California Environmental Protection Agency

Air Resources Board

PUBLIC MEETING AGENDA

Thursday, May 22, 2014

LOCATION:
Air Resources Board
Byron Sher Auditorium, Second Floor
1001 I Street
Sacramento, California 95814
http://www.calepa.ca.gov/EPAbldg/location.htm

This facility is accessible by public transit. For transit information, call (916) 321-BUSS, website: http://www.sacrt.com
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TO SUBMIT WRITTEN COMMENTS ON AN AGENDA ITEM IN ADVANCE OF THE MEETING GO TO: http://www.arb.ca.gov/lispub/comm/bclist.php

Thursday
May 22, 2014
9:00 a.m.

CONSENT CALENDAR:
The following items on the consent calendar will be presented to the Board immediately after the start of the public meeting, unless removed from the consent calendar either upon a Board member's request or if someone in the audience wishes to speak on it.

Consent Item #

14-4-1: Public Meeting to Consider Six Research Proposals

Staff will seek Board approval of research proposals that were developed based on the Board-approved Fiscal Year 2014-2015 Annual Research Plan.

1) *"Characterizing the Climate Impacts of Brown Carbon," University of California, San Diego, $452,500, Proposal No. 2769-278.*

2) *"Evaluation of the Feasibility, Cost-effectiveness, and Necessity of Equipping Small Off-Road Diesel Engines with Advanced PM and/or NOx Aftertreatment," University of California, Riverside, $800,000, Proposal No. 2770-278.*

3) *"Characterizing Formaldehyde Emissions from Home Central Heating and Air-Conditioning Filters," Lawrence Berkeley National Laboratory, $350,000, Proposal No. 2771-278.*

4) *"Protocol Developments for Vehicle Emission Toxicity Testing for Particulate Matter," University of California, Davis, $100,000, Proposal No. 2772-278.*

5) *"Improving DNDC Modeling Capability to Quantify Mitigation Potential of Nitrous Oxide from California Agricultural Soils," University of New Hampshire, $199,797, Proposal No. 2773-278.*

6) *"Evaluation of the Impacts of Emissions Averaging and Flexibility Programs for All Tier 4 Final Off-Road Diesel Engines," University of California, Riverside, $300,000, Proposal No. 2774-278.*

14-4-2: Public Meeting to Consider the Regional Haze Mid-Course Review

Staff will seek Board approval to submit the California Regional Haze Plan 2014 Progress Report to the United States Environmental Protection Agency. The 2014 Progress Report shows that visibility is improving throughout California due to continuing reductions in emissions of air pollutants that contribute to impaired visibility.

DISCUSSION ITEMS:

Note: The following agenda items may be heard in a different order at the Board meeting.

Agenda Item #

14-4-3: Public Meeting to Consider Proposed First Update to the Climate Change Scoping Plan

Staff will present the Final Proposed First Update to the Climate Change Scoping Plan for consideration for approval along with the Environmental Analysis (EA) prepared for the Update and written responses to environmental comments received on the EA. The Proposed Update describes the State's progress toward the 2020 Greenhouse Gas Emissions (GHG) goal and describes additional actions the State will take to maintain GHG emission reductions. These actions include the development of a plan to reduce emissions of short-lived climate pollutants, such as methane and black carbon.

14-4-4: Mobile Source Measurements Showcase

Staff will present an informational item describing the range of mobile source emission measurement methods and tools that support the Board's on- and off-road regulatory programs. Staff will describe how these methods and tools have improved since the 1960s to address ARB's changing mobile source program priorities and how they will need to continue to evolve to meet air quality and climate challenges in the coming decades. As part of this Board item, a number of different instruments will be on display in and adjacent to the California Environmental Protection Agency Building to demonstrate how these tools are being used to measure emissions of air and climate pollution from a variety of on- and off-road vehicles.

14-4-5: Public Meeting to Update the Board on San Joaquin Valley Sustainable Communities Strategy Development

Staff will present an informational update to the Board on the San Joaquin Valley Metropolitan Planning Organizations' (MPO) development of their Sustainable Communities Strategies (SCS). Under Senate Bill 375, the Sustainable Communities and Climate Protection Act of 2008, each of the California MPOs is required to prepare and adopt a regional transportation plan with an SCS that includes a forecasted development pattern for the region that is integrated with the transportation network, measures, and policies that could, if feasible, meet the greenhouse gas emission reduction targets set by the Air Resources Board. Each of the eight San Joaquin Valley MPOs has published their draft SCSs for public review. This informational update will provide an overview of the measures and policies that are reflected in these published SCSs.

CLOSED SESSION

The Board will hold a closed session, as authorized by Government Code section 11126(e), to confer with, and receive advice from, its legal counsel regarding the following pending or potential litigation, and as authorized by Government Code section 11126(a):

POET, LLC, et al. v. Corey, et al., Superior Court of California (Fresno County), Case No. 09CECG04850; plaintiffs' appeal, California Court of Appeal, Fifth District, Case No. F064045; California Supreme Court, Case No. S213394.

Rocky Mountain Farmers Union, et al. v. Corey, U.S. District Court (E.D. Cal. Fresno), Case No. 1:09-CV-02234-LJO-DLB; ARB interlocutory appeal, U.S. Court of Appeals, Ninth Circuit, Case No. 09-CV-02234; petition for certiorari, U.S. Supreme Court, Case No. 13-1148.

American Fuels and Petrochemical Manufacturing Associations, et al. v. Corey, et al., U.S. District Court (E.D. Cal. Fresno), Case No. 1:10-CV-00163-AWI-GSA; ARB's interlocutory appeal, U.S. Court of Appeals, Ninth Circuit, Case No. 10-CV-00163; petition for certiorari, U.S. Supreme Court, Case No.13-11490.

California Dump Truck Owners Association v. Nichols, U.S. District Court (E.D. Cal. Sacramento), Case No. 2:11-CV-00384-MCE-GGH; plaintiffs' appeal, U.S. Court of Appeals, Ninth Circuit, Case No. 13-15175.

Engine Manufacturers Association v. California Air Resources Board, Sacramento Superior Court, Case No. 34-2010-00082774; ARB's appeal, California Court of Appeal, Third District, Case No. C071891.

Truck and Engine Manufacturers Association v. California Air Resources Board, Sacramento Superior Court, Case No. 34-2013-00150733.

Alliance of Automobile Manufacturers v. California Air Resources Board; Sacramento Superior Court, Case No. 34-2013-00152974.

Citizens Climate Lobby and Our Children's Earth Foundation v. California Air Resources Board, San Francisco Superior Court, Case No. CGC-12-519554, plaintiffs' appeal, California Court of Appeal, First District, Case No. A138830.

California Chamber of Commerce et al. v. California Air Resources Board, Sacramento Superior Court, Case No. 34-2012-80001313; plaintiffs' appeal, California Court of Appeal, Third District, Case No. C075930.

Morning Star Packing Company, et al. v. California Air Resources Board, et al., Sacramento Superior Court, Case No. 34-2013-800001464; plaintiffs' appeal, California Court of Appeal, Third District, Case No. C075954.

Delta Construction Company, et al. v. United States Environmental Protection Agency, U.S. Court of Appeals, District of Columbia Circuit, Case No. 11-1428.

City of Los Angeles through Department of Water and Power v. California Air Resources Board, et al., Los Angeles Superior Court, Case No. BS140620 (transferred to Sacramento Superior Court, Case No. 34-2013-80001451-CU-WM-GDS).

Alliance for California Business v. Nichols et al., Glenn County Superior Court, Case No. 13CV01232.

Dalton Trucking, Inc. v. United States Environmental Protection Agency, U.S. Court of Appeals, District of Columbia Circuit, Case No. 13-1283.

Owner-Operator Independent Drivers Association Inc. et al. v. Richard W. Corey et al., U.S. District Court, (E.D. Cal. Fresno) Case No. 1:13-CV-01998-LJO-SAB (transferred by court to E.D.Cal. Sacramento, Case No. 2:14-CV-00186-MCE-AC).

OPPORTUNITY FOR MEMBERS OF THE BOARD TO COMMENT ON MATTERS OF INTEREST

Board members may identify matters they would like to have noticed for consideration at future meetings and comment on topics of interest; no formal action on these topics will be taken without further notice.

OPEN SESSION TO PROVIDE AN OPPORTUNITY FOR MEMBERS OF THE PUBLIC TO ADDRESS THE BOARD ON SUBJECT MATTERS WITHIN THE JURISDICTION OF THE BOARD

Although no formal Board action may be taken, the Board is allowing an opportunity to interested members of the public to address the Board on items of interest that are within the Board's jurisdiction, but that do not specifically appear on the agenda. Each person will be allowed a maximum of three minutes to ensure that everyone has a chance to speak.

TO ELECTRONICALLY SUBMIT WRITTEN COMMENTS ON AN AGENDA ITEM IN ADVANCE OF THE MEETING GO TO:

http://www.arb.ca.gov/lispub/comm/bclist.php

(Note: not all agenda items are available for electronic submittals of written comments.)

IF YOU HAVE ANY QUESTIONS, PLEASE CONTACT THE CLERK OF THE BOARD:
1001 I Street, 23rd Floor, Sacramento, California 95814
(916) 322-5594
ARB Homepage: www.arb.ca.gov

SPECIAL ACCOMMODATION REQUEST

Consistent with California Government Code Section 7296.2, special accommodation or language needs may be provided for any of the following:

- An interpreter to be available at the hearing;
- Documents made available in an alternate format or another language;
- A disability-related reasonable accommodation.

To request these special accommodations or language needs, please contact the Clerk of the Board at (916) 322-5594 or by facsimile at (916) 322-3928 as soon as possible, but no later than 7 business days before the scheduled Board hearing. TTY/TDD/Speech to Speech users may dial 711 for the California Relay Service.

Consecuente con la sección 7296.2 del Código de Gobierno de California, una acomodación especial o necesidades lingüísticas pueden ser suministradas para cualquiera de los siguientes:

- Un intérprete que esté disponible en la audiencia
- Documentos disponibles en un formato alterno u otro idioma
- Una acomodación razonable relacionados con una incapacidad

Para solicitar estas comodidades especiales o necesidades de otro idioma, por favor llame a la oficina del Consejo al (916) 322-5594 o envié un fax a (916) 322-3928 lo más pronto posible, pero no menos de 7 días de trabajo antes del día programado para la audiencia del Consejo. TTY/TDD/Personas que necesiten este servicio pueden marcar el 711 para el Servicio de Retransmisión de Mensajes de California.

SMOKING IS NOT PERMITTED AT MEETINGS OF THE CALIFORNIA AIR RESOURCES BOARD

California Environmental Protection Agency

Air Resources Board

PUBLIC MEETING AGENDA

LOCATION:
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PROPOSED

State of California
AIR RESOURCES BOARD

Characterizing the Climate Impacts of Brown Carbon

RESEARCH PROPOSAL

Resolution 14-8

May 22, 2014

Agenda Item No.: 14-4-1

WHEREAS, the Air Resources Board (ARB) has been directed to carry out an effective research program in conjunction with its efforts to combat air pollution, pursuant to Health and Safety Code sections 39700 through 39705;

WHEREAS, a research proposal, number 2769–278, titled "Characterizing the Climate Impacts of Brown Carbon," has been submitted by the University of California, San Diego; and

WHEREAS, the Research Division staff has reviewed Proposal Number 2769-278 and finds that in accordance with Health and Safety Code section 39701, the focus of the research study will help to identify sources of Brown Carbon (BrC) and quantify its relative contribution to the absorption of solar radiation by particulate matter (PM). This will allow for improved assessment of the potential climate benefit of reducing specific PM sources with high organic carbon emissions that are determined to be large contributors to BrC. The results of this study will help ARB to determine the climate benefit of the ongoing mitigation of BrC emission sources in California. Research Division staff recommends this proposal for approval.

WHEREAS, in accordance with Health and Safety Code section 39705, the Research Screening Committee recommends for funding:

> Proposal Number 2769-278, entitled "Characterizing the Climate Impacts of Brown Carbon," submitted by the University of California, San Diego, for a total amount not to exceed $452,500.

NOW, THEREFORE BE IT RESOLVED that the Air Resources Board, pursuant to the authority granted by Health and Safety Code section 39700 through 39705, hereby accepts the recommendations of the Research Screening Committee and Research Division Staff and approves the following:

Proposal Number 2769–278 titled "Characterizing the Climate Impacts of Brown Carbon," submitted by the University of California, San Diego, for a total amount not to exceed $452,500.

BE IT FURTHER RESOLVED that the Executive Officer is hereby authorized to initiate administrative procedures and execute all necessary documents and contracts for the research effort proposed herein, and as described in Attachment A, in an amount not to exceed $452,500.

ATTACHMENT A

"Characterizing the Climate Impacts of Brown Carbon"

Background

Airborne particulate matter (PM) is one of the main drivers of human health impacts associated with air pollution exposure, and also plays an important role in the climate system. Among the various types of PM, carbonaceous PM, containing organic carbon (OC) and black carbon (BC), is especially important because of both its abundance in the atmosphere and its health effects, which are the focus of increasing interest. With respect to the climate impacts of PM, BC is the principal absorber of visible solar radiation in the atmosphere, whereas OC is often described as light-reflecting. However, recent studies show that certain OC fractions can also absorb solar radiation efficiently, although they differ from typical BC; these fractions are referred to as brown carbon (BrC).

Although BrC is pervasive in the atmosphere, neither its sources nor the extent to which it contributes to direct aerosol climate forcing are well understood. Brown carbon emissions released from residential, agricultural, and wildfire burning activities are highly seasonal or episodic, and are thus a poorly characterized fraction of PM2.5 in California. Because their emissions are highest in the winter months when air quality is worst in the San Joaquin Valley and Sierra foothill communities, quantifying their role in the atmosphere is essential both to improving local air quality and to understanding their net impact on the climate.

Objective

This research project will characterize the extent to which BrC contributes to climate forcing in California, identify likely sources of BrC in the State, and assess BrC's contribution to regional and global climate impacts.

Methods

Through a multi-institutional collaboration, this research study will identify and characterize the contribution of BrC to climate forcing in California by (1) applying advanced instrumentation that will provide unprecedented chemical and optical characterization of BrC sources, (2) quantifying the BrC organic components from burning emissions and from atmospheric formation of secondary components at two California locations, and (3) examining the globally and regionally-averaged climate response of BrC. The proposed research will include measurements at two California sites and investigates at least two types of BrC (e.g. residential burning and urban secondary organic aerosols). BrC particles and their sources will be chemically characterized and quantified to attribute the measured mass of BrC to sources based on trace elemental signatures. These results will be used to develop climate model simulations to examine the globally and regionally-averaged climate response of BrC.

Expected Results
This research study will help to identify sources of BrC and quantify its relative contribution to the absorption of solar radiation by PM. This will allow for improved assessment of the potential climate benefit of reducing specific PM sources with high organic carbon emissions that are determined to be large contributors to BrC.

Significance to the Board
This project will improve ARB's understanding of the fundamental processes that dominate brown carbon formation and its evolution in the atmosphere, and help to determine the potential climate benefit of mitigating sources of brown carbon emissions in California. This research will also provide useful new measurements and analysis of immediate value for developing air quality attainment strategies in California and the development of State Implementation Plans, and for understanding the pathways leading to secondary organic aerosols.

Contractor:
University of California, San Diego

Contract Period:
36 months

Principal Investigator:
Lynn Russell, Ph.D.

Contract Amount:
$452,500

Basis for Indirect Cost Rate:
The State and the UC system have agreed to a ten percent indirect cost rate.

Past Experience with this Principal Investigator:
Professor Lynn Russell will serve as the principal investigator, coordinating and synthesizing the effort for the overall project. Her 15 plus years of experience in aerosol science and strong publication record make her ideal to fulfill this role. Professor Russell has successfully completed several projects for ARB and showed exceptional effort to produce valuable reports.

Prior Research Division Funding to University of California, San Diego:

Year	2013	2012	2011
Funding	$ 0	$ 24,080	$ 0

BUDGET SUMMARY

University of California, San Diego

"Characterizing the Climate Impacts of Brown Carbon"

DIRECT COSTS AND BENEFITS			
1.	Labor and Employee Fringe Benefits	$ 152,097	
2.	Subcontractors	$ 252,500[1]	
3.	Equipment	$ 0	
4.	Travel and Subsistence	$ 6,720	
5.	Electronic Data Processing	$ 0	
6.	Reproduction/Publication	$ 0	
7.	Mail and Phone	$ 1,250	
8.	Supplies	$ 9,331	
9.	Analyses	$ 3,500	
10.	Miscellaneous	$ 11,625	
	Total Direct Costs		$ 437,023
INDIRECT COSTS			
1.	Overhead	$ 15,477	
2.	General and Administrative Expenses	$ 0	
3.	Other Indirect Costs	$ 0	
4.	Fee or Profit	$ 0	
	Total Indirect Costs		$ 15,477
TOTAL PROJECT COSTS			**$ 452,500**

[1] The subcontractors will play critical roles in this project by performing measurements and analyzing and interpreting the results. The subcontractors will also conduct comprehensive data analysis and employ sophisticated regional and global climate models that are uniquely suited to the objectives of this project.

ATTACHMENT 1

SUBCONTRACTORS' BUDGET SUMMARY

University of California, Davis (UCD)

DIRECT COSTS AND BENEFITS			
1.	Labor and Employee Fringe Benefits	$ 160,850	
2.	Subcontractors	$ 50,000[1]	
3.	Equipment	$ 0	
4.	Travel and Subsistence	$ 8,991	
5.	Electronic Data Processing	$ 8,525	
6.	Reproduction/Publication	$ 1,452	
7.	Mail and Phone	$ 0	
8.	Supplies	$ 2,000	
9.	Analyses	$ 0	
10.	Miscellaneous	$ 0	
	Total Direct Costs		$ 231,818
INDIRECT COSTS			
1.	Overhead	$ 20,682	
2.	General and Administrative Expenses	$ 0	
3.	Other Indirect Costs	$ 0	
4.	Fee or Profit	$ 0	
	Total Indirect Costs		$ 20,682
TOTAL PROJECT COSTS			**$ 252,500**

[1] UCD investigators will apply advanced instrumentation that will provide unprecedented chemical and optical characterization of brown carbon sources and investigate its formation pathways. They will also apply source-oriented model, weather research and forecasting model coupled with chemistry, which provides unique capabilities in linking climate impacts with specific aerosol sources.

ATTACHMENT 2

SUBCONTRACTORS' BUDGET SUMMARY

Dr. Mark Z. Jacobson, independent subcontractor
Scientific Collaborator at Stanford

The subcontractor will run and analyze two types of 3-D computer simulations: (1) global simulations to simulate the climate response of brown carbon, and (2) nested global-regional simulations focusing on California to examine the spatial distribution, optical properties, radiative effects, and human exposure to brown carbon in the state. Twenty-year global simulations (2010-2030) will be simulated with and without brown carbon to examine the globally and regionally-averaged climate impact of brown carbon. The work proposed here will complement ongoing work by Jacobson funded under the National Science Foundation titled, "Effects of Absorbing Aerosols on Clouds: Satellite and Modeling Analysis."

DIRECT COSTS AND BENEFITS			
1.	Labor and Employee Fringe Benefits	$ 50,000	
2.	Subcontractors	$ 0	
3.	Equipment	$ 0	
4.	Travel and Subsistence	$ 0	
5.	Electronic Data Processing	$ 0	
6.	Reproduction/Publication	$ 0	
7.	Mail and Phone	$ 0	
8.	Supplies	$ 0	
9.	Analyses	$ 0	
10.	Miscellaneous	$ 0	
	Total Direct Costs		$ 50,000
INDIRECT COSTS			
1.	Overhead	$ 0	
2.	General and Administrative Expenses	$ 0	
3.	Other Indirect Costs	$ 0	
4.	Fee or Profit	$ 0	
	Total Indirect Costs		$ 0
TOTAL PROJECT COSTS			**$ 50,000**

PROPOSED

State of California
AIR RESOURCES BOARD

Evaluation of the Feasibility, Cost-Effectiveness, and Necessity of Equipping Small Off-Road Diesel Engines with Advanced PM and/or NO_X Aftertreatment

RESEARCH PROPOSAL

Resolution 14-9

May 22, 2014

Agenda Item No.: 14-4-1

WHEREAS, the Air Resources Board (ARB) has been directed to carry out an effective research program in conjunction with its efforts to combat air pollution, pursuant to Health and Safety Code sections 39700 through 39705;

WHEREAS, a research proposal, number 2770-278, entitled: "Evaluation of the Feasibility, Cost-Effectiveness, and Necessity of Equipping Small Off-Road Diesel Engines with Advanced PM and/or NO_X Aftertreatment," has been submitted by the University of California, Riverside; and

WHEREAS, the Research Division staff has reviewed Proposal Number 2770-278 and finds that in accordance with Health and Safety Code section 39701, research is needed to improve ARB's understanding of small off-road diesel engine emissions. Results from this project will consist of nitrogen oxides (NO_X) and particulate matter (PM) emissions data for small (less than 37 kilowatts) off-road diesel engines, both with and without emission control technologies such as Diesel Particulate Filters and Selective Catalytic reduction. Results will include a detailed cost-benefit analysis of such controls, and predictions of their economic effects (i.e., consumer choices, manufacturer market share). Furthermore, results will inform ARB policy makers about the effectiveness of stricter emission standards and the advanced aftertreatment technologies that they would necessitate. Research Division staff recommends this proposal for approval.

WHEREAS, in accordance with Health and Safety Code section 39705, the Research Screening Committee recommends for funding:

> Proposal Number 2770-278 entitled "Evaluation of the Feasibility, Cost-Effectiveness, and Necessity of Equipping Small Off-Road Diesel Engines with Advanced PM and/or NO_X Aftertreatment," submitted by the University of California, Riverside, for a total amount not to exceed $800,000.

NOW, THEREFORE, BE IT RESOLVED that the Air Resources Board, pursuant to the authority granted by Health and Safety Code section 39703, hereby accepts the recommendations of the Research Screening Committee and Research Division staff and approves the following:

> Proposal Number 2769-278 entitled: "Evaluation of the Feasibility, Cost-Effectiveness, and Necessity of Equipping Small Off-Road Diesel Engines with Advanced PM and/or NO_X Aftertreatment," submitted by the University of California, Riverside, for a total amount not to exceed $800,000.

BE IT FURTHER RESOLVED that the Executive Officer is hereby authorized to initiate administrative procedures and execute all necessary documents and contracts for the research effort proposed herein, and as described in Attachment A, in an amount not to exceed $800,000.

Attachment A

"Evaluation of the Feasibility, Cost-Effectiveness, and Necessity of Equipping Small Off-Road Diesel Engines with Advanced PM and/or NO_X Aftertreatment"

Background

Off-road diesel engines are an important source of nitrogen oxides (NO_X) and particulate matter (PM), both nationally and within California. The development of emissions factors and inventories for off-road equipment has been more challenging than for on-road vehicles due largely to both the variability in the types of off-road diesel engines, and variability in operating conditions that are difficult to replicate during controlled dynamometer tests.

In California, the majority of mobile source off-road diesel engines sold as new after 2011 are subject to federal and State regulations that require compliance with stringent Tier 4 PM and NO_X exhaust standards. These standards generally require the use of advanced aftertreatment technologies, such as Diesel Particulate Filters (DPF) for PM removal and Selective Catalytic reduction (SCR) for control of NO_X. However, off-road diesel engines less than 37 kilowatts are allowed to certify with emissions at higher levels due to the belief that advanced aftertreatment could severely impact the cost of these smaller engines. A Regulatory Impact Analysis (RIA) estimated the costs of anticipated emission control technologies that were not in wide production when Tier 4 standards were implemented in 2004. However, some of the control technologies anticipated in the RIA are now common today in both the off- and on-road diesel sectors. This project will examine the potential for more stringent exhaust standards for the less than 37kW off-road engine sector, in light of the "economies of scale" of today's market, as well as the availability of additional exhaust control strategies and techniques that were not evaluated in the RIA.

Objectives

The goal of this study is to evaluate the potential effectiveness, feasibility, and cost effectiveness of implementing regulations to control emissions from mobile off-road diesel engines with rated powers of less than 37 kilowatts. Such regulations would essentially require the use of advanced emission control strategies such as DPFs and SCR. Specific objectives include: a comprehensive review of available aftertreatment and other technologies; a demonstration of selected aftertreatment technologies on actual engines; verification of the emissions performance of these devices through a series of emissions and durability tests; evaluation of the potential impacts on the emissions inventory; and evaluation of the impact of potential costs on the small engine marketplace and consumer choice.

Methods

The project will consist of the following major tasks: 1) Prescreening for cost-effective controls; Test method development; Testing of small off-road diesel engines; Cost/benefit analysis of advanced emission control strategies for small off-road diesel engines; 2) Determination of the impact of feasible emission control measures on the

emissions inventory and air quality; and 3) Determination of how new regulatory control measures could affect consumer choices and manufacturer market share.

The research team will review existing and emerging emission control technologies that could be employed on off-road diesel engines with power ratings of less than 37 kilowatts to significantly reduce PM and NO_X. They will then select at least seven new less than 37 kilowatts diesel engines that can be operated with either one or a combination of the emission control technologies (i.e., DPFs and SCR) previously identified by the contractor as effective and reasonable. Emissions from these engines will be measured at least three times over the course of at least 1,000 hours of actual operation. A cost-benefit analysis will be performed based on these results along with consultation with individual manufacturers.

The research team will then work with the ARB's diesel engine modeling staff and new engine certification staff to determine the environmental impact of the tested emission controls on small diesel engines. Specifically, ARB's Diesel Off-road On-line Reporting System will be used to estimate the population of relevant engines. Contractors will then use these populations and the measured emission rates as inputs to a dispersion model such as the United States Environmental Protection Agency's Community Multi-scale Air Quality (CMAQ) Model to produce air quality predictions.

Finally, the research team will gauge how the implementation of stricter PM and NO_X standards would influence the economic interests of small off-road diesel engine manufacturers. To accomplish this, the team will rely on existing relationships with these manufacturers and their trade associations, including the Outdoor Power Equipment Institute, the Association of Equipment Manufacturers, and the Engine Manufacturers Association. Based on input from these groups, the contractor will predict the influence of such standards on both consumer choice and manufacturer market share.

Expected Results

The results from this project will consist of NO_X and PM emissions data for small (less than 37 kilowatts) off-road diesel engines, both with and without emission control technologies such as DPFs and SCR. They will include a detailed cost-benefit analysis of such controls, and predictions of their economic effects (i.e., consumer choices, manufacturer market share).

Significance to the Board

Ambient PM is associated with adverse health effects. Elevated NO_X can lead to ozone production and can result in formation of secondary PM nitrate aerosol. Much progress has been made in recent years in reducing the PM and NO_X emissions for on-road diesel engines. Regulation of off-road engines has lagged slightly but is beginning to catch up. However, small off-road engines have been largely exempted from the strictest emissions standards. This project will provide both more accurate estimates of the contributions of small engines to ambient PM and NO_X, as well as the economic effects of Tier 4 (or similar) standards applied to these engines. Results from this

project will inform ARB policy makers about the effectiveness of applying new emission standards to small diesel engines.

Contractor:
University of California, Riverside

Contract Period:
36 months

Principal Investigator (PI):
Thomas Durbin, Ph.D.

Contract Amount:
$800,000

Basis for Indirect Cost Rate:
The State and the UC System have agreed to a ten percent indirect cost rate.

Past Experience with the Principal Investigator:
ARB staff have successfully managed several previous contracts with Dr. Thomas Durbin that have estimated emission rates from off-road diesel engines. This new project will build on these previous projects.

Prior Research Division Funding to the University of California, Riverside:

Year	2013	2012	2011
Funding	$ 777,062	$ 0	$ 390,004

BUDGET SUMMARY

University of California, Riverside

"Evaluation of the Feasibility, Cost-Effectiveness, and Necessity of Equipping Small Off-Road Diesel Engines with Advanced PM and/or NO_X Aftertreatment"

DIRECT COSTS AND BENEFITS			
1.	Labor and Employee Fringe Benefits	$ 261,402	
2.	Subcontractors	$ 0	
3.	Equipment	$ 55,615	
4.	Travel and Subsistence	$ 3,425	
5.	Electronic Data Processing	$ 0	
6.	Reproduction/Publication	$ 0	
7.	Mail and Phone	$ 0	
8.	Supplies	$ 8,050	
9.	Analyses	$ 278,184[1]	
10.	Miscellaneous	$ 139,623[2]	
	Total Direct Costs		$ 746,299
INDIRECT COSTS			
1.	Overhead	$ 53,701	
2.	General and Administrative Expenses	$ 0	
3.	Other Indirect Costs	$ 0	
4.	Fee or Profit	$ 0	
	Total Indirect Costs		$ 53,701
TOTAL PROJECT COSTS			**$ 800,000**

[1] The laboratory testing will be conducted in the Center for Environmental Research and Technology's (CE-CERT) Vehicle Emissions Research Laboratory, which has an hourly rate of $590. The in-use testing will be conducted with PEMS, which have daily rates for their use ($3000/day) and also for preparing to test ($1500/day).

[2] Miscellaneous costs are for rental of CE-CERT, which is an off-campus facility and therefore requires a rental fee of 26 percent of the modified total direct costs.

PROPOSED

State of California
AIR RESOURCES BOARD

Characterizing Formaldehyde Emissions from Home Central Heating and Air Conditioning Filters

RESEARCH PROPOSAL

Resolution 14-10

May 22, 2014

Agenda Item No.: 14-4-1

WHEREAS, the Air Resources Board has been directed to carry out an effective research program in conjunction with its efforts to combat air pollution, pursuant to Health and Safety Code sections 39700 through 39705;

WHEREAS, a research proposal, number 2771-278, entitled "Characterizing Formaldehyde Emissions from Home Central Heating and Air Conditioning Filters," has been submitted by Lawrence Berkeley National Laboratory; and

WHEREAS, the Research Division staff has reviewed Proposal Number 2771-278 and finds that in accordance with Health and Safety Code Section 39701, research is needed to quantify the impact of fiberglass filters on formaldehyde exposures in California, and determine the benefits of the use of synthetic particle filters to reduce human exposures to formaldehyde. Results from this project will help inform decision-makers about whether synthetic particle filters are a part of the solution to reduce indoor formaldehyde exposures. Research Division staff recommends this proposal for approval.

WHEREAS, in accordance with Health and Safety Code section 39705, the Research Screening Committee recommends for funding:

> Proposal Number 2771-278 entitled "Characterizing Formaldehyde Emissions from Home Central Heating and Air Conditioning Filters," submitted by Lawrence Berkeley National Laboratory, for a total amount not to exceed $350,000.

NOW, THEREFORE BE IT RESOLVED that the Air Resources Board, pursuant to the authority granted by Health and Safety Code section 39703, hereby accepts the recommendations of the Research Screening Committee and Research Division staff and approves the following:

Proposal Number 2771-278 entitled "Characterizing Formaldehyde Emissions from Home Central Heating and Air Conditioning Filters," submitted by Lawrence Berkeley National Laboratory, for a total amount not to exceed $350,000.

BE IT FURTHER RESOLVED that the Executive Officer is hereby authorized to initiate administrative procedures and execute all necessary documents and contracts for the research effort proposed herein, and as described in Attachment A, in an amount not to exceed $350,000.

ATTACHMENT A

"Characterizing Formaldehyde Emissions from Home Central Heating and Air Conditioning Filters"

Background

Formaldehyde has been classified as a known human carcinogen by the International Agency for Research on Cancer and designated as a toxic air contaminant in California by the Air Resources Board (ARB) with no safe level of exposure. Based on recent research by Lawrence Berkeley National Laboratory (LBNL), fiberglass particle filters in central heating and air systems may be the second largest source of indoor formaldehyde levels, after composite wood products. The formaldehyde apparently is attributable to urea-formaldehyde resins used in fiberglass filters. In limited laboratory and field studies, fiberglass particle filters produced indoor concentrations that exceeded the Office of Environmental Health Hazard Assessment's (OEHHA) non-cancer 8-hour and Chronic Reference Exposure Levels (RELs) for formaldehyde (both set at 9 $\mu g/m^3$). LBNL found that emissions of formaldehyde from some fiberglass filters increased with increasing relative humidity. The LBNL study suggests that changing filter type from fiberglass filters to synthetic filters could reduce indoor concentrations by about 4-5 $\mu g/m^3$ in homes. This reduction would result in a level that is approximately 50 percent lower than OEHHA's non-cancer 8-hour and Chronic RELs for formaldehyde.

However, these preliminary results were based on just a few measurements of emissions from filters used primarily in commercial buildings under limited test conditions. Further study is needed to quantify the contribution of residential fiberglass and synthetic filters to indoor concentrations of formaldehyde under a variety of conditions found in California homes and evaluate the benefits of synthetic filters.

Objective

The objective of this project is to quantify the emissions of formaldehyde from fiberglass particle filters relative to synthetic particle filters, and estimate their contributions to indoor concentrations for California homes. The specific objectives are to measure formaldehyde emission rates from fiberglass particle filters and synthetic particle filters across a range of humidity levels, temperatures and air velocities typical of California homes, and estimate the impacts of fiberglass particle filters and synthetic particle filters on indoor formaldehyde levels under typical scenarios in California homes.

Methods

The investigators will identify fiberglass particle filters and synthetic particle filters marketed or designed for use in residential central heating and air conditioning systems in California, and test at least four types of fiberglass filters that are likely to emit formaldehyde and four types of synthetic filters that, based on prior data, are not expected to have significant emissions. The investigators will modify the experimental chamber and ancillary equipment that LBNL used to test formaldehyde emissions from

particle filters for commercial buildings in a previous study for the purpose of this project.

Formaldehyde emission rates of fiberglass and synthetic particle filters will be determined in bench-scale and full-scale tests. Bench-scale tests will determine formaldehyde emission rates of filter media under different conditions. A 4-inch diameter filter sample cut from each filter will be placed in an air-tight holder connected with the experimental chamber. Formaldehyde concentrations upstream and downstream of the filters will be measured. Each filter will be tested across a range of real world conditions observed in California homes, including at least three humidity levels, two temperatures, and three air velocities passing through filters. In addition, a few used filters will be tested to determine if formaldehyde emissions increase with filter loading. In total, the investigators will conduct 36 bench-scale tests.

Formaldehyde emission rates of complete filters will be measured in full-scale tests in order to determine if filter frames emit substantial amounts of formaldehyde. Ductwork will be used to connect the experimental chamber to a filter holder which can host a complete filter. Formaldehyde concentrations upstream and downstream of the filters will be measured. In total, the investigators will conduct 4 full-scale tests.

Using the measured formaldehyde emission rates and modeling parameters appropriate for California homes, the contributions of fiberglass particle filters to indoor formaldehyde levels under typical scenarios will be estimated using a mass balance model. The contributions of fiberglass filters and synthetic filters under similar conditions will be compared to quantify the exposure reduction that would likely be achieved by switching to synthetic filters.

Expected Results
The results from this project will consist of formaldehyde emission rates of fiberglass filters and synthetic filters across a range of conditions in typical California homes, the contributions of these filters to indoor formaldehyde concentrations in typical California homes, and potential health risks of exposures to formaldehyde from these filters.

Significance to the Board
The results will help quantify the impact of fiberglass filters on formaldehyde exposures in California, and determine the benefits of the use of synthetic particle filters to reduce human exposures to formaldehyde. This project will help inform decision-makers about whether synthetic particle filters are a part of the solution to reduce indoor formaldehyde exposures.

Contractor:
Lawrence Berkeley National Laboratory

Contract Period:
30 months

Principal Investigator (PI):
Hugo Destaillats, Ph.D.

Contract Amount:
$350,000

Basis for Indirect Cost Rate:
The State and Lawrence Berkeley National Laboratory have agreed to a 51 percent indirect cost rate.

Past Experience with this Principal Investigator:
ARB staff is currently managing a contract with Dr. Hugo Destaillats, which evaluates pollutant emissions from portable air cleaners. Dr. Destaillats and his team of researchers showed broad knowledge and extensive experience in the field of source characterization, analytical chemistry, and indoor air quality assessment. He is very responsive and cooperative in terms of meeting ARB's research needs.

Prior Research Division Funding to Lawrence Berkeley National Laboratory:

Year	2013	2012	2011
Funding	$ 0	$ 2,530,873	$ 754,264

BUDGET SUMMARY

Contractor: Lawrence Berkeley National Laboratory

"Reducing Formaldehyde Emissions from Home Central Heating and Air Conditioning Filters"

DIRECT COSTS AND BENEFITS			
1.	Labor and Employee Fringe Benefits	$ 154,051	
2.	Subcontractors	$ 0	
3.	Equipment	$ 0	
4.	Travel and Subsistence	$ 2,236	
5.	Electronic Data Processing	$ 0	
6.	Reproduction/Publication	$ 0	
7.	Mail and Phone	$ 0	
8.	Supplies	$ 18,198	
9.	Analyses	$ 0	
10.	Miscellaneous	$ 57,595[1]	
Total Direct Costs			$ 232,080
INDIRECT COSTS			
1.	Overhead	$ 117,920	
2.	General and Administrative Expenses	$ 0	
3.	Other Indirect Costs	$ 0	
4.	Fee or Profit	$ 0	
	Total Indirect Costs		$ 117,920
TOTAL PROJECT COSTS			**$ 350,000**

[1] Miscellaneous include:
1. Organization and ALD burden ($27,113): a direct cost applied to total salaries plus fringe benefits.
2. Department burden ($10,291): a direct cost applied to total salaries plus fringe benefits, comprising general departmental costs including, but not limited to, laboratory and office space recharges, telephone charges, faxes, electronic backups, photocopying, and department-level administrative support, and other miscellaneous recharges, corresponding to facilities and laboratory services.
3. Stipends and honoraria ($20,000): a stipend of $2,000/month will be paid for 10 months for a student hired to help on carrying out the experimental work.
4. Electricity ($191): estimated at a monthly rate of $19-$20/month.

PROPOSED

State of California
AIR RESOURCES BOARD

Protocol Development for Vehicle Emission Toxicity Testing for Particulate Matter

RESEARCH PROPOSAL

Resolution 14-11

May 22, 2014

Agenda Item No.: 14-4-1

WHEREAS, the Air Resources Board (ARB) has been directed to carry out an effective research program in conjunction with its efforts to combat air pollution, pursuant to Health and Safety Code sections 39700 through 39705;

WHEREAS, a research proposal, number 2772-278, entitled "Protocol Development for Vehicle Emission Toxicity Testing for Particulate Matter," has been submitted by the University of California, Davis; and

WHEREAS, the Research Division staff has reviewed Proposal Number 2772-278 and finds that in accordance with Health and Safety Code Section 39701, research is needed to improve and standardize ARB's methodology for preparation of vehicle emission samples for toxicity testing. Results from this project will be used to establish a standard operating procedure for ARB researchers and improve the ability of staff to evaluate possible health risks associated with vehicle emissions. Research Division staff recommends this proposal for approval.

WHEREAS, in accordance with Health and Safety Code section 39705, the Research Screening Committee recommends for funding:

> Proposal Number 2772-278 entitled "Protocol Development for Vehicle Emission Toxicity Testing for Particulate Matter" submitted by the University of California, Davis for a total amount not to exceed $100,000.

NOW, THEREFORE BE IT RESOLVED that the Air Resources Board, pursuant to the authority granted by Health and Safety Code section 39703, hereby accepts the recommendations of the Research Screening Committee and Research Division staff and approves the following:

> Proposal Number 2772-278 entitled "Protocol Development for Vehicle Emission Toxicity Testing for Particulate Matter" submitted by the University of California, Davis, for a total amount not to exceed $100,000.

BE IT FURTHER RESOLVED that the Executive Officer is hereby authorized to initiate administrative procedures and execute all necessary documents and contracts for the research effort proposed herein, and as described in Attachment A, in an amount not to exceed $100,000.

Attachment A

"Protocol Development for Vehicle Emission Toxicity Testing for Particulate Matter"

Background

The Air Resources Board (ARB) evaluated the toxicity of Particulate Matter (PM) in numerous studies from a variety of sources, such as engine emissions, indoor air, and concentrated ambient air pollutant samples. Due to the lack of a standard operating protocol (SOP), individual researchers used different methodologies for PM sample preparation which can affect the toxicological properties of the sample. Toxicological variations arise from the different physical manipulations and chemical interactions that occur during processing which can preserve some critical PM components, eliminate others, and possibly introduce artifacts that could lead to false positive results. While possibly acceptable for comparison of samples for a particular assay, the different procedures used for PM sample preparations have compromised the ability to directly compare the toxicity of samples from different researchers even for the same PM sample. For example, some researchers use whole PM samples for *in vitro* studies while others use extracts from PM dissolved in either aqueous or organic solvents. It is not certain if any of these methods favor particular PM components or directly introduces toxicological artifacts, making result comparisons difficult. Best practices for sample preparation are needed, and there has not been a comprehensive evaluation of the merits of the various procedures.

The results of this research will contribute to the scientific baseline in the field of *in vitro* evaluation of PM by being one of the first studies to systematically compare a comprehensive panel of PM preparation methodologies and thus provide valid references for other researchers in the field. ARB staff plans to use the study results for standardizing toxicological evaluations in future engine emissions studies. Also, these results may be used to identify possible biased data in previously conducted *in vitro* toxicological studies and allow for reinterpretation of previous results. The knowledge gained and the improved methodology will help ARB in its current Vehicle Emissions Research Programs (VERP). VERP has been ongoing since 1998 and has included toxicological evaluation of PM from different fuels (biodiesel and renewable diesel), and from newer engine technologies (for both heavy duty and light duty vehicles). This project could affect the interpretation of these studies if it's shown that PM preparation methodology employed may have influenced toxicological results.

Objectives

The primary objective of this research is to develop a recommended SOP for the preparation of PM samples collected on filters for toxicological assays. This objective will be accomplished by investigating how different methodologies for isolating PM samples from filters can affect the results in standard toxicological screening assays. To the extent possible, the research will compare the recommended protocol with previously used procedures to assist ARB in interpreting the toxicity results from past studies. The adoption of a SOP would provide a streamlined methodology for future PM sample preparation for toxicological studies.

Methods
This study will evaluate commonly used procedures for preparation of PM samples collected on filters, assess the relative merits of these procedures, and recommend a SOP for sample preparation. The initial phase of the study will involve a detailed literature review of recent studies which involved the isolation of whole PM and PM extracts for use in toxicological investigations. The evaluation will focus on which procedures are the best at protecting sample chemical integrity, retaining the most toxicologically relevant chemical components of the samples, and producing the fewest false positive toxicological artifacts. The results of this phase of the project will be a document detailing a review of all relevant studies, a summary of various methodologies with a critique on strengths and weaknesses. In addition, this document will outline the experimental protocol including five to six unique sample preparation methodologies to be used for this study.

Upon approval of the study document and experimental protocols, the investigator will be given archived filter samples from a previous dynamometer diesel engine study. To allow direct comparisons of various methodologies, all filters will be from the same test run. In addition, as a control, the investigator will obtain a standard diesel PM sample from the National Institutes of Standards and Technology (NIST) to be used for the study. Both whole PM and PM extract samples will be prepared from both the engine PM filter and the NIST standard using the methods outlined in the experimental protocol. The whole PM and PM extract samples along with relevant preparations from blank filters will be used in *in vitro* assays for inflammation, oxidative stress, and genotoxicity, the major physiological impacts related to engine PM health effects. The ability of the samples to elicit inflammatory and oxidative stress markers will be determined by measurement of the production of inflammatory biomarkers, such as COX-2, IL-8, CYP1A1, and HO-1, in a human macrophage cell culture. Oxidative stress potential of the samples will also be determined using a cell-free chemical assay. This will consist of measuring the ability of isolated PM or PM extracts to oxidize the chemical dithiolthreitol in an aqueous system. Genotoxicity of the PM sample will be assayed using the standard Ames assay which measures the ability of a sample to cause mutations in a bacterial sample.

Expected Results
Upon completion of the toxicological studies, the results will be analyzed using standard statistical methods in consultation with a staff statistician. The principal investigator, Dr. Keith Bein, will then summarize the results regarding which methodology produced the most optimal results for each toxicological assay. Based on these results the investigator will produce a SOP for sample preparation of PM collected on filters along with a final report detailing the study.

Significance to the Board
Research is needed to improve and standardize the ARB's methodology for preparation of vehicle emission samples for toxicity testing. Results from this project will be used to establish a SOP for Air Resources Board researchers and improve the ability of staff to evaluate possible health risks associated with vehicle emissions.

Contractor:
University of California, Davis

Contract Period:
24 Months

Principal Investigator (PI):
Keith Bein, Ph.D.

Contract Amount:
$100,000

Basis for Indirect Cost Rate:
The State and the UC system have agreed to a ten percent indirect cost rate.

Past Experience with this Principal Investigator:
ARB has not had any contracts with Dr. Keith Bein as a PI; however, the investigator has had ample experience in the field as demonstrated by his recent work on sample preparation techniques for two ARB-funded toxicological studies. Given his background in PM isolation techniques for both whole PM and PM extract samples, he is well-suited for this study which focuses on both preparation methods using methodologies similar to those he has previously employed.

Prior Research Division Funding to the University of California, Davis:

Year	2013	2012	2011
Funding	$ 1,131,716	$ 4,949,363	$ 1,394,560

BUDGET SUMMARY

University of California at Davis

"Protocol Development for Vehicle Emission Toxicity Testing for Particulate Matter"

DIRECT COSTS AND BENEFITS				
1.	Labor and Employee Fringe Benefits	$	72,732	
2.	Subcontractors	$	0	
3.	Equipment	$	0	
4.	Travel and Subsistence	$	1,000	
5.	Electronic Data Processing	$	0	
6.	Reproduction/Publication	$	0	
7.	Mail and Phone	$	0	
8.	Supplies	$	14,490[1]	
9.	Analyses	$	0	
10.	Miscellaneous	$	2,687	
	Total Direct Costs			$ 90,909
INDIRECT COSTS				
1.	Overhead	$	9,091	
2.	General and Administrative Expenses	$	0	
3.	Other Indirect Costs	$	0	
4.	Fee or Profit	$	0	
	Total Indirect Costs			$ 9,091
TOTAL PROJECT COSTS				**$ 100,000**

[1] Laboratory supplies for sample preparation tasks (chemicals, glassware, hardware, consumables) is $4590. Laboratory supplies for toxicological assays (cell culture supplies, biochemicals, assay kits, Ames assay supplies) is $9,900.

PROPOSED

State of California
AIR RESOURCES BOARD

Improving DNDC Modeling Capability to Quantify Mitigation Potential of Nitrous Oxide from California Agricultural Soils

RESEARCH PROPOSAL

Resolution 14-12

May 22, 2014

Agenda Item No.: 14-4-1

WHEREAS, the Air Resources Board (ARB) has been directed to carry out an effective research program in conjunction with its efforts to combat air pollution, pursuant to Health and Safety Code sections 39700 through 39705;

WHEREAS, a research proposal, number 2773-278, entitled "Improving DNDC Modeling Capability to Quantify Mitigation Potential of Nitrous Oxide from California Agricultural Soils," has been submitted by the University of New Hampshire; and

WHEREAS, the Research Division staff has reviewed Proposal Number 2773-278 and finds that in accordance with Health and Safety Code Section 39701, research is needed to improve ARB's capability to quantify nitrous oxide (N_2O) emission reductions under a variety of agricultural management practices. The results of this project will inform ARB policy makers about the most effective strategies for reducing agricultural N_2O emissions. Research Division staff recommends this proposal for approval.

WHEREAS, in accordance with Health and Safety Code section 39705, the Research Screening Committee recommends for funding:

> Proposal Number 2773-278, entitled "Improving DNDC Modeling Capability to Quantify Mitigation Potential of Nitrous Oxide from California Agricultural Soils," submitted by the University of New Hampshire, for a total amount not to exceed $199,797.

NOW, THEREFORE BE IT RESOLVED that the Air Resources Board, pursuant to the authority granted by Health and Safety Code section 39703, hereby accepts the recommendations of the Research Screening Committee and Research Division staff and approves the following:

> Proposal Number 2773-278 entitled: "Improving DNDC Modeling Capability to Quantify Mitigation Potential of Nitrous Oxide from California Agricultural Soils,"

submitted by the University of New Hampshire for a total amount not to exceed $199,797.

BE IT FURTHER RESOLVED that the Executive Officer is hereby authorized to initiate administrative procedures and execute all necessary documents and contracts for the research effort proposed herein, and as described in Attachment A, in an amount not to exceed $199,797.

ATTACHMENT A

"Improving DNDC Modeling Capability to Quantify Mitigation Potential of Nitrous Oxide from California Agricultural Soils"

Background

Agricultural soils are a major source of nitrous oxide (N_2O), a potent greenhouse gas (GHG) contributing to global warming, in California. Because N_2O is produced in soil by microbial activities which are affected by numerous environmental factors, process-based modeling incorporating site-specific conditions is considered a better approach characterizing N_2O emissions from agricultural crop land. Previous studies have indicated that significant mitigation of N_2O emissions from agricultural soils is possible through various management practices; however, a quantitative tool would be required to estimate emission reductions from these practices.

Objective

The objective of the project is to develop and deliver to ARB a California-specific modeling tool that can be used to calculate mitigation potential of N_2O emissions from a variety of mitigation practices for major California cropping systems.

Methods

The project will build upon a recently completed DeNitrification-DeComposition (DNDC) modeling system that has been evaluated and validated against California-specific crop growth and N_2O emissions data focusing largely on business-as-usual management scenarios for baseline emission assessment. Additional N_2O emission data are being collected from several key projects investigating mitigation strategies from major cropping systems in California as well as fundamental mechanisms leading to N_2O emissions from soils.

The proposed project will refine the DNDC model based on this newly acquired information. The project will incorporate into the DNDC model new and emerging research on N_2O formation mechanisms (such as Zhu et al., 2013) and field N_2O emission data, including an ongoing mitigation study sponsored by ARB and a paired study sponsored by USDA. Both projects are tasked to assess emission mitigation potentials for a variety of mitigation options such as use of nitrification inhibitors, dripping irrigations, cover crops, nitrogen fertilizer types and application methods. This project will also improve the flexibility and robustness of the DNDC model in deriving N_2O estimates through additional DNDC model development, calibration and validation for the selected mitigation scenarios to ensure that the model captures the impact of alternative management on crop growth and yields. Any new findings of N_2O formation pathways will be incorporated into the model improvement.

Researchers will conduct statistical analysis to assess DNDC model uncertainty. This will entail performing statistical analysis of modeled versus measured residuals and quantifying model uncertainty by using Monte Carlo and Bootstrapping approaches to ensure that model estimates of GHG emissions reduction are realistic and conservative. This project will provide estimates of mitigation potential in terms of N_2O, carbon dioxide, and methane reductions for all of California agricultural land using the newly

improved DNDC modeling tool, including the updated GIS databases and crop models developed from the recently completed DNDC modeling project. Ultimately this project will produce a DNDC interface that would facilitate model inputs, including automatic links to the USDA's Soil Survey Geographic database and climate data from the California Irrigation Management Information System and other meteorological networks, and post-modeling data processing, for mitigation potential calculations.

Expected Results
The project will further develop the DNDC model into a rigorous mitigation calculation tool for prevailing mitigation measures in California at the field scale, and produce a DNDC interface to facilitate model inputs and data processing.

Significance to the Board
This project will improve ARB's capability to quantify N_2O emission reductions under a variety of agricultural management practices. The results of this project will inform ARB policy makers about the most effective strategies for reducing agricultural N_2O emissions.

Contractor:
The University of New Hampshire

Contract Period:
24 months

Principal Investigator (PI):
Changsheng Li, Ph.D.

Contract Amount:
$199,797

Basis for Indirect Cost Rate:
The University of New Hampshire has agreed to a ten percent indirect cost rate.

Past Experience with this Principal Investigator:
The Principal Investigator, Dr. Changsheng Li, recently completed a contract with ARB using DNDC to assess baseline N_2O emissions under business-as-usual management scenarios. The new project will build upon this earlier project to further develop the DNDC into a rigorous mitigation assessment tool for California-specific agro-ecosystems.

Prior Research Division Funding to the University of New Hampshire

Year	2013	2012	2011
Funding	$ 0	$ 0	$ 249,688

BUDGET SUMMARY

Contractor: The University of New Hampshire, Durham, NH

"Improving DNDC Modeling Capability to Quantify Mitigation Potential of Nitrous Oxide from California Agricultural Soils"

DIRECT COSTS AND BENEFITS			
1.	Labor and Employee Fringe Benefits	$ 86,131	
2.	Subcontractor(s)/Consultant(s)	$ 87,559	
3.	Equipment	$ 0	
4.	Travel and Subsistence	$ 7,944	
5.	Electronic Data Processing	$ 0	
6.	Photocopying & Printing	$ 0	
7.	Mail, Telephone & Fax	$ 0	
8.	Materials & Supplies	$ 0	
9.	Analyses – Service Provider (W. Salas)	$ 0	
10.	Miscellaneous	$ 0	
	Total Direct Costs		$ 181,634
INDIRECT COSTS			
1.	Overhead	$ 0	
2.	General and Administrative Expenses	$ 18,163	
3.	Other Indirect Costs	$ 0	
4.	Fee or Profit	$ 0	
	Total Indirect Costs		$ 18,163
TOTAL PROJECT COSTS			**$ 199,797**

ATTACHMENT B

SUBCONTRACTORS' BUDGET SUMMARY

Subcontractor: Applied GroSolutions LLC, Durham, NH 03824

Description of subcontractor's responsibility: Perform DNDC model structural and database-induced uncertainties and develop a California-specific modeling interface for GHG mitigation calculation.

DIRECT COSTS AND BENEFITS			
1.	Labor and Employee Fringe Benefits	$ 87,559	
2.	Subcontractors	$ 0	
3.	Equipment	$ 0	
4.	Travel and Subsistence	$ 0	
5.	Electronic Data Processing	$ 0	
6.	Reproduction/Publication	$ 0	
7.	Mail and Phone	$ 0	
8.	Supplies	$ 0	
9.	Analyses	$ 0	
10.	Miscellaneous	$ 0	
	Total Direct Costs		$ 87,559
INDIRECT COSTS			
1.	Overhead	$ 0	
2.	General and Administrative Expenses	$ 0	
3.	Other Indirect Costs	$ 0	
4.	Fee or Profit	$ 0	
	Total Indirect Costs		$ 0
TOTAL PROJECT COSTS			**$ 87,559**

PROPOSED

State of California
AIR RESOURCES BOARD

"Evaluation of the Impacts of Emissions Averaging and Flexibility Programs for all Tier 4 Final Off-Road Diesel Engines"

RESEARCH PROPOSAL

Resolution 14-13

May 22, 2014

Agenda Item No.: 14-4-1

WHEREAS, the Air Resources Board (ARB) has been directed to carry out an effective research program in conjunction with its efforts to combat air pollution, pursuant to Health and Safety Code sections 39700 through 39705;

WHEREAS, a research proposal, number 2774-278, entitled "Evaluation of the Impacts of Emissions Averaging and Flexibility Programs for all Tier 4 Final Off-Road Diesel Engines" has been submitted by the University of California, Riverside; and

WHEREAS, the Research Division staff has reviewed Proposal Number 2774-278 and finds that in accordance with Health and Safety Code Section 39701, results will provide estimates of the impacts of the Averaging, Banking and Trading (ABT) and Transition Program for Equipment Manufacturers (TPEM) program engine populations on California's air quality for the regions studied during the project. Furthermore, the results will inform ARB policy makers regarding the impacts of these national programs on California's air quality. Research Division staff recommends this proposal for approval.

WHEREAS, in accordance with Health and Safety Code section 39705, the Research Screening Committee recommends for funding:

> Proposal Number 2774-278 entitled "Evaluation of the Impacts of Emissions Averaging and Flexibility Programs for all Tier 4 Final Off-Road Diesel Engines," submitted by the University of California, Riverside, for a total amount not to exceed $300,000.

NOW, THEREFORE BE IT RESOLVED that the Air Resources Board, pursuant to the authority granted by Health and Safety Code section 39703, hereby accepts the recommendations of the Research Screening Committee and Research Division staff and approves the following:

Proposal Number 2774-278 entitled "Evaluation of the Impacts of Emissions Averaging and Flexibility Programs for all Tier 4 Final Off-Road Diesel Engines," submitted by the University of California, Riverside for a total amount not to exceed $300,000.

BE IT FURTHER RESOLVED that the Executive Officer is hereby authorized to initiate administrative procedures and execute all necessary documents and contracts for the research effort proposed herein, and as described in Attachment A, in an amount not to exceed $300,000.

ATTACHMENT A

"Evaluation of the Impacts of Emissions Averaging and Flexibility Programs for all Tier 4 Final Off-Road Diesel Engines"

Background

California is a participant in the Averaging, Banking and Trading (ABT) and Transition Program for Equipment Manufacturers (TPEM) programs, which are administered at the federal level by the United States Environmental Protection Agency (US EPA). California does not have independent ABT or TPEM requirements apart from the federal programs.

The ABT program is a permanent component of the off-road regulations that allows engine manufacturers the flexibility of continuing to certify engine families to less-stringent previous-tier standards, as long as the manufacturer also certifies a sufficient number of "counter-balancing" engines below the more-stringent current-tier standard, so that the manufacturer's entire fleet average is at or below numerical Tier 4 levels.

The TPEM program allows equipment manufacturers the flexibility to continue selling a portion of their new equipment with previous-tier engines to ease the transition to the new standards for up to seven years following the introduction of Tier 4 standards. The TPEM program also has a permanent component for providing hardship relief to equipment manufacturers.

These programs are administered only on a national level, so the specific sales fractions of Tier 4 and non-Tier 4 engines in California are unknown, and it is possible that the state or some localities within the state could receive a disproportionate share of higher-emitting engines, and have average emissions from new engines that are higher than the Tier 4 standards. Because California has areas in non-attainment with air quality standards, and has communities adversely affected by poor air quality, it is important for California to receive the benefits expected from the Tier 4 emission standards, and to verify that the ABT and TPEM programs are not adversely affecting either California as a whole, or specific communities in California.

Objective

The objectives of this project are to characterize the national ABT and TPEM off-road diesel engine populations, and the subsets of these populations sold and operating in California, and to assess the emissions impact of these engines in California.

Methods

The project will focus on three air basins that represent about three quarters of the off-road PM and NO_X emissions inventories: the South Coast Air Basin, the San Joaquin Valley, and the San Francisco Bay Area.

The contractor will first determine the percentages of ABT and TPEM engines sold nationally and in California from post-processed copies of the ABT/TPEM national database provided by the ARB. CE-CERT will determine the specific numbers of ABT

engines being produced by each engine manufacturer, and by each participating TPEM equipment manufacturer. The researchers will deploy surveys to off-road equipment fleet owners to determine specific California locations where ABT and TPEM engines have been deployed. Data analyses will be conducted to determine the impact of the ABT/TPEM programs on fleets in locations such as the ports, engines located on transportation refrigeration units (TRUs) and other similar locations with significant public or occupational exposure.

In the event that ABT/TPEM program engines are determined to represent a disproportionate fraction of national ABT/TPEM program sales, the contractor will determine the emissions impact of these engines.

Expected Results
The research will provide estimates of the impacts of ABT and TPEM program engine populations on California's air quality for the regions studied during the project.

Significance to the Board
Results will inform ARB policy makers regarding the impacts of these national programs on California's air quality.

Contractor:
University of California, Riverside

Contract Period:
24 months

Principal Investigators (PIs):
Robert Russell Ph.D.
Kent Johnson, Ph.D., co-PI
Tom Durbin, Ph.D., co-PI

Contract Amount:
$300,000

Basis for Indirect Cost Rate:
The State and the UC system have agreed to a ten percent indirect cost rate.

Past Experience with the Principal Investigators:
Co-PIs Drs. Kent Johnson and Tom Durbin have previously conducted HDT-related research projects for ARB, the US EPA, the Engine Manufacturers Association, and other clients, and have developed experience procuring and emissions testing diesel off-road equipment. Most recently (2013), Drs. Johnson, Durbin and Robert Russell successfully completed an ARB off-road diesel equipment emissions test projects for ARB emissions modeling staff.

Prior Research Division Funding to the University of California, Riverside:

Year	2013	2012	2011
Funding	$ 405,338	$ 0	$ 390,004

BUDGET SUMMARY

University of California, Riverside

"Evaluation of the Impacts of Emissions Averaging and Flexibility Programs for all Tier 4 Final Off-Road Diesel Engines"

DIRECT COSTS AND BENEFITS				
1.	Labor and Employee Fringe Benefits	$	193,500	
2.	Subcontractors	$	0	
3.	Equipment	$	0	
4.	Travel and Subsistence	$	26,566	
5.	Electronic Data Processing	$	0	
6.	Reproduction/Publication	$	0	
7.	Mail and Phone	$	0	
8.	Supplies	$	2,000	
9.	Analyses	$	0	
10.	Miscellaneous	$	56,286[1]	
Total Direct Costs				$ 278,352
INDIRECT COSTS				
1.	Overhead	$	21,648	
2.	General and Administrative Expenses	$	0	
3.	Other Indirect Costs	$	0	
4.	Fee or Profit	$	0	
	Total Indirect Costs			$ 21,648
TOTAL PROJECT COSTS				**$ 300,000**

[1] As an off-campus facility of the University of California, Riverside, CE-CERT recovers direct, lease-based facilities rental charges. Facilities rental is charged at 26 percent of Modified Total Direct Costs (MTDC; total direct costs less any equipment, graduate student tuition/partial fee remission, and subcontracts beyond the first $25,000).

CALIFORNIA AIR RESOURCES BOARD

NOTICE OF PUBLIC MEETING TO CONSIDER APPROVAL OF THE 2014 PROGRESS REPORT FOR THE CALIFORNIA REGIONAL HAZE MID-COURSE REVIEW

The Air Resources Board (ARB or Board) will conduct a public meeting at the time and place noted below to consider approval of the California Regional Haze Plan 2014 Progress Report (RH Progress Report) for submittal to the United States Environmental Protection Agency (U.S. EPA).

DATE: May 22, 2014

TIME: 9:00 a.m.

PLACE: California Environmental Protection Agency
Air Resources Board
Byron Sher Auditorium
1001 I Street
Sacramento, California 95814

This item will be considered at a one-day meeting of the Board, which will commence at 9:00 a.m., May 22, 2014. This item is scheduled to be heard on the Board's Consent Calendar. All agenda items on the Consent Calendar – unless removed upon the request of a Board member or if someone in the audience submits a request to speak card on that item – will be voted on by the Board at the beginning of the public meeting.

BACKGROUND

The federal Clean Air Act established a national policy of achieving visibility comparable to natural conditions at the most treasured federal lands and scenic areas of the country. In 1999, U.S. EPA adopted the Regional Haze Rule (RH Rule) to guide this process nationwide. The RH Rule sets requirements for states to follow for improving visibility at 156 specific national parks, forests, seashores, monuments, and wilderness areas across the United States, deemed "Class 1 Areas". To ensure continuous progress to natural conditions visibility by 2064, the RH Rule requires each state to develop a state implementation plan (SIP) that includes interim visibility goals every ten years.

In 2009, ARB adopted the California Regional Haze Plan (RH Plan) setting Reasonable Progress Goals for 2018 (2018 RPG) for the 29 Class 1 Areas in California that were based on California's comprehensive emission control strategy. ARB submitted the RH Plan to U.S. EPA on March 16, 2009, which was approved on June 14, 2011. The next RH Plan SIP revision, due in 2018, will set RPGs for 2028. The RH Rule also requires each state to perform a mid-course progress review in the

SPECIAL ACCOMMODATION REQUEST

Consistent with California Government Code Section 7296.2, special accommodation or language needs may be provided for any of the following:

- An interpreter to be available at the meeting;
- Documents made available in an alternate format or another language;
- A disability-related reasonable accommodation.

To request these special accommodations or language needs, please contact the Clerk of the Board at (916) 322-5594 or by facsimile at (916) 322-3928 as soon as possible, but no later than 10 business days before the scheduled Board meeting. TTY/TDD/Speech to Speech users may dial 711 for the California Relay Service.

Consecuente con la sección 7296.2 del Código de Gobierno de California, una acomodación especial o necesidades lingüísticas pueden ser suministradas para cualquiera de los siguientes:

- Un intérprete que esté disponible en la audiencia;
- Documentos disponibles en un formato alterno u otro idioma;
- Una acomodación razonable relacionados con una incapacidad.

Para solicitar estas comodidades especiales o necesidades de otro idioma, por favor llame a la oficina del Consejo al (916) 322-5594 o envié un fax a (916) 322-3928 lo más pronto posible, pero no menos de 10 días de trabajo antes del día programado para la audiencia del Consejo. TTY/TDD/Personas que necesiten este servicio pueden marcar el 711 para el Servicio de Retransmisión de Mensajes de California.

CALIFORNIA AIR RESOURCES BOARD

Richard W. Corey
Executive Officer

Date: April 21, 2014

The energy challenge facing California is real. Every Californian needs to take immediate action to reduce energy consumption. For a list of simple ways you can reduce demand and cut your energy costs, see our website at www.arb.ca.gov.

PROPOSED

State of California
AIR RESOURCES BOARD

REGIONAL HAZE PLAN MID-COURSE REVIEW

Resolution 14-15

May 22, 2014

Agenda Item No.: 14-4-2

WHEREAS, sections 39600 and 39601 of the Health and Safety Code authorize the Air Resources Board (ARB or Board) to adopt standards, rules, and regulations and to do such acts as may be necessary for the proper execution of the powers and duties granted to and imposed upon the Board by law;

WHEREAS, the Legislature in Health and Safety Code section 39602 has designated ARB as the air pollution control agency for all purposes set forth in federal law;

WHEREAS, ARB has responsibility for ensuring that local and regional air pollution control and air quality management districts (districts) meet their responsibilities under the federal Clean Air Act (Act) (42 U.S.C. section 7401 et seq.) pursuant to sections 39002, 39500, 39602, 40406, and 41650 of the Health and Safety Code;

WHEREAS, sections 39515 and 39516 of the Health and Safety Code provide that any duty may be delegated to the Board's Executive Officer as the Board deems appropriate;

WHEREAS, in 1977, Congress amended the Act to establish a national visibility goal at 156 mandatory Class 1 Areas where visibility is an important value and impairment was a result of manmade air pollution;

WHEREAS, 29 mandatory Class 1 Areas are located in California;

WHEREAS, on July 1, 1999, the United States Environmental Protection Agency (U.S. EPA) finalized the Regional Haze Rule (RH Rule) (40 CFR 51.308 et seq.) which established requirements states must consider in reducing visibility impairment and meeting the goal of natural visibility at all mandatory Class 1 Areas by 2064;

WHEREAS, ARB is responsible for the preparation of the State Implementation Plan (SIP) for making reasonable progress towards meeting the national goal of improving visibility in mandatory federal Class I Areas as required by the Act, and to this end is directed by Health and Safety Code section 39602 to coordinate the activities of all air districts necessary to comply with the Act;

WHEREAS, on January 22, 2009, the Board adopted the California Regional Haze Plan (RH Plan) setting Reasonable Progress Goals for 2018 (2018 RPGs) for the 29 Class 1 Areas in California;

WHEREAS, on June 14, 2011, U.S. EPA approved the RH Plan;

WHEREAS, the RH Rule requires states to submit to U.S. EPA a periodic report describing progress towards the state's RPGs, five years after submitting the initial RH Plan, and each SIP revision;

WHEREAS, ARB staff prepared the California Regional Haze Plan 2014 Progress Report (RH Progress Report) to meet the periodic report requirement in the RH Rule;

WHEREAS, pursuant to the RH Rule, the RH Progress Report describes:

1) The status of implementation of measures in the RH Plan;
2) A summary of the emission reductions achieved through implementation of the measures included in the RH Plan;
3) An assessment of the visibility conditions and progress at the 17 visibility monitors assigned to the Class 1 Areas in California;
4) An analysis of changes in the inventory from stationary, mobile, and area sources from the baseline period (2000-2004) for five-year periods through 2020;
5) An assessment of any significant emissions changes that have impeded progress in visibility improvement;
6) An assessment of the sufficiency of the RH Plan for enabling achievement of RPGs in other affected states; and
7) A determination that the current Interagency Monitoring of Protected Visual Environments monitoring network was appropriate and will continue to be used as the monitoring strategy;

WHEREAS, pursuant to the RH Rule, the RH Progress Report demonstrates that no change to ARB's adopted control strategy, existing monitoring strategy, or the 2018 RPGs in the RH Plan is necessary;

WHEREAS, pursuant to the RH Rule, each state must provide the Federal Land Managers (FLMs) an opportunity for consultation in person and at least 60 days prior to any public hearing on a regional haze plan or plan revision;

WHEREAS, on April 10, 2013, at an in-person meeting of the Air and Land Managers, ARB staff briefed the FLMs representing California's Class 1 Areas on the status of visibility improvements, and the requirements of the RH Progress Report, and sought their input in concert with the consultation process described in the RH Plan;

WHEREAS, on January 28, 2014, ARB provided a copy of the RH Progress Report to the FLMs for their 60-day review and on March 11, 2014, held a conference call to discuss the draft RH Progress Report;

WHEREAS, the ARB staff received written comments from the FLMs as part of the 60-day review;

WHEREAS, the RH Progress Report includes the FLM comments and written responses, along with a description of the continued consultation with the FLMs;

WHEREAS, on April 21, 2014, ARB staff released the RH Progress Report for public review;

WHEREAS, the RH Progress Report does not contain any proposed control strategies, but reports only on the status of implementation of already-adopted measures, and determines that no further revisions to the RH Plan are needed at this time to achieve the 2018 RPGs; and

WHEREAS, on May 22, 2014, ARB held a public hearing on the RH Progress Report.

NOW, THEREFORE, BE IT RESOLVED, the Board finds that:

1) The RH Progress Report demonstrates that the RH Plan control strategy is adequate to ensure that the 2018 RPGs are met in Class 1 Areas in California;
2) The RH Progress Report meets the requirements of the Act and the RH Rule; and,
3) Further revision of the RH Plan is not needed at this time.

BE IT FURTHER RESOLVED the Board hereby approves the RH Progress Report.

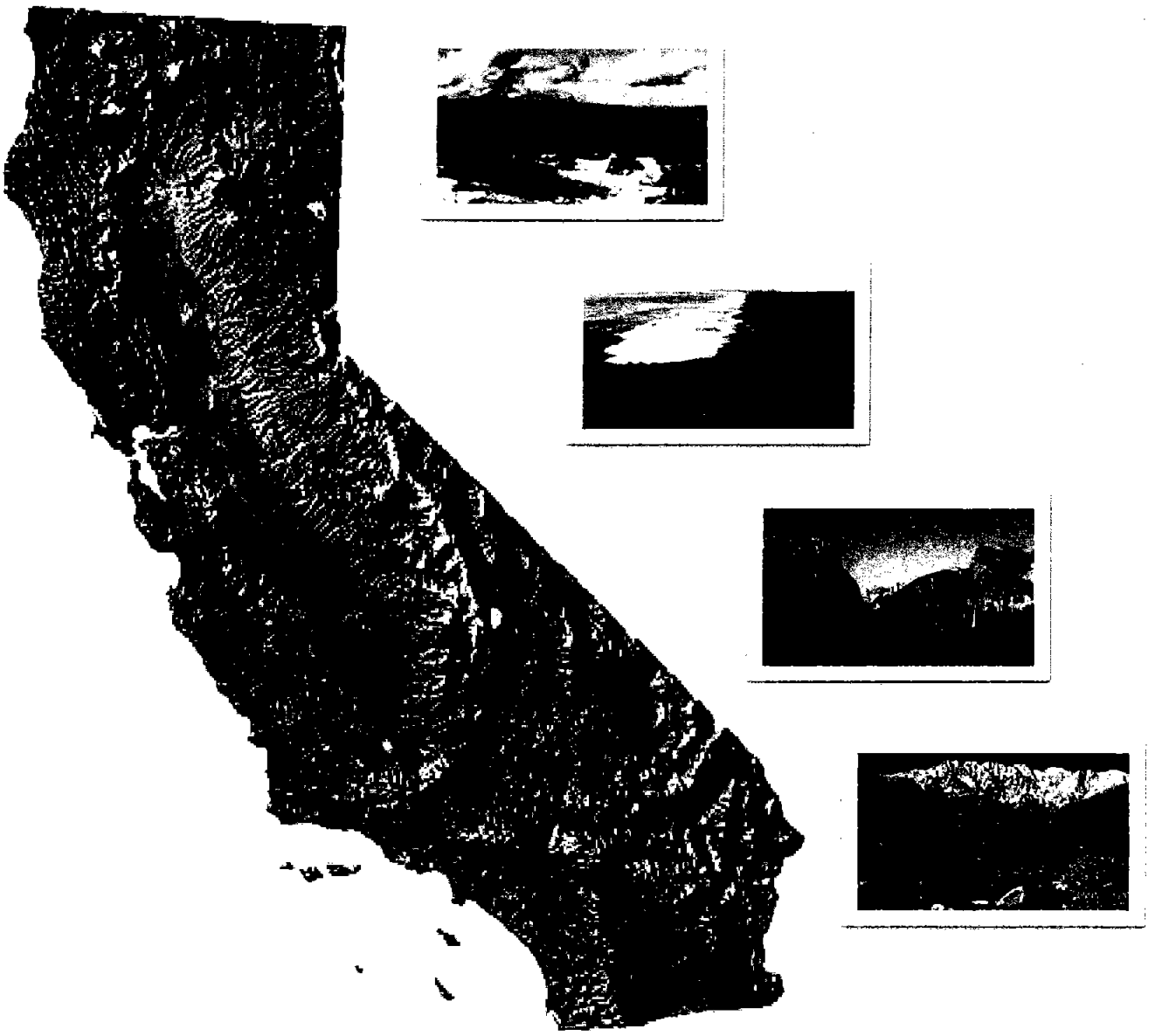
BE IT FURTHER RESOLVED that the Board directs the Executive Officer to forward the RH Progress Report as approved, to U.S. EPA for purposes of federal law.

BE IT FURTHER RESOLVED that the Board authorizes the Executive Officer to include in the RH Progress Report submittal any technical corrections, clarifications, or additions, including the administrative record that may be necessary to secure U.S. EPA approval.

BE IT FURTHER RESOLVED that the Board directs the Executive Officer to work with U.S. EPA and take appropriate action to resolve any completeness or approvability issues that may arise regarding the RH Progress Report submission.

BE IT FURTHER RESOLVED that the Board hereby certifies pursuant to 40 CFR section 51.102 that the RH Progress Report was adopted after notice and public hearing as required by 40 CFR section 51.102.

California Regional Haze Plan 2014 Progress Report



California Environmental Protection Agency

Air Resources Board

PUBLIC REVIEW DRAFT
April 21, 2014

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EXECUTIVE SUMMARY

The landscapes of California include some of the most beautiful and dramatic national parks, forests, wilderness areas, mountains, deserts, and seashores in the United States. Twenty-nine of these California locations were designated Class 1 Areas by those who manage them, to support national goals of improving visibility at these treasured public lands. California continues to reduce emissions of pollutants that result in regional haze, and visibility is improving at these unique places. State residents and visitors from all over the world have access to these special areas, making the short- and long-term goals of visibility improvement a worthwhile effort for everyone's benefit.

There are many ways to measure visibility improvements; human visual perception is only one of them. Particles scatter and absorb light in the atmosphere, causing haze, which impairs the clarity of scenic vistas and views. The nationwide visibility monitoring program measures particles in the air as a way to track and compare variations in the amount of haze particles near the nation's Class 1 Areas. Analyzing relative changes in concentrations of specific pollutant species over time helps identify potential sources, or causes of haze, at different times, seasons, and locations. These sources are both natural and man-made. The monitoring record in California now illustrates both short and long-term trends for most areas of the State. Overall, the record shows visibility has improved.

The California Regional Haze Plan addresses visibility goals and describes a strategy for controlling air pollution from man-made emission sources, including rigorous controls for stationary, area, and mobile sources. The State also supports initiatives to incentivize the development and use of innovative pollution control technology. The benefit of this concerted effort is more days of pristine air for viewing the magnificent landscapes of Class 1 Areas in California and in neighboring states. In fact, visibility at the Class 1 Areas in Southern California, nearest the most densely populated areas, has improved the most from emissions reductions.

This Progress Report examines the visibility data to show that reductions of precursor emissions are on track for meeting our visibility goals. California strategies for reducing oxides of nitrogen (NOx) have lowered nitrate particle concentrations and reduced haze levels throughout the State. Average visibility on the worst haze days is improving, although natural wildfire smoke continues to be the strongest driver of reduced visibility on worst days, at areas where progress is slower.

The California Regional Haze Plan control strategy is working to reduce emissions to reach short-term goals for 2018, as required. Reducing haze is a regional effort and California continues to work with the other western states and the federal land managers to plan for the required 2018 revision of State Implementations Plans for Regional Haze. The states are focusing on strategies for continued reduction of controllable emissions. Quantification of the impacts of wildfire smoke and other sources beyond State regulatory jurisdiction will continue, for the purposes of defining the burden these sources place on achieving visibility goals.

The long-term trends for Worst Days averages show visibility improving at every monitoring site, in the absence of very high wildfire years. Current Best Days are all better or the same as those of the baseline period. As evidenced by reductions in anthropogenic source emissions in California and the concurrent improvement in visibility at all of California's Class 1 Area IMPROVE monitors, California determines the current RH plan strategies are sufficient for California and its neighboring states to meet their 2018 RPGs. In accordance with the requirements of the RHR, California has determined that no further substantive revision of the RH Plan is warranted at this time in order to achieve the 2018 RPGs for visibility improvement.

1. Background and Overview of Progress Report Requirements

Congress recognized the importance of visibility in our national parks and wilderness areas by amending the Clean Air Act (Act) in 1977 to include a goal for "prevention of any future, and the remedying of any existing, impairment of visibility."[1] In order to implement this provision of the Act, the U.S. Environmental Protection Agency (U.S. EPA) established the Regional Haze Rule (RHR)[2] in 1999, specifying how states must work towards this visibility improvement goal. The RHR requires that states identify and implement pollution control strategies to make continuous progress towards a goal of "natural conditions"[3] state of visibility by 2064.

Progress towards natural conditions visibility is expected by reducing or eliminating man-made impairment of visibility at the 156 Class 1 Areas in the United States. These public areas are national parks, forests, monuments, seashores, and wilderness areas managed by federal land management agencies. The RHR requires that continuous progress towards visibility improvement goals be evaluated at periodic checkpoints, with State Implementation Plans (SIPs) required every 10 years, and interim progress reports every five years.

The Air Resources Board (ARB or Board) adopted the California Regional Haze Plan (RH Plan) in January 2009 and transmitted it to U.S. EPA in March 2009. U.S. EPA approved the RH Plan in June 2011. The RH Plan described visibility conditions for the baseline years 2000-2004 and included the State strategy for reaching the first Reasonable Progress Goals (RPGs) in 2018. The 2018 RPGs are interim visibility improvement benchmarks on a path to the ultimate, long-term goal of natural background conditions. The 2018 RPGs were developed by ARB for each Class 1 Area in California, in consultation with other affected states and the federal land managers.

This first Progress Report (Report) evaluates progress made towards the 2018 RPGs and addresses the following:

- Status of RH Plan State strategy;
- Emissions reductions from RH Plan control strategies;
- Visibility progress;
- Emission trends;
- Assessment of changes impeding visibility progress;
- Assessment of current strategy;
- Review of visibility monitoring strategy;
- RH Plan adequacy determination; and
- Federal Land Manager comments.

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[1] *Section 169A of the Clean Air Act.*

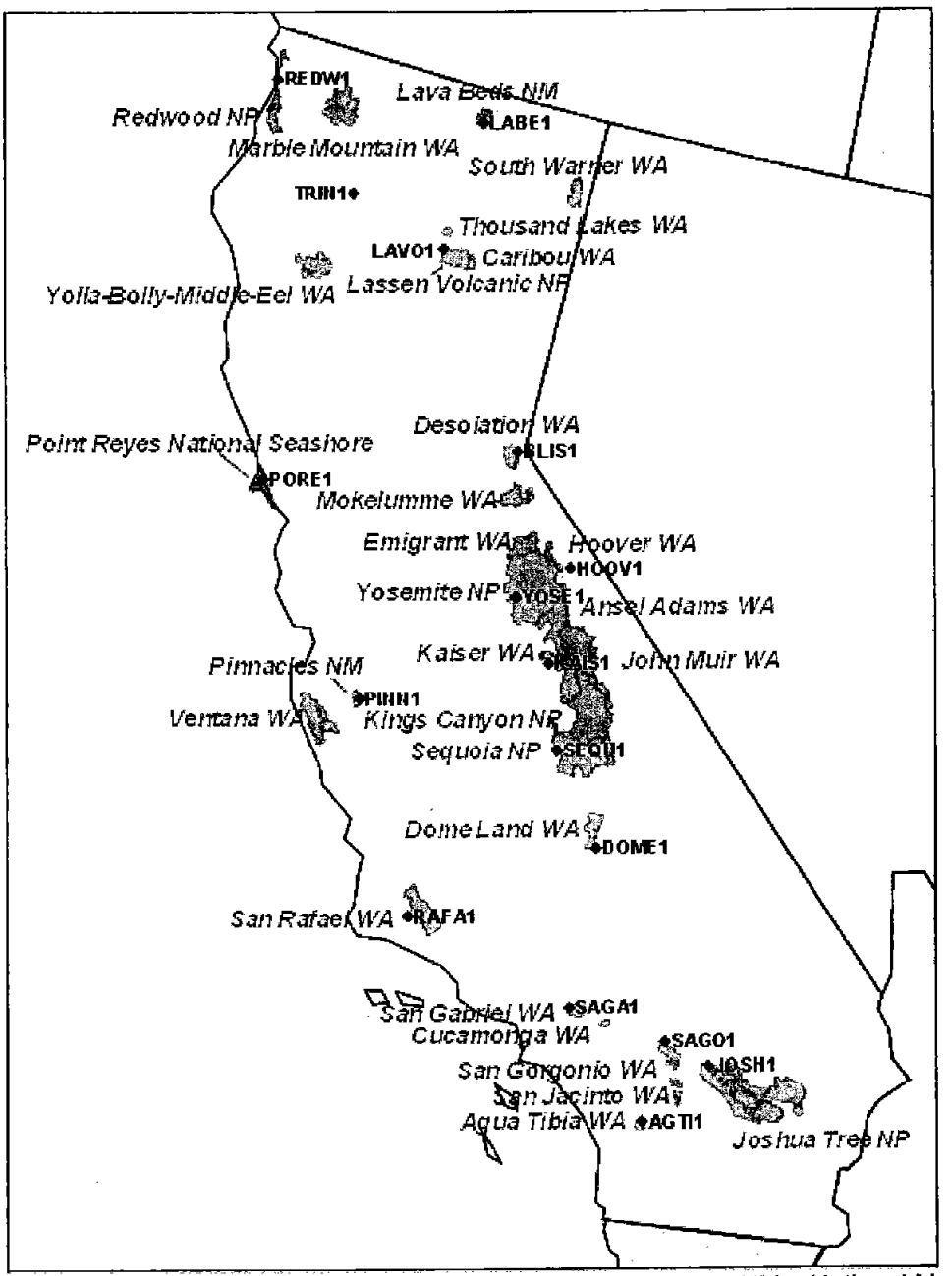
[2] *CFR 40 Part 51 Regional Haze Regulations; Final Rule, July 1, 1999*

[3] *Note that "default" natural conditions as defined by the U.S. EPA are subject to revisions. States can extend the period of time needed to achieve natural conditions, beyond the nominal 2064 in the RHR, defining and defending new interim reasonable progress rates and adjusting the 2064 end year as needed (see CFR Section 51.308).*

1.1. California Class 1 Areas

California has 29 Class 1 Areas, more than any other state. Progress towards better visibility is calculated from data collected at the Interagency Monitoring of Protected Visual Environments (IMPROVE) network. There are 17 IMPROVE monitors representing one or more of the Class 1 Areas in California. Class 1 Areas in California with their respective IMPROVE monitor names and locations are shown in Figure 1.

Figure 1
Map of Class 1 Areas and IMPROVE monitors



◆ *IMPROVE monitor WA = Wilderness Area NP = National Park NM = National Monument*

1.2. Measuring Visibility

Measuring visibility is complex. Particle and aerosol pollution in the air causes haze (light extinction) by extinguishing and absorbing light. The haze-causing particles and aerosols in the air are ammonium nitrates (nitrates), ammonium sulfates (sulfates), organic carbon matter aerosols (OMC), elemental carbon (EC), fine soil (FS), coarse mass (CM), and sea salt (SS). There is also natural light scattering by gases, Rayleigh scattering, with a constant light extinction value based on elevation. Reducing the concentrations of the pollutant species means their contribution to light extinction lessens, and visibility improves.

The IMPROVE monitors measure the concentration of each haze-causing pollutant every three days. Since each pollutant species has a different capacity to extinguish light, a mathematical formula was created to add up the light extinction caused by constant Rayleigh scattering and the different concentrations of pollutants on each measurement day. This formula, called the Haze Algorithm, converts the total light extinction calculated for each day into units of visibility called "deciviews".[4] One deciview (dv) unit corresponds with the minimum visibility change detectable to the human eye. As deciview levels decrease, visibility improves.

The RHR requires that assessments of visibility progress must be based on five-year averages of the deciview values for the annual haziest (Worst) and clearest (Best) days at each IMPROVE monitor. The Worst Days measurement is the average of the deciview levels for the 20 percent of the sampling days with the highest visibility impairment each year. The Best Days measurement is the annual average of the lowest 20 percent deciview days.

The 2018 RPGs are the projected deciview levels for the Worst Days averages at each monitor in 2018, after implementing the RH Plan's State strategy. U.S. EPA approved the 2018 RPGs when they approved the RH Plan. Worst Days deciview levels should be decreasing as they progress towards the 2018 RPGs. The RHR also specifies that Best Days averages should not degrade from the baseline period (2000-2004).

1.3. Source Impacts on Visibility

A better understanding of visibility improvement emerges from relating reductions in precursor emissions in and near the Class 1 Areas to changes in concentrations of haze species measured at the monitors. Also important is the change in each haze species' contribution to light extinction, as the mix of precursor emissions changes. Emissions from both natural sources and from man-made activities (anthropogenic sources) affect visibility. These sources can be located within California, but long-range transport also brings visibility-impairing pollutants from out-of-State and international sources into

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[4] *Appendix A of the initial RH Plan explains further how deciviews are calculated from measurements of mass concentrations of haze species at each IMPROVE monitor.*

California's atmosphere. California's emissions control strategy focuses on sources within the State's regulatory jurisdiction.

The fact that "uncontrollable" natural and anthropogenic sources affect visibility is not neglected in this analysis. For example, visibility progress in western states is slowed by the increased frequency and intensity in wildfires during the summer. Smoke originating from wildfires within and outside California generates enormous concentrations of organic carbon aerosols that form far-reaching plumes impacting many visibility monitors before dissipating. Depending on the wildfire location, smoke impacts different monitors from year-to-year. Another annual event occurring beyond California's borders are spring windstorms in the Gobi Desert, which have detectable but minor haze consequences in California at this time. Every year these seasonal windstorms send natural geologic material, coated with industrial emissions from Asia, into the jet stream which deposits dust at IMPROVE monitors in California and other western states.[5]

Uncontrollable emissions sources add to the atmospheric mix of visibility-impairing pollutants produced by anthropogenic sources in California, all detected but not differentiated by the IMPROVE monitors. Seasonal inversions, sea breezes, and humidity enhance the impact of these variable emissions. California's coastal location, complicated topography, and complex meteorology, may result in somewhat uneven year-to-year deciview progress at some sites, despite steady reductions of emissions. The Progress Report appendices describe localized and regional situations where uncontrollable emissions intensify the impacts on visibility progress.

1.4. Initial Reporting Requirements

In this first Progress Report, the RHR requires all states to report on the implementation status for emission control measures implemented within the state for achieving reasonable progress towards the 2018 goals for Class I Areas within and outside the state. California's first Progress Report is due to U.S. EPA in the Spring of 2014. In April 2013, U.S. EPA issued Guidance[6] that states evaluate visibility improvement using the most recent monitoring data available for the initial Progress Reports. At the time of preparation of this Progress Report for the required review by the Federal Land Managers, the most recent monitoring data was available through 2011 at all but one of the seventeen IMPROVE monitors.[7]

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[5] *VanCuren, R., and T. Cahill (2002), Asian aerosols in North America: Frequency and concentration of fine dust, J.Geophys. Res., 107(D24), 4804, doi:10.1029/2002JD002204.*

[6] *"General Principles for the 5-Year Regional Haze Progress Reports for the Initial Regional Haze State Implementation Plans (Intended to Assist States and EPA Regional Offices in Development and Review of the Progress Reports)", U.S. EPA, Office of Air Quality Planning Standards, April 2013.*

[7] *The IMPROVE monitor SAGA, serving the San Gabriel Wilderness and the Cucamonga Wilderness, was destroyed in the summer wildfire called the Station Fire of 2009. SAGA was reestablished at the same location in the fall of 2011. Therefore data from the years 2005-2008 comprise the "current period" evaluated for SAGA in this Progress Report. The years 2009-2011 have incomplete deciview day data at SAGA so that Worst and Best Days annual deciview averages for those years do not exist.*

In this Progress Report, "current" conditions are the five-year averages of 2007-2011 visibility data, which is compared with "baseline" conditions, 2000-2004, from the initial California Regional Haze Plan. While some years may not have enough deciview days statistically to calculate the annual Worst and Best Days values, good information is still available for extensive parts of the year. Analyzing all the data gives a better understanding of seasonal patterns and long-term trends in visibility improvement.

For further analysis on a regional scale, California joined with fourteen other states to prepare the Western Regional Air Partnership (WRAP) Regional Summary Report included in Appendix A. The WRAP Summary Report was released in June 2013 and includes a comprehensive analysis of both measured visibility changes at the IMPROVE monitors and changes in emissions inventories between the baseline period and the five following years (2005-2009) to meet some of the RHR reporting requirements. California's Progress Report goes further to update the Regional Summary Report with the 2007-2011 California-specific data.

The 2012 visibility data became available at the end of February 2014, during the Federal Land Managers review period. The timing of the data does not allow for an extensive analysis to be done in this Progress Report. However, the 2012 data is provided in Appendix C in summary format and mentioned in the Appendix D Case Studies. The 2012 summary data continues to illustrate progress in visibility improvement and does not change the conclusions of this Progress Report.

2. Control Strategy Status and Emissions

In California, nitrate and organic carbon aerosols are the primary drivers of poor visibility on Worst Days. Sulfates can also play a role. Therefore, reductions in the precursors for these pollutants, NOx, ROG and SOx, along with directly-emitted PM2.5 support improvements in visibility throughout the State. In the RH Plan Control Strategy, California addressed all three precursors along with directly-emitted PM2.5.

Mobile Sources are the primary contributor to NOx emissions, a precursor to nitrate. They also contribute SOx emissions, a precursor to sulfates; ROG emissions, a precursor to organic carbon aerosols; and PM2.5, a direct-emitter of organic carbon aerosols. Statewide control measures have been effective in driving all three of these types of emissions downward. Light-duty passenger vehicles, heavy-duty diesel-powered trucks, and off-road equipment were the three largest sub-category sources of all NOx emissions in 2000.

2.1. Status of Control Strategies in the RH Plan

The RH Plan Control Strategy relied upon already adopted ARB control measures for mobile sources and consumer products that reduce precursors of haze pollutants: NOx, SOx, ROG, and PM2.5. California's aggressive and innovative control measures go beyond the federal requirements and defined a comprehensive and long-term basis for setting the 2018 RPGs. By regulating fuel and product formulations as well as mobile source equipment and pollution control technology, California's control measures continue to provide significant emission reductions through 2018. Integrated programs addressing Diesel Risk Reduction, Goods Movement, and Smoke Management are designed to cover multiple source categories. California's Smoke Management Program, certified by U.S. EPA in August 2003, continues to manage the occurrence of prescribed fires and smaller agricultural burns, by coordinating private, local, State, and federal actions. The Smoke Management Program requires that Class 1 Areas be identified as sensitive receptors. California also continues to supplement regulatory programs with financial incentives to accelerate early emission reductions and promote new technologies.

2.2. BART Requirement

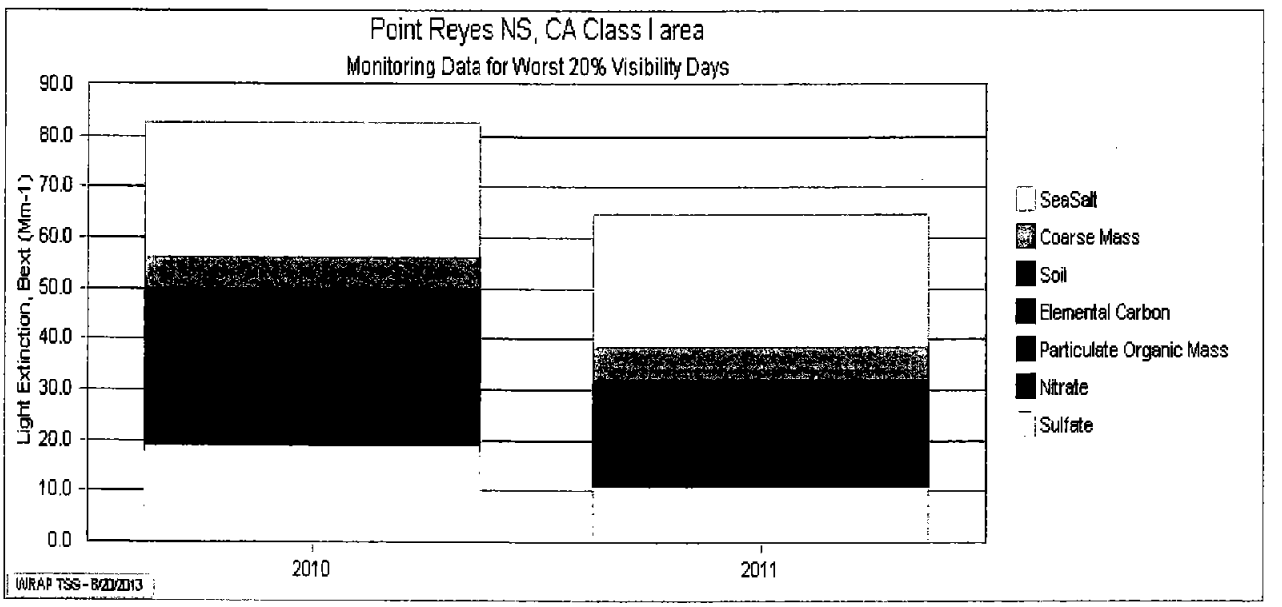
In the RH Plan, Best Available Retrofit Technology (BART) was required for one source, the Main Stack at the Valero refinery in Benicia, California. The new control equipment was installed and operating by February 2011, prior to the 2013 compliance deadline. The BART determination concluded that the Main Stack and its contributing sources would be rebuilt to reduce emissions of SO2, NOx, and PM10. A fluidized coker, a fluidized catalytic cracker unit, and two CO boilers feed to the Main Stack.

The RH Plan BART determination described a technically feasible control system for the components that also produced a beneficial reduction in deciview levels modeled at the nearest Class 1 Area, Point Reyes National Seashore. A regenerative amine scrubber

and a pre-scrubber were used for SO2 removal. The pre-scrubber also removes PM10. NOx is removed by selective catalytic reduction. Low NOx-burners are used for the CO boilers. With the installation of the improvements to the Main Stack as summarized in the RH Plan, reductions of 0.65 tpd NOx, 15.7 tpd SOx, and 0.06 tpd PM10 were achieved.

Point Reyes National Seashore is the primary Class 1 Area affected by emissions from the Valero Refinery. Deciview and light extinction data from 2010 and 2011 are available for comparison prior to and after installation of the retrofit equipment. Figure 2 shows the drop in light extinction, especially from nitrates and sulfates, at the PORE IMPROVE monitor. The corresponding deciview level for the Worst Days annual average went from 22 dv in 2010 to 20.2 dv in 2011.

Figure 2
Comparison of Light Extinction at the PORE Monitor



2.3. New Control Strategies

In the RH Plan, California committed to give an update on new control strategies not included in the RH Plan. Due to the nonattainment challenges in California, ARB and local districts are regularly revising rules to account for new technologies. ARB research, coupled with incentives, provides the bridge to develop these new innovative technologies. The RH Plan reflected emissions from strategies adopted through 2004. Since the RH Plan was developed, ARB has adopted additional control measures. Table 1 includes a list of these control measures and appropriate implementation dates that were adopted by ARB and not reflected in the RH Plan Control Strategy. These control measures further reduced forecasted emissions in 2018 beyond what was in the RH Plan. Since these control measures were not used to set the 2018 RPGs, they will provide additional emission reduction benefits to help California reach the 2018 RPGs.

Table 1
Control Strategies

Category Program	Actions	Implementation
Passenger Vehicles		
Transit Bus Rule Additions	2005	2010
Zero Emission Bus Rule Amendments	2006	2010
Smog Check Improvements	2007-2009	2008-2010; 2013
Expanded Vehicle Retirement (AB 118)	2007	2009
Modifications to Reformulated Gasoline Program	2007	2010
Trucks		
Heavy-Duty Sleeper Truck Idling Technology	2005	2010
Public and Utility Diesel Truck Fleet Rule	2005	2010
Border Truck Inspection Program Protocol Improvements	2006	2006
Cleaner In-Use Heavy-Duty Trucks	2007, 2008, 2010	2011-2015
Goods Movement Sources		
Diesel Cargo Handling Equipment Rule	2005	2010
Ship Auxiliary Engine Cleaner Fuel Requirements	2005	2010
Auxiliary Ship Engine Cold Ironing & Other Clean Technologies	2007, 2008	2010
Cleaner Main Ship Engines and Fuel	2008-2011	2009-2015
Port Truck Modernization	2007,2008, 2010	2008-2020
Accelerated Introduction of Cleaner Line-Haul Locomotives	2008	2012
Clean Up Existing Harbor Craft	2007, 2010	2009-2018
Off-Road Equipment		
Forklifts and Other Spark-Ignition Equipment Regulation	2006	2010
Off-Highway Recreational Vehicle Regulation Amendments	2006	2010
Cleaner In-Use Off-Road Equipment	2007, 2010	2009
Other Off-Road Sources		
In-Use Diesel Agricultural Engine Requirements	2006	2012
Enhanced Vapor Recovery for Above-Ground Storage Tanks	2008	2009-2016
Additional Evaporative Emission Standards	2009	2010-2012
Areawide Sources		
Portable Fuel Container Requirements	2005	2015
Consumer Product Lower Emission Limits	2006	2010
Consumer Products Program	2008-2011	2010, 2013-2014

In California, local air districts implement stationary source and indirect source control programs. This also includes the New Source Review and Prevention of Significant Deterioration permit programs. The Districts also utilize local and pass-through funds to incentivize reductions. Some local air districts encourage residential improvements that

reduce emissions, such as swap-outs, to battery-powered lawnmowers or to U.S. EPA-certified wood-pellet stoves. These programs have localized benefits for meeting the federal and State criteria pollutant standards. They also decrease emissions transported from populated areas to the more remote Class 1 Areas.

2.4. Emission Inventory

California's control measures discussed above are reflected in the Statewide emission inventories shown in Table 2. This inventory is ARB's latest inventory used for the 2013 Almanac and is based on information developed for the daily PM2.5 standard SIPs recently sent to U.S. EPA. The table includes both past and forecasted inventory years in five-year increments and includes years, 2000, 2005, 2010, 2015, and 2020. The ARB inventory is different from that of the WRAP Summary Report in Appendix A since ARB has more recently updated the inventory to reflect revised emission factors and new assumptions for growth along with the units. ARB reflects the inventory in an annual tons per day unit which can be multiplied by 365 in order to get the WRAP tons per year unit. Appendix B includes additional information on the ARB emission inventory.

Table 2
California Statewide Inventory Summary (Tons Per Day)

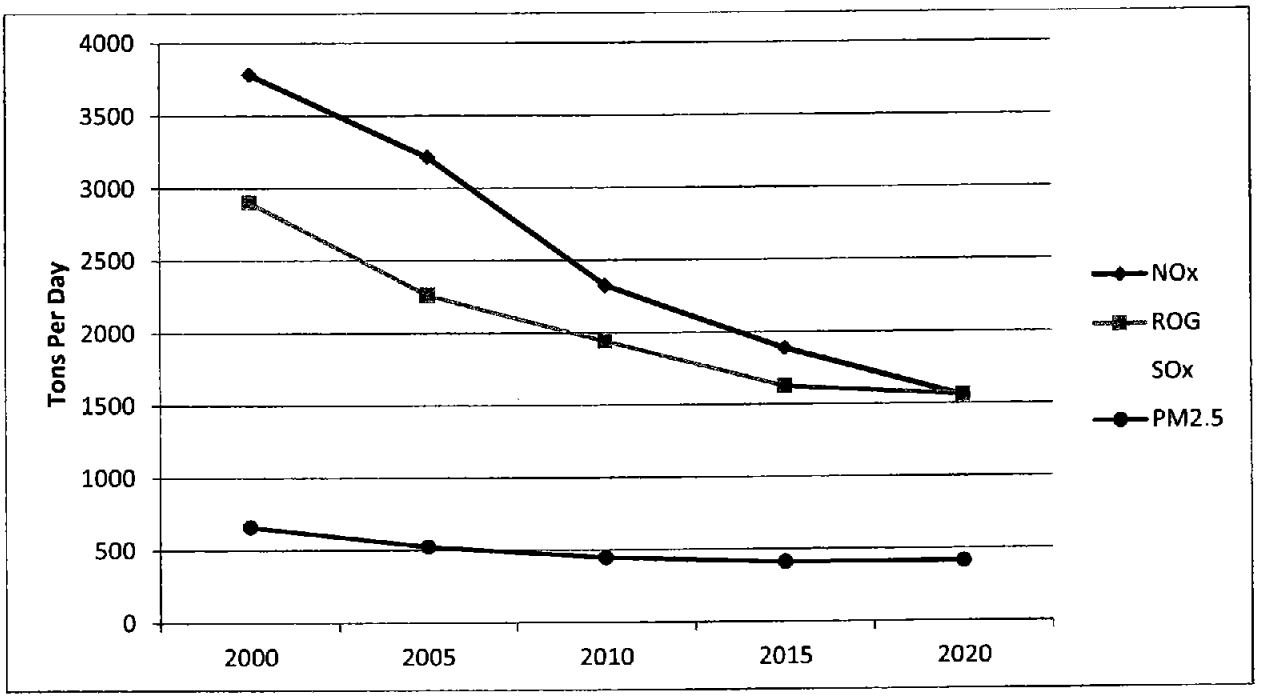
POLLUTANT	CATEGORY	2000	2005	2010	2015	2020
NOx	STATIONARY SOURCES	584	402	313	288	291
NOx	AREAWIDE SOURCES	96	85	75	74	74
NOx	MOBILE SOURCES	3,103	2,727	1,935	1,525	1,188
NOx	GRAND TOTAL STATEWIDE	3,782	3,214	2,324	1,887	1,553
ROG	STATIONARY SOURCES	564	416	417	401	425
ROG	AREAWIDE SOURCES	783	713	655	611	630
ROG	MOBILE SOURCES	1,555	1,133	871	613	506
ROG	GRAND TOTAL STATEWIDE	2,902	2,261	1,943	1,624	1,561
SOx	STATIONARY SOURCES	132	97	64	54	55
SOx	AREAWIDE SOURCES	9	7	7	6	6
SOx	MOBILE SOURCES	148	182	52	18	21
SOx	GRAND TOTAL STATEWIDE	289	287	123	78	82
PM2.5	STATIONARY SOURCES	92	91	82	65	69
PM2.5	AREAWIDE SOURCES	445	309	275	277	281
PM2.5	MOBILE SOURCES	123	124	90	68	64
PM2.5	GRAND TOTAL STATEWIDE	661	524	447	410	414

2013 Almanac
SOURCE: http://www.arb.ca.gov/aqd/almanac/almanac13/chap313.htm

2.5. Control Measure Emission Reductions

California emissions have declined for all precursors since 2000 as shown in Figure 3. Between 2000 and 2020, mobile source NOx, ROG, and PM2.5 emissions are projected to be reduced by about 60, 65, and 50 percent, respectively. Stationary sources are also projected to decline for all precursors. Areawide sources also decline but not at the rate of mobile and stationary sources. Overall, between 2000 and 2020, NOx, ROG, SOx, and PM2.5 emissions decline almost 40 percent. These emission reductions reflect the maturity of California's emission control program.

Figure 3
California Statewide Inventory Trends



3. Visibility Progress

The RHR requires each state to assess visibility conditions and changes, using the Worst Days and Best Days metrics. The RHR requires states to assess current visibility, the change compared to baseline, and change over the past five years for both Worst Days and Best Days. For this initial Progress Report, the current conditions are the 2007-2011 period; the baseline period and past five years are the same, 2000-2004.

Table 3 compares Current and Baseline Worst Days and Best Days including the visibility changes as required by the RHR. Table 3 also compares Worst Days current conditions with the U.S. EPA approved 2018 RPG at each monitoring site, to show the percent progress achieved since the baseline, using the 2007-2011 five-year average. Visibility is improving on the Best Days at all monitoring sites meeting the RHR requirement that Best Days should not degrade. At nine monitoring sites, the current conditions already meet the 2018 RPGs. Visibility improvement at all but three of the monitoring sites indicates that by the end of 2011, progress exceeds 50 percent of that needed to reach the 2018 goals. Appendix C contains the Worst Day record since the baseline period. Looking at just 2011, all sites recorded values below the 2018 RPGs.

The three monitoring sites with the least progress, using the 2007-2011 five-year averages, are the LAVO, BLIS, and REDW IMPROVE monitors. Further analysis of trends in haze-causing pollutant concentrations and their contributions to light extinction at these three monitors reveals the cause of the limited progress. In the western U.S., wildfire smoke can elevate Worst Days values at particular monitors in a single year, as well as skew subsequent five-year averages. In 2008 and 2009, wildfire smoke caused unusually high deciview Worst Day values with the first and third highest Worst Day value in 23 years of monitoring at the LAVO monitoring site. Wildfire smoke also impacted the BLIS monitoring site in 2007 and 2008 and caused the highest and second highest Worst Days annual averages in 16 years of deciview calculations at that location. In 2008, wildfire smoke also impacted the REDW monitoring site. As mentioned later, in Section 4, wildfire smoke can significantly impact visibility and mask improvements from emission controls. Appendix D examines the composition and timing of the Worst Day values in detail for these three monitoring sites.

Offshore emissions from ocean-going vessels (OGV) contribute to sulfate formation, impacting visibility at monitoring sites closest to the coast. California has near-shore controls on OGV SOx emissions, however, sulfates are long-lasting once formed in the atmosphere. The coastal REDW, PINN, and RAFA monitoring sites may also be affected more by offshore sources, because they are located in remote areas with few other large SOx-emitting sources nearby. The current visibility at PINN and RAFA, while over 50 percent towards the 2018 RPG since the baseline period, are not improving as quickly as some of the other sites in California. No further analysis is included for RAFA and PINN because their current conditions years also include Worst Day values with high wildfire contributions in 2007 and 2008. In contrast, visibility improvement at PORE is progressing more quickly, because it is much closer to emissions reductions in a highly urbanized area.

Table 3
Statewide 2018 Reasonable Progress Goal Summary

IMPROVE Monitor	California Class I Area(s)	Best Days Baseline (dv)	Best Days (2007-2011) (dv)	Visibility Change (dv)	Worst Days Baseline (dv)	Worst Days (2007-2011) (dv)	Visibility Change (dv)	2018 RPG (dv)	Progress to 2018 RPG by 2011
NORTHERN CALIFORNIA									
TRIN	Marble Mountain W. Yolla Bolly-Middle Eel W.	3.4	3.2	0.2	17.4	**15.2**	2.1	**16.4**	210%
LABE	Lava Beds N.M. South Warner W.	3.2	2.8	0.4	15.1	**13.0**	2.1	**14.4**	300%
LAVO	Lassen Volcanic N.P. Caribou W. Thousand Lakes W.	2.7	2.5	0.2	14.1	**15.6**	-1.5	**13.3**	-188%
SIERRA CALIFORNIA									
BLIS	Desolation W. Mokelumne W.	2.5	2.2	0.3	12.6	**13.0**	-0.4	**12.3**	-133%
HOOV	Hoover W.	1.4	1.3	0.1	12.9	**11.5**	1.4	**12.5**	350%
YOSE	Yosemite N.P. Emigrant W.	3.4	2.9	0.5	17.6	**16.0**	1.6	**16.7**	178%
KAIS	Ansel Adams W. Kaiser W. John Muir W.	2.3	1.6	0.2	15.5	**14.9**	0.6	**14.9**	100%
SEQU	Sequoia N.P. Kings Canyon N.P.	8.8	7.9	0.9	25.4	**22.3**	3.1	**22.7**	115%
DOME	Dome Lands W.	5.1	5.1	0	19.4	**18.3**	1.1	**18.1**	85%
COASTAL CALIFORNIA									
REDW	Redwood N.P.	6.1	5.6	0.5	18.5	**18.5**	0	**17.8**	0%
PORE	Point Reyes N.S.	10.5	9.1	1.4	22.8	**21.6**	1.2	**21.3**	80%
PINN	Pinnacles W. Ventana W.	8.9	8.0	0.9	18.5	**17.5**	1.0	**16.7**	56%
RAFA	San Rafael W.	6.4	5.5	0.9	18.8	**18.0**	0.8	**17.3**	53%
SOUTHERN CALIFORNIA									
SAGA	San Gabriel W. Cucamonga W.	4.8	4.5	0.3	19.9	**18.0** ***(2005-2008)***	1.9	**17.4**	76% by 2008
SAGO	San Gorgonio W. San Jacinto W.	5.4	4.5	0.9	22.2	**18.7**	3.5	**19.9**	152%
AGTI	Agua Tibia W.	9.6	7.4	2.2	23.5	**19.8**	3.7	**21.6**	195%
JOSH	Joshua Tree N.P.	6.1	5.3	0.8	19.6	**16.1**	3.5	**17.9**	206%

W = Wilderness N.M. = National Monument N.P. = National Park N.S. = National Seashore

4. Assessment of Changes Impeding Visibility Progress

As discussed in the RH Plan, in California, there are three factors, largely beyond State control, that can interfere with progress towards improved visibility in Class 1 Areas: wildfire smoke, offshore shipping emissions, and Asian dust. These factors are either from natural sources (wildfire smoke), uncontrollable sources (shipping emissions beyond California's jurisdiction), or both (Asian dust, a combination of anthropogenic and natural sources beyond California's control.)

Each factor can produce a spike in the sampling record measuring concentrations of each haze species. Whether wildfire smoke originates in California or is transported from out of state, the signature appears as elevated organic carbon concentrations that can last for several consecutive sampling days or weeks, depending on the size of the fire.

Pacific offshore shipping emissions from vessels burning sulfur-containing fuels, have increased dramatically in the last decade due to shifts in the global economy. These SOx emissions form sulfates, with higher levels near the California coastline, likely due to the higher humidity along the shoreline enhancing sulfate formation. Sulfates are normally elevated during the summer at all California monitors. They can be the secondary driver of haze at some monitors on Worst Days when elevated organic carbon is the primary driver. California has controlled both in-port and near-port shipping emissions with recently adopted measures. These controls have dampened the impact of shipping emissions, but cannot offset the changes beyond the State's jurisdiction. The RH Plan estimated that more than 50 percent of the sulfate measured at the California coastal monitors was beyond the State's control.

Asian dust, which has been identified by small amounts of marker soil elements at high elevation IMPROVE monitors, has the most visible influence in the spring. At that time, seasonal windstorms in the Asian deserts load the atmosphere with geologic dust. As these strong winds move across eastern Asia, the natural dust combines with, and is coated by, industrial pollution. These pollution-laden winds enter the jet stream crossing the Pacific Ocean and their plumes are visible in satellite photos. Asian dust is detected at the IMPROVE monitors as episodes of coarse mass and fine soils on single days, March through May, when these two haze species spike at the same time at many monitors in a region. Depending on other sources affecting a particular monitor, Asian dust events may elevate normal measurements sufficiently to cause occasional Worst Days in California. The WRAP Summary Report has more information about these regional transported dust episodes.

Wildfires are occurring more frequently. The largest wildfires in California, measured in acreage burned since 1950, occurred in the first decade of the 21st century. Figure 4 illustrates this increase.[8,9]

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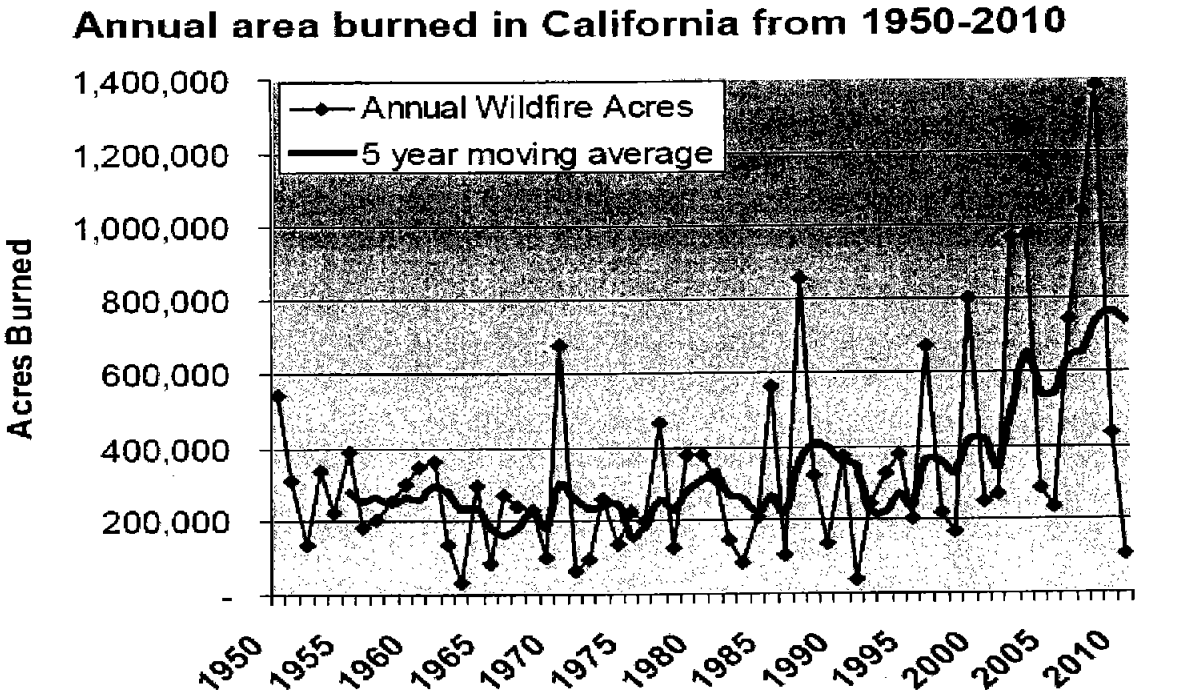
[8] http://oehha.ca.gov/multimedia/epic/pdf/ClimateChangeIndicatorsReport2013.pdf, p. 137.
[9] http://frap.fire.ca.gov/assessment/assessment2010/document.html, 2010 graph.

Figure 4
Wildfire Acreage Burned in California

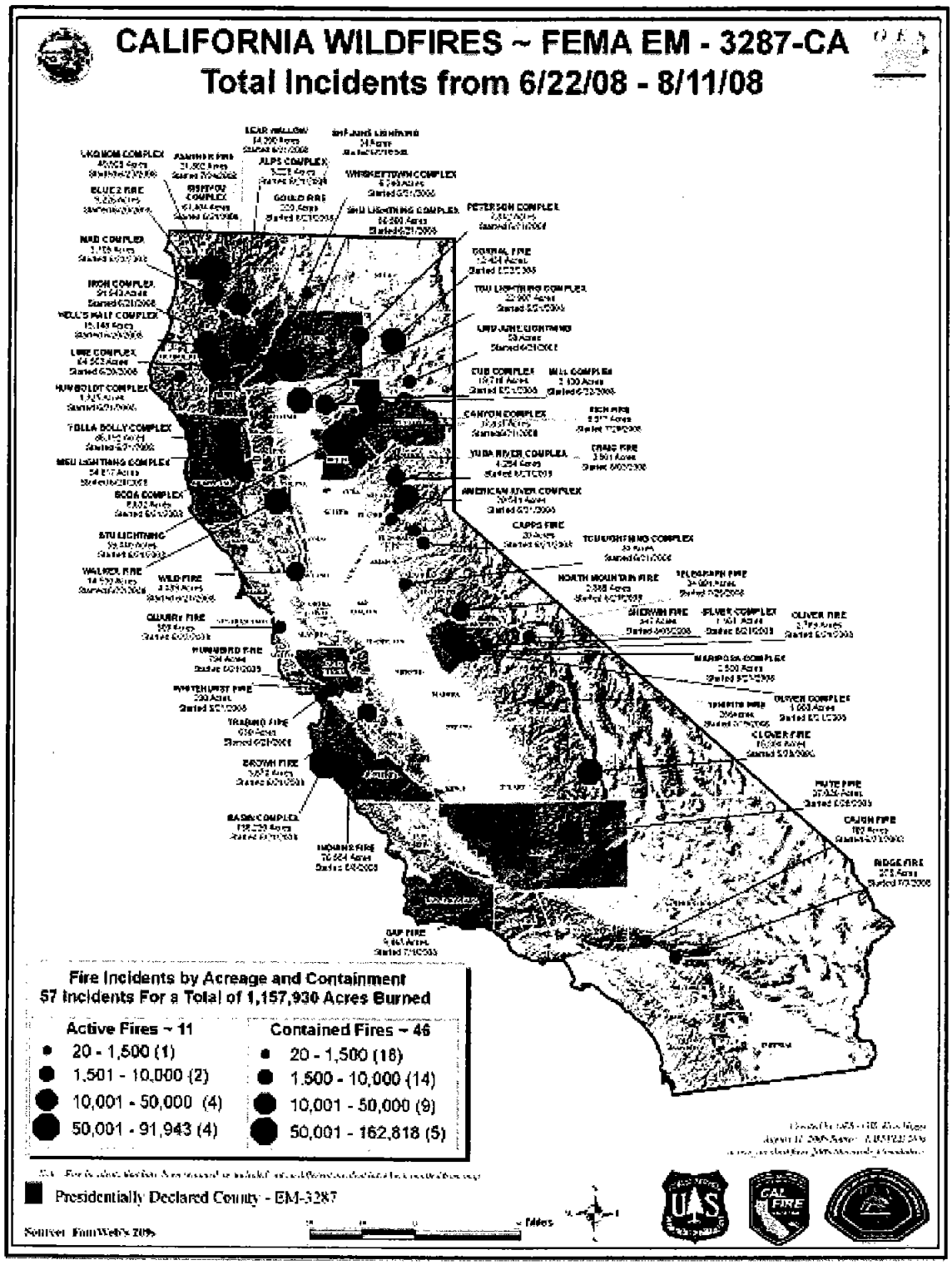


Source: CalFire, 2011

Wildfires cause organic carbon concentrations to increase significantly on days when wildfire smoke reaches a Class 1 Area, often remaining high for several consecutive days or even weeks. Organic carbon is the largest contribution to light extinction on those days, sometimes making the deciview level high enough to skew the annual Worst Days average. Further analysis of which haze species cause the Worst Days, and their timing, clearly implicates wildfire smoke as a challenge that impacts California on a regular basis.

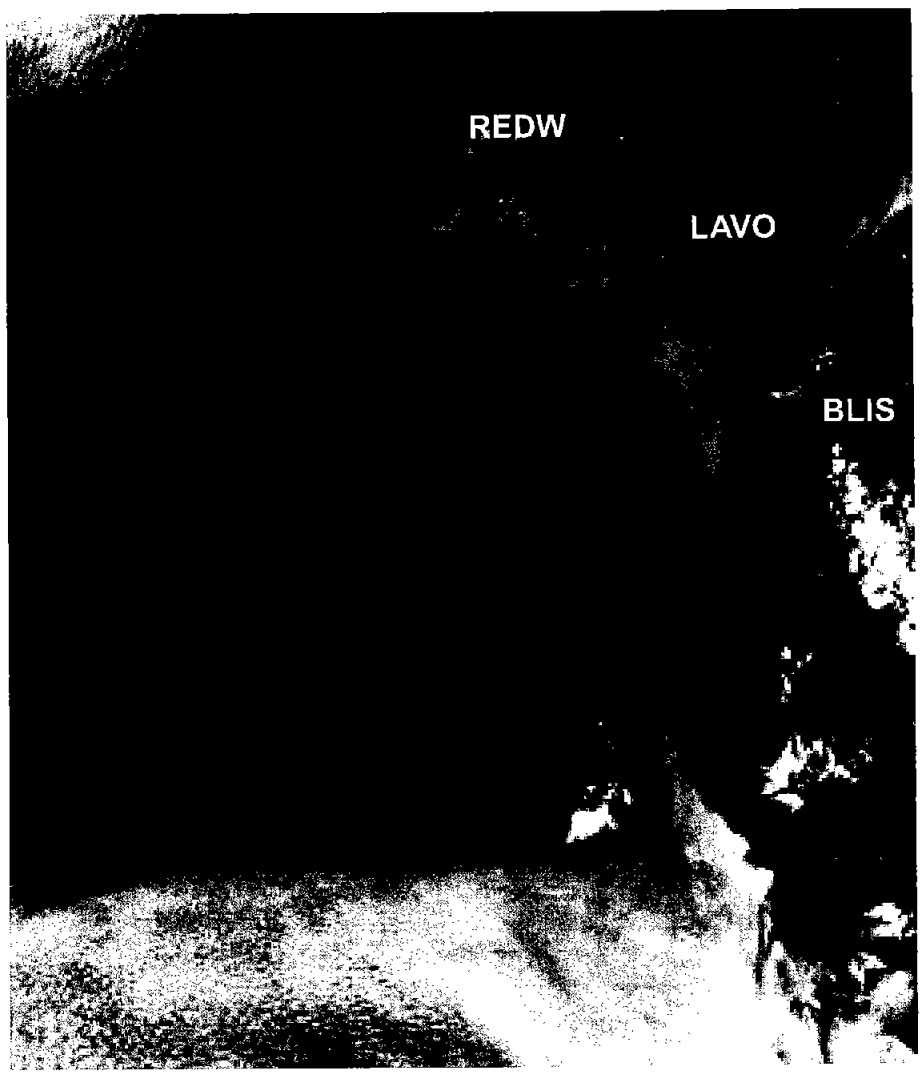
In 2008, Northern, Sierra, and Coastal California were particularly affected by a large number of wildfires known collectively as the 2008 Lightning Strike Complex. Wildfire smoke began June 22 and did not die out until after the last ignition in August. Figure 5 shows the name, location, and size of these fires, many of which burned and smoldered beyond their containment date. This smoke directly impacted the Class 1 Areas and had an overwhelming impact on visibility progress at many monitoring sites throughout California and the west.

Figure 5
The 2008 "Lightning Strike Complex"



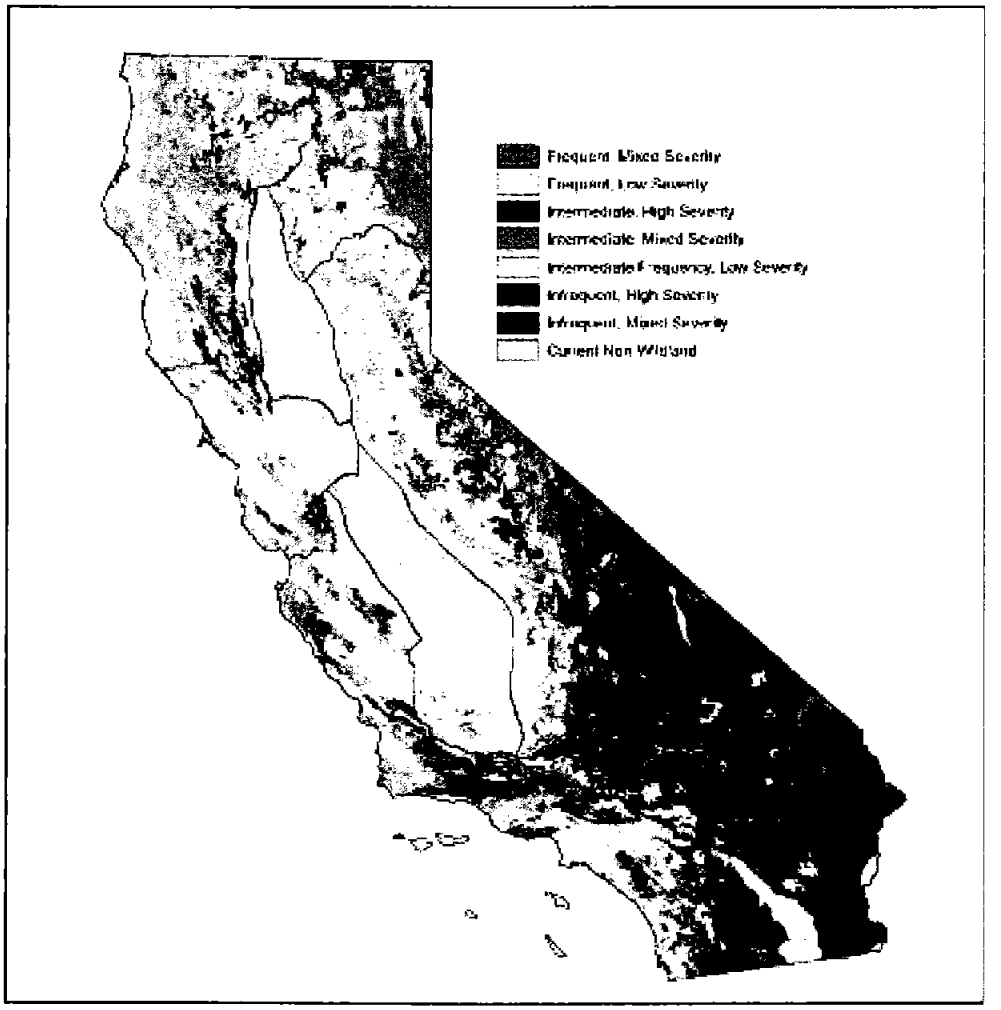
The satellite image in Figure 6 shows the extent of smoke plumes during the summer of 2008, almost three weeks after lightning strikes first ignited the dozens of wildfires throughout the State. The image shows how wildfire smoke can be transported far beyond its origin. The image also shows the wildfire smoke proximity to the REDW, BLIS, and LAVO monitoring sites. These were the only monitors in California, based on 2007-2011 data, where current visibility progress was less than halfway towards reaching the 2018 RPGs. The technical analysis of long-term deciview trends, monitoring data not impacted by wildfires, and anthropogenic emissions, found in Appendix D, demonstrates that visibility is otherwise improving at these locations.

Figure 6
NASA Satellite Photo: July 9, 2008



The California Department of Forestry and Fire Protection (CalFire) estimates that 80 percent of the State is considered wildlands, with a range of fire frequency and severity as shown in Figure 7.[10] California's Class 1 Areas are all susceptible to wildfires. Even Joshua Tree National Park, the only Class 1 Area partially within an area which infrequently burns, is directly downwind of smoke plumes from frequent and severe fires burning in the San Bernardino and San Jacinto Mountains. Depending on when and where they occur, wildfires will continue to be an impediment to reaching natural conditions in the future.

Figure 7
Wildfire Frequency and Intensity



[10] *California Department of Forestry and Fire Protection, Draft Vegetation Treatment Program Environmental Impact Report, October 30, 2012, Chapter 4 and Figure 4.2.1.*

5. Assessment of Current Control Strategy

The RH Plan Control Strategy is sufficient for meeting California's 2018 RPGs. The recent IMPROVE data year, 2011, shows that all sites for the year 2011 are below the 2018 RPGs. In addition, California continues to strengthen existing control measures due to the severity of the air quality problem. California is currently developing SIPs for the 75 ppb 8-hour ozone standard and the 12 ug/m3 annual PM2.5 standard which are due in the 2016 timeframe. This provides strong evidence that California is on track to meeting the 2018 RPGs throughout the State.

The RH Plan control strategy is also sufficient to lessen California's impact on neighboring states. In the RH Plan, California determined that the State contributed about three percent or less nitrate on Worst Days at Jarbridge Wilderness Area, Kalmiopsis Wilderness Area, Crater Lake National Park, Sycamore Canyon Wilderness Area, and Grand Canyon National Park. In the RH Plan, the NOx emissions were forecast to decrease about 40 percent in California by 2018. Now, California NOx emissions are decreasing by almost 60 percent between 2000 and 2020, exceeding what was in the RH Plan.

6. Visibility Monitoring Strategy

California will continue to rely on the IMPROVE network to collect and analyze the visibility data. During the current reporting period, the SAGA monitor was destroyed by the Station Fire in August of 2009. The site was re-established in October of 2011. The U.S. Forest Service (USFS) and their contractors were able to collect data and calculate light extinction for parts of 2009 and 2011. There was sufficient data for averaging four years, 2005-2008, used as the current reporting period for SAGA without data substitution. There are no current recommendations for changing the monitoring locations.

7. RH Plan Commitments and Continued Consultation

In the RH Plan, California committed to update the 2018 RPGs with the latest WRAP modeling if appropriate. Since submission of the RH Plan, WRAP has not updated the modeling for the California 2018 RPGs. California will continue to examine refinements to the Natural Conditions targets, given the increases in wildfires in California.

ARB staff regularly confers with other western states to discuss mutual concerns and strategies for reducing haze, through the WRAP and the Western States Air Resources Council (WESTAR.) ARB staff participated in the WESTAR Regional Haze Subcommittee, which developed recommendations regarding continued implementation of the Regional Haze Rule. These recommendations were presented to the U.S. EPA in August of 2013. ARB staff also consulted with the other western states, regarding whether anthropogenic sources or controllable activities in California affected the progress towards 2018 RPGs of these states. There is general agreement that smoke emissions from wildfires, especially in 2007, 2008, and 2009, did impact other States.

In turn, smoke emissions from Oregon wildfires sometimes impacted California Class 1 Area monitors. California has determined that absent these natural wildfire smoke impacts, visibility is improving sufficiently due to reduction of anthropogenic emissions, in-state and out-of-state.

ARB staff also meets routinely with the Federal Land Management Agencies (FLMs) with Class 1 Areas in California to review visibility progress, to share technical and research information, and to discuss policies leading to air quality improvement. This occurs at the staff level throughout the year at Interagency Air and Smoke Council meetings and through senior management meetings of ARB, air districts, CalFire, and FLM representatives in the State at the Air and Land Managers meetings. California provided the draft Progress Report to the FLMs sixty days in advance of the public notice of the hearing on the Progress Report, for their review and comments. Appendix E includes their written comments and the responses from ARB staff.

8. Adequacy of Regional Haze Plan

California is making adequate progress overall in improving visibility due to reductions in emissions from RH Plan control strategy. The trends for Worst Days averages show visibility improving at every monitoring site, in the absence of very high wildfire years. Current Best Days are all better or the same as those of the baseline period. As evidenced by reductions in anthropogenic source emissions in California and the concurrent improvement in visibility at all of California's Class 1 Area IMPROVE monitors, California determines the current RH plan strategies are sufficient for California and its neighboring states to meet their 2018 RPGs. In accordance with the requirements of the RHR, California has determined that no further substantive revision of the RH Plan is warranted at this time in order to achieve the 2018 RPGs for visibility improvement.

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Appendix A

WRAP Regional Summary Report

The "Western Regional Air Partnership Regional Haze Rule Reasonable Progress Summary Report" contains analyses for 15 states in the western region of the United States and is available at: http://www.wrapair2.org/RHRPR.aspx. The Summary Report section for California can be downloaded from the same website, as Section 6.3, under the State Summaries (and State Specific Appendices):
California (pdf) (1.1 MB, 39 pages), Appendix C (pdf) (2.6 MB, 154 pages.)

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Appendix B

Emission Inventory
2013 Almanac

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NOx Emissions (TPD)

Statewide	2000	2005	2010	2015	2020
Electric Utilities	60.6	26.8	23.1	25.3	26.8
Cogeneration	28.7	18.1	15.9	17.2	20.6
Oil And Gas Production (Combustion)	24.7	14.4	10.2	9	8.4
Petroleum Refining (Combustion)	46.9	25.6	20.2	19.7	19.6
Manufacturing And Industrial	145.2	80.3	63.1	65.3	64.9
Food And Agricultural Processing	42	36.3	28.3	15.3	9.5
Service And Commercial	72.1	49.6	46.5	45.8	47.2
Other (Fuel Combustion)	20.1	17.2	12.3	14.7	13.5
Sewage Treatment	0.4	0.4	0.4	0.5	0.5
Landfills	0.6	1	1	1.1	1.2
Incinerators	1.7	2.1	2.6	2.7	2.9
Soil Remediation	0.1	0.1	0.1	0.1	0.1
Other (Waste Disposal)	0.1	0	0	0	0
Laundering	0	0	0	0	0
Degreasing	0	0	0	0	0
Coatings And Related Process Solvents	0.1	0.1	0	0.1	0.1
Printing	0	0	0	0	0
Adhesives And Sealants	0	0	0	0	0
Other (Cleaning And Surface Coatings)	0.1	0.1	0.1	0.2	0.2
Oil And Gas Production	3.6	2.7	2.2	2	1.8
Petroleum Refining	9.9	5.4	13.8	2.3	2.3
Petroleum Marketing	0.7	0.2	0.2	0.3	0.3
Other (Petroleum Production And Marketing)	0	0	0	0	0
Chemical	1.8	2	1.7	1.9	2
Food And Agriculture	0.7	0.2	0.1	0.2	0.2
Mineral Processes	101.2	103.3	54.4	57	61.9
Metal Processes	1.5	1.1	1	0.7	0.7
Wood And Paper	3.8	2.5	1	1	1.1
Glass And Related Products	13.7	10.1	5.8	4.1	4.4
Electronics	0	0	0	0	0
Other (Industrial Processes)	3.4	2.7	9.1	1.1	1.4
Consumer Products	0	0	0	0	0
Architectural Coatings And Related Process Solvents	0	0	0	0	0
Pesticides/Fertilizers	0	0	0	0	0
Asphalt Paving / Roofing	0	0	0	0	0
Residential Fuel Combustion	80.6	68.1	59.9	59.3	59
Farming Operations	0	0	0	0	0
Construction And Demolition	0	0	0	0	0

NOx Emissions (TPD) (continued)

Statewide	2000	2005	2010	2015	2020
Paved Road Dust	0	0	0	0	0
Unpaved Road Dust	0	0	0.1	0	0
Fugitive Windblown Dust	0	0	0	0	0
Structural and Automobile Fires	0.2	0.2	0.2	0.2	0.2
Managed Burning And Disposal	15	16.6	14.7	14.6	14.6
Cooking	0	0	0	0	0
Other (Miscellaneous Processes)	0	0	0	0	0
Light Duty Passenger (Lda)	463.7	249.8	157.4	83.7	50.5
Light Duty Trucks - 1 (Ldt1)	166.8	66.9	39.2	26.6	17.6
Light Duty Trucks - 2 (Ldt2)	265.3	148.1	101	56.9	32.2
Medium Duty Trucks (Mdv)	117	127.2	107.1	75.5	52.2
Light Heavy Duty Gas Trucks - 1 (Lhdv1)	28.1	49.6	47.9	41	34.4
Light Heavy Duty Gas Trucks - 2 (Lhdv2)	9.7	5.6	4.2	3.3	2.6
Medium Heavy Duty Gas Trucks (Mhdv)	18.3	12	10.5	6.5	4.1
Heavy Heavy Duty Gas Trucks (Hhdv)	11.3	4	3.9	3.5	3.2
Light Heavy Duty Diesel Trucks - 1 (Lhdv1)	24.6	98	102.1	74.7	53.6
Light Heavy Duty Diesel Trucks - 2 (Lhdv2)	23.7	27.1	25.8	18.9	13.8
Medium Heavy Duty Diesel Trucks (Mhdv)	161.7	162.7	100.6	64.7	32.2
Heavy Heavy Duty Diesel Trucks (Hhdv)	706.3	728.3	432	286.2	192.6
Motorcycles (Mcy)	4.4	7.5	9.1	9.1	9.5
Heavy Duty Diesel Urban Buses (Ub)	44.2	35.7	34.2	30.2	26.5
Heavy Duty Gas Urban Buses (Ub)	2.8	2.2	2.2	2	1.9
School Buses - Gas (Sbg)	1	0.8	0.7	0.5	0.5
School Buses - Diesel (Sbd)	10.8	10	7.3	6.8	5.9
Other Buses - Gas (Obg)	2.7	4.4	3.5	2.7	1.9
Other Buses - Motor Coach - Diesel (Obc)	12.4	12.3	8.2	5.5	2.8
All Other Buses - Diesel (Obd)	7.5	7.6	5.1	4	2.1
Motor Homes (Mh)	14.6	8.9	8	5.9	4.5
Aircraft	42.6	45.8	53.2	57.7	64.1
Trains	198.8	157.4	95.6	111.3	109.7
Ships And Commercial Boats	0.2	0.1	0.1	0.1	0.1
Ocean Going Vessels	170.5	218.2	196.1	236.2	224.9
Commercial Harbor Craft	83.4	74.3	63.6	44.9	36.5
Recreational Boats	16.6	20.5	19.5	18.6	18.4
Off-Road Recreational Vehicles	0.4	1.5	1.4	2.7	3
Off-Road Equipment	339.5	307.3	188.7	163.9	126.9
Farm Equipment	154	132.5	106.9	81.4	59.7
Fuel Storage And Handling	0	0	0	0	0
Total (TPD)	**3782**	**3214**	**2323**	**1887**	**1553**

SOx Emissions (TPD)

Statewide	2000	2005	2010	2015	2020
Electric Utilities	5.4	4.1	5	5.1	5.5
Cogeneration	1.8	1.2	1.1	1.2	1.4
Oil And Gas Production (Combustion)	7.4	1.3	2.1	0.6	0.6
Petroleum Refining (Combustion)	12.8	11.9	18.9	8.9	8.1
Manufacturing And Industrial	9.1	6.3	7.6	8.7	8.4
Food And Agricultural Processing	1.1	0.7	0.6	0.4	0.4
Service And Commercial	3	2.5	2.8	3	3.1
Other (Fuel Combustion)	0.4	0.9	0.4	0.4	0.4
Sewage Treatment	0.2	0.2	0.2	0.3	0.3
Landfills	0.2	0.5	0.5	0.5	0.5
Incinerators	0.1	0.3	0.5	0.6	0.6
Soil Remediation	0	0	0	0	0
Other (Waste Disposal)	0	0	0	0	0
Laundering	0	0	0	0	0
Degreasing	0	0	0	0	0
Coatings And Related Process Solvents	0	0	0	0	0
Printing	0	0	0	0	0
Adhesives And Sealants	0	0	0	0	0
Other (Cleaning And Surface Coatings)	0	0	0	0.1	0.1
Oil And Gas Production	0.1	0.1	0.1	0.1	0.1
Petroleum Refining	56.6	40.1	5	4.7	4.2
Petroleum Marketing	0	0	0	0	0
Other (Petroleum Production And Marketing)	0	0	0	0	0
Chemical	2.9	3.4	2.6	2.6	3
Food And Agriculture	1.8	0.3	0.5	0.5	0.6
Mineral Processes	20.7	18.9	12.4	13.3	14.9
Metal Processes	0.2	0	0.1	0.1	0.1
Wood And Paper	0.7	0	0	0	0
Glass And Related Products	6.6	2.9	2.5	1.8	1.9
Electronics	0	0	0	0	0
Other (Industrial Processes)	0.8	1	1.4	0.5	0.7
Consumer Products	0	0	0	0	0
Architectural Coatings And Related Process Solvents	0	0	0	0	0
Pesticides/Fertilizers	0	0	0	0	0
Asphalt Paving / Roofing	0	0	0	0	0
Residential Fuel Combustion	5.4	3.8	3.4	2.7	2.7
Farming Operations	0	0	0	0	0
Construction And Demolition	0	0	0	0	0

SOx Emissions (TPD) (continued)

Statewide	2000	2005	2010	2015	2020
Paved Road Dust	0	0	0	0	0
Unpaved Road Dust	0	0	0	0	0
Fugitive Windblown Dust	0	0	0	0	0
Structural and Automobile Fires	0	0	0	0	0
Managed Burning And Disposal	3.6	3.6	3.5	3.6	3.6
Cooking	0	0	0	0	0
Other (Miscellaneous Processes)	0	0	0	0	0
Light Duty Passenger (Lda)	2.7	1.8	1.9	2	1.8
Light Duty Trucks - 1 (Ldt1)	0.7	0.3	0.3	0.3	0.3
Light Duty Trucks - 2 (Ldt2)	1.4	0.9	0.9	1	0.9
Medium Duty Trucks (Mdv)	0.6	1	1	1	1
Light Heavy Duty Gas Trucks - 1 (Lhdv1)	0.1	0.2	0.3	0.3	0.3
Light Heavy Duty Gas Trucks - 2 (Lhdv2)	0	0	0	0	0
Medium Heavy Duty Gas Trucks (Mhdv)	0	0	0	0	0
Heavy Heavy Duty Gas Trucks (Hhdv)	0	0	0	0	0
Light Heavy Duty Diesel Trucks - 1 (Lhdv1)	0.2	0.7	0.1	0.1	0.1
Light Heavy Duty Diesel Trucks - 2 (Lhdv2)	0.2	0.2	0	0	0
Medium Heavy Duty Diesel Trucks (Mhdv)	1.2	1.4	0.1	0.1	0.2
Heavy Heavy Duty Diesel Trucks (Hhdv)	4.9	5.8	0.6	0.7	0.8
Motorcycles (Mcy)	0	0	0	0	0
Heavy Duty Diesel Urban Buses (Ub)	0.4	0.4	0	0	0
Heavy Duty Gas Urban Buses (Ub)	0	0	0	0	0
School Buses - Gas (Sbg)	0	0	0	0	0
School Buses - Diesel (Sbd)	0.1	0.1	0	0	0
Other Buses - Gas (Obg)	0	0	0	0	0
Other Buses - Motor Coach - Diesel (Obc)	0.1	0.1	0	0	0
All Other Buses - Diesel (Obd)	0.1	0.1	0	0	0
Motor Homes (Mh)	0.1	0	0	0	0
Aircraft	3	3.2	3.5	3.8	4.2
Trains	8.4	7.5	0.6	0.1	0.1
Ships And Commercial Boats	0	0	0	0	0
Ocean Going Vessels	120.9	155.1	41.6	8.1	10.2
Commercial Harbor Craft	0.9	0.9	0.4	0.4	0.4
Recreational Boats	0	0	0	0	0
Off-Road Recreational Vehicles	0	0.1	0	0.1	0.1
Off-Road Equipment	1.4	1.6	0.2	0.2	0.2
Farm Equipment	1	0.9	0.1	0.1	0.1
Fuel Storage And Handling	0	0	0	0	0
Total (TPD)	**289.3**	**286.3**	**122.8**	**78**	**81.9**

VOC Emissions (TPD)

Statewide	2000	2005	2010	2015	2020
Electric Utilities	4.8	3.2	2.4	2.4	2.4
Cogeneration	3	1.8	1.7	2.1	2.5
Oil And Gas Production (Combustion)	2.9	2.6	2.6	2.3	2.1
Petroleum Refining (Combustion)	1.8	2.9	2.6	3	3
Manufacturing And Industrial	11.7	6.6	7.5	7.8	8.3
Food And Agricultural Processing	5.1	4.9	3.8	2.8	2.3
Service And Commercial	5.6	4	4.9	5.2	5.4
Other (Fuel Combustion)	2.2	1.4	1.1	1	0.9
Sewage Treatment	0.6	0.7	1.1	0.7	0.8
Landfills	13.7	10.6	11.4	12.3	13.1
Incinerators	0.2	3.2	1.3	1.5	1.5
Soil Remediation	0.3	0.5	0.4	0.4	0.4
Other (Waste Disposal)	22.6	27.6	27.6	24.8	26.3
Laundering	1.6	2.2	2.1	1.8	1.9
Degreasing	64.1	32.5	33.6	38.1	43
Coatings And Related Process Solvents	90.8	67.3	57.4	64.9	71.6
Printing	24	18.8	17.4	18.8	20.1
Adhesives And Sealants	26.4	19.9	19.8	20.5	21.3
Other (Cleaning And Surface Coatings)	6.2	5.2	7.2	8.1	8.9
Oil And Gas Production	58.6	42.1	37.3	34.3	31
Petroleum Refining	38.4	12.3	16.4	11.9	11.9
Petroleum Marketing	109.4	80.6	80.1	81.8	84.5
Other (Petroleum Production And Marketing)	0.4	0.3	15.9	0.3	0.3
Chemical	22.6	18.4	15.8	17.1	20.2
Food And Agriculture	15.2	16.4	17.7	18.8	20.6
Mineral Processes	6.8	6	4.1	4.2	4.7
Metal Processes	1.3	0.5	0.4	0.4	0.4
Wood And Paper	3.6	2.9	2.5	2.5	2.7
Glass And Related Products	0.2	0	0	0	0
Electronics	0.9	0.4	0.3	0.3	0.3
Other (Industrial Processes)	19.2	19.9	20.6	10.5	12.5
Consumer Products	255.2	230.4	213	202.2	210.6
Architectural Coatings And Related Process Solvents	119.7	104.6	87.7	76.4	79.8
Pesticides/Fertilizers	59.1	47.1	36.8	42	41.9
Asphalt Paving / Roofing	27	28.4	29	30.6	31.9
Residential Fuel Combustion	95.4	71.5	57.5	57.8	57.8
Farming Operations	174.8	177	178.9	149.7	155.5
Construction And Demolition	0	0	0	0	0

VOC Emissions (TPD) (continued)

Statewide	2000	2005	2010	2015	2020
Paved Road Dust	0	0	0	0	0
Unpaved Road Dust	0	0	0.3	0	0
Fugitive Windblown Dust	0	0	0	0	0
Structural and Automobile Fires	0.6	0.7	0.7	0.7	0.7
Managed Burning And Disposal	43.2	45.1	42.6	42.6	42.5
Cooking	6	6.3	6.7	7.1	7.6
Other (Miscellaneous Processes)	1.9	1.9	1.9	1.9	1.9
Light Duty Passenger (Lda)	500.8	283.9	191.8	90.1	51.9
Light Duty Trucks - 1 (Ldt1)	165.8	74.5	52.2	31	21.5
Light Duty Trucks - 2 (Ldt2)	160.5	93.7	72.8	43.5	29.4
Medium Duty Trucks (Mdv)	59	63.8	62.8	49.2	41.5
Light Heavy Duty Gas Trucks - 1 (Lhdv1)	16.5	30.2	29.2	21	17.3
Light Heavy Duty Gas Trucks - 2 (Lhdv2)	12.5	5.3	2.9	1.6	1.1
Medium Heavy Duty Gas Trucks (Mhdv)	20	10.4	7.6	3.6	2
Heavy Heavy Duty Gas Trucks (Hhdv)	8	2.6	1.9	0.8	0.4
Light Heavy Duty Diesel Trucks - 1 (Lhdv1)	0.7	3.2	4	3.3	2.7
Light Heavy Duty Diesel Trucks - 2 (Lhdv2)	0.7	0.9	0.9	0.8	0.7
Medium Heavy Duty Diesel Trucks (Mhdv)	8	7.9	5.1	2.8	1.8
Heavy Heavy Duty Diesel Trucks (Hhdv)	37.1	38.6	23.7	13.8	14.3
Motorcycles (Mcy)	48.5	48.4	41.5	31.6	31.1
Heavy Duty Diesel Urban Buses (Ub)	1.5	1.4	1.3	1.2	1.1
Heavy Duty Gas Urban Buses (Ub)	1.8	1.3	1.1	0.9	0.9
School Buses - Gas (Sbg)	1.5	1.1	0.7	0.5	0.3
School Buses - Diesel (Sbd)	0.8	0.7	0.5	0.1	0.1
Other Buses - Gas (Obg)	2.2	2.2	1.5	1.1	0.9
Other Buses - Motor Coach - Diesel (Obc)	0.6	0.6	0.4	0.2	0.2
All Other Buses - Diesel (Obd)	0.5	0.5	0.3	0.1	0.1
Motor Homes (Mh)	8.3	3.8	2.5	1.5	0.9
Aircraft	26.5	26.2	27.8	30.3	33.8
Trains	11.5	12.2	8.3	7.6	6.1
Ships And Commercial Boats	0	0	0	0	0
Ocean Going Vessels	6.9	8.8	8.3	11.2	14.5
Commercial Harbor Craft	5.3	5.1	4.8	4.3	4.2
Recreational Boats	143.8	126.5	107.1	87.5	72.4
Off-Road Recreational Vehicles	30.1	39.8	36.6	32.2	31.5
Off-Road Equipment	195.4	177.4	132.3	110.9	100.1
Farm Equipment	30.1	26.2	20.7	14.9	10.7
Fuel Storage And Handling	50.3	35.7	20.5	14.9	12.3
Total (TPD)	**2902.3**	**2261.6**	**1943.2**	**1624.1**	**1560.9**

PM2.5 Emissions (TPD)

Statewide	2000	2005	2010	2015	2020
Electric Utilities	6.9	5.6	5.1	4.8	5
Cogeneration	3.7	2.9	3	2.6	3.2
Oil And Gas Production (Combustion)	1.9	1.8	2.1	1.9	1.7
Petroleum Refining (Combustion)	4	3.4	3.4	1.8	1.8
Manufacturing And Industrial	8.9	5.9	5.9	4.8	4.8
Food And Agricultural Processing	2.4	2.2	1.7	1.3	1.1
Service And Commercial	5.1	3.9	4.8	4.5	4.7
Other (Fuel Combustion)	4.6	3.6	0.7	0.6	0.5
Sewage Treatment	0	0	0	0	0
Landfills	0.3	3.1	0.3	0.5	0.5
Incinerators	0.1	0.3	0.2	0.1	0.1
Soil Remediation	0	0	0	0	0
Other (Waste Disposal)	0.1	0.1	0	0	0.1
Laundering	0	0	0	0	0
Degreasing	0	0	0	0.1	0.1
Coatings And Related Process Solvents	1.1	1.8	1.7	1.8	2
Printing	0	0.2	0.2	0.2	0.2
Adhesives And Sealants	0	0	0	0	0
Other (Cleaning And Surface Coatings)	0	0	0.1	0.8	0.8
Oil And Gas Production	0.1	0.1	0	0	0
Petroleum Refining	2	3.3	3	1.5	1.5
Petroleum Marketing	0.1	0	0	0	0
Other (Petroleum Production And Marketing)	0	0	0	0	0
Chemical	3.1	1.9	1.6	1	1.1
Food And Agriculture	4	3.6	3.3	3.5	3.9
Mineral Processes	24.1	26.1	22.7	22.9	24.8
Metal Processes	1	0.8	0.7	0.4	0.4
Wood And Paper	9.5	9.1	6.6	7.3	8.1
Glass And Related Products	1.4	1.8	0.6	0.5	0.5
Electronics	0	0	0	0	0
Other (Industrial Processes)	7.4	9.2	13.9	1.5	1.7
Consumer Products	0	0	0	0	0
Architectural Coatings And Related Process Solvents	0	0	0	0	0
Pesticides/Fertilizers	0	0	0	0	0
Asphalt Paving / Roofing	0	0	0	0	0
Residential Fuel Combustion	96	71.2	56.4	55.5	55.5
Farming Operations	28.5	21.8	21.4	21.1	20.9
Construction And Demolition	15.4	15.3	16.2	17.9	20.3

PM2.5 Emissions (TPD) (continued)

Statewide	2000	2005	2010	2015	2020
Paved Road Dust	23.9	24.3	26.1	24.8	25.4
Unpaved Road Dust	27.8	27.9	25.5	27.1	27.1
Fugitive Windblown Dust	175.3	67.2	49	48.8	48.5
Structural and Automobile Fires	1	1.1	1.1	1.1	1.2
Managed Burning And Disposal	51.4	53.7	50.6	50.4	50.3
Cooking	25.8	26.5	28.1	29.8	31.6
Other (Miscellaneous Processes)	0.3	0.3	0.3	0.3	0.3
Light Duty Passenger (Lda)	15.5	12.3	11.4	11	11.2
Light Duty Trucks - 1 (Ldt1)	3.5	1.9	1.7	1.6	1.5
Light Duty Trucks - 2 (Ldt2)	5.3	4.4	4.1	4	4.1
Medium Duty Trucks (Mdv)	2	3.5	3.4	3.3	3.4
Light Heavy Duty Gas Trucks - 1 (Lhdv1)	0.3	0.7	0.7	0.7	0.7
Light Heavy Duty Gas Trucks - 2 (Lhdv2)	0.1	0.1	0.1	0.1	0.1
Medium Heavy Duty Gas Trucks (Mhdv)	0.1	0.1	0.1	0.1	0.1
Heavy Heavy Duty Gas Trucks (Hhdv)	0	0	0	0	0
Light Heavy Duty Diesel Trucks - 1 (Lhdv1)	0.4	1.3	1.5	1.3	1.1
Light Heavy Duty Diesel Trucks - 2 (Lhdv2)	0.4	0.4	0.4	0.4	0.3
Medium Heavy Duty Diesel Trucks (Mhdv)	6.3	6.4	4.2	2.4	1.6
Heavy Heavy Duty Diesel Trucks (Hhdv)	23.7	24.6	17.4	6.2	5.5
Motorcycles (Mcy)	0.1	0.1	0.1	0.1	0.1
Heavy Duty Diesel Urban Buses (Ub)	1.4	1.2	1.2	1.2	1.2
Heavy Duty Gas Urban Buses (Ub)	0	0	0	0	0
School Buses - Gas (Sbg)	0	0	0	0	0
School Buses - Diesel (Sbd)	0.7	0.6	0.5	0.2	0.2
Other Buses - Gas (Obg)	0	0	0	0	0
Other Buses - Motor Coach - Diesel (Obc)	0.4	0.4	0.3	0.1	0.1
All Other Buses - Diesel (Obd)	0.4	0.4	0.2	0.1	0.1
Motor Homes (Mh)	0.2	0.2	0.2	0.1	0.1
Aircraft	7.8	7.5	7.7	8.2	8.9
Trains	4.2	4.4	2.7	2.9	2.5
Ships And Commercial Boats	0	0	0	0	0
Ocean Going Vessels	15.2	19.5	7.1	4.1	5.3
Commercial Harbor Craft	3.4	3.1	2.6	1.7	1.2
Recreational Boats	6.2	5.9	4.9	4	3.3
Off-Road Recreational Vehicles	0.2	0.3	0.3	0.3	0.3
Off-Road Equipment	16.9	16.9	11.7	10	7.8
Farm Equipment	8.5	7.6	6.1	4.5	3.3
Fuel Storage And Handling	0	0	0	0	0
Total (TPD)	**660.4**	**523.8**	**446.9**	**409.8**	**413.7**

Appendix C

Deciview Record (2000-2012)

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Table C-1
Worst Days Deciview Record*

IMPROVE Monitor	Baseline Average (2000-2004)	2005	2006	2007	2008	2009	2010	2011	2012**	2018 RPGs
TRIN*	17.4	na	19.7	13.9	23.1	12.7	12.4	13.9	17.1	**16.4**
LABE	15.1	13.5	14.4	12.2	16.9	13.9	10.4	11.7	15.9	**14.4**
LAVO	14.1	12.4	14.1	14.1	22.4	17.1	12.8	11.7	14.3	**13.3**
BLIS	12.6	12.0	12.5	14.8	16.8	12.0	10.0	11.2	11.0	**12.3**
HOOV	12.9	10.4	10.5	12.6	15.5	12.0	8.8	8.6	9.8	**12.5**
YOSE	17.6	15.7	15.9	17.7	18.6	16.5	12.8	14.4	13.9	**16.7**
KAIS*	15.5	15.2	na	16.2	17.4	14.1	13.1	13.7	12.8	**14.9**
SEQU	25.4	23.1	23.4	24.7	24.7	21.0	20.1	21.2	20.6	**22.7**
DOME*	19.4	na	na	20.9	19.3	17.6	16.7	17.1	17.0	**18.1**
REDW*	18.5	18.1	20.8	18.2	19.8	18.9	na	17.2	16.5	**17.8**
PORE	22.8	22.3	22.0	22.4	22.1	21.3	22	20.2	20.1	**21.3**
PINN	18.5	18.1	17.9	18.3	19.8	17.8	15.1	16.4	15.6	**16.7**
RAFA	18.8	18.3	20.2	20.6	19.6	17	16.6	16.5	15.7	**17.3**
SAGA*	19.9	19.5	17.4	17.4	17.9	na	na	na	14.3	**17.4**
SAGO	22.2	21.5	19.9	21.5	20.2	19.2	16.7	15.9	16.1	**19.9**
AGTI*	23.5	21.2	na	22.0	21.0	19.4	18.4	18.1	17.8	**21.6**
JOSH	19.6	19.4	18.1	18.1	16.7	16.8	14.7	14.2	14.9	**17.9**

Table C-2
Best Days Deciview Record*

IMPROVE Monitor	Baseline Average (2000-2004)	2005	2006	2007	2008	2009	2010	2011	2012**
TRIN*	3.4	na	2.1	3.9	4.0	2.6	1.9	2.8	2.2
LABE	3.2	2.9	2.4	3.6	2.6	2.5	2.5	3.1	2.3
LAVO	2.7	2.5	2.2	2.9	2.8	2.4	1.6	2.1	1.8
BLIS	2.5	2.1	2.0	2.7	2.2	1.9	1.6	2.1	1.5
HOOV	1.4	1.1	1.3	1.7	1.2	1.1	0.9	1.3	0.9
YOSE	3.4	3.2	3.4	3.9	2.0	2.3	1.8	2.7	2.8
KAIS*	2.3	1.2	na	1.8	1.4	1.8	1.1	1.5	1.0
SEQU	8.8	7.2	7.7	9.2	9.3	6.2	5.7	7.5	6.8
DOME*	5.1	na	na	5.7	4.9	4.8	3.9	5.6	3.7
REDW*	6.1	5.7	5.9	6.0	5.4	4.9	na	6.7	4.7
PORE	10.5	9.8	9.6	8.9	9.5	7.8	8.0	8.8	6.9
PINN	8.9	8.0	7.9	8.5	8.4	7.2	7.2	7.6	7.0
RAFA	6.4	5.0	5.2	6.8	5.9	4.6	4.2	4.5	4.3
SAGA*	4.8	4.3	4.4	5.4	3.7	na	na	na	2.7
SAGO	5.4	4.1	5.0	5.5	4.4	3.6	3.0	3.3	3.5
AGTI*	9.6	6.9	na	9.0	7.5	6.3	6.8	6.0	6.7
JOSH	6.1	5.5	5.7	5.7	5.1	4.4	4.5	4.3	4.2

* *Complete data was not available for the years marked "na."*

** *Data made available February 28, 2014 is outside the Mid-Course Review time frame but is shown here for continuity, and to illustrate further progress.*

Table C-3
Statewide 2018 Reasonable Progress Goal Summary using 2012 Data

IMPROVE Monitor	California Class I Area(s)	Best Days Baseline (dv)	Best Days (2008-2012) (dv)	Visibility Change (dv)	Worst Days Baseline (dv)	Worst Days (2008-2012) (dv)	Visibility Change (dv)	2018 RPG (dv)	Progress to 2018 RPG by 2012
NORTHERN CALIFORNIA									
TRIN	Marble Mountain W. Yolla Bolly-Middle Eel W.	3.4	2.7	0.7	17.4	15.8	1.6	**16.4**	160%
LABE	Lava Beds N.M. South Warner W.	3.2	2.6	0.6	15.1	13.7	1.4	**14.4**	200%
LAVO	Lassen Volcanic N.P. Caribou W. Thousand Lakes W.	2.7	2.1	0.6	14.1	15.6	-1.5	**13.3**	-188%
SIERRA CALIFORNIA									
BLIS	Desolation W. Mokelumne W.	2.5	1.9	0.6	12.6	12.2	0.4	**12.3**	133%
HOOV	Hoover W.	1.4	1.1	0.3	12.9	10.9	2	**12.5**	500%
YOSE	Yosemite N.P. Emigrant W.	3.4	2.3	1.1	17.6	15.2	2.4	**16.7**	267%
KAIS	Ansel Adams W. Kaiser W. John Muir W.	2.3	1.4	0.9	15.5	14.2	1.3	**14.9**	217%
SEQU	Sequoia N.P. Kings Canyon N.P.	8.8	7.1	1.7	25.4	21.5	3.9	**22.7**	144%
DOME	Dome Lands W.	5.1	4.6	0.5	19.4	17.5	1.9	**18.1**	146%
COASTAL CALIFORNIA									
REDW	Redwood N.P.	6.1	5.4	0.7	18.5	18.1 *(missing 2010)*	0.4	**17.8**	57%
PORE	Point Reyes N.S.	10.5	8.2	2.3	22.8	21.2	1.6	**21.3**	107%
PINN	Pinnacles W. Ventana W.	8.9	7.5	1.4	18.5	16.9	1.6	**16.7**	89%
RAFA	San Rafael W.	6.4	4.7	1.7	18.8	17.1	1.7	**17.3**	113%
SOUTHERN CALIFORNIA									
SAGA	San Gabriel W. Cucamonga W.	4.8	3.2	1.6	19.9	16.1 *(2008,2012 only)*	3.8	**17.4**	152%
SAGO	San Gorgonio W. San Jacinto W.	5.4	3.6	1.8	22.2	17.6	4.6	**19.9**	200%
AGTI	Agua Tibia W.	9.6	6.7	2.9	23.5	18.9	4.6	**21.6**	242%
JOSH	Joshua Tree N.P.	6.1	4.5	1.6	19.6	15.4	4.2	**17.9**	247%

W = Wilderness N.M. = National Monument N.P. = National Park N.S. = National Seashore

Appendix D

Technical Analyses of Factors Impeding Progress

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Purpose of Focused Technical Analysis

The annual deciview levels in California are trending downward over the long-term, as measured by the IMPROVE monitors, indicating diminishing light extinction from haze-causing pollutants in ambient air. Episodic events, such as wildfires and dust storms, cause short-term increases in the concentrations of these pollutants. These events are predominately natural in origin, but can be significant. Some of the episodic wildfire emissions are substantial enough to skew an annual average, and influence the five-year average trend. There are other activities, beyond the regulatory jurisdiction of the State of California, which also influence the deciview levels at some sites. The following Case Studies analyze the data from three monitoring sites to explain how these events and activities impede short-term progress in otherwise long-term visibility improvements.

ARB examined five-year deciview average trends at the IMPROVE monitors representing California's Class 1 Areas and selected the three IMPROVE monitors that did not show short-term progress in the reporting period ending with 2011 IMPROVE monitoring data. Individually, the BLIS, LAVO, and REDW monitors have collected data for over twenty years and show long-term visibility improvements. The ARB emissions inventory shows continuous reductions in emissions from the RH Plan control strategy, which should assure improved visibility. Closer examination of the monitoring data comprising the five-year averages through 2011, shows how reasonable progress from the reductions in anthropogenic emissions within California's jurisdiction is sometimes masked by uncontrollable factors. These uncontrollable factors are pollution from natural events and man-made emissions beyond the regulatory jurisdiction of individual states.

IMPROVE monitoring data for 2012 was posted to the WRAP-TSS website, on February 28, 2014. See http://vista.cira.colostate.edu/tss/Results/HazePlanning.aspx to use the interactive Haze Planning tool and view the monitoring data and recent five-year deciview averages.

Case Study: BLIS

Wildfire Impacts

Organic carbon (OMC) is the primary driver of haze on Worst Days at BLIS. Figure D-1 shows that in every year in the past decade, except 2010, OMC has contributed more than any other species to light extinction on Worst Days. The years with higher OMC extinction correlate with wildfire smoke impacts. Notably, in 2010, when no significant wildfires affected BLIS, the OMC contribution to extinction was less than natural Rayleigh gas scattering. Rayleigh scattering consists mainly of light scattering from atmospheric gases that are smaller in diameter than the wavelength of incoming light. Additional light scattering and light absorption by larger particulate matter are what adds to haze. Gaps in data in 2004 meant that neither Best nor Worst Days averages could be calculated that year.

Figure D-1
Species Driving Light Extinction at BLIS on Worst Days

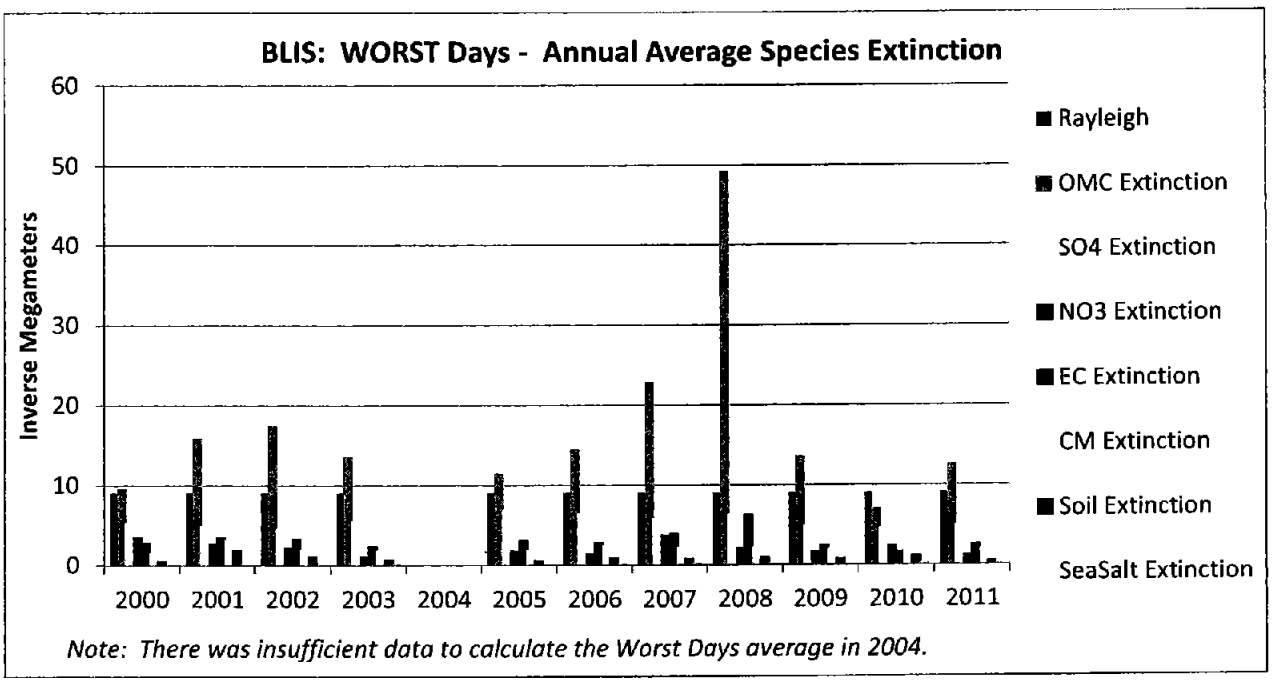


Figure D-2 shows the relationship between OMC light extinction and deciview for each sampling day at BLIS since 1990. Although there are wildfire impact days in almost every year in the past decade, the magnitude of natural wildfire smoke impacts at BLIS is most obvious in 2008. Fifty-seven named wildfires were burning at the same time in California, consuming more than one million acres of primarily forested natural areas. The American River Complex wildfire (20,500 acres) was the largest of the six named fires within 50 miles of the BLIS monitor during June through August. Figure D-2 shows that in 2008, daily OMC extinction and deciview levels reached the highest levels in 21

years of recordkeeping at BLIS. The five worst deciview days in 2008 had OMC extinction values 5-33 times the average levels for that time of year. Those five days alone caused a 3.0 deciview increase in the Worst Days annual average for 2008.

Figure D-2
Historical Record of OMC Extinction and Deciview Levels at BLIS

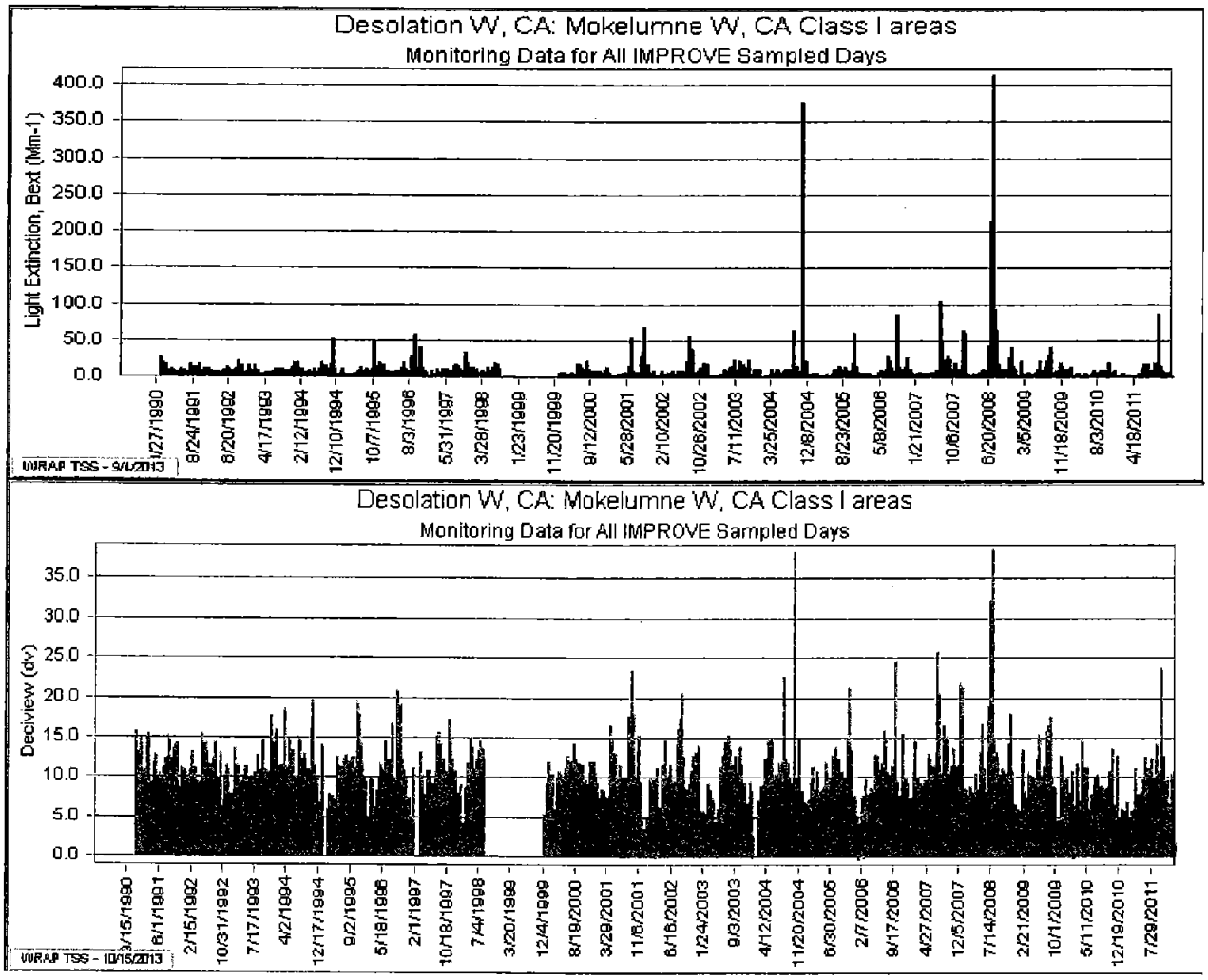


Table D-1 shows how the Worst Days annual averages pattern for OMC light extinction (green column) corresponds with that for deciviews (last column) in the past decade. The slopes of the trend lines from 2000-2011, for each species contribution, are shown on the bottom line. The slopes indicate that almost all species are trending downward in their contribution to light extinction (haze) since 2000. The increasing trend in light extinction due to sea salt was not analyzed further because its contribution to light extinction is negligible, and the source is natural. Elemental carbon (EC) is occasionally elevated from wildfire smoke, but the annual average Worst Days EC extinction level is decreasing over the long term due to the strict regulation of diesel-fuel combustion emissions, which also generate EC. The dramatic decrease in nitrate extinction is

attributed to NOx source controls. The high OMC light extinction in 2008 correlates with the Lightning Strike Complex Fires.

Table D-1
Annual Averages for Worst Days
Light Extinction (in Inverse Megameters) and Deciviews at BLIS

Year*	Sulfate Extinction	Nitrate Extinction	Organic Carbon Extinction	Elemental Carbon Extinction	Fine Soil Extinction	Coarse Mass Extinction	Sea Salt Extinction	Rayleigh Gas Extinction	Deciview
2000	5.29	3.55	9.5	2.8	0.47	1.51	0	9	11.6
2001	4.91	2.74	15.78	3.48	1.91	3.21	0.01	9	13.4
2002	4.56	2.15	17.36	3.26	1.04	1.91	0	9	13.4
2003	5.54	1.06	13.57	2.42	0.62	1.78	0.06	9	12.2
2005	6.79	1.77	11.4	3.12	0.51	1.86	0.03	9	12
2006	6.34	1.38	14.42	2.81	0.86	2.42	0.05	9	12.5
2007	5.79	3.67	22.75	3.88	0.77	2.17	0.11	9	14.8
2008	6.3	2.08	49.24	6.29	0.94	2.25	0.08	9	16.8
2009	4.86	1.69	13.54	2.42	0.69	1.97	0.07	9	12
2010	4.52	2.31	7	1.58	1.09	2.13	0.09	9	10
2011	4.89	1.19	12.51	2.49	0.4	1.99	0.18	9	11.2
SLOPE	***-0.01***	***-0.09***	[illegible]	***-0.02***	***-0.03***	***-0.003***	***0.01***	***constant***	***-0.05***

**Insufficient sampling points for calculating Worst Days averages for 2004.*

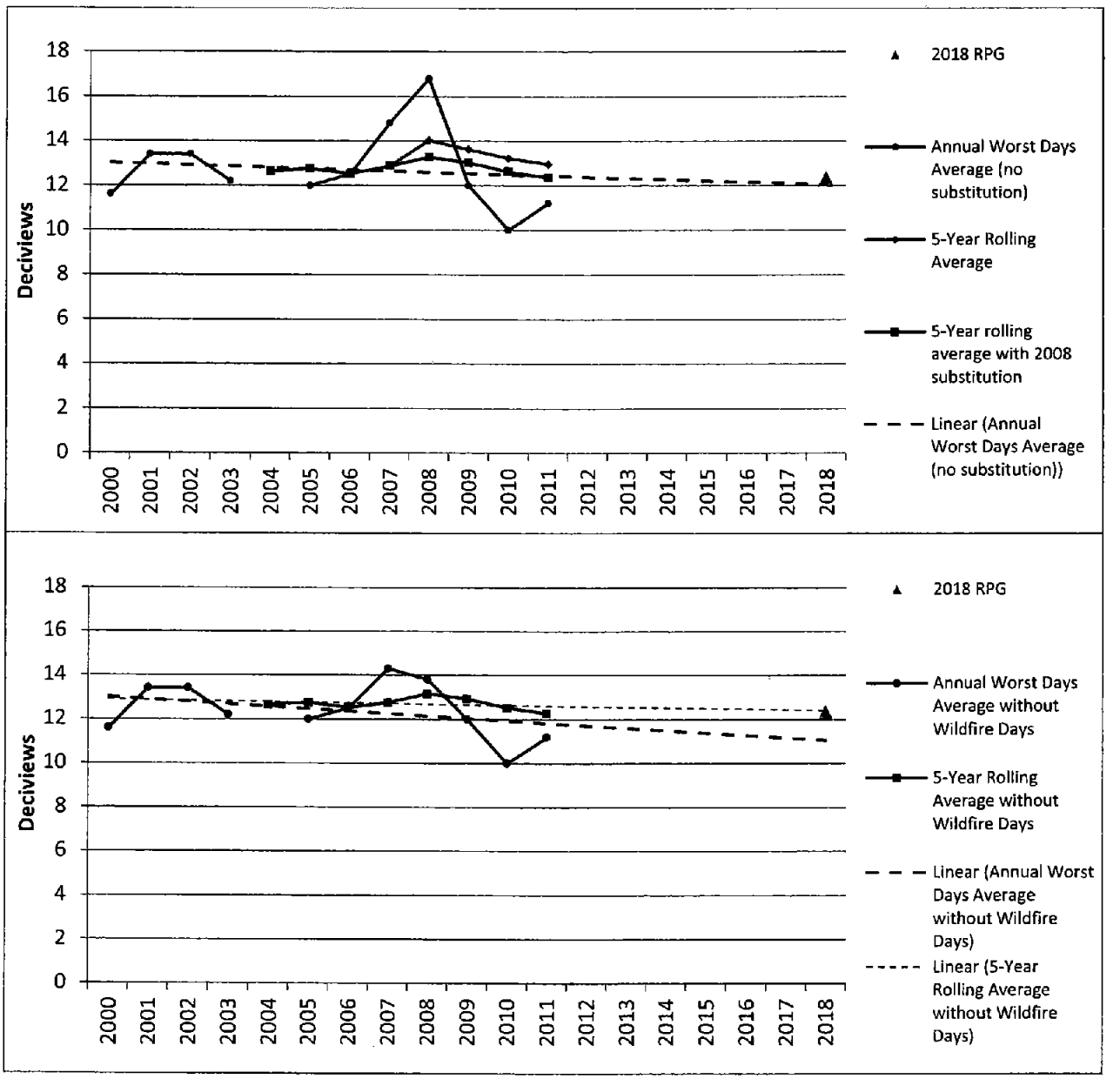
Although the annual Worst Days deciview average trends downwards, further analysis shows that elevated OMC extinction on Worst Days in 2008 subsequently impeded the rate of progress measured by the 5-year rolling average. If the top five Worst Days occurring during the Lightning Strike Complex Fires are excluded, recalculation of the 2008 OMC light extinction average becomes 17.0 inverse megameters, and the slope of the trendline for OMC becomes -0.01 (decreasing trend.) If those same top five Worst Days are not included in the Worst Days annual average by deciviews, the 2008 deciview level would be 13.8 dv. As shown in Table D-2, the 5-year rolling average changes to a decreasing trendline.

Table D-2
BLIS without Wildfire Days

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Slope
Deciview	11.6	13.4	13.4	12.2		12	12.5	14.8	16.8	12	10	11.2	**-0.05**
5-year Rolling Average					12.7	12.8	12.5	12.9	14.0	13.6	13.2	13.0	**0.11**
Recalculated 2008 Deciview	11.6	13.4	13.4	12.2		12	12.5	14.8	13.8	12	10	11.2	**-0.10**
Recalculated 5-year Rolling Average					12.7	12.8	12.5	12.9	13.3	13.0	12.6	12.4	**-0.01**

Annual deciview values and the forecast trendlines to 2018 (dashed line) are plotted in Figure D-3 to show progress to the 2018 RPG. The trendlines are regression lines that display a straight-line trend based on available data. While they cannot forecast a long-term glide path, they illustrate the sensitivity of trends to single point changes. The top graph shows how the 5-year rolling average for Worst Days would change with the substitutions made for 2008. In the absence of large wildfire impacts, visibility at BLIS is improving, even though the 2008 data dampens progress for the 5-year rolling average from 2008 through 2011. Wildfire smoke also led to several Worst Days in 2007 at BLIS. If those days are also removed from annual average calculations, the rolling averages for 2007 through 2011 improve even more, as shown in the lower graph.

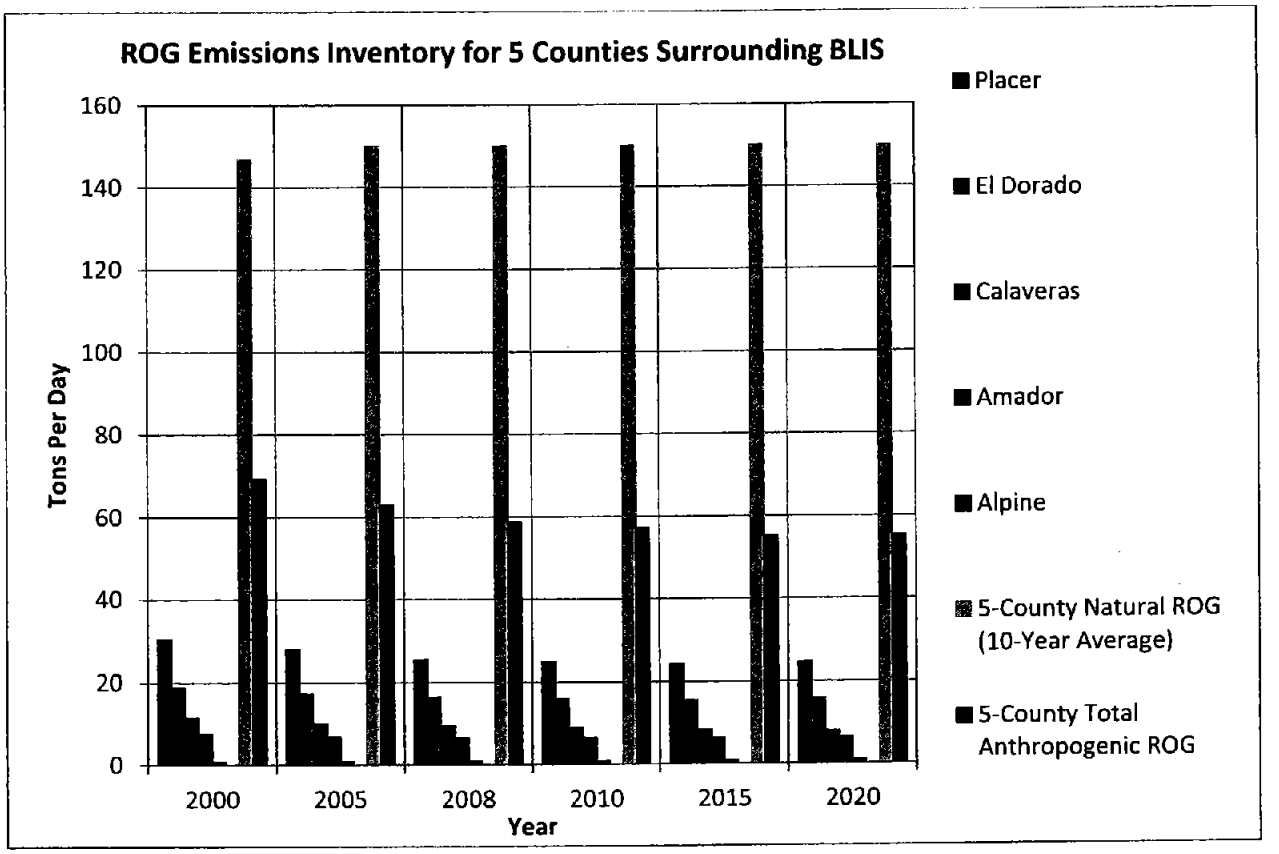
Figure D-3
BLIS: Worst Days Averages with Wildfire Adjustments



The BLIS monitor is located in El Dorado County. It represents the Desolation Wilderness in Placer and El Dorado Counties and the Mokelumne Wilderness in Alpine, Amador and Calaveras counties. A quick examination of the emissions inventories for these surrounding counties further illustrates the impact of wildfires. Total organic gas (TOG) emissions are used as a surrogate for OMC because they include the building blocks for organic aerosol molecules, in the absence of a precise inventory of directly emitted organic aerosols.

The local emissions inventory of Reactive Organic Gases (ROG) from anthropogenic sources in these counties is decreasing. The 10-year average of natural ROG sources (predominately from biogenic emissions) is included for comparison. Emissions from natural sources make up more than 50 percent of the ROG inventory. Figure D-4 shows that despite natural source emissions, anthropogenic source control strategies are effectively reducing precursor emissions. The summary result is that the annual Worst Days deciview average at BLIS is trending downward, despite the progress impeded by the impacts of uncontrollable sources on visibility.

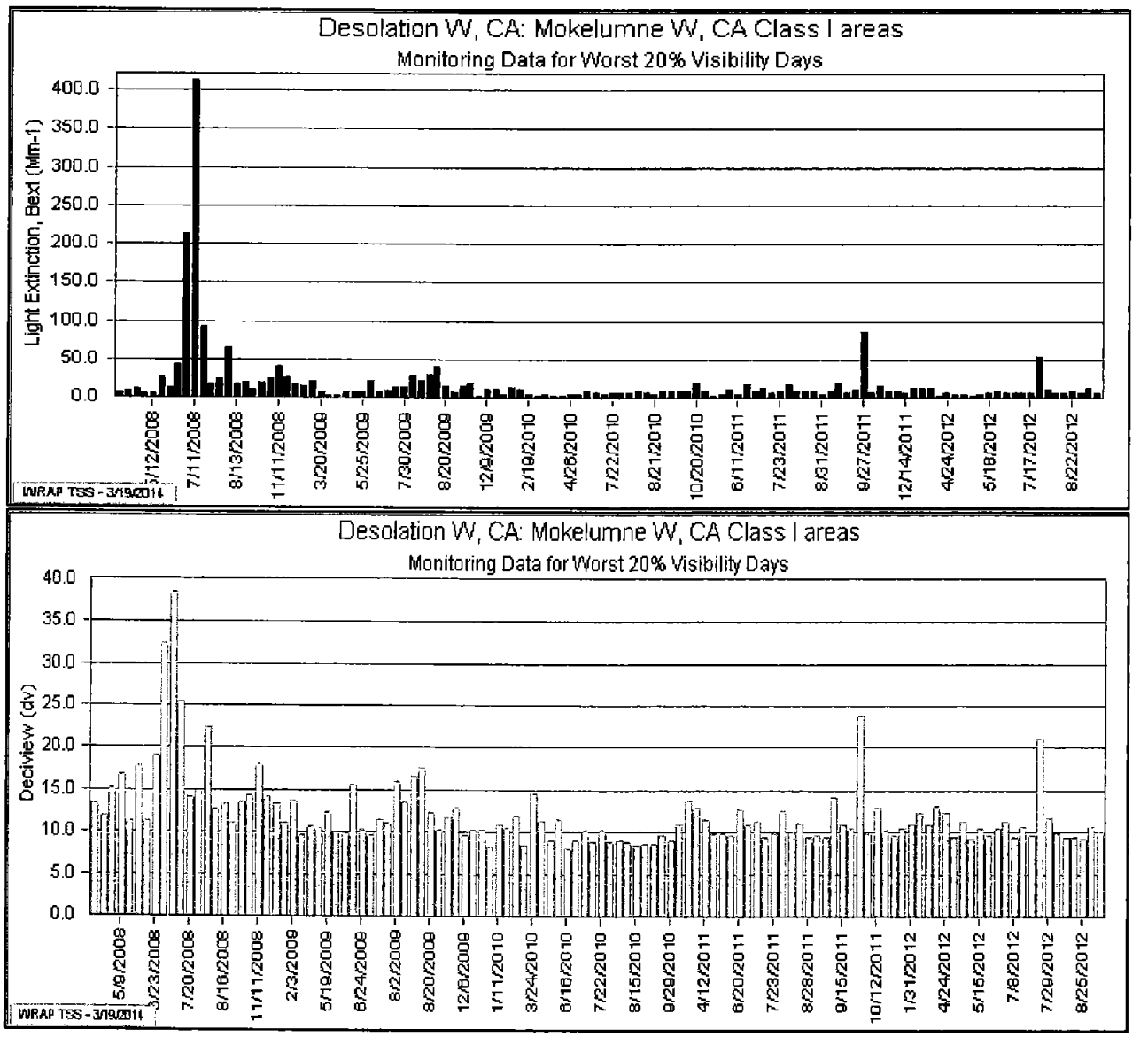
Figure D-4
Local Inventory Changes Over Time



Impact of 2012 data for BLIS

The 2012 Worst Days deciview average for BLIS is 11.0 dv. The five-year Worst Days Rolling Average for the years 2008-2012 at BLIS is 12.2 dv. Both of these deciview values are below 12.3 dv, the 2018 RPG for BLIS. The years after 2008 were low wildfire impact years at BLIS, as indicated by the OC extinction levels on the Worst Days from 2008 through 2012, shown below in Figure D-5. The single high OMC extinction days in 2011 and 2012 contribute to high deciview days, but the remaining days have deciview levels slightly lower than those prior to 2008, shown in Figure D-2.

Figure D-5
Recent OMC Extinction and Deciview Levels at BLIS on Worst Days (2008-2012)

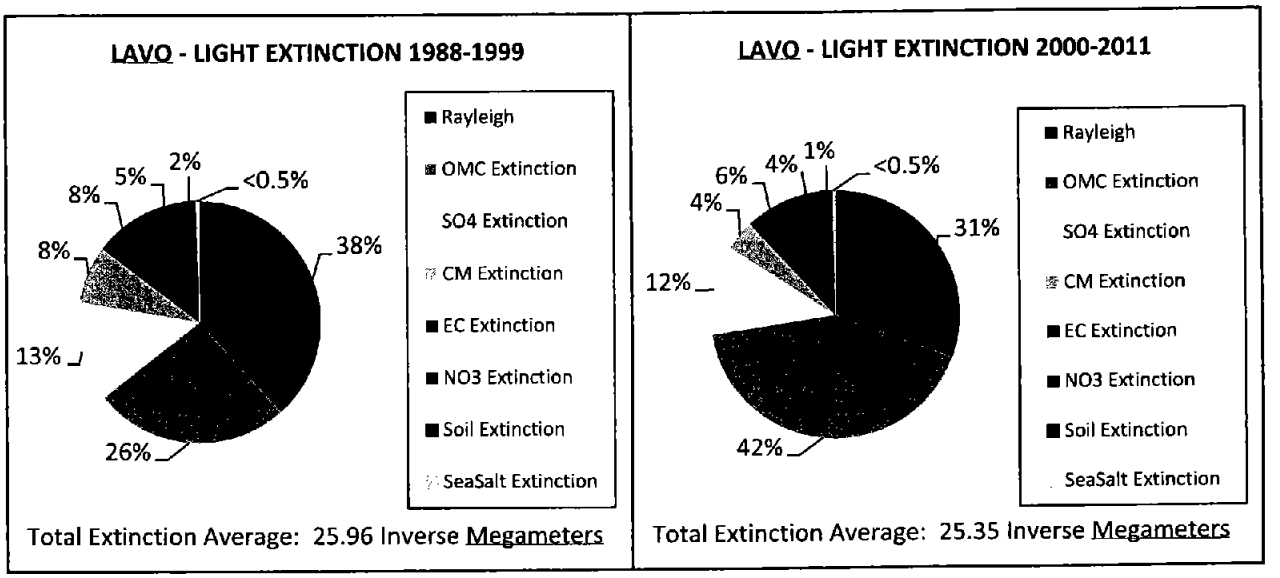


Case Study: LAVO

Wildfire Impacts

Data has been collected at the LAVO monitoring site since 1988. Comparing pre-2000 data for all sampling days with that from 2000-2011 shows that OMC contributions to total light extinction increased 60 percent while other contributions decreased slightly on average. The net effect is a very slight decrease in the decadal deciview average, for all monitored days. Figure D-6 shows light extinction for all sampling days over two decades. The Best Days annual average is improving, as is the average for all Sampling Days. The following analysis shows that wildfire smoke, rather than anthropogenic sources, are skewing long-term progress on Worst Days.

Figure D-6
Changes in Light Extinction at LAVO – All Sampling Days

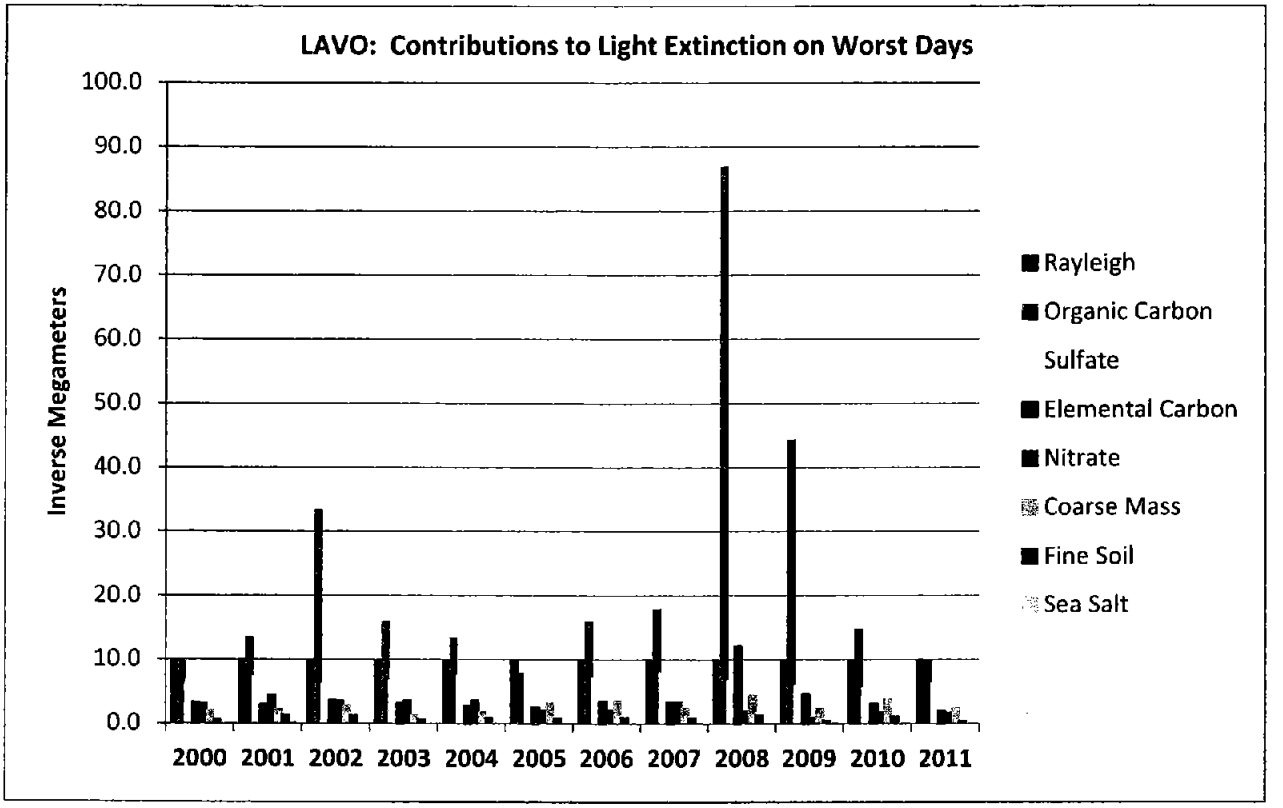


Wildfire Smoke and OMC Extinction

Worst Days occur most frequently June through September at LAVO. Elevated organic mass extinction tracks with the occurrence of Worst Days. OMC extinction at LAVO can be about 40 percent of total extinction on Worst Days. No Best Days occurred in July or August from 2000 through 2011, when organic mass extinction contributions are normally at their highest. The fire season begins in May or June and can run through November, depending on moisture conditions. There are almost no residences having the potential to generate woodsmoke near LAVO, which is why there is very low organic matter extinction in winter months. This pattern is the basis for suggesting that wildfire smoke alone can skew the annual deciview levels and mask progress in reducing anthropogenic emissions.

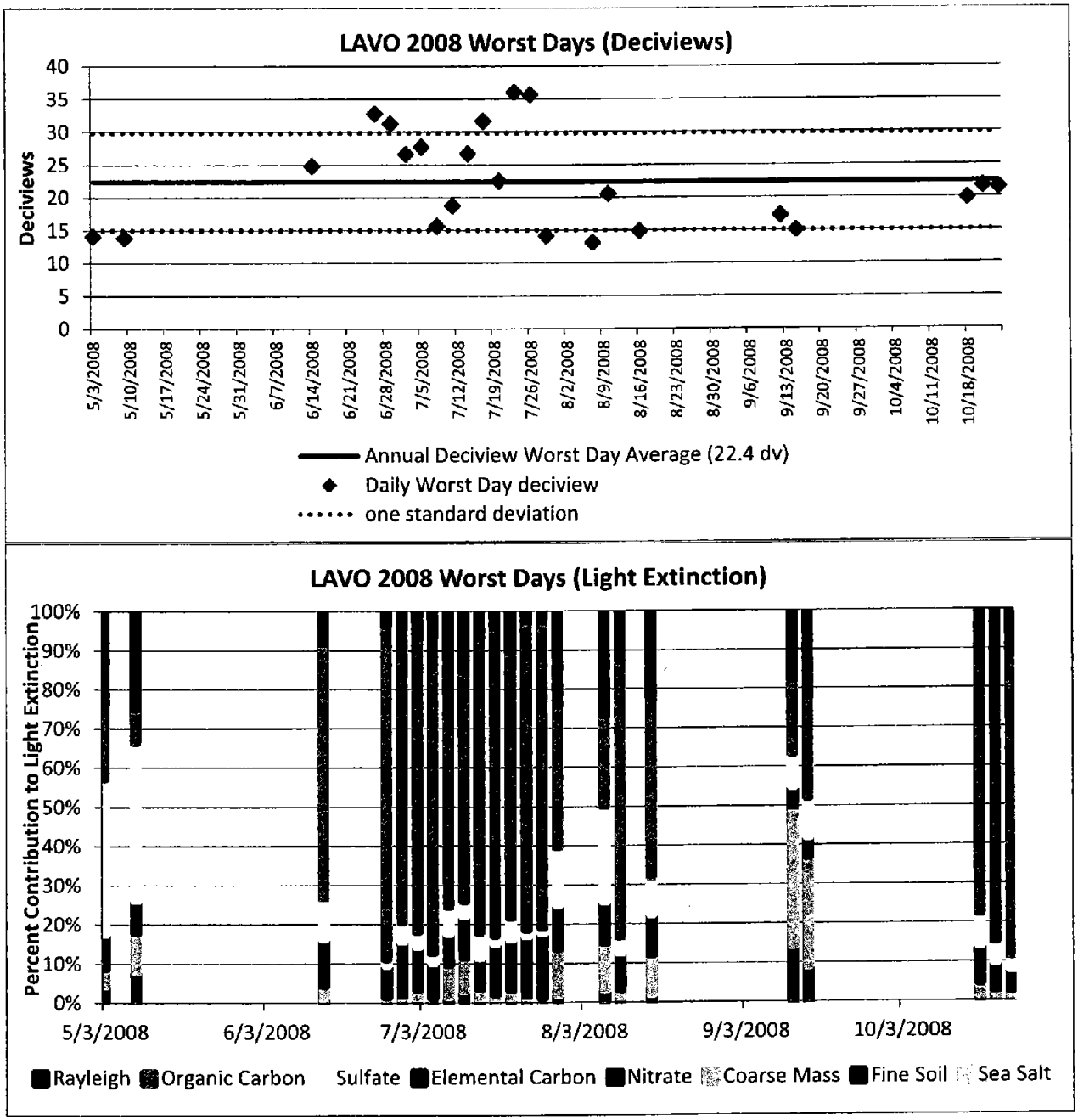
The long-term Worst Days deciview average for 1989 through 2011 is 14.3 dv, higher than the 2000-2004 baseline average of 14.1 dv. In the recent years of 2002, 2008, and 2009, both averages were exceeded. In those specific years, large wildfires occurred in southern Oregon or northern California with wildfire smoke impacting the monitor. Every other year since 2000 was equal to or below the baseline Worst Day average (14.1dv.) Figure D-7 shows the particle species and Rayleigh contribution to light extinction on Worst Days since 2000, demonstrating the influence of OMC contributions to haze.

Figure D-7
Relative Contributions to Total Light Extinction at LAVO



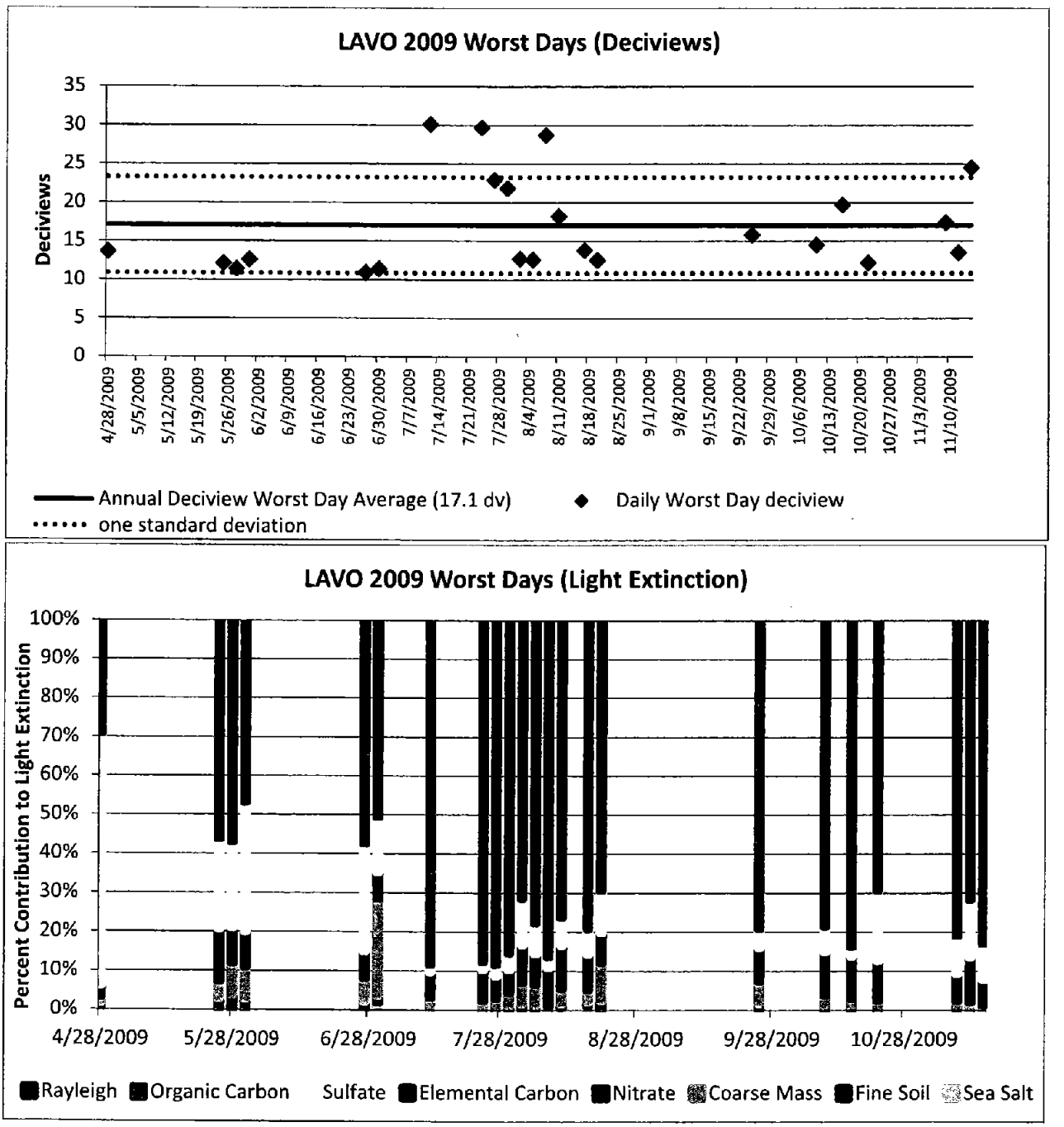
The charts in Figure D-8 compare the Worst Days deciview levels for 2008 with the contributions to light extinction on those days. The highest deciview values correlate with the highest OMC contributions to light extinction, and coincide with the timing of the 2008 Lightning Strike Complex fires. There is a 23-deciview spread between the minimum and maximum values for Worst Days in 2008, with the two highest values almost two standard deviations from the average. OMC has the highest contribution to light extinction in every Worst Day above the Worst Day annual average, evidence of its strength in controlling the twenty percent Worst Days average.

Figure D-8
Comparison of Deciview Value and Causes of Light Extinction (2008)



Several very high deciview days also occur in 2009. Two in July are more than two standard deviations from the average. They correspond with high OMC extinction days, as shown in Figure D-9. At that time, there were several wildfires close to the southeastern corner of Shasta County, where the LAVO monitor is located, as shown in Figure D-10. As with 2008, all of the days above the annual average for Worst Days were driven by elevated OMC.

Figure D-9
Comparison of Deciview Value and Causes of Light Extinction (2009)



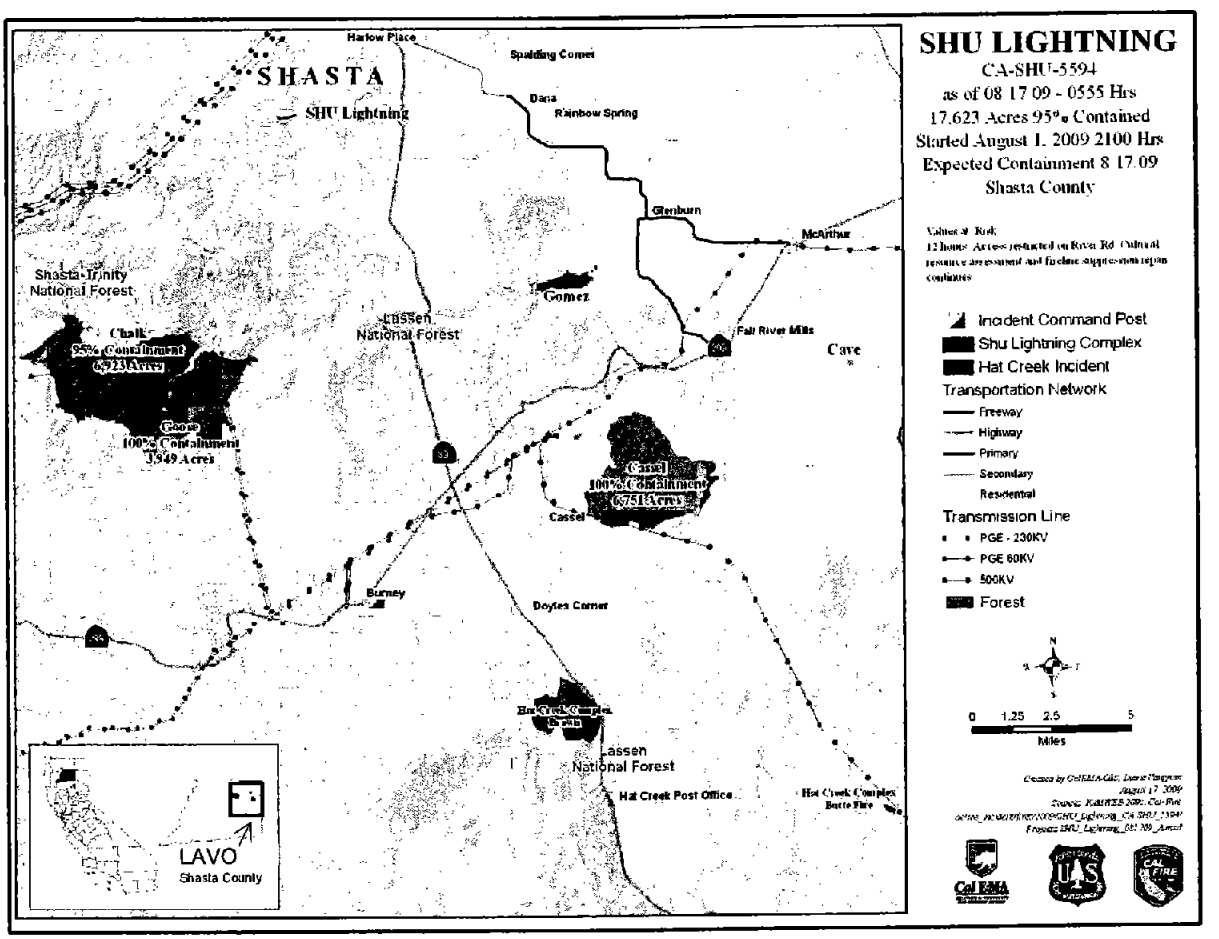
The Table D-3 lists the dates of wildfires in counties close to LAVO, to compare with deciview levels at the same time. There is fluctuation in the monitor values over the

several weeks of active and smoldering fires, as the wind shifts and alters the tracks of smoke plumes.[11]

Table D-3
Large Wildfires (>500 acres)

Year	Fire Name	Location & Acreage	Dates
2008	*Lightning Strike Complex*	*See Figure 8*	*6/22 through 8/11/2008*
2009	*Backbone*	*Trinity Alps/Trinity County*	*7/7/09*
2009	*Tennant*	*Macdoel/Siskiyou County*	*7/19/09*
2009	*Dodge Complex SHU Lightning*	*Lassen County, 1,601 acres Shasta County, 17,623 acres*	*8/1 through 8/18, 2009*
2009	*Hat Creek Complex*	*Lassen/Shasta Counties, 11,269 acres*	*8/1 through 8/26, 2009*
2009	*Day*	*Lassen County*	*8/27/09*
2009	*Silver*	*Meadow Valley/Plumas County*	*9/19/09*

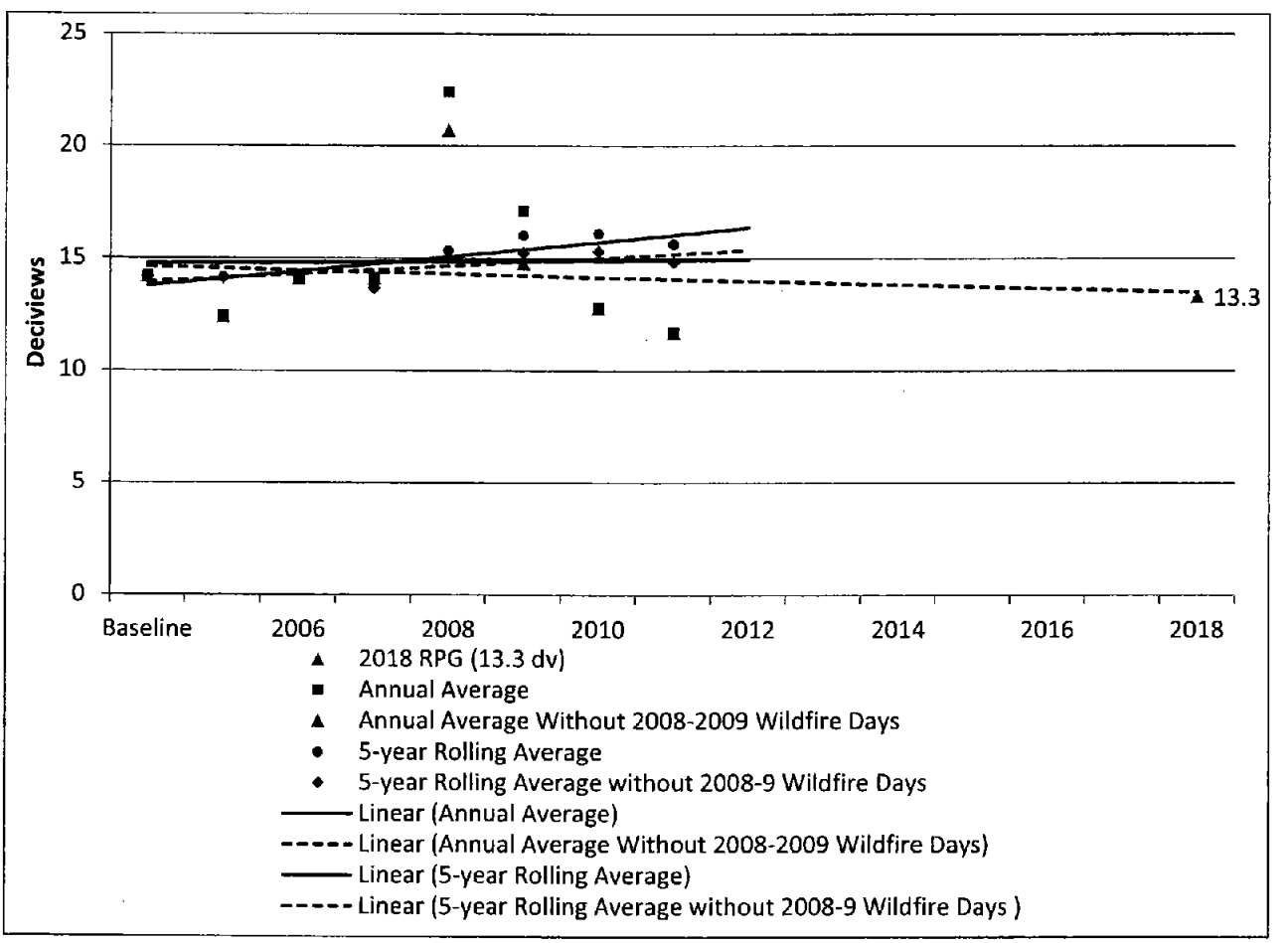
Figure D-10
Location of 2008 Wildfires near LAVO



[11] http://www.arb.ca.gov/smp/wildfire/wildfire.htm

There is a ten-deciview spread between the highest (22.4 dv in 2008) and lowest (11.7dv in 2011) Worst Days annual averages in the past ten years at LAVO. The large variation is shown in Figure D-11. The two most recent years, 2010 and 2011, are actually below the 2018 RPG of 13.3 dv, in contrast with the two highest values in the two prior years. Both 2008 and 2009 are in five-year averaging periods for several consecutive years, flattening the linear forecast trendline for the five-year rolling average shown as the dashed blue line in Figure D-11. They also flatten the linear forecast trendline for the annual Worst Days deciview average, shown as the solid brown line. As previously noted, these trendlines do not forecast a long-term glide path, but they do illustrate the sensitivity of the short-term slope to single year point values.

Figure D-11
Forecast Trend Lines for LAVO

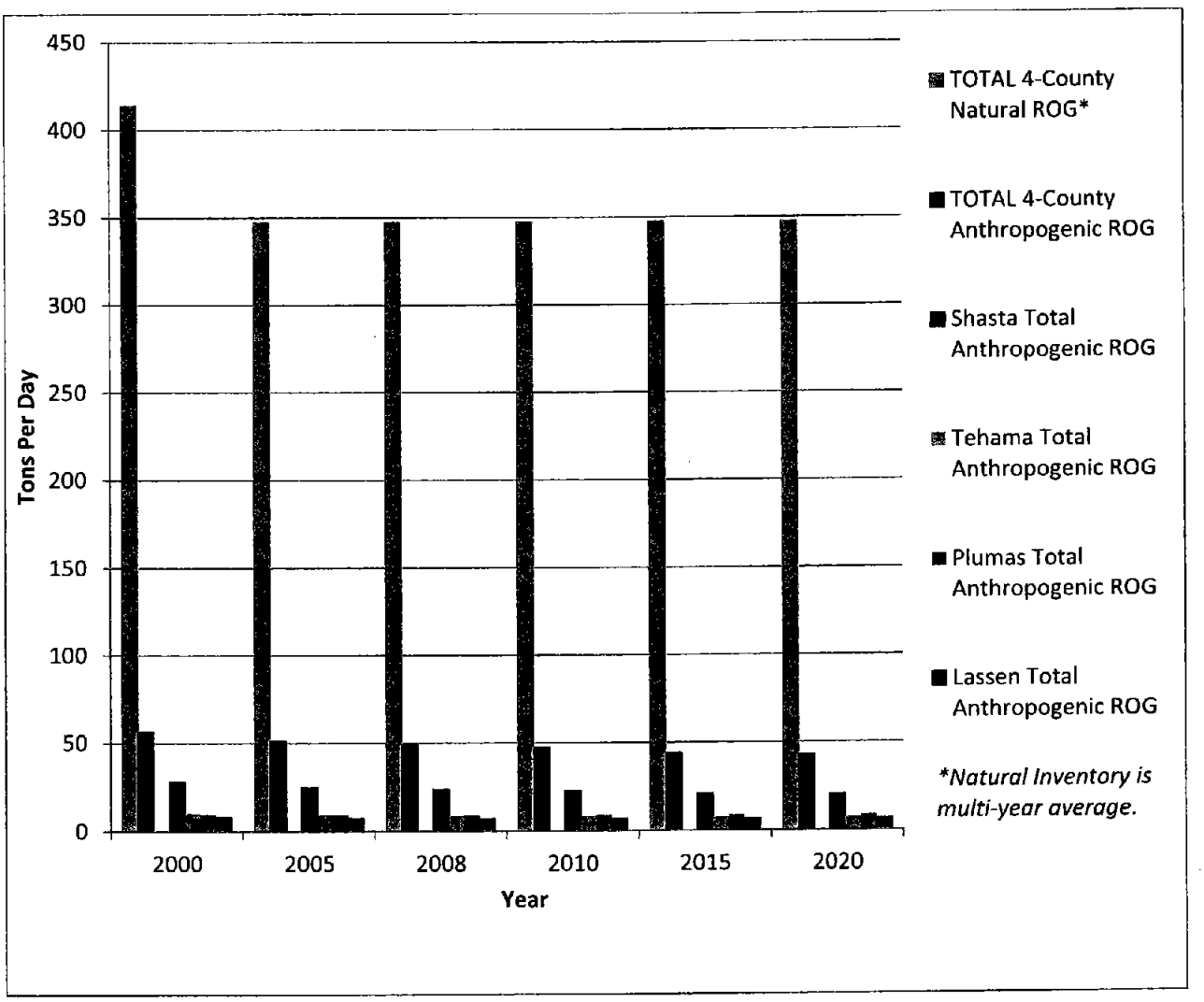


If the two wildfire-impacted years of 2008 and 2009 are excluded from the Worst Days annual averages, the linear forecast trendline (dashed red line) approaches the 2018 RPG. Otherwise, the annual average trendline (solid red line) is level. The solid blue line shows the forecast trendline for the five-year rolling average. If only the highest smoke-impacted days are removed from the calculation of the 2008 and 2009 Worst Days averages (the new values for 2008 and 2009 are the orange triangles), the five-

year average begins to level out (dashed blue line). This demonstrates the impact of outlier days from wildfire smoke on the rolling averages and forecasts. In 2010 and 2011, the annual averages for Worst Days were actually lower (better) than the 2018 RPG.

Reductions in the anthropogenic emissions inventory support a forecast of improved visibility, as shown in Figure D-12. Emissions of NOx, ROG, and SOx are all declining in the four counties surrounding LAVO. PM is the only increasing category due primarily to the formula predicting growth in road dust as vehicle miles traveled increases with population growth. Coarse Mass and Fine Soil are major components of road dust, but neither of these haze pollutants is a strong light extinguisher and both have limited impact on the Worst Days averages.

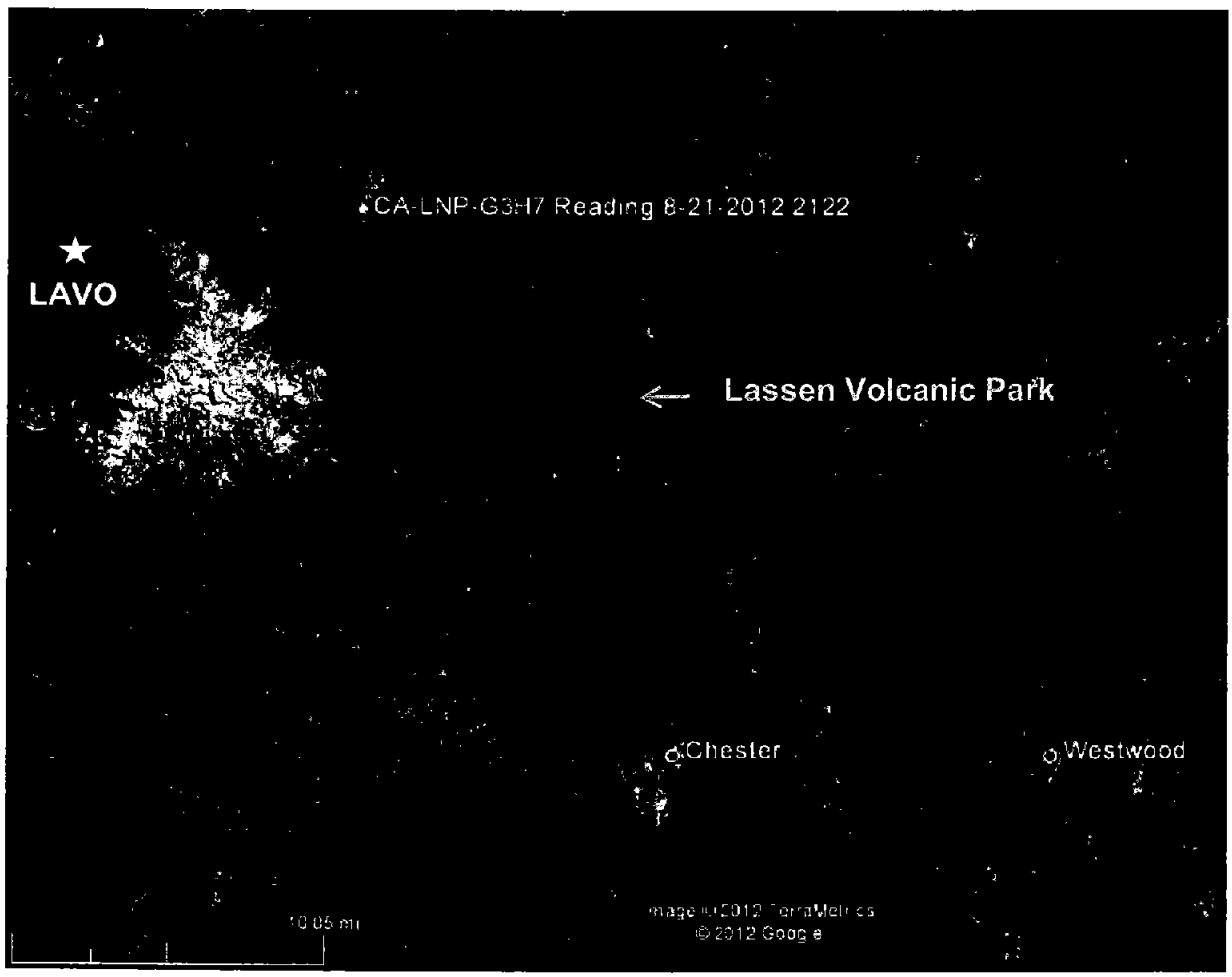
Figure D-12
Local Inventory Changes over Time



Impact of 2012 data for LAVO

The 2012 Worst Days deciview average for LAVO is 14.3 dv. The five-year Worst Days Rolling Average for the years 2008-2012 at LAVO is 15.6 dv. Both of these deciview values are above 13.3 dv, the 2018 RPG for LAVO. While the Worst Days deciview annual averages were decreasing each year since the high year of the 2008-2012 period, wildfire smoke in 2012 reversed the trend. In that year, a lightning strike wildfire started June 23 and burned more than 28,000 acres of predominately forested land through the containment date of August 22. As Figure D-13 below illustrates, the fire was located within 15 miles of the monitor.

Figure D-13
Reading Fire of 2012



Despite prevailing winds from the southwest, occasional easterly winds brought smoke to the LAVO monitor location. As a result, seven of the 23 Worst Days in 2012 occurred during that period. One of the days, August 19, 2012, recorded 41.9 dv, the highest deciview level measured since recordkeeping began in 1989. That value was nearly twice the next highest deciview level measured in 2012 (21.6 dv) and the OMC mass

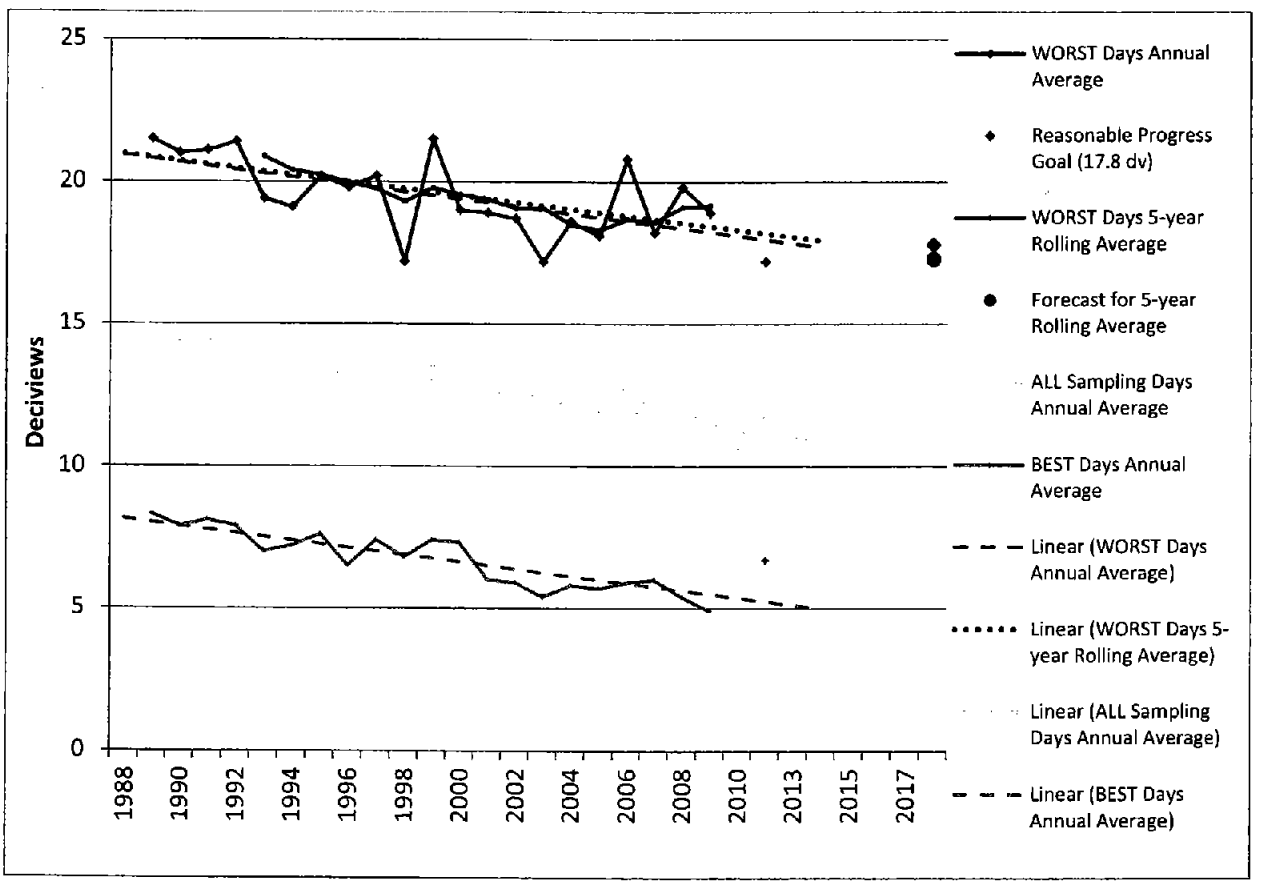
concentration that day was 12.3 times the average OMC mass on Worst Days that year. If that single high deciview day value is removed, and the Worst Days average recalculated for 2012, it would be 13.0 dv, lower than the 2018 RPG of 13.3 dv.

Case Study: REDW

Impacts from Pacific Offshore Shipping and Wildfire Smoke

Since 1988, when data was first collected at REDW, all the long-term trends indicate that visibility is improving. Figure D-14 plots the Worst Days annual averages (brown), the All Sampling Days annual averages (green), the Best Days annual averages (blue), and the required rolling Worst Days 5-year averages (black). Examining this data further explains why visibility improvement appears to level off using the 2005-2009 and 2007-2011 five-year averages. Figure D-12 shows the years 2006, 2008, and 2009 were the only years since 2000 above the long-term Worst Days annual average trendline (dashed brown line.) All three years skew the reported five-year average in Table 3 of the Progress Report and warrant further analysis.

Figure D-14
Long-Term Trends at REDW



If the long-term 5-year rolling average linear trend line (black dotted line) is extended to 2018, the 5-year deciview average is predicted to be 17.3 dv. That is actually lower than the RPG of 17.8 dv. The annual Worst Days averages are also trending downward (brown dashed line) and could reach 17.1 dv by 2018. The Best and Worst Days annual averages are not available for 2010 due to incomplete data, however, the

average of all avaliable data indicates that visibility was improving in 2010 also. The following discussion examines what caused the averages for 2006, 2008, and 2009 to be above the trendline.

Figure D-15 shows that sea salt, organic carbon, and sulfates contributed the most to light extinction on the Worst Days in 2006, 2008, and 2009. The year 2007 is included for comparison because the Worst Day deciview average is just under the long-term trendline for Worst Days. It is also one of the years in both the 2005-2009 and 2007-2011 five-year averages. Seasonal contributions to light extinction by particles on the Worst Days for all the years show that the summer months have the most Worst Days at REDW. This is the time of year when organic mass and sulfate mass concentrations are usually at their highest at all California IMPROVE monitors. Sea salt is not analyzed further because it is a natural contributor to light extinction.

Figure D-15
Particle Contributions to Light Extinction on Worst Days

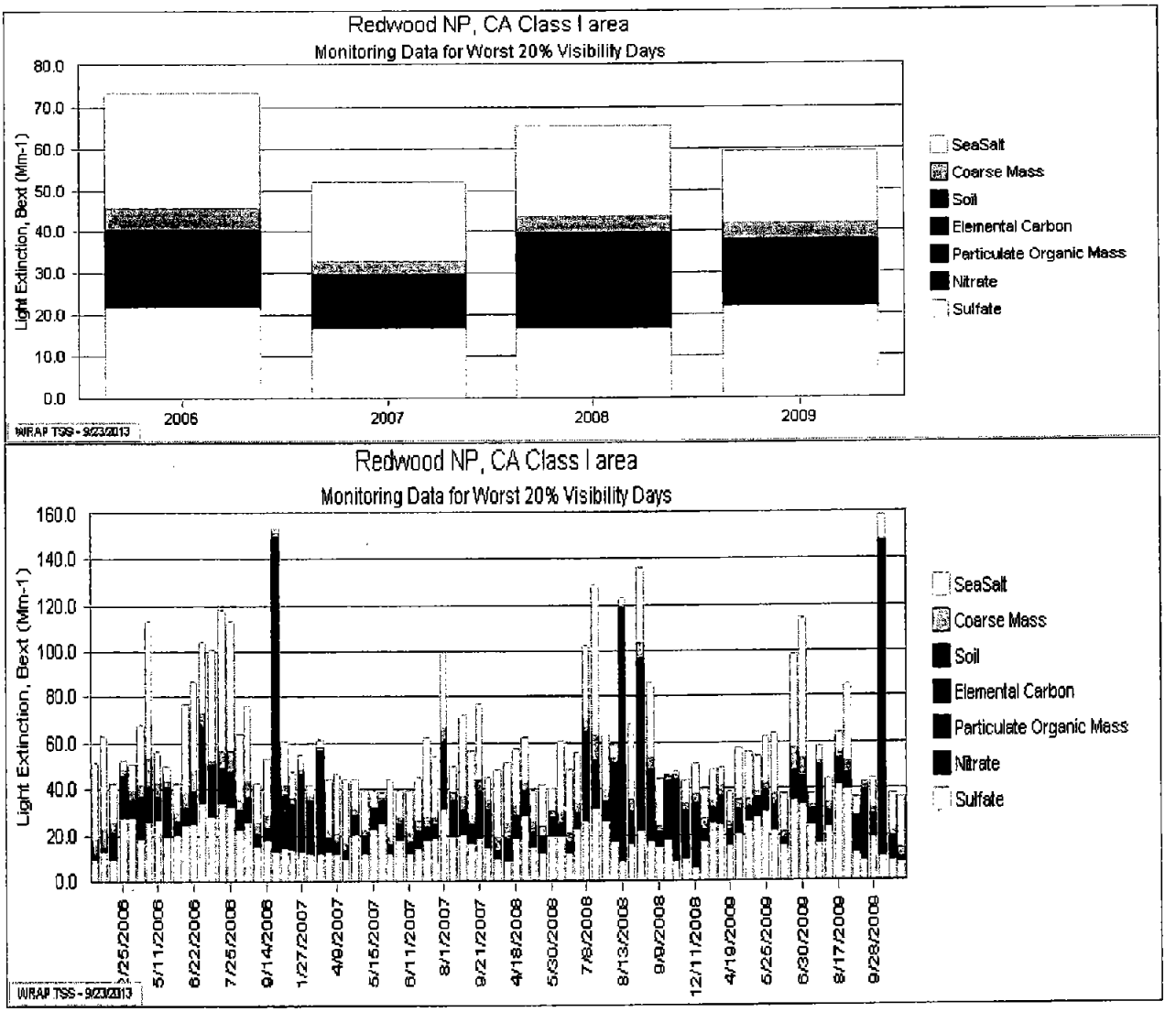
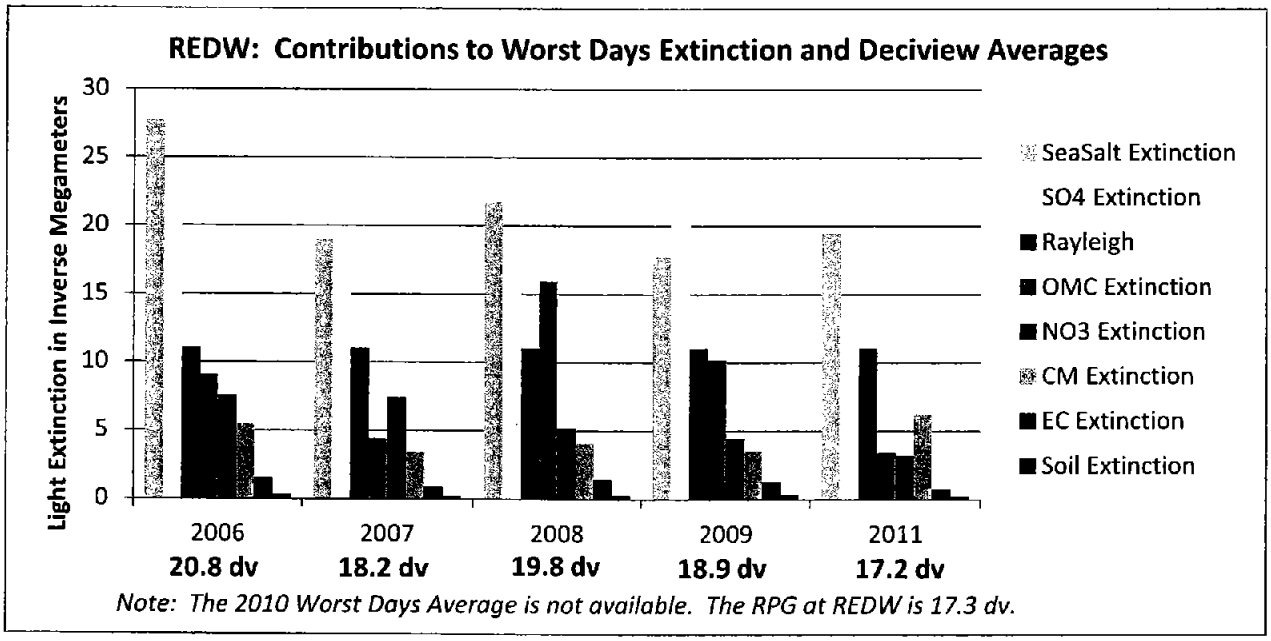


Figure D-16 shows the particle and natural Rayleigh gas scattering contributions to total light extinction for the Worst Days annual averages at REDW. Rayleigh is a natural and constant component of light extinction. Sea salt is a major natural component of haze found in coastal areas; the concentrations vary daily with ocean breezes. Disregarding sea salt and Rayleigh, sulfates are the strongest contributor to light extinction on Worst Days at REDW in the most recent years. Elevated deciview levels also occur when OMC light extinction is elevated, as it was in 2006, 2008, and 2009. Nitrate contributions are steadily declining, showing the effectivenes of California's NOx control measures over time. The three remaining constitutuents – Coarse Mass, Elemental Carbon, and Fine Soil – have fluctuating contributions that are not significant enough in light extinction to impair visibility improvement at this time.

Figure D-16
Comparison of Light Extinction and Recent Deciview Levels



Note: The 2010 Worst Days Average is not available. The RPG at REDW is 17.3 dv.

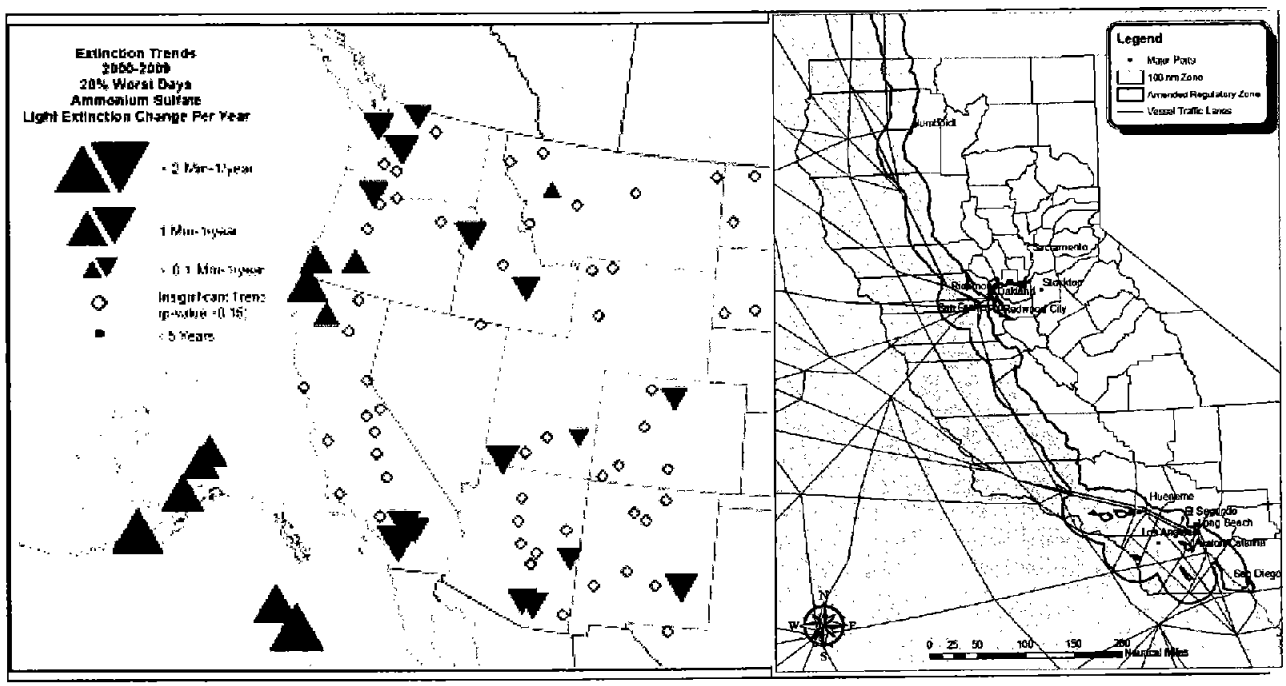
Whether the annual Worst Days average is below or above the long-term trend line appears to depend on the relative contributions of sulfates and OMC to light extinction in any given year. Trends in the emissions inventory for sources of SOx and reactive organic gases (ROG) gases, as precursors of sulfates and OMC, can be examined further to explain the high years.

The REDW monitor is located at 244 meters above sea level, within one mile of the Pacific Ocean, at the mouth of the Klamath River. The delta of the Klamath River is undeveloped, limiting the anthropogenic sources nearest REDW to local two-lane roads to a scenic overlook and a few homes and buildings. The REDW monitor is exposed to ocean fogs year-round, offshore emissions from ocean-going vessels, and smoke drainage down the Klamath River from inland wildfires during the dry season in the mountains. Elevated humidity also supports the formation of nitrates at lower

temperatures in the winter, although relatively few Worst Days occur then at REDW. Light extinction by sulfates, nitrates, and organic aerosols is heightened by elevated relative humidity, another factor causing higher haze levels at coastal locations nationwide.

The WRAP Summary Report shows an increase in sulfate extinction on Worst Days at four monitors near the Pacific coast at the Oregon-California border (REDW, TRIN, KALM, and CRLA). This area has very few SOx-emitting sources other than the influence from offshore shipping emissions, compared to more populated areas along the coast. The relative magnitude of offshore shipping emissions has a greater impact on this sparsely populated area. The location of shipping lanes is shown in Figure D-17 for comparison.

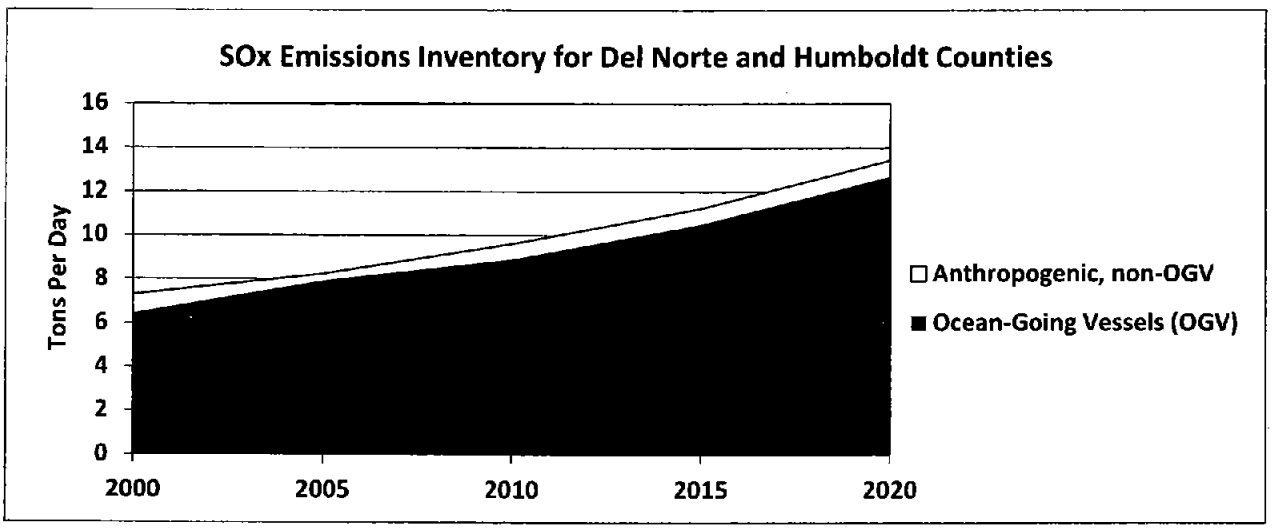
Figure D-17
Sulfate Extinction Trends Near Shipping Lanes



In the past decade traffic in these shipping lanes has increased dramatically in response to changes in global production and shipment of goods from Asia to North American markets. California has developed an inventory of emissions from ocean-going vessels (OGV) in shipping lanes within 100 nautical miles of the California coast. Since 2005, California has also implemented several control measures aimed at reducing in-port emissions and in-transit emissions for ships within 24 nautical miles of the California coastline. Vessels travelling outside the State's jurisdictional control boundary may still burn higher sulfur fuel until after 2012, when international agreements to reduce the emissions from sulfur fuels begin scheduled implementation.

Figure D-18 shows the increase in the relative magnitude of OGV SOx emissions within one hundred miles offshore of Del Norte and Humboldt Counties, north and south of REDW. The emissions are backcast and forecast, with growth and control factors applied, using 2008 as the base year. The emissions do not include the shipping emissions offshore the Oregon coast, a little more than 30 miles north of the REDW monitor, nor do they include emissions from Curry County in Oregon, the sparsely populated county north of the interstate border. The ocean-going vessel emissions of SOx along the California coast alone overwhelm the local anthropogenic sources of SOx from the two coastal California counties surrounding REDW and containing Redwood National Park.

Figure D-18
Anthropogenic Emissions near REDW

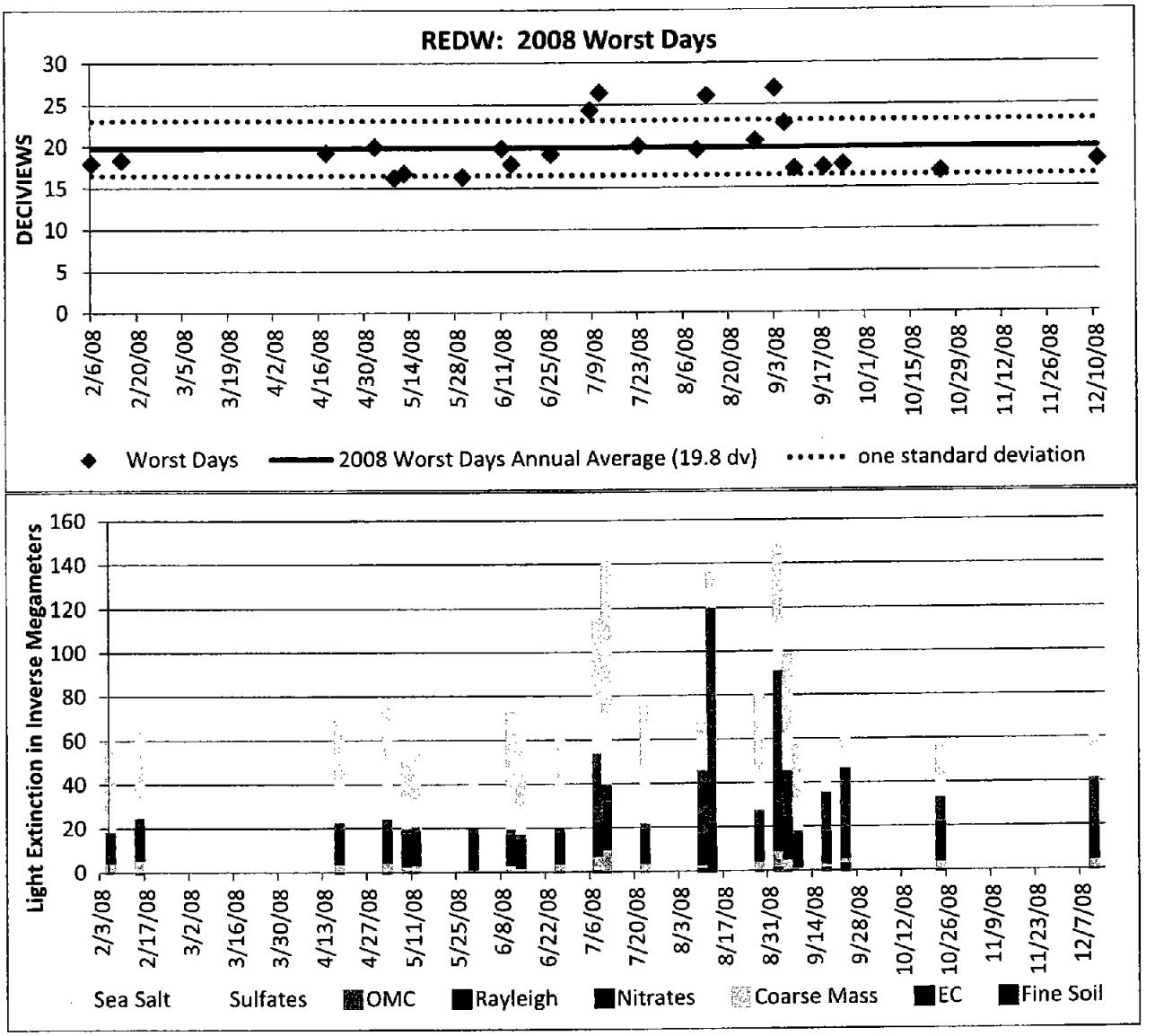


Forecasted growth in Pacific shipping will continue to impact REDW. Continued reductions of other anthropogenic sources of NOx and ROG will offset potential increases in sulfate formation by lessening nitrate and OMC formation. As evidence, the Worst Days annual average for 2011 already achieves the 2018 RPG. The relative reduction in OMC light extinction in 2011 occurred because there were fewer wildfire smoke incidents impacting REDW.

As shown in Figure D-19, wildfire smoke in the summer of 2008 also impacted REDW. Beginning in late June and lasting into September, nighttime drainage of wildfire smoke down the Klamath River was trapped in the marine layer near REDW. Figure D-19 illustrates how wildfire smoke results in high OMC contributions to light extinction. If just the highest of the smoke-related OMC-driven Worst Days is removed from the calculation of the annual average for 2008, the deciview level would be 19.3 dv. If the three highest smoke days during that time are removed, the Worst Days average would be 18.6 dv. When the Worst Days average in a single year is skewed due to very high wildfire smoke influence on a few days, both the annual average and the rolling averages are also elevated by this natural source. These statistics mask progress

made by reductions in anthropogenic emissions. The 2018 RPG at REDW is 17.8dv. In 2011, the Worst Days average was 17.2 dv.

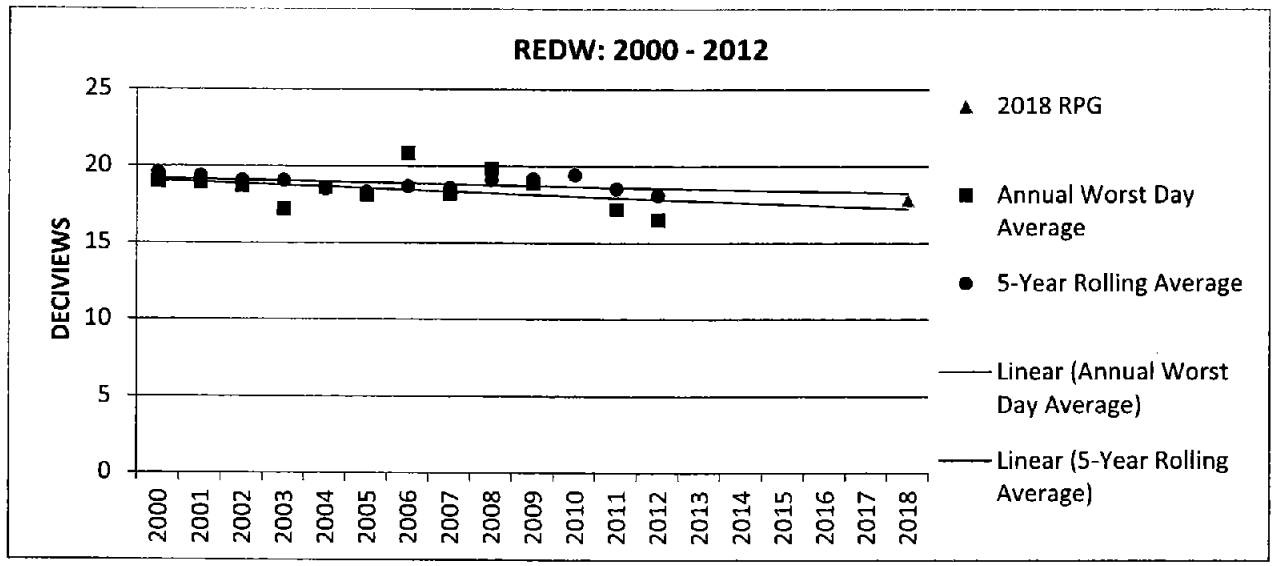
Figure D-19
Wildfire Smoke affects Deciview Calculation



Impact of 2012 data for REDW

In 2011, and again in 2012, wildfire smoke impacts were not significant at REDW. The Worst Days annual average was 17.2 dv in 2011, and even lower in 2012, at 16.5 dv. Both of these values are below the 2018 RPG for REDW, 17.8 dv. The Worst Days annual average could not be calculated for 2010, giving additional weight to the 2008 value in the most recent five-year averaging period. The 2008 Worst Days annual average skews the rolling 5-year average through 2012, masking progress made by reductions in anthropogenic emissions. Comparing the baseline period average of 18.5 dv with the most recent five-year average of 18.1 dv for 2008-2012, indicates that visibility is improving at REDW, even if the rate of progress is slowed by high wildfire smoke days in the calculations for 2008. This improving visibility trend is shown by the linear trendlines in Figure D-20.

Figure D-20
Wildfire Smoke affects Deciview Calculation



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Appendix E

Comments of Federal Land Management Agencies with CARB Responses

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Comments and Responses to the Letter from the U.S. Department of the Interior, National Park Service, dated March 27, 2014

1. Comment: **"Please briefly discuss the major federal and state regulations beyond those implemented specifically under CA's Regional Haze Plan that were included in CA's reasonable progress goals, as these earlier requirements, plus those listed in Table 1, appear to account for most of the emissions reductions observed since 2000 in CA."**

Response: The RH plan includes a discussion of the regulations used to establish the 2018 RPGs. The 2018 RPGs were based on rules adopted by the end of the baseline period, including those with quantifiable reductions scheduled for implementation after 2004 and before 2018. The RH Plan also described the State strategy for continual adoption and implementation of measures to reduce emissions, for which reductions had not been quantified for the RH Plan modeling of the 2018 RPGs. The Progress Report lists new and modified rules adopted 2005 through 2011, which clearly have provided additional emission reduction benefits through 2020 that go beyond the emission reductions included in the RH Plan.

2. Comment: **"Please clarify if CA's Smoke Management Program meets the enhanced smoke management goals for states submitting plans under 40 CFR 51.309. Are Class I Areas identified as sensitive receptors in CA's Smoke Management Plan?"**

Response: California elected to prepare its RH Plan pursuant to 40 CFR 51.308. California's Smoke Management Program was established in State regulation at Title 17 California Code of Regulations sections 80100- 80330. Class 1 Areas are listed and defined in the regulation and must be listed as sensitive smoke receptors in smoke management plans prepared by those conducting prescribed burns, with provisions made to minimize smoke impacts. The Progress Report has been updated to clarify that California's Smoke Management Program identifies Class 1 areas as sensitive receptors.

3. Comment: **"Please also provide a summary in tons/per year [for the emissions inventory], since the conversion from tons per day to tons per year likely differs for different emissions categories."**

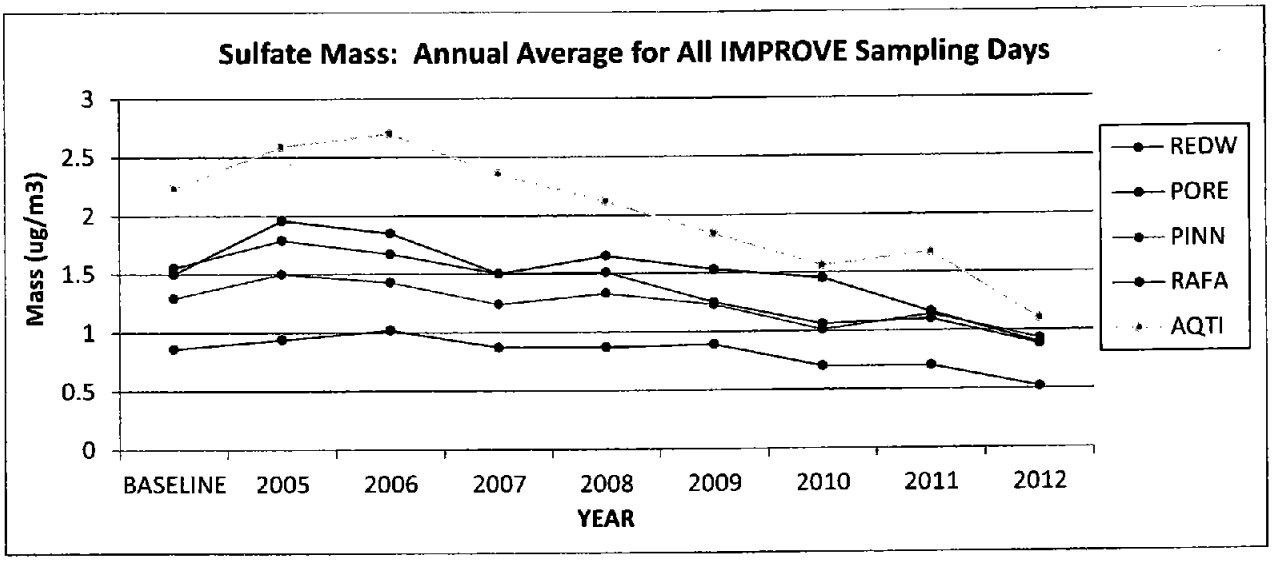
Response: The California emissions inventory shown in the RH Progress Report is in tons per day, using the annual average. To obtain the emissions in tons per year, each daily value can be multiplied by 365. The Progress Report has been updated to include a statement to calculate tons per year.

4. **Comment: "Please cite or include in Appendix A the Western Regional [Air] Partnership Reasonable Progress Summary Report for California."**

Response: A citation and link has been added to Appendix A of the Progress Report for the California Section of the WRAP Reasonable Progress Summary Report, in addition to the link for the entire report.

5. **Comment: "Please add to the discussion of impacts from off shore shipping that the North American Emissions Control Area international treaty limits sulfur dioxide content in fuels for marine vessels operating within 200 nautical miles of the US and Canadian coastlines, beginning in 2012."**

Response: Appendix D Case Study REDW includes a discussion of the impacts from off shore shipping. The benefits of the North American Emissions Control Area will begin to be reflected in the data beginning in 2012. Since the 2012 data became available after the Progress Report was prepared, California did not include an extensive analysis of this data. The summary graph below shows that sulfate is being reduced at all coastal sites with a sharp decline in 2012.



6. **Comment: "CARB concludes that CA emissions reductions are sufficient to meet 2018 Reasonable Progress Goals. Please add a table comparing current emissions and current projections through 2020 to the 2018 emission projections that were used to set the Reasonable Progress Goals."**

Response: California is constantly making improvements to its emissions inventory both in methodology and data used to forecast. These updates and refinements are based on the best available information about changes in regulations, population, business, vehicle and travel data, and control technology implementation for the base year of an inventory update. These updates can cause emissions to increase or decrease relative to a previous inventory. Since the modeling that the RPGs were based on looked at changes on a relative basis, comparing inventories on a relative basis is most appropriate. When comparing the RH Plan inventories with the Progress Plan inventories, Progress Plan emissions are being reduced at a greater rate for all pollutants compared to the RH Plan. Based on this comparison, California concluded that the emission reductions are sufficient to meet the 2018 RPGs.

7. **Comment: "CARB asserts [that] CA emissions reductions are sufficient to lessen CA's impact, and specifically CA's contributions to ammonium nitrate, at neighboring Class 1 Areas. WRAP provided the western states with particulate source apportionment analyses using the CAMx regional air quality model for 2002 and 2018 inventories [including Crater Lake National Park in Oregon and Grand Canyon National Park in Arizona.] We suggest that [California] include such example plots to support CARB's demonstration."**

Response: The plots referenced in your comment have not been updated by the WRAP since the RH Plan. As explained in Table 8.1 of the RH Plan, nitrates cause less than 10 percent of light extinction (haze) on Worst Days, on average, at Crater Lake in Oregon and at the Grand Canyon in Arizona. Nitrates are the second strongest extinguishers of light when compared to the other haze pollutants; therefore reducing their formation from NOx emissions is still an important visibility strategy. Due to new control measures, California NOx emissions will continue to decline beyond the levels included in the RH Plan.

Comments and Responses to the Letter from the U.S. Department of Agriculture, Forest Service, dated April 8, 2014

1. Comment: **A review of the US EPA's "Interim Air Quality Policy" and ARB's "Title 17" indicate that natural fires managed-for-resource-benefits (those meeting the objectives defined in Land/Resource Management Plans) to be considered as prescribed burns whereas the "Exceptional Event Rule" consider these as naturally ignited fires. We look forward to addressing this discrepancy with CARB. The FLMs and the California Air Resources Board (CARB) need to continue a dialogue in developing strategies, before the revision of the SIP in 2019, that can lead to less severe wildfires and thus attain the reduction required on targeted "worst days".**

Response: ARB will continue this discussion at a policy level through the regular Air and Land Managers meetings of policy makers from the public land management and air quality agencies in California. The technical issues relating to planned and unplanned burns and air quality will continue to be discussed by the technical staff participating in the regular meetings of California's Interagency Air and Smoke Council. Both of these forums have operated for more than a decade to explore these issues, develop protocols, and advance practicable policies.

United States Department of the Interior

NATIONAL PARK SERVICE
Air Resources Division
P.O. Box 25287
Denver, CO 80225-0287

TRANSMITTED VIA ELECTRONIC MAIL - NO HARDCOPY TO FOLLOW

N3615 (2350)

March 27, 2014

Christine Suarez-Murias
California Air Resources Board
1001 I Street
Sacramento, CA 95812

Dear Ms. Suarez-Murias:

Thank you for the opportunity to review and comment on California's Regional Haze Plan 2014 Progress Report. We agree with California Air Resources Board (CARB)'s conclusion, consistent with the periodic reporting requirements of 40 CFR 51.308(g), that the emissions reductions under California's Regional Haze Plan and other CARB requirements are sufficient for California and neighboring states to meet the 2018 Reasonable Progress Goals set in the State's Regional Haze plan. We also agree that no further revision of the Regional Haze Plan is needed at this time to meet the 2018 goals.

We suggest some additions to the draft Progress Report to better support California's demonstration:

- Section 2.1: Status of Emissions Control Strategies: Please briefly discuss the major federal and state regulations beyond those implemented specifically under CA's Regional Haze Plan that were included in CA's reasonable progress goals, as these earlier requirements, plus those listed in Table 1, appear to account for most of the emissions reductions observed since 2000 in CA.
- Section 2.1: Please clarify if CA's Smoke Management Program meets the enhanced smoke management goals for states submitting plans under 40 CFR 51.309. Are Class I areas identified as sensitive receptors in CA's Smoke Management Plan? Section 1.3 is clear that wildfire is a major uncontrollable source impacting visibility in Class I areas in CA. A discussion of the possible role of prescribed fire in reducing wildfire smoke impacts to visibility is beyond the scope of this progress review, but is a topic for further discussion in developing the regional haze plan due in 2018.
- Section 2.4 Emissions Inventory: CARB presents emissions in tons/day in Table 2 and Figure 3 that indicate decreasing emissions from 2000 to 2020. Please also provide a

summary in tons/year, since the conversion from tons per day to tons per year likely differs for different emission source categories. Please cite or include in Appendix A the Western Regional Partnership (WRAP) Regional Haze Reasonable Progress Summary Report for CA[1]. Annual emissions in Tables 6.3-8 through 6.3-15 in this summary or from the 2011 National Emissions Inventory are more readily compared to those of other western states.

- Section 4 Changes Impeding Visibility Progress: Please add to the discussion of impacts from off shore shipping that the North American Emission Control Area international treaty limits sulfur dioxide content in fuels for marine vessels operating within 200 nautical miles of the US and Canadian coastlines, beginning in 2012. These requirements will result in lower contributions from marine sources to Class I areas in CA.
- Section 5 Current Control Strategy: CARB concludes that CA emissions reductions are sufficient to meet 2018 Reasonable Progress Goals. Please add a table comparing current emissions and current projections through 2020 to the 2018 emission projections that were used to set the Reasonable Progress Goals.
- CARB asserts than CA emissions reductions are sufficient to lessen CA's impact, and specifically CA's contributions to ammonium nitrate, at neighboring Class I areas. WRAP provided the western states with particulate source apportionment analyses using the CAMx regional air quality model for 2002 and 2018 inventories. Example plots for Crater Lake National Park in Oregon and Grand Canyon National Park in Arizona are enclosed. We suggest that you include such example plots to support CARB's demonstration.

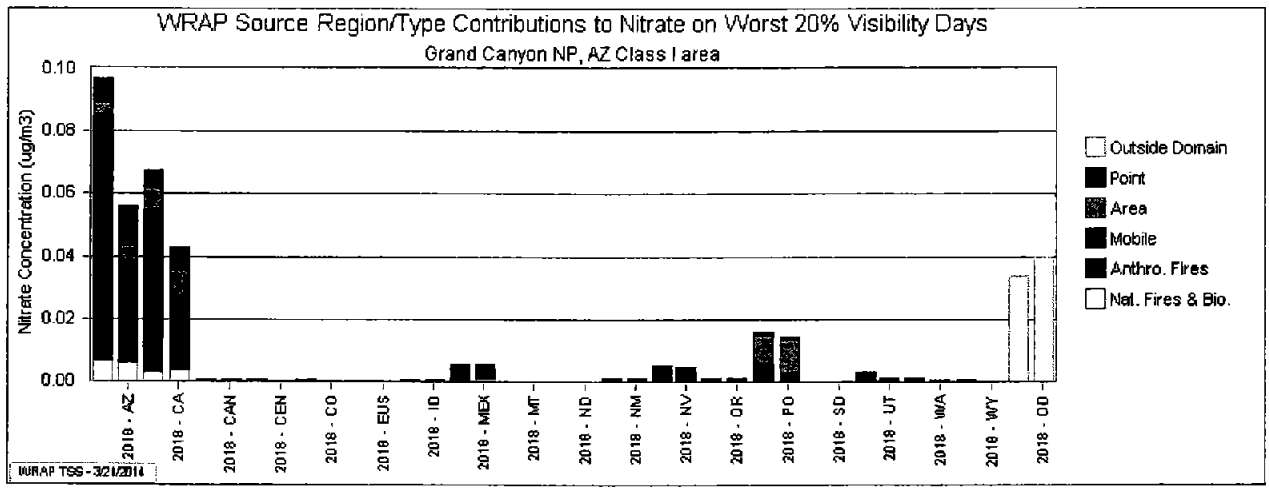
We appreciate the opportunity to work closely with CARB to improve visibility in our Class I national park and wilderness areas. We agree that reducing haze is a regional effort, and we will continue to work with California and other western states to plan for the next Regional Haze State Implementation Plans due in 2018. If you have questions, please call Pat Brewer at (303) 969-2153.

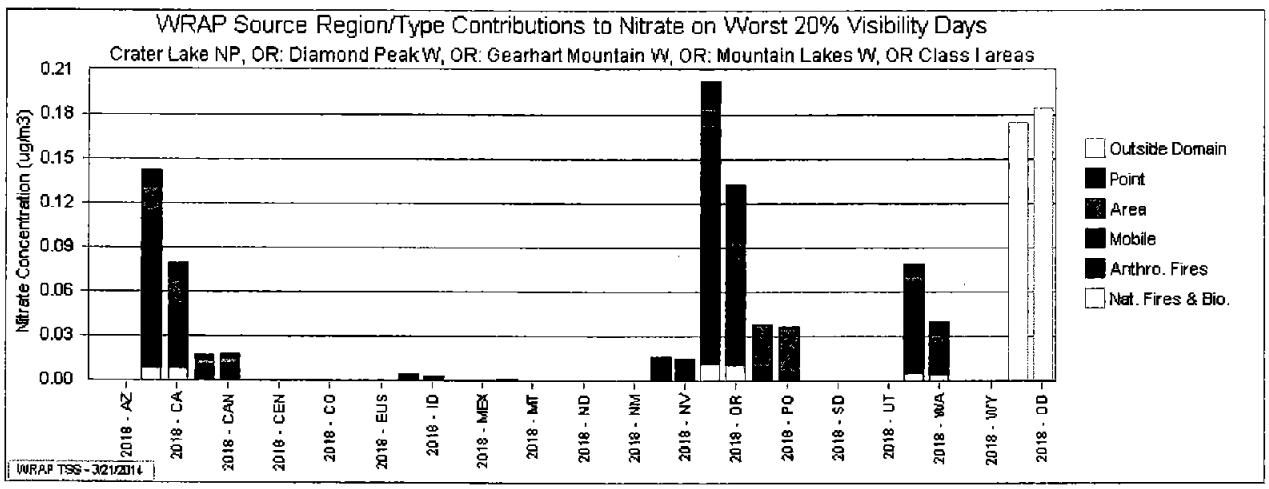
Sincerely,

Pat Brewer for

Susan Johnson
Chief, Policy, Planning, and Permit Review Branch

[1]http://www.wrapair2.org/documents/6.0%20STATE%20AND%20CLASS%20I%20AREA%20SUMMARIES/6.03%20California/WRAP_RHRPR_Sec_6_State_Summaries-California.pdf


WRAP Source Region/Type Contributions to Nitrate on Worst 20% Visibility Days
Grand Canyon NP, AZ Class I area
Nitrate Concentration (ug/m3)
0.10
0.08
0.06
0.04
0.02
0.00
2018 - AZ
2018 - CA
2018 - CAN
2018 - CEN
2018 - CO
2018 - EUS
2018 - ID
2018 - MEX
2018 - MT
2018 - ND
2018 - NM
2018 - NV
2018 - OR
2018 - PO
2018 - SD
2018 - UT
2018 - WA
2018 - WY
2018 - OD
Outside Domain
Point
Area
Mobile
Anthro. Fires
Nat. Fires & Bio.
WRAP TSS - 3/21/2014


WRAP Source Region/Type Contributions to Nitrate on Worst 20% Visibility Days
Crater Lake NP, OR; Diamond Peak W, OR; Gearhart Mountain W, OR; Mountain Lakes W, OR Class I areas
Nitrate Concentration (ug/m3)
0.21
0.18
0.15
0.12
0.09
0.06
0.03
0.00
2018 - AZ
2018 - CA
2018 - CAN
2018 - CEN
2018 - CO
2018 - EUS
2018 - ID
2018 - MEX
2018 - MT
2018 - ND
2018 - NM
2018 - NV
2018 - OR
2018 - PO
2018 - SD
2018 - UT
2018 - WA
2018 - WY
2018 - OD
Outside Domain
Point
Area
Mobile
Anthro. Fires
Nat. Fires & Bio.
WRAP TSS - 3/21/2014

USDA United States Department of Agriculture | Forest Service | Pacific Southwest Region

Regional Office, R5
1323 Club Drive
Vallejo, CA 94592
(707) 562-8737 Voice
(707) 562-9240 Text (TDD)

File Code: 2580
Date: APR 08 2014

Christine M. Suarez-Murias, AICP
Air Pollution Specialist
California Air Resources Board
1001 I Street
Sacramento, CA 95812

Dear Ms. Suarez-Murias:

Thank you for your continued excellent outreach and collaboration in protecting and improving visibility in our Class I Wilderness Areas. On January 29, 2014, we received an invitation to comment on the draft report entitled, *California Regional Haze Plan 2014 Progress Report.* The Regional Haze Rule (RHR) published in 2000 required all states to submit visibility State Implementation Plans (SIP) using 2000-2004 as the base years. SIPs must be revised every 10 years and a progress report submitted every 5 years to demonstrate improvement. California has 29 Class I areas with 20 of them being managed by the Forest Service. This is the first progress report that will be submitted to the EPA after Federal Land Manager (FLM) review and subsequent public review.

The Air Resources Board (ARB) adopted the California Regional Haze Plan (RH Plan) in January, 2009, and transmitted it to the U.S. EPA in March of 2009. The U.S. EPA approved the RH Plan in June of 2011. The RH Plan included California's strategy for reaching the first Reasonable Progress Goals (RPGs) in 2018. The 2018 RPGs are visibility improvement benchmarks on a path to the long term goal of natural background conditions by 2064. The 2018 RPGs were developed by the ARB for each Class 1 area in California, in consultation with other affected states and the FLMs.

The data presented in table 3 shows the statewide 2018 RPG Summary and indicates all 29 of the Class I areas are showing improvement on the "best days" as required under the RHR. At 9 sites the current conditions already meet the 2018 RPGs. Three Class I Areas, Lassen Volcanic, Desolation and Redwood show the least progress and the analysis indicates smoke from wildfire as the principle reason. The years with most wildfire occurrence show the least progress in the category of "worst visibility days".

California has determined that the RHR control strategies are sufficient for meeting the 2018 RPGs goals. Three factors, wildfires, Asian dust storms and marine shipping emissions have slowed progress of the worst visibility days at a few sites but are considered natural and/or outside the control of the state.

Our goal for the Pacific Southwest Region is to retain and restore ecological resilience of the National Forest lands to achieve sustainable ecosystems that provide a broad range of services to humans and other organisms. Ecologically healthy and resilient landscapes, rich in biodiversity, will have greater capacity to adapt and thrive in the face of natural disturbances and large scale threats to sustainability, especially under changing and uncertain future environmental conditions such as those driven by climate change and increasing human use.

California's Smoke Management Program (SMP) has resulted in reduced incidences of prescribed burns impacting public health, but it should be recognized that it does impede the pace and scale of restoration that can reduce the negative impacts of wildfire on reaching the 2064 natural background targets in some areas. Indicators suggest that disturbance impacts already outpace the benefits of restoration work. A review of the US EPA's "Interim Air Quality Policy" and ARB's "Title 17" indicate that natural fires managed-for-resource-benefits (those meeting the objectives defined in Land/Resource Management Plans) to be considered as prescribed burns whereas the "Exceptional Event Rule" consider these as naturally ignited fires. We look forward to addressing this discrepancy with CARB. The FLMs and the California Air Resources Board (CARB) need to continue a dialogue in developing strategies, before the revision of the SIP in 2019, that can lead to less severe wildfires and thus attain the reduction required on targeted "worst days".

Based on the data shown and the progress reported, we feel CARB has successfully demonstrated a technically sound path for improving visibility in Class I areas. We have determined that this Interim report satisfies the Regional Haze requirement and does not require further analysis. However, if the state further modifies the SIP or applies additional strategies we will request an analysis of the visibility impacts.

Thanks for the opportunity to be involved in the review process. We value our good working relationship with CARB and look forward to continued collaboration. If you have any questions, please contact Trent Procter at 559-783-3308 / tprocter@fs.fed.us or Dr. Suraj Ahuja at 916-616-3881 / sahuja@fs.fed.us/.

Sincerely,

Jeanne Wade Evans

for RANDY MOORE
Regional Forester

cc: Suraj Ahuja, Phil Bowden, Trent Procter

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State of California
AIR RESOURCES BOARD

NOTICE OF PUBLIC AVAILABILITY OF THE DRAFT ENVIRONMENTAL ANALYSIS PREPARED FOR PROPOSED FIRST UPDATE TO THE CLIMATE CHANGE SCOPING PLAN

AND

NOTICE OF PUBLIC HEARING

Public Availability Date:	**March 14, 2014**
Deadline for Public Comment:	**April 28, 2014**
Public Hearing Date:	**May 22, 2014**

This notice announces the availability for public review and comment the Draft Environmental Analysis prepared for the Proposed First Update to the Climate Change Scoping Plan (Proposed Update) in accordance with ARB's certified regulatory program (California Code of Regulation, title. 17, sections 60006-60008) to comply with the requirements of the California Environmental Quality Act (CEQA).

Public Hearing

The Board will conduct a public hearing at the time and place noted below to consider approving the Proposed Update. The Board will also consider the Environmental Analysis and staff's written responses to comments on the draft Environmental Analysis received during the 45-day comment period.

DATE:	May 22, 2014
TIME:	9:00 a.m.
PLACE:	California Environmental Protection Agency Air Resources Board Byron Sher Auditorium 1001 I Street, Second Floor Sacramento, California 95814

This item may be considered at a two-day meeting of the Board, which will commence at 9:00 a.m., May 22, 2014, and may continue at 8:30 a.m., on May 23, 2014. This item may not be considered until May 23, 2014. Please consult the agenda for the meeting, which will be available at least 10 days before May 22, 2014, to determine the day on which this item will be considered.

Background on the Proposed First Update to the Climate Change Scoping Plan:

The Proposed Update builds upon the successful framework established by the initial Scoping Plan by outlining priorities and recommendations for the State to achieve its long-term climate objectives. The Proposed Update describes actions for California to undertake to ensure it continues on a path toward a cleaner, more sustainable and prosperous future. This approach is designed to ensure the State is able to meet its long-term climate objectives that will achieve continual emissions reductions, while simultaneously supporting a range of economic, environmental, water supply, energy security, environmental justice, and public health priorities.

The Proposed Update was developed by ARB in collaboration with the Climate Action Team and reflects the input and expertise of a range of State and local government agencies; it also reflects public input and recommendations from business, environmental, environmental justice, and community-based organizations.

A discussion draft of the Proposed Update was released on October 1, 2013 and presented to the Board at a public meeting on October 24, 2013. The Proposed Update was released for public comment on February 10, 2014 and presented to the Board as an informational item at a public hearing on February 20, 2014. The Plan Update and its appendices are available on ARB's website at: http://www.arb.ca.gov/cc/scopingplan/document/updatedscopingplan2013.htm.

Comments on the Plan Update and appendices will be accepted until April 28, 2014. To be considered by ARB, comments on the Plan Update must be received **no later than 5pm on April 28, 2014** and must be addressed to the following:

Postal mail: Clerk of the Board, Air Resources Board
1001 I Street, Sacramento, California 95814

Electronic submittal: http://www.arb.ca.gov/cc/scopingplan/2013comments.htm

Environmental Analysis

ARB, as the lead agency for the Proposed Update, prepared a Draft Environmental Analysis (EA) in accordance with the requirements of its regulatory program certified by the Secretary of Natural Resources. (California Code of Regulation, title 17, sections 60006-60008; California Code of Regulation, title 14, section 15251, subdivision (d).) The resource areas from the CEQA Guidelines Environmental Checklist were used as a framework for a programmatic environmental analysis of the reasonably foreseeable compliance responses that would implement recommended actions for each of the nine sectors discussed in the Proposed Update. The EA provides an analysis of both the beneficial and adverse impacts and feasible mitigation measures for the reasonably foreseeable compliance responses associated with recommended future actions in each of the nine sectors under each of the 17 environmental resource areas.

Collectively, across all sectors, the EA concluded implementation of these actions could result in the following impacts: beneficial impacts to agriculture and forest resources, air quality, biological resources, energy demand, greenhouse gases, hydrology and water quality; less than significant impacts to aesthetics, agriculture and forest resources, air quality, biological resources, energy demand, geology and soils, greenhouse gases, hazards and hazardous materials, land use planning, mineral resources, noise, population and housing, public services, recreational services, transportation/ traffic, and utilities and services systems; and potentially significant and unavoidable adverse impacts to aesthetics, agriculture and forest resources, air quality, biological resources, cultural resources, geology and soils, hazards and hazardous materials, hydrology and water quality, noise, transportation/traffic, and utilities and service systems, primarily related to short-term construction related activities.

The EA is included as **Appendix F** to the Proposed Update and can be obtained from ARB's website at:
http://www.arb.ca.gov/cc/scopingplan/document/updatedscopingplan2013.htm

Paper copies of the Draft EA may also be obtained from:

ARB's Public Information Office,
1001 I Street, First Floor, Environmental Services Center,
Sacramento, California, 95814

After the close of the 45-day public comment period, ARB staff will prepare written responses to significant environmental issues raised in comments received on the EA as provided in California Code of Regulations, title 17, section 60007(a). Although all comments received on the Proposed Update and the EA will be considered by ARB, only those comments relating to the EA will be responded to in writing in the supplemental response document. The supplemental response document containing staff's written responses to comments received on the EA will be posted on ARB's website before the public hearing scheduled for the Board to consider approving the Proposed Update.

Submittal of Comments:

ARB invites comments on the Draft EA during the 45-day public comment period that begins on **March 14, 2014** and ends on **April 28, 2014**.

To be responded to in writing and considered by the Board, written comments on the Draft EA must be received **no later than 5pm on April 28, 2014**, and must be addressed to the following:

Postal mail: Clerk of the Board, Air Resources Board
1001 I Street, Sacramento, California 95814

Electronic submittal: http://www.arb.ca.gov/lispub/comm/bclist.php

Please note that under the California Public Records Act (Government Code section 6250 et seq.), your written and verbal comments, attachments, and associated contact information (e.g., your address, phone, email, etc.) become part of the public record and can be released to the public upon request.

SPECIAL ACCOMMODATION REQUEST

Special accommodation or language needs can be provided for any of the following:

- An interpreter to be available at the meeting.
- Documents made available in an alternate format or another language.
- A disability-related reasonable accommodation.

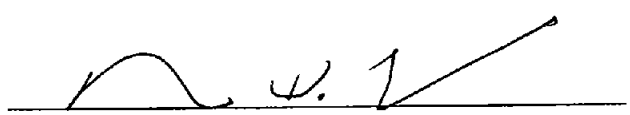
To request these special accommodations or language needs, please contact the Clerk of the Board at (916) 322-5594 or by facsimile at (916) 322-3928 as soon as possible, but no later than 10 business days before the scheduled Board meeting. TTY/TDD/Speech to Speech users may dial 711 for the California Relay Service.

Comodidad especial o necesidad de otro idioma puede ser proveído para alguna de las siguientes:

- Un intérprete que esté disponible en la audiencia.
- Documentos disponibles en un formato alterno u otro idioma.
- Una acomodación razonable relacionados con una incapacidad.

Para solicitar estas comodidades especiales o necesidades de otro idioma, por favor llame a la oficina del Consejo al (916) 322-5594 o envíe un fax a (916) 322-3928 lo más pronto posible, pero no menos de 10 días de trabajo antes del día programado para la audiencia del Consejo. TTY/TDD/Personas que necesiten este servicio

CALIFORNIA AIR RESOURCES BOARD



Richard W. Corey
Executive Officer

Date: March 14, 2014

CALIFORNIA AIR RESOURCES BOARD

NOTICE OF PUBLIC MEETING TO PROVIDE AN UPDATE ON SAN JOAQUIN VALLEY SUSTAINABLE COMMUNITIES STRATEGY DEVELOPMENT

The Air Resources Board (ARB or Board) will conduct a public meeting at the time and place noted below to consider an update on the status of the San Joaquin Valley Metropolitan Planning Organizations' (MPO) development of their Sustainable Communities Strategies (SCS).

DATE: May 22, 2014

TIME: 9:00 a.m.

PLACE: California Environmental Protection Agency
Air Resources Board
Byron Sher Auditorium
1001 I Street, Second Floor
Sacramento, California 95814

This item may be considered at a one-day meeting of the Board, which will commence at 9:00 a.m., May 22, 2014, and may continue at 8:30 a.m., on May 23, 2014. This item may not be considered until May 23, 2014. Please consult the agenda for the meeting, which will be available at least 10 days before May 22, 2014, to determine the day on which this item will be considered.

Under Senate Bill 375 (SB 375), the Sustainable Communities and Climate Protection Act of 2008, (Stats. 2008, ch. 728) each of the California MPOs is required to prepare and adopt a regional transportation plan with an SCS (or an Alternative Planning Strategy) that includes a forecasted development pattern for the region that is integrated with the transportation network, measures, and policies that could, if feasible, meet the greenhouse gas emission reduction targets set by the ARB. In 2010, ARB established these targets for 2020 and 2035 for each region covered by one of the State's MPOs.

Each of the eight San Joaquin Valley MPOs has published a draft SCS for public review. ARB staff will provide an oral briefing with an overview of the measures and policies reflected in each these eight published draft SCSs. This is an informational item and no Board action will be taken.

Interested members of the public may present comments orally or in writing at the meeting and may provide comments by postal mail or by electronic submittal before the meeting. To be considered by the Board, written comments not physically submitted at the meeting, must be received **no later than 5:00 pm, Monday, May 19, 2014,** and addressed to the following:

Postal mail: Clerk of the Board, Air Resources Board
1001 I Street, Sacramento, California 95814

Electronic submittal: http://www.arb.ca.gov/lispub/comm/bclist.php

Please note that under the California Public Records Act (Government Code section 6250 et seq.), your written and verbal comments, attachments, and associated contact information (e.g., your address, phone, email, etc.) become part of the public record and can be released to the public upon request.

ARB requests that written and email statements on this item be filed at least 10 days prior to the meeting so that ARB staff and Board members have additional time to consider each comment. Further inquiries regarding this matter should be directed to Ms. Terry Roberts, Manager, Sustainable Communities Policy and Planning Section, at (626) 450-6182.

SPECIAL ACCOMMODATION REQUEST

Consistent with California Government Code Section 7296.2, special accommodation or language needs may be provided for any of the following:

- An interpreter to be available at the meeting;
- Documents made available in an alternate format or another language;
- A disability-related reasonable accommodation.

To request these special accommodations or language needs, please contact the Clerk of the Board at (916) 322-5594 or by facsimile at (916) 322-3928 as soon as possible, but no later than 10 business days before the scheduled Board meeting. TTY/TDD/Speech to Speech users may dial 711 for the California Relay Service.

Consecuente con la sección 7296.2 del Código de Gobierno de California, una acomodación especial o necesidades lingüísticas pueden ser suministradas para cualquiera de los siguientes:

- Un intérprete que esté disponible en la audiencia;
- Documentos disponibles en un formato alterno u otro idioma;
- Una acomodación razonable relacionados con una incapacidad.

Para solicitar estas comodidades especiales o necesidades de otro idioma, por favor llame a la oficina del Consejo al (916) 322-5594 o envié un fax a (916) 322-3928 lo más pronto posible, pero no menos de 10 días de trabajo antes del día programado para la audiencia del Consejo. TTY/TDD/Personas que necesiten este servicio pueden marcar el 711 para el Servicio de Retransmisión de Mensajes de California.

CALIFORNIA AIR RESOURCES BOARD

Richard W. Corey
Executive Officer

Date: May 7, 2014

The energy challenge facing California is real. Every Californian needs to take immediate action to reduce energy consumption. For a list of simple ways you can reduce demand and cut your energy costs, see our website at www.arb.ca.gov.