

Table of Contents

Executive Summary

Table of Contents

Acronyms

Chapters

Chapter 1:	Introduction	1-1
1.1	The Valley's Unique Challenges	1-1
1.2	Ozone and Associated Health Impacts	1-2
1.3	National Ambient Air Quality Standards	1-4
	1.3.1 EPA's Standard-Setting Process	1-4
	1.3.2 Federal Ozone Standards and Implementation	1-5
	1.3.3 1-Hour Ozone Requirements.....	1-7
	1.3.4 State Standards.....	1-9
1.4	Public Process of Plan Development	1-9
Chapter 2:	Scientific Foundation, Trends, and Modeling Results	2-1
2.1	Contributions to the Valley's 1-Hour Ozone Levels	2-1
	2.1.1 The Valley's Natural Environment	2-1
	2.1.2 Emissions of Ozone Precursors	2-4
	2.1.3 The Nature and Formation of Ozone.....	2-6
	2.1.3.1 The Ozone Life Cycle	2-6
	2.1.3.2 Relative Roles of VOCs and NO _x in Ozone Formation	2-8
	2.1.3.3 The Nature and Formation of Ozone	2-9
	2.1.4 SJV Trans-Boundary Emissions and Policy-Relevant Background Ozone.....	2-9
2.2	Air Quality Research Focused on Ozone	2-11
	2.2.1 Central California Ozone Study	2-11
	2.2.2 PAMS Monitoring	2-12

	2.2.3	VOC Reactivity Trends.....	2-13
	2.2.4	Trans-Boundary Ozone Research.....	2-14
	2.2.5	Arvin Ozone Saturation Study	2-15
2.3		1-Hour Ozone Air Quality in the Valley.....	2-16
	2.3.1	Number of Exceedance Days as the Attainment Test	2-16
	2.3.2	1-Hour Ozone Design Value Trend	2-17
	2.3.3	Exceedance Window.....	2-18
2.4		Modeling Approach and Results	2-19
Chapter 3:		Control Strategy	3-1
3.1		Comprehensive Regulatory Control Strategy	3-1
	3.1.1	Current Regulatory Control Strategy	3-2
		Ozone Reductions	3-2
	3.1.1.1	District Regulations Contributing to Continued Ozone Reductions	3-2
	3.1.1.2	ARB Regulations Contributing to Attainment.....	3-4
	3.1.2	Evaluation of Potential Future Regulatory Control Strategies	3-7
	3.1.3	New Regulatory Control Measure Commitments	3-8
	3.1.4	Commitments for Further Study	3-9
3.2		Incentives.....	3-13
	3.2.1	EPA Section 185 Fees	3-14
	3.2.2	Current District incentives programs	3-15
	3.2.2.1	Heavy-Duty Trucks	3-15
	3.2.2.2	Agricultural Pumping Engines.....	3-15
	3.2.2.3	Agricultural Equipment.....	3-16
	3.2.2.4	Locomotives	3-16
	3.2.2.5	Forklifts	3-16
	3.2.2.6	School Bus Replacement and Retrofit	3-17
	3.2.2.7	Alternative Fuel Infrastructure.....	3-17
	3.2.2.8	Community Incentives	3-18
	3.2.3	Potential new incentive programs.....	3-20
3.3		Technology Advancement.....	3-21
	3.3.1	Technology Focus Areas.....	3-21

3.3.2	Future demonstration projects.....	3-22
3.3.3	Interagency Collaborative Demonstration Projects.....	3-22
3.3.3.1	Zero-Emission Commercial Lawn and Garden Equipment Demonstration – ARB.....	3-22
3.3.3.2	Natural-Gas-Fired, Fan-Type Central Furnaces with Reduced NOx Emissions – South Coast AQMD.....	3-23
3.3.3.3	Vision for Clean Air: A Framework for Air Quality and Climate Planning – SCAQMD & ARB.....	3-24
3.3.3.4	On-Road Heavy-Duty Development, Integration, And Demonstration of Ultra-Low Emissions Natural Gas Engines – California Energy Commission, South Coast AQMD, and Southern California Gas Company.....	3-24
3.4	Legislative Strategy.....	3-25
3.4.1	Current Legislative Strategy.....	3-25
3.4.1.1	Common Sense Improvements to the Federal Clean Air Act.....	3-26
3.4.1.2	Extend Sunset Dates of Critical State Funding Programs.....	3-26
3.4.1.3	Support Streamlined Climate Change Regulations that Do Not Hinder Criteria and Toxic Pollutant Emissions Reductions.....	3-27
3.4.1.4	Support Streamlining of CEQA.....	3-27
3.4.1.5	Support the Establishment of an Air Quality and Health Empowerment Zone Designation.....	3-28
3.4.1.6	Seek Funding and Support from ARG and EPA for Additional Monitoring Equipment.....	3-28
3.4.1.7	Support the Establishment of an Air Quality and Health Empowerment Zone Designation.....	3-29
3.4.1.8	Support Energy Efficiency and Alternative Energy Policies for Emissions Reductions and Alternatives to Agricultural Burning.....	3-29
3.4.1.9	Support Resources and Policies to Reduce the	

	Impact of Wildfires	3-29
	3.4.1.10 Support Continued Federal Farm Bill Funding for Equipment Replacement	3-30
	3.4.2 Potential Future Legislative Strategies	3-30
3.5	Public Outreach.....	3-30
	3.5.1 Current Public Outreach Strategy.....	3-30
	3.5.1.1 Air Alerts	3-30
	3.5.1.2 Real-Time Air Advisory Network (RAAN).....	3-31
	3.5.1.3 Multi-Media Efforts.....	3-32
	3.5.1.4 Real-Time Outdoor Activity Risk (ROAR)	3-32
	3.5.1.5 Healthy Air Living.....	3-33
	3.5.1.6 Air Quality Flag Program	3-33
3.6	Other Innovative Strategies.....	3-33
	3.6.1 Green Purchasing and Contracting	3-33
	3.6.2 Energy Efficiency.....	3-34
	3.6.3 Eco-Driving.....	3-34
	3.6.4 Urban Heat Island Mitigation	3-35
	3.6.5 Alternative Energy	3-35
Chapter 4:	Demonstration of Federal Requirements	4-1
4.1	Attainment Demonstration.....	4-1
4.2	Reasonably Available Control Measures (RACM) Demonstration	4-2
	4.2.1 District RACM Opportunities.....	4-3
	4.2.2 ARB RACM Opportunities	4-3
	4.2.3 Metropolitan Planning Organizations (MPOs) RACM Opportunities	4-4
4.3	Rate of Progress (ROP)	4-4
	4.3.1 ROP Requirements	4-4
	4.3.2 ROP Calculations and Demonstration.....	4-5
4.4	Contingency Reductions	4-7
4.5	Clean Fuels and Clean Technologies for Boilers	4-10
4.6	Vehicle Miles Traveled (VMT) Demonstration	4-10

Appendices

Appendix A:	Ambient 1-hour Ozone Data Analysis.....	A-1
A.1	Overview	A-1
A.2	Ozone Monitoring Network	A-1
A.3	Effect of the Natural Environment On Ozone In The Valley.....	A-3
A.3.1	Meteorology.....	A-3
A.3.2	Wildfires.....	A-7
A.4	Exceedance Day Trends	A-7
A.4.1	Exceedance Days as the Attainment Test.....	A-7
A.4.2	Where Do Exceedance Days Occur?	A-11
A.4.3	When Are Exceedance Days Occurring?	A-15
A.4.4	Analysis of 2011-2012 Exceedance Days	A-19
A.5	Hourly Ozone Trends	A-27
A.5.1	Number of Exceedance Hours	A-27
A.5.2	Exceedance Window	A-30
A.5.3	Trends in Diurnal Ozone Profiles.....	A-31
A.6	Design Values	A-37
A.7	Trends in Daily Maximum Ozone Concentrations	A-40
A.7.1	Daily Maximum AQI/ROAR levels	A-40
A.7.2	Box-and-Whisker Plots	A-41
A.7.3	Meteorologically Adjusted Trends	A-46
Appendix B:	Emission Inventory	B-1
B.1	Emissions Inventory Tables.....	B-3
B.2	Emissions Inventory Calculations and Revisions	B-9
B.2.1	Base-Year Inventory.....	B-10
B.2.2	Emissions Forecasts	B-10
B.2.3	Annual, Seasonal, and Modeling Inventories	B-11
B.2.4	Quality Assurance and Quality Control.....	B-11
Appendix C:	Stationary and Area Source Control Strategy Evaluation	C-1
	Introduction.....	C-1
	Regulations Contributing to Attainment	C-1

Appendix C Organization and Evaluation	C-3
Control Measure Evaluations	C-3
C.1 Combustion Devices.....	C-7
C.1.1 Rule 4301 Fuel Burning Equipment.....	C-8
C.1.2 Rule 4307 Boilers, Steam Generators, and Process Heaters— 2.0 MMBtu/hr to 5.0 MMBtu/hr	C-10
C.1.3 Rule 4308 Boilers, Steam Generators, and Process Heaters— 0.075 MMBtu/hr to less than 2.0 MMBtu/hr ...	C-12
C.1.4 Rule 4309 Dryers, Dehydrators, and Ovens.....	C-14
C.1.5 Rule 4320 Advanced Emission Reduction Options for Boilers, Steam Generators, and Process Heaters Greater than 5.0 MMBtu/hr	C-16
C.1.6 Rule 4352 Solid Fuel Fired Boilers, Steam Generators, and Process Heaters	C-18
C.1.7 Rule 4702 Internal Combustion Engines	C-20
C.1.8 Rule 4703 Stationary Gas Turbines	C-23
C.2 Industrial Processes	C-25
C.2.1 Rule 4311 Flares	C-26
C.2.2 Rule 4313 Lime Kilns	C-28
C.2.3 Rule 4354 Glass Melting Furnaces	C-29
C.2.4 Rule 4641 Cutback, Slow Cure, and Emulsified Asphalt, Paving, and Maintenance Operations.....	C-31
C.2.5 Rule 4681 Rubber Tire Manufacturing	C-33
C.2.6 Rule 4682 Polystyrene, Polyethylene, and Polypropylene Products Manufacturing	C-34
C.2.7 Rule 4684 Polyester Resin Operations	C-36
C.2.8 Rule 4691 Vegetable Oil Processing Operations	C-38
C.2.9 Rule 4694 Wine Fermentation and Storage Tanks.....	C-39
C.2.10 Rule 4695 Brandy Aging and Wine Aging Operations....	C-40
C.3 Coatings and Solvents.....	C-42
C.3.1 Rule 4601 Architectural Coatings	C-44
C.3.2 Rule 4602 Motor Vehicle Assembly Coatings.....	C-46

C.3.3	Rule 4603 Surface Coating of Metal Parts and Products, Plastic Parts and Products, and Pleasure Crafts.....	C-47
C.3.4	Rule 4604 Can and Coil Coating Operations.....	C-49
C.3.5	Rule 4605 Aerospace Assembly and Component Coating Operations.	C-51
C.3.6	Rule 4606 Wood Products and Flat Wood Paneling Products Coating Operations	C-53
C.3.7	Rule 4607 Graphic Arts and Paper Film, Foil, and Fabric Coatings.....	C-55
C.3.8	Rule 4610 Glass Coating Operations	C-57
C.3.9	Rule 4612 Motor Vehicle and Mobile Equipment Coating Operations.....	C-59
C.3.10	Rule 4652 Coatings and Ink Manufacturing.....	C-61
C.3.11	Rule 4653 Adhesives and Sealants.....	C-62
C.3.12	Rule 4661 Organic Solvents.....	C-64
C.3.13	Rule 4662 Organic Solvent Degreasing Operations.....	C-66
C.3.14	Rule 4663 Organic Solvent Cleaning, Storage, and Disposal.....	C-68
C.3.15	Rule 4672 Petroleum Solvent Dry Cleaning Operations.....	C-69
C.4	Oil and Gas	C-70
C.4.1	Rule 4401 Steam-Enhanced Crude Oil Production Wells.....	C-72
C.4.2	Rule 4402 Crude Oil Production Sumps.....	C-73
C.4.3	Rule 4404 Heavy Oil Test Station—Kern County	C-74
C.4.4	Rule 4407 In-Situ Combustion Well Vents.....	C-75
C.4.5	Rule 4408 Glycol Dehydration Systems	C-76
C.4.6	Rule 4409 Components at Light Crude Oil Production Facilities, Natural Gas Production Facilities, and Natural Gas Processing Facilities	C-77
C.4.7	Rule 4453 Refinery Vacuum Producing Devices or Systems.....	C-79
C.4.8	Rule 4454 Refinery Process Unit Turnaround.....	C-80

C.4.9	Rule 4455 Components at Petroleum Refineries, Gas Liquids Processing Facilities, and Chemical Plants.....	C-82
C.4.10	Rule 4621 Gasoline Transfer Into Stationary Storage Containers, Delivery Vessels, and Bulk Plants.....	C-84
C.4.11	Rule 4622 Gasoline Transfer Into Motor Vehicle Fuel Tanks.....	C-86
C.4.12	Rule 4623 Storage of Organic Liquids.....	C-88
C.4.13	Rule 4624 Transfer of Organic Liquid.....	C-90
C.5	Managed Burning.....	C-92
C.5.1	Rule 4103 Open Burning.....	C-94
C.5.2	Rule 4106 Prescribed Burning and Hazard Reduction Burning.....	C-96
C.6	Agricultural Processes.....	C-99
C.6.1	Rule 4570 Confined Animal Facilities.....	C-100
C.7	Residential and Commercial.....	C-102
C.7.1	Rule 4693 Bakery Ovens.....	C-104
C.7.2	Rule 4902 Residential Water Heaters.....	C-106
C.7.3	Rule 4905 Natural Gas-Fired, Fan-Type, Residential Central Furnaces.....	C-108
C.8	Waste Management.....	C-110
C.8.1	Rule 4302 Incinerator Burning.....	C-111
C.8.2	Rule 4565 Biosolids, Animal Manure, and Poultry Litter Operations.....	C-112
C.8.3	Rule 4566 Organic Material Composting Operations.....	C-114
C.8.4	Rule 4625 Wastewater Separators.....	C-116
C.8.5	Rule 4642 Solid Waste Disposal Sites.....	C-118
C.8.6	Rule 4651 Soil Decontamination Operations.....	C-119
C.9	Emission Inventory Codes.....	C-120
Appendix D:	VMT Emissions Offset Demonstration.....	D-1
D.1	Introduction.....	D-1
D.2	Background.....	D-1
D.3	EPA Guidance on VMT Offset Requirement.....	D-2
D.4	Transportation Control Strategies and Transportation Control Measures.....	D-2

D.5	Methodology.....	D-3
D.5.1	Analysis Using 1990 as the Base Year for 1-Hour Ozone.....	D-3
D.5.2	Analysis Using 1990 as the Base Year for 8-Hour Ozone.....	D-5
D.6	Summary	D-6
Attachment A:	State of California Motor Vehicle Control Program (1990-Present) Transportation Control Strategies Adopted by the California Air Resources Board Since 1990	D-9
Attachment B:	Adopted Transportation Control Measures.....	D-15
Appendix E:	Modeling Protocol	E-i
	Table of Contents	E-ii
	List of Figures.....	E-v
	List of Tables	E-vi
	Acronyms	E-vii
1	Introduction.....	E-1
1.1	Purpose	E-1
1.2	Approach	E-1
1.3	History of Field Studies in the Region	E-1
1.4	Background	E-5
2	Selection of the Modeling Periods	E-11
2.1	Available Observational Data	E-12
2.2	Routinely Collected Data	E-12
3	Model Selection	E-14
3.1	Meteorological Model	E-14
3.2	Photochemical Model	E-15
4	Modeling Domain and Grid Structure	E-17
4.1	Meteorological Modeling Domain	E-17
4.2	Photochemical Modeling Domain	E-20
5	Model Initialization and Boundary Conditions.....	E-22
5.1	Initialization of the Meteorological Model.....	E-22
5.1.1	WRF Model Options	E-23

	5.1.2	WRF Initial and Boundary Conditions (IC/BC)	E-23
	5.1.3	WRF Four Dimensional Data Assimilation	E-24
	5.1.4	Meteorological Data Quality Assurance	E-24
5.2		Initialization of the Air Quality Model	E-24
	5.2.1	CMAQ Model Options	E-24
	5.2.2	Photochemical Mechanism	E-25
	5.2.3	CMAQ Initial and Boundary Conditions (IC/BC) and Spin-Up period.....	E-27
6		Emission Inputs	E-29
	6.1	Emission Inventory Development	E-29
	6.1.1	Background	E-30
	6.1.2	Terminology.....	E-31
	6.2	Point and Area Source Emissions	E-32
	6.2.1	Development of Base-Year Emission Inventory	E-32
	6.2.2	Quality Assurance of Base Year Emissions ...	E-34
	6.3	Future Year (Forecasted) Emissions	E-35
	6.3.1	Growth Factors.....	E-36
	6.3.2	Control Factors.....	E-36
	6.4	Day-Specific Emissions	E-37
	6.4.1	Wildfires and Prescribed Burns	E-38
	6.4.2	Agricultural Burn Data for San Joaquin Valley	E-38
	6.4.3	Ocean-Going Vessels	E-39
	6.5	Temporally and Spatially Resolved Emissions	E-39
	6.6	Surface Temperature and Relative Humidity Fields	E-40
	6.7	On-Road Mobile Source Emissions.....	E-42
	6.7.1	General Methodology	E-42
	6.8	Biogenic Emissions	E-49
	6.9	Spatial Allocation	E-51
	6.9.1	Grid Definition.....	E-52
	6.9.2	Spatial Surrogates.....	E-53
	6.10	Speciation.....	E-57

	6.10.1	Speciation Profiles.....	E-58
	6.10.2	Chemical Mechanisms	E-60
	6.11	Quality Assurance	E-63
	6.11.1	Examples of Standard Tabular Summaries	E-63
	6.11.2	Spatial Plots	E-68
	6.11.3	Time Series Plots	E-69
7		Model Performance Evaluation	E-71
	7.1	Meteorological Model Performance Evaluation	E-71
	7.1.1	Known Performance Issues of Meteorological Models in the Complex Terrain of California and Current Attempts to Improve Performance.....	E-71
	7.1.2	Ambient Data Base and Quality of Data.....	E-73
	7.1.3	Model Performance Evaluation Procedures and Metrics	E-73
		7.1.3.1 Statistical Evaluation.....	E-74
		7.1.3.2 Phenomenological Evaluation.....	E-78
	7.2	Air Quality Model Performance Evaluation	E-78
8		Attainment Demonstration	E-82
	8.1	Criteria for Use of Modeled Days in RRF Calculations.....	E-82
	8.2	Relative Reduction Factors	E-83
9		Procedural Requirements.....	E-85
	9.1	How Modeling and other Analyses will be Archived, Documented, and Disseminated	E-85
	9.2	Specific Deliverables to U.S. EPA	E-86
		References	E-87
Appendix F:		Modeling Approach and Results.....	F-1
	1.1	Modeling Overview	F-1
	1.2	Modeling Requirements.....	F-2
	1.3	General Methodology and Approach	F-2
	1.3.1	Meteorology Modeling	F-3

	1.3.2	Air Quality Modeling	F-3
1.4		Modeling results	F-4
	1.4.1	Development of Relative Response Factors (RRFs) for the 1-hr ozone National Ambient Air Quality Standard (NAAQS):	F-4
	1.4.2	Attainment Demonstration	F-7
	1.4.3	Band RRF Figures for All Sites:.....	F-8
Appendix G:		Weight of Evidence	G-1
1		Introduction.....	G-1
	1.1	Elements Commonly Included in an Attainment Demonstration	G-1
	1.2	Assessment of Valley-wide Progress in Ozone Air Quality	G-2
2		Ozone Air Quality Trends Adjusted to Baseline Meteorology from 2003-2005	G-10
	2.1	Using Met-Adjusted 8-Hour Ozone Trends to Represent 1-Hour Ozone	G-10
	2.2	Met-Adjusted Trends for the Central and Southern Regions of the SJV.....	G-13
3		Trends for Ozone Precursors in Ambient Air	G-15
	3.1	Analysis of PAMS Data	G-15
	3.2	Analysis of Routine Ambient NOx Data	G-18
4		Trends for Emissions Inventories of Ozone Precursors.....	G-20
5		Ambient Analysis of Ozone Sensitivity to ROG and NOx	G-24
	5.1	ROG vs. NOx Sensitivity Based on Weekday vs. Weekend Ozone.....	G-24
6		Modeling Results	G-26
	6.1	Single RRF Approach.....	G-26
	6.2	Comparison of Single vs. Band RRF	G-26
	6.3	Carrying Capacity Diagrams.....	G-33
7		Summary	G-39

Appendix G-1: Methodology Used to Impute Values for		
Missing Data		G-41
Introduction.....		G-41
What methodology was used to produce “imputed” values?		G-41
What are imputed values and how are they created?.....		G-41
Why does the I-Bot method work?.....		G-42
What is the I-Bot method?		G-42
What does the I-Bot method produce?		G-43
How well does the I-Bot method work?		G-44
Appendix G-2: Methodology Used to Prepare Meteorologically		
Adjusted Ozone Trends for the San Joaquin Valley.....		G-47
Introduction.....		G-47
What methodology was used to prepare met-adjusted trends?.....		G-47
Appendix G-3: Methodology Used to Evaluate the Ozone		
Weekend effect in the San Joaquin Valley		G-54
Introduction.....		G-54
What is the Ozone Weekend Effect?		G-54
Analytical Method for Ozone Weekend Effect		G-54
Appendix H: Emission Reduction Credits.....		H-1
H.1 Introduction.....		H-1
H.2 Pre-Baseline Emission Reduction Credits		H-1
H.3 List of ERCs		H-11
Appendix I: Triennial Progress Report and Plan Update for State Ozone		
Standards		I-1
I.1 Introduction.....		I-1
I.2 Ozone Air Quality Indicators.....		I-2
I.2.1 Expected Peak Day Concentration (EPDC)		I-2
I.2.2 Exposure Indicators.....		I-5
I.2.2.1 Exposure Indicature Calculations, Generally..		I-6
I.2.2.2 Population-Weighted Exposure Calculation ...		I-6
I.2.2.3 Area Weighted Exposure Calculation		I-7
I.3 District Control Measures		I-8
I.4 Mobile Source Control Measures		I-10

I.4.1	District Transportation Strategies	I-10
I.4.2	District Incentive Programs.....	I-11
I.4.3	District Land Use Programs.....	I-12
I.5	Pollutant Transport Mitigation	I-12
I.6	Plan Revision	I-13
I.6.1	Control Strategy	I-14
I.6.2	Cost-Effectiveness Ranking	I-15
I.6.3	Emissions Trends.....	I-16
I.6.4	Meeting State Requirements for Plan Revisions	I-18
Appendix J:	Summary of Significant Comments and Responses.....	J-1
Written Comments, August 20, 2013 Proposed Plan		J-1
Verbal Comments, April 16, 2013 Public Workshop		J-3
Written Comments, April 16, 2013 Public Workshop.....		J-7

List of Figures

Figure ES-1	San Joaquin Valley Basin-Day 1-hour Ozone Exceedences	ES-6
Figure ES-2	Total Hours Over the 1-hour Ozone Standard Among All Sites	ES-7
Figure ES-3	District Regional 1-Hour Ozone Maximum Value Trend	ES-7
Figure 1-1	Ozone Formation	1-3
Figure 2-1	San Joaquin Valley Air Basin	2-2
Figure 2-2	Effect of Temperature Inversion on Pollutant Dispersion	2-3
Figure 2-3	2012 Monthly Average Ozone at Clovis	2-4
Figure 2-4	Summer NOx Trends in the Valley	2-5
Figure 2-5	Summer VOC Trends in the Valley	2-6
Figure 2-6	Photochemical Process for a Valley Summer Ozone Day	2-8
Figure 2-7	VOC Reactivity Trends by PAMS Site	2-14
Figure 2-8	Basin-Day Exceedences per Year from 1980-2012	2-17
Figure 2-9	Valley Maximum 1-Hour Ozone Design Value Trend	2-18
Figure 2-10	1-Hour Ozone Exceedance Window Trend	2-19
Figure 4-1	Creditable Emissions Reductions Relative to ROP Targets	4-7
Figure 4-2	VOC and NOx Emissions Using Valley “2013 FTIP” VMT for 1-Hour Ozone Planning	4-11
Figure 4-3	VOC and NOx Emissions Using Valley “2013 FTIP” VMT for 8-Hour Ozone Planning	4-11
Figure A-1	Monitoring Network within the San Joaquin Valley	A-2
Figure A-2	Peak Concentrations during Ozone Season	A-3
Figure A-3	San Joaquin Valley Wind Patterns during the Ozone Season	A-4
Figure A-4	Effect of Temperature Inversion on Pollutant Dispersion	A-5
Figure A-5	Basin-Day Exceedences per Year	A-11
Figure A-6	Exceedance Day Trend at Fresno-First (Garland 2012)	A-12
Figure A-7	Exceedance Day Trend at Parlier	A-12
Figure A-8	Exceedance Day Trend at Edison	A-13
Figure A-9	Exceedance Day Trend at Arvin-Bear Mountain	A-13
Figure A-10	Average Frequency of 1-hour Ozone Exceedences per Year per Day of the Week from 1990-1992	A-18

Figure A-11	Average Frequency of 1-hour Ozone Exceedances per Year Per Day of the Week from 2000-2002	A-18
Figure A-12	Average Frequency of 1-hour Ozone Exceedances per Year Per Day of the Week from 2000-2002	A-19
Figure A-13	Sample Wind/Pollution Rose Diagram	A-20
Figures A-14 to A-17	Wind and Pollution Roses for Fresno-Sky Park (7/12/2012) and Clovis (9/22/2011)	A-22
Figures A-18 to A-21	Wind and Pollution Roses for Clovis (9/29/2011) and Fresno-Garland (7/12/2012)	A-23
Figures A-22 to A-25	Wind and Pollution Roses for Fresno-Drummond (9/20/2011 and 9/22/2011)	A-24
Figures A-26 to A-29	Wind and Pollution Roses for Fresno-Drummond (9/29/2011 and 8/10/2012)	A-25
Figures A-30 to A-33	Wind and Pollution Roses for Parlier (9/20/2011 and 6/1/2012)	A-26
Figure A-34	Number of Hours over 1-hour Ozone Standard by Year at Clovis	A-27
Figure A-35	Number of Hours over 1-hour Ozone Standard by Year at Fresno-First/Garland.....	A-28
Figure A-36	Number of Hours over 1-hour Ozone Standard by Year at Parlier.....	A-28
Figure A-37	Number of Hours over 1-hour Ozone Standard by Year at Edison	A-29
Figure A-38	Number of Hours over 1-hour Ozone Standard by Year at Arvin-Bear Mountain	A-29
Figure A-39	1-hour Ozone Exceedance Window Trend	A-31
Figure A-40	Ozone Diurnal Profiles at Modesto-14th	A-32
Figure A-41	Ozone Diurnal Profiles at Clovis	A-33
Figure A-42	Ozone Diurnal Profiles at Fresno-First/Garland	A-33
Figure A-43	Ozone Diurnal Profiles at Fresno-Drummond	A-34
Figure A-44	Ozone Diurnal Profiles at Parlier.....	A-34
Figure A-45	Ozone Diurnal Profiles at Visalia-Church.....	A-35
Figure A-46	Ozone Diurnal Profiles at Bakersfield-California.....	A-35
Figure A-47	Ozone Diurnal Profiles at Edison	A-36
Figure A-48	Ozone Diurnal Profiles at Arvin-Bear Mountain	A-36
Figure A-49	Valley Maximum 1-hour Ozone Design Value Trend	A-39
Figure A-50	Distribution of ROAR Levels from 1980 to 2012	A-41

Figure A-51	Box-and-Whisker Plot Interpretation	A-42
Figures A-52 to A-55	Ozone Distributions for Stockton-Hazelton, Modesto-14th, Merced-Coffee, Clovis	A-43
Figures A-56 to A-59	Ozone Distributions for Fresno-First/Garland, Fresno-Drummond, Parlier, Visalia-Church.....	A-44
Figures A-60 to A-63	Ozone Distributions for Bakersfield-California, Edison, Arvin-Bear Mountain, Arvin-DiGiorgio	A-45
Figure A-64	Meteorologically Adjusted Ozone Trends in the Northern San Joaquin Valley	A-48
Figure A-65	Meteorologically Adjusted Ozone Trends in the Central San Joaquin Valley	A-49
Figure A-66	Meteorologically Adjusted Ozone Trends in the Central San Joaquin Valley	A-50
Figure A-67	Meteorologically Adjusted Ozone Trends in the Southern San Joaquin Valley	A-51
Figure A-68	Meteorologically Adjusted Ozone Trends in the Southern San Joaquin Valley	A-52
Figure D-1	VOC Emissions Using San Joaquin Valley “2013 FTIP” VMT	D-7
Figure D-2	NOx Emissions Using San Joaquin Valley “2013 FTIP” VMT	D-7
Figure D-3	VOC Emissions Using San Joaquin “2013 FTIP” VMT	D-8
Figure D-4	VOC Emissions Using San Joaquin “2013 FTIP” VMT	D-8
Figure 1.1	California Air Basins and Counties	E-9
Figure 1.2	California Air Districts and Counties	E-10
Figure 2.1	Existing routine ozone and nitrogen oxides monitoring sites	E-13
Figure 4.1	The three nested grids for the WRF model (D01 36km; D02 12km; and D03 4km)	E-18
Figure 4.2	Modeling domains used by ARB.....	E-20
Figure 6.1	ARB Modeling Domain with urban areas and shipping lanes shown ...	E-55
Figure 7.1	Terrain height changes along with counties and major rivers and lakes in California (http://geology.com/state-map/california.shtml)	E-74
Figure 7.2	Sub-regions of air quality model performance evaluation (7: Northern San Joaquin Valley region, 10: Central San Joaquin Valley region, 11: San Joaquin Valley APCD About 3000 feet region, 14 Southern San Joaquin Valley region).....	E-80

Figure F-1	The Band RRF procedure for Shafter-Walker Street monitoring site ...	F-7
Figure F-2	The Band RRF procedure for Edison monitoring site	F-9
Figure F-3	The Band RRF procedure for Arvin – Bear Mountain monitoring site	F-10
Figure F-4	The Band RRF procedure for Fresno – 1st Street monitoring site	F-11
Figure F-5	The Band RRF procedure for Clovis – North Villa Avenue monitoring site	F-12
Figure F-6	The Band RRF procedure for Fresno – Sierra Sky Park monitoring site	F-13
Figure F-7	The Band RRF procedure for Parlier monitoring site	F-14
Figure F-8	The Band RRF procedure for Sequoia and Kings Canyon monitoring site	F-15
Figure F-9	The Band RRF procedure for Bakersfield – 5558 California Avenue monitoring site	F-16
Figure F-10	The Band RRF procedure for Sequoia National Park – Lower Kiawah River monitoring site	F-17
Figure F-11	The Band RRF procedure for Visalia – North Church Street monitoring site	F-18
Figure F-12	The Band RRF procedure for Oildale – 3311 Manor Street monitoring site	F-19
Figure F-13	The Band RRF procedure for Fresno – Drummond Street monitoring site	F-20
Figure F-14	The Band RRF procedure for Hanford – South Irwin Street monitoring site	F-21
Figure F-15	The Band RRF procedure for Modesto – 14th Street monitoring site .	F-22
Figure F-16	The Band RRF procedure for Turlock – South Minaret Street monitoring site	F-23
Figure F-17	The Band RRF procedure for Merced – South Coffee Avenue monitoring site	F-24
Figure F-18	The Band RRF procedure for Maricopa – Stanislaus Street monitoring site	F-25
Figure F-19	The Band RRF procedure for Madera – Pump Yard monitoring site	F-26
Figure 1	Design Value Trend for the San Joaquin Valley Air Basin	G-2

Figure 2	Reductions in spatial extent and number of Exceedance Days In the San Joaquin Valley Air Basin	G-4
Figure 3	Three High-ozone Sites in the Central SJV	G-5
Figure 4	Air Quality Trends for Air Quality Trends for Clovis – N Villa Avenue.....	G-6
Figure 5	Air Quality Trends for Fresno – 1st Street/Garland.....	G-6
Figure 6	Air Quality Trends for Fresno – Drummond	G-7
Figure 7	Two High-ozone Sites in the Southern SJV	G-8
Figure 8	Air Quality Trends for Edison	G-9
Figure 9	Air Quality Trends for Arvin – Bear Mountain.....	G-9
Figure 10	Correlation of Max. 1-hr and 8-hr Ozone at Edison	G-11
Figure 11	Correlation of Max. 1-hr and 8-hr Ozone at Fresno – 1st Street.....	G-12
Figure 12	Met-Adjusted Trends.....	G-14
Figure 13	July-Aug Means at all SJV PAMS Stations (5-7am / 4-6am)	G-16
Figure 14	July-Aug Means at Central SJV PAMS Stations (5-7am / 4-6am)	G-16
Figure 15	July-Aug Means at Southern SJV PAMS Stations (5-7am / 4-6am)	G-17
Figure 16	Central SJV Trends for Ambient 24-hour NOx from May-Oct	G-18
Figure 17	Southern SJV Trends for Ambient 24-hour NOx from May-Oct	G-19
Figure 18	Overall ROG and NOx Emissions Trends for the SJV	G-20
Figure 19	ROG and NOx Emissions Trends for the Central SJV	G-21
Figure 20	ROG and NOx Emissions Trends for the Southern SJV	G-22
Figure 21	Summer NOx Emissions by County.....	G-22
Figure 22	Summer ROG Emissions by County.....	G-23
Figure 23	ROG and NOx Carrying Capacity in 2017 for Sites in the SJV	G-34
Figure 1	Observed and Imputed Values for Daily Max. 1-Hour Ozone at Fresno – 1st Street in 2011.....	G-45
Figure 2	Observed and Imputed Values for Daily Max. 1-Hour Ozone at Arvin – Bear Mountain in 2010.....	G-46
Figure 1	San Joaquin Valley – Central Subregion Observed vs. Predicted Ozone: Models-in-Months for 2005-2007.....	G-48
Figure 2	San Joaquin Valley – Southern Subregion Observed vs. Predicted Ozone: Models-in-Months for 2005-2007.....	G-48
Figure I-1	EPDC at the Clovis-N. Villa Avenue Monitor.....	I-3
Figure I-2	EPDC at the Fresno-1st Street Monitor	I-4

Figure I-3 EPDC at the Fresno-Sierra Skypark Monitor I-4

Figure I-4 EPDC at the Edison Monitor I-5

Figure I-5 Valley Population-Weighted Exposure per Person I-7

Figure I-6 Valley Area-Weighted Exposure per Square Kilometer I-8

Figure I-7 VOC & NOx Emissions using Valley “2013 FTIP” VMT for 1-Hour
Ozone Planning I-10

List of Tables

Table ES-1	Federal Air Quality Standards and Valley Status for Ozone	ES-4
Table ES-2	2013 Plan for Revoked 1-Hour Ozone Standard Federal Requirements	ES-9
Table 1-1	Estimated Valley Population by County, 2010-2020	1-2
Table 1-2	Federal Air Quality Standards and Valley Status for Ozone	1-6
Table 1-3	2013 Plan for the Revoked 1-Hour Ozone Standard Federal Requirements	1-8
Table 1-4	2013 Plan for Revoked 1-Hour Ozone Standard Timeline	1-9
Table 2-1	San Joaquin Valley PAMS Monitoring Network	2-12
Table 2-2	PAMS VOC Target Species	2-13
Table 2-3	Base Year and Future Year 1-Hour Ozone Design Values	2-20
Table 3-1	Adopted District Rules	3-3
Table 3-2	Adopted ARB Regulations	3-4
Table 3-3	Regulatory Control Measure Commitments	3-9
Table 3-4	Further Study Measures	3-10
Table 3-5	Potential New Incentive Programs	3-20
Table 3-6	Summary of the 2013 Legislative Platform Priorities	3-26
Table 4-1	Base-Year and Future-Year 1-Hour Ozone Design Values (DV)	4-2
Table 4-2	ROP Demonstration	4-6
Table 4-3	Attainment Contingencies from Adopted Regulatory Reductions	4-8
Table 4-4	Demonstration of Sufficient Attainment-Year Contingency Reductions	4-9
Table A-1	1-Hour Ozone Exceedance Days by Site per Year from 1990-2012....	A-9
Table A-2	Attainment Test: Number of Exceedance Days per 3-Year Averaging Period from 1990 to 2012	A-10
Table A-3	1-hour Ozone Exceedance Days by County per Year From 1980-2012	A-14
Table A-4	1-hour Ozone Basin Exceedances by Month per Year from 1980-2012	A-16
Table A-5	Summary of Wind and Pollution Rose Results	A-21
Table A-6	1-hour Ozone Design Values (ppm) by Site per Year from 1990-2012	A-38

Table A-7	1-hour Ozone ROAR Levels Based on RAAN	A-40
Table B-1	NOx Emissions (Summer Daily Averages in Tons per Day)	B-3
Table B-2	VOC Emissions (Summer Daily Averages in Tons per Day	B-6
Table B-3	Valley-Wide Biogenic Emissions for 2007 in Tons per Day	B-9
Table C-1	District Stationary and Area Source Regulations Contributing to NAAQS Attainment of Ozone	C-2
Table C-2	Regulatory Evaluation Summary	C-4
Table C-3	Current Combustion Devices Rules	C-7
Table C-4	Current Industrial Processes Rules	C-25
Table C-5	Current Coatings and Solvents Rules	C-42
Table C-6	Current Oil and Gas Rules	C-70
Table C-7	Current Managed Burning Rules	C-93
Table C-8	Current Agricultural Processes Rules	C-99
Table C-9	Current Residential and Commercial Rules	C-103
Table C-10	Current Waste Management Rules	C-110
Table D-1	Base year (1990) VMT and Emissions	D-3
Table D-2	VOC and NOx Emissions Calculations for Attainment Year (2017)	D-4
Table D-3	Base Year (1990) VMT and Emissions	D-5
Table D-4	VOC and NOx Emissions Calculations for Attainment Year (2023)	D-6
Table D-5	State of California Motor Vehicle Control Program (1990-Present) Transportation Control Strategies Adopted by the California Air Resources Board since 1990	D-9
Table D-6	San Joaquin Council of Governments Summary of Commitments – 2002 Severe Area Ozone Plan	D-16
Table D-7	Stanislaus Council of Governments Summary of Commitments – 2002 Severe Area Ozone Plan	D-19
Table D-8	Merced County Association of Governments Summary of Commitments – 2002 Severe Area Ozone Plan	D-22
Table D-9	Madera County Transportation Commission Summary of Commitments – 2002 Severe Area Ozone Plan	D-24
Table D-10	Fresno Council of Governments Summary of Commitments – 2002 Severe Area Ozone Plan	D-26
Table D-11	Tulare County Association of Governments Summary of Commitments – 2002 Severe Area Ozone Plan	D-31

Table D-12	Kings County Association of Governments Summary of Commitments – 2002 Severe Area Ozone Plan	D-35
Table D-13	Kern Council of Governments Summary of Commitments – 2002 Severe Area Ozone Plan	D-37
Table 1.1	Major Field Studies in Central California and surrounding areas	E-4
Table 2.1	The 2007 Ozone Design Values for the San Joaquin Valley	E-11
Table 4.1	WRF 30 Vertical Layer Configuration for the modeling period	E-18
Table 4.2	Vertical Layer Heights (m) of Photochemical Modeling	E-21
Table 5.1	WRF Physics Options	E-23
Table 5.2	CMAQ v4.7.1 Schemes used for Current Simulations	E-25
Table 6.1	Inventory Terms	E-32
Table 6.2	EMFAC2007 Classifications	E-44
Table 6.3	DTIM Emission Categories	E-46
Table 6.4	SJV domain-wide biogenic emissions for 2007 in tons/day	E-50
Table 6.5	Summary of spatial surrogates	E-56
Table 6.6	ARB’s SAPRC-99 Emitted Organic Model Species	E-61
Table 6.7	Model Species for NOx	E-63
Table 7.1	Model Performance Expectations	E-77
Table 7.2	Statistics for evaluating base year air quality model performance for all sub-regions	E-80
Table 7.3	Graphical tools for evaluating base year air quality model performance	E-81
Table F-1	The 2007 and 2017 DVs for monitoring sites in the San Joaquin Valley.....	F-8
Table 1	ROG (ppbC) and NOx (ppb) Concentrations in the SJV.....	G-17
Table 2	Site-by-Site and Regional “Ozone Weekend Effects” (%) in the Central and Southern Sub-regions of the SJV.....	G-25
Table 3	Design values (in ppb) in 2007 and 2017 for Monitoring Sites In the SJV	G-27
Table 4	Projected values in 2017 for the top 10 base-case observations of 1-hour ozone (ppb) at SJV sites using single and band RRFs.....	G-28
Table 1	Key information contained in I-Bot output	G-43

Table 1	Meteorological and day-of-week parameters used in statistical models to quantify daily ozone-forming potential (OFP) in the SJV during selected sets of calibration years	G-49
Table 2	Variables used for Models-in-Months based on data from 2005-2007.	G-50
Table 3	OFP Bins for SJV Central	G-51
Table 4	OFP Bins for SJV South	G-52
Table H-1	Estimated NOx Growth, Control, and Estimated Offset Use	H-5
Table H-2	Estimated VOC Growth, Control, and Estimated Offset Use	H-8
Table H-3	Current List of NOx and VOC Emission Reduction Credits, 7/31/2013.....	H-11
Table I-1	Ozone Precursor Emissions Reductions (VOC and NOx) from District Rules (2005-2011)	I-9
Table I-2	Regulatory Control Measure Commitments	I-14
Table I-3	Further Study Measures	I-15
Table I-4	Control Measure Cost-Effectiveness Rankings.....	I-16
Table I-5	ROG Emissions Trend (average summer tons per day)	I-17
Table I-6	NOx Emissions Trend (average summer tons per day)	I-17
Table I-7	CCAA §40925 Requirements for Triennial Plan Revisions	I-18