

South Coast Air Basin Remaining Emissions Due to CARB Actions

CARB REGULATIONS	COMMITMENT		ACHIEVED	
	2014[a]	**2023[b]**	**2014[a]**	**2023[b]**
NOx EMISSIONS (TPD)[c]				
Smog Check Improvements (BAR)	134.2	74.3	131.6	73.1
Cleaner In-Use Heavy-Duty Trucks & Buses	151.2	76.8	132.6	49.4
Cleaner In-Use Off-Road Equipment (over 25hp)	28.0	18.9	27.5	15.8
Ship Auxiliary Engine Cold Ironing & Clean Tech.	23.7	40.3	15.6	12.0
Cleaner Main Ship Engines and Fuel - Main Engines	38.5	65.8	20.9	21.3
Accelerated Intro. of Cleaner Line-Haul Locomotives	18.3	21.0	18.3	21.0
Clean Up Existing Harbor Craft	15.2	18.4	11.1	8.4
Cargo Handling Equipment	3.2	1.8	3.2	1.8
New Emission Standards for Recreational Boats	11.0	18.3	11.0	18.3
Co-Benefits from Greenhouse Gas Reduction Measures[d]	--	--	--	--
All other local, state, and federal emissions	166	157	159	147[e]
TOTAL NOx REMAINING EMISSIONS WITH RULES ADOPTED TO DATE	**589**	**493**	**530**	**368**

TABLE 1-3 (continued)

South Coast Air Basin Remaining Emissions Due to CARB Actions

CARB REGULATIONS	COMMITMENT		ACHIEVED	
	2014[a]	2023[b]	2014[a]	2023[b]
VOC EMISSIONS (TPD)[c]				
Smog Check Improvements (BAR)	132.1	97.4	123.5	92.1
Cleaner In-Use Heavy-Duty Trucks & Buses	8.7	6.6	5.4	5.3
Cleaner In-Use Off-Road Equipment (over 25hp)	2.6	2.0	2.5	1.7
Ship Auxiliary Engine Cold Ironing & Clean Tech.	0.9	1.5	0.7	0.9
Cleaner Main Ship Engines and Fuel - Main Engines	1.9	3.2	1.4	2.5
Accelerated Intro. of Cleaner Line-Haul Locomotives	2.3	2.4	2.3	2.4
Clean Up Existing Harbor Craft	1.2	1.0	1.1	0.5
Cargo Handling Equipment	0.3	0.6	0.3	0.6
New Emission Standards for Recreational Boats	37.9	50.8	37.9	50.8
Expanded Off-Road Rec. Vehicle Emission Standards	6.7	13.4	6.7	13.4
Consumer Products Program	102.6	109.5	96.7	102.4
All other local, state, and federal emissions	221	241	206	226[e]
TOTAL VOC REMAINING EMISSIONS WITH RULES ADOPTED TO DATE	**518**	**529**	**485**	**498**
PM2.5 EMISSIONS (TPD)[c]				
Smog Check Improvements (BAR)	7.8	--	7.5	--
Cleaner In-Use Heavy-Duty Trucks & Buses	6.0	--	3.4	--
Cleaner In-Use Off-Road Equipment (over 25hp)	1.3	--	1.3	--
Ship Auxiliary Engine Cold Ironing & Clean Tech.	0.5	--	0.4	--
Cleaner Main Ship Engines and Fuel - Main Engines	3.9	--	0.4	--
Accelerated Intro. of Cleaner Line-Haul Locomotives	0.7	--	0.7	--
Clean Up Existing Harbor Craft	0.6	--	0.4	--
Cargo Handling Equipment	0.1	--	0.1	--
All other local, state, and federal emissions	74	--	73	--

TABLE 1-3 (concluded)

South Coast Air Basin Remaining Emissions Due to CARB Actions

CARB REGULATIONS	COMMITMENT		ACHIEVED	
	2014[a]	2023[b]	2014[a]	2023[b]
TOTAL PM2.5 REMAINING EMISSIONS WITH RULES ADOPTED TO DATE	**95**	**--**	**87**	**--**
SOx EMISSIONS (TPD)[c]				
Cleaner In-Use Heavy-Duty Trucks & Buses	0.3	--	0.3	--
Ship Auxiliary Engine Cold Ironing & Clean Tech.	1.1	--	0.8	--
Cleaner Main Ship Engines and Fuel - Main Engines	38.7	--	1.7	--
All other local, state, and federal emissions	21	--	17	--
TOTAL SOX REMAINING EMISSIONS WITH RULES ADOPTED TO DATE	**61**	--	**20**	--

a. The 2014 emissions data reflect the 2014 Emissions Inventory that was included in the March 2011 *Progress Report on Implementation of PM2.5 State Implementation Plans*. The inventory is in the process of being updated, and may change slightly in the Final AQMP.
b. The 2023 emissions data tables reflect the 2023 Emissions Inventory that was current as of August 2011. The inventory is in the process of being updated, and may change slightly in the Final AQMP.
c. These are remaining emissions. If achieved emissions are lower than the committed emissions, it means the SIP targets are met.
d. Remaining emissions are included in "other local, state, and federal emissions"
e. Includes benefits of local emission reductions that were not reflected in the revised RFP estimates.

The actual emissions inventory in 2008, the base year of the Final 2012 AQMP, can be compared to the previous projections for 2008 in the 2007 AQMP. As shown in Figure 1-4, actual 2008 emissions were lower than 2007 AQMP projections for VOC, NOx, and direct PM2.5. The only exception, SOx, was due to a court ordered stay of a CARB marine vessel regulation that resulted in higher emissions of SOx in 2008 than what was projected. However, the regulation was reinstated in 2009 and beyond, and thus SOx emissions have been lower than projections since 2008.

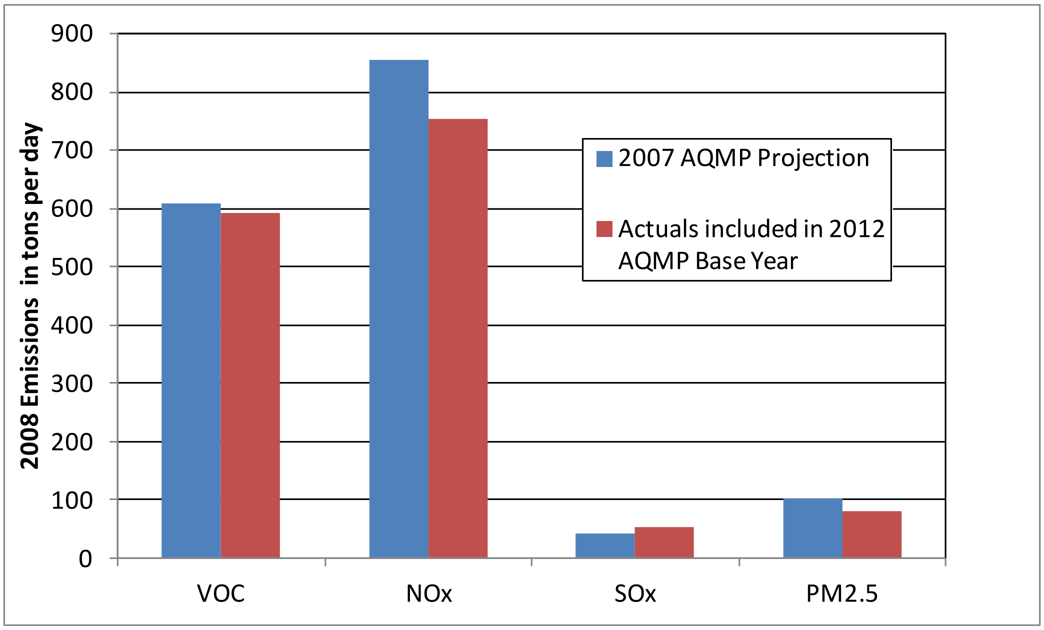


FIGURE 1-4

Actual 2008 Emissions Compared with 2008 Projections in the 2007 AQMP (tpd)

U.S. EPA Actions

The U.S. EPA did not commit to SIP-creditable emissions reductions in their approval of the 2007 AQMP. However, their actions will facilitate future emissions reductions, although some with implementation timelines too late for the Basin's mandated deadlines. U.S. EPA actions taken since the 2007 AQMP include the 2008 Locomotive Rule which promulgated more stringent Tier 3 and Tier 4 emission standards; the 2009 Category 3 Marine Diesel Engine regulation for U.S. flagged ocean-going ships which established more stringent emission standards and marine fuel sulfur limits; and, along with the Canadian Government, the successful proposal to the International Maritime Organization (IMO), which will amend MARPOL Annex VI to designate most North American coastal waters as an emissions control area (ECA) for the control of SOx, NOx, and PM.

FINAL 2012 AQMP

Scope

As mentioned earlier in this chapter, this 2012 AQMP is designed to address the federal 24-hour PM2.5 air quality standards in the Basin, to satisfy the planning requirements of the federal Clean Air Act, and to provide an update on the strategy to meet the 8-hour ozone standard. Once approved by the District Governing Board and CARB, the Final 2012 AQMP will be submitted to U.S. EPA as the 24-hour PM2.5 SIP addressing the 2006 PM2.5 National Ambient Air Quality Standards (NAAQS) and as limited updates to the current 8-hour ozone SIP.

In addition, the 2012 AQMP includes a chapter on the emerging issues surrounding ultrafine particles and near-roadway exposures (Chapter 9). It also includes a chapter on energy issues within the Basin and their relationship to the region's climate and air quality challenges. A separate chapter reporting on the air quality status of the Salton Sea Air Basin (Coachella Valley) is also included. Two separate appendices serve to satisfy recent U.S. EPA requirements for a new attainment demonstration of the revoked 1-hour ozone standard, as well as a vehicle miles travelled (VMT) emissions offset demonstration.

Approach

The U.S. EPA deadline for meeting the 24-hour PM2.5 NAAQS is 2014, with a possible extension of up to five years. The extension is not automatic, and approval of an extension request is based on a demonstration that there are no additional feasible control measures available to move up the attainment date by one year. However, as demonstrated in Chapter 5, with the existing control program and the new control strategy in the Final 2012 AQMP, the Basin can attain the 24-hour PM2.5 standard by 2014. Under the federal CAA, the Basin must achieve the federal NAAQS "as expeditiously as practicable." Therefore, if feasible measures are available, they must be adopted and implemented in the SIP. Chapter 4 of the Final 2012 AQMP outlines a comprehensive control strategy that meets the requirement for expeditious progress towards a 2014 attainment date for the 24-hour PM2.5 NAAQS. The strategy also includes specific measures and commitments to continue implementing measures that assist in attaining the 1997 8-hour ozone (80 ppb) standard by 2023. The 2007 AQMP demonstrated attainment with the 80 ppb standard using a provision of the federal CAA Section 182(e)(5) that allows credit for emissions reductions from future improvements in control techniques and technologies. As shown in the ozone discussion in Chapter 5, these "black box" emissions reductions are still needed to show attainment with the 1997 8-hour ozone NAAQS. Accordingly, these Section 182(e)(5) reductions still account for about 65% of the remaining NOx emissions in 2023. Given the magnitude of these needed emission reductions, it is critical that the District maintain its continuing progress and work actively towards achieving as many emissions reductions as possible, and not wait until subsequent AQMPs to begin to address this looming shortfall.

The control measures contained in the Final 2012 AQMP, described in Chapter 4, can be categorized as follows:

Basin-wide and Episodic Short-term PM2.5 Measures. Measures that apply Basin-wide and in some cases only episodically, have been determined to be feasible, will be implemented prior to the 2014 attainment date, and are required to be implemented under state and federal law.

Contingency Measures. Measures to be automatically implemented if the Basin fails to achieve the 24-hour PM2.5 standard by 2014.

8-hour Ozone Implementation Measures. Measures that provide for necessary actions to meet the 1997 8-hour ozone NAAQS, including technology assessments, key investments, incentives, and rules.

Transportation Control Measures. Measures generally designed to reduce vehicle miles travelled (VMT) as included in SCAG's 2012 Regional Transportation Plan or otherwise.

Many of the control measures proposed are not based on command and control regulations, but instead focus on incentives, outreach, and education to bring about emissions reductions through voluntary participation and behavioral changes.

Need for Integrated and Coordinated Planning

The Basin faces several ozone and PM2.5 attainment challenges as strategies for significant emission reductions become harder to identify and the federal standards continue to become more stringent. California's greenhouse gas reductions targets under AB 32 add new challenges and timelines that affect many of the same sources that emit criteria pollutants. In finding the most cost-effective and efficient path to meet multiple deadlines for multiple air quality and climate objectives, it is best that an integrated planning approach is developed. Responsibilities for achieving these goals span all levels of government, and coordinated and consistent planning efforts among multiple government agencies are a key component of an integrated approach.

To this end and concurrent with the development of the Final 2012 AQMP, the District, CARB, and San Joaquin Valley Air Pollution Control District engaged in a joint effort to take a coordinated and integrated look at strategies needed to meet California's multiple air quality and climate goals. California's success in reducing smog has largely relied on technology and fuel advances, and as health-based air quality standards are tightened, the introduction of cleaner technologies must keep pace. More broadly, a transition to zero- and near-zero emission technologies is necessary to meet 2023 and 2032 air quality standards and 2050 climate goals. Many of the same technologies will address both air quality and climate needs. As such, strategies developed for air quality and climate change planning should be coordinated to make the most efficient use of limited resources and the time needed to develop cleaner technologies. The product of this collaborative effort, the draft *Vision for Clean Air: A Framework for Air Quality and Climate Planning,* examines how those technologies can meet both air quality and climate goals over time. A public review draft of this document is now available (http://www.aqmd.gov/aqmp/2012aqmp/VisionDocument), and serves as context and a resource for the Final 2012 AQMP.

Economic Considerations

As the Basin slowly emerges from the recession, it remains important to be cognizant of the economic impacts of control strategies in the 2012 AQMP. However, history has shown that large improvements to air quality can be achieved concurrent with periods of healthy economic growth. As shown in Figure 1-5, approximately 50% air quality improvements were realized over a time period where the Basin’s population and Gross Domestic Product (GDP, inflation adjusted) increased by approximately 22% and 42%, respectively. But as many businesses continue to struggle under difficult and uncertain economic conditions, it is imperative for the District to work closely with businesses and industry groups to identify the most cost–effective and efficient path to meeting clean air goals.

Furthermore, the effort to achieve multiple clean air goals will require significant public investments in the region. This has the potential to create new Southern California jobs in clean technology sectors such as renewable power, energy efficiency, clean products, and advanced emissions controls. Fulfilling this unique opportunity to concentrate these clean air investments and jobs in the region where the air quality problems exist will require strong partnerships between all levels of government and business interests.

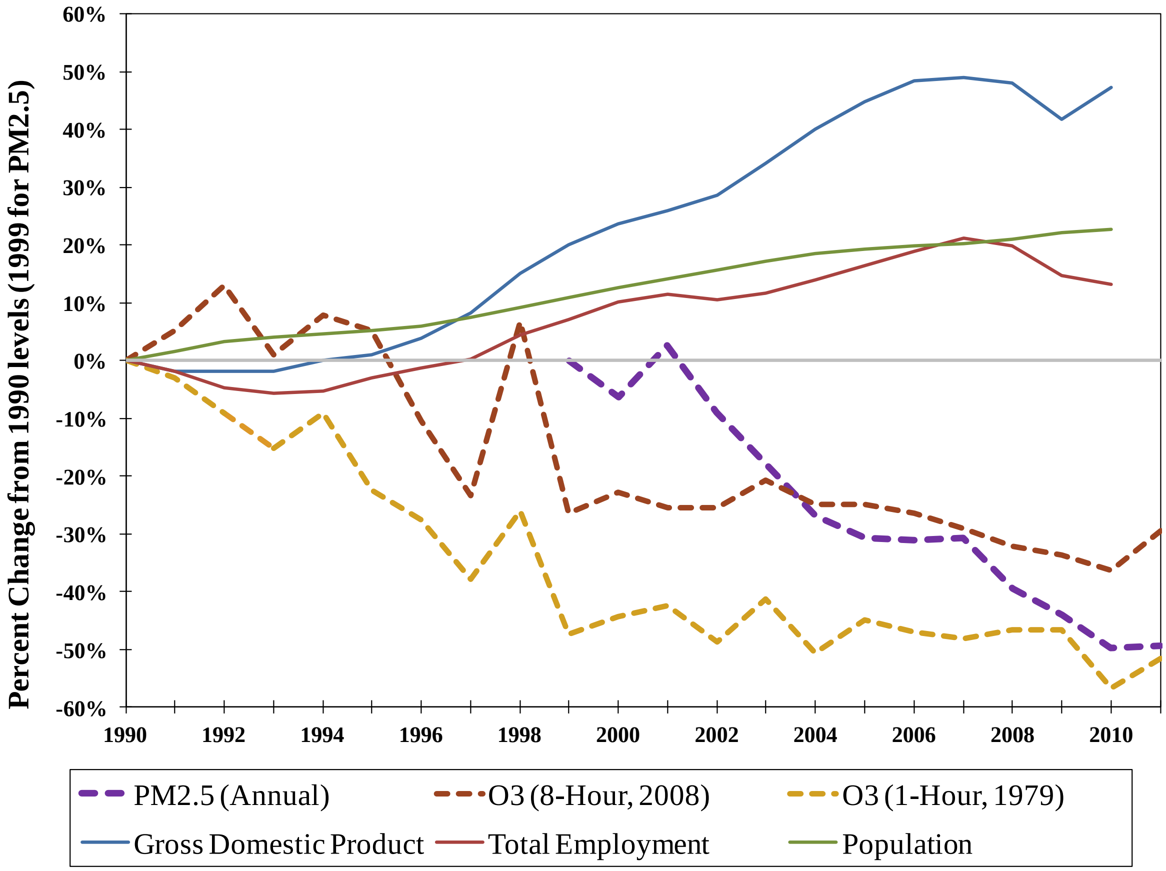


FIGURE 1-5

Percent Change in Air Quality Along with Demographic Data of the 4-County Region (1990-2011)

Federal CAA Planning Requirements Addressed by the Final 2012 AQMP

In November 1990, Congress enacted a series of amendments to the Clean Air Act intended to intensify air pollution control efforts across the nation. One of the primary goals of the 1990 CAA Amendments was an overhaul of the planning provisions for those areas not currently meeting National Ambient Air Quality Standards. The CAA identifies specific emission reduction goals, requires both a demonstration of reasonable further progress and an attainment demonstration, and incorporates more stringent sanctions for failure to attain or to meet interim milestones.

There are several sets of general planning requirements in the federal CAA, both for nonattainment areas (Section 172(c)) and for implementation plans in general (Section 110(a) (2)). These requirements are listed and briefly described in Tables 1-4 and 1-5, respectively. The general provisions apply to all applicable pollutants unless superseded by pollutant-specific requirements. Chapter 6 of the AQMP describes how the Final 2012 AQMP satisfies these CAA requirements.

TABLE 1-4

Nonattainment Plan Provisions
[CAA Section 172(c)]

REQUIREMENT	DESCRIPTION
Reasonably available control measures	Implementation of all reasonably available control measures as expeditiously as practicable.
Reasonable further progress	Provision for reasonable further progress which is defined as "such annual incremental reductions in emissions of the relevant air pollutant as are required for the purpose of ensuring attainment of the applicable national ambient air quality standard by the applicable date."
Inventory	Development and periodic revision of a comprehensive, accurate, current inventory of actual emissions from all sources.
Allowable emission levels	Identification and quantification of allowable emission levels for major new or modified stationary sources.
Permits for new and modified stationary sources	Permit requirements for the construction and operation of new or modified major stationary sources.
Other measures	Inclusion of all enforceable emission limitations and control measures as may be necessary to attain the standard by the applicable attainment deadline.
Contingency measures	Implementation of contingency measures to be undertaken in the event of failure to make reasonable further progress or to attain the NAAQS.

TABLE 1-5

General CAA Requirements for Implementation Plans
[CAA Section 110(a)]

REQUIREMENT	DESCRIPTION
Ambient monitoring	An ambient air quality monitoring program. [Section 110(a)(2)(B)]
Enforceable emission limitations	Enforceable emission limitations or other control measures as needed to meet the requirements of the CAA. [Section 110(a)(2)(A)]
Enforcement and regulation	A program for the enforcement of adopted control measures and emission limitations and regulation of the modification and construction of any stationary source to assure that the NAAQS are achieved. [Section 110(a)(2)(C)]
Interstate transport	Adequate provisions to inhibit emissions that will contribute to nonattainment or interfere with maintenance of NAAQS or interfere with measures required to prevent significant deterioration of air quality or to protect visibility in any other state. [Section 110(a)(2)(D)]
Adequate resources	Assurances that adequate personnel, funding, and authority are available to carry out the plan. [Section 110(a)(2)(E)]
Source testing and monitoring	Requirements for emission monitoring and reporting by the source operators. [Section 110(a)(2)(F)]
Emergency authority	Ability to bring suit to enforce against source presenting imminent and substantial endangerment to public health or environment. [Section 110(a)(2)(G)]
Plan revisions	Provisions for revising the air quality plan to incorporate changes in the standards or in the availability of improved control methods. [Section 110(a)(2)(H)]
Other CAA requirements	Adequate provisions to meet applicable requirements relating to new source review, consultation, notification, and prevention of significant deterioration and visibility protection contained in other sections of the CAA. [Section 110(a)(2)(I),(J)]
Impact assessment	Appropriate air quality modeling to predict the effect of new source emissions on ambient air quality. [Section 110(a)(2)(K)]
Permit fees	Provisions requiring major stationary sources to pay fees to cover reasonable costs for reviewing and acting on permit applications and for implementing and enforcing the permit conditions. [Section 110(a)(2)(L)]
Local government participation	Provisions for consultation and participation by local political subdivisions affected by the plan. [Sections 110(a)(2)(M) & 121]

The CAA requires that most submitted plans include information on tracking plan implementation and milestone compliance. Requirements for these elements are described in Section 182(g). Chapter 4 addresses these issues.

The U.S. EPA also requires a public hearing on many of the required elements in SIP submittals before considering them officially submitted. The District's AQMP public process includes multiple public workshops and public hearings on all of the required elements prior to submittal. Chapter 11 describes the comprehensive outreach program for the Final 2012 AQMP.

State Law Requirements addressed by the Final 2012 AQMP

The California Clean Air Act (CCAA) was signed into law on September 30, 1988, became effective on January 1, 1989, and was amended in 1992. Also known as the Sher Bill (AB 2595), the CCAA established a legal mandate to achieve health-based state air quality standards at the earliest practicable date. The Lewis Presley Act provides that the District's plan must also contain deadlines for compliance with all state ambient air quality standards and the federally mandated primary ambient air quality standards (Health and Safety Code (H&SC) 40462(a)). In September 1996, AB 3048 (Olberg) amended Sections 40716, 40717.5, 40914, 40916, 40918, 40919, 40920, 40920.5, and 44241, and repealed Sections 40457, 40717.1, 40925, and 44246 of the Health and Safety Code relating to air pollution. The amendments to the Health and Safety Code became effective January 1, 1997. Chapter 6 describes how the Final 2012 AQMP meets the state planning requirements under the CCAA, including plan effectiveness, emissions reductions of 5% per year or adoption of all feasible measures, reducing population exposure, and control measure ranking by cost-effectiveness. While these requirements do not specifically apply to PM2.5, they provide useful benchmarks.

FORMAT OF THIS DOCUMENT

This document is organized into eleven chapters, each addressing a specific topic. Each of the remaining chapters is summarized below.

Chapter 2, "Air Quality and Health Effects," discusses the Basin's current air quality in comparison with federal and state air pollution standards.

Chapter 3, "Base Year and Future Emissions," summarizes recent updates to the emissions inventories, estimates current emissions by source and pollutant, and projects future emissions with and without growth.

Chapter 4, "Control Strategy and Implementation," presents the control strategy, specific measures, and implementation schedules to attain the air quality standards by the specified attainment dates.

Chapter 5, "Future Air Quality," describes the modeling approach used in the AQMP and summarizes the Basin's future air quality projections with and without controls.

Chapter 6, "Federal and State Clean Air Act Requirements," discusses specific federal and state requirements as they pertain to the Final 2012 AQMP.

Chapter 7, "Current and Future Air Quality – Desert Nonattainment Areas," describes the air quality status of the Coachella Valley, including emissions inventories, designations, and current and future air quality.

Chapter 8, "Looking Beyond Current Requirements," assesses the Basin's status with respect to the recently proposed lowering of the annual PM2.5 standard from 15 ug/m^3 to 12-13 ug/m^3, as well as potential new ozone standards under consideration.

Chapter 9, "Near-Roadway Exposure and Ultrafine Particles," examines the emerging issue of near-roadway exposure and health impacts, including a focus on ultrafine particles, research needs and potential future actions.

Chapter 10, "Energy and Climate" provides a description of current and projected energy demand and supply issues in the Basin and their relationship to air quality improvement and greenhouse gas mitigation goals.

Chapter 11, "Public Process and Participation" describes the District's public outreach effort associated with the development of the Final 2012 AQMP.

A "Glossary" is provided at the end of the document, presenting definitions of commonly used terms found in the Final 2012 AQMP.

Chapter 2

Air Quality and Health Effects

South Coast Air Quality Management District

Cleaning the air that we breathe...™

CHAPTER 2

AIR QUALITY AND HEALTH EFFECTS

Introduction

Ambient Air Quality Standards

Current Air Quality

Comparison to Other U.S. Areas

Summary

INTRODUCTION

In this chapter, air quality is summarized for the year 2011, along with prior year trends, in both the South Coast Air Basin (Basin) and the Riverside County portion of the Salton Sea Air Basin (SSAB), primarily the Coachella Valley, as monitored by the South Coast Air Quality Management District (District). The District's 2011 air quality is compared to national ambient air quality standards (NAAQS). Nationwide air quality data for 2011 is also briefly summarized in this chapter, comparing air quality in the Basin to that of other U.S. and California urban areas. Health effects of the criteria air pollutants, that is, those that have NAAQS, are also discussed. More detailed information on the health effects of air pollution can be found in Appendix I: Health Effects.

Statistics presented in this chapter indicate the current attainment or non-attainment status of the various NAAQS for the criteria pollutants to assist the District in planning for future attainment. For ozone (O_3) and fine particulate matter (PM2.5, particles less that 2.5 microns in diameter), the main pollutants for which the U.S. EPA has declared the Basin to be a nonattainment area, maps are included to spatially compare the air quality throughout the Basin in 2011. The Los Angeles County portion of the Basin is also currently a nonattainment area for the federal lead (Pb) standard due to source-specific monitoring, but Pb air quality data and attainment has been addressed separately in greater detail in the 2012 Lead SIP for Los Angeles County. The Basin is a nonattainment area for the federal PM10 (particules less than 10 microns in diameter) standard, although a request to U.S. EPA to redesignate to attainment is pending. The Coachella Valley is currently declared a nonattainment area for both ozone and PM10 by U.S. EPA, although a request to redesignate to attainment for PM10 is pending. Appendix II: Current Air Quality provides additional information on current air quality and air quality trends, changes in the NAAQS, the impact on the District's attainment status for different pollutants, and air quality compared to state standards, as well as more information on specific monitoring station data.

There were some minor changes to the AQMD monitoring network since the 2007 AQMP, which included air quality data through 2005. New stations were added at South Long Beach, close to the Ports of Los Angeles and Long Beach, and at Temecula in southern Riverside County. In addition, the extent and frequency of PM2.5 monitoring has been increased throughout the District.

AMBIENT AIR QUALITY STANDARDS

Federal and State Standards

Ambient air quality standards for ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter (PM10 and PM2.5), and lead (Pb) have been set by both the State of California and the federal government. The state has also set standards for sulfates (SO_4^{2-}) and visibility. The state and federal ambient air quality standards for each of the criteria pollutants and their effects on health are summarized in Table 2-1.

Several changes to the NAAQS have occurred since the last AQMP update in 2007. The federal 1-hour ozone standard was revoked by the U.S. EPA and replaced by the 8-hour average ozone standard, effective June 15, 2005. However, the Basin and the former Southeast Desert Modified Air Quality Management Area (which included the Coachella Valley) had not attained the 1-hour federal ozone NAAQS by the attainment date and have some continuing obligations under the former standard. The 8-hour ozone NAAQS was subsequently lowered from 0.08 to 0.075 ppm, effective May 27, 2008. However, the SIP submittal for this standard is not due until 2015. In 2010, U.S. EPA proposed to lower the 8-hour ozone NAAQS again and solicited comments on a proposed standard between 0.060 and 0.070 ppm. To date, U.S. EPA has not taken final action on a lower ozone standard and the NAAQS currently remains at 0.075 ppm, as established in 2008. Statistics presented in this chapter refer to the most current 2008 8-hour ozone standard (0.075 ppm) and the former 1979 1-hour ozone standard for purposes of historical comparison.

U.S. EPA revoked the annual PM10 NAAQS (50 $\mu g/m^3$) and lowered the 24-hour PM2.5 NAAQS from 65 $\mu g/m^3$ to 35 $\mu g/m^3$, effective December 17, 2006. On June 14, 2012, U.S. EPA proposed to strengthen the annual PM2.5 federal standard from 15 $\mu g/m^3$ to a proposed range between 12 and 13 $\mu g/m^3$. U.S. EPA also proposed to require near-roadway PM2.5 monitoring. Final action on the proposed PM2.5 standards is expected by December 14, 2012.

The national standard for Pb was revised on October 15, 2008 to a rolling 3-month average of 0.15 $\mu g/m^3$, from a quarterly average of 1.5 $\mu g/m^3$. Most recently, U.S. EPA established a new 1-hour NO_2 federal standard of 0.100 ppm, effective April 7, 2010, and revised the SO_2 federal standard by establishing a new 1-hour standard of 0.075 ppm and revoking the annual (0.03 ppm) and 24-hour (0.14 ppm) standards, effective August 2, 2010.

TABLE 2-1

Current Ambient Air Quality Standards and Health Effects

AIR POLLUTANT	STATE STANDARD Concentration, Averaging Time	FEDERAL STANDARD (NAAQS) Concentration, Averaging Time	RELEVANT HEALTH EFFECTS[#]
Ozone (O_3)	0.09 ppm, 1-Hour 0.070 ppm, 8-Hour	0.075 ppm, 8-Hour (2008) 0.08 ppm, 8-Hour (1997)	(a) Pulmonary function decrements and localized lung edema in humans and animals; (b) Risk to public health implied by alterations in pulmonary morphology and host defense in animals; (c) Increased mortality risk; (d) Risk to public health implied by altered connective tissue metabolism and altered pulmonary morphology in animals after long-term exposures and pulmonary function decrements in chronically exposed humans; (e) Vegetation damage; (f) Property damage
Carbon Monoxide (CO)	20 ppm, 1-Hour 9.0 ppm, 8-Hour	35 ppm, 1-Hour 9 ppm, 8-Hour	(a) Aggravation of angina pectoris and other aspects of coronary heart disease; (b) Decreased exercise tolerance in persons with peripheral vascular disease and lung disease; (c) Impairment of central nervous system functions; (d) Possible increased risk to fetuses
Nitrogen Dioxide (NO_2)	0.18 ppm, 1-Hour 0.030 ppm, Annual	100 ppb, 1-Hour 0.053 ppm, Annual	(a) Potential to aggravate chronic respiratory disease and respiratory symptoms in sensitive groups; (b) Risk to public health implied by pulmonary and extra-pulmonary biochemical and cellular changes and pulmonary structural changes; (c) Contribution to atmospheric discoloration
Sulfur Dioxide (SO_2)	0.25 ppm, 1-Hour 0.04 ppm, 24-Hour	75 ppb, 1-Hour	Bronchoconstriction accompanied by symptoms which may include wheezing, shortness of breath, and chest tightness during exercise or physical activity in persons with asthma
Suspended Particulate Matter (PM10)	50 µg/m^3, 24-Hour 20 µg/m^3, Annual	150 µg/m^3, 24-Hour	(a) Exacerbation of symptoms in sensitive patients with respiratory or cardiovascular disease; (b) Decline in pulmonary function or growth in children; (c) Increased risk of premature death
Suspended Particulate Matter (PM2.5)	12.0 µg/m^3, Annual	35 µg/m^3, 24-Hour 15.0 µg/m^3, Annual	
Sulfates-PM10 (SO_4^{2-})	25 µg/m^3, 24-Hour	N/A	(a) Decrease in lung function; (b) Aggravation of asthmatic symptoms; (c) Aggravation of cardio-pulmonary disease; (d) Vegetation damage; (e) Degradation of visibility; (f) Property damage
Lead (Pb)	1.5 µg/m^3, 30-day	0.15 µg/m^3, 3-month rolling	(a) Learning disabilities; (b) Impairment of blood formation and nerve conduction
Visibility-Reducing Particles	In sufficient amount such that the extinction coefficient is greater than 0.23 inverse kilometers at relative humidity less than 70 percent, 8-hour average (10am - 6pm)	N/A	Visibility impairment on days when relative humidity is less than 70 percent

ppm – parts per million by volume   ppb – parts per billion by volume
State standards are "not-to-exceed" values; Federal standards follow the design value form of the NAAQS
[#] More detailed health effect information can be found in the 2012 AQMP Appendix I or the U.S. EPA NAAQS documentation at http://www.epa.gov/ttn/naaqs/

U.S. EPA allows certain air quality data to be flagged in the U.S. EPA Air Quality System (AQS) database and not considered for NAAQS attainment status when that data is influenced by exceptional events, such as high winds, wildfires, volcanoes, or some cultural events (Independence Day fireworks) that meet strict requirements. For a few PM measurements in the Basin in 2007 and 2008, the District applied the U.S. EPA Exceptional Events Rule to flag PM10 and PM2.5 data due to high wind natural events, wildfires and Independence Day fireworks (the District has submitted the required documentation and U.S EPA concurrence with these flags is pending). In the Coachella Valley, PM10 data has been flagged for high wind natural events, under the current Exceptional Events Rule and the previous U.S. EPA Natural Events Policy[1]. All of the exceptional event flags through 2011 have been submitted by the District to U.S. EPA's AQS along with the data. The most recent of these are pending submittal of the District's final documentation for each event and all are pending U.S. EPA concurrence. The pending PM10 redesignation request for the Coachella Valley may hinge on U.S EPA's concurrence with the exceptional event flags and the appropriate treatment of these uncontrollable natural events.

In this chapter and in Appendix II, air quality statistics are presented for the maximum concentrations measured at stations or in air basins, as well as for the number of days exceeding state or federal standards. These statistics are instructive in regards to trends and control effectiveness. However, it should be noted that an exceedance of the concentration level of a federal standard does not necessarily mean that the NAAQS was violated or that it would cause a nonattainment designation. The form of the standard must also be considered. For example, for 24-hour PM2.5, the form of the standard is the 98th percentile measurement of all of the 24-hour PM2.5 samples at each station. For 8-hour ozone, the form of the standard is the 4th highest measured 8-hour average concentration at each station. For NAAQS attainment/nonattainment decisions, the most recent 3 years of data are considered (1 year for CO and 24-hour SO_2), along with the form of the standard, and are typically averaged to calculate a *design value*[2] for each station. The overall design value for an air basin is the highest

[1] The U.S. EPA Exceptional Events Rule, *Treatment of Data Influence by Exceptional Events*, became effective May 21, 2007. The previous U.S. EPA *Natural Events Policy* for Particulate Matter was issued May 30, 1996. On July 6, 2012, U.S. EPA released the *Draft Guidance To Implement Requirements for the Treatment of Air Quality Monitoring Data Influenced by Exceptional Events* for public comment.

[2] A design value is a statistic that describes the air quality status of a given area relative to the level and form of the National Ambient Air Quality Standards (NAAQS). For most criteria pollutants, the design value is a 3-year average and takes into account the form of the short-term standard (e.g., 98th percentile, fourth high value, etc.) Design values are especially helpful when the standard is exceedance-based (e.g. 1-hour ozone, 24-hour PM10, etc.) because they are expressed as a concentration instead of an exceedance count, thereby allowing a direct comparison to the level of the standard.

design value of all the stations in that basin. Table 2-2 shows the NAAQS, along with the design value and form of each federal standard.

TABLE 2-2

National Ambient Air Quality Standards (NAAQS) and Design Value Requirements

POLLUTANT	AVERAGING TIME	STANDARD LEVEL	DESIGN VALUES AND FORM OF STANDARDS*
Ozone (O_3)	1-Hour** (1979)	0.12 ppm	Not to be exceeded more than once per year averaged over 3 years
	8-Hour** (1997)	0.08 ppm	Annual fourth highest 8-hour average concentration, averaged over 3 years
	8-Hour (2008)	0.075 ppm	Annual fourth highest 8-hour average concentration, averaged over 3 years
Carbon Monoxide (CO)	1-Hour	35 ppm	Not to be exceeded more than once a year
	8-Hour	9 ppm	
Nitrogen Dioxide (NO_2)	1-Hour	100 ppb	3-year avg. of the annual 98th percentile of the daily maximum 1-hour average concentrations (rounded)
	Annual	0.053 ppm	Annual avg. concentration, averaged over 3 years
Sulfur Dioxide (SO_2)	1-Hour	75 ppb	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	24-Hour#	0.14 ppm	Not to be exceeded more than once per year
	Annual#	0.03 ppm	Annual arithmetic average
Particulate Matter (PM10)	24-Hour	150 μg/m^3	Not to be exceeded more than once per year averaged over 3 years
	Annual**	50 μg/m^3	Annual average concentration, averaged over 3 years
Particulate Matter (PM2.5)	24-Hour	35 μg/m^3	3-year average of the annual 98th percentile of daily 24-hour concentration
	Annual	15.0 μg/m^3	Annual avg. concentration, averaged over 3 years
Lead (Pb)	3-Month Rolling##	0.15 μg/m^3	Highest rolling 3-month average of the 3 years

* Standard is attained when the design value (form of concentration listed) is equal to or less than the NAAQS; for pollutants with the design values based on "exceedances" (1-hour O_3, 24-hour PM10, CO, and 24-hour SO_2), the NAAQS is attained when the concentration associated with the design value is less than or equal to the standard:

- For 1-hour O_3 and 24-hour PM10, the standard is attained when the 4th highest daily concentrations of the 3-year period is less than or equal to the standard
- For CO and 24-hour SO_2, the standard is attained when the 2nd highest daily concentration of the most recent year is equal to or less than the standard

** Standard is revoked or revised. For 1-hour O_3, nonattainment areas have some continuing obligations under the former 1979 standard. For 8-hour O_3, standard is lowered from (0.08 ppm to 0.075 ppm), but the 1997 O_3 standard and most related implementation rules remain in place until the 1997 standard is revoked by U.S. EPA

Annual and 24-hour SO_2 NAAQS will be revoked one year from attainment designations for the new (2010) 1-hour SO_2 standard

3-month rolling averages of the first year (of the three year period) include November and December monthly averages of the prior year. The 3-month average is based on the average of "monthly" averages

NAAQS Attainment Status

Figure 2-1 shows the South Coast and Coachella Valley 3-year design values (2009-2011) for ozone and PM2.5, as a percentage of the corresponding federal standards. The current status of NAAQS attainment for the criteria pollutants is presented in Table 2-3 for the Basin and in Table 2-4 for the Riverside County portion of the SSAB (Coachella Valley).

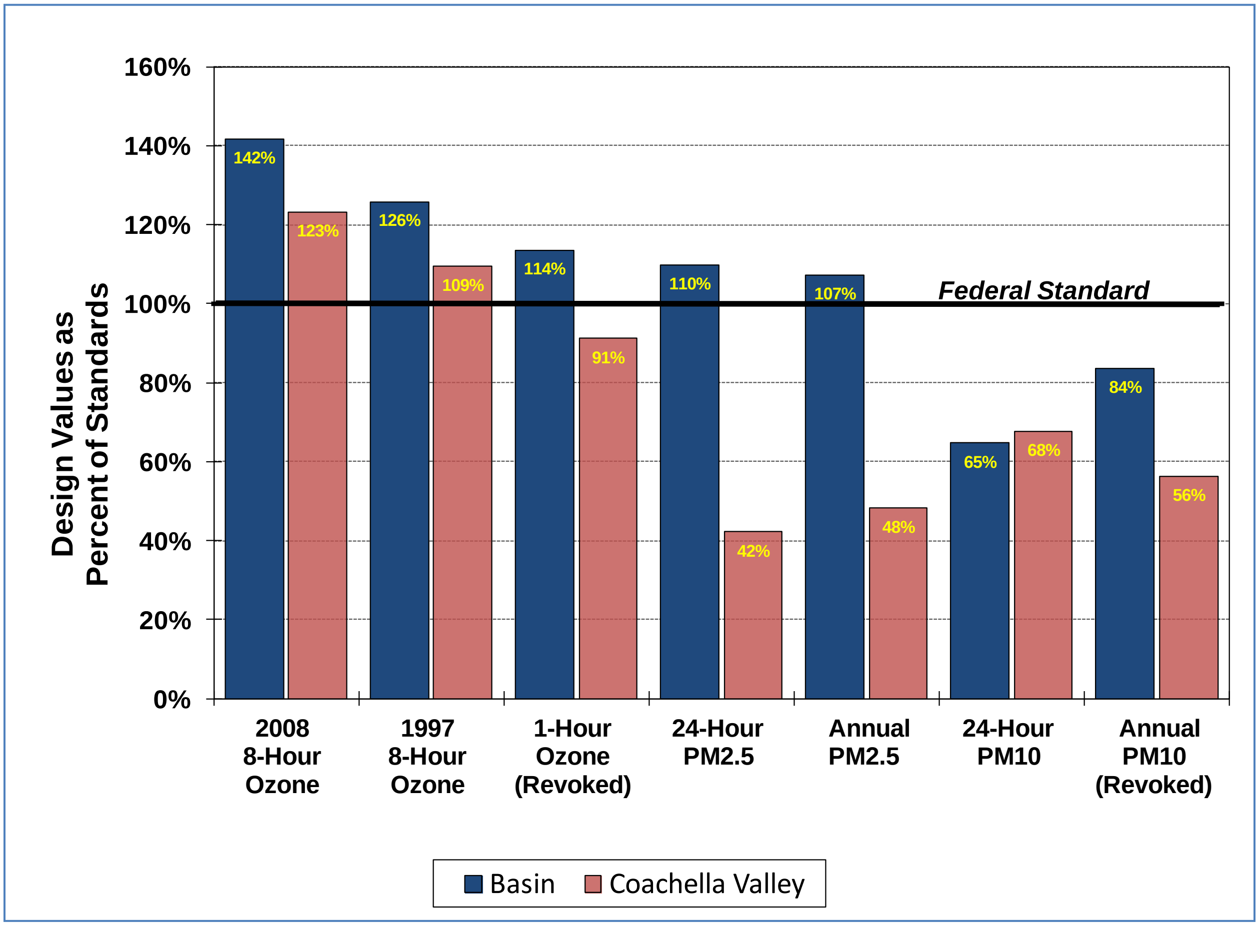


FIGURE 2-1

South Coast Air Basin and Coachella Valley 3-Year (2009-2011) Design Values
(Percentage of Federal Standards, by Criteria Pollutant)

TABLE 2-3

National Ambient Air Quality Standards (NAAQS) Attainment Status
South Coast Air Basin

CRITERIA POLLUTANT	AVERAGING TIME	DESIGNATION [a]	ATTAINMENT DATE [b]
1979 **1-Hour Ozone**[c]	1-Hour (0.12 ppm)	Nonattainment (Extreme)	11/15/2010 (not attained)[c]
1997 **8-Hour Ozone**[d]	8-Hour (0.08 ppm)	Nonattainment (Extreme)	6/15/2024
2008 **8-Hour Ozone**	8-Hour (0.075 ppm)	Nonattainment (Extreme)	12/31/2032
CO	1-Hour (35 ppm) 8-Hour (9 ppm)	Attainment (Maintenance)	6/11/2007 (attained)
NO_2[e]	1-Hour (100 ppb)	Unclassifiable/Attainment	Attained
	Annual (0.053 ppm)	Attainment (Maintenance)	9/22/1998
SO_2[f]	1-Hour (75 ppb)	Designations Pending	Pending
	24-Hour (0.14 ppm) Annual (0.03 ppm)	Unclassifiable/Attainment	3/19/1979 (attained)
PM10	24-hour (150 µg/m^3)	Nonattainment (Serious)[g]	12/31/2006 (redesignation request submitted)[g]
PM2.5	24-Hour (35 µg/m^3)	Nonattainment	12/14/2014[h]
	Annual (15.0 µg/m^3)	Nonattainment	4/5/2015
Lead	3-Months Rolling (0.15 µg/m^3)	Nonattainment (Partial)[i]	12/31/2015

a) U.S. EPA often only declares Nonattainment areas; everywhere else is listed as Unclassifiable/Attainment or Unclassifiable

b) A design value below the NAAQS for data through the full year or smog season prior to the attainment date is typically required for attainment demonstration

c) 1-hour O_3 standard (0.12 ppm) was revoked, effective June 15, 2005; however, the Basin has not attained this standard based on 2008-2010 data and has some continuing obligations under the former standard

d) 1997 8-hour O_3 standard (0.08 ppm) was reduced (0.075 ppm), effective May 27, 2008; the 1997 O_3 standard and most related implementation rules remain in place until the 1997 standard is revoked by U.S. EPA

e) New NO_2 1-hour standard, effective August 2, 2010; attainment designations January 20, 2012; annual NO_2 standard retained

f) The 1971 annual and 24-hour SO_2 standards were revoked, effective August 23, 2010; however, these 1971 standards will remain in effect until one year after U.S. EPA promulgates area designations for the 2010 SO_2 1-hour standard. Area designations are expected in 2012, with Basin designated Unclassifiable /Attainment

g) Annual PM10 standard was revoked, effective December 18, 2006; redesignation request to Attainment of the 24-hour PM10 standard is pending with U.S. EPA

h) Attainment deadline for the 2006 24-Hour PM2.5 NAAQS is December 14, 2014

i) Partial Nonattainment designation – Los Angeles County portion of Basin only

TABLE 2-4

National Ambient Air Quality Standards (NAAQS) Attainment Status
Coachella Valley Portion of the Salton Sea Air Basin

CRITERIA POLLUTANT	AVERAGING TIME	DESIGNATION [a)]	ATTAINMENT DATE [b)]
1979 **1-Hour Ozone**[c)]	1-Hour (0.12 ppm)	Nonattainment (Severe-17)	11/15/2007 (not timely attained[c)])
1997 **8-Hour Ozone**[d)]	8-Hour (0.08 ppm)	Nonattainment (Severe-15)	6/15/2019
2008 **8-Hour Ozone**	8-Hour (0.075 ppm)	Nonattainment (Severe-15)	12/31/2027
CO	1-Hour (35 ppm) 8-Hour (9 ppm)	Unclassifiable/Attainment	Attained
NO_2[e)]	1-Hour (100 ppb)	Unclassifiable/Attainment	Attained
	Annual (0.053 ppm)	Unclassifiable/Attainment	Attained
SO_2[f)]	1-Hour (75 ppb)	Designations Pending	Pending
	24-Hour (0.14 ppm) Annual (0.03 ppm)	Unclassifiable/Attainment	Attained
PM10	24-hour (150 $\mu g/m^3$)	Nonattainment (Serious)[g)]	12/31/2006 (redesignation request submitted)[g)]
PM2.5	24-Hour (35 $\mu g/m^3$) Annual (15.0 $\mu g/m^3$)	Unclassifiable/Attainment	Attained
Lead	3-Months Rolling (0.15 $\mu g/m^3$)	Unclassifiable/Attainment	Attained

a) U.S. EPA often only declares Nonattainment areas; everywhere else is listed as Unclassifiable/Attainment or Unclassifiable
b) A design value below the NAAQS for data through the full year or smog season prior to the attainment date is typically required for attainment demonstration
c) 1-hour O_3 standard (0.13 ppm) was revoked, effective June 15, 2005; the Southeast Desert Modified Air Quality Management Area, including the Coachella Valley, has not attained this standard based on 2005-2007 data and has some continuing obligations under the former standard (latest 2009-2011 data shows attainment)
d) 1997 8-hour O_3 standard (0.08 ppm) was reduced (0.075 ppm), effective May 27, 2008; the 1997 O_3 standard and most related implementation rules remain in place until the 1997 standard is revoked by U.S. EPA
e) New NO_2 1-hour standard, effective August 2, 2010; attainment designations January 20, 2012; annual NO_2 standard retained
f) The 1971 Annual and 24-hour SO_2 standards were revoked, effective August 23, 2010; however, these 1971 standards will remain in effect until one year after U.S. EPA promulgates area designations for the 2010 SO_2 1-hour standard. Area designations expected in 2012 with SSAB designated Unclassifiable /Attainment
g) Annual PM10 standard was revoked, effective December 18, 2006; redesignation request to Attainment of the 24-hour PM10 standard is pending with U.S. EPA

In 2011, the Basin exceeded federal standards for either ozone or PM2.5 at one or more locations on a total of 124 days, based on the current federal standards for 8-hour ozone and 24-hour PM2.5. Despite substantial improvement in air quality over the past few decades, some air monitoring stations in the Basin still exceed the NAAQS for ozone more frequently than any other stations in the U.S. In 2011, three of the top five stations in the nation most frequently exceeding the 8-hour federal ozone NAAQS were located within the Basin (i.e., Central San Bernardino Mountains, East San Bernardino Valley and Metropolitan Riverside County). In the year 2011, the former 1-hour[3] and current 8-hour average federal standard levels for ozone were exceeded at one or more Basin locations on 16 and 106 days, respectively.

PM2.5 in the Basin has improved significantly in recent years, with 2010 and 2011 being the cleanest years on record. In 2011, only one station in the Basin (Metropolitan Riverside County at Mira Loma) exceeded the annual PM2.5 NAAQS and the 98th percentile form of the 24-hour PM2.5 NAAQS, as well as the 3-year design values for these standards. (Although other stations had 24-hour averages exceeding the federal 24-hour PM2.5 standard concentration level in 2011, the 98th percentile concentration did not exceed.) Basin-wide, the federal PM2.5 24-hour standard level was exceeded in 2011 on 17 sampling days[4].

The Basin and the Coachella Valley have technically met the PM10 NAAQS and redesignation for attainment for the federal PM10 standard has been requested for both. These requests are still pending with U.S. EPA at this time[5].

The District is currently in attainment for the federal standards for SO_2, CO, and NO_2. While the concentration level of the new 1-hour NO_2 federal standard (100 ppb) was exceeded in the Basin at two stations (Central Los Angeles and Long Beach, on the same day) in 2011, the NAAQS NO_2 design value has not been exceeded (the 3-year average of the annual 98th percentile of the daily 1-hour maximums). Therefore, the Basin remains in attainment of the NO_2 NAAQS. U.S. EPA requirements for future

[3] The federal 1-hour O_3 NAAQS has been revoked by U.S. EPA, although certain nonattainment areas, including the Basin, may be still required to demonstrate attainment of that standard based on recent court decisions.

[4] The number of PM exceedances may have been higher at some locations, since PM2.5 samples are collected every 3 days at most sites. However, seven sites sample every day, including the Basin maximum concentration stations. PM10 filter samples are collected every 6 days, except at the design value maximum sites in the Basin and the Coachella Valley at which samples are collected every 3 days. Daily PM10 data for the Basin maximum stations is provided by supplementing the filter measurements with Federal Equivalent Method (FEM) continuous monitors. The gaseous pollutants, including O_3, NO_2, SO_2, and CO, are sampled continuously.

[5] U.S. EPA has requested additional PM10 monitoring in the southeastern Coachella Valley for a 1-year period to further assess windblown dust in that area. This project is currently ongoing.

near-road NO_2 measurements are not a part of the current ambient NO_2 NAAQS determinations.

U.S. EPA designated the Los Angeles County portion of the Basin (excluding the high desert areas, and San Clemente and Santa Catalina Islands) as nonattainment for the recently revised (2008) federal lead standard (0.15 μg/m^3, rolling 3-month average), due to the addition of source- specific monitoring under the new federal regulation. This designation was based on two source-specific monitors in Vernon and in the City of Industry exceeding the new standard in the 2007-2009 period of data used. For the most recent 2009-2011 data period, only one of these stations (Vernon) still exceeded the lead standard, with a maximum 3-month rolling average of 0.67 μg/m^3 occurring in 2009. In 2011, the rolling 3-month average at that site was 0.46 μg/m^3.

The remainder of the Basin, outside the Los Angeles County nonattainment area, and the Coachella Valley remain in attainment of the 2008 lead standard and no ambient monitors exceed that are not source-oriented. For areas in attainment of the old 1978 lead standard (1.5 μg/m^3, as a quarterly average), the old standard remained in effect until one year after an area was designated for the 2008 standard. While the entire Basin and the Coachella Valley have remained in attainment of the 1978 lead standard, U.S. EPA's current lead designations for the new standard became effective on December 31, 2010; thus, the old standard is now superseded by the 2008 revised NAAQS. A separate SIP revision addressing the 2008 lead standard has been submitted to U.S. EPA.

CURRENT AIR QUALITY

In 2011, O_3, PM2.5, NO_2 and Pb exceeded federal standard concentration levels at one or more of the routine monitoring stations in the Basin. An exceedance of the concentration level does not necessarily mean a violation of the NAAQS, given that the form of the standard must be considered. For example, the Basin did not violate the federal NO_2 standard, based on the form of the standard. Ozone and PM10 concentrations exceeded the federal standard concentration levels in the Coachella Valley.

The PM2.5 2011 maximum 24-hour average (94.6 μg/m^3, measured in the East San Gabriel Valley area) and annual average (15.3 μg/m^3, measured in the Metropolitan Riverside County area) concentrations were 266 and 101 percent of the federal 24-hour and annual average standard concentration levels, respectively. The highest 24-

hour PM2.5 concentration in the Basin, mentioned above, was recorded on July 5, 2011, associated with Independence Day firework activities and has been flagged in the U.S. EPA Air Quality System (AQS) database for exclusion for NAAQS compliance consideration according to the U.S. EPA Exceptional Event Rule. The next highest 24-hour average PM2.5 concentration was 65 $\mu g/m^3$ recorded in Central San Bernardino Valley. The PM2.5 federal standard was nearly exceeded on one day in the Coachella Valley, during an exceptional event in which dust was entrained by outflow from a large summertime thunderstorm complex over Arizona and Mexico, transporting high concentrations of PM10 and PM2.5 into the Coachella Valley. None of these three stations with the highest 24-hour average PM2.5 concentrations had 98th percentile concentrations exceeding the standard. Only the Metropolitan Riverside County (Mira Loma) station had a 98th percentile concentration over the 24-hour federal standard.

The 2011 maximum PM10 24-hour average concentration measured in the South Coast Air Basin was 152 $\mu g/m^3$ in the Metropolitan Riverside County area, nearly 100% of the federal standard (but not exceeding it, since a concentration of 155 $\mu g/m^3$ is needed to exceed the PM10 standard). This maximum 24-hour average concentration was measured with a Federal Equivalent Method (FEM) continuous monitor. The highest 24-hour PM10 concentration in the Basin measured with the Federal Reference Method (FRM) filter sampler was 84 $\mu g/m^3$ recorded in Central San Bernardino Valley, 56 percent of the standard. The maximum annual average PM10 concentration (42.3 $\mu g/m^3$ in the Metropolitan Riverside County area) is 85 percent of the former (now revoked) federal annual average standard level. The two routine AQMD monitoring stations in the Coachella Valley exceeded the 24-hour PM10 federal standard on two days, both related to windblown dust generated by thunderstorm activity. These two days have been flagged by the District in the U.S. EPA AQS database for consideration under the Exceptional Event Rule.

The 2011 maximum ozone concentrations continued to exceed federal standards by wide margins. Maximum 1-hour and 8-hour average ozone concentrations (0.160 ppm and 0.136 ppm, both recorded in the Central San Bernardino Mountains area) were 128 and 181 percent of the former 1-hour and current 8-hour federal standards, respectively. The Coachella Valley did not exceed the former 1-hour federal standard in 2011, but the maximum 8-hour concentration (0.098 ppm) was 130 percent of the current federal standard.

The maximum 1-hour average NO_2 concentration in 2011 (110 ppb, measured in Central Los Angeles) was 109 percent of the federal standard, exceeding the concentration level, but not the 98th percentile form of the NAAQS. Lead concentrations in 2011 were well below the recently (2008) revised federal standard at all ambient monitoring sites not located near lead sources. However, the source-specific monitoring site immediately downwind of a stationary lead source in the City of Vernon recorded a maximum 3-month rolling average of 0.46 μg/m^3, or 297 percent of the standard. Concentrations of other criteria pollutants (SO_2 and CO) remained well below the federal standards.

Figure 2-2 shows the trend of maximum pollutant concentrations in the Basin for the past two decades, as percentages of the corresponding federal standards. Most pollutants show significant improvement over the years, with PM2.5 showing the most dramatic decrease. Again, these are maximum concentrations and actual attainment of the standards is based on the design value.

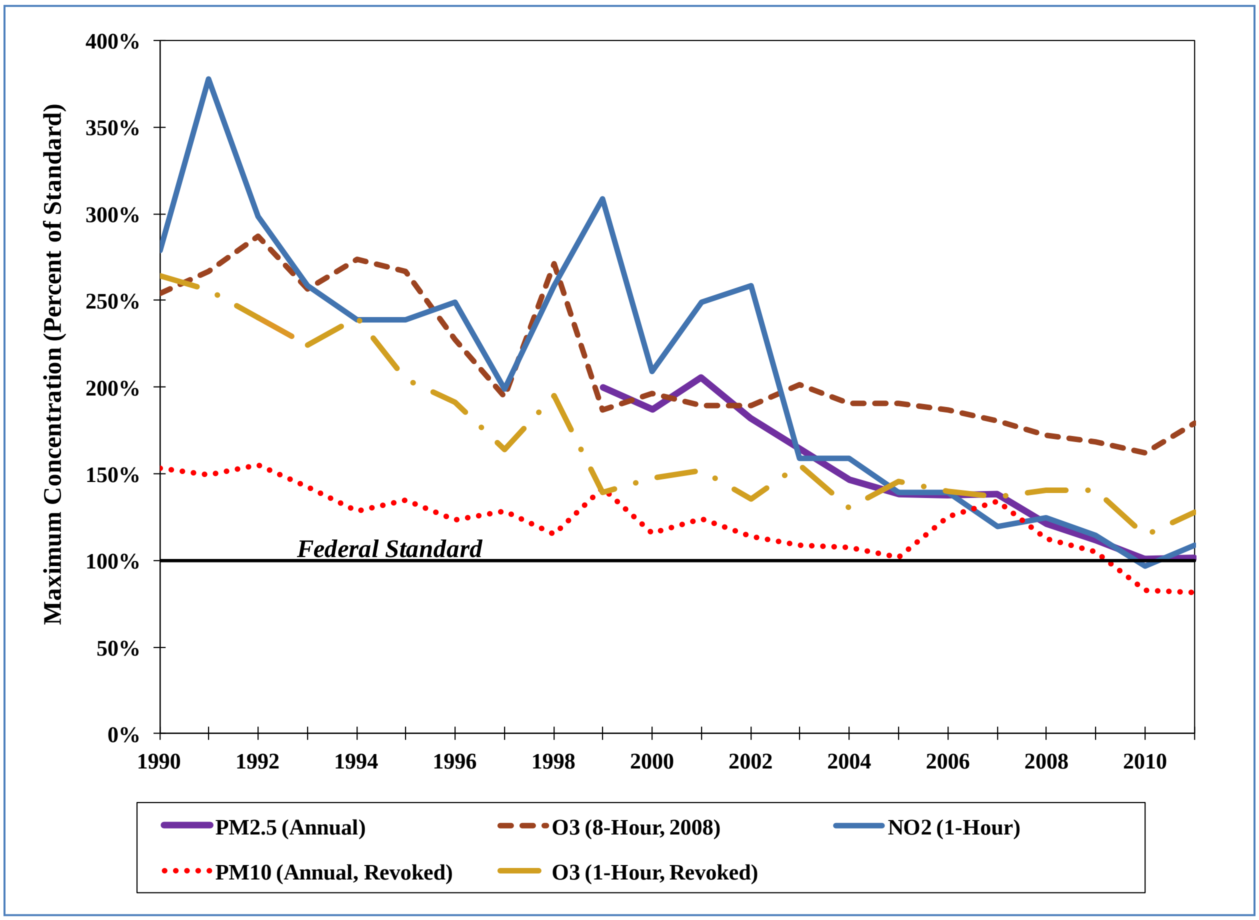


FIGURE 2-2

Trends of South Coast Air Basin Maximum Pollutant Concentrations
(Percentages of Federal Standards)

Particulate Matter (PM2.5 and PM10) Specific Information

Health Effects, Particulate Matter

A significant body of peer-reviewed scientific research, including studies conducted in Southern California, points to adverse impacts of particulate matter air pollution on both increased illness (morbidity) and increased death rates (mortality). The 2009 U.S. EPA *Integrated Science Assessment for Particulate Matter*[6] describes these health effects and discusses the state of the scientific knowledge. A summary of health effects information and additional references can also be found in the 2012 AQMP, Appendix I.

There was considerable controversy and debate surrounding the review of particulate matter health effects and the consideration of ambient air quality standards when U.S. EPA promulgated the initial PM2.5 standards in 1997[7]. Since that time, numerous additional studies have been published[8]. In addition, some of the key studies supporting the 1997 standards were closely scrutinized and the analyses repeated and extended. These reanalyses confirmed the initial findings associating adverse health effects with PM exposures.

Several studies have found correlations between elevated ambient particulate matter levels and an increase in mortality rates, respiratory infections, number and severity of asthma attacks, and the number of hospital admissions in different parts of the United States and in various areas around the world. In recent years, studies have reported an association between long-term exposure to PM2.5 and increased mortality, reduction in life-span, and an increased mortality from lung cancer.

Daily fluctuations in PM2.5 concentration levels have also been related to increased mortality due to cardiovascular or respiratory diseases, hospital admissions for acute respiratory conditions, school and kindergarten absences, a decrease in respiratory function in normal children, and increased medication use in children and adults with asthma. Long-term exposure to PM has been found to be associated with reduced lung function growth in children. The elderly, people with pre-existing respiratory

[6] U.S. EPA. (2009). Integrated Science Assessment for Particulate Matter (Final Report). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-08/139F.
[7] Vedal, S. (1997). Critical Review. Ambient Particles and Health: Lines that Divide. JAMA, 47(5):551-581.
[8] Kaiser, J. (2005). Mounting Evidence Indicts Fine-Particle Pollution. Science, 307:1858-1861.
Enstrom, J.E. (2005), "Fine particulate air pollution and total mortality among elderly Californians, 1973–2002," *Inhalation Toxicology* 17:803–16

and/or cardiovascular disease, and children appear to be more susceptible to the effects of PM10 and PM2.5.

The U.S. EPA, in its most recent review, has concluded that long term exposure to PM2.5 is causally related to increases in mortality rates. Despite this, skepticism remains among some quarters whether exposures to PM2.5 in California are responsible for increases in mortality.[9] An expanded discussion of studies relating to PM exposures and mortality is contained in Appendix I of this document.

Air Quality, PM2.5

The District began regular monitoring of PM2.5 in 1999 following the U.S. EPA's adoption of the national PM2.5 standards in 1997. In 2011, PM2.5 concentrations were monitored at 21 locations throughout the District, 20 of which had filter-based FRM monitoring sites while one had only continuous monitoring. Six sites had collocated, continuous monitoring in addition to the FRM samplers. The maximum 24-hour and annual average PM2.5 concentrations in 2011 are shown in Tables 2-5 and 2-6.

Figure 2-3 maps the distribution of annual average PM2.5 concentrations in different areas of the Basin. Similar to PM10 concentrations, PM2.5 concentrations were higher in the inland valley areas of metropolitan Riverside County (highest at the Mira Loma Station). PM2.5 concentrations were also elevated in the metropolitan area of Los Angeles County, but did not exceed the level of the annual federal standard in 2011. Although maximum 24-hour concentrations exceed the standard, the 98th percentile form of the 2009-2011 design value only exceeded the standard at one station in Metropolitan Riverside County (Mira Loma).

The higher PM2.5 concentrations in the Basin are mainly due to the secondary formation of smaller particulates resulting from mobile, stationary and area source emissions of precursor gases (i.e., NOx, SOx, NH_4, and VOC) that are converted to PM in the atmosphere. In contrast to PM10, PM2.5 concentrations were low in the Coachella Valley area of SSAB. PM10 concentrations are normally higher in the desert areas due to windblown and fugitive dust emissions; PM2.5 is relatively low in the desert area due to fewer combustion-related emissions sources.

[9] CARB Symposium: Estimating Premature Deaths from Long-term Exposure to PM2.5, February 26, 2010, [http://www.arb.ca.gov/research/health/pm-mort/pm-mort-ws_02-26-10.htm].

TABLE 2-5

2011 Maximum 24-hour Average PM2.5 Concentrations by Basin and County

BASIN/COUNTY	MAXIMUM 24-HR AVERAGE# (μG/M³)	PERCENT OF FEDERAL STANDARD* (35 μG/M³)	AREA
South Coast Air Basin			
Los Angeles**	49.5	139	East San Gabriel Valley
Orange	39.2	110	Central Orange County
Riverside	60.8	171	Metropolitan Riverside County
San Bernardino	65.0	183	Central San Bernardino Valley
Salton Sea Air Basin			
Riverside***	35.4	99.7	Coachella Valley

\# Based on FRM data

* Although maximum 24-hour concentrations exceed the standard, the 98th percentile form of the 2009-2011 design value only exceeded the standard at one station in Metropolitan Riverside County (Mira Loma)

** One higher concentration that was recorded due to "Independence Day" firework activities has been flagged for exclusion from NAAQS comparison in accordance with the U.S. EPA Exceptional Events Rule; with this data included, the 2009-2011 design value for East San Gabriel Valley would also exceed the federal standard

*** While this concentration of 35.4 μg/m³ is near the level of the standard, it is technically not exceeding the standard (35.5 μg/m³ exceeds); this concentration was associated with a high wind exceptional event

TABLE 2-6

2011 Maximum Annual Average PM2.5 Concentrations by Basin and County

BASIN/COUNTY	ANNUAL AVERAGE* (μG/M³)	PERCENT OF FEDERAL STANDARD (15 μG/M³)	AREA
South Coast Air Basin			
Los Angeles	13.3	89	Central Los Angeles
Orange	11.0	73	Central Orange County
Riverside	15.3	101	Metropolitan Riverside County
San Bernardino	13.3	89	Southwest San Bernardino Valley
Salton Sea Air Basin			
Riverside	7.1	47	Coachella Valley

* Based on FRM data

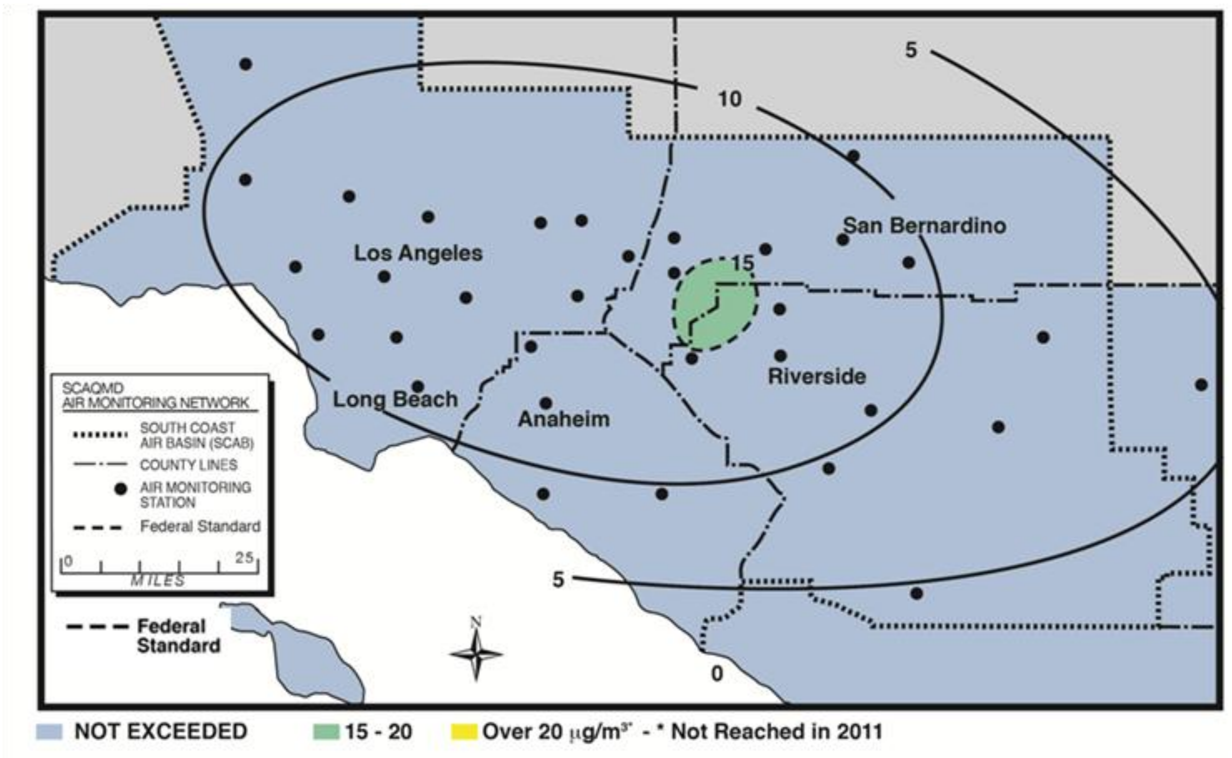


FIGURE 2-3

2011 PM2.5: Annual Average Concentration Compared to the Federal Standard
(Federal standard = 15 µg/m^3, annual arithmetic mean)

<u>Air Quality, PM10</u>

In 2011, the District monitored PM10 concentrations at 25 routine sampling locations, 22 with Federal Reference Method (FRM) filter samplers and 3 with Federal Equivalent Method (FEM) continuous monitors. Five sites had collocated FRM and FEM samplers. Maximum 24-hour and annual average PM10 concentrations in 2011 are shown in Tables 2-7 and 2-8.

The highest annual PM10 concentrations were recorded in Riverside and San Bernardino Counties, in and around the metropolitan Riverside County area and further inland in the San Bernardino valley areas. The federal 24-hour standard was not exceeded at any of the locations monitored in 2011, although Riverside County came close with a 24-hour average concentration of 152 µg/m^3 (155 µg/m^3 is needed to exceed). The revoked annual average PM10 federal standard (50 µg/m^3) was not exceeded in either the Basin or the Coachella Valley in 2011. The much more stringent state standards were exceeded in most areas of the Basin and in the Coachella Valley.

TABLE 2-7

2011 Maximum 24-hour Average PM10 Concentrations by Basin and County

BASIN/COUNTY	MAXIMUM 24-HR AVERAGE* (µG/M^3)	PERCENT OF FEDERAL STANDARD (150 µG/M^3)$^{\#}$	AREA
South Coast Air Basin			
Los Angeles	119	77	Central Los Angeles
Orange	79	51	Central Orange County
Riverside	152	98	Metropolitan Riverside County
San Bernardino	127	82	Central San Bernardino Valley
Salton Sea Air Basin**			
Riverside	120	77	Coachella Valley

* Based on the FRM and FEM data

** Higher concentrations were recorded for high wind events in the Coachella Valley which have been flagged for exclusion from NAAQS comparison in accordance with the U.S. EPA Exceptional Events Rule

155 µg/m^3 is needed to exceed the PM10 standard

TABLE 2-8

2011 Maximum Annual Average PM10 Concentrations by Basin and County

BASIN/COUNTY	ANNUAL AVERAGE* (µG/M^3)	PERCENT OF FEDERAL STANDARD** (50 µG/M^3)	AREA
South Coast Air Basin			
Los Angeles	32.7	64	East San Gabriel Valley
Orange	24.9	49	Central Orange County
Riverside	41.4	81	Metropolitan Riverside County
San Bernardino	31.8	62	Central San Bernardino Valley
Salton Sea Air Basin			
Riverside	32.6	64	Coachella Valley

* Based on the FRM and FEM data

** The federal annual PM10 standard was revoked in 2006

Ozone (O_3) Specific Information

Health Effects, O_3

The adverse effects of ozone air pollution exposure on health have been studied for many years, as is documented by a significant body of peer-reviewed scientific research, including studies conducted in southern California. The 2006 U.S. EPA document, *Air Quality Criteria for Ozone and Related Photochemical Oxidants*[10], describes these health effects and discusses the state of the scientific knowledge and research. A summary of health effects information and additional references can also be found in the 2012 AQMP, Appendix I.

Individuals exercising outdoors, children, and people with preexisting lung disease, such as asthma and chronic pulmonary lung disease, are considered to be the most susceptible sub-groups to ozone effects. Short-term exposures (lasting for a few hours) to ozone at levels typically observed in Southern California can result in breathing pattern changes, reduction of breathing capacity, increased susceptibility to infections, inflammation of the lung tissue, and some immunological changes. Elevated ozone levels are associated with increased school absences and daily hospital admission rates. An increased risk for asthma has been found in children who participate in multiple sports and live in high ozone communities.

Ozone exposure under exercising conditions is known to increase the severity of the above-mentioned observed responses. Animal studies suggest that exposures to a combination of pollutants which include ozone may be more toxic than exposure to ozone alone. Although lung volume and resistance changes observed after a single exposure diminish with repeated exposures, biochemical and cellular changes appear to persist, which can lead to subsequent lung structural changes.

Air Quality, O_3

In 2011, the District regularly monitored ozone concentrations at 29 locations in the Basin and the Coachella Valley portion of the SSAB. All areas monitored measured 1-hour average ozone levels well below the Stage 1 episode level (0.20 ppm), but the maximum concentrations measured in the Basin exceeded the health advisory level (0.15 ppm, 1-hour) in San Bernardino County. The maximum ozone concentrations in Los Angeles, Riverside and San Bernardino Counties all exceeded the former

[10] U.S. EPA. (2006). Air Quality Criteria for Ozone and Related Photochemical Oxidants (2006 Final). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-05/004aF-cF.

1-hour federal standard in 2011; Orange County and the Coachella Valley did not exceed that standard. Maximum ozone concentrations in the SSAB areas monitored by the District were lower than in the Basin and were below the health advisory level. All counties of the Basin and the Coachella Valley exceeded the current 8-hour ozone standard in 2011. Tables 2-9 and 2-10 show maximum 1-hour and 8-hour ozone concentrations by air basin and county.

TABLE 2-9

2011 Maximum 1-Hour Average Ozone Concentrations by Basin and County

BASIN/COUNTY	MAXIMUM 1-HR AVERAGE (PPM)	PERCENT OF FEDERAL STANDARD (0.12 PPM)	AREA
South Coast Air Basin			
Los Angeles	0.144	115	Santa Clarita Valley
Orange	0.095	76	North Orange County
Riverside	0.133	106	Lake Elsinore
San Bernardino	0.160	128	Central San Bernardino Mountains
Salton Sea Air Basin			
Riverside	0.124	99	Coachella Valley

TABLE 2-10

2011 Maximum 8-Hour Average Ozone Concentrations by Basin and County

BASIN/COUNTY	MAXIMUM 8-HR AVERAGE (PPM)	PERCENT OF FEDERAL STANDARD (0.075 PPM)	AREA
South Coast Air Basin			
Los Angeles	0.122	162	Santa Clarita Valley
Orange	0.083	110	Saddleback Valley
Riverside	0.115	152	Metropolitan Riverside County
San Bernardino	0.136	180	Central San Bernardino Mountains
Salton Sea Air Basin			
Riverside	0.098	130	Coachella Valley

The number of days exceeding federal standards for ozone in the Basin varies widely by area. Figures 2-4 and 2-5 map the number of days in 2011 exceeding the current 8-hour and former 1-hour ozone federal standards in different areas of the Basin in 2011. The former 1-hour federal standard was not exceeded in areas along or near the coast in the Counties of Los Angeles and Orange, due in large part to the prevailing sea breeze which transports emissions inland before high ozone concentrations are reached. The standard was exceeded most frequently in the Central San Bernardino Mountains. Ozone exceedances also extended through San Bernardino and Riverside County valleys in the eastern Basin, as well as the northeast and northwest portions of Los Angeles County in the foothill and valley areas. The number of exceedances of the 8-hour federal ozone standard was also lowest at the coastal areas, increasing towards the Riverside and San Bernardino valleys and the adjacent mountain areas. The Central San Bernardino Mountains area recorded the greatest number of exceedances of the 1-hour and 8-hour federal standards (8 days and 84 days, respectively) and 8-hour state standard (103 days). While the Coachella Valley did not exceed the former 1-hour ozone standard in 2011, the 2008 8-hour federal standard was exceeded on 54 days.

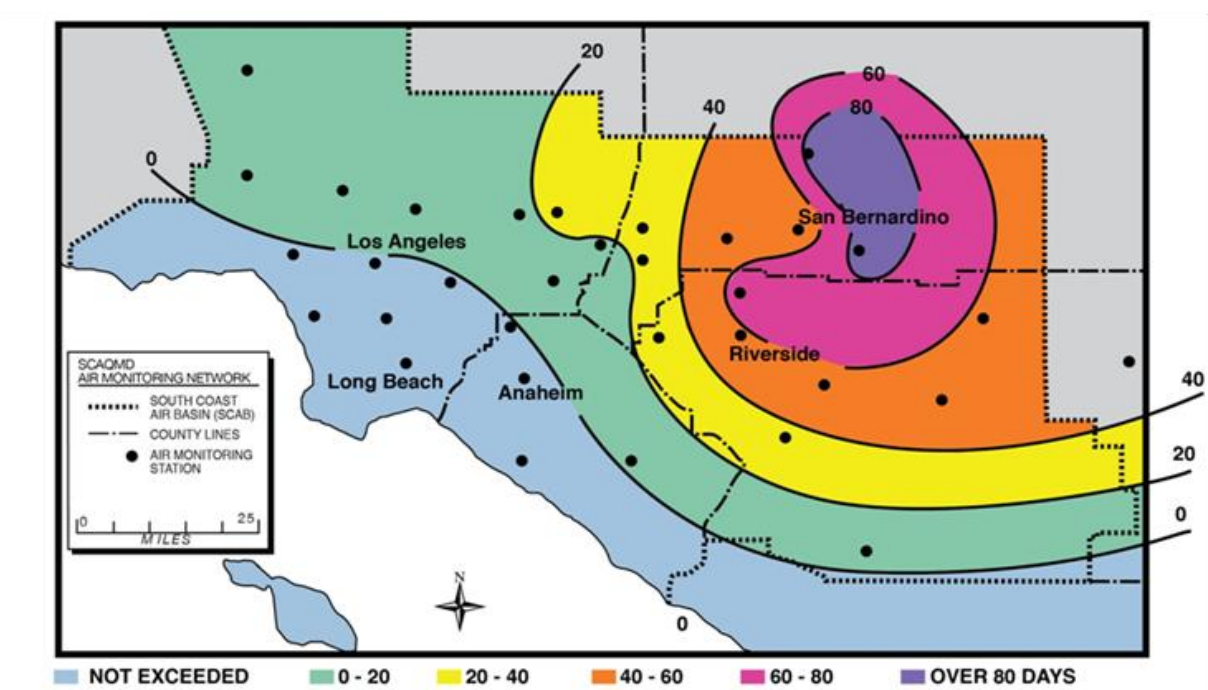


FIGURE 2-4

Number of Days in 2011 Exceeding the 2008 8-Hour Ozone Federal Standard
(8-hour average O_3 > 0.075 ppm)

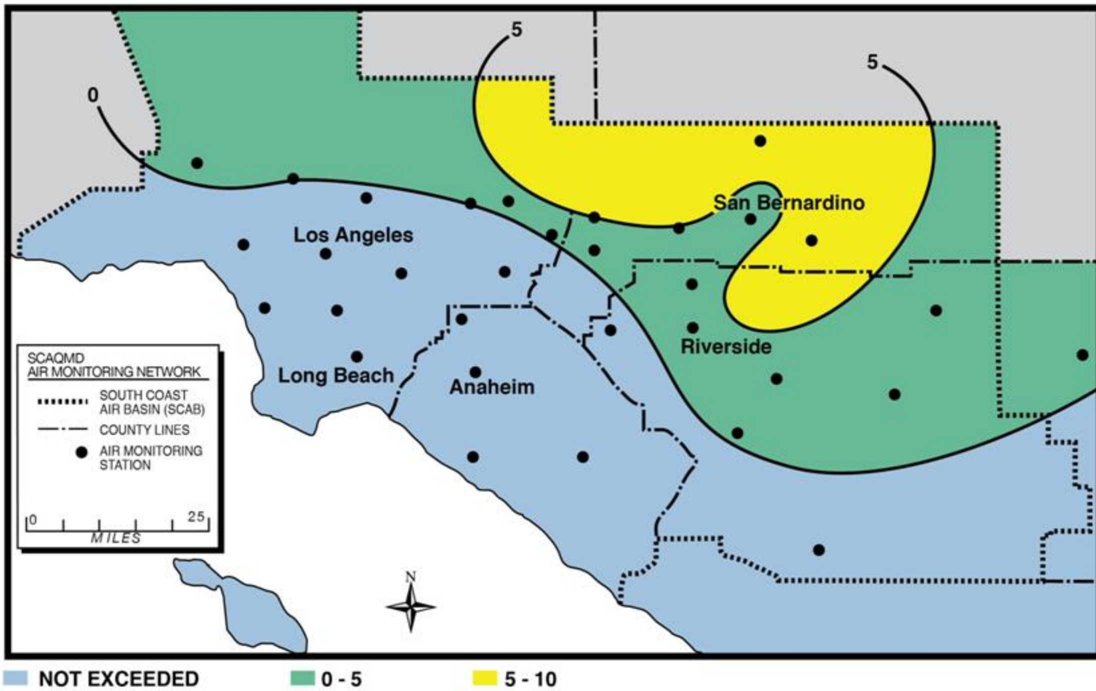


FIGURE 2-5

Number of Days in 2011 Exceeding the 1979 1-Hour Federal Ozone Standard
(1-hour average O_3 > 0.12 ppm)

Other Criteria Air Pollutants

<u>Carbon Monoxide (CO) Specific Information</u>

Health Effects, CO

The adverse effects of ambient carbon monoxide air pollution exposure on health have been recently reviewed in the 2006 U.S. EPA *Integrated Science Assessment for Carbon Monoxide.*[11] This document presents a detailed review of the available scientific studies and conclusions on the causal determination of the health effects of CO. A summary of health effects information and additional references can also be found in the 2012 AQMP, Appendix I.

Individuals with a deficient blood supply to the heart are the most susceptible to the adverse effects of CO exposure. The effects observed include earlier onset of chest

[11] U.S. EPA. (2010). Integrated Science Assessment for Carbon Monoxide (Final Report). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-09/019F.

pain with exercise, and electrocardiograph changes indicative of worsening oxygen supply delivery to the heart.

Inhaled CO has no known direct toxic effect on the lungs, but exerts its effect on tissues by interfering with oxygen transport, by competing with oxygen to combine with hemoglobin present in the blood to form carboxyhemoglobin (COHb). Hence, people with conditions requiring an increased oxygen supply can be adversely affected by exposure to CO. Individuals most at risk include patients with diseases involving heart and blood vessels, fetuses, and patients with chronic hypoxemia (oxygen deficiency) as seen at high altitudes.

Reductions in birth weight and impaired neurobehavioral development have been observed in animals chronically exposed to CO resulting in COHb levels similar to those observed in smokers. Recent studies have found increased risks for adverse birth outcomes with exposure to elevated CO levels. These include pre-term births and heart abnormalities.

Air Quality, CO

Carbon monoxide concentrations were measured at 25 locations in the Basin and neighboring SSAB areas in 2011. Table 2-11 shows the 2011 maximum 8-hour and 1-hour average concentrations of CO by air basin and county.

In 2011, no areas exceeded the CO air quality standards. The highest concentrations of CO continued to be recorded in the areas of Los Angeles County where vehicular traffic is most dense, with the maximum 8-hour and 1-hour concentration (4.7 ppm and 6.0 ppm, respectively) recorded in the South Central Los Angeles County area. All areas of the Basin have continued to remain below the federal standard level since 2003.

TABLE 2-11

2011 Maximum 8-Hour and 1-Hour CO Concentrations by Basin and County

BASIN/COUNTY	MAXIMUM 8-HR AVERAGE (PPM)	PERCENT OF FEDERAL STANDARD (9 PPM)	MAXIMUM 1-HR AVERAGE (PPM)	PERCENT OF FEDERAL STANDARD (35 PPM)	AREA
South Coast Air Basin					
Los Angeles	4.7	49	6.0	17	South Central L.A. County
Orange	2.2	23	3.4	10	North Coastal Orange County
Riverside	1.9	20	2.7	8	Metropolitan Riverside County
San Bernardino	1.7	18	1.8	5	Central San Bernardino Valley
Salton Sea Air Basin					
Riverside	0.6	6	3.0	8	Coachella Valley

<u>Nitrogen Dioxide (NO_2) Specific Information</u>

Health Effects, NO_2

The adverse effects of ambient nitrogen dioxide air pollution exposure on health have been recently reviewed in the 2008 U.S. EPA *Integrated Science Assessment for Oxides of Nitrogen – Health Criteria*[12]. This document presents a detailed review of the available scientific studies and conclusions on the causal determination of the health effects of NO_2, including evidence supporting the recently adopted short-term NO_2 standard (1-hour, 100 ppb). A summary of health effects information and additional references can also be found in the 2012 AQMP, Appendix I.

Population-based studies suggest that an increase in acute respiratory illness, including infections and respiratory symptoms in children (not infants), is associated with long-term exposures to NO_2 at levels found in homes with gas stoves, which are higher than ambient concentrations found in Southern California. Increase in resistance to air flow and airway contraction is observed after short-term exposure to NO_2 in healthy subjects. Larger decreases in lung functions are observed in

[12] U.S. EPA. (2008). Integrated Science Assessment for Oxides of Nitrogen – Health Criteria (Final Report). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-08/071.

individuals with asthma and/or chronic obstructive pulmonary disease (e.g., chronic bronchitis, emphysema) than in healthy individuals, indicating a greater susceptibility of these sub-groups. More recent studies have found associations between NO_2 exposures and cardiopulmonary mortality, decreased lung function, respiratory symptoms, and emergency room asthma visits.

In animals, exposure to levels of NO_2 that are considerably higher than ambient concentrations results in increased susceptibility to infections, possibly due to the observed changes in cells involved in maintaining immune functions. The severity of lung tissue damage associated with high levels of ozone exposure increases when animals are exposed to a combination of ozone and NO_2.

Based on the review of the NO_2 standards, U.S. EPA has established the 1-hour NO_2 standard to protect the public health against short-term exposure. The standard is set at 100 ppb 1-hour average, effective April 7, 2010.

Air Quality, NO_2

In 2011, NO_2 concentrations were monitored at 25 locations, including one in the Coachella Valley. The Basin has not exceeded the federal annual standard for NO_2 (0.0534 ppm) since 1991, when the Los Angeles County portion of the Basin recorded the last exceedance of the standard in any U.S. county. The recently established 1-hour average NO_2 standard (100 ppb), however, was exceeded on one day in 2011 (but the 98^{th} percentile form of the standard was not exceeded). The higher relative concentrations in the Los Angeles area are indicative of the concentrated emission sources, especially motor vehicles. The maximum 1-hour and annual average concentrations for 2011 are shown in Table 2-12, by basin and county.

TABLE 2-12

2011 Maximum 1-Hour and Annual Average NO_2 Concentrations by Basin and County

BASIN/COUNTY	MAXIMUM 1-HOUR AVERAGE (PPB)	PERCENT OF FEDERAL STANDARD (100 PPB)	MAXIMUM ANNUAL AVERAGE (PPB)	PERCENT OF FEDERAL STANDARD (53 PPB)	AREA
South Coast Air Basin					
Los Angeles	109.6*	109	24.6	46	Central Los Angeles County; Pomona/Walnut Valley
Orange	73.8	73	17.7	33	Central Orange County
Riverside	63.3	63	16.9	32	Metropolitan Riverside County
San Bernardino	76.4	76	21.1	39	Central San Bernardino Valley
Salton Sea Air Basin					
Riverside	44.7	44	8.0	15	Coachella Valley

* Although the maximum 1-hour concentrations exceeded the standard, the 98th percentile form of the design value did not exceed the NAAQS

Sulfur Dioxide (SO_2) Specific Information

Health Effects, SO_2

The adverse effects of SO_2 air pollution exposure on health have been recently reviewed in the 2008 U.S. EPA *Integrated Science Assessment (ISA) for Sulfur Oxides – Health Criteria*.[13] This document presents a detailed review of the available scientific studies and conclusions on the causal determination of the health effects of SO_2, including the justification to rescind the 24-hour standard and replace it with the new (2010) 1-hour standard (75 ppb). A summary of health effects information and additional references can also be found in the 2012 AQMP, Appendix I.

Individuals affected by asthma are especially sensitive to the effects of SO_2. Exposure to low levels (0.2 to 0.6 ppm) of SO_2 for a few (5-10) minutes can result in airway constriction in some exercising asthmatics. In asthmatics, increase in

[13] U.S. EPA. (2008). Integrated Science Assessment (ISA) for Sulfur Oxides – Health Criteria (Final Report). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-08/047F.

resistance to air flow, as well as reduction in breathing capacity leading to severe breathing difficulties, are observed after acute high exposure to SO_2. In contrast, healthy individuals do not exhibit similar acute responses even after exposure to higher concentrations of SO_2.

Animal studies suggest that even though SO_2 is a respiratory irritant, it does not cause substantial lung injury at ambient concentrations. However, very high levels of exposure can cause lung edema (fluid accumulation), lung tissue damage, and sloughing off of cells lining the respiratory tract.

Some population-based studies indicate that the mortality and morbidity effects associated with fine particles show a similar association with ambient SO_2 levels. In these studies, efforts to separate the effects of SO_2 from those of fine particles have not been successful. It is not clear whether the two pollutants act synergistically or one pollutant alone is the predominant factor.

Based on the review of the SO_2 standards, U.S. EPA has established the 1-hour SO_2 standard to protect the public health against short term exposure. The 1-hour average standard is set at 75 ppb, revoking the existing annual (0.03 ppm) and 24-hour (0.14 ppm) standards, effective August 2, 2010.

Air Quality, SO_2

No exceedances of federal or state standards for sulfur dioxide occurred in 2011 at any of the seven District locations monitored. Though sulfur dioxide concentrations remain well below the standards, sulfur dioxide is a precursor to sulfate, which is a component of fine particulate matter. Maximum concentrations of sulfur dioxide for 2011 are shown in Table 2-13. Sulfur dioxide was not measured at the Coachella Valley sites in 2011. Historical measurements showed concentrations in the Coachella Valley to be well below state and federal standards and monitoring has been discontinued.

TABLE 2-13

2011 Maximum 1-Hour Average SO_2 Concentrations by Basin and County

BASIN/COUNTY	MAXIMUM 1-HR AVERAGE (PPB)	PERCENT OF FEDERAL STANDARD (75 PPB)	AREA
South Coast Air Basin			
Los Angeles	43.4	57	South Coastal LA County
Orange	7.8	10	North Coastal Orange County
Riverside	51.2	68	Metropolitan Riverside County
San Bernardino	12.4	16	Central San Bernardino Valley
Salton Sea Air Basin			
Riverside	N.D.		Coachella Valley

N.D. = No Data. Historical measurements and lack of emissions sources indicate concentrations are well below standards

Sulfates (SO_4^{2-}) Specific Information

Health Effects, SO_4^{2-}

In 2002, CARB reviewed and retained the state standard for sulfates, retaining the concentration level (25 µg/m^3) but changing the basis of the standard from a Total Suspended Particulate (TSP) measurement to a PM10 measurement. In their 2002 staff report,[14] CARB reviewed the health studies related to exposure to ambient sulfates, along with particulate matter, and found an association with mortality and the same range of morbidity effects as PM10 and PM2.5, although the associations were not as consistent as with PM10 and PM2.5. The 2009 U.S. EPA *Integrated Science Assessment for Particulate Matter*[15] also contains a review of sulfate studies. A summary of health effects information can also be found in the 2012 AQMP, Appendix I.

Most of the health effects associated with fine particles and SO_2 at ambient levels are also associated with sulfates. Thus, both mortality and morbidity effects have been observed with an increase in ambient sulfate concentrations. However, efforts to

[14] CARB. (2002). Staff Report: Public Hearing to Consider Amendments to the Ambient Air Quality Standards for Particulate Matter and Sulfates. California Air Resources Board, Sacramento, CA. http://www.arb.ca.gov/regact/aaqspm/isor.pdf

[15] U.S. EPA. (2009). Integrated Science Assessment for Particulate Matter (Final Report). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-08/139F.

separate the effects of sulfates from the effects of other pollutants have generally not been successful.

Clinical studies of asthmatics exposed to sulfuric acid suggest that adolescent asthmatics are possibly a subgroup susceptible to acid aerosol exposure. Animal studies suggest that acidic particles such as sulfuric acid aerosol and ammonium bisulfate are more toxic than non-acidic particles like ammonium sulfate. Whether the effects are attributable to acidity or to particles remains unresolved.

Air Quality, SO_4^{2-}

Sulfate from PM10 was measured at 22 stations in 2011, including one in the Coachella Valley. In 2011, the state PM10-sulfate standard was not exceeded anywhere in the Basin or the Coachella Valley. Maximum concentrations by air basin and county are shown in Table 2-14.

TABLE 2-14

2011 Maximum 24-Hour Average Sulfate (PM10) Concentrations by Basin and County

BASIN/COUNTY	MAXIMUM 24-HR AVERAGE ($\mu G/M^3$)	PERCENT OF STATE STANDARD (25 $\mu G/M^3$)	AREA
South Coast Air Basin			
Los Angeles	8.0	32	Central Los Angeles County
Orange	6.5	26	Central Orange County
Riverside	5.4	22	Metropolitan Riverside County
San Bernardino	6.0	24	Central San Bernardino Valley
Salton Sea Air Basin			
Riverside	5.7	23	Coachella Valley

Lead (Pb) Specific Information

Health Effects, Pb

The adverse effects of ambient lead exposures on health have been reviewed in the 2006 U.S. EPA document, *Air Quality Criteria for Lead (2006) Final Report*.[16] This document presents a detailed assessment of the available scientific studies and presents conclusions on the causal determination of the health effects of lead, including the justification to lower the federal lead standard.

Fetuses, infants, and children are more sensitive than others to the adverse effects of lead exposure. Exposure to low levels of lead can adversely affect the development and function of the central nervous system, leading to learning disorders, distractibility, inability to follow simple commands, and lower intelligence quotient. In adults, increased lead levels are associated with increased blood pressure.

Lead poisoning can cause anemia, lethargy, seizures, and death. It appears that there are no direct effects of lead on the respiratory system. Lead can be stored in the bone from early-age environmental exposure, and elevated blood lead levels can occur due to breakdown of bone tissue during pregnancy, hyperthyroidism (increased secretion of hormones from the thyroid gland), and osteoporosis (breakdown of bony tissue). Fetuses and breast-fed babies can be exposed to higher levels of lead because of previous environmental lead exposure of their mothers.

Air Quality, Pb

Based on the review of the NAAQS for lead, U.S. EPA has established a new standard of 0.15 $\mu g/m^3$ for a rolling 3-month average, effective October 15, 2008 (measured from total suspended particulates, TSP). Except for the source-specific monitoring that is now required under the new standard, there have been no violations of the lead standards at the District's regular air monitoring stations since 1982, as a result of removal of lead from gasoline. However, monitoring at two stations immediately adjacent to stationary sources of lead have recorded exceedances of the standards in localized areas of the Basin in more recent years. Table 2-15 shows the maximum 3-month rolling average concentrations recorded in 2011. In 2011, lead concentrations in the Basin exceeded the new 3-month rolling average standard (0.15 $\mu g/m^3$) at one source-specific monitoring site in Los Angeles County, located immediately downwind of a stationary lead source. The federal rolling 3-month and

[16] U.S. EPA. (2006). Air Quality Criteria for Lead (2006) Final Report. U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-05/144aF-bF, 2006.

state 30-day standards for lead were not exceeded in any other area of the District in 2011.

TABLE 2-15

2011 Maximum 3-Month Rolling Average Lead Concentrations by Basin and County

BASIN/COUNTY	MAXIMUM 3-MONTH ROLLING AVERAGE (μG/M³)	PERCENT OF FEDERAL STANDARD (0.15 μG/M³)	AREA
South Coast Air Basin			
Los Angeles*	0.46	297	Central Los Angeles
Orange	N.D.		
Riverside	0.01	6	Metropolitan Riverside County
San Bernardino	0.01	6	Northwest San Bernardino Valley, Central San Bernardino Valley
Salton Sea Air Basin			
Riverside	N.D.		Coachella Valley

* This high lead concentration was measured at a site immediately downwind of a lead source.
N.D. = No Data. Historical measurements indicate concentrations are well below standards.

COMPARISON TO OTHER U.S. AREAS

The Basin's severe air pollution problem is a consequence of the combination of emissions from the nation's second largest urban area, mountainous terrain surrounding the Basin that traps pollutants as they are pushed inland with the sea breeze, and meteorological conditions which are adverse to the dispersion of those emissions. The average wind speed for Los Angeles is the lowest of the nation's ten largest urban areas. In addition, the summertime daily maximum mixing heights (an index of how well pollutants can be dispersed vertically in the atmosphere) in Southern California are the lowest, on average, in the U.S., due to strong temperature inversions in the lower atmosphere that effectively trap pollutants near the surface. The Southern California area is also an area with abundant sunshine, which drives the photochemical reactions which form pollutants such as ozone and a significant portion of PM2.5.

In the Basin, high concentrations of ozone are normally recorded during the late spring and summer months, when more intense sunlight drives enhanced photochemical reactions. In contrast, higher concentrations of carbon monoxide are generally recorded in late fall and winter, when nighttime radiation inversions trap the emissions at the surface. High PM10 and PM2.5 concentrations can occur throughout the year, but occur most frequently in fall and winter in the Basin. Although there are changes in emissions by season, the observed variations in pollutant concentrations are largely a result of seasonal differences in weather conditions.

Figures 2-6 and 2-7 show maximum pollutant concentrations in 2011 for the South Coast Air Basin compared to other urban areas in the U.S. and California, respectively. Maximum concentrations in all of these areas exceeded the federal 8-hour ozone standard. The annual PM2.5 standard was exceeded in the Basin and in one other California air basin (San Joaquin Valley). The 24-hour PM2.5 standard, however, was exceeded in a few of the other large U.S. urban areas and in many California air basins. The 24-hour PM10 standard was exceeded in one of the U.S. urban areas shown (Phoenix), although potential flagging of exceptional events may affect the treatment of that data. It is important to note that maximum pollutant concentrations do not necessarily indicate potential nonattainment designations, as the design values that are used for attainment status are based on the form of the standard.

Nitrogen dioxide concentrations exceeded the recently established 1-hour standard in the Basin and Phoenix (on one day each). Denver, Colorado (not shown in Figure 2-7), was the only other U.S. urban area exceeding the NO_2 standard in 2011. Sulfur dioxide concentrations were below the recently established 1-hour federal standard in the Basin and all of the urban areas shown in Figures 2-6 and 2-7. However, the SO_2 standard was exceeded in other U.S. areas, with the highest concentrations recorded in Hawaii, due to volcano emissions. The CO standards were not exceeded in the U.S. in 2011.

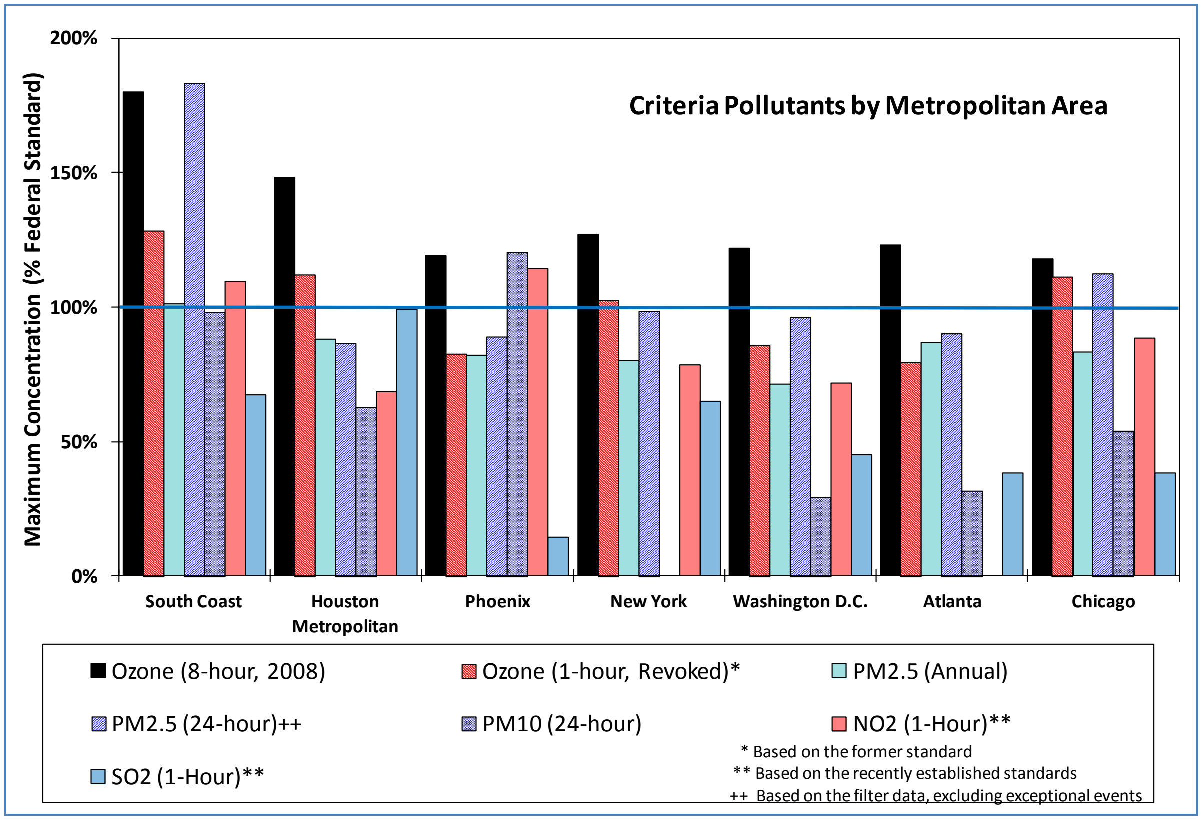


FIGURE 2-6

2011 South Coast Air Basin Air Quality Compared to Other U.S. Metropolitan Areas (Maximum Pollutant Concentrations as Percentages of Corresponding Federal Standards)

In 2011, the Central San Bernardino Mountains area in the Basin recorded the highest maximum 1-hour and 8-hour average ozone concentrations in the nation (0.160 and 0.136 ppm, respectively). The highest 8-hour average concentration was more than one and a half times the federal standard level. In 2011, seven out of ten stations with the highest maximum 8-hour average ozone concentrations in the nation were located in the Basin[17]. The South Coast Air Basin also exceeded the 8-hour ozone standard on more days (106) than most other urban areas in the country in 2011, with only California's San Joaquin Valley exceeding on more days (109).

[17] The 10 highest measured ozone concentrations in 2011 included 7 Basin stations: Central San Bernardino Mountains (Crestline), East San Bernardino Valley (Redlands), Central San Bernardino Valley (Fontana and San Bernardino), Santa Clarita Valley (Santa Clarita), Northwest San Bernardino Valley (Upland), and Metropolitan Riverside (Rubidoux).

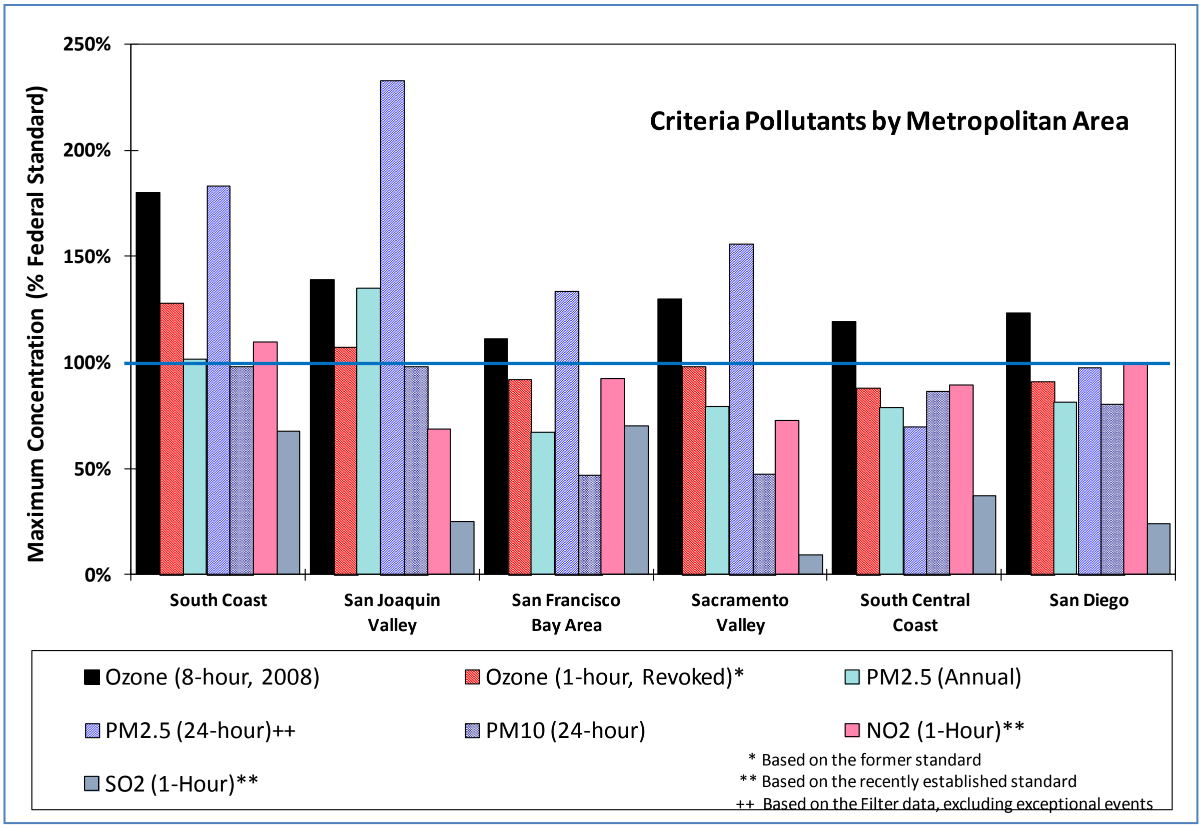


FIGURE 2-7

2011 South Coast Air Basin Air Quality Compared to Other California Air Basins
(Maximum Pollutant Concentrations as Percentages of Corresponding Federal Standards)

SUMMARY

In 2011, the Basin continued to exceed federal and state standards for ozone and PM2.5. The maximum measured concentrations for these pollutants were among the highest in the country, although significant improvement has been seen in recent years for both 24-hour and annual PM2.5 concentrations and only one location in the Basin is currently exceeding the 24-hour and annual design value form of the PM2.5 federal standards. The Basin's federal 3-year design values for ozone and PM2.5 have continued to exhibit downward trends through 2011.

The Coachella Valley area in the Riverside County portion of the Salton Sea Air Basin exceeded federal and state standards for ozone and PM10. However, the high PM10 concentrations exceeding the federal 24-hour PM10 standard occurred on days influenced by high-wind natural events, which the District has flagged in the U.S. EPA AQS database so that U.S. EPA will consider excluding such data when determining the NAAQS attainment status in accordance with U.S. EPA's Exceptional Events Rule. For the stations in the Coachella Valley, the federal 3-year design values for 8-hour ozone have continued to exhibit downward trends through 2011.

The NO_2 concentrations in Los Angeles County exceeded the recently established short-term federal standard on one day at two locations, but did not exceed the standards anywhere on any other day in the Basin. The 98th percentile form of the federal NO_2 standard was not exceeded and the Basin's attainment status remains intact. The Los Angeles County portion of the Basin also exceeded the 3-month rolling average Pb federal standard at one source-specific monitor adjacent to a Pb source. A separate SIP revision has been submitted to address Pb violations. Maximum concentrations for SO_2, CO, and sulfate (measured from PM10) continued to remain below the state and federal standards.

Chapter 3

Base Year and Future Emissions

South Coast Air Quality Management District
Cleaning the air that we breathe...™

South Coast AQMD

CHAPTER 3

BASE YEAR AND FUTURE EMISSIONS

INTRODUCTION

This chapter summarizes emissions that occurred in the Basin during the 2008 base year, and projected emissions in the years 2014, 2019, 2023, and 2030. More detailed emission data analyses are presented in Appendix III of the Final 2012 AQMP. The 2008 base year emissions inventory reflects adopted air regulations with current compliance dates as of 2008; whereas future baseline emissions inventories are based on adopted air regulations with both current and future compliance dates. A list of the District and CARB's rules and regulations that are part of the base year and future-year baseline emissions inventories is presented in Appendix III of the Final 2012 AQMP. The District is committed to implement the District rules that are incorporated in the Final 2012 AQMP future baseline emissions inventories.

The emissions inventory is divided into four major classifications: point, area, on-road, and off-road sources. The 2008 base year point source emissions are based principally on reported data from facilities using the District's Annual Emissions Reporting Program. The area source emissions are estimated jointly by CARB and the District. The on-road emissions are calculated by applying CARB's EMFAC2011 emission factors to the transportation activity data provided by Southern California Association of Governments (SCAG) from their adopted 2012 Regional Transportation Plan (2012 RTP). CARB's 2011 In-Use Off-Road Fleet Inventory Model is used for the construction, mining, gardening and agricultural equipment. CARB also provides other off-road emissions, such as ocean-going vessels, commercial harbor craft, locomotives and cargo handling equipment. Aircraft emissions are based on an updated analysis by the District. The future emission forecasts are primarily based on demographic and economic growth projections provided by SCAG. In addition, emission reductions resulting from District regulations adopted by June, 2012 and CARB regulations adopted by August 2011 are included in the baseline.

This chapter summarizes the major components of developing the base year and future baseline inventories. More detailed information, such as CARB's and the District's emission reductions resulting from adopted rules and regulations since the 2007 AQMP, growth factors, and demographic trends, are presented in Appendix III of the Final 2012 AQMP. In addition, the top ten source categories contributing to the 2008, 2014, and 2023 emission inventories are identified in this chapter. Understanding information about the highest emitting source categories leads to the identification of potentially more effective and/or cost effective control strategies for improving air quality.

EMISSION INVENTORIES

Two inventories are prepared for the Final 2012 AQMP for the purpose of regulatory and SIP performance tracking and transportation conformity: an annual average inventory, and a summer planning inventory. Baseline emissions data presented in this chapter are based on average annual day emissions (i.e., total annual emissions divided by 365 days) and seasonally adjusted summer planning inventory emissions. The Final 2012 AQMP uses annual average day emissions to estimate the cost-effectiveness of control measures, to rank control measure implementation, and to perform PM2.5 modeling and analysis. The summer planning inventory emissions are developed to capture the emission levels during a poor air quality season, and are used to report emission reduction progress as required by the federal and California Clean Air Acts.

Detailed information regarding the emissions inventory development for the base year and future years, the emissions by major source category of the base year, and future baseline emission inventories are presented in Appendix III of the Final 2012 AQMP. Attachments A and B to Appendix III list the annual average and summer planning emissions by major source category for 2008, 2014, 2017, 2019, 2023 and 2030, respectively. Attachment C to Appendix III has the top VOC and NOx point sources which emitted greater than or equal to ten tons per year in 2008. Attachment D to the Appendix III contains the on-road emissions by vehicle class and by pollutant for 2008, 2014, 2019, 2023 and 2030. Attachment E to Appendix III shows emissions associated with the combustion of diesel fuel for various source categories. Attachment F to Appendix III has the greenhouse gas emission inventory by major source categories.

Stationary Sources

Stationary sources can be divided into two major subcategories: point and area sources. Point sources are large emitters with one or more emission sources at a permitted facility with an identified location (e.g., power plants, refineries). These facilities have annual emissions of 4 tons or more of either Volatile Organic Compounds (VOC), Nitrogen Oxide (NOx), Sulfur Oxide (SOx), or total Particulate Matter (PM), or annual emissions of over 100 tons of Carbon Monoxide (CO). Facilities are required to report their criteria pollutant emissions and selected toxics to the District on an annual basis, if any of these thresholds are exceeded.

Area sources consist of many small emission sources (e.g., residential water heaters, architectural coatings, consumer products as well as permitted sources smaller than the above thresholds) which are distributed across the region. There are about 400 area source categories for which emissions are jointly developed by CARB and the District. The emissions from these sources are estimated using activity information and emission factors. Activity data are usually obtained from survey data or scientific reports (e.g., Energy Information Administration (EIA) reports for fuel consumption other than natural gas fuel, Southern California Gas Company for natural gas consumption, paint suppliers and, District databases). The emission factors are based on rule compliance factors, source tests, Material Safety Data Sheets (MSDS), default factors (mostly from AP-42, U.S. EPA's published emission factor compilation), or weighted emission factors derived from the point source facilities' annual emissions reports. Additionally, the emissions over a given area may be calculated using socioeconomic data.

Appendix III of the Final 2012 AQMP has more detail regarding emissions from specific source categories such as fuel combustion sources, landfills, composting waste, metal-coating operations, architectural coatings, and livestock waste. Since the 2007 AQMP was finalized, new area source categories, such as LPG transmission losses, storage tank and pipeline cleaning and degassing, and architectural colorants, were created and included in the emission inventories. These updates and new additions are listed below:

- Fuel combustion sources: The emissions from commercial and industrial internal combustion engines were updated to include the portable equipment emissions.
- Landfills: The emission estimation methodology for this area source category was revised to incorporate CARB's landfills greenhouse gas (GHG) emission inventory data.
- Composting waste category: The emission estimation methodology for this area source category was revised to include the emissions from green waste composting covered under District Rule 1133.3. The 2007 AQMP only included the emissions from co-composting, as it relates to District Rule 1133.2.
- Metal coating operations: This area source category in the 2007 AQMP only included the emissions from small permitted facilities with VOC emissions below 4 tons per year. As such, emissions from these sources maybe underreported in the 2007 AQMP. During the rule development process for amending Rule 1107, staff discovered numerous small shops using coating materials with compliant high solid concentrations, which are subsequently thinned beyond the allowable limits permitted by Rule 1107. The Final 2012

AQMP revised inventory adjusts the 2007 AQMP inventory to account for excess emissions from these coating activities.

- Architectural coating category: Three new area source categories were added under this category to accurately track the emissions from colorants.
- LPG transmission losses: This newly added area source category was created to include the emissions from LPG storage and fueling losses.
- Livestock waste sources: This inventory was updated to reflect the difference amongst dairy cattle based on the fraction of milking cows, dry cows, calves, and heifers as each has different VOC and NH3 emission factors based on the quantity of manure production.
- Storage tanks and pipeline cleaning: This new area source category was added to include the emissions from these types of operations.

Mobile Sources

Mobile sources consist of two subcategories: on-road and off-road sources. On-road vehicle emissions are calculated by applying CARB's EMFAC2011 emissions factors to the transportation activity data provided by SCAG from their adopted 2012 RTP. Spatial distribution data from Caltrans' Direct Travel Impact Model (DTIM4) are used to generate the gridded emissions. Off-road emissions are calculated using CARB's 2011 In-Use Off-Road Fleet Inventory model for construction, mining, gardening, and agricultural equipment. Ship, locomotive, and aircraft emissions are excluded from CARB's In-Use Off-Road Fleet Inventory model. Their emissions for 2008 and future years were revised separately based on the most recently available data.

<u>On-Road</u>

CARB's EMFAC2011 has been updated to reflect more recent vehicle population, activity, and emissions data. Light-duty motor vehicle fleet age, vehicle type, and vehicle population are updated based on 2009 California Department of Motor Vehicles data. The model also reflects recently adopted rules and benefits that were not reflected in EMFAC2007. The rules and benefits include on-road diesel fleet rules, the Pavley Clean Car Standards, and the Low Carbon Fuel standard. The most important improvement in the model is the integration of new data and methods to estimate emissions from diesel trucks and buses. CARB's Truck and Bus Regulation for the on-road heavy-duty in-use diesel vehicles applies to nearly all privately owned diesel fueled trucks and privately and publicly owned school buses with a gross vehicle weight rating (GVWR) greater than 14,000 pounds. EMFAC2011 includes the emissions benefits of the Truck and Bus Rule and previously adopted rules for other on-road diesel equipment. The impacts of the recent recession on emissions, quantified as part of the truck and bus rulemaking, are also included.

EMFAC2011 uses a modular emissions modeling approach that departs from past EMFAC versions. The first module, named EMFAC-LDV, is used as the basis for estimating emissions from gasoline powered on-road vehicles, diesel vehicles below 14,000 pounds GVWR, and urban transit buses. The second module, called EMFAC-HD, is the basis for emissions estimates for diesel trucks and buses with a GVWR greater than 14,000 pounds operating in California. This module is based on the Statewide Truck and Bus Rule emissions inventory that was developed between 2007 and 2010 and approved by the CARB Board in December 2010. The third module is called EMFAC2011SG. It takes the output from EMFAC-LDV and EMFAC-HD and applies scaling factors to estimate emissions consistent with user-defined vehicle miles of travel and vehicle speeds. Together the three modules comprise EMFAC2011.

Several external adjustments were made to EMFAC2011 in the Final 2012 AQMP to reflect CARB's rules and regulations which were adopted after the development of EMFAC2011. The adjustments include the advanced clean cars regulations, reformulated gasoline, and smog check improvement.

Figure 3-1 compares the on-road emissions between EMFAC2007 V2.3 used in the 2007 AQMP and EMFAC2011 used in the Final 2012 AQMP, respectively. It should be noted that the comparison for 2008 reflects changes in methodology whereas the comparison for 2023 includes adopted rules and updated growth projections since the release of EMFAC2007. In general, the emissions are lower in EMFAC2011 as compared to EMFAC2007. The lower emissions can be attributed to additional rules and regulations which result in reduced emissions, revisions to growth projections, and the economic impacts of the recent recession.

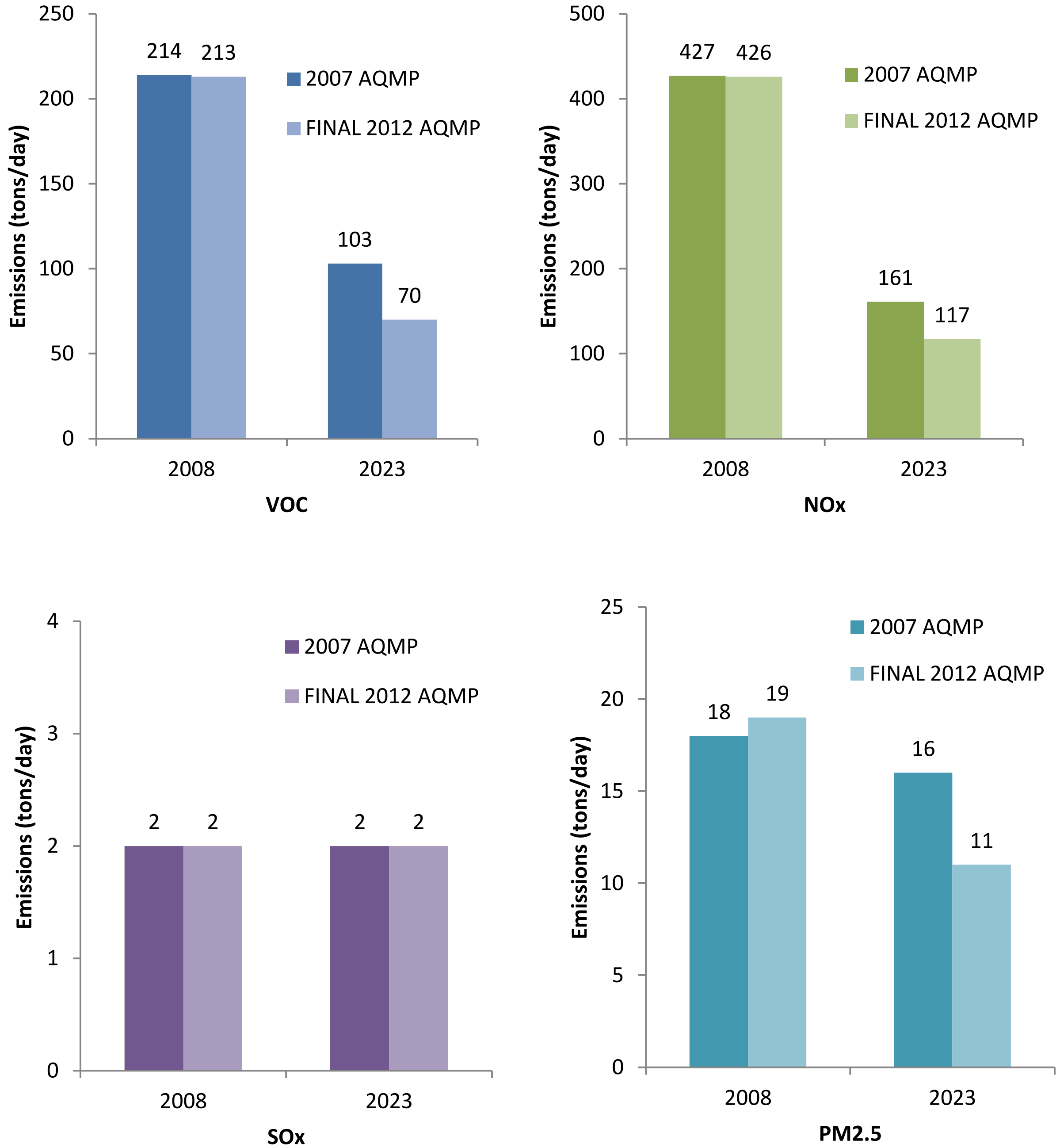


FIGURE 3-1

Comparison of On-Road Emissions Between EMFAC2007 V2.3 (2007 AQMP) and EMFAC2011 (Final 2012 AQMP)

(VOC & NOx – Summer Planning; SOx & PM2.5 – Annual Average Inventory)

Off-Road

Emissions from off-road vehicle categories (construction & mining equipment, lawn & gardening equipment, ground support equipment, agricultural equipment) in CARB's In-Use Off-Road Model were developed primarily based on estimated activity levels and emission factors. Ships, commercial harbor crafts, locomotives, aircrafts, and cargo handling equipment emissions are not included in CARB's In-Use Off-Road Fleet Inventory Model. Separate models or estimations were used for these emissions sources. The off-road source population, activities, and emission factors were re-evaluated and re-estimated since the last AQMP. Consequently, the emissions are modified accordingly.

The major updates and/or improvements to the off-road inventory include:

1. The equipment population in CARB's In-Use Off-Road Fleet Inventory model is updated by using the equipment population reported to CARB for rule compliance. Based on information from CARB, the total population in 2009 was 26% lower than had been anticipated in 2007 due to fleet downsizing during the recent recession.

2. The equipment hours of use in CARB's In-Use Off-Road Fleet Inventory model are updated based on the reported activity data between 2007 and 2009. According to CARB, the new data indicates a 30% or more reduced activity in most cased for 2009 as compared to 2007 due to recession.

3. The equipment load factor in CARB's In-Use Off-Road Fleet Inventory model is updated using a 2009 academic study and information from engine manufacturers. According to CARB, the new data suggests that the load factors should be reduced by 33%.

4. According to CARB, construction activity and emissions have dropped by more than 50% between 2005 and 2011. Future emissions are uncertain and depend on the pace of economic recovery. The future growth in CARB's In-Use Off-Road Fleet Inventory model is projected based on the average of the future forecast scenarios. CARB's data suggest off-road activity and emissions will recover slowly from the recessionary lows.

5. Locomotive inventories reflect the 2008 U.S. EPA Locomotive regulations and adjustments due to economic activity.

6. Cargo handling equipment has been updated for population, activity, recessionary impacts on growth, and engine load. The updates are based on new information collected since 2005. The new information includes CARB's regulatory reporting data which provides an accounting of all the cargo handling equipment in the state including their model year, horsepower and activity. In addition, the Ports of Los Angeles and Long Beach have developed annual emissions inventories and a number of the major rail yards and other ports in the state have completed individual emission inventories.

7. Ocean-going vessel emissions in the Final 2012 AQMP include CARB's fuel regulation for ocean-going vessels and the 2007 shore power regulation. In addition, the improvements and corrections include recoding the model for speed, updating auxiliary engine information, updating ship routing, revising vessel speed reduction compliance rates, and an adjustment factor to estimate the effects of the recession. In March 2010, the International Maritime Organization (IMO) officially designated the waters within 200 miles of the North American Coast as an Emissions Control Area (ECA). Beginning August 2012, IMO requires ships that travel these waters to use fuel with a sulfur content of less than or equal to 1.0% and in 2015 the sulfur limit will be further reduced to 0.1%. Additionally, vessels built after January 1, 2016 will be required to meet the most stringent IMO Tier 3 NOx emission levels while transiting within the 200 mile ECA zone. Outer Continental Shelf (OCS) emissions (i.e. emissions from vessels beyond the three-mile state waters line) are included in the ships emissions as well.

8. Another improvement is the development of a separate emission category for the commercial harbor craft from a new commercial harbor craft database. CARB approved a regulation to significantly reduce diesel PM and NOx emissions from diesel-fueled engines on commercial harbor craft vessels. These vessels emit an estimated 3 tons per day of diesel PM and 70 tons per day of NOx statewide in 2007. The harbor craft database includes emissions from crew & supply, excursion, fishing, pilot, tow boats, barge, and dredge vessels.

9. The aircraft emissions inventory is updated for the 2008 base year and the 2035 forecast year based on the latest available activity data and calculation methodologies. A total of 43 airports were identified as having aircraft operations within the District boundaries including commercial air carrier, air

taxi, general aviation, and military aircraft operations. The sources of activity data include airport operators (for several commercial and military airports), FAA's databases (i.e., Bureau of Transportation Statistics, Air Traffic Activity Data System, Terminal Area Forecast), and SCAG. For commercial air carrier operations, SCAG's 2035 forecast, which is consistent with the forecast adopted for the 2012 RTP, reflects the future aircraft fleet mix. The emissions calculation methodology is primarily based on the application of FAA's Emissions and Dispersion Modeling System (EDMS) model for airports with detailed activity data for commercial air carrier operations (by aircraft make and model). For other airports and aircraft types (i.e., general aviation, air taxi, military), the total number of landing and takeoff activity data is used in conjunction with the U.S. EPA's average emission factors for major aircraft types (e.g., general aviation, air taxi, military). For the intermediate milestone years, the emissions inventories are linearly interpolated between 2008 and 2035.

Several external adjustments to the off-road emissions are made to reflect CARB's rules and regulations and new estimates of activity. The adjustments include locomotives, large spark ignition engines and non-agricultural internal combustion engines.

Figure 3-2 shows a comparison between the off-road baseline emissions in the 2007 AQMP and the Final 2012 AQMP. In general, the emissions are lower in the 2011 In-Use Off-Road Fleet Inventory model, except for 2008 SOx emissions. The projected 2008 off-road NOx emissions in the 2007 AQMP were 339 tons per day, while the 2008 base year off-road NOx emissions in the Final 2012 AQMP are 207 tons per day. The 2011 In-Use Off-Road Fleet Inventory emissions are lower because of the rules and regulations adopted since 2007 OFFROAD model, updated data, future growth corrections and recessionary impacts to commercial and industrial mobile equipment. The higher 2008 estimated SOx emissions reflect a temporary stay in the implementation of the lower sulfur content marine fuel regulation for a portion of 2008.

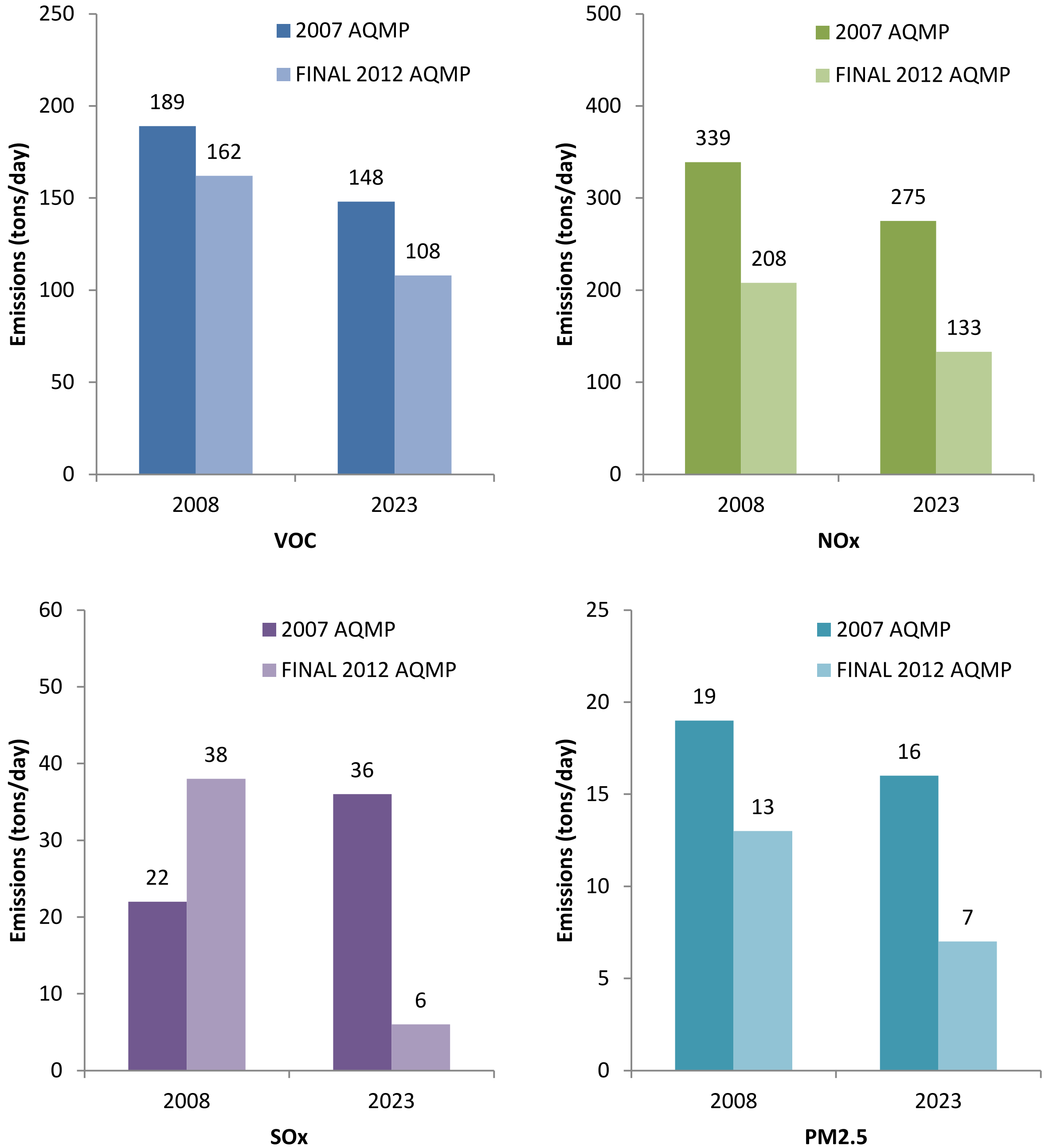


FIGURE 3-2

Comparison of Off-Road Emissions Between 2007 AQMP and Final 2012 AQMP

(VOC & NOx – Summer Planning; SOx & PM2.5 – Annual Average Inventory)

Uncertainty in the Inventory

An effective AQMP relies on a complete and accurate emission inventory. Over the years, significant improvements have been made to quantify emission sources for which control measures are developed. Increased use of continuous monitoring and source tests has contributed to the improvement in point source inventories. Technical assistance to facilities and auditing of reported emissions by the District have also improved the accuracy of the emissions inventory. Area source inventories that rely on average emission factors and regional activities have inherent uncertainty. Industry-specific surveys and source-specific studies during rule development have provided much-needed refinement to the emissions estimates.

Mobile source inventories remain the greatest challenge due to continuously collected new information from the large number and types of equipment and engines. Every AQMP revision provides an opportunity to further improve the current knowledge of mobile source inventories. The Final 2012 AQMP is not an exception. As described earlier, many improvements were included in EMFAC2011 and such work is still ongoing. However, it should be acknowledged that there are still areas that could be significantly improved if better data were available. Technological changes and advancement in the area of electric, hybrid, flexible fuel, fuel cell vehicles coupled with changes in future gasoline prices, all add uncertainty to the on-road emissions inventory.

It is important to note that the recent recession began in 2007, and being unforeseen, its impacts were not included in the 2007 AQMP. As the Final 2012 AQMP is being developed, Southern California is still in the midst of a slow economic recovery. The impact of the recession is deep and is still being felt, and thus adds to the uncertainty in the emissions provided here. Relative to future growth, there are many challenges with making accurate projections, such as where vehicle trips will occur, the distribution between various modes of transportation (such as trucks and trains), as well as estimates for population growth and changes to the number and type of jobs. Forecasts are made with the best information available; nevertheless, they contribute to the overall uncertainty in emissions projections. Fortunately, AQMP updates are generally developed every three to four years; thereby allowing for frequent improvements to the inventories.

Gridded Emissions

For air quality modeling purposes, the region extends to Southern Kern County in the north, the Arizona border in the east, northern Mexico in the south and more than 100 miles offshore to the west. The modeling area is divided into a grid system comprised of 4 km by 4 km grid cells defined by Lambert Conformal coordinates. Both stationary and mobile source emissions are allocated to individual grid cells within this system. In general, the modeling emissions data features daily emissions. Variations in temperature, hours of operation, speed of motor vehicles, or other factors are considered in developing gridded motor vehicle emissions. The "gridded" emissions data used for both PM2.5 and ozone modeling applications differ from the average annual day or planning inventory emission data in two respects: (1) the modeling region covers larger geographic areas than the Basin; and (2) emissions represent day-specific instead of average or seasonal conditions. Summary of emissions inventories are generated for the PM2.5 and ozone modeling applications. For PM2.5, the annual average day is used, which represents the characteristic of emissions that contribute to year-round particulate impacts. The summer planning inventory focuses on the warmer months (May through October) when evaporative VOC emissions play an important role in ozone formation.

BASE YEAR EMISSIONS

2008 Emission Inventory

Table 3-1A compares the annual average emissions between the 2008 base year in the Final 2012 AQMP and the projected 2008 emissions in the 2007 AQMP by major source category for VOC and NOx. Table 3-1B compares the annual average emissions between the 2008 base year in the Final 2012 AQMP and the projected 2008 emissions in the 2007 AQMP for SOx and PM2.5. Due to the economic recession which began in 2007, it is expected that the more recent 2008 base year emissions estimates should be lower than the previously projected 2008 emissions. Yet, several categories show higher emissions in the 2008 base year in the Final 2012 AQMP, such as fuel consumption, waste disposal, petroleum production and marketing for VOC; fuel consumption for NOx; off-road emissions for SOx; and industrial processes for PM2.5. The reasons are as follows:

1. Fuel consumption – The emissions from commercial and industrial internal combustion engines were updated to include portable equipment emissions which were overlooked in the 2007 AQMP. The update causes increases in emissions for this category.

2. Waste disposal – Due to erroneous activity data reported by point sources in the 2007 AQMP, landfill emissions increased drastically. In addition, landfill

emission estimation methodology was revised to incorporate CARB's GHG Emission Inventory data to calculate the amount of methane being generated in 2008. Industry stakeholders have requested further evaluation of the emission factors currently used. As a result, the District staff will initiate a working group to undertake this effort.

3. Petroleum production and marketing – Two new area source categories (LPG transmission, storage tanks and pipeline cleaning and degassing) were added to the Final 2012 AQMP. LPG transmission source category tracks the fugitive emissions associated with transfer and dispensing of LPG and is based on emission rates derived from the District source tests conducted in 2008 and 2011, sale volumes provided by the industry association, and category breakdowns. A total of 8.4 tons per day VOC emissions were added to the 2008 inventory. Storage tanks and pipeline cleaning and degassing source category was updated based on Rule 1149 amendments to reflect more frequent degassing events as well as the effectiveness of control techniques. During the amendment, it was determined that the actual degassing events were more than triple the amount that was estimated when the rule was originally developed. It was also assumed that once the degassing rule requirements were fulfilled, there would be no more fugitive emissions; however, a review of degassing logs indicated that sludge and product residual in the storage tanks significantly increase the emissions emanating from the storage tanks. Finally, the source category was expanded to include previously exempted tanks and pipelines. The storage tanks and pipeline source adds 1.4 tons per day VOC to the 2008 base year.

4. Off-road SOx – CARB adopted a regulation in 2005 to set sulfur content limits on marine fuels for auxiliary diesel engines and diesel-electric engines operated on ocean-going vessels within California waters and 24 nautical miles of the California coastline. The regulation became effective January 1, 2007, and as a result the SOx reductions were accounted for in the 2007 AQMP. However, pursuant to an injunction issued by a federal district court (district court), CARB ceased enforcing the regulation in the fall of 2007. See *Pacific Merchant Shipping Ass'n v. Thomas A. Cackette* (E.D. Cal. Aug. 30, 2007), No. Civ. S-06 2791-WBS-KJM. CARB filed an appeal with the Ninth Circuit and requested a stay of the injunction pending the appeal. As permitted under the appellate court stay, CARB decided to continue to enforce the regulation while litigation involving the regulation remained active. On May 7, 2008,

CARB issued another announcement to discontinue enforcement of the regulation pursuant to the same injunction after the Court of Appeals issued its decisions which invalidated the 2005 regulation. In the meantime, CARB staff prepared a new Ocean-Going Vessel Clean Fuel Regulation that was approved by its Board on July 24, 2008, and implementation began on July 1, 2009. The 2008 regulation includes the auxiliary engines and also the main engines and auxiliary boilers on ocean-going vessels within the same 24 nautical miles zone as the earlier auxiliary engine rule. The 2008 regulation achieves higher SOx reductions than the original auxiliary engine rule, primarily due to regulating the main engines and auxiliary boilers in addition to the auxiliary engines.

Tables 3-2A and 3-2B show the 2008 emissions inventory by major source category. Table 3-2A shows annual average emissions, while Table 3-2B shows the summer planning inventory. Stationary sources are subdivided into point (e.g., chemical manufacturing, petroleum production, and electric utilities) and area sources (e.g., architectural coatings, residential water heaters, consumer products, and permitted sources smaller than the emission reporting threshold – generally 4 tpy). Mobile sources consist of on-road (e.g., light-duty passenger cars) and off-road sources (e.g., trains and ships). Entrained road dust is also included.

Figure 3-3 characterizes relative contributions by stationary and mobile source categories. On- and off-road sources continue to be the major contributors for each of the five pollutants. Overall, total mobile source emissions account for 59% of the VOC and 88% of the NOx emissions for these two ozone-forming pollutants, based on the summer planning inventory. The on-road mobile category alone contributes about 33 and 59% of the VOC and NOx emissions, respectively, and approximately 68% of the CO for the annual average inventory. For directly emitted PM2.5, mobile sources represent 40% of the emissions with another 10% due to vehicle-related entrained road dust.

Within the category of stationary sources, point sources contribute more SOx emissions than area sources. Area sources play a major role in VOC emissions, emitting about seven times more than point sources. Area sources, including sources such as commercial cooking, are the predominant source of directly emitted PM2.5 emissions (39%).

TABLE 3-1A

Comparison of VOC and NOx Emissions By Major Source Category of
2008 Base Year in Final 2012 AQMP and Projected 2008 in 2007 AQMP
Annual Average Inventory (tpd[1])

SOURCE CATEGORY	2007 AQMP	Final 2012 AQMP	% Change	2007 AQMP	Final 2012 AQMP	% Change
	VOC			NOx		
STATIONARY SOURCES						
Fuel Combustion	7	14	+100%	30	41	+36%
Waste Disposal	8	12	+50%	2	2	0%
Cleaning and Surface Coatings	37	37	0%	0	0	0%
Petroleum Production and Marketing	32	41	+28%	0	0	0%
Industrial Processes	19	16	-16%	0	0	0%
Solvent Evaporation						
Consumer Products	97	98	+1%	0	0	0%
Architectural Coatings	23	22	-5%	0	0	0%
Others	3	2	-33%	0	0	0%
Misc. Processes	15	15	0%	26	26	0%
RECLAIM SOURCES	0	0	0%	29	23	-21%
Total Stationary Sources	**241**	**257**	**+7%**	**87**	**92**	**+6%**
MOBILE SOURCES						
On-Road Vehicles	207	209	+1%	447	462	+3%
Off-Road Vehicles	150	127	-15%	325	204	-37%
Total Mobile Sources	**357**	**336**	**-6%**	**772**	**666**	**-14%**
TOTAL	**598**	**593**	**-1%**	**859**	**758**	**-12%**

[1] Values are rounded to nearest integer.

TABLE 3-1B

Comparison of SOx and PM2.5 Emissions By Major Source Category of
2008 Base Year in Final 2012 AQMP and Projected 2008 in 2007 AQMP
Annual Average (tpd[1])

SOURCE CATEGORY	2007 AQMP	Final 2012 AQMP	% Change	2007 AQMP	Final 2012 AQMP	% Change
	SOx			PM2.5		
STATIONARY SOURCES						
Fuel Combustion	2	2	0%	6	6	0%
Waste Disposal	0	0	0%	0	0	0%
Cleaning and Surface Coatings	0	0	0%	1	1	0%
Petroleum Production and Marketing	1	1	0%	1	2	+100%
Industrial Processes	0	0	0%	5	7	+40%
Solvent Evaporation						
Consumer Products	0	0	0%	0	0	0%
Architectural Coatings	0	0	0%	0	0	0%
Others	0	0	0%	0	0	0%
Misc. Processes *	1	1	0%	52	32	-39%
RECLAIM SOURCES	12	10	-17%	0	0	0%
Total Stationary Sources	**16**	**14**	**-12%**	**65**	**48**	**-26%**
MOBILE SOURCES						
On-Road Vehicles	2	2	0%	18	19	+6%
Off-Road Vehicles	14	38[2]	+171%	18	13	-28%
Total Mobile Sources	**16**	**40**	**+150%**	**36**	**32**	**-11%**
TOTAL	**32**	**54**	**+69%**	**101**	**80**	**-21%**

[1] Values are rounded to nearest integer.

2 Refer to Base Year Emissions – Off-road-Sox.

TABLE 3-2A

Summary of Emissions By Major Source Category: 2008 Base Year
Average Annual Day (tpd[1])

SOURCE CATEGORY	VOC	NOx	CO	SOx	PM2.5
STATIONARY SOURCES					
Fuel Combustion	14	41	57	2	6
Waste Disposal	12	2	1	0	0
Cleaning and Surface Coatings	37	0	0	0	1
Petroleum Production and Marketing	41	0	5	1	2
Industrial Processes	16	0	2	0	7
Solvent Evaporation					
Consumer Products	98	0	0	0	0
Architectural Coatings	22	0	0	0	0
Others	2	0	0	0	0
Misc. Processes*	15	26	72	1	32
RECLAIM Sources	0	23	0	10	0
Total Stationary Sources	**257**	**92**	**137**	**14**	**48**
MOBILE SOURCES					
On-Road Vehicles	209	462	1966	2	19
Off-Road Vehicles	127	204	778	38	13
Total Mobile Sources	**336**	**666**	**2743**	**40**	**32**
TOTAL	**593**	**758**	**2881**	**54**	**80**

[1] Values are rounded to nearest integer.

TABLE 3-2B

Summary of Emissions By Major Source Category: 2008 Base Year
Summer Planning Inventory (tpd[1])

SOURCE CATEGORY	SUMMER OZONE PRECURSORS	
	VOC	**NOx**
STATIONARY SOURCES		
Fuel Combustion	14	41
Waste Disposal	12	2
Cleaning and Surface Coatings	43	0
Petroleum Production and Marketing	41	0
Industrial Processes	19	0
Solvent Evaporation		
Consumer Products	99	0
Architectural Coatings	25	0
Others	2	0
Misc. Processes	9	20
RECLAIM Sources	0	24
Total Stationary Sources	**264**	**87**
MOBILE SOURCES		
On-Road Vehicles	213	426
Off-Road Vehicles	162	208
Total Mobile Sources	**375**	**634**
TOTAL	**639**	**721**

[1] Values are rounded to nearest integer.

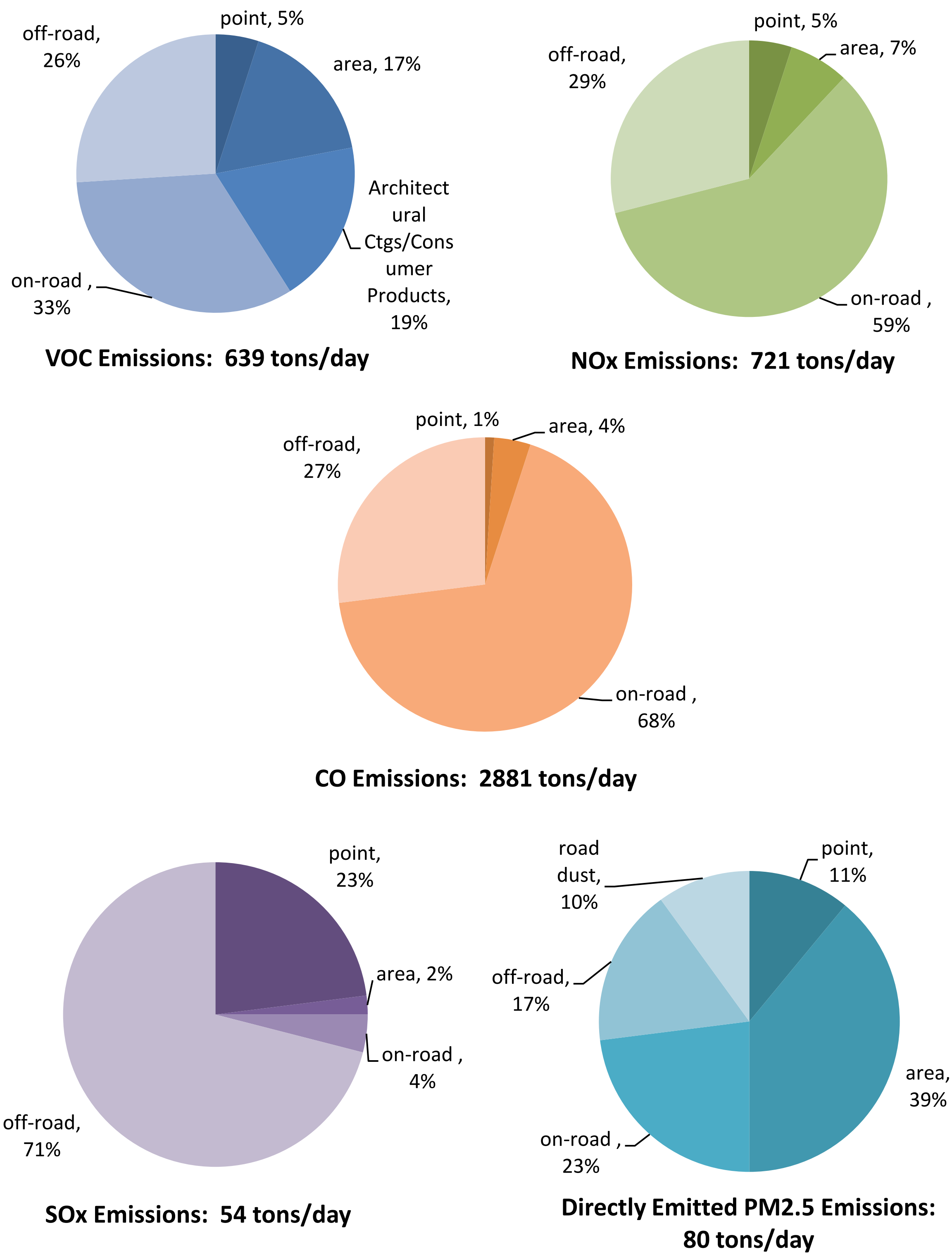


FIGURE 3-3

Relative Contribution by Source Category to 2008 Emission Inventory
(VOC & NOx – Summer Planning; CO, SOx, & PM2.5 – Annual Average Inventory)

FUTURE EMISSIONS

Data Development

The milestone years 2008, 2014, 2019, 2023, and 2030 are the years for which inventories were developed as they are relevant target years under the federal CAA and the CCAA. The base year for the attainment demonstration is 2008. 2014 is the attainment year for the federal 2006 24-hour PM2.5 standard without an extension, and 2019 represents the latest attainment date with a full five-year extension. The 80 ppb federal 8-hour ozone standard attainment deadline is 2023, and the new 75 ppb 8-hour ozone standard deadline is 2032. A 2030 inventory will be used to approximate this latter year.

Future stationary emissions are divided into RECLAIM and non-RECLAIM emissions. Future NOx and SOx emissions from RECLAIM sources are estimated based on their allocations as specified by District Rule 2002 –Allocations for NOx and SOx. The forecasts for non-RECLAIM emissions were derived using: (1) emissions from the 2008 base year; (2) expected controls after implementation of District rules adopted by June, 2012, and CARB rules adopted as of August 2011; and (3) activity growth in various source categories between the base and future years.

Demographic growth forecasts for various socioeconomic categories (e.g., population, housing, employment by industry), developed by SCAG for their 2012 RTP, are used in the Final 2012 AQMP. Industry growth factors for 2008, 2014, 2018, 2020, 2023, and 2030 are also provided by SCAG, and interim years are calculated by linear interpolation. Table 3-3 summarizes key socioeconomic parameters used in the Final 2012 AQMP for emissions inventory development.

TABLE 3-3

Baseline Demographic Forecasts in the Final 2012 AQMP

CATEGORY	2008	2023	2023 % GROWTH FROM 2008	2030	2030 % GROWTH FROM 2008
Population (Millions)	15.6	17.3	11%	18.1	16%
Housing Units (Millions)	5.1	5.7	12%	6.0	18%
Total Employment (Millions)	7.0	7.7	10%	8.1	16%
Daily VMT (Millions)	379	396	4%	421	11%

Current forecasts indicate that this region will experience a population growth of 11% between 2008 and 2023, with a 4% increase in vehicle miles traveled (VMT); and a population growth of 16% by the year 2030 with a 11% increase in VMT.

As compared to the projections in the 2007 AQMP, the current 2030 projections in the Final 2012 AQMP show about 1.5 million less population (7.6% less), 900,000 less total employment (10% less), and 32 million miles less in the daily VMT forecast (7.1% less).

Summary of Baseline Emissions

Emissions data by source categories (point, area, on-road mobile and off-road mobile sources) and by pollutants are presented in Tables 3-4 through 3-7 for the years 2014, 2019, 2023, and 2030. The tables provide annual average, as well as summer planning inventories.

Without any additional controls, VOC, NOx, and SOx emissions are expected to decrease due to existing regulations, such as controls on off-road equipment, new vehicle standards, and the RECLAIM programs. Figure 3-4 illustrates the relative contribution to the 2023 inventory by source category. A comparison of Figures 3-3 and 3-4 indicates that the on-road mobile category continues to be a major contributor to CO and NOx emissions. However, due to already-adopted regulations, 2023 on-road mobile sources account for: about 16% of total VOC emissions compared to 33% in 2008; about 36% of total NOx emissions compared to 59% in 2008; and about 38% of total CO emissions compared to 68% in 2008. Meanwhile, area sources become the major contributor to VOC emissions from 36% in 2008 to 50% in 2023. See Figures 3-5 through 3-16 for the top ten highest-ranking source categories for 2008, 2014, and 2023.

TABLE 3-4A

Summary of Emissions By Major Source Category: 2014 Baseline
Average Annual Day (tpd[1])

SOURCE CATEGORY	VOC	NOx	CO	SOx	PM2.5
STATIONARY SOURCES					
Fuel Combustion	13	27	54	2	6
Waste Disposal	12	2	1	0	0
Cleaning and Surface Coatings	39	0	0	0	2
Petroleum Production and Marketing	38	0	5	1	2
Industrial Processes	13	0	2	0	7
Solvent Evaporation					
Consumer Products	85	0	0	0	0
Architectural Coatings	15	0	0	0	0
Others	2	0	0	0	0
Misc. Processes*	17	21	102	1	33
RECLAIM Sources	0	27	0	8	0
Total Stationary Sources	**234**	**77**	**164**	**12**	**50**
MOBILE SOURCES					
On-Road Vehicles	117	272	1165	2	12
Off-Road Vehicles	100	157	766	4	8
Total Mobile Sources	**217**	**429**	**1931**	**6**	**20**
TOTAL	**451**	**506**	**2095**	**18**	**70**

[1] Values are rounded to nearest integer.

TABLE 3-4B

Summary of Emissions By Major Source Category: 2014 Baseline Summer Planning Inventory (tpd[1])

	Summer Ozone Precursors	
SOURCE CATEGORY	**VOC**	**NOx**
Stationary Sources		
Fuel Combustion	13	28
Waste Disposal	12	2
Cleaning and Surface Coatings	45	0
Petroleum Production and Marketing	38	1
Industrial Processes	15	0
Solvent Evaporation		
Consumer Products	86	0
Architectural Coatings	18	0
Others	2	0
Misc. Processes	10	15
RECLAIM Sources	0	27
Total Stationary Sources	**239**	**73**
Mobile Sources		
On-Road Vehicles	120	251
Off-Road Vehicles	128	161
Total Mobile Sources	**248**	**412**
TOTAL	**487**	**485**

[1] Values are rounded to nearest integer.

TABLE 3-5A

Summary of Emissions By Major Source Category: 2019 Baseline
Average Annual Day (tpd[1])

SOURCE CATEGORY	VOC	NOx	CO	SOx	PM2.5
Stationary Sources					
Fuel Combustion	14	27	56	2	6
Waste Disposal	13	2	1	1	0
Cleaning and Surface Coatings	46	0	0	0	2
Petroleum Production and Marketing	36	0	5	1	2
Industrial Processes	15	0	2	0	8
Solvent Evaporation					
Consumer Products	87	0	0	0	0
Architectural Coatings	16	0	0	0	0
Others	2	0	0	0	0
Misc. Processes*	16	18	102	1	34
RECLAIM Sources	0	27	0	6	0
Total Stationary Sources	**245**	**74**	**166**	**11**	**52**
Mobile Sources					
On-Road Vehicles	80	186	755	2	11
Off-Road Vehicles	90	145	795	5	7
Total Mobile Sources	**170**	**331**	**1550**	**7**	**18**
TOTAL	**415**	**405**	**1716**	**18**	**70**

[1] Values are rounded to nearest integer.

TABLE 3-5B

Summary of Emissions By Major Source Category: 2019 Baseline
Summer Planning Inventory (tpd[1])

	Summer Ozone Precursors	
SOURCE CATEGORY	**VOC**	**NOx**
Stationary Sources		
Fuel Combustion	14	28
Waste Disposal	13	2
Cleaning and Surface Coatings	53	0
Petroleum Production and Marketing	36	0
Industrial Processes	17	0
Solvent Evaporation		
Consumer Products	88	0
Architectural Coatings	19	0
Others	2	0
Misc. Processes	9	13
RECLAIM Sources	0	27
Total Stationary Sources	**251**	**70**
Mobile Sources		
On-Road Vehicles	83	173
Off-Road Vehicles	114	148
Total Mobile Sources	**197**	**321**
TOTAL	**448**	**391**

[1] Values are rounded to nearest integer.

TABLE 3-6A

Summary of Emissions By Major Source Category: 2023 Baseline
Average Annual Day (tpd[1])

SOURCE CATEGORY	VOC	NOx	CO	SOx	PM2.5
Stationary Sources					
Fuel Combustion	14	27	56	2	6
Waste Disposal	14	2	1	0	0
Cleaning and Surface Coatings	49	0	0	0	2
Petroleum Production and Marketing	36	0	5	1	2
Industrial Processes	16	0	2	0	8
Solvent Evaporation					
Consumer Products	89	0	0	0	0
Architectural	17	0	0	0	0
Others	2	0	0	0	0
Misc. Processes*	16	17	102	1	35
RECLAIM Sources	0	27	0	6	0
Total Stationary Sources	**253**	**73**	**166**	**10**	**53**
Mobile Sources					
On-Road Vehicles	67	125	591	2	11
Off-Road Vehicles	86	130	826	6	7
Total Mobile Sources	**153**	**255**	**1417**	**8**	**18**
TOTAL	**406**	**328**	**1583**	**18**	**71**

[1] Values are rounded to nearest integer.

TABLE 3-6B

Summary of Emissions By Major Source Category: 2023 Baseline
Summer Planning Inventory (tpd[1])

	Summer Ozone Precursors	
SOURCE CATEGORY	**VOC**	**NOx**
Stationary Sources		
Fuel Combustion	14	27
Waste Disposal	14	2
Cleaning and Surface Coatings	56	0
Petroleum Production and Marketing	37	0
Industrial Processes	17	0
Solvent Evaporation		
Consumer Products	91	0
Architectural	20	0
Others	3	0
Misc. Processes	9	13
RECLAIM Sources	0	27
Total Stationary Sources	**261**	**69**
Mobile Sources		
On-Road Vehicles	69	117
Off-Road Vehicles	108	133
Total Mobile Sources	**177**	**250**
TOTAL	**438**	**319**

[1] Values are rounded to nearest integer.

TABLE 3-7A

Summary of Emissions By Major Source Category: 2030 Baseline
Average Annual Day (tpd[1])

SOURCE CATEGORY	VOC	NOx	CO	SOx	PM2.5
Stationary Sources					
Fuel Combustion	15	28	59	3	6
Waste Disposal	15	2	1	0	0
Cleaning and Surface Coatings	54	0	0	0	2
Petroleum Production and Marketing	38	0	5	1	2
Industrial Processes	17	0	2	0	9
Solvent Evaporation					
Consumer Products	93	0	0	0	0
Architectural	18	0	0	0	0
Others	2	0	0	0	0
Misc. Processes*	16	15	102	1	36
RECLAIM Sources	0	27	0	6	0
Total Stationary Sources	**268**	**72**	**169**	**11**	**55**
Mobile Sources					
On-Road Vehicles	55	101	446	2	12
Off-Road Vehicles	84	116	886	7	6
Total Mobile Sources	**139**	**217**	**1332**	**9**	**18**
TOTAL	**407**	**289**	**1501**	**20**	**73**

[1] Values are rounded to nearest integer.

TABLE 3-7B

Summary of Emissions By Major Source Category: 2030 Baseline
Summer Planning Inventory (tpd[1])

	Summer Ozone Precursors	
SOURCE CATEGORY	**VOC**	**NOx**
Stationary Sources		
Fuel Combustion	15	29
Waste Disposal	15	2
Cleaning and Surface Coatings	62	0
Petroleum Production and Marketing	38	0
Industrial Processes	19	0
Solvent Evaporation		
Consumer Products	95	0
Architectural	20	0
Others	3	0
Misc. Processes	9	12
RECLAIM Sources	0	27
Total Stationary Sources	**276**	**70**
Mobile Sources		
On-Road Vehicles	56	95
Off-Road Vehicles	105	119
Total Mobile Sources	**161**	**214**
TOTAL	**437**	**284**

[1] Values are rounded to nearest integer.

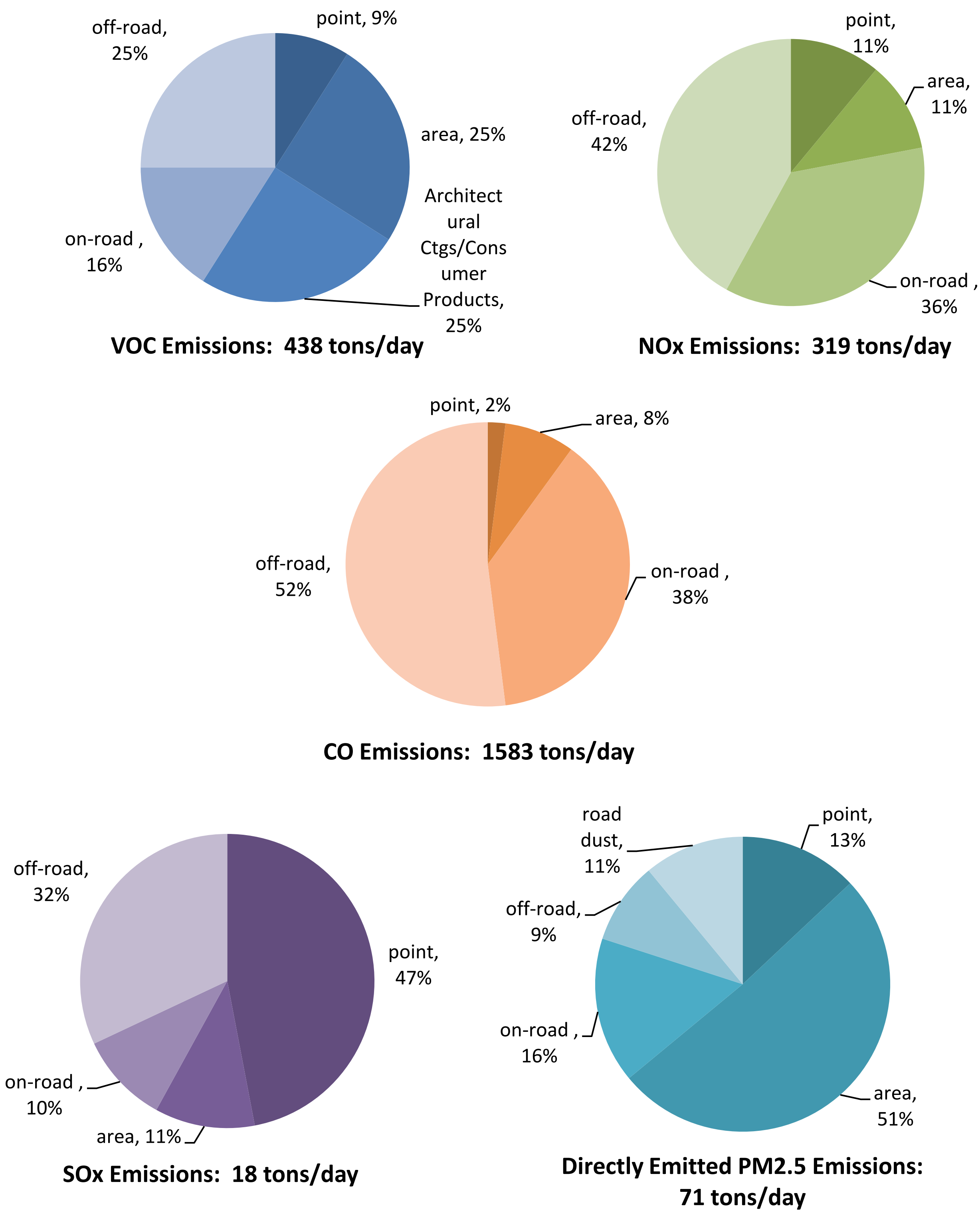


FIGURE 3-4

Relative Contribution by Source Category to 2023 Emission Inventory
(VOC & NOx – Summer Planning; CO, SOx, & PM2.5 – Annual Average Inventory)

IMPACT OF GROWTH

The Final 2012 AQMP forecasts the 2030 emissions inventories ‘‘with growth’’ through a detailed consultation process with SCAG. The region is likely to see a 16% growth in population, 18% growth in housing units, 16% growth in employment, and 11% growth in vehicle miles traveled between 2008 and 2030. To illustrate the impact of demographic growth on emissions, year 2030 no-growth emissions were estimated by removing the growth factors from the 2030 baseline emissions. Table 3-8 presents the comparison of the projected 2030 emissions with and without growth. It should be noted that in this analysis, the benefit of potential applications of BACT under District’s Reg XIII-New Source Review (NSR) is not included. The growth impacts to year 2030 for VOC, NOx, CO, SOx and PM2.5 are 77, 76, 311, 5 and 11 tons per day respectively.

Pre-Base-Year Offsets

The District’s growth projections include pre-base year emissions, consistent with the requirements of 40 CFR § 51.165(a)(3)(i)(C)(*1*). To the extent offsets are required under NSR for permitted facilities to be sited or expanded in this region, pre-2008 emission credits authorized under Reg XIII can be used and are explicitly identified and accounted for in the Final 2012 AQMP through growth projections, up to the amounts shown in Table 3-8. While Table 3-8 includes projected growth in certain sources not subject to NSR, the AQMP does not limit growth to individual source categories. Therefore, Table 3-8 explicitly identifies pre-base-year offsets in the amounts up to the difference between the growth and no-growth projections for the point and area source categories that are potentially subject to NSR and could potentially require the use of pre-base-year offsets. *See* 57 Fed. Reg. 13, 498.

This growth presents a formidable challenge to our air quality improvement efforts since the projected growth will offset the impressive progress made in reducing VOC and NOx and PM2.5 emissions through adopted regulations. Meeting the U.S. EPA’s current and future more-stringent air quality standards will require the continuation of aggressive emissions reduction efforts from all levels of government.

TABLE 3-8

Growth Impact to 2030 Emissions* in Tons per Day

WITH GROWTH	VOC	NOX	CO	SOX	PM2.5
Point	38	33	38	9	10
Area	230	39	131	2	37
Road Dust	0	0	0	0	8
On-Road	55	101	446	2	12
Off-Road	84	116	886	7	6
Total	**407**	**289**	**1501**	**20**	**73**
NO GROWTH	**VOC**	**NOX**	**CO**	**SOX**	**PM2.5**
Point	29	32	33	8	8
Area	188	28	117	1	32
Road Dust	0	0	0	0	8
On-Road	49	82	398	2	10
Off-Road	64	71	642	4	4
Total	**330**	**213**	**1190**	**15**	**62**
IMPACT OF GROWTH	**VOC**	**NOX**	**CO**	**SOX**	**PM2.5**
Point	9	1	5	1	2
Area	42	11	14	1	5
Road Dust	0	0	0	0	0
On-Road	6	19	47	0	2
Off-Road	20	45	245	3	2
Total	**77**	**76**	**311**	**5**	**11**

*Annual Average Inventory

TOP TEN SOURCE CATEGORIES (2008, 2014, 2023)

The rankings of the top ten source contributors to the emissions inventories for VOC, NOx, SOx and PM2.5 are listed and briefly discussed in this section. The 2023 summer planning inventory for VOC and NOx, along with the 2008, 2014 and 2023 annual average inventory for VOC, NOx, SOx and PM2.5 are shown in the figures 3-5 to 3-16. These source categories are fairly broad and are intended for illustration purposes only.

Table 3-9 lists the top ten categories for each of the three inventory years for VOCs. Two of top five categories are on-road mobile sources in the 2008 inventory, but none of the on-road categories are found in the top five categories for 2023. This demonstrates the effect of more-stringent on-road standards in the future. Table 3-9 shows that consumer products, off-road equipment, and recreational boats remain as high-emitting categories over time. The top 10 categories account for 78% of the total VOC inventory in 2008 and 71% in 2023.

TABLE 3–9

Top Ten Ranking Emitters for VOC Emissions (Annual Average: 2008, 2014, and 2023)

	2008	**2014**	**2023**
1	Consumer Products	Consumer Products	Consumer Products
2	Passenger Cars	Off-Road Equipment	Off-Road Equipment
3	Off-Road Equipment	Passenger Cars	Petroleum Marketing
4	Light-Duty Trucks	Petroleum Marketing	Coatings & Related Processes
5	Recreational Boats	Light-Duty Trucks	Recreational Boats
6	Petroleum Marketing	Recreational Boats	Light-Duty Trucks
7	Medium-Duty Trucks	Coatings & Related Processes	Passenger Cars
8	Architectural Coatings	Medium-Duty Trucks	Architectural Coatings
9	Coatings & Related Processes	Architectural Coatings	Medium-Duty Trucks
10	Heavy-Duty Gasoline Trucks	Degreasing	Degreasing

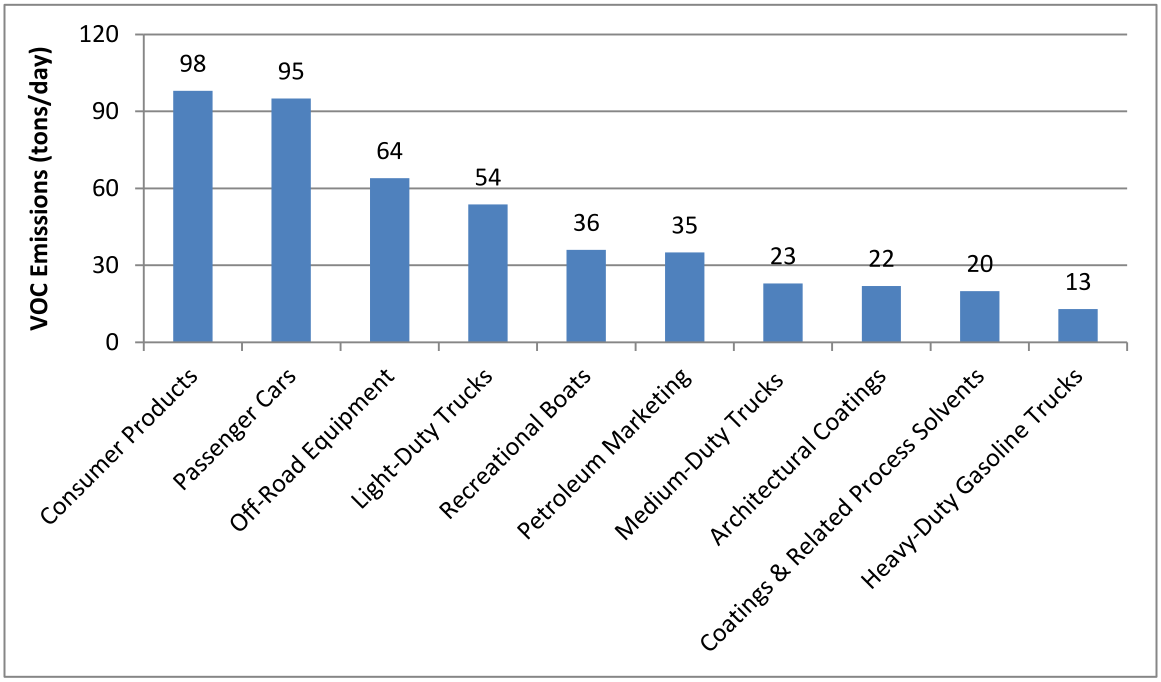


FIGURE 3-5

Top Ten Emitter Categories for VOC in 2008 (Annual Average)

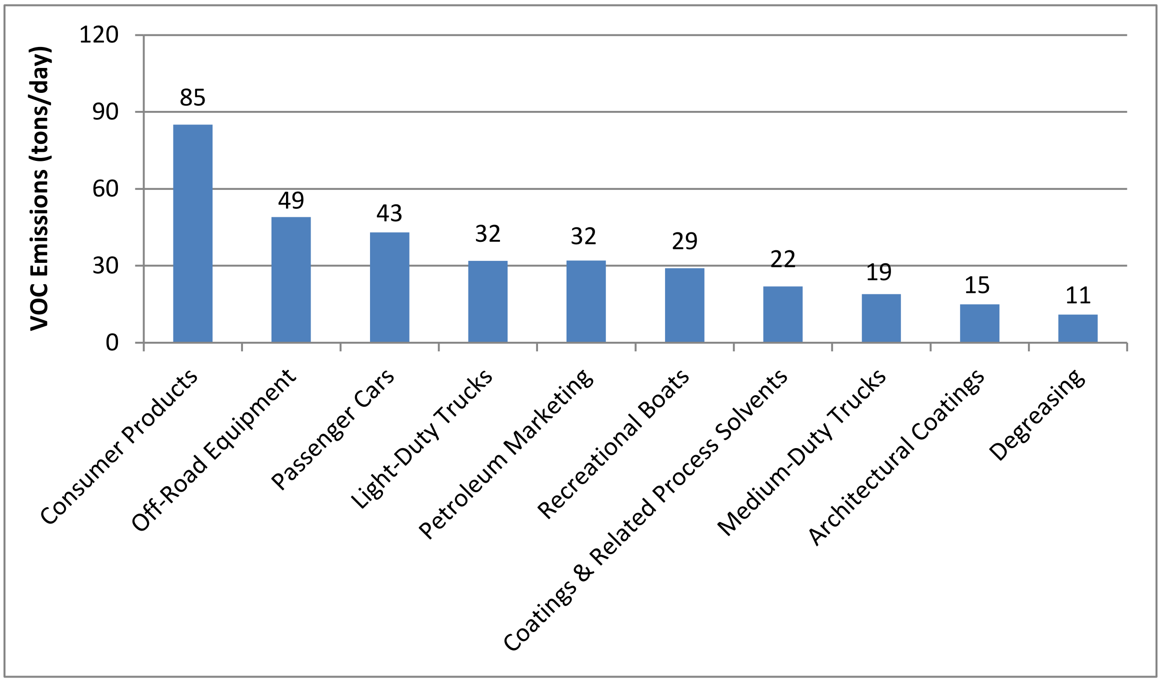


FIGURE 3-6

Top Ten Emitter Categories for VOC in 2014 (Annual Average)

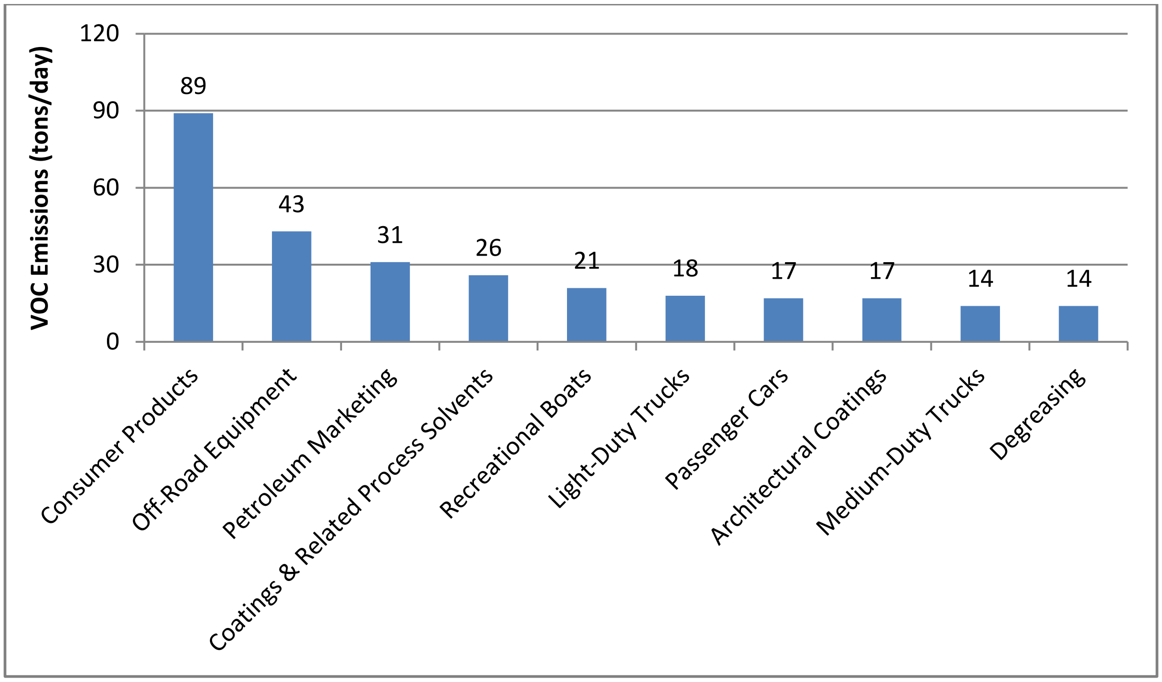


FIGURE 3-7A

Top Ten Emitter Categories for VOC in 2023 (Annual Average)

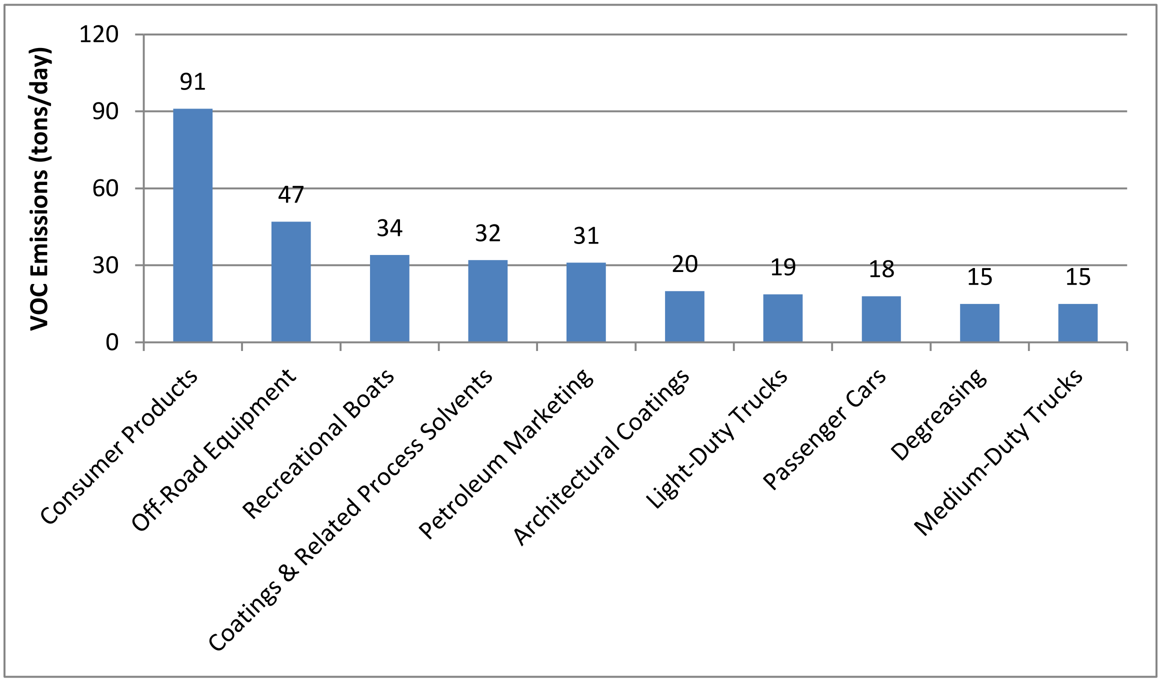


FIGURE 3-7B

Top Ten Emitter Categories for VOC in 2023 (Summer Planning)

Table 3-10 shows the top ten categories for NOx emissions in each of the three years. Mobile source categories remain the predominant contributor to NOx emissions. Heavy-duty diesel trucks and off-road equipment make the top two on the list for all three years. NOx RECLAIM and residential fuel combustion are the two non-mobile categories which make it to the top ten list. The top ten categories account for 87% of the total NOx inventory in 2008, and 78% in 2023.

TABLE 3-10

Top Ten Ranking Emitters for NOx Emissions (Annual Average: 2008, 2014, and 2023)

	2008	2014	2023
1	Heavy-Duty Diesel Trucks	Heavy-Duty Diesel Trucks	Heavy-Duty Diesel Trucks
2	Off-Road Equipment	Off-Road Equipment	Off-Road Equipment
3	Passenger Cars	Ships & Commercial Boats	Ships & Commercial Boats
4	Light-Duty Trucks	Passenger Cars	NOx RECLAIM
5	Ships & Commercial Boats	Light-Duty Trucks	Locomotives
6	Medium-Duty Trucks	Medium-Duty Trucks	Aircraft
7	Heavy-Duty Gasoline Trucks	NOx RECLAIM	Residential Fuel Combustion
8	Locomotives	Heavy-Duty Gasoline Trucks	Heavy-Duty Gasoline Trucks
9	Residential Fuel Combustion	Locomotives	Passenger Cars
10	NOx RECLAIM	Residential Fuel Combustion	Light-Duty Trucks

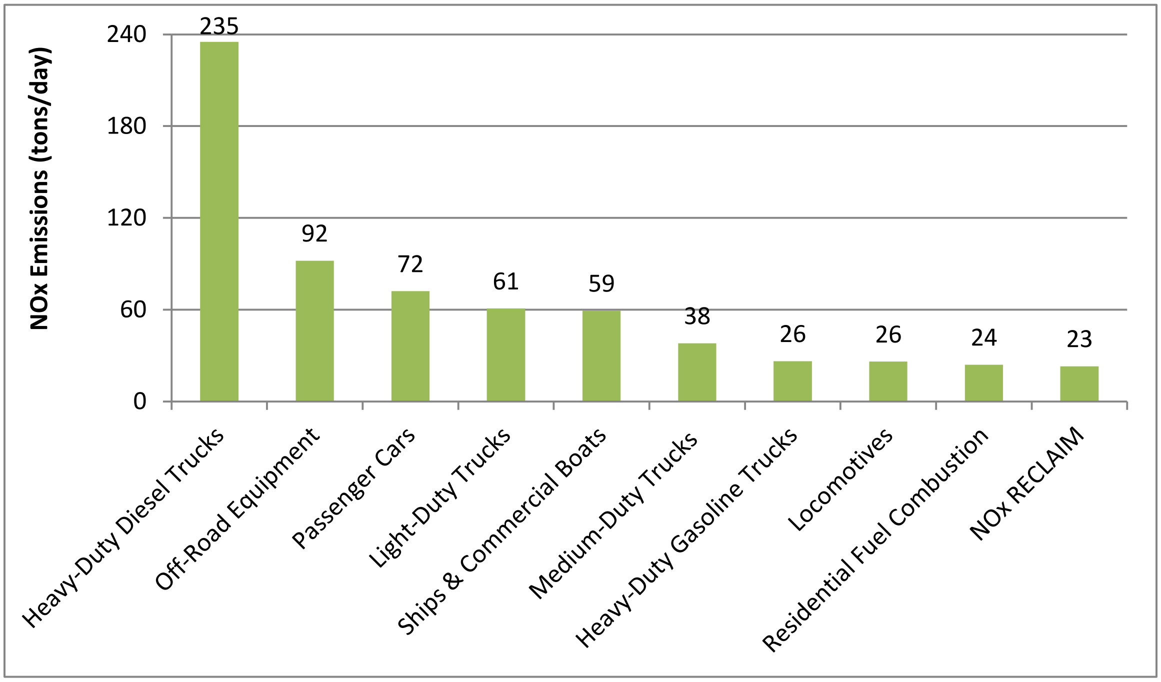


FIGURE 3-8

Top Ten Emitter Categories for NOx in 2008 (Annual Average)

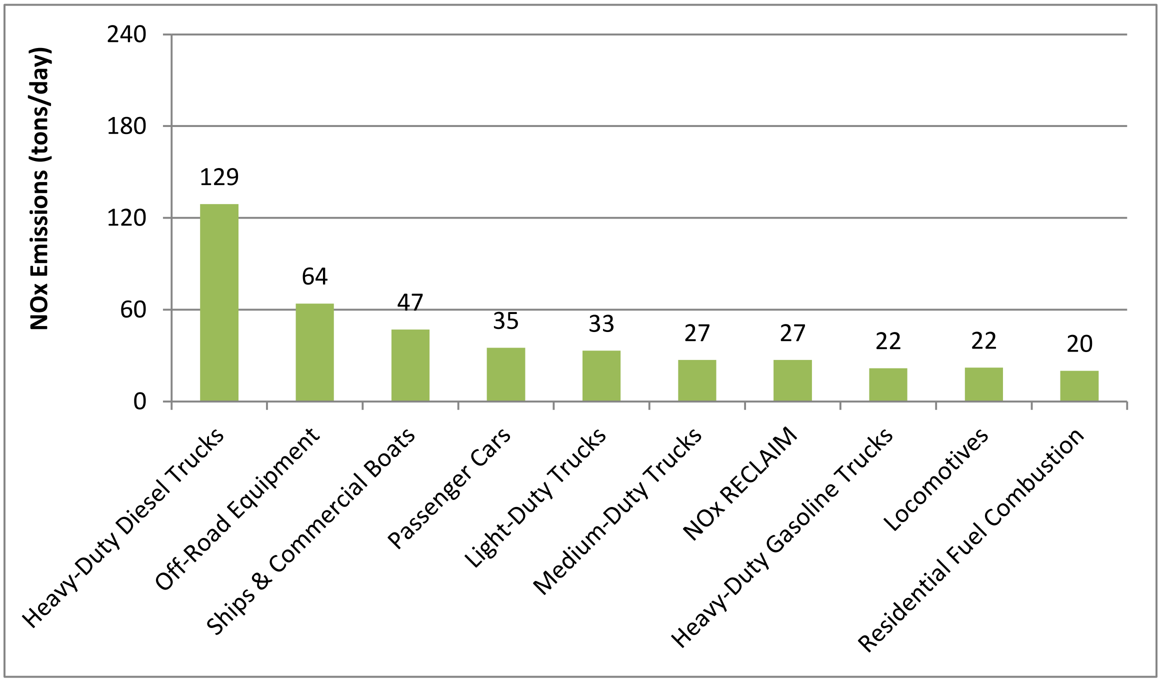


FIGURE 3-9

Top Ten Emitter Categories for NOx in 2014 (Annual Average)

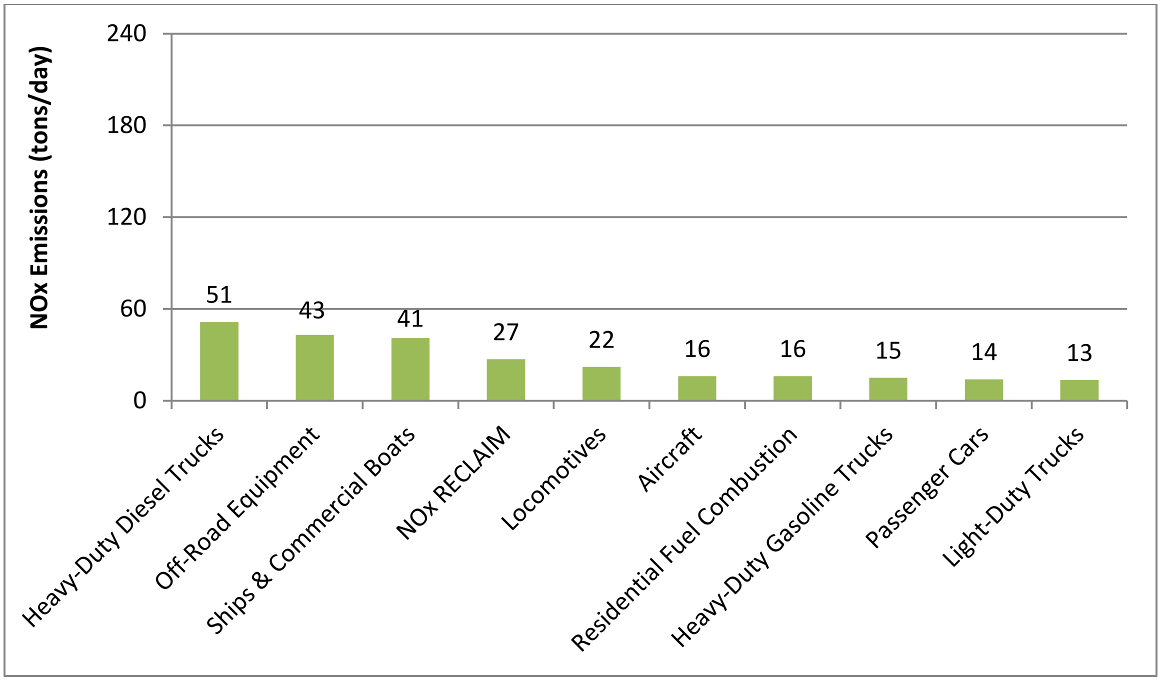


FIGURE 3-10A

Top Ten Emitter Categories for NOx in 2023 (Annual Average)

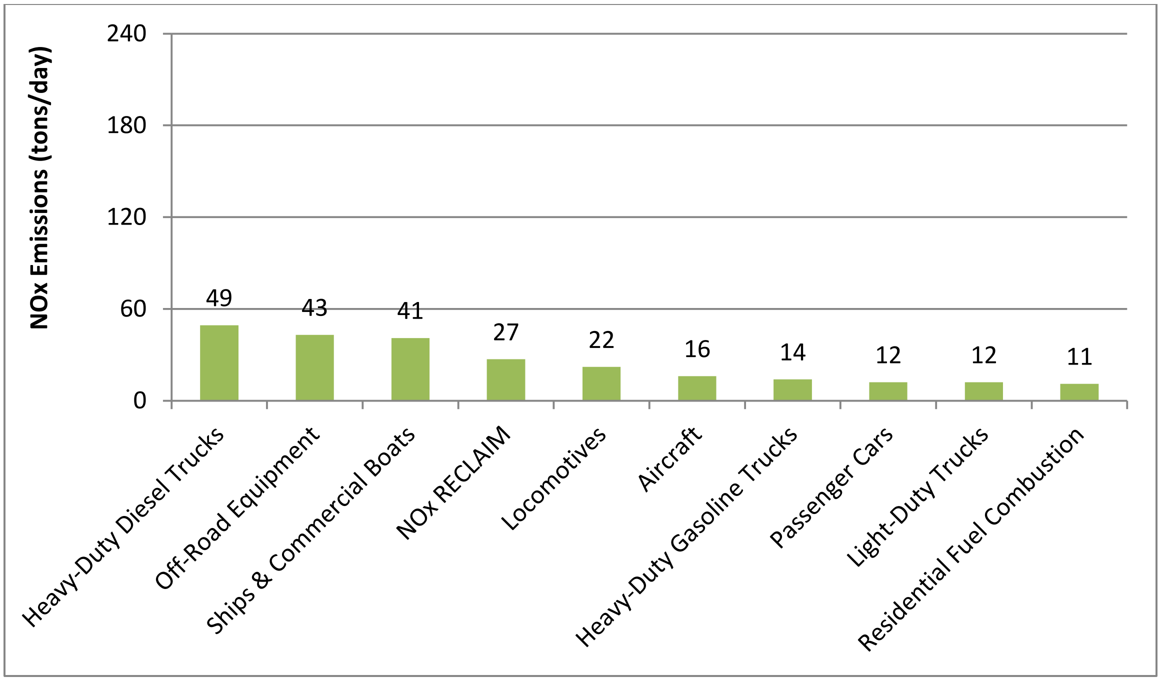


FIGURE 3-10B

Top Ten Emitter Categories for NOx in 2023 (Summer Planning)

Table 3-11 shows the top source categories for SOx emissions in the years 2008, 2014 and 2023. The emissions level of SOx is relatively low. Therefore, only the categories that emit more than 0.5 tons per day of SOx are ranked and listed. The top five high emitting source categories remain the same in 2008 and 2023. Ships & Commercial Boats and SOx RECLAIM emissions are the most significant contributors. The top categories represent 93% of the total SOx inventory in 2008 and 81% in 2023.

TABLE 3-11

Top Emitter Categories for SOx Emissions (Annual: 2008, 2014, 2023) over 0.5 tpd

	2008	**2014**	**2023**
1	Ships & Commercial Boats	SOx RECLAIM	SOx RECLAIM
2	SOx RECLAIM	Ships and Commercial Boats	Ships & Commercial Boats
3	Aircraft	Aircraft	Aircraft
4	Service and Commercial Combustion	Service and Commercial Combustion	Service and Commercial Combustion
5	Passenger Cars	Passenger Cars	Passenger Cars
6	Petroleum Refining	Petroleum Refining	Manufacturing and Industrial Combustion
7	--	Manufacturing and Industrial Combustion	Petroleum Refining
8	--	Light-Duty Trucks	--

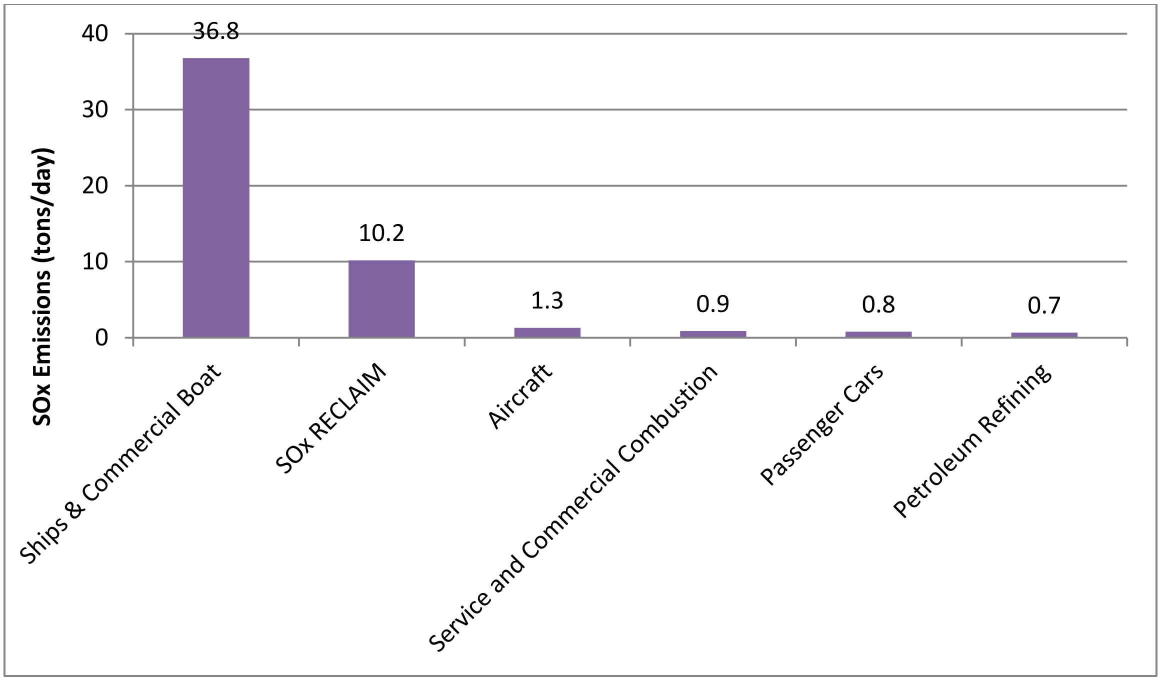


FIGURE 3-11

Top Emitter Categories for SOx Over 0.5 tpd in 2008 (Annual Average)

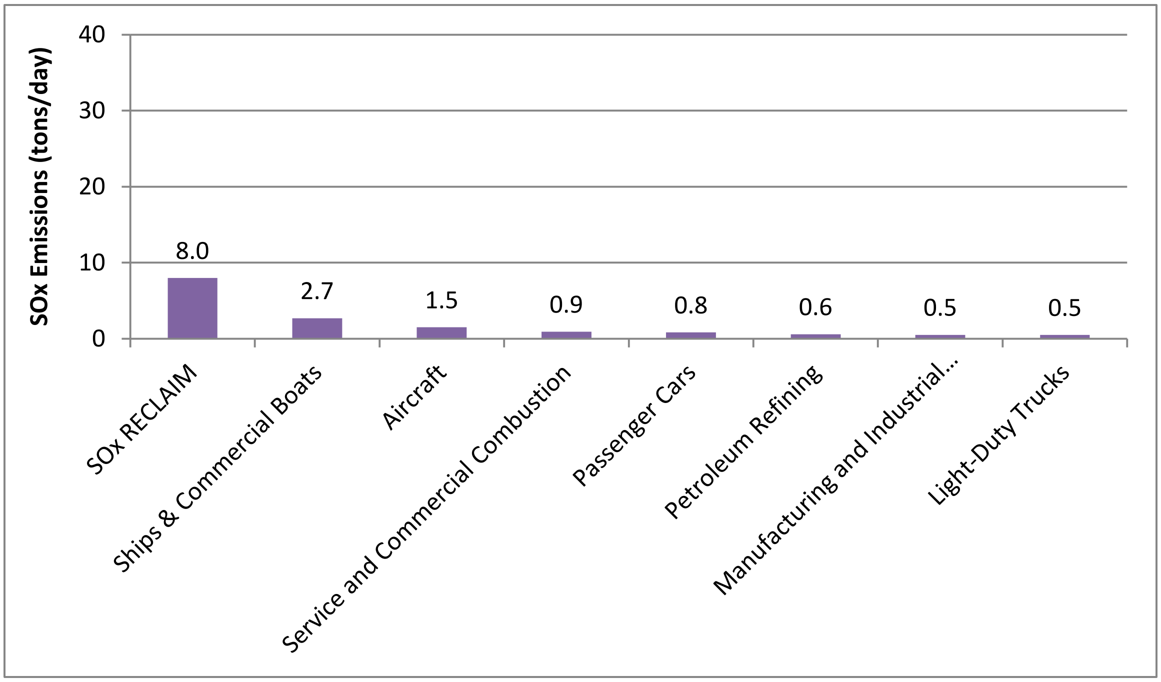


FIGURE 3-12

Top Emitter Categories for SOx Over 0.5 tpd in 2014 (Annual)

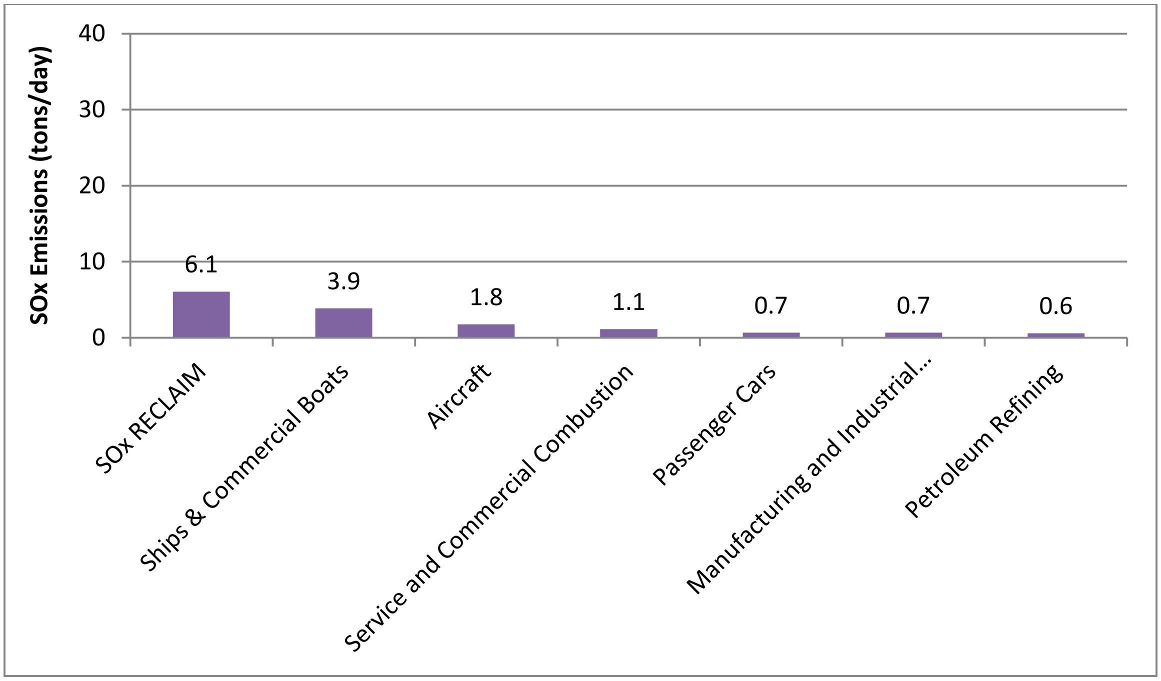


FIGURE 3-13

Top Emitter Categories for SOx Over 0.5 tpd in 2023 (Annual)

Table 3-12 shows the top ten source categories in each of the three years for directly emitted PM2.5. Commercial cooking, paved road dust, and residential fuel combustion are the top three highest emitting categories in both 2008 and 2023. The top ten categories represent 71% of the total directly emitted PM2.5 inventory in 2008 and 70% in 2023.

TABLE 3-12

Top Ten Ranking Emitters for Directly Emitted PM2.5 Emissions (Annual: 2008, 2014, 2023), from Highest to Lowest

	2008	2014	2023
1	Commercial Cooking	Commercial Cooking	Commercial Cooking
2	Heavy-Duty Diesel Trucks	Residential Fuel Combustion	Paved Road Dust
3	Residential Fuel Combustion	Paved Road Dust	Residential Fuel Combustion
4	Paved Road Dust	Waste Burning and Disposal	Waste Burning and Disposal
5	Off-Road Equipment	Passenger Cars	Passenger Cars
6	Passenger Cars	Off-Road Equipment	Mineral Processes
7	Ships & Commercial Boats	Heavy-Duty Diesel Trucks	Wood and Paper
8	Mineral Processes	Mineral Processes	Off-Road Equipment
9	Light-Duty Trucks	Wood and Paper	Construction and Demolition
10	Wood and Paper	Construction and Demolition	Heavy-Duty Diesel Trucks

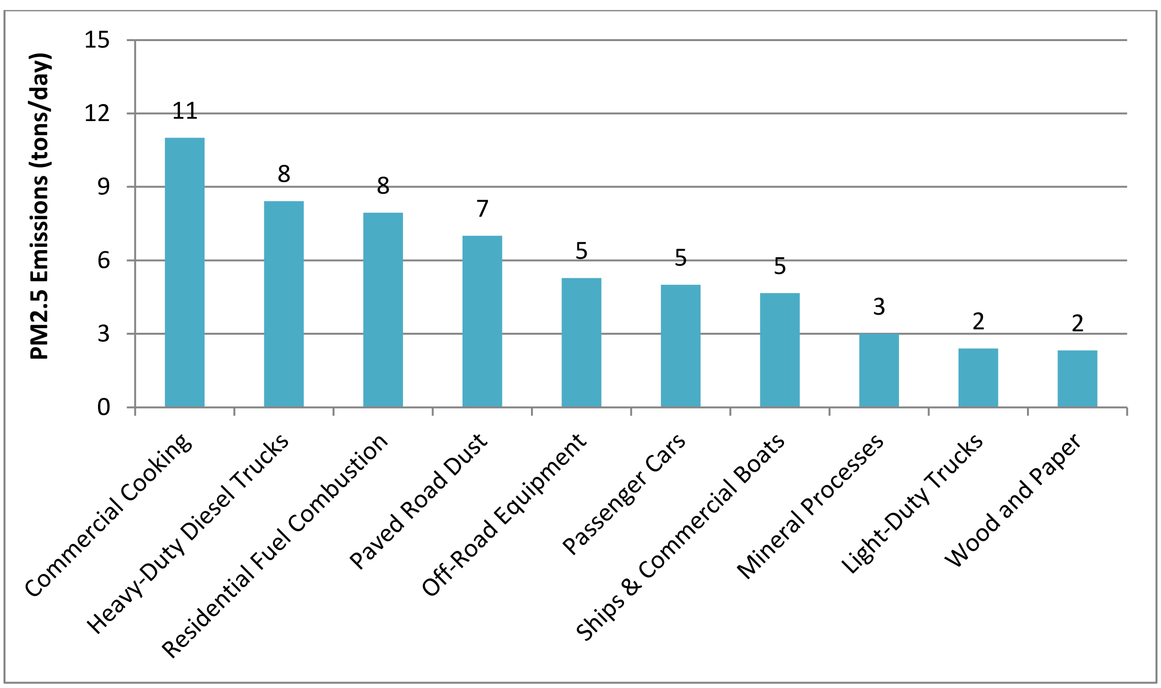


FIGURE 3-14

Top Ten Emitter Categories for Directly Emitted PM2.5 in 2008 (Annual)

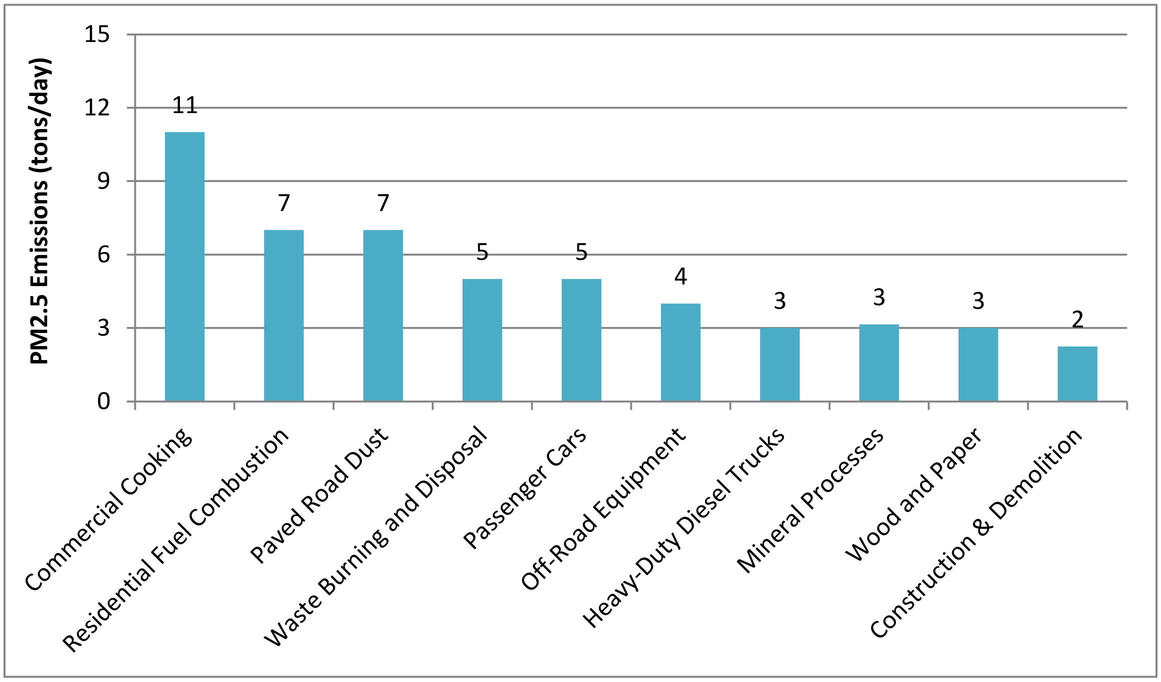


FIGURE 3-15

Top Ten Emitter Categories for Directly Emitted PM2.5 in 2014 (Annual)

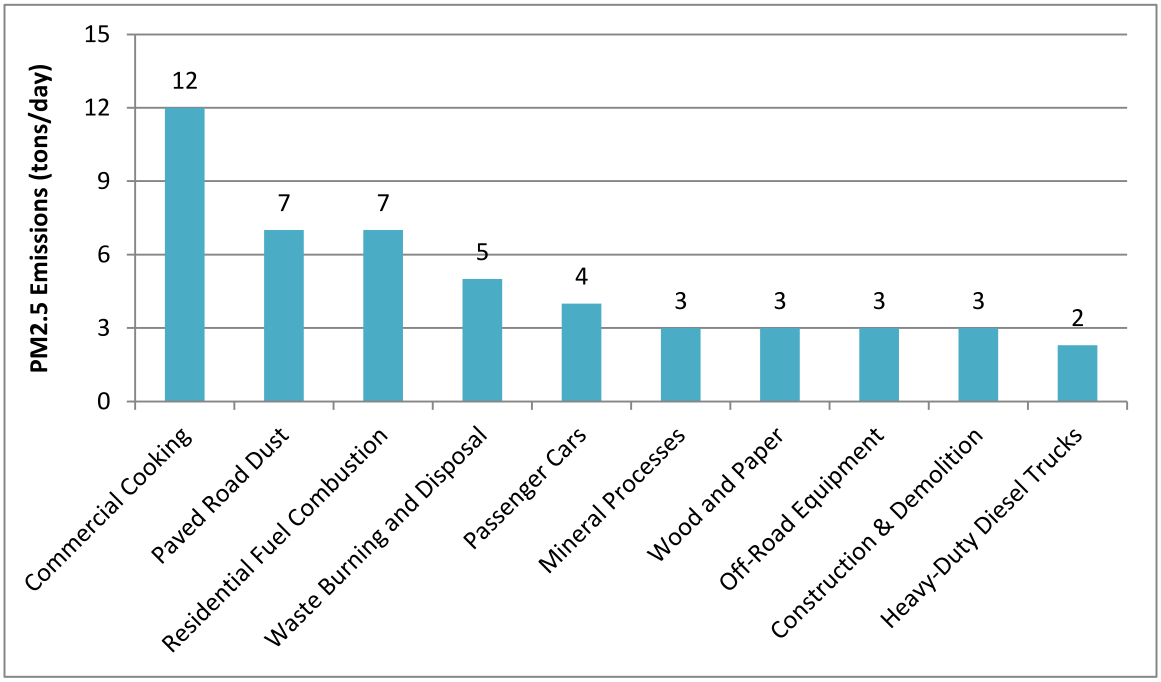


FIGURE 3-16

Top Ten Emitter Categories for Directly Emitted PM2.5 in 2023 (Annual)

Chapter 4

Control Strategy and Implementation

South Coast Air Quality Management District

Cleaning the air that we breathe...™

South Coast AQMD

CHAPTER 4

CONTROL STRATEGY AND IMPLEMENTATION

INTRODUCTION

The overall control strategy in the Final 2012 AQMP provides a path to achieving emission reductions and air quality goals. Implementation of the Final 2012 AQMP will be based on a series of control measures and strategies that vary by source type (i.e., stationary or mobile) as well as by the pollutant that is being targeted. Although great strides have been made in air pollution control technologies and emission reduction programs, air quality goals cannot be achieved without significant further emission reductions. The 2012 AQMP is designed to achieve the 2006 24-hour PM2.5 standard by 2014. In addition, the sheer magnitude of emission reductions needed for the attainment of the 8-hour ozone national ambient air quality standards (NAAQS) by 2023 and 2032 poses a tremendous challenge to the South Coast Air Basin. This challenge requires an aggressive control strategy and close collaboration with federal, state, and regional governments, local agencies, businesses, and the public. This chapter outlines the proposed control strategy and implementation schedule for the Final 2012 AQMP as required to achieve the air quality goals in the Basin.

OVERALL ATTAINMENT STRATEGY

The overall control strategy for this Plan is designed to meet applicable federal and state requirements, including attainment of ambient air quality standards. The focus of the Final 2012 AQMP is to demonstrate attainment of the federal 2006 24-hour PM2.5 ambient air quality standard by the 2014 attainment date, as well as an update to further define measures to meet the federal and state 8-hour ozone standards. The attainment demonstration for the new 8-hour ozone standard (75 ppb) will be addressed in the 2015 ozone plan.

The Final 2012 AQMP provides base year emissions and future baseline emission projections (see Chapter 3 and Appendix III). In doing so, the Final 2012 AQMP relies upon the most recent planning assumptions and the best available information including: CARB's latest emission factors (EMFAC2011) for the on-road mobile source emissions inventory; CARB's 2011 in-use fleet inventory for the off-road mobile source emission inventory; the latest point source inventory; updated area source inventories; and SCAG's forecast growth assumptions based on its recent 2012 Regional Transportation Plan. The baseline emission projections provide a snapshot of the future air quality conditions, including the effects from already adopted rules and regulations, but without a proposed control strategy.

Air quality modeling (see Chapter 5 and Appendix V) is conducted to determine the Basin's "carrying capacity," which is the allowable level of emissions to meet the standards. The remaining emissions above the carrying capacity are the amount of emissions that must be reduced in order to achieve the standards. To meet the targeted carrying capacity emissions level, a control strategy has been developed.

The development of the control strategy entails integrated planning to identify, to the extent feasible, co-benefit opportunities in achieving multi-pollutant reductions to meet standards with multiple deadlines. As such, control measures for attainment of one pollutant standard can assist in the attainment of another pollutant standard. For example, some control measures chosen to reduce criteria pollutants can also result in the reduction of greenhouse gases (GHG) and/or toxic emissions. In doing so, implementation of the Final 2012 AQMP control strategy could also assist in reaching the GHG target goals in the AB32 Scoping Plan or the air quality goals in CARB's Freight Transport Plan.

The control measures were chosen based on technical and economic feasibility, as well as other factors such as promoting fair share responsibility and maximizing private/public partnerships. Table 4-1 provides an overview of the criteria used in evaluating and selecting feasible control measures, in no particular order.

TABLE 4-1

Criteria for Evaluating 2012 AQMP Control Measures (not ranked by priority)

CRITERIA	DESCRIPTION
Cost-Effectiveness	The cost of a control measure to reduce air pollution by one ton [cost includes purchasing, installing, operating and maintaining the control technology].
Emission Reduction Potential	The total amount of pollution that a control measure can actually reduce.
Enforceability	The ability to ensure that polluters comply with a control measure.
Legal Authority	Ability of the District or other adopting agency to implement the measure or the likelihood that local governments and agencies will cooperate to approve a control measure.
Public Acceptability	The likelihood that the public will cooperate in the implementation of a control measure that applies to members of the public.
Rate of Emission Reduction	The time it will take for a control measure to reduce a certain amount of air pollution.
Technological Feasibility	The likelihood that the technology for a control measure will be available as anticipated.

For the Final 2012 AQMP control measure development, District staff conducted an AQMP Technology Symposium in September 2011 to solicit new control concepts and innovative ideas from industry experts, professional consultants, and government specialists. Internal staff suggestions and external recommendations assisted in identifying additional control measures and assessing control measure feasibility. Since the adoption of the 2007 AQMP, the District has made significant strides in achieving further emission reductions from stationary sources. Table 1-2 in Chapter 1 provides a list of rules adopted by the District since adoption of the 2007 AQMP as well as the SIP commitment and the emission reductions achieved for each rule. The proposed control strategy in the Final 2012 AQMP includes some revised and partially implemented measures from the 2007 AQMP, and new measures deemed feasible and necessary to provide additional control opportunities to achieve the air quality standards.

The Final 2012 AQMP is proposing a control strategy that includes emission reductions from both stationary and mobile sources. The proposed stationary source control measures in the Final 2012 AQMP are based on implementation of all feasible control measures through the application of available cleaner technologies, best management practices, incentive programs, as well as development and implementation of zero- and near-zero technologies and control methods. The stationary source control measures presented in the Plan are proposed to further reduce emissions from both point sources (permitted facilities) and area sources (generally small and non-permitted) in addition to smaller permitted sources with emissions less than the reporting threshold in the District's Annual Emissions Reporting Program). The basic principles followed in developing the District's stationary source control measures include: 1) identify PM2.5, ammonia and/or NOx reduction opportunities and maximize reductions by the 2014 attainment date, and 2) initiate programs or rule making activities for VOC and further NOx control strategies aiming at maximum reductions by the 2023 timeframe to further implement the ozone plan for the 1997 8-hour ozone standard.

The mobile source strategy includes actions seeking further emission reductions from both on-road and off-road mobile sources, such as accelerated penetration of zero- and near-zero emission vehicles and early retirement of older vehicles. In addition, the mobile source strategy includes research and development of advanced control technologies from various mobile sources. Some of the proposed actions need to be implemented by several agencies that currently have the statutory authority to implement such measures. For more details about the responsibilities of the other agencies, refer to the last section of this chapter under Implementation.

The Final 2012 AQMP relies on a comprehensive and integrated control approach aimed at achieving the 2006 24-hour PM2.5 standard by the 2014 attainment date through implementation of short-term 24-hour PM2.5 control measures. For each control measure, the District will seek to achieve the maximum reduction potential that is technically feasible and cost-effective. The overall control strategy provides for attainment of the 2006 24-hour PM2.5 standard, with additional ozone measures to further implement the ozone plan for the 8-hour ozone standard.

The following sections provide an overview of the two-part control strategy.

24-Hour PM2.5 Strategy

In December 2009, the U.S. EPA designated the Basin as nonattainment for the 2006 24-hour PM2.5 NAAQS, and required attainment of the standard by 2014. To develop the Plan's required control strategy for meeting state and federal requirements, an iterative process of technology/strategy review and ambient air quality modeling is utilized. The emission inventories for nonattainment areas include base year (2008) and future years' emissions through the attainment year (see Chapter 3 for detail of the inventory) which include emissions reductions achieved by already-adopted measures. The remaining emissions target is initially defined utilizing air quality modeling that will achieve the ambient air quality standards based on reductions from all sources. Control measures based on existing technologies and advancements are then evaluated to determine their effectiveness in meeting this remaining emissions target. Further modeling analyses are conducted using the actual emissions reductions achieved based on the technology forecast. Ultimately an overall emissions target (i.e., carrying capacity) is determined for achieving the ambient air quality standards and for which controls have been proposed.

<u>Modeling Results</u>

In accordance with U.S. EPA guidelines, the District modeled air quality based on emission reductions achieved due to already-adopted and implemented rules at the federal, state and local levels. This analysis provided the air quality improvements that such programs are projected to offer for the nonattainment area. Future air quality projections for 24-hour PM2.5 concentrations as shown in Chapter 5 show an air quality improvement over time. There are many factors (e.g., current regulations, fleet turnover, etc.) contributing to the downward trend of 24-hour PM2.5 levels, but the reductions from already adopted regulations are not enough to meet the attainment date of 2014 at all monitoring stations. The U.S. EPA does allow an area that cannot meet the standard by the attainment date, based on the severity of its nonattainment problem and feasibility of pollution control measures, to request an extension of the initial attainment date for a period of up to five years. As demonstrated in Chapter 5, the inclusion of the control strategy in combination with already adopted measures will enable the region to achieve attainment by 2014.

Sensitivity Analysis

There are five major contributors resulting in the formation of PM2.5 including NOx, SOx, VOC, directly emitted PM2.5, and ammonia. Various combinations of reductions of these pollutants could provide a path to achieve clean air standards. It is useful to weigh the value in tons per day of emissions reductions relative to ambient concentration improvements of PM2.5, since different pollutant emissions contribute differently to overall PM2.5 levels. The Final 2007 AQMP established a set of factors relating regional per ton precursor emissions reductions to microgram per cubic meter improvements of ambient PM2.5 for the annual average concentration. The current CMAQ model simulations provide a similar set of factors, but this time related to 24-hour average PM2.5. For 24-hour average PM2.5, the simulations determined that VOC emissions reductions have the lowest benefit in terms of micrograms per cubic meter ambient PM2.5 reduced per ton of emissions reduction, a third of NOx's effectiveness. The analysis further indicated that SOx emissions were about 7.8 times more effective than NOx, and that directly emitted PM2.5 is approximately 14.8 times more effective than NOx. It is important to note that the contribution of ammonia emissions is embedded as a component of the SOx and NOx factors, since ammonium nitrate and ammonium sulfate are the resultant particulate compounds formed in the ambient chemical process.

Basin-wide and Episodic Short-Term PM2.5 Measures

The Basin-wide 24-hour PM2.5 attainment strategy is primarily focused on directly-emitted PM2.5 and NOx reductions which can be feasibly achieved by the attainment date of 2014. Direct PM2.5 emissions can be substantially reduced by episodically curtailing residential wood burning and open burning from agricultural or prescribed (e.g., brush clearing) sources. NOx is a precursor to both PM2.5 and ozone, and thus NOx reductions are preferred since they are also needed for ozone. Thus, further NOx reductions from RECLAIM facilities are being proposed as a contingency measure if attainment of the 24-hour PM2.5 standard is not achieved by 2014. The Basin-wide control strategy also includes a backstop measure for indirect sources at the ports, initiation of control technology assessments, and a measure focused on education and outreach.

8-hour Ozone Strategy

Although the Basin is projected to meet the 2006 24-hour PM2.5 standards by the applicable attainment deadlines with the strategy discussed above, significant challenges remain in meeting the federal ozone standards. The next AQMP in 2015 will include a more detailed analysis to demonstrate attainment of the 1997 and 2008 8-hour ozone standards, but it is prudent for both the District and stakeholders to immediately begin development of control strategies for ozone given the looming 2023 deadline. The District will pursue actions that can be implemented over the next two to three years to work towards meeting the 8-hour ozone standards. Ozone reduction strategies and programs need to be continued and accelerated to ensure that the air basin will meet the 8-hour ozone standards by 2024 and 2032. Proposed measures to reduce ozone include emission reductions from coatings, and RECLAIM facilities as well as early transitions to cleaner technologies.

To ultimately achieve the ozone ambient air quality standards, significant additional emissions reductions will be necessary from a variety of sources, including those primarily under the jurisdiction of CARB (e.g., on-road motor vehicles, off-road equipment, and consumer products) and U.S. EPA (e.g., aircraft, ships, trains, and pre-empted off-road equipment). Without an adequate and fair-share level of reductions from all sources, the emission reduction burden would unfairly be shifted to sources that have already been doing their part for clean air. Moreover, the District will continue to use its available regulatory authority to further control mobile source emissions where federal or State actions do not meet regional needs.

Overall, the Final 2012 AQMP includes 21 stationary and 17 mobile source measures. The following seven sections discuss the control measures, SIP commitments, overall emission reductions and implementation as outlined below:

- Proposed Short-term PM2.5 Control Measures (see Appendix IV-A for detailed descriptions of the District's stationary source control measures)
- Proposed PM2.5 Contingency Measures (see Chapter 6 for a detailed discussion of the contingency requirements)

- SCAG's Regional Transportation Strategy and Transportation Control Measures (see Appendix IV-C for detailed descriptions of the regional transportation strategy and control measures)
- Proposed 8-hour Ozone Measures (see Appendix IV-A for detailed descriptions of the District's stationary source control measures and Appendix IV-B for detailed descriptions of the District's mobile source measures)
- District's SIP Emission Reduction Commitment
- Overall Emission Reductions
- Implementation

PROPOSED PM2.5 SHORT-TERM CONTROL MEASURES

The proposed short-term PM2.5 control measures include stationary source control measures, episodic controls, technology assessments, an indirect source measure and one education measure. As noted earlier in this chapter, a public process to solicit input assisted District staff in developing and proposing feasible control measures and strategies that could be adopted and implemented in the short-term. The assessment considered whether adoption and implementation of control measures could reasonably take place prior to 2014 resulting in attainment of the 2006 24-hour PM2.5 standard of 35 $\mu g/m^3$ by the 2014 attainment year. Each short-term PM2.5 control measure was evaluated to determine the potential emission reductions that could be achieved. In some cases, only a range of possible emissions reductions could be determined, and for some others, the magnitude of potential reductions cannot be determined at this time.

Table 4-2 provides a list of the District's short-term PM2.5 measures along with the anticipated adoption date, implementation date and emissions reduction. The measures target a variety of source categories: Combustion Sources (CMB), PM Sources (BCM), Indirect Sources (IND), Educational Programs (EDU) and Multiple Component Sources (MCS).

TABLE 4-2

List of District's Adoption/Implementation Dates and Estimated Emission Reductions from Short-Term PM2.5 Control Measures

NUMBER	TITLE	ADOPTION	IMPLEMENTATION PERIOD	REDUCTION (TPD)
CMB-01	Further NOx Reductions from RECLAIM [NOx] –*Phase I (Contingency)*	2013	2014	2-3 [a]
BCM-01	Further Reductions from Residential Wood Burning Devices [PM2.5]	2013	2013-2014	7.1 [b]
BCM-02	Further Reductions from Open Burning [PM2.5]	2013	2013-2014	4.6 [c]
BCM-03 (*formerly BCM-05*)	Emission Reductions from Under-Fired Charbroilers [PM2.5]	Phase I – 2013 (*Tech Assessment*) Phase II - TBD	TBD	1 [d]
BCM-04	Further Ammonia Reductions from Livestock Waste [NH3]	Phase I – 2013-2014 (*Tech Assessment*) Phase II - TBD	TBD	TBD [e]
IND -01 (*formerly MOB-03*)	Backstop Measures for Indirect Sources of Emissions from Ports and Port-Related Facilities [NOx, SOx, PM2.5]	2013	12 months after trigger	N/A [f]
EDU-01 (*formerly MCS-02, MCS-03*)	Further Criteria Pollutant Reductions from Education, Outreach and Incentives [All Pollutants]	Ongoing	Ongoing	N/A [f]
MCS-01 (*formerly MCS-07)*	Application of All Feasible Measures Assessment [All Pollutants]	Ongoing	Ongoing	TBD [e]

a. Emission reductions are included in the SIP as a contingency measure.
b. Winter average day reductions based on episodic conditions and 75 percent compliance rate.
c. Reductions based on episodic day conditions.
d. Will submit into SIP once technically feasible and cost effective options are confirmed.
e. TBD are reductions to be determined once the technical assessment is complete, and inventory and control approach are identified.
f. N/A are reductions that cannot be quantified due to the nature of the measure (e.g., outreach, incentive programs) or if the measure is designed to ensure reductions that have been assumed to occur will in fact occur.

Each control measure type relies on a number of control methods. Table 4-3 provides the types of proposed short-term measures and their typical corresponding control methods.

TABLE 4-3

Proposed Short-Term Measure Control Methods

SOURCE CATEGORY	CONTROL METHOD
Combustion Sources	• Add-On Controls • Market Incentives • Process Improvement • Improved Energy Efficiency
Best Available Control Measures for Fugitive Ammonia Sources	• Best Management Practices • Best Available Control Technology • Process Improvement
Multiple Component Sources	• Geographic Controls • Process Modifications and Improvements • Add-On Controls • Best Management Practices • Best Available Control Technology • Market Incentives • Energy Efficiency and Conservation
Indirect Source	• Emission Control Plans • Contractual Requirements • Tariffs, Incentives/Disincentives
Educational Programs	• Increased Awareness • Technical Assistance

The following text provides a brief description of the District's short-term measures.

<u>Combustion Sources</u>

This category includes a control measure that further reduces NOx emissions from RECLAIM facilities.

CMB-01 – FURTHER NOX REDUCTIONS FROM RECLAIM (PHASE I): This proposed control measure is a contingency measure to be automatically triggered if the 24-hour PM2.5 standard is not met by the 2014 attainment date. The control measure will seek further reductions of 2 tpd of NOx allocations if triggered. In addition, staff would seek to identify appropriate approaches during rulemaking to implement the allocation shaving methodology. The control measure has the ability to produce co-benefits in the reduction of PM2.5 and ozone.

PM Sources

This category includes four control measures, including episodic curtailment of residential wood burning and opening burning, PM2.5 emission reductions from under-fired charbroilers and ammonia emission reductions from livestock waste. The under-fired charbroiler measure has been carried over from the 2007 AQMP.

BCM-01 - FURTHER REDUCTIONS FROM RESIDENTIAL WOOD BURNING DEVICES: The purpose of this measure would be to seek further PM2.5 emissions reductions from residential wood burning fireplaces and wood stoves whenever key areas in the South Coast Air Basin are forecast to approach the federal 24-hour PM2.5 standard. A review of other California air district regulations has indicated that the most appropriate amendment to the existing AQMD wood smoke control program would be to decrease the mandatory wood burning curtailment forecast threshold from 35 $\mu g/m^3$ to a more conservative 30 $\mu g/m^3$. In addition to the existing sub-regional curtailment program of Rule 445 (based on areas forecast to exceed the existing PM2.5 standard), this measure would implement a curtailment that would apply Basin-wide whenever a PM2.5 level of greater than 30 $\mu g/m^3$ is forecast at any monitoring station, which has recorded violations of the design value for the current PM2.5 24-hour standard of 35 $\mu g/m^3$ for either of the two previous three-year design value periods. Lowering the wood burning curtailment forecast threshold and applying the curtailment to the entire Basin when triggered could potentially reduce Basin-wide ambient PM2.5 concentrations on these episodic no-burn days by about 7.1 tons per winter day (assuming 75% rule effectiveness).

BCM-02 - FURTHER REDUCTIONS FROM OPEN BURNING: Rule 444 outlines the criteria and guidelines for agricultural and prescribed burning, as well as training burns, to minimize PM emissions and smoke in a manner that is consistent with state and federal laws. Agricultural burning is open burning of vegetative materials produced from the growing and harvesting of crops. Prescribed burning is a planned open burning of vegetative materials, usually conducted by a fire protection agency and/or department of forestry, to promote a healthier habitat for plants and animals, to prevent plant disease and pests, and to reduce the risk of wild fires. Training burns are hands-on instructional events conducted by fire protection agencies on methods of preventing and/or suppressing fire. Rule 444 currently contains requirements that a no-burn day may be called under a combination of geographical, meteorological, and air quality conditions. This control measure would potentially increase the number of no-burn days by establishing an additional criteria for no-burn during episodic days as described in control measure BCM-01 by implementing a curtailment that would apply Basin-wide whenever a PM2.5 level of greater than 30 $\mu g/m^3$ is forecast at any monitoring station which has recorded violations of the design value for the current PM2.5 24-hour standard of 35 $\mu g/m^3$ for either of the two previous three-year design value periods. Enhancing the open burning restrictions with this new threshold criteria and applying a curtailment to the entire Basin could potentially reduce Basin-wide ambient PM2.5 concentrations on these episodic no-burn days by about 4.6 tons per winter day. Since the burning would likely be shifted to other days, the total annual emissions would remain the same, but would not occur on days where high PM2.5 levels are forecast.

BCM-03 - EMISSION REDUCTIONS FROM UNDER-FIRED CHARBROILERS: This proposed measure seeks emission reductions by potentially requiring new and/or existing medium to large volume restaurants with under-fired charbroilers to install control devices meeting a minimum efficiency requirement. Under-fired charbroilers are responsible for the majority of emissions from restaurant operations – 84 percent of PM and 71 percent of VOC emissions. Several control options are currently being evaluated and tested including electrostatic precipitators (ESP), high efficiency particulate arresting (HEPA) filters, wet scrubbers, and thermal oxidizers. Under-fired charbroilers are one of the largest unregulated sources of directly emitted PM. A technical assessment of potential control technologies is currently ongoing at University of California, Riverside (CE-CERT), to evaluate the efficiency and the cost-effectiveness of various control devices for the capture and control of filterable and/or condensable forms of PM from under-fired charbroilers. The Bay Area AQMD adopted a rule for commercial cooking equipment that controls both chain-driven and under-fired charbroilers. The Bay Area measure will be evaluated to meet the all feasible measures requirement. Technical and economic feasibility, as well as affordability of controls, particularly for existing restaurants relative to retrofit installation and operation/maintenance, will be considered in conjunction with any future rule development to establish requirements for under-fired charbroilers.

BCM-04 – FURTHER AMMONIA REDUCTIONS FROM LIVESTOCK WASTE: This measure seeks to reduce ammonia emissions from livestock operations with emphasis on dairies. Existing Rule 1127 – Emission Reductions from Livestock Waste requires best management practices for dairies and specific requirements regarding manure removal, handling, and composting; however, the rule does not focus on fresh manure, which is one of the largest dairy sources of ammonia emissions. An assessment will be conducted to evaluate the use of sodium bisulfate (SBS) at local dairies to evaluate the technical and economic feasibility of its application, as well as potential impacts to ground water, and the health and safety of both workers and dairy stock. Reducing pH level in manure through the application of acidulant additives (acidifier), such as SBS, is one of the potential mitigations for ammonia. SBS is currently being considered for use in animal housing areas where high concentrations of fresh manure are located. Research indicates that best results occur when SBS is used on “hot spots”. SBS can also be applied to manure stock piles and at fencelines, and upon scraping manure to reduce ammonia spiking from the leftover remnants of manure and urine. SBS application may be required seasonally or episodically during times when high ambient PM2.5 levels are forecast.

Multiple Component Sources

There is one short-term control measure for all feasible measures.

MCS-01: APPLICATION OF ALL FEASIBLE MEASURES ASSESSMENT: This control measure is to address the state law requirement for all feasible measures for ozone. Existing rules and regulations for pollutants such as VOC, NOx, SOx and PM reflect current best available retrofit control technology (BARCT). However, BARCT continually evolves as new technology becomes available that is feasible and cost-effective. Through this proposed control measure, the District would commit to the adoption and implementation of the new retrofit control technology standards. Finally, staff will review actions taken by other air districts for applicability in our region.

Indirect Sources

This category includes a proposed control measure carried over from the 2007 AQMP (formerly MOB-03) that establishes a backstop measure for indirect sources of emissions at ports.

IND-01- BACKSTOP MEASURE FOR INDIRECT SOURCES OF EMISSIONS FROM PORTS AND PORT-RELATED FACILITIES: The goal of this measure is to ensure that NOx, SOx and PM2.5 emissions reductions from port-related sources are sufficient to attain the 24-hr federal PM2.5 ambient air quality standard. If emission levels projected to result from the current regulatory requirements and voluntary reduction strategies specified by the Ports are not realized, the 24-hr federal PM2.5 ambient air quality standard may not be achieved. This control measure is designed to ensure that the necessary emission reductions from port-related sources projected in the 2012 AQMP milestone years are achieved or if it is later determined through a SIP amendment that additional region-wide reductions are needed due to the change in Basin-wide carrying capacity for PM2.5 attainment. In this case, the ports will be required to further reduce their emissions on a "fair-share" basis.

Educational Programs

There is one proposed educational program within this category.

EDU-01: FURTHER CRITERIA POLLUTANT REDUCTIONS FROM EDUCATION, OUTREACH AND INCENTIVES: This proposed control measure seeks to provide educational outreach and incentives for consumers to contribute to clean air efforts. Examples include the usage of energy efficient products, new lighting technology, "super compliant" coatings, tree planting, and the use of lighter colored roofing and paving materials which reduce energy usage by lowering the ambient temperature. In addition, this proposed measure intends to increase the effectiveness of energy conservation programs through public education and awareness as to the environmental and economic benefits of conservation. Educational and incentive tools to be used include social comparison applications (comparing your personal environmental impacts with other individuals), social media, and public/private partnerships.

PROPOSED PM2.5 CONTINGENCY MEASURES

Pursuant to CAA section 172(c)(9), contingency measures are emission reduction measures that are to be automatically triggered and implemented if an area fails to attain the national ambient air quality standard by the applicable attainment date, or fails to make reasonable further progress (RFP) toward attainment. Further detailed descriptions of contingency requirements can be found in Chapter 6 – Clean Air Act Requirements. As discussed in Chapter 6 and consistent with U.S. EPA guidance, the District is proposing to use excess air quality improvement from the proposed control strategy, as well as potential NOx reductions from CMB-01 listed above, to demonstrate compliance with this federal requirement.

SCAG's REGIONAL TRANSPORTATION STRATEGY AND TRANSPORTATION CONTROL MEASURES

The Southern California Association of Governments (SCAG), the Metropolitan Planning Organization (MPO) for Southern California, is mandated to comply with federal and state transportation and air quality regulations. Federal transportation law authorizes federal funding for highway, highway safety, transit, and other surface transportation programs. The federal CAA establishes air quality standards and planning requirements for various criteria air pollutants.

Transportation conformity is required under CAA Section 176(c) to ensure that federally supported highway and transit project activities "conform to" the purpose of the SIP. Conformity currently applies to areas that are designated non-attainment, and those re-designated to attainment after 1990 ("maintenance areas" with plans developed under CAA Section 175[A]) for the specific transportation-related criteria pollutants. Conformity to the purpose of the SIP means that transportation activities will not cause new air quality violations, worsen existing violations, or delay timely attainment of the relevant NAAQS. The transportation conformity regulation is found in 40 CFR Part 93.

Pursuant to California Health and Safety Code section 40460, SCAG has the responsibility of preparing and approving the portions of the AQMP relating to regional demographic projections and integrated regional land use, housing, employment, and transportation programs, measures, and strategies. The District combines its portion of the Plan with those prepared by SCAG.

The transportation strategy and transportation control measures (TCMs), included as part of the 2012 PM2.5 AQMP and SIP for the South Coast Air Basin, are based on SCAG's adopted 2012-2035 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS) and 2011 Federal Transportation Improvement Program (FTIP). This was developed in consultation with federal, state and local transportation and air quality planning agencies and other stakeholders.

The Regional Transportation Strategy and Transportation Control Measures portion of the 2012 AQMP/SIP consists of the following three related sections.

Section I. Linking Regional Transportation Planning to Air Quality Planning

As required by federal and state laws, SCAG is responsible for ensuring that the regional transportation plan, program, and projects are supportive of the goals and objectives of AQMPs/SIPs. SCAG is also required to develop demographic projections and a regional transportation strategy and control measures for the AQMPs/SIPs.

The RTP/SCS, updated every four years, is a long-range regional transportation plan that provides a vision for transportation investments throughout the SCAG Region. The 2012-2035 RTP/SCS also integrates land use and transportation planning to achieve regional greenhouse gas (GHG) reduction targets set by ARB pursuant to SB375.

SCAG also develops the biennial FTIP. The FTIP is a multimodal program of capital improvement projects to be implemented over a six year period. The FTIP implements the programs and projects in the RTP/SCS.

Section II. Regional Transportation Strategy and Transportation Control Measures

The SCAG Region faces daunting mobility, air quality, and transportation funding challenges. Under the guidance of the goals and objectives adopted by SCAG's Regional Council, the 2012-2035 RTP/SCS was developed to provide a blueprint to integrate land use and transportation strategies to help achieve a coordinated and balanced regional transportation system. The 2012-2035 RTP/SCS represents the culmination of more than two years of work involving dozens of public agencies, 191 cities, hundreds of local, county, regional and state officials, the business community, environmental groups, as well as various nonprofit organizations. The 2012-2035 RTP/SCS was formally adopted by the SCAG Regional Council on April 4, 2012.

The 2012-2035 RTP/SCS contains a host of improvements to every component of the regional multimodal transportation system including:

- Active transportation (non-motorized transportation, such as biking and walking)
- Transportation demand management (TDM)
- Transportation system management (TSM)
- Transit

- Passenger and high-speed rail
- Goods movement
- Aviation and airport ground access
- Highways
- Arterials
- Operations and maintenance

Included within these transportation system improvements are TCM projects that reduce vehicle use or change traffic flow or congestion conditions. TCMs include the following three main categories of transportation improvement projects and programs:

- High occupancy vehicle (HOV) measures,
- Transit and systems management measures, and
- Information-based transportation strategies.

New to this cycle of the RTP is the inclusion of the SCS as required by SB 375. The primary goal of the SCS is to provide a vision for future growth in Southern California that will decrease per capita GHG emissions from passenger vehicles. However, the strategies contained in the 2012-2035 RTP/SCS will produce benefits for the region far beyond simply reducing GHG emissions. The SCS integrates the transportation network and related strategies with an overall land use pattern that responds to projected growth, housing needs, changing demographics, and transportation demands. The regional vision of the SCS maximizes current voluntary local efforts that support the goals of SB 375. The SCS focuses the majority of new housing and job growth in high-quality transit areas and other opportunity areas on existing main streets, in downtowns, and commercial corridors, resulting in an improved jobs-housing balance and more opportunity for transit-oriented development. In addition, SCAG is a strategic partner in a regional effort to accelerate fleet conversion to near-zero and zero-emission transportation technologies, including planning for the expansion of alternative-fuel infrastructure to accommodate the anticipated increase in alternative fueled vehicles.

Section III. Reasonably Available Control Measure (RACM) Analysis for Transportation Control Measures

As required by the CAA, a RACM analysis must be included as part of the overall control strategy in the AQMP/SIP to ensure that all potential control measures are evaluated for implementation and that justification is provided for those measures that are not implemented. Appendix IV-C contains the RACM TCM component for the Basin's 24-hour PM2.5 control strategy. In accordance with U.S. EPA procedures, this analysis considers TCMs in the 2012-2035 RTP/SCS, measures identified by the CAA, and relevant measures adopted in other non-attainment areas of the country. Based on this comprehensive review, it is determined that the TCMs being implemented in the Basin are inclusive of all TCM RACM. None of the candidate measures reviewed and determined to be infeasible meets the criteria for RACM implementation.

The emission benefits associated with the RTP/SCS are reflected in the 2012 AQMP projected emissions. The transportation strategy is estimated to reduce 0.4 ton per day of NOx and 0.1 ton per day VOC in 2014. The estimated emissions benefits of future TCM projects in 2014 are reductions of 0.7 ton per day of NOx, 0.3 ton per day of VOC, and 0.1 ton per day of PM2.5.

For a detailed discussion of the regional transportation strategy, refer to Appendix IV-C: Regional Transportation Strategy and Control Measures.

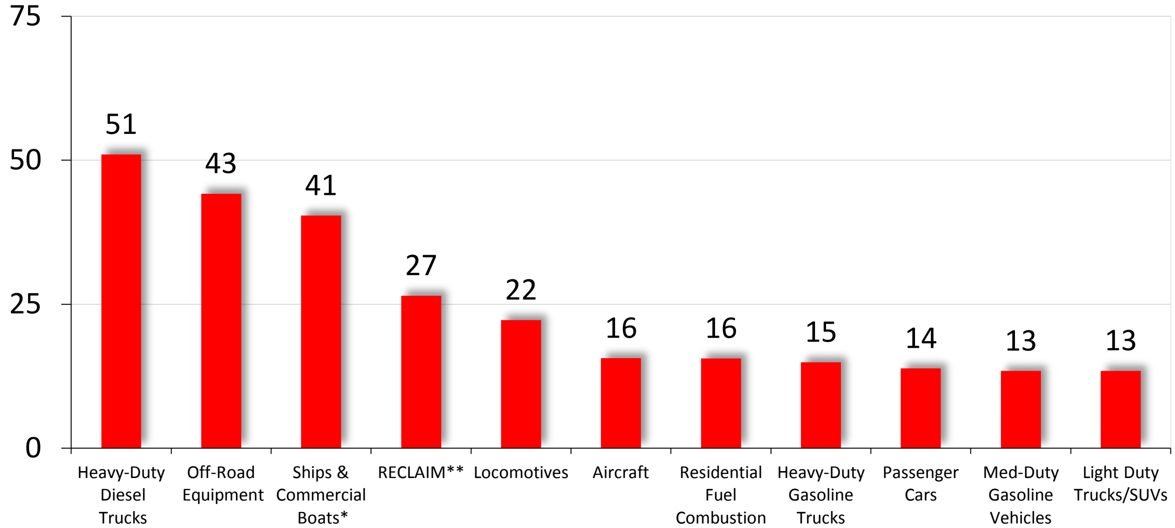
PROPOSED 8-HOUR OZONE MEASURES (TO REDUCE EMISSIONS ASSOCIATED WITH CAA SECTION 182(e)(5) MEASURES)

The 2007 State Implementation Plan (SIP) for the 8-hour ozone NAAQS contains commitments for emission reductions that rely on advancement of technologies, as authorized under Section 182(e)(5) of the federal Clean Air Act. These measures, which have come to be known as the "black box," account for a substantial portion of the NOx emission reductions needed to attain the federal ozone standards – over 200 tons/day. The deadlines to reduce ozone concentrations in the region are 2023 (to attain the 80 ppb NAAQS), and 2032 (to attain 75 ppb NAAQS)[1]. Attaining these standards will require substantial reductions in emissions of NOx well beyond reductions resulting from current rules, programs, and commercially available technologies. Given the relatively large size of the "black box" measures, it is important to continue to reduce the reliance on Section 182(e)(5) long-term emissions reductions as ozone attainment dates approach. To this end, all feasible

[1] The attainment deadline for the 75 ppb standard (adopted in 2008) for an extreme non-attainment area is December 31, 2032.

ozone control measures are included in this Final 2012 AQMP as an update to the previously approved 2007 8-hour ozone SIP.

Mobile sources emit over 80 percent of regional NOx and therefore must be the largest part of the solution. As provided in Figure 4-1, on-road truck categories are projected to comprise the single largest contributor to regional NOx in 2023. Other equipment involved in goods movement, such as marine vessels, locomotives and aircraft, are also substantial NOx sources.



**Oceangoing vessels = 32 tons/day*
***RECLAIM: 320 largest stationary sources, including all refineries and power plants*

FIGURE 4-1

Top NOx Emissions Categories and Corresponding NOx Emissions (tons per day) in 2023 in the South Coast Air Basin, Annual Average Day

Figure 4-2 shows projections indicating that the region must reduce regional NOx emissions by about 65% by 2023, and 75% by 2032, to attain the 8-hour ozone NAAQS as required by federal law.

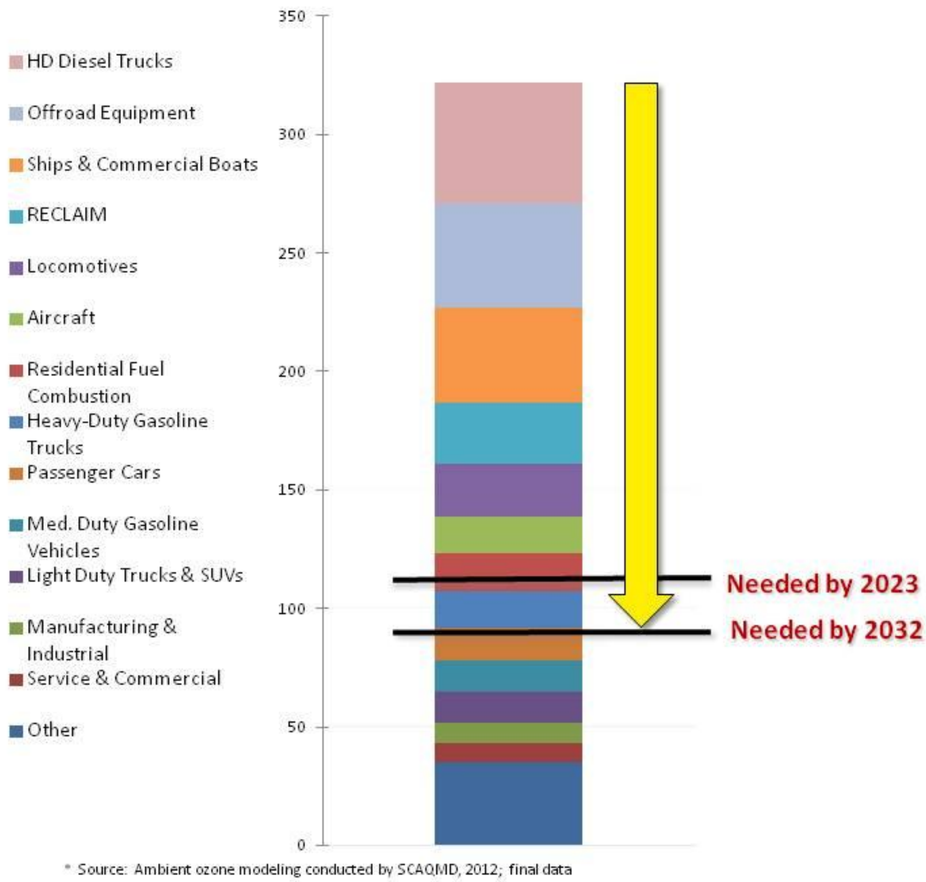


FIGURE 4-2

Needed NOx Emission Reductions to Achieve
Federal 8-Hour Ozone Ambient Air Quality Standards

Since most significant emission sources are already controlled by over 90%, attainment of the ozone standards will require broad deployment of zero- and near-zero[2] emission technologies in the 2023 to 2032 timeframe. On-land transportation sources such as trucks, locomotives, and cargo handling equipment have technological potential to achieve zero- and near-zero emission levels. Current and potential technologies include hybrid-electric, battery-electric, and hydrogen fuel cell

[2] The term "near-zero emissions" refers to emissions approaching zero and will be delineated for individual source categories through the process of developing the Air Quality Management Plan/State Implementation Plan and subsequent control measures. Based on current analyses, on-land transportation sources will need to achieve zero emissions where possible, and otherwise will need to be substantially below adopted emission standards — including standards with future effective dates. Near-zero emissions technologies can help meet this need, particularly if they support a path toward zero emissions (e.g. electric/fossil fuel hybrids with all-electric range).

on-road vehicle technologies. New types of hybrids could also serve long-term needs while providing additional fuel diversity. These could include, for example, natural gas-electric hybrid technologies for on-road and other applications, particularly if coupled with improved after-treatment technologies. Equipment powered solely by alternative fuels such as natural gas may also play a long-term role in some applications, if those applications are found to pose technological barriers to achieving zero or near-zero emissions. Even in such applications, however, substantial additional emission reductions will be needed through development of new, advanced after-treatment technologies. In addition, alternative fuels will likely play a transitional near-term role. Alternative fuels such as natural gas have historically helped the region make progress toward attaining air quality standards, and -- while not achieving zero or near-zero NOx emission levels -- they are generally cleaner than conventional fuels. Given the region's need to attain air quality standards in a few short years, alternative fueled engines will continue to play a role. Finally, we emphasize that air quality regulatory agencies have traditionally set policies and requirements that are performance based and technology and fuel neutral -- a policy that the District intends to continue. In short, all technologies and fuels should be able to compete on equal footing to meet environmental needs.

While there has been much progress in developing and deploying transportation technologies with zero- and near-zero emissions (particularly for light-duty vehicles and passenger transit), additional technology development, demonstration and commercialization will be required prior to broad deployment in freight and other applications. This section describes a path to evaluate, develop, demonstrate, fund and deploy such technologies for land-based transportation sources. It also proposes near-term measures to accelerate fleet turnover to the lowest emission units, and require deployment of zero-emission technologies where most feasible.

The District staff believes that a combination of regulatory actions and public funding is the most effective means of achieving these emission reductions. Voluntary incentive programs such as the Carl Moyer Program can help to accelerate turnover to the cleanest commercially available equipment. A majority of the on-road and off-road measures proposed are based on existing funding programs implemented by the District or the California Air Resources Board. However, several of the existing funding programs will sunset in the 2014 – 2015 timeframe. Continued funding beyond 2015 will be needed to reduce the emissions associated with the black box. Developing, demonstrating and deploying new technologies will require public/private partnerships and, in some cases, regulatory actions.

The measures described in this section are a relatively small down payment on the total emission reductions needed to attain the current NAAQS for ozone. The measures proposed in this section and further discussed in Appendix IV-A and IV-B are feasible steps that must commence in the near-term to establish a path toward a broader transition to the technologies that will be needed to attain federal air quality standards. Between now and 2015, the additional measures needed to attain both the 75 and 80 ppb ozone NAAQS will be fleshed out in greater detail as required under the federal Clean Air Act as part of the next AQMP revision (see Chapters 5 and 6 for further discussions). Given the magnitude of needed emission reductions, and the time remaining until attainment deadlines, it is important that progress and momentum to identify, develop, and deploy needed technologies be sustained and accelerated.

The District staff recognizes these are very difficult policy choices the Basin is facing. Transitioning over the next 10 to 20 years to cleaner transportation technologies will involve major costs and effects on the economy. However, adopting sufficient plan measures to attain the ozone air quality standard by 2024 is required by federal law and therefore, failing to do so is not an acceptable public policy. Such failure would also risk adverse health consequences highlighted in recent health studies, not to mention the potential adverse economic impacts on the region due to potential federal sanctions. The following sections summarize the measures to help reduce the emissions associated with the "black box" (Section 182(e)(5)) measures. More detailed discussions are provided in Appendix IV-A and IV-B.

Proposed Stationary Source 8-hour Ozone Measures

The proposed stationary source ozone measures are designed to assist in the attainment of the 8-hour ozone standard. The measures target a number of source categories including Coatings and Solvents (CTS), Combustion Sources (CMB), Petroleum Operations and Fugitive VOC Emissions (FUG), Multiple Component Sources (MCS), Incentive Programs (INC) and Educational Programs (EDU). There are 15 stationary source measures with the majority anticipated to be adopted in the next 2-3 years and implemented after 2015. Table 4-4 provides a list of the District's 8-hour ozone measures for stationary sources along with the anticipated adoption date, implementation date and emission reduction.

TABLE 4-4

List of the District's Adoption/Implementation Dates and Estimated Emission Reductions from Stationary Source 8-hour Ozone Measures

NUMBER	TITLE	ADOPTION	IMPLEMENTATION PERIOD	REDUCTION (TPD)
CTS-01	Further VOC Reductions from Architectural Coatings (R1113) [VOC]	2015 - 2016	2018 – 2020	2-4
CTS-02	Further Emission Reduction from Miscellaneous Coatings, Adhesives, Solvents and Lubricants [VOC]	2013 - 2016	2015 – 2018	1-2
CTS-03	Further VOC Reductions from Mold Release Products [VOC]	2014	2016	0.8 – 2
CMB-01	Further NOx Reductions from RECLAIM [NOx] – Phase II	2015	2020	1-2 [a]
CMB-02	NOx Reductions from Biogas Flares [NOx]	2015	Beginning 2017	TBD [b]
CMB-03	Reductions from Commercial Space Heating [NOx]	Phase I – 2014 (Tech Assessment) Phase II - 2016	Beginning 2018	0.18 by 2023 0.6 (total)
FUG-01	VOC Reductions from Vacuum Trucks [VOC]	2014	2016	1 [c]
FUG-02	Emission Reduction from LPG Transfer and Dispensing [VOC] – Phase II	2015	2017	1-2
FUG-03	Further Reductions from Fugitive VOC Emissions [VOC]	2015 -2016	2017-2018	1-2
MCS-01	Application of All Feasible Measures Assessment [All Pollutants]	Ongoing	Ongoing	TBD [b]
MCS-02	Further Emission Reductions from Greenwaste Processing (Chipping and Grinding Operations not associated with composting) [VOC]	2015	2016	1 [c]
MCS-03 (formerly MCS-06)	Improved Start-up, Shutdown and Turnaround Procedures [All Pollutants]	Phase I – 2012 (Tech Assessment) Phase II - TBD	Phase I – 2013 (Tech Assessment) Phase II – TBD	TBD [b]

TABLE 4-4 (concluded)

List of the District's Adoption/Implementation Dates and Estimated Emission Reductions from Stationary Source 8-hour Ozone Measures

NUMBER	TITLE	ADOPTION	IMPLEMENTATION PERIOD	REDUCTION (TPD)
INC-01	Economic Incentive Programs to Adopt Zero and Near-Zero Technologies [NOx]	2014	Within 12 months after funding availability	TBD [b]
INC-02	Expedited Permitting and CEQA Preparation Facilitating the Manufacturing of Zero and Near-Zero Technologies [All Pollutants]	2014-2015	Beginning 2015	N/A [d]
EDU-01 (*formerly MCS-02, MCS-03*)	Further Criteria Pollutant Reductions from Education, Outreach and Incentives [All Pollutants]	Ongoing	Ongoing	N/A [d]

a. If Control Measure CMB-01, RECLAIM Phase I, contingency measure emission reductions are not triggered and implemented, Phase II will target a cumulative 3-5 TPD of NOx emission reductions.
b. TBD are reductions to be determined once the inventory and control approach are identified.
c. Reductions submitted in SIP once emission inventories are included in the SIP.
d. N/A are reductions that cannot be quantified due to the nature of the measure (e.g., outreach, incentive programs) or if the measure is designed to ensure reductions that have been assumed to occur will in fact occur.

Each control measure type typically relies on a number of control methods. Table 4-5 provides the types of proposed short-term measures and their typical corresponding control methods.

TABLE 4-5

Proposed Short-Term Measure Control Methods

SOURCE CATEGORY	CONTROL METHOD
Coatings and Solvents	• Reformulation • Higher Transfer Efficiency • Process Improvements • Add-On Controls • Alternative Coating and Solvent Application Methods • Market Incentives • Improved Housekeeping Practices
Combustion Sources	• Add-On Controls • Market Incentives • Process Improvement • Improved Energy Efficiency
Petroleum Operations and Fugitive VOC Emissions	• Process Modifications • Add-On Controls Systems • Market Incentives • Enhanced Inspection and Maintenance • Improved Vapor Recovery Systems • Good Management Practices
Multiple Component Sources	• Process Modifications and Improvements • Add-On Controls • Best Management Practices • Best Available Control Technology • Market Incentives • Energy Efficiency and Conservation
Incentive Programs	• Funding • Investment in Clean Technologies • Private/Public Partnerships
Educational Programs	• Increased Awareness • Technical Assistance

The following text provides a brief description of the proposed stationary source 8-hour ozone measures.

<u>Coatings and Solvents</u>

The category of coatings and solvents is primarily targeted at reducing VOC emissions from these VOC-containing products. This category includes three proposed control measures that are based on additional emission reductions from architectural coatings; miscellaneous coatings, solvents, adhesives and lubricants; and mold release products.

CTS-01 – FURTHER VOC REDUCTIONS FROM ARCHITECTURAL COATINGS: The District adopted Rule 1113 – Architectural Coatings, in 1977 and it has since undergone numerous amendments. This proposed control measure seeks to reduce the VOC emissions from large volume coating categories such as flat, non-flat and primer, sealer, undercoaters (PSU) and from phasing out the currently exempt use of high-VOC architectural coatings sold in one liter containers or smaller. Additional emission reductions could be achieved from the application of architectural coatings by use of application techniques with greater transfer efficiency. Such transfer efficiency improvements could be achieved through the use of a laser paint targeting system, which has been shown to improve transfer efficiency on average by 30% over equipment not using a targeting system, depending on the size, shape and configuration of the substrate. The proposal is anticipated to be accomplished with a multi-phase adoption and implementation schedule.

CTS-02 – FURTHER VOC REDUCTIONS FROM MISCELLANEOUS COATINGS, ADHESIVES, SOLVENTS, AND LUBRICANTS: This control measure seeks VOC emission reductions by focusing on select coating, adhesive, solvent and lubricant categories by further limiting the allowable VOC content in formulations. Examples of the categories to be considered include but are not limited to, coatings used in aerospace applications; adhesives used in a variety of sealing applications; solvents for graffiti abatement activities; and lubricants used as metalworking fluids to reduce heat and friction to prolong life of the tool, improve product quality and carry away debris. Reductions would be achieved by lowering the VOC content of the coatings, adhesives and lubricants. For solvents, reductions could be achieved with the use of alternative low-VOC products or non-VOC product/equipment at industrial facilities. The proposal is anticipated to be accomplished with a multi-phase adoption and implementation schedule.

CTS-03 – FURTHER VOC REDUCTION FROM MOLD RELEASE PRODUCTS: Metal, fiberglass, composite and plastic products are often manufactured using molds which form the product into a particular configuration. Mold release agents are used to ensure that the parts, as they are made, can be released easily and quickly from the molds. These agents often contain VOC solvent carriers and may also contain toxic components like toluene and xylene. Mold release products are also used for concrete stamping operations to keep the mold from adhering to the fresh concrete. Residential and commercial concrete stamping is a rapidly growing industry, and overall VOC emissions are estimated to be significant. This control measure seeks to reduce emissions from mold release products on metal, fiberglass, composite and plastic products, as well as concrete stamping operations, by requiring the use of low-VOC mold release products.

Combustion Sources

This category includes three proposed measures for stationary combustion equipment. There is one control measure that further reduces NOx emissions from RECLAIM facilities. A second proposed measure seeks a reduction from biogas flares, and a third proposed control measure seeks to reduce NOx emissions from commercial space heaters.

CMB-01 – FURTHER NOX REDUCTIONS FROM RECLAIM (PHASE II): This proposed control measure will seek further reductions of 1-2 tpd in NOx allocations by the year 2020. This phase of control is to implement periodic BARCT evaluation as required under the state law. If Control Measure CMB-01, RECLAIM Phase I, contingency measure emission reductions are not triggered and implemented, Phase II will target a cumulative 3-5 TPD of NOx emission reductions, which will be incorporated into the 2015 AQMP. The control measure has the ability to produce co-benefits in the reduction of PM2.5 and ozone.

CMB-02 – NOX REDUCTIONS FROM BIOGAS FLARES: There are no source-specific rules regulating NOx emissions from biogas flares. Flare NOx emissions are regulated through new source review and BACT. This control measure proposes that, consistent with the all feasible measures measure, older biogas flares be gradually replaced with flares that meet current BACT. Strategies that minimize flaring and associated emissions can also be considered as alternative control options.

CMB-03 – REDUCTIONS FROM COMMERCIAL SPACE HEATING: This control measure applies to natural gas-fired commercial space heaters used for comfort heating. SCAQMD Rule 1111 - NOx Emissions from Natural Gas-Fired Fan Type Central Furnaces, regulates space heaters with input rates less than 175,000 Btu/hr. This measure proposes to establish a NOx emission limit for new space heaters for commercial applications, which can be achieved through the use of low-NOx burners or other technologies.

Petroleum Operations and Fugitive VOC Emissions

This category pertains primarily to operations and materials associated with the petroleum, chemical, and other industries. Within this category, there is one proposed control measure targeting fugitive VOC emissions with improved leak detection and repair. Other proposed measures include reductions from vacuum truck venting, and propane transfer and dispensing.

FUG-01 – VOC REDUCTIONS FROM VACUUM TRUCKS: This control measure seeks to reduce emissions from the venting of vacuum trucks. Emissions from such operations can be further reduced through the utilization of control technologies, including but not limited to, carbon adsorption systems, internal combustion engines, thermal oxidizers, refrigerated condensers and liquid scrubbers. Additionally, implementation of a leak detection and repair (LDAR) program may further reduce fugitive emissions.

FUG-02 - EMISSION REDUCTION FROM LPG TRANSFER AND DISPENSING: The District recently adopted Rule 1177 - Liquefied Petroleum Gas (LPG) Transfer and Dispensing (June 2012). The rule requires use of low-emission fixed liquid level gauges or equivalent alternatives during filling of LPG-containing tanks and cylinders, use of low-emission connectors, routine leak checks and repairs of LPG transfer and dispensing equipment. The purpose of this control measure is to reduce fugitive VOC emissions associated with the transfer and dispensing of LPG by expanding rule applicability to include LPG transfer and dispensing at currently exempted facilities such as refineries, marine terminals, natural gas processing plants and pipeline transfer stations, as well as facilities that conduct fill-by-weight techniques.

FUG-03 – FURTHER REDUCTIONS FROM FUGITIVE VOC EMISSIONS: This control measure seeks to broaden the applicability of improved leak detection and repair (LDAR) programs to remove additional fugitive VOC emissions. Areas for further study may include, but are not limited to, Rule 1142 - Marine Vessel Tank Operations, and wastewater separators. This control measure would explore the opportunity of incorporating a recently developed advanced optical gas imaging technology to detect leaks (Smart LDAR) to more easily identify and repair leaks in a manner that is less time consuming and labor intensive. Additionally, vapor recovery systems are currently required to be 95% control efficient. In an effort to further reduce emissions from these operations, this control measure would explore opportunities and the feasibility of further improving the collection/control efficiency of existing control systems resulting in additional VOC reductions.

Multiple Component Sources

There are a total of three stationary source 8-hour ozone measures proposed in this category. The first measure seeks reductions of all feasible measures after such an assessment is made. Another measure seeks further emission reductions from greenwaste processing, which is chipping and grinding not associated with composting. The third measure seeks to minimize emissions during equipment startup and shutdown and to reduce emissions by applying the state requirement of all feasible control measures.

MCS-01 – APPLICATION OF ALL FEASIBLE MEASURES ASSESSMENT: This control measure is to address the state law requirement for all feasible measures for ozone. Existing rules and regulations for pollutants such as VOC, NOx, SOx and PM reflect current best available retrofit control technology (BARCT). However, BARCT continually evolves as new technology becomes available that is feasible and cost-effective. Through this proposed control measure, the District would commit to the adoption and implementation of the new retrofit control technology standards. Finally, staff will review actions taken by other air districts for applicability in our region.

MCS-02 - FURTHER EMISSION REDUCTIONS FROM GREENWASTE PROCESSING (CHIPPING AND GRINDING NOT ASSOCIATED WITH COMPOSTING): Chipped or ground greenwaste and/or wood waste has a potential to emit VOCs when being stockpiled or land-applied for various purposes. Chipping and grinding is a process to mechanically reduce the size of greenwaste and wood waste. The District rules currently establish best management practices (BMPs) for greenwaste composting and related operations under Rule 1133.1 – Chipping and Grinding Activities, and Rule 1133.3 – Greenwaste Composting Operations. During rule development, stakeholders raised the need to develop a holistic approach to identifying and accounting for emissions from all greenwaste streams and reducing potential emissions from greenwaste material handling operations at chipping and grinding facilities and other related facilities, and not just the ones associated with composting operations. This control measure would seek to establish additional Best Management Practices (BMPs) for handling processed or unprocessed greenwaste material by greenwaste processors, haulers, and operators who inappropriately stockpile material or directly apply the material to land. The implementation of the control measure would be in two phases. First, the existing database would be reviewed to refine the greenwaste material inventory, and second, staff would potentially develop a rule to incorporate technically feasible and cost-effective BMPs or controls.

MCS-03 - IMPROVED START-UP, SHUTDOWN AND TURNAROUND PROCEDURES: This proposed control measure seeks to reduce emissions during equipment startup, shutdown, and turnaround. Opportunities for further reducing emissions from start-up, shut-down and turnaround activities potentially may exist at refineries as well as other industries. Examples of possible areas for improvement may include best management practices, better engineering and equipment design, diverting or eliminating process streams that are vented to flares, and installation of redundant equipment to increase operational reliability. This measure will be implemented through a two-phase effort to first collect/refine emissions and related data and then, based on the data collected, assess viable controls, if appropriate.

<u>Incentive Programs</u>

There are two proposed incentive programs within this category. The first program seeks to provide incentives for new and existing facilities to install and operate clean, more-efficient combustion equipment beyond what is currently required. The second program provides expedited permitting processing and development of applicable CEQA documentation if a company manufactures zero or near-zero emission technology.

INC-01: ECONOMIC INCENTIVE PROGRAMS TO ADOPT ZERO AND NEAR-ZERO TECHNOLOGIES: The primary objective of this measure is to develop programs that promote and encourage adoption and installation of cleaner, more-efficient combustion equipment with a focus on zero and near-zero technologies, such as boilers, water heaters and commercial space heating, through economic incentive programs, subject to the availability of public funding. Incentives may include grants for new purchases of equipment as well as loan programs in areas where long-term cost savings from increased efficiency are achieved.

INC-02: EXPEDITED PERMITTING AND CEQA PREPARATION FACILITATING THE MANUFACTURING OF ZERO AND NEAR-ZERO TECHNOLOGIES: This proposed measure is aimed at providing incentives for companies to manufacture zero and near-zero emission technologies locally, thus populating the market, potentially lowering the purchase cost, and increasing demand. With availability and usage of such technologies, air quality benefits will be achieved. This proposed measure focuses on two elements: 1) process the required air permit(s) in an expedited procedure; and 2) prioritize the preparation, circulation and certification of the applicable CEQA document. A stakeholder process will be initiated to design the program and collaborate with other existing District or local programs.

Educational Programs

There is one proposed educational program within this category.

EDU-01: FURTHER CRITERIA POLLUTANT REDUCTIONS FROM EDUCATION, OUTREACH AND INCENTIVES: This proposed control measure seeks to provide educational outreach and incentives for consumers to contribute to clean air efforts. Examples include the usage of energy efficient products, new lighting technology, “super compliant” coatings, tree planting, and the use of lighter colored roofing and paving materials which reduce energy usage by lowering the ambient temperature. In addition, this proposed measure intends to increase the effectiveness of energy conservation programs through public education and awareness as to the environmental effects and benefits from conservation. Finally, educational and incentive tools to be used include comparison of energy usage and efficiency, social media, public/private partnerships.

Proposed Mobile Source 8-hour Ozone Measures

Depending on the mobile source sector and the proposed control approach, District staff analyzed the need to accelerate the penetration of cleaner engine technologies. The proposed mobile source 8-hour ozone measures are based upon a variety of control technologies that are commercially available and/or technologically feasible to implement in the next several years. The focus of these measures includes accelerated retrofits or replacement of existing vehicles or equipment, acceleration of vehicle turnover through voluntary vehicle retirement programs, and greater use of cleaner fuels in the near-term. In the longer-term, in order to attain the federal ozone ambient air quality standard, there is a need to increase the penetration and deployment of near-zero and zero-emission vehicles such as plug-in hybrids, battery-electric, and fuel cells, even further use of cleaner fuels (either alternative fuels or new formulations of gasoline and diesel fuels), and additional emission reductions from locomotive and aircraft engines.

Ten measures are proposed as actions to reduce mobile source emissions and seven additional measures are proposed to accelerate the development and deployment of near-zero and zero-emission technologies for goods movement related sources and off-road equipment. The measures call for greater emission reductions through accelerated turnover of older vehicles to the cleanest vehicles currently available and increased penetration of commercially-available near-zero and zero-emission technologies through existing incentives programs.

Drawing upon the recent draft "Vision for Clean Air: A Framework for Air Quality and Climate Planning" (or Vision), a document produced jointly between the District staff, the California Air Resources Board, and the San Joaquin Valley Air Pollution Control District, seven measures are proposed to further the development of zero- and near-zero emission technologies for on-road and off-road mobile sources. The draft Vision document discusses the need to accelerate deployment of the cleanest combustion technologies and zero- and near-zero emission technologies earlier to meet federal ambient air quality standards and long-term climate goals. The document provides actions for several key transportation sectors and off-road equipment.

Partial-zero and zero-emission technologies are rapidly being introduced into the on-road light- and medium-duty vehicle categories in large part due to the CARB Low Emission Vehicle (LEV) and the Zero-Emission Vehicle (ZEV) Regulations. In addition, next-generation electric hybrid trucks are being commercialized for light-heavy and medium-heavy heavy-duty on-road vehicles. However, additional research and demonstration are needed to commercialize zero- and near-zero emission technologies for the heavier heavy-duty vehicles (with gross vehicle weight ratings greater than 26,000 lbs.).

For many of the off-road mobile sources such as locomotives, cargo handling equipment, commercial harbor craft, and off-road equipment, some form of "all zero-emission range" is feasible to demonstrate and implement beginning in the latter part of this decade. For other sectors such as marine vessels and aircraft, the development of cleaner combustion technologies beyond existing emission standards will be needed. The Vision document provides a broad discussion of the potential zero- and near-zero technologies or cleaner combustion technologies that could be demonstrated in the near-term. The potential technologies are discussed further in each of the "ADV" measures. A summary of the 17 measures is provided in Table 4-6.

TABLE 4-6

List of Adoption/Implementation Dates and Estimated Emission Reductions from Mobile Source 8-hour Ozone Measures

ON-ROAD MOBILE SOURCES					
Number	**Title**	**Adoption**	**Implementation Period**	**Implementing Agency**	**Reduction (tpd) by 2023**
ONRD-01	Accelerated Penetration of Partial Zero-Emission and Zero-Emission Vehicles [VOC, NOx, PM]	N/A	Ongoing	CARB, SCAQMD	TBD [a]
ONRD-02	Accelerated Retirement of Older Light- and Medium-Duty Vehicles [VOC, NOx, PM]	N/A	Ongoing	CARB, Bureau of Automotive Repair, SCAQMD	TBD [a]
ONRD-03	Accelerated Penetration of Partial Zero-Emission and Zero-Emission Light-Heavy- and Medium-Heavy-Duty Vehicles [NOx, PM]	N/A	Ongoing	CARB, SCAQMD	TBD [a]
ONRD-04	Accelerated Retirement of Older On-Road Heavy-Duty Vehicles [NOx, PM]	2014	2015-2023	CARB, SCAQMD	TBD [a,b]
ONRD-05	Further Emission Reductions from Heavy-Duty Vehicles Serving Near-Dock Railyards [NOx, PM]	2014	2015-2020	CARB	0.75 [NOx] 0.025 [PM2.5]

TABLE 4-6 (continued)

List of Adoption/Implementation Dates and Estimated Emission Reductions
from Mobile Source 8-hour Ozone Measures

OFF-ROAD MOBILE SOURCES					
Number	**Title**	**Adoption**	**Implementation Period**	**Implementing Agency**	**Reduction (tpd) by 2023**
OFFRD-01	Extension of the SOON Provision for Construction/Industrial Equipment [NOx]	N/A	Ongoing	SCAQMD	7.5
OFFRD-02	Further Emission Reductions from Freight Locomotives [NOx, PM]	Ongoing	2015 – 2023	CARB, U.S. EPA, San Pedro Bay Ports	12.7 [NOx][c] 0.32 [PM2.5][c]
OFFRD-03	Further Emission Reductions from Passenger Locomotives [NOx, PM]	Ongoing	Beginning 2014-2023	SoCal Regional Rail Authority	3.0 [NOx][d] 0.06 [PM2.5][d]
OFFRD-04	Further Emission Reductions from Ocean-Going Marine Vessels While at Berth [NOx, SOx, PM]	2014	Ongoing	San Pedro Bay Ports, CARB, SCAQMD	TBD[a]
OFFRD-05	Emission Reductions from Ocean-Going Marine Vessels [NOx]	N/A	Ongoing	San Pedro Bay Ports, CARB, U.S. EPA	TBD[a]
ADVANCED CONTROL TECHNOLOGIES					
ADV-01	Actions for the Deployment of Zero- and Near-Zero Emission On-Road Heavy-Duty Vehicles [NOx]	N/A	2012 and on	SCAQMD, San Pedro Bay Ports, CARB, U.S. EPA	TBD[e]
ADV-02	Actions for the Deployment of Zero- and Near-Zero Emission Locomotives [NOx]	N/A	2012 and on	SCAQMD, San Pedro Bay Ports, CARB, U.S. EPA	TBD[e]
ADV-03	Actions for the Deployment of Zero- and Near-Zero Emission Cargo Handling Equipment [NOx]	N/A	2012 and on	SCAQMD, San Pedro Bay Ports, CARB, U.S. EPA	TBD[e]
ADV-04	Actions for the Deployment of Cleaner Commercial Harborcraft [NOx]	N/A	2012 and on	SCAQMD, San Pedro Bay Ports, CARB, U.S. EPA	TBD[e]

TABLE 4-6 (concluded)

List of Adoption/Implementation Dates and Estimated Emission Reductions from Mobile Source 8-hour Ozone Measures

ADVANCED CONTROL TECHNOLOGIES					
Number	**Title**	**Adoption**	**Implementation Period**	**Implementing Agency**	**Reduction (tpd) by 2023**
ADV-05	Actions for the Deployment of Cleaner Ocean-Going Marine Vessels [NOx]	N/A	2012 and on	SCAQMD, San Pedro Bay Ports, CARB, U.S. EPA	TBD [e]
ADV-06	Actions for the Deployment of Cleaner Off-Road Equipment [NOx]	N/A	2012 and on	SCAQMD, CARB, U.S. EPA	TBD [e]
ADV-07	Actions for the Deployment of Cleaner Aircraft Engines [NOx]	N/A	2012 and on	SCAQMD, CARB, FAA, U.S. EPA	TBD [e]

a. Emission reductions will be determined after projects are identified and implemented.
b. Reductions achieved locally in Mira Loma region.
c. Emission reductions provided are updated from the 2007 SIP values reflecting a revised future year base emission levels. The reductions are not included in the 2012 AQMP SIP submittal
d. Submitted into the SIP once technically feasible and cost effective options are confirmed.
e. Emission reduction will be quantified after projects are demonstrated.

On-Road Mobile Source Measures

Five on-road mobile source control measures are proposed. The first two measures focus on on-road light- and medium-duty vehicles operating in the South Coast Air Basin. By 2023, it is estimated that about 12 million vehicles will be operating in the Basin. The first measure would implement programs to accelerate the penetration and deployment of partial zero-emission and zero-emission vehicles in the light- and medium-duty vehicles categories. The second control measure would seek to accelerate retirement of older gasoline and diesel powered vehicles up to 8,500 gross vehicle weight (GVW). These vehicles include passenger cars, sports utility vehicles, vans, and light duty pick-up trucks.

The remaining three measures focus on heavy-duty vehicles. The first of these measures seeks additional emission reductions from the early deployment of partial zero-emission and zero-emission light- and medium-heavy-duty vehicles with gross vehicle weights between 8,501 pounds to 26,000 pounds. The second control measure for heavy-duty vehicles seeks additional emissions reductions from older, pre-2010 heavy-duty vehicles beyond the emission reductions targeted in CARB's Truck and Bus Regulation. Additional emission reductions could be achieved if an additional percentage of the oldest, pre-2010 heavy duty vehicles not subject to the Truck and Bus Regulation are targeted. The fifth on-road measure seeks emission reductions at near-dock railyards through the deployment of zero-emission heavy-duty vehicles. District staff is recommending a minimum funding level of $85 million per year for incentives to implement on-road mobile source measures.

Off-Road Mobile Source Measures

Five control measures that seek further emission reductions from off-road mobile sources and industrial equipment are proposed. Transportation sources such as aircraft, locomotives, and marine vessels are associated with anticipated economic growth not only in the Basin, but also nationwide. These sources are principally regulated by federal and state agencies. In addition, certain local actions can result in emission reductions beyond the emissions standard setting authority of the state and U.S. EPA. The first measure calls for the continuation of the Surplus Off-Road Opt-In for NOx (SOON) provision of the statewide In-Use Off-Road Diesel Fleet Regulation beyond 2014. The SOON provision implemented to-date has realized additional NOx reductions beyond the statewide regulation. The second and third measures call for additional emission reductions from freight and passenger locomotives. The fourth measure seeks additional emission reductions from ocean-going vessels while at berth. The fifth measure recognizes the efforts that the Ports of Los Angeles and Long Beach are implementing to incentivize Tier 2 and Tier 3 ocean-going vessels to call at the ports. District staff is recommending a minimum funding level of $30 million per year for incentives to implement off-road mobile source measures.

Actions to Deploy Advanced Control Technologies

Seven additional measures are proposed to deploy the cleanest control technologies as early as possible and to foster the development and deployment of near-zero and zero-emission technologies. Many of these actions have already begun. However, additional research and development will be needed that will lead to commercial deployment of control technologies that achieve emission levels below current adopted emission standards. Other near-zero and zero-emission technologies that are commercially available will require infrastructure development to facilitate their deployment.

The term "near-zero" technology is not defined in these actions. The term's specific meaning could depend on the source category and feasible technologies. The actions needed to deploy zero-emission technologies, "near-zero" emission technologies, and the next generation of cleaner combustion engines will be discussed in the development of the proposed measures and future AQMPs. To initiate the development of cleaner engines (either through in-cylinder or after-treatment controls or in combination with hybrid systems that lead to further criteria pollutant emission reductions), District staff is proposing that optional NOx standards be adopted. Having such optional standards will facilitate the early development of cleaner technologies and assist to deploy these technologies as soon as possible. They would be set by the level of emission reductions commercially achievable in the near-term. Several of the technologies to achieve emission levels lower than current standards, or zero-emission levels, are currently available and are potentially transferrable to various vehicle vocations and in-use applications. However, further research and demonstration are needed for many of these technologies to evaluate their performance prior to commercialization. Each measure contains a timeline for actions to bring about the zero-emission or cleaner technologies.

The District staff, U.S. Department of Energy, U.S. Environmental Protection Agency, Federal Aviation Administration, California Air Resources Board, California Energy Commission, engine manufacturers, advanced engine control developers, and electric hybrid systems developers have been discussing potential technologies to further reduce engine exhaust emissions or eliminate exhaust emissions entirely. Public forums such as technology symposiums will be used to solicit public input on technology development as part of the proposed actions.

The following text provides a brief description of the District staff's proposed mobile source measures:

ONRD-01 – ACCELERATED PENETRATION OF PARTIAL ZERO-EMISSION AND ZERO EMISSION VEHICLES: This measure proposes to continue incentives for the purchase of zero-emission vehicles and hybrid vehicles with a portion of their operation in an "all electric range" mode. The state Clean Vehicle Rebate Pilot (CVRP) program is proposed to continue from 2015 to 2023 with a proposed funding for up to $5,000 per vehicle. The proposed measure seeks to provide funding assistance for up to 1,000 zero-emission or partial-zero emission vehicles per year.

ONRD-02 – ACCELERATED RETIREMENT OF OLDER LIGHT- AND MEDIUM-DUTY VEHICLES: This proposed measure calls for promoting the permanent retirement of older eligible vehicles through financial incentives currently offered through local funding incentive programs and the AB 118 Enhanced Fleet Modernization Program (EFMP). The proposed measure seeks to retire up to 2,000 older light- and medium-duty vehicles (up to 8,500 lbs gross vehicle weight) per year. Funding incentives of up to $2,500 per vehicle are proposed for the scrapping of the vehicle, which may include a replacement voucher for a newer or new vehicle.

ONRD-03 – ACCELERATED PENETRATION OF PARTIAL ZERO-EMISSION AND ZERO-EMISSION LIGHT-HEAVY- AND MEDIUM-HEAVY-DUTY VEHICLES: The objective of the proposed action is to accelerate the introduction of advanced hybrid and zero-emission technologies for Class 4 through 6 heavy-duty vehicles. The state is currently implementing a Hybrid Vehicle Incentives Project (HVIP) program to promote zero-emission and hybrid heavy-duty vehicles. The proposed measure seeks to continue the program from 2015 to 2023 to deploy up to 1,000 zero- and partial-zero emission vehicles per year with up to $25,000 funding assistance per vehicle. Zero-emission vehicles and hybrid vehicles with a portion of their operation in an "all electric range" mode would be given the highest priority.

ONRD-04 – ACCELERATED RETIREMENT OF OLDER ON-ROAD HEAVY-DUTY VEHICLES: This proposed measure seeks to replace up to 1,000 heavy-duty vehicles per year with newer or new vehicles that at a minimum, meet the 2010 on-road heavy-duty NOx exhaust emissions standard of 0.2 g/bhp-hr. Given that exceedances of the 24-hour PM2.5 air quality standard occur in the Mira Loma region, priority will be placed on replacing older diesel trucks that operate primarily at the warehouse and distribution centers located in the Mira Loma area. Funding assistance of up to $35,000 per vehicle is proposed and the level of funding will depend upon the NOx emissions certification level of the replacement vehicle. In addition, a provision similar to the Surplus Off-Road Option for NOx (SOON) provision of the statewide In-Use Off-Road Fleet Vehicle Regulation will be sought to ensure that additional NOx emission reduction benefits are achieved.

ONRD-05 – FURTHER EMISSION REDUCTIONS FROM HEAVY-DUTY VEHICLES SERVING NEAR-DOCK RAILYARDS: This proposed control measure calls for a requirement that any cargo container moved between the Ports of Los Angeles and Long Beach to the nearby railyards (the Intermodal Container Transfer Facility and the proposed Southern California International Gateway) be with zero-emission technologies. The measure would be fully implemented by 2020 through the deployment of zero-emission trucks or any alternative zero-emission container movement system such as a fixed guideway system. The measure calls for CARB to either adopt a new regulation or amend an existing regulation to require such deployment by 2020. To the extent the measure can feasibly be extended beyond near-dock railyards, this would be considered for adoption by CARB.

OFFRD-01 – EXTENSION OF THE SOON PROVISION FOR CONSTRUCTION/INDUSTRIAL EQUIPMENT: This measure seeks to continue the Surplus Off-Road Option for NOx (SOON) provision of the statewide In-Use Off-Road Fleet Vehicle Regulation beyond 2014 through the 2023 timeframe. In order to implement the SOON program in this timeframe, funding of up to $30 million per year would be sought to help fund the repower or replacement of older Tier 0 and Tier 1 equipment, with reductions that are considered surplus to the statewide regulation with Tier 4 or cleaner engines.

OFFRD-02 – FURTHER EMISSION REDUCTIONS FROM FREIGHT LOCOMOTIVES: The proposed control measure is to meet the commitment in the 2007 SIP for the accelerated use of Tier 4 locomotives in the South Coast Air Basin. The measure calls for CARB to seek further emission reductions from freight locomotives through enforceable mechanisms within its authority to achieve 95 percent or greater introduction of Tier 4 locomotives by 2023.

OFFRD-03 – FURTHER EMISSION REDUCTIONS FROM PASSENGER LOCOMOTIVES: This measure recognizes the recent actions by the Southern California Regional Rail Authority (SCRRA or Metrolink) to consider replacement of their existing Tier 0 passenger locomotives with Tier 4 locomotives. The SCRRA adopted a plan that contains a schedule to replace their older existing passenger locomotives with Tier 4 locomotives by 2017. More recently, SCRRA released a Request for Quotes on the cost of new or newly manufactured passenger locomotives with locomotive engines that meet Tier 4 emission levels.

OFFRD-04 – FURTHER EMISSION REDUCTIONS FROM OCEAN-GOING MARINE VESSELS WHILE AT BERTH: This measure seeks additional emission reductions from ocean-going marine vessels while at berth. The actions would affect ocean-going vessels that are not subject to the statewide Shorepower Regulation or vessel calls that are considered surplus to the statewide regulation. The measure seeks at a minimum to have an additional 25 percent of vessel calls beyond the statewide regulation to deploy shorepower technologies or alternative forms of emissions reduction as early as possible. Such actions could be implemented through additional incentives programs or through the San Pedro Bay Ports as part of the implementation of the Ports Clean Air Action Plan.

OFFRD-05 – EMISSION REDUCTIONS FROM OCEAN-GOING MARINE VESSELS: This measure recognizes the recent actions at the Ports of Los Angeles and Long Beach to initiate an incentives program for cleaner ocean-going vessels to call at the ports. The program has been initiated as part of the San Pedro Bay Ports Clean Air Action Plan. The program will provide financial incentives for cleaner Tier 2 and Tier 3 ocean-going vessels to call at the ports. This measure also recognizes the need to monitor progress under such programs and augment them as necessary to ensure sufficient results. The program will be monitored on annual basis and, if necessary, any adjustments to the program will be made.

ADV-01 –ACTIONS FOR THE DEPLOYMENT OF ZERO- AND NEAR-ZERO EMISSION ON-ROAD HEAVY-DUTY VEHICLES: This measure would continue the efforts underway to develop zero-emission and near-zero emission technologies for on-road heavy-duty vehicle applications. Such technologies include, but not limited to, fuel cell, battery-electric, hybrid-electric with all electric range, and overhead catenary systems. Hybrid-electric systems incorporate an engine powered by conventional fuels or alternative fuels such as natural gas. The actions provided in the proposed measure are based on the SCAG 2012 Regional Transportation Plan.

ADV-02 –ACTIONS FOR THE DEPLOYMENT OF ZERO- AND NEAR-ZERO EMISSION LOCOMOTIVES: This measure calls for the development and deployment of zero-emission and near-zero emission technologies for locomotives. Such technologies include overhead catenary systems, hybrid locomotives that have some portion of their operation in an “all electric range” mode, and alternative forms of external power such as a battery tender car. The actions provided in the proposed measure are based on the SCAG 2012 Regional

Transportation Plan. The zero-emission technologies could apply to freight and passenger locomotives.

ADV-03 –ACTIONS FOR THE DEPLOYMENT OF ZERO- AND NEAR-ZERO EMISSION CARGO HANDLING EQUIPMENT: This measure recognizes the actions underway to develop and deploy zero- and near-zero emission technologies for various cargo handling equipment. The San Pedro Bay Ports are currently demonstrating battery-electric yard tractors. In addition, battery-electric, fuel cell, and hybridized systems could be deployed on smaller cargo handling equipment. In addition, the use of alternative fuels for conventional combustion engines could potentially result in greater emissions benefits.

ADV-04 –ACTIONS FOR THE DEPLOYMENT OF CLEANER COMMERCIAL HARBORCRAFT: Several commercial harbor craft operators have begun deployment of hybrid systems in their harbor craft to further reduce criteria pollutant emissions and improve fuel efficiency. Other cleaner technologies include the use of alternative fuels, retrofit of existing older marine engines with selective catalytic converters, and diesel particulate filters. This measure recognizes several efforts between the District and the Ports of Los Angeles and Long Beach to further demonstrate control technologies that could be deployed on commercial harbor craft that could go beyond the statewide Harbor Craft Regulation.

ADV-05 –ACTIONS FOR THE DEPLOYMENT OF CLEANER OCEAN-GOING MARINE VESSELS: The Ports of Los Angeles and Long Beach, CARB, and the District have sponsored research and demonstration of various control technologies to further reduce emissions from ocean-going vessels. In addition, the San Pedro Bay Ports Clean Air Action Plan contains a measure to further demonstrate such technologies on ocean-going vessels. This measure recognizes many of these efforts and the need to further demonstrate retrofit technologies on existing ocean-going vessels.

ADV-06 –ACTIONS FOR THE DEPLOYMENT OF CLEANER OFF-ROAD EQUIPMENT: The District, Mobile Source Air Pollution Reduction Review Committee (MSRC), and CARB have been conducting an off-road "showcase" program for retrofit technologies to further reduce emissions from older off-road equipment. In addition, several major off-road engine manufacturers are investigating the potential use of hybrid systems to further reduce criteria pollutant and greenhouse gas emissions. Potential advanced technologies include hybrid systems that utilize batteries, fuel cells, or plug-in capabilities, which could result in lower emissions compared to Tier 4 emission levels when combined with future Tier 4 compliant engines. The measure is implemented by the District, CARB and U.S. EPA.

ADV-07 –ACTIONS FOR THE DEPLOYMENT OF CLEANER AIRCRAFT ENGINES: This measure recognizes the efforts of the Federal Aviation Administration's Continuous Lower Energy, Emissions and Noise (CLEEN) Program. The goal of the CLEEN Program is the development of new aircraft engines that potentially can be up to 60 percent cleaner in NOx emissions than current aircraft engines. The actions under this measure are to continue the development of cleaner aircraft engines and work with the airlines and local airport authorities to develop mechanisms to route the cleanest aircraft to serve the South Coast Air Basin.

DISTRICT'S SIP EMISSION REDUCTION COMMITMENT

The SIP commitment of the Final 2012 AQMP is structured into two components. Reductions from adopted rules and reductions from the 2012 AQMP control measures are divided into commitments for the 24-hr PM2.5 SIP and the 8-hour ozone SIP. Taken together, these reductions are relied upon to demonstrate expeditious progress and attainment of the federal 24-hr PM2.5 standard, and implemented to reduce the black box commitment for the 8-hour ozone standard. The following sections first describe the methodology for SIP emission reduction calculations and the creditable SIP reductions, then describe what procedures will be followed to ensure fulfillment of the commitment.

SIP Emission Reduction Tracking

For purposes of tracking progress in emission reductions, the baseline emissions for the year 2014 (annual average) and 2023 (planning inventory) in the Final 2012 AQMP will be used, regardless of any subsequent new inventory information that reflects more recent knowledge. This is to ensure that the same "currency" is used in measuring progress as was used in designing the Plan. This will provide a fair and equitable measurement of progress. Therefore, it makes no difference whether progress is measured by emission reductions or remaining emissions for a source category. However, the most recent emission inventory information at the time of rule development will continue to be used for calculating reductions, and assessing cost-effectiveness and socioeconomic impacts of the proposed rule. Therefore, for future rulemaking activity, both the most recent and AQMP inventories will be reported.

Any non-mandatory emissions reductions achieved beyond the existing District regulations are creditable only if they are also SIP-enforceable. Therefore, in certain instances, the District may have to adopt regulations to reflect the existing industry practices in order to claim SIP reduction credit, with the understanding that there may not be additional reductions beyond what has already occurred. Exceptions can be made where reductions are real, quantifiable, surplus to the Final 2012 AQMP baseline inventories, and enforceable through other State and/or federal regulations. Also, any emissions inventory revisions, which have gone through a peer review and public review process, can also be SIP creditable.

Reductions from Adopted Rules

A number of control measures contained in the 2007 AQMP have been adopted as rules. These adopted rules and their projected emission reductions become assumptions in developing AQMP's future year inventories. Although they are not part of the control strategy in the Final 2012 AQMP, continued implementation of those rules is essential in achieving clean air goals and maintaining the attainment demonstration. Table 1-2 of Chapter 1 lists the rules adopted by the District since the adoption of the 2007 AQMP and their expected emission reductions.

<u>Reductions from District's Stationary Source Control Measures</u>

For purposes of implementing an approved SIP, the District is committed to adopt and implement control measures that will achieve, in aggregate, emission reductions specified in Tables 4-7 and 4-8 to demonstrate expeditious implementation of measures toward meeting the federal 2006 24-hr PM2.5 standard and the 1997 8-hour ozone standard, respectively. Emission reductions achieved in excess of the amount committed to in a given year can be applied to the emission reduction commitments of subsequent years. The District is committed to adopt the control measures in Tables 4-2 and 4-4 unless these measures or a portion thereof are found infeasible and other substitute measures that can achieve equivalent reductions in the same adoption or implementation timeframes are adopted. Findings of infeasibility will be made at a regularly scheduled meeting of the District Governing Board with proper public notification. For purposes of the SIP commitment, infeasibility means that the proposed control technology is not reasonably likely to be available by the implementation date in question, or achievement of the emission reductions by that date is not cost-effective. It should be noted that the reductions in Tables 4-7 and 4-8 are committed only to the extent needed to achieve attainment by 2014 and if any substitution is needed, the alternative measures will need to achieve the same emission reductions or air quality benefit. The District acknowledges that this commitment is enforceable under Section 304(f) of the federal Clean Air Act. U.S. EPA will not credit SIP reductions unless the control measures are adopted and approved into the SIP at the time of their action on the plan.

Adoption and Implementation of District's Stationary Source Control Measures

As a partial response to concerns raised by the regulated community that costly controls may be required to meet the SIP obligations, the District proposes to establish a threshold of $16,500 per ton of VOC and $22,500 per ton of NOx reduction for tiered levels of analysis. Specifically, proposed rules with an average cost-effectiveness above the threshold will trigger a more rigorous average cost-effectiveness, incremental cost-effectiveness, and socioeconomic impact analysis. A public review and decision process will be instituted to seek lower cost alternatives. In addition, the District staff, with input from stakeholders, will attempt to develop viable control alternatives within the industry source categories that a rule is intended to regulate. If it is determined that control alternatives within the industry source category are not feasible, staff will perform an evaluation of the control measure as described in the next paragraph. Viable alternatives shall be reviewed by the District Governing Board at a public meeting no less than 90 days prior to rule adoption and any needed direction will be given back to staff for further analysis. During this review process, incremental cost-effectiveness scenarios and methodology will be specified, and industry-specific affordability issues will be identified as well as possible alternative control measures. The District Governing Board may adopt the original or an alternative that is consistent with state and federal law. In addition, staff shall include in all set hearing items a notification that proposed rules do or do not exceed the cost threshold.

Adoption and Implementation of Alternative/Substitute Measures

Under the Final 2012 AQMP, the District will be allowed to substitute District stationary source measures in Tables 4-2 and 4-4 with other measures, provided the overall equivalent emission reductions by the adoption and implementation dates in Tables 4-2 and 4-4 are maintained and the applicable measure in Tables 4-2 and 4-4 is deemed infeasible. In order to provide meaningful public participation, when new control concepts are introduced for rule development, the District is committed to provide advanced public notification beyond its regulatory requirements (i.e., through its Rule Forecast Report). The District will also report quantitatively on the AQMP's implementation progress annually at its regularly scheduled Governing Board meetings. Included in the reports will be any new control measures being proposed or measures, or portions thereof, that have been found to be infeasible and the basis of such finding. In addition, at the beginning of the year, any significant emission reduction related rules to be considered would be listed in the Board's Rule Forecast Report. Upon any finding of a new feasible control measure to substitute for a measure deemed infeasible, rule development will be completed no later than 12 months from the adoption date of the control measure substituted, and implementation of the new measure will occur no later than two years from the final implementation date of the measure substituted. The existing rule development outreach efforts such as public workshops, stakeholder working group meetings or public consultation meetings will continue to solicit public input. In addition, if additional technical analysis, including source testing, indicates that actual emissions are less than previously estimated, the reductions would then be creditable toward SIP commitments. In order for reductions from improved emission calculation methodologies to be SIP creditable, a public review process will also be instituted to solicit comments and make appropriate revisions, if necessary.

TABLE 4-7

24-Hr PM2.5 SIP Basin-wide Emission Reductions Commitment
to be Achieved through the District's Regulatory Programs

(2014, Average Annual Day, tons per day)

YEAR	VOC		PM2.5		NOx		SOx	
	Based on Adoption Date	Based on Imple. Date[a]	Based on Adoption Date	Based on Imple. Date[a]	Based on Adoption Date	Based on Imple. Date[a]	Based on Adoption Date	Based on Imple. Date[a]
2013	---	---	11.7[b]	---	---	---	---	---
2014	---	---	---	11.7[b]	---	---	---	---
TOTAL			**11.7[b]**	**11.7[b]**				

[a] Represents the final, full implementation date; typically a rule contains multiple implementation dates.
[b] Represents winter episodic emissions.

TABLE 4-8

2007 Ozone SIP Emission Reductions Commitment to be Achieved Through the District's
Stationary and Mobile Source Regulatory Programs

(2023, Planning Inventory, tons per day)

YEAR	VOC		NOx	
	Based on Adoption Date	Based on Implementation Date[a]	Based on Adoption Date	Based on Implementation Date[a]
2013	---	---	7.5	---
2014	0.80	---	---	---
2015	1	---	3	---
2016	4	0.8	0.2	---
2017	---	1	---	---
2018	---	2	---	0.2
2019	---	---	---	---
2020	---	2	---	3
2021	---	---	---	---
2022	---	---	---	---
2023	---	---	---	7.5
TOTAL	**5.8**	**5.8**	**10.7**	**10.7**

[a] Represents the final, full implementation date; typically a rule contains multiple implementation dates.

TABLE 4-9

Emission Reductions Commitment to be Achieved Through CARB's Regulatory Programs

(2023, Planning Inventory, tons per day)

YEAR	NOx	
	Based on Adoption Date	Based on Implementation Date[a]
2013		---
2014	0.75	---
2015	---	---
2016	---	---
2017	---	---
2018	---	---
2019	---	---
2020	---	0.75
2021	---	---
2022	---	---
2023	---	
TOTAL	**0.75**	**0.75**

[a] Represents the final, full implementation date; typically a rule contains multiple implementation dates.

OVERALL EMISSION REDUCTIONS

A summary of emission reductions for the proposed control measures for the years 2014 and 2023 is provided in Tables 4-10 through 4-11. These reductions reflect the emission reductions associated with implementation of control measures under local, State, and federal jurisdiction. Emission reductions represent the difference between the projected baseline and the remaining emissions. Table 4-10 identifies projected reductions based on the annual average inventory for directly emitted PM2.5 and its precursors (NOx, and SOx), and VOC for basin-wide stationary and mobile control measures. It represents the level of control needed to achieve the federal 2006 24-hr PM2.5 standard by 2014. For attainment of the 1997 ozone standard by 2023, Table 4-11 identifies projected reductions based on the summer planning inventory for VOC and NOx emissions as an ongoing effort to reduce reliance on the Section 182(e)(5) measures in the 2007 AQMP.

TABLE 4-10

Emission Reductions for 2014 Based on Average Annual Emissions Inventory
(tons per day)

SOURCES	VOC	NOx	SOx	PM2.5
Year 2014 Baseline[1]	451	506	18	70
Adjustments to Baseline[2]	0.28	16	---	0.46
Emission Reductions:				
Stationary Sources	---	---	---	12 [3]
Mobile Sources	---	---	---	---
TOTAL Reductions (all measures)	---	---	---	12 [3]
2014 Remaining Emissions	**451**	**490**	**18**	**58**

[1] Emission assumptions from SCAG's 2012 Regional Transportation Plan are already reflected in the AQMP baseline, including TCMs.
[2] Emissions reductions from executed contracts under mobile source incentive programs (Proposition 1B, Carl Moyer, AB1493)
[3] Based on episodic winter day.

TABLE 4-11

Emission Reductions for 2023 Based on
Summer Planning Inventory (tons per day)

SOURCES	VOC	NOx
Year 2023 Baseline[1]	438	319
Emission Reductions:		
Stationary Sources	6	3
Mobile Sources	---	8
TOTAL Reductions (all measures)	6	11
2023 Remaining Emissions	**432**	**308**

[1] Emission assumptions from SCAG's 2012 Regional Transportation Plan are already reflected in the AQMP baseline, including TCMs.

IMPLEMENTATION

Achieving clean air objectives requires the effective and timely implementation of the control measures. Similar to approaches taken by previous AQMPs, the SIP commitment is to bring each control measure for regulatory consideration in a specified time frame. The time frame is based on the ability to implement certain control strategies that will result in the reductions necessary to demonstrate attainment by the required attainment date. There is a commitment to achieve a total emission reduction target, with the ability to substitute for control measures deemed infeasible, so long as equivalent reductions are met by other means. These measures are also designed to satisfy the federal Clean Air Act requirement of Reasonably Available Control Technologies [Section 172(c)], and the California Clean Air Act requirement of Best Available Retrofit Control Technologies (BARCT) [Health and Safety Code Section 40440(b)(1)].

The adoption and implementation schedule of the control measures proposed in the Final 2012 AQMP can be found in Tables 4-2, 4-4 and 4-6. Multiple agencies are necessary for implementation of the mobile source ozone measures in Table 4-6. This section describes each agency's area of responsibility.

Responsible Agencies

Implementation of the control strategies requires a cooperative partnership of governmental agencies at the federal, state, regional and local level. These agencies form the four cornerstones from which implementation programs will evolve.

At the federal level, the U.S. EPA and sometimes other agencies are charged with reducing emissions from federally controlled sources such as commercial aircraft, trains, marine vessels, and other sources. At the state level, CARB is primarily responsible for reducing emissions from motor vehicles and consumer products.

At the regional level, the District is responsible for the overall development and implementation of the AQMP. The District is specifically authorized to reduce the emissions from stationary, point, and some area sources such as coatings and industrial solvents. Emission reductions are also sought through funding programs designed to accelerate vehicle turnover and the purchase of cleaner vehicles. In addition, the District regulates indirect sources under Health and Safety Code Sections 40716 (a)(1) and 40440(b)(3). As a means of achieving further emission reductions, the District may seek additional authority to regulate sources that have not been completely under the District's jurisdiction in the past such as marine vessels, consumer products, and other on-road and off-road sources. The District implements its responsibilities with participation from the regulated community through an extensive rule development and implementation program. This approach maximizes the input of those parties affected by the proposed rule through consultation meetings, public workshops, and ongoing working groups.

At the regional level, the Southern California Association of Governments (SCAG) assists sub-regional and local governments in playing a formative role in the air quality elements of transportation planning. In addition, local governments serve an important role in developing and implementing the transportation control measures that are included in the Final 2012 AQMP. SCAG is responsible for providing the socioeconomic forecast (e.g., population and growth forecasts) upon which the Plan is based. SCAG also provides assessments for conformity of regionally significant transportation projects with the overall Plan and is responsible for the adoption of the Regional Transportation Plan (RTP) and the Regional Transportation Improvement Program (RTIP) which include growth assumptions and transportation improvement projects that could have significant air quality impacts, and transportation control measures as required by the CAA.

Table 4-12 list the responsibilities of the key agencies involved in the implementation of the 2012 AQMP.

TABLE 4-12

Agencies Responsible for Implementation
of the 2012 AQMP for the South Coast Air Basin

AGENCY	PRINCIPAL RESPONSIBILITIES
U.S. EPA	• Mobile vehicle emission standards; • Airplanes, trains, and ships; • New off-road construction & farm equipment below 175 hp
CARB	• On-road/Off-road vehicles (emission standards and in-use fleets as authorized under Section 209(e) of the Clean Air Act) • Motor vehicle fuels; • Consumer products
SCAQMD	• Stationary (e.g., industrial/commercial) and area sources; • Indirect sources; • Certain mobile sources (e.g., in-use fleet regulations, incentives for accelerated vehicle turnover, reduction in average vehicle ridership, etc.)
SCAG	• Conformity assessments for Regional Transportation Plan and other transportation projects; • Regional Transportation Improvement Program; • Transportation Control Measures
Local Government	• Transportation and local government actions (i.e., land use approvals & ports); • Transportation facilities

Chapter 5

Future Air Quality

South Coast Air Quality Management District

Cleaning the air that we breathe...™

South Coast AQMD

CHAPTER 5

FUTURE AIR QUALITY

INTRODUCTION

Air quality modeling is an integral part of the planning process to achieve clean air. The attainment demonstrations provided in this Final 2012 AQMP reflect the updated baseline emissions estimates, new technical information, enhanced air quality modeling techniques, and the control strategy provided in Chapter 4 for 24-hour PM2.5. Projections for progress towards meeting the annual PM2.5 standard by 2014 and the 1997 8-hour ozone standard by 2023 are also presented in this chapter. These latter two requirements are addressed in the 2007 AQMP.

The Basin is currently designated nonattainment for PM2.5, and extreme nonattainment for ozone. The District's goal is to develop an integrated control strategy which: 1) ensures that ambient air quality standards for all criteria pollutants are met by the established deadlines in the federal Clean Air Act (CAA); and 2) achieves an expeditious rate of progress towards attaining the state air quality standards. The overall control strategy is designed so that efforts to achieve the standard for one criteria pollutant do not cause unnecessary deterioration of another. A two-step modeling process which is consistent with the approach used in the 2007 AQMP has been conducted for the Final 2012 AQMP. First, future year 24-hour PM2.5 levels are simulated for 2014 and 2019 to determine the earliest possible date of attainment. If attainment cannot be demonstrated by 2014, U.S. EPA can grant up to an additional five years to demonstrate attainment of the 24-hour standard. However, the length of the extension is contingent upon the earliest year beyond 2014 that the 24-hour average PM2.5 standard can be achieved implementing all feasible control measures.

BACKGROUND

During the development of the 2003 AQMP, the District convened a panel of seven experts to independently review the regional air quality modeling. The consensus of the panel was for the District to move to the more current state-of-the-art dispersion platforms and chemistry modules. In keeping with the recommendations of the expert panel as well as the Scientific Technical Modeling Peer Review Committee, the Final 2012 AQMP has continued to move forward to incorporate the current state-of-the-art modeling platforms to conduct regional modeling analyses in support of the PM2.5 attainment demonstrations and ozone update. The Final 2012 AQMP PM2.5 attainment demonstration has been developed using the U.S. EPA supported Community Multiscale Air Quality (CMAQ) (version 4.7) modeling platform with SAPRC99 chemistry, and the Weather Research and Forecasting Model (WRF) (version 3.3) meteorological fields. Supporting PM2.5 and ozone simulations were also conducted using the most current and publicly available version of CAMx (version 5.3), which also used SAPRC99 chemistry and WRF meteorology, to ensure smooth transition from the CAMx platform used in the 2007 AQMP to CMAQ. The model analyses were conducted on an expanded domain, with increased resolution in the vertical structure, and a finer 4 km grid size.

Detailed information on the modeling approach, data gathering, model development and enhancement, model application, and interpretation of results is presented in Appendix V. The following sections summarize the results of the 24-hour PM2.5 attainment demonstration modeling effort and provide an update to the annual PM2.5 and future projected Basin ozone levels given new emissions, design values and modeling tools.

MODELING APPROACH

Design Values and Relative Response Factors (RRF)

As first employed in the 2007 AQMP, the Final 2012 AQMP modeling approach to demonstrate attainment of the air quality standards relies heavily on the use of design values and relative response factors (RRF) to translate regional modeling simulation output to the form of the air quality standard. Both PM2.5 and ozone have standards that require three consecutive years of monitored data, averaged according to the form of the standard to derive a design value, to assess compliance. The 24-hour PM2.5 design value is determined from the three-year average of the 98^{th} percentile of all 24-hour concentrations sampled at a monitoring site. The annual PM2.5 design value is based on quarterly average PM2.5 concentrations, averaged by year, for a three-year period. In the case of ozone, compliance with the standard is determined from a three-year average of the 4^{th} highest daily ozone 8-hour average concentration.

<u>Design Value Selection</u>

U.S. EPA guidance recommends the use of multiple year averages of design values, where appropriate, to dampen the effects of single year anomalies to the air quality trend due to factors such as adverse or favorable meteorology or radical changes in the local emissions profile. The trend in the Basin 24-hour PM2.5 design values, determined from routinely monitored Federal Reference Monitoring (FRM), from 2001 through 2011 (Figure 5-1) depicts sharp reductions in concentrations over the period. The 24-hour PM2.5 design value for 2001 was 76 $\mu g/m^3$ while the 2008 design value (based on data from 2006, 2007 and 2008) is 53 $\mu g/m^3$. Furthermore, the most current design value computed for 2011 has been reduced to 38 $\mu g/m^3$. The annual PM2.5 design value has demonstrated a reduction of 13.6 $\mu g/m^3$ over the 10-year period from 2001 through 2011. In each case, the trend in PM2.5 is steadily moving in the direction of air quality improvement. The trend of Basin ozone design values is presented in Figure 5-2. The design values have averaged a reduction of approximately three parts per billion over the 14-year period; however the most recent design value (107 ppb) continues to exceed the 1997 8-hour ozone standard (80 ppb) by 34 percent and the 2006 ozone standard by 43 percent (75 ppb).

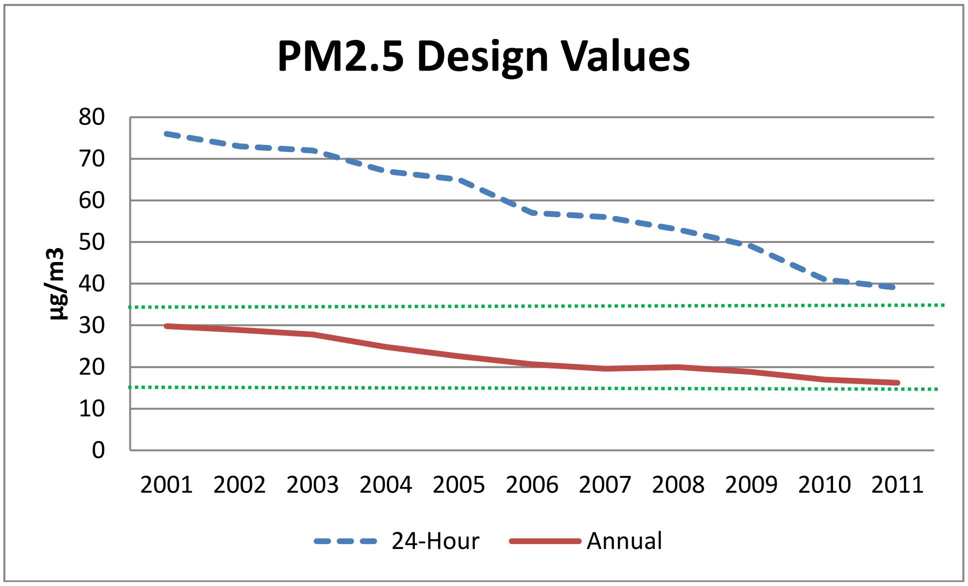


FIGURE 5-1

South Coast Air Basin 24-Hour Average and Annual PM2.5 Design Values
Note: Each value represents the 3-year average of the highest annual average PM2.5 concentration

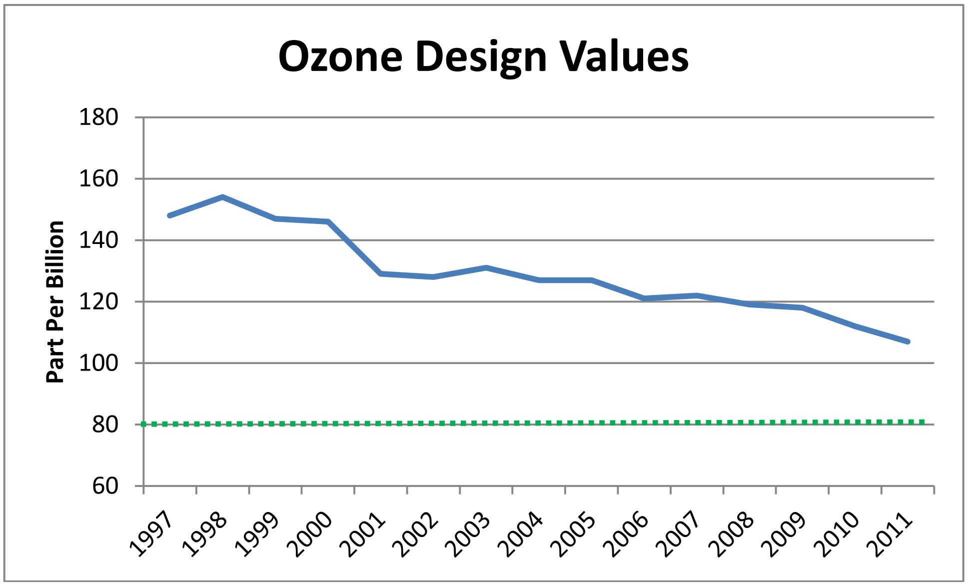


FIGURE 5-2

South Coast Air Basin 8-Hour Average Ozone Design Values
Note: Each value represents the 3-year average of the 4^{th} highest 8-Hour Average Ozone concentration

The Final 2012 AQMP relies on a set of five years of particulate data centered on 2008, the base year selected for the emissions inventory development and the anchor year for the future year PM2.5 projections. In July, 2010, U.S. EPA proposed revisions to the 24-hour PM2.5 modeling attainment demonstration guidance. The new guidance suggests using five years of data, but instead of directly using quarterly calculated design values, the procedure requires the top 8 daily PM2.5 concentrations days in each quarter to reconstruct the annual 98th percentile. The logic in the analysis is twofold: by selecting the top 8 values in each quarter the 98th percentile concentration is guaranteed to be included in the calculation. Second, the analysis projects future year concentrations for each of the 32 days in a year (160 days over five years) to test the response of future year 24-hour PM2.5 to the proposed control strategy. Since the 32 days in each year include different meteorological conditions and particulate species profiles it is expected those individual days will respond independently to the projected future year emissions profile and that a new distribution of PM2.5 concentrations will result. Overall, the process is more robust in that the analysis is examining the impact of the control strategy implementation for a total of 160 days, covering a wide variety of potential meteorology and emissions combinations.

Table 5-1 provides the weighted 2008 24-hour average PM2.5 design values for the Basin.

TABLE 5-1

2008 Weighted 24-Hour PM2.5 Design Values (µg/m^3)

MONITORING SITE	24-HOURS
Anaheim	35.0
Los Angeles	40.1
Fontana	45.6
North Long Beach	34.4
South Long Beach	33.4
Mira Loma	47.9
Rubidoux	44.1

<u>Relative Response Factors and Future Year Design Values</u>

To bridge the gap between air quality model output evaluation and applicability to the health-based air quality standards, U.S. EPA guidance has proposed the use of relative response factors (RRF). The RRF concept was first used in the 2007 AQMP modeling attainment demonstrations. The RRF is simply a ratio of future year predicted air quality with the control strategy fully implemented to the simulated air quality in the base year. The mechanics of the attainment demonstration are pollutant and averaging period specific. For 24-hour PM2.5, the top 10 percentile of modeled concentrations in each quarter of the simulation year are used to determine the quarterly RRFs. For the annual average PM2.5, the quarterly average RRFs are used for the future year projections. For the 8-hour average ozone simulations, the aggregated response of multiple episode days to the implementation of the control strategy is used to develop an averaged RRF for projecting a future year design value. Simply stated, the future year design value is estimated by multiplying the non-dimensional RRF by the base year design value. Thus, the simulated improvement in air quality, based on multiple meteorological episodes, is translated as a metric that directly determines compliance in the form of the standard.

The modeling analyses described in this chapter use the RRF and design value approach to demonstrate future year attainment of the standards.

PM2.5 Modeling

Within the Basin, PM2.5 particles are either directly emitted into the atmosphere (primary particles), or are formed through atmospheric chemical reactions from precursor gases (secondary particles). Primary PM2.5 includes road dust, diesel soot, combustion products, and other sources of fine particles. Secondary products, such as sulfates, nitrates, and complex carbon compounds are formed from reactions with oxides of sulfur, oxides of nitrogen, VOCs, and ammonia.

The Final 2012 AQMP employs the CMAQ air quality modeling platform with SAPRC99 chemistry and WRF meteorology as the primary tool used to demonstrate future year attainment of the 24-hour average PM2.5 standard. A detailed discussion of the features of the CMAQ approach is presented in Appendix V. The analysis was also conducted using the CAMx modeling platform using the "one atmosphere" approach comprised of the SAPRC99 gas phased chemistry and a static two-mode particle size aerosol module as the particulate modeling platform. Parallel testing was conducted to evaluate the CMAQ performance against CAMx and the results indicated that the two model/chemistry packages had similar performance. The CAMx results are provided in Appendix V as a component of the weight of evidence discussion.

The Final 2012 modeling attainment demonstrations using the CMAQ (and CAMx) platform were conducted in a vastly expanded modeling domain compared with the analysis conducted for the 2007 AQMP modeling attainment demonstration. In this analysis, the PM2.5 and ozone base and future simulations were modeled simultaneously. The simulations were conducted using a Lambert Conformal grid projection where the western boundary of the domain was extended to 084 UTM, over 100 miles west of the ports of Los Angeles and Long Beach. The eastern boundary extended beyond the Colorado river while the northern and southern boundaries of the domain extend to the San Joaquin Valley and the Northern portions of Mexico (3543 UTM). The grid size has been reduced from 5 kilometers squared to 4 kilometers squared and the vertical resolution has been increased from 11 to 18 layers.

The final WRF meteorological fields were generated for the identical domain, layer structure and grid size. The WRF simulations were initialized from National Centers for Environmental Prediction (NCEP) analyses and run for 3-day increments with the option for four dimensional data assimilation (FDDA). Horizontal and vertical boundary conditions were designated using a "U.S. EPA clean boundary profile."

PM2.5 data measured as individual species at six-sites in the AQMD air monitoring network during 2008 provided the characterization for evaluation and validation of the CMAQ annual and episodic modeling. The six sites include the historical PM2.5 maximum location (Riverside- Rubidoux), the stations experiencing many of the highest county concentrations (among the 4-county jurisdiction including Fontana, North Long Beach and Anaheim) and source oriented key monitoring sites addressing goods movement (South Long Beach) and mobile source impacts (Central Los Angeles). It is important to note that the close proximity of Mira Loma to Rubidoux and the common in-Basin air flow and transport patterns enable the use of the Rubidoux speciated data as representative of the particulate speciation at Mira Loma. Both sites are directly downwind of the dairy production areas in Chino and the warehouse distribution centers located in the northwestern corner of Riverside County. Speciated data monitored at the selected sites for 2006-2007 and 2009-2010 were analyzed to corroborate the applicability of using the 2008 profiles.

Day-specific point source emissions were extracted from the District stationary source and RECLAIM inventories. Mobile source emissions included weekday, Saturday and Sunday profiles based on CARB's EMFAC2011 emissions model, CALTRANS weigh-in-motion profiles, and vehicle population data and transportation analysis zone (TAZ) data provided by SCAG. The mobile source data and selected area source data were subjected to daily temperature corrections to account for enhanced evaporative emissions on warmer days. Gridded daily biogenic VOC emissions were provided by CARB using the MEGAN biogenic emissions model. The simulations benefited from enhancements made to the emissions inventory including an updated ammonia inventory, improved emissions characterization that split organic compounds into coarse, fine and primary particulate categories, and updated spatial allocation of primary paved road dust emissions.

Model performance was evaluated against speciated particulate PM2.5 air quality data for ammonium, nitrates, sulfates, secondary organic matter, elemental carbon, primary and total particulate mass for the six monitoring sites (Rubidoux, Central Los Angeles, Anaheim, South Long Beach, Long Beach, and Fontana).

The following section summarizes the PM2.5 modeling approach conducted in preparation for this Plan. Details of the PM2.5 modeling are presented in Appendix V.

<u>24-Hour PM2.5 Modeling Approach</u>

CMAQ simulations were conducted for each day in 2008. The simulations included 8784 consecutive hours from which daily 24-hour average PM2.5 concentrations (0000-2300 hours) were calculated. A set of RRFs were generated for each future year simulation. RRFs were generated for the ammonium ion (NH_4), nitrate ion (NO_3), sulfate ion (SO_4), organic carbon (OC), elemental carbon (EC) and a combined grouping of crustal, sea salts and metals (Others). A total of 24 RRFs were generated for each future year simulation (4 seasons and 6 monitoring sites).

Future year concentrations of the six component species were calculated by applying the model generated quarterly RRFs to the speciated 24-hour PM2.5 (FRM) data, sorted by quarter, for each of the five years used in the design value calculation. The 32 days in each year were then re-ranked to establish a new 98^{th} percentile concentration. The resulting future year 98^{th} percentile concentrations for the five years were subjected to weighted averaging for the attainment demonstration.

In this chapter, future year PM2.5 24-hour average design values are presented for 2014, and 2019 to (1) demonstrate the future baseline concentrations if no further controls are implemented; (2) identify the amount of air quality improvement needed to advance the attainment date to 2014; and (3) confirm the attainment demonstration given the proposed PM2.5 control strategy. In addition, Appendix V will include a discussion and demonstration that attainment will be satisfied for the entire modeling domain.

<u>Weight of Evidence</u>

PM2.5 modeling guidance strongly recommends the use of corroborating evidence to support the future year attainment demonstration. The weight of evidence demonstration for the Final 2012 AQMP includes brief discussions of the observed 24-hour PM2.5,

emissions trends, and future year PM2.5 predictions. Detailed discussions of all model results and the weight of evidence demonstration are provided in Appendix V.

FUTURE AIR QUALITY

Under the federal Clean Air Act, the Basin must comply with the federal PM2.5 air quality standards by December 2014 [Section 172(a)(2)(A)]. An extension of up-to five years (until 2019) could be granted if attainment cannot be demonstrated any earlier with all feasible control measures incorporated.

24-Hour PM2.5

A simulation of 2014 baseline emissions was conducted to substantiate the severity of the 24-hour PM2.5 problem in the Basin. The simulation used the projected emissions for 2014 which included all adopted control measures that will be implemented prior to and during 2014, including mobile source incentive projects under contract (Proposition 1B and Carl Moyer Programs). The resulting 2014 future-year Basin design value (37.3$\mu g/m^3$) failed to meet the federal standard. As a consequence additional controls are needed.

Simulation of the 2019 baseline emissions indicates that the Basin PM2.5 will attain the federal 24-hour PM2.5 standard in 2019 without additional controls. With the control program in place, the 24-hour PM2.5 simulations project that the 2014 design value will be 34.3 $\mu g/m^3$ and that the attainment date will advance from 2019 to 2014.

Figure 5-3 depicts future 24-hour PM2.5 air quality projections at the Basin design site (Mira Loma) and six PM2.5 monitoring sites having comprehensive particulate species characterization. Shown in the figure, are the base year design values for 2008 along with projections for 2014 with and without control measures in place. All of the sites with the exception of Mira Loma will meet the 24-hour PM2.5 standard by 2014 without additional controls. With implementation of the control measures, all sites in the Basin demonstrate attainment.

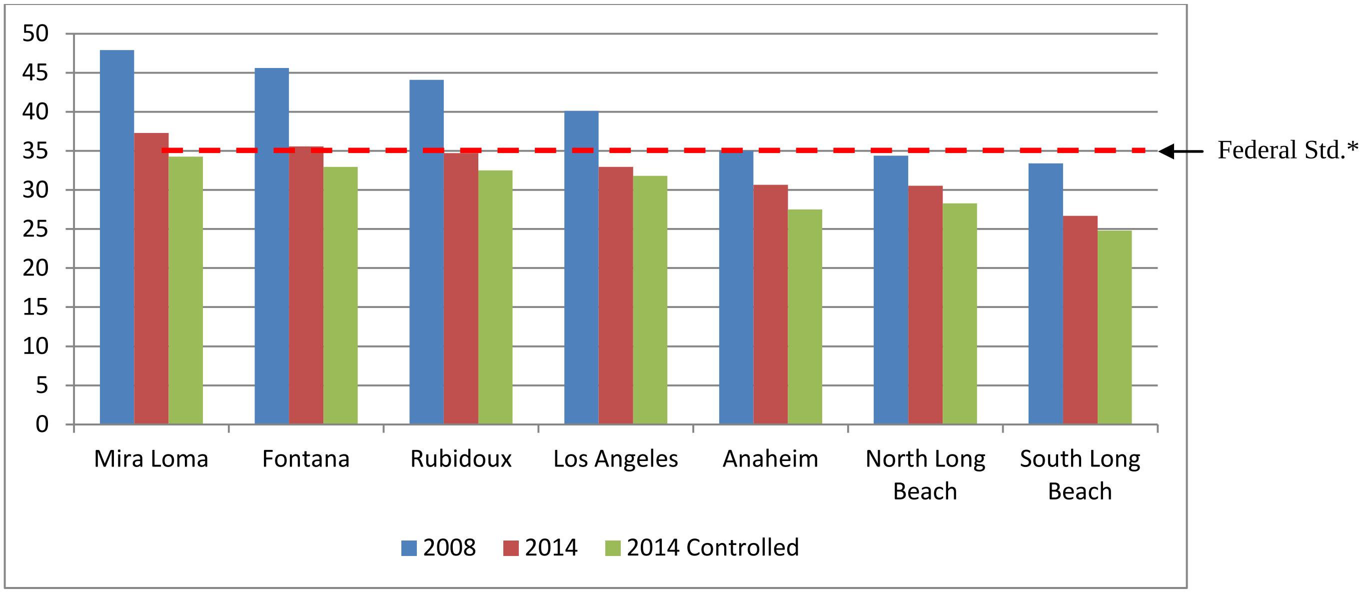


FIGURE 5-3

Maximum 24-Hour Average PM2.5 Design Concentrations:
2008 Baseline, 2014 and 2014 Controlled

<u>Spatial Projections of PM2.5 Design Values</u>

Figure 5-4 provides a perspective of the Basin-wide spatial extent of 24-hour PM2.5 impacts in the base year 2008, with all adopted rules and measures implemented. Figures 5-5 and 5-6 provide a Basin-wide perspective of the spatial extent of 24-hour PM2.5 future impacts for baseline 2014 emissions and 2014 with the proposed control program in place. With no additional controls, several areas around the northwestern portion of Riverside and southwestern portion of San Bernardino Counties depict grid cells with weighted PM2.5 24-hour design values exceeding 35 $\mu g/m^3$. By 2014, the number of grid cells with concentrations exceeding the federal standard is restricted to a small region surrounding the Mira Loma monitoring station in northwestern Riverside County. With the control program fully implemented in 2014, the Basin does not exhibit any grid cells exceeding the federal standard.

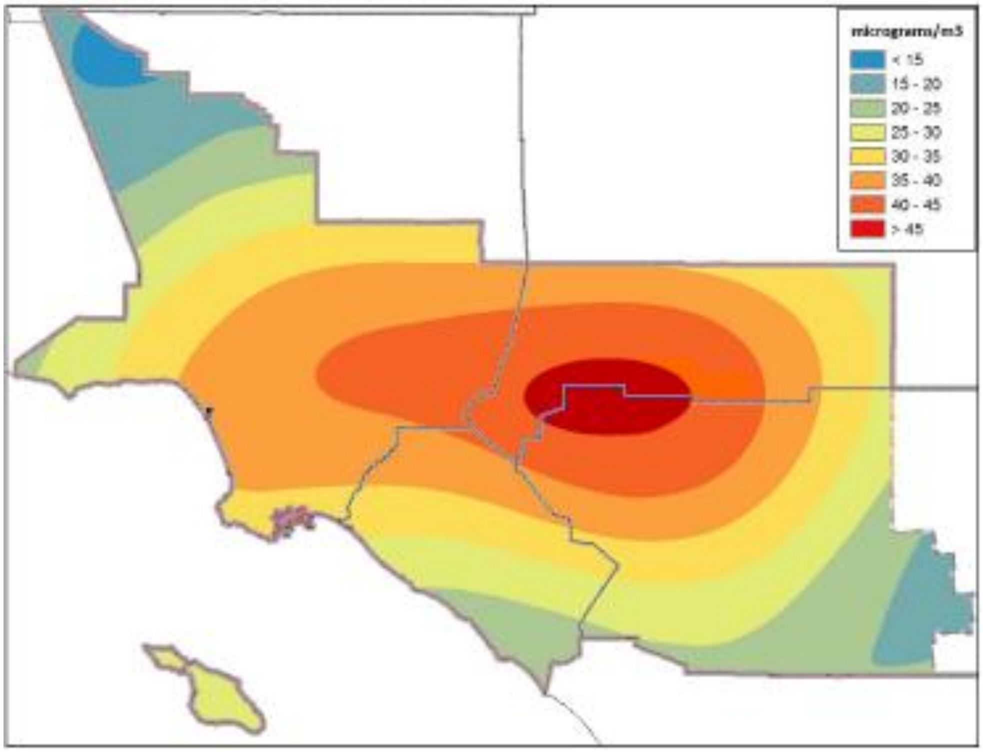


FIGURE 5-4

2008 Baseline 24-Hour PM2.5 Design Concentrations (µg/m^3)

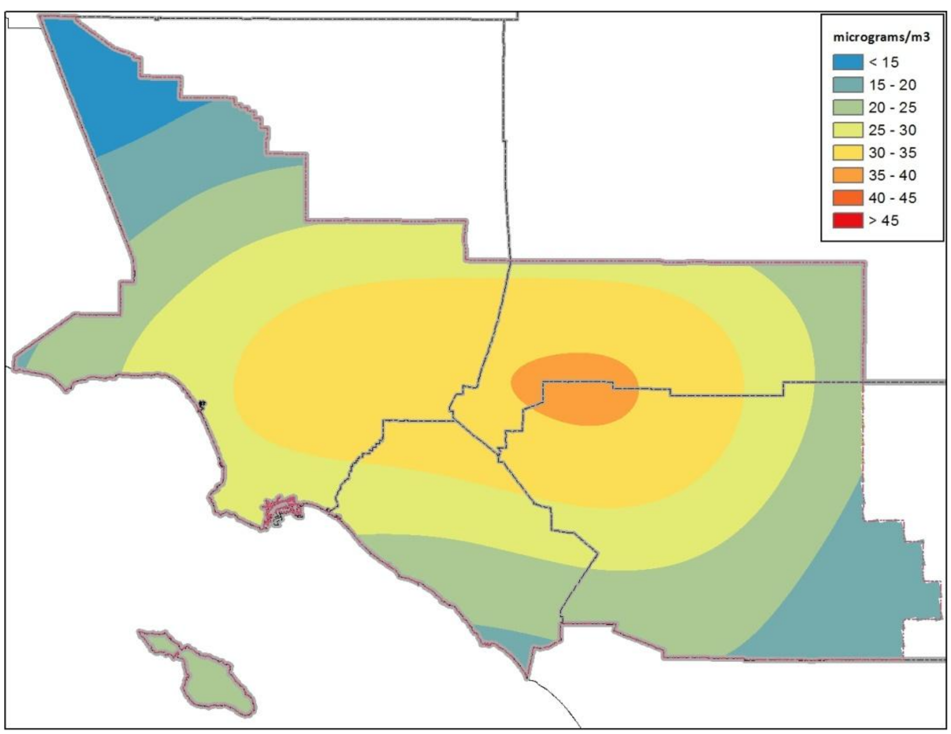


FIGURE 5-5

2014 Baseline 24-Hour PM2.5 Design Concentrations (µg/m^3)

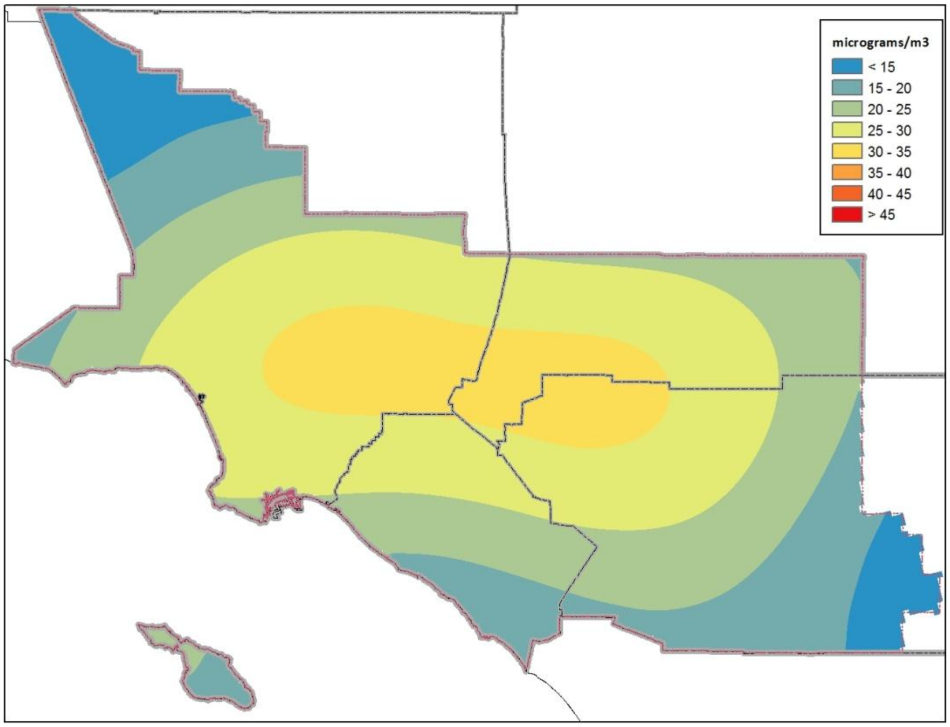


FIGURE 5-6

2014 Controlled 24-Hour PM2.5 Design Concentrations (µg/m^3)

Weight of Evidence Discussion

The weight of evidence discussion focuses on the trends of 24-hour PM2.5 and key precursor emissions to provide justification and confidence that the Basin will meet the federal standard by 2014.

Figure 5-7 depicts the long term trend of observed Basin 24-hour average PM2.5 design values with the CMAQ projected design value for 2014. Also superimposed on the graph is the linear best-fit trend line for the observed 24-hour average PM2.5 design values. The observed trend depicts a steady 49 percent decrease in observed design value concentrations between 2001 and 2011. The rate of improvement is just under 4 µg/m^3 per year. If the trend is extended beyond 2011, the projection suggests attainment of the PM2.5 24-hour standard in 2013, one year earlier than determined by the attainment demonstration. While the straight-line future year approximation is aggressive in its projection, it offers insight to the effectiveness of the ongoing control program and is consistent with the attainment demonstration.

Figures 5-8 depicts the long term trend of Basin NOx emissions for the same period. Figure 5-9 provides the corresponding emissions trend for directly emitted PM2.5. Base year NOx inventories between 2002 (from the 2007 AQMP) and 2008 experienced a 31 percent reduction while directly emitted PM2.5 experienced a 19 percent reduction over the 6-year period. The Basin 24-hour average PM2.5 design value experienced a concurrent 27 percent reduction between 2002 and 2008. The projected trend of NOx emissions indicates that the PM2.5 precursor associated with the formation of nitrate will continue to be reduced though 2019 by an additional 48 percent. Similarly, the projected trend of directly emitted PM2.5 projects a more moderate reduction of 13 percent through 2019. However, as discussed in the 2007 AQMP and in a later section of this chapter, directly emitted PM2.5 is a more effective contributor to the formation of ambient PM2.5 compared to NOx. While the projected NOx and direct PM2.5 emissions trends decrease at a reduced rate between 2012 and 2019, it is clearly evident that the overall significant reductions will continue to result in lower nitrate, elemental carbon and direct particulate contributions to 24-hour PM2.5 design values.

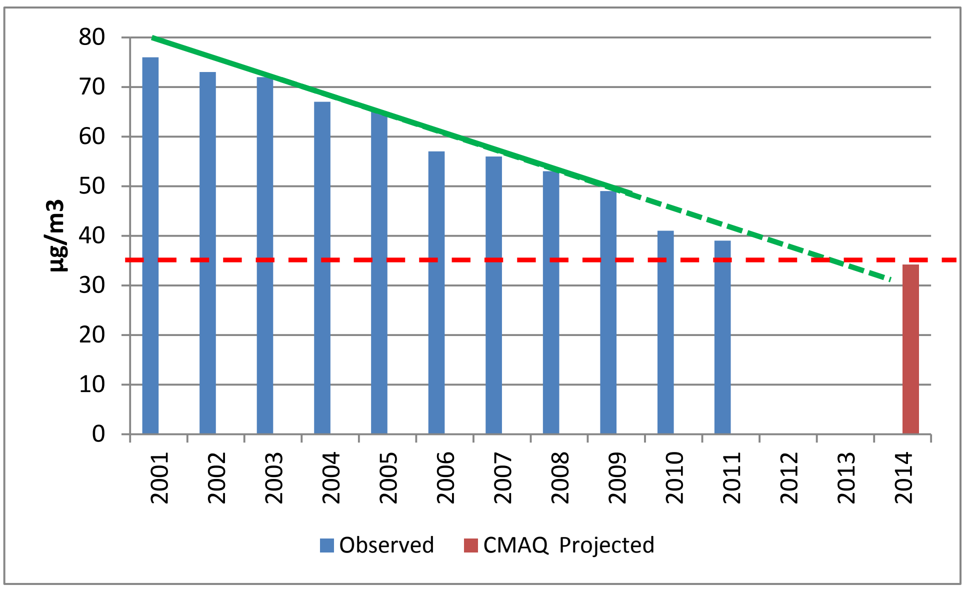


FIGURE 5-7

Basin Observed and CMAQ Projected
Future Year PM2.5 Design Concentrations (µg/m^3)

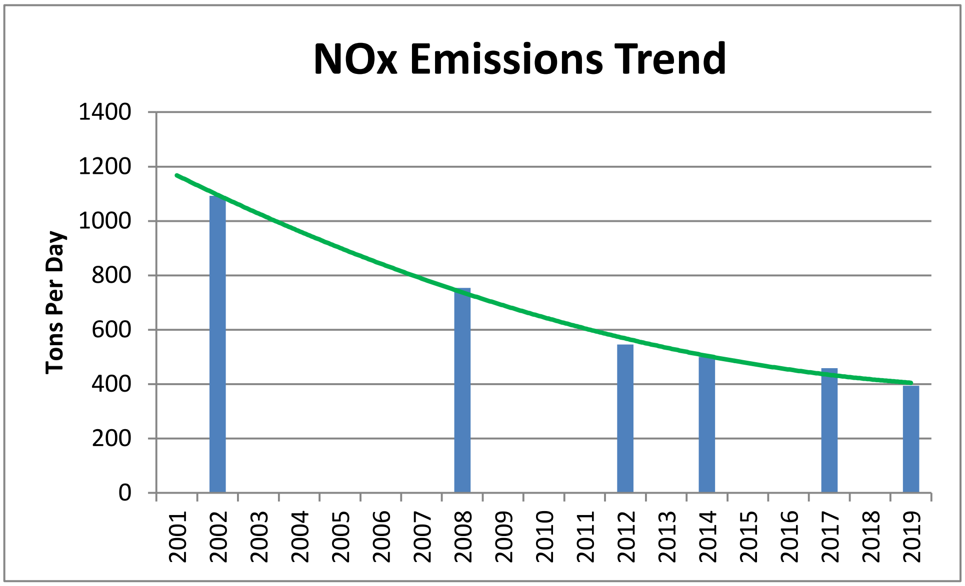


FIGURE 5-8

Trend of Basin NOx Emissions (Controlled)

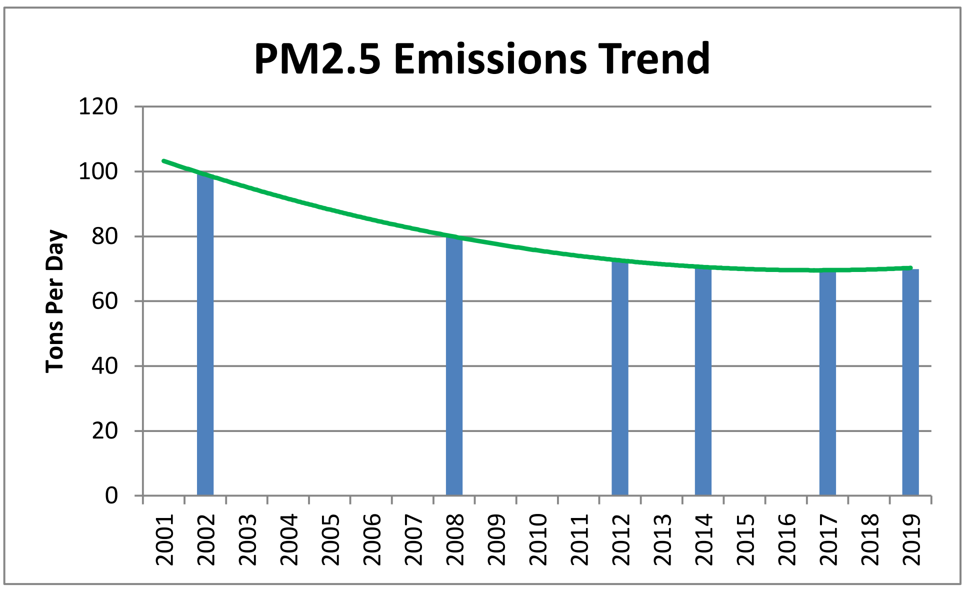


FIGURE 5-9

Trend of Basin PM2.5 Emissions (Controlled)

Control Strategy Choices

PM2.5 has five major precursors that contribute to the development of the ambient aerosol including ammonia, NOx, SOx, VOC, and directly emitted PM2.5. Various combinations of reductions in these pollutants could all provide a path to clean air. The 24-hour PM2.5 attainment strategy presented in this Final 2012 AQMP relies on a dual approach to first demonstrate attainment of the federal standard by 2019 and then focuses on controls that will be most effective in reducing PM2.5 to accelerate attainment to the earliest extent. The 2007 AQMP control measures since implemented will result in substantial reductions of SOx, direct PM2.5, VOC and NOx emissions. Newly proposed short-term measures, discussed in Chapter 4, will provide additional regional emissions reductions targeting directly emitted PM2.5 and NOx.

It is useful to weigh the value of the precursor emissions reductions (on a per ton basis) to microgram per cubic meter improvements in ambient PM2.5 levels. As presented in the weight of evidence discussion, trends of PM2.5 and NOx emissions suggest a direct response between lower emissions and improving air quality. The Final 2007 AQMP established a set of factors to relate regional per ton precursor emissions reductions to PM2.5 air quality improvements based on the annual average concentration. The Final 2012 AQMP CMAQ simulations provided a similar set of factors, but this time directed at 24-hour PM2.5. The analysis determined that VOC emissions reductions have the lowest return in terms of micrograms reduced per ton reduction, one third of the benefit of NOx reductions. SOx emissions were about eight times more effective than NOx reductions. However, directly emitted PM2.5 reductions were approximately 15 times more effective than NOx reductions. It is important to note that the contribution of ammonia emissions is embedded as a component of the SOx and NOx factors since ammonium nitrate and ammonium sulfate are the resultant particulates formed in the ambient chemical process. Table 5-2 summarizes the relative importance of precursor emissions reductions to 24-hour PM2.5 air quality improvements based on the analysis. (A comprehensive discussion of the emission reduction factors is presented in Attachment 8 of Appendix V of this document). Emission reductions due to existing programs and implementation of the 2012 AQMP control measures will result in projected 24-hour PM2.5 concentrations throughout the Basin that meet the standard by 2014 at all locations. Basin-wide curtailment of wood burning and open burning when the PM2.5 air quality is projected to exceed 30 $\mu g/m^3$ in Mira Loma will effectively accelerate attainment at Mira Loma from 2019 to 2014. Table 5-3 lists the mix of the four primary precursor’s emissions reductions targeted for the staged control measure implementation approach.

TABLE 5-2

Relative Contributions of Precursor Emissions Reductions to Simulated Controlled Future-Year 24-hour PM2.5 Concentrations

PRECURSOR	PM2.5 COMPONENT (μg/m^3)	STANDARDIZED CONTRIBUTION TO AMBIENT PM2.5 MASS
VOC	Organic Carbon	Factor of 0.3
NOx	Nitrate	Factor of 1
SOx	Sulfate	Factor of 7.8
PM2.5	Elemental Carbon & Others	Factor of 14.8

TABLE 5-3

Final 2012 AQMP
24-hour PM2.5 Attainment Strategy
Allowable Emissions (TPD)

YEAR	SCENARIO	VOC	NOx	SOx	PM2.5
2014	Baseline	451	506	18	70
2014	Controlled	451	490	18	58*

*Winter episodic day emissions

ADDITIONAL MODELING ANALYSES

As a component of the Final 2012 AQMP, concurrent simulations were also conducted to update and assess the impacts to annual average PM2.5 and 8-hour ozone given the new modeling platform and emissions inventory. This update provides a confirmation that the control strategy will continue to move air quality expeditiously towards attainment of the relevant standards.

Annual PM2.5

<u>Annual PM2.5 Modeling Approach</u>

The Final 2012 AQMP annual PM2.5 modeling employs the same approach to estimating the future year annual PM2.5 as was described in the 2007 AQMP attainment demonstrations. Future year PM2.5 annual average air quality is determined using site and species specific quarterly averaged RRFs applied to the weighted quarterly average 2008 PM2.5 design values per U.S. EPA guidance documents.

In this application, CMAQ and WRF were used to simulate 2008 meteorological and air quality to determine Basin annual average PM2.5 concentrations. The future year attainment demonstration was analyzed for 2015, the target set by the federal CAA. The 2014 simulation relies on implementation of all adopted rules and measures through 2014. This enables a full year-long demonstration based on a control strategy that would be fully implemented by January 1, 2015. It is important to note that the use of the quarterly design values for a 5-year period centered around 2008 (listed in Table 5-4) continue to be used in the projection of the future year annual average PM2.5 concentrations. The future year design reflects the weighted quarterly average concentration calculated from the projections over five years (20 quarters).

TABLE 5-4

2008 Weighted Annual PM2.5 Design Values* (μg/m^3)

MONITORING SITE	ANNUAL*
Anaheim	13.1
Los Angeles	15.4
Fontana	15.7
North Long Beach	13.6
South Long Beach	13.2
Mira Loma	18.6
Rubidoux	16.7

* Calculated based on quarterly observed data between 2006 – 2010

Future Annual PM2.5 Air Quality

The projections for the annual state and federal standards are shown in Figure 5-10. All areas will be in attainment of the federal annual standard (15.0 μg/m^3) by 2014. The 2014 design value is projected to be 9 percent below the federal standard. However, as shown in Figure 5-10, the Final 2012 AQMP does not achieve the California standard of 12 μg/m^3 by 2014. Additional controls would be needed to meet the California annual PM2.5 standard.

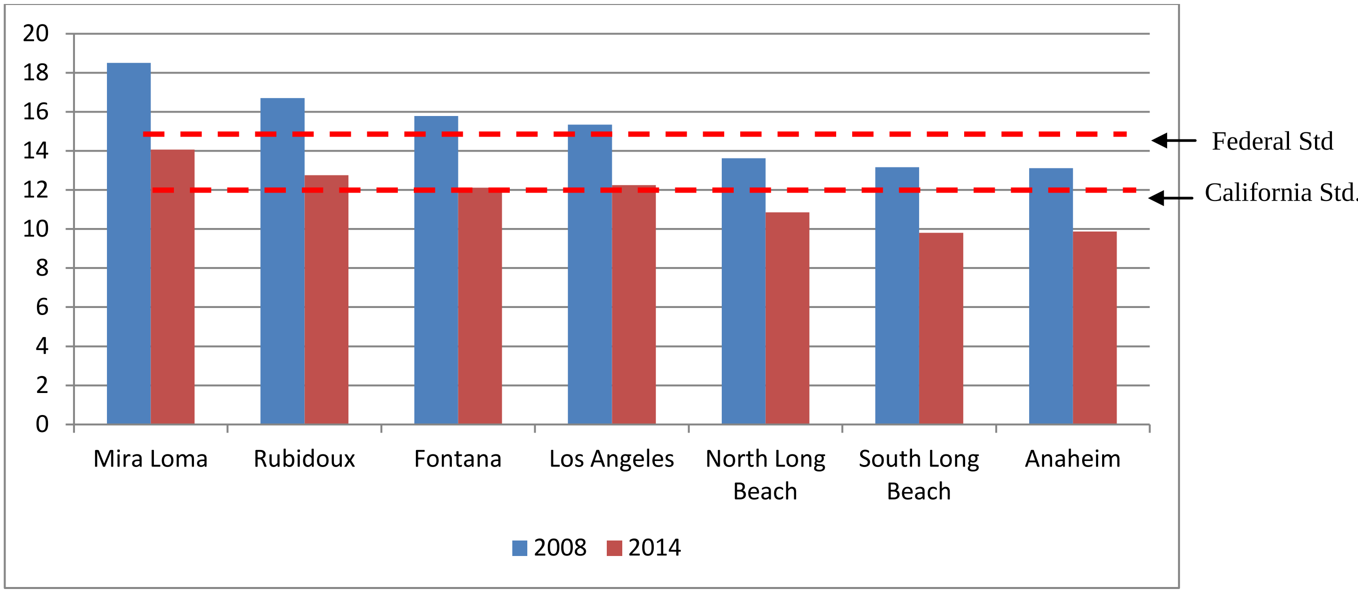


FIGURE 5-10

Annual Average PM2.5 Design Concentrations:
2008 and 2014 Controlled

Ozone Modeling

The 2007 AQMP provided a comprehensive 8-hour ozone analysis that demonstrated future year attainment of the 1997 federal ozone standard (80 ppb) by 2023 with implementation of short-term measures and CAA Section 182(e)(5) long term emissions reductions. The analysis concluded that NOx emissions needed to be reduced approximately 76 percent and VOC 22 percent from the 2023 baseline in order to demonstrate attainment. The 2023 base year VOC and NOx summer planning emissions inventories included 536 and 506 TPD, respectively.

As presented in Chapter 3, the Final 2012 AQMP controlled 2023 emissions of both precursor pollutants are estimated to be lower than the 2023 baseline established in the 2007 AQMP. The 2023 baseline VOC and NOx emission summer planning emissions have been revised to 438 and 319 TPD, respectively. The emissions revision incorporated changes made to the on-road truck and off-road equipment categories that resulted from CARB rulemaking. The new emissions inventory also reflects the impact of the economic slowdown and revisions to regional growth estimates. As a consequence, it is important to revisit the projections of 2023 baseline ozone to investigate the impact of the inventory revision on the attainment demonstration and equally important, what is the impact on the size of the proposed long term NOx emissions reduction commitment.

Ozone Representativeness

As a component of the PM2.5 attainment demonstration, the CMAQ modeling provided Basin-wide ozone air quality simulations for each hour in 2008. Past ozone attainment demonstrations evaluated a set of days characterized by restrictive meteorology or episodes occurring during concurrent intensive field monitoring programs. Of great importance, these episodic periods needed to be rated in terms of how representative they were in reference to the ozone standard being evaluated. For the now revoked 1-hour ozone standard, the attainment demonstration focused on a limited number of days closely matching the annual design value. Typically, the analysis addressed fewer than 5 days of simulations. The 2007 AQMP was the first to address the 8-hour ozone standard and the use of the RRFs in the future year ozone projection. To provide a robust characterization of the RRFs for use in the attainment demonstration, the analysis simulated 36 days. The ozone modeling guidance recommends that a minimum of 5-days of simulations meeting modeling acceptance criteria be used in a future year RRF calculation, but recommends incorporating as many days as possible to fully capture both the meteorological variations in the ozone season and the response of ozone formation for different daily emissions profiles.

This update to the future year ozone projection focuses on 91 days of ozone air quality observed during June through August 2008. During this period, seven well defined multiday ozone episodes occurred in the Basin with 75 total days having daily Basin-wide maximum concentrations of 80 ppb or higher. More importantly, when adjusted by a normalized meteorological potential using a regression based weighting covering 30-years of data (1998-2010), summarized in the 2003 AQMP, 8 days during the 2008 period were ranked above the 95th percentile in the long term distribution and another 19 were ranked between the 90th and 94th percentile.

Figure 5-11 depicts the time series of the daily Basin 8-hour maximum and Crestline (the Basin design station) daily maximum 8-hour ozone air quality during the three month period in 2008. The seven primary meteorological episodes which occur between mid June and August are highlighted in the figure. It is important to note that the analysis not only focused on the seven periods or Crestline specifically. All station days meeting the acceptance criteria for calculating a daily RRF were included in the analysis. Several locations in the San Bernardino and Riverside Valleys exhibit similar transport and daily patterns of ozone formation as Crestline. The peak Basin 2008 8-hour average ozone concentration was observed at Santa Clarita on August 2nd at a value of 131 ppb, along a distinctly different transport route.

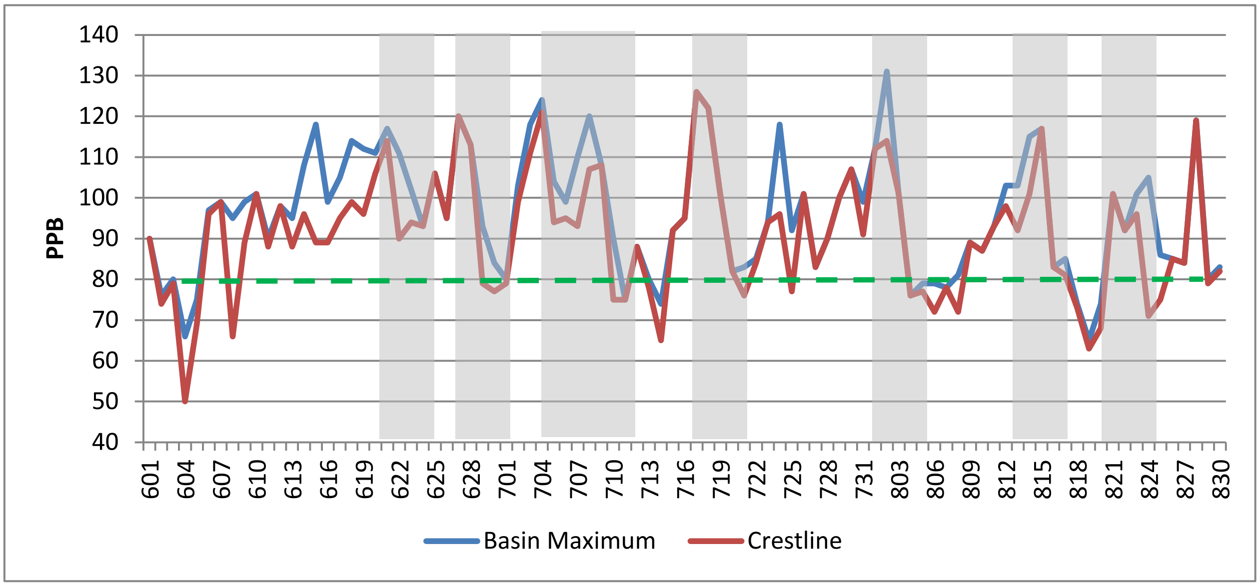


FIGURE 5-11

Observed Basin and Crestline Daily Maximum 8-Hr Average Ozone Concentrations

(Shaded areas indicate multiple day regional ozone episodes)

Overall, the 91-day period provides a robust description of the 2008 ozone-meteorological season. Table 5-4 lists the number of days each Basin station exceeded the 8-hour ozone standard during the June through August 2008 period. Also listed in Table 5-4 are the 2008, 5-year weighted design values used in the future year ozone projections.

TABLE 5-4

2008 Basin Weighted Design Values* and Number of Days Daily Maximum Concentrations Exceeded 80 ppb

STATION	2008 5-YEAR WEIGHTED DESIGN (PPB)	NUMBER OF DAYS IN 2008 WITH OBSERVED 8-HR AVERAGE MAXIMUM OZONE > 80 PPB
Azusa	94	16
Burbank	88	10
Reseda	94	16
Pomona	97	19
Pasadena	90	7
Santa Clarita	101	41
Glendora	106	26
Rubidoux	101	39
Perris	104	47
Lake Elsinore	99	39
Banning Airport	102	49
Upland	106	31
Crestline	116	66
Fontana	107	36
San Bernardino	109	46
Redlands	109	50

*Stations having design values greater than 80 ppb

Ozone Modeling Approach

The ozone modeling approach used in this update follows the same criteria employed for the 2007 AQMP attainment demonstration. Briefly, the set of 91 days from June 1 through August 30, 2008, simulated as a subset of the annual PM2.5 simulations, were analyzed to determine daily 8-hour average maximum ozone for the 2008 and 2023 emissions inventories. A separate 2023 simulation was conducted to assess future year ozone with VOC and NOx emissions specified at the levels defined by the 2007 AQMP attainment demonstration carrying capacity (420 TPD VOC and 114 TPD NOx). Finally, a set of simulations with incremental VOC and NOx emissions reductions from 2023 baseline emissions was generated to create ozone isopleths for each station in the Basin. The ozone isopleths provide updated guidance to the determination of the future control strategy, particularly in light of the challenge in meeting the current 75 ppb standard which will require an attainment demonstration to be submitted to U.S. EPA in 2015.

The ozone RRFs were calculated using the ratio methodology described for the PM2.5 modeling. Individual station day inclusion in the analysis was determined by three basic criteria: (1) the observed ozone concentration had to be ± 30 percent of the station's weighted design value; (2) the absolute prediction accuracy of the base 2008 simulation for that day was required to be within 20 percent; and (3) the observed daily maximum concentration needed to be greater than 84 ppb. The criteria were designed to eliminate extreme values from entering the analysis and to only focus on station days where model performance met the long-standing criteria for acceptance used in previous attainment demonstrations. Finally, only station days where ozone exceeded the 84 ppb threshold established to demonstrate attainment of the 1997 ozone standard, as specified in the U.S. EPA Modeling Attainment Guidance Document, were included in the analysis.

Future Ozone Air Quality

Table 5-5 summarizes the results of the updated ozone simulations. Included for general comparison are the 2023 ozone baseline and 2023 controlled ozone projections from the 2007 AQMP ozone attainment demonstration modeling analysis approved by U.S. EPA as part of the SIP The Final 2012 AQMP baseline ozone simulations reflect the changes made to the 2023 baseline inventory. The Final 2012 summer planning inventory has a higher ratio between VOC and NOX emissions, 1.39 vs. 1.05, although total tonnages of both precursor emissions are lower than presented in the 2007 AQMP. The higher VOC to NOx ratio is indicative of a more reactive pollutant mix with average projected ozone design concentrations 9 percent higher than previously projected. One implication of this simulation is that moderate VOC emissions reductions in the years between 2014 and 2023 will benefit regional ozone concentrations. Yet, the projected 2023 baseline design value of 108 ppb continues to exceed the federal standard by 35 percent. With the implementation of the Final 2012 AQMP short term control measures and the Section 185(e)(5) long-term control measures, (defined in this update as the difference between the Final 2012 AQMP 2023 base year VOC and NOx emissions and the corresponding Basin 2007 AQMP ozone attainment demonstration carrying capacity), projected regional ozone design values closely match those defined in the 2007 AQMP ozone attainment demonstration. Regardless, it will still require a 64 percent reduction in NOx emissions and an additional 3 percent reduction in VOC emissions to attain the 1997 ozone standard.

TABLE 5-5

Model-Predicted 8-Hour Ozone Concentrations

LOCATION	2007 OZONE SIP-2023 BASELINE DESIGN (PPB)	2007 OZONE SIP-2023 CONTROLLED DESIGN (PPB)	FINAL 2012 AQMP-UPDATED 2023* BASELINE DESIGN (PPB)	FINAL 2012 AQMP- UPDATED* 2023*CONTROLLED DESIGN (PPB)
Azusa	82	80**	95	77
Burbank	86	70**	88	72
Reseda	86	68	90	73
Pomona	85	75	100	80
Pasadena	78	74**	92	76
Santa Clarita	95	74	94	73
Glendora	91	79	107	84
Riverside	92	78	100	77
Perris	94	78***	88	66
Lake Elsinore	80	64	85	66
Banning	88	70	94	73
Upland	92	78	106	83
Crestline	100	83	107	81
Fontana	97	81	104	81
San Bernardino	92	78	108	83
Redlands	98	81	103	77

* Informational purpose only based on draft emissions inventories and across-the-board reductions.
** Based on the city-station specific RRF's determined from the 19 episode day average.
*** Based on the average of the RRF's determined from the stations meeting the criteria having more than 5 episode days.
Note: Attainment with the 1997 Federal 8-hour ozone standard requires 84 ppb or less

With controls in place, the updated analysis corroborates the approved 2007 AQMP ozone attainment demonstration in that it is expected that all stations in the Basin will meet the federal 8-hour ozone standard. The east Basin stations in the San Bernardino Valley continue to have among the highest projected 8-hour controlled design values for this update. The 2023 controlled ozone design value at Glendora is also projected to exceed 80 ppb, but all stations show attainment with the federal 8-hour ozone standard ($\leq$84ppb). Glendora, Upland, Fontana and San Bernardino are downwind receptors along the primary wind transport route that moves precursor emissions and developing ozone eastward by the daily sea breeze. The higher projected design value at Glendora reflects the higher VOC to NOx ratio observed in the 2023 baseline inventory relative to the 2007 AQMP 2023 baseline inventory. The 2023 controlled design value at Glendora for the Final 2012 AQMP actually represents a greater response to emissions reductions than in the 2007 AQMP attainment demonstration. Future year projections of ozone for this update along the northerly transport route through the San Fernando Valley indicate that the ozone design value in the Santa Clarita Valley will be approximately 15 percent below the standard.

<u>Spatial Projections of 8-Hour Ozone Design Values</u>

The spatial distribution of ozone design values for the 2008 base year is shown in Figure 5-12. Future year ozone air quality projections for 2024 with and without implementation of all control measures are presented in Figures 5-13 and 5-14. The predicted ozone concentrations will be significantly reduced in the future years in all parts of the Basin with the implementation of proposed control measures in the South Coast Air Basin.

Appendix V provides base year model performance statistics, grid level spatial plots of simulated ozone (base cases and future year controlled) as well as weight of evidence discussions to support the modeling attainment demonstration.

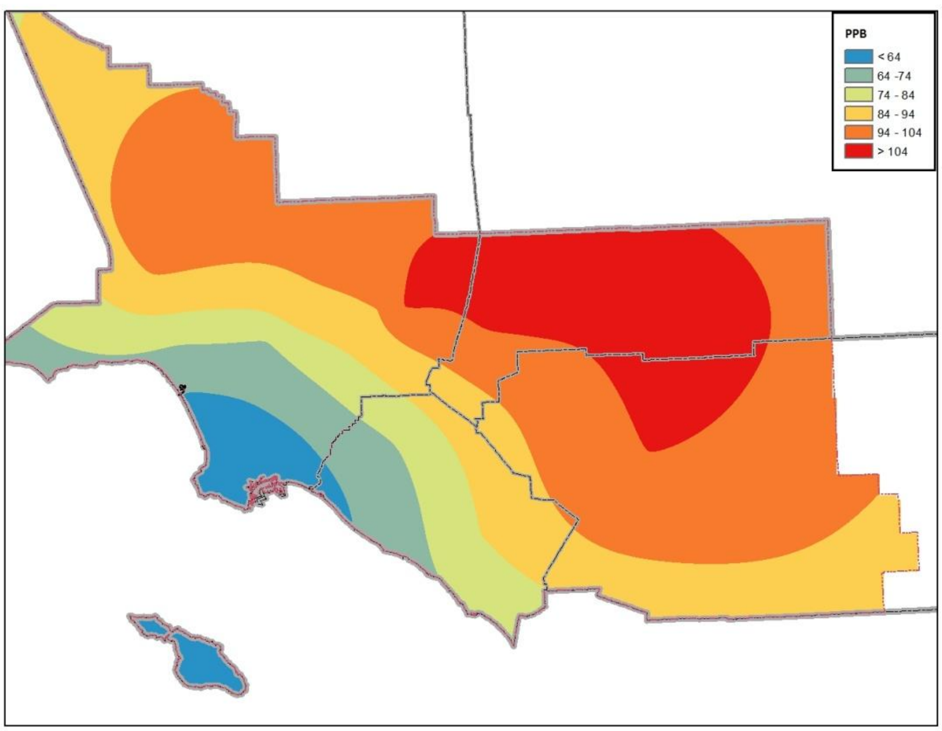


FIGURE 5-12

2008 Baseline 8-Hour Ozone Design Concentrations (ppb)

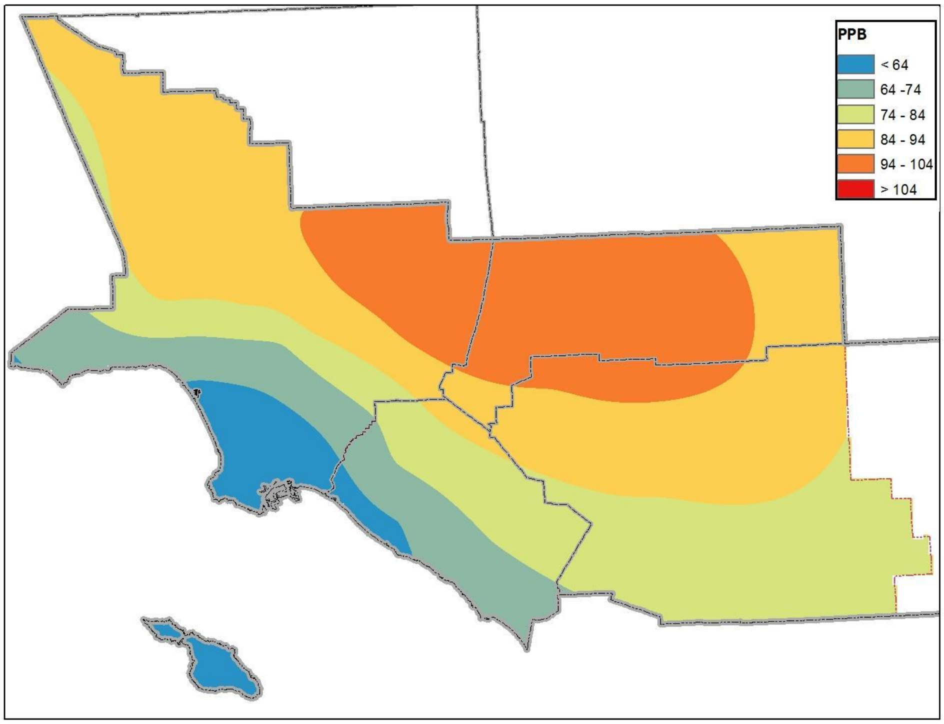


FIGURE 5-13

Model-Predicted 2023 Baseline 8-Hour Ozone Design Concentrations (ppb)

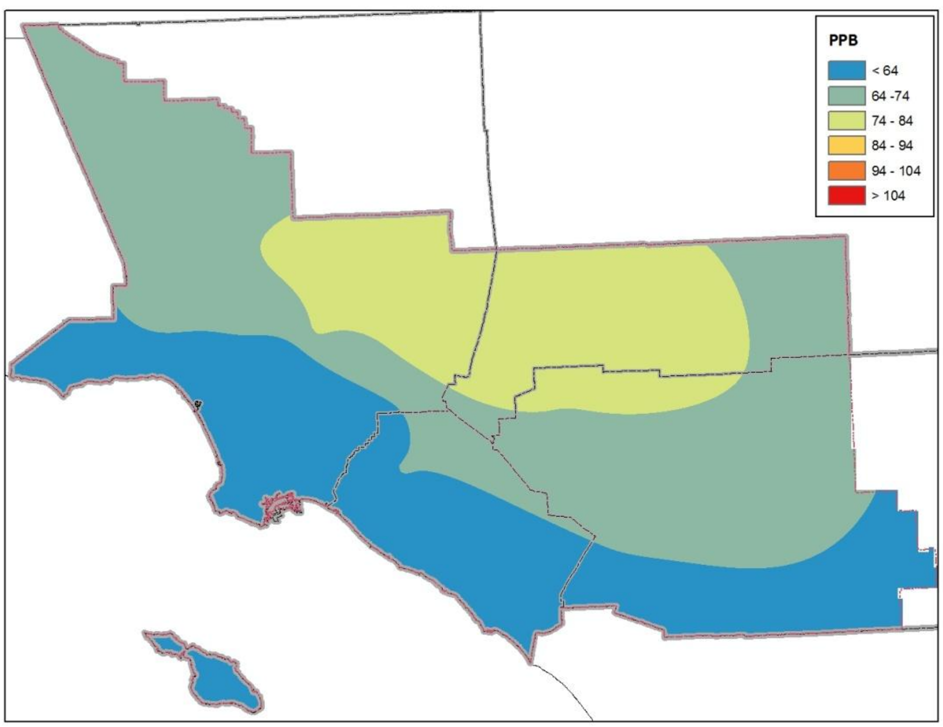


FIGURE 5-14

Model-Predicted 2023 Controlled 8-Hour Ozone Design Concentrations (ppb)

A First Look at Attaining the 2006 8-Hour Ozone Standard

In 2006, the U.S. EPA lowered the federal 8-hour ozone standard to 75 ppb. Recent 8-hour ozone rule implementation guidance requires that a SIP revision with an updated attainment demonstration and control strategy be submitted to U.S. EPA no later than December 2015. The Basin has been designated as an extreme non-attainment area for the new standard, consistent with the classification of the 80 ppb standard. Thus, the deadline for attainment of the 75 ppb standard is 2032, 8-years after the attainment date for the previous 80 ppb federal standard in 2024. It is critical to conduct preliminary analyses to assess the need for potential adjustments to the overall control strategy considering this new standard and deadline

The preliminary projections, based upon a modeling evaluation of how VOC and NOx reductions affect the Basin's ozone levels (ozone "isopleths") indicates that that a 75 percent reduction in NO_X emissions beyond the 2023 baseline is needed to meet the 75 ppb level in 2032. The resulting 2032 Basin NOx carrying capacity could be as low as to 85 tpd. Further discussion of the ozone isopleths and a glance at the potential impact to the control strategy and carrying capacity for potential future revisions to the 8-hour ozone standard is presented in Chapter 8.

SUMMARY AND CONCLUSIONS

Figure 5-15 shows the 2008 observed and model-predicted regional peak concentrations for 24-hour average and annual PM2.5 as percentages of the most stringent federal standard, for 2014. The federal 24-hour and annual PM2.5 standards are predicted to be met in 2014 with implementation of the Final 2012 AQMP control strategy. The California annual PM2.5 standard will not be attained before 2019. (See Figure 5-16).

Given the changes made to the modeling platform, the number of episodes evaluated, and the distinct changes in the projected Final 2012 AQMP 2023 baseline inventory, projected 8-hour ozone design values with implementation of the short- and long-term controls are very consistent with those presented in the 2007 AQMP attainment demonstration. Again, an approximate 65 percent reduction in NOx emissions in 2023 will be required to meet the 1997 80 ppb standard by 2024.

The challenges of meeting potential future standards for 8-hour ozone and a proposed federal annual PM2.5 standard between 12 and 13 $\mu g/m^3$ are discussed in Chapter 8 of this document.

The challenge of future year attainment of proposed revisions to the federal annual PM2.5 standard at a value between 12 and 13 µg/m^3 are discussed in Chapter 8 of the Draft Final 2012 AQMP.

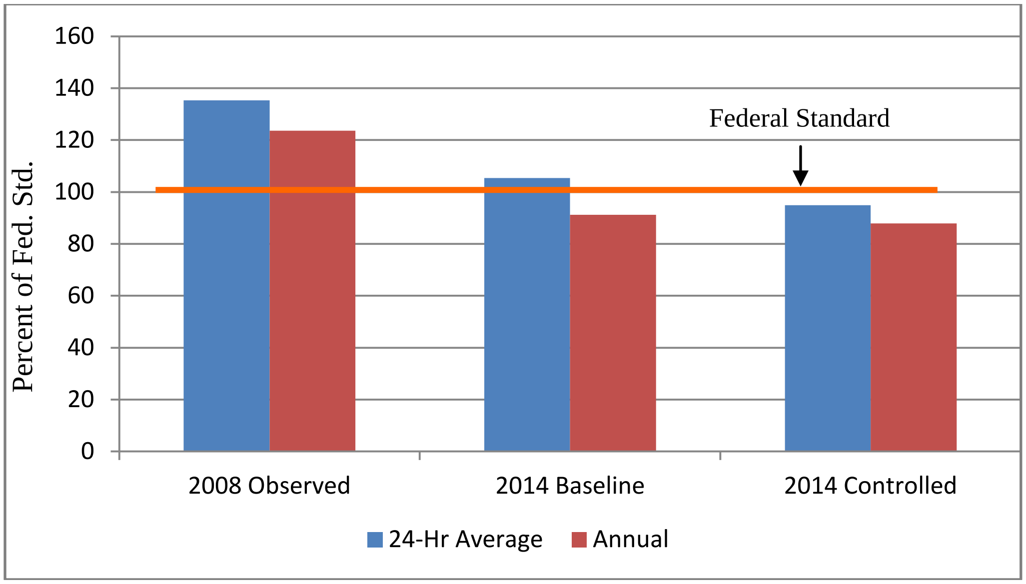


FIGURE 5-15

Projection of Future Air Quality in the Basin in Comparison with the Federal Standards.

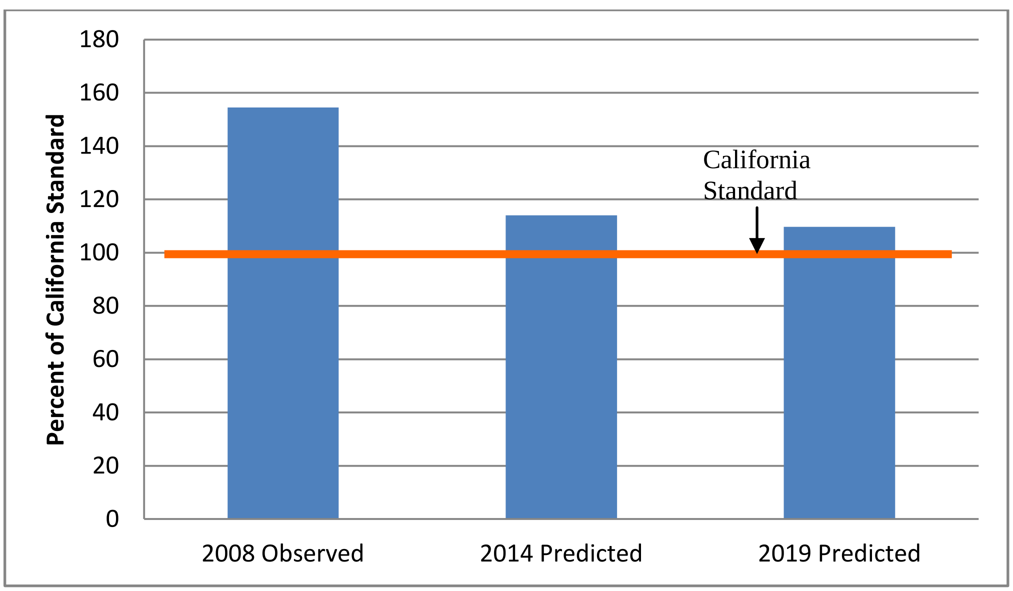


FIGURE 5-16

Projection of Future PM2.5 in the Basin in Comparison with California State Standard

Chapter 6

Federal and State Clean Air Act Requirements

South Coast Air Quality Management District
Cleaning the air that we breathe...™
South Coast AQMD

CHAPTER 6

FEDERAL & STATE CLEAN AIR ACT REQUIREMENTS

INTRODUCTION

The purpose of the 2012 revision to the AQMP for the South Coast Air Basin is to set forth a comprehensive program that will assist in leading the Basin and those portions of the Salton Sea Air Basin under the District's jurisdiction into compliance with all federal and state air quality planning requirements. Specifically, the Final 2012 AQMP is designed to satisfy the SIP submittal requirements of the federal CAA to demonstrate attainment of the 24-hour PM2.5 ambient air quality standards, the California CAA triennial update requirements, and the District's commitment to update transportation emission budgets based on the latest approved motor vehicle emissions model and planning assumptions. Specific information related to the air quality and planning requirements for portions of the Salton Sea Air Basin under the District's jurisdiction are included in the Final 2012 AQMP and can be found in Chapter 7 – Current and Future Air Quality – Desert Nonattainment Area. The Final 2012 AQMP will be submitted to U.S. EPA as SIP revisions once approved by the District's Governing Board and CARB.

SPECIFIC 24-HOUR PM2.5 PLANNING REQUIREMENTS

In November 1990, Congress enacted a series of amendments to the CAA intended to intensify air pollution control efforts across the nation. One of the primary goals of the 1990 CAA amendments was to overhaul the planning provisions for those areas not currently meeting the National Ambient Air Quality Standards (NAAQS). The CAA identifies specific emission reduction goals, requires both a demonstration of reasonable further progress and an attainment demonstration, and incorporates more stringent sanctions for failure to attain or to meet interim milestones. There are several sets of general planning requirements, both for nonattainment areas [Section 172(c)] and for implementation plans in general [Section 110(a)(2)]. These requirements are listed and briefly described in Chapter 1 (Tables 1-4 and 1-5). The general provisions apply to all applicable criteria pollutants unless superseded by pollutant-specific requirements. The following sections discuss the federal CAA requirements for the 24-hour PM2.5 standards.

FEDERAL AIR QUALITY STANDARDS FOR FINE PARTICULATES

The U.S. EPA promulgated the NAAQS for Fine Particles (PM2.5) in July 1997. Following legal actions, the statements were eventually upheld in March 2002. The annual standard was set at a level of 15 micrograms per cubic meter ($\mu g/m^3$), based on the 3-year average of annual mean PM2.5 concentrations. The 24-hour standard was set at a level of 65 μg/m^3 based on the 3-year average of the 98th percentile of 24-hour concentrations. U.S. EPA issued designations in December 2004, which became effective on April 5, 2005.

In January 2006, U.S. EPA proposed to lower the 24-hour PM2.5 standard. On September 21, 2006, U.S. EPA signed the "Final Revisions to the NAAQS for Particulate Matter." In promulgating the new standards, U.S. EPA followed an elaborate review process which led to the conclusion that existing standards for particulates were not adequate to protect public health. The studies indicated that for PM2.5, short-term exposures at levels below the 24-hour standard of 65 μg/m^3 were found to cause acute health effects, including asthma attacks and breathing and respiratory problems. As a result, the U.S. EPA established a new, lower 24-hour average standard for PM2.5 at 35 μg/m^3. No changes were made to the existing annual PM2.5 standard which remained at 15 μg/m^3 as discussed in Chapter 2. On June 14, 2012, U.S. EPA proposed revisions to this annual standard. The annual component of the standard was set to provide protection against typical day-to-day exposures as well as longer-term exposures, while the daily standard protects against more extreme short-term events. For the 2006 24-hour PM2.5 standard, the form of the standard continues to be based on the 98th percentile of 24-hour PM2.5 concentrations measured in a year (averaged over three years) at the monitoring site with the highest measured values in an area. This form of the standard was set to be health protective while providing a more stable metric to facilitate effective control programs. Table 6-1 summarizes the U.S. EPA's PM2.5 standards.

TABLE 6-1

U.S. EPA's PM2.5 Standards

	1997 STANDARDS		**2006 STANDARDS**	
	Annual	**24-Hour**	**Annual**	**24-Hour**
PM2.5	15 μg/m^3 Annual arithmetic mean, averaged over 3 years	65 μg/m^3 24-hour average, 98th percentile, averaged over 3 years	15 μg/m^3 Annual arithmetic mean, averaged over 3 years	35 μg/m^3 24-hour average, 98th percentile, averaged over 3 years

On December 14, 2009, the U.S. EPA designated the Basin as nonattainment for the 2006 24-hour PM2.5 NAAQS. A SIP revision is due to U.S. EPA no later than December 14, 2012, which is three years from the effective date of designation, demonstrating attainment with the standard by 2014. Under Section 172 of the CAA, U.S. EPA may grant an area an extension of the initial attainment date for a period of up to five years. With implementation of all feasible measures as outlined in this Plan, the Basin will demonstrate attainment with the 24-hour PM2.5 standard by 2014, so no extension is being requested.

FEDERAL CLEAN AIR ACT REQUIREMENTS

For areas such as the Basin that are classified nonattainment for the 2006 24-hour PM2.5 NAAQS, Section 172 of subpart 1 of the CAA applies. Section 172(c) requires states with nonattainment areas to submit an attainment demonstration. Section 172(c)(2) requires that nonattainment areas demonstrate Reasonable Further Progress (RFP). Under subpart 1 of the CAA, all nonattainment area SIPs must include contingency measures. Section 172(c)(1) of the CAA requires nonattainment areas to provide for implementation of all reasonably available control measures (RACM) as expeditiously as possible, including the adoption of reasonably available control technology (RACT). Section 172 of the CAA requires the implementation of a new source review program including the use of "lowest achievable emission rate" for major sources referred to under state law as "Best Available Control Technology" (BACT) for major sources of PM2.5 and precursor emissions (i.e., precursors of secondary particulates).

This section describes how the Final 2012 AQMP meets the 2006 24-hour PM2.5 planning requirements for the Basin. The requirements specifically addressed for the Basin are:

1. Attainment demonstration and modeling [Section 172(a)(2)(A)];
2. Reasonable further progress [Section 172(c)(2)];
3. Reasonably available control technology (RACT) and Reasonably available control measures (RACM) [Section 172(c)(1)] ;
4. New source review (NSR) [Sections 172(c)(4) and (5)];
5. Contingency measures [Section 172(c)(9)]; and
6. Transportation control measures (as RACM).

Attainment Demonstration and Modeling

Under the CAA Section 172(a)(2)(A), each attainment plan should demonstrate that the area will attain the NAAQS "as expeditiously as practicable," but no later than five years from the effective date of the designation of the area. If attainment within five years is considered impracticable due to the severity of an area's air quality problem and the lack of available control measures, the state may propose an attainment date of more than five years but not more than ten years from designation.

This attainment demonstration consists of: (1) technical analyses that locate, identify, and quantify sources of emissions that contribute to violations of the PM2.5 standard; (2) analysis of future year emission reductions and air quality improvement resulting from adopted and proposed control measures; (3) proposed emission reduction measures with schedules for implementation; and (4) analysis supporting the region's proposed attainment date by performing a detailed modeling analysis. Chapter 3 and Appendix III of the Final 2012 AQMP present base year and future year emissions inventories in the Basin, while Chapter 4 and Appendix IV provide descriptions of the proposed control measures, the resulting emissions reductions, and schedules for implementation of each measure. The detailed modeling analysis and attainment demonstration are summarized in Chapter 5 and documented in Appendix V.

Reasonable Further Progress (RFP)

The CAA requires SIPs for most nonattainment areas to demonstrate reasonable further progress (RFP) towards attainment through emission reductions phased in from the time of the SIP submission until the attainment date time frame. The RFP requirements in the CAA are intended to ensure that there are sufficient PM2.5 and precursor emission reductions in each nonattainment area to attain the 2006 24-hour PM2.5 NAAQS by December 14, 2014.

Per CAA Section 171(1), RFP is defined as "such annual incremental reductions in emissions of the relevant air pollutant as are required by this part or may reasonably be required by the Administrator for the purpose of ensuring attainment of the applicable national ambient air quality standard by the applicable date." As stated in subsequent federal regulation, the goal of the RFP requirements is for areas to achieve generally linear progress toward attainment. To determine RFP for the 2006 24-hour PM2.5 attainment date, the plan should rely only on emission reductions achieved from sources within the nonattainment area.

Section 172(c)(2) of the CAA requires that nonattainment area plans show ongoing annual incremental emissions reductions toward attainment, which is commonly expressed in terms of benchmark emissions levels or air quality targets to be achieved by certain interim milestone years. The U.S. EPA recommends that the RFP inventories include direct PM2.5, and also PM precursors (such as SOx, NOx, and VOCs) that have been determined to be significant.

40 CFR 51.1009 requires any area that submits an approvable demonstration for an attainment date of more than five years from the effective date of designation to also submit an RFP plan. The Final 2012 AQMP demonstrates attainment with the 24-hour PM2.5 standard in 2014, which is five years from the 2009 designation date. Therefore, no separate RFP plan is required.

Reasonably Available Control Measures (RACM) and Reasonably Available Control Technology (RACT) Requirements

Section 172(c)(1) of the CAA requires nonattainment areas to

> *Provide for the implementation of all reasonably available control measures as expeditiously as practicable (including such reductions in emissions from existing sources in the area as may be obtained through the adoption, at a minimum, of reasonably available control technology) and shall provide for attainment of the national primary ambient air quality standards.*

The District staff has completed its RACM analysis as presented in Appendix VI of the Final 2012 AQMP.

The U.S. EPA provided further guidance on the RACM in the preamble and the final "Clean Air Fine Particle Implementation Rule" to implement the 1997 PM2.5 NAAQS which were published in the Federal Register on November 1, 2005 and April 25, 2007, respectively.[1, 2] The U.S. EPA's long-standing interpretation of the RACM provision stated in the 1997 PM2.5 Implementation Rule is that the non-attainment air districts should consider all candidate measures that are available and technologically and economically feasible to implement within the non-attainment areas, including any measures that have been suggested; however, the districts are not obligated to adopt all measures, but should demonstrate that there are no additional reasonable measures available that would advance the attainment date by at least one year or contribute to reasonable further progress (RFP) for the area.

With regard to the identification of emission reduction programs, the U.S. EPA recommends that non-attainment air districts first identify the emission reduction programs that have already been implemented at the federal level and by other states and local air districts. Next, the U.S. EPA recommends that the air districts examine additional RACM/RACTs adopted for other non-attainment areas to attain the ambient air quality standards as expeditiously as practicable. The U.S. EPA also recommends

[1] See 70FR 65984 (November 1, 2005)
[2] See 72FR 20586 (April 25, 2007)

that the air districts evaluate potential measures for sources of direct PM2.5, SOx and NOx first. VOC and ammonia are only considered if the area determines that they significantly contribute to the PM2.5 concentration in the non-attainment area (otherwise they are pressured not to significantly contribute). The PM2.5 Implementation Rule also requires that the air districts establish RACM/RACT emission standards that take into consideration the condensable fraction of direct PM2.5 emissions after January 1, 2011. In addition, the U.S. EPA recognizes that each non-attainment area has its own profile of emitting sources, and thus neither requires specific RACM/RACT to be implemented in every non-attainment area, nor includes a specific source size threshold for the RACM/RACT analysis.

A RACM/RACT demonstration must be provided within the SIP. For areas projected to attain within five years of designation, a limited RACM/RACT analysis including the review of available reasonable measures, the estimation of potential emission reductions, and the evaluation of the time needed to implement these measures is sufficient. The areas that cannot reach attainment within five years must conduct a thorough RACM/RACT analysis to demonstrate that sufficient control measures could not be adopted and implemented cumulatively in a practical manner in order to reach attainment at least one year earlier.

In regard to economic feasibility, the U.S. EPA did not propose a fixed dollar per ton cost threshold and recommended that air districts include health benefits in the cost analysis. As indicated in the preamble of the 1997 PM2.5 Implementation Rule:

> *In regard to economic feasibility, U.S. EPA is not proposing a fixed dollar per ton cost threshold for RACM, just as it is not doing so for RACT…Where the severity of the non-attainment problem makes reductions more imperative or where essential reductions are more difficult to achieve, the acceptable cost of achieving those reductions could increase. In addition, we believe that in determining what are economically feasible emission reduction levels, the States should also consider the collective health benefits that can be realized in the area due to projected improvements.*

Subsequently, on March 2, 2012, the U.S. EPA issued a memorandum to confirm that the overall framework and policy approach stated in the PM2.5 Implementation Rule for the 1997 PM2.5 standards continues to be relevant and appropriate for addressing the 2006 24-hour PM2.5 standards.

As described in Appendix VI, the District has concluded that all District rules fulfill RACT for the 2006 24-hour PM2.5 standard. In addition, pursuant to California Health and Safety Code Section 39614 (SB 656), the District evaluated a statewide list of feasible and cost-effective control measures to reduce directly emitted PM2.5 and its potential precursor emissions (e.g., NOx, SOx, VOCs, and ammonia). The District has concluded that for the majority of stationary and area source categories, the District was identified as having the most stringent rules in California (see Appendix VI). Under the RACM guidelines, transportation control measures must be included in the analysis. Consequently, SCAG has completed a RACM determination for transportation control measures in the Final 2012 AQMP, included in Appendix IV-C.

New Source Review

New source review (NSR) for major and in some cases minor sources of PM2.5 and its precursors are presently addressed through the District's NSR and RECLAIM programs (Regulations XIII and XX). In particular, Rule 1325 has been adopted to satisfy NSR requirements for major sources of directly-emitted PM2.5.

Contingency Measures

Contingency Measure Requirements

Section 172(c)(9) of the CAA requires that SIPs include contingency measures.

> *Such plan shall provide for the implementation of specific measures to be undertaken if the area fails to make reasonable further progress, or to attain the national primary ambient air quality standard by the attainment date applicable under this part. Such measures shall be included in the plan revision as contingency measures to take effect in any such case without further action by the State or the Administrator.*

In subsequent NAAQS implementation regulations and SIP approvals/disapprovals published in the Federal Register, U.S. EPA has repeatedly reaffirmed that SIP contingency measures:

1. Must be fully adopted rules or control measures that are ready to be implemented, without significant additional action (or only minimal action) by the State, as expeditiously as practicable upon a determination by U.S. EPA that the area has failed to achieve, or maintain reasonable further progress, or attain the NAAQS by the applicable statutory attainment date (40 CFR § 51.1012, 73 FR 29184)

2. Must be measures not relied on in the plan to demonstrate RFP or attainment for the time period in which they serve as contingency measures and should provide SIP-creditable emissions reductions equivalent to one year of RFP, based on "generally

linear" progress towards achieving the overall level of reductions needed to demonstrate attainment (76 FR 69947, 73 FR 29184)

3. Should contain trigger mechanisms and specify a schedule for their implementation (72 FR 20642)

Furthermore, U.S. EPA has issued guidance that the contingency measure requirement could be satisfied with already adopted control measures, provided that the controls are above and beyond what is needed to demonstrate attainment with the NAAQS (76 FR 57891).

U.S. EPA guidance provides that contingency measures may be implemented early, i.e., prior to the milestone or attainment date. Consistent with this policy, States are allowed to use excess reductions from already adopted measures to meet the CAA sections 172(c)(9) and 182(c)(9)contingency measures requirement. This is because the purpose of contingency measures is to provide extra reductions that are not relied on for RFP or attainment, and that will provide a cushion while the plan is being revised to fully address the failure to meet the required milestone. Nothing in the CAA precludes a State from implementing such measures before they are triggered.

Thus, an already adopted control measure with an implementation date prior to the milestone year or attainment year would obviate the need for an automatic trigger mechanism.

Air Quality Improvement Scenario

The U.S. EPA Guidance Memo issued March 2, 2012, "Implementation Guidance for the 2006 24-Hour Fine Particle (PM2.5) National Ambient Air Quality Standard (NAAQS)", provides the following discussion of contingency measures:

The preamble of the 2007 PM2.5 Implementation Rule (see 79 FR 20642-20645) notes that contingency measures "should provide for emission reductions equivalent to about one year of reductions needed for reasonable further progress (RFP)." The term "one year of reductions needed for RFP" requires clarification. This phrase may be confusing because all areas technically are not required to develop a separate RFP plan under the 2007 PM2.5 Implementation Rule. The basic concept is that an area's set of contingency measures should provide for an amount of emission reductions that would achieve "one year's worth" of air quality improvement proportional to the overall amount of air quality improvement to be achieved by the area's attainment plan; or alternatively, an amount of emission reductions (for all pollutants subject to control measures in the attainment plan) that would achieve one year's worth of emission reductions proportional to the overall amount of emission *reductions needed to show attainment. Contingency measures can include measures that achieve emission reductions from outside the nonattainment area as well as from within the nonattainment area, provided that the measures produce the appropriate air quality impact within the nonattainment area.*

The U.S. EPA believes a similar interpretation of the contingency measures requirements under section 172(c)(9) would be appropriate for the 2006 24-hour PM2.5 NAAQS.

The March 2, 2012 memo then provides an example describing two methods for determining the required magnitude of emissions reductions to be potentially achieved by implementation of contingency measures:

Assume that the state analysis uses a 2008 base year emissions inventory and a future year projection inventory for 2014. To demonstrate attainment, the area needs to reduce its air quality concentration from 41ug/m^3 in 2008 to 35 ug/m^3 in 2014, equal to a rate of change of 1 μg/m^3 per year. The attainment plan demonstrates that this level of air quality improvement would be achieved by reducing emissions between 2008 and 2014 by the following amounts: 1,200 tons of PM2.5; 6,000 tons of NOx; and 6,000 tons of SO2.

Thus, the target level for contingency measures for the area could be identified in two ways:

1) *The area would need to provide an air quality improvement of 1 ug/m^3 in the area, based on an adequate technical demonstration provided in the state plan. The emission reductions to be achieved by the contingency measures can be from any one or a combination of all pollutants addressed in the attainment plan, provided that the state plan shows that the cumulative effect of the adopted contingency measures would result in a 1 ug/m^3 improvement in the fine particle concentration in the nonattainment area; and*

2) *The contingency measures for the area would be one-sixth (or approximately 17%) of the overall emission reductions needed between 2008 and 2014 to show attainment. In this example, these amounts would be the following: 200 tons of PM2.5; 1,000 tons of NOx; and 1,000 tons of SO2.*

The two approaches are explicitly mentioned in regulatory form at 40 CFR § 51.1009:

(g) The RFP plan due three years after designation must demonstrate that emissions for the milestone year are either:

(1) At levels that are roughly equivalent to the benchmark emission levels for direct PM2.5 emissions and each PM2.5 attainment plan precursor to be addressed in the plan; or

(2) At levels included in an alternative scenario that is projected to result in a generally equivalent improvement in air quality by the milestone year as would be achieved under the benchmark RFP plan.

(h) The equivalence of an alternative scenario to the corresponding benchmark plan must be determined by comparing the expected air quality changes of the two scenarios at the design value monitor location. This comparison must use the information developed for the attainment plan to assess the relationship between emissions reductions of the direct PM2.5 emissions and each PM2.5 attainment plan precursor addressed in the attainment strategy and the ambient air quality improvement for the associated ambient species.

The first method in the example and the alternative scenario in the regulation, 40 CFR § 51.1009 (g)(2), base the required amount of contingency measure emission reductions on one year's worth of air quality improvements. The most accurate way of demonstrating that the emissions reductions will lead to air quality improvements is through air quality modeling such as that used in the attainment demonstration (40 CFR § 51.1009 (h) above). If the model results show the required air quality improvements, then the emissions reductions included in the model input are therefore shown to be sufficient to achieve those air quality improvements. The second method in the example, and (g)(1) in the regulation, is based solely on emission reductions, without a direct demonstration that there will be a corresponding improvement in air quality.

Logically, the method based on air quality is more robust than the method based solely on emissions reductions in that it demonstrates that emissions reductions will in fact lead to corresponding air quality improvements, which is the ultimate goal of the CAA and the SIP. The second method relying on overall emissions reductions alone does not account for the spatial and temporal variation of emissions, nor does it account for where and when the reductions will occur. As the relationship between emissions reductions and resulting air quality improvements is complex and not always linear, relying solely on prescribed emission reductions may not ensure that the desired air quality improvements will result when and where they are needed. Therefore, determining the magnitude of reductions required for contingency measures based on air quality improvements, derived from a modeling demonstration, is more effective in achieving the objective of this CAA requirement.

Magnitude of Contingency Measure Air Quality Improvements

The example for determining the required magnitude of air quality improvement to be achieved by contingency measures provided in the March 2, 2012 guidance memo uses the attainment demonstration base year as the base year in the calculation (2008). This is based on the memo's statement that "*contingency measures should provide for an amount of emission reductions that would achieve 'one year's worth' of air quality improvement proportional to the overall amount of air quality improvement to be achieved by the area's attainment plan."* The original preamble (79 FR 20642-20645) states that contingency measures *"should provide for emission reductions equivalent to about one year of reductions needed for reasonable further progress (RFP)."* The term "reasonable further progress" is defined in Section 171(1) of the CAA as *"such annual incremental reductions in emissions of the relevant air pollutant as are required by this part or may reasonably be required by the Administrator for the purpose of ensuring attainment of the applicable NAAQS by the applicable date."*

40 CFR 51.1009 is explicit on how emissions reductions for RFP are to be calculated. In essence, the calculation is a linear interpolation between base-year emissions and attainment-year (full implementation) emissions. The Plan must then show that emissions or air quality in the milestone year (or attainment year) are "roughly equivalent" or "generally equivalent" to the RFP benchmark. As stated earlier in this chapter, given the 2014 attainment year, there are no interim milestone RFP requirements. The contingency measure requirements, therefore, only apply to the 2014 attainment year. In 2014, contingency measures must provide for about one year's worth of reductions or air quality improvement, proportional to the overall amount of air quality improvement to be achieved by the area's attainment plan.

The 2008 base year design value in the 24-hour PM2.5 attainment demonstration is 47.9 $\mu g/m^3$, and the 2014 attainment year design value must be less than 35.5 $\mu g/m^3$ (see Chapter 5). Linear progress towards attainment over the six year period yields one year's worth of air quality improvements equal to approximately 2 $\mu g/m^3$. Thus, contingency measures should provide for approximately 2 $\mu g/m^3$ of air quality improvements to be automatically implemented in 2015 if the Basin fails to attain the 24-hour PM2.5 standard in 2014.

Satisfying the Contingency Measure Requirements

As stated above, the contingency measure requirement can be satisfied by already adopted measures resulting in air quality improvements above and beyond those needed for attainment. Since the attainment demonstration need only show an attainment year concentration below 35.5 μg/m^3, any measures leading to improvement in air quality beyond this level can serve as contingency measures. As shown in Chapter 5, the attainment demonstration yields a 2014 design value of 34.28 μg/m^3. The excess air quality improvement is therefore approximately 1.2 μg/m^3.

In addition to these air quality improvements beyond those needed for attainment, an additional contingency measure is proposed that will result in emissions reductions beyond those needed for attainment in 2014. Control Measure CMB-01 Phase I seeks to achieve an additional two tons per day of NOx emissions reductions from the RECLAIM market if the Basin fails to achieve the standard by the 2014 attainment date. CMB-01 Phase I is scheduled for near-term adoption and includes the appropriate automatic trigger mechanism and implementation schedule consistent with CAA contingency measure requirements. Taken together with the 1.2 μg/m^3 of excess air quality improvement described above, this represents a sufficient margin of "about one year's of progress" and "generally linear" progress to satisfy the contingency measure requirements. Note that based on the most recent air quality data at the design value site, Mira Loma, the actual measured air quality is already better (by over 4 μg/m^3 in 2011) than that projected by modeling based on linear interpolation between base year and attainment year.

To address U.S. EPA's comments regarding contingency measures, the excess air quality improvements beyond those needed to demonstrate attainment should also be expressed in terms of emissions reductions. This will facilitate their enforceability and any future needs to substitute emissions reductions from alternate measures to satisfy contingency measure requirements. For this purpose, Table 6-2 explicitly identifies the portions of emissions reductions from proposed measures that are designated as contingency measures. Table 6-2 also includes the total equivalent basin-wide NOx emissions reductions based on the PM2.5 formation potential ratios described in Chapter 5.

TABLE 6-2

Emissions Reductions for Contingency Measures (2014)

MEASURE	ASSOCIATED EMISSIONS REDUCTIONS FROM CONTINGENCY MEASURES (TONS/DAY)
BCM-01 – Residential Wood Burning[1,2]	2.84(PM2.5)
BCM-02 – Open Burning [1,2]	1.84(PM2.5)
CMB-01 – NOx reductions from RECLAIM	2 (NOx)
Total	71 ($NOx_{(e)}$)[3]

[1]40% of the reductions from these measures, as shown in Table 4-2, are designated for contingency purposes.

[2] Episodic emissions reductions occurring on burning curtailment days.

[3] NOx equivalent emissions based on PM2.5 formation potentials described in Chapter 5 (Table 5-2). The PM2.5:NOx ratio is 14.83:1.

Transportation Control Measures

As part of the requirement to demonstrate that RACM has been implemented, transportation control measures meeting the CAA requirements must be included in the plan. Updated transportation control measures included in this plan for attainment of the federal 2006 24-hour PM2.5 standard are described in Appendix IV-C – Regional Transportation Strategy & Control Measures.

Section 182(d)(1)(A) of the CAA requires the District to include transportation control strategies (TCS) and transportation control measures (TCM) in its plans for ozone that offset any growth in emissions from growth in vehicle trips and vehicle miles traveled. Such control measures must be developed in accordance with the guidelines listed in Section 108(f) of the CAA. The programs listed in Section 108(f) of the CAA include, but are not limited to, public transit improvement projects, traffic flow improvement projects, the construction of high occupancy vehicle (HOV) facilities and other mobile source emission reduction programs. While this is not an ozone plan, TCMs may be required if they are RACM.[3] TCMs have been developed for the Final 2012 AQMP and are described in Appendix IV-C. TCMs in the Final 2012 AQMP include the capital-based and non-capital-based facilities, projects and programs contained in the Regional Transportation Plan (RTP) and programmed through the Regional Transportation Implementation Plan (RTIP) process. As an additional measure to reduce mobile source emissions, Section 182(d)(1)(B) of the CAA allows the implementation of employer-based trip reduction programs that are aimed at improving the average vehicle occupancy (AVO) rates. As an alternative to trip reduction programs, Section 182(d)(1)(B) also allows the substitution of these programs with alternative programs that achieve equivalent emission reductions. Rule 2202 - On-Road Motor Vehicle Mitigation Options, adopted in December 1995, was developed to comply with CAA Section 182(d)(1)(B).

CALIFORNIA CLEAN AIR ACT REQUIREMENTS

The Basin is designated as nonattainment with the state ambient air quality standards for both PM10 and PM2.5. The California Clean Air Act (CCAA) requires that a plan for attaining the ozone standard be reviewed, and revised as necessary, every three years (Health & Safety Code § 40925). The Final 2012 AQMP satisfies this triennial update requirement. The CCAA established a number of legal mandates to facilitate achieving health-based state air quality standards at the earliest practicable date. The following CCAA requirements do not directly apply to particulate matter plans but are addressed for ozone in the remainder of this chapter:

(1) Demonstrate the overall effectiveness of the air quality program;

(2) Reduce nonattainment pollutants at a rate of 5% per year, or include all feasible measures and an expeditious adoption schedule;

(3) Reduce Population Exposure to severe nonattainment pollutants according to a prescribed schedule; and

(4) Rank control measures by cost-effectiveness.

Plan Effectiveness

The CCAA requires, beginning on December 31, 1994 and every three years thereafter, that the District assess its progress toward attainment of the state ambient air quality

[3] The District will in the future take actions as required to satisfy ozone TCM provisions when so directed by U.S. EPA.

standards [Health & Safety Code § 40924(b)] and that this assessment be incorporated into the District's triennial plan revision. To demonstrate the effectiveness of the District's program, air quality trends since 1990 depicting maximum pollutant concentrations are provided in Figure 6-1. While this statute does not apply to particulate matter, it is useful to discuss progress towards attainment of the PM10 and PM2.5 standards. Basin maximum annual average PM10 concentrations have decreased continuously since 1990 from a high of nearly 80 $\mu g/m^3$ to a 2011 level of just above 41 $\mu g/m^3$. PM2.5 annual concentrations have decreased nearly 50% since 1999 to a 2011 level of 15.3 $\mu g/m^3$. The State annual standards are 20 $\mu g/m^3$ and 12 $\mu g/m^3$ for PM10 and PM2.5, respectively.

1-hour ozone concentrations have decreased about 50% since 1990 to a 2011 level of 0.16 ppm. 8-hour ozone concentrations have also decreased continuously from 1990 levels of 0.194 ppm to 2011 levels of 0.136. The state annual standards are 0.09 ppm and 0.07 ppm for 1-hour ozone and 8-hour ozone, respectively.

NO_2 and CO air quality have also improved substantially since 1990. NO_2 and CO metrics are not shown since the Basin currently meets all state and federal NO_2 and CO standards. A comprehensive discussion of local air quality trends can be found in Chapter 2 and Appendix II – Current Air Quality.

Basin Air Quality Trends

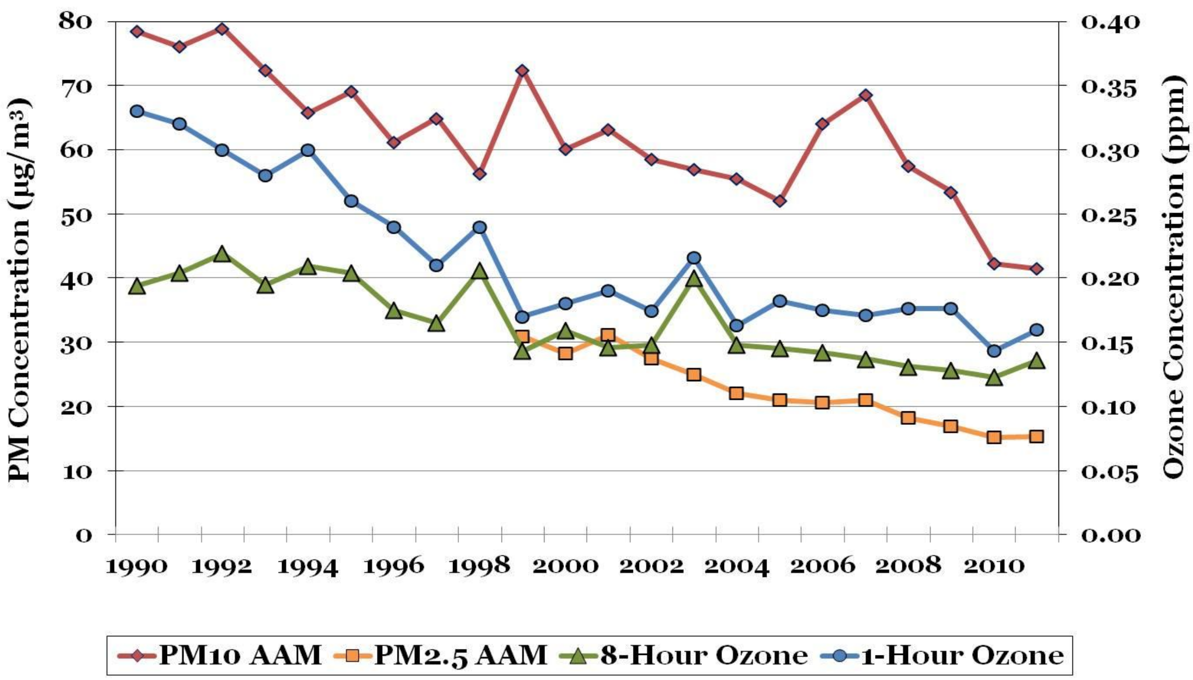


FIGURE 6-1

Ozone, PM10, and PM2.5 Trends Since 1990

Emission Reductions

The CCAA requires that each district plan be designed to achieve a reduction in district-wide emissions of 5% or more per year for each covered non-attainment pollutant or its precursors, averaged every consecutive three-year period (Health & Safety Code § 40914). This requirement does not apply to particulate matter, but does apply to ozone. If this cannot be achieved, a plan may instead show that it has implemented all feasible measures as expeditiously as possible. Nevertheless, all feasible measures should be implemented for particulate matter in order to assure attainment as expeditiously as practicable.

It is not practical nor does the federal CAA require an air district to develop an emissions inventory for every year between the base year and attainment year; therefore, consecutive three-year averages have not been explicitly calculated. Furthermore, based on the emissions projections provided in Chapter 3, 5% or more of reductions per year cannot be achieved for all pollutants and precursors with all feasible measures implemented. As discussed earlier in this chapter with respect to the RACM / RACT analysis, this Plan implements all available feasible measures as expeditiously as possible.

Population Exposure

The CCAA also requires a reduction in overall population exposure to criteria pollutants. Specifically, exposure to the designated severe nonattainment pollutants (i.e., ozone) above standards must be reduced by at least:

(1) 25 percent by December 31, 1994;

(2) 40 percent by December 31, 1997; and

(3) 50 percent by December 31, 2000.

Reductions are to be calculated based on per-capita exposure and the severity of the exceedances. For the Basin, this provision is applicable to ozone [Health & Safety Code § 40920(c)]. The definition of exposure is the number of persons exposed to a specific pollutant concentration level above the state standard times the number of hours exposed. The per-capita exposure is the population exposure (units of pphm-persons-hours) divided by the total population. This requirement for the specific milestone years listed in the CCAA has been shown to have already been satisfied in previous AQMPs.

Cost-Effectiveness Ranking

The CCAA requires that each plan revision shall include an assessment of the cost-effectiveness of available and proposed control measures and contain a list which ranks the control measures from the least cost-effective to the most cost-effective. Table 6-3 provides a list of stationary source control measures for the 24-hour PM2.5 standard ranked by cost-effectiveness. Tables 6-4 and 6-5 provide a list of stationary and mobile source control measures for ozone ranked by cost-effectiveness.

In developing an adoption and implementation schedule for a specific control measure, the District shall consider the relative cost-effectiveness of the measure as well as other factors including, but not limited to, technological feasibility, total emission reduction potential, the rate of reduction, public acceptability, and enforceability (Health & Safety Code § 40922). These requirements also do not apply to particulate matter, but provide useful information. The PM2.5 control strategy and implementation schedule is provided in Chapter 4.

TABLE 6-3

Cost-Effectiveness Ranking of District's Stationary Source Control Measures for PM2.5 [a,b]

MEASURE NUMBER	DESCRIPTION	DOLLARS/TON[a,b]	RANKING BY COST EFFECTIVENESS
BCM-01	Further Reductions from Residential Wood Burning Devices [PM2.5]	Minimal	1
BCM-02	Further Reductions from Open Burning [PM2.5]	Minimal	1
CMB-01	Further NOx Reductions from RECLAIM [NOx] –*Phase I*	$7950/ton	2
BCM-03 (*formerly BCM-05*)	Emission Reductions from Under-Fired Charbroilers [PM2.5]	$15,000/ton[c]	3
BCM-04	Further Ammonia Reductions from Livestock Waste [NH3]	TBD[d]	
IND -01 (*formerly MOB-03*)	Backstop Measures for Indirect Sources of Emissions from Ports and Port-Related Sources [NOx, SOx, PM2.5]	N/A[e]	
EDU-01 *(formerly MCS-02, MCS-03)*	Further Criteria Pollutant Reductions from Education, Outreach and Incentives [All Pollutants]*	N/A[e]	
MCS-01 (*formerly MCS-07*)	Application of All Feasible Measures Assessment [All Pollutants]	TBD[d]	

[a] The cost-effectiveness values of these measures are based on the Discount Cash Flow methodology and 4% real interest rate.
[b] Where a range exists, the ranking was done based on the low end of the range.
[c] preliminary estimate, actual cost-effectiveness will be determined by the Phase I technology assessment.
[d] TBD – emissions reductions and costs to be determined once the inventory and control approach are identified
[e] N/A – emissions reductions and costs cannot be quantified due to the nature of the measure (e.g., outreach, incentive programs) or if the measure is designed to ensure reductions that have been assumed to occur will in fact occur.

TABLE 6-4

Cost-Effectiveness Ranking of Stationary Source Control Measures for Ozone[a,b]

MEASURE NUMBER	DESCRIPTION	DOLLARS/TON[a,b]	RANKING BY COST EFFECTIVENESS
FUG-01	Further VOC Reductions from Vacuum Trucks [VOC]	$3,000/ton	1
CTS-03	Further VOC Reductions from Mold Release Products [VOC]	$4,000-$8,000/ton	2
FUG-02	Emission Reduction from LPG Transfer and Dispensing [VOC] – *Phase II*	$4,000-$10,000/ton	3
CTS-02	Further Emission Reduction from Miscellaneous Coatings, Adhesives, Solvents and Lubricants [VOC]	$8,000-$12,000/ton	4
CTS-01	Further VOC Reductions from Architectural Coatings (R1113) [VOC]	$10,000-$20,000/ton	6
FUG-03	Further VOC Reductions from Fugitive VOC Emissions [VOC]	$11,000/ton	7
CMB-01	Further NOx Reductions from RECLAIM [NOx] – *Phase II*	$16,000/ton	8
CMB-02	NOx Reductions from Biogas Flares [NOx]	$20,000/ton	9
CMB-03	Reductions from Commercial Space Heating [NOx]	$20,000/ton	9
MCS-01 (*formerly MCS-07*)	Application of All Feasible Measures Assessment [All Pollutants]	TBD[c]	
MCS-02	Further Emission Reductions from Green Waste Processing (Chipping and Grinding Operations not associated with composting) [VOC]	TBD[c]	
MCS-03 (*formerly MCS-06*)	Improved Start-up, Shutdown and Turnaround Procedures [All Pollutants]	TBD[c]	
INC-01	Economic Incentive Programs to Adopt Zero and Near-Zero Technologies [NOx]	TBD[c]	
INC-02	Expedited Permitting and CEQA Preparation Facilitating the Manufacturing of Zero and Near-Zero Technologies [All Pollutants]	N/A[d]	
EDU-01 (*formerly MCS-02, MCS-03*)	Further Criteria Pollutant Reductions from Education, Outreach and Incentives [All Pollutants]*	N/A[d]	

[a] The cost-effectiveness values of these measures are based on the Discount Cash Flow methodology and 4% real interest rate.
[b] Where a range exists, the ranking was done based on the low end of the range.
[c] TBD – emissions reductions and costs to be determined once the inventory and control approach are identified
[d] N/A – emissions reductions and costs cannot be quantified due to the nature of the measure (e.g., outreach, incentive programs)

TABLE 6-5
Cost-Effectiveness Ranking of Mobile Source Control Measures for Ozone [a,b]

MEASURE NUMBER	DESCRIPTION	DOLLARS/TON[a,b]	RANKING BY COST EFFECTIVENESS
OFFRD-03	Further Emission Reductions from Passenger Locomotives [NOx, PM]	$5,000/ton	1
OFFRD-01	Extension of the SOON Provision for Construction/Industrial Equipment [NOx]	$11,000/ton	2
OFFRD-02	Further Emission Reductions from Freight Locomotives [NOx, PM]	TBD[b, d]	
ONRD-05	Further Emission Reductions from Heavy-Duty Vehicles Serving Near-Dock Railyards [NOx, PM]	TBD[b]	
ONRD-01	Accelerated Penetration of Partial Zero-Emission and Zero- Emission Vehicles [VOC, NOx, PM]	TBD[b, c]	
ONRD-02	Accelerated Retirement of Older Light- and Medium-Duty Vehicles [VOC, NOx, PM]	TBD[b, c]	
ONRD-03	Accelerated Penetration of Partial Zero-Emission and Zero-Emission Light-Heavy- and Medium-Heavy-Duty Vehicles [NOx, PM]	TBD[b, c]	
ONRD-04	Accelerated Retirement of Older On-Road Heavy-Duty Vehicles [NOx, PM]	TBD[b, c]	
OFFRD-04	Further Emission Reductions from Ocean-Going Marine Vessels While at Berth [NOx, PM]	TBD[b, c]	
OFFRD-05	Emission Reductions from Ocean-Going Marine Vessels [NOx]	TBD[b, c]	

[a] The cost-effectiveness values of these measures are based on the Discount Cash Flow methodology and 4% real interest rate.
[b] Emissions reductions and costs will be determined after projects are identified and implemented. See Appendix IV-B for cost information for specific measures.
[c] Voluntary incentive programs
[d] This measure was included in the 2007 Ozone SIP and is included in the Final 2012 AQMP with updated technical information.

TRANSPORTATION CONFORMITY BUDGETS

The Final 2012 AQMP sets forth the strategy for achieving the 2006 24-hour PM2.5 and 8-hour ozone standards. For on-road mobile sources, Section 176(c) of the CAA requires that transportation plans and programs do not cause or contribute to any new violation of a standard, increase the frequency or severity of any existing violation, or delay the timely attainment of the air quality standards. Therefore, on-road mobile sources must "conform" to the attainment demonstration contained in the SIP.

U.S. EPA's transportation conformity rule, found in 40 CFR parts 51 and 93, details the requirements for establishing motor vehicle emissions budgets in SIPs for the purpose of ensuring the conformity of transportation plans and programs with the SIP attainment demonstration. The on-road motor vehicle emissions budgets act as a "ceiling" for future on-road mobile source emissions. Exceedances of the budget indicate an inconsistency with the SIP, and could lead to a conformity "lapse" and its related consequences if not corrected before the next conformity deadline (e.g., during a lapse, certain categories of transportation projects cannot proceed). As required by the CAA, a comparison of regional on-road mobile source emissions to these budgets will occur during the periodic updates of regional transportation plans and programs.

The on-road motor vehicle emissions estimates for the Final 2012 AQMP were analyzed using CARB's EMFAC2011 emission factors for the transportation activity data provided by Southern California Association of Governments (SCAG) from their adopted 2012 Regional Transportation Plan (2012 RTP). For the Final 2012 AQMP, on-road motor vehicle emissions budgets are provided in Table 6-6 for 2014. The PM2.5 emissions budgets for PM2.5, and the PM2.5 precursors, VOC and NOx, are derived from the annual average inventory.

This approach is consistent with U.S. EPA's transportation conformity rule, which provides that if emissions budgets rely on new control measures, these measures must be specified in the SIP and the emissions reductions from each control measure must be quantified and supported by agency commitments for adoption and implementation schedules. Moreover, the rule provides that conformity analyses by transportation agencies may not take credit for measures which have not been implemented unless the measures are "projects, programs, or activities" in the SIP supported by written implementation commitments by the responsible agencies (40 CFR 93.122(a)(3)). The emissions budgets for PM2.5 are provided for the 2014 attainment year. However, since transportation analyses are needed beyond the attainment dates, the carrying capacities for the PM2.5 attainment demonstration also serve as the budgets for future years. For transportation conformity analysis, a trading mechanism can be established based on the PM2.5 forming potential developed through the modeling analysis for the emission budgets for various pollutants in SCAB.

TABLE 6-6

2014 Motor Vehicle Emissions Budgets: PM2.5
(Annual Average - Tons Per Day)*

	VOC	NOx	PM2.5
Baseline Inventory	115.6	263	11.9
PM2.5: Re-entrained Road Dust (paved)	--	--	7.09
PM2.5 Re-entrained Road Dust (unpaved)	--	--	0.58
Road Construction Dust	--	--	0.25
Adjusted Inventory	--	--	19.8
2014 Mobile Source Emission Budget**	**116**	**263**	**20**

* Derived based on EMFAC2011 and external adjustments associated with on-road mobile source incentive programs (Proposition 1B, Carl Moyer, AB1493). 2014 budget is applicable to all future years beyond 2014.
** Rounded up to the nearest whole number

In the Final 2012 AQMP the approximate weighting ratios of the precursor emissions for 24-hour PM2.5 formation in equivalent tons per day of NOx are: VOC: 0.3 (reducing one ton of VOC is equivalent to reducing 0.3 ton of NOx), NOx: 1.0, and PM2.5: 14.8 (i.e., reducing one ton of PM2.5 is equivalent to reducing 14.8 tons of NOx). This mechanism allows emissions below the budget for one pollutant to be used to supplement another pollutant exceeding the budget based on the ratios established herein. Clear documentation of the calculations used in the trading should be included in the conformity analysis. This trading approach is consistent with what U.S. EPA approved in 2011, The Revisions to the 2007 PM2.5 SIP, where the precursor substitution methodology was established.

The basic trading ratios are defined by the 24-hour PM2.5 regional modeling attainment demonstration. Briefly, NOx emissions reductions are scaled to the reduction of Basin ammonium nitrate (including water bonding). Similarly, reductions of VOC are scaled to changes in the organic carbon species while reductions in directly emitted particulates are scaled to the projected changes in the elemental carbon and “others” portions of the PM2.5 mass. Table 6-7 summarizes the trading equivalencies in TPD.

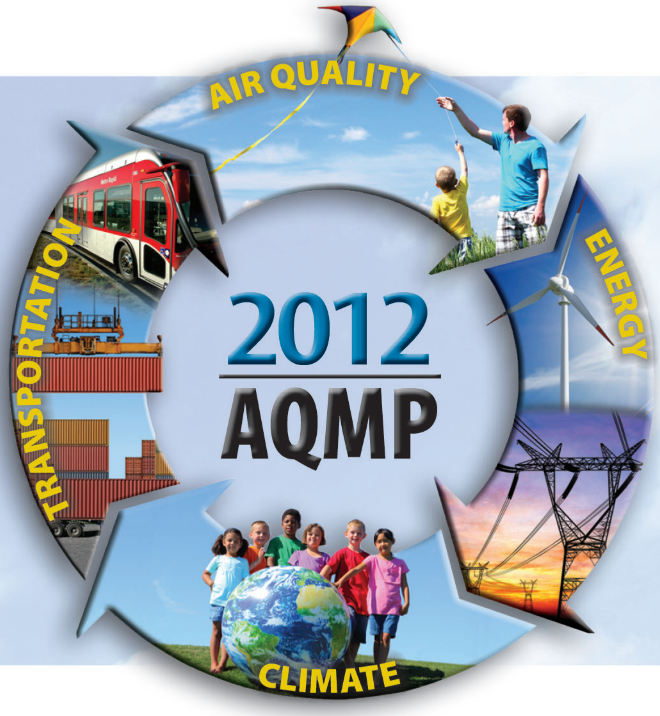
TABLE 6-7

Trading Equivalencies for PM2.5Motor Vehicle Emissions Budgets

ONE TON OF	IS EQUIVALENT IN TERMS OF PM2.5 FORMATION TO THIS MANY TONS OF		
	NOx:	**VOC:**	**PM2.5:**
NOx	1	3.151	0.067
VOC	0.317	1	0.021
PM2.5	14.833	46.792	1

An example of how the trading mechanism would work follows; If the amount of NOx calculated exceeds the budget by 0.75 TPD, then that overage could be offset by trading 2.36 TPD of excess VOC emissions reductions (e.g 3.151 VOC/1 ton of NOx x 0.75 TPD NOx required = 2.36 TPD VOC). In this case, "excess" VOC emission reductions would be those beyond what are needed to meet the VOC budget. Similarly 0.050 TPD of directly emitted PM2.5 emissions below the budgeted amount could also be traded to the NOx emissions category and subtracted from the NOx total to allow NOx to meet its budget. In other words, the trading mechanism can be multi-pollutant and multi-directions. It should be noted that the trading calculations are performed prior to the final rounding to demonstrate conformity with the budgets.

It is also important to note that the ratios and equivalencies are targeted for a 2014 application. Ratios beyond 2017 would need to be adjusted based on the projected emissions and regional modeling analyses. A comprehensive discussion of the calculation of the trading ratios is provided in Attachment 8 of Appendix V of this document.



Chapter 7

Current and Future Air Quality – Desert Nonattainment Areas

South Coast Air Quality Management District

Cleaning the air that we breathe...™

CHAPTER 7

CURRENT AND FUTURE AIR QUALITY – DESERT NONATTAINMENT AREAS

INTRODUCTION

The District has jurisdiction over the South Coast Air Basin and the desert portion of Riverside County in the Salton Sea Air Basin. Figure 7-1 shows a map of the area and topography. The Coachella Valley, located in the desert portion of Riverside County does not exceed the federal standard for PM2.5. However, it exceeds the PM10 federal standard on days when high wind events cause transport of windblown dust from both disturbed and natural desert areas (these days can be flagged as exceptional events [1] under U.S. EPA regulations). Also, the Coachella Valley exceeds the federal 8-hour ozone standards, both the 1997 standard (0.08 ppm, or 80 ppb) and the lower 2008 standard (0.075 ppm, or 75 ppb). For both ozone standards, the Coachella Valley is classified as a "severe" ozone nonattainment area. This chapter summarizes the current air quality setting for the Coachella Valley and the most recent updates to the attainment status.

While the 2007 AQMP addressed and satisfied the Clean Air Act (CAA) planning requirements for the Coachella Valley, the 2012 AQMP specifically addresses CAA planning requirements for the 24-hour PM2.5 standard in the South Coast Air Basin and not in the Coachella Valley, which is designated by U.S. EPA as unclassifiable/attainment of this standard. Since the Coachella Valley is not in attainment of the federal 8-hour ozone standards, this chapter will address the current status of ozone air quality and provide the latest projections of future ozone levels, based on the latest emissions inventories and modeling efforts. However, the 2007 AQMP adequately addressed and satisfied the CAA planning requirements for ozone in the Coachella Valley, and this chapter is for information only. This AQMP confirms that with the latest emissions and modeling projections, the strategy toward attainment of the federal ozone standards in the Coachella Valley remains effective.

On April 18, 2003, U.S. EPA approved the Coachella Valley State Implementation Plan (2003 CVSIP), which addressed future year attainment of the PM10 standards and incorporated the latest mobile source emissions model results and planning assumptions. Over the past five years, annual average PM10 concentrations have met the levels of the revoked federal annual standard (50 $\mu g/m^3$), and peak 24-hour

[1] The U.S. EPA Exceptional Events Rule, *Treatment of Data Influence by Exceptional Events*, became effective May 21, 2007. The previous U.S. EPA *Natural Events Policy* for Particulate Matter was issued on May 30, 1996. Under the Exceptional Events Rule, U.S. EPA allows certain data to be flagged in the U.S. EPA Air Quality System (AQS) database and not considered for NAAQS attainment status when that data is influenced by exceptional events, such as high winds, wildfires, volcanoes, or some cultural events (Independence Day fireworks) that meet strict requirements.

average PM10 concentrations have not exceeded the current federal standard (150 $\mu g/m^3$). The Coachella Valley is currently eligible for redesignation as attainment (after high-wind natural events were flagged under the Exceptional Events Rule). Requests have been made to U.S. EPA to redesignate the Coachella Valley and South Coast Air Basin as attainment for PM10; the redesignations are still pending at this time[2]. Since the 2012 AQMP does not include new modeling efforts for PM10, future projections for Coachella Valley PM10 levels in the 2003 CVSIP are still applicable.

Like the South Coast Air Basin, the Coachella Valley is a rapidly growing area, as shown in Table 7-1. By 2030, the population in the Coachella Valley is projected to more than double that of 2000. On a percentage basin, the Coachella Valley growth exceeds that of the Basin. This population growth is taken into account in the emissions projections for future years, used to demonstrate attainment of the air quality standards.

TABLE 7-1

Historic Population and Projections for South Coast Air Basin and Coachella Valley

AREA	1980	1990	2000	2010	2020	2030
South Coast Air Basin	10,500,000	13,022,000	14,681,000	15,759,412	16,901,492	18,129,690
Coachella Valley	139,000	267,000	320,892	439,357	558,321	710,430

[2] U.S. EPA has requested additional temporary PM10 monitoring in the southeastern Coachella Valley to further assess windblown dust in that area; this project is currently ongoing.

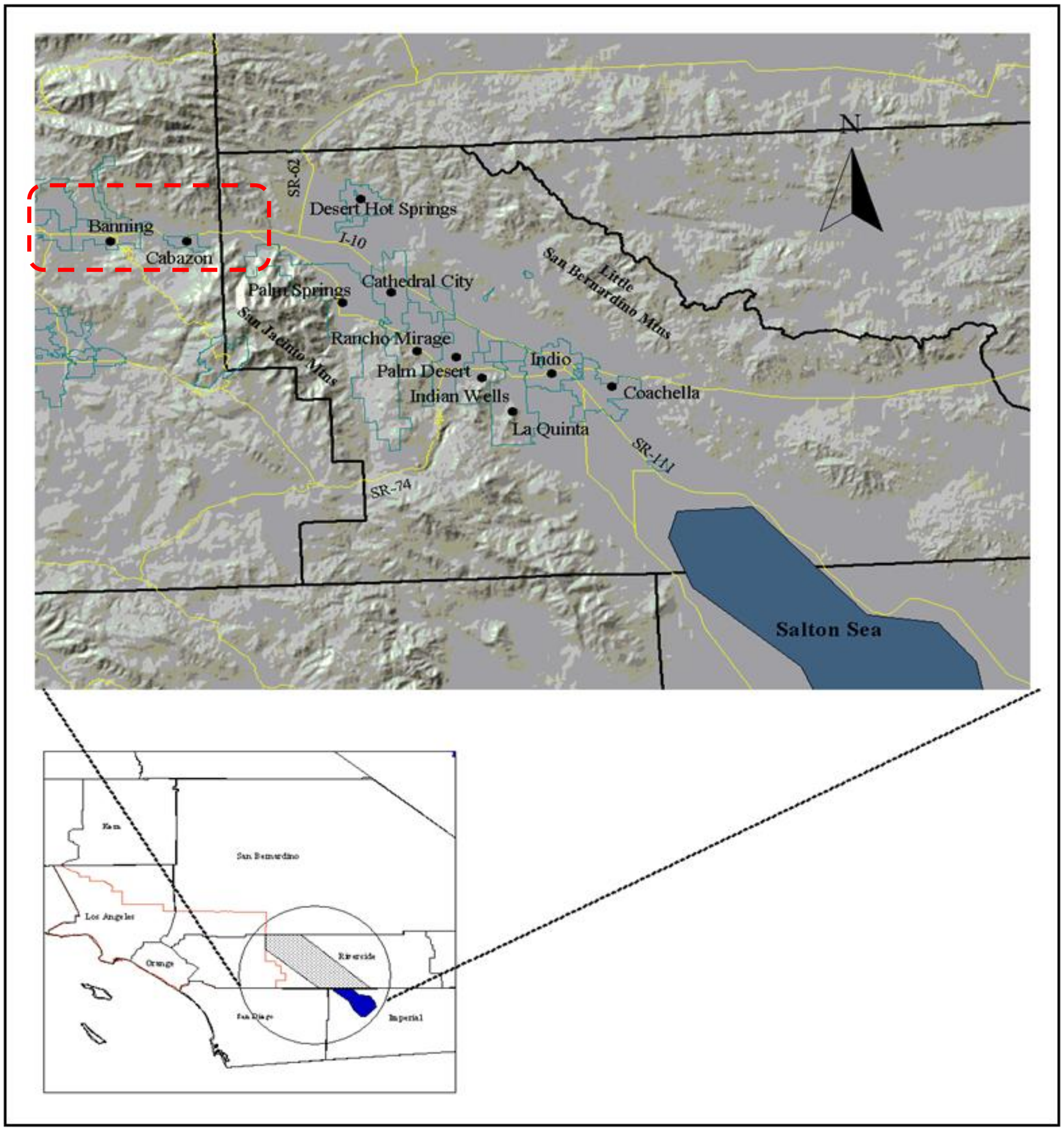


FIGURE 7-1

Location and Topography of the Coachella Valley (Dashed red box indicates the San Gorgonio Pass; SCAQMD Coachella Valley air monitoring stations at Palm Springs and Indio)

AIR QUALITY SETTING

Air Quality Summary

In 2011, the District monitored air quality at two permanent locations in the Riverside county portion of the Salton Sea Air Basin (SSAB), both in the Coachella Valley. One air monitoring station (Palm Springs) is located closer to the San Gorgonio Pass, predominantly downwind of the densely populated Basin. The other station (Indio) is located further into the Coachella Valley, on the predominant downwind side of the main population areas of the Coachella Valley. A summary of the recent and historic air pollution data collected in the Coachella Valley is included in Appendix II. Information on the health effects associated with criteria air pollutants are summarized in Chapter 2 and detailed in Appendix I.

Attainment Status

In 2011, air pollutant concentrations in the Coachella Valley exceeded state and federal standards for both ozone and PM10. However, the two days that exceeded the federal 24-hour PM10 standard were associated with high-wind natural events and have been flagged in the U.S. EPA Air Quality System (AQS) database to be excluded for comparison to the National Ambient Air Quality Standards (NAAQS), as allowed by the U.S. EPA Exceptional Events Rule. After application of the U.S. EPA Exceptional Event Rule (and its predecessor, the Natural Events Policy) to high wind natural events in the Coachella Valley, no days since the mid-1990s have exceeded the federal 24-hour PM10 standard at Indio or Palm Springs. As a result, the District requested that U.S. EPA redesignate the Coachella Valley from nonattainment to attainment of the PM10 NAAQS. Further action by U.S. EPA on this request is still pending. The current federal NAAQS attainment designations for the Coachella Valley are presented in Table 7-2.

The maximum concentrations of ozone, PM2.5, PM10, nitrogen dioxide (NO_2), carbon monoxide (CO), and sulfate (SO_4^{2-}) recorded at these locations in 2011 are shown in Figure 7-2, as percentages of the state and federal standards. Figure 7-3 shows the Coachella Valley design value[3] for ozone, PM2.5 and PM10 for the 3-year period 2009-2011, as percentages of the current and revoked federal standards.

[3] A design value is a statistic that describes the air quality status of a given area relative to the level and form of the National Ambient Air Quality Standards (NAAQS). For most criteria pollutants, the design value is a 3-year average and takes into account the form of the short-term standard (e.g., 98th percentile, fourth high value, etc.).

TABLE 7-2

National Ambient Air Quality Standards (NAAQS) Attainment Status
Coachella Valley Portion of the Salton Sea Air Basin

CRITERIA POLLUTANT	AVERAGING TIME	DESIGNATION [a)]	ATTAINMENT DATE [b)]
1979 **1-Hour Ozone**[c)]	1-Hour (0.12 ppm)	Nonattainment (Severe-17)	11/15/2007 (not timely attained)[c)]
1997 **8-Hour Ozone**[d)]	8-Hour (0.08 ppm)	Nonattainment (Severe-15)	6/15/2019
2008 **8-Hour Ozone**	8-Hour (0.075 ppm)	Nonattainment (Severe-15)	12/31/2027
CO	1-Hour (35 ppm) 8-Hour (9 ppm)	Unclassifiable/Attainment	Unclassifiable/Attainment
NO_2[e)]	1-Hour (100 ppb)	Unclassifiable/Attainment	Unclassifiable/Attainment
	Annual (0.053 ppm)	Unclassifiable/Attainment	Unclassifiable/Attainment
SO_2[f)]	1-Hour (75 ppb)	Designations Pending	Designations Pending
	24-Hour (0.14 ppm) Annual (0.03 ppm)	Unclassifiable/Attainment	Unclassifiable/Attainment
PM10	24-hour (150 µg/m^3)	Nonattainment (Serious)[g)]	12/31/2006 (redesignation request submitted)[g)]
PM2.5	24-Hour (35 µg/m^3) Annual (15.0 µg/m^3)	Unclassifiable/Attainment	Unclassifiable/Attainment
Lead	3-Months Rolling (0.15 µg/m^3)	Unclassifiable/Attainment	Unclassifiable/Attainment

a) U.S. EPA often only declares Nonattainment areas; everywhere else is listed as Unclassifiable/Attainment or Unclassifiable
b) A design value below the NAAQS for data through the full year or smog season prior to the attainment date is typically required for attainment demonstration
c) 1-hour ozone standard (0.13 ppm) was revoked, effective June 15, 2005; the Southeast Desert Modified Air Quality Management Area, including the Coachella Valley, did not attain this standard based on 2005-2007 data and has some continuing obligations under the former standard (latest 2009-2011 data shows attainment)
d) 1997 8-hour ozone standard (0.08 ppm) was reduced (0.075 ppm), effective May 27, 2008; the 1997 ozone standard and most related implementation rules remain in place until the 1997 standard is revoked by U.S. EPA
e) New NO_2 1-hour standard, effective August 2, 2010; attainment designations January 20, 2012; annual NO_2 standard retained
f) The 1971 Annual and 24-hour SO_2 standards were revoked, effective August 23, 2010; however, these 1971 standards will remain in effect until one year after U.S. EPA promulgates area designations for the 2010 SO_2 1-hour standard. Area designations expected in 2012 with Unclassifiable /Attainment designation likely for SSAB Coachella Valley
g) Annual PM10 standard was revoked, effective December 18, 2006; redesignation request to Attainment of the 24-hour PM10 standard is pending with U.S. EPA

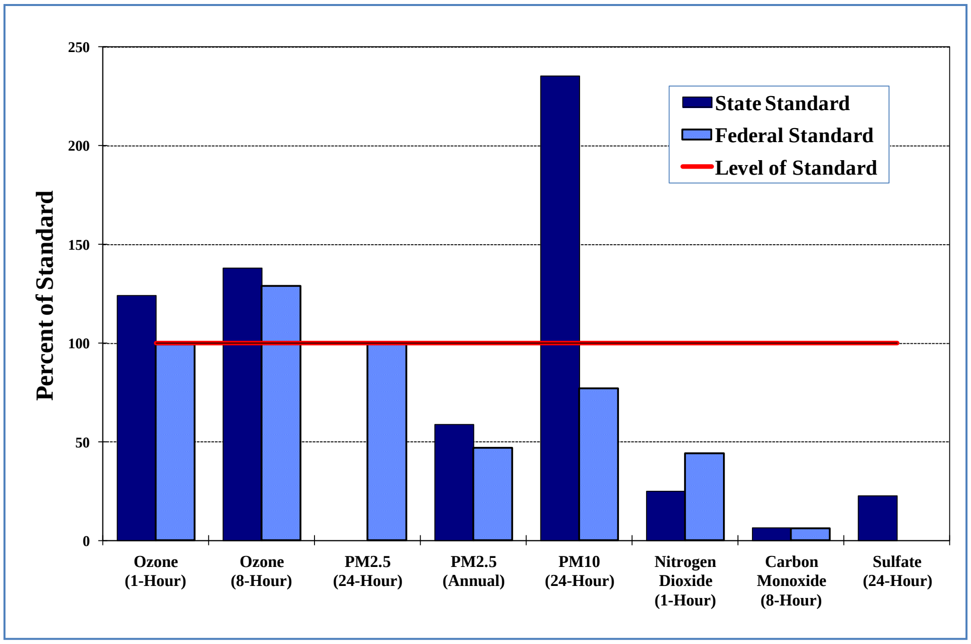


FIGURE 7-2

Coachella Valley 2011 Maximum Pollutant Concentrations as Percent of State and Federal Standards

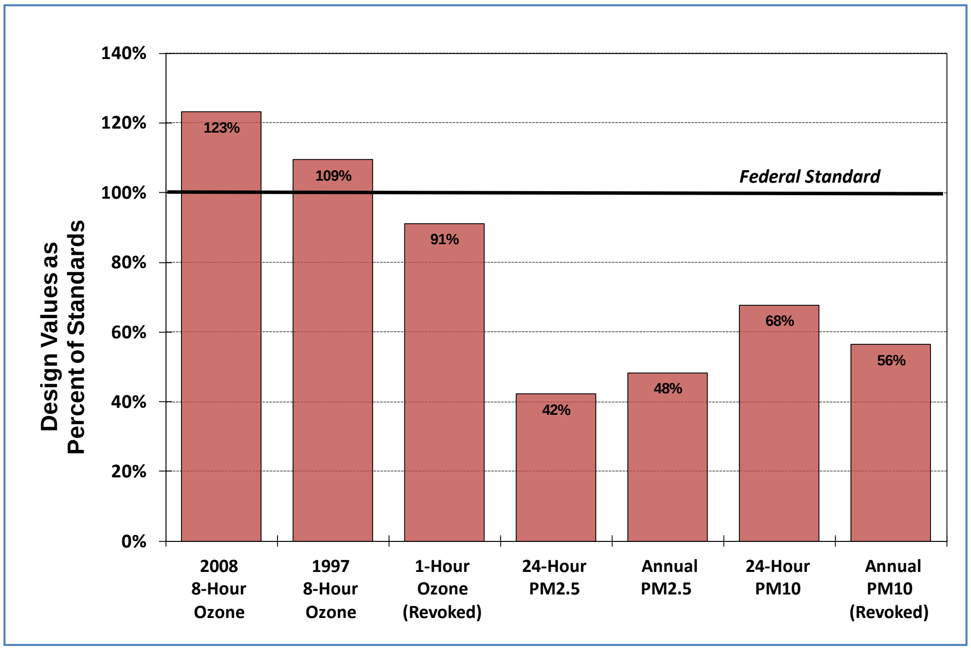


FIGURE 7-3

Coachella Valley 3-Year (2009-2011) Design Values as Percent of Federal Standards

PM10

PM10 is measured daily at both Indio and Palm Springs by supplementing the (primary) 1-in-3-day Federal Reference Method (FRM) filter sampling at Indio and the 1-in-6-day FRM sampling at Palm Springs with (secondary) continuous hourly Federal Equivalent Method (FEM) measurements at both stations.

Although exceedances of the ozone standard in the Coachella Valley area are due to the transport of ozone from the densely populated areas of the upwind Basin, the same cannot be said for PM10 exceedances. PM10 in the Coachella Valley is primarily due to locally generated sources of fugitive dust (e.g., construction activities, re-entrained dust from paved and unpaved road travel, and natural wind-blown sources) and not as a result of secondary PM generated from precursor gaseous emissions. The Coachella Valley is subject to frequent high winds that generate wind-blown sand and dust, leading to high episodic PM10 concentrations, especially from disturbed soil and natural desert blowsand areas. PM10 is the only pollutant which has sometimes reached higher concentrations in the SSAB than in the Basin. On some of the high days, transport of wind-generated dust and sand occurs with relatively light winds in the Coachella Valley, when deeply entrained dust from desert thunderstorm outflows travels to the Coachella Valley from the desert areas of southeastern California, Arizona, Nevada or northern Mexico. All days in recent years that exceeded the 24-hour federal PM10 standard at Indio or Palm Springs would not have exceeded except for the contribution of windblown dust and sand due to strong winds in the upwind source area (high-wind natural events).

In 2011, two high-wind exceptional events occurred in the Coachella Valley that caused high 24-hour PM10 concentrations (397 and 344 $\mu g/m^3$, at Palm Springs and Indio, respectively on July 3; 375 and 265 $\mu g/m^3$ at Indio and Palm Springs, respectively on August 28). Both of these days had high PM10 due to strong outflows from thunderstorms over Arizona and northern Mexico that deeply entrained dust and sand and transported it to the Coachella Valley. They have been flagged as high-wind exceptional events in accordance with the U.S. EPA Exceptional Events Rule, with further documentation and U.S. EPA concurrence pending. After flagging these high-wind natural events, the federal 24-hour and former annual PM10 standards were not exceeded in the Riverside County part of the SSAB in 2011. Therefore, the maximum 24-hour and annual average PM10 concentrations were 120 $\mu g/m^3$ and 32.6 $\mu g/m^3$, 77 percent and 65 percent of the current 24-hour federal PM10 standard (150 μg/m^3) and the revoked annual federal standard (50 μg/m^3), respectively.

When considering the form of the federal PM10 standards, after taking the exceptional events into account, the 3-year (2009-2011) design values for the Coachella Valley are 68 percent of the 24-hour PM10 NAAQS and 56 percent of the revoked annual PM10 NAAQS. For the year 2011 and without the two exceptional events included, the Coachella Valley maximum 24-hour average PM10 concentration (120 μg/m^3) was 77 percent of the federal 24-hour PM10 standard (150 μg/m^3) and 238 percent of the state 24-hour standard (50 μg/m^3). The annual average PM10 concentration (32.6 μg/m^3) was 65 percent of the revoked federal annual PM10 standard (50 μg/m^3) and 151 percent of the state annual PM10 standard (20 μg/m^3).

In 2011, the state 24-hour PM10 standard (50 μg/m^3) was exceeded on a maximum of 19 days (21 days if the high-wind events are included) in the Coachella Valley, which is 5.2 percent of the sampling days (FRM and FEM data combined). The state annual standard (20 μg/m^3) was also exceeded. The maximum annual average PM10 concentration was 151 percent of the state standard. Figure 7-4 shows the trend of the annual average PM10 concentrations in the Coachella Valley for the station showing the highest PM10 measurements from 1990 through 2011.

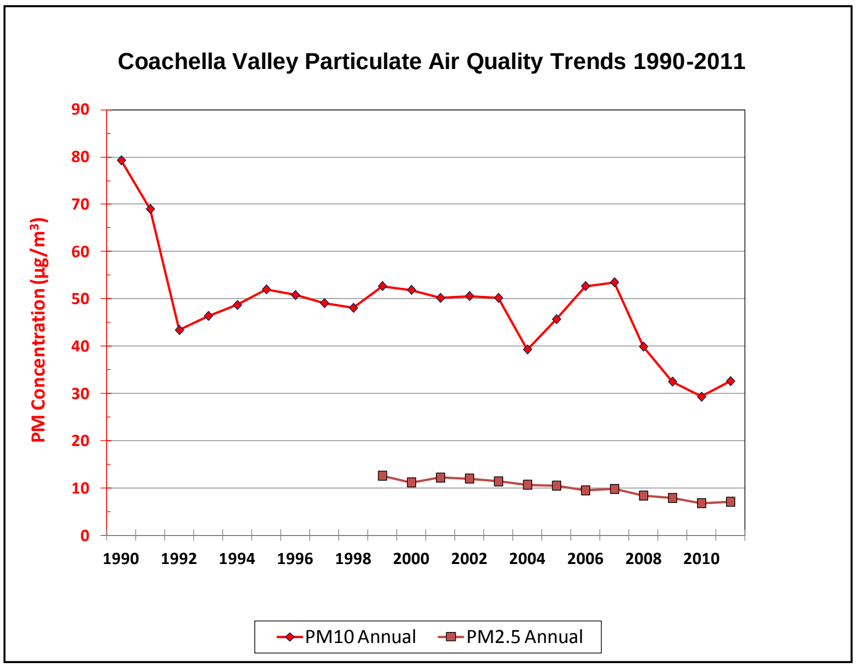


FIGURE 7-4

Coachella Valley Trend of Annual Average PM2.5 and PM10, 1990-2011

PM2.5

PM2.5 has been measured in Coachella Valley since 1999, when the District began PM2.5 monitoring. It has remained relatively low compared to the South Coast Air Basin due to fewer combustion sources and the increased vertical mixing and horizontal dispersion in the desert area. In 2011, federal PM2.5 standards (35 µg/m^3 24-hour and 15.0 µg/m^3 annual) were not exceeded at either of the two Coachella Valley air-monitoring sites. The Coachella Valley maximum 24-hour average and annual average concentrations recorded in 2011 (35.4 µg/m^3 and 7.2 µg/m^3) were, respectively, 99.7 percent and 48 percent of the federal 24-hour and annual standards. While not technically exceeding the 24-hour federal standard (with rounding, a value of at least 35.5 is needed to exceed the NAAQS), the relatively high 24-hour concentration of 35.4 µg/m^3 was unusual for the Coachella Valley and occurred at Indio on one of the exceptional event days that had extremely high PM10. The second highest 24-hour PM2.5 average for the Coachella Valley was 26.3 µg/m^3 (74 percent of the federal standard), at Palm Springs. When looking at the 3-year design value (2009-2011) that considers the form of the federal standard, the Coachella Valley PM2.5 design value is 42 percent of the PM2.5 24-hour standard and 48 percent of the annual standard.

The annual PM2.5 state standard (12.0 µg/m^3) was not exceeded in the Coachella Valley, with the maximum annual average of 7.2 µg/m^3 (at Palm Springs) at 60 percent of the standard. This gives insight that the Coachella Valley will also be in attainment of the proposed new annual PM2.5 federal standard that will be between 12.0 and 13.0 µg/m^3 (proposed June 14, 2012). Figure 7-4 (above) shows the trend of the annual average PM2.5 concentrations in the Coachella Valley for the station measuring the highest PM2.5 from 1990 through 2011.

Ozone (O_3)

Atmospheric ozone in the Riverside county portion of SSAB is both directly transported from the Basin and formed photochemically from precursors emitted upwind. These precursors are emitted in greatest quantity in the coastal and central Los Angeles County areas of the Basin. The Basin's prevailing sea breeze causes polluted air to be transported inland. As the air is being transported inland, ozone is formed, with peak concentrations occurring in the inland valleys of the Basin, extending from eastern San Fernando Valley through the San Gabriel Valley into the Riverside-San Bernardino area and the adjacent mountains. As the air is transported still further inland into the desert areas, ozone concentrations typically decrease due to dilution, although ozone standards can be exceeded.

In 2011, the former 1-hour federal ozone standard level was not exceeded in the Coachella Valley. The maximum 1-hour concentration measured was 0.124 ppm, just below (99 percent) the former 1-hour federal standard (0.125 ppm is required to exceed). The 1997 8-hour federal ozone standard (0.08 ppm) was exceeded on 18 days. The most recent (2008) and more stringent 8-hour federal standard (0.075 ppm) was exceeded on 54 days. The maximum 8-hour ozone concentration was 0.098 ppm (129 percent of the 2008 standard and 115 percent of the 1997 standard). Ozone concentrations and the number of days exceeding the federal ozone standard are greatest in summer, with no exceedances during the winter months.

The 1-hour and 8-hour state ozone standards were exceeded on 25 days and 78 days, respectively, in the Coachella Valley in 2011. The 1-hour ozone health advisory level (0.15 ppm) has not been exceeded in the Coachella Valley area since 1999. No 1-hour Stage 1 episode levels (0.20 ppm) have been recorded in the Coachella Valley area since 1989.

Figure 7-5 shows the trend of the annual highest ozone concentrations (1-hour and 8-hour averages) measured in the Coachella Valley between 1990 and 2011. Figure 7-6 shows the annual number of days exceeding federal ozone standards at Coachella Valley monitoring sites for the years 1990-2011.

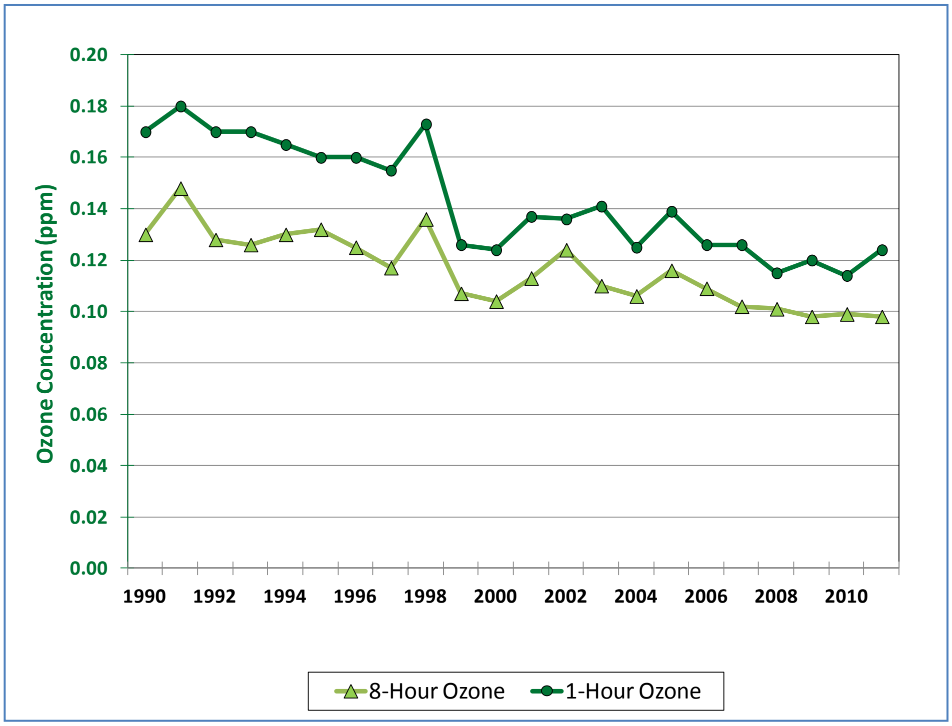


FIGURE 7-5

Trends of Coachella Valley Maximum 1-hour and 8-hour Ozone Concentrations, 1990-2011

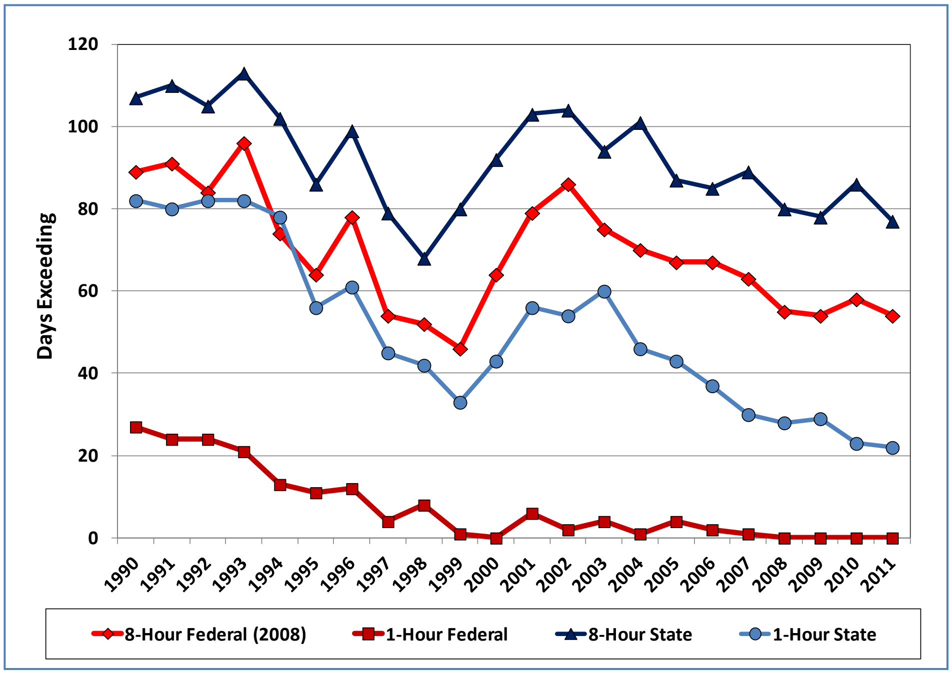


FIGURE 7-6

Coachella Valley Federal and State Ozone Trends, 1990-2011
(Number of Days Exceeding Standards)

Other Criteria Pollutants

Carbon monoxide (CO) was measured at one Coachella Valley air monitoring station (Palm Springs) in 2011. Neither the federal nor state standards were exceeded. The maximum 8-hour average CO concentration recorded in 2011 (0.6 ppm) was less than 7 percent of both the federal and state standards. The maximum 1-hour CO concentration (3.0 ppm) was 8 percent of the federal and 15 percent of the state 1-hour CO standards. Historical carbon monoxide air quality and trends in the Riverside county SSAB area show that the area has not exceeded the federal CO standards in nearly three decades.

Nitrogen dioxide (NO_2) was measured at one station in the Coachella Valley in 2011. The maximum annual average NO_2 concentration (8.0 ppb) was approximately 15 percent of the federal annual standard and 27 percent of the state annual standard. The maximum 1-hour average concentration (44.7 ppb) was 44 percent of the new (2010) federal and 25 percent of the state 1-hour standard.

Sulfur dioxide (SO_2) concentrations were not measured in the Riverside County SSAB in 2011. Historical measurements have shown SO_2 concentrations to be well below the state and federal standards and there are no significant emissions sources in the Coachella Valley.

Sulfate (SO_4^{2-}) from PM10 was measured at one station in the Coachella Valley in 2011. The maximum 24-hour average sulfate concentration was 5.7 $\mu g/m^3$ (23 percent of the 25 $\mu g/m^3$ state sulfate standard). There is no federal sulfate standard.

Lead (Pb) concentrations were not measured at either of the two Coachella Valley air monitoring stations in 2011. Measurements in past years have shown concentrations to be less than the state and federal standards and no major sources of lead emissions are located in the Coachella Valley.

Pollutant Transport

The pollutant transport pathway from the South Coast Air Basin to the Salton Sea Air Basin is through the San Gorgonio Pass (sometimes referred to as the Banning Pass) to the Coachella Valley.[4] The transport pathway to the Coachella Valley is well documented and this phenomenon has been studied considerably in the past.

[4] Keith, R.W. 1980. A Climatological Air Quality Profile: California's South Coast Air Basin. Staff Report, South Coast Air Quality Management District.

An experiment to study this transport pathway concluded that the South Coast Air Basin was the source of the observed high oxidant levels in the Coachella Valley.[5] Transport from Anaheim to Palm Springs was directly identified with an inert sulfur hexafluoride tracer release.[6] A comprehensive study of transport from the South Coast Air Basin to the Salton Sea Air Basin confirmed the ozone transport pathways to the Coachella Valley.[7]

Ozone pollutant transport to the Coachella Valley can be demonstrated by examining averaged ozone concentration by time of day for various stations along the transport corridor from Los Angeles County to the Coachella Valley. Figure 7-7 shows the diurnal distribution of averaged 1-hour ozone concentrations for the May-October smog season, by hour for 2011. The Coachella Valley transport route is represented, starting at Central Los Angeles in the main emissions source region and passing through Riverside-Rubidoux and Banning and finally through San Gorgonio Pass to Palm Springs in the Coachella Valley. Near the source regions, ozone peaks occur just after at mid-day (1:00 to 2:00 p.m. Pacific Standard Time, PST), on average, during the peak of incoming solar radiation and therefore the peak of ozone production. Downwind of the source region, ozone peaks occur later in the day as ozone and ozone precursors are transported downwind and photochemical reactions continue. At Palm Springs, ozone concentration peaks occur between 5:00 and 6:00 p.m. PST. If this peak were locally generated, it would be occurring closer to near mid-day, as is seen in the major source areas of the South Coast Air Basin, and not in the late afternoon or early evening, as is seen at Palm Springs.

[5] Kauper, E.K. 1971. Coachella Valley Air Quality Study. Final Report, Pollution Res. & Control Corp., Riverside County Contract & U.S. Public Health Service Grant No. 69-A-0610 RI.

[6] Drivas, P.J., and F.H. Shair. 1974. A Tracer Study of Pollutant Transport in the Los Angeles Area. Atmos. Environ. 8: 1155-1163.

[7] Smith, T.B., et al. 1983. The Impact of Transport from the South Coast Air Basin on Ozone Levels in the Southeast Desert Air Basin. CARB Research Library Report No. ARB-R-83-183. ARB Contract to MRI/Caltech.

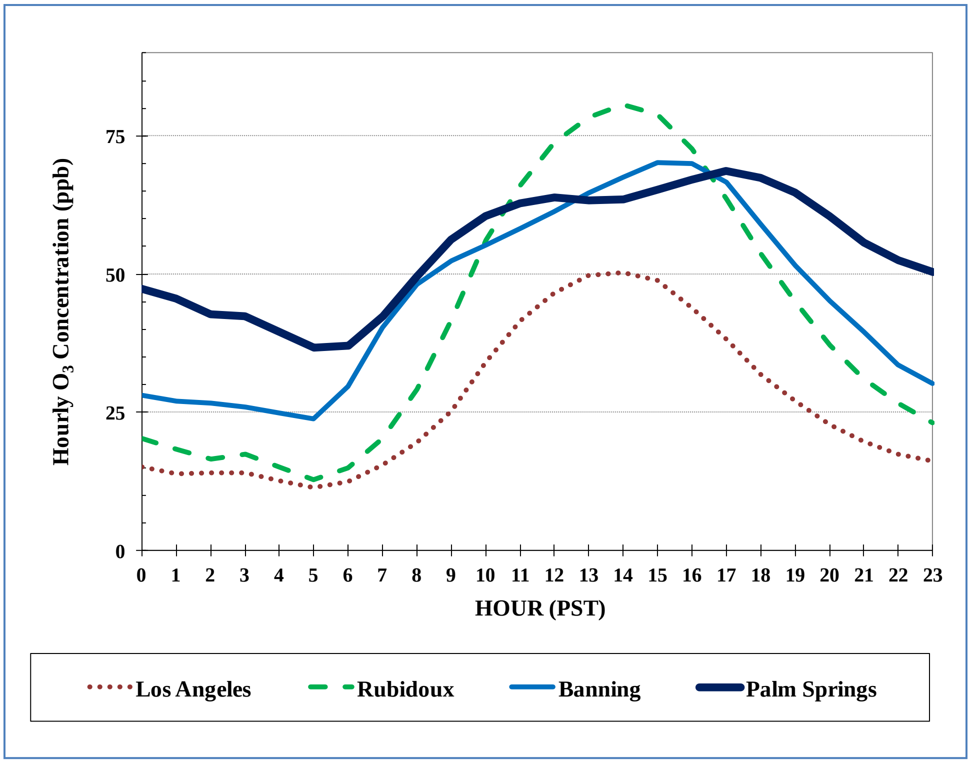


FIGURE 7-7

Diurnal Profile of 2011 Hourly Ozone Concentrations
along the Coachella Valley Transport Route

(Hours in Pacific Standard Time, Averaged for the May-October Ozone Season by Hour)

Palm Springs also exhibits an early ozone concentration increase that is not seen in the South Coast Air Basin near the main emissions source areas (i.e., Los Angeles and Rubidoux). The stations in the South Coast have more local NO_x emissions (mostly from mobile sources) to help scavenge the ozone after dark when the ozone production photochemistry ceases. The Coachella Valley has limited local NO_x emissions to help scavenge the ozone at night. This elevated overnight ozone contributes to an early morning bump in the Coachella Valley ozone concentrations, starting around 8 a.m. PST, with the ample sunlight and strong overnight temperature inversions in the desert. Ozone concentrations in this area reach an initial peak before noon and then drop slightly with increased mixing in the early afternoon, before climbing to the daily peak as the normal onshore flow reaches the Coachella Valley through the San Gorgonio Pass, transporting new ozone from the South Coast Air Basin.

Emissions Inventories

For illustrative purposes only, Table 7-3A shows base year (2008) and future-year emission inventories for the Coachella Valley, based on the AQMP inventory methodology as described in Appendix III. Emissions, in tons per day, of volatile organic compounds (VOC), oxides of nitrogen (NOx), carbon monoxide (CO), sulfur oxides (SOx), PM10, PM2.5 and ammonia (NH_3) are shown. Table 7-3B adds the Coachella Valley emissions for the Competitive Power Ventures, LLC (CPV) Sentinel power plant, as it is projected to be operational in Desert Hot Springs in 2014 and after. The corresponding inventories for the South Coast Air Basin are shown for comparison in Table 7-3C. The South Coast Air Basin emissions, typically upwind of the Coachella Valley, overwhelm the locally-generated emissions. Depending on the pollutant, emissions in the South Coast Air Basin are 10 to over 350 times greater than emissions in the Coachella Valley. It is clear that improved air quality in the Coachella Valley depends on reduced emissions in the South Coast Air Basin. This is further illustrated by the trends in ozone air quality described earlier.

TABLE 7-3A

Coachella Valley Annual Average Emissions for Base Year (2008) and Future Years

COACHELLA VALLEY EMISSIONS (TONS/DAY)							
YEAR	**VOC**	**NOx**	**CO**	**SOx**	**PM10**	**PM2.5**	**NH_3**
2008	15.60	32.27	76.13	0.14	17.13	3.92	2.55
2012	13.34	23.62	64.38	0.14	15.33	3.49	2.46
2014	13.25	21.89	60.72	0.15	17.23	3.48	2.46
2017	13.39	19.06	56.59	0.17	19.61	3.75	2.41
2019	13.38	16.73	53.66	0.18	20.97	3.86	2.38
2020	13.39	15.72	53.15	0.18	21.57	3.92	2.39
2023	14.12	13.22	52.85	0.20	23.25	4.18	2.37
2030	16.08	12.65	56.99	0.24	26.62	4.73	2.39
2035	16.24	13.15	60.01	0.27	28.17	4.90	2.40

TABLE 7-3B

Coachella Valley Annual Average Emissions for Base Year (2008) and Future Years with the CPV Sentinel Power Plant Emissions starting in 2014

COACHELLA VALLEY EMISSIONS (TONS/DAY) WITH CPV SENTINEL POWER PLANT							
YEAR	**VOC**	**NOx**	**CO**	**SOx**	**PM10**	**PM2.5**	**NH_3**
2008	15.60	32.27	76.13	0.14	17.13	3.92	2.55
2012	13.34	23.62	64.38	0.14	15.33	3.49	2.46
2014	13.37	22.28	61.26	0.17	17.43	3.68	2.46
2017	13.51	19.45	57.13	0.19	19.81	3.95	2.41
2019	13.50	17.12	54.20	0.20	21.17	4.06	2.38
2020	13.51	16.11	53.69	0.20	21.77	4.12	2.39
2023	14.24	13.61	53.39	0.22	23.45	4.38	2.37
2030	16.20	13.04	57.53	0.26	26.82	4.93	2.39
2035	16.36	13.54	60.55	0.29	28.37	5.10	2.40

TABLE 7-3C

South Coast Air Basin Annual Average Emissions for Base Year (2008) and Future Years

SOUTH COAST AIR BASIN EMISSIONS (TONS/DAY)							
Year	**VOC**	**NOx**	**CO**	**SOx**	**PM10**	**PM2.5**	**NH_3**
2008	592.71	757.25	2880.52	54.24	167.22	79.83	108.59
2012	478.92	550.00	2306.35	23.93	154.73	71.76	102.92
2014	451.11	506.22	2094.59	18.40	155.34	69.89	102.13
2017	427.43	451.63	1867.07	18.05	158.99	70.26	99.62
2019	414.70	404.93	1715.54	17.61	161.24	70.18	97.76
2020	411.66	385.03	1675.50	17.60	162.58	70.29	97.15
2023	405.85	328.14	1583.20	18.12	164.33	70.69	95.72
2030	406.72	289.27	1501.25	20.00	171.47	73.19	97.31
2035	386.80	285.84	1473.01	21.76	173.40	72.85	96.65

FUTURE AIR QUALITY

In the 2007 AQMP and the subsequent SIP submittal, the District requested that U.S. EPA redesignate the Riverside County portion of the Salton Sea Air Basin from "Serious" nonattainment to "Severe-15" and extend the attainment date of the 1997 8-hour ozone standard (80 ppb) to 2019. This Severe-15 nonattainment redesignation was approved by U.S. EPA and subsequently applied to the nonattainment designation for the new 2008 8-hour ozone standard (75 ppb), for a new attainment date of December 31, 2027. This chapter is intended to update the progress toward attainment of the current ambient air quality standards; it is not an update to the Ozone SIP attainment demonstration. A new Ozone SIP attainment demonstration for the 2008 ozone standard will be required to be submitted to U.S. EPA in 2015.

The CAA requires that ozone nonattainment areas designated as serious and above use a regional photochemical model to demonstrate attainment. To meet this requirement, the Community Multi-scale Air Quality (CMAQ) modeling system is used in this analysis for the Coachella Valley. To provide further confidence with the CMAQ model and to establish consistency with the 2007 AQMP, comparisons were also made with the Comprehensive Air Quality Model with Extensions (CAMx), with comparable results. The complete SCAQMD modeling system and its application is described in detail in Chapter 5 and Appendix V, along with base and future year results, sensitivity analyses and performance evaluations. To develop relative response factors (RRFs) to project future air quality, CMAQ was run using a full 3-month period (June, July and August of 2008; 91 days) during the peak of the ozone season. During this period, seven well-defined, multi-day high ozone episodes occurred that ranked high in terms of meteorological potential for ozone production. Of the modeled days in 2008, the 1997 8-hour federal ozone standard was exceeded on 75 days in the South Coast Air Basin and 19 days in the Coachella Valley.

The 8-hour average ozone design values (based on a 5-year weighted average as recommended in U.S. EPA modeling guidance) for the Coachella Valley air quality stations, Palm Springs and Indio, in base year 2008 were 96 ppb and 86 ppb, respectively. The baseline emissions inventory assumes no further control beyond existing rules and regulations. Between 2008 and 2019, controls are being implemented in the South Coast Air Basin to reduce emissions.

The results of the CMAQ model simulations and corresponding RRFs using the baseline emissions for 2019 project a maximum 8-hour concentration in the Coachella Valley of 84 ppb, meeting the 1997 federal ozone standard. The CMAQ simulations of the future year ozone using the baseline regional emissions indicate that the 2008 federal 8-hour ozone standard (75 ppb) will not be attained in the Coachella Valley by the 2027 attainment date. However, using the Final 2012 AQMP controlled emissions inventory, the Coachella Valley attains the 2008 federal ozone standard by 2024, in advance of the required attainment date. Further details of the future-year air quality projections in South Coast Air Basin and the Coachella Valley are presented in Appendix V.

CONCLUSIONS

With the Severe-15 ozone nonattainment designation, the Coachella Valley attainment date for the 1997 8-hour federal ozone NAAQS is in 2019. Modeling simulations of the ozone episodes indicate that the 1997 federal 8-hour standard will be attained in the Coachella Valley in 2019 with no additional emissions controls. The attainment date for the more stringent 2008 8-hour federal ozone standard is 2027. With future emissions controls in place in the South Coast Air Basin, the 2008 federal 8-hour federal ozone standard will be attained in the Coachella Valley by 2024, three years in advance of the attainment date for that standard. Future emissions reductions implemented in the South Coast Air Basin will ensure timely attainment of existing standards, and also help to achieve potentially more stringent PM2.5 and ozone standards in the future.

Chapter 8

Looking Beyond Current Requirements

South Coast Air Quality Management District

Cleaning the air that we breathe...™

CHAPTER 8

LOOKING BEYOND CURRENT REQUIREMENTS

INTRODUCTION

This Chapter presents additional analyses which are not legally required, but are presented here for informational purposes to initiate stakeholder discussion on future air quality planning and to place the 2012 AQMP in context of long-range transformation needed for this region to meet the health-based air quality standards and provide co-benefits to GHG and air toxic reductions, energy security, and mobility.

POTENTIAL CHANGES IN THE FEDERAL OZONE STANDARD

The Clean Air Act (CAA) requires U.S. EPA to periodically review the existing air quality standards in light of the findings of new and emerging epidemiological and health studies. The CAA sets up a 5-year review cycle for the national ambient air quality standards. The current cycle for ozone began in 2008, and U.S. EPA will revisit the most recent standards in 2013. The Clean Air Scientific Advisory Committee (CASAC) has already begun a new and forthcoming scientific review in preparation of the 2013 review of the ozone standards and U.S. EPA expects to propose potential revisions to the ozone standard in the fall of 2013 and finalize any revisions to the standard in 2014. Based on the previous recommendations by CASAC and the previous reviews and proposals by U.S. EPA, it is anticipated that the 8-hour ozone standard may be lowered to a level between 0.060 ppm and 0.070 ppm (60 – 70 ppb). If finalized in 2014, designations would follow in 2015, and the new attainment date (for extreme non-attainment areas such as the Basin) would be in the 2035 time frame.

IMPLICATIONS OF A NEW OZONE STANDARD FOR THE BASIN

Based on the modeling results presented in Chapter 5 and Appendix V, the Basin can demonstrate attainment with the existing federal 8-hour ozone standards by the corresponding attainment deadlines (2023 and 2032) only by using a provision of the federal CAA Section 182(e)(5) that allows credit for emissions reductions from future improvements in control techniques and technologies. The projected ozone isopleths for the average 8-hour ozone design values at Crestline monitoring station are shown in Figure 8-1 for illustration purpose. The upper right corner represents the projected VOC and NOx emissions inventory in 2023 with full implementation of all adopted control measures (baseline). Moving down and left on the figure corresponds to relative emissions reductions of NOx (down) and VOC (left). The curved lines within the figure signify the projected 8-hour ozone design value resulting from those emissions reductions.

Figure 8-1 demonstrates that in order to meet the 80 ppb ozone level in 2023, an approximate 70% reduction (30% remaining) in NO_X emissions will be necessary beyond already adopted measures. VOC reductions are not as effective as NOx reductions, but concurrent 60% VOC reductions would reduce the needed NOx reductions to about 65%. Figure 8-1 also indicates that a 75% reduction in NO_X emissions is needed to meet the 75 ppb level in 2032. A full discussion of the emissions reductions needed to meet current ozone standards is included in Chapter 5 and Appendix V.

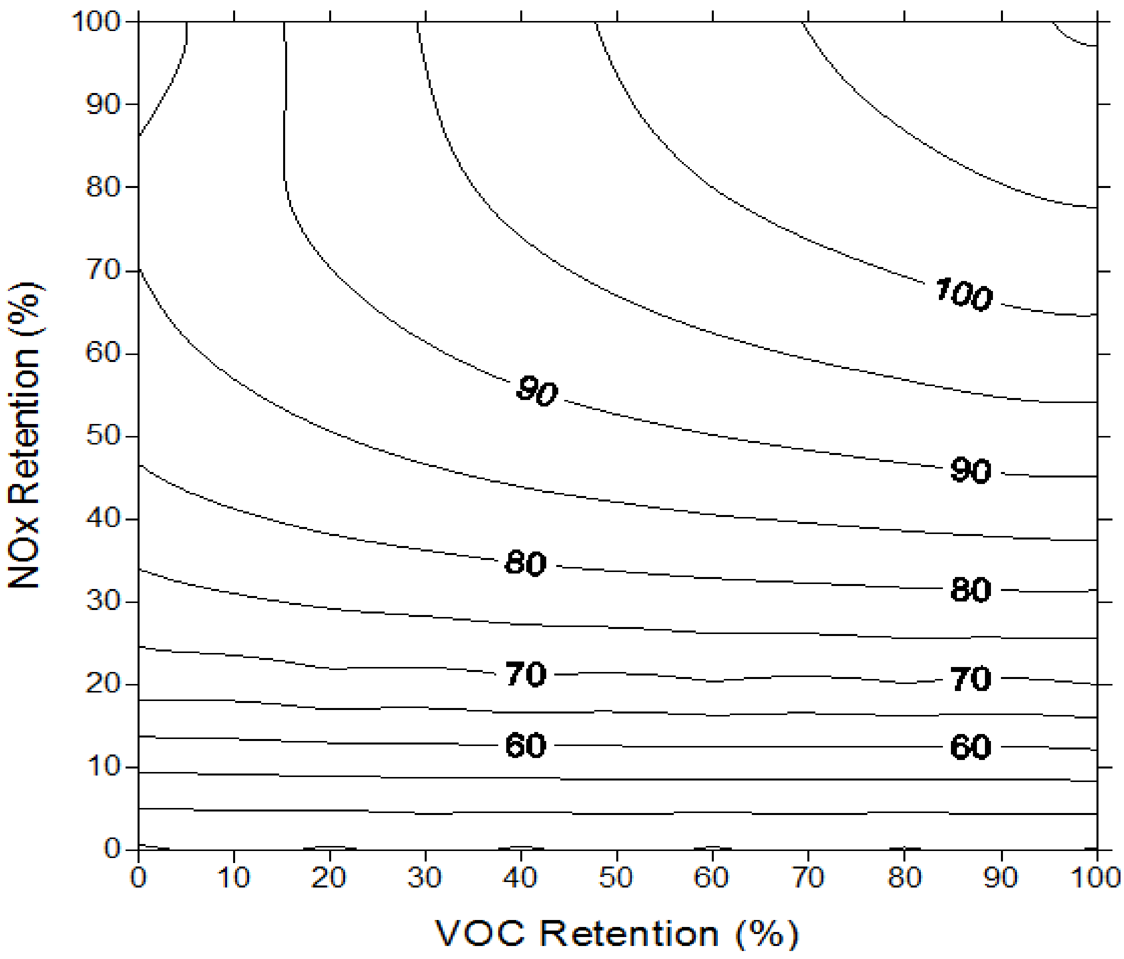


FIGURE 8-1

2023 Preliminary 8-hour Average Ozone Basin Design Value Isopleths
at Crestline Monitoring Station

As stated above, it is anticipated that the 8-hour ozone standard may be lowered to a level between 60 and 70 ppb. Therefore, in order to demonstrate attainment in the 2035 time frame, an additional 80% to 88% NO_X emissions reduction below 2023 baseline would be needed. Assuming the 75 ppb standard is met in 2032 with a 75% NOx reduction below 2023 baseline helps to illustrate the significant difference between a new 60 ppb 8-hour ozone standard and a 70 ppb standard. A 70 ppb standard represents an approximate 20% NOx reduction between 2032 and 2035, while a 60 ppb standard requires a 50% NOx reduction in that three year time span. A standard at 60 ppb is also within 12 ppb of the Basin background level of ozone, which has been estimated to be about 48 ppb by modeling the Basin with all man-made sources removed. Figure 8-1 also demonstrates that the effectiveness of NOx emission reductions continues to be most effective at these lower ozone levels. It would be the greatest air quality challenge the region has ever faced relative to achieving additional NOx emission reductions necessary to demonstrate attainment with these potential new standards and would further necessitate transformational technologies with zero or near-zero combustion emissions.

1-HOUR OZONE REQUIREMENTS

The federal 1-hour ozone standard was revoked when the 8-hour standard was established. U.S. EPA guidance indicated that while certain planning requirements remained in effect, a new SIP would not be required if an area failed to attain the standard by the attainment date. However, a recent court decision has led U.S. EPA to propose an action requiring a new 1-hour ozone attainment demonstration for the south coast Basin. The attainment demonstration would be due within 12 months of publication of the final action. The attainment demonstration would have to show attainment within 5 years with a potential 5-year extension, which would be a similar timeframe as is required for the 1997 8-hr ozone standard (deadline of 2023). However, many new technical issues such as modeling for the attainment demonstration and other CAA requirements would require U.S. EPA's guidance, since the previous preambles and guidelines are no longer directly applicable. Based on previous modeling estimates, the control strategies that are needed to attain the 8-hour ozone standard are nearly identical to those that would be needed to attain the 1-hour ozone standard.

PROPOSED CHANGES TO THE FEDERAL PARTICULATE MATTER STANDARDS

U.S. EPA revoked the annual PM10 standard of 50 $\mu g/m^3$ and lowered the 24-hour PM2.5 standard from 65 $\mu g/m^3$ to 35 $\mu g/m^3$, effective December 17, 2006. At the time, no changes were made to the existing 24-hour PM10 standard of 150 $\mu g/m^3$ and the annual PM2.5 standard of 15 $\mu g/m^3$. As part of the requirements of the CAA, every five years, U.S. EPA must review the ambient air quality standards and propose revisions, if necessary, to "protect public health with an adequate margin of safety," based on the latest, best-available, science. Under a court order, U.S. EPA was directed to propose updated standards no later than June 14, 2012. In response to that court order, U.S. EPA proposed updated national ambient air quality standards for PM2.5 on June 14, 2012. U.S. EPA and the litigants have agreed to a proposed consent decree that would require U.S. EPA to issue final standards by December 14, 2012. These proposed revisions to the PM standards also respond to a court remand of two of the existing PM2.5 standards, which were issued in 2006.

The CAA requires U.S. EPA to set two types of outdoor air quality standards: primary standards, meant to protect public health, and secondary ambient air quality standards, meant to protect the public against adverse environmental effects. When setting air quality standards, the air quality statistics used to determine if an area meets the standard must also be specified. This is known as the "form" of the standard.

The new PM NAAQS rule proposed on June 14, 2012 includes the following:

- **Annual PM2.5 standard:** The proposed rule will strengthen the annual PM2.5 standard by lowering the level from 15 $\mu g/m^3$ to a level within the range of 12 $\mu g/m^3$ to 13 $\mu g/m^3$. U.S. EPA is also seeking comment and input on alternative levels for the annual PM2.5 standard, down to 11 $\mu g/m^3$. The form of the standard would be unchanged and would be based on the three-year average of an area's annual average PM2.5 concentrations. The current annual PM2.5 standard has been in place since 1997.

- **24-hour PM2.5 standard:** U.S. EPA is proposing to retain the existing standard of 35 $\mu g/m^3$ and the current form of the standard, which continues to be based on the 98th percentile of 24-hour PM2.5 concentrations measured in a year (averaged over three years) at the monitoring site with the highest measured values in an area. The current 24-hour PM2.5 standard has been in place since 2006.

- **24-hour PM10 standard:** U.S. EPA is proposing to retain the existing standard of 150 $\mu g/m^3$ and the current form of the standard, which continues to be based on the maximum concentrations measured in a year (averaged over three years) at the monitoring site with the highest measured values in an area. The current 24-hour PM10 standard has been in place since 1987.

Particle pollution causes haze and visibility degradation in cities and some of the country's national parks. Additionally, nitrate and sulfate particles can contribute to acid rain formation, which affects the acidity in water bodies, streams, and rivers, impacting the flora and fauna which rely on those waters for survival. Currently, the secondary PM10 and PM2.5 standards are the same as the primary PM10 and PM2.5 standards, respectively. For secondary standards, the proposed rule includes the following:

- **<u>24-hour PM2.5 secondary standard:</u>** U.S. EPA is proposing to add a 24-hour secondary standard for PM2.5 to protect visibility in urban areas. This standard would be measured in "deciviews", similar to what is used in the U.S. EPA's Regional Haze Program. Two alternative levels are being proposed – 30 deciviews and 28 deciviews. The U.S. EPA would calculate a "visibility index" value, using data from fine particle samples that have been analyzed to determine their chemical composition, along with information on the relative humidity of the area. The form of the standard would be the three year average of the 90th percentile of 24-hour visibility index values in one year. U.S. EPA is also seeking additional comment and input on an alternative level, down to 25 deciviews, along with comments on alternate averaging times.

- **<u>Retention of all other secondary standards:</u>** U.S. EPA is proposing to retain all other secondary standards such that they are identical to the primary standards, as discussed previously.

In addition to these revisions, U.S. EPA is also proposing to revise the public air quality reporting convention, the Air Quality Index (AQI), for PM2.5 by setting the 100 value of the index at the level of the current 24-hour PM2.5 standard, which is 35 $\mu g/m^3$.

Fine particles come from a variety of sources, including vehicles, and are also formed when emissions from vehicles and other sources undergo atmospheric reactions. U.S. EPA has proposed changes to the PM2.5 monitoring requirements by including for the first time a requirement for PM2.5 monitoring along heavily traveled roadways in large urban areas. The required monitors, to be located at near-road monitoring sites measuring nitrogen dioxide and carbon monoxide, would have to be operational no later than January 1, 2015.

U.S. EPA anticipates making attainment/nonattainment designations of the new annual PM2.5 standard by December 2014, with those designations likely becoming effective in early 2015. States would have until 2020 to meet the new PM2.5 NAAQS, with up to a 5-year extension to 2025.

IMPLICATIONS OF THE PROPOSED NEW PM2.5 STANDARDS FOR THE BASIN

As presented above, U.S. EPA's proposed rule would strengthen the annual PM2.5 standard by lowering the level from 15 $\mu g/m^3$ to a level within the range of 12 $\mu g/m^3$ to 13 $\mu g/m^3$. Based on the baseline modeling performed in Chapter 5, it is projected that the annual PM2.5 design value in 2023 will be 13.0 $\mu g/m^3$ and will occur at the Mira Loma air monitoring station. Thus, the Basin should be able to demonstrate attainment with a 13 $\mu g/m^3$ NAAQS with already adopted control measures by 2023. With the proposed measures in the Final 2012 AQMP, it may be possible to advance attainment to an earlier date. While the proposed episodic measures are designed to address the 24-hour PM2.5 standard, they will also help to achieve annual standards. Alternatively, if the standard is set lower at 12 $\mu g/m^3$, additional controls may be necessary to demonstrate attainment with the standard by 2025. Whether additional emissions reductions are needed to demonstrate attainment with the potential new primary annual PM2.5 NAAQS will depend largely on the level of the standard and other factors, such as economic growth or unfavorable weather. It should also be noted NOx controls needed for attainment of the 8-hr ozone standard of 80 ppb by 2023 will assist in the attainment of the annual PM2.5 standard by 2025 or sooner.

The status of the Basin with regard to the proposed secondary visibility standard cannot be fully assessed until additional implementation guidance is provided by U.S. EPA.

Chapter 9

Near Roadway Exposure and Ultrafine Particles

South Coast Air Quality Management District

Cleaning the air that we breathe...™

South Coast AQMD

CHAPTER 9

NEAR ROADWAY EXPOSURE AND ULTRAFINE PARTICLES

INTRODUCTION

There is growing concern about the potential health effects as caused by exposure for people living near major roadways to criteria pollutants and air toxics emitted from both gasoline and diesel vehicles (HEI, 2010). Recent toxicological and epidemiological studies have identified living near major roadways as a risk factor for respiratory and cardiovascular problems and other health related issues including: asthma and allergic diseases, reduced lung function and growth, low birth weight and pre-term newborns, lung cancer and premature death (Brugge et al., 2007; Kan et al., 2008; Balmes et al., 2009; Jerrett et al., 2009; Andersen et al., 2010; Hoek et al., 2010).

Motor-vehicle emissions consist of a complex mixture of particulate and gaseous pollutants such as fine particulate matter (PM2.5; particles with a diameter less than 2.5 µm), ultrafine particles (UFPs; diameter < 0.1 µm), metals, organic material, black carbon (BC), volatile organic compounds (VOC), nitrogen oxides (NOx; mostly NO and NO_2) and carbon monoxide (CO). While PM2.5 and NO_2 are currently regulated as criteria pollutants, UFPs have been shown to be toxic and have health impacts, but are not specifically regulated.

In 1998, the California Air Resources Board (CARB) classified diesel exhaust PM as a toxic air contaminant, citing its potential to cause cancer and other health problems. The U.S. EPA concluded that long-term exposure to diesel engine exhaust is likely to pose a lung cancer hazard to humans and can also contribute to other acute and chronic health effects.[1] The International Agency for Research on Cancer (IARC), part of the World Health Organization, recently classified diesel exhaust as a human carcinogen (Benbrahim-Tallaa et al., 2012). A recent study conducted by the District suggested that exposure to diesel PM is the major contributor to the remaining air toxics cancer risk in the South Coast Air Basin (Basin), accounting on average for about 84% of the carcinogenic risk attributable to air pollutants (MATES III; AQMD, 2008).[2]

While substantial effort has been made to characterize the health risks associated with exposure to diesel PM, information about the health impacts of UFPs is just now

[1] http://www.epa.gov/ttn/atw/dieselfinal.pdf

[2] http://www.aqmd.gov/prdas/matesIII/matesIII.html

emerging. These very minute particles (consisting primarily of organic material, soot, and trace elements) have a different chemical composition than the larger PM fractions (PM2.5 and PM_{10}). Due to their small size, UFPs can penetrate deeply into the human respiratory tract, into the blood stream, and be transported to other critical organs such as the heart and brain. Furthermore, their large surface area may provide a mechanism for delivering potentially toxic adsorbed material into the lung and other organs. This penetration capability is suspected to have human health implications because UFPs' toxic components may initiate or facilitate biological processes that may lead to adverse effects to the heart, lung, and other organs (HEI, 2010).

UFPs are emitted from almost every fuel combustion process, including diesel, gasoline, and jet engines, as well as external combustion processes such as wood burning. Consequently, there is growing concern that people living in close proximity to highly trafficked roadways and other sources of combustion-related pollutants (e.g. airports and rail yards) may be exposed to significant levels of UFPs and other air toxics.

Over the last decade, substantial efforts have been made to better characterize the physical and chemical properties of UFPs and their potential impact on people living in close proximity to roadways and other emissions sources. Two areas of research have received particular attention:

- <u>On-roadways, near-roadways, and in-vehicle measurements</u>: UFP emissions from motor vehicles are not static after leaving the tailpipe and undergo physical transformation and chemical reactions in the atmosphere as they are transported away from the source. In order to study the dynamic nature of UFP formation, evolution and transport, as well as their physical and chemical properties, and human exposure, UFP measurements have been taken at the tailpipe, at different distances from the edge of roadways, and inside vehicles.

- <u>Effect of UFP reduction technologies</u>: As modern engines and emissions controls continue to evolve, the mass of combustion-related PM has been dramatically reduced through sophisticated control of combustion conditions, introduction of ultra low sulfur diesel fuel, and the application of after-treatment control technologies such as diesel particulate filters (DPFs). In some cases, emission controls designed for PM mass have facilitated the formation of a greater number of UFPs. However, properly designed emission control technologies can limit the formation and emission of UFP as well as PM mass.

From a regulatory perspective, the U.S. focus has been on reducing the mass of PM emitted in the ambient air. However, UFPs contribute a very small portion of the overall atmospheric particle mass concentration. Thus, there has been growing interest over the last two decades to study, understand, and regulate the size and number of particles found in PM generated from diesel and other combustion engines. Partly because light-duty diesel vehicles are very common in European countries, the European Union has already adopted standards that phase in particle number limits for passenger car and light-duty vehicle emissions. However, there are still concerns related to the health impacts of non-solid organic UFP components that are not addressed by the European solid particle number standard.

Recently, CARB staff prepared a preliminary discussion paper on proposed amendments to California's Low-Emission Vehicle (LEV III) Regulations, to address UFP emissions from light-duty motor vehicles by promoting a solid particle number based PM compliance strategy (CARB, 2010)[3]. CARB staff ultimately decided that the complexity of the issues warranted further study and understanding before proceeding. Although the District has limited authority to regulate mobile source pollution in the near-roadway environment, District staff has implemented a variety of measures to assess and reduce the health impacts of near-roadway emissions on local communities. The District continues to demonstrate and incentivize the deployment of zero/near-zero emission technology, has implemented numerous installations of high-efficiency air filtration in schools, and conducts outreach and education on near-roadway health impacts. Furthermore, on July 1, 2012 the District began the next Multiple Air Toxics Exposure Study (MATES IV) to characterize the carcinogenic risk from exposure to air toxics in the Basin. A new focus of MATES IV will be the inclusion of measurements of UFP and BC concentrations across the Basin, and near specific combustion sources (e.g. airports, freeways, rail yards, busy intersections, and warehouse operations) to evaluate the long- and short-term exposures to these pollutants.

This chapter of the AQMP first presents background information on UFPs and other important air pollutants emitted from motor vehicles. Next, recent results from ambient measurement studies conducted near traffic sources, on roadways, and inside vehicles are reviewed, followed by an explanation of the current state of knowledge

[3] http://www.arb.ca.gov/msprog/levprog/leviii/meetings/051810/pm_disc_paper-v6.pdf

on the health effects caused by UFPs and near-roadway exposure to pollutants. Finally, potential control, mitigation, and policy strategies for limiting such exposures are discussed with recommendations for future actions to address this emerging and important topic.

ULTRAFINE PARTICLES

Formation and Transport

UFPs are emitted from both natural and anthropogenic sources, although in most urban environments vehicular fossil fuel combustion constitutes the major contributing source. The terms UFPs and nanoparticles (NP; diameter < 0.05 µm) are often used interchangeably, and the definitions of each generally vary with the study or application. While PM2.5 dominates the mass distribution of atmospheric particles, UFPs account for about 90% of the total particle number (Stanier et al., 2004a and Zhang et al., 2004). For this reason, their concentration is usually expressed in terms of total particle count (i.e. # per cubic centimeter of sampled air, or $\#/cm^3$), even though a small fraction of the particles being counted may be above 100 nm.

In the late 1990s, pioneering research by the University of Minnesota (Kittelson, 1998) made significant new progress by identifying three size categories for particles found in diesel engine emissions: 1) coarse mode (1 µm < d < 10 µm), 2) accumulation mode (~ 0.05 µm < d < 1 µm), and 3) nuclei mode (d < 0.05 µm). As shown in Figure 9-1, UFPs (d < 0.1 µm) and NPs in particular dominate the total number concentration (blue line).

Today we know that, typically, three UFP size modes appear in the exhaust of motor vehicles:

- Narrow nucleation mode at around 10 nm that corresponds to nucleated particles that have grown by condensation of gaseous precursors. It is mostly comprised of sulfate particles and semi-volatile organic compounds (SVOCs).

- Larger nucleation mode at around 20 to 30 nm which also contains sulfate particles and SVOCs.

- Accumulation mode at around 60 nm that results from the combustion process and that mostly includes soot and non-volatile organic compounds, but also sulfate and SVOCs. This mode is primarily associated with diesel exhaust.

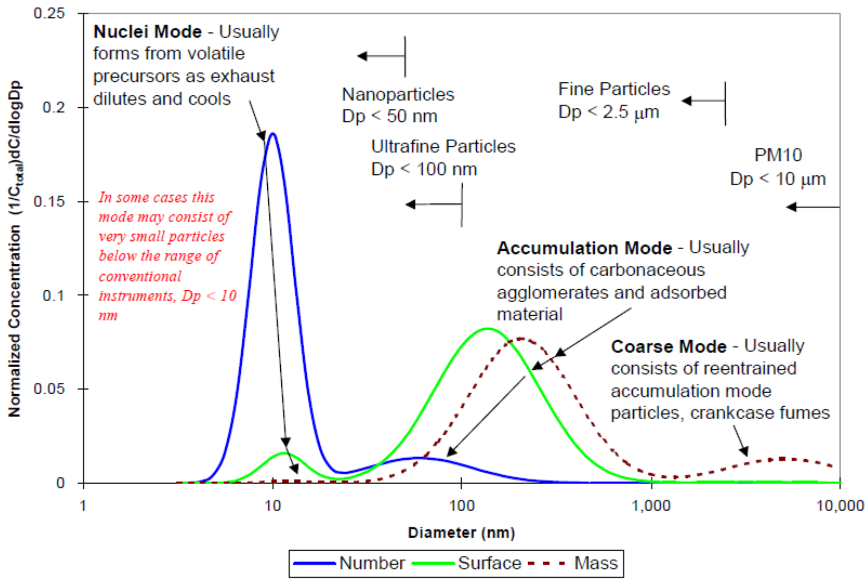


FIGURE 9-1

Typical Particle Size Distribution for Uncontrolled Diesel Emissions (Kittelson, 1998)

Particles from motor vehicle emissions can be divided into two broad categories, depending on the location of their formation:

- Primary combustion particles: formed in the engine or tailpipe, they are mostly sub-micrometer agglomerates of solid phase carbonaceous material ranging in size from 30 to 500 nm. These particles may also contain metallic ash (from lubricating oil additives and from engine wear), adsorbed or condensed hydrocarbons, and sulfur compounds (Morawska et al., 2008).

- Near-tailpipe UFPs: as the hot exhaust gases are expelled from the tailpipe, they quickly cool and condense on existing particles or nucleate to form large numbers of very small particles in the air. They consist mainly of hydrocarbons and hydrated sulfuric acid, are generally 30 nm or less in diameter and are most commonly observed near busy freeways, especially those where a large fraction of heavy-duty diesel vehicles is present (Westerdahl et al., 2005; Ntziachristos et al., 2007; eskinen and Ronkko, 2010). These particles are formed very quickly and are distinct from UFPs derived from photochemical nucleation processes occurring in the atmosphere further away from the source (Stanier et al., 2004b).

Once released into the atmosphere, UFPs undergo dilution with ambient air and are subject to chemical reactions and physical processes such as evaporation, condensation, and coagulation. Thus, particles measured away from roadways and other emission sources generally have different characteristics than those measured immediately after formation. Wind speed and direction, precipitation, relative humidity, and temperature are the main meteorological factors affecting UFP transport.

Ambient Diurnal and Seasonal Variations

In ambient urban environments, strong diurnal variations in UFP concentration have been reported in many studies and shown to closely follow the temporal variation in traffic density, with the highest levels observed on weekdays during rush hours (Hussein et al., 2004; Morawska et al., 2008; AQMD, 2012)[4]. Typically, weekdays are characterized by two peaks in UFPs, one early in the morning and another in the afternoon coinciding with traffic rush hours. A wider mid-day peak is usually observed on weekends. Photochemical particle formation also contributes to increasing the afternoon number concentration of UFPs, especially in the summer.

Several meteorological factors contribute to the seasonal variability in the concentration of atmospheric PM and UFPs; these include:

- Lower mixing layer height and greater atmospheric stability in winter, which tend to increase particle levels by not allowing for vertical mixing in the atmosphere.
- Lower winter temperature, which leads to increased nucleation of volatile combustion products, particularly during morning rush hours.
- Higher photochemical activity in the summer, which favors photochemical particle formation.

It should be noted that the effects of these meteorological factors on particle concentration are more pronounced in areas where there are significant meteorological differences between seasons. Pirjola et al. (2006) and Virtanen et al. (2006) showed that the average UFP concentrations in winter in Finland were 2–3 times higher than in the summer, with the highest values observed in February. The highest and lowest monthly average UFP concentrations in Pittsburgh (U.S.A.) reported by Zhang et al. (2004) were measured in December and July, respectively.

[4] http://www.aqmd.gov/tao/AQ-Reports/I710Fwy_Study.pdf

In the wintertime most of the factors leading to an increase in particle concentration tend to occur early in the morning (i.e. rush hour traffic, low mixing height, low wind speed and temperature). Summer minima are usually associated with increased ambient temperature (which does not favor the nucleation process), although increased photochemical activity can lead to new UFP formation.

Concentration Levels in Different Environments

Morawska et al. (2008) compared particle concentration levels reported for different environments including: road tunnel, on-road, road-side, street canyon, urban, urban background, rural, and clean background (Figure 9-2). The mean and median values for each category were calculated using available literature data and are shown below to illustrate the typical atmospheric variability in UFP number concentration measurements.

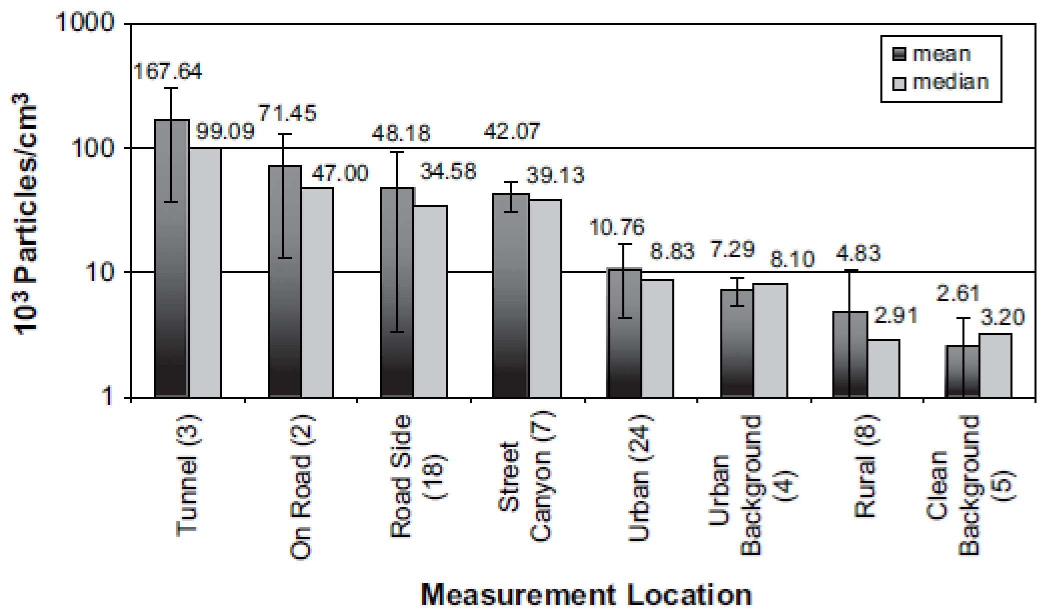


FIGURE 9-2

Mean and Median Particle Number Concentrations for Different Environments

In brackets are the numbers of sites for each environment used to calculate the mean and median UFP values. Vertical lines represent standard deviations (from Morawska et al., 2008)

Substantially higher peak particle number levels are expected in each environment over shorter time periods (e.g. seconds to minutes), and in close proximity to specific sources such as roadways and airports. For example, in a recent study conducted by the District near the Santa Monica Airport (SMO; a general aviation airport), 1-min average UFP levels as high as 2,600,000 #/cm3 were measured 35 m downwind of the runway during jet aircraft take-off (AQMD, 2011)5. One-minute maxima between 1,500,000 and 2,000,000 #/cm3 (also associated with jet aircraft departures) were observed 100 m downwind of the runway in the backyard of a local residence.

Chemical Composition

Comprehensive knowledge of the chemical composition of UFPs in ambient air is still not available, mostly because of the small amount of mass available for analysis, and because most studies have been conducted using different measurement protocols, sampled particles in different size ranges, and focused on different aspects of their chemical composition (Morawska et al., 2008). However, it is known that engine emissions include sulfur dioxide (SO_2) or sulfur trioxide (SO_3) and NOx, and that nucleation of these gaseous species into sulfate and nitrate particles is an important mechanism for increasing particle formation near traffic sites.

A few studies have investigated the composition of UFPs in urban environments. Kuhn et al. (2005) showed that UFP samples collected in downtown Pittsburgh were mostly comprised of organic matter (45 to 55% by weight) and salts of ammonium and sulfate (35 to 40%). In a study conducted at two Los Angeles sites (urban and inland), Sardar et al. (2005) found that organic carbon (OC; the amount of carbon present in the collected organic material) ranged from 32 to 69% (by weight), elemental carbon (EC; an indicator of diesel PM and closely related to BC) from 1 to 34%, sulfate from 0 to 24% and nitrate from 0 to 4%. In these and other cases, organic material was found to comprise the larger fraction of UFP by mass especially in the summer, when photochemical formation of organic aerosol is higher. UFP chemistry, including elemental composition, was investigated by Pakkanen et al. (2001) at two sites (urban and rural) in Helsinki (Finland). The most important trace elements at both sites were Ca, Na, Fe, K and Zn (present in higher concentrations), and Ni, V, Cu, and Pb (“heavy metals”). These measured species accounted for less than 1% of the total UFP mass and their presence was probably related to local combustion sources, possibly traffic exhaust, and combustion of heavy fuel oil. Overall, the

[5] http://www.aqmd.gov/tao/AQ-Reports/Supplement_GA_Report.pdf

chemical composition of UFPs differs significantly from place to place and depends on the types of local sources and their relative contributions.

Measurement Methods

A basic knowledge of the instruments used for monitoring UFPs is critical as the resulting measurements are dependent on the method and measurement principle used. Since there is no “standard” measurement technique or calibration standard by which different instruments can be evaluated and compared, UFP measurements are somewhat operationally defined. Below is a list of the most common instruments that have been used to monitor the mass and number concentration and size distribution of UFPs in the atmosphere and in exhaust streams. For a more comprehensive discussion on the issues associated with measuring UFPs see Maricq and Maldonado (2010) and Robinson et al. (2010).

- Condensation Particle Counter (CPC): it provides the total number concentration of particles above a lower size limit (~3 -20 nm, depending on make and model) in real-time. UFPs are grown through condensation in a controlled super-saturation environment to larger sizes and then measured (counted) using a photodetector. Alcohol or water are usually used as condensing liquids. Although CPCs are the most widely used instruments in most applications, they do not provide any information on the original size of the particles counted.

- Scanning Mobility Particle Sizer (SMPS): particle counters can also be used in conjunction with electrostatic classifiers (used to separate airborne particles according to their size) to characterize the particle size distribution of UFPs. Typically, SMPSs provide size distribution data in almost real-time for particles as small as 10 nm.

- Electrical Low-Pressure Impactors (ELPI): this instrument provides real-time number weighted size distributions in the particle diameter range of 30 to 10,000 nm. ELPIs are very sensitive instruments and measure ambient aerosol concentrations and size distributions. They can be used to measure particle charge distribution in real-time, and also allow for particle collection and direct mass measurements.

- Engine Exhaust Particle Sizer (EEPS): it measures particle size distributions in real time and covers a range from ~3 to 500 nm. It was designed specifically to measure particles emitted from internal combustion engines and motor vehicles, but newer versions are designed for ambient applications. Its fast response (e.g. ~10 Hz data collection) allows for the measurement of transient signals, but also tracks well with the CPC concentrations and SMPS size distributions.

- Micro Orifice Uniform Deposition Impactor (MOUDI): it provides integrated mass-based size distribution measurements covering particle sizes from ~56 to10000 nm. Nano MOUDIs are used for smaller particle size ranges (i.e. ~ 10 to 56 nm). Particle samples collected using a MOUDI can also be analyzed for chemical composition in the lab.

Most of the instruments outlined above have been used in engine/vehicle emission testing. Ambient air monitoring of UFPs is also performed using some of the same instrumentation, especially CPCs and SMPSs. It should be noted that different make/model CPCs are characterized by different particle size ranges, sampling flow rates, optical detection techniques, and other instrumental characteristics and, thus, they may provide significantly different results. Therefore, UFP number measurements from different studies should be compared with caution. The District has worked in collaboration with the University of California, Los Angeles (UCLA), CARB, and with various CPC manufacturers to study intra- and inter-model variations in total number concentration measurements taken with several CPC units (Lee et al., submitted).

OTHER NEAR-ROADWAY POLLUTANTS

The majority of air monitoring studies conducted near- and on-roadways in the past decade has focused not only on the measurements of UFPs, but also on the emissions of more traditional and well-studied pollutants. These include:

- Carbon monoxide (CO): ambient concentrations of this pollutant have declined through the adoption of emission control technologies and regulations. However, motor vehicles (especially light-duty, gasoline-powered vehicles) remain the primary source of CO at most locations.

- Oxides of nitrogen (NOx): although all motor vehicles emit NOx, the majority of current on-road NOx emissions occur from diesel vehicles. In terms of primary emissions, the majority of NOx exhaust is in the form of NO. NO_2 is the focus of concern in terms of health effects and quickly forms by a photochemical reaction from the oxidation of NO. Primary NOx emissions from heavy-duty diesel engines with after-treatment devices may contain a greater percentage of NO_2 relative to NO.

- Particulate matter (PM): suspended particles are generally divided in UFP (already discussed), PM2.5 and PM_{10}. Significant near-roadway sources of PM mass include direct emissions from motor vehicle combustion (mostly PM2.5), brake and tire wear, and re-suspension of dust from the road surface (mostly PM_{10} and larger). The atmospheric concentration of PM2.5 is mostly affected by contributions from regional sources, and the impact of direct emissions from motor vehicles is generally small in near-roadway environments.

- Volatile organic compounds (VOCs) and carbonyls: these gaseous air toxics are emitted from both natural and anthropogenic sources (including motor vehicles), are involved in the photochemical formation of atmospheric O_3, and some of them have been associated with both short- and long-term toxic health effects. Typical VOCs of concern for near-road monitoring include benzene, toluene, ethylbenzene, xylenes, styrene, formaldehyde, acetaldehyde, and acrolein, all of which are also toxic air contaminants.

- Black (or elemental) carbon (BC or EC): often referred to as "soot," BC (or EC) is a common constituent emitted from motor vehicles. Both BC and EC are operationally defined and represent the black, graphitic-containing portion of PM. Although BC and EC are often associated with emissions from heavy-duty diesel engines, a portion of all motor vehicle combustion emissions contains these constituents. A recent study conducted by Liggio et al. (2012) has shown that BC emissions from light-duty-gasoline-vehicles may be at least a factor of 2 to 9 times higher than previously thought. Other sources of BC exist in urban areas, but emissions from motor vehicles, primarily diesel trucks, usually dominate these sources in near-roadway environments.

Most near-road studies showed good correlation among the pollutants listed above (with the exception of PM2.5, whose atmospheric concentration is mostly influenced by regional sources), indicating a common traffic origin (Zhu et al., 2002a,b; Sardar et al., 2005; Hagler et al., 2010). In particular, BC is often very well correlated with UFP concentrations in urban air, given that both are emitted from motor vehicles and the larger relative BC content found in the ultrafine particle size range.

AMBIENT MEASUREMENTS

Near-Roadway Studies

The majority of all near-roadway studies conducted to date have focused on the influence of proximity to roadways on outdoor (residential) and indoor exposure to air pollutants. In virtually all of these works, it was found that the outdoor concentrations of primary pollutants emitted from motor-vehicle emissions (UFP and BC in particular) were more strongly correlated with distance from roadways than the outdoor concentrations of species dominated by atmospheric formation or other regional sources (e.g. PM2.5). Measured concentrations of these primary pollutants were typically highest in close proximity to a roadway and decreased exponentially with increasing distance from (and downwind of) the source. In a study conducted in the Los Angeles area in the daytime, Zhu et al. (2002a) found that the concentrations of CO, BC, and UFPs were highest in the immediate vicinity (17 m) of the I-710 (a freeway highly influenced by heavy-duty diesel trucks), and decreased exponentially to upwind background levels after about 300 m (Figure 9-3a). A companion study was carried out next to the I-405 freeway (dominated by gasoline vehicle traffic) with similar results (Zhu et al. 2002b) (Figure 9-3b).[6] As discussed earlier, the dynamic pollutant mix evolves during transport from the road: nucleation leads to formation of new particles very soon after emission, followed by their growth by condensation, diffusion to surfaces, evaporation and coagulation. Therefore, at the edge of a roadway, particle concentrations are dominated by the smallest particles (in the 6-10 nm range), with the peak in distribution shifting to the larger sizes at greater distances.

[6] For each air pollutant, upwind and downwind concentrations were normalized to the highest level measured at the edge of the freeway and expressed as relative values (i.e. 0 to 1)

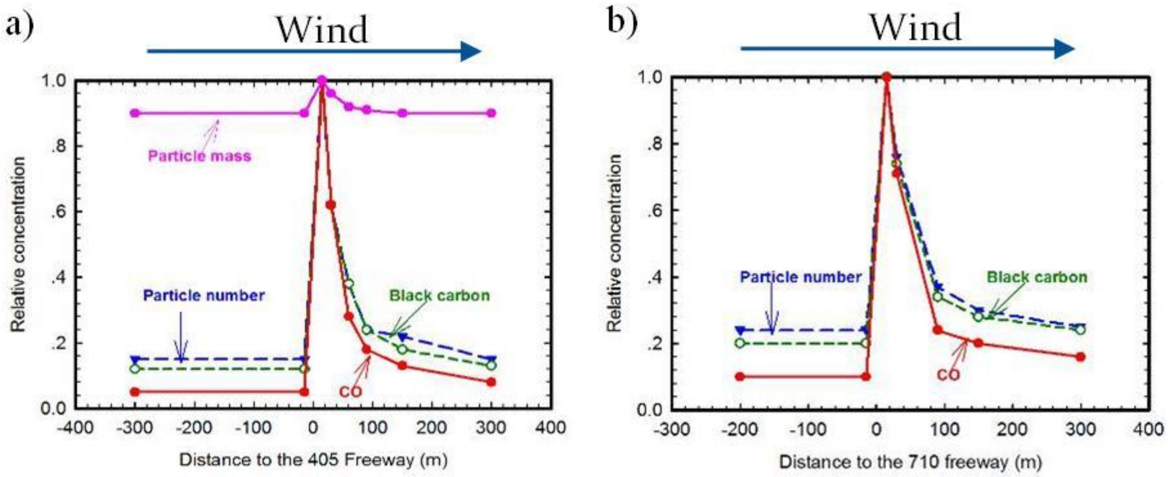


FIGURE 9-3

Relative Black Carbon (BC), Carbon Monoxide (CO), Particle Number (a surrogate for ultrafine particles or UFP), and Particle Mass (PM2.5) Concentrations Upwind and Downwind of the I-405 (a) and I-710 (b) Freeways (from Zhu et al., 2002a; 2002b).

Note that PM2.5 was not measured at the I-710.

Measurements conducted in communities adjacent to the Ports of Los Angeles and Long Beach revealed that concentrations of UFP, BC, and NO_2 (mostly from heavy-duty diesel trucks) were frequently elevated two to five times within 150 m downwind of freeways (compared to more than 150 m) and up to two times within 150 m downwind of arterial roads with significant amounts of diesel traffic (Kozawa et al. 2009). In the winter and summer of 2009 the District conducted an intensive study in the vicinity of the I-710 to characterize the spatial and temporal variations of motor vehicle emissions, and their potential impact on the surrounding communities (AQMD, 2012)[7]. Emissions 15 m downwind of the freeway were found to be enriched in BC, UFP, and NO_x, combustion pollutants emitted directly from gasoline and, especially, diesel vehicles. The atmospheric concentration of PM2.5 mass and VOCs was not as heavily impacted by proximity to the I-710.

During a recent daytime study conducted in New York City before, during, and after vehicle traffic was excluded from a major street (Park. Ave.), Whitlow et al. (2011)

[7] http://www.aqmd.gov/tao/AQ-Reports/I710Fwy_Study.pdf

showed that the curbside airborne PM2.5 level always peaked in the morning regardless of traffic conditions, while UFP number concentration was 58% lower during mornings without traffic. Furthermore, UFP count varied linearly with traffic flow, while PM2.5 spiked sharply in response to random traffic events that were weakly correlated with the traffic signal cycle. As expected, UFP concentrations decayed exponentially with distance from the street with unrestricted traffic flow, reaching background levels within 100 m of the source. It is likely that background concentrations of most motor vehicle related pollutants in large urban areas like New York City are more elevated than those found elsewhere.

Karner et al., (2010) summarized data reported in 41 roadside monitoring studies (all conducted during daytime) and found that almost all combustion-related pollutants decay to background by 115-570 m from the edge of road. Changes in pollutant concentrations with increasing distance from the road fell into one of three groups: 1) at least a 50% decrease in peak/edge-of-road concentration by 150 m, followed by consistent but gradual decay toward background (e.g. CO and UFP); 2) consistent decay or change over the entire distance range (e.g. benzene and NO_2); and 3) little or no trend with distance (e.g. PM2.5 mass concentrations).

It should be noted that nighttime conditions can lengthen the distance at which near-road pollutant concentrations decay to background. For instance, Hu et al. (2009) observed a wider area of air pollutant impact downwind of the I-10 freeway during pre-sunrise hours. In particular, UFP concentrations peaked immediately downwind of the I-10 and reached background levels only after a distance of about 2600 m (Figure 9-4).[8] Other combustion related pollutants, such as NO and particle-bound polycyclic aromatic hydrocarbons (p-PAHs), exhibited similar long-distance downwind concentration gradients. The authors associated these elevated pre-sunrise concentrations over a wide area with a nocturnal surface temperature inversion, low wind speeds, and high relative humidity. It should be noted that, occasionally, nighttime near-road UFP number concentrations exceeded daytime conditions, despite reduced traffic volumes.

Further work is needed to integrate daytime and nighttime findings and to assess their relative importance given daytime and nighttime differences in traffic activity, near-road pollutant concentrations, and factors affecting human exposure.

---

[8] Upwind and downwind UFP concentrations were normalized to the highest level measured at the edge of the freeway and expressed as relative values (i.e. 0 to 1)

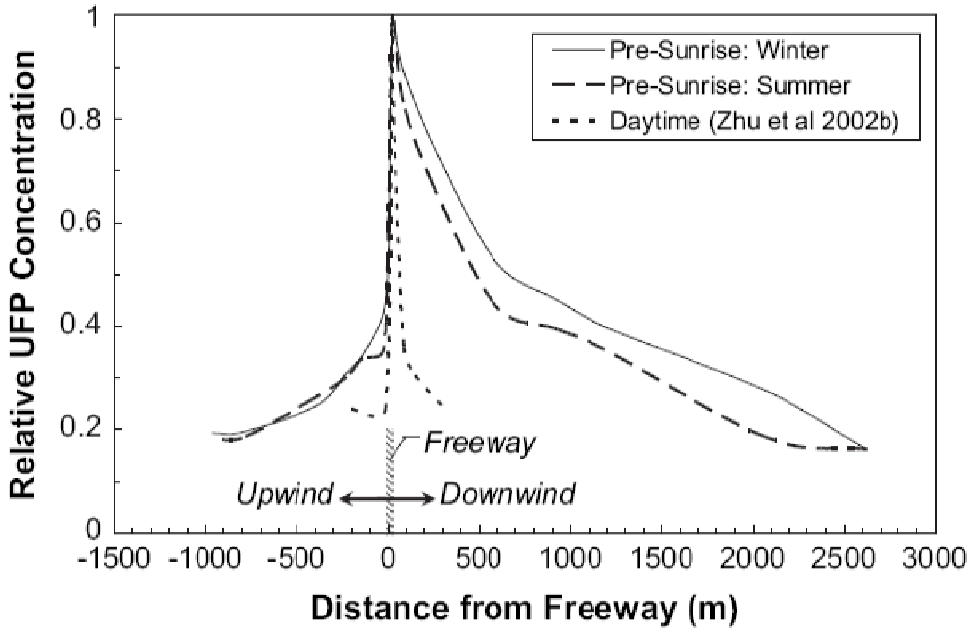


FIGURE 9-4

Relative Averaged UFP Concentrations and Gradients During Pre-sunrise Hours along the I-10 (Hu et al., 2009) and the I-710 Freeways (Zhu et al., 2002b)

In the last few years, new powerful instruments have been developed to characterize the physical and chemical characteristics of freshly emitted aerosols in real time. For example, Sun et al. (2012) used a High-Resolution Time-of-Flight Aerosol Mass Spectrometer to study the mass concentrations and chemical composition of sub-micron aerosol species (PM_1) in the vicinity (30 m) of a major highway in New York City. The mass spectrometer data (taken at 1-min time resolution) was complemented by rapid measurements (down to 1 Hz) of particle number concentrations and size distributions. Overall, hydrocarbon-like organic (HOA) species dominated the composition of traffic-related PM_1 especially during periods of high traffic intensity. Significant enhancements in ultrafine organic aerosol mass and particle number concentrations were frequently observed in traffic plumes, suggesting that UFPs are dominated by HOA species from vehicle emissions near highways.

On-road Studies and In-Vehicle Exposure

Several studies have found that, while commuting, individuals are exposed to air toxic levels that are several times higher than the corresponding ambient concentrations measured at fixed near-roadway monitoring sites. Most of these on-road studies have been conducted using zero-emissions mobile platforms outfitted with real-time instruments to spatially characterize particle and gaseous pollutant concentrations. Fujita et al. (2003) found that concentrations of BC and NOx in Harbor communities of Wilmington, West Long Beach, and San Pedro (California) were about ten times higher on roadways than at regional air monitoring sites. Similarly, Westerdahl et al. (2005) showed that concentrations of UFP, NO, BC and CO on Los Angeles freeways were often ten times higher than those on residential streets.

Heavily impacted industrial communities are also characterized by increased on-road air pollutant concentrations. For example, elevated UFP, BC, and NO concentrations were observed across the residential neighborhood of Boyle Heights in Los Angeles (Hu et al. 2012). UFP concentrations were nearly uniform spatially, in contrast to other areas in the greater metropolitan area of Los Angeles where UFP concentrations exhibit strong gradients downwind of roadways. This was attributed to the presence of high heavy-duty traffic volumes on the freeways surrounding Boyle Heights, and substantial numbers of high-emitting vehicles on local surface streets. The high density of stop signs and lights, and short block lengths, requiring frequent acceleration of vehicles, may contribute to elevated UFP levels observed in this area.

Fruin et al. (2008) characterized air pollutant concentrations on Los Angeles freeways and arterial roads. On freeways, concentrations of UFPs, BC, NOx, and p-PAH were generated primarily by diesel emissions, despite the relatively low fraction (~6%) of diesel-powered vehicles. However, UFP concentrations on arterial roads appeared to be driven mainly by proximity to gasoline-fueled cars undergoing hard accelerations. Concentrations were roughly one-third of those on freeways. They concluded that 33 to 45% of total UFP exposure for Los Angeles residents occurs due to time spent traveling in vehicles. A previous study conducted by the same research group showed that time spent in vehicles contributes between 30 and 55% of Californian’s total exposure to diesel PM (Fruin et al., 2004). The applicability of these estimates to other regions of the United States is largely unknown.

Due to the high air exchange rates (AERs) of moving cars/trucks, in-vehicle concentrations are typically close to roadway concentrations. Inside-to-outside UFP concentration ratios are best measured under realistic conditions because AERs and other factors influencing these ratios are determined by vehicle speed and ventilation preference, in addition to vehicle characteristics such as age. Two independent studies conducted in Southern California showed that in-cabin concentration of UFPs can be reduced substantially (i.e. up to ~85%) by turning the recirculation fan on (Zhu et al. 2007; Hudda et al. 2011). Evidence suggests that increased ventilation is also a key determinant of in-cabin UFP concentrations in buses, ferries, and rail modes (Knibbs et al., 2011). Where a vehicle is fitted with a cabin air filter, its particle removal efficiency is a key determinant of what proportion of on-road UFPs reach the cabin (Burtscher et al., 2008; Pui et al., 2008).

Important Factors Affecting Near-Roadway Measurements

The air quality monitoring studies described above measured elevated concentrations of UFPs and other combustion pollutants near roadways. However, most of these studies were conducted under different environmental conditions. In order to interpret results from these and future near-roadway activities and to better evaluate the risks associated with living in close proximity to highly trafficked freeways, it is important to consider all variables influencing the observed monitoring data. These may include:

- Traffic activity: parameters such as the total number of vehicles, the fleet mix (e.g., gasoline vs. diesel), and vehicle speeds affect the concentration of near-road pollutants. This information can usually be obtained from local transportation agencies or on the web.[9]

- Meteorological parameters: wind speed and direction, temperature, humidity, and atmospheric stability can be used to better evaluate the generation, transformation and transport of traffic-generated emissions and for interpreting near-road air quality data.

- Roadway type: proximity to busy freeways has generally been associated with an increase in atmospheric UFPs. However, most urban areas contain arterial roadways that experience regular increases in UFP levels, especially during morning and afternoon rush hours. Increased number of stop-and-go operations from traffic signals, longer idling times, and cold start conditions all contribute to increased UFP emissions.

- Roadway design: road grades create an increased load on vehicles ascending the grade, leading to increased exhaust emissions and potential tire wear, while

[9] For example, see Caltrans' Performance Measurement System (PeMS); http://pems.dot.ca.gov

vehicles descending the grade experience increased brake emissions. The presence of ramps, intersections, and lane merge locations can also lead to increased brake wear emissions and idling vehicle conditions due to increased congestion (Baldouf et al., 2009).

- <u>Roadside structures</u>: the presence of roadside features such as noise barriers, trees, and buildings can change the dynamics of air pollutant dispersion downwind of a freeway. Results from two recent studies conducted in Raleigh, NC and in Los Angeles indicate that near-roadway concentrations of combustion particles (e.g. UFP and BC) and related gaseous co-pollutants (e.g. CO and NO_2) were lower where a noise barrier was present than in open terrain (Bowker et al., 2007 and Ning et al., 2010). However, a longer downwind distance was generally needed to reach background levels, indicating a larger impact zone of traffic emission sources. Noise barriers adjacent to a roadway may also inhibit air movements off the road, leading to elevated on-road pollutant concentrations (Bowker et al. 2007; Baldauf et al. 2008). The District has several ongoing research efforts to better evaluate the mitigation potential of various roadside features.

HEALTH EFFECTS

Ultrafine Particles

Short- and long-term exposure to particles produced from combustion processes have been associated with numerous adverse health effects in humans including various cardiovascular and respiratory diseases (Pope and Dockery, 2006). It has been hypothesized that the ultrafine portion of atmospheric PM may be responsible for the majority of the observed health effects (Brugge et al., 2007; Balmes et al., 2009; Jarrett et al., 2009; Hoek et al., 2010; Ljubimova et al., 2012). Thus, recent research studies have specifically focused on UFPs and their ability to be absorbed deeply into the lungs, move across cell membranes, and translocate into the bloodstream and other parts of the body. As noted in the preceding sections, the formation and subsequent evolution of UFPs is complex. They are formed and processed on the order of minutes, but their composition continues to change depending on intricate interactions in the exhaust stream and in ambient air. Thus, exposures will vary depending on location within the exhaust plume and with distance from the emission source.

The mechanisms linking UFP exposure to observed health impacts are still not completely understood, but one of the most plausible hypotheses is that many of the adverse health effects may derive from oxidative stress, initiated by the formation of reactive oxygen species (ROS) within affected cells. Work conducted at the University of California Los Angeles (UCLA) Southern California Particle Center in the past decade has demonstrated that because of their high OC and polycyclic aromatic hydrocarbon (PAH) content, UFPs have the highest potential to generate ROS and to induce oxidative stress in macrophages and epithelial cells (Li et al., 2003). This, in turn, may promote allergic inflammation in the lungs, the progression of atherosclerosis, and precipitation of acute cardiovascular responses ranging from increased blood pressure to myocardial infarction (Delfino et al., 2005; Araujo et al., 2008). From the analysis of summertime ambient PM samples collected near downtown Los Angeles in the morning and in the afternoon, Verma et al. (2009) showed that both primary (traffic dominated) and photochemically formed quasi-ultrafine particles ($d < 250$ nm) possess high reduction-oxidation activity. However, the latter particle type appeared to be more potent in terms of generating oxidative stress and leading to subsequent damage in cells. The semi-volatile component of quasi-ultrafine urban aerosols (mostly OC and PAHs) seems to be responsible for most of the oxidative potential of PM (Verma et al., 2011).

Recent works have examined the health consequences due to UFP exposure on the most susceptible part of the population such as elderly individuals, children and subjects with asthma and diabetes. For example, between 2005 and 2007 the University of California Irvine (UCI) led a multi-disciplinary project (i.e. Cardiovascular Health and Air Pollution Study or CHAPS) to study the health effects of environmental exposure to different PM fractions (including UFPs) in elderly retirees affected by coronary artery disease (Delfino et al. 2008; 2009). Results suggested that traffic-related emissions of primary OC, PAHs, and UFPs were associated with adverse cardio-respiratory responses including elevated blood pressure (Delfino et al., 2010) and increased risk of myocardial ischemia (Delfino et al., 2011).

Other studies tried to elucidate the link between inhalation of UFPs and cardiovascular responses in children and young adults. In most studies, healthy young subjects were exposed to filtered "particle-free" air or UFPs at rest and during exercise (e.g. Shah, et al. 2008; Zareba, et al. 2009; Samet, et al. 2009). Short-term exposure to UFPs did not cause marked changes to the electrocardiography (ECG) parameters, although acute exposure had mild inflammatory and prothrombotic responses. In a recent experiment conducted by Pope et al. (2011), healthy, non-smoking young adults were exposed a) to known amounts of PM2.5 (150-200 $\mu g/m^3$) from wood and coal combustion, and b) to uncontrolled ambient air. The researchers did not find any vascular response following the few hours of PM2.5 exposure, but noted declines in vascular response with elevated ambient particle exposures, possibly due to the deleterious contributions from mobile source emissions.

There are no long-term studies of human population exposure to ultrafine particles, as there is a lack of a monitoring network in the U.S. There have been several cross sectional epidemiological studies of ultrafine particles, mainly from Europe. Some of these studies found effects on hospital admissions, emergency department visits, for respiratory and cardiovascular effects. Other studies, however, have not found such effects (U.S. EPA, 2009). Concentrations of ultrafine particles can vary geographically, and it is not clear how well central site monitors may capture actual exposures.

The current U.S. EPA Integrated Science Assessment for Particulate Matter (U.S. EPA, 2009)[10] summarized that evidence is inadequate to determine a causal relationship between short-term exposures of UFPs to mortality or central nervous system effects, but that the evidence is suggestive of short-term exposures causing cardiovascular and respiratory effects. The Assessment also concluded that there is inadequate evidence linking long-term exposure of UFPs to health effects, including respiratory, developmental, cancer, and mortality. Overall, epidemiological studies of atmospheric PM suggest that cardiovascular effects are associated with smaller particles, but there are few reports that make a clear link between UFP exposures and increased mortality.

Recently, Hesterberg et al. (2011) hypothesized that the health effects caused by exposure to controlled diesel exhaust will be much less than those from uncontrolled diesel emissions, mostly because particles generated from nucleation of unfiltered sulfur vapors are believed to be less toxic than UFPs emitted from uncontrolled diesel combustion, which are made primarily of organic compounds (Seigneur, 2008). Additional studies are needed to support this hypothesis. The current ongoing Advanced Collaborative Emissions Study (ACES) will provide more data on the health effects of newer diesel engines meeting the U.S. 2007 standards. Similar

[10] http://www.epa.gov/ncea/isa/pm.htm

testing may be necessary for advanced gasoline and alternative fueled engine exhaust as well as for the newer heavy-duty diesel engines meeting the U.S. 2010 standards.

Considerably more information and data are needed in order to understand the underlying mechanisms and emission properties that affect human health. In 2011, the Health Effects Institute (HEI) convened an expert panel to conduct a critical evaluation of knowledge regarding the potential for UFP and NP to harm human health. The panel's report will be published as part of the HEI Perspective series. The Advanced Collaborative Emissions Study (ACES), which is jointly managed by HEI and the Coordinating Research Council (CRC) has undertaken a major effort to document improvements in vehicle emissions associated with advanced emissions controls. HEI investigators are analyzing the associated health effects.

Near-Roadway Health Impacts

Recent studies have found a positive association between living near busy roadways and asthma exacerbation, decreased lung function, increased heart disease, and other respiratory and cardiovascular effects (Kan et al., 2008; Andersen et al., 2010; HEI, 2010). Exposure to traffic emissions has also been linked to a faster progression of atherosclerosis in subjects living within 100 m of highways in Los Angeles (Künzli et al., 2010), increased risk of low birth weight and premature delivery (Llop et al., 2010; Wilhelm et al., 2011), and lower immune function and increased risk of Type 2 diabetes in post-menopausal women (Krämer et al., 2010; Williams et al., 2011). These studies do not differentiate exactly which pollutant or pollutants may be responsible.

Children are among the most susceptible segment of the population affected by exposure to traffic related pollutants. Their immune, neurological, and respiratory systems are still under development, they typically spend a substantial amount of time playing outdoors, and they have higher breathing rates per body mass. Neighborhood exposure to traffic-related air pollution has been linked to increased medical visits and hospital admissions for childhood asthma, increased wheezing and bronchitis, and the development of new asthma cases (McConnell et al., 2006; 2010; Chang et al., 2010).

In 2005 the District sent an advisory to all school districts under its jurisdiction to bring attention to findings regarding the potential for adverse health effects resulting from exposures to traffic emissions, and to encourage school districts to consider exposure to vehicle emissions when selecting and evaluating sites for new facilities such as schools, playgrounds, and residences (http://www.aqmd.gov/prdas/aqguide/doc/School_Guidance.pdf). As mentioned early in this document, the concentration of vehicle related pollutants drops off to near-background levels after about 300 m from the edge of the roadway (Zhu et al., 2002a; 2002b). A survey of California schools revealed that approximately 2.3% of public schools were located within 150 meters of high-traffic roads (greater than 50,000 vehicles per day), and an additional 7.2 % were within 150 meters of medium traffic roads (25,000 – 50,000 vehicles per day) (Green et al., 2004).

FUTURE RESEARCH AND ASSESSMENT NEEDS

Chemical Composition

Large differences in UFP chemical composition depend on many factors, including vehicle technology, fuel used and after-treatment devices, but also on atmospheric chemical reactions after being emitted. Since particle composition may be a factor determining particle toxicity, there is a need for developing a better knowledge of UFP chemistry near roadways and in different environments.

Processes Leading to Formation

More work is needed to better characterize the mechanisms that lead to UFP formation right after emission and in the atmosphere. Developing a clearer picture of particle formation dynamics in different environments, including those which are influenced by traffic, would greatly assist control measures to regulate emissions of UFPs.

Standardized Measurement Methods and Procedures

Currently, there is no standard method for conducting size-classified or particle-number measurements. The terms UFP and NP are not clearly defined and often used improperly. In addition, the UFP characteristics measured in ambient and emission testing studies (e.g. volatile vs. solid components; mass vs. number concentration) are highly dependent on the measurement instrument/protocol used and its setting. Therefore, there is a need to develop and utilize standardized measurement methods and procedures to enhance meaningful comparison between results from different studies and to guarantee reproducible results.

Increased Measurements at "Hot Spot" Locations

The range of UFP number concentrations between clean and vehicle-affected environments spans over two orders of magnitude. UFPs and NPs are usually not uniformly dispersed in the atmosphere, but concentrated in areas where large numbers of vehicles are operated. Thus, future ambient UFP measurements should be conducted in areas where concentrations are likely to be higher ("hot spots"). These may include busy roads and intersections, rail yards, airports, etc.

Emission Inventories

Currently vehicle emission factors for different particle size ranges and for particle numbers are highly uncertain, and there are no emission inventories for UFPs from motor vehicles. Also, long-term UFP concentration data in urban environments is scarce. This knowledge is critical for developing management and control strategies for UFP emissions. New estimations of UFP levels should not be derived solely based on vehicle emission factors (which mostly reflect emissions of primary combustion particles), but have to include predictions for UFP formation near the tailpipe and in the atmosphere.

Air Quality Modeling

Exposure assessment of UFPs will require the development of modeling tools to simulate formation and transport over a wide range of atmospheric conditions and emission scenarios. In particular, there is a need to better understand the atmospheric dispersion and transformation of UFP and UFP precursor emissions within the first few hundred meters of the roadway, a region often characterized by complex flow. This complex flow may also affect how pollutants enter multi-story buildings characteristic of higher density environments. Additional new near-roadway studies and laboratory measurements are also necessary to better validate these models.

Health Effects

New toxicological and epidemiological studies targeting exposure to controlled and uncontrolled emissions from gasoline and diesel vehicles are needed to better characterize the exposure-response relationships to UFPs and to help develop health guidelines and potential regulations. The health effects of inorganic (largely related to oil consumption ash constituents) UFP emissions from vehicles are only now starting to receive significant attention.

Other Types of Sources

UFPs are formed through many types of combustion processes. Motor vehicles powered by internal combustion engines are major sources, but stationary source combustion and other processes also contribute significantly to UFP emissions and formation. More work is needed to better understand the size, composition and health impact of these particles near airports, rail-yards, port areas, natural gas electric generators and other potential "hotspot" locations.

PLANNING AND REGULATORY ISSUES

Jurisdiction over Near-Roadway Exposures

The jurisdictional authority for controlling exposure to mobile source pollutants in the near-roadway environment is generally split between 1) federal and state authority over vehicle tailpipe emissions standards; and 2) local government (e.g. cities, counties) authority over land use planning and zoning decisions. In broad terms, tailpipe emission standards affect the source of mobile source emissions, while land use planning affects the exposure to those pollutants. In particular:

- <u>On-road emission standards</u>: U.S. EPA and CARB set standards for the level of pollutants that are allowed from new on-road engines and the fuels used to power them. Chapter 3 and Appendix III details how the emission standards for on-road vehicles are projected to affect total vehicle emissions in future years. While tighter emission standards in the future are expected to lower overall emissions, the near-roadway environment is still expected to have higher concentrations of mobile source pollutants relative to areas further away, especially for ultrafine particles.

- <u>Local land use planning and zoning</u>: local governments maintain the authority to determine the types of land use that are allowed within their jurisdiction. For example, in city General Plans, each parcel of land within that city is given a land use designation (e.g. residential, industrial, etc.). Land use types that do not fall within the General Plan designation are not allowed, with limited exceptions.[11] Because the majority of the area within the District jurisdiction has been built out in the past century, many of the current land use patterns are based on historical

[11] For example, school districts generally have the authority to supersede local land use authority when determining where to site new schools.

land use decisions. These legacy decisions have resulted in a large number of residents living in close proximity to freeways. As an example, approximately 691,000 people in Los Angeles County live within 500 feet of a freeway.[12]

Sustainable Communities Strategies

Pursuant to California Senate Bill 375 (SB 375) passed in 2008, CARB developed regional greenhouse gas reduction targets for passenger vehicle emissions in years 2020 and 2035. As required by SB 375, the Southern California Association of Governments (SCAG) used these regional targets[13] to develop a Sustainable Communities Strategy (SCS) integrating land use, housing, and transportation planning, all as a part of the adopted 2012 Regional Transportation Plan (RTP).

One of the key features of the RTP/SCS is the encouragement of Transit-Oriented Development (TOD) that promotes higher residential and employment densities in High Quality Transit Areas (HQTA)[14]. Among the many benefits of well designed TODs, one of their primary purposes under SB 375 is to reduce the total vehicle miles travelled (VMT) in the region by placing homes and jobs closer to public transportation. However, because much of the original and planned transit network lies in close proximity to existing freeways, many of the HQTA areas overlap with freeway proximate areas. For example, with implementation of the RTP/SCS, approximately 282,000 households in the SCAG region will be located both within a HQTA and within 500 feet of a freeway in the year 2035. Some TODs can therefore present a challenge by potentially reducing regional emissions while increasing the exposure of residents in those project areas to elevated pollutant concentrations found in the near-roadway environment.

Enhanced Environmental Analysis

The California Environmental Quality Act (CEQA) requires that all projects requiring discretionary action by a public agency must evaluate and identify the potential environmental impacts of that project, and implement all feasible methods to reduce,

[12] 2012 Regional Transportation Plan, SCAG. Environmental Justice Appendix, Table 40.

[13] 8% reduction below 2005 levels on a per capita basis by 2020, and 13% reduction by 2035

[14] A HQTA is defined as the ½ mile corridor surrounding a fixed bus route with service intervals no longer than 15 minutes during peak commute hours, or the ½ mile area surrounding a rail transit station, ferry terminal served by bus or rail, or the intersection of two or more major bus routes with service intervals no longer than 15 minutes during peak commute periods. See Public Resources Code 21155(b) and 21064.3 for further details.

avoid, or eliminate any significant adverse impacts.[15] This analysis is reported in CEQA documents such as Negative Declarations or Environmental Impact Reports. Therefore, CEQA requires that a project proponent analyze how the project itself may impact its surrounding environment. For example, if a project includes a new apartment building located adjacent to a freeway, the project will result in new emissions from vehicles driven by future residents of the apartment building, and these emissions must be evaluated to determine the impact on air quality and the environment.

In a more rigorous CEQA analysis, the impacts from the surrounding environment on people living in the project itself could also be evaluated (Figure 9-5). Using the same example from above, emissions from all of the vehicles on the adjacent freeway would also be evaluated for their potential impact on the proposed apartment residents.

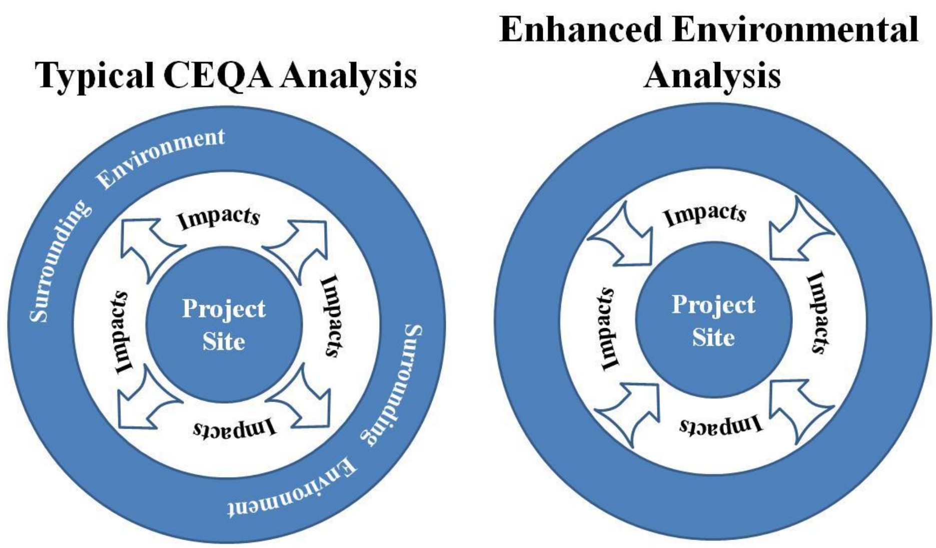


FIGURE 9-5

Example of Typical and Enhanced Environmental Analyses

Although section 15162.2 of the CEQA Guidelines provides that an environmental impact report "shall also analyze any significant environmental effects the project might cause by bringing development and people into the area affected," recent court

---

[15] Public Resources Code §21000 *et seq.*

rulings have found that CEQA does not require an analysis of the impacts of the environment on a project.[16]

However, notwithstanding these court rulings, lead agencies (such as a city or county or air district) that approve CEQA documents retain the authority to include any additional information they deem relevant to assessing and mitigating the environmental impacts of a project. Because of the District's concern about the potential public health impacts of siting sensitive populations within close proximity of freeways, District staff will continue to recommend that, prior to approving the project, lead agencies consider the impacts of air pollutants on people who will live in a new project and provide mitigation where necessary.

Guidance is available for conducting health risk assessments related to mobile sources from the District and from the California Air Pollution Controls Officers Association (CAPCOA).[17]

Mitigation Measures

A variety of mitigation measures have been proposed and are under study to reduce exposure to the high concentration of pollutants found in the near-roadway environment. Although some of these exposure controls may have some effectiveness, the solution that would have the greatest effect still lies in source control. Reducing vehicle emissions remains the only way to ensure that all pollutant concentrations in the near-roadway environment can be reduced for everyone, not just for certain pollutants, or for those that can implement mitigation. While emissions from vehicles are expected to continue to decline with existing regulations and fleet turnover, near-roadway environments are still expected to have elevated concentrations of some mobile source pollutants for the foreseeable future. In the interim, there are some measures that may reduce exposure that are briefly described in the table below. All of these conventional methods require further research to determine their effectiveness and feasibility for the variety of land uses found in the near-roadway

[16] *Ballona Wetlands Land Trust v. City of Los Angeles* (2011) 201 Cal.App.4th 455, 473-474 (a revised environmental impact report for a coastal multi-family residential development was not *required* to address impacts on the project from sea-level rise caused by global warming); *see also South Orange County Wastewater Authority v. City of Dana Point* (2011) 196 Cal.App.4th 1604 (analysis of impacts from locating a residential development next to an existing source of noxious odors was not *required*)

[17] http://www.aqmd.gov/ceqa/handbook/mobile_toxic/mobile_toxic.html

http://www.capcoa.org/wp-content/uploads/2012/03/CAPCOA_HRA_LU_Guidelines_8-6-09.pdf environment. In addition, District staff will continue to support and monitor the outcome of research on newer technologies such as photocatalytic cement, roadway canopies, and sound barriers with active or passive filtration/ventilation.

Besides buffer zones, none of the measures listed in the table below (Table 9-1) has been found to be effective to reduce all mobile source pollutants to background levels in the near roadway-environment. Because of this limitation, the mitigation considered for new land uses may be different than that considered for existing land uses. For example, new land uses could consider buffer zones or site configurations before considering other measures such as enhanced HVAC filtration.

For existing land uses that do not have the same ability to incorporate buffer zones as new land uses, other measures may be considered first, such as encouraging development of outdoor recreation spaces and playgrounds within walking distance but beyond 300 m from a freeway at the same time as considering enhanced filtration in HVAC systems.

Emission Control Technologies

The application of advanced emissions control technologies to both compression-ignition (diesel) and spark-ignition (gasoline, natural gas) engines has led to new concerns about the formation and health effects of UFPs. Since larger accumulation mode particles have effectively been removed from the exhaust of state-of-the-art vehicles, this has eliminated possible condensation surfaces for volatile gases and UFPs. The net result is that while larger-sized particles (accounting for most of the PM mass) are dramatically reduced by control technologies such as diesel particulate filters (DPFs), an increase in the number of UFPs and NP may potentially occur. Additional evaluation regarding a possible increase in UFP and NP number concentration should be addressed. Below is a brief description of the two main PM control technologies in use today:

- Particulate filters are devices capable of achieving over 90% reduction of the solid portion of the total exhaust particles, with some control of the soluble organic fraction (SOF). With most of the solid particles removed, nucleation, rather than condensation, of the remaining gas phase species can occur, potentially increasing particle number emissions (Morawska et al., 2008). However, particulate filters can also be effective in controlling UFPs if designed properly, for example when used in conjunction with an oxidation catalyst.

TABLE 9-1

MITIGATION MEASURE	POLLUTANT TARGETED	RANGE OF REDUCTION	COMMENTS	KEY REFERENCES
Buffer zones	All pollutants	0-100%	Varies with distance. Up to 100% reduction to background levels at 500 feet.	-CARB Air Quality and Land Use Handbook, (2005) (http://www.arb.ca.gov/ch/handbook.pdf)
Enhanced filtration in building Heating, Ventilation, and Air Conditioning (HVAC) systems	PM	30-90% for indoor environments	Effectiveness varies depending upon rating of filter (>MERV 13 recommended near roadways), HVAC design, maintenance of HVAC system, whether doors and windows stay closed, and amount of time people spend outdoors	-AQMD Pilot Study of High Performance Air Filtration for Classroom Applications (http://www.aqmd.gov/rfp/attachments/2010/AQMDPilotStudyFinalReport.pdf) -SCAG 2012 RTP/SCS PEIR Appendix G Measure AQ-19 (http://rtpscs.scag.ca.gov/Documents/peir/2012/final/2012fPEIR_AppendixG_ExampleMeasures.pdf)
Sound walls	All pollutants	15-50% close to barrier at ground level	Effectiveness varies with distance from freeway, with concentrations sometimes increasing >80m downwind of wall. Other site-specific characteristics may significantly alter effectiveness.	-Impact of noise barriers on near-road air quality, Baldauf et al., (2008) -Impact of noise barriers on particle size distributions and pollutant concentrations near freeways, Ning et al., (2010) -The effect of roadside structures on the transport and dispersion of ultrafine particles from highways, Bowker et al., (2007)
Vegetated barriers	PM	Varies	Effectiveness varies with barrier height, thickness, density, and species. Some configurations may increase concentrations.	-Local measures for PM10 hotspots in London, Air Quality Consultants (2009) -Field investigation of roadside vegetative and structural barrier impact on near-road ultrafine particle concentrations under a variety of wind conditions, Hagler et al., (2012)

Common Mitigation Measures Adopted To Reduce Exposure to Motor Vehicle Emissions In Near-Road Environments

- Oxidation catalysts are effective in removing more than 90% of the SOF fraction of total emissions as well as UFPs formed later in the exhaust. Their effectiveness, however, depends on whether the catalyst is formulated to produce little or no sulfate emissions at high temperature. In fact, special catalyst formulations must be employed to hinder the catalytic generation of sulfate particles from SO2 present in the exhaust gas. While oxidation catalysts are effective in reducing the SOF fraction and smaller particles, it has little effect on larger accumulation or coarse mode particles. An effective control technology should be based on a system addressing both particle mass and number emission reduction.

Testing Protocols

Under the U.S. gravimetric method for certifying heavy-duty engines, exhaust PM mass is collected on inert filters as each engine is operated over official engine dynamometer testing schedules (e.g. the Federal Test Procedure, or FTP). A constant volume sampler (CVS) system collects the exhaust at prescribed conditions (e.g. temperature, dilution ratio). The preconditioned particulate filters are then weighed to obtain the mass of PM emitted over the test cycle. The mass of emitted PM is then normalized according to the work performed over the test cycle in brake horsepower-hour (bhp-hr). The calculated mass emissions values are compared to the PM emissions standard in g/bhp-hr.

Procedures for characterizing emissions from light-duty (diesel) vehicles are similar from the perspective of collecting the PM on preconditioned filters and determining mass emissions. A key difference is that the light-duty vehicle emissions standards are in grams of pollutant per distance driven (g/mile in the U.S.), instead of work performed. Testing of light-duty vehicles is conducted on chassis dynamometers in contrast to heavy-duty engines, which are tested on engine dynamometers prior to vehicle integration.

In the U.S., the focus on measuring and controlling PM emissions has been almost exclusively on the heavy-duty vehicle sector, because overall emissions are dominated by diesel engines. The mass-focused testing methodology described above has worked well for heavy-duty engine technologies meeting PM standards of 0.1 g/bhp-hr (i.e. up to the 2006 engine model year). Such engines emit relatively large amounts of solid material (soot, metals, and ash) from combustion, engine wear, and lube oils. All of this is collected on the preconditioned filters, along with volatiles in the exhaust that condense on the filters including water vapor, sulfates, and other organics. The net result is that the mass of PM collected during the test cycle over a known amount of work performed can be compared to the PM emissions standard.

However, as more advanced diesel PM control technology was developed and deployed to meet tighter emissions standards (DPFs to meet the U.S. 2007 heavy-duty engine PM standard) the PM mass collected over the FTP was significantly reduced. In some cases, PM mass levels were too low for detection by existing instrumentation in the test methodology. Also, at these low mass levels, testing anomalies can occur due to absorption of semi-volatile gas molecules on sampling filters or on PM already collected, which possibly leads to bias towards higher weight measurements. Similarly, tunnel wall or sampling line losses can also cause erroneous results. The need for better precision at low mass levels led U.S. EPA to revise the protocol to improve accuracy. At the same time, testing in the United States and in Europe shed new light on the characteristics of diesel PM in the exhaust, raising questions as to the relative importance of measuring particle mass versus particle number and/or size (Swanson et al., 2010).

In the late 1990s, the occupational health and safety authorities of Austria, Switzerland and Germany conducted a comprehensive program called Verminderung der Emissionen von Real-Dieselmotoren im Tunnelbau (VERT), which in English stands for Reduction of Diesel-emissions in tunneling to ensure functional and beneficial systems are utilized for the removal of harmful diesel emissions in underground environments. One of the main objectives of VERT was to look at the composition of diesel exhaust in terms of particle size, surface area, and concentration, and to establish whether mass is a good proxy for subsequent exposures and human health effects. PM, primarily BC and UFPs were found to be of major concern to the extent that in tunneling and other major construction sites, particle-traps for diesel equipment/vehicles became mandatory. This work laid the foundation for two additional important programs, the "Particulates Program" and the "Particle Measurement Programme" (PMP), both of which are further discussed below.

- Particulates Program: this program developed a sampling procedure to characterize both the volatile and non-volatile components of exhaust emissions from light- and heavy-duty vehicles. In particular, it developed sampling methodologies capable of assessing the formation of nucleation- and accumulation-mode particles from a minimum size of 7 nm. Figure 9-6 shows the sampling system used in the Particulates Program. The main results for light-duty and for heavy-duty-vehicle applications are described in Ntziachristos et al. 2004, and in Thompson et al. 2004, respectively.

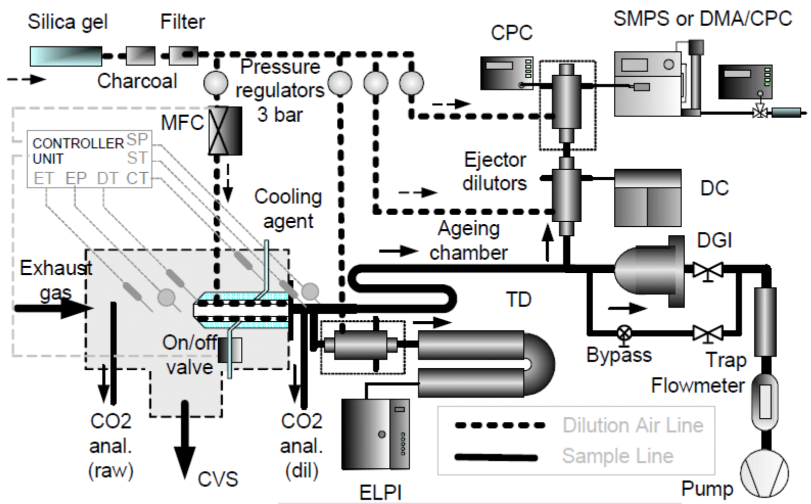


Figure 9-6

Sampling System used in the Particulates Program (from Samaras et al., 2006)

The basic premise behind the testing protocol was that each vehicle technology can and should be tested under consistent conditions. This enables comparison between the various technologies and fuels used. The procedure entails measuring particle mass, active surface (surrogate for surface area), solid particle number, total particle number, and particle size distribution. Both light-duty and heavy-duty programs investigated the effects of vehicle technology, fuel properties, and driving cycle.

- Particle Measurement Programme (PMP): this program is aimed at developing a test protocol to measure only the impact of solid particles in motor vehicle exhaust. The PMP is a collaboration of the United Nations Economic Commission for Europe and GRPE (Working Party on Pollution and Energy). The goal of this program is to find a new approach to measure particle emissions from vehicles that can either replace or coexist with the current mass-based particulate measurements. A result of this work has been the development of instrumentation and methodologies for counting solid (i.e. low-volatility particles that survived evaporation after a residence time of 0.2 seconds at 300 ^{0}C) particles down to a size of 23 nm. The PMP was implemented in a number of testing labs in Europe, Japan, and the U.S. The results of the lab emission testing for light- and heavy-duty vehicles is provided by Andersson et al. (2007; 2010). Figure 9-7 shows an example of a PMP setup for particle number count testing. New test requirements are continuously being added to European light-duty vehicle emissions regulations, including those specific to particle number.

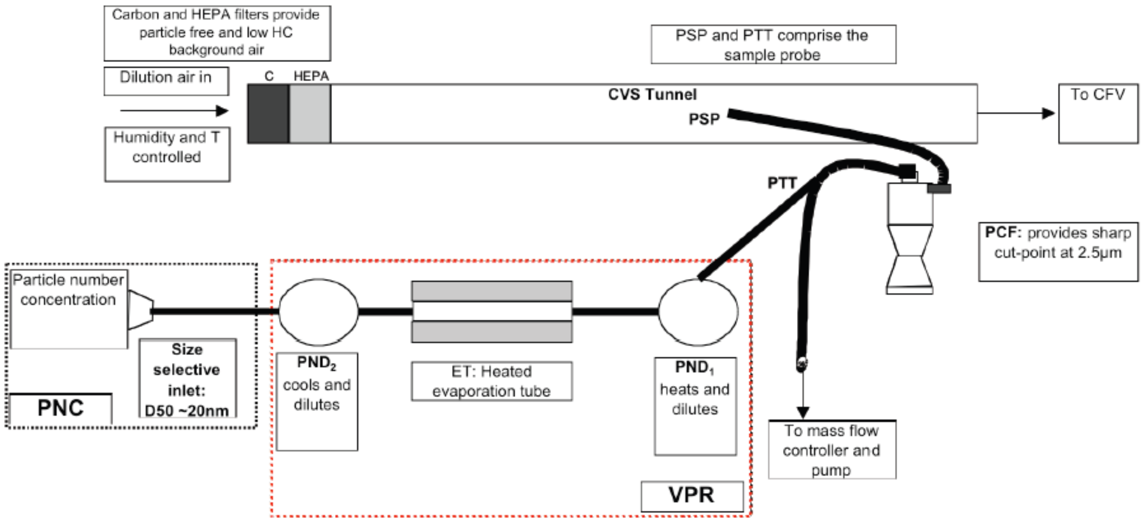


FIGURE 9-7

Schematic of PMP Testing Setup for Particle Number Count (from Kasper et al., 2006)

There have also been a number of related studies or research reports on the evaluation of various components of the PMP methodology. For example, CARB studied this method for light-duty vehicles using the "Golden Vehicle" (GV; a single vehicle that has been shipped to laboratories in Italy, Sweden, United Kingdom, Germany, Greece, Japan, Korea and France for testing) and the Golden Particle Measurement System (GPMS; a set of particle counting instruments that was sent along with the GV) to compare results with the other nine international laboratories that participated in the PMP (CARB, 2008).[18] Additional testing was done on heavy-duty vehicles and results indicated that further study was needed to include a wider range of vehicles and after-treatment systems (Robertson et al., 2007).

The PMP protocol has gained acceptance in Europe and Japan. American regulators, industry and researchers continue to evaluate this methodology. Researchers in the U.S. (e.g., Swanson et al. 2010) favor alternative methods that focus on measuring surface area including solids and volatiles. Kittelson et al. (2011**)** noted that for engines equipped with particle filters setting the limit to 23 nm effectively regulates all sizes. However, vehicles without filters may emit large concentrations of solid

[18] http://www.arb.ca.gov/research/veh-emissions/pmp-ld/CARB_Golden_Vehicle_PMP_Report_Final-05JAN09.pdf

particles below 23 nm that are not counted by the current method. The next generation of high-efficiency direct injection gasoline engines is also challenged by the current 23 nm limit. They proposed extending solid PM measurements to 10 nm although this may be problematic due to formation of particles as small as 3 nm downstream of the PMP Volatile Particle Remover (VPR) system.[19]

As noted, the European PMP protocol has been implemented to include numbers-based particle emission standards. While there is no consensus in the U.S. at present regarding how to standardize particle measurements, research work and regulatory discussions are ongoing among industry and regulatory agencies such as U.S. EPA, CARB, and the District. For now, U.S. EPA and CARB continue to regulate PM mass only.

Emissions Standards

European Standards

Europe's new emission levels for light-duty and medium-duty vehicles are Euro 5 and Euro 6. Euro 5's goal is to reduce the emissions of PM from diesel cars from 25 mg/km to 5 mg/km. Euro 6 will become effective in January 2014, and will reduce the NO_x emissions from diesel cars from 180 mg/km to 80 mg/km. A solid particle number emission limit of $6x10^{11}$ km^{-1} became effective in September 2011 for all categories of diesel vehicles. Europe's reason for adopting the number standard is to promote the use of DPF technology. A particle number emissions limit for gasoline vehicles will be determined in 2014.

California Standards

In 2010, CARB considered adopting certain particle number standards as an alternative under the LEV III requirements, and proposed that for all vehicles subject to LEV III, beginning in 2014, manufacturers must select one of two standards to demonstrate compliance (CARB, 2010)[20]:

1. Federal Test Procedure weighted PM mass emission limit to 0.006 g/mi (2014) and 0.003 g/mi (2017)

2. Federal Test Procedure weighted particle number emission limit to $6.0x10^{12}$ particles/mi (2014) and $3.0x10^{12}$ particles/mi (2017)

[19] http://www.unece.org/fileadmin/DAM/trans/doc/2011/wp29grpe/PMP-26-06e.pdf

[20] http://www.arb.ca.gov/msprog/levprog/leviii/meetings/051810/pm_disc_paper-v6.pdf

CARB's reason for proposing the particle number limit is to take advantage of the latest methodology advances by PMP. The PMP method was considered because it is the only particle emission measurement method that went through extensive international scrutiny and laboratory testing. Excellent sources of information about CARB's LEV III proposals and objectives specific to fine particles can be found on CARB's 2011 publication "LEV III PM Technical Support Document: Development of Particulate Mass Standards for Future Light-Duty Vehicles".[21]

National Standards

The National Ambient Air Quality Standards (NAAQS) set by the U.S. EPA are designed to protect public health and the environment. The standards are developed based on a variety of scientific studies, including the results of epidemiologic studies that evaluate how human health has been affected by pollutant concentrations in the past. These standards are periodically reviewed and updated based on recent scientific developments. Most recently, the NO_2 and CO NAAQS were reviewed and updated, with a new provision that new permanent monitors must be established near roadways. The most recent AQMD monitoring plan provides details about how and where these new monitors may be located.[22] The recent PM NAAQS revision proposed on June 14, 2012, by U.S. EPA for the first time includes near-roadway monitoring requirements for PM2.5. Currently, U.S. EPA notes that, in their assessment, there is not sufficient health evidence to support a separate standard for UFPs.

DISTRICT FUTURE ACTIONS

Although the District has limited authority to regulate mobile source pollution in the near-roadway environment, there are a variety of measures that District staff will continue to take to reduce this public health impact.

- The District will continue to fund health effects, exposure, atmospheric chemistry, modeling, and other research activities aimed at investigating the impact of UFPs exposure in communities impacted by traffic emissions. An AQMD-funded study is currently underway to assess potential air quality impacts and the effectiveness of mitigation measures (e.g. sound walls and vegetated barriers) in the near roadway environment. The multi-pronged approach of this study includes a

[21] http://www.arb.ca.gov/regact/2012/leviiighg2012/levappp.pdf

[22] http://www.aqmd.gov/tao/AQ-Reports/AQMonitoringNetworkPlan/AQnetworkplan.htm

review of different mitigation techniques implemented throughout the world, pollutant monitoring combined with dispersion modeling of local freeway emissions, development of alternative models, and laboratory-based simulations in flow tanks. The results of this study are expected by early 2013.

- Since the problem of near-roadway exposure can effectively be addressed by controlling tailpipe emissions, the District will continue to encourage U.S.EPA and CARB to set vehicle emission standards for UFP.

- District staff will continue to work with local and state agencies to address near-roadway exposures. This includes outreach and education to local governments and elected officials on the health risks associated with mobile source pollution and recommending measures that can be taken to reduce those risks. As an example, General Plans prepared for a city can include requirements to provide buffer zones, as feasible, between freeways and any new development with sensitive receptors.

- Through the CEQA Intergovernmental Review program, CEQA documents submitted to the District are reviewed during the public comment period. For those projects that may expose sensitive populations to elevated concentrations of mobile source pollution, District staff will recommend that the potential impacts be quantified and that all feasible mitigation measures be considered to reduce this impact below a significant level.

- As part of the Clean Communities Program (CCP), District staff will continue to work in the pilot study areas of Boyle Heights and San Bernardino to address exposure to mobile source pollution and will apply those lessons learned to other areas in the District. Further, as part of CCP Measures Outreach-1 and Agency-01, District staff will prepare a document titled “Proximity Matters” that will provide an additional resource for local agency planners to use when addressing near-roadway exposures.

- On July 1, 2012 the District began MATES IV, a year-long study designed to characterize the carcinogenic risk caused by exposure to air toxics in the Basin. MATES IV will enhance the spatial resolution of previous measurement efforts by characterizing the localized exposure to UFPs and Diesel Particulate Matter in residential, industrial, and commercial communities. Mobile monitoring platforms will be deployed for short-term monitoring at six to eight sites in areas close to mobile sources such as airports, rail yards, freeways and warehouse operations.

- District staff will continue to work with instrument manufacturers, CARB, and U.S. EPA on the evaluation of new technologies for monitoring UFPs, BC and other traffic-related pollutants, and on the development of methods for the standardization of UFP measurements.

REFERENCES

Andersson, J., Barouch, G., Munoz-Bueno, R., Sandbach, E., and Dilara, P. (2007) “Particle Measurement Programme (PMP), “Light-duty Inter-laboratory Correlation Exercise (ILCE_LD) Final Report”, Institute for Environment and Sustainability, European Commission - Directorate General - Joint Research Center, EUR 22775 EN

Andersen, Z.J., Hvidberg, M., Jensen, S.S., Ketzel, M., Loft, S., Sørensen, M., Tjønneland, A., Overvad, K., Raaschou-Nielsen, O. (2010) “Chronic Obstructive Pulmonary Disease and Long-Term Exposure to Traffic-Related Air Pollution: A Cohort Study”, American Journal of Respiratory and Critical Care Medicine, doi: 10.1164/rccm.201006-0937OC

Andersson, J., Mamakos, A., Giechaskiel, B., Carriero, M., Martini, G. (2010) “Particle Measurement Programme (PMP) Heavy-duty Inter-laboratory Correlation Exercise (ILCE_HD) Final Report”, JRC Scientific and Technical Reports, EUR 24561 EN

Araujo, J.A., Barajas, B., Kleinman, M., Wang, X.P. et al. (2008) “Ambient particulate pollutants in the ultrafine range promote early atherosclerosis and systemic oxidative stress”, Circulation Research, 102(5): 589-596

Baldauf, R., Thoma, E., Khlystov, A., et al. (2008) “Impacts of noise barriers on near-road air quality”, Atmospheric Environment, 42(32): 7502-7507

Baldauf, R., Watkins, N., Heist, D., Bailey, C., Rowley, R., Shores, R. (2009) “Near-road air quality monitoring: Factors affecting network design and interpretation of data”, Air Quality Atmospheric Health, 2:1-9

Balmes, J.R., Earnest, G., Katz, P.P., Yelin, E.E., Eisner, M.D., Chen, H., Trupin, L., Lurmann, F. and Blanc, P.D. (2009) “Exposure to traffic: Lung function and health status in adults with asthma”, The Journal of Allergy and Clinical Immunology, 123(3):626-631

Bowker, G.E., Baldauf, R., Isakov, V., et al. (2007) “The effects of roadside structures on the transport and dispersion of ultrafine particles from highways”, Atmospheric Environment, 41(37): 8128-8139

Brugge, D., Durant, J.L. and Rioux, C. (2007) "Near-highway pollutants in motor vehicle exhaust: A review of epidemiologic evidence of cardiac and pulmonary health risks", Environmental Health, 6:23

Burtscher, H., Loretz, S., Keller, A., Mayer, A., Kasper, M., Artley, R.J., Strasser, R., Czerwinski, J. (2008) "Nanoparticle filtration for vehicle cabins" SAE Paper 2008-01-0827

Chang, J., Delfino, R.J., Gillen, D. et al. (2010) "Repeated Respiratory Hospital Encounters Among Children With Asthma and Residential Proximity to Traffic" Occupational Environmental Medicine, 66: 90-98

Delfino, R.J., Sioutas, C., Malik, S. (2005) "Potential role of ultrafine particles in associations between airborne particle mass and cardiovascular health", Environmental Health Perspectives, 113(8): 934-946

Delfino, R.J., Staimer, N., Tjoa, T., Polidori, A., et al. (2008) "Circulating biomarkers of inflammation, antioxidant activity, and platelet activation are associated with primary combustion aerosols in subjects with coronary artery disease", Environmental Health Perspectives, 116(7): 898-906

Delfino, R.J., Staimer, N., Tjoa, T., et al (2009) "Air Pollution Exposures and Circulating Biomarkers of Effect in a Susceptible Population: Clues to Potential Causal Component Mixtures and Mechanisms", Environmental Health Perspectives, 117(8): 1232-1238

Delfino, R.J., Tjoa, T., Gillen, D.L. et al. (2010) "Traffic-related Air Pollution and Blood Pressure in Elderly Subjects With Coronary Artery Disease", Epidemiology, 21(3): 396-404

Delfino, R.J., Gillen, D.L., Tjoa, T., et al. (2011) "Electrocardiographic ST-Segment Depression and Exposure to Traffic-Related Aerosols in Elderly Subjects with Coronary Artery Disease", Environmental Health Perspectives, 119(2): 196-202

Fruin, S.A., Winer, A.M., Rodes, C.E. (2004) "Black carbon concentrations in California vehicles and estimation of in-vehicle diesel exhaust particulate matter exposures", Atmospheric Environment, 38(25): 4123-4133

Fruin, S., Westerdahl, D., Sax, T., Sioutas, C., Fine, P.M. (2008) "Measurement and Predictors of On-Road Ultrafine Particle Concentrations and Associated Pollutants in Los Angeles", Atmospheric Environment, 42(2), 207-219

Fujita E.M., Campbell, D.E., Zielinska, et al. (2003) "Diurnal and weekday variations in source contributions of ozone precursors in California's south coast air basin", Journal of the Air & Waste Management Association, 53:844-863

Green R, Smorodinsky S, Kim J, McLaughlin R, Ostro B. (2004) "Proximity of California Public Schools to Busy Roads", Environmental Health Perspectives 112;1:61-66

Hagler, G.S., Thoma, E.D., Baldauf R, W. (2010) "High-resolution mobile monitoring of carbon monoxide and ultrafine particle concentrations in a near-road environment", Journal of the Air & Waste Management Association, 60(3): 328-36

Hagler, G.S.W., Lin, M.Y., Khlystov, A., et al. (2102) "Field investigation of roadside vegetative and structural barrier impact on near-road ultrafine particle concentrations under a variety of wind conditions", Science of the Total Environment, 419: 7-15

Health Effects Institute (2010) "Traffic-Related Air Pollution: A Critical Review of the Literature on Emissions, Exposure, and Health Effects", http://pubs.healtheffects.org/

Hesterberg, T.W., Long, C.M., Sax, S.N., et al. (2011) "Particulate Matter in New Technology Diesel Exhaust (NTDE) is Quantitatively and Qualitatively Very Different from that Found in Traditional Diesel Exhaust (TDE)", Journal of the Air & Waste Management Association, 61(9): 894-913

Hoek, G., Boogaard, H., Knol, A., De Hartog, J. et al. (2010) "Concentration Response Functions for Ultrafine Particles and All-Cause Mortality and Hospital Admissions: Results of a European Expert Panel Elicitation", Environmental Science & Technology, 44: 476-482

Hu, S.S., ; Fruin, S., Kozawa, K., et al. (2009) "A wide area of air pollutant impact downwind of a freeway during pre-sunrise hours", Atmospheric Environment, 43(16): 2541-2549

Hu, S.S., Paulson, S.E., Fruin, S. et al. (2012) “Observation of elevated air pollutant concentrations in a residential neighborhood of Los Angeles California using a mobile platform”, Atmospheric Environment, 51: 311-319

Hudda, N., Kostenidou, E., Sioutas, C., Delfino, R.J., Fruin, S.A. (2011) “Vehicle and Driving Characteristics That Influence In-Cabin Particle Number Concentrations”, Environmental Science & Technology, 45(20): 8691-8697

Hussein, T., Puustinen, A., Aalto, P., Makela, J., Hameri, K., Kulmala, M. (2004) “Urban aerosol number size distributions”, Atmospheric Chemistry and Physics Discussions 4, 391–411

Jerrett, M., Finkelstein, M.M., Brook, J.R., Arain, M.A., Kanaroglou, P., Stieb, D.M. Gilbert, N.L. Verma, D., Finkelstein, N., Chapman, K.R. and Sears, M.R. (2009) “A Cohort A-33 Study of Traffic-Related Air Pollution and Mortality in Toronto, Ontario, Canada” Environmental Health Perspectives, 117:772-777

Kan, H., Heiss, G., Rose, K.M., Whitsel, E.A., Lurmann, F., London, S.J. (2008) “Prospective analysis of traffic exposure as a risk factor for incident coronary heart disease: the Atherosclerosis Risk in Communities (ARIC) study”, Environmental Health Perspectives 116 (11): 1463-1468

Karner, A., Eisinger, A. and Niemeier, D. (2010) “Near-Roadway Air Quality: Synthesizing the Findings from Real-World Data”, Environmental Science and Technology, 44:5334–5344

Keskinen, J. and Ronkko, T. (2010) “Can Real-World Diesel Exhaust Particle size Distribution be Reproduced in the Laboratory? A Critical Review”, Journal of the Air & Waste Management Association, 60: 1245-1255

Kim, J.J., Smorodinsky, S., Lipsett, M., Singer, B., Hodgson, A., Ostro, B. (2004) “Traffic-related air pollution near busy roads: The East Bay Children’s Respiratory Health Study”, American Journal of Respiratory & Critical Care Medicine, 170: 520-526

Kittelson, B.D. (1998) “Engines and nanoparticles: a review”, Journal of Aerosol Science 29 (5), 575–588

Knibbs, L.D., Cole-Hunter, T., Morawska, L. (2011) "A review of commuter exposure to ultrafine particles and its health effects", 45(16): 2611-2622

Kozawa, K.H., Fruin, S.A., Winer, A.M. (2009) "Near-road air pollution impacts of goods movement in communities adjacent to the Ports of Los Angeles and Long Beach", Atmospheric Environment, 43(18): 2960-2970

Krämer, U., Herder, C., Sugiri, D., Strassburger, K., Schikowski, T., Ranft, U., Rathmann, W. (2010) "Traffic-related air pollution and incident type 2 diabetes: results from the SALIA cohort study", Environmental Health Perspectives, 118(9): 1273-1279

Kuhn, T., Krudysz, M., Zhu, Y., Fine, P., Hinds, W., Froines, J., Sioutas, C. (2005) "Volatility of indoor and outdoor ultrafine particulate matter near a freeway", Journal of Aerosol Science 36, 291–302

Künzli, N., Jerrett, M., Garcia-Esteban, R., Basagaña, X., Beckermann, B., Gilliland, F., Medina, M., Peters, J., Hodis, H.N., Mack, W.J. (2010) "Ambient air pollution and the progression of atherosclerosis in adults", PloS One 5(2): 90-96

Lamia Benbrahim-Tallaa, Robert A Baan, Yann Grosse, Béatrice Lauby-Secretan, Fatiha El Ghissassi, Véronique Bouvard, Neela Guha, Dana Loomis, Kurt Straif, on behalf of the International Agency for Research on Cancer Monograph Working Group, Carcinogenicity of diesel-engine and gasoline-engine exhausts and some nitroarenes, The Lancet Oncology, Early Online Publication, 18 June 2012, doi:10.1016/S1470-2045(12)70280-2 http://www.thelancet.com/journals/lanonc/article/PIIS1470-2045(12)70280-2/fulltext

Lee, E.S., Polidori, A., Koch, M., Fine, P.M., et al. "Water-based Condensation Particle Counters Comparison Near a Major Freeway with Significant Heavy-Duty Diesel Traffic", submitted for publication to Atmospheric Environment

Li, N., Sioutas, C., Cho, A., Schmitz, D., Misra, C. et al. (2003) "Ultrafine particulate pollutants induce oxidative stress and mitochondrial damage", Environmental Health Perspectives, 111(4): 455-460

Liggio, J., Gordon, M., Smallwood, G., et al. (2012) "Are Emissions of Black Carbon from Gasoline Vehicles Underestimated? Insights from Near and On-Road Measurements", Environmental Science & Technology, 46(9): 4819-4828

Ljubimova, J.Y., P.R. Gangalum, J. Portilla-Arias, R. Patil, B. Konda, M. Paff, J. Markman, S. Inoue, A. Espinoza, A. Chesnokova, M. Kleinman, R. Holler, K.L. Black. "Molecular Changes in Rat Brain Due to Air Nano Pollution," Nanotechnology Conference and Expo, June, 2012, Santa Clara, CA

Llop S, Ballester F, Estarlich M, Esplugues A, Rebagliato M, Iñiguez C. 2010. Preterm birth and exposure to air pollutants during pregnancy. Environmental Research 110 (8): 778-785

Maricq, M.M. and Maldonado, H. (2010) "Directions for Combustion Engine Aerosol Measurement in the 21st Century", Journal of the Air & Waste Management Association, 60(10): 1165-1176

McConnell, R., Berhane, K., Yao, L., et al. (2006) "Traffic, susceptibility, and childhood asthma", Environmental Health Perspectives, 114(5): 766-772

McConnell, R., Islam, T., Shankardass, K., et al. (2010) "Childhood Incident Asthma and Traffic-Related Air Pollution at Home and School", Environmental Health Perspectives, 118(7): 1021-1026

Morawska, L., Ristovski, Z., Jayaratne, E.R., Keogh, D.U., Ling, X. (2008) "Ambient nano and ultrafine particles from motor vehicle emissions: Characteristics, ambient processing and implications on human exposure", Atmospheric Environment 42 (2008) 8113–8138

Ning, Z., Hudda, N., Daher, N., et al. (2010) "Impact of roadside noise barriers on particle size distributions and pollutants concentrations near freeways", Atmospheric Environment, 44(26): 3118-3127

Ntziachristos, L., Mamakos, A., Samaras, Z., Mathis, U., Mohr, M., Thompson, N., Stradling, R., Forti, L., de Serves, C. (2004) "Overview of the European "Particulates" Project on the Characterization of Exhaust Particulate Emissions From Road Vehicles: Results for Light-Duty Vehicles", SAE 2004-01-1985

Ntziachristos, L., Ning, Z., Geller, M.D., Sioutas, C. (2007) "Particle concentration and characteristics near a major freeway with heavy duty diesel traffic", Environmental Science and Technology 41, 2223–2230

Pakkanen, T., Kerminen, V., Korhonen, C., Hillamo, R., Aarino, P., Koskentalo, T., Maenhaut, W. (2001) “Urban and rural ultrafine (PM0.1) particles in the Helsinki area”, Atmospheric Environment 35, 4593–4607

Pirjola, I., Paasonen, P., Pfeiffer, D., Hussein, T., Hameri, K., Koskentalo, T., Virtanen, A., Ronkko, T., Keskinen, J., Pakkanen, T., Hillamo, R. (2006) “Dispersion of particles and trace gases nearby a city highway: mobile laboratory measurements in Finland”, Atmospheric Environment 40, 867–879

Pope, C.A., Hansen, J.C., Kuprov, R., et al. (2011) “Vascular Function and Short-Term Exposure to Fine Particulate Air Pollution”, Journal of the Air & Waste Management Association, 61(8): 858-863

Pui, D.Y.H., Qi, C., Stanley, N., Oberdörster, G. (2008) “Recirculating air filtration significantly reduces exposure to airborne nanoparticles”, Environmental Health Perspectives 116: 863-866

Robertson, W.H., Herner, J.D., Ayala, A., Durbin, T.D. (2007) “Investigation of the Application of the European PMP Method to Clean Heavy Duty Vehicles”, Presented at the 2007 Diesel Engine-Efficiency and Emissions Research Conference, August 2007

Robinson, A.L., Grieshop, A.P., Donahue, N.M., Hunt, S.W. (2010) “Updating the Conceptual Model for Fine Particle Mass Emissions from Combustion Systems”, Journal of the Air & Waste Management Association, 60: 1204-1222

Samet, J.M., Rappold, A., Graff, D., et al. (2009) “Concentrated Ambient Ultrafine Particle Exposure Induces Cardiac Changes in Young Healthy Volunteers”, American Journal of Respiratory and Critical Care Medicine, 179(11): 1034-1042

Sardar, S.B., Fine, P.M., Mayo, P.R., Sioutas, C. (2005) “Size-fractionated measurements of ambient ultrafine particle chemical composition in Los Angeles using the NanoMOUDI”, Environmental Science and Technology 39, 932–944

Seigneur, C. (2009) “Current Understanding of Ultrafine Particulate Matter Emitted from Mobile Sources”, Journal of the Air & Waste Management Association, 59: 3-17

Shah, A.P., Pietropaoli, A.A., Frasier, L.M., et al. (2008) "Effect of inhaled carbon ultrafine particles on reactive hyperemia in healthy human subjects", Environmental Health Perspectives, 116(3): 375-380

Stanier, C., Khlystov, A., Pandis, S. (2004a) "Ambient aerosol size distributions and number concentrations measured during the Pittsburgh Air Quality Study (PAQS)", Atmospheric Environment 38, 3275–3284

Stanier, C., Khlystov, A., Pandis, S. (2004b) "Nucleation events during the Pittsburgh air quality study: description and relation to key meteorological, gas phase, and aerosol parameters", Aerosol Science and Technology 38 (S1), 253–264

Sun, Y.L., Zhang, Q., Schwab, J.J. et al. (2012) "Characterization of near-highway submicron aerosols in New York City with a high-resolution aerosol mass spectrometer", Atmospheric Chemistry and Physics, 12(4): 2215-2227

Swanson, J., Kittelson, D., Pui, D., Watts, Wi. (2010) "Alternatives to the Gravimetric Method for Quantification of Diesel Particulate Matter Near the Lower Level of Detection", Journal of the Air & Waste Management Association, 60: 1177-1191

Thompson, N., Ntziachristos, L., Samaras, Z., Aakko, P., Wass, U., Hausberger, S., Sams, T. (2004) "Overview of the European Particulates Project on the Characterization of Exhaust Particulate Emissions From Road Vehicles: Results for Heavy Duty Vehicles", SAE 2004-01-1986

Venn, A.J., Lewis, S.A., Cooper, M., Hubbard, R., Britton, J. (2001) "Living near a main road and the risk of wheezing illness in children", American Journal of Respiratory and Critical Care Medicine, 164(12): 2177-2180

Verma, V., Ning, Z., Cho, A.K., Schauer, J.J. et al. (2009) "Redox activity of urban quasi-ultrafine particles from primary and secondary sources", Atmospheric Environment, 43(40): 6360-6368

Verma, V., Pakbin, P., Cheung, K.L., et al. (2011) "Physicochemical and oxidative characteristics of semi-volatile components of quasi-ultrafine particles in an urban atmosphere", Atmospheric Environment, 45(4): 1025-1033

Virtanen, A., Ronkko, T., Kannosto, J., Ristimaki, J., Makela, J., Keskinen, J., Pakkanen, T., Hillamo, R., Pirjola, L., Hameri, K. (2006) "Winter and summer time distributions and densities of traffic related aerosol particles at a busy highway in Helsinki", Atmospheric Chemistry and Physics 6, 2411–2421

Westerdahl, D., Fruin, S., Sax, T., Fine, P., Sioutas, C. (2005) "Mobile platform measurements of ultrafine particles and associated pollutant concentrations on freeways and residential streets in Los Angeles", Atmospheric Environment 39, 3597–3610

Whitlow, T.H., Hall, A., Zhang, K.M., Anguita, J. (2011) "Impact of local traffic exclusion on near-road air quality: Findings from the New York City Summer Streets campaign", Environmental Pollution, 159(8-9): 2016-2027

Wilhelm, M., Ghosh, J.K., Su, J., Cockburn, M., Jerrett, M., Ritz, B. (2011) "Traffic-related air toxics and preterm birth: a population-based case-control study in Los Angeles County, California", Environ Health 10: 89

Williams, L.A., Ulrich, C.M., Larson, T., Wener, M.H., Wood, B., Campbell, P.T., Potter, J.D., McTiernan, A., De Roos, A.J. (2009) "Proximity to traffic, inflammation, and immune function among women in the Seattle, Washington, area", Environmental Health Perspectives, 117(3): 373-8

Zareba, W., Couderc, J.P., Oberdorster, G., et al. (2009) "ECG Parameters and Exposure to Carbon Ultrafine Particles in Young Healthy Subjects", Inhalation Toxicology, 21(3): 223-233

Zhang, Q., Stanier, C., Canagaratna, M., Jayne, J.,Worsnop, D., Pandis, S., Jimenez, J. (2004) "Insights into the chemistry of new particle formation and growth events in Pittsburgh based on aerosol mass spectrometry", Environmental Science and Technology 38, 4797–4809

Zhu, Y., Hinds, W., Kim, S., Shen, S., Sioutas, C. (2002a) "Study of ultrafine particles near a major highway with heavy duty diesel traffic", Atmospheric Environment 36, 4323–4335

Zhu, Y., Hinds, W.C., Kim, S., Sioutas, C. (2002b) "Concentration and size distribution of ultrafine particles near a major highway", Journal of the Air and Waste Management Association 52 (9), 1032–1042

Zhu, Y.F., Eiguren-Fernandez, A., Hinds, W.C. Miguel, A.H. (2007) "In-cabin commuter exposure to ultrafine particles on Los Angeles freeways", Environmental Science & Technology, 41(7): 2138-2145

Chapter 10

Energy and Climate

South Coast Air Quality Management District

Cleaning the air that we breathe...™

South Coast AQMD

CHAPTER 10

ENERGY AND CLIMATE

INTRODUCTION

In September of 2011, the SCAQMD Governing Board adopted the SCAQMD Air Quality-Related Energy Policy. This policy was developed to integrate air quality, energy issues, and climate change in a coordinated holistic manner and provides a review of energy usage within the Basin followed by ten policies and ten actions (Tables 10-1a and 10-1b). One of the action items is to provide an update of energy usage within the District in each AQMP (SCAQMD, 2011). Energy projections made in this chapter reflect past energy usage in the South Coast Basin and energy projections made from utility and other agencies' planning documents. These projections reflect existing policies and regulations. This review does not include an analysis of energy implications from the control measures within this AQMP; this analysis is conducted within the EIR review.

Energy use in Southern California plays a major role in everyone's lives for purposes such as transportation, comfort, goods movement, manufacturing, and entertainment. In the South Coast Basin this reliance on energy was at a cost of over $50 billion in 2008 and is projected to increase to over $70 billion by 2023. Unfortunately our reliance on energy usage is also the main source of criteria pollutants and greenhouse gases in Southern California. In particular, on-road transportation sources are the largest sources of GHG and criteria pollutants, emitting over 80% of the NOx and 70% of the CO_2 emissions in the Basin.

Technology changes are needed in the transportation sector over the next 10 to 20 years to meet criteria pollutant standards and 2050 GHG goals. In the jointly developed *Vision for Clean Air: A Framework for Air Quality and Climate Planning*, technology scenarios are outlined for the transportation sector that provide insight relative to pathways forward to achieving criteria pollutant standards and climate change goals. The likely pathways also would result in greater energy independence and less money spent on energy. For example, newer transportation technologies such as hybrid and electric vehicles provide much greater efficiencies than typical internal combustion engines alone.

Despite the large quantities of energy consumed in California, the per capita energy consumption is the fourth lowest in the nation (EIA, 2011). This low per-capita energy consumption is due to California's energy efficiency programs as well as the relatively mild California climate. However, there are large improvements that need to be made through increased efficiency, renewable fuels, conservation, and renewable energy generation from all sources.

TABLE 10-1a

SCAQMD Air Quality-Related Energy Policy

POLICIES	
1.	Promote zero and near-zero emission technologies through ultra clean energy strategies, to meet air quality, energy security, and climate change objectives
2.	Promote zero and near-zero emission technologies in both stationary and mobile applications to the extent feasible
3.	Promote diversification of electricity generation technologies to provide reliable, feasible, affordable, sustainable, and zero or near-zero emission electricity supply for the Basin in partnership with local power producers
4.	Promote demand side management programs to manage energy demand growth. Such programs include, but are not limited to, energy conservation, energy efficiency and load-shifting measures
5.	Promote in-Basin distributed electricity generation, with emphasis on distributed renewable electricity generation, to reduce reliance on energy imports or central power plants, and to minimize the air quality, climate and cross-media environmental impacts of traditional power generation
6.	Promote electricity storage technology to improve the supply reliability, availability, and increased generation technology choices
7.	Require any new/repowered in-Basin fossil-fueled generation power plant to incorporate Best Available Control Technology (BACT) as required by District rules, considering energy efficiency for the application. These power plants shall also comply with any requirements adopted by the California Air Resources Board (CARB), California Energy Commission (CEC), Public Utilities Commission (PUC), California Independent System Operator (ISO), or the governing board of a publicly-owned electric utility, as well as state law under the California Environmental Quality Act (CEQA)
8.	Advocate, within the existing CEQA review process, maximum cost effective mitigation in the communities affected by emission increases resulting from the siting of new or repowered power plants
9.	Educate and incentivize the public and businesses to shift toward the lowest emission technologies, considering emissions of criteria pollutants, toxic air contaminants, greenhouse gases, energy efficiency, and the potential to create local jobs
10.	Incorporate energy efficiency and conservation as an emissions reductions strategy for stationary and mobile sources through SCAQMD's planning, rule making, advocacy, and CEQA commenting activities

TABLE 10-1b

SCAQMD Air Quality-Related Energy Policy

ACTIONS	
1.	Advocate for, conduct, and/or support detailed technical studies to identify viable zero and near-zero emission technologies and associated energy delivery and capacity needs to support these technologies as part of the clean air strategy for the Basin
2.	Conduct appropriate socioeconomic studies to identify the societal costs and benefits for the implementation of zero and near-zero emissions strategies, including but not limited to, further electrification and impacts on businesses and jobs
3.	Where feasible, develop an SCAQMD action plan to develop and deploy electrification and other zero and near-zero emissions measures for various sectors, including identification of implementation barriers and strategies to overcome such barriers
4.	Conduct studies to identify measures to reduce emissions from the transportation sector, including incentivizing early introduction of zero and near-zero emission measures and identify potential new transportation funding mechanisms to support substantial penetration of such technologies within the transportation sector
5.	Further develop and demonstrate low emitting biogas technologies and other clean energy sources from biomass
6.	Coordinate this Energy Policy with California state energy policy as promulgated by the California Energy Commission (CEC), California Public Utilities Commission (PUC), and the California Air Resources Board (CARB), and assure that rules and regulations adopted by the Board are not in conflict with state and federal laws. Actively participate in CEC, PUC, and CARB proceedings to promote policies and regulatory actions that further clean air objectives, consistent with state and federal law
7.	Convene a stakeholder working group (including, but not limited to, representatives from the building industry, local fire departments and building departments, and utilities) to develop and recommend standardized installations of electricity recharging, natural gas refueling, and other zero/near-zero emission refueling equipment for residential and commercial building applications to facilitate greater plug-in electric vehicle (PEV), natural gas vehicle (NGV), fuel cell vehicle, and other zero or near-zero emission vehicle market penetration
8.	Advocate for electricity rate structures that incentivize off-peak charging for PEVs through the Statewide PEV Collaborative (comprised of CEC, PUC, CARB, local air districts and utilities) while remaining sensitive to potential impacts on rates for existing customers
9.	Partner with local utilities and local government stakeholders to promote energy conservation and efficiency through local actions
10.	Compile and track Basin-wide energy usage and supply profiles in conjunction with each Air Quality Management Plan (AQMP) update

Many of the recently adopted and existing State regulations developed for energy efficiency, greenhouse gas reductions, and fuel economy will have impacts on the future amounts and types of energy use in Southern California and influence future-year energy consumption projections. This review helps us understand the amounts of energy being used, the associated costs, the historical and projected trends, and the energy-related emissions.

In this chapter, an overview of energy consumption within the District is presented for year 2008 and projected years 2014, 2019 and 2023. This review incorporates recent planning documents from other federal and state agencies, and utility providers. The review also utilizes information presented in other chapters and appendices of the 2012 AQMP. Finally, this chapter includes a discussion of the large benefits efficiency improvements provide and a discussion of the Basin's energy future to meet both criteria and pollutant GHG goals.

ENERGY CONSUMPTION INVENTORY AND PROJECTIONS

In 2008, the end use energy needs of the South Coast Basin were 2.1 quads (1 quadrillion [10^{15}] British Thermal Units) as shown in Figure 10-1. This is equivalent to 2% of the energy consumption within the U.S. The large majority of energy use in the South Coast Basin is devoted to transportation purposes as shown in Figure 10-2. This is the result of several factors related to the region's dense urban population, development structure, and economy. Southern California has two of the largest maritime ports in the United States that account for up to 40% of all U.S. container traffic. This goods movement system includes local distribution networks that require numerous diesel-powered trucks and trains. The Basin also has three large airports that involve both air and ground transportation. Most importantly Southern California is home to approximately 16 million residents that primarily rely on freeway and road infrastructure for mobility. As a result the largest energy use is gasoline consumption. As shown in Figure 10- 1, in 2008, 0.9 quads of gasoline were consumed in the South Coast Basin, approaching 50% of the total energy consumed. End use electricity consumption accounts for the second largest source of energy in Southern California, principally the result of commercial and residential usage.

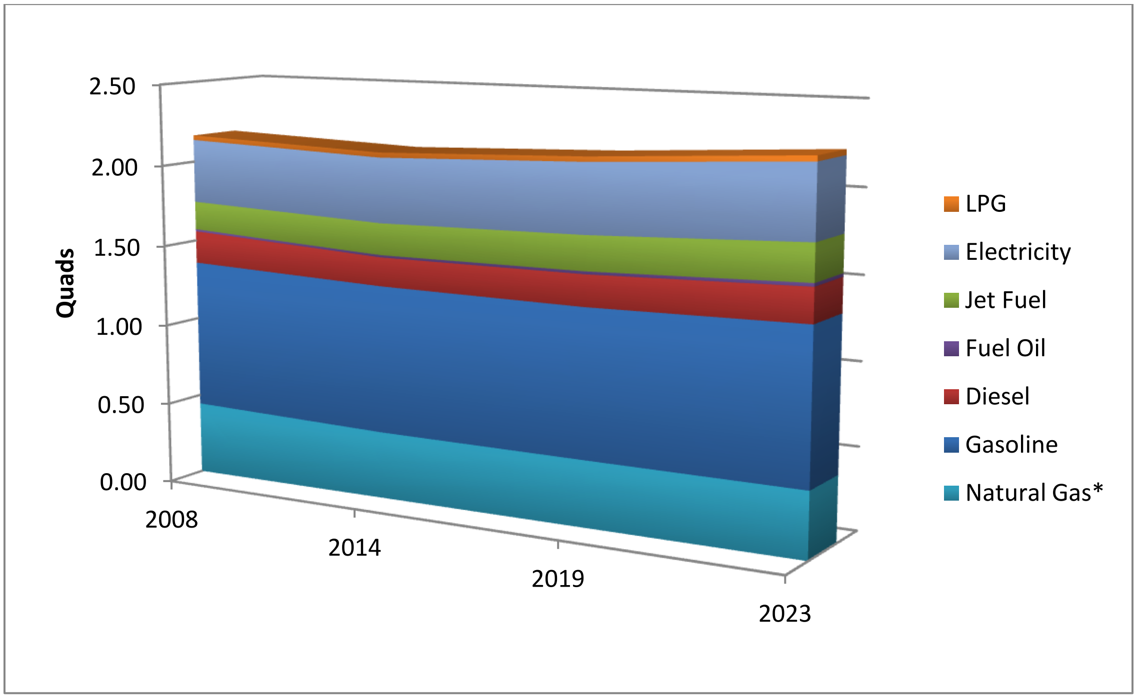


FIGURE 10-1

Total End Use Energy Consumption in the South Coast Basin by Fuel Type in 2008 and Forecasted Energy Growth

*Natural Gas consumption does not include consumption for electricity generation. Future projections are discussed in each energy type category.

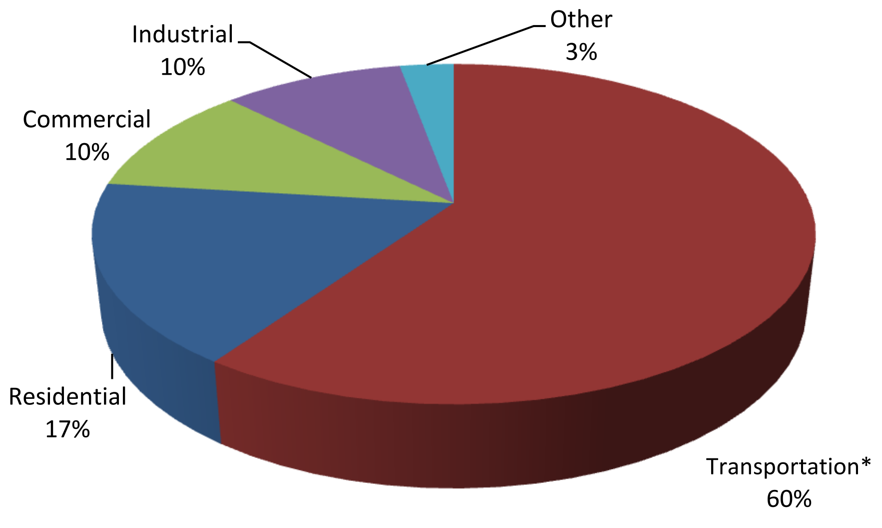


FIGURE 10-2

Share of Energy Use in South Coast Basin in 2008

*Transportation includes off-road sources

The energy usage in Southern California comes with a significant price tag. In 2008, over $54 billion was spent on energy usage within the Basin. As shown in Figure 10-3, the energy usage is projected to grow relatively slowly and will reach slightly over 2.2 quads in 2023 (i.e., a 0.1 quad increase between 2008 and 2023). Unfortunately, Figure 10-4 shows that the cost of energy consumption within the Basin is projected to increase by 27% in 2023 to $74 billion (EIA AEO, 2011).

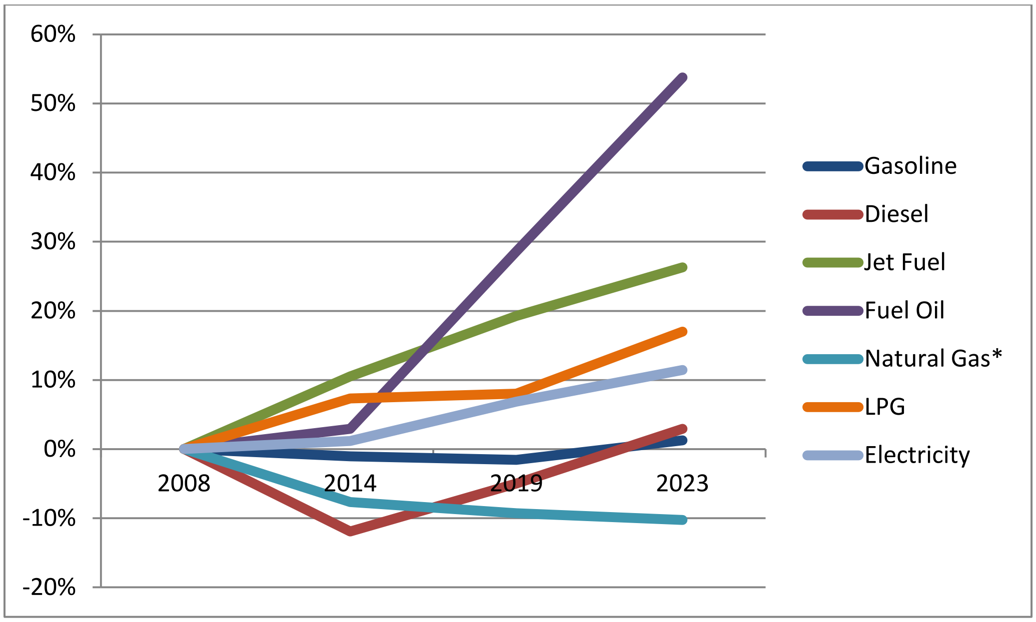


FIGURE 10-3

Projected Basin Energy Usage Growth by Fuel Type Relative to 2008

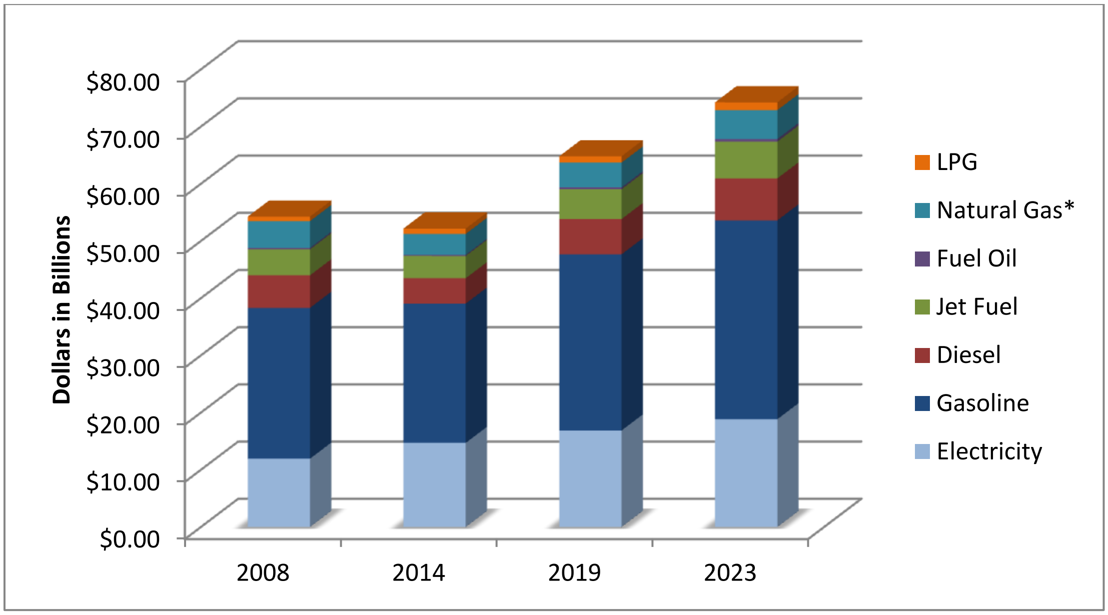


FIGURE 10-4

Dollars Spent on Energy End Use in 2008 and
Projected Years in the South Coast Basin

Note: Prices based on EIA Energy Outlook 2011 reference case for the Pacific except electricity (EIA AEO, 2011); electricity prices based on LADWP and SCE rates for 2008 and projected (CEC Energy Demand, 2009).

While transportation sources accounts for over 50% of the energy use, the majority of NOx emissions are attributable to transportation sources (Figures 10-5 and 10-6). Within the transportation sector, the majority of the NOx is emitted from diesel-powered vehicles. This is largely the result of years of effective stationary source and light-duty vehicle controls, the large numbers of vehicles in use, and the slow rate of fleet turnover for diesel- powered vehicles. Increased fleet turnover, fuel economy standards, diesel repowering and other state regulations are projected to lower NOx emissions. However, these reductions are far from what is needed to achieve ozone standards. Figure 10-7 provides the corresponding data for PM2.5 emissions by fuel type. Similarly, the majority of PM2.5 emissions are attributable to transportation sources.

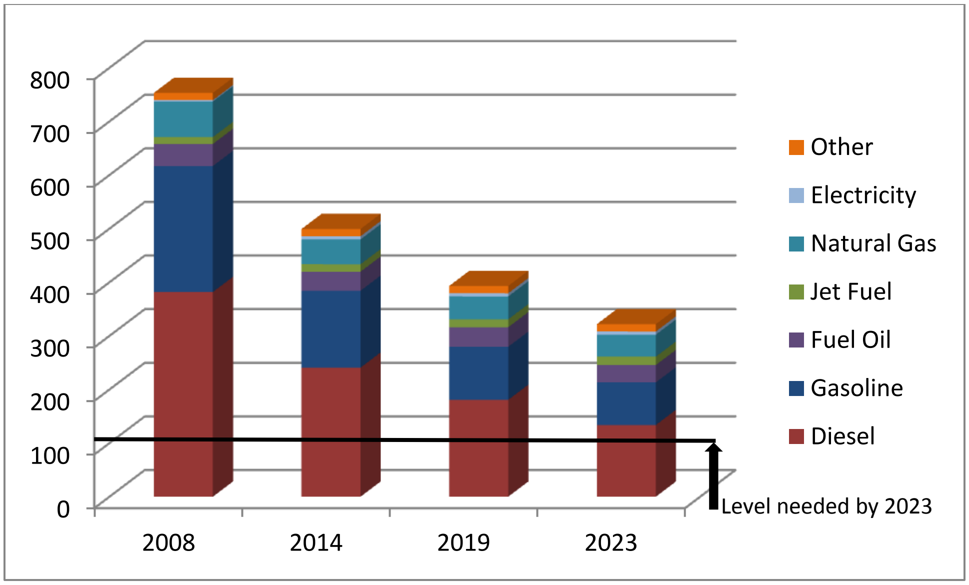


FIGURE 10-5

NOx Emissions in Tons per Day by Fuel Type

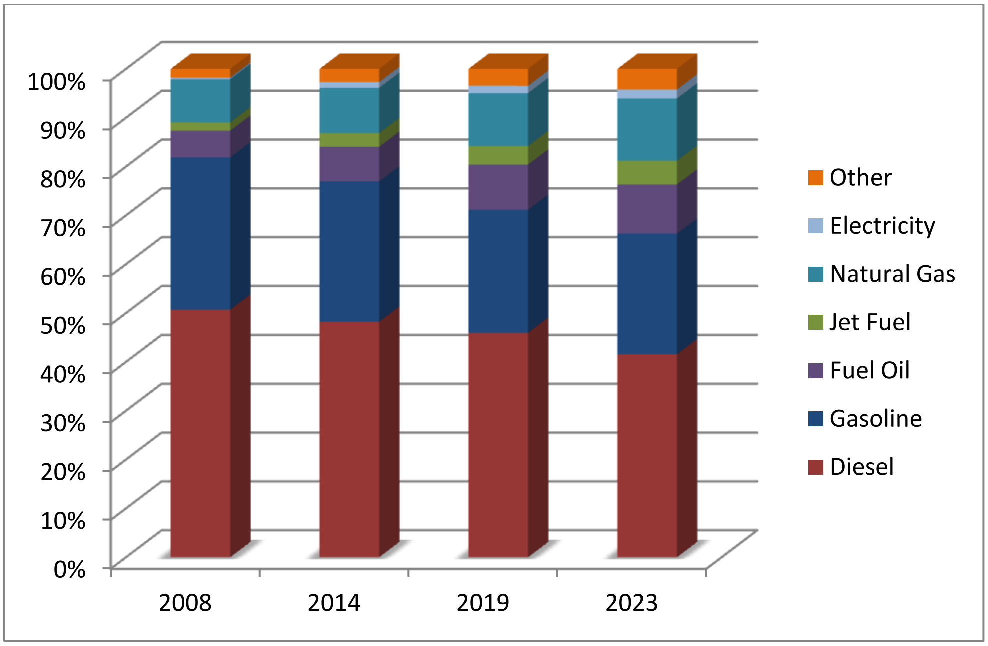


FIGURE 10-6

Percentage of NOx Emissions by Fuel Type

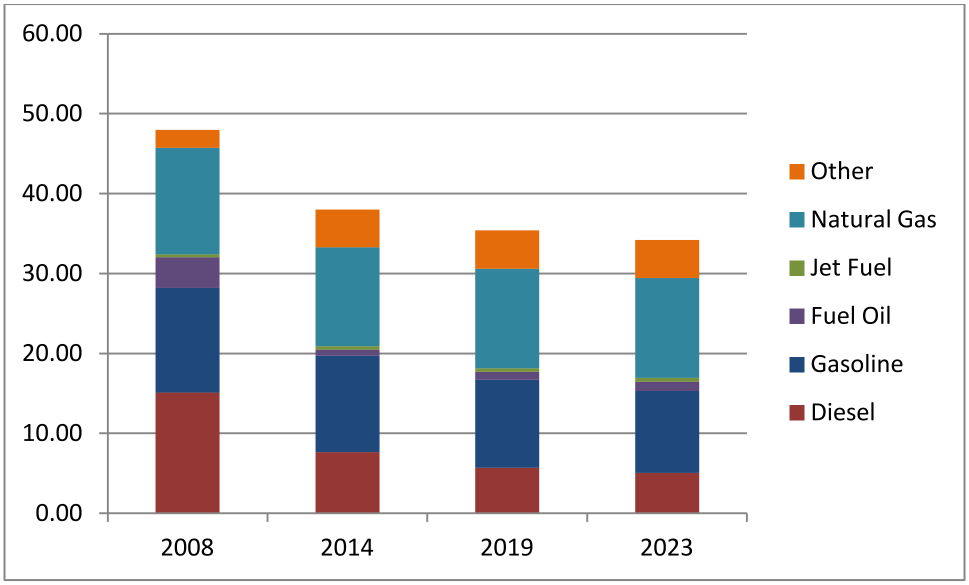


FIGURE 10-7

PM2.5 Emissions by Fuel Type

In 2008, the carbon dioxide emissions from fuel use were 134 MMT (million metric tons) in the Basin (Figure 10-8). This accounts for 32% of the total 421 MMT of carbon dioxide released in California in 2008 (CARB). The CO2 emissions from fuel usage in Southern California are dominated by the use of transportation fuels. By 2023, emissions of carbon dioxide are projected to remain relatively flat. This is largely the result of programs and regulations being implemented in California and discussed in further sections.

The carbon dioxide emissions in Figure 10-8 were determined from fuel consumption data and future fuel consumption projections. Sector-specific carbon dioxide emissions can be found in Appendix III – Table F.

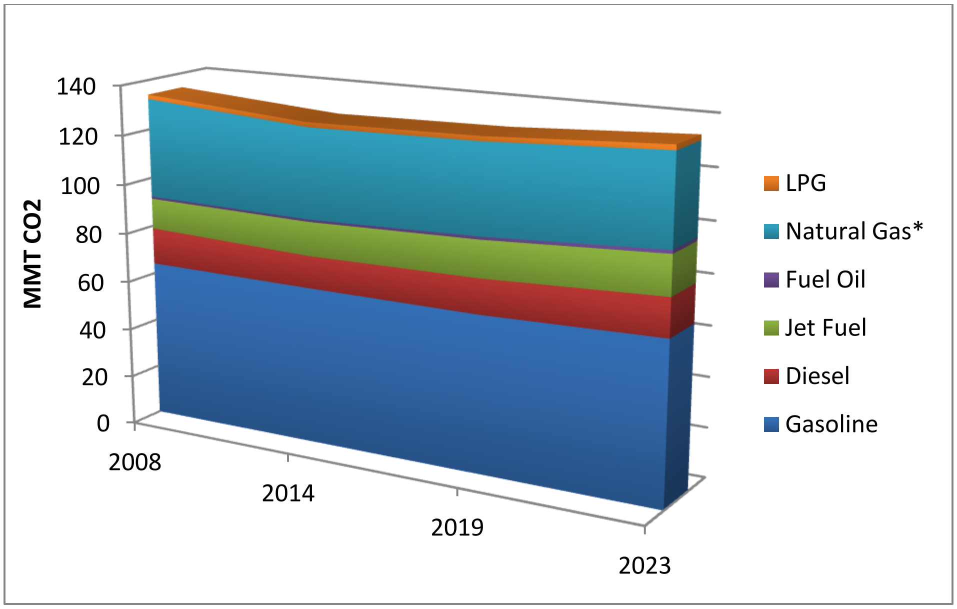


FIGURE 10-8

Carbon Dioxide Emissions by Fuel Type

*Natural Gas emissions include all combustion sources including electricity generation

Electricity Sources

Within the Basin in 2008, electricity end use accounted for 114,400 GWh of energy usage and 23% of the energy costs. While electricity generated within the Basin accounted for 26,000 GWh or 24% of the total electricity consumed in the Basin (CEC QFER). The generation mix for electricity produced within the Basin as of 2008 was mostly from natural gas fueled power plants (Figure 10-9) as it is for most of California; the majority of electricity in the U.S. derives from coal-fired power plants. As shown in Figure 10-9, the remaining supply of electricity into the Basin from Southern California Edison (SCE) and Los Angeles Department of Water and Power (LADWP) are likewise broken out to show percentages of their electricity from coal-powered plants in 2008. The percentages of power from coal between these two utilities have come down from 12% and 44% for SCE and LADWP to 7% and 39% in 2010 respectively (SB1305). SB 1368 (Perata, Chapter 598, 2006), and its implementing regulations by the CEC and CPUC, has explicit constraints on utilities regarding the development of new coal-powered facilities or contracts for coal-powered generation. Due to this legislation, and as the State's renewable portfolio standard and cap-and-trade program are implemented, the power procurement from coal will continue to decline through time.

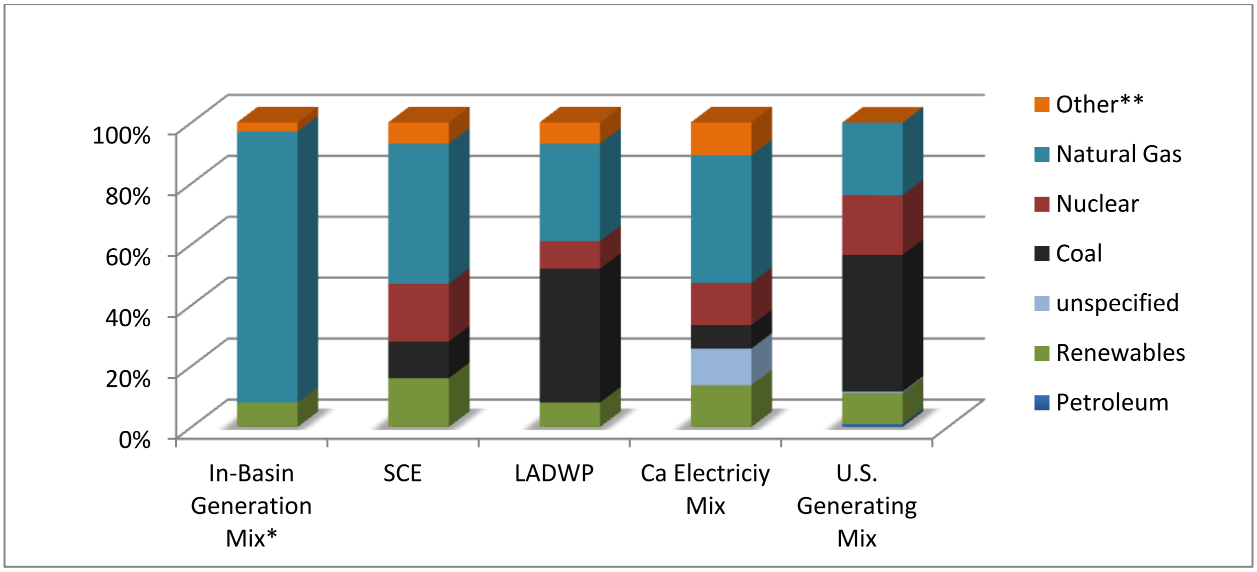


FIGURE 10-9

Electricity Generating Mix by Type in 2008

*Wind and Solar not included in Basin generation renewable mix, location data not available;
** Includes large hydro not accounted in renewable and fossil derived co-generation

Basin Electricity Consumption

As stated above, total electricity consumption within the Basin was 114,400 GWh in 2008 and is predicted to grow to an estimated 123,600 GWh by 2020 as shown in Figure 10-10. This is determined from the net energy loads for L.A. Basin and LADWP service territories within the CEC California Energy Demand Forecast 2010-2020 (CEC Energy Demand Outlook, 2009). Electricity consumption is recovering from a recent decline due to the economic recession that began in 2008.

The projected electricity use within the Basin is estimated to grow an average of 0.5% per year until 2020. In 2008, $12 billion was spent on end use electricity deliveries within the Basin. Using the projected electricity rates in the CA Demand Forecasts and anticipated electricity deliveries between SCE and LADWP, it is estimated that $18 billion will be spent on electricity in the Basin in 2020.

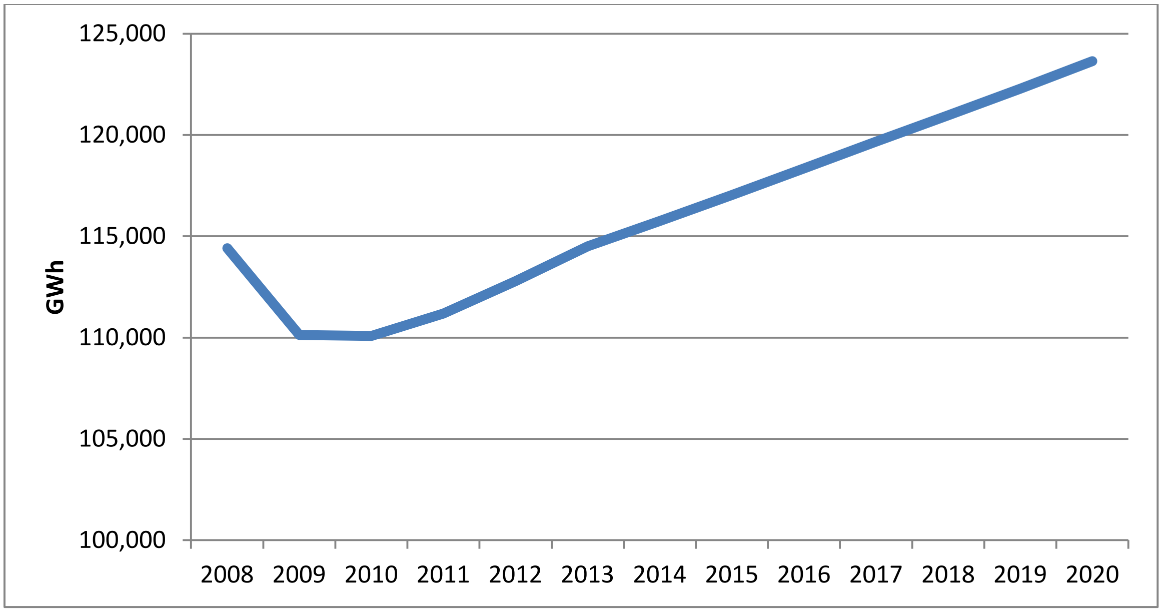


FIGURE 10-10

Total Basin End Use Electricity Consumption and Projections
within the South Coast Basin

Electricity Consumption by Sector

The 2008 electricity consumption and future projections within the residential, industrial, and commercial source categories are shown in Figure 10-11 based on the SCE and LADWP service areas in the adopted CEC California energy demand forecasts and prices (CEC Energy Demand Outlook, 2009). These projections include electricity energy efficiency savings of 14,000 GWh in 2008, growing to an estimated 24,000 GWh in 2020. These savings are anticipated from new and existing appliance standards, building standards, and utility programs.

Electricity projections from SCE and LADWP utility service areas correspond closely, but not exactly, to the expected electricity use in the Basin. For instance, total electricity consumption in the Basin in 2008 was 114,400 GWh as compared to 129,700 GWh in these service areas. These two utility service area demand forecasts include the local municipal utilities located within the Basin, except for electricity services provided by the Cities of Burbank, Glendale and Pasadena; individual source categories for these power providers were not available.

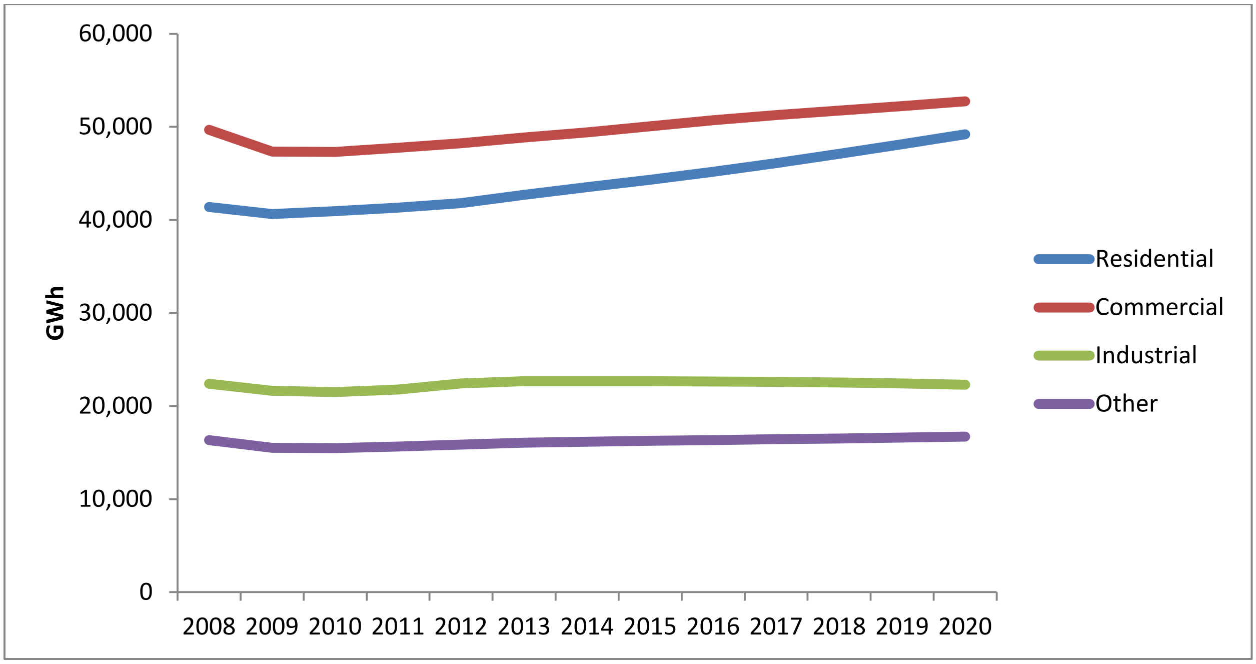


FIGURE 10-11

Electricity Consumption and Projections for LADWP and SCE Service Areas by Sector

RECENTLY IMPLEMENTED STATE REGULATIONS AND ELECTRICITY GENERATION

There are several state regulations that will impact the sources of electricity, the emissions of GHGs from electricity production, and the demand for repowered or new fossil-fueled plants in the future. These regulations were very recently implemented and represent a groundbreaking shift in how electricity is generated in California. The number of recently adopted regulations that affect the power sources in California, along with future conservation and efficiency programs, will significantly impact energy planning efforts in the future.

SBX 1-2 Renewable Portfolio Standard (RPS) – The expanded RPS was adopted in April 2011 and requires both publicly owned utilities and investor owned utilities to serve 33% of retail electricity sales with renewable generation sources by 2020. Compliance periods monitor the progress of procuring renewable power by California electricity-servicing utilities; the first period ending in 2013 requires utilities to have an average of 20% of sales from eligible renewables; by 2016, 25% must be from renewables; and then 33% by 2020 and beyond. Eligible renewable power sources that meet the compliance requirements include photovoltaics, wind, geothermal, solar thermal, power from renewable fuels, and small hydroelectric less than 30 MW.

Adding large percentages of renewable power requires changes to the existing grid and generation requirements for fossil-fueled plants. Large solar power generation facilities in the desert areas have required new transmission lines, such as the San Diego Sunrise 500 kV line linking the Imperial Valley solar resources with the San Diego urban area demand. Other implications include providing ancillary services on the grid to account for the intermittency of some renewable power generation sources. New and existing fossil-fueled generation will need to provide some of these services since these generating sources can provide voltage support through inertia and fast ramp rates when needed. Storage technologies and pumped hydro may also help provide the needed ancillary services for supply stability.

Once-Through Cooling (OTC) – In May 2010, the State Water Resources Control Board adopted the Statewide Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling. This regulation places restrictions on the use of seawater for power plant cooling in order to protect marine life. Using billions of gallons of seawater to cool California's power plants significantly harms the environment by killing marine life primarily on the lower end of the food chain as they are trapped against the intake screens or drawn into the power plant cooling system where they are exposed to high heat and pressure. In California, nineteen power plants are affected by this regulation. The plants may undertake several options to comply, including incorporating a 93% reduction in their seawater intake, screening, or switching to evaporative cooling, with certain exceptions given to the two nuclear generating facilities. The coastal plants affected by this regulation in Southern California include seven fossil fuel powered plants and the San Onofre Nuclear plant. These Southern California plants provide over 7,000 MW of generating capacity and have varying compliance dates under this regulation (Table 10-2). To comply with this regulation, some of the Southern California fossil-powered generation plants will need repowering and some units are planned for shutdown.

TABLE 10-2

Southern California Fossil-Fueled Power Plants affected by OTC

FACILITY	UNITS	TOTAL MW	OTC REPLACEMENT DATE
Alamitos, Long Beach	Boilers 1-6	1,950	2020
Huntington Beach	Boilers 1-4	880	2020
Redondo Beach	Boilers 5-8	1,310	2020
El Segundo	Boilers 3-4	670	2015
Haynes, Los Angeles	Boilers 1,2,5,6 Turbines 9,10	1,654	2029
Harbor, Los Angeles	Turbines 1,2	364	2029
Scattergood, Playa del Rey	Boilers 1-3	818	2024

SCAB Electricity Needs Assessment (AB 1318) – The passage of AB 1318 required the state power regulatory agencies, in conjunction with CARB, to conduct a needs assessment of electricity generation for the South Coast Basin. This analysis is also needed for implementing the OTC regulation, to determine how many plants will need to be repowered. This analysis is currently being conducted and initial estimates under several base case scenarios indicate the OTC regulation results in new generation needs of 2,400 MW. A draft report is expected in the summer of 2012.

Cap-and-Trade – The Global Warming Solutions Act of 2006 (AB 32) seeks to reduce GHG emissions in California to 1990 levels by 2020. Under the Governor's Executive Order, an additional goal was established to reduce GHG emissions 80% below 1990 levels by 2050. To achieve the initial 2020 goal CARB has set forth a scoping plan that contains voluntary and regulatory measures to help reduce GHG emissions. One of these measures is to establish a cap on GHG emissions for the largest emitters in the state. The CARB cap-and-trade regulation was adopted in October 2011 and goes into effect in January 2013 for facilities with emissions greater than 25,000 MT CO_2e. This inclusion threshold encompasses most large fossil fueled generating plants. Additionally, the cap-and- trade program also applies to fuel providers and importers of electricity. Participants falling under this regulation must surrender allowances to meet their emissions over three-year compliance periods with some annual monitoring. Allowances under this program will be obtained through direct issuance, available through auctions; or may be partially obtained from allowable GHG offsets. Under this regulation, the electrical distribution utilities will be given allowances that they must auction, the proceeds from these allowance auctions are then used to help isolate the electricity ratepayers from fee increases (§95892 Cap-and-Trade Regulation). How the utilities will use these proceeds may provide opportunities to further reduce consumption and incentivize clean power through incentives such as efficiency programs and appropriate distributed generation sources while also providing other co-benefits.

NATURAL GAS

Figure 10-12 shows the natural gas consumption by major customer end use categories, including the electricity-generating sector, in the Southern California Gas Company's service area within the District (consumption data and forecast provided by Sothern California Gas Company).

The decline of natural gas prices relative to liquid fuels will likely result in natural gas continuing to be a large component of California's electricity production and increased usage as a transportation fuel. In addition, natural gas plants will help integrate renewables into the grid by providing peaking assistance, fast ramp rates and other ancillary services. The declining consumption forecast for natural gas in the commercial and industrial sectors is due to improved energy efficiency/conservation programs in place through the CEC and CPUC. This declining consumption is partially offset by a projected increased usage for transportation purposes.

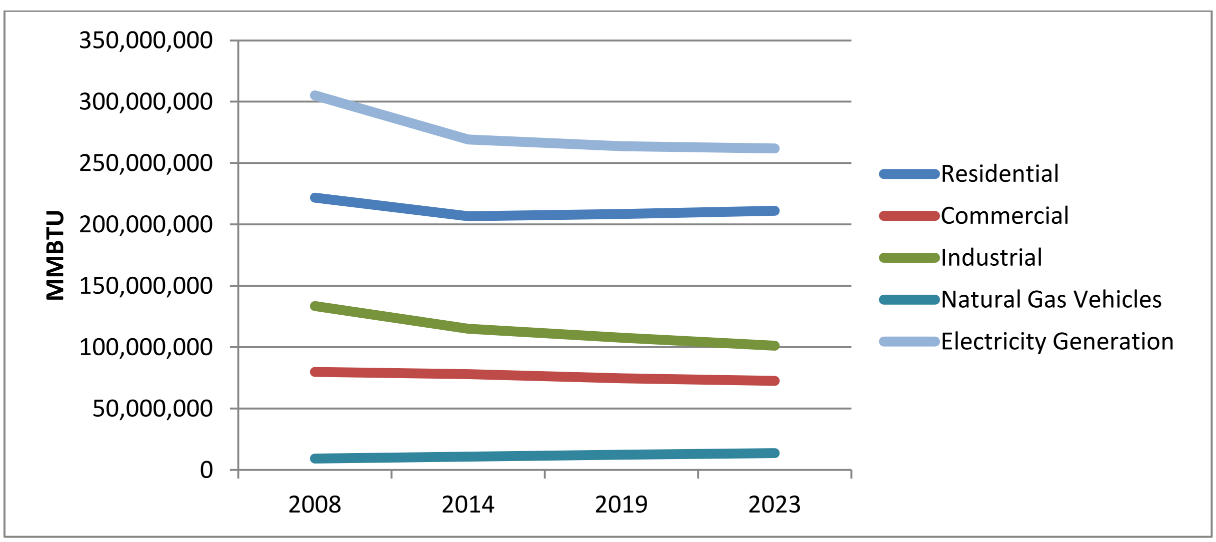


FIGURE 10-12

Natural Gas Consumption in the Basin by Sector

TRANSPORTATION FUELS

The use of transportation fuels in Southern California as shown previously in Figures 10-6 and 10-7 accounts for the majority of NOx emissions and fuel-related emissions of fine particulate. Diesel fuel use in Southern California is dominated by on-road heavy-duty diesel vehicles. Overall usage of transportation fuels in the Basin is slightly over a staggering 10 billion gallons annually (Figures 10-13 and 10-14).

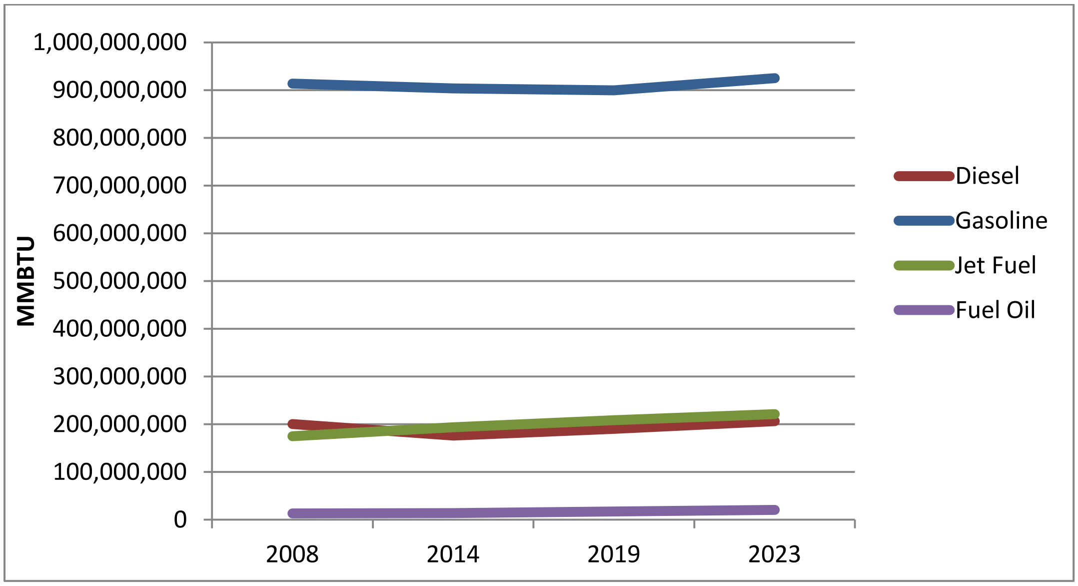


FIGURE 10-13

Consumption of Transportation Fuels in the Basin in 2008 and Projected Years

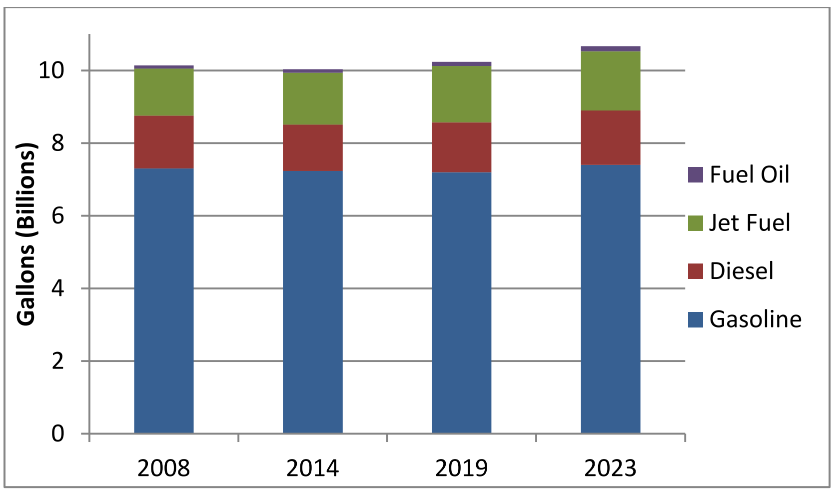


FIGURE 10-14

Fuel Consumption by Type

Fuel consumption figures for transportation fuels were obtained from several sources. The on-road portions of diesel and gasoline vehicles were obtained from the annual average emissions in Appendix III within attachment D. An estimation of the jet fuel consumption within the Basin was determined using the EIA sales to California for 2008 and adjusting for the Basin consumption using the NOx inventory for the Basin relative to the State, then projected to future years using the inventory in Appendix III (CARB Almanac). The diesel consumption estimates for ocean-going vessels were limited to the 100 nm regulatory zone for the Basin ports (CARB OGV). The consumption figures estimated for trains were determined using consumption numbers developed in 2004 for South Coast and grown using inventory numbers for future years (CARB). Other off-road users of diesel were determined from CARB's OFFROAD model.

EFFICIENCY IMPACTS ON ENERGY USE

Energy efficiency is an increasingly important strategy in reducing impacts from volatile and rising energy prices. For example, in 2008 the South Coast Basin consumed over 8 billion gallons of gasoline at a cost of over $26 billion dollars. Unfortunately, the typical gasoline fueled vehicle utilizes, at best, 20% of the energy contained in a gallon of gasoline for propulsion (fueleconomy.gov). The remaining 80% of the energy content of gasoline is mostly wasted as heat. Small changes in the fuel efficiency of gasoline vehicles can have major impacts on the amount of gasoline consumed and money spent while also providing major emission reductions.

Other benefits of implementing efficiency projects include helping to minimize strains on existing infrastructure, providing positive environmental impacts, helping to promote economic growth, and providing job opportunities. Although the term energy efficiency is often used interchangeably with energy conservation, there are key differences. Energy conservation techniques typically involve reducing the "level of service" consumers derive from energy usage, such as raising thermostat levels in the summer or driving less by foregoing leisure travel. Conservation measures are typically behavior based and more difficult to rely on for meeting a specific air quality or climate objective. Energy efficiency, on the other hand, means obtaining the same level of service while using less energy. An example of an energy efficiency project might be installing a high efficiency air conditioning unit as a replacement for an older less efficient one. The consumer is still obtaining the benefit of a cool house, but uses less electricity, requiring less power generated, and thus less pollution from such power plants.

In California, incentive funding administered by the CPUC and distributed to ratepayers through utilities for efficiency projects has helped alleviate the need for new power plants while also reducing the infrastructure needs for energy distribution. Since 2010 these efficiency incentives in the South Coast Basin have reduced 3.8 million GWh of electricity and 71,000 MMBTU of natural gas (http://eega.cpuc.ca.gov/Default.aspx) consumption, resulting in a reduction of 1.4 million MT of CO_2 from being released into the atmosphere (equivalent to the combustion of 154 million gallons of gasoline) and energy cost savings of well over half a billion dollars (based on $0.10.kWh and $2/therm). In addition to energy cost savings, these efficiency projects have reduced criteria pollutant emissions such as PM and NOx. Other efficiency requirements, such as the Title 24 building standards for residential and non-residential buildings, have saved an estimated $66 billion in energy costs since 1978. These efforts have helped California's per-capita energy consumption to remain relatively flat since 1973 while the U.S. per-capita consumption has increased over 60% during this time (CEC per capita).

Globally there is an increase in energy use and demand as emerging markets further develop and thus, global energy markets are becoming increasingly volatile. Addressing energy issues through policy and technology improvements is a lengthy process, combining scientific, engineering, economic, social, and political elements that take long periods of time to develop and implement. However, implementing efficiency measures provides for actions that can be taken quickly and provide several immediate benefits. These benefits include emission reductions from electricity generation or process equipment and typically have quick payback periods given the energy cost savings.

Example: Manufacturing, Industrial and Commercial Boilers

The manufacturing and industrial sectors have significant opportunities for additional efficiency gains that can be captured as a compliance strategy for NOx and GHG reductions. These two sectors account for 20% of energy end use in the United States and 23% within California (IEA). It is estimated that 4.7-7.7 quads of energy can be saved in the United States by 2020 in these sectors through efficiency measures that have rates of return from energy savings of at least 10% (NAS). Of the equipment within these sectors, boilers account for the largest sources of energy consumption. Efficiency improvements on boilers often have higher initial capital costs but result in quick payback from energy savings. Table 10-3 shows a partial list of efficiency improvements, which when properly applied, have payback periods of less than two years (DOE; Itron).

TABLE 10-3

High Impact Efficiency Measures for Boilers

NATURAL GAS BOILER EFFICIENCY MEASURE	DESCRIPTION	POTENTIAL EFFICIENCY GAIN
Reduce Steam Demand	Optimize process steam requirements	High
Maintenance	Maintain burners and condensate return systems, clean heat transfer surfaces, use proper water treatment, steam trap maintenance	>30%
Economizer	Flue gas heat used to preheat feed water	4-8%
Burner Efficiency	Oxygen trim systems to optimize air-fuel mixture, new burners	2-5%
Load Control	Optimize use of several boilers	3-5%
Improved Insulation	Improving insulation (type, thickness, quality)	6-26%
Scheduling	Optimizing boiler usage	2-8%

Boilers have widespread use to produce steam and provide hot water for industrial processes and commercial buildings. Because boilers are large consumers of fuel, primarily natural gas in Southern California, there are numerous opportunities to implement efficiency measures with quick payback periods from reduced energy use. Nearly 49% of fuel consumed by U.S. manufacturers is used for steam processes (http://www1.eere.energy.gov/manufacturing/tech_deployment/steam.html). In the South Coast Basin there are over 2,000 boilers ranging in size from 5 to greater than 50 MMBtu/hr with an average age greater than 14 years old which consumed 143,000 mmscf of natural gas (2008). This accounts for 20% of natural gas consumed within the South Coast Basin. Figure 10-15 below shows energy usage in 2008 from boilers was 143,000 mmscf of natural gas at a cost of $1.23 billion dollars. This resulted in emissions of 870 tons of NO_x and 8 million MT of CO_2. (http://info.ornl.gov/sites/publications/files/Pub25191.pdf).

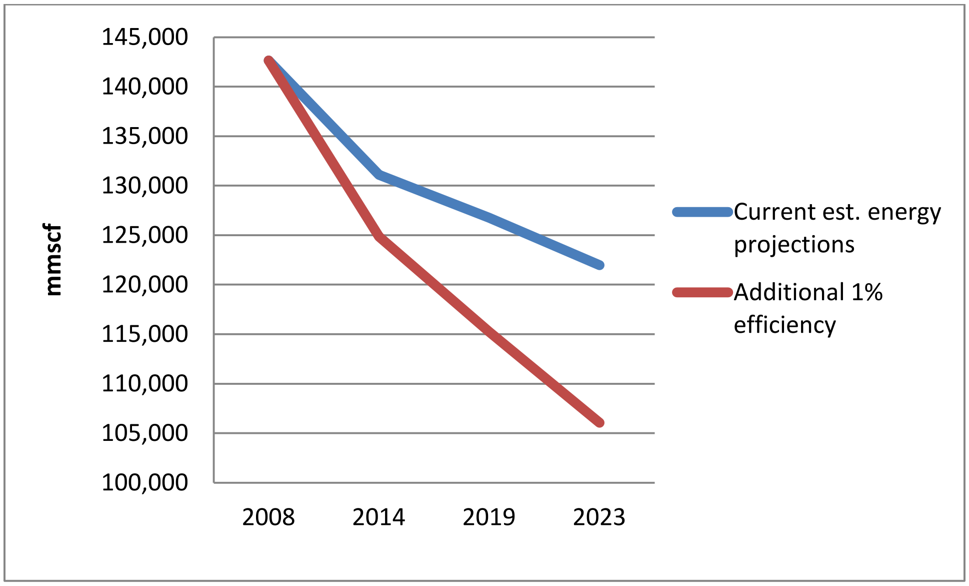


FIGURE 10-15

Boiler Energy Usage within the Basin

Note: Current estimated energy use projections accounting for existing efficiency programs and an accelerated one percent per year efficiency increase above projection.

Efficiency programs already in place are projected to decrease the natural gas consumption used in boilers as shown in Figure 10-15. If these efficiency measures can be enhanced to achieve an additional one percent efficiency gain per year, the resulting savings in 2023 will be 16,000 mmscf. This would result in a yearly savings of $140 million, prevent 87,000 MT of CO_2 emissions, and produce reductions in criteria pollutant emissions.

Waste Heat Recovery

Additional efficiencies can be gained in the commercial, manufacturing and industrial sectors through utilizing waste heat recovery. There are widespread applications of waste heat recovery in the commercial, industrial and manufacturing sectors. Applying waste heat recovery systems can provide a holistic approach to energy use. Some technical approaches to waste heat recovery include the following:

Combined Heat and Power (CHP) - Utilizing CHP takes advantage of both electricity production and thermal energy from one energy source. Efficiency benefits of CHP systems can be achieved through utilizing waste heat of electricity production from small generating sources like a fuel cell or micro turbine to increase the efficiency of another thermal process such as preheating boiler feed water. Combined systems can achieve overall thermal efficiencies greater than 90%. Certain steam industrial applications may benefit from generating power directly from their steam production using a high pressure steam boiler coupled with a turbine. In California, currently 8,444 MW are online from approximately 1,000 CHP systems (ICF database). In Southern California some of the largest generators of electricity are utilizing waste heat to generate electricity (CEC QFER, large kWh from refinery CHPs).

Waste Heat to Cooling or Refrigeration - Waste heat may also be used to help with cooling or refrigeration needs utilizing absorption chillers.

Heat to Heat – Some applications can use waste heat to supplement another heating process such as supplementing space heating requirements or utilizing an economizer to preheat feed water.

Available Tools to Develop Projects

The DOE has developed a suite of software tools to evaluate existing boiler systems and provide benefit estimates from a suite of efficiency and performance tools. Other resources such as energy assessments on specific industries, best practices, and literature resources are available at the DOE Advanced Manufacturing website (http://www1.eere.energy.gov/manufacturing/tech_deployment/steam.html). The providing local utilities also offer technical assistance in developing efficiency projects.

EFFICIENCY INCENTIVES AND FINANCING

There are many business reasons for undertaking efficiency projects, including rising energy prices, high demand use charges, environmental concerns and regulations, increased productivity, and business sustainability. Despite these strong business cases and potentially short payback periods for capital investments, financing and incentives are necessary to help implement efficiency projects (AP NORC). Implementing efficiency projects on industrial applications often requires a large initial capital outlay, time to implement the project, and personnel to administer the project. Often the largest hurdle is securing the initial capital to undertake the project. Providing efficiency incentives and loan programs can help overcome the limited capital improvement budgets that businesses have for such projects. Additionally, incentive programs also can provide funding and technical assistance in developing a project which also helps limit staff hours allocated to these projects. Incentives available for efficiency projects include direct rebate incentives often administered through the local utility, tax incentives, and favorable loan terms. Some resources to find available incentives include:

-Flex Your Power: www.fypower.org
-CEC low-interest loans for energy efficiency projects:
www.energy.ca.gov/efficiency/financing/index.html
-Energy Star: http://www.energystar.gov/index.cfm?c=tax_credits.tx_index
-WRCOG HERO program: http://herofinancing.com/HEROFinancing/

SOUTHERN CALIFORNIA'S ENERGY FUTURE

The energy use projections presented above represent a base case scenario of energy use in the South Coast Basin in the near future. The control measures proposed as SIP commitments for the PM2.5 attainment and progress toward the ozone standard do not in themselves cause substantial change in current energy consumption. However, in order to meet the ozone standards and GHG goals, energy consumption related NOx and carbon emissions would need to be reduced. In the transportation sector, fleet turnover along with newer emission control designs will help reduce criteria pollutants from this sector but as shown in Figure 10-5 these reductions alone will not be enough to meet federal ozone standards by the 2023 deadline.

To greatly impact energy usage, attain healthful air quality levels, and meet the 2050 climate change goals, significant technology shifts are needed in the transportation sector, including efficiency shifts and increased renewable sources of energy, especially for electricity production.

Transportation and goods movement are our largest energy consumption sectors, responsible for 80% of NOx emissions and 70% of the CO2. The majority of our transportation and goods movement activities rely on the internal combustion engine, which has dominated these sectors for well over the past hundred years and is inherently energy inefficient. Reliance on internal combustion engines results in a vehicle fleet that utilizes only 20% of the gasoline energy consumed for mobility while the rest is lost primarily to wasted heat. From the over $26 billion spent on gasoline in 2008 within the South Coast Basin, this significant inefficiency means over $20 billion in gasoline costs was wasted as unused heat. On a national level in

2008, $455 billion was spent on gasoline, thus wasting $364 billion dollars as unused heat. Other transportation fuels for the most part have a slightly higher efficiency than gasoline; however, a similar situation applies, resulting in the vast majority of the fuel being wasted as heat. This wastefulness in transportation fuels represents a dramatic opportunity for efficiency increases in the transportation and goods movement sector that would reduce criteria and toxic pollutant emissions, GHG emissions and provide many other co-benefits.

Currently, emerging global markets are developing infrastructures reliant on existing transportation technologies. As these are implemented, more people globally are being exposed to the same transportation-related emissions and will encounter the negative effects of volatile energy prices. It will not take long for the cost benefits of a cleaner more efficient transportation system to be realized, especially when looking at the energy cost savings. The business-as-usual scenario without these changes may cause significant increases and will certainly delay decreases in air pollution related health problems as the population increases, both in California and the rest of the world.

New fuel economy standards will eventually help improve the effectiveness of transportation fuels in providing mobility. More transportation choices are coming into the marketplace providing higher efficiencies that utilize electricity either solely or in hybrid applications. In the jointly developed Vision for Clean Air: A Framework for Air Quality and Climate Planning, information is presented that shows the benefits of implementing these new technologies and renewable energy sources.

As outlined earlier, more renewable power sources will be put online as utilities work toward meeting their obligations under the Renewable Portfolio Standard. Coupling renewable electricity sources with transportation can mean large reductions in the total amount of energy spent for transportation, provide emission reductions in all areas, and support energy independence along with buffering from increasingly volatile transportation fuel prices. Under AB32, there is also a need to implement renewable sources of transportation fuels which would help with GHG reductions.

Transformation of the Energy Sector

The recent shutdown of the San Onofre Nuclear Generating Station has required temporary return to service of two units at the Huntington Beach natural gas plant which had been voluntarily shut down. This event demonstrates the vulnerabilities in the current energy planning process. The planning and investments in the energy infrastructure must consider reliability; reductions in criteria pollutants, air toxics, and greenhouse gases; provide energy security, energy diversity, and energy cost certainty. The transformation of the energy sector to maximize these co-benefits can start with:

- Coordinated planning efforts – Agencies such as the CEC, CPUC, CARB, SCAQMD, U.S. EPA, and CaISO need to be working closely together in planning and regulatory efforts. A holistic, integrated approach, considering the objectives, constraints, and legal responsibilities of all agencies, needs to be addressed. Regulations and actions by one agency can negatively impact the planning efforts of other agencies. A coordinated planning strategy would not only help to avoid such conflicts, but also identify synergies whereby the goals of multiple agencies could be furthered simultaneously.

- Scheduling for infrastructure and technology needs – New and existing mobile source technologies can provide a more efficient means of mobility and goods movement. Implementing these technologies requires the supporting energy infrastructure to allow acceptance and greater use, similar to the Actions to Deploy Advanced Control Technologies (ADV) measures in Chapter 4 and Appendix IV-B. These efforts should also be implemented in a coordinated manner with multi-agency participation and support.

To achieve these planning objectives, the District will enhance its outreach and coordination efforts with the appropriate state and federal agencies. Through scheduled public hearing testimony, as well as meetings, conferences, workshops, and the formation of interagency working groups, the District desires to help catalyze the coordinated planning efforts that are needed to achieve air quality, climate and energy goals.

REFERENCES

SCAQMD, 2011 – SCAQMD Air Quality Related Energy Policy http://www.aqmd.gov/prdas/climate-change/EnergyPolicy.html;

AP NORC Efficiency survey www.apnorc.org

EIA per capita energy use by state – http://www.eia.gov/state/state-energy-rankings.cfm?keyid=60&orderid=1

EIA AEO (2011) - Fuel price projections are based on EIA energy price forecasts for the Pacific region – http://www.eia.gov/oiaf/aeo/tablebrowser/#release=EARLY2012&subject=3-EARLY2012&table=3-EARLY2012&region=1-9&cases=full2011-d020911a,early2012-d121011b

CARB – The California Almanac of Emissions and Air Quality – http://www.arb.ca.gov/aqd/almanac/almanac.htm

CARB - California Greenhouse Gas Emissions Inventory: 2000-2009 – http://www.arb.ca.gov/cc/inventory/pubs/reports/ghg_inventory_00-09_report.pdf

CARB – Ocean Going Vessel Emission Inventory Methodology Appendix D – http://www.arb.ca.gov/regact/2011/ogv11/ogv11.htm

CARB - Table VI-4: Intrastate Locomotive Diesel Fuel Consumption by Region – http://www.arb.ca.gov/regact/carblohc/isor.pdf

CEC per capita – A Comparison of the Per Capita Electricity Consumption in the United States and California –http://www.energy.ca.gov/2009publications/CEC-200-2009-015/CEC-200-2009-015.PDF

CEC Energy Demand Outlook – http://www.energy.ca.gov/2009publications/CEC-200-2009-012/index.html

CEC (Quarterly Energy and Fuel Report) QFER Database – http://www.energyalmanac.ca.gov/electricity/web_qfer/

DOE, Results from the U.S. DOE 2008 Save Energy Now Assessment Initiative – http://info.ornl.gov/sites/publications/files/Pub25191.pdf

Fueleconomy.gov (Department of Energy) – Fuel Economy: Where the Energy Goes –http://www.fueleconomy.gov/feg/atv.shtml

Improving Process Heating System Performance: A Sourcebook for Industry, DOE 2004.

Improving Steam System Performance: A Sourcebook for Industry, DOE 2004.

ICF Database of CHP systems and size in California – http://www.eea-inc.com/chpdata/States/CA.html; http://www1.eere.energy.gov/manufacturing/distributedenergy/pdfs/chp_accomplishments_booklet.pdf

Waste Heat Recovery: Technology and Opportunities U.S. Industry – http://www1.eere.energy.gov/manufacturing/intensiveprocesses/pdfs/waste_heat_recovery.pdf

High Pressure Boilers with Steam Turbine – http://www1.eere.energy.gov/manufacturing/tech_deployment/pdfs/steam22_backpressure.pdf; http://www1.eere.energy.gov/manufacturing/tech_deployment/pdfs/wasteheatrecovery_factsheet.pdf

Itron and KEMA, CA Energy Efficiency Potential Study, 2008

International Energy Agency (IEA), Climate and Electricity Annual, 2011

LADWP 2008 Power Content Label – http://www.ladwpnews.com/external/content/document/1475/289273/1/Jan-Feb09%20FINAL%20lo%20Res.pdf

National Academy of Sciences (NAS) – Real Prospects for Energy Efficiency in the U.S., 2010 – http://www.nap.edu/catalog.php?record_id=1262

SCE 2008 Power Content Label – http://asset.sce.com/Documents/Shared/2008_SCE_Power_Content_Label.pdf

SB1305 - Power content labels – http://www.energy.ca.gov/sb1305/labels/index.html

Chapter 11

Public Process and Participation

South Coast Air Quality Management District
Cleaning the air that we breathe...™

South Coast AQMD

CHAPTER 11

PUBLIC PROCESS AND PARTICIPATION

INTRODUCTION

The development of the 2012 AQMP has been a regional and multi-agency effort including the District Governing Board, CARB, SCAG, and U.S. EPA. The AQMP includes control strategies and contingency measures that demonstrate attainment with NAAQS by specified deadlines. The 2012 AQMP incorporates the latest scientific and technological information and planning assumptions, including SCAG's 2012 Regional Transportation Plan/Sustainable Communities Strategy, an updated emission inventory and modeling methodologies for various source categories.

A 2012 AQMP Advisory Group was formed to provide feedback and recommendations on the development of the plan, including policy and control measure strategies. The Advisory Group represents a diverse cross section of stakeholders, such as large and small businesses, government agencies, environmental and community groups, and academia. In addition, a Scientific, Technical, and Modeling Peer Review (STMPR) Advisory Group convened to make recommendations on air quality modeling, emissions inventory and socioeconomic modeling and analysis. Both Advisory Groups meet monthly throughout the AQMP development process and those meetings have been open to the public. There has been ongoing close coordination between U.S. EPA, CARB, SCAG and SCAQMD staff on all elements of AQMP development.

The 2012 AQMP Outreach Program is designed to go above and beyond the usual Advisory Group, public workshop and public hearing mandates in order to more broadly disseminate information and engage a wider range of stakeholders. The approach aims to achieve multiple goals, such as:

- Reach a broader and more diverse audience
- Ensure greater transparency in the process
- Facilitate greater participation and engagement
- Develop partnerships with stakeholder groups

The outreach approach has been designed to help formulate the policy debate by ensuring all stakeholders share a common set of essentials facts, understand the federal requirements, and thus have adequate information to make informed comments on the AQMP.

The clean air goals in the 2012 AQMP will not be achieved solely by the actions of the District. The proposed control strategy will require participation from affected businesses, local communities, and government agencies. Achieving the mutual goals of protecting public health, providing environmental equity and promoting robust and sustainable economic development can only be accomplished through strong partnerships. Thus, it was critical to inform and engage a wide range of stakeholders on the requirements, approach, goals, and impacts of the Final 2012 AQMP.

OUTREACH PROGRAM

Audience

Stakeholders for the 2012 AQMP include community members, businesses, trade associations, environmental organizations, health advocates and local, regional, state and federal governmental entities. Table 11-1 lists specific stakeholder groups targeted for outreach efforts. The stakeholders were notified of all Advisory Group meetings, workshops and hearings, as well as invited to participate in various activities designed to assist in the communication and development of the 2012 AQMP.

Format

A variety of formats and communication outreach methods were utilized as part of the Outreach Program. The format used for specific activities were tailored to the particular audience or venue where information was being presented and discussed. Formats and methods include:

- SCAQMD Advisory Groups and Committee meetings
- Workshops
- Air Quality Institutes
- Open houses and community meetings
- Panel discussions
- Conference calls
- Invited presentations at conferences, seminars, board/council meetings, etc.
- Printed materials such as the Advisor newsletter and collaterals
- Dissemination of information through stakeholder newsletters, websites and other communication tools
- Clean Air Connection email blasts
- Distribution at the SCAQMD Public Information Center
- SCAQMD website including postings and links from partner organizations
- Social media
- Telephone “hold” message
- Radio telephone operators

TABLE 11-1

Stakeholders Targeted for Outreach Efforts

Public Agencies	• CARB • California Energy Commission • California Public Utility Commission • California ISO • CalWaste • U.S. EPA • U.S. Department of Transportation • U.S. Department of Energy
Local/Regional Government	• Councils of Governments • SCAG • Transportation Commissions • Local Planning Departments • Building and Fire Departments • Tribal Governments
Special Districts	• School Districts • Sanitation Districts • Water Districts
Health Advocates	• Medical Practitioners • Health Researchers • Health Providers
Community/Health/Environmental Groups	• Public Health Departments • Environmental Justice Organizations • Environmental Advocacy Groups • Faith-based Organizations • Labor Organizations
Academia	• Universities • National Laboratories
Business	• Energy Industry (Electricity, Petroleum Refining, Natural Gas, Biofuels, Renewables, etc.) • Green Technologies • Goods Movement and Logistics (Warehousing, Trucking, Railroads, Ports) • Dairy Operations • Printing/Coating Industry • Airport/Airline Operations • Engine Technologies • After-treatment Technologies • Building and Construction Industry • Chambers of Commerce/ Business Councils • Small Businesses

Outreach Activities

As in previous AQMPs, multiple public workshops will be held throughout the District. Mandatory public hearings will also be held as required. In addition, the following specific activities are planned to fulfill the goals of the Outreach Program:

- Key agency coordination meetings (CARB, U.S. EPA, SCAG)
- Local stakeholder meetings
- Topical workshops
- Public agency engagement (CEC, CPUC, solid waste agencies, sanitation districts, transportation agencies, etc.)
- Focus groups
- Peer review
- General public outreach

Key Agency Coordination Meetings

Throughout the 2012 AQMP development process, staff has and continues to hold frequent coordination meetings with the key AQMP partner agencies (CARB, U.S. EPA and SCAG). Meetings occurred several times per month to raise and discuss technical and control strategy issues.

Local Stakeholder Meetings

Meetings with specific stakeholder groups have been held to communicate the purpose and scope of the 2012 AQMP, discuss the concerns of the representatives, solicit recommendations for inclusion, and gather further outreach suggestions. Stakeholders include all those listed in Table 11-1, such as regional council of governments (COGs), county transportation commissions, labor organizations, Chambers of Commerce, business councils, trade groups and associations, environmental and health advocates, community groups, and faith-based organizations. Outreach methods included agendized SCAQMD presentations at COGs, participation at conferences and seminars, and face-to-face meetings as requested.

Topical Workshops

In addition to the regional workshops/hearings, topical workshops have been held to focus on specific AQMP related topics such as economics, incentives, employment impacts, health benefits, modeling issues, climate/energy, transportation, environmental justice, and goods movement. Attendance at the public workshops has been comprised of experts and interested parties from various stakeholder groups, but focused on a particular aspect of the AQMP. These topical workshops provided a forum where different opinions on specific topics could be shared and discussed.

Focus Groups

Focus groups have been formed to address specific issues including the evaluation and development of the emission inventory and certain control measures. The control measure topics included, but were not limited to, coatings and solvents, petroleum operations, combustion sources, energy, transportation, mobile sources and incentive programs. The focus groups were comprised of experts for the particular inventory or control technology under evaluation, including equipment manufacturers and suppliers. The focus groups met as often as necessary to provide any recommendations.

Peer Review

In addition to the feedback provided by the 2012 AQMP Advisory Group and the STMPR Advisory Group, additional expert peer review of specific 2012 AQMP components has been sought. One specific example is the focused peer review of the socioeconomic/health impacts and a cost-benefit analysis of the 2012 AQMP and associated control strategy. Another review was focused on modeling methods and assumptions, including growth and emissions projections. Expert reviewers were from a diverse range of institutions and perspectives. All results of the peer reviews have and will be made public to ensure full transparency and open discussion of any issues raised.

General Public Outreach

The 2012 AQMP has been included in the District's extensive community outreach activities – including, but not limited to events, community forums and other meetings – to promote better public awareness of its purpose and significance. Non-technical brochures have been created and distributed at events at which SCAQMD participates. Furthermore, web-based and social media communication tools have been utilized to distribute AQMP information and provide an opportunity for interactive feedback.

OUTREACH RESULTS

As of the release of the Final 2012 AQMP, fourteen (27) Focus Groups convened, including: Ports of LA and Long Beach, CCEEB, The Gas Company, SoCal Edison, Regulatory Flexibility Group, Sanitation Districts (4 counties), Manufacturer's of Emission Control Association (MECA), Construction Industry Air Quality Coalition (CIAQC), American Coatings Association, Environmental and Health Community, the Western States Petroleum Association (WSPA), Compost/Greenwaste Processing/Composting, Mobile Source Committee, and Mira Loma Focus Group.

Thirty-one (21) topical workshops took place with: AQMP Advisory Groups, Home Rule Advisory Group (HRAG), Environmental Justice Advisory Group (EJAG), Technology Symposium, Transportation Research Board, Independent Lubricant Manufacturing Association (ILMA), Valley Green Building Education Conference and Expo, and SCAQMD Student Interns.

Eight (8) meetings with key agencies were coordinated with: SCAG, CARB, U.S. EPA, and San Joaquin Valley APCD (SJVAPCD).

Forty-two (48) meetings with local stakeholders occurred with: WRCOG (Executive Council), Santa Monica City Council Task Force on the Environment, LA Chamber of Commerce (Energy, Water and Environmental), WRCOG (Technical Advisory Committee), Valley Industrial Commerce Association (VICA), ALA/Inland Empire Air Quality Committee, Inland Action Committee, Loma Linda Chamber of Commerce, San Gabriel Valley Economic Partnership (Legislative Action), SCAG (Energy and Environment), San Fernando Valley COG, STEM Learning Institute, San Bernardino Association of Governments (Major Projects), Orange County COG, San Gabriel Valley COG (Energy, Environment and Natural Resources), South Bay Cities COG, Gateway COG, SCAG (Regional Council), City of Los Angeles, Orange County (OC) COG Technical Advisory Committee, OC Business Council, U.S. Forest Service, Jurupa Valley Parks/ Chamber of Commerce/ Rotary Club, DWP, SoCal Edison, SoCal Gas, Department of Housing and Community Development, City of Redondo Beach, AEP, Environmental Groups, BizFed, SCAG GLUE Council, Association of CA Cities of Orange County (ACCOG), Assembly Budget Committee/Assemblymember Blumenfield's office, and Inland Action Committee.

Approximately sixty-five (101) presentations were given regarding the development of 2012 AQMP.

SUMMARY OF OUTREACH ACTIVITIES

Table 11-2 provides the specific efforts conducted to implement the outreach program for the 2012 AQMP. The table provides the outreach format (e.g., an air quality institute, key agency coordination meeting, etc.), the date the activity took place, with what organization(s), what was discussed or accomplished, and the type of activity (e.g., conference, meeting, presentation, etc.). In addition to meeting and giving presentations, SCAQMD staff also attended a number of meetings conducted by other organizations (e.g., cities, councils of government, chambers, etc.) where a brief announcement regarding the 2012 AQMP was made. These types of announcement include any information in regards to the date, time and location of the next AQMP Advisory meeting or the latest status in the development of the 2012 AQMP. That list is provided in Table 11-3.

TABLE 11-2

Outreach Activities for the 2012 AQMP*

DATE	ORGANIZATION	STAKEHOLDER	TYPE OF OUTREACH
7/19/2011	SCAQMD AQMP Advisory Group Meeting	Open to Public	Topical Workshop
8/18/2011	SCAQMD AQMP Advisory Group Meeting	Open to Public	Topical Workshop
10/20/2011	SCAQMD AQMP Advisory Group Meeting	Open to Public	Topical Workshop
12/15/2011	SCAQMD AQMP Advisory Group Meeting	Open to Public	Topical Workshop
9/28/2011	Technology Symposium	Business, Government	Topical Workshop
1/10/2012	Ports of LA, Long Beach	Business	Focus Group
1/12/2012	SCAG	Public Agency	Key Agency Coordination
1/19/2012	SCAQMD AQMP Advisory Group Meeting	Open to Public	Topical Workshop
1/19/2012	CARB	Public Agency	Key Agency Coordination
1/20/2012	Mobile Source & Stationary Source Committees	Open to Public	Focus Group
1/23/2012	Transportation Research Board	Business, Government	Topical Workshop
1/26/2012	Transportation Research Board	Business, Government	Air Quality Institute
1/31/2012	SCAG	Public Agency	Key Agency Coordination
2/1/2012	SCAG	Public Agency	Key Agency Coordination
2/7/2012	Mobile Source & Stationary Source Committees	Open to Public	Focus Group
2/14/2012	Ports of LA, Long Beach	Business	Focus Group
2/16/2012	SCAQMD AQMP Advisory Group Meeting	Open to Public	Topical Workshop
2/16/2012	CCEEB	Business Representative	Focus Group
3/5/2012	WRCOG (Executive Council)	Council of Governments	Local Stakeholder

TABLE 11-2 (continued)

Outreach Activities for the 2012 AQMP*

DATE	ORGANIZATION	STAKEHOLDER	TYPE OF OUTREACH
3/6/2012	Mobile Source & Stationary Source Committees	Open to Public	Focus Group
3/7/2012	The Gas Company	Business	Focus Group
3/8/2012	Independent Lubricant Manufacturing Association (ILMA)	Business Representative	Topical Workshop
3/15/2012	SCAQMD AQMP Advisory Group Meeting	Open to Public	Topical Workshop
3/15/2012	CARB	Public Agency	Key Agency Coordination
3/28/2012	SoCal Edison, Gas Company	Business	Focus Group
4/10/2012	Regulatory Flexibility Group	Business Representative	Focus Group
4/19/2012	SCAQMD AQMP Advisory Group Meeting	Open to Public	Topical Workshop
4/20/2012	Mobile Source & Stationary Source Committees	Open to Public	Focus Group
4/25/2012	Sanitation Districts (4 counties)	Business	Focus Group
5/3/2012	Santa Monica City Council Task Force on the Environment	Local Government	Local Stakeholder
5/9/2012	LA Chamber of Commerce (Energy, Water & Environmental Sustainability; Transportation & Goods Movement Councils)	Business Representative	Local Stakeholder
5/9/2012	WRCOG (Technical Advisory Committee)	Council of Governments	Local Stakeholder
5/17/2012	SCAQMD AQMP Advisory Group Meeting	Open to Public	Topical Workshop
5/18/12	Mobile Source & Stationary Source Committees	Open to Public	Focus Group
5/22/2012	Manufacturer's of Emission Control Association (MECA)	Business Representative	Focus Group
5/24/12	Environmental Groups	Environmental Advocacy	Local Stakeholder
6/6/2012	Construction Industry Air Quality Coalition (CIAQC)	Business Representative	Focus Group

TABLE 11-2 (continued)

Outreach Activities for the 2012 AQMP*

DATE	ORGANIZATION	STAKEHOLDER	TYPE OF OUTREACH
6/7/2012	Valley Green Building Education Conference and Expo	Business, Environmental	Topical Workshop
6/7/2012	Valley Industrial Commerce Association (VICA)	Business Representative	Local Stakeholder
6/13/2012	U.S. EPA, CARB, SJVAPCD	Public Agency	Key Agency Coordination
6/13/2012	ALA/Inland Empire Air Quality Committee	Health Advocates	Local Stakeholder
6/14/2012	SCAQMD AQMP Advisory Group Meeting	Open to Public	Topical Workshop
6/14/2012	American Coatings Association	Business Representative	Focus Group
6/14/2012	SCAQMD Student Interns	Students	Topical Workshop
6/15/12	Mobile Source & Stationary Source Committees	Open to Public	Focus Group
6/19/2012	Inland Action Committee	Business, Government	Local Stakeholder
6/20/2012	Loma Linda Chamber of Commerce	Business Representative	Local Stakeholder
6/27/2012	San Gabriel Valley Economic Partnership (Legislative Action	Business, Government,	Local Stakeholder
6/28/2012	SCAQMD Student Interns	Students	Topical Workshop
7/5/2012	SCAG (Energy & Environment)	Council of Governments	Local Stakeholder
7/10/2012	Orange County	Open to Public	Public Workshop
7/11/2012	San Bernardino County	Open to Public	Public Workshop
7/11/2012	Riverside County	Open to Public	Public Workshop
7/11/2012	SCAQMD Advisory Council	Open to Public	Local Stakeholder
7/12/2012	Los Angeles County	Open to Public	Public Workshop
7/12/2012	San Fernando Valley COG	Council of Governments	Local Stakeholder

TABLE 11-2 (continued)

Outreach Activities for the 2012 AQMP*

DATE	ORGANIZATION	STAKEHOLDER	TYPE OF OUTREACH
7/12/2012	Orange County AWMA	Environmental Advocacy	Local Stakeholder
7/13/2012	Environmental/Health Community (NRDC, CBE, etc.)	Environmental Advocacy	Focus Group
7/17/2012	STEM Learning Institute	Academic	Local Stakeholder
7/19/2012	San Bernardino Association of Governments (Major Projects)	Council of Governments	Local Stakeholder
7/19/2012	WRCOG (Technical Advisory Committee)	Council of Governments	Local Stakeholder
7/19/2012	Western States Petroleum Association (WSPA)	Business Representative	Focus Group
7/24/2012	Home Rule Advisory Group	Open to Public	Focus Group
7/24/2012	Los Angeles County	Open to Public	Public Workshop
7/25/2012	Orange County COG	Council of Governments	Local Stakeholder
7/25/2012	San Gabriel Valley COG (Energy, Environment & Natural Resources)	Council of Governments	Local Stakeholder
7/25/2012	Compost/Greenwaste Processing/Composting	Business Representative	Focus Group
7/25/2012	City of Los Angeles	City Government	Local Stakeholder
7/26/2012	SCAQMD AQMP Advisory Group Meeting	Open to Public	Topical Workshop
7/26/2012	American Coatings Association	Business Representative	Focus Group
7/26/2012	South Bay Cities COG	Council of Governments	Local Stakeholder
7/27/2012	Mobile Source & Stationary Source Committees	Open to Public	Focus Group
7/27/2012	EJAG	SCAQMD Advisory Council	Focus Group
8/1/2012	Gateway COG	Council of Governments	Local Stakeholder
8/2/2012	Concerned Residents Against Airport Pollution	Business Representative	Local Stakeholder

TABLE 11-2 (continued)

Outreach Activities for the 2012 AQMP*

DATE	ORGANIZATION	STAKEHOLDER	TYPE OF OUTREACH
8/7/2012	Orange County COG (Technical Advisory Committee)	Council of Governments	Local Stakeholder
8/8/2012	U.S. EPA Staff Meeting	Public Agency	Key Agency Coordination
8/9/2012	Coachella Valley	Open to Public	Public Workshop
8/14/2012	OC Business Council	Business Representative	Local Stakeholder
8/17/2012	US Forest Service	Public Agency	Local Stakeholder
8/21/2012	Mira Loma Focus Group	Environmental Advocacy	Focus Group
8/22/2012	Environmental Groups	Environmental Advocacy	Local Stakeholder
8/23/2012	CEQA Scoping Session	Open to Public	Public Workshop
8/23/2012	Vision for Clean Air Workshop	Open to Public	Public Workshop
8/23/2012	Jurupa Valley Parks Board / Chamber of Commerce / Rotary Club	Business Representative	Local Stakeholder
8/28/2012	DWP, So Cal Edison, So Cal Gas, U.S. EPA	Business Representative	Local Stakeholder
8/29/2012	Department of Housing & Community Development / AQ Task	Business Representative	Local Stakeholder
8/29/2012	Inland Empire US Green Building Council	Contractors, Government,	Topical Workshop
9/6/2012	SCAG (Regional Council)	Council of Governments	Local Stakeholder
9/11/2012	Los Angeles County	Open to Public	Public Hearing
9/12/2012	Orange County	Open to Public	Public Hearing
9/13/2012	Riverside County	Open to Public	Public Hearing
9/13/2012	San Bernardino	Open to Public	Public Hearing
9/18/2012	City of Redondo Beach	Open to Public	Local Stakeholder

TABLE 11-2 (continued)

Outreach Activities for the 2012 AQMP*

DATE	ORGANIZATION	STAKEHOLDER	TYPE OF OUTREACH
9/20/2012	AEP	Professionals	Local Stakeholder
9/20/2012	SCAQMD AQMP Advisory Group Meeting	Open to Public	Topical Workshop
9/21/2012	Mobile Source & Stationary Source Committees	Open to Public	Focus Group
9/26/2012	Environmental Groups	Environmental Advocacy	Local Stakeholder
9/27/2012	Orange County COG	Council of Government	Local Stakeholder
9/27/2012	Department of Housing and Community Development	Task Force	Focus Group
10/18/2012	SCAQMD AQMP Advisory Group Meeting	Open to Public	Topical Workshop
10/19/2012	Mobile Source & Stationary Source Committees	Open to Public	Focus Group
10/19/2012	Hemet/San Jacinto Valley Chamber of Commerce	Business Representative	Local Stakeholder
10/22/2012	2012 Valley Mobility Summit	Business Representative	Local Stakeholder
10/24/2012	Environmental Groups	Environmental Advocacy	Local Stakeholder
10/26/2012	BizFed	Business Representative	Local Stakeholder
10/30/2012	U.S. EPA	Government	Key Agency Coordination
10/31/2012	SCAG GLUE Council	Council of Government	Local Stakeholder
11/1/2012	ACE Trench Groundbreaking Ceremony	Business Representative	Topical Workshop
11/1/2012	Association of CA Cities, Orange County (ACCOC)	Council of Government	Local Stakeholder
11/1/2012	SCAG Regional Council	Council of Government	Local Stakeholder
11/1/2012	BizFed Advocacy Committee	Business Representative	Local Stakeholder
11/2//2012	Assembly Budget Committee / Assemblymember Blumenfield’s office	Government	Local Stakeholder

TABLE 11-2 (concluded)

Outreach Activities for the 2012 AQMP*

DATE	ORGANIZATION	STAKEHOLDER	TYPE OF OUTREACH
11/13/2012	AQMP Regional Public Hearing - LA County	Open to Public	Public Hearing
11/14/2012	AQMP Regional Public Hearing - Orange County	Open to Public	Public Hearing
11/15/2012	AQMP Regional Public Hearing - Riverside County	Open to Public	Public Hearing
11/15/2012	AQMP Regional Public Hearing - San Bernardino County	Open to Public	Public Hearing
11/15/2012	Orange County COG	Council of Government	Local Stakeholder
11/16/2012	Mobile Source & Stationary Source Committees	Open to Public	Focus Group
11/24/2012	Joint Socioeconomic Workshop & STMPR Meeting	Open to Public	Topical Workshop
11/27/2012	Inland Action Committee	Business, Government	Local Stakeholder
11/30/2012	Angeles National Foresters	Business, Government	Local Stakeholder
12/6/2012	OCBC, BizFed, et al	Business, Government	Local Stakeholder
12/7/2012	SCAQMD Governing Board	Open to Public	Public Hearing

*Events will be added as more meetings are held prior to the December Board Meeting

TABLE 11-3

Announcements at Other Meetings Regarding the 2012 AQMP

DATE	ORGANIZATION	STAKEHOLDER
11/2/2011	Irwindale Business of Commerce	Business
11/16/2011	San Gabriel Valley Economic Partnership	Business
11/17/2011	San Gabriel Valley Council of Governments	Council of Governments
12/14/2011	Assembly member Anthony Portantino	Other Government
12/14/2011	Wilmington Business of Commerce	Business
12/15/2011	Assembly member Roger Hernandez	Other Government
12/15/2011	Government of Diamond Bar	Government
12/15/2011	Government of Walnut	Government
12/16/2011	Legislative Alliance of South Orange County	Business
1/3/2012	Government of Azusa	Government
1/5/2012	League of California Cities - LA Division	Political Organizations
1/5/2012	San Bernardino Association of Governments	Council of Governments
1/5/2012	San Bernardino Business of Commerce	Business
1/10/2012	Government of Torrance	Government
1/10/2012	Loma Linda Business of Commerce	Business
1/11/2012	Government of San Marino	Government
1/11/2012	Irwindale Business of Commerce	Business
1/11/2012	South Pasadena Business of Commerce	Business
1/12/2012	South Bay Cities Council of Governments	Council of Governments
1/12/2012	Upland Business of Commerce	Business
1/13/2012	Crenshaw Business of Commerce	Business
1/14/2012	Irwindale Business of Commerce	Business
1/17/2012	Government of Monrovia	Government
1/18/2012	Government of South Pasadena	Government
1/18/2012	San Gabriel Valley Council of Governments	Council of Governments
1/19/2012	Fontana Business of Commerce	Business
1/19/2012	San Gabriel Valley Council of Governments	Council of Governments
1/19/2012	South Bay Cities Council of Governments	Council of Governments
1/24/2012	Alhambra Business of Commerce	Business

TABLE 11-3 (continued)

Announcements at Other Meetings Regarding the 2012 AQMP

DATE	ORGANIZATION	STAKEHOLDER
1/24/2012	Government of Compton	Government
1/24/2012	Government of Rosemead	Government
1/25/2012	California Black Women's Health Project	Health
1/25/2012	Government of Sierra Madre	Government
1/25/2012	Metropolitan Churches Los Angeles	Faith
1/25/2012	San Gabriel Valley Council of Governments	Council of Governments
1/25/2012	San Gabriel Valley Economic Partnership	Business
1/26/2012	Compton Business of Commerce	Business
1/26/2012	Gardena Business of Commerce	Business
1/26/2012	Greater Los Angeles African American Business of Commerce	Faith
1/26/2012	South Bay Cities Council of Governments	Council of Governments
2/1/2012	Carson Business of Commerce	Business
2/1/2012	Government of Baldwin Park	Government
2/1/2012	Inglewood Airport Business of Commerce	Business
2/1/2012	Redlands Business of Commerce	Business
2/2/2012	Environmental Priorities Network	Faith
2/2/2012	League of California Cities - LA Division	Political Organizations
2/7/2012	Government of Arcadia	Government
2/7/2012	Government of Commerce	Government
2/8/2012	5 Mountain Communities Business of Commerce	Business
2/8/2012	Azusa Business of Commerce	Business
2/8/2012	Redondo Beach Business of Commerce	Business
2/8/2012	San Pedro Peninsula Business	Business
2/8/2012	South Pasadena Business of Commerce	Business
2/8/2012	Wilmington Business of Commerce	Business
2/9/2012	Government of Industry	Government
2/9/2012	Palos Verde Peninsula Business of Commerce	Business
2/9/2012	Torrance Business of Commerce	Business
2/9/2012	Upland Business of Commerce	Business
2/10/2012	Crenshaw - Watts Rotary Club	Business

TABLE 11-3 (continued)

Announcements at Other Meetings Regarding the 2012 AQMP

DATE	ORGANIZATION	STAKEHOLDER
2/10/2012	LAX Business of Commerce	Business
2/10/2012	West Los Angeles Business of Commerce	Business
2/14/2012	Government of Duarte	Government
2/14/2012	Pomona Business of Commerce	Business
2/14/2012	San Pedro Peninsula Business of Commerce	Business
2/15/2012	Black Business Association	Business
2/15/2012	Environmental Charter High School	Education
2/16/2012	Fontana Business of Commerce	Business
2/17/2012	Greater Los Angeles African American Business of Commerce	Business
2/17/2012	Torrance Business of Commerce	Business
2/21/2012	Government of San Gabriel	Government
2/21/2012	Santa Monica Business of Commerce	Business
2/22/2012	Carson Business of Commerce	Business
2/22/2012	South Bay Association of Business of Commerce	Business
2/23/2012	South Bay Workforce Investment Board	Industry Trade Groups
2/24/2012	South Bay Cities Council of Governments	Council of Governments
2/24/2012	South Orange County Economic Coalition	Business
3/1/2012	Government of Beverly Hills	Government
3/1/2012	Government of Torrance	Government
3/1/2012	League of California Cities - LA Division	Political Organizations
3/1/2012	Metro	Public Agencies
3/4/2012	Government of Inglewood	Government
3/6/2012	5 Mountain Communities Business of Commerce	Business
3/6/2012	Government of Norwalk	Government
3/6/2012	Concerned Citizens of Compton	Environmental & Community Organizations
3/7/2012	Gateway Council of Governments	Council of Governments
3/7/2012	Inland Empire Air Quality Committee	Health

TABLE 11-3 (continued)

Announcements at Other Meetings Regarding the 2012 AQMP

DATE	ORGANIZATION	STAKEHOLDER
3/7/2012	International Brotherhood of Electrical Worker/National Electrical Contractors Association	Labor
3/7/2012	Irwindale Business of Commerce	Business
3/7/2012	North Orange County Legislative Alliance	Business
3/7/2012	San Gabriel Valley Mountains Regional Conservancy	Environmental & Community Organizations
3/7/2012	Santa Monica Business of Commerce	Business
3/8/2012	100 Black Men	Faith
3/8/2012	Government of Los Angeles	Government
3/8/2012	Government of Santa Fe Springs	Government
3/8/2012	Upland Business of Commerce	Business
3/8/2012	Watts Health Foundation	Health
3/8/2012	Wilmington Neighborhood Council	Environmental & Community Organizations
3/13/2012	Assembly member Isadore Hall	Government Organizations
3/13/2012	Celebrate Life Cancer Church	Faith
3/13/2012	Government of Redondo Beach	Government
3/14/2012	Good Samaritan Hospital/USC	Health
3/14/2012	Inland Empire Resource Conservation District	Environmental & Community Organizations
3/14/2012	Metro	Public Agencies
3/14/2012	South Pasadena Business of Commerce	Business
3/14/2012	Southern California Ecumenical Council	Faith
3/15/2012	Beverly Hills Business of Commerce	Business
3/15/2012	Carson Business of Commerce	Business
3/15/2012	Inland Empire League of California Cities	Political Organizations
3/15/2012	West Hollywood Business of Commerce	Business
3/16/2012	Assemblymember Chris Norby	Government Organizations
3/20/2012	Pasadena Business of Commerce	Business

TABLE 11-3 (continued)

Announcements at Other Meetings Regarding the 2012 AQMP

DATE	ORGANIZATION	STAKEHOLDER
3/20/2012	Temple Government	Government
3/21/2012	Government of Laguna Woods	Government
3/21/2012	San Gabriel Valley Council of Governments	Council of Governments
3/22/2012	Assembly member Tony Mendoza	Government Organizations
3/22/2012	Congress member Grace Napolitano	Government Organizations
3/22/2012	Orange County Council of Governments	Council of Governments
3/22/2012	Port of Los Angeles	Public Agencies
3/22/2012	South Bay Cities Council of Governments	Council of Governments
3/23/2012	South Orange County Economic Coalition	Business
3/27/2012	Alhambra/Rosemead Business of Commerce	Business
3/27/2012	Assembly member Isadore Hall	Government Organizations
3/27/2012	Government of Santa Monica	Government
3/27/2012	San Bernardino County Unified School District (SBCUSD) - Pacific High School AP Science Class	Education
3/28/2012	Dollarhide Senior Center	Environmental & Community Organizations
3/28/2012	San Gabriel Valley Regional Business of Commerce	Business
3/29/2012	San Gabriel Valley Council of Governments	Council of Governments
4/3/2012	Government of Irwindale	Government
4/3/2012	South Bay Association of Business of Commerce	Business
4/4/2012	Inglewood Senior Citizens Center	Environmental & Community Organizations
4/4/2012	Irwindale Business of Commerce	Business
4/4/2012	North Orange County Legislative Alliance	Business
4/4/2012	Santa Monica Business of Commerce	Business
4/5/2012	Westchester Senior Center	Environmental & Community Organizations
4/6/2012	Orange Business of Commerce	Business
4/11/2012	Redlands Business of Commerce	Business

TABLE 11-3 (continued)

Announcements at Other Meetings Regarding the 2012 AQMP

DATE	ORGANIZATION	STAKEHOLDER
4/12/2012	Upland Business of Commerce	Business
4/13/2012	Moreno Valley Business of Commerce	Business
4/13/2012	San Gabriel Valley Economic Partnership	Business
4/16/2012	Government of West Hollywood	Government
4/17/2012	Carson Business of Commerce	Business
4/17/2012	Government of Bradbury	Government
4/17/2012	Government of Norwalk	Government
4/17/2012	Pasadena Business of Commerce	Business
4/19/2012	San Gabriel Valley Council of Governments	Council of Governments
4/25/2012	San Gabriel Valley Economic Partnership	Business
4/25/2012	Wilmington Neighborhood Council	Environmental & Community Organizations
5/1/2012	South Bay Association of Business of Commerce	Business
5/3/2012	League of California Cities - LA Division	Political Organizations
5/8/2012	Government of Redondo Beach	Government
5/8/2012	Loma Linda Business of Commerce	Business
5/9/2012	Athens/Willowbrook Task Force	Environmental & Community Organizations
5/9/2012	Orange County Green Business of Commerce	Business
5/9/2012	Positive Aging Committee	Faith
5/10/2012	Upland Business of Commerce	Business
5/15/2012	Inglewood Business of Commerce	Business
5/16/2012	Inland Empire Asthma Coalition	Health
5/16/2012	San Pedro Business of Commerce	Business
5/18/12 - 5/20/12	California Contract Cities Association	Political Organizations
5/22/2012	Alhambra Business of Commerce	Business
5/23/2012	San Pedro Business of Commerce	Business
5/24/2012	Citizens Climate Lobby - Pasadena Foothills Chapter	Environmental & Community Organizations

TABLE 11-3 (continued)

Announcements at Other Meetings Regarding the 2012 AQMP

DATE	ORGANIZATION	STAKEHOLDER
5/24/2012	South Bay Council of Governments	Council of Governments
5/30/2012	San Gabriel Valley Mountains Regional Conservancy	Environmental & Community Organizations
5/31/2012	San Gabriel Valley Council of Governments	Council of Governments
6/4/2012	Volunteers and Organizations Improving Community's Environment (VOICE)	Environmental & Community Organizations
6/5/2012	5 Mountain Communities	Business
6/5/2012	South Bay Area Business of Commerce	Business
6/6/2012	Santa Monica Business of Commerce	Business
6/7/2012	Irwindale Business of Commerce	Business
6/7/2012	League of CA Cities - Los Angeles Division	Political Organizations
6/8/2012	Government of Torrance	Government
6/8/2012	South Coast Interfaith Council	Faith
6/13/2012	Los Angeles Clean Cities Coalition	Government Organizations
6/13/2012	South Pasadena Business of Commerce	Business
6/14/2012	Wilmington Business of Commerce	Business
6/19/2012	Carson Business of Commerce	Business
6/19/2012	Culver Government Business of Commerce	Business
6/20/2012	Loma Linda Business of Commerce	Business
6/21/2012	San Gabriel Valley Council of Governments	Council of Governments
6/21/2012	San Gabriel Valley Council of Governments	Council of Governments
6/21/2012	San Gabriel Valley Mountains Regional Conservancy	Environmental & Community Organizations
6/22/2012	Assembly member Diane Harkey	Other Government
6/22/2012	Hawthorne Senior Center	Environmental & Community Organizations
6/22/2012	Congressman John Campbell	Other Government
6/22/2012	Senator Mimi Walters	Other Government

TABLE 11-3 (continued)

Announcements at Other Meetings Regarding the 2012 AQMP

DATE	ORGANIZATION	STAKEHOLDER
6/22/2012	South Orange County Regional Business of Commerce	Business
6/22/2012	Stevenson Village Homeowners Association	Environmental & Community Organizations
6/26/2012	Alhambra Business of Commerce	Business
6/26/2012	Inglewood Senior Citizens Center	Environmental & Community Organizations
6/27/2012	Crenshaw Business of Commerce	Business
6/28/2012	Carson Black Business of Commerce	Business
6/28/2012	South Bay Council of Governments	Business
6/29/2012	100 Black Men	Environmental & Community Organizations
6/29/2012	Black Business Association	Industry Trade Groups
6/29/2012	San Gabriel Valley Economic Partnership	Business
7/3/2012	Irwindale Business of Commerce	Business
7/3/2012	South Bay Area Business of Commerce	Business
7/3/2012	Yvonne Burke Senior Center	Environmental & Community Organizations
7/5/2012	Government of Monterey Park	Government
7/10/2012	Pasadena Chamber of Commerce	Business
7/10/2012	Santa Clarita Valley Chamber of Commerce	Business
7/11/2012	Los Angeles Regional Collaborative for Climate Action and Sustainability	Environmental & Community Organizations
7/11/2012	South Pasadena Chamber of Commerce	Business
7/13/2012	Orange County Business Council	Business
7/17/2012	California Institute of Technology	Education
7/17/2012	United Nations Association - Foothill Chapter	Environmental & Community Organizations
7/18/2012	League of Women Voters - West San Gabriel Valley	Environmental & Community Organizations
7/18/2012	Orange County City Managers Association	Political Organizations

TABLE 11-3 (continued)
Announcements at Other Meetings Regarding the 2012 AQMP

DATE	ORGANIZATION	STAKEHOLDER
7/18/2012	Western Riverside Council of Governments	Council of Governments
7/19/2012	Industrial Environmental Coalition of Orange County	Industry Trade Groups
7/19/2012	Pasadena Forward	Environmental & Community Organizations
7/19/2012	San Gabriel Valley Council of Governments	Council of Governments
7/20/2012	Anaheim Chamber of Commerce	Business
7/20/2012	West Orange County Chamber of Commerce	Business
7/25/2012	San Gabriel Valley Council of Governments Energy, Environment & Natural Resources Committee	Council of Governments
7/25/2012	San Gabriel Valley Economic Partnership	Business
7/26/2012	South Bay Cities Council of Governments	Council of Governments
8/1/2012	Gateway Cities Council of Governments	Council of Governments
8/1/2012	Pasadena Sierra Club	Environmental & Community Organizations
8/2/2012	League of California Cities - Los Angeles Division	Political Organizations
8/3/2012	Assemblymember Jose Solorio	Government
8/9/2012	Southern California Chinese-American Environmental Protection Association	Environmental & Community Organizations
8/15/2012	Brea Chamber of Commerce	Business
8/15/2012	California Contract Cities Association	Political Organizations
8/15/2012	Inland Empire Asthma Coalition	Environmental & Community Organizations
8/16/2012	San Gabriel Valley Council of Governments	Council of Governments
8/17/2012	Anaheim Chamber of Commerce	Business
8/17/2012	West Orange County Chamber of Commerce	Business
8/22/2012	Orange County Public Affairs Association	Industry Trade Groups
8/24/2012	San Gabriel Valley Economic Partnership	Business
8/24/2012	South Orange County Economic Coalition	Business
8/29/2012	League of Cities, San Bernardino Legislative Committee	Government

TABLE 11-3 (continued)

Announcements at Other Meetings Regarding the 2012 AQMP

DATE	ORGANIZATION	STAKEHOLDER
9/4/2012	5 Mountain Communities Chambers of Commerce	Business
9/5/2012	Government of Baldwin Park	Government
9/5/2012	Irwindale Chamber of Commerce	Business
9/5/2012	Orange County City Managers Association	Political Organizations
9/6/2012	Riverside Transit Agency Transportation NOW	Public Agencies
9/6/2012	Southern California Association of Governments	Council of Governments
9/7/2012	Greater Corona Valley Chamber of Commerce	Business
9/7/2012	Youth Science Center	Environmental & Community Organizations
9/11/2012	Government of Buena Park	Government
9/11/2012	Government of Duarte	Government
9/11/2012	Government of La Puente	Government
9/12/2012	Indio Chamber of Commerce	Business
9/12/2012	Inland Empire Air Quality Committee	Environmental & Community Organizations
9/12/2012	Los Angeles Area Chamber of Commerce	Business
9/12/2012	South Pasadena Chamber of Commerce	Business
9/13/2012	Independent Cities Association	Political Organizations
9/13/2012	Irwindale Chamber of Commerce	Business
9/14/2012	Orange County Business Council	Business
9/18/2012	Government of Arcadia	Government
9/18/2012	Government of Redondo Beach	Government
9/18/2012	Pasadena Chamber of Commerce	Business
9/19/2012	Monterey Park Environmental Commission	Environmental & Community Organizations
9/20/2012	San Gabriel Valley Council of Governments	Council of Governments
9/21/2012	San Gabriel Valley Mountains Regional Conservancy	Environmental & Community Organizations
9/25/2012	Alhambra Chamber of Commerce	Business
9/25/2012	Government of Sierra Madre	Government

TABLE 11-3 (continued)
Announcements at Other Meetings Regarding the 2012 AQMP

DATE	ORGANIZATION	STAKEHOLDER
9/26/2012	Irwindale Chamber of Commerce	Business
9/26/2012	San Gabriel Valley Economic Partnership	Business
9/27/2012	Orange County Council of Governments	Council of Governments
9/27/2012	United Nations Association - Foothill Chapter	Environmental & Community Organizations
9/28/2012	South Orange County Economic Coalition	Business
10/1/2012	Government of La Verne	Government
10/1/2012	Santa Monica Chamber of Commerce	Business
10/2/2012	5 Mountain Communities Chambers of Commerce	Business
10/2/2012	Government of San Gabriel	Government
10/2/2012	South Bay Cities Council of Governments	Council of Governments
10/3/2012	Athens/Willowbrook Community Task Force	Environmental & Community Organizations
10/3/2012	Gateway Cities Council of Governments	Council of Governments
10/3/2012	Government of Los Angeles	Government
10/3/2012	Irwindale Chamber of Commerce	Business
10/3/2012	North Orange County Legislative Alliance	Business
10/3/2012	Orange County City Managers Association	Political Organizations
10/3/2012	San Gabriel Valley Councils of Governments	Council of Governments
10/3/2012	Santa Monica Chamber of Commerce	Business
10/4/2012	Crenshaw Watts Rotary Club	Business
10/4/2012	League of California Cities - Los Angeles Division	Political Organizations
10/4/2012	Monterey Park Environmental Commission	Environmental & Community Organizations
10/9/2012	Cal State Long Beach	Education
10/9/2012	Government of Compton	Government
10/9/2012	Government of Glendora	Government
10/9/2012	Government of Rosemead	Government
10/9/2012	South Bay M.A.P.S	Environmental & Community Organizations
10/10/2012	Compton Chamber of Commerce	Business
10/10/2012	Indio Chamber of Commerce	Business

TABLE 11-3 (continued)
Announcements at Other Meetings Regarding the 2012 AQMP

DATE	ORGANIZATION	STAKEHOLDER
10/10/2012	LAX Coastal Area Chamber of Commerce	Business
10/10/2012	South Pasadena Chamber of Commerce	Business
10/12/2012	Moreno Valley Chamber of Commerce	Business
10/16/2012	American Jewish Committee	Environmental & Community Organizations
10/16/2012	Carson Chamber of Commerce	Business
10/16/2012	Culver City Chamber of Commerce	Business
10/16/2012	Government of Diamond Bar	Government
10/16/2012	Carson Chamber Legislative Meeting	City Government
10/16/2012	Culver City Chamber GAC	Business Representative
10/16/2012	Monterey Park Environmental Commission's "Environmental Meet & Greet"	City Government
10/17/2012	San Gabriel Valley City Managers Association	Political Organizations
10/17/2012	Western Riverside Council of Governments	Council of Governments
10/17/2012	WRCOG/WR Clean Cities Coalitions Stakeholders Mtg.	Council of Government
10/18/2012	Association of California Cities - Orange County Division	Political Organizations
10/18/2012	Bear Valley Chamber of Commerce	Business
10/18/2012	Gardena Brownfields Community Relations Committee	Industry Trade Groups
10/18/2012	San Gabriel Valley Council of Governments	Council of Governments
10/18/2012	Assoc. of Calif. Cities, OC City Leaders Reception	City Government
10/18/2012	Bear Valley GAC and Transport. Committee	City Government
10/18/2012	SGVCOG Board Meeting	Council of Government
10/19/2012	Anaheim Chamber of Commerce	Business
10/19/2012	Claremont Chamber of Commerce	Business
10/19/2012	Government of Long Beach	Government
10/19/2012	Long Beach Alliance for Children with Asthma	Environmental & Community Organizations
10/19/2012	Robert F. Kennedy Institute of Community & Family Medicine	Environmental & Community Organizations
10/19/2012	West Orange County Chambers Legislative Alliance	Business
10/19/2012	Anaheim Chamber of Commerce Legislative Committee	Business Representative

TABLE 11-3 (continued)
Announcements at Other Meetings Regarding the 2012 AQMP

DATE	ORGANIZATION	STAKEHOLDER
10/19/2012	City of Hemet	City Government
10/19/2012	City of San Jacinto	City Government
10/19/2012	Congresswoman Mary Bono Mack District Office	Government
10/19/2012	West OC Chambers Legislative Committee	Business Representative
10/24/2012	US Green Building Council, Inland Empire	Business
10/24/2012	Huntington Beach Chamber of Commerce	Business
10/24/2012	San Gabriel Valley Economic Partnership	Business
10/24/2012	City of Temecula	Government
10/24/2012	City of Wildomar	Government
10/24/2012	Huntington Beach Chamber of Commerce Legislative Committee	Representative
10/24/2012	State Senator Joel Anderson District Office	Government
10/24/2012	Temecula Chamber of Commerce	Business Representative
10/24/2012	Westside Cities Council of Governments Transportation Committee	Council of Government
10/25/2012	Irwindale Chamber of Commerce	Business Representative
10/25/2012	SBV COG	Council of Government
10/26/2012	City of Lake Elsinore	City Government
10/26/2012	City of Murrieta	City Government
10/26/2012	Lake Elsinore Chamber of Commerce	Business Representative
10/26/2012	South OC Economic Coalition	Business Representative
10/26/2012	Murrieta Chamber of Commerce	Business Representative
10/31/2012	City of Menifee	City Government
10/31/2012	Sun City	City Government
11/1/2012	Environmental Priorities Network	Business Representative
11/1/2012	Monterey Park Environmental Commission Mtg	City Government
11/2/2012	Gardena Valley Chamber of Commerce	City Government
11/2/2012	City of Gardena/Public Works	City Government
11/2/2012	South Bay Environmental Service Center	Business Representative
11/2/2012	Palos Verdes Peninsula School District	School District
11/4/2012	City of Wildomar	City Government
11/4/2012	WRCOG Technical Advisory Committee Meeting	Business Representative
11/6/2012	5 Mountain Communities Chamber of Commerce - Leg Committee	Business Representative

TABLE 11-3 (concluded)

Announcements at Other Meetings Regarding the 2012 AQMP

DATE	ORGANIZATION	STAKEHOLDER
11/6/2012	South Bay Area Chambers of Commerce	Business Representative
11/7/2012	Palos Verdes Peninsula Chamber	Business Representative
11/7/2012	Santa Monica Chamber of Commerce	Business Representative
11/8/2012	Bike SGV	Business Representative
11/8/2012	City of San Clemente	City Government
11/9/2012	American Heart Association	Professionals
11/9/2012	Greater Riverside Chamber of Commerce	Business Representative
11/9/2012	WRCOG	Council of Government
11/13/2012	City of Hemet	City Government
11/14/2012	Hemet Chamber of Commerce GAC Committee Meeting	Business Representative
11/14/2012	Inland Empire Air Quality Committee	Professionals
11/14/2012	Inland Empire Asthma Coalition	Professionals
11/14/2012	SANBAG	Council of Government

Glossary

South Coast Air Quality Management District

Cleaning the air that we breathe...™

South Coast AQMD

GLOSSARY

GLOSSARY

AAQS (Ambient Air Quality Standards): Health and welfare based standards for clean outdoor air that identify the maximum acceptable average concentrations of air pollutants during a specified period of time. (See NAAQS)

Acute Health Effect: An adverse health effect that occurs over a relatively short period of time (e.g., minutes or hours).

Aerosol: Particles of solid or liquid matter that can remain suspended in air for long periods of time because of their small size and light weight.

Air Pollutants: Amounts of foreign and/or natural substances occurring in the atmosphere that may result in adverse effects on humans, animals, vegetation, and/or materials.

Air Quality Simulation Model: A computer program that simulates the transport, dispersion, and transformation of compounds emitted into the air and can project the relationship between emissions and air quality.

Air Toxics: A generic term referring to a harmful chemical or group of chemicals in the air. Typically, substances that are especially harmful to health, such as those considered under U.S. EPA's hazardous air pollutant program or California's AB 1807 toxic air contaminant program, are considered to be air toxics. Technically, any compound that is in the air and has the potential to produce adverse health effects is an air toxic.

Airborne Toxic Control Measure (ATCM): A type of control measure, adopted by the CARB (Health and Safety Code Section 39666 et seq.), which reduces emissions of toxic air contaminants from nonvehicular sources.

Alternative Fuels: Fuels such as methanol, ethanol, hydrogen, natural gas, and liquid propane gas that are cleaner burning and help to meet mobile and stationary emission standards.

Ambient Air: The air occurring at a particular time and place outside of structures. Often used interchangeably with "outdoor" air.

APCD (Air Pollution Control District): A county agency with authority to regulate stationary, indirect, and area sources of air pollution (e.g., power plants, highway construction, and housing developments) within a given county, and governed by a district air pollution control board composed of the elected county supervisors and in most cases, representatives of cities within the district.

AQMD (Air Quality Management District): A group or portions of counties, or an individual county specified in law with authority to regulate stationary, indirect, and area sources of air pollution within the region and governed by a regional air pollution control board comprised mostly of elected officials from within the region.

AQMP (Air Quality Management Plan): A Plan prepared by an APCD/AQMD, for a county or region designated as a nonattainment area, for the purpose of bringing the area into compliance with the requirements of the national and/or California Ambient Air Quality Standards. AQMPs designed to attain national ambient air quality standards are incorporated into the State Implementation Plan (SIP).

Area-wide Sources (also known as "area" sources): Smaller sources of pollution, including permitted sources smaller than the districts's emission reportin threshold and those that do not receive permits (e.g. water heaters, gas furnace, fireplaces, woodstoves, architectural coatings) that often are typically associated with homes and non-industrial sources. The CCAA requires districts to include area sources in the development and implementation of the AQMPs.

Atmosphere: The gaseous mass or envelope surrounding the earth.

Attainment Area: A geographic area which is in compliance with the National and/or California Ambient Air Quality Standards (NAAQS OR CAAQS).

Attainment Plan: In general, a plan that details the emission reducing control measures and their implementation schedule necessary to attain air quality standards. In particular, the federal Clean Air Act requires attainment plans for nonattainment areas; these plans must meet several requirements, including requirements related to enforceability and adoption deadlines.

BACT (Best Available Control Technology): The most up-to-date methods, systems, techniques, and production processes available to achieve the greatest feasible emission reductions for given regulated air pollutants and processes. BACT is a requirement of NSR (New Source Review) and PSD (Prevention of Significant Deterioration). BACT as used in federal law under PSD applies to permits for sources of attainment pollutants and other regulated pollutants is defined as an emission limitation based on the maximum degree of emissions reductions allowable taking into account energy, environmental & economic impacts and other costs. [(CAA Section 169(3)]. The term BACT as used in state law means an emission limitation that will achieve the lowest achievable emission rates, which means the most stringent of either the most stringent emission limits contained in the SIP for the class or category of source, (unless it is demonstrated that the limitation is not achievable) or the most stringent emission limit achieved in practice by that class in category of source. "BACT" under state law is more stringent than federal BACT and is equivalent to federal LAER (lowest achievable emission rate) which applies to nonattainmentNSR permit actions.

BAR (Bureau of Automotive Repair): An agency of the California Department of Consumer Affairs that manages the implementation of the motor vehicle Inspection and Maintenance Program.

CAA (Federal Clean Air Act): A federal law passed in 1970 and amended in 1977 and 1990 which forms the basis for the national air pollution control effort. Basic elements of the act include national ambient air quality standards for major air pollutants, air toxics standards, acid rain control measures, and enforcement provisions.

CAAQS (California Ambient Air Quality Standards): Standards set by the State of California for the maximum levels of air pollutants which can exist in the outdoor air without unacceptable effects on human health or the public welfare. These are more stringent than NAAQS.

CARB (California Air Resources Board): The State's lead air quality agency, consisting of a nine-member Governor-appointed board. It is responsible for attainment and maintenance of the State and federal air quality standards, and is primarily responsible for motor vehicle pollution control. It oversees county and regional air pollution management programs.

CCAA (California Clean Air Act): A California law passed in 1988 which provides the basis for air quality planning and regulation independent of federal regulations. A major element of the Act is the requirement that local APCDs/AQMDs in violation of state ambient air quality standards must prepare attainment plans which identify air quality problems, causes, trends, and actions to be taken to attain and maintain California's air quality standards by the earliest practicable date.

CEQA (California Environmental Quality Act): A California law which sets forth a process for public agencies to make informed decisions on discretionary project approvals. The process aids decision makers to determine whether any environmental impacts are associated with a proposed project. It requires significant environmental impacts associated with a proposed project to be identified, disclosed, and mitigated to the maximum extent feasible.

CFCs (Chlorofluorocarbons): Any of a number of substances consisting of chlorine, fluorine, and carbon. CFCs are used for refrigeration, foam packaging, solvents, and propellants. They have been found to cause depletion of the atmosphere's ozone layer.

Chronic Health Effect: An adverse health effect which occurs over a relatively long period of time (e.g., months or years).

CO (Carbon Monoxide): A colorless, odorless gas resulting from the incomplete combustion of fossil fuels. Over 80% of the CO emitted in urban areas is contributed by mobile sources. CO interferes with the blood's ability to carry oxygen to the body's tissues and results in numerous adverse health effects. CO is a criteria air pollutant.

Community Multiscale Air Quality Model (CMAQ): A computer modeling system designed to address air quality as a whole by including state-of-the-science capabilities for modeling multiple air quality issues, including tropospheric ozone, fine particles, toxics, acid deposition, and visibility degradation.

Comprehensive Air Quality Model with Extensions (CAMx): An open-source modeling system for multi-scale integrated assessment of gaseous and particulate air pollution.

Conformity: Conformity is a process mandated in the federal Clean Air Act to insure that federal actions do not impede attainment of the federal health standards. General conformity sets out a process that requires federal agencies to demonstrate that their actions are air quality neutral or beneficial. Transportation conformity sets out a process that requires transportation projects that receive federal funding, approvals or permits to demonstrate that their actions are air quality neutral or beneficial and meet specified emissions budgets in the SIP.

Congestion Management Program: A state mandated program (Government Code Section 65089a) that requires each county to prepare a plan to relieve congestion and reduce air pollution.

Consumer Products: Products for consumer or industrial usesuch as detergents, cleaning compounds, polishes, lawn and garden products, personal care products, and automotive specialty products which are part of our everyday lives and, through consumer use, may produce air emissions which contribute to air pollution.

Contingency Measure: Contingency measures are statute-required back-up control measures to be implemented in the event of specific conditions. These conditions can include failure to meet interim milestone emission reduction targets or failure to attain the standard by the statutory attainment date. Both state and federal Clean Air Acts require that District plans include contingency measures.

Electric Motor Vehicle: A motor vehicle which uses a battery-powered electric motor as the basis of its operation. Such vehicles emit virtually no air pollutants. Hybrid electric motor vehicles may operate using both electric and gasoline powered motors. Emissions from hybrid electric motor vehicles are also substantially lower than conventionally powered motor vehicles.

EMFAC: The EMission FACtor model used by CARB to calculate on-road mobile vehicle emissions. The 2012 AQMP is based on the latest version, EMFAC2011.

Emission Inventory: An estimate of the amount of pollutants emitted from mobile and stationary sources into the atmosphere over a specific period such as a day or a year.

Emission Offset (also known as an emission trade-off): A regulatory requirement whereby approval of a new or modified stationary source of air pollution is conditional on the reduction of emissions from other existing stationary sources of air pollution or banked reductions. These reductions are required in addition to reductions required by BACT.

Emission Standard: The maximum amount of a pollutant that is allowed to be discharged from a polluting source such as an automobile or smoke stack.

FIP (Federal Implementation Plan): In the absence of an approved State Implementation Plan (SIP), a plan prepared by the U.S. EPA which provides measures that nonattainment areas must take to meet the requirements of the Federal Clean Air Act.

Fugitive Dust: Dust particles which are introduced into the air through certain activities such as soil cultivation, off-road vehicles, or any vehicles operating on open fields or dirt roadways.

Goods Movement: An event that causes movement of commercial materials or stock typically at ports, airports, railways, highways, including dedicated truck lanes and logistics centers.

Greenhouse Gases (GHGs): A gas in an atmosphere that absorbs long-wave radiant energy reflected by the earth, which warms the atmosphere. GHGs also radiate long-wave radiation both upward to space and back down toward the surface of the earth. The downward part of this long-wave radiation absorbed by the atmosphere is known as the "greenhouse effect."

Growth Management Plan: A plan for a given geographical region containing demographic projections (i.e., housing units, employment, and population) through some specified point in time, and which provides recommendations for local governments to better manage growth and reduce projected environmental impacts.

Hybrid Electric Vehicles (HEV): Hybrids commercially available today combine an internal combustion engine with a battery and electric motor.

Hydrocarbon: Any of a large number of compounds containing various combinations of hydrogen and carbon atoms. They may be emitted into the air as a result of fossil fuel combustion, fuel volatilization, and solvent use, and are a major contributor to smog. (Also see VOC)

Hydrogen Fuel Cell Vehicles (HFCV): Vehicles that produce zero tailpipe emissions and run on compressed hydrogen fed into a fuel cell "stack" that produces electricity to power the vehicle.

Incentives – tax credits, financial rebates/discounts, or non-monetary conveniences offered to encourage further use of advanced technology and alternative fuels for stationary and mobile sources.

Indirect Source: Any facility, building, structure, or installation, or combination thereof, which generates or attracts mobile source activity that results in emissions of any pollutant (or precursor). Examples of indirect sources include employment sites, shopping centers, sports facilities, housing developments, airports, commercial and industrial development, and parking lots and garages.

Indirect Source Control Program: Rules, regulations, local ordinances and land use controls, and other regulatory strategies of air pollution control districts or local governments used to control or reduce emissions associated with new and existing indirect sources.

Inspection and Maintenance Program: A motor vehicle inspection program implemented by the BAR. It is designed to identify vehicles in need of maintenance and to assure the effectiveness of their emission control systems on a biennial basis. Enacted in 1979 and strengthened in 1990. (Also known as the "Smog Check" program.)

Low Emission Vehicle (LEV): A vehicle which is certified to meet the CARB 1994 emission standards for low emission vehicles.

Maintenance Plan: In general, a plan that details the actions necessary to maintain air quality standards. In particular, the federal Clean Air Act requires maintenance plans for areas that have been redesignated as attainment areas.

Mobile Sources: Moving sources of air pollution such as automobiles, motorcycles, trucks, off-road vehicles, boats and airplanes.

Model Year: Model year refers to the actual annual production period (year) as determined by the manufacturer.

NAAQS (National Ambient Air Quality Standards): Standards set by the federal U.S. EPA for the maximum levels of air pollutants which can exist in the outdoor air without unacceptable effects on human health or the public welfare.

Near-Zero Emission Technologies: Refers to emissions approaching zero and will be delineated for individual source categories through the process of developing the Air Quality Management Plan/State Implementation Plan and subsequent control measures.

Nitrogen Oxides (Oxides of Nitrogen, NO_x): A general term pertaining to compounds of nitric acid (NO), nitrogen dioxide (NO_2), and other oxides of nitrogen. Nitrogen oxides are typically created during combustion processes, and are major contributors to smog formation and acid deposition. NO_2 is a criteria air pollutant, and may result in numerous adverse health effects; it absorbs blue light, resulting in a brownish-red cast to the atmosphere and reduced visibility.

Nonattainment Area: A geographic area identified by the U.S. EPA and/or CARB as not meeting either NAAQS or CAAQS standards for a given pollutant.

NSR (New Source Review): A program used in development of permits for new or modified industrial facilities which are in a nonattainment area, and which emit nonattainment criteria air pollutants. The two major requirements of NSR are Best Available Control Technology and Emission Offsets.

Ozone: A strong smelling reactive toxic chemical gas consisting of three oxygen atoms. It is a product of the photochemical process involving the sun's energy. Ozone exists in the upper atmosphere ozone layer as well as at the earth's surface. Ozone at the earth's surface causes numerous adverse health effects and is a criteria air pollutant. It is a major component of smog.

Ozone Precursors: Chemicals such as hydrocarbons and oxides of nitrogen, occurring either naturally or as a result of human activities, which contribute to the formation of ozone, a major component of smog.

Partial Zero Emission Vehicle (PZEV): A vehicle emissions rating within California's exhaust emission standards. Cars that are certified as PZEVs meets the Super Ultra Low Emission Vehicle exhaust emission standard and has zero evaporative emissions from its fuel system.

Permit: Written authorization from a government agency (e.g., an air quality management district) that allows for the construction and/or operation of an emissions generating facility or its equipment within certain specified limits.

PIC (Particle-in-Cell) Model: An air quality simulation model that is used to apportion sulfate and nitrate PM10 concentrations to their precursor emissions sources. The PIC model uses spatially and temporally resolved sources of NOx and SOx emissions, with meteorological, physical, and simplified chemical processes, to calculate the contributions from various emission source categories.

Plug-in Electric Vehicle (PEV): Vehicles that can be recharged from any external source of electricity and the electricity is stored in a rechargeable battery pack to drive or contribute to drive the wheels.

Plug-in Hybrid Electric Vehicle (PHEV): Vehicles similar to traditional hybrids but are also equipped with a larger, more advanced battery that allows the vehicle to be plugged in and recharged in addition to refueling with gasoline. This larger battery allows the car to drive on battery alone, gasoline alone, or a combination of electric and gasoline fuels.

PM (Particulate Matter): Solid or liquid particles of soot, dust, smoke, fumes, and aerosols.

PM10 (Particulate Matter less than 10 microns): A major air pollutant consisting of tiny solid or liquid particles of soot, dust, smoke, fumes, and aerosols. The size of the particles (10 microns or smaller, about 0.0004 inches or less) allows them to easily enter the air sacs in the lungs where they may be deposited, resulting in adverse health effects. PM10 also causes visibility reduction and is a criteria air pollutant.

PM2.5 (Particulate Matter less than 2.5 microns): A major air pollutant consisting of tiny solid or liquid particles, generally soot and aerosols. The size of the particles (2.5 microns or smaller, about 0.0001 inches or less) allows them to easily enter the air sacs deep in the lungs where they may cause adverse health effects, as noted in several recent studies. PM2.5 also causes visibility reduction,

PSD (Prevention of Significant Deterioration): A program used in development of permits for new or modified industrial facilities in an area that is already in attainment. The intent is to prevent an attainment area from becoming a non-attainment area. This program, like require BACT as defined in the Clean Air Act and, if an AAQS is projected to be exceeded, Emission Offsets.

Public Workshop: A workshop held by a public agency for the purpose of informing the public and obtaining its input on the development of a regulatory action or control measure by that agency.

Regional Transportation Plan (RTP): The long-range transportation plan developed by the Southern California Association of Governments that provides a vision for transportation investments throughout the South Coast region. The RTP considers the role of transportation in the broader context of economic, mobility, environmental, and quality-of-life goals for the future, identifying regional transportation strategies to address regional mobility needs.

ROG (Reactive Organic Gas): A reactive chemical gas, composed of hydrocarbons, that may contribute to the formation of smog. Also sometimes referred to as Non-Methane Organic Compounds (NMOCs). (Also see VOC)

Salton Sea Air Basin (SSAB): Area comprised of a central portion of Riverside County (the Coachella Valley) and Imperial County. The Riverside county portion of the SSAB is bounded by the San Jacinto Mountains in the west and spans eastward up to the Palo Verde Valley.

SIP (State Implementation Plan): A document prepared by each state describing existing air quality conditions and measures which will be taken to attain and maintain national ambient air quality standards (see AQMP).

Smog: A combination of smoke, ozone, hydrocarbons, nitrogen oxides, and other chemically reactive compounds which, under certain conditions of weather and sunlight, may result in a murky brown haze that causes adverse health effects. The primary source of smog in California is motor vehicles.Smog Check Program: (See Inspection and Maintenance Program.)

Smoke: A form of air pollution consisting primarily of particulate matter (i.e., particles). Other components of smoke include gaseous air pollutants such as hydrocarbons, oxides of nitrogen, and carbon monoxide. Sources of smoke may include fossil fuel combustion, agricultural burning, and other combustion processes.

SO_2 (Sulfur Dioxide): A strong smelling, colorless gas that is formed by the combustion of fossil fuels. Ocean-going vessels, which may use oil high in sulfur content, can be major sources of SO_2. SO_2 and other sulfur oxides contribute to ambient PM2.5. SO_2 is also a criteria pollutant.

South Coast Air Basin (SCAB or Basin): Area bounded by the Pacific Ocean to the west and the San Gabriel, San Bernardino, and San Jacinto Mountains to the north and east. It includes all of Orange County and the non-desert portions of Los Angeles, Riverside, and San Bernardino Counties.

Stationary Sources: Non-mobile sources such as power plants, refineries, and manufacturing facilities which emit air pollutants; can include area sources depending on context.

Super Ultra Low Emission Vehicle (SULEV): A vehicle emissions rating within California's LEV 1 and LEV 2 exhaust emission standards.

Sustainable Communities Strategy (SCS): Planning element in the RTP that integrates land use and transportation strategies that will achieve CARB's greenhouse gas emissions reduction targets.

Toxic Air Contaminant: An air pollutant, identified in regulation by the CARB, which may cause or contribute to an increase in deaths or in serious illness, or which may pose a present or potential hazard to human health. TACs are considered under a different regulatory process (California Health and Safety Code Section 39650 et seq.) than pollutants subject to CAAQS. Health effects due to TACs may occur at extremely low levels, and it is typically difficult to identify levels of exposure which do not produce adverse health effects.

Transportation Control Measure (TCM): Under Health & Safety Code Section 40717, any control measure to reduce vehicle trips, vehicle use, vehicle miles traveled, vehicle idling, or traffic congestion for the purpose of reducing motor vehicle emissions. TCMs can include encouraging the use of carpools and mass transit. Under federal law, includes, but is not limted to those measures listed in CAA Section 108(f).

Ultrafine Particles (UFP): Particles with a diameter less than 0.1 μm (or 100nm).

Ultra Low Emission Vehicle (ULEV): Vehicles with low emission ratings within California's LEV 1 or LEV 2 exhaust emission standards. The LEV 1 emission standards typically apply to cars from 1994-2003. The LEV 2 emission standards were adopted in 1998 and typically apply to cars from 2004-2010.

U.S. EPA (United States Environmental Protection Agency): The federal agency charged with setting policy and guidelines, and carrying out legal mandates for the protection of national interests in environmental resources.

VMT: Total vehicle miles traveled by all or a subset of mobile sources.

Visibility: The distance that atmospheric conditions allow a person to see at a given time and location. Visibility reduction from air pollution is often due to the presence of sulfur and nitrogen oxides, as well as particulate matter.

VOCs (Volatile Organic Compounds): Hydrocarbon compounds that exist in the ambient air. VOCs contribute to the formation of smog and/or may themselves be toxic. VOCs often have an odor, and some examples include gasoline, alcohol, and the solvents used in paints.

Zero-Emission Technologies: Advanced technology or control equipment that generates zero end-use emissions from stationary or mobile source applications.

Zero Emission Vehicle (ZEV): A vehicle that produces no emissions from the on-board source of power.